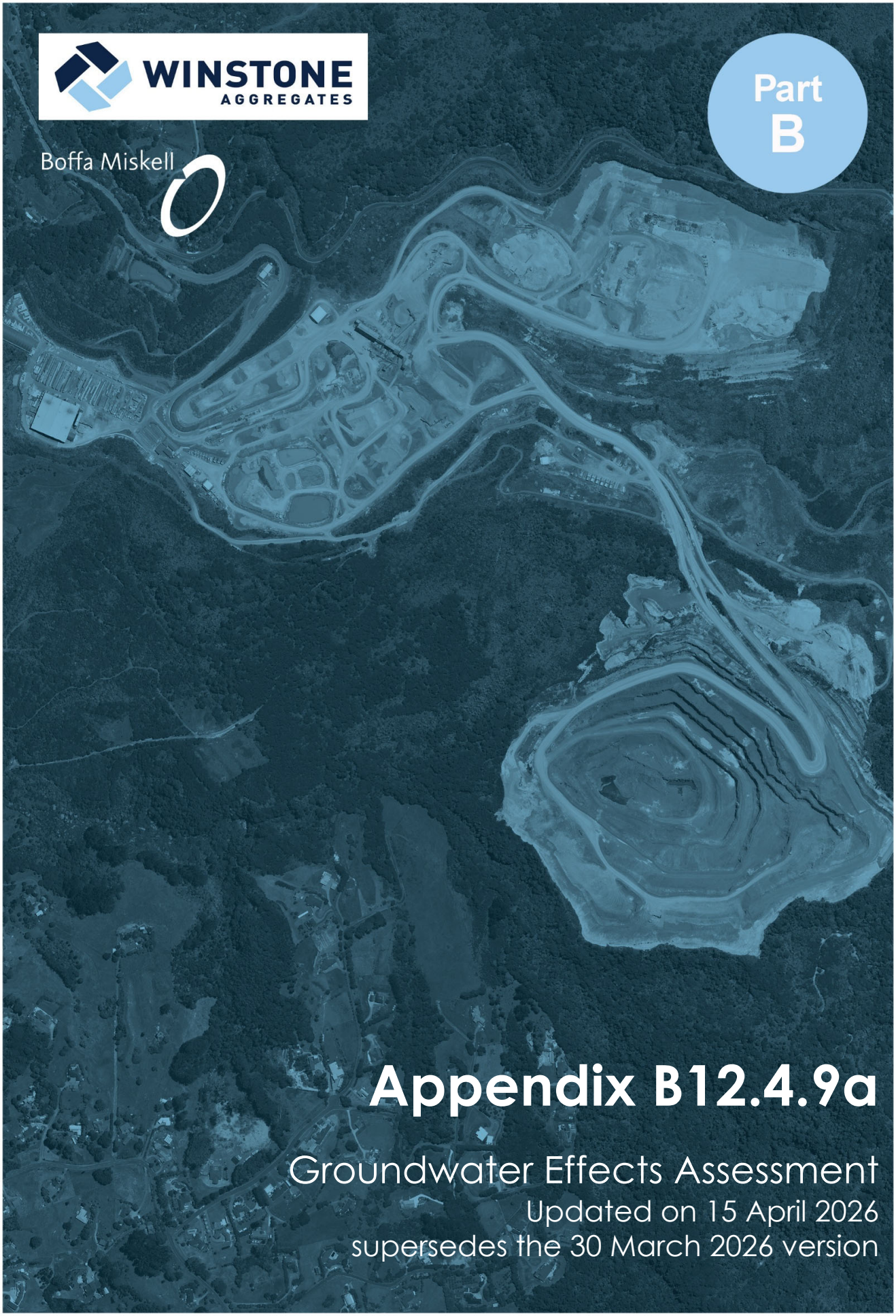

Appendix B12.4.9a

Groundwater Effects Assessment

Updated on 15 April 2026
supersedes the 30 March 2026 version

Hunua Quarry Development: Groundwater Effects Assessment

Prepared for

Winstone Aggregates Limited a division of Fletcher Concrete and Infrastructure Limited

March 2026

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Limitations:

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Winstone Aggregates Limited a division of Fletcher Concrete and Infrastructure Ltd and others (not directly contracted by PDP for the work). PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This report has been prepared by PDP on the specific instructions of Winstone Aggregates Limited a division of Fletcher Concrete and Infrastructure Ltd for the limited purposes described in the report. PDP acknowledges that this report may be used and relied upon by the expert panel appointed under the Fast-track Approvals Act 2024. PDP accepts no liability if the report is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk. This report has been prepared in accordance with the Environment Court's Code of Conduct for Expert Witnesses, contained in the Environment Court's Practice Note 2023. The authors of this report agree to comply with the Code of Conduct, and confirm that unless otherwise stated, the issues addressed in this report are within the area of expertise of the authors. No material facts have been omitted that might alter or detracted from the opinions expressed in this report.

Executive Summary

Pattle Delamore Partners Limited (PDP) has been commissioned by Winstone Aggregates (Winstone), a division of Fletcher Concrete and Infrastructure Limited, to provide an assessment of the groundwater and surface water effects arising from the proposed development of the Symonds Hill Pit at the Hunua Quarry.

EXISTING ENVIRONMENT

Overview of Pit Operations in Relation to Groundwater and Surface Water

The Hunua Quarry consists of two pits: the Hunua Pit and the Symonds Hill Pit, both located within the same regional aquifer but situated in separate surface water catchments (Figure 1). The Symonds Hill Pit is approximately 1 km south of the Hunua Pit, separated by a ridgeline that divides the Waipokopu and Mangapū Stream catchments. Winstone has developed the Hunua Pit over the last 100 years; extraction there has now ceased, and the pit is being backfilled. Operational focus has shifted to the Symonds Hill Pit for the past 15 years.

The current groundwater level at the Symonds Hill Pit, influenced by pumping from the Hunua Pit, is approximately RL60m. Historical records indicate the pre-quarry level was about RL75m. The Hunua Pit is currently being backfilled, which has raised groundwater levels nearby from RL20m to RL52m (based on monitoring bore HUN07/8, Figure 1). Future backfilling will not affect regional groundwater levels, as these are now controlled by Symonds Hill Pit dewatering and are not expected to recover further.

Existing Takes and Uses

The existing Consent (WAT60152106-A) authorises the diversion and take of shallow and regional groundwater from the Hunua West Greywacke, Hunua Wairoa Greywacke, and Waitemata aquifers for dewatering both pits and for stream flow augmentation. It permits dewatering the Symonds Hill Pit to RL -5m and a total take of 5,340 m^3/d, comprising:

- 3,000 m^3/d (regional groundwater) for dewatering
- 2,000 m^3/d (regional groundwater) for quarry operations
- 100 m^3/d (shallow groundwater) at the Hunua Pit
- 240 m^3/d (shallow groundwater) at the Symonds Hill Pit

In 2022, Winstone applied for a new consent (WAT60400593 and WAT601152106-B) to relocate the operational water take point from a damaged water supply bore (HUN18/1) to the current supply bore (HUN14/8) and the Symonds Hill Pit sump. This consent authorised a maximum take of 1,400 m^3/d from HUN14/8. Granted in July 2022 for a short term, it expired in May 2023. A replacement application was lodged in 2023 and is currently under Council consideration.

The current quarry water supply for processing, dust suppression, and stream augmentation is sourced from water supply bore HUN14/8 (near Coal Mine Road) and the Symonds Hill Pit sump.

Existing Augmentation Regime

An augmentation programme is currently in place to mitigate effects on low flows in streams affected by quarry dewatering. This includes monitoring and controlled discharge of water from the sump back to the receiving environment to maintain streams baseflow characteristics.

Discharges and Water Quality Monitoring

Discharges from quarry operations are directed to the Mangapū Stream (upstream of a gauging station called Downstream, Figure 1). The Mangapū Stream water quality monitoring undertaken in 2013 and December 2025 confirms that quarry operations have not had a measurable adverse effect on stream water quality. Sampling results show negligible variation between upstream and downstream sites, with any minor exceedances of guideline values occurring consistently both upstream and downstream, indicating they reflect natural background conditions rather than quarry influence.

CONCEPTUAL HYDROGEOLOGICAL MODEL

Four factors are key to this effects assessment:

1) Hydrogeological Setting

Both Hunua and Symonds Hill Pits are situated within greywacke basement rock, comprising thinly-bedded, alternating sandstone and siltstone with variable fracture density. Two groundwater systems have been identified:

Regional Groundwater: At depth, the greywacke is fully saturated. Groundwater movement is irregular, dependent on fracture intensity and continuity. Inflow to the Symonds Hill Pit is sourced from a greywacke block bounded by geological features (e.g., the Hunua and Drury Faults), referred to in this report as the "Hunua Greywacke Block" (Figure 3).

Shallow Groundwater: Above the regional water table, localised perched saturated zones exist. These are not directly connected to the regional system and typically discharge to local streams.

2) Groundwater Movement and Levels

The current zone of influence for pumping from HUN14/8 and dewatering to RL 60m is constrained to the east, south, and west by geological faults or low-permeability zones. No known flow barrier fault has been intercepted to the north; the northern boundary is controlled by the significant deepening of the greywacke basement.

A sharp groundwater level rise east of the Symonds Hill Pit suggests a flow barrier impeding natural westward groundwater movement. Post-dewatering monitoring indicates a direct relationship between former Hunua Pit dewatering and drawdown in deep bores to the south. The data also suggests a low-permeability zone approximately 4.7 km south of the Hunua Pit, likely forming the southern boundary of the Hunua Greywacke Block, consistent with the conceptual model for the existing consent.

3) Recharge

Recharge to both shallow and regional groundwater occurs via rainfall infiltration:

Shallow Groundwater Recharge: Estimated via Mean Annual Low Flow (MALF) correlation at approximately 7% of rainfall.

Regional Groundwater Recharge: Calculated via throughflow analysis at approximately 645 m^3/d per km, representing flow across the Drury Fault that discharges to shallow groundwater or seeps into the Manukau lowlands alluvium. This equates to a recharge rate of about 60 mm/year (4.6% of annual rainfall).

4) Hydraulic Conductivity

Hydraulic conductivity values derived from field permeability tests, long-duration pumping tests, and back-analysis indicate a transmissivity value of 86 m^2/d, which is used for the existing consent and results in conservative effect assessments.

THE PROPOSAL

The proposed development involves excavating the Symonds Hill Pit to a floor level of RL-50m, which will require dewatering approximately 125 m below the regional groundwater level. This expansion will require only minor changes to the total authorised abstraction volume compared to the existing consent (WAT60152106-A).

Groundwater Takes

The predicted groundwater inflows for the ultimate pit development are:

- Maximum long-term regional groundwater inflow to the sump and from supply bore HUN14/8: 4,520 m^3/d (includes 2,610m^3/d for the quarry water use)
- Maximum short-term increase in inflow (storage release): 1,000 m^3/d
- Maximum shallow groundwater inflow to the pit: 300 m^3/d
- Total inflow/take: 5,820 m^3/d

This total comprises water pumped from the pit floor (dewatering) and water taken for quarry operations (processing, dust suppression). The proposed take of 2,610 m^3/d is within the Auckland Council available resource for take from the designated Hunua West Groundwater Management Area (3,147 m^3/d).

Discharges

Water collected in the pit sump (including dewatering volume) will be discharged back to the Mangapū Stream via the existing discharge infrastructure, maintaining the current management practice where the majority of water is returned to the catchment. No change in the discharge point location compared with the existing consent is proposed.

Augmentation

Augmentation will be implemented if stream flow monitoring confirms low flow reductions exceed 5%, consistent with the framework established under the existing take consent.

Comparison with Existing Consent

The proposal differs slightly from the existing consented situation. The maximum zone of influence remains identical to that defined under existing consent WAT60152106-A, as it is controlled by the same geological boundaries. However, drawdown magnitudes within this zone will increase, and the pit floor will be deepened from RL -5m to RL -50m. The total take increases marginally from 5,340 m^3/d to 5,820 m^3/d.

The following summary table compares the differences between the existing consent and the proposed development:

Differences between Existing and Proposed Development			
Aspect	**Existing Consent (WAT60152106-A)**	**Proposed Development**	**Change**
Pit Floor Level	RL -5m	RL -50m	Deeper by 45m
Total Take	5,340 m^3/d	5,820 m^3/d	+480 m^3/d (+9%)
Zone of Influence	31 km^2	31 km^2	Unchanged
Affected Bores	9 identified	19 identified (10 newly identified)	More users within same zone

ASSESSMENT OF EFFECTS

Effects on the Availability of Groundwater

There is no change in the predicted total groundwater resource within the greywacke block compared to that already assessed under Consent WAT60152106-A. The regional groundwater resource (excluding storage contribution) within the Hunua Greywacke Block is calculated to be about 4,900 m^3/d.

Effects on Bore Owners/Groundwater Users (Drawdown)

The maximum zone of influence for the proposed development is predicted to be identical to that defined under the existing consent, as it is controlled by the same geological boundaries. All potentially affected private bores are located within this zone.

A total of 19 farm wells have been identified within the maximum zone of influence (a recent Auckland Council database search in December 2025 identified an additional 10 farm wells within the same zone). The potential drawdown effects on all 19 wells have been assessed and are presented in Table 11. Consistent with the existing consent, conditions of consent will mitigate any adverse effects on individual bores should monitoring identify any adverse effects.

Effects of the Proposed Stream Diversion (Shallow Groundwater)

Effects on the Southern Tributary (proposed for diversion) and Mangapū Stream have been assessed using correlated MALF and reductions in contributing catchment area per quarry stage:

- Mangapū Stream at US1 gauging station: Minimal effect anticipated (0–1% flow loss).
- Southern Tributary: Minor loss (0–1%) for Stages 0–2, increasing to 5% for Stages 3–6, and 10% for Stages 7–8 due to shallow groundwater interception.

Where low flow reductions exceed 5% (i.e., beyond natural variability), a mitigation measure which may include augmentation is recommended, subject to confirmation via proposed stream low flow monitoring.

Effects on Stream Baseflow within Regional Groundwater

Consistent with the existing consent, the proposed development may reduce baseflow in two streams - the Mangapū and Waipokopu Streams - in downstream areas (<RL 60m) where they receive discharge from regional groundwater.

For the current dewatering and groundwater take (approx. 1,280 m^3/d), estimated losses are 655 m^3/d (Mangapū) and 555 m^3/d (Waipokopu). For dewatering to RL-50m, predicted losses increase to 946 m^3/d (34% reduction) for Mangapū Stream and 2,290 m^3/d (35% reduction) for Waipokopu Stream. These predictions are based on a conservative methodology assuming full hydraulic connection

between the streams (below RL60m) and the regional groundwater in the greywacke. In reality, due to the clogging of the stream channel with silts and clays, the actual loss (if any) is likely to be significantly less than the above percentages. Therefore, any potential baseflow loss should be confirmed via the proposed stream flow monitoring programme before implementing any augmentation.

Effects on Wetlands

Some wetlands are within the proposed quarry expansion and will be removed. There are also two wetlands located within the shallow groundwater zone (Figure 4) in the immediate vicinity of the proposed pit footprint (Stage 8). The location of these wetlands is shown in Figure 26 of the Boffa Miskell ecological assessment (2026). The shallow groundwater within this zone is likely to drain to the pit rather than sustain soil moisture in these wetlands. Therefore, these two identified wetlands may also be adversely affected by the proposed quarry development. The characteristics of these wetlands and a proposed mitigation plan to address effects are detailed in Boffa Miskell (2026).

Outside the immediate vicinity of the pit footprint (i.e., beyond the shallow groundwater zone shown in Figure 4), the perched and shallow groundwater systems that sustain nearby wetlands are hydraulically disconnected from the regional groundwater within the greywacke aquifer. Consequently, dewatering for the proposed pit expansion is not expected to affect these shallow groundwater systems and is therefore predicted to have no adverse effects on other wetlands outside the shallow groundwater zone.

Effects on Watercare Reservoir at Hunua

Monitoring data from Watercare piezometers near the reservoir since 2014 indicates the groundwater system there is likely separate, with no interaction from Hunua Pit dewatering. This is expected to continue with the Symonds Hill Pit development.

Summary of Effects and Comparison with Existing Consent

The key effects are similar in nature to those already assessed and consented under WAT60152106-A, but with increased magnitude for drawdowns within the Hunua Greywacke Block. In addition, a new effect, not present under the existing consent is that shallow groundwater interception may affect the baseflow of the proposed diversion stream after Stage 3. A comprehensive monitoring programme and mitigation measures are proposed to offset any loss of flow.

The overall level of effect is considered to be less than minor, provided the recommended monitoring, augmentation, and mitigation measures are implemented. This is consistent with the findings of the existing consent assessment.

PROPOSED AUGMENTATION, MONITORING PROGRAMME AND MITIGATION CONDITIONS

The existing augmentation programme, groundwater monitoring network, and stream gauging sites on the Waipokopu and Mangapū Streams remain appropriate for the proposed development. The following modifications are recommended:

- Minor modifications to the number of stream flow gauging sites,
- A new set of groundwater trigger levels to account for increased drawdown magnitudes,
- Confirmation monitoring to verify predicted effects before augmentation is triggered, and
- Augmentation objective is to maintain the streams existing MALF.

These changes are proposed to ensure the monitoring framework remains fit-for-purpose for the expanded operation and are detailed in Section 6.

SUMMARY

Given the conservative nature of the assessments and the recommended augmentation, monitoring, and mitigation programmes, the proposed Symonds Hill Pit development is expected to have no more than minor effects on the groundwater environment or stream low-flow conditions. The effects are consistent with, and an extension of, those already assessed and managed under the existing consent framework and are therefore acceptable.

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1.0 Introduction

1.1 Site Description and History

The Hunua Quarry comprises two separate pits: the Hunua Pit and the Symonds Hill Pit, located approximately 1 km apart (Figure 1). Quarrying has transitioned from the Hunua Pit, where extraction is complete, to the Symonds Hill Pit, which is the current focus of operations. The Hunua Pit is now being backfilled using overburden from Symonds Hill Pit development and imported fill material.

1.2 Historical and Current Groundwater Conditions

Dewatering at the Hunua Pit commenced in November 2002 to enable rock extraction, lowering the regional groundwater level from a pre-quarry level of approximately RL 64m to RL 20m by July 2015. Following the commencement of backfilling in 2017, groundwater levels have partially recovered to around RL 52m (as of December 2025). However, levels remain below the pre-quarry state due to ongoing, lower-intensity dewatering at the Symonds Hill Pit and water supply pumping from bore HUN14/8. The historical dewatering resulted in a maximum drawdown of approximately 45m at Hunua Pit.

At the Symonds Hill Pit (with an area of about 31 ha within the Mangapū Stream catchment), dewatering has drawn the regional groundwater level from a pre-quarry level of RL 75m to an average of RL 63.6m, fluctuating between RL 67m and RL 60m. This represents a current average drawdown of about 11.4m.

1.3 Existing Consents and Proposed Project

Winstone Aggregates holds regional consents (WAT60152106-A, NRSI 43407) authorising the dewatering of the Symonds Hill Pit to RL -5m and a total groundwater take of 5,340 m^3/d, for its quarrying operation for the site allocated as follows:

- 3,000 m^3/d for dewatering
- 2,000 m^3/d for quarry operations (sourced from the Symonds Hill Pit sump and supply bore HUN14/8)
- 100 m^3/d from shallow groundwater at the Hunua Pit
- 240 m^3/d from shallow groundwater at the Symonds Hill Pit

In 2022, Winstone applied for a new consent (WAT60400593 and WAT601152106-B) to relocate the operational water take point from a damaged water supply bore (HUN18/1) to the current supply bore (HUN14/8) and the Symonds Hill Pit sump. This consent authorised a maximum take of 1,400 m^3/d from HUN14/8. Granted in July 2022 for a short term, it expired in May 2023. A replacement application was lodged in 2023 and is currently under Council

consideration. Winstone is seeking to progress this replacement application with urgency. While, at the present time, the take does not form part of the existing environment / consented baseline, it will (in the event that the replacement consent is granted prior to any decision on the substantive application for the Quarry development).

1.4 Purpose of this Assessment

Pattle Delamore Partners Ltd (PDP) has been engaged by Winstone to assess the groundwater and surface water effects of a proposed expansion under the Fast-Track Approvals Act 2024 process. The proposal involves deepening the Symonds Hill Pit to at least RL -50m, which will require significant additional drawdown. This report has been prepared to support the consent application by evaluating the potential effects of that additional drawdown (beyond the consented baseline) on:

(a) Groundwater resources and levels,

(b) Neighbouring groundwater takes (bores and wells),

(c) Stream baseflows and the hydrological integrity of adjacent wetlands.

1.5 Previous Work at Hunua Quarry

PDP has been the principal hydrogeological consultant for the Hunua Quarry since the first dewatering consent application for the Hunua Pit in February 2001.

This long-term engagement includes the following key investigations and assessments:

2005–2007: Symonds Hill Pit Baseline & Design. PDP conducted initial groundwater investigations for the Symonds Hill development. Data confirmed the Mangapū Stream is perched (within shallow groundwater) near the pit, with a about 20 m head difference above the regional aquifer, indicating its baseflow is sourced locally. PDP also prepared a Surface Water Management Design Assessment to support the 2008 consent (34129).

2006: Hydraulic Characterization. A long-duration pumping test on the artesian bore HUN5/3 provided critical data on greywacke hydraulic conductivity and aquifer boundary conditions, informing subsequent Hunua Pit dewatering assessments.

2011: Groundwater Model Update. PDP updated the site conceptual model and effects assessment for the Hunua Pit, predicting a total dewatering inflow of 5,100 m^3/d to RL -5m. PDP was also engaged to undertake ongoing compliance monitoring reviews.

2017: Inflow Event Response. PDP investigated a sharp groundwater inflow increase at the Hunua Pit caused by intercepting a subsurface barrier fault. The assessment of this storage-release event supported the operational decision to shift primary extraction to the Symonds Hill Pit.

2020–2021: Symonds Hill Pit Dewatering Consent. PDP prepared the Assessment of Environmental Effects (AEE) that secured consent (WAT60152106-A) to dewater the Symonds Hill Pit below the regional water table to RL -5m.

2022: Operational Water Supply Reconfiguration. PDP assisted in varying the consent to relocate the operational water take from a damaged bore (HUN18/1) to bore HUN14/8 and the Symonds Hill Pit sump, including a 7-day pumping test on HUN14/8 to validate the new source.

2024: Ongoing Support. PDP has provided further technical input to support an application concerning la renewal of the permit for long-term water extraction from HUN14/8, which is currently being processed by Auckland Council.

1.6 Objectives

The objective of this technical report is to assess the groundwater and surface water effects arising from the proposed quarry expansion.

The main objectives of the report are:

- Assess the regional and shallow groundwater diversion rate required to dewater Symonds Hill Pit to RL -50m;
- Assess the zone of influence as a result of the proposed diversion of groundwater associated with deepening of Symonds Hill pit to RL -50m, including assessing potential effects on the neighbouring wells, stream baseflows and groundwater resources;
- Assess the stream flow loss as a result of the proposed Southern Tributary diversion.

1.7 Scope

This assessment is primarily based on a desktop groundwater study using existing geological and hydrogeological data. Groundwater levels and inflow data monitored by Winstone, along with annual streamflow surveys of Waipokopu and Mangapū Streams since 2010, have also informed this assessment.

PDP has gathered all available borehole and groundwater level data from the registered or unregistered well owners in the surrounding areas of the Hunua and Symonds Hill Pits (PDP 2011). The farm well bore data was updated in December 2025 based on the Council bore database. This data was also used for the assessments.

The scope of the Groundwater Effects Assessment is as follows:

- Characterise the conceptual groundwater model;
- Assess the current and future zones of influence;
- Estimate long-term groundwater inflow;
- Assess the effects of the quarry pump out on the groundwater resource;
- Assess the effects of the quarry pump out on groundwater users;
- Assess the effects on groundwater resources in other aquifers;
- Provide an assessment of potential effects on the base flows of streams, wetlands and Watercare Reservoir;
- Assess the effects of the proposed stream diversion on the Mangapū Stream low flows;
- Assess the effects of the proposed activities on surface and groundwater quality; and
- Assess any required changes to the existing groundwater monitoring, stream flow monitoring, and stream augmentation plan required by existing consent conditions (WAT60152106-A).

1.8 Proposed Symonds Hill Pit Development

As discussed above, Winstone is proposing to develop the Symonds Hill Pit. The pit is contained within the upstream of Mangapū Stream catchment.

The proposed indicative quarry stages are presented in Table 1. The quarry plan includes the proposed full extent of the pit 94ha with the lowest sump water level at RL -50m.

As part of the long-term development of the Symonds Hill Pit, Winstone may consider the expansion and deepening of the quarry below RL-50m in future as part of a separate resource consent application. However, any additional quarry expansion and deepening would only be progressed once the earlier stages of the pit have been quarried. The final Life of Quarry Strategy will be confirmed prior to any excavation below RL-50m and will detail further investigations necessary to ensure that adverse environmental effects associated with later-stage extraction and/or rehabilitation are appropriately identified, assessed, and managed (including obtaining any regional consents required).

Table 1: Proposed Symonds Hill Pit Stages

Quarry Dewatering Phase	Quarry Operational Stage	Approximate Duration (years)	Pit Floor (m, RL)	Quarry Stage Area (ha)
Existing Pit	Existing Pit		60	31
Dewatering Phase 1	Stage 0	1 - 4	45	33
	Stage 1			44
	Stage 2	1		46
	Stage 3	1		51
	Stage 4	43 - 73		56
	Stage 5			
Dewatering Phase 2	Stage 6		15	
Dewatering Phase 3	Stage 7		-50	74
	Stage 8			94

1.9 Quarry Operation Groundwater Demand

The existing consent authorises a maximum take of 1,400 m^3/d from HUN14/8, which is the bore's rated capacity and the rest (currently 600m^3/d) from the Symonds Hill sump. Winstone has no plans to increase abstraction from this bore. Winstone have estimated the groundwater use requirement for the proposed quarry development (Winstone Pers. Comm, 2026).

The water requirement for the processing plant (washing aggregates), is about 1,620m^3/d. Additional water supply is required for dust suppression, and it is estimated that for the proposed finals stage of the development (Stage 8), approximately 750 m^3/d of water will be required. Therefore, the proposed maximum take for the quarry operation is about 2,610 m^3/d (1,400m^3/d from HUN14/8 and 1,210 m^3/d from the sump). The proposed water use breakdown is presented in Table 2.

Table 2: Proposed Water Take Requirements - Hunua Quarry

Water Use in Plant Processes	Total Use (m^3/d)	Total Water Loss (m^3/d)
WASHED5 (15% Water Loss)	10,800	1,620
Water for Dust Suppression (at maximum pit depth of RL-50m)		750
Mobile Crushing Water (15% water loss)	1,600	240
Total Site Water Requirement		**2,610**

2.0 Field Investigation

Significant volume of data on groundwater levels, stream flow, and Hunua Pit groundwater inflow has been collected by Winstone since the first consent was granted in 2001. Additional data has been gathered since the 2014 consent variation and the 2021 for the water supply take from HUN14/8 investigations. The analysis of this long-term dataset has been instrumental in defining the site-specific groundwater trigger levels and designing the optimized monitoring network that form the basis of the proposed mitigation conditions.

2.1 Groundwater Level Monitoring

Groundwater levels in up to 36 piezometers surrounding the Hunua Quarry have been monitored as part of the quarry monitoring programme carried out since 1997. The monitoring data reported by Winstone (2024) and relevant results are discussed in this report. The locations of the groundwater level monitoring bores are shown on Figure 1, and the bores hydrographs are shown in Appendix A.

In addition to the above monitoring data, a survey of private water supply bores within 5km of Hunua Quarry was undertaken by Grant Fisher in 2010 (GFIG). Water level data in these wells was collected during the survey (access permitting). This survey was updated in December 2025 using the latest Council bores database. The available information from these bores is presented in Appendix B. The locations of these private farm wells are shown on Figure 1.

2.2 Stream Flow Gauging

Stream flow gauging in the Waipokopu Stream has been undertaken by Winstone since 2003, and in the Mangapū Stream since 2010. The location of the gauging stations is shown in Figure 1.

2.3 Water Quality Sampling

The groundwater and surface water quality sampling within the Mangapū and Waipokopu Streams Catchments has been undertaken by Winstone previously. As part of this current assessment, four additional samples were taken from the streams within the upper Mangapū Catchment, and the results are summarised in Appendix C.

2.4 Quarry Pump Out and Sump Water Level Monitoring

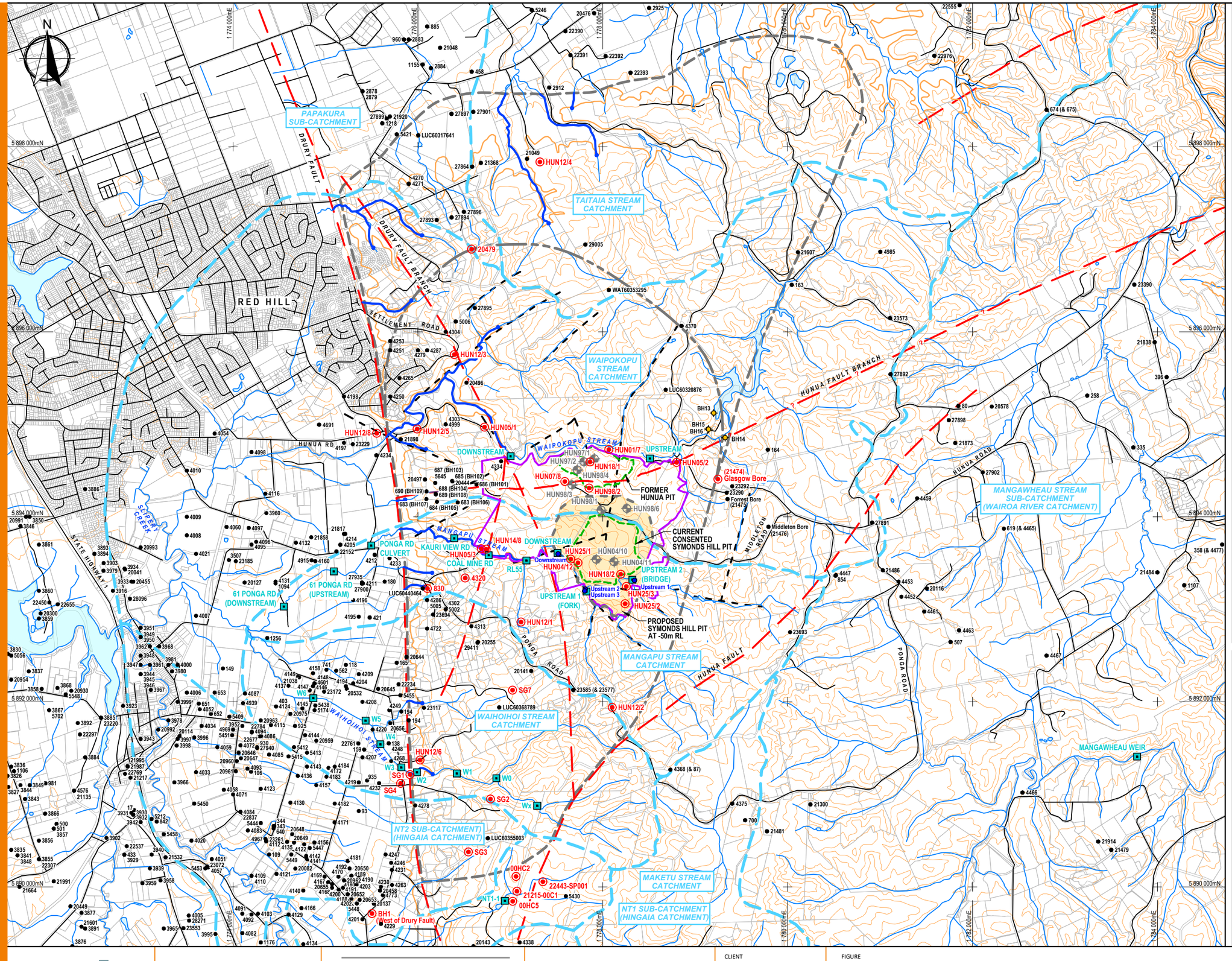
The Hunua Pit sump groundwater level and sump groundwater inflow have been monitored by Winstone since November 2002 until 2019. Since 2019 the take data has been monitored from the new water supply bore (HUN14/8) next to the Mangapū Stream. The pit floor (at the Symonds Hill Pit) has now intercepted the regional groundwater, and inflow has been monitored by Winstone.

2.5 Aquifer Tests

A set of field permeability tests or "slug tests" were carried out in HUN4/12 and HUN18/2 (Figure 1) at Symonds Hill on 16 May 2019 to provide data on the hydraulic conductivity of the greywacke in the vicinity of the pit. The geological logs for the above two piezometers and piezometer details are shown in Appendix D.

The slug tests were undertaken using rising and falling head techniques and based on the methodology recommended by Butler (1998) using solid PVC slugs (the slugs cause a sudden change in the groundwater levels in piezometers for the tests).

PDP has also conducted two long duration pumping tests in 2006 and 2021 on the Coal Mine Rd artesian bore (HUN5/3) and water supply bore (HUN14/8) next to the Mangapū Stream respectively, to assess the hydraulic conductivity of the greywacke (PDP 2006 and 2021). The hydraulic conductivity results are discussed in Section 3.6.



KEY :

- HUN05/2 — GROUNDWATER MONITORING BORE
- HUN98/6 — DESTROYED/SUSPENDED GROUNDWATER MONITORING BORE
- BH13 — WATERCARE MONITORING BORE
- 22976 — FARM WELL (AC BORE ID/CONSENT No.)
- STREAM GAUGING SITE
- MANGAPU STREAM SAMPLING SITE
- SHALLOW GROUNDWATER CATCHMENT BOUNDARY
- POTENTIALLY AFFECTED STREAM REACH
- 60m GROUND LEVEL CONTOUR (AMSL)
- FAULT (APPROX.)
- LINEAMENT FROM AERIAL PHOTOS
- FLETCHER CONCRETE AND INFRASTRUCTURE PROPERTY BOUNDARY
- ESTIMATED ZONE OF INFLUENCE FOR DEWATERING LEVEL AT 60.0m RL AND 45.0m RL
- ESTIMATED ZONE OF INFLUENCE FOR DEWATERING LEVEL AT 15.0m RL AND -50.0m RL (HUNUA GRAYWACKE BLOCK)
- ESTIMATED SHALLOW ZONE OF INFLUENCE FOR SYMONDS HILL PIT

SOURCE:
1. TOPOGRAPHICAL AND CADASTRAL MAP DERIVED FROM LINZ DATA.
2. BASED ON GRANT FISHER INDUSTRIAL GEOLOGY WELL SURVEY COMPILED (14/12/2010) AND GROUNDWATER MONITORING DATA COMPILED (SEP 2025).
3. OTHER FARM WELLS DERIVED FROM AC BORE SEARCH, RECEIVED DEC 2025.

0 0.5 1.0 1.5km

SCALE 1:40,000 (A3)

NO.	REVISION	DATE
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FIGURE: FIGURE 1: LOCATION PLAN

PROJECT: HUNUA QUARRY DEVELOPMENT: GROUNDWATER EFFECTS ASSESSMENT

FILED: A055680016-FIG-001 NZTM LocationPlan.dwg

3.0 Conceptual Hydrogeological Model

The conceptual hydrogeological model presented in this assessment is in agreement with the technical foundations established in the PDP (2011) and updated PDP (2020) reports for the existing consent (WAT60152106-A).

A significant volume of additional data on groundwater levels, stream flow and Hunua Pit groundwater inflow data has been collected by Winstone for the past 20 years. These data have been used to further refine the conceptual model and assessments.

The conceptual model for the Symonds Hill Pit and surrounding areas is shown along two hydrogeological sections (AA' and BB'). The hydrogeological sections are shown in Figure 5. The location of sections is shown in Figure 4.

The following hydrogeological characteristics of the site are defined as part of the conceptual model.

- Site geological characteristics;
- Groundwater movements and levels under the existing dewatering conditions;
- Groundwater recharge and discharge mechanisms;
- Greywacke hydraulic conductivity;
- Groundwater/surface water interaction; and
- Groundwater quality.

3.1 Geological Characteristics

3.1.1 Geological Logs

As part of a reconnaissance study for the proposed new Symonds Hill Pit development in 2004, four boreholes with piezometers were drilled (HUN4/9 to HUN4/12). Three of these bores have since been destroyed by the quarry excavations (HUN4/9 to HUN4/11) and new groundwater monitoring bores with shallow and deep piezometers were installed between 2018 and 2025:

- HUN18/2L&U
- HUN25/1L&U
- HUN25/2 with two shallow piezometers
- HUN25/3 with two shallow piezometers.

The location of these bores is shown in Figures 1 and 3. The geological logs for the above bores are presented in Appendix D.

3.1.2 Geology

The general geology of the site and its surrounding area is shown in Figures 2 and 3 based on IGNS (2001). The main geological formations within the Symonds Hill catchment are Waipapa Group (greywacke), Tertiary sediments (Waitemata and Te Kuiti Groups), Taupo pumice alluvium and basalt/scoria of the South Auckland volcanic field.

Based on the geological data, the rocks quarried at the Symonds Hill Pit, belong to the Waipapa Group which forms the basement rocks for New Zealand. It is commonly referred to as "greywacke" but contains many different facies of siltstones and sandstones. These rocks have been intensely deformed by tectonic activity resulting in strata that is faulted and fractured with veins composed of quartz, calcite, prehnite, chlorite and zeolites.

The greywacke at the Symonds Hill and Hunua Pits have similar geological characteristics. The greywacke rocks at both sites consist of thin-bedded alternating fine-grained sandstone and siltstone layers with variable fracture density.

The available geological logs indicate that overlying the greywacke, especially in the upper and middle catchment areas (Figure 3) are Tertiary sedimentary rocks of the Waitemata and Te Kuiti Groups (Waikato Coal Measures).

The Waitemata Group has been eroded in stream channels and on the lower slopes of valleys exposing the greywacke. The contact between the Waitemata Group and the greywacke is an irregular erosion surface with a paleo-weathering profile evident at the top of the greywacke. The lower catchment area is underlain by alluvium, basalt and scoria. The volcanic rocks belong to the South Auckland volcanic field.

The Waitemata Group, the Waikato Coal Measures and the highly weathered greywacke form overburden materials to the rock resource. The borehole data suggests that the thickness of the overburden materials ranges between 3 and 30 m at the Symonds Hill Pit.

3.1.3 Geological Faults

A study of the fault lineaments in the area was carried out previously by PDP (PDP 2004). The inferred fault lineaments are shown on Figure 3. The Symonds Hill Pit will not directly intersect any known major fault zones. A branch of the Drury Fault passes about 200 m to the west of the Symonds Hill Pit footprint and the main Hunua Fault is located more than 1 km to the south-east of the footprint. An east-west fault (a branch of the Hunua Fault) identified to the south of the existing Hunua Pit passes about 400 m to the north of the Symonds Hill Pit, between the Hunua and Symonds Hill Pits.

The Hunua Fault is truncated at a north-south splay of Drury Fault 2.5 km south of Symonds Hill. The main Drury Fault forms the boundary between the up-faulted Hunua ranges and the down-faulted Manukau Lowlands. The implication of these faults on the groundwater movement is provided in Section 3.7.

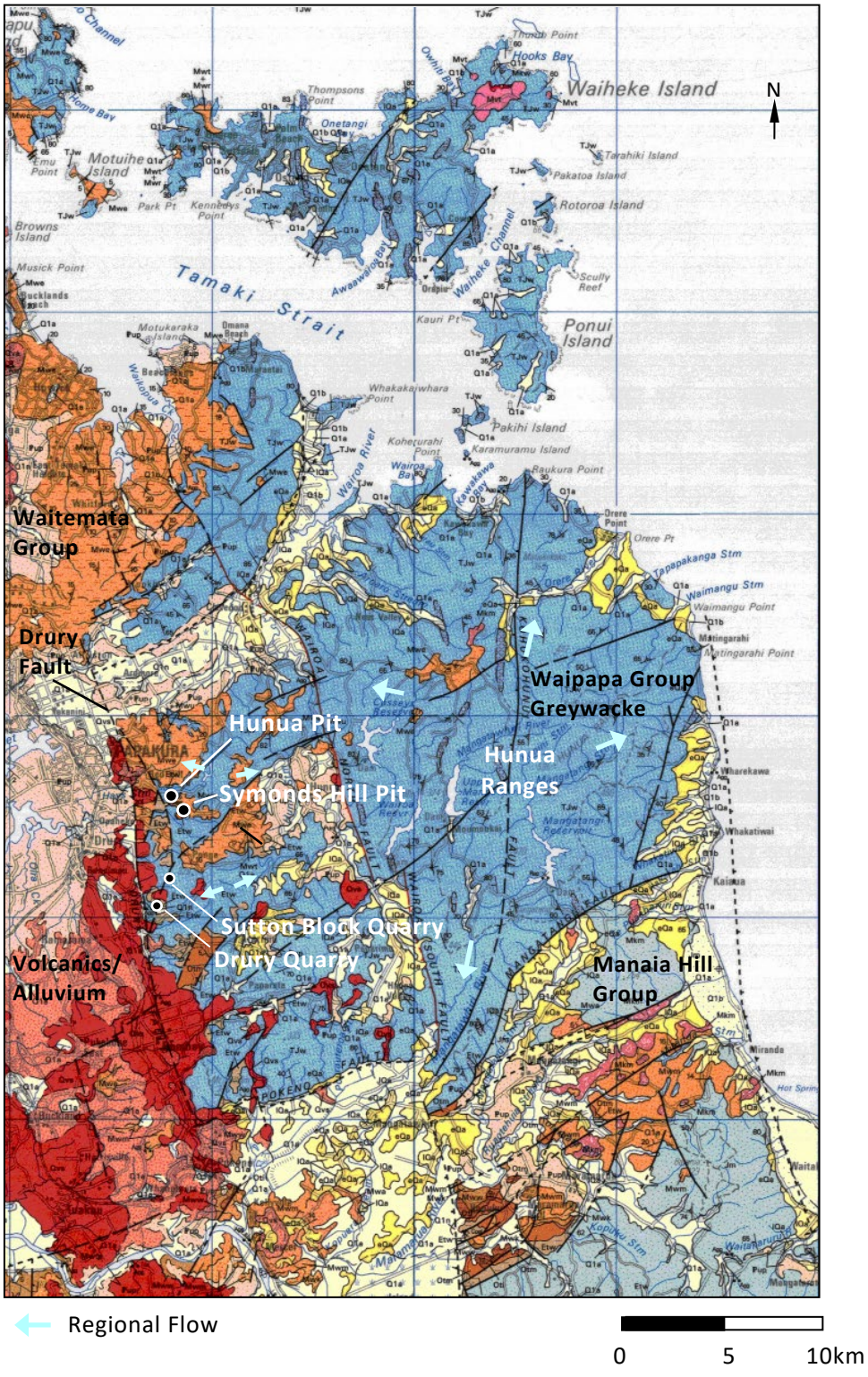
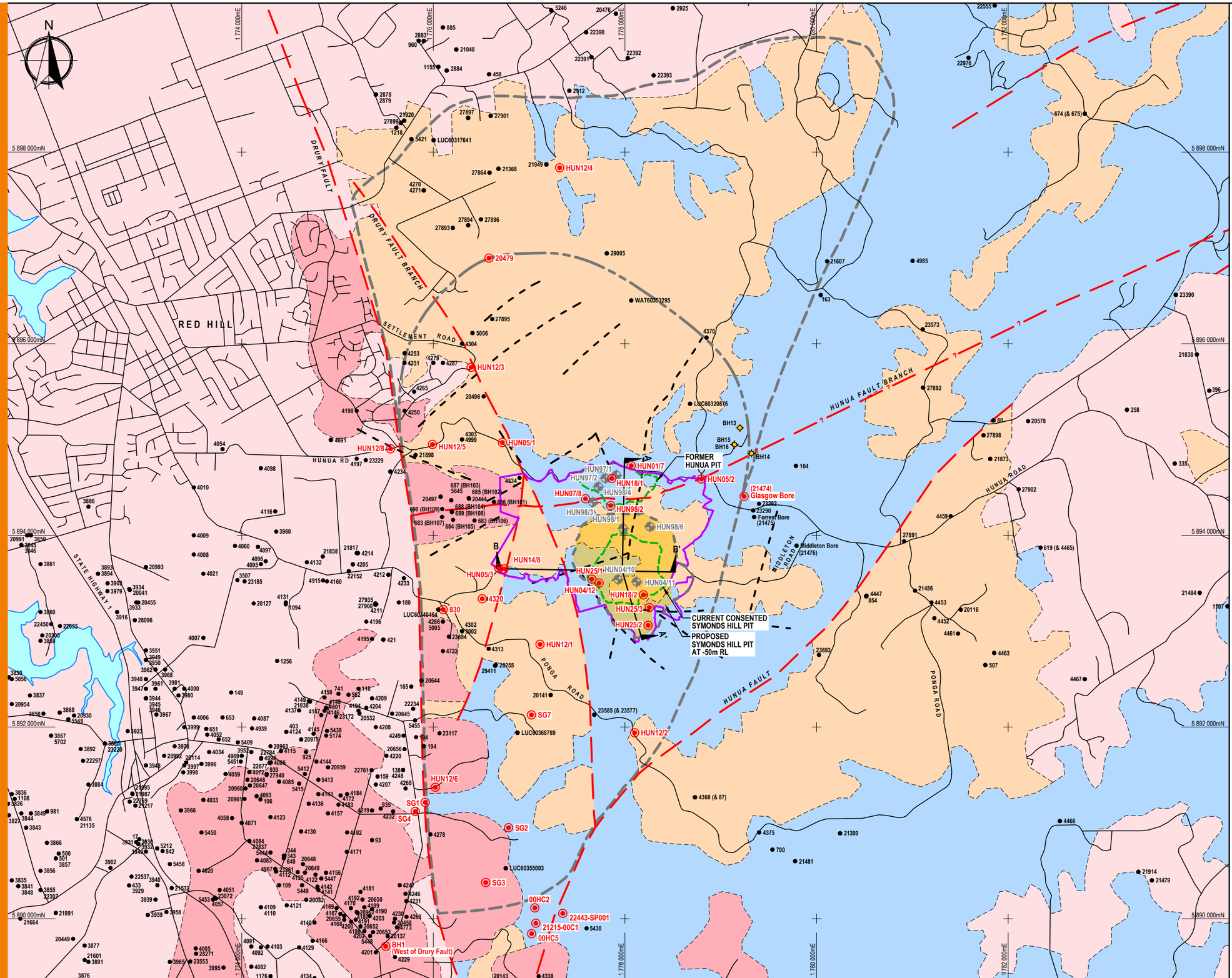


Figure 2: Regional Geology



KEY :

- HUN05/2 — GROUNDWATER MONITORING BORE
- HUN98/6 — DESTROYED/SUSPENDED GROUNDWATER MONITORING BORE
- BH13 — WATERCARE MONITORING BORE
- 22976 — FARM WELL (AC BORE ID/CONSENT No.)
- FLETCHER CONCRETE AND INFRASTRUCTURE PROPERTY BOUNDARY
- ESTIMATED ZONE OF INFLUENCE FOR DEWATERING LEVEL AT 60.0m RL AND 45.0m RL
- ESTIMATED ZONE OF INFLUENCE FOR DEWATERING LEVEL AT 15.0m RL AND -50.0m RL (HUNUA GRAYWACKE BLOCK)
- ESTIMATED SHALLOW ZONE OF INFLUENCE FOR SYMONDS HILL PIT
- A — A' SECTION LINE

GEOLOGICAL LEGEND

- SOUTH AUCKLAND VOLCANIC FIELD
- PUMICE DEPOSITS & PUKETOKA FORMATION (ALLUVIUM)
- WAITEMATA GROUP/TE KUITI GROUP (WAIKATO COAL MEASURES)
- WAIPAPA GROUP
- FAULT (APPROX.)
- LINEAMENT FROM AERIAL PHOTOS

SOURCE:

1. GEOLOGICAL UNITS AND FAULTS FROM EDBROOKE, S.W. (COMPILER) 2001, IGNS 1:250,000 GEOLOGICAL MAP 3. HUNUA FAULT BRANCH MODIFIED BY PDP.
2. BORE DATA COMPILED BY GRANT FISHER INDUSTRIAL GEOLOGY (14/12/2010) AND GROUNDWATER MONITORING DATA COMPILED (SEP 2025).
3. OTHER FARM WELLS DERIVED FROM AC BORE SEARCH, RECEIVED DEC 2025.

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A	DRAFT	JAN 26

CLIENT: WINSTONE AGGREGATES

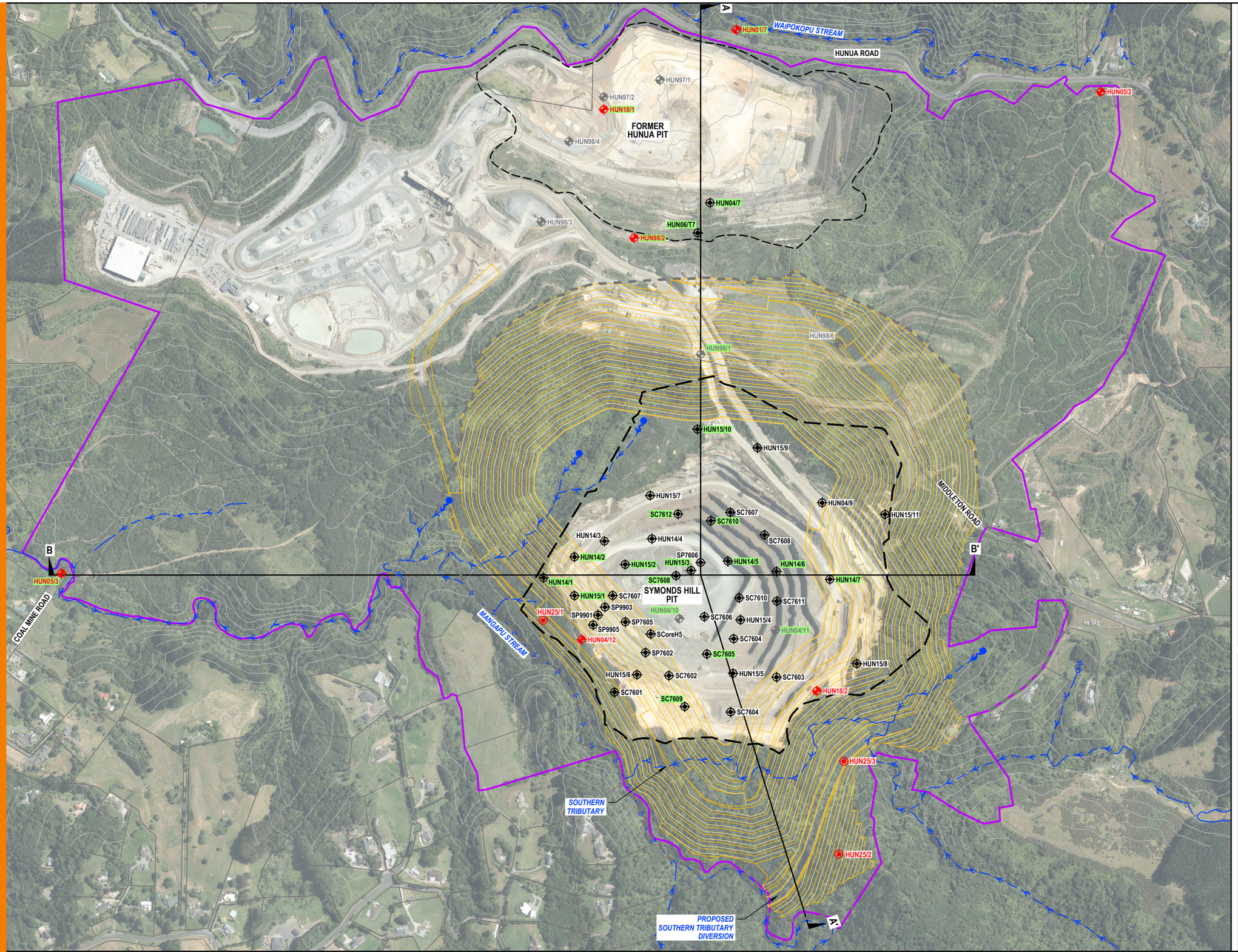
FIGURE

FIGURE 3: GEOLOGY

PROJECT

HUNUA QUARRY DEVELOPMENT: GROUNDWATER EFFECTS ASSESSMENT

FILED: A035680016-FIG-003 NZTM Geology.dwg



KEY :

- HUN05/2 — MONITORING BOREHOLE, CURRENT
- HUN97/2 — MONITORING BOREHOLE, DESTROYED/SUSPENDED
- HUN04/7 — SELECTED GEOLOGICAL INVESTIGATION BOREHOLE
- HUNXXX — PROJECTED DRILLHOLE (SEE FIGURE 5)
- SPRING
- FLETCHER CONCRETE AND INFRASTRUCTURE PROPERTY BOUNDARY
- FORMER HUNUA PIT EXTENT
- CURRENT CONSENTED SYMONDS HILL PIT EXTENT
- PROPOSED SYMONDS HILL PIT LAYOUT AT -50m RL
- ESTIMATED SHALLOW ZONE OF INFLUENCE FOR SYMONDS HILL PIT
- A — A' SECTION LINE

SOURCE:

1. URBAN AERIAL IMAGERY (FLOWN 2024-2025) SOURCED FROM THE LINZ DATA SERVICE AND LICENSED BY AUCKLAND COUNCIL FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. BACKGROUND CONTOURS (10m INTERVAL) SUPPLIED BY PRECISION AERIAL SURVEYS, DATED 18/08/2019.
3. PROPOSED SYMONDS HILL PIT LAYOUT AT -50m RL DERIVED FROM st8-fin.dxf, DATED 17/11/2025, SUPPLIED BY GRAEME FULTON.
4. CADASTRAL INFORMATION (AS AT 08/09/2019) DERIVED FROM LINZ DATA.

0 100 200 300m

SCALE 1:7,500 (A3)

NO.	REVISION	DATE
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A	DRAFT	JAN 26

CLIENT: WINSTONE AGGREGATES

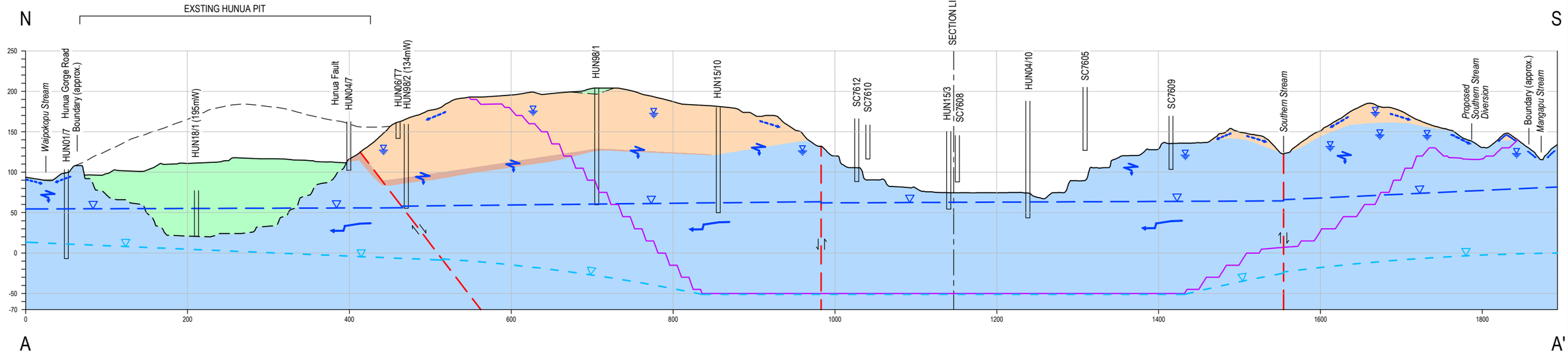
FIGURE

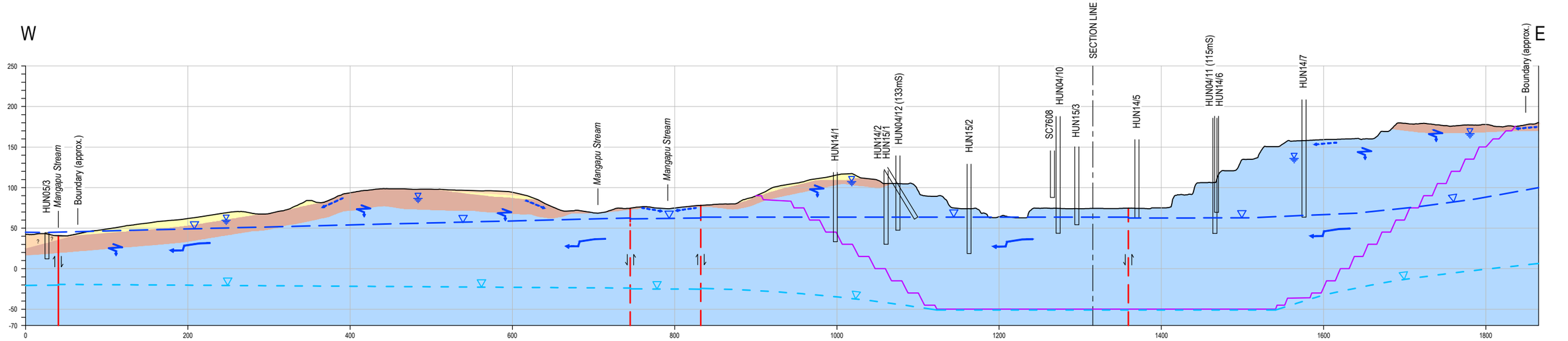
FIGURE 4: SYMONDS HILL PIT AND WINSTONE AGGREGATES PROPERTY BOUNDARY

PROJECT

HUNUA QUARRY DEVELOPMENT: GROUNDWATER EFFECTS ASSESSMENT

FILED: A035680016-FIG-004 MTE2000 Property8dy.dwg





KEY :

- QUARRY CLEAN FILL
- WAITEMATA GROUP
- TE KUITI GROUP
- HIGHLY WEATHERED GREYWACKE (WAIPAPA GROUP)
- MODERATELY WEATHERED TO FRESH GREYWACKE (WAIPAPA GROUP)

- SP7606 — DRILLHOLE
- GROUND SURFACE (OCT 2025)
- ORIGINAL GROUND SURFACE (APPROX.)
- PROPOSED SYMONDS HILL PIT AT -50m RL
- INFERRED FAULT/LINEAMENT (APPROX.)

- REGIONAL & SHALLOW GROUNDWATER FLOW PATH IN GREYWACKE
- SHALLOW GROUNDWATER FLOW PATH IN WEATHERED GREYWACKE/WAITEMATA GROUP
- RECHARGE TO DEEP/REGIONAL SYSTEM ALONG FRACTURE ZONES
- PERCHED GROUNDWATER
- DEEP GROUNDWATER LEVEL (JULY 2019)
- FUTURE GROUNDWATER LEVEL (-50m RL)

SOURCE:
1. GEOLOGICAL SECTIONS ADAPTED FROM (xs-pdp-aa-tot.dxf AND xs-pdp-bb-tot.dxf) SUPPLIED BY GRAEME FULTON, RECEIVED 30/09/2019.
2. GROUND SURFACE PROFILE AND QUARRY FILL PROFILE DERIVED FROM END OF MONTH SURVEY (OCT 2025), SUPPLIED BY WINSTONE AGGREGATES.
3. PROPOSED SYMONDS HILL PIT PROFILE AT -50m RL DERIVED FROM st8-fin.dxf, DATED 17/11/2025, SUPPLIED BY GRAEME FULTON.

0 100 200
SCALE 1:5,000 (A3)

NO.	REVISION	DATE
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A	DRAFT	JAN 26

CLIENT
WINSTONE AGGREGATES

FIGURE
FIGURE 5: INDICATIVE HYDROGEOLOGICAL SECTIONS

PROJECT
HUNUA QUARRY DEVELOPMENT: GROUNDWATER EFFECTS ASSESSMENT

FILED: A035680016-FIG-005 Sections.dwg

3.2 Groundwater Movement

The fault and fracture zones in the greywacke have created complex aquifer conditions in which perched groundwater, i.e. discontinuous zone of saturation are common. The available data indicates that both the rock matrix that make up the Waitemata Group and the greywacke have low permeabilities insufficient to contribute to significant groundwater flow. However, openings created by faulting and fracturing create aquifer conditions where low to moderate groundwater flows may occur. The presence of weathered material and gouge within, and in the margins of, the fault zones have in some areas created groundwater flow barriers. The barrier properties of the Drury Fault are supported by the results of groundwater monitoring carried out east and west of the Drury Fault as part of the consent conditions for both Drury and Hunua Quarries (PDP 2011, PDP 2012, PDP 2020 and PDP 2025).

While the greywacke extends in depth for several kilometres, the main groundwater movement is thought to occur within its upper sections where rock defect openings are widest.

The groundwater hydrographs for 32 bores and piezometers within the greywacke block are given in Appendix A. The results show, the shallow groundwater does not respond to the lowering of the sump while the groundwater level in the deeper bores respond to dewatering (i.e. lowering the sump water level).

In 2010, PDP as part of the consent (36513) located and recorded groundwater levels in residential bores surrounding the Hunua Pit at or within a 2 km radius (Appendix B). Based on this collated information, bore depths, geology and subsequent groundwater level monitoring data (Appendix A), two groundwater systems are identified. These are referred to as:

- Shallow groundwater (discontinuous zones of saturation)
- Regional groundwater (continuous zone of saturation)

These are discussed in further detail below and illustrated in Figures 3 and 5.

3.3 Shallow Groundwater

The shallow groundwater (or perched groundwater) occurs within the Tertiary sedimentary rocks and greywacke at shallow depths and are characterised by discontinuous zones of saturation, which respond and behave according to rainfall patterns (PDP 2011, PDP2020 and PDP 2025). Based on the monitoring data, the shallow groundwater within the greywacke block is generally encountered at elevations above RL60m.

Groundwater within the Waitemata Group and Waikato Coal Measures moves along the interface between weathered greywacke and overlying materials, ultimately discharging into the Mangapū Stream. As illustrated in Figure 4, springs are observed along the track on the western side of Symonds Hill Pit, typically originating from contact between Waitemata and greywacke formations.

The discontinuous nature of the shallow groundwater in greywacke is due to the heterogeneous nature of the greywacke with its sheared and weathered siltstone layers and variations in fracture density and width.

The geological data from bore logs indicate that the shallow groundwater in the greywacke occur over rocks with low fracture density, and over weathered siltstones and fractures filled with low permeability materials.

The response of groundwater levels to dewatering of the Hunua Pit supports the presence of the shallow and regional groundwaters. In general, the shallow groundwater has not shown any response to the dewatering operation and remains unaffected by the regional groundwater dewatering.

3.4 Regional Groundwater

The regional groundwater is defined as the zone of continuous saturation that extends to full depth within the greywacke across the region.

The regional groundwater is confined in some areas within the greywacke block by overburden mudstone layers within the Waitemata Group and the Waikato Coal Measures (Figure 3).

The boundary between the shallow and regional groundwater systems is generally a transitional zone where there is a gradual increase in the extent of the saturated zone with depth. The dewatering operation can also cause formation of perched conditions within the greywacke as shallow groundwater can be developed within the less permeable zones (i.e. zones with minor joints) that remain unaffected by under-drainage due to dewatering activities.

3.5 Groundwater Levels

3.5.1 Shallow Groundwater

The current monitoring piezometer details interpreted to screen in the shallow groundwater are shown in Table 3. The hydrographs for these bores are presented in Appendix A.

Table 3: Shallow Groundwater Monitoring Bores

Monitoring Bores and Piezometers	Ground Level (m, RL)	Borehole Depth (m, RL)	Current Groundwater Level (Sep 2025) (m, RL)	Formation
HUN98/1U[1]	204.89	167.96	181.40	Waitemata G.
HUN98/2L	169.3	70.6	101.05	Greywacke
HUN98/2U	169.3	101.45	127.84	Waitemata G.
HUN1/7U	103.19	62.0	87.84	Greywacke
HUN5/2U	142.16	100	126.24	Greywacke
HUN12/1U	149.8	129.81	141.42	Te Kuiti
HUN12/3U	100.4	45.2	58.52	Waitemata
HUN12/4U	73.7	38.7	42.96	Waitemata
Hun12/5U	45.6	20.6	28.64	Waitemata
HUN12/6U	55.7	31.7	35.94	Basalt
HUN 12/6L	55.9	0.9	34.12	Volcanics
HUN12/8U	27.4	19.4	24.56	Scoria/Alluvium
HUN12/8L	27.4	0.4	22.26	Basalt/Scoria
HUN12/2U	256.8	220.7	243.45	Greywacke
HUN18/2U	150.5	110	128.24	Greywacke
HUN25/2U	191	111	183[2]	Greywacke
HUN25/3U	150	115	143[2]	Greywacke

Note:

1) ***Destroyed in March 2023.***
2) ***Groundwater level on 12 Dec 2025 (HIN25/2) and 5 Dec 2025 (HUN25/3).***

The groundwater level in the Waitemata Group, Te Kuiti Group, volcanics (basalt and scoria) and alluvium have shown no response to the former Hunua Pit dewatering. Piezometers screened in the shallow greywacke rocks also show no response to the Hunua Pit dewatering and its recovery in mid to late 2017 (e.g. HUN98/2L, HUN12/2U, HUN5/2U, HUN1/7U). This confirms the hydraulic separation between the shallow groundwater and the regional groundwater. Only piezometers drilled in the deep greywacke (with screens below RL60m) have responded to dewatering.

As mentioned previously, the shallow groundwater in greywacke is caused by limited hydraulic connectivity between local pockets of saturation at shallow depths and the regional groundwater. The above limited hydraulic connectivity minimises any underdrainage effects as a result of dewatering. Therefore, the current or proposed dewatering has no effects on the shallow bores with the bore intake zone above the regional groundwater.

3.5.2 Regional Groundwater Level

The majority of monitoring bores screened in the greywacke block (Table 4) have responded to the dewatering at the former Hunua Pit. The hydrographs for these bores are shown in Appendix A. Groundwater level contour map constructed for the regional groundwater is shown in Figure 6. The contours are based on measurements taken from the deep boreholes. As shown in Figure 6, although on a local scale due to small scale faults, the flow regime is complex, on a regional scale there is a general westerly flow direction from the elevated areas of the catchments to the east. The western boundary of the Wairoa catchment (including the Mangawheau sub-catchment) forms a groundwater divide between the groundwater in greywacke that flows to the Firth of Thames and the groundwater that flows toward the Drury Fault (Figure 6).

The contours indicate a general westward trending flow pattern in the regional groundwater. These contours have been developed on relatively sparse information assuming uniform hydrogeological conditions. The water table contours can be considered indicative of the general trend in gradient across the area but are only likely to provide approximate predictions in water level between data points.

Other patterns can be deduced if the potential effects from known faults are taken into account. Weathered materials and gouge zones within fault zones can reduce hydraulic connectivity across them which may lead to the formation of fault compartments with elevated groundwater levels. If gouge zones are present the groundwater contours would be expected to show steps or discontinuities across them. A significant step is believed to occur across the main Drury Fault 2 km west of Symonds Hill and is likely to form a barrier to the westward flow of groundwater (PDP 2020).

Table 4: Regional Groundwater Monitoring Bores in Greywacke

Monitoring Bores and Piezometers	Ground Level (m, RL)	Borehole Depth (m, RL)	Current Groundwater Level (Sep 2025) (m, RL)	Formation
HUN1/7L	103.2	-6.81	54.27	Greywacke
HUN5/1L	82.03	-8.27	51.22	
HUN5/2U	142.16	97.16	126.24	
HUN5/2L	142.16	-1.34	124.42	
HUN5/3	44.21	12.21	44.9	
HUN7/8	150.16	-0.44	52.14	
HUN4/12	139.34	47.54	63.60[1]	
HUN12/1L	149.8	5.76	50.53	
HUN12/5L	45.7	-52.8	30.54	
HUN12/3L	100.5	-36.5	28.99	
HUN12/4L	73.3	-0.5	55.68	
HUN12/2L	259.0	171.5	179.77	
HUN12/4L	73.3	-0.5	55.68	
HUN14/8	46.5	-13.5	36.60	
HUN18/1	77	24	49.49 (Jan21)	
HUN18/2L	150.5	24.5	61.49	
HUN25/1U	108.6	63.5	69.9	
HUN25/1L	108.6	-4.4	57.1	
830	62.12	-34	48.37	
4320-New	87	37	50.66	
20479	127.1	10	43.92	
4370	253.0	119.8	191.37 (Feb 2018)	
Glasgow	195.0	93.6	159.7	

Note:

1) Destroyed in September 2024

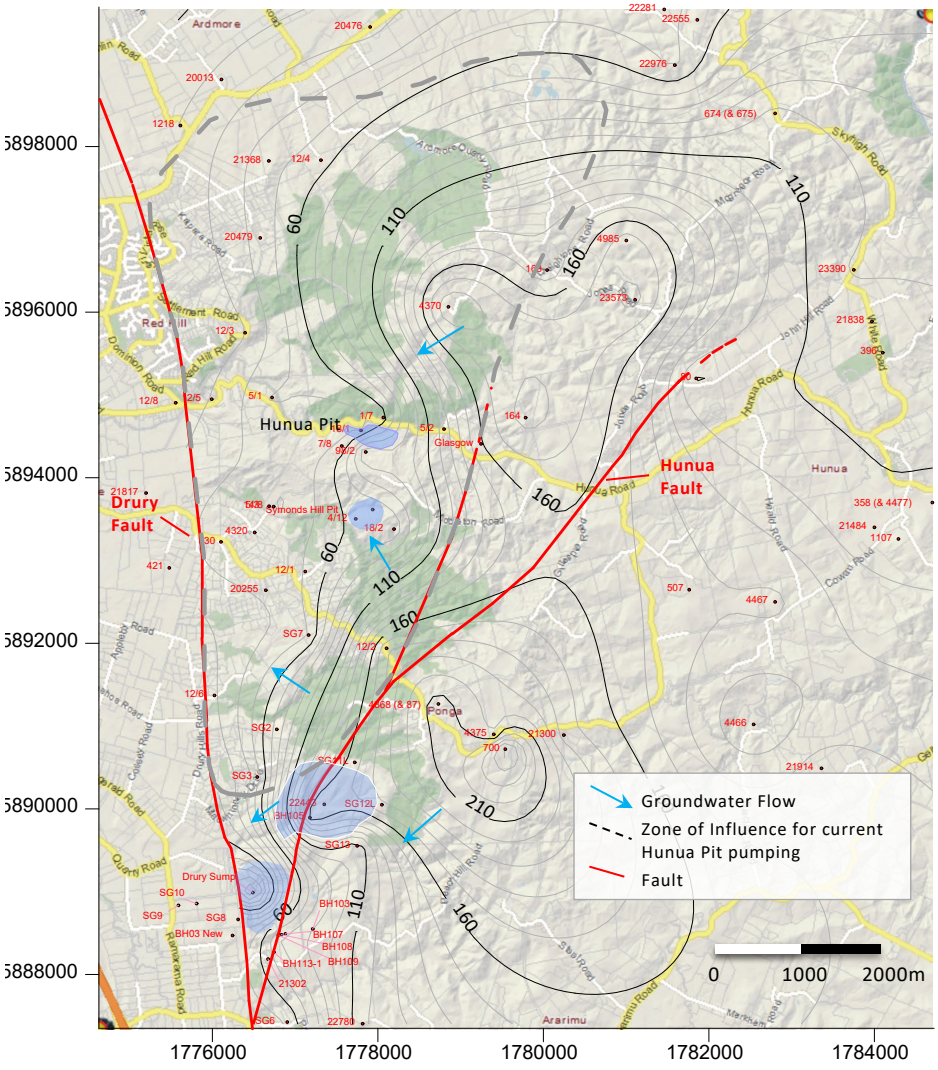


Figure 6: Groundwater Level Contours for Regional Groundwater in Greywacke (September 2025)

3.6 Groundwater Catchments

The boundary between the neighbouring groundwater catchments is defined as a groundwater divide. The locations of the greywacke groundwater divides between the neighbouring catchments are expected to be roughly midway between the respective regional groundwater sinks or discharge zones (i.e. lower reaches of the streams).

Based on a previous study (PDP 2011, 2020), the boundaries of the groundwater catchments east of the Drury Fault are roughly coincident with the topographic boundaries (i.e. surface water catchments). The configuration of the groundwater catchments in the general vicinity of Hunua Quarry is shown in Figure 1. It should be noted that the groundwater flow barriers (Hunua and Drury Faults) and their branches, can alter the undisturbed groundwater catchment boundaries.

The regional groundwater system does not appear to be freely connected to the streams at elevations above RL 60m and its flow pattern is strongly controlled by structural features such as faults.

Prior to dewatering the Hunua Pit, the regional groundwater within the general quarry area and surrounding catchment was flowing in a westerly direction towards the lower parts of the catchments where streams cross the Drury Fault (towards the groundwater sinks). Some of this groundwater now flows to the new pumping well (HUN14/8) close to Coal Mine Rd.

There is a sharp change in the slope of the regional groundwater to the east of both the Hunua and Symonds Hill Pits. This is likely to be due to a low permeability groundwater flow barrier east of Hunua Quarry, impeding the natural westward movement of groundwater from the upper catchment areas. The general westerly groundwater flow in the regional groundwater in greywacke is also disrupted by the presence of the flow barrier faults (e.g. Hunua and Drury Faults).

The shallow groundwater flow paths are contained within each surface water sub-catchment. Flow paths within the shallow groundwater are generally short and discharge close to the location of recharge in upper catchment areas, while others are longer (deeper) and discharge to lower parts of catchments.

3.7 Groundwater Flow Barriers

Across the Hunua and Drury Faults there is a significant head difference in groundwater in the greywacke confirming the flow barrier properties of these faults. These two faults extend to the north encompassing both Drury Quarry and Symonds Hill Pit.

3.7.1 Drury Fault

The Drury Fault zone forms a barrier to the natural westerly flow of groundwater (Murray North Ltd, 1987, GCNZ 1989 and Namjou 1997).

In the vicinity of where the Peach Hill and NT1 Streams cut across the Drury Fault, the regional groundwater (before any quarrying) was estimated to have been dammed up behind the Drury Fault. Under the current dewatering conditions, the head differences between the sump (RL -45m) and the groundwater level in volcanic/alluvium west of the Drury Fault (RL 31.52m at BH03New, January 2026) is about 77m. No seepage is observed on the quarry western wall which is adjacent and along the Drury Fault. Considering the above, the barrier properties of the fault are unlikely to be localised (PDP 2020).

Perched groundwater is also expected within the alluvium and Tauranga Group west of the Drury Fault above the groundwater level in basalt. However, both perched groundwater and regional groundwater west of the Drury Fault will not be affected by any quarry dewatering to the east of the Drury Fault.

3.7.2 Hunua Fault

The Hunua Fault also forms a boundary to the groundwater flow. As shown in the AA' cross sections across the quarry, the deep groundwater level in the greywacke to the east of the Hunua Fault stands above the groundwater just to the west of the fault. The average regional groundwater levels in recently drilled piezometers SG11L and SG12L west of the Hunua Fault is about RL 170m. This is about 125m higher than the groundwater level in SG3L (at RL 44.6m) east of the Hunua Fault confirming the flow barrier properties of the Hunua Fault. A similar head loss across the Hunua Fault has been documented in the vicinity of Drury Quarry (PDP 2020). Similarly, the groundwater level in Glasgow bore (ID 21474) east of the Symonds Hill Pit (Figure 1) has remained unaffected by the dewatering at the former Hunua Pit and the existing Symonds Hill Pits. This consistency indicates that the barrier property of the Hunua Fault is a widespread regional characteristic, not a localised feature.

The above results support the previous conclusions made on the groundwater barrier properties of the Hunua Fault (Murray North Ltd, 1987, GCNZ 1989 and Namjou 1997).

There are other groundwater flow barrier faults which may not yet have been detected.

3.8 Greywacke Blocks

The groundwater flow barriers (Drury and Hunua Faults and their branches) have divided the regional groundwater west of the Hunua flow barrier fault into multiple hydrogeological blocks (PDP 2025).

The two identified greywacke blocks are:

- Hunua Greywacke Block
- Drury Greywacke Block

The greywacke block to the east has been referred to the Sutton Greywacke block (PDP 2025). However, the boundaries of this block especially to the east is unknown.

3.8.1 Hunua Greywacke Block

The proposed Symonds Hill Pit development is situated within a distinct hydrogeological unit, herein defined as the Hunua Greywacke Block. This block is the primary zone contributing regional groundwater inflow to the former Hunua Pit and the current Symonds Hill Pit. A detailed discussion on the boundaries of this block is presented in Section 4.1. A general summery of the block hydraulic boundaries is presented below.

1. Hydraulic Boundaries of the Block

The zone of influence for the Symonds Hill Pit dewatering is constrained by low-permeability geological structures as shown in Figure 6 (groundwater contour map):

a) Eastern and Western Boundaries: Formed by geological fault boundaries (i.e., the Hunua and Drury Faults and their branches) or low-permeability zones, as evidenced by sharp groundwater level gradients (Figure 6).

b) Southern Extent: Monitoring data indicate a potential low-permeability zone approximately 4.7 km south of the Hunua Pit, likely forming the southern boundary of the block just south of bore SG3L (Figure 3). A significant drop in the Drury Quarry sump level (RL 16m to -45m) did not cause apparent drawdown within the Hunua Greywacke Block, and vice-versa (PDP 2020).

c) Northern Extent: Pleistocene deposits overlying the Waitemata Group and Greywacke rock mass 5 km to the north of the Symonds Hill Pit form the northern geological boundary of the Hunua Greywacke Block.

2. Internal Hydraulic Connectivity

Data reveal strong connectivity within the block but with localized barriers:

Strong Regional Connectivity: Groundwater level contours (Figure 6) and hydrograph (Figure 7) responses show significant hydraulic connectivity across the block, particularly to the south and southwest of the pits. A sudden increase in inflow at the Hunua Pit in late 2016, due to intercepting a fault, caused synchronous water level drops in deep monitoring bores across the block (e.g., HUN5/3, 4320) and north of the Drury Quarry (SG7, SG3D).

Localized Barrier at Symonds Hill: Reduced connectivity is evident between the Symonds Hill Pit and the broader block. Pumping tests at Coal Mine Road (HUN5/3) did not affect water levels at Symonds Hill (HUN4/12) (PDP 2006, 2021). This suggests a local barrier fault or zone of tighter fracturing may be isolating the Symonds Hill groundwater system, explaining its consistently higher water levels (about 10 m above other block bores).

3. Summary of Hunua Greywacke Block Conceptual Model

Therefore, the regional groundwater inflow to the pits is sourced from this discrete greywacke block, bounded by the Hunua, Drury Faults and the northern Pleistocene geological contact. This definition of the Hunua Greywacke Block confirms and refines the conceptual model developed for previous consent applications (40317, WAT60152106-A) and provides the defined hydrogeological context for the proposed development.

Note that some interference effects are expected as a result of the Sutton Block Quarry development which will be addressed in Section 4.2.3.

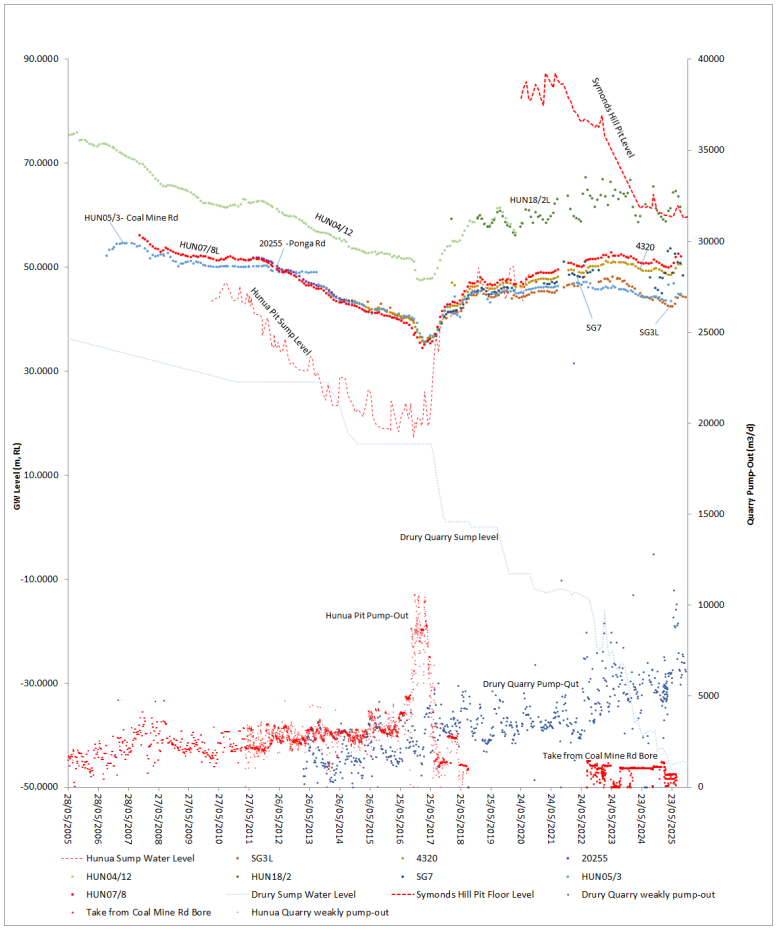


Figure 7: Hydrographs for Deep Greywacke Bores showing Dewatering Levels and Pump-Outs for both Hunua and Drury Quarries

3.8.2 Drury Greywacke Block

Groundwater monitoring data confirm the existence of a distinct, separate hydrogeological unit south of the Hunua Greywacke Block, herein defined as the Drury Greywacke Block. A low-permeability zone hydraulically separates this block from the Hunua Block to the north, preventing interference between the Drury Quarry and Symonds Hill Pit dewatering operations.

1. Evidence for a Hydraulic Boundary and Separate Blocks

The interpretation of two distinct blocks is supported by the following data:

Lack of Hydraulic Connection: Monitoring data show no relationship between water level changes in the Drury Quarry sump and drawdown within the Hunua Greywacke Block (Section 3.8). Conversely, drawdown in the Hunua Block correlates directly with dewatering of the former Hunua Pit.

Distinct Groundwater Level Zones: The groundwater level contour map (Figure 6) shows two relatively flat zones separated by a gradient:

A northern zone (Hunua Greywacke Block) between the Hunua Pit and Drury Quarry, including bore SG3L, controlled by Hunua Pit dewatering.

A southern zone (Drury Greywacke Block) bounded by the Hunua and Drury Faults and extending to their southern intersection, controlled by Drury Quarry dewatering.

Interpreted Low-Permeability Zone: The data indicate a low-permeability zone is likely present between the Drury Quarry and the deep monitoring bore SG3L, forming the hydraulic boundary between the two blocks.

Sutton Block Quarry and Potential Future Hydraulic Connectivity: The recently consented (Fast Track) development of the Sutton Block Quarry to the east involves the partial removal of a segment of the Hunua Fault. This has the potential to alter the fault's barrier properties, creating some degree of hydraulic connectivity between the Hunua Greywacke Block and the greywacke east of the fault. The implications of this potential change for the zone of influence and dewatering management have been assessed in detail in Section 4.2.3.

2. Summary of Drury Greywacke Block Conceptual Model

Therefore, the Drury Greywacke Block is a self-contained hydrogeological unit. Due to the separating low-permeability boundary, no interference effects are expected between the dewatering of the Drury Quarry and the proposed dewatering at the Symonds Hill Pit within the Hunua Block.

3.9 Recharge

The regional groundwater is recharged by downward percolation from the shallow groundwater or directly through greywacke outcrops in catchments. Locally, significant recharge may occur through the exposed fractured greywacke (including exposed fractured greywacke within the quarry pit area).

A portion of the recharge is intercepted by the perched shallow groundwater while the remainder permeates downwards to recharge the regional groundwater. The recharge intercepted by the perched layers is sufficient to sustain the base flow of the streams in the upstream areas. In general, the regional system is lower than the stream beds at elevations above RL 60m in the general vicinity of the Hunua Quarry and this prevents regional groundwater from contributing to the streams in the upper catchment areas.

3.9.1 Shallow Groundwater Recharge

The quantification of recharge to the shallow groundwater is essential, as this recharge sustains groundwater discharge to streams during dry conditions. The Mean Annual Low Flow (MALF) is adopted as a reasonable and conservative proxy for estimating this average annual recharge. This approach is based on the principle of baseflow-recharge equilibrium, where, during sustained dry periods, streamflow is dominated by baseflow discharge from the shallow aquifer. For a

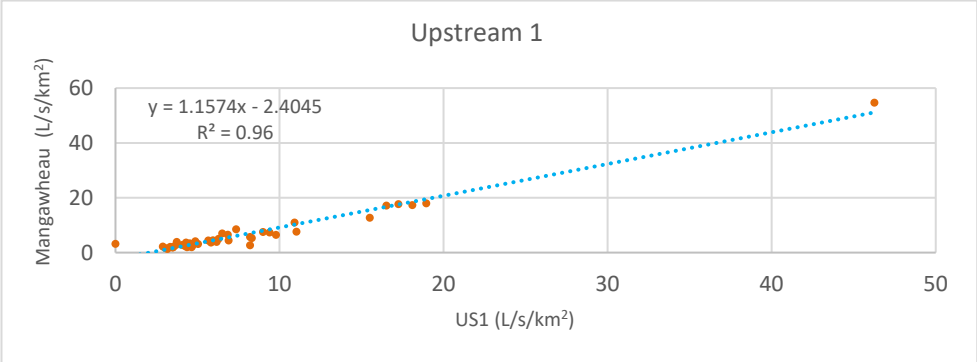
catchment in approximate long-term equilibrium, this discharge volume must be balanced by the recharge volume.

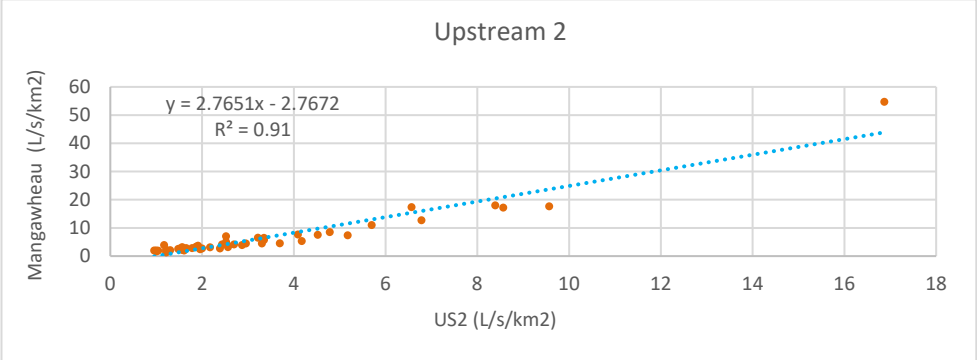
MALF is considered a more appropriate and conservative measure of this contribution than more extreme low-flow indices (e.g., the Q5, or 1-in-5-year low flow), as it represents a typical annual stress condition rather than a I-in-5 year dry conditions. Therefore, MALF provides a robust approximation of the effective recharge sustaining the shallow groundwater system.

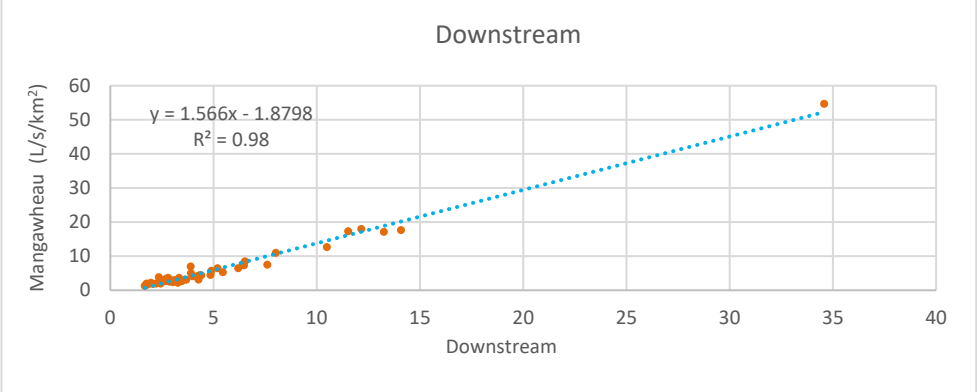
For this study the MALF is estimated based on the Mangapū and Waipokopu Streams low flow data and its correlation with the flow data from the closest catchment to the site with long-term stream flow data and a similar geology. The Auckland Council operates a stream flow monitoring station (8529) at the Mangawheau catchment which has an area of 30.4 km^2. This station has been monitored since 1988 and has been used for the stream flow correlations. Based on the Auckland Council stream flow data, the MALF for the Mangawheau Stream is 2.51 $L/s/km^2$.

Stream flow monitoring records for the Mangapū and Waipokopu Streams have been collected as part of the existing consent and are presented in Annual Groundwater Monitoring reports (e.g. Winstone 2024). The flow data for stations below RL 60, may have been affected by the Hunua Pit dewatering or regional groundwater inflows. Therefore, the assessment of recharge to shallow groundwater was made based on the correlation of the stations above RL 60m located over the greywacke (Upstream Bridge or US2, Downstream, Upstream Fork or US1 and Hays Upstream, Figure 1). The correlations for these four stations with the concurrent flows at the Mangawheau station are shown in Figure 8.

Note that the stream flow monitoring at the above stations is required as part of the existing consent (WAT60152106-A). All monitoring sites will be retained as part of the proposed consent conditions for the Symonds Hill Pit development. The coordinates of the stream flow monitoring stations are presented in Section 8.







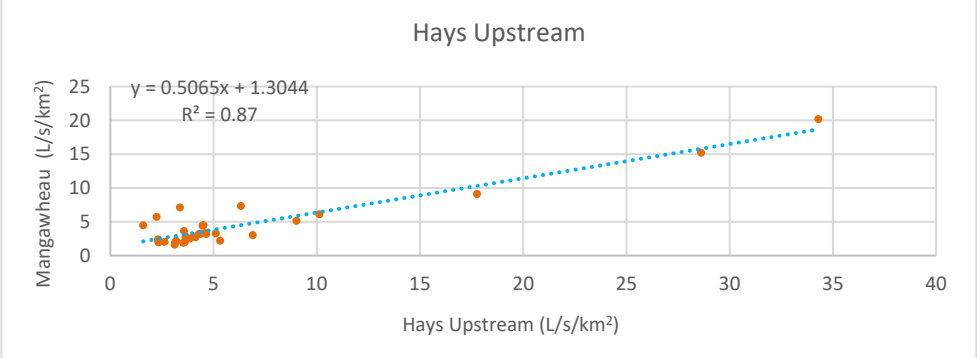


Figure 8: Correlations of Flows between Mangapū and Waipokopu Streams and Mangawheau Stream

The correlation accuracy (R^2) and the resulting MALF and Q5 (for comparison) for the above gauging stations are given in Table 5. The R^2 is above 0.87, indicating a good correlation between the data sets.

Using the same methodology, MALF and Q5 for 3 other stations along the Mangapū Stream below RL 60m (RL 55, Coal Mine and Kauri View) are also calculated as shown in Table 5. Stream bed conditions and the contributing catchment geology (e.g. extent of the overlying Waitemata Group) has contributed to variations in calculated MALF and Q5 with elevation.

Table 5: Specific Discharge Q5 for Selected Gauging Stations

Gauging Station	R^2	Q5 Low Flow L/s/km^2	MALF L/s/km^2	Catchment Area (km^2)	Elevation (m, RL)
Mangawheau Stream	-	2.03	2.51	30.4	101.5
Upstream Bridge	0.91	1.73	1.91	1.77	141
Upstream Fork	0.96	3.83	4.25	2.30	108
Downstream	0.87	2.50	2.80	4.68	77.5
RL 55	0.99	1.88	2.20	5.15	55
Coal Mine	0.91	2.14	2.45	5.73	50
Kauri View	0.91	2.41	2.72	6.18	38.5
Waipokopu Upstream[1]	0.87	1.43	2.38	9.93	106

Note:

1) The Waipokopu Stream flow data on 12 June 2009 was affected by a storm event during the gauging and was excluded from the correlation.

The average MALF of 2.84 L/s/km^2 for the stations above RL 60m along the Mangapū and Waipokopu Stream in greywacke equates to a recharge rate of about 89 mm/year, or about 7% of annual rainfall (i.e. 1,300 mm/year, Winstone 2019). This is the recharge to the shallow groundwater within the Mangapū Stream Catchment.

The estimated recharge (7% of rainfall) to the shallow groundwater is in agreement with the average recharge estimated based on the previous study (PDP 2011, 2020) as part of the existing consent (WAT60152106-A).

3.9.2 Regional Groundwater

In addition to shallow groundwater recharge, quantifying recharge to the deeper regional groundwater system is critical for assessing the long-term availability and sustainability of the regional resource. Unlike shallow recharge, regional groundwater dynamics are less directly influenced by stream low flows and are more appropriately characterized by groundwater throughflow analysis based on Darcy's Law (i.e. Q = Transmissivity × Hydraulic Gradient). Applying this method,

with a transmissivity of 86 m^2/d and a regional hydraulic gradient of 0.007, yields an average throughflow of approximately 645 m^3/d per kilometre of groundwater flowpath width. This throughflow represents the rate at which water moves through the regional aquifer, discharges to streams at elevations below RL 60m, or forms seepage into the Manukau lowlands alluvium, primarily transmitted across the Drury Fault.

This throughflow can be expressed as percentage of rainfall over the aquifer. Over the maximum predicted zone of influence of 30 km^2 (Figure 3), the calculated total throughflow of 4,900 m^3/d (645 $m^3/d/km \times 7.6$ km) equates to an average recharge rate of approximately 60 mm per year. This represents 4.6% of the mean annual rainfall (1,300 mm), a value which is identical to the regional groundwater recharge rate adopted for the existing consent (WAT60152106-A).

3.10 Groundwater Discharge Mechanism

The manner in which the natural groundwater throughflow in the regional groundwater discharges at the Hunua or Drury Faults is uncertain, but it can be inferred from the pressure heads and available hydrogeological information.

A direct seepage across these faults is not likely, due to the barrier properties of the faults discussed above. However, general upward seepage along the fault planes is likely. This is evident from springs observed behind the Hunua and Drury Faults (PDP 2011, 2012 and 2020).

The stream across the inferred position of the Drury Fault flows over alluvium deposits. Therefore, any contribution from the regional groundwater to the stream via springs (or alluvium beneath the stream channel) across the fault may be lost back to the alluvium before it can be registered in the streams within the alluvium deposits (PDP 2011).

3.11 Groundwater and Surface Water Interaction

The elevation of Mangapū Stream in the vicinity of the Symonds Hill Pit is between RL 100 to RL 120m. Before the quarry extraction commenced at the Hunua Pit, the groundwater levels at Symonds Hill (HUN4/10, HUN4/11 and HUN4/12) were at about RL 75m. Therefore, the stream is more than 20 m above the regional groundwater measured in the boreholes at Symonds Hill. The 20 m head difference indicates that the Mangapū Stream is perched in the vicinity of the Pit. This head difference reduces in a downstream direction due to the steeper gradient of the stream bed compared with the regional groundwater level. However, the stream does not appear to come in contact with the regional water table above RL 60m. The stream reaches that may potentially interact with the regional groundwater in greywacke are shown in Figure 1. Thus, the stream baseflow immediately adjacent to, and above, the Symonds Hill Pit is sourced solely from shallow groundwater.

The proposed Symonds Hill Pit development includes diversion of a tributary of the Mangapū Stream referred to as Southern Tributary (Figure 4). This tributary is above RL75m and is positioned above the regional groundwater table and are fed by discharge from the shallow groundwater system.

3.12 Hydraulic Conductivity

The hydraulic conductivity (k) is a parameter used to define the ease with which groundwater moves through the aquifer and transmissivity (T) is product of hydraulic conductivity and the aquifer thickness. The hydraulic conductivity of the greywacke rocks is controlled by fracturing and interconnection between fracture zones.

A long-term (28 days) constant head test was undertaken on HUN5/3 as part of a previous study for Winstone (PDP 2006). The results indicate a transmissivity (T) for the deeper greywacke rock of 86 m^2/d in this location. Assuming an effective aquifer thickness of 100 m, this equates to a hydraulic conductivity value of 1×10^{-5}m/s.

A more recent pumping test on HUN14/8 (PDP 2020), indicated a higher transmissivity of 258m^2/d. Assuming a similar effective thickness of 100 m, the hydraulic conductivity based on this test equates to 3×10^{-5}m/s. This higher hydraulic conductivity is not representative of whole Hunua Greywacke Block. For example, a much lower hydraulic conductivity detected in bores closer to the Symonds Hill Pit (HUN4/12 and HUN18/2). The hydraulic conductivity in these bores based on slug test were 1×10^{-7}m/s and 4×10^{-7} m/s. A lower hydraulic conductivity was also detected in HUN5/2L east of the Hunua Pit. The hydraulic conductivity results are summarised in Table 6.

Table 6: Hydraulic Conductivity Results

Bore	Test Method		T m^2/s	T m^2/s (Average)	K (m/s)
HUN5/2L	Falling Head	Bouwer & Rice	138	138	8×10^{-6}
HUN4/12	Falling and Rising Head Test s	Bouwer & Rice	1.7	1.7	1×10^{-7}
HUN18/2	Falling and Rising Head Tests	Bouwer & Rice	6.9	6.9	4×10^{-7}
HUN05/3	Free Flowing Test	Jacob and Lohman	86	198	1.3×10^{-5}
	Constant Discharge	Cooper and Jacob	260		

		Theis Recovery	248		
HUN14/8	Constant Discharge	Cooper and Jacob	259	261	1.5 x 10^{-5}
		Theis Recovery	264		
Geometric Mean				**38.6**	**2.2 x 10^{-6}**

The slug tests (falling and rising heads) are less accurate than pumping tests, so the actual hydraulic conductivity is likely to be higher than the above geometric mean. Nevertheless, the results suggest a potentially lower permeability zone in the vicinity of the Symonds Hill Pit. This may also explain a 10m head difference between the groundwater levels next to the Symonds Hill Pit and the groundwater levels next to the Hunua Pit and to the west and south of the Symonds Hill Pit.

In addition, back calculations using the inflow test data suggest a higher bulk permeability in the vicinity of the Symonds Hill Pit than 39m^2/d. The Symonds Hill pit inflow test carried out between 10 Dec and 15 Dec 2025 in dry condition (no rainfall). During this period, the inflow to the sump was measured as 424 m^3/day. Pumping has created a drawdown of approximately 3.7 m from the initial groundwater level (RL 63.6m) to the current pit floor (RL 60m), where the water level is being maintained. Based on sump water level data, the pit has intercepted the regional groundwater table since 12 March 2024, a period of 643 days. The storativity is calculated based on the pumping test to be about 4 x 10^{-4}. Using the above parameters and Jacob approximation, the hydraulic conductivity is back calculated to be about 5 x 10^{-6}m/s (T = 86 m^2/d for 200 m effective aquifer thickness).

This is the same transmissivity used for the existing consent and considered to be appropriate for the current assessments for the proposed Symonds Hill Pit development.

3.13 Water Quality

Samples for water quality analysis were taken from Mangapū Stream in 2013. Two rounds of surface water quality sampling were undertaken on 1 Feb 2013 and 14 March 2013 at several points along Mangapū Stream. The sampling sites were at RL 55, Kauri, Ponga Rd (Bridge) and Ponga Downstream (61 Ponga Rd) as shown in Figure 1. A sample was also taken from HUN5/3 (Coal Mine Rd) for water quality analysis on 12 December 2005 and the chemistry of the Hunua Pit sump water has been monitored since 2003 (Winstone 2019). The Symonds Hill Pit sump was also sampled in October 2024. For complementing the above data, samples were also taken from Mangapū Stream in December 2025 at four locations as per Figure 1 – Downstream, Upstream 1 (Fork)[east], Upstream 1 (Fork)[south], Upstream 2. Piper diagrams were used to differentiate the water samples into water types according to their respective ionic compositions.

These diagrams are useful for looking at similarities and differences among water samples. The ionic compositions of samples recovered to date, as described above, are shown in Figure 9.

Groundwater and surface water are clearly differentiated. Groundwater is magnesium-bicarbonate type with some pit samples being mixed to calcium-chloride type (possibly reflecting some contribution from the Waitemata and Te Kuiti Groups to the sump water). The Symonds Pit has a similar chemical composition to the Hunua Pit.

Surface water above RL 60m elevation in both the Symonds and Waipokopu Stream Catchments are sodium-chloride type. Whereas surface water below RL 60m elevation in the Symonds Catchment has a more mixed ionic composition. This likely reflects a regional groundwater contribution to stream baseflow at lower elevations up to the Drury Fault.

Based on the results, the water chemistry of Mangapū Stream does not change noticeably as the stream crosses the Drury Fault. The similarity in chemistry on both sides of the fault may indicate that the shallow groundwater contribution to the stream flow is more significant than any contribution from the regional groundwater. This is also in line with the conclusion (PDP 2020) that any contribution from the regional groundwater to the stream (or alluvium beneath the stream channel) across the fault may be lost back to the alluvium aquifer to the west of the Drury Fault before it can be detected at the stream flow gauging stations west of the Drury Fault (Ponga Rd and Ponga Rd Downstream Stations).

The water chemistry in the stream closely reflects the expected chemistry of rainwater. This is evident from the very low electrical conductivities (EC <25 mS/m) for the stream samples. Groundwater samples taken from the Hunua Pit sump show a higher EC (50-60 mS/m) due to the high carbonate (alkalinity) and high sulphate content. This is expected for groundwater in greywacke with high carbonate and sulphate, both of which have a high solubility in neutral pH. The elevated levels of these ions in the groundwater compared with surface water samples along Mangapū Stream indicates that the stream is fed predominantly by shallow groundwater rather than regional groundwater (though regional groundwater may account for some proportion of flow below RL 60m elevation as discussed above).

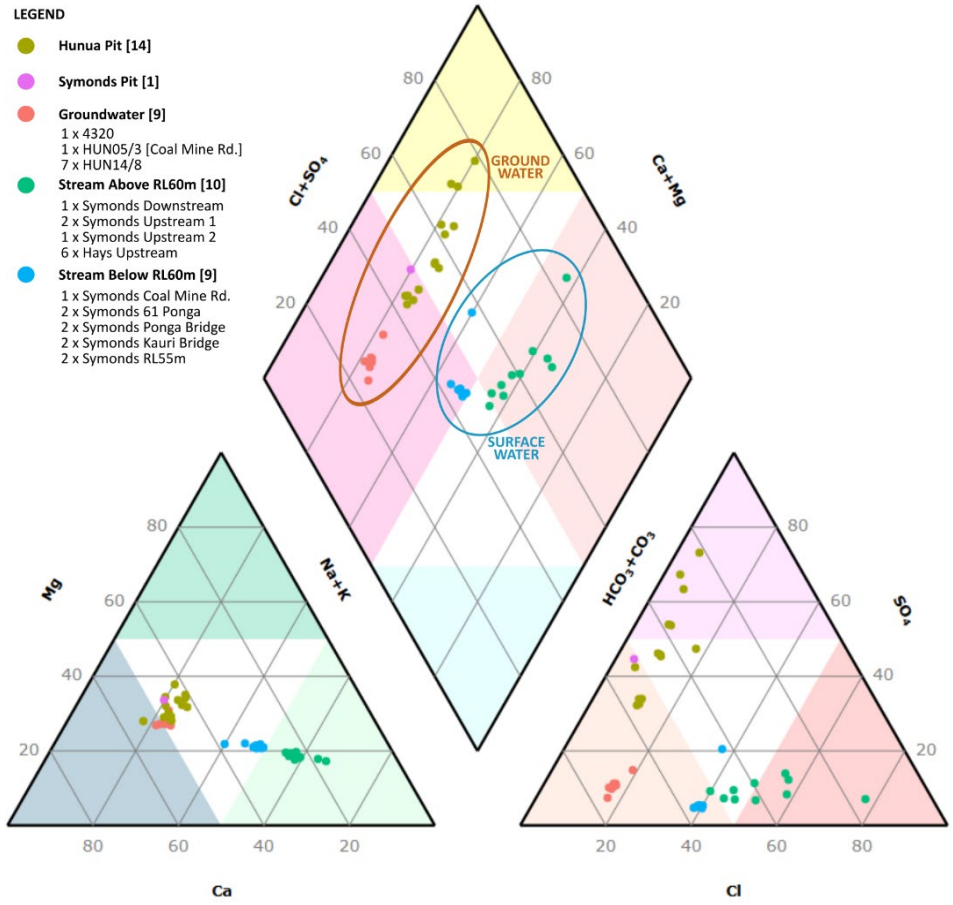


Figure 9: Piper Diagram - Groundwater and Surface Water Chemistry

3.13.1 Proposed Stream Diversion Baseline Water Quality

Water quality samples were taken at four locations along Mangapū Stream on December 1, 2025: Upstream 1, Upstream 2 (tributary), Upstream 3, and Downstream (see Figure 1). Upstream 2 is the stream planned for diversion. Key results are in Table 7; the complete lab report is in Appendix C.

The data shows little to no variation between sampling sites that are upstream of the quarry discharge and the downstream sampling point. The concentration of some parameters (Aluminium, Copper and Iron) exceeds default guideline values for 95% species protection. However, the exceedances are relatively minor both upstream and downstream of the quarry discharge, indicating the quarry discharge has less than minor effects on stream water quality.

Table 7: Mangapū Stream Baseline Chemistry (December 2025)

Parameter	Unit	Upstream 1	Upstream 2	Upstream 3	Downstream	DGV (95% Species Protection)
Total Aluminium	g/m^3	0.4	0.57	0.65	0.59	0.055
Total Arsenic	g/m^3	< 0.0011	< 0.0011	< 0.0011	< 0.0011	0.024
Total Boron	g/m^3	< 0.053	< 0.053	< 0.053	< 0.053	0.94
Total Cadmium	g/m^3	0.000181	< 0.000053	< 0.000053	< 0.000053	0.0002
Total Chromium	g/m^3	0.00068	0.00062	0.0009	0.00089	0.001
Total Copper	g/m^3	0.00144	0.00143	0.0014	0.00167	0.0014
Total Iron	g/m^3	1.01	1.16	0.91	0.99	0.28
Total Lead	g/m^3	0.00048	0.00063	0.00055	0.0006	0.0034
Total Manganese	g/m^3	0.027	0.0181	0.0147	0.0146	1.9
Total Mercury	g/m^3	< 0.00011	< 0.00011	< 0.00011	< 0.00011	0.0006
Total Molybdenum	g/m^3	< 0.00021	< 0.00021	< 0.00021	< 0.00021	0.034
Total Nickel	g/m^3	0.00081	0.00078	0.00067	0.00072	0.011
Total Zinc	g/m^3	0.0025	0.0028	0.0021	0.0023	0.008
Total Ammoniacal-N	g/m^3	< 0.010	0.011	< 0.010	< 0.010	0.9
Nitrate-N	g/m^3	0.39	0.39	0.27	0.28	1.1

In summary, the water quality evidence demonstrates that the existing quarry operation is not adversely affecting the Mangapū Stream water quality. The proposed development is predicted to continue this outcome, as it relies on the same proven management practices within an unchanged hydrological system.

4.0 Assessment of Effects on Groundwater

4.1 Current Zone of Influence

Winstone is currently taking groundwater for their quarry operation from a pumping bore (HUN14/8). The average groundwater take from this bore from 2022 to the present has been about 856m^3/d. In addition, the current inflow to the existing sump at RL60m based on the 5 days sump inflow test (as per existing consent conditions) in dry conditions is 424 m^3/d. Therefore, the current total inflow and take from the greywacke regional groundwater is 1,280 m^3/d.

The current zone of influence for the above inflow and take is contained within the Hunua Greywacke Block, as defined in the conceptual model (Section 3.8). This section defines the extent of the current zone of influence and the associated drawdown distribution.

To quantify drawdown from current operations, pre-quarry groundwater levels were subtracted from recent groundwater level monitoring data. Pre-quarry groundwater at the Hunua Pit was approximately RL64m. Dewatering commenced in November 2002, with the sump level reaching a minimum of RL20m by July 2015. This level was maintained until an inrush event in 2017 before backfilling. The water level has since recovered to approximately RL52m (September 2025, Bore HIN07/8). Figure 10 shows the calculated drawdown contours resulting from the current dewatering and water supply bore abstraction.

4.1.1 Extent of the Current Zone of Influence

Based on the drawdown analysis, the current zone of influence extends approximately 2.4 km north and 4.7 km south of the quarry sump, covering an area of roughly 18 km² (Figures 3 and 10). The zone is estimated to have reached its maximum practical extent to the east, west, and south, forming a wedge-shaped area centred on the Hunua Pit.

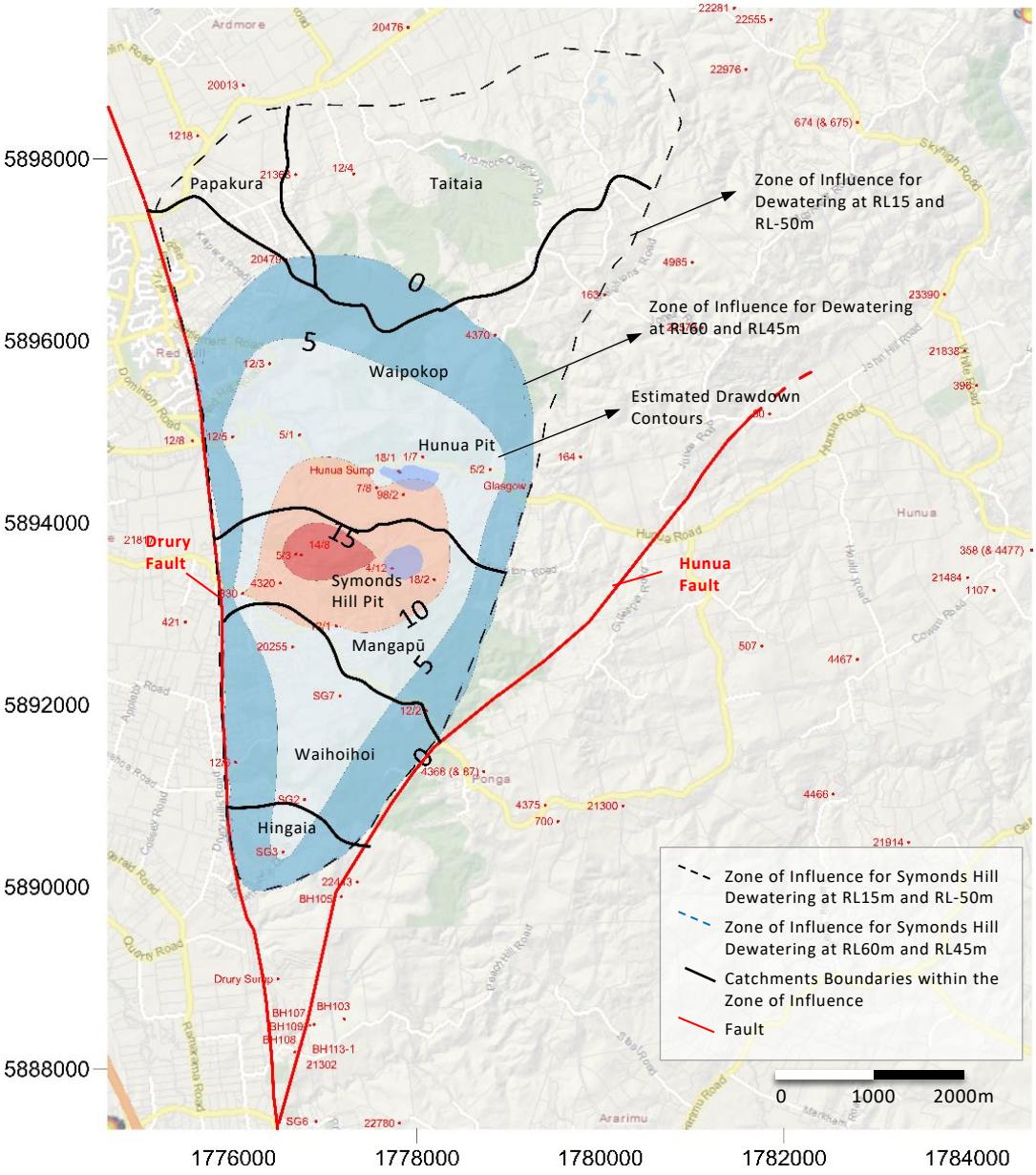


Figure 10: Symonds Hill Pit Current Zone of Influence for Dewatering Level at RL 60m and Estimated Drawdown Contours

Western Boundary of Zone of Influence

Groundwater level data (Appendix A) shows that the groundwater levels in alluvium and volcanic rocks, west of the Drury Fault are about 15 to 40 m lower than the groundwater levels within the greywacke block to the east of the Drury Fault within the greywacke block.

On the basis of the information collected for this project and from other sites, the Drury Fault is shown to act as a groundwater flow and drawdown response barrier. Note that the basaltic dykes that have intruded within or next to the fault zone do not appear to provide a hydraulic connection between the aquifers either side of the fault and behave independently. The groundwater levels west of the Drury Fault show normal natural seasonal variations and do not show any downward trends associated with dewatering quarry excavations (PDP 2011, PDP 2015 and 2020).

Eastern Boundary of Zone of Influence

Groundwater level data shows a steep hydraulic gradient (sharp rise in groundwater levels) towards the Glasgow bore (21474, Figure 6).

The groundwater level monitoring data for Glasgow bore (to the east of the Hunua flow barrier fault) was analysed to confirm the barrier property of the fault which forms the eastern boundary of the Hunua Greywacke Block.

To confirm this, groundwater levels in the Glasgow Bore were compared to Accumulated Monthly Residual Rainfall (AMRR, see Ferdowsian et al. 2001), a tool to distinguish climatic trends from pumping impacts.

AMRR is the progressive accumulation of rainfall for each month less the average monthly rainfall for the period of analysis and can be used to assess groundwater level characteristics such as rainfall influence, recharge lag times and potential external effects on the aquifer (Ferdowsian et al 2001). The AMRR value trends upwards during times of rainfall excess and trends downwards during times of rainfall deficit compared to the mean. AMRR (based on 70-year average) at NIWA station 1965 (Ardmore) and groundwater hydrograph for the Glasgow bore is shown in Figure 11. The rainfall data from the Hunua pit station gathered since 2003 was incorporated into the data set for a more accurate assessment of local rainfall conditions at the site in the past 22 years.

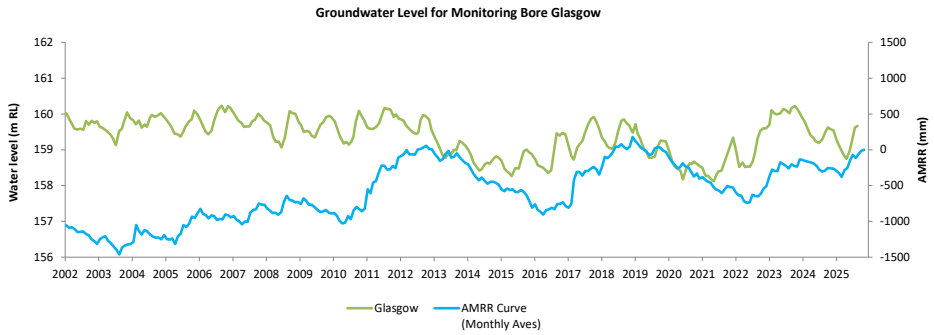


Figure 11: Groundwater Levels in the Glasgow Bore as compared to the Accumulated Monthly Residual Rainfall

The data shows a reduction in rainfall between 2013 and 2016 and then again between 2019 and 2022. The rise in rainfall is evident between 2017 to 2018 and then again between 2022 and 2024.

A similar trend is evident for the hydrograph. The minor reduction in groundwater levels in the Glasgow bore is more likely to be due to the reduction in long-term rainfall trend rather than any dewatering effects.

A similar reduction in groundwater levels is also observed between the groundwater levels in the monitoring bores within the greywacke block and farm wells to the east (Bores 164 and 23573) and south (Bore 700).

An abrupt hydraulic head drop of over 125m between the groundwater elevation in the Glasgow Bore and the other wells in the greywacke rocks to the east of the pit (Bores 164, 23573 and 700) is likely to be due to geological structure (groundwater flow barrier faults) impeding the natural westward movement of groundwater from the upper catchment areas or a low permeability zone in the greywacke. The potential barrier fault (or low permeability zone) forms the eastern boundary to the zone of influence and acts to restrict drawdown effects from extending eastwards. The structure is likely to be an uncharted branch of the Hunua Fault that are not identified on the geological maps (PDP 2011 and PDP 2020).

A similar head drop has also observed along the same fault to the south. The head difference between SG12L (to the east of the Hunua Faut) and SG3 to the west of the same fault is about (170-60m). This indicates the barrier properties of the Hunua Fault, and its branches are widespread and this barrier fault forms the eastern boundary of the Hunua Greywacke block.

Southern Extent of Zone of Influence

The southern boundary of the zone of influence is defined by the hydrogeological separation between the Hunua and Drury quarries.

Monitoring data from deep bores south of the Hunua Pit (e.g., HUN5/3, HUN12/1L, 20255, 830, 4320, SG3L, and SG7) show a clear and synchronous response to dewatering at the Hunua Pit. A sharp drop in levels across all these bores between October 2016 and April 2017 corresponds to a sudden storage release into the Hunua Pit (Figure 7). Following the Hunua Pit backfilling (May–October 2017), groundwater levels in these same bores recovered with similar trends.

Critically, this recovery occurred despite a concurrent 15-metre drop in the dewatering level at the Drury Quarry sump, located 1.4 km south of SG3L, between July 2017 and October 2018. This demonstrates a lack of hydraulic connection; water levels in bores north of SG3L (within the Hunua Greywacke Block) are controlled by Hunua Pit conditions, not by the Drury Quarry.

This interpretation is supported by groundwater level profiles along a north-south section (Figure 12). Profiles from 2017 (Hunua Pit at RL 26m, Drury at RL 16m) and August 2018 (after Hunua recovery and the 15m Drury drawdown) show that all bores between the pits responded to the Hunua Pit recovery, irrespective of the major drawdown at Drury.

The data indicate a low-permeability zone or hydraulic divide exists south of SG3L, separating the drawdown zones of influence of the Hunua and Drury Quarries. This conceptual model aligns with previous assessments (PDP 2011, PDP 2012) that informed the existing resource consents.

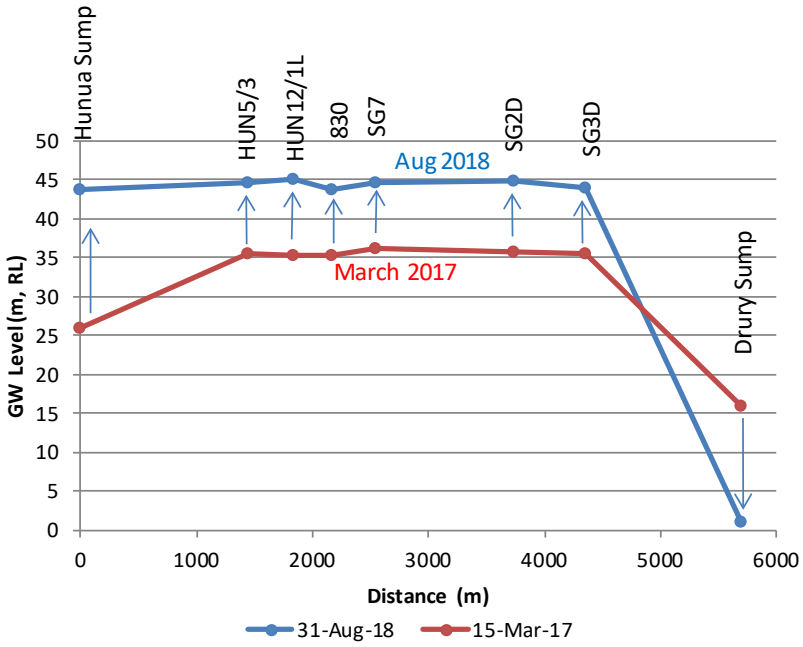


Figure 12: Groundwater Level Profile between the Hunua Pit and Drury Quarry (SG7 measurement in 2018 is for May 2018 after its installation)

Northern Extent of Zone of Influence

Monitoring data confirm the current zone of influence does not extend significantly to the north, limited by geological structure and depth. North of the quarry, Pleistocene deposits overlie the greywacke, and the rock head elevation drops sharply towards the Ardmore-Clevedon valley, reaching depths of approximately RL -300m. Hydrographs from the northern deep greywacke bores (20479, HUN12/4, and 4370) show no measurable response to Hunua Pit dewatering.

This is confirmed by analysing groundwater levels in bores HUN12/4 and 4370 against Accumulated Monthly Residual Rainfall (AMRR) (Figures 13 & 14). The hydrographs track long-term seasonal climatic trends, with no deviation correlated to quarry dewatering activities. The zone of influence has therefore not propagated north to affect these boreholes.

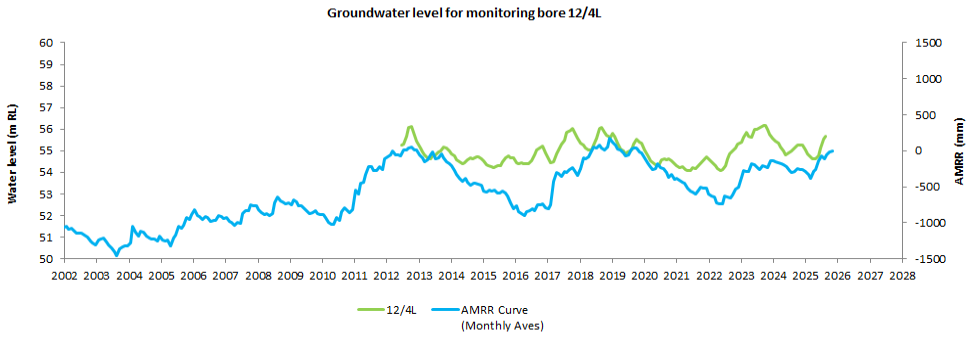


Figure 13: Groundwater levels in HUN12/4 as compared to the Accumulated Monthly Residual Rainfall

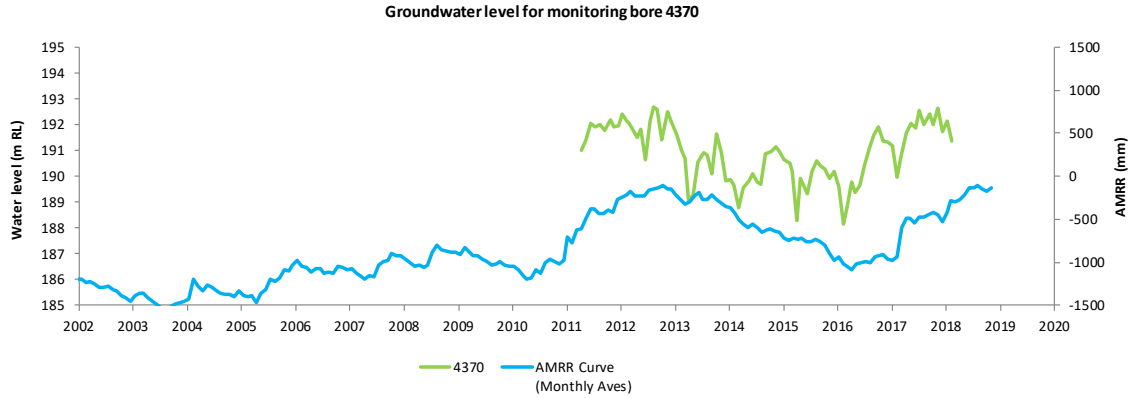


Figure 14: Groundwater levels in 4370 as compared to the Accumulated Monthly Residual Rainfall (monitoring was discontinued in this bore since 2018 due to access)

In summary, the current zone of influence is contained within the Hunua Greywacke Block, a wedge-shaped area bounded by the Drury Fault to the west, a branch of the Hunua Fault to the east, a hydraulic divide near the Drury Quarry to the south, and geological deepening to the north. Its maximum extent under current pumping conditions is shown in Figure 3.

4.2 Predicted Zone of Influence and Drawdowns

As discussed in Section 3.8 and 4.1, geological boundaries (including groundwater flow-barrier faults) create significant variability in groundwater level response to dewatering. Given this complexity, an empirical approach has been adopted to predict future dewatering impacts.

Drawdown effects were assessed for the maximum proposed dewatering level (RL -50m) and for all three quarry dewatering phases 1 to 3 (RL45m, RL15m and RL-50m).

4.2.1 Methodology and Assumptions

Drawdown predictions at monitoring bores are based on an empirical distance–drawdown relationship derived from historical dewatering and abstraction data. After a prolonged period of pumping, drawdown plotted against the logarithm of distance from the dewatering area typically forms a straight line, consistent with the Cooper–Jacob solution for radial flow to a pumping well.

The slope of this semi-logarithmic plot - denoted **A** and expressed in metres per log-cycle of distance - was determined from groundwater-level drawdowns measured in monitoring bores. This empirically derived slope inherently incorporates all site-specific conditions, including aquifer properties, interference between abstraction points, and the influence of surrounding geological boundaries.

For this assessment, it is conservatively assumed that the slope **A** remains constant as the pit deepens and total abstraction increases, representing a geometrically similar expansion of the cone of depression.

Distance–drawdown plots were generated for two distinct dewatering scenarios as Shown in Figure 15:

Scenario A: Hunua Pit Data (2017)
When the Hunua Pit was at its lowest level (RL 20m, ≈45 m of drawdown), the sump was held constant for over one year with an average inflow of ≈2000 m^3/d (before the sudden spike in groundwater inflow). The slope **A** was calculated in two ways:

- **Best fit:** Based on all monitoring data.
- **Conservative fit:** Based on the maximum observed drawdowns in monitoring bores.

Results:
Best-fit slope = 22.1 m/log-cycle
Conservative slope = 11.4 m/log-cycle

Scenario B: Existing Conditions (Post-2022)
Under current operations, abstraction is dominated by the Coal Mine Rd Bore (HUN 14/8), supplemented by inflow to the sump, which has recently intersected groundwater. Given the potential for a low-permeability boundary between the Symonds Hill Pit and the surrounding greywacke block, the production bore HUN 14/8 is treated as the effective centre of the cone of depression under the current dewatering conditions.

As in Scenario A, the slope **A** was determined for:

- **Best fit:** All monitoring data.
- **Conservative fit:** Maximum observed drawdowns.

Results:
Best-fit slope = 6.7 m/log-cycle
Conservative slope = 3.4 m/log-cycle

4.2.2 Predicted Drawdowns

Drawdowns in bores hydraulically connected to the Symonds Hill Pit were predicted using the established logarithmic distance–drawdown relationship, consistent with previous consent-supporting assessments.

The **flatter slope (A = 3.4 m/log-cycle)** represents a conservative, worst-case scenario for regional impacts, as it implies drawdown attenuates more slowly with distance. This value, derived from current operations under the influence of both abstraction points (HUN 14/8 and the sump), has been adopted for all quarry-deepening stages.

To address uncertainty regarding interference effects—especially as the sump drops to RL -50 m (about 125 m of drawdown)—the following conservative simplifications were applied:

1. The distance–drawdown relationship is centred on the sump (the dominant future take point).
2. For each monitoring bore, the **distance to the nearest abstraction point** is used (e.g., HUN 5/3 is 50 m from the take sink (HUN 14/8) but 1.2 km from the Symonds Hill sump, so the distance used for drawdown prediction is 50 m).
3. The conservative slope (A = 3.4 m/log-cycle) is retained.

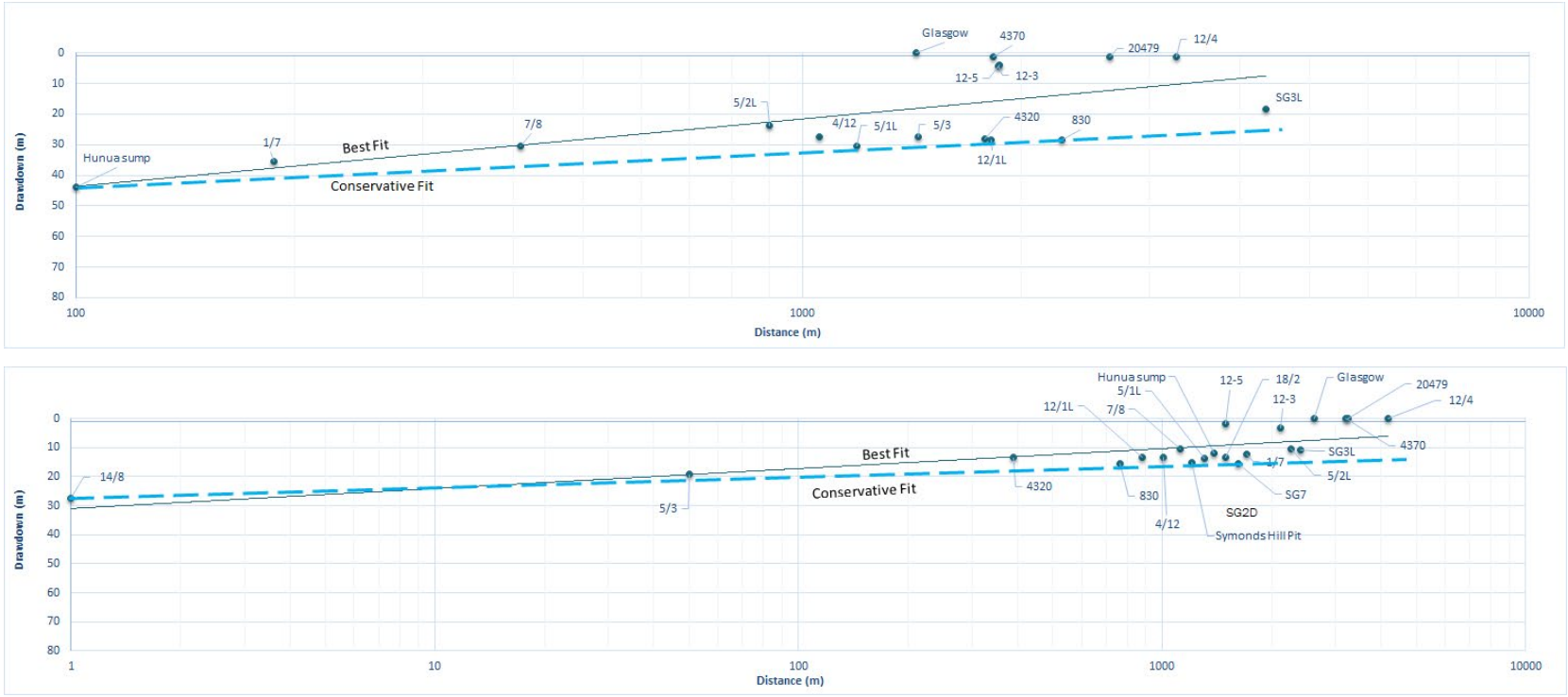


Figure 15: Observed Distance Drawdown Plots for Hunua Pit at its Lowest Level, RL 20m in 2017 (Scenario A, Top) and the Existing Dewatering Conditions (Scenario B, bottom)

This approach can produce drawdown estimates that exceed the sump drawdown at very close distances (e.g., drawdown of 128.5 m at HUN 5/3) and may cause data points to deviate from a straight line on a distance–drawdown plot. While this likely overestimates impacts (because interference is already embedded in the empirical slope), the above conservative approach is considered justified given the uncertainties associated with major increases in dewatering depth.

Predictions are calculated using the equation:

$$s(r) = s_{sump} - A \times \log_{10}\left(\frac{r}{r_{sump}}\right)$$

where:

- s(r) = predicted drawdown at the monitoring bore (m),
- s_{sump} = target drawdown at the sump (m),
- A = 3.4 m/log-cycle (conservative slope),
- r = distance from the monitoring bore to the nearest abstraction point (m),
- r_{sump} = effective radius of the dewatering area (i.e. 150 m, based on a 7ha pit below RL 75 m).

The predicted distance drawdown plots for the dewatering levels for dewatering Stages 1, 2 and 3 (at RL45m, RL15m and RL-50m respectively) is shown in Figure 16. The predicted drawdowns for all monitoring bores are presented in Table 7.

As discussed in Section 4.1, no drawdowns have been observed in 20479, HUN04/12 and 4370 under the past Hunua Pit dewatering at RL20m (45 m drawdowns) or current dewatering conditions at the Symonds Hill Pit with the sump water level at RL60m (drawdown of about 15 m). This may be due to a low permeability zone or a barrier fault to the north of the Hunua Pit. There is a possibility that as the Symonds Hill pit widens and deepens, some hydraulic connection between the above bores and the pit may be established. Therefore, it is conservatively assumed that the drawdowns in these bores will be about 20% of the maximum drawdowns in the Symonds Hill Pit.

It should be emphasised, that variability in geological conditions will likely cause individual locations to deviate from this relationship as has occurred previously. A potential for a barrier fault or low permeability greywacke (with tighter fractures) between Symonds Hill and the rest of the greywacke block can also attenuate the drawdowns away from the Symonds Hill Pit and reduce the extent of zone of influence (envelop of effects).

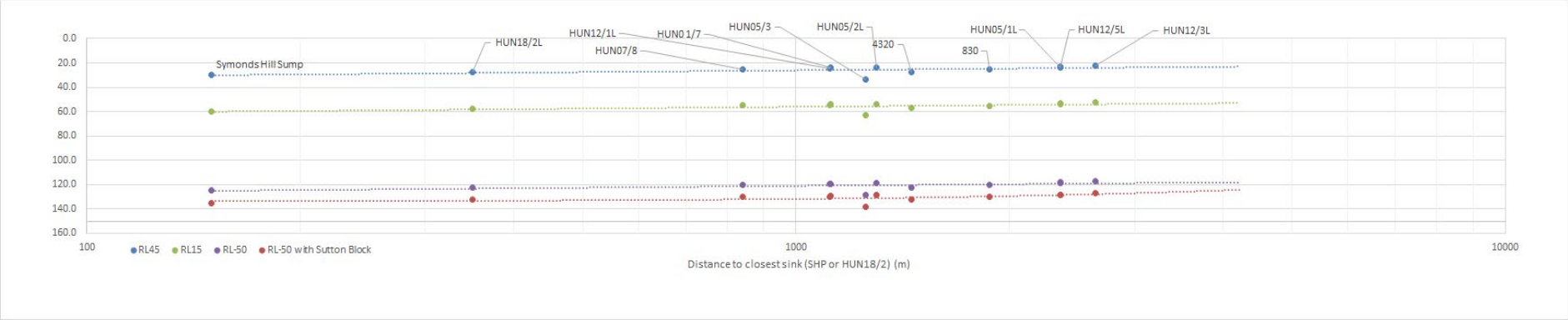


Figure 16: Distance drawdown plots for Proposed Symonds Hill Dewatering Stages including Dewatering Stage 3 with Interference Effects from the Sutton Block Quarry Dewatering

4.2.3 Interference Effects with the Sutton Block Quarry

The Hunua Fault acts as a flow barrier fault and if it would have remained intact, there was no interference effects between the Sutton Block Quarry and the groundwater levels within the Hunua Greywacke Block.

The future dewatering level at the recently consented Sutton Block Quarry requires partial removal of a section of the barrier fault (Hunua Fault) which forms the eastern boundary of the Hunua Greywacke Block. This may cause interference effects after the Sutton Block Quarry floor drops below the target dewatering level at the Symonds Hill Pit.

Before reaching the target dewatering level of RL -50m (at the Symonds Hill Pit), there would be no interference effects as a result of the partial removal of the Hunua Fault. Currently the groundwater level to the east of the Hunua Fault within the proposed Sutton Block Quarry is about 100m above the pre-quarry groundwater level at the Hunua Greywacke Block (at about RL 64m). This means, the dewatering excavation at the Sutton Blocks will be commenced 100 m above the current Symonds Hill sump level at RL 59.5m. Therefore, the pit floor at the Sutton Block Quarry is likely to remain always above the Symonds Hill Pit (Figure 17) until the Symonds Hill Pit reaches its lowest target level at RL -50m (Dewatering Phase 3). Before this point, any partial removal of the barrier fault occurs above the regional groundwater in the Hunua Greywacke Block and no interference effects is expected.

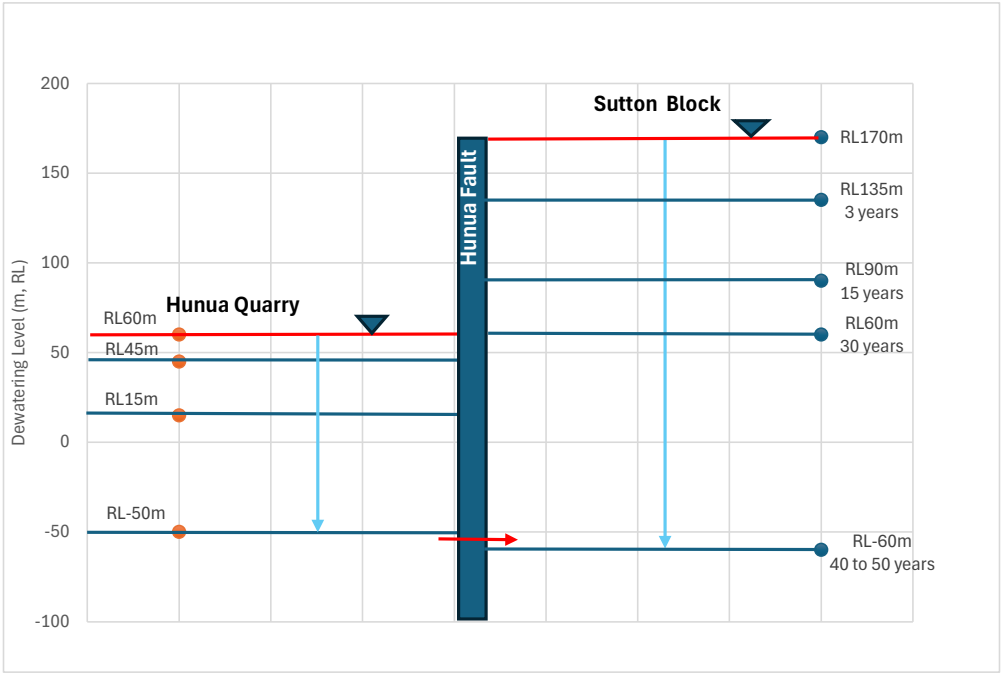


Figure 17: Pit development Progression for Symonds Hill Pit and Sutton Block

After the Symonds Hill target depth is achieved (i.e. RL -50m), and the Sutton Block pit floor dropped to RL -60m, i.e. 10m below the Symonds Hill pit, then some interference effects may occur.

Considering the low hydraulic gradient detected west of the Hunua Fault, when the Sutton Block Quarry dewatering drops to RL -60m, the flow direction within the Hunua Greywacke Block may shift towards the lowest groundwater sink (Sutton Block Quarry). This may cause the drawdown predicted for the final dewatering level at the Symonds Hill Pit (i.e. RL -50m) to drop by additional 10m. The predicted drawdown for this scenario is shown in Table 8 and the drawdown contours in Figure 16.

Under this scenario, the dewatering at the Sutton Block Quarry may controls the groundwater levels within the Hunua Greywacke Block.

In reality, partial removal of the small portion of the Hunua Fault, may only affect local areas in the vicinity of the Hunua Fault close to the Sutton Block Quarry (3.5 km from the Symonds Hill Pit) as the intervening barrier faults are common in the greywacke in this area and this is likely to reduce the above conservative predicted drawdowns. In addition, the fact that only 5% of the Hunua Fault (east of the Hunua and Drury Greywacke Blocks) will be breached during the gradual progression of the Sutton Block Pit expansion, is likely to cause further reductions in theoretical drawdowns predicted for the Symonds Hill Pit development presented in Table 8. Therefore, the above predicted drawdowns (Table 8) may need to be updated (as part of the consent conditions as more monitoring data during the development of both pits becomes available.

Table 8: Predicted Drawdown in Monitoring Bores

Bore	Distance to Sump (m)	Distance to HUN14/8 (m)	Drawdowns (m)			
			Dewatering Level RL 45	Dewatering Level RL 15	Dewatering Level RL -50	Dewatering Level RL -50 (with Sutton Block at RL -60m)
Symonds Hill Sump	-	1204	30.0	60.0	125.0	135.0
HUN0 1/7	1118	1709	24.1	54.1	119.1	129.1
HUN07/8	841	1121	24.9	54.9	119.9	129.9
HUN05/2L	1299	2265	23.6	53.6	118.6	128.6
HUN18/2L	350	1491	27.5	57.5	122.5	132.5
HUN25/1L	292	924	13.0	58.0	123.0	133.0
HUN05/1L	2358	1308	23.6	53.6	118.6	128.6
HUN05/3	1252	50	33.2	63.2	128.2	138.2
830	1876	767	25.2	55.2	120.2	130.2
HUN12/1L	1115	881	24.8	54.8	119.8	129.8
4320	1453	389	27.2	57.2	122.2	132.2
4370	2613	3210	6.0	12.0	25.0	35.0
20479	1530	3240	6.0	12.0	25.0	35.0
HUN12/4	4220	4170	6.0	12.0	25.0	35.0
HUN12/3L	2639	2121	22.2	52.2	117.2	127.2
HUN12/5L	2356	1490	23.2	53.2	118.2	128.2
Glasgow	1530	2623	22.5	52.5	117.5	127.5
SG7	1702	1614	23.0	53.0	118.0	128.0
SG3L	3560	2395	21.8	51.8	116.8	126.8

4.2.4 Predicted Zone of Influence for each Quarry Dewatering Phase

Using the above drawdown plots along four different directions, the drawdowns and zones of influence (envelop of effects) for the Symonds Hill Pit dewatering is estimated and shown in Figures 18 to 21. The predicted zones of influence represent the envelop of effects for the Symonds Hill Pit dewatering at RL 45m, RL 15m and RL -50m (i.e., quarry dewatering Phases 1, 2 and 3).

Considering no drawdowns were observed in 4370 and 20479 when the Hunua Pit dewatering level was at its lowest level (RL 20m), it is conservatively assumed the extent of the zone of influence to the north for the proposed dewatering at the Symonds Hill Pit at RL 60m remains similar to the current zone of influence for the Hunua Pit (covering an area of about 18 km^2).

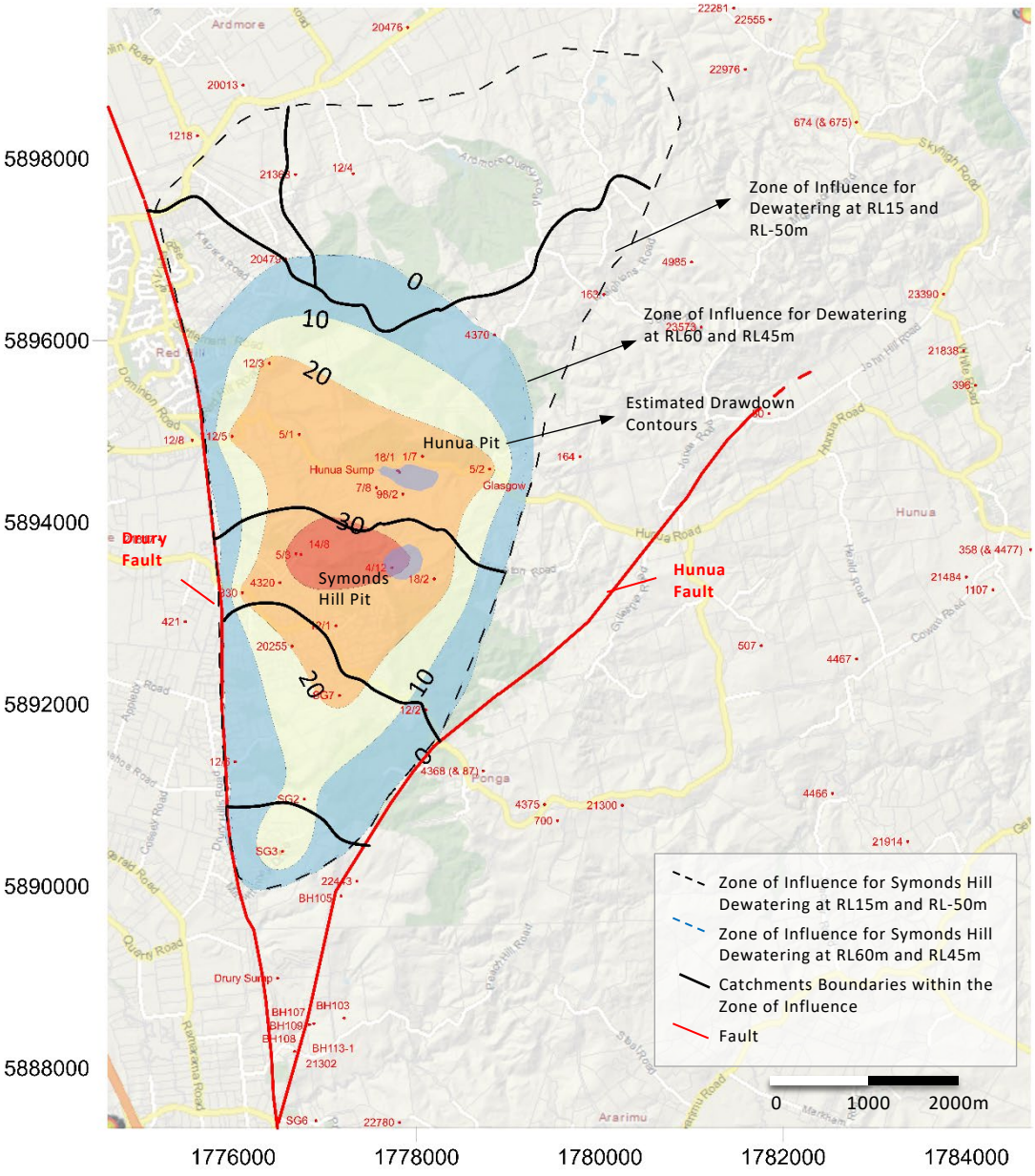


Figure 18: Symonds Hill Pit Zone of Influence for Dewatering Level at RL 45m and Estimated Drawdown Contours

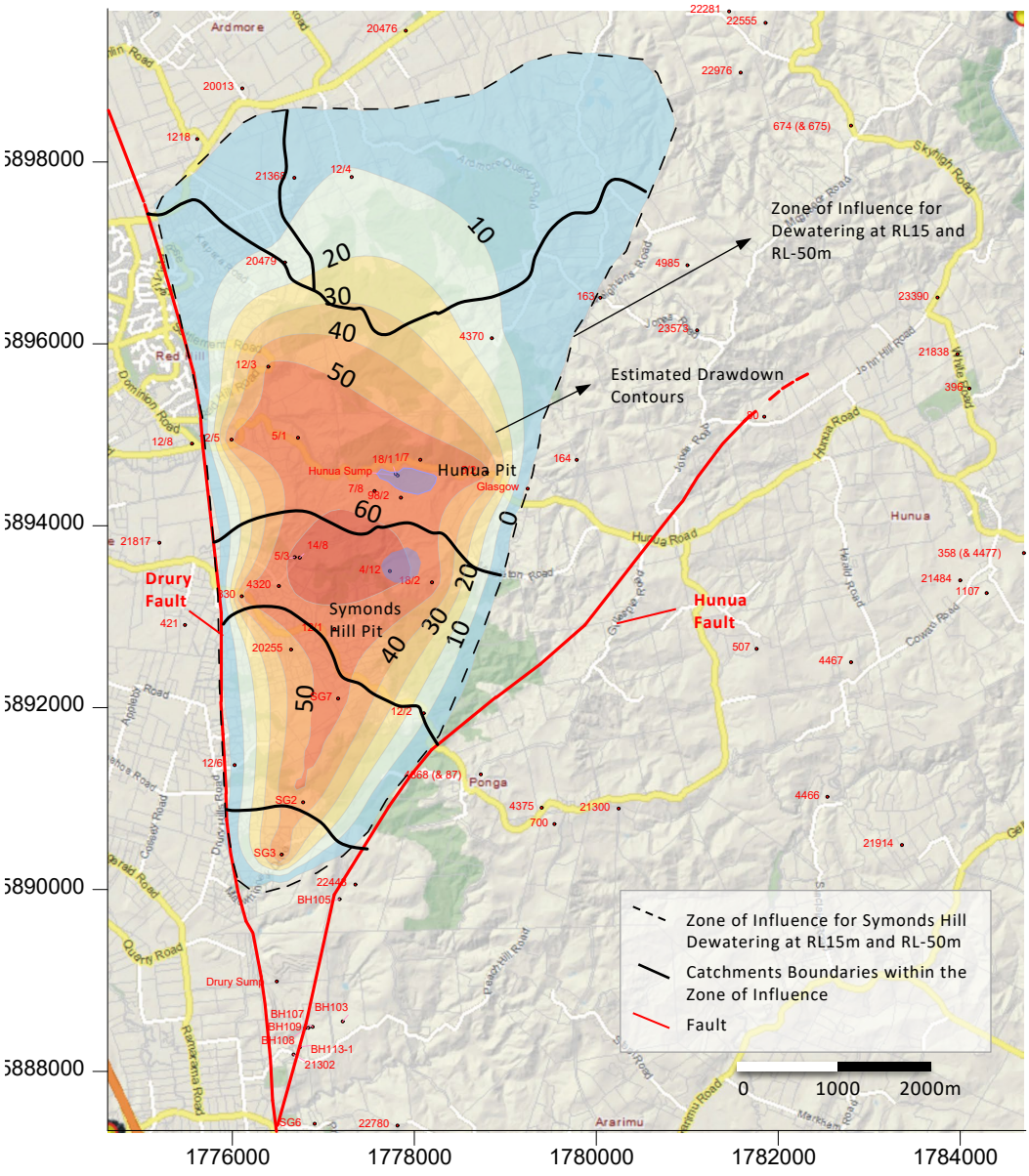


Figure 19: Symonds Hill Pit Zone of Influence for Dewatering Level at RL 15m and Estimated Drawdown Contours

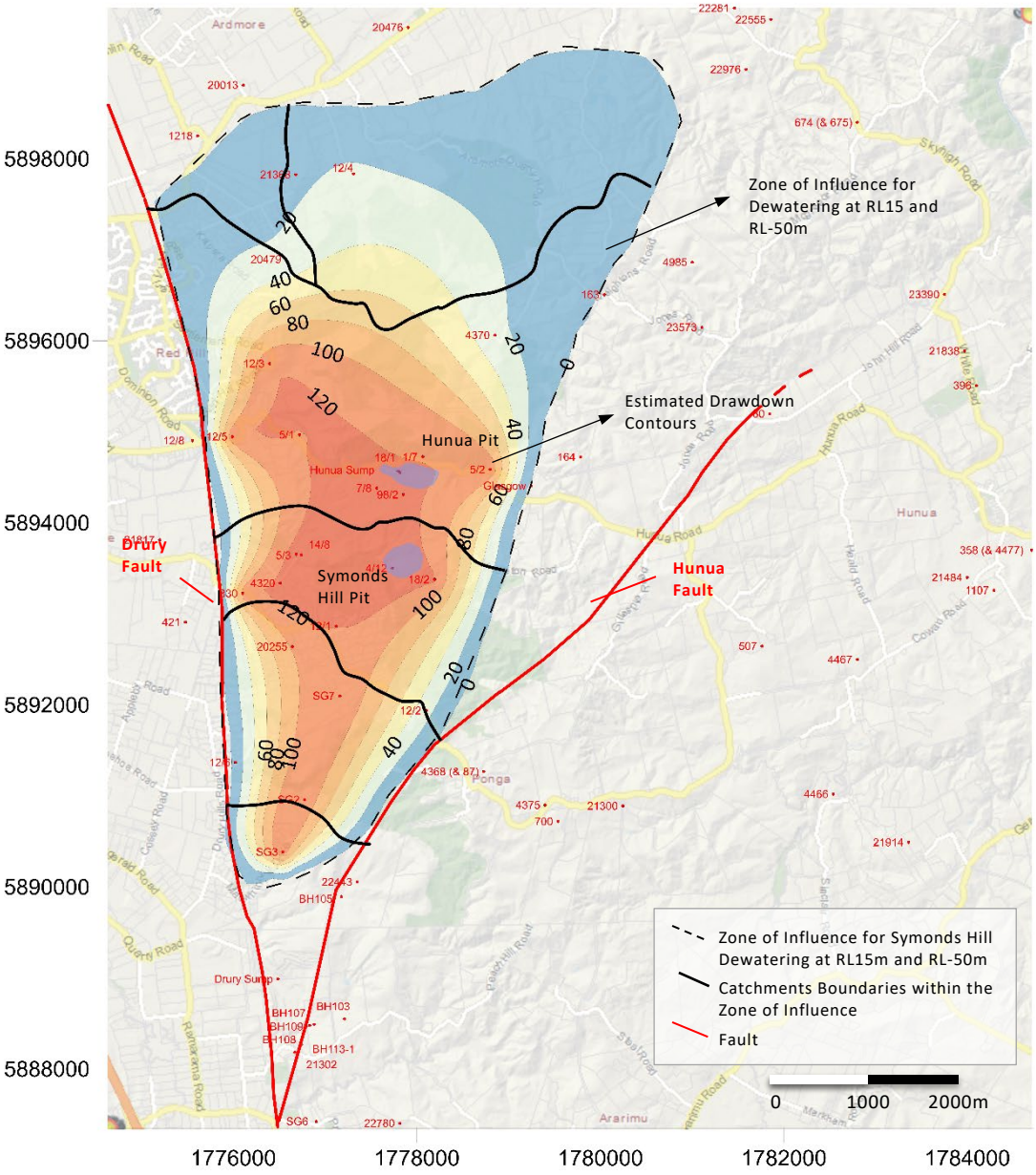


Figure 20: Symonds Hill Pit Zone of Influence for Dewatering Level at RL -50m and Estimated Drawdown Contours

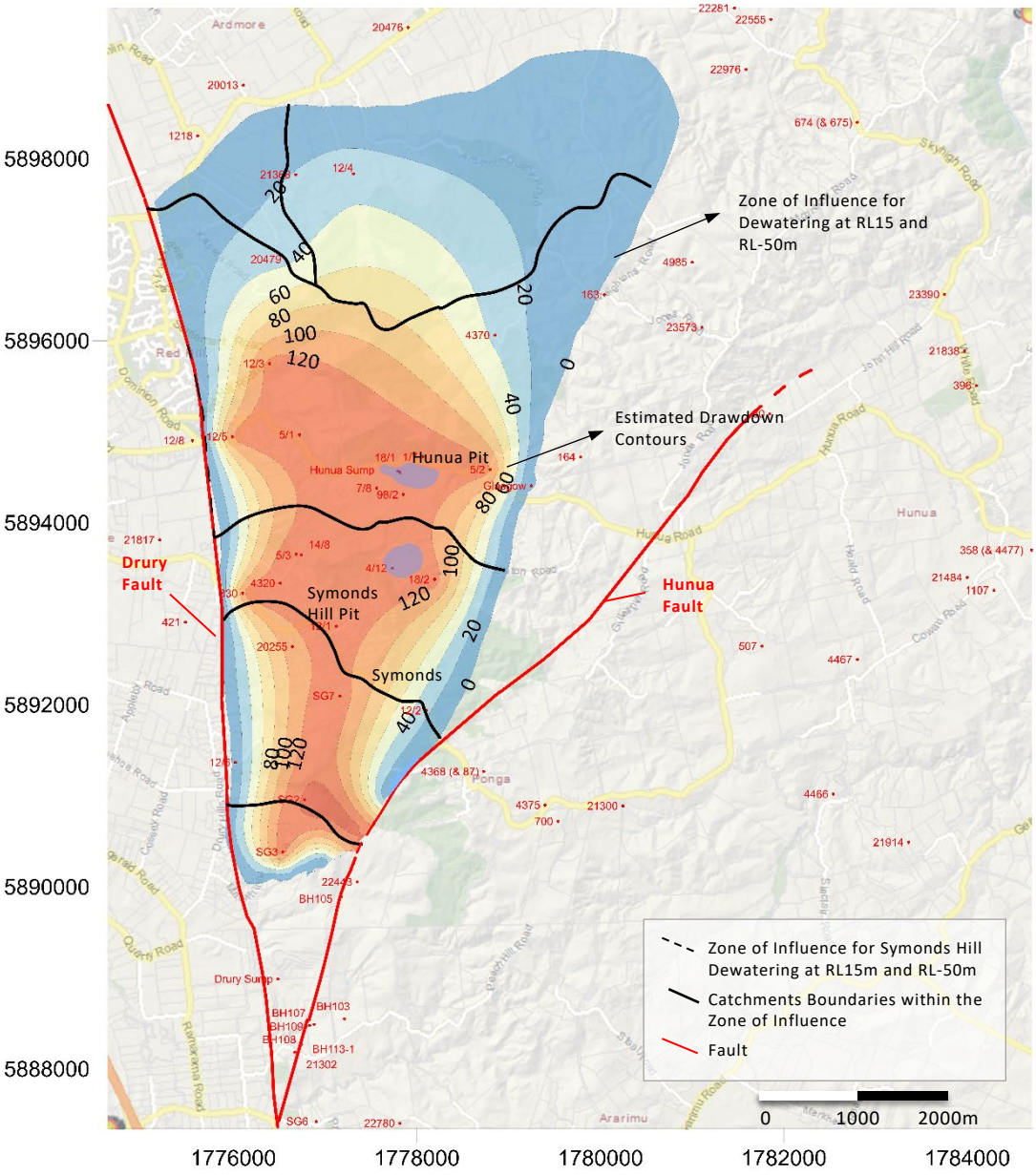


Figure 21: Symonds Hill Pit Zone of Influence for Dewatering Level at RL -50m (with Sutton Block Quarry at RL -60m) and Estimated Drawdown Contours

4.3 Predicted Steady State Groundwater Inflow for Symonds Hill Sump

For this assessment, the established historical relationship between dewatering level and groundwater inflow for the Hunua Pit is assumed to apply to the Symonds Hill Pit, located approximately 1km to the south. This represents a conservative approach, as it assumes full hydraulic continuity between the Hunua and Symonds Hill Pits despite the possibility of a low-permeability geological boundary separating the Symonds Hill excavation from the broader greywacke aquifer block.

The inflow-drawdown relationship (Figure 22) was developed by fitting a logarithmic trend to Hunua Pit data (plus the latest inflow measurements for the current dewatering level at the Symonds Hill Pit), constrained by the maximum sustainable groundwater throughflow available to the fault-bounded aquifer system (i.e. 4,520m^3/d). This recharge-limited maximum establishes a physically realistic asymptotic upper bound for the relationship based on the existing conceptual model.

The groundwater inflow data indicates that the storage release from the aquifer after each dewatering step is significant at first but gradually depleted with time (within about two years) if no deepening of the pit occurs (PDP 2011). Based on the historical monitoring data it was concluded that the maximum groundwater inflow contribution from storage is about 1,000 m^3/d (PDP 2011).

For intermediate dewatering levels between current conditions and the final depth, inflows are estimated by interpolation along this recharge-constrained trend line.

Note that the best fit line indicates a higher inflow of 5,800m3/d for the final quarry dewatering stage. This inflow is less likely considering the aquifer availability constraint. Therefore, a lower bound estimate of 4,540 m^3/d has been adopted for this assessment to account for the following factors:

- Potential for development of fully perched conditions beneath the lower reaches of the streams as the regional groundwater levels drop below the level of the streams at the Drury Fault. This will prevent any continuing increase in contribution to the quarry inflow being derived from this area of the groundwater block.
- The boundaries to the zone of influence are likely to be faults which have been shown to act predominantly as low hydraulic conductivity boundaries (attenuating dewatering effects).
- Internal block boundaries are likely to become more apparent as the groundwater levels fall within the overall block. This will reduce interconnectivity of the pit sump with the more distant recharge zones.

- The greywacke permeability is expected to decrease with depth in conjunction with increasing rock stress.

Considering the above, groundwater inflow to the Symonds Hill Pit at RL -50m is likely to be about 4,520 m^3/d.

The estimated long-term groundwater inflow for the intermediate quarry dewatering stages is provided in Table 9.

Table 9: Regional Groundwater Inflow

Dewatering Level	Inflow (m^3/d)
RL 60m (existing conditions)	1,280
RL 45m	1,700
RL 15m	3,000
RL -50m	4,520

It is important to highlight that if the Symonds Hill Pit expansion intercepts a major barrier fault - similar to the Hunua Pit in 2016 - a comparable spike in groundwater inflow from the sudden release of stored groundwater would be expected. However, the potential for a similar event at the Symonds Hill Pit is less likely due to a potential low-permeability zone between the two pits. This is evidenced by a persistent 10-meter hydraulic head difference between monitoring bores adjacent to the Symonds Hill Pit and those near the Hunua Pit. This head difference suggests that the Symonds Hill Pit may not be located within the same greywacke groundwater compartment as the Hunua Pit. Consequently, the specific hydraulic barrier intercepted at the Hunua Pit, which caused the inflow spike, may not be present or may not be hydraulically connected to the Symonds Hill Pit.

A significant increase on the groundwater inflow (6,000 to 8,261 m^3/d between October 2016 and April 2017) occurred at the Hunua Pit when the pit was being expanded to final extents at RL 20m. However, considering potential low permeability zone between the Hunua Pit and Symonds Hill Pit (evidenced by a 10 m head difference between the bores next to the Symonds Hill Pit compared with bores next to the Hunua Pit), the Symonds Hill Pit may not be located on a same greywacke compartment as the Hunua Pit and the same hydraulic barrier which was intercepted at the Hunua Pit and resulted in a spike in groundwater inflow may not be intercepted at the Symonds Hill Pit.

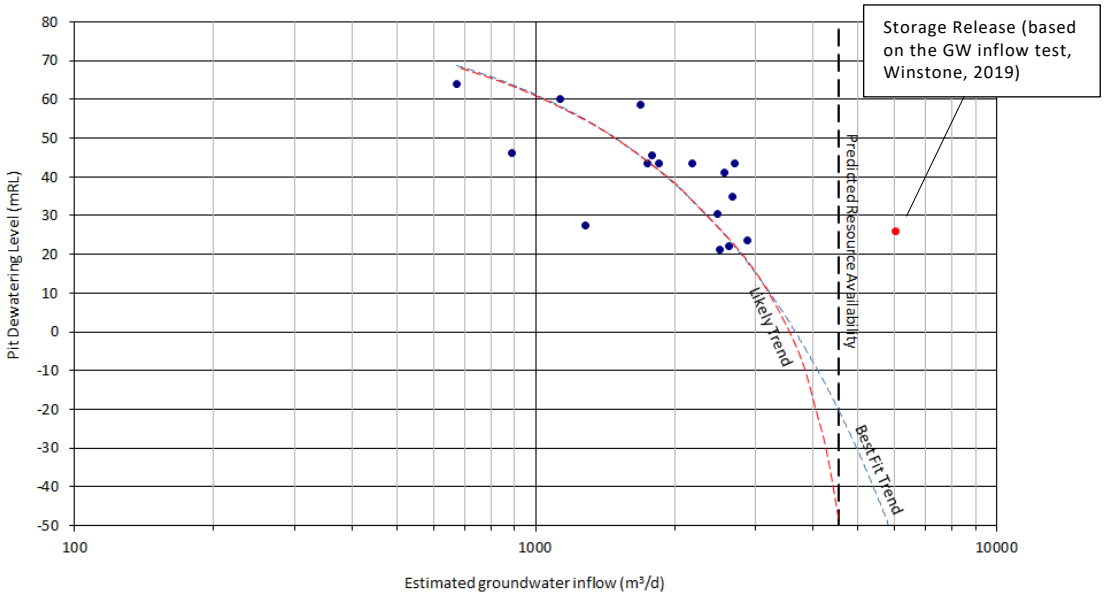


Figure 22: Dewatering Level versus Estimated Groundwater Inflow at Hunua Pit

4.4 Effects on Water Resource Availability and Groundwater Users

4.4.1 Effects on the Deep Groundwater Resource in Greywacke

The recent decision on the Sutton Block Fast Track application provides helpful guidance on assessing the effects of dewatering and takes on the availability of the groundwater resources for other groundwater users.

The calculated groundwater resource (based on recharge calculations, excluding groundwater in storage) within the predicted zone of influence (for the Symonds Hill Pit dewatering level at RL -5m) is about 4,900 m^3/d (645 $m^3/d/km$ x 7.6 km, Section 3.9.2). Only 19 private bores have been identified as tapping into the greywacke within the predicted zone of influence. These bores are operating under permitted activity status and are listed in Table 11. Assuming a pumping rate of 20 m^3/d for each well (the permitted activity rate), the current abstraction is only about 380 m^3/d (or less than 8% of the long-term resource within the predicted zone of influence). Subtracting the above abstraction rate from the calculated resource (4,900 m^3/d), the available throughflow is about 4,520 m^3/d (4,900 m^3/d – 380 m^3/d).

The regional groundwater inflow to the Symonds Hill Pit is estimated to be about 4,520 m^3/d (excluding the storage contribution). Therefore, about 92% of the calculated long-term groundwater resource within the zone of influence may be captured by the proposed quarry operation. However, it should be noted that

this inflow to the sump is accessible for any current and future groundwater supply bores, within the Hunua Greywacke Block (maximum zone of influence) if the bore's intake zone is below the sump dewatering level. This requires the bore's screen to be placed below the Symonds Hill Pit dewatering level.

4.4.2 Effects on Resource Availability for Hunua West Groundwater Management Area

The Symonds Hill Pit is located within the Hunua West Groundwater Management Area (GMA), as currently defined by Auckland Council. It is noted that the aquifer boundaries for this GMA are under Council review and may be revised.

Council's Stated Resource Availability

Pursuant to section 30(3)(a) of the Fast Track Approvals Act (FTAA), Auckland Council reviewed its records in 2025 for the Sutton Block Fast Track application, and recent communications with Auckland Council (Pers. Comm, 2026) on the Hunua West GMA availability, the following resource figures for this GMA are confirmed (Table 10):

- Total Available Recharge (Inflow): 4,620,000 m^3/year (12,658 m^3/d)
- Total Available Resource for Take: 1,617,000 m^3/year (4,430 m^3/d)
- Existing Allocated Demand: 468,386 m^3/year (1,283 m^3/d), excluding the Hunua Quarry take
- Remaining Availability: 1,148,614 m^3/year (3,147 m^3/d)

Reconciliation with Site-Specific Assessment

a) **Recharge Rate**: The effective recharge rate applied in the Council's model aligns with the rate (60 mm/year) used in this site-specific assessment.

b) **Area Discrepancy:** The Council's GMA (77 km^2) is more than twice the size of the hydrogeologically defined Hunua Greywacke Block (31 km^2), which forms the maximum zone of influence for the quarry, bounded by confirmed flow-barrier faults (e.g., Hunua Fault). Consequently, the Council's GMA-wide inflow (12,658 m^3/d) is significantly higher than the site-specific throughflow calculated for the Greywacke Block (4,900 m^3/d).

c) **Regulatory Baseline:** Notwithstanding this technical discrepancy, the Council's Available Resource figure of 3,147 m^3/d has been adopted as the conservative, policy-compliant baseline for assessing the authorised maximum take. The Council has also confirmed this 'available resource' pertains only to consumptive use and excludes dewatering water intercepted and returned to streams.

Proposed Take Within Regulatory Allocation

The proposed operational water take of 2,610 m^3/d (Section 1.5) is less than the Council's stated Total Available Resource. Therefore, based on the Council's own allocation framework, the proposed take is within the allocated groundwater resource for the Hunua West GMA.

Table 10: Auckland Council Groundwater Availability for Hunua West Groundwater Management Area		
Aquifer Area	77	km^2
Recharge	60	mm/yr
Recharge	4,620,000	m^3/yr
Availability (35% of recharge)	**1,617,000**	**m^3/yr**
Takes		
Drury Quarry (Water Use) WAT60277068- C	124,830	m^3/yr
Sutton Block (Water Use) FFTAA-2503-1037	124,830	m^3/yr
Fahey Road (WAT60277318)	117,000	m^3/yr
WAT60430618	30,200	m^3/yr
AC model s14	51,526	m^3/yr
PA	20,000	m^3/yr
Total Water Demand	**468,386**	m^3/yr
Remaining Availability (without Symonds Hill Pit diversion and take)	1,148,614 (3,146m^3/d)	m^3/yr
Proposed Symonds Hill Water Use	952,650 (2,610m^3/d)	m^3/yr
Remaining Availability	**195,964**	**m^3/year**

4.4.3 Effects on Groundwater Users in Greywacke

Existing deep private bores identified in Table 11, have the potential to be affected by the lowering of the water level in the quarry sump. Based on the historical monitoring data bores in the shallow groundwater are unlikely to be affected.

Based on the well survey by GFIG (Appendix B) and AC database search (Dec 2025) there are about 50 identified existing user wells within the predicted zone of influence of the quarry. However, many of the wells will be tapping the shallow groundwater and will remain unaffected by the dewatering. Only 19 bores are identified as tapping the greywacke within the predicted zone of influence (Appendix A).

Table 11 shows the predicted drawdowns effects for farm wells within the zone of influence for dewatering at RL 45m, RL 15m, RL -50m and RL -50m (with Sutton Block Quarry at RL -60m). The predictions are based on the indicative distance drawdown plot discussed in Section 4.2. Private bores that take from the regional groundwater may experience up to about 132 m of water level reduction if they intercept geological structures that connect to the pit.

The results indicate that the proposed dewatering below RL 45m, may affect all farm wells within the maximum zone of influence. The majority of these bores (all with PA status) may need to be deepened in order to increase their available drawdown so they would not be adversely affected by the proposed dewatering. As for the existing consent (WAT60152106-A), no drawdown is expected in the bores drilled into the shallow groundwater such as Glasgow bore.

The ongoing groundwater level monitoring programme under the existing consent conditions (WAT60152106-A) has been designed to monitor the drawdown effects. This groundwater level monitoring programme will be retained as part of the proposed consent conditions.

As part of any future consent review process, the data from the above ongoing monitoring programme will be used to identify the actual (observed) drawdowns and compare them with predictions as the Symonds Hill Pit intercepts the regional groundwater. A set of trigger drawdown levels for Winstone's monitoring bores (including a few private farm wells) are proposed as part of the proposed consent conditions (Section 6) requiring Winstone to mitigate any adverse effects on the neighbouring bores as a result of this application.

As for the existing consent (WAT60152106-A, Condition 48), remedial measures are available to address these effects such as deepening the pump setting or deepening the well.

Table 11: Drawdown Effects on Farm Wells within Zone of Influence

Bore	GL (m, RL)	Bore Depth (mbgl)	Casing Depth (mbgl)	Estimated Pump Depth (mbgl)[3]	GW Level (mbgl)	Seasonal Variations (m)[1]	Estimated Available Drawdown (m)[2]	Closest distance to the GW sink (m)	Predicted Drawdown (m) for RL 45m	Predicted Drawdown (m) for RL 5m	Predicted Drawdown (m) for RL -50m	Predicted Drawdown (m) for RL -50m with Sutton Block
20141	62	182.9	NA	173	145.1	4	22	1,411	23.4	53.4	118.4	128.4
20255	136	126.5	120	120	72	0.54	45	1,023	24.3	54.3	119.3	129.3
4320	87	113	58.5	58	20	1.1	35	389	27.2	57.2	122.2	132.2
830	62	96	65	60	12.4	2.17	43	767	25.2	55.2	120.2	130.2
4370	253	119.8	NA	110	61.6	3.17	43	2,613	6	12	25	35
20479	128	117.4	NA	107	84	1.31	20	3,240	6	12	25	35
21368	80	149.5	NA	140	32.8	4	101	4,174	20.2	50.2	115.2	125.2
5421	50	181.3	NA	171	26.8	4	138.5	4,581	19.9	49.9	114.9	124.9
4313	126	50	NA	NA	NA	NA	NA	858	24.8	54.8	119.8	129.8
WAT60353295	162	NA	NA	NA	NA	NA	NA	2841	21.3	51.3	116.3	126.3
LUC60320876	221	NA	NA	NA	NA	NA	NA	1,897	22.5	52.5	117.5	127.5
LUC60317641	46	NA	NA	NA	NA	NA	NA	4,509	19.9	49.9	114.9	124.9
LUC60440464	50	130	80	NA	NA	NA	NA	815	25.0	55.0	120.0	130.0
LUC60368789	170	240	160	NA	NA	NA	NA	1,718	22.8	52.8	117.8	127.8
LUC60355003	191	NA	NA	NA	NA	NA	NA	3,135	21.0	51.0	116.0	126.0
29411	135	180	120	NA	NA	NA	NA	1,016	24.4	54.4	119.4	129.4
27864	67	101	39.2	NA	18	NA	NA	4,131	20.2	50.2	115.2	125.2
23585	225	NA	NA	NA	NA	NA	NA	1,514	23.2	53.2	118.2	128.2
29005	100.5	108	NA	NA	37.4	NA	NA	3,354	20.8	50.8	115.8	125.8

Notes:

1) *Seasonal variations (SV) based on Winstone (2019). If no SV is available, a conservative value of 4 m is assumed.*
2) *For calculating the available drawdowns, 2 m pump submergence requirements were assumed.*
3) *If no casing or pump depths are available, it is assumed the pumps are located 10 m above the bottom of the bore.*
4) *4320 is considered as a deep bore in regional groundwater in this assessment.*

4.4.4 Effects on Groundwater Users Compared with the Existing Consent

The maximum zone of influence for the proposed Symonds Hill Pit dewatering (to RL-50m) is predicted to be consistent with the zone defined for the existing consent (WAT60152106-A). All potentially affected private bores are located within this zone of influence. Therefore, consistent with the existing consent, no bore owners outside this established zone are expected to be affected by the proposed development.

A total of 19 farm wells have been identified within the maximum zone of influence (a recent Auckland Council database search in December 2025 identified an additional 10 farm wells within the same zone compared with the existing consent). The potential drawdown effects on all 19 wells have been assessed and are presented in Table 11.

Should monitoring indicate any adverse effects on these bores, mitigation will be implemented as per recommended consent conditions, which are consistent with the framework established under the existing consent (WAT60152106-A, specifically Condition 48).

4.4.5 Effects on Groundwater Resource in other Aquifers

As for the existing consent for the dewatering at Hunua Pit, the only other aquifer that may be affected by the proposed lowering of the Symonds Hill Pit is the alluvium aquifer west of the Drury Fault.

Based on the monitoring data, groundwater levels west of the Drury Fault (Appendix A) have not been affected by the past Hunua Pit dewatering (or Drury Quarry dewatering). These bores show normal natural seasonal variations without any downward trend in groundwater levels which can be contributed to the dewatering.

As a result of the proposed dewatering, the piezometric heads in greywacke east of the Drury Fault may drop below the water table in the alluvium/volcanic aquifers. However, considering the barrier properties of the Drury Fault any backflow from the alluvium to the greywacke will be unlikely.

The selected bores within the alluvium/volcanics have been monitored as part of the existing consent conditions and this monitoring programme will continue to detect any unlikely dewatering effects west of the Drury Fault.

4.4.6 Effects on the Watercare Reservoir

The Watercare reservoir is located about 1.7 km to the north-east of the pit behind a dam on the main stem of the Waipokopu Stream (Waipokopu Creek Dam). According to the geological map (Figure 3) its reservoir is in greywacke terrain. When full, its water surface is at RL 157.5m (PDP 2011). While currently not in operation, water from the dam has previously been used (when required) to feed Auckland's municipal water supply system.

The Watercare monitoring bores are shown in Figure 1 (BH13 to BH16). Based on the monitoring data collected by Watercare since 2014 (Winstone 2024), the current dewatering operation has had no effect on the regional groundwater in the vicinity of the reservoir. Similarly, the proposed dewatering at the Symonds Hill Pit is also unlikely to have any adverse effects on the reservoir. This is supported by the following factors:

- The dam is located within the shallow groundwater system in greywacke. Therefore, there is likely to be little interaction between the reservoir and the regional groundwater as a result of the proposed dewatering.
- If the reservoir forms a recharge source for the regional groundwater in the greywacke, a groundwater mound centred at the reservoir would likely be evident. The groundwater level data from the available neighbouring wells do not indicate the presence of a mound.
- The dam is located in the Waipokopu Stream groundwater catchment. The proposed dewatering occurs at a different groundwater catchment (Mangapū Stream catchment) further away from the dam.
- A low permeability zone identified between the Symonds Hill and the rest of the greywacke block is likely to further reduce any potential adverse effects on the dam as a result of the dewatering at the Symonds Hill Pit.
- The dam is located within the greywacke rocks with a higher groundwater level than the rest of the greywacke block within the estimated zone of influence (Figure 6). Therefore, similar to Glasgow and Bore 164 (with groundwater level between RL 159m to RL 184m), the groundwater underneath the reservoir may be within a separate groundwater system, having little interaction with the groundwater that flows to the former Hunua Pit or proposed Symonds Hill sumps.

Therefore, as concluded for the existing consent, no effects on the Watercare dam as a result of the proposed Symonds Hill Pit development are expected.

4.5 Effects on Shallow Groundwater Resource

The Symonds Hill Pit is located within the shallow groundwater at elevations above RL 60m. As mentioned previously the Mangapū Stream low flow in the vicinity of the pit is sourced from the shallow groundwater.

The effects of the lowering the Symonds Hill Pit on the shallow groundwater resources was assessed previously (PDP 2020) based on the long-term monitoring of the Symonds and Waipokopu Streams and its correlation with the Mangawheau Stream flows has been used to assess the effects on the shallow groundwater resources that contribute to the Mangapū Stream baseflow.

The Mangapū Stream catchment east of Drury Fault is about 7 km^2 in area (PDP 2020). Using the specific discharge MALF of 3.0 L/s/km^2 (Section 3.9.1) based on the steam flow monitoring in upstream of Mangapū (above RL 60 m), the shallow groundwater resource in this catchment is estimated to be about 1,814 m^3/d. The shallow groundwater system is conceptualised as a collection of predominantly discontinuous zones of saturation. As such, groundwater movement within the system is driven mainly by gravity through the geological structure and is insensitive to hydraulic stresses in adjacent areas.

Shallow groundwater within, and in the vicinity of, the proposed pit area is expected to be affected by the proposed development. Perched zones of groundwater will be intercepted by quarrying and zones adjacent to the pit walls may drain into the pit where the orientation of structural features or layers promotes lateral drainage. These zones will drain dry as they are intercepted and then only flow following prolonged heavy rainfall events. The discontinuous nature of the shallow zones will limit the drainage effects to relatively short distances from the pit wall.

The width of the drainage zone outside the pit will depend on topography as well as geology due to the competing drainage attraction of the natural slopes surrounding the quarry. For the purposes of assessing the amount of resource potentially affected, the ridgelines of adjacent gullies have been taken as flow divides in the shallow resource. This identifies a margin around the pit boundary between 50 and 300 m wide where the shallow resource may drain to the pit instead of reporting to the Mangapū Stream. This is a conservative assumption as it requires the shallow groundwater in fractured greywacke to move towards the pit floor with an angle less than 45 degrees. Considering the discontinuous nature of the shallow system in greywacke such a low angle lateral movement above the regional water table is not likely.

The estimated existing shallow groundwater zone of influence for the pit (at Stage 8) is shown in Figure 4. The total area of the pit plus the margin is about 107 ha. Using the average MALF for 3.0L/s/km^2 (Upstream, Upstream and downstream), this area may contribute up to about 300 m^3/d. The pit contribution under the current pit footprint is about 200 m^3/d.

All minor inflows from the shallow groundwater to the pit will be collected by the pit water management system. Eventually, these inflows will be released to the Mangapū Stream via a stormwater treatment and management system (PDP 2020). Therefore, as for the existing consent, the proposed Symonds Hill Pit development will have a no more than minor net effect on the shallow groundwater resources or its contribution to the Mangapū Stream.

4.5.1 Effects on Wetlands

Some wetlands are within the proposed quarry expansion and will be removed. There are also two wetlands located within the shallow groundwater zone (Figure 4) in the immediate vicinity of the proposed pit footprint (Stage 8). The location of these wetlands is shown in Figure 26 of the Boffa Miskell ecological assessment (2026). The shallow groundwater within this zone may drain to the pit rather than sustain soil moisture in these wetlands. Therefore, these two identified wetlands may also be adversely affected by the proposed quarry development. The characteristics of these wetlands and a proposed mitigation plan to address effects are detailed in Boffa Miskell (2026).

Outside the immediate vicinity of the pit footprint (i.e., beyond the shallow groundwater zone shown in Figure 4), the perched and shallow groundwater systems that sustain nearby wetlands are hydraulically disconnected from the regional groundwater within the greywacke aquifer. Consequently, dewatering for the proposed pit expansion is not expected to affect these shallow groundwater systems and is therefore predicted to have no adverse effects on other wetlands outside the shallow groundwater zone.

4.6 Effects on Stream Low Flows within Shallow Groundwater (including the Diverted Stream)

Shallow groundwater within and adjacent to the proposed pit area will be affected by the development. Perched zones will be intercepted by quarrying, and water from zones near the pit walls may drain into the pit where structural features or layers promote lateral drainage. The discontinuous nature of these shallow zones will limit drainage effects to relatively short distances from the pit wall.

The total loss of shallow groundwater as a result of the proposed Symonds Hill development and expansion of the footprint is discussed in Section 4.5. The total shallow groundwater loss to the future pit (at RL-50m) is estimated to be about 300 m^3/d. Most of this loss is sourced from the Mangapū Stream catchment.

The following section focuses on local streamflow loss for: (i) a tributary proposed for diversion (Southern Tributary, downstream of US2, Figure 23); and (ii) a reach of Mangapū Stream just west of the proposed future pit (upstream of the US1 gauging station, Figure 23).

4.6.1 Existing MALF for US1 and US2

The shallow groundwater recharge has been quantified by assuming it is close to the long-term low-flow specific discharge value (baseflow) for the surface water catchments. The specific discharge based on MALF (Mean Annual Low Flow) was used for shallow groundwater recharge estimation.

The MALF for the Southern Tributary and the Mangapū Stream (above RL 75m) is estimated based on the low flow data and its correlation with the flow data from the closest catchment to the site with long-term stream flow data and a similar hydrogeology (i.e. Mangawheau Stream).

The flow data for the two existing gauging sites above RL 75m (i.e. above the regional groundwater) close to the proposed stream diversion (US1 and US2 Stations) with 15 years of stream flow data was used for the assessment. The location of these two stations is shown in Figure 23.

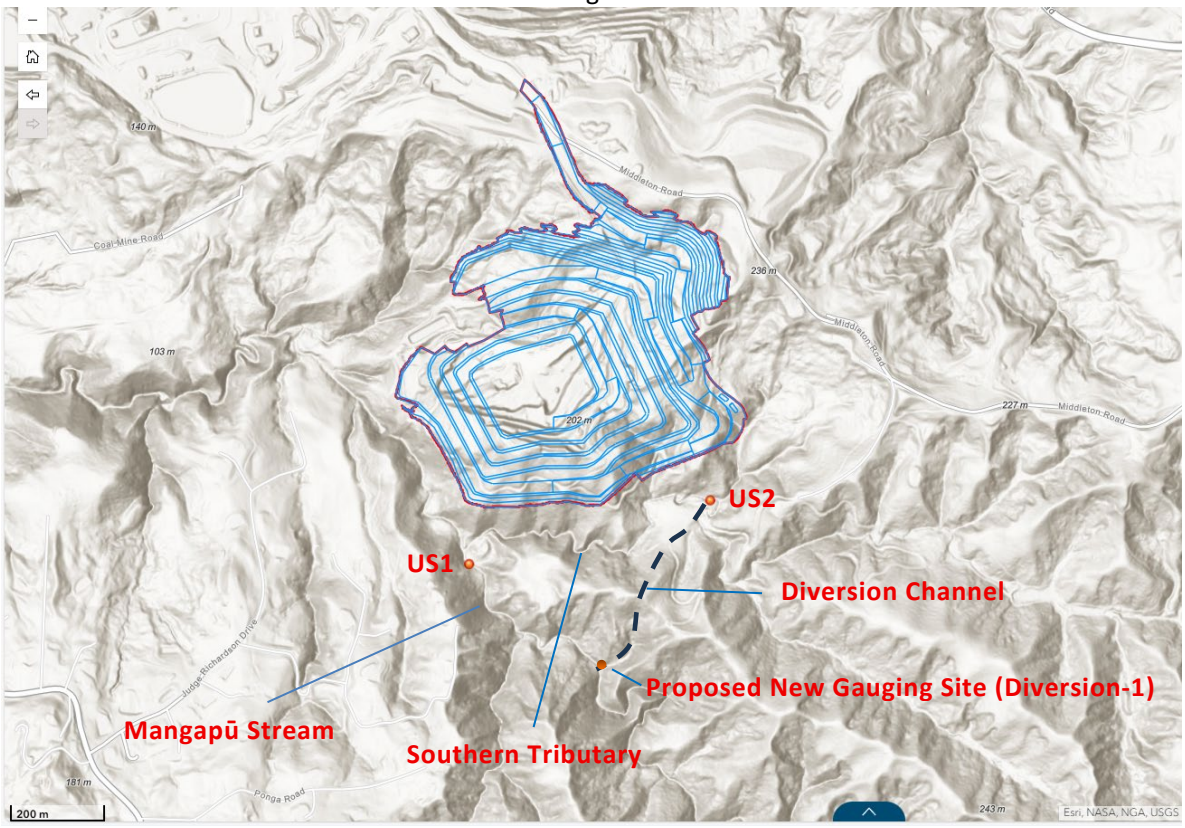


Figure 23: Mangapū Upstream Gauging Stations

The correlation result for these two stations is shown in Figure 8. The correlation accuracy (R^2) and the resulting MALF estimates for the above gauging stations are given in Table 12. With an R^2 above 0.90, the model demonstrates excellent fit to the observed data.

Table 12: Specific Discharge MALF for US1 and US2

Gauging Station	R^2	MALF Low Flow L/s/km^2	Catchment Area (km^2)	Elevation (m, RL)
Upstream Bridge (US1)	0.96	4.25	1.77	141
Upstream Fork (US2)	0.91	1.91	2.30	108

4.6.2 Predicted Baseflow Loss for the Diverted Stream and Mangapū Stream at US1

The effects of the proposed quarry expansion on the Southern Tributary and the Mangapū Stream (above RL 75m) are assessed using the correlated MALF (discussed above) and the calculated reductions in the contributing catchment area for each quarry stage. The results are summarised in Tables 13 and 14.

Table 13: Main Mangapū Stream at US1

Stage	Area (km^2)	Existing MALF ($L/s/km^2$)	Existing MALF (L/s)	Remaining Low Flow (L/s)	Flow Reduction (L/s)	Reduction %
Existing Conditions	2.30	4.25	9.77	-	-	-
Stages 0 to 3	2.30			9.77	0	0
Stages 4 to 8	2.27			9.66	0.11	1

Table 14: Southern Tributary (proposed tributary to be diverted)

Stage	Area (km^2)	Existing MALF ($L/s/km^2$)	Existing MALF (L/s)	Remaining Low Flow (L/s)	Flow Reduction (L/s)	Reduction %
Existing Conditions	1.77	1.91	3.37	-	-	-
Stage 0	1.77			3.37	0	0
Stages 1 and 2	1.75			3.33	0.04	1
Stages 3 to 6	1.67			3.19	0.18	5
Stages 7 to 8	1.60			3.05	0.32	10

Based on the results, the effects on the Mangapū Stream (above RL 75m) are less than minor (0 to 1%; Table 13). Flow loss in the Southern Tributary (Table 14) as a result of the proposed diversion is also less than minor (0 to 1%) for Stages 0 to 2 but increases to 5% for Stages 3 to 6 and 10% for Stages 7 to 8. This is caused by diversion of the shallow groundwater especially within the Southern Tributary catchment area to the future pit. The low flow reductions more than 5% exceeds the natural variability. Therefore, as for other streams, if the low flow reduction more than 5% is confirmed via proposed stream low flow monitoring (at US1 and Diveresion-1, Figure 23), a mitigation plan will be implemented (Section 6).

4.6.3 Effects on Streams Low Flows within the Regional Groundwater

The predicted effects on the stream low flows from the dewatering of the Symonds Hill excavation are assessed using the same methodology (water budget analysis) outlined as part of the existing consent (WAT60152106-A) for the Symonds Hill Pit dewatering down to RL-5m (PDP 2020).

At elevations below RL 60m, dewatering is expected to divert regional groundwater to the proposed quarry sump. This may cause a reduction in flow in the streams within the regional groundwater (Below RL60m).

The existing hydrogeological information indicates that the regional groundwater in the greywacke rockmass in general discharges into the shallow sediments and the streams at elevations below RL 60m and in the vicinity of the Drury Fault zone. Its pathway from depth at the Drury Fault is along sheared and broken zones in greywacke or along the contact between the overlying Waitemata Group and the basaltic dykes east of the fault.

Figure 24 shows the Mangapū Stream flow data (by subtracting the augmentation flow from the stations below Coal Mine Rd Station) versus time (data for a storm event on 31/3/2017 has been removed from the graph). As shown in Figure 24, the spike in storage release (due to intercepting a barrier fault) in 2017 resulted in a clear reduction in flow for the Symonds Hill Stream reaches below RL 60m (Ponga Rd, Kauri View Rd and Coal Mine Rd). However, the stations above RL 60m (e.g. R55) showed no response to the increase in the Hunua sump inflow. Therefore, the proposed dewatering at Symonds Hill may potentially affect the stream low flows below RL 60m and also cause a reduction in the regional groundwater contribution to the streams east of the fault as some of this upwelling groundwater flow could be diverted to the pit instead.

The stream catchments that may be affected by this groundwater diversion are Taitaia, Waipokopu, Mangapū, Waihoihoi and sub-catchments of Hingaia (refers to as NT2) and small portion of Papakura sub-catchment, west of Taitata (Figure 1).

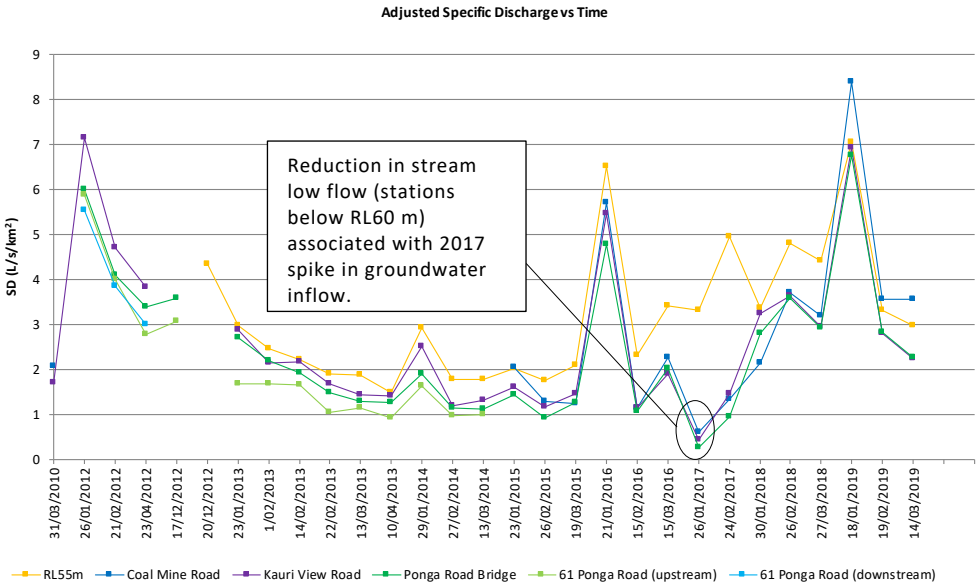


Figure 24: Adjusted Mangapū Stream Flow Data versus Time

The maximum probable effect of the proposed dewatering on the regional groundwater contribution to the streams has been assessed based on a simplified water budget analysis of existing data.

Two scenarios have been considered in order to derive the potential effects on the streams:

1. The effects on the stream sections in the vicinity of the Drury Fault (or below RL 60m) before the streams receive any recharge from the alluvium (or basalt) aquifer west of the fault (or north of the zone of influence). This is considered to represent a worst case scenario.
2. The effects on streams within the whole catchment including wider downstream catchment incorporating the expected recharge from the alluvium aquifers west of the fault or north of the zone of influence.

4.6.4 Assumptions

The analysis has been based on the conceptual model and the following assumptions:

- The boundaries of the groundwater catchments are assumed to coincide with the topographic boundaries of the surface water catchments.
- All of the diverted deep flow, whether to shallow aquifers or directly to streams, manifests to an equivalent amount in reduced stream flows.

- Under pre-quarry conditions, the amount of regional groundwater discharge to the streams is assumed proportional to the areas of the respective groundwater catchments.
- The total natural (pre-quarry) groundwater flow in the greywacke block (within the maximum zone of influence) east of the Drury Fault is estimated to be approximately 4,900 m^3/d and farm well abstraction is estimated to be approximately 380 m^3/d. Therefore, the available groundwater flow (pre-quarry) in each catchment which may contribute to the stream baseflow (4,900-380 m^3/d or 4,520 m^3/d) is assumed to be proportional to the groundwater catchment areas east of the Drury Fault.
- Not all available groundwater within the pre-quarry greywacke block zone of influence (4,520 m^3/d) reports to the Symonds Hill Pit (or pumped from HUN14/8) as a portion of the groundwater may discharge to the streams in the vicinity of the Drury Fault or alluvium beneath the streams channels across the fault.
- The current regional groundwater take from the water supply bore (HUN14/8) and the augmentation bore is about 1,280 m^3/d. The total predicted regional groundwater inflow to the Symonds Hill Pit for the dewatering level at RL 45m, RL 15 and RL -50m is predicted to be 1,700 m^3/d, 3,000 m^3/d and 4,520m3/d (Section 4.3).
- Considering the close proximity of Hunua and Symonds Hill Pits and their assumed hydraulic connectivity, the total proposed takes from HUN14/8 and the Symonds Hill Pit has been considered for the analysis.
- The estimated contribution of regional groundwater throughflow diverted to the Symonds Hill Pit (or pumped from HUN14/8) is assumed to be controlled by the predicted drawdowns in each catchment.
- The maximum percentage contribution is assumed for the catchment with maximum drawdowns and for other catchments, the contribution percentages are reduced proportional to reduction in predicted drawdowns. The maximum percentage contribution is assigned so the total groundwater inflow matches with the above estimated groundwater inflow for each quarry dewatering stages (i.e. 1,700 m^3/d to 4,520 m^3/d).
- The shallow groundwater contribution to the baseflow for each catchment has been estimated based on the average MALF for stations discussed in Section 3.9. In catchments where there are no low flow data available (e.g. Taitaia catchment), the MALF for the nearest catchment is applied.
- The regional groundwaters in the Taitaia catchment and a small Papakura sub-catchment (1 km^2) to the north of the greywacke block, discharge to the Wairoa River and the Papakura Stream respectively rather than towards the streams west of the Drury Fault.

- The geology to the west of the Drury Fault consists of basalt and alluvium. A total recharge rate of 20% (PDP 2020) has been assumed for these aquifers where baseflow reductions for the wider downstream catchments were calculated.

4.6.5 Results

The results of the water budget analysis for the existing conditions (with the Symonds Hill Pit dewatering level at RL 60m) and future dewatering levels at RL 45m, RL 15m and RL -50m are summarised in Tables 15, 16, 17 and 18 respectively.

1) Effects on Mangapū and Waipokopu Streams

For the current total pumping rate of about 1,280 m^3/d (from HUN14/8 and Symonds Hill Pit), the estimated baseflow losses for the Mangapū Stream and Waipokopu Stream equates to 655 m^3/d and 555 m^3/d respectively. For the dewatering levels at RL -50m (Table 18), the estimated loss of base flow for Mangapū and Waipokopu Streams is predicted to be 946 m^3/d (i.e. reduction in baseflow of 34%) and 2,290 m^3/d (reduction in baseflow of 35%) respectively.

2) Effects on Waihoihoi Stream

The maximum theoretical contribution from the Waihoihoi catchment to the Symonds Hill Pit (for dewatering level at RL-50m) is about 610 m^3/d (Table 18). However, based on the groundwater level contours (Figure 6), the groundwater level in the greywacke within the Waihoihoi Catchment is likely to have dropped below the stream level east of the Drury Fault (the elevation of the stream before it crosses the Drury Fault is at about RL 36.5m). This may have occurred as a result of the past Hunua Pit dewatering.

No greywacke encountered in SG1U, SG1D and HUN12/6 (all screened in basalt) in the vicinity of Waihoihoi downstream catchment areas, where the stream crosses the Drury Fault. The shallow groundwater level in basalt (SG1U) next to the stream at the downstream areas (east of the Drury Fault) has remained above the stream at about RL 38m unaffected by the dewatering at the Hunua Pit. Therefore, currently the Waihoihoi Stream flow at RL <60m is considered to be maintained by shallow groundwater predominantly sourced from the surrounding basalt aquifer rather than the deep greywacke.

In addition, no reduction in baseflow at any stream flow gauging sites along the Waihoihoi Stream has been detected as a result of the past Hunua Pit dewatering (PDP 2019). Considering the above, as per the existing consent (WAT60152106-A) and related assessments (PDP 2020), no reduction in the current baseflow of the Waihoihoi Stream as a result of the deeper regional groundwater discharge to the proposed Symonds Hill Pit is expected.

3) Effects on Papakura, Taitaia and Hingaia Streams Tributaries

The Papakura, Taitaia and Hingaia Streams low flow may be affected after the dewatering level reaches RL15m. This is the quarry stage that the zone of influence expands to its maximum extent. The conservative reduction in baseflow for these tributaries for dewatering level at RL-50m is presented in Table 18.

A tributary of the Papakura Stream, north of the zone of influence flows over the shallow Waitemata Group and is not likely to be affected by the proposed dewatering.

For dewatering levels above RL45m, a tributary of the Taitaia Stream is also located to the north of the zone of influence. The tributary is outside the zone of influence for the dewatering level down to RL45m. For the dewatering level at RL50m a reduction of 19% in baseflow of this tributary is predicted (Table 18). However, considering the stream is about 3.5 km north of the proposed dewatering, it is likely that intervening faults or structures will minimise the potential adverse effects on the low flows of this tributary.

A tributary of Hingaia Steam (refer to as NT2, Figure 1) is located close to the southern boundary of the envelop of effects, 3.5 km south of the Symonds Hill Pit (Figure 1). The stream in this catchment sourced from basalt rather than the deep greywacke. Therefore, no effects on the baseflow for this tributary as a result of dewatering of the regional groundwater at the Symonds Hill Pit is likely.

It should be emphasised that as a result of the complex nature of the groundwater flow through the greywacke, the above calculated reductions are only indicative and in practice the actual effects are likely to be less due to intervening flow barrier faults.

Table 15: Potential Effects of Baseflow (Current Conditions, Symonds Hill Sump at RL60m)

Catchments	Groundwater catchment area contributing to throughflow across Drury Fault (km^2)	Estimated regional GW throughflow to stream across Drury Fault, m^3/d	Estimated maximum predicted drawdowns (m)	Approx. predicted drawdown as % of maximum	Estimated inflow to the sump and HUN14/8, m^3/d	Estimated catchment areas for shallow groundwater contribution to streams, km^2	Estimated average MALF ($L/s/km^2$)	Estimated shallow groundwater contribution, m^3/d	Estimated total baseflow, m^3/d	Predicted reduction in baseflow, %
Waipokopu										
Pre-Quarry Condition	19	2669				19	2.4	3825	6494	0
Dewatering RL60m			10	21	555	19	2.4	3825	5938	-9
Mangapu										
Pre-Quarry Condition	7	1004				7	3.0	1806	2811	0
Dewatering RL60m			18	65	655	7	3.0	1806	2155	-23
Waihoihoi										
Pre-Quarry Condition	5	717				5	2.1	886	1603	0
Dewatering RL60m			8	10	70	5	2.1	886	1534	-4
Hingaia Sub-Catchment										
Pre-Quarry Condition	1	129				1	2.1	159	289	0
Dewatering RL60m			6	0	0	1	2.1	159	289	0
Total		**4520**			**1280**					

Table 16: Potential Effects of Baseflow (Symonds Hill Sump at RL45m)

Catchments	Groundwater catchment area contributing to throughflow across Drury Fault (km^2)	Estimated regional GW throughflow to stream across Drury Fault, m^3/d	Estimated maximum predicted drawdowns (m)	Approx. predicted drawdown as % of maximum	Estimated inflow to the sump and HUN14/8, m^3/d	Estimated catchment areas for shallow groundwater contribution to streams, km^2	Estimated average MALF ($L/s/km^2$)	Estimated shallow groundwater contribution, m^3/d	Estimated total baseflow, m^3/d	Predicted reduction in baseflow, %
Waipokopu										
Pre-Quarry Condition	19	2669				19	2.4	3825	6494	0
Dewatering RL45m			25	33	893	19	2.4	3825	5601	-14
Mangapu										
Pre-Quarry Condition	7	1004				7	3.0	1806	2811	0
Dewatering RL45m			33	58	579	7	3.0	1806	2231	-21
Waihoihoi										
Pre-Quarry Condition	5	717				5	2.1	886	1603	0
Dewatering RL45m			23	27	196	5	2.1	886	1407	-12
Hingaia Sub-Catchment										
Pre-Quarry Condition	1	129				1	2.1	159	289	0
Dewatering RL45m			22	24	31	1	2.1	159	257	-11
Total		**4520**			**1700**					

Table 17: Potential Effects of Baseflow (Symonds Hill Sump at RL15m)

Catchments	Groundwater catchment area contributing to throughflow across Drury Fault (km^2)	Estimated regional GW throughflow to stream across Drury Fault, m^3/d	Groundwater catchment area contributing to Wairoa & Papakura Streams (km^2)	Estimated regional GW throughflow to Papakura Stream and Wairoa River, m^3/d	Estimated maximum predicted drawdowns (m)	Approx. predicted drawdown as % of maximum	Estimated inflow to the sump and HUN14/8, m^3/d	Estimated catchment areas for shallow groundwater contribution to streams, km^2	Estimated average MALF ($L/s/km^2$)	Estimated shallow groundwater contribution, m^3/d	Estimated total baseflow, m^3/d	Predicted reduction in baseflow, %
Taitaia												
Pre-Quarry Condition	0	0	8	1244				8	2.4	1659	2903	0
Dewatering RL-5m					30	40	500	8	2.4	1659	2403	-17
Waipokopu												
Pre-Quarry Condition	19	2669	0	0				19	2.4	3825	6494	0
Dewatering RL-50m					60	90	2407	19	2.4	3825	4086	-37
Mangapu												
Pre-Quarry Condition	7	1004	0	0				7	3.0	1806	2811	0
Dewatering RL-50m					60	90	906	7	3.0	1806	1905	-32
Waihoihoi												
Pre-Quarry Condition	5	717	0	0				5	2.1	886	1603	0
Dewatering RL-50m					53	79	563	5	2.1	886	1040	-35
Hingaia Sub-Catchment												
Pre-Quarry Condition	1	129	0	0				1	2.1	159	289	0
Dewatering RL-50m					52	77	99	1	2.1	159	189	-34
Papakura Sub-Catchment												
Pre-Quarry Condition	0	0	1	187				1	2.4	249	435	0
Dewatering RL-5m					20	24	44	1	2.4	249	392	-10
Total		**4520**					**4520**					

Table 18: Potential Effects of Baseflow (Symonds Hill Sump at RL-50m)

Catchments	Groundwater catchment area contributing to throughflow across Drury Fault (km^2)	Estimated regional GW throughflow to stream across Drury Fault, m^3/d	Groundwater catchment area contributing to Wairoa & Papakura Streams (km^2)	Estimated regional GW throughflow to Papakura Stream and Wairoa River, m^3/d	Estimated maximum predicted drawdowns (m)	Approx. predicted drawdown as % of maximum	Estimated inflow to the sump and HUN14/8, m^3/d	Estimated catchment areas for shallow groundwater contribution to streams, km^2	Estimated average MALF ($L/s/km^2$)	Estimated shallow groundwater contribution, m^3/d	Estimated total baseflow, m^3/d	Predicted reduction in baseflow, %
Taitaia												
Pre-Quarry Condition	0	0	8	1244				8	2.4	1659	2903	0
Dewatering RL-5m					70	44	549	8	2.4	1659	2354	-19
Waipokopu												
Pre-Quarry Condition	19	2669	0	0				19	2.4	3825	6494	0
Dewatering RL-50m					120	86	2290	19	2.4	3825	4203	-35
Mangapu												
Pre-Quarry Condition	7	1004	0	0				7	3.0	1806	2811	0
Dewatering RL-50m					130	94	946	7	3.0	1806	1865	-34
Waihoihoi												
Pre-Quarry Condition	5	717	0	0				5	2.1	886	1603	0
Dewatering RL-50m					119	85	610	5	2.1	886	993	-38
Hingaia Sub-Catchment												
Pre-Quarry Condition	1	129	0	0				1	2.1	159	289	0
Dewatering RL-50m					100	69	89	1	2.1	159	199	-31
Papakura Sub-Catchment												
Pre-Quarry Condition	0	0	1	187				1	2.4	249	435	0
Dewatering RL-5m					40	19	36	1	2.4	249	400	-8
Total		**4520**					**4520**					

4.6.6 Predicted Maximum Reduction in Baseflow Compared with the Existing Consent

The changes in predicted baseflow reduction relative to the existing consent (WAT60152106-A) are presented in Table 19. The same water balance methodology has been applied, and overall, the results are broadly comparable. The observed differences arise from the following factors:

Refined pre-quarry groundwater inflow: The estimated baseline (pre-quarry) groundwater inflow has been slightly reduced from 4,700 m^3/d to 4,529 m^3/d, reflecting an improved understanding of the total takes within the system.

Updated drawdown distribution: Minor adjustments to the predicted drawdown distribution among contributing catchments have been made, informed by additional groundwater level monitoring data collected since the existing consent was granted.

Table 19: Changes in Flow Loss Compared with the Existing Consent

Catchment	Predicted Reduction in Baseflow for Existing Consent (m^3/d)	Predicted Reduction in Baseflow for Proposed Development (m^3/d)	Change (m^3/d)	Percentage increase in flow loss (%)
Taitaia	311	549	238	76.5
Waipokopu	2099	2290	191	9.1
Mangapū	1053	946	-107	-10.2
Waihoihoi	564	610	46	8.2
Hingaia Sub-Catchment	76	89	13	17.1
Papakura Sub-Catchment	23	36	13	56.5
Total	**4127**	**4520**	**394**	**9.5**

The net total predicted baseflow reduction is 394 m^3/d (9.5%). While percentage changes in some smaller catchments (e.g., Papakura, Taitaia) appear relatively high, these correspond to modest absolute increases of 13 m^3/d and 238 m^3/d, respectively. These predictions are based on a conservative methodology assuming complete hydraulic connection between the streams and regional groundwater. In reality, factors such as streambed clogging with fine sediments

mean the actual baseflow reduction is likely to be lower than these worst-case estimates. Accordingly, a stream flow monitoring programme with a 5% augmentation trigger is proposed to detect any actual baseflow loss and implement mitigation if required. With this adaptive management framework in place, any potential adverse effects can be identified and addressed, such that the residual effect after mitigation is considered less than minor.

5.0 Proposed Monitoring and Augmentation Programme

5.1 Proposed Monitoring Programme

The existing monitoring conditions within (Consent WAT60152106-A) for the Symonds Hill dewatering down to RL-5m are also appropriate for the proposed Symonds Hill Pit development (with some minor modifications) as presented below:

5.1.1 Gauging Stations

It is recommended to establish two additional low flow gauging stations along the Waipokopu Stream (at the Drury Fault) and the diverted tributary (Stage 2) to monitor any loss of baseflow as a result of the proposed dewatering at Symonds Hill Pit. This station is referred to as Hunua Road Bridge (RL 25m) and Diversion-1. The location of these additional gauging stations are shown in Figure 25.

5.1.2 Monitoring Bores/Piezometers

The existing consent (WAT60152106-A) includes a groundwater level monitoring schedule of bores and piezometers (Schedule A). There have been some changes in the monitoring bores since 2011 due to lack of access (e.g. 20255) or a bore becoming inoperable (4320). A number of bores in Schedule A have also been drilled since WAT60152106-A was granted (Winstone 2019).

Schedule A has been updated with bore details for those bores which have been constructed since Consent WAT60152106-A was granted. The locations of monitoring bores are shown in Figure 25.

5.2 Proposed Drawdown Trigger levels

The existing consent (WAT60152106-A) includes trigger levels for private bores and monitoring piezometers to confirm that actual drawdowns remain within modelled predictions.

5.2.1 Trigger Level for Regional Groundwater

A similar methodology has been applied to refine the drawdown predictions and establish updated trigger levels for the proposed Symonds Hill Pit development. The changes to the trigger levels are primarily attributable to the proposed

additional deepening of the pit floor. The revised trigger levels, which account for predicted drawdowns, are presented in Schedule A.

5.2.2 Trigger Level for Shallow Groundwater

As determined as part of the existing consent, no drawdowns (other than those in the immediate surrounds of the pit) are predicted for shallow groundwater. The shallow groundwater trigger levels within the existing consent conditions can be carried over with no changes (Schedule A).

5.2.3 Proposed Augmentation Programme

The objective of the proposed augmentation programme is to maintain the existing MALF established for the gauging stations. The recommended augmentation conditions are provided in Section 6.0 below.

6.0 Recommended Consent Conditions

General Conditions

1. Pursuant to Section 36 of the Resource Management Act 1991 (RMA) this consent (or any part thereof) must not be exercised until such time as all charges in relation to the receiving, processing and granting of this resource consent are paid in full.
2. The take and use of groundwater must be in accordance with the plans and information submitted with the application and numbered by the council subject to such amendments as may be required by the following conditions of consent.
3. This consent expires after 35 years, unless it has lapsed, been surrendered or been cancelled at an earlier date pursuant to the RMA.
4. Pursuant to section 123 of the RMA, these groundwater take and diversion permits expire 35 years from the date of commencement unless surrendered or cancelled at an earlier date.
5. The servants and agents of the council must be permitted access to the relevant parts of the property at all reasonable times for the purposes of carrying out inspections, surveys, investigations, tests, measurements or taking samples.

<u>Purpose of Consent</u>

6. To authorise the taking of groundwater from the Hunua West Greywacke Aquifer Zone, Hunua Wairoa Greywacke Aquifer and the Waitemata Aquifer and the use of this groundwater for quarrying activities at Hunua Quarry.

Works

7. A quarry pit sump located approximately 500 metres south of Middleton Road, (known as the Symonds Pit groundwater access point) and the Mangapū Stream Bore (Reference HUN 18/4) located adjacent to Mangapū Stream, at Hunua Quarry, Papakura.

Site Location

8. Hunua Quarry, 489 Hunua Road, Papakura

Legal Description of land Lot 2, 55769, Allot 38 & Pt Allots 79 Hunua Psh,

from which water is diverted Blk I, Opaheke SD, Blk IX Drury SD (CT/576/104 & 575/139) & 1/1 Lot 1 Deposited Plan 60065.

Territorial Authority: Auckland Council

Take Point Map Ref (NZTM):

(1778000mE 5893600mN) Symonds Pit Sump

(1776740mE 5893650mN) Mangapū Stream Bore (HUN14/8, (AC Bore ID29379))

Authorised quantities

9. The total abstraction of groundwater from the Symonds Pit Sump and the Mangapū Stream Bore (HUN14/8), including groundwater inflow to the sump, must not exceed 5,820 m^3/d when averaged over any seven consecutive days. The water take and use from these sources must not exceed 2,610 m^3/d when averaged over any seven consecutive days.

10. The total abstraction of groundwater from the Symonds Pit Sump and the Mangapū Stream Bore (HUN14/8), including groundwater inflow to the sump, must not exceed 2,124,300 m^3 when averaged over the twelve-month period commencing 1 June and ending 31 May of any year. The water take and use from these sources must not exceed 952,650 m^3 when averaged over the same twelve-month period.

Groundwater Monitoring and Contingency Plan

11. A Groundwater Monitoring and Contingency Plan ("the GMCP") shall be completed and submitted to Auckland Council within three months of the commencement date of this consent for review and written certification. The GMCP shall accurately record all management and operational procedures, monitoring requirements, methodologies and contingency measures necessary to comply with the conditions of this consent. A copy of the GMCP shall also be provided to Watercare Services Limited (WSL). The GMCP shall include, but not be limited to, details of:

a) a monitoring and reporting schedule which integrates the requirements relating to pit groundwater inflow, quarry pit water levels, bore water levels, and monitoring required by the consent,

b) details of the step-wise groundwater level drawdown process,

c) a procedure for quarry pit groundwater inflow measurement,

d) a Schedule and plan of all monitoring bores and piezometers for groundwater pressures and/or groundwater level monitoring, giving location, elevation RL, construction details, and Practices for bore water level monitoring,

e) a procedure to undertake stream flow measurements in the Waipokopu Stream and Mangapū Stream and the realigned Mangapū Tributary to determine the magnitude of any loss of flow in the streams as a result of taking groundwater from the Regional Hunua Greywacke Aquifers, and the amount of augmentation required to Hays Stream as a result of taking water from the Regional Hunua Greywacke Aquifers,

f) a schedule of frequency of all monitoring requirements,

g) details of all contingency plans for remedial actions should decrease in stream baseflow, spring flows or bore water levels caused by the exercising of this consent,

h) details of the Hunua Quarry site management structure and details of personnel responsible for the maintenance of the GMCP, and of the related record keeping and reporting requirements.

Monitoring Bore Construction & Maintenance

12. The Consent Holder must, unless otherwise agreed in writing by AC, maintain the monitoring bores of the construction and locations as specified in Schedule A.

Schedule A – Monitoring Bores and Trigger Levels							
Bore	**Map Reference NZTM**	**Collar Elevation RL(m)**	**Screen Interval RL(m)**	**Depth GW (m, RL) (Sep 2025)**	**Formation**	**Screen Length (m)**	**Drawdown Trigger Values (m, RL)**
HUN12/1U	1777118 / 5892865	149.76	135.8 – 129.8	141.42	Greywacke	6	130.21
HUN12/1L	1777122 / 5892866	149.80	17.8 – 5.8	50.53	Greywacke	12	-66
HUN12/2U	1778103 / 5891943	258.79	226.7-220.7	243.45	Greywacke	6	224.96
HUN12/2L	1778104 / 5891939	259.008	99.5 – 87.5	179.77	Greywacke	12	55.1
HUN12/3U	1776392 / 5895751	100.43	51.2-45.2	58.52	Waitemata	6	43.02
HUN12/3L	1776395 / 5895750	100.53	-30.5- -36.5	28.99	Greywacke	6	-95.2
HUN12/4U	1777313/ 5897789	73.71	44.7-38.7	42.96	Waitemata	6	38.21
HUN12/4L	1777311/ 5897785	73.34	11.5 – 0.5	55.68	Greywacke	12	20
HUN12/5U	1775995 / 5894949	45.63	27.6 – 20.6	28.64	Waitemata	6	18.51
HUN12/5L	1775991 / 5894948	45.72	-46.8 – - 2.8	30.54	Greywacke	6	-96
HUN12/6U	1776022 / 5891368	55.67	34.7 – 31.7	35.94	Greywacke	6	28.43
HUN12/6L	1776025 / 5891369	55.86	12.9 – 0.9	34.12	Volcanics	12	27.14
HUN12/7U	1780450 / 5893900	181	30m below ground level	TBC	Greywacke	NA	TBC
HUN12/7L	1780450 / 5893900	181	TBC	TBC	Greywacke	NA	TBC
HUN12/8U	1775555 / 5894902	27.39	22.4 – 19.4	24.56	Scoria / Alluvium	3	21.37
HUN12/8L	1775559 / 5894905	27.44	6.4 - 0.4	22.26	Basalt / Scoria	+6	19.83
HUN05/2L	1778799 / 5894587	142.16	7.16 – 1.16	124.42	Greywacke	+6	6.2
830	1776103 / 5893220	62.12	-3 – -3.4	48.37	Greywacke	31	-66

Schedule A – Monitoring Bores and Trigger Levels							
Bore	**Map Reference NZTM**	**Collar Elevation RL(m)**	**Screen Interval RL(m)**	**Depth GW (m, RL) (Sep 2025)**	**Formation**	**Screen Length (m)**	**Drawdown Trigger Values (m, RL)**
20479	1776578 / 5896896	127.11	44.3 – 9.7	43.92	Greywacke	34.6	9
21474 (Glasgow)	1779246 / 5894408	194.72	123.2 – 93.3	159.7	Greywacke	29.9	153.19
HUN25/1L	1777654/ 5893543	108.6	1.6 – -4.4	57.1	Greywacke	6	-58

Notes:

a. Bore coordinates are based on the survey results following the drilling of the bores set out in the Hunua Groundwater Monitoring and Contingency Plan 2015 (GMCP).

b. Collar Elevation is also known as 'Bore Head Elevations'.

c. Drawdown Trigger Values are obtained from the PDP Technical Report 2026.

d. Bores HUN12/7U and HUN12/7L to be drilled when the groundwater level drawdown in the Glasgow monitoring bore (21474) is greater than seasonal variation plus 10 metres (RL 148.19m).

e. Bores in Schedule A with Drawdown Trigger Values below the Screen Interval will be addressed as per Condition 13 below.

13. Monitoring bores of construction (screen interval and geological formation) and locations as specified in Schedule A shall be maintained. In the event of:

    a) any of the monitoring bores being destroyed;

    b) becoming inoperable;

    c) the water level being or dropping below the bottom of the bore; or

    d) the bore landowner not allowing access,

    then that bore shall be substituted with another constructed, or otherwise identified as suitable, with the written approval of the Council. For an existing private bore, the substitute bore may be an existing Winstone series monitoring bore. Access to the bore locations shall be maintained for sampling, monitoring and compliance purposes.

14. That the Consent Holder must ensure that provision at the top of the bores specified in Schedule B and operated by the consent holder for water quality sampling be made and be maintained in accordance with the details outlined in this water permit (see Note b).

Monitoring Conditions

15. That the Consent Holder must maintain on the outlet of the pump a meter which must measure the total quantity of water being taken. The Consent Holder must read the meter at 15 minute intervals and electronically provide to the Council daily records quarterly starting on the following date for a water permit that allows water to be taken at the rate specified, in accordance with the Resource Management (Measurement and Reporting of Water Takes) Amendment Regulations 2020. The water meter, its installation and maintenance, must be in accordance with the details outlined in this water permit (see Conditions 28 Note C).

16. That the Consent Holder must measure and record water levels in the bores listed in Schedule B (or use best endeavours with respect to the private bores 830, 20013, 20479, and 21474 (Glasgow bore)) at monthly intervals from the date of commencement of this consent. The Consent Holder must keep records of each date and corresponding water level for each bore in accordance with the details outlined in this water permit (see Condition 28 Note d).

17. The Consent Holder must measure the rate at which groundwater is diverted into the Symonds Pit groundwater access point (sump) at annual intervals. The flow rate must be measured by monitoring and recording the water level in the quarry pit sump over a period of no less than five consecutive days. The measurements must be made during dry weather conditions. with appropriate measures taken to quantify the sources of inflow into the Symonds Pit groundwater access point (sump) in particular groundwater inflows.

18. When the Symonds Pit groundwater access point intercepts the regional groundwater table, the Consent Holder must collect, have analysed and record the results of a water sample from the Symonds Pit groundwater access point (sump) at annual intervals when the rate of groundwater inflow is measured as per condition 17 above. The collection of the water sample, the parameters analysed and their analysis method, must be in accordance with the details outlined in this resource consent (see Condition 28 Note e).

19. That the Consent Holder must return the records required under Condition 17 and 18 above, by no later than 10 working days after 31 May each year. The records must include details of the measurement procedure employed, records of rainfall prior to and during the

measurement, and the time and corresponding water level measurements within the Symonds Pit groundwater access point (sump).

20. That the Consent Holder must measure and record flows at each of the following gauging sites on Mangapū Stream at approximate Map References provided below:

Schedule B: Mangapū Stream Low Flow Gauging Sites		
5894655	5894655	5894655
Upstream1 (Fork)	1777824	5893193
Upstream 2 (Bridge)	1778320	5893320
Diversion-1	1778094	5892968
Downstream	1777471	5893630
RL 55	1777174	5893528
Coal Mine Road	1776765	5893585
Kauri View Road	1776385	5893770
Ponga Road Culvert	1775495	5893690
61 Ponga Road (upstream)	1775090	5893410
61 Ponga Road (downstream)	1774550	5893030

The monitoring shall be carried out twice per year. The precise locations can be changed if approved in writing by the Council after visiting the sites to ensure access to and the sustainability of each location for stream flow measurement. The flow must be measured during dry weather conditions within the period commencing 1 January and ending 30 April of each year. All field measurements and procedures shall be as in the Hydrologists Field Manual, Fenwick, J, DSIR 1991 or any subsequent replacement, or as agreed in writing with the Council.

21. That the Consent Holder must measure and record flows at each of the three gauging sites on Waipokopu Stream at per Schedule C:

Schedule C: Waipokopu Stream Low Flow Gauging Sites		
Gauging Site	**Easting**	**Northing**
Upstream Site	1778510	5894630
Downstream Site	1777002	5894655
Bridge Site	1775733	5894655
RL 40[1]	TBM	TBM

Note:

1) RL 40 is the replacement for Downstream site in future, if required). The location of the RL 40 to be advised as part of the annual monitoring report.

The monitoring shall be carried out twice per year. The flow must be measured during dry weather conditions within the period commencing 1 January and ending 30 April of each year. All field measurements and procedures shall be as in the Hydrologists Field Manual, Fenwick, J, DSIR 1991 or any subsequent replacement, or as agreed in writing with Council.

'RL 40' is yet to be established to replace Downstream Site, to between RL 40 and RL 45.

22. The Consent Holder must collect, have analysed and record the results of a water sample from the production bore HUN14/8 and the Symonds Hill Sump at annual intervals. The collection of the water sample, the parameters analysed and their analysis method, must be· in accordance with the details outlined in this resource consent (see Condition 28 Note e).

23. That the Consent Holder must return the records required under Condition 22 above, by no later than 10 working days after 31 May each year. The records must include details of the method, dates and times of the gauging procedure employed, all measurements taken and flow calculations.

24. That the Consent Holder must ensure that the records collected under Conditions 15 to 23 (inclusive) for the preceding quarter must be submitted to the Council by no later than 10 working days after 28 February, 31 May, 31 August and 30 November each year.

25. That the Consent Holder must submit by 30·June of each year, to the Council, a report which provides an analysis of the results of water use monitoring, water level monitoring information, groundwater inflow and water chemistry and the results of stream flow measurements required under Conditions 15 to 23 of this resource consent.

The report must be prepared to a standard acceptable to the Council and consider all data collected from the date of this consent commencing (in terms of secti9n 116 of the Resource Management Act 1991) and in particular examine and evaluate compliance with consent conditions and any effects on the environment during the previous year and since this consent commenced.

Contingency Conditions

26. A correlation must be prepared for the purpose of quantifying the specific discharge for the mean annual low flow (MALF) of all the gauging stations (including the diversion stream (Diversion-1 after Stage 2). The flow correlation must relate to the natural stream flow data collected in accordance with the requirements of the conditions of this consent, for the period since data commenced and ending 30 April each year, with concurrent flows at the Auckland Council Mangawheau Stream flow site at Aldridge Road, Hunua (site number 08529) and any other relevant site as required in writing by the Southern Council, Resource Consents and Compliance. The correlation graphs, values for r2, y intercept, slope, regression expression and MALF for all stations must be completed, interpreted and submitted to the Council within 10 working days after 30 April each year.

    In the event that more than 5% drop in the recognised MALF of the above gauging stations on Mangapū Stream, Waipokapu Stream and the diverted stream, the Consent Holder must augment flows upstream of the Waipokapu Stream (Downstream Site), Mangapū Stream (RL 55 Site) and the diverted Stream (Diversion-1 Site) at a constant rate by at least the maximum difference between the MALF and the average specific discharge flow for each station in a way to compensate for any loss of flow. The required augmentation rates for each station should be presented in the annual monitoring report.

    Where the specific discharge measured at the Upstream Site (i.e. Mangapū Stream Upstream-2 or Waipokopu Stream Upstream falls more than 5% below its established MALF, the reduction shall be attributed to drought conditions. In such circumstances, the augmentation requirement for any downstream site shall be adjusted proportionally to reflect the natural reduction in flow. The adjusted augmentation flow to be maintained at any downstream site shall be the downstream site's MALF reduced by the same percentage by which the upstream site's current flow falls below its MALF. For example, if the upstream reference site flow is recorded at 70% of its MALF (a 30% reduction due to drought), the Consent Holder shall only be required to augment the downstream site to 70% of MALF.

If insufficient data has been collected to meet the requirements of this condition, then the commencement date of the augmentation flows can be changed following receipt of written confirmation from the Council.

In addition, the consent holder may, following receipt of written confirmation from the Council, change the augmentation rate if the monitoring, as required by this consent or any additional flow gauging identifies that augmentation flows are excessive or insufficient.

27. Augmentation Water Quality Monitoring

Monitoring Requirements

The Consent Holder shall measure and record water temperature and dissolved oxygen concentration at the following specified sites:

- In the augmentation flow discharge to Symonds Stream and Hays Stream; and
- In the receiving Symonds Stream and Hays Stream, immediately upstream and downstream of the discharge points.

Monitoring shall be undertaken:

- At two-weekly intervals; and
- Whenever an augmentation flow discharge has been occurring for at least one hour.

Measurements shall be completed within the period commencing 1 November and ending 31 May each year, at approximately the same time on each day of recording.

Monitoring Accuracy

Water temperature shall be measured to an accuracy of ±0.5 degrees Celsius. Dissolved oxygen concentration shall be measured to an accuracy of ±0.2 milligrams per litre.

All monitoring activities, including bore purging, sample bottle selection and filling, sample transport and handling, laboratory measurements, data processing, and quality assurance, shall be undertaken in accordance with the "National Environmental Monitoring Standards – Water Quality Part 1: Sampling, Measuring, Processing and Archiving of Discrete Groundwater Quality Data" (March 2019 or latest edition), available at www.nems.org.nz, or an equivalent standard approved in writing by the Council.

Performance Standards

Following commencement of augmentation, the receiving environment shall meet the following criteria:

- The water temperature of Symonds Stream and Hays Stream below the augmentation flow discharge point shall be equal to or less than the water temperature above the discharge point; and
- The dissolved oxygen concentration below the discharge point shall be equal to or greater than 6 milligrams per litre.

Dispensation from Dissolved Oxygen Monitoring

The obligation to measure dissolved oxygen concentration in accordance with this condition may be dispensed with at the Council's discretion, provided the Council receives technical information demonstrating that the dissolved oxygen concentration below the discharge point has consistently been equal to or greater than 6 milligrams per litre over the previous two years. This information shall include measurements on at least three days when the published maximum Auckland air temperature is equal to or greater than 25°C.

Monitoring at two-weekly intervals shall recommence upon written instruction from the Council in the event of a material change in the augmentation flow source or pumping system.

28. That the Consent Holder must, in the event of the abandoning of work on-site, first take adequate steps to ensure that flows in Mangapū and Waipokapu Streams meet the requirements of this consent at all times.

Notes:

a. *Adequate provision must be made at the wellhead so that a probe can be lowered vertically into the bore between the riser tubes and casing to measure the static water level in the bore. This can be achieved by having an access hole of at least 2 centimetres in diameter at the top of the bore. In order to keep out foreign matter, the hole should be fitted with an easily removed plug. The probe hole must be maintained to the specific dimensions and in working order at all times.*

b. *Adequate provision must be made at the wellhead so that a sample of water can be taken from the bore for water quality analysis.*

c. *The water meter must be capable of measuring to an accuracy of at least plus or minus 5% and it is to display to at least 1 cubic metres. The meter is to be installed to the manufacturer's*

specifications and to the satisfaction of the Council and must be maintained to the specific requirements and in working conditions at all times.

d. *The water level must be measured from the top of the casing and must be recorded to the nearest 0.01 of a metre (i.e. the nearest centimetre). The bores operated by the Consent Holder should not have been pumped for at least 24 hours prior to the water level measurement being taken.*

e. *Samples must be collected and analysed in accordance with APHA "Standard Methods for the Examination of Water and Wastewater (latest Edition) or the equivalent as approved in writing by the Council. Analysis will be for the following parameters:*

    i. *pH*
    ii. *Conductivity at 250C (m/Sm)*
    iii. *Potassium (K)*
    iv. *Chloride (C1)*
    v. *Silica (SiO2)*
    vi. *Sulphate (SO4)*
    vii. *Total Alkalinity (CaCO3)*
    viii. *Total Hardness (CaCO3)*
    ix. *Sodium (Na)*
    x. *Boron (B)*
    xi. *and any other parameters required to obtain an ion balance for the sample of between 95 and 105%.*

KEY :

- HUN05/1 — PROPOSED GROUNDWATER MONITORING BORE
- BRIDGE — PROPOSED STREAM GAUGING SITE
- SHALLOW GROUNDWATER CATCHMENT BOUNDARY
- FAULT (APPROX.)
- FLETCHER CONCRETE AND INFRASTRUCTURE PROPERTY BOUNDARY
- ESTIMATED ZONE OF INFLUENCE FOR DEWATERING LEVEL AT 60.0m RL AND 45.0m RL
- ESTIMATED ZONE OF INFLUENCE FOR DEWATERING LEVEL AT 15.0m RL AND -50.0m RL (HUNUA GRAYWACKE BLOCK)
- ESTIMATED SHALLOW ZONE OF INFLUENCE FOR SYMONDS HILL PIT

SOURCE:
1. URBAN AERIAL IMAGERY (FLOWN 2024-2025) AND RURAL AERIAL IMAGERY (FLOWN 2010-2012) SOURCED FROM THE LINZ DATA SERVICE AND LICENSED BY AUCKLAND COUNCIL FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. TOPOGRAPHICAL INFORMATION DERIVED FROM LINZ DATA.

0 0.5 1.0 1.5km

SCALE 1:40,000 (A3)

NO.	REVISION	DATE
C	ISSUED FOR CONSENT	MAR 26
B	DRAFT	FEB 26
A	DRAFT	JAN 26

CLIENT: WINSTONE AGGREGATES

FIGURE
FIGURE 25: PROPOSED MONITORING PLAN

PROJECT
HUNUA QUARRY DEVELOPMENT: GROUNDWATER EFFECTS ASSESSMENT

FILED: A035680016-FIG-025 NCTM MonitoringPlan.dwg

7.0 Conclusions

The groundwater effects assessment is based on robust historical and ongoing monitoring data, including drawdowns from the former Hunua Pit dewatering and those observed from the existing take from the Coal Mine Road Bore (HUN14/8) and the Symonds Hill Pit inflow.

1) Predicted Groundwater Inflow

The proposed development at Symonds Hill Pit will require only minor changes to the total authorised abstraction compared to the existing consent (WAT60152106-A). Dewatering to the final floor level of RL -50m is predicted to result in the following inflows:

- Maximum long-term regional groundwater inflow and take (i.e. inflow to sump and take from HUN14/8): **4,520 m³/d**
- Short-term inflow increase (storage release): **1,000 m³/d**
- Maximum shallow groundwater inflow: **300 m³/d**
- Total predicted inflow/take: **5,820 m³/d**

2) Predicted Groundwater Resources

There is no change to the predicted available regional groundwater resource within the Hunua Greywacke Block from the previous assessment. This resource (excluding storage), defined by geological boundaries, is estimated at **4,900 m³/d.**

3) Effects on Groundwater Users

The maximum zone of influence for the proposed dewatering to RL -50m is predicted to be identical to that defined under the existing consent, as it is controlled by the same established geological boundaries. However, drawdown magnitude within this zone is expected to increase. A recent Auckland Council bore search (December 2025) identified ten additional farm wells, and effects on all bores have been assessed. As per the existing consent, conditions are proposed to mitigate any adverse effects on individual private water supplies.

4) Effects on the Proposed Stream Diversion

For the shallow groundwater system (above RL 60m), effects on the Mangapū Stream and the diversion of the Southern Tributary are considered minimal (0–1% flow loss) for early project stages. As the pit progresses to Stages 3–8, flow loss as the result of the diversion is predicted to increase to 5–10% due to the interception of shallow groundwater. This is above the natural stream low flow variability (about 5%). Therefore, if future monitoring confirms ecological effects from this reduction are more than minor, flow augmentation from the quarry sump will be implemented for the relevant stages, as provided for in the recommended consent conditions.

5) Effects on Stream Baseflow (Regional Groundwater)

Consistent with the existing consent assessment, the development may reduce baseflow in two streams fed by the regional groundwater: the Waipokopu and Mangapū Streams. For dewatering to RL-50m, predicted losses increase to 946 m^3/d (34% reduction) for Mangapū Stream and 2,290 m^3/d (35% reduction) for Waipokopu Stream. These predictions are based on a conservative methodology assuming full hydraulic connection between the streams (below RL60m) and the regional groundwater in the greywacke. In reality, due to the clogging of the stream channel with silts and clays, the actual loss (if any) is likely to be significantly less than the above percentages. Therefore, any potential baseflow loss should be confirmed via the proposed stream flow monitoring programme before implementing any augmentation.

6) Effects on Wetlands

There are several wetlands in the vicinity of the maximum extent of the proposed pit footprint (Stage 8) and within the pit's shallow groundwater zone (Figure 4). The shallow groundwater is likely to drain to the pit rather than sustain soil moisture in the wetlands surrounding the pit. Therefore, all identified wetlands within this zone can be adversely affected by the proposed quarry development. The characteristics of these wetlands and a proposed mitigation plan to address effects are detailed in Boffa Miskell (2026).

Outside the immediate vicinity of the pit footprint (i.e., beyond the shallow groundwater zone shown in Figure 4), the perched and shallow groundwater systems that sustain nearby wetlands are hydraulically disconnected from the regional groundwater within the greywacke aquifer. Consequently, dewatering for the proposed pit expansion is not expected to affect these shallow groundwater systems and is therefore predicted to have no adverse effects on wetlands outside the shallow groundwater zone.

7) Effects on Watercare Reservoir at Hunua

Monitoring since 2014 indicates the groundwater system beneath the nearby Watercare Reservoir is separate and has shown negligible interaction with historic quarry dewatering. No interaction with the proposed Symonds Hill Pit development is expected.

8) Mitigation and Compliance

The existing monitoring and augmentation frameworks are appropriate for the proposed development. Minor modifications are recommended as consent conditions to ensure continued effectiveness.

Overall Conclusion

Considering the conservative assumptions in this assessment and the implementation of the proposed mitigation, monitoring, and augmentation measures, the environmental effects of the proposed Symonds Hill Pit development on groundwater and stream low-flow conditions are expected to be no more than minor.

8.0 References

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Pattle Delamore Partners (2019) Drury Quarry Annual Groundwater / Surface Water Monitoring Report 2018-2019, Prepared for Fulton Hogan, 21 October 2019.

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Pattle Delamore Partners (2013) Hunua Pit Dewatering – Effects of Dewatering on Mangapū Stream Baseflow (2010-2013), Prepared for Winstone Aggregates, 10 July 2013.

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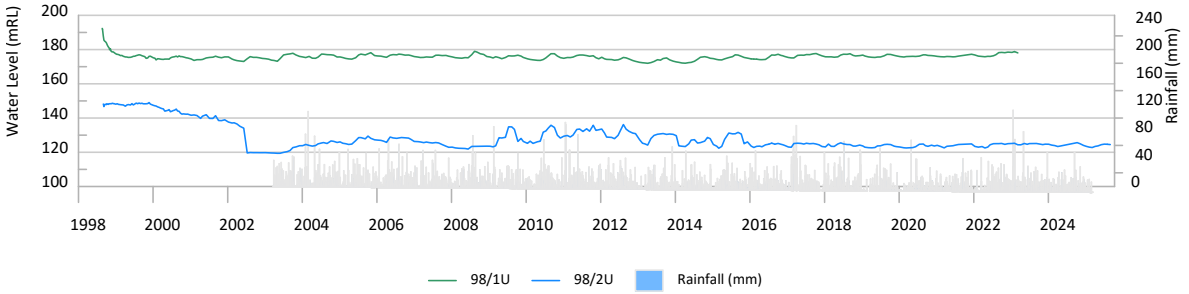
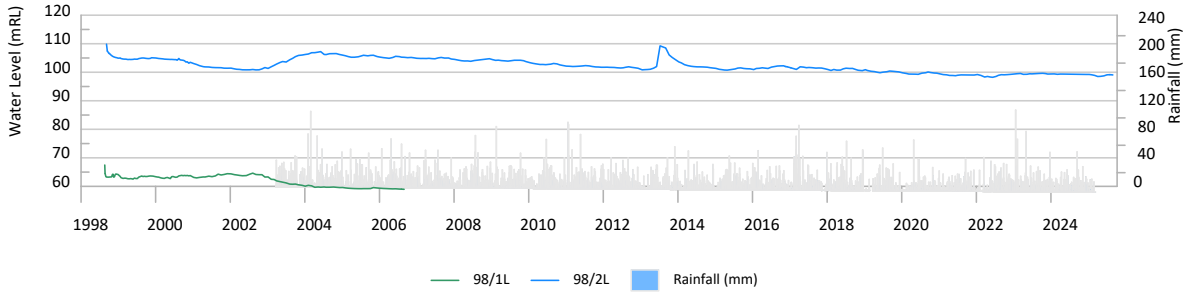
Winstone Aggregates (2014 and 2019) Hunua Quarry, Groundwater Take Permits 30206, 34129 and 43407, Quarry Discharge Permit 34131, 2019 Annual Monitoring Reports.

Appendix A: Hydrographs – Groundwater Level Monitoring Data


Water Level (mRL)
200
180
160
140
120
100
Rainfall (mm)
240
200
160
120
80
40
0
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
98/1U
98/2U
Rainfall (mm)


Water Level (mRL)
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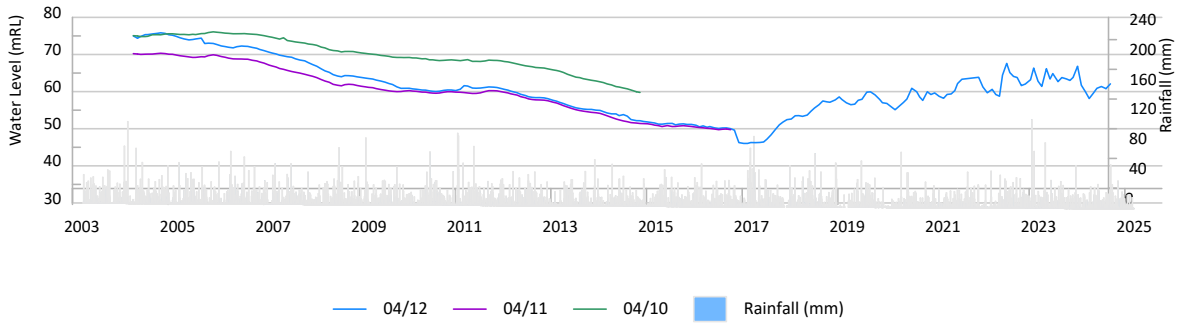
110
100
90
80
70
60
Rainfall (mm)
240
200
160
120
80
40
0
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
98/1L
98/2L
Rainfall (mm)


Water Level (mRL)
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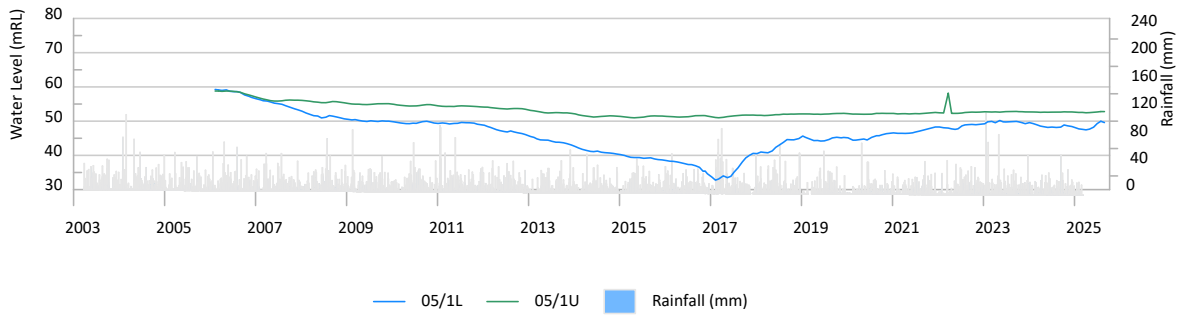
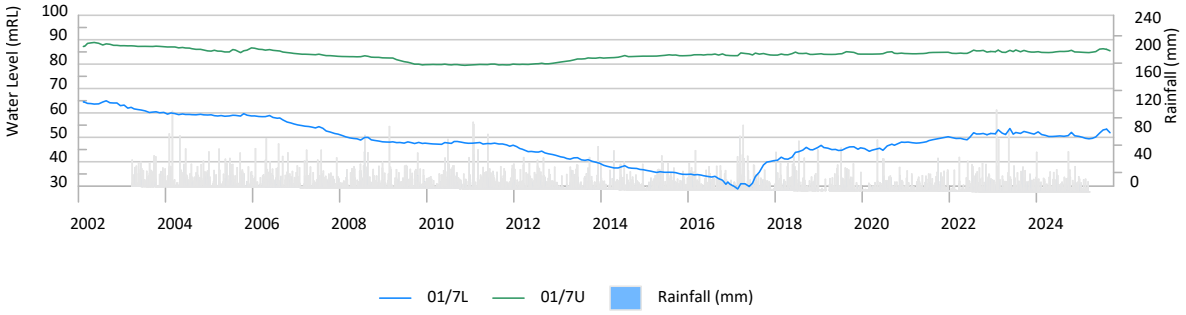
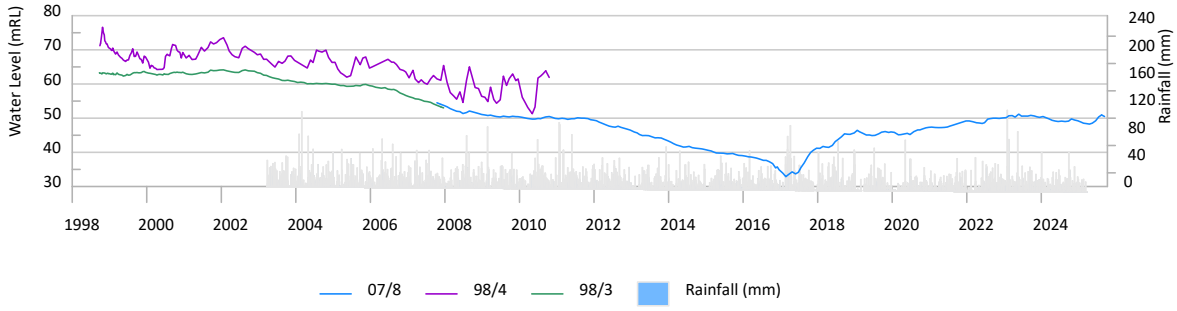
70
60
50
40
30
Rainfall (mm)
240
200
160
120
80
40
0
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
2025
04/12
04/11
04/10
Rainfall (mm)


Water Level (mRL)
80
70
60
50
40
30
Rainfall (mm)
240
200
160
120
80
40
0
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
2025
05/1L
05/1U
Rainfall (mm)


Water Level (mRL)
100
90
80
70
60
50
40
30
240
200
160
120
80
40
0
Rainfall (mm)
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
01/7L
01/7U
Rainfall (mm)


Water Level (mRL)
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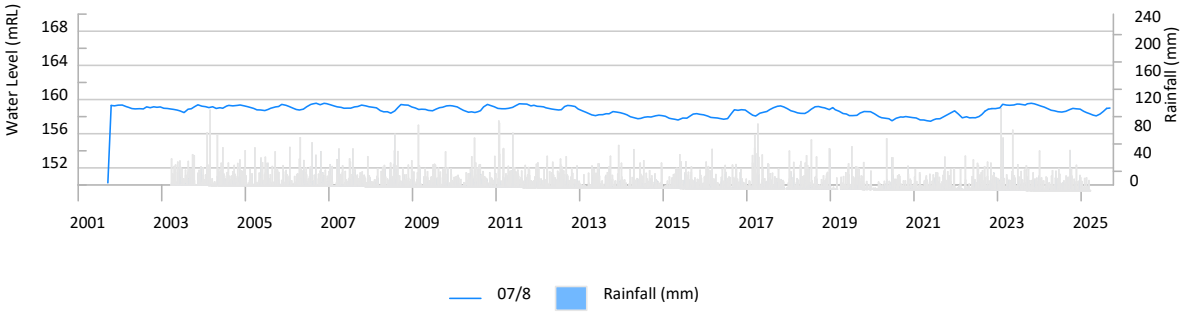
70
60
50
40
30
240
200
160
120
80
40
0
Rainfall (mm)
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
07/8
98/4
98/3
Rainfall (mm)


Water Level (mRL)
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160
156
152
240
200
160
120
80
40
0
Rainfall (mm)
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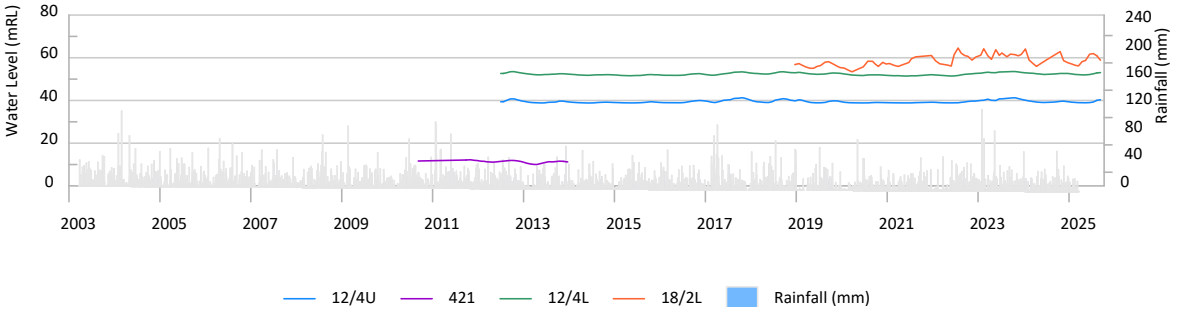
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
2025
07/8
Rainfall (mm)


Water Level (mRL)
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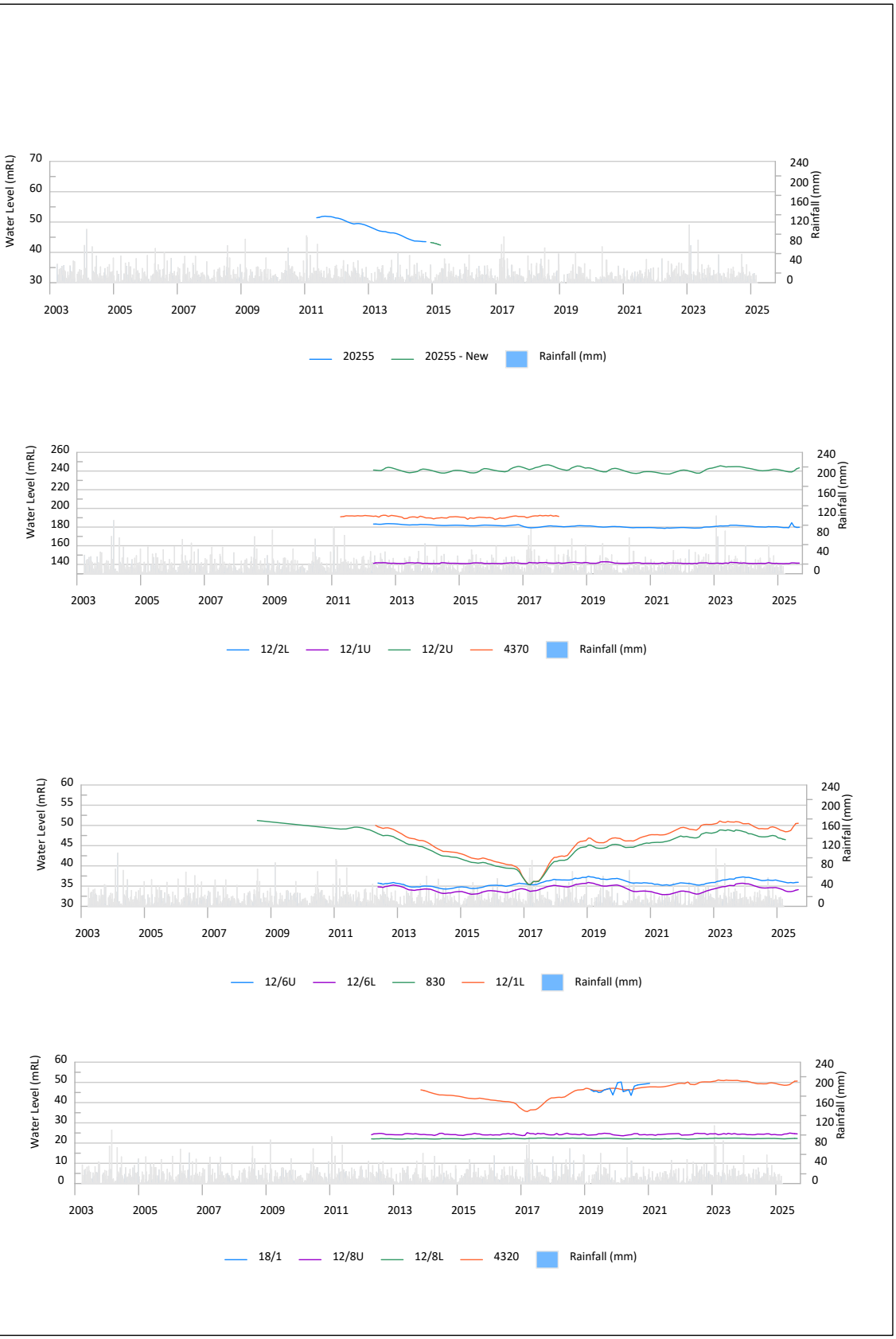
60
40
20
0
240
200
160
120
80
40
0
Rainfall (mm)
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
2025
12/4U
421
12/4L
18/2L
Rainfall (mm)


Water Level (mRL)
Rainfall (mm)
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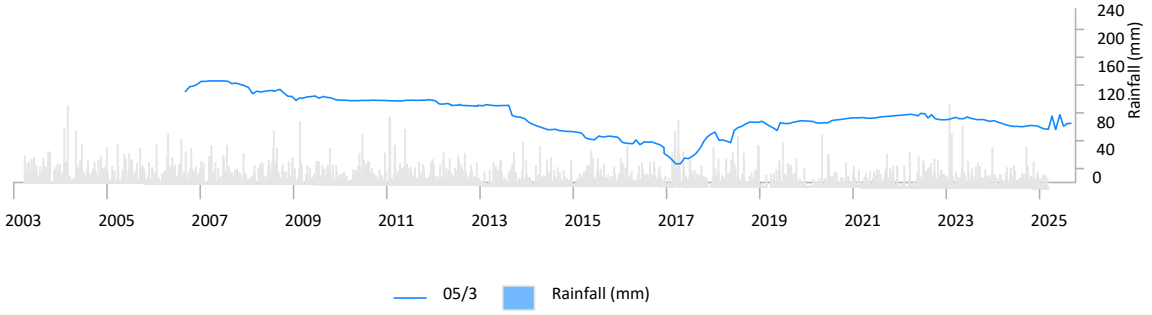
20255 - New
Rainfall (mm)
Water Level (mRL)
Rainfall (mm)
12/2L
12/1U
12/2U
4370
Rainfall (mm)
Water Level (mRL)
Rainfall (mm)
12/6U
12/6L
830
12/1L
Rainfall (mm)
Water Level (mRL)
Rainfall (mm)
18/1
12/8U
12/8L
4320
Rainfall (mm)


240
200
160
120
80
40
0
Rainfall (mm)
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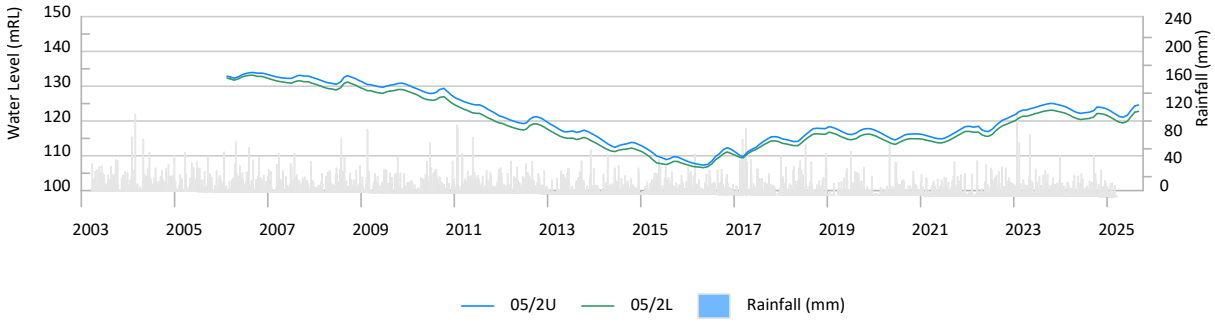
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
2025
05/3
Rainfall (mm)


Water Level (mRL)
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140
130
120
110
100
240
200
160
120
80
40
0
Rainfall (mm)
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
2025
05/2U
05/2L
Rainfall (mm)

Appendix B: Hunua Quarry – Summary of Surrounding Groundwater Bores (GFIG 2010) and Additional Farm Wells within Maximum Zone of Influence (AC, 2025)

Table B-1: Hunua Well Survey (14/12/2010) - Bores considered to be within regional groundwater in greywacke

					Co-ordinates (NZTM 2000)									
ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
80	Murray, Stuart Marshall Campbell & Suzanne Claire	96-102 Garvie Road, R D 3 Papakura 2583	17/08/2010	4.0	1781846	5895199	165	55.8	109	<90	Waipapa (Possibly)?	No Log	Stock (chickens) & domestic (2 houses)	Bore depth, pump setting & water level recorded by Parker Roy F & Son Ltd. Service address is 111 Garvie Road, R D 3 Papakura 2583. Some iron.
163	Munro, Raymond G & A D	2 Jones Road, R D 2 Papakura 2582	12/12/2008 (PDP)	2.9	1780044	5896508	162	20.0	142	114	Waipapa	Bore Geology: 0-42m clay and silts (Weathered Waipapa) & 42-EOH Waipapa.	Irrigation, domestic & summer backup	Airlifted 4 cubic meters per hour. The water level data from AC.
164	Lees, Hugh Robert & Robin Francis (as executors)	1500 Hunua Road, R D 3 Papakura 2583	20/07/2010	1.9	1779785	5894725	221	37.0	184	123	Waipapa	0-60m Clays (Waitemata >36m to Weathered Waipapa?) & 60m-EOH Waipapa.	Currently not in use	Off-site owners (family trust). Shown bore by J. Glasgow. Pumped 1.5m^3/hour at 73m. SWL 37m after drilling (22/3/1988). Good water quality (produced sand?).
258	Wilson, Wayne G & S M	2151 Hunua Road, R D 3 Papakura 2583		5.4	1783240	5895310	106.5	Above GL		123	Waipapa	0-78m Clays & silts (Tauranga to Weathered Waitemata?) & 78m-EOH Waipapa (variably weathered).	Domestic & stock	Artesian (17 gph, 29/8/1988). Airlifted 455-400 gph at 65m for 2.75 hours (660 to 250 kPa). Possibly located on 2151B Hunua Road.
335	Bennetts Poultry Limited (Bennett, Yvonne Barbara & Wheeler, Briar Rosalind & Robertson, Selwyn Bryce & Nash, Bruce Robert)	2198 Hunua Road, R D 3 Papakura 2583		5.9	1783740	5894750	103			60.9	Waipapa	0-13.4m Tauranga (pumice silts & timber >10.5m), 13.4-28m Clays & silts (Tauranga/Weathered Waitemata) & 28m-EOH Waipapa (variably weathered, fragmented with silt matrix >39.5m).	Domestic & stock (chickens)	Airlifted 7,000-6,300 gph at 39m for >0.5 hours.
358 (& 4477)	Ready, Graeme R & G J	2364 Hunua Road, R D 3 Papakura 2583		6.9	1784700	5893700	124	11.5	112.5	134.5	Waipapa (Probably) ?	0-28m Clays (Tauranga to Weathered Waitemata?), 28-51m Silts (sandy >37.5m) (Waitemata?) & 51m-EOH Waipapa (weathered <114.5m).		Airlifted 900-440 gph at 71.5-78m for 4.25 hours (500 to 230 kPa). SWL 11.5m day after drilling (morning 27/4/1989). SWL 24.9m after development (afternoon 27/4/1989). Bore 4477 is duplicate.
396	Franklin District Council (Auckland Council)	Cnr Whites Road & Falls Roads (Pt Allot 89), R D 3 Papakura 2583.		6.3	1784100	5895510	138	31.9	106.1	165.5	Waipapa	0-12m Tauranga (clay & silt with peat >10m), 12-29m Silts with weathered rock layers >20m (Tauranga to Weathered Below?), 29-54m Soft to hard rock (basalt >44.5m) (Kerikeri Volcanics/Waitemata (conglomerate)?), 54-92.5m Silts (sandy <69m) (Waitemata?), 92.5-114.5m Weathered rock with silt layers (Waipapa?) & 114.5m-EOH Waipapa.	Domestic & stock	Located in Hunua Domain Recreation Reserve. Airlifted 1,350-1,100 gph at 96.5m (>92 to 52 PSI). SWL 31.9m three days after drilling (14/8/1989). Service address is Private Bag 92300, Auckland 1142.
458	New Zealand Kennel Club Inc	743 Papakura Clevedon Road, R D 2 Papakura 2582	19/08/2010	4.4	1776582	5898812	44	17.2	26	68	Waitemata & Waipapa	0-22m Clays (Tauranga to Weathered Waitemata?), 22-51m Waitemata & 51m-EOH Waipapa.	General supply.	16m^3 maximum daily abstraction. Airlifted 240 gph at 65m for >4 hrs (90 to 65 PSI). SWL 17.2m day after drilling (13/12/1989). Some iron.
507	Batkin, Ross & Helen Edith	76 Batkin Road, R D 4 Papakura 2584	19/08/2010	4.4	1781762	5892647	188	45.8	142	>89	Waipapa	0-11m Silts & clays, 11-14.5m mudstone & sandstone (Waitemata?), 14.5-51m Te Kuiti (some coal 39.2-45.5m) & 51m-EOH Waipapa.	Stock & cowshed	Airlifted 3,900-3,800 gph at 87.5m for >2.25 hours (470 to 415kPa). SWL 45.3m two days after drilling (12/2/1990). Deepened in late 1990?. Some calcium & E-coli.

Table B-1: Hunua Well Survey (14/12/2010) - Bores considered to be within regional groundwater in greywacke

					Co-ordinates (NZTM 2000)									
ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
619 (& 4465)	Batkin, Ross & Helen Edith	Heald Road, R D 3 Papakura (between 88-144) (Lot 1 DP117131)	19/08/2010	4.6	1782339	5893872	119	>-0.67		64.33	Waipapa	0-5m Clays with peat 3-3.6m (Tauranga to Weathered Waitemata?), 5-29m Silts (sandy <22.5m, some shell >21m) (Waitemata?), 29-44m Waitemata & 44m-EOH Waipapa.	Stock	Artesian (1,055 gph) after drilling (13/11/1990). Airlifted 6,092 gph at 57.5m for 3hrs. Surface pumped at 1931-2,400 for drawdowns of >3.7-5.8m. Contact address is 76 Batkin Road, R D 4 Papakura 2584. Old bore cemented off (14/11/1990). Original location of duplicate bore 4465 plots on 2002 Hunua Road (No bore confirmed by J Rennie).
674 (& 675)	Powell, Janet Lesley & James Margaret Alice	7 McGregor Road, R D 2 Papakura 2582		6.2	1782800	5898400	165	62.4	102.6	176	Waitemata & Waipapa	0-106m Waitemata (conglomeratic 58-64m & 68-94m, limestone 64-68m) & 106m-EOH Waipapa.	Domestic & stock	Airlifted 1,050-440 gph at 142m for 5 hours (130 to 76 PSI). SWL 62.4m day after drilling (20/2/1991). Old bore sealed with concrete (20/2/1991).
700	Van der Klip, Richard Hendrive & Elizabeth Jane	1740 Ponga Road, R D 4 Papakura 2584	28/07/2008 (PDP)	4.1	1779540	5890720	287	28.7	258	116.7	Waipapa	0-18.1m Clays (Weathered Waitemata/Te Kuiti?) & 18.1m-EOH Waipapa (weathered <42.3m).	Stock	Fills 5000 L tank 2-3 times per annum. Airlifted 770-790 gph at 16 rod lengths for >3 hrs (101 to 66 PSI). SWL 28.7m day after drilling (26/3/1991). PDP indicates deepened to 300m?
830	Antrobus, Dorothy J	25 Harry Dreaden Road, R D 4 Papakura 2584	13/09/2010 & 28/07/2008 (PDP)	2.2	1776103	5893225	62	12.4	50	96	Waipapa	0-32m Clays to silt with boulders (>9m) (Kerikeri Volcanic?), 32-63m Waitemata & 63m-EOH Waipapa (weathered <65m).	Domestic	Airlifted 1800 gph?. SWL 10m after drilling (30/3/1992) & 10.97m (28/7/2008).
1107	Hartshome, Lance Byron & Alvin Florence	24 Stevens Road, R D 3 Papakura 2583		6.6	1784290	5893260	165	51.8	113.2	111.4	Waipapa	0-29m Clays (Weathered Waipapa?) & 29m-EOH Waipapa (variably weathered <55m).	Domestic & stock	Airlifted 2,000-1,700 gph at 110.5m (105 to 60 PSI). SWL 51.8m after drilling (16/11/1993). Bore deepened (2000).
1218	Hamlin Road Trustee Ltd (Chen, Wei Gu & Lin, Fei & Guo, Hua Yun & Wei, Cheng Hua)	161 Hamlin Road, R D 2 Papakura 2582	13/09/2010	4.3	1775614	5898253	51	24.0	27	102	Waipapa	0-16m Clay to silts (Weathered Waitemata?), 16-56m Waitemata (some gravels 16-48m and some limestone >48m) & 56m-EOH Waipapa.	Irrigation (nursery)	$40m^3$ maximum daily abstraction. Total abstraction of $5,349m^3$ (since meter installed). Airlifted 1,500-1,200 gph at 90m (110 to 40 PSI). SWL 26m day after drilling (3/5/1994). Significant iron. Service address is 34 Carrick Glen Avenue, Flatbush Manukau 2016. Tenanted (Paul Running & Hamlin Nurseries (Barbara Morris)).
4313	Norris, Brett W & Leonie K	471 Ponga Road, R D 4 Papakura 2584	18/08/2010	2.2	1776578	5892817	126	n/a		50	Waipapa (Probably) ?	No Log	Domestic	Original location plots on 461 Ponga Road (No bore confirmed by J Cumming). Original bore supplying neighbourhood.
4320	Orr, William H & Leonie E	55 Coal Mine Road, R D 4 Papakura 2584	12/12/2008 (PDP)	1.9	1776511	5893338	87	20?		50	Waitemata (Probably) ?	No Log	Domestic & stock	Old bore (fixed).

Table B-1: Hunua Well Survey (14/12/2010) - Bores considered to be within regional groundwater in greywacke

					Co-ordinates (NZTM 2000)									
ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
4368 (& 87)	Tulp, John & Louise Hubertina (& Railey, Derek George)	1605 Ponga Road, R D 4 Papakura 2584	12/08/2010	3.3	1778731	5891267	284	69.2	215	148	Waitemata (& Waipapa)	0-107m Waitemata, 107-136m Te Kuiti & 136m-EOH Waipapa.	Stock & garden irrigation	Original location plotted on 1189 Ponga Road. Used by two neighbouring properties. Airlifted 800-1800 gph (overnight). Yield of 196.36m^3/day. Drawdown of 2.14m. SWL 66m after drilling (20/11/1987). Meter reads 20,232.1m^3. Some calcium. Bore 87 appears to be pilot hole (cased 15m? & SWL 1.43m).
4370	Lifegate Trust	896 Hunua Road, R D 3 Papakura 2583	28/9/2010 & 11/02/2010 and 23 March 2011 (WA)	1.8	1778852	5896063	253	61.4	191	119.8	Waitemata & Waipapa	0-84.3m Waitemata (limestone >82.2m) & 84.3m-EOH Waipapa (variably weathered <91.6m).	Domestic	Approximate location & elevation only. Private village. 20m^3 maximum daily abstraction. Total abstraction of 15,478m^3 since meter installed. Airlifted 2500 gph. Transmissivity 4.9m^2/d. No sample 54.6-83.2m. Significant calcium & iron. SWL 58.8m (4/5/1984), 57m (1986). Variable water levels recorded during well refurbishment in March 2011 (54.3 to 61.4m).
4375	Crowther, Trula Avril & G	1720 Ponga Road, R D 4 Papakura 2584	Phoned	4.0	1779400	5890900	265	67.1	198	102.1	Waipapa	0-41m Clays (Weathered Waitemata to Waipapa?) & 41m-EOH Waipapa (weathered <99.4m).		Yield of 43.6m^3/day. Specific Capacity of 4.8m^2/day. Drawdown of 9.1m. SWL 67.1m after drilling (14/12/1962). No surviving bore on 1720 or 1723 Ponga Road confirmed by T. Crowther & N Poles.
4453	Davey, L J & G P	5 Batkin Road R D 4 Papakura 2584	Phoned	3.7	1781200	5893300	206	n/a		55	Waipapa (Possibly)?	No Log		No surviving bore (duplicate of 4423 or 21486?). Contact address is 10 Alexander Avenue, Maraetai 2018. No bore on 2169 Ponga Road confirmed by Mr Elliott.
4459	Henwood, Michael & Watts, Jennifer	1933 Hunua Road, R D 3 Papakura 2583	18/08/2010	3.7	1781400	5894200	173	n/a			Waipapa (Possibly)?	No Log		No surviving bore (spring supply). Also no bore on 1896-1942 Hunua Road confirmed by B. Taylor & S. Jolley (spring supply visited).
4461	Jenkin, Andrew C & Helen A	40 Batkin Road, R D 4 Papakura 2584?	2/09/2010	4.0	1781477	5892976	205	n/a		61	Waipapa (Possibly)?	No Log	Filling pool & general back-up supply	Original location plots on 33 Batkin Road (No bore confirmed by K. Powell). Takes 8-9 hrs to fill water tank (5,000 gallon).
4466	The Church of Christ New Zealand Trust Board	199 Sinclair Road, R D 3 Drury 2579		5.9	1782540	5891020	120	1.8	118.2	102.8	Waipapa	0-13.9m Clay (Weathered Waipapa) & 13.9m-EOH Waipapa (variably weathered).	Domestic & stock	20m^3 maximum daily abstraction. Airlifted 426-390 gph at 65m for 1 hour (640 to 140 kPa). SWL 1.8m two days after drilling (11/12/1989). Water analysis. Service address is PO Box 27201, Mount Roskill 1440.
4467	Arnet, Ronald Bruce & Stokes, Shirley Phyllis & Mansell, Robert			5.4	1782800	5892500	157.5	15	142.5	59.8	Waipapa	0-7m Clays (Tauranga?), 7- 25m Te Kuiti (coal 23-25m), 25-36m Siltstone (Te Kuiti/Weathered Waipapa?) & 36m-EOH Waipapa (weathered <37.8m).		Yield of 982m^3/day. Drawdown of 5.1m (with airline at 54m). SWL 15m after drilling. Service address is Heald Road, R D 3 Papakura 2583.

Table B-1: Hunua Well Survey (14/12/2010) - Bores considered to be within regional groundwater in greywacke

					Co-ordinates (NZTM 2000)									
ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
4985	Bettio, Enzo G & Margaret (Vin Alto Winery)	424 Creightons Road, R D 2 Papakura 2582	19/08/2010	3.9	1781002	5896865	209	33.4	176	140.3	Waipapa	0-24m Silts (volcanic >3m?) & 24m-EOH Waipapa (variably weathered <74m).	Stock & back-up domestic supply	Airlifted 1,900-1,750 gph at 102.4m for 3.5 hours (90 to 46 PSI). SWL 35.5m day after drilling (10/1/1996).
5246	Marilyn Coombe Family Trust (Simon & Mathew Coombe)	124 Mullins Road, R D 2 Papakura 2582	2/09/2010	4.9	1777231	5899479	37	8.1	28	76.04	Waitemata (& Waipapa)	0-15m Tauranga, 15-70.9m Waitemata & 70.9m-EOH Waipapa.	Stock & domestic (cottage)	Airlifted 616 gph at 70m for 6 hours (90 to 21 PSI). SWL 7.6m day after drilling (22/4/1996). Estate of Marilyn E Kent.
5421	Murdoch, John Newwell	864 Papakura-Clevedon Road, R D 2 Papakura 2582	18/08/2010	4.1	1775771	5898135	50	26.8	23	181.3	Waipapa	0-6m Clays (Weathered Waitemata?), 6-35.7m Waitemata (gravel & shell 17-18m) & 35.7m-EOH Waipapa.	Stock	Airlifted 188-146 gph at 96m for >3.5 hours (99 to 25 PSI). SWL 26.8m day after drilling (7/11/1996).
20013	Schofield, D F & Gail H	7 Bullens Road, R D 2 Papakura 2582	19/08/2010	4.5	1776108	5898808	38	14.0	23	187.7	Waipapa	0-16m Silts (Tauranga to Weathered Waitemata >11m), 16-60.5m Waitemata (some limestone bands >50m) & 60.5m-EOH Waipapa.	Formerly industrial	Airlifted 800 gph at 103m for >5hrs (100 to 55 PSI). SWL 14.1m two days after drilling (10/9/1997).
20141	Montgomerie, Brian J & Elizabeth A	649 Ponga Road, R D 4 Papakura 2584	14/09/2010	2.4	1777225	5892334	197	145.1	51	182.9	Waipapa	0-4.8m Clay, boulders & silt (Alluvium?) & 4.8m-EOH Waipapa (variably weathered).	Domestic & stock	Airlifted 1,584-1,480 gph at 179m for 4 hours (85 to 82 PSI). SWL 132m two days after drilling (2/4/1998). Also supplies stock water to 671 Ponga Road (P & V Grant), and occasionally other neighbours.
20479	Dick, Susan R & Sean C	86 Awanui Rise, R D 2 Papakura 2582	11/12/2008 (PDP)	2.6	1776581	5896893	128	84.0	44	117.4	Waipapa	0-82m Clays (Weathered Waitemata to Waipapa?) & 82m-EOH Waipapa (faulted >115m).	Domestic	Bore shared with neighbour. Estimated use of 15-20m^3 per annum. Pumped 400 gph (at 97.5m?) for four days. SWL 84m day after drilling (28/9/1999).
20255	McFall, Kevin J & Cheryl S & Oxley, Martin Ross	473 Ponga Road, R D 4 Papakura 2584	17/07/2008 (site visited by PDP, no WL measurements)	2.3	1776650	5892646	136	90?		100	Waipapa	0-45.29m Clays (Weathered Te Kuiti to Waipapa >34.56m) & 45.29m-EOH (84.17m) Waipapa (variably weathered).	Pond, spa & summer backup	Deepened in 2008 after running dry (No log). Original hole grouted 64-72m. SWL 70.5m after drilling (17/10/1998). Drawdown of 0.5m from pumping (airlift?) at 400 gph for 4.75 hours. Clean water. No bore recorded in response to ARC Survey. Site visited by PDP but water level could not be measured (the estimation is according to the owner).
21300	Ponga 2006 Ltd (Tai, Men Yeng & Wang, Chen Jian & Wong, Kam Son & Lucky 6 Ltd (Fong, Wai Vincent & Ling) & Kuang, Xiao Lan	1800 Ponga Road, R D 4 Papakura 2584	13/09/2010 & 28/07/2008 (PDP)	4.4	1780246	5890891	217	41.8	175	105.2	Waipapa	0-28.5m Clays (Weathered Te Kuiti?), 28.5-40m Te Kuiti (some coal <31m) & 40m-EOH Waipapa.	Stock & summer backup	Used by Higgins (09-2991700). Airlifted 5,462 gph at 90m for 1.75 hours (78 to 70 PSI). SWL 41.6m after drilling (15/11/2000) & 42.7m (28/7/2008). No bore on 1804 Ponga Road confirmed by A Finley. Tenanted (Joan McLean). Service address is PO Box 38966, Howick Manukau 2145.
21368	Ken Davidson Ltd (Davidson, Christine Adele & Kenneth W)	752 Papakura Clevedon Road, R D 2 Papakura 2582	8/09/2010	3.4	1776681	5897826	80	32.8	47	149.5	Waipapa	0-23m Clays to silt (Weathered Waitemata?), 23-42m Waitemata (some limestone <33m) & 42m-EOH Waipapa.	Stock	Residence on Ohiwa Road. Airlifted 5,500-3,800 gph at 91m for 2 hours (90 to 50 PSI). SWL 32.8m day after drilling (20/3/2001). Service address is PO Box 2721722, Papakura 2244.

Table B-1: Hunua Well Survey (14/12/2010) - Bores considered to be within regional groundwater in greywacke

					Co-ordinates (NZTM 2000)									
ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
21474	Glasgow, John & Marlene	1040 Hunua Road, R D 3 Papakura 2583	20/07/2010	1.4	1779245	5894407	195	35.5	160	101.4	Waipapa	0-62m Waitemata, 62-68.5m siltstone (Waitemata and/or Weathered Waipapa) & 68.5m-EOH Waipapa.	Stock, garden & back-up domestic supply	Formerly used for piggery. Airlifted 770-800 gph at 96m for >5.5 hours (500 to 240 kPa). SWL 34.7m day after drilling (12/7/1987). 0.6 ppm iron. Monitored by WA. Disused bore 10m SE (high iron).
21475	Square Cut Holdings Ltd (Forrest, Stephen Rex)	1041 Hunua Road, R D 3 Papakura 2583	18/08/2010	1.6	1779349	5894192	201	n/a		96?	Waipapa (Possibly)?	No Log	Stock & back-up domestic supply	Significant iron. Service address is 101 Middleton Road, R D 3, Papakura 2583.
21479	Meacham, Scott James & Brocklehurst, Paula Jayne	40 Farquharson Road, R D 3 Papakura 2583.		7.1	1783500	5890400	155			40	Waipapa (Probably) ?	No Log		Data from Wairoa River catchment Survey 1995-97. Plots on 40 (or 42) Farquharson Road, R D 3 Papakura 2583. Suspect location.
21481	Simpson, Brett & Trudy V	1742 Ponga Road, R D 4 Papakura 2584	18/08/2010	4.5	1779776	5890601	253	>64		>82.2	Waipapa (Probably) ?	No Log	Back-up supply (stock)	Some iron. Possibly same bore as 4375.
21484	Lockwood, Reginald Stanley & Jean Frances	76 Cowan Road, R D 3 Papakura 2583		6.3	1784000	5893400	114.5	3		70	Waipapa (Probably) ?	No Log		Data from Wairoa River catchment Survey 1995-97.
21486	Shields, Karen and Wojcik, Kazimierz	2168 Ponga Road, R D 4 Papakura 2584	19/08/2010	3.4	1781029	5893423	214	n/a			Waipapa (Possibly)?	No Log	Stock, garden & back-up domestic supply	Single bore on property.
21838	Malpass, David Andrew & Christine Beverley	162 White Road, R D 3 Papakura 2583		6.3	1783970	5895888	128	21.8	106.2	130	Waipapa	0-18m Tauranga (peat 6-8m, 12-12.5m & >15m), 18-84m Clay & silt (Tauranga to Waitemata?) & 84m-EOH Waipapa (weathered <86m).	Domestic & stock	Airlifted 1,760-1,550 gph at 91m for >5 hours (103 to 38 PSI). SWL 21.8m day after drilling (6/3/2003).
21914	Meacham, Scott James & Brocklehurst, Paula Jayne	40 Farquharson Road, R D 3 Papakura 2583.		6.9	1783360	5890490	162	16.5	145.5	90.5	Waipapa	0-33m Clay (Weathered Waipapa?) & 33m-EOH Waipapa (variably weathered).	Domestic & stock	Airlifted <1.64m^3/hr at 78m. Pumped 1m^3/hr at 48m for 3hours. Drawdown of 25.5m. SWL 16.5m after drilling (4/11/2003).
20476	FRENZ Producers	592 Clevedon Road			1777906	5899444		5.5		62	Waitemata	0-16m clays and silts, 16-44m Waitemata sandstone, 44-60m Waitemata sandstone with limestone bands, 60-EOH Waipapa		The second of two bores drilled in December 1998. The first bore was abandoned and backfilled. The water level data from AC.
22281	Nicoll, David John & Russell, Mark Thomas & Wood, Penelope Linda	75 Munros Road, R D 2 Papakura 2582		6.2	1781460	5899656	69.5	23.6	45.9	123.6	Waipapa	0-17m Silt & clays with weathered rock >10m (Weathered Waipapa) & 17m-EOH Waipapa.	Domestic & stock	Airlifted 684-694 gph at 96.5m for 1.5 hours (120 to 40 PSI). SWL 23.6m day after drilling (5/5/2005).
22443	Stevenson Properties Ltd	1189 Ponga Road, R D 4 Papakura 2584	E-mailed	4.6	1777350	5890058	182	n/a		139	Waipapa	0-10m clays, 10-EOH Waipapa	Monitoring	Piezometer at Drury Quarry. Proposed screen interval 133-139m & grouted <112m. No water bores within survey area. Unable to provide any information related to groundwater levels. Service address is 1060 Private Bag 94000, Manukau 2241.

Table B-1: Hunua Well Survey (14/12/2010) - Bores considered to be within regional groundwater in greywacke

					Co-ordinates (NZTM 2000)									
ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
22555	Eastgate, Darryl Raymond & Karen Marie	37 Munros Road, R D 2 Papakura 2582		6.3	1781860	5899530	85	29	56.0	57	Waipapa	0-29m Waitemata (conglomeratic >19m) & 29m-EOH Waipapa (weathered <31m).	Domestic & stock	Airlifted 3.6m^3/hr at 50m for 3.5 hours. Drawdown of 16m. SWL 29m after drilling (4/4/2006). Minor iron.
22976	Keane, Glenn Campbell & Katharine Lucy	26-36 Munros Road, R D 2 Papakura 2582		5.8	1781587	5898983	84	36	48.0	81	Waipapa	0-37m Clay with rotten rock >5m (Weathered Waipapa) & 37m-EOH Waipapa (weathered <43.5m).	Domestic & stock	Pumped 3.6m^3/hr at 50m for 3 hours. Drawdown of 9m. SWL 36m after drilling (14/11/2007). Minor iron.
23390	Power, James Francis, Margaret Marie, Robert James & Worth, Kim Elizabeth	18 Sky High Road, R D 3 Papakura 2583		6.2	1783750	5896510	110	11.2	98.8	60	Waipapa	0-49m Clay to rotten rock (less weathered & some red >36m) (Tauranga to Weathered Waipapa?) & 49m-EOH Waipapa.	Stock	Airlifted 3.6m^3/hr. SWL 11.2m after drilling (17/7/2009). Minor iron.
23573	High Hope Two Trust (Trustees Ian H Armstrong & Michael G C Stephens)	119 Jones Road, R D 3 Papakura 2583	18/08/2010	3.6	1781108	5896149	236	52.3	184	183	Waipapa	0m-EOH Waipapa (variably weathered <70m).	Garden irrigation & domestic back-up supply	Formerly 68 Jones Road. Pumped 2.16m^3/hr for 4hrs at 91m. Drawdown of 27.34m. SWL 54.74m day after drilling (23/4/2010).
20843	Auckland Council	Burnsides Rd, Clevedon			1777704	5900243		Artesian		168.7	Waipapa	0-22m Tauranga Group, 22-168m Waitemata (Papakura Limestone at base), 168m EOH Waipapa.	Monitoring	100mm steel casing to 154.25m

Note:

1) *Bore 4370 is considered to be within a shallow groundwater system in greywacke*
2) *Information obtained from ARC databases, responses to mail-out to residents of Ponga Road and consultation by Winstone Aggregates.*
3) *Recorded bores within 5km of Hunua Pit east of Drury Fault and 3km west of Drury Fault.*
4) *Locations of unvisited bores are approximate and may be on nearby properties with different ownership.*
5) *Grey shaded: Wells Identified within the predicted zone of influence in greywacke*

Table B-2: Hunua Well Survey (14/12/2010) - Bores considered to be within shallow groundwater

					Co-ordinates (NZTM 2000)									
ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
180	Graham, Ian J & Diana F	36 Jack Paterson Road, R D 4 Papakura 2584		2.6	1775640	5893300	30	9.0	21	67.1	Waitemata (Possibly basal Waitemata beds?)	0-57m Tauranga, 56.4 - EOH basal Waitemata beds (greywacke gravels?)	Domestic & stock	Alternative address is 2/18 Walmsley Road, St Heliers Auckland 1071. 80mm casing to 58.5m depth. Pumping test following drilling yielded 42L/min with a 3.6m drawdown (May 1988)
194	Broadbent, Stephen & Krauts, Richard Anthony & Jan Lesley	46 Elizabeth Place, R D 1		3.4	1775900	5891800	50	11.2	38	69.7	Kerikeri Volcanic	0-68.7m Kerikeri Volcanic (with sediments 16.5-27m) & 68.7-EOH Clays.	Domestic & stock	Possibly located on 449 Drury Hills Road. Pumped 1280 gph at 67m (PWL 59.77m). Recovered from 54.84 to 18.93m in 20 minutes after pumping. SWL 11.2m day after drilling (1/9/1988).
343	Auckland Regional Council	230 Fitzgerald Road (Fielding Road Reserve), R D 1 Drury 2577	2/09/2010 (ARC)	5.2	1774444	5890648	19.0	7.8	11	115.6	Tauranga	0-15.3m Clay & Tephra (Weathered Kerikeri Volcanic?), 15.3-45.64m Kerikeri Volcanic (basalt with scoriaceous-ash intervals), 45.64m-EOH Tauranga (variable materials with organic intervals >75.9m).	Monitoring	ARC monitoring bore ("Fielding Road Sand Bore"). Bore backfilled (aggregate) to 64m. Airlifted 1,760 gph at 65m (675 to 270 PSI). SWL 11.8m day after drilling (31/3/1989). Transmissivity of 5.7m^2/d. Water level data from 4/04/1989. Service address is Private Bag 92012, Auckland 1142.
344	Auckland Regional Council	230 Fitzgerald Road (Fielding Road Reserve), R D 1 Drury 2577	2/09/2010 (ARC)	5.2	1774447	5890658	19.3	3.2	16	46.68	Kerikeri Volcanic	0-15.4m Clay & Tephra (Weathered Kerikeri Volcanic?), 15.4-46.1m Kerikeri Volcanic (basalt with scoriaceous-ash intervals), 46.1m-EOH Tauranga (sandy silts).	Monitoring	ARC monitoring bore ("Fielding Road Volcanic Bore"). Estimated location (ARC records 1774451mE & 5890646mN). Water level data from 4/04/1989. Service address is Private Bag 92012, Auckland 1142.
421	Sisters Inc Ltd (Humphreys, Nicholas)	76 Jack Paterson Road, R D 4 Papakura 2584	2/09/2010	2.9	1775478	5892912	32	17.4	14	60.1	Kerikeri Volcanic	0-35.1m Tauranga (variable with organic material near 24.5-25m), 35.1-58.8m Kerikeri Volcanic (basalt with some ash layers), 58.8m-EOH Mudstone with some shell (Waitemata?).	Stock and domestic	Airlifted 2,300-2,100 gph at 32.5m for several hours (58 to 56 kPa). SWL 17.5m after drilling (29/9/1989). Service address is 21 Hauraki Road, Waiheke Island 1081. Tenanted (Rob & Jean).

Table B-2: Hunua Well Survey (14/12/2010) - Bores considered to be within shallow groundwater

					Co-ordinates (NZTM 2000)									
ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
640	Auckland Regional Council	230 Fitzgerald Road (Fielding Road Reserve), R D 1 Drury 2577	2/09/2010 (ARC)	5.2	1774439	5890631	18.4	6.8	12	273	Waitemata	0-10.56m Clay & Tephra (Weathered Kerikeri Volcanic?), 10.56-44.9m Kerikeri Volcanic (basalt & scoria), 45.64-109.2m Tauranga (variable materials with organic intervals), 109.2-149m silts & sands (Tauranga to Weathered Waitemata <128m) & 149m-EOH Waitemata (occasional peat intervals or shell >155m).	Monitoring	ARC monitoring bore ("Fielding Road Waitemata Bore"). Transmissivity of $5m^2/d$. Water level data from 24/04/1991. Service address is Private Bag 92012, Auckland 1142.
683 (BH106)	Papakura District Council	109 Hunua Road, R D 3 Papakura 2583	4/05/2010 (URS, Piezo C)	1.5	1776430	5894155	138	41.0	97	50	Waitemata	0m-EOH Waitemata (generally glauconitic >38.2m).	Monitoring	Piezometer at Hunua Gorge Landfill. SWL 39.62m after drilling (26/3/1991). Resistivity logging undertaken. No sample 40-48m. Service address is Private Bag 7 Papakura 2244.
683 (BH107)	Papakura District Council	109 Hunua Road, R D 3 Papakura 2583	20-21/04/1993 (ECL, Piezo C)	1.8	1776091	5894192	100	34.9	65	35	Waitemata	0-2.5m Kerikeri Volcanic & 2.5m-EOH Waitemata.	Monitoring	Piezometer at Hunua Gorge Landfill. SWL 32.61m after drilling (28/3/1991). Resistivity logging undertaken. No sample 20.7-33m. Piezometer B is often dry (& occasionally Piezo C).
684 (BH105)	Papakura District Council	109 Hunua Road, R D 3 Papakura 2583	4/05/2010 (URS, Piezo B)	1.7	1776206	5894162	120	32.6	87	50	Waitemata	0m-EOH Waitemata (generally glauconitic >19m).	Monitoring	Piezometer at Hunua Gorge Landfill. SWL 12.8m after drilling (25/3/1991). Resistivity logging undertaken. No sample 9-12.5m.
685 (BH102/1)	Papakura District Council	109 Hunua Road, R D 3 Papakura 2583	20-21/04/1993 (ECL, Piezo C)	1.5	1776370	5894389	126	39.3	87	50	Waitemata	0m-EOH Waitemata (Faults 25.6-28m & 48.3m-EOH).	Monitoring	Piezometer at Hunua Gorge Landfill. SWL 24.08m after drilling (14/3/1991). Resistivity logging undertaken (uniform response).
685 (BH102/2)	Papakura District Council	109 Hunua Road, R D 3 Papakura 2583	13/05/1992 (ECL, Piezo D)	1.5	1776372	5894385	126	23.0	103	25	Waitemata	As for BH102/1.	Monitoring	Piezometer at Hunua Gorge Landfill. SWL 14.8m after drilling (18/3/1991). Located 4.75m south (350^o mag) of BH102/1. Destroyed by April 1993.

Table B-2: Hunua Well Survey (14/12/2010) - Bores considered to be within shallow groundwater

					Co-ordinates (NZTM 2000)									
ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
686 (BH101)	Papakura District Council	109 Hunua Road, R D 3 Papakura 2583	4/05/2010 (URS, Piezo B)	1.2	1776633	5894350	145	39.8	105	50	Waitemata	0m-EOH Waitemata.	Monitoring	Piezometer at Hunua Gorge Landfill. SWL 2.45m (A) & 35.2m (B) after drilling (14/3/1991).
687 (BH103)	Papakura District Council	109 Hunua Road, R D 3 Papakura 2583	13/05/1992 (ECL, Piezo A)	1.7	1776187	5894366	115	3.8	111	35	Waitemata	0m-EOH Waitemata.	Monitoring	Piezometer at Hunua Gorge Landfill. SWL 3.05m after drilling (19/3/1991). Resistivity logging undertaken (uniform response). Piezometer B dry by 23/4/1991.
688 (BH104)	Papakura District Council	109 Hunua Road, R D 3 Papakura 2583	20-21/04/1993 (ECL, Piezo A)	1.7	1776192	5894249	101	17.5	84	35	Waitemata	0m-EOH Waitemata.	Monitoring	Piezometer at Hunua Gorge Landfill. SWL 30.8m after drilling (20/3/1991). Resistivity logging undertaken. No sample 21.7-32m. Piezometer B is sometimes dry.
689 (BH108)	Papakura District Council	109 Hunua Road, R D 3 Papakura 2583	4/05/2010 (URS)	1.7	1776194	5894242	102	38.2	64	59	Waitemata	0m-EOH Waitemata (Fault near 57-58m).	Monitoring	Piezometer at Hunua Gorge Landfill. SWL 30.2m after drilling (18/3/1992). No sample 19-57m & 58m-EOH.
690 (BH109)	Papakura District Council	109 Hunua Road, R D 3 Papakura 2583	4/05/2010 (URS, Piezo B)	1.8	1776093	5894275	98	42.9	56	59	Waitemata	0m-EOH Waitemata (generally glauconitic, common shells by 40m, conglomeratic 44-49m & conglomerate 58.6m-EOH).	Monitoring	Piezometer at Hunua Gorge Landfill. SWL 28.4m (A) & 40.82m (B) day after drilling (16/3/1992).
854	Taylor, Rodney Mitchell & Carolyn Alice	63 Gillespie Road, R D 3 Papakura 2583	11/08/2010	3.0	1780518	5893364	220	44.5	175	77.5	Waitemata	0-25m Clays with some weathered greywacke >16m (Weathered Waitemata), 25-75.4m Waitemata & 75.4m-EOH Clay (Te Kuiti?).	Stock & domestic (cottage toilet)	Labelled 845 in Ponga Survey. Airlifted 2,639-3,167 gph at 69m for 2.75 hours (470 to 460 kPa). SWL 44.3m three days after drilling (12/6/1992). Significant iron. Service address is 27 Gillespie Road, R D 3 Papakura 2583.
885	Erceg, Barry Keith	49 Bullens Road, R D 2 Papakura 2582		5.0	1776100	5899300	38	14.1	24	98	Waitemata	0-8m Clays to silts (Tauranga to Weathered Waitemata?), 8m-EOH Waitemata (generally glauconitic, some shell >64m).	Stock, domestic & orchard	Location recorded as 51 Bullens Road (but plots 49). Slow drilling >89m. No circulation 17-39m & 95.4m-EOH. Airlifted 13,700-14,600 gph at 64m for >4 hours (560 to 510 PSI). SWL 14.1m day after drilling (6/10/1992). Possible

Table B-2: Hunua Well Survey (14/12/2010) - Bores considered to be within shallow groundwater

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ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
														alternative contact address is 24 Friedlanders Rd Manurewa 2102.
960	Auckland Regional Council	51 Bullens Road (Road Reserve), R D 2 Papakura 2582	16/09/2010 (ARC)	5.0	1775848	5899160	35	11.2	24	75	Waitemata	0-11m Tauranga to Weathered Waitemata (>7.2m), 11m-EOH Waitemata (calcareous >45m & limestone >71m) .	Monitoring	ARC monitoring bore. Water level data from 21/06/1993. Service address is Private Bag 92012, Auckland 1142.
1155	Schofield, D F & Gail H	7 Bullens Road, R D 2 Papakura 2582	19/08/2010	4.6	1776052	5898889	38	10.5	27	71.5	Waitemata	0-5m Tauranga & 5m-EOH Waitemata (with some limestone >57.3m) .	Formerly irrigation & industrial	Some greywacke cuttings near EOH. Airlifted 9,900 gph at 45m (75 to 68 PSI). SWL 12.3m after drilling (13/1/1994). Selling property.
2878	Pakikaikutu Trust	140 Hamlin Road, R D 2 Papakura 2582		4.7	1775400	5898600	35	11.2	24	71.3	Waitemata	0-7.6m Tauranga & 7.6m-EOH Waitemata ("peat" 18.3-18.9m & limestone >67.6m).		Same location as bore 2879. Yield of 218.1m^3/day. Specific Capacity of 52.43m^2/day. Drawdown of 4.16m?. SWL 11.2m after drilling (29/10/1975).
2879	Liew, Hui & Thye Ying and Kwan, Dip	146 Hamlin Road, R D 2 Papakura 2582		4.7	1775400	5898600	35	n/a		71	Waitemata (Probably)?	No Log	Stock & domestic	Shared with Fowler's farm. Plots on 140 Hamlin Road.
2883	Lipscombe, M A & L E	51 Bullens Road, R D 2 Papakura 2582		5.0	1775900	5899160	35	9.5	25	72.73	Waitemata	0-15m Tauranga, 15-70m Waitemata (conglomeratic limestone near base) & 70m-EOH Waipapa.	Irrigation	Location from Map in Clevedon drilling and pump testing report. 510m^3 maximum daily abstraction. Yield of 870m^3/day. SWL 9.5m after drilling (28/1/1982). Iron 2ppm.
2884	Schofield, D F & Gail H	7 Bullens Road, R D 2 Papakura 2582	19/08/2010	4.6	1776140	5898850	37	10.6	26	61.5	Waitemata	0-15m Tauranga & 15m-EOH Waitemata (with thin limestone bands 50-60.1m).	Irrigation & industrial	No surviving bore at recorded location. Airlifted 3,000 gph at 32m. Yield of 327.3m^3/day. SWL 21.2m after drilling (20/12/1985)?
2912	Manukau City Council	26 Ardmore Quarry Road, R D 2 Papakura 2582		4.1	1777420	5898640	46	18.3	27	72.7	Waitemata	0-15.2m Tauranga & 15.2m-EOH Waitemata (cavity 70.7-71.9m & limestone >71.9m).	Animal pound	SWL 18.3m after drilling (22/8/1975). Service address is Private Bag 76917, Manukau City (Attention Property Council Commercial).

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ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
2925	JSM Investment Ltd (Li, Judson Jianjun)	550 Papakura-Clevedon Road, R D 2 Papakura 2582		4.9	1778500	5899500	29	-0.4	29	35	Waitemata	0-14m Tauranga & 14m-EOH Waitemata (with some limestone >28m).		Yield of 240m^3/day. SWL 0.4m above surface (artesian) after drilling (Dec 1983). Service address is 30 Roscommon Rd, Wiri, Manukau 2025.
4098	Heron Construction Co Ltd (Kroef, Gerhardus Paul & Leon Herman & Hendricus Jozef)	73 Boundary Road, Papakura 2110		3.6	1774200	5894700	16	11.6	4	79.2	Waitemata	0-57.9m Soft sediments (Tauranga to Weathered Waitemata) & 57.9m-EOH Waitemata.		Yield of 21.8m^3/day. Specific Capacity of 3.6m^2/day. Drawdown of 6.1m. SWL 11.6m after drilling (Sept 1964). Service address is PO Box 72561, Papakura 2244.
4195	Coyne, Kaye Olwen & Seal, Robin Michael & Whitney, Dwight Keller	71 Jack Paterson Road, R D 4 Papakura 2584		3.0	1775360	5892920	32	n/a		67	Kerikeri Volcanic (Possibly?)	No Log		
4196	Penrose, Calum Maxwell & Carole Anne & Murray, Barbara Ann.	51 Jack Paterson Road, R D 4 Papakura 2584		3.0	1775300	5893100	22	n/a			Waitemata (Possibly?)	No Log		
4197	Mobile Abrasive Blasters Ltd (McCauley, Robert David & Margaret Anne)	41 Hunua Road, Papakura 2110		2.7	1775200	5894800	23	-0.8	23	25.6	Kerikeri Volcanic	0-8.8m Tauranga (gravel 5.2-6.1m & >7m) & Kerikeri Volcanic (basalt & scoria).		Yield of 196.2m^3/day. Specific Capacity of 93.4m^2/day. Drawdown of 2.1m. SWL 0.8m above surface (artesian) after drilling (12/10/1961). Almost identical log to Bore 4234. Service address is 342 Great South Road, Opaheke Papakura 2113.
4198	Herbert, Charles M & A E	246 Dominion Road, Red Hill		2.7	1775200	5895300	33	5.5	27	15.8	Kerikeri Volcanic	0-10.7m Volcanic soil & ash (basalt boulders >7.9m) (Weathered Kerikeri Volcanic) & 10.7m-EOH Kerikeri Volcanic (hard basalt).		Possibly located on 1 Mack Place. Yield of 21.8m^3/day. Specific Capacity of 12.1m^2/day. Drawdown of 1.8m. SWL 5.5m after drilling (18/12/1959)
4205	Piggott, Kerry Raymond & SLA Trustees Limited.	174 Ponga Road, R D 4 Papakura 2584	13/09/2010	2.8	1775160	5893698	32	27.1		40.2	Kerikeri Volcanic (Possibly)?	No Log	Domestic	Original location plots on 154 Ponga Road. SWL 27.1m (5/12/1961). ARC records deeper bore (73m). Fills tank (5,000 g) in <8 hours.

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4211	Sanford, Donald J & Carol A	41 Jack Paterson Road, R D 4 Papakura 2584	9/09/2010	2.8	1775404	5893282	25	4.5	21	81.5	Waitemata?	0-16m Clays with pumice silts (10.5-14m) (gravel & timber 4.5-5.5m) (Tauranga), 16-44m Sandstone (<17m) to Mudstone (pumice silts 31-31.6m) (Waitemata?) & 44m-EOH Volcanic sandstone with ash & clay (hard basalt >80m) (Waitemata?).	Abandoned	Old bore indicated by D. Sanford?. Yield of 818.2m^3/day. Airlifted 3,000 & 7,500 gph. Pumped 500 gph at 6.8m. SWL 4.5m after drilling (11/7/1985). No surviving bore on 35 Jack Paterson Road confirmed by R & C Turner.
4212	Paterson, Kathleen I & Cynthia	215 Ponga Rd, R D 4 Papakura 2584	28/09/2010	2.5	1775532	5893589	29	5.5	24	54.3	Waitemata?	0-44.5m Clays, undifferentiated sediments (5.5-17.7m) & gravel (17.7-20.7m) (Tauranga to Waitemata?) & 44.5m-EOH Greywacke (Suspect Logging).	Stock & future domestic	Yield of 27.3m^3/day. Specific Capacity of 4.5m^2/day. Drawdown of 6.1m. SWL 5.5m after drilling (18/3/1965). Some iron. Service address is PO Box 281041, Maraetai Beach Manukau 2148.
4214	Erceg, Lynette Therese	198 Ponga Road, R D 4 Papakura 2584	9/09/2010	2.8	1775213	5893815	29	n/a			Kerikeri Volcanic (Possibly)?	No Log	Back-up supply	Old bore (1930's).
4233	Ward & Morley Trusts (Paul & Adrienne Dodd)	233 Ponga Road, R D 4 Papakura 2584	3/09/2010	2.4	1775693	5893553	33	10.8	22	90.86	Waitemata?	0-24m Tauranga (peat 5-8m, sands & pumice >14m), 24-26m Silty clays (Weathered Waitemata?) & 26m-EOH Mudstone & volcanic sandstone with thin ash layers (hard), basalt & greywacke boulders >67.5m (Waitemata?).	Domestic & stock	Original location plots on 24 Jack Paterson Road. Provides water to 221, 233 & 241 Ponga Road and 24 Jack Peterson Road. Airlifted 5,200-11,168gph (at 60m?) for 2.75 hours. Owner indicated original SWL about 15m (30/10/1985). Total abstraction of 36,000m^3 since drilled (30/10/1985).
4234	Erceg, Lynette Therese	79 Hunua Road, R D 4 Papakura 2584	9/09/2010	2.3	1775551	5894665	26	0.0	26	25.6	Kerikeri Volcanic	0-8.8m Tauranga (gravel 5.2-6.1m & >7m) & Kerikeri Volcanic (basalt & scoria).	Stock	Original location plots on ER 53 Hunua Road. Yield of 218.1m^3/day. SWL near surface after drilling. Almost identical log to Bore 4197. Service address is 198 Ponga Road, R D 4 Papakura 2584. No surviving bore on ER 53 or 69 Hunua Road (confirmed in field).

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4250	Nemaia, Miriam T & G	44 Red Hill Road, Papakura 2110		2.3	1775700	5895300	96	44.2	52	75.7	Waitemata	0-51.8m Kerikeri Volcanic & 51.8m-EOH Waitemata (some shell <54.9m).		Yield of 54.5m^3/day. Specific Capacity of 36.3m^2/day. Drawdown of 1.5m. SWL 44.2m after drilling (25/10/1962).
4251	Lee Clive M & B A	15 Tanah Merah Place, Papakura 2110		2.5	1775700	5895800	73	18.3	54	67.1	Waitemata	0m-EOH (31.7m) Waitemata.		Yield of 43.6m^3/day. Specific Capacity of 29.1m^2/day. Drawdown of 1.5m. SWL 18.3m after drilling at 31.7m (20/8/1959). Bore deepened to 67.1m (No Log).
4253	Shakespeare, Glenn Garnet & Hunt, Linda	5 Tanah Merah Drive, Papakura 2110	Received Fax & Phoned	2.5	1775700	5895900	63	n/a			Waitemata (Possibly)?	No Log	Abandoned?	No surviving water bore confirmed by L. Hunt. Received map showing locations of three geotechnical bores & two pits by Geotek Services Ltd. Possibly on R 135 Settlement Rd.
4265	Harrison, Kim Diana & David J	3 Gibbs Crescent, Papakura 2110	Received E-mail	2.3	1775800	5895500	97	n/a		82	Waitemata (Possibly)?	No Log		No surviving bore confirmed by D Harrison.
4270	Sorrenti, Paul Owen Jackson, Teresa, Rocco, Orazio & Frank	51 Heard Road, R D 2 Papakura 2582		3.6	1775900	5897600	63	Dry?		84.4	Waitemata	0-6.4m Clay (Weathered Waitemata?), 6.4-43.9m Waitemata (some limestone >25.9m & cavity 38.7-40.2m), 43.9-73.2m Mudstone (Waitemata/Te Kuiti?), 73.2-82.3m Greywacke Gravel & Clay (Weathered Waipapa?) & 82.3m-EOH Waipapa.	Abandoned	Abandoned bore ("dry") near 4271. Casing removed after drilling (17/1/1967). Inconsistent data in ARC records. Log details possibly as for 4271.
4271	Sorrenti, Paul Owen Jackson, Teresa, Rocco, Orazio & Frank	51 Heard Road, R D 2 Papakura 2582		3.6	1775900	5897600	63	30.5	33	39.6	Waitemata	0-8.2m Clay (Weathered Waitemata?), 8.2m-EOH Waitemata (some weathered greywacke >25.9m & cavity >38.7m).		Yield of 65.4m^3/day. Specific Capacity of 27.3m^2/day. Drawdown of 2.4m. SWL 30.5m after drilling (1/7/1966). Inconsistent data in ARC records. Log details possibly as for 4270.
4278	Donald, Denise Margaret	249 Drury Hills Road, Drury 2577		4.2	1775970	5890880	62	n/a		15?	Kerikeri Volcanic (Possibly)?	No Log		

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4279	Tijsen, Guustaf Johan	17 Margan Place, Red Hill Papakura 2110		2.2	1776000	5895800	112	n/a			Waitemata (Possibly)?	No Log		
4286	Richards, John N & Wang, Jing V	11 Harry Dreadon Road, R D 4 Papakura 2584		2.3	1776100	5893100	62	n/a		94	Waitemata (Probably)?	No Log		Same location as bore 5005.
4287	Lowe, Vicki A & S M	96 Red Hill Road, Papakura 2110		2.1	1776100	5895800	99	n/a		60	Waitemata (Probably)?	No Log		Plots on 10 Tanah Merah Drive.
4302	Hieatt, Desmond Charles & June Bessie	36 Harry Dreadon Road, R D 4 Papakura 2584	28/09/2010	2.2	1776300	5893000	99	n/a		45	Waitemata (Probably)?	No Log		No surviving bore confirmed by D Hieatt.
4303	Lafferty, Pamela and Raill, Michael Carol	245 Hunua Road, R D 3 Papakura 2583?		1.6	1776300	5895000	86	n/a		33	Waitemata (Probably)?	No Log		Same location as bore 4999. Suspect located on 241 Hunua Road.
4304	Munn, Joan Olive & Fredrickson, Grant	248 Settlement Road, Papakura 2110	9/09/2010	2.1	1776300	5896000	121	n/a		100	Waitemata (Probably)?	No Log	Currently not in use	Owner indicated bore near 1776349mE & 5896084mN. Bore damaged & buried (2m down) near service cable. Owner wants to reinstate bore. Recalls bore on property to north in vicinity of 242-246 Settlement Road (but possibly gone). Service address is 250 Settlement Road, Papakura 2110.
4334	Fletcher Concrete & Infrastructure Ltd (Winstone Aggregates)	489 Hunua Road, R D 3		0.9	1776900	5894600	91	Dry		30.5	None	0-30.5m Weathered Waipapa.	Abandoned	Abandoned ("Dry") bore located near entrance ponds in Hunua Quarry (Jan 1961). Service address is PO Box 17-195 Greenlane 1546.
4447	Taylor, Rodney Mitchell & Carolyn Alice	63 Gillespie Road, R D 3 Papakura 2583	11/08/2010	3.0	1780522	5893369	221	43.2	177	67	Waitemata (Probably)?	No Log	Abandoned	Near bore 854. Back-filled with aggregate & cement to surface. SWL 43.2m prior to abandonment (10/6/1992).

Table B-2: Hunua Well Survey (14/12/2010) - Bores considered to be within shallow groundwater

					Co-ordinates (NZTM 2000)									
ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
4452	KACSM Ltd (Maxwell, Craig Steven & Kathryn Anne)	8 Batkin Road, R D 4 Papakura 2584	2/09/2010	3.7	1781230	5893136	208	39.0	169	55	Waitemata	0-28.96 sand and clay (weathered Waitemata) & 28.96-EOH Waitemata	Stock, garden irrigation & domestic back-up supply	Single bore on property. Owner indicated old bore on 1912 Hunua Road (Simon & S I Jolley, 09-2924788).
4463	Batkin, Ross & Helen Edith	Batkin Road, R D 4 Papakura (Lot 4 DP44501)	19/08/2010	4.4	1781854	5892773	203	21.5	181.0	51	Waitemata	0-11.28 sand and clay (weathered Waitemata) & 11.28-EOH Waitemata	None	Original location plots on 33 Batkin Road (No bore confirmed by K. Powell). Not used for many years (collapsed?).
4691	Humes Pipeline Systems	72 Hunua Rd, Papakura 2110	1/09/2010 & 8/09/2010	2.9	1774931	5894996	22	13.3	9	251.2	Waitemata	0-1.5m Fill (aggregate & concrete), 1.5-24m Tauranga (gravel & silt with peat-timber 3.5-5m), 24-117m silt & mudstone (peat & timber 60-68m) (Tauranga to Weathered Waitemata) & 117m-EOH Waitemata.	Industrial back-up supply	45m^3 maximum daily abstraction. Total abstraction of 61,454.5m^3 since drilled. Airlifted 6,000-5,800 gph at 64m for >3.75 hours (590 to 390 PSI). SWL 13.3m day after drilling (26/1/1995). Service address is Private Bag 92817, Penrose Auckland 1642.
4722	KUEGLER, Raewynne Pamela & Frederick William Alva & Kuegler Trustee Company Ltd.	51 Harry Dreadon Road, R D 4 Papakura 2584	13/09/2010 & 28/07/2008 (PDP)	2.5	1776100	5892792	96	8.3	88	34	Kerikeri Volcanic	0-26m Silt with boulders >16m (Tauranga/Weathered Kerikeri Volcanic), 26-28m Clay & 28m-EOH Kerikeri Volcanic.	Stock	Drawn down 4m in 3 hours at 6m^3/hr. SWL 16m after drilling (4/2/1995). Trace iron. PDP indicates deepened to 160m?
4999	Druitt, Peter Clive	315 Hunua Road, R D 3 Papakura 2583?		1.6	1776300	5895000	86	n/a		32.6	Waitemata	0-29.9m Waitemata (limestone >3m) & 29.9m-EOH Waipapa.		Plots on 245 Hunua Road. Yield of 327m^3/day.
5005	Richards, John N & Wang, Jing V	11 Harry Dreadon Road, R D 4 Papakura 2584?		2.3	1776100	5893100	88	24.4	64	93.8	Waitemata	0-15.2m Kerikeri Volcanic (tephra >11.9m) & 15.2-EOH Waitemata.		Possibly located on R31 Harry Dreadon Road. Yield of 6.5m^3/day. SWL 24.4m after drilling (7/3/1961).
5006	Browning, Simon David & Tania Jane and Vodanovich, Ivan Milan	252 Settlement Road, Papakura 2110	28/09/2010 & 11/12/2008 (PDP)	2.1	1776408	5896111	112	62.7	49	99.5	Waitemata	0m-EOH Waitemata.	Domestic (2 houses)	Airlifted 1,200 gph. Yield of 130.9m^3/day. SWL 58m after drilling (3/7/1985). Small water tank at 1776386mE & 5896100mN. Bore shared with 258 Settlement Road (C & J McLeod).

Table B-2: Hunua Well Survey (14/12/2010) - Bores considered to be within shallow groundwater

					Co-ordinates (NZTM 2000)									
ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
5645 (BH103C)	Papakura District Council	109 Hunua Road, R D 3 Papakura 2583	4/05/2010 (URS)	1.7	1776187	5894366	115	46.9	68	48.9	Waitemata	0m-EOH Waitemata.	Monitoring	Piezometer at Hunua Gorge Landfill. No sample below 45m.
5645 (BH110)	Papakura District Council	109 Hunua Road, R D 3 Papakura 2583	4/05/2010 (URS)	1.6	1776262	5894244	108.08	7.4	101	15	Waitemata	0m-EOH Waitemata.	Monitoring	Piezometer at Hunua Gorge Landfill.
20116	Orium, Brian D & C E	16 McMurray Road, R D 4 Papakura 2584	17/08/2010	3.9	1781506	5893225	192	25.2	167	76	Waitemata (& Te Kuiti)	0-27m Sandy clays (Weathered Waitemata), 27-61m Sandstone (Waitemata?) & 61m-EOH Te Kuiti (some coal >73m).	Stock & back-up domestic supply	Occupied by G B Bassett. Airlifted 9m^3/hr for 5hrs (Drawdown of 1m). SWL 27m after drilling (23/2/1998). Some iron. Fills 4-5 tanks (5,000g) per year.
20444 (BH102d)	Papakura District Council	109 Hunua Road, R D 3 Papakura 2583	4/05/2010 (URS)	1.5	1776373	5894383	128	43.8	84	56	Waitemata	0-13m Clays (Weathered Waitemata?) & 13m-EOH Waitemata.	Monitoring	Piezometer at Hunua Gorge Landfill. No sample below 44.2m. SWL 40m after drilling (15/1/1999).
20444 (BHL1)	Papakura District Council	109 Hunua Road, R D 3 Papakura 2583	4/05/2010 (URS)	1.6	1776314	5894245	131	Dry		7.5	Waitemata	0m-EOH Fill.	Monitoring	Piezometer at Hunua Gorge Landfill. No sample below 5.5m.
20496	Verissimo, Michele & Scott, Terry	320 Hunua Road, R D 3 Papakura 2583	28/09/2010 & 17/07/2008 (PDP)	1.6	1776524	5895448	67	23.1	44	43	Waitemata (& Te Kuiti?)	0-34m Waitemata (conglomeratic 19-31m & some shell >31m), 34-41m sandstone (Waitemata/Te Kuiti?) & 41m-EOH Clay.	Domestic, irrigation, stock & summer backup	Airlifted 3.6m^3/hr for 8.5 hours (1.9m drawdown). SWL 23.1m after drilling (3/3/1999) & 23.5m (17/7/2008). Adequate quality.
20497	Jarvis Securities Ltd (Chris Verissimo)	95 Hunua Road, R D 3 Papakura 2583	28/09/2010 & 25/08/2008 (PDP)	1.8	1776076	5894404	107	41.9	65	72.5	Waitemata	0m-EOH Waitemata (conglomeratic limestone >66m).	Domestic (excl. drinking), irrigation & stock	Airlifted 4m^3/hr for 4 hours (8.4m drawdown). SWL 41.63m after drilling (26/2/1999) & 42.38m (25/8/2008). Service address is 39 Saint Vincent Avenue, Remuera 1050.
20578	Exton, George H & Pauline J	63 Garvie Road, R D 3 Papakura 2583	12/12/2008 (PDP)	4.4	1782208	5895192	132	19.5	112	74.2	Waitemata	0-15m Clay (<4m) to silts (Tauranga to Weathered Waitemata), 15m-EOH Waitemata.	Domestic	Airlifted 11,300-11,168 gph at 65m for 4 hours (72 to 65 PSI). SWL 19.5m after drilling (4/5/1999).

Table B-2: Hunua Well Survey (14/12/2010) - Bores considered to be within shallow groundwater

					Co-ordinates (NZTM 2000)									
ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
20644	Walker, Glen D & Swanwick-Tr, Debbie	296 Appleby Road, R D 1 Drury 2577	1/09/2010	2.9	1775876	5892485	47	20.8	26		Kerikeri Volcanic (Possibly)?	No Log	Domestic & stock	
21048	Ward, Kevin & J E	19 Bullens Road, R D 2 Papakura 2582		4.8	1776240	5899070	37	n/a		83	Waitemata (Probably)?	No Log	Orchard irrigation	250m^3 maximum daily abstraction.
21049	New Zealand Defence Force	100 Petersons Road, R D 2 Papakura 2582		3.3	1777180	5897870	60	n/a		18	Waitemata (Possibly)?	No Log	Domestic	22m^3 maximum daily abstraction.
21476	Nixon, Graham Lee & Weir, Brendan David	27 Middleton Road, R D 3 Papakura 2583	9/09/2010	2.1	1779792	5893892	216	n/a		40	Waitemata (Probably)?	No Log	Domestic & stock	Some calcium (hard). Service address is 34 Middleton Road, R D 3 Papakura 2583.
21607	Richardson, Peter Charles	92 Cherrington Road, R D 2 Papakura 2582		3.2	1780110	5896860	210	Dry		20	None	0m-EOH Clay with silt (Weathered Waipapa?).	Monitoring	
21817	Erceg, Lynette Therese	198 Ponga Road, R D 4 Papakura 2584	9/09/2010	2.8	1775200	5893816	28	15.8	12	60.5	Kerikeri Volcanic	0-31m Clay (<4m) to silt (some basalt chips >6.1m) (Tauranga to Weathered Volcanics?), 31-59.8m Kerikeri Volcanic (basalt with scoriaceous interval 40.5-42.8m) & 59.8-EOH Fine sand (Waitemata?).	Irrigation, stock & domestic (2 houses)	Produced sand (spot grouted near 58m?). Airlifted 1,500 gph at 38m for 2 hours (35 to 18 PSI). SWL 17m two days after drilling (9/3/2003). ARC records bore depth of 132m (cased to 82m). Low water level shut down occurred last three summers.
21858	Erceg, Lynette Therese	94 Ponga Road, R D 4 Papakura 2584	9/09/2010	3.1	1774846	5893779	22	14.8	7	177	Waitemata	0-19m Tauranga (peat >16m), 19m-50m Soft sandstone & conglomerates (21.5-35m) (Waitemata?) & 50m-EOH Waitemata (trace shell 70-82m).	Domestic & stock	Airlifted 10m^3/hr at 30m for 4.5hrs. Drawdown of 10.6m. SWL 15.4m after drilling (9/4/2003). Service address is 198 Ponga Road, R D 4 Papakura 2584.
21873	Murray, Stuart Marshall Campbell & Suzanne Claire	111 Garvie Road, R D 3 Papakura 2583	17/08/2010	4.0	1781813	5894798	163	45.0	117	90.3	Waitemata?	0-11m Clays (Weathered Waitemata?), 11m-EOH Waitemata (uncertain >69m).	Stock (chickens) & domestic (3 houses)	Pump setting & water level recorded by Parker Roy F & Son Ltd. Airlifted 1,800-1,840 gph at <71.5m for 2.25 hours (48 to 31 PSI). SWL 51.7m after drilling (15/4/2003). No sample below

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ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
														72.8m. Abstraction between 4-12m^3/day. Bio-security area.
21898	Piggotts Contracting Ltd (Piggott, Lionel Parker, K R & K W and Glass, J)	151 Hunua Road, R D 3 Papakura 2583	13/09/2010	2.0	1775814	5894838	48	8.3	39	68	Waitemata	0-9m Clay to silt with boulders (3-4m) (Landfill to Weathered Waitemata), 9m-EOH Waitemata (conglomeratic 13-14.5m & 25-34m).	Domestic & stock	Airlifted 2.1m^3/hr at 40m for 4.5hrs. Drawdown of 21.2m. SWL 10.8m after drilling (1/7/2003). Abandoned first bore (1m west) encountered Te Kuiti Group (coal) near EOH (102m). Owner reluctant for visit (disclaimer required in future).
21920	Park, Mee-Sook & J	168 Hamlin Road, R D 2 Papakura 2582	13/09/2010	4.3	1775696	5898327	55	27.5	27	61.8	Waitemata	0-15.5m Clays to silts (Weathered Waitemata?) & 15.5m-EOH Waitemata.	Formerly irrigation (nursery)	SWL 26m on 25/9/1987. Total abstraction of 74,744.6m^3 (since drilled?). No contact details for owner. Tenanted (Hamlin Nurseries (Barbara Morris)).
22152	Walker, Kenneth Thomas & Kathleen Louise	154 Ponga Road, R D 4 Papakura 2584	2/09/2010	2.9	1775118	5893626	31	16.8	14	81.9	Waitemata	0-9m Topsoil (<0.5m) to clays (Tauranga), 9-22m Marine sediments (Tauranga?), 22-30.5m Peat, clay & gravels (Tauranga?), 33-50m Rock (Kerikeri Volcanic?) & 50m-EOH Waitemata (no recovery >70.1m).	Irrigation & domestic (barn)	Produced 3.54m^3/hr with test pump at 48.2m. SWL 16.6m day after drilling (21/10/2004). Owner resident in Australia. Service address is C/O Stuart Walker, 8 Raphoe Place, Ellerslie 1051. Owner indicated an old bore north of Waipokopu Stream (N 37 Hunua Road) has been destroyed.
22390	Bell Farms Ltd (Bell, Adrienne Florence & Allan Robert)	638 Papakura Clevedon Road, R D 2 Papakura 2582		4.7	1777595	5899250	31	n/a		45	Waitemata (Probably)?	No Log	Stock	Location from bore permit 22124.
22391	Bell Farms Ltd (Bell, Adrienne Florence & Allan Robert)	638 Papakura Clevedon Road, R D 2 Papakura 2582		4.4	1777650	5898990	40	n/a			Waitemata (Possibly)?	No Log	Stock	Location from bore permit 22124.
22392	Bell Farms Ltd (Bell, Adrienne Florence & Allan Robert)	638 Papakura Clevedon Road, R D 2 Papakura 2582		4.4	1778030	5898980	39	n/a			Waitemata (Possibly)?	No Log	Stock	Location from bore permit 22124. Plots on 40 Church Road Ardmore.

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ARC Bore ID (Labelled N if unavailable)	Bore Owner	Site Address	Date Visited	Distance from sump (km)	Easting	Northing	Ground Level (above msl)	Water Level (m bgl)	Water Level (elevation)	Total Bore Depth (m)	Aquifer Geology	Bore Geology	Uses	Comments
22393	Bell Farms Ltd (Bell, Adrienne Florence & Allan Robert)	638 Papakura Clevedon Road, R D 2 Papakura 2582		4.2	1778300	5898800	40	n/a			Waitemata (Possibly)?	No Log	Stock	Location from bore permit 22124. Plots on 40 Church Road Ardmore.
23585 (& 23577)	McKeown, Michael J & Stanley, Sandra M	777 Ponga Road, R D 4 Papakura 2584	12/12/2008 (PDP)	2.5	1777680	5892128	225	n/a			Waipapa (Possibly)?	No Log	Domestic	Two filters installed for iron problems. PDP bore N1. Single bore in area confirmed by M. McKeown.
23693 (N2)	Costello, Raymond Peter & Judith Leonie	160 Gillespie Rd, R D 3 Papakura 2583	12/08/2010	2.9	1780026	5892753	223	n/a			Waipapa (Possibly)?	No Log	Formerly stock	Not in use (broken-down). Tight hole located in old landslide. Significant iron. Current supply from springs & roofs.
27891	Kelly, Sharon A & L M	1893 Hunua Road, R D 3 Papakura 2583	18/08/2010	3.1	1780914	5893938	193	n/a			Waipapa (Possibly)?	No Log	Stock	Residence at 1883 Hunua Road.
27892	Lees, Robin F & H R	210 Jones Rd, R D 2 Papakura 2582	12/12/2008 (PDP)	3.4	1781113	5895542	254	n/a			Waipapa (Possibly)?	No Log	Stock & irrigation	Shared with neighbours.
27893	Hung, Y & Ping, Shih Liu Yu Man	21 Patea Place, R D 2 Papakura 2582	11/12/2008 (PDP)	3.1	1776203	5897208	77	n/a			Waipapa (Probably)?	No Log		Owners denied having bore (but visible from neighbouring driveway).
27894	Edwards Wade M & Megan J	53 Awanui Rise, R D 2 Papakura 2582	11/12/2008 (PDP)	3.0	1776364	5897237	86	n/a			Waipapa (Probably)?	No Log	Currently not in use	Edwards' plan to get bore working in future.
27895	Osborne, Glenn Philip & Glenda Suzanne and R G Trustee Services Ltd (Graham, Rhonda Margot)	254 Settlement Road, Papakura 2110	11/12/2008 (PDP)	2.1	1776615	5896257	101	n/a			Waitemata (Probably?	No Log		Owner not home (bore visible from drive).
27896	Nelson, Sandra C & M J	50 Awanui Rise, R D 2 Papakura 2582	11/12/2008 (PDP)	3.0	1776497	5897297	75	n/a			Waipapa (Probably)?	No Log		Owner indicated water pumped from spring only.
23694	Twyford, Nicholas J & Katherine M & Paterson, Alan M	37 Harry Dreadon Road, R D 4 Papakura 2584	2/09/2010	2.4	1776163	5892944	98	27.8	70	28.3	Kerikeri Volcanic (Possibly)?	No Log	Stock & domestic back-up supply (regular)	Bore depth, pump setting & water level recorded (2005) by Parker Roy F & Son Ltd. Takes 4 days to fill water tank (3000 gallon, 1-2 weeks

Table B-2: Hunua Well Survey (14/12/2010) - Bores considered to be within shallow groundwater

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														use). Corroded casing. Possibly bore 4302.
27897	Murdoch, Myrtle & C	772 Papakura-Clevedon Road, R D 2 Papakura 2582	18/08/2010	4.0	1776363	5898356	52	n/a			Waipapa (Possibly)?	No log	Currently not in use	Service address is C/O John Murdoch, 864 Papakura-Clevedon Road, R D 2 Papakura 2582.
27898	Murray, Stuart Marshall Campbell & Suzanne Claire	111 Garvie Road, R D 3 Papakura 2583	17/08/2010	3.9	1781743	5895045	165	<38		71.88	Waitemata (Probably)?	No log	Stock & domestic back-up supply	Bore depth, pump setting & water level recorded by Parker Roy F & Son Ltd. Significant iron.
27899	Hamlin Road Trustee Ltd (Chen, Wei Gu & Lin, Fei & Guo, Hua Yun & Wei, Cheng Hua)	161 Hamlin Road, R D 2 Papakura 2582	13/09/2010	4.3	1775661	5898304	53	n/a			Waipapa (Possibly)?	No Log	Currently not in use	Old bore with corroded casing. Service address is 34 Carrick Glen Avenue, Flatbush Manukau 2016. Tenanted (Paul Running & Hamlin Nurseries (Barbara Morris)).
27900	Sanford, Donald J & Carol A	41 Jack Paterson Road, R D 4 Papakura 2584	9/09/2010	2.8	1775394	5893277	25	5.3	20	75	Waitemata?	0-12m Clay (Tauranga), 12-50m Mudstone (peat-timber 18-19m, carbonaceous 19-44m, conglomerate 44-48m & some timber >48m) (Tauranga to Waitemata?) & 50-75m basalt (soft) with thin ash layers (Waitemata?).	Domestic & stock	Airlifted 12m^3/hr at 37.5m for 3hrs. Drawdown of 22.5m. SWL 7.5m after drilling (4/10/2006). Some calcium (hard). Abandoned old bore (4211?) approximately 11m ENE.
27901	Ken Davidson Ltd (Davidson, Christine Adele & Kenneth W)	752 Papakura Clevedon Road, R D 2 Papakura 2582	8/09/2010	4.0	1776599	5898378	51	24.1	27	>24.7	Waitemata (Possibly)?	No Log	Abandoned	Residence on Ohiwa Road. Old bore (collapsed?). Dirty water. Service address is PO Box 2721722, Papakura 2244.
27902	Marshall, Chris J & Susan E	2008 Hunua Road, R D 3 Papakura 2583	18/08/2010	4.3	1782110	5894481	124	2.4	122		Waipapa (Possibly)?	No Log	Stock & pool	Significant iron & some sediment (increasing). Two possible old shallow wells.

Note:

1) *Information obtained from ARC databases, responses to mail-out to residents of Ponga Road and consultation by Winstone Aggregates.*
2) *Recorded bores within 5km of Hunua Pit east of Drury Fault and 3km west of Drury Fault. Refer separate spreadsheet for outstanding bore permits.*
3) *Locations of unvisited bores are approximate and may be on nearby properties with different ownership.*

Appendix B-3: Auckland Council Database (AC 2025) - Additional Farm Wells within Maximum Zone of Influence

BORE_ID	CONSENT_HOLDER	CONSENT_STATUS	GRANTED_DATE	REVIEW_DATE	EXPIRY_DATE	PROCESSING_OFFICER	PURPOSE	WORKS_DESCRIPTION	EASTING	NORTHING	ACTIVITY_STATUS	LAND_USE	LAND_USE_UPDATED	LAND_USE_NOTE	BORE_USE	ACTIVITY_DESCRIPTION	SITE_NAME	SITE_DESCRIPTION	MAIN_AQUIFER	AQUIFER	SUB_AQUIFER1	SUB_AQUIFER2	ENVIRONMENT_REPORTING_AREA	ALW_PLAN_ZONES	TLA	HYDSYS_NUMBER	DATE_DRILLED	TOTAL_DEPTH	GROUND_ELEVATION	STATIC_WATER_LEVEL	STATIC_WATER_DATE	BORE_LOG	AQUIFER_TEST	DIAMETER_FROM	DIAMETER_TO	DIAMETER	CASING_FROM	CASING_TO	CASING_TYPE	CASING_DIAMETER	SCREEN_FROM	SCREEN_TO	SCREEN_TYPE	CONTRACTOR	CONSULTANT	DATE_CREATED	PROPERTY_ADDRESS	LOC_TYP	created_user	last_edited_user	last_edited_date	created_date	VALIDATIONSTATE	inside_x	inside_y
29005	New Zealand Defence Force DPG Environmental Services (NY290) HMNZ N	Expired	20130725		20140729	Reginald Samuel	To authorise the construction of one bore for a pumping test, water supply and private purposes.	The construction of a 100mm diameter bore to an approximate depth of 75m. Installation of casing material to an approximate depth of 75m.	1777811	5896943	Drilled	Other	20130813		Water Supply	To drill and construct one bore for use in a training facility.	New Zealand Defence Force		Greywacke	Clevedon Greywacke					Papakura		20130807	108	100.5	37.4															Opus International Consultants Ltd	20170601	Petersons Road Papakura Auckland	Point	MASTER	MASTER	20170601 094303	20170601 094303	3	1777811	5896943

BORE_ID	OBJECTID	CONSENT_NUMBER	FILE_REFERENCE	CONSENT_HOLDER	GRANTED_DATE	REVIEW_DATE	EXPIRY_DATE	CONSENT_STATUS	PROCESS	PURPOSE	WORKS_DESCRIPTI	EASTING	NORTHING	ACTIVITY_S	LAND_USE	LAND_USE	LAND_USE_N	BORE_USE	ACTIVITY_	SITE_NAME	SITE_DESCRIPTI	MAIN_AQ	AQUIFER	SUB_AQUI	SUB_AQUI	ENVIRONM	ALW_PLAN	TLA	HYDSYS_N	DATE_DRI	TOTAL_DE	GROUND_	STATIC_W	STATIC_W	BORE_LOG	AQUIFER_	DIAMETER	DIAMETER	DIAMETER	CASING_F	CASING_T	CASING_T	CASING_D	SCREEN_F	SCREEN_T	SCREEN_T	CONTRAC	CONSULTA	DATE_CRE	PROPERTY	LOC_TYP	created_u	last_edite	last_edite	created_d	VALIDATIO	inside_x	inside_y
29411	7556	53156	C512-12-5460		20141022			Assessment Completed	Reginald S	The construction of one replacement bore for domestic purposes.	The construction of	1776645	5892640	Proposed				Domestic	The const	Colin Van de Ven								Papakura																				Winstone	20170601	473 Ponga	Point	MASTER	MASTER	201706010	201706010	3	1776645	5892640
27864	9773	39053	C512-12-4800	Clive Newell Murdoch & Myrtle Murdoch	20110401		20120405	Expired	Reginald S	To authorise the construction of one bore for stock and domes		1776587	5897784	Drilled				Domestic/	To author	Clive & Myrtle Murdoch		Greywack	Clevedon Greywacke					Papakura		20110418	101		18	20110418	Y	Y	0	101	100	0	39.2		100						20170601	772 Papa	Point	MASTER	MASTER	201706010	201706010	3	1776587	5897784
23585	4063											1777680	5892128	Drilled	Lifestyle	20100322		Other	Drilled pr	McKeown, Michael J, Stanley &		Greywack	Hunua West Greywacke					Papakura				225					0		100										20170601		Point	MASTER	MASTER	201706010	201706010	3	1777680	5892128

ConsentReference	ConsentDescription	TransactionTypeDescription	FormTypeDescription	ConsentStatus	ApplicationSubType	LodgedDate	DecisionDate	IssuedDate	ConsentD	ConsentGISClassification	_inside_x	_inside_y
WAT60353295	Permitted Activity - To take groundwater (Bore ID 29005) for the purposed of operation and wash down of training facilities.	Resource Management Appli	Water Consent application	Complete	Take	20200219	20200409	20200409	Granted	RMA Consent	1778066.16	5896451.77
LUC60320876	Permitted Activity - To authorise a replacement bore for domestic and stock supply.	Resource Management Conse	Land Use Consent	Complete	Drill or Alter Bore		20180615120000	20180615	No Monito	RMA Consent	1778680.18	5895372.94
LUC60317641	Permitted Activity - To authorise a replacement bore for stock and domestic supply.	Resource Management Conse	Land Use Consent	Complete	Drill or Alter Bore	19000101	20180404	20180404	No Monito	RMA Consent	1776003.26	5898124.09
LUC60440464	The construction of a new water bore for domestic use. Bore Depth 80-130(m), Bore Diameter 104 (mm), Casing Depth 30-80(m) & PVC Grade C material, Grouting length 30-80(m) into Hunua West Greywacke A	Resource Management Conse	Land Use Consent	Construction Monito	Drill or Alter Bore	19000101		20241213		RMA Consent	1776052.60	5893225.76
LUC60368789	To drill a 100mm bore to a depth of 190m to 240m deep, installing 100mm steel socketed and screwed casing to 160 deep and fully grou ting into place with 80 bags of cement.	Resource Management Conse	Land Use Consent	Complete	Drill or Alter Bore		20210616	20210122	Monitorin	RMA Consent	1776878.98	5891940.50
LUC60355003	Water Bore	Resource Management Conse	Land Use Consent	New	Drill or Alter Bore	19000101		20200702		RMA Consent	1776755.89	5890526.11

Appendix C: Water Quality Results (2025)

Figure C-1: Sampling sites

Appendix D: Geological Logs

BOREHOLE No. HUN04/12

LOCATION: HUNUA QUARRY | GRID REF: 320907.74E 676685.37N | SHEET 1 OF 5

CLIENT: Winstone Aggregates LTD | COLLAR ALTITUDE: 139.34m

JOB No. WAL04/1 | DATUM: Geodetic 1949 (Mt Eden Circuit)

DATE STARTED: 17-3-04 | DRILLER: Brown Bros (NZ) LTD | STAND PIPE: 0.64m

DATE FINISHED: 23-3-04 | TYPE OF DRILLING RIG: Rig 8 SIMCO 5000 TR3 | ORIENTATION: | PLUNGE: 90°

LOGGED BY: GDF

Recovery (%) 25 50 75	Core >100mm (%) 0 5 2 10 50 100	Sample	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref Code	Piezometer Construction (Piezometer Diameters in mm)	Comments
					0.35m CLAYEY SILT; light orangish brown, firm (disturbed)-stiff, plastic. [Residual Soil]. Very soft (disturbed) mud with some sand, minor aggregate and rootlets near top [Fill]. SANDY SILT; patchy pale brown to orangish brown with some light brownish red (above 0.8m), very soft-firm (disturbed), non-plastic. Fractured texture by 0.8m. Surface weathered, greywacke rock (corestones) near 0.7m (<100mm) and 2.15m (<70mm). [HW Greywacke].	D		RQD entered into penetration field in database from 6.6m. - maximum depth of contact. Some pieces (<10mm) of off-white, hard material (disturbed weathered veins) near 0.55m.
			1			ORH		
			2		2.65m - uncertain [HW-MW greywacke] below 2.3m. Recovered sample consists of mottled light orangish brown and off-white, loose (washed sample), sand with some gravel (<50mm). Gravel consists of variably weathered greywacke and off-white, VWK, vein material.			- rock generally crisscrossed by indistinct shear bands (<5mm) spaced <50mm apart.
			3		GREYWACKE SANDSTONE [MW-SW]; grey with some irregular orange-brown seams, WK-VS, weathered to fresh (<75%). Limonite-stained joints spaced 50-200mm apart and coated by off-white to orangish brown, low plasticity silt-clay (<10mm). White veins (<3mm, quartz) spaced 50-200mm apart. - minor patches (clasts <15mm) of dark grey, S, siltstone above 3.8m. Irregular >60° seam (<70mm) of fine-grained rock between 3.85-4.15m.			Core broken along irregular NV joint(s) filled by off-white to light orangish brown, low plasticity clay (<10mm) 3.95-4.05m. Core broken along joints 4.15-4.5m. - 35° joint filled by mottled light orangish brown and dark brown, slightly plastic silt (<10mm).
			4					
			5			RSWt		
			6		- minor siltstone patches (clasts <10mm) between 5.7-6.15m.			Core broken along joints 5.9-7m. - 35° joint filled by light orangish brown, plastic clay-silt (<10mm).
			7		6.75m GREYWACKE SANDSTONE [SW-FW]; grey, VS, partly altered (weakened <10mm along joints) to fresh (<95%). Joints-broken veins (some limonite-stained) spaced 50-300mm apart. White veins (<3mm, quartz, occasional voids <10mm) spaced 10-100mm apart.			- 50° joint-weathered vein (<5mm). Veins (<5mm, quartz) spaced <20mm apart 6.75-7.1m. Irregular NV seam (<50mm) of grey, S-SV, fine-grained rock and associated irregular elongated patches (<20mm) of dark grey, S, siltstone 6.75-7.25m.
			8					
			9		- crisscrossed by veins (<3mm, quartz) spaced 5-50mm apart below 8.55m.			
			10		- discoloured grey, S and slightly altered 10.3-10.7m.			- 35° & 40° limonite-stained joints filled by orange-brown, non-plastic silt (<2mm) at 9.75 & 9.95m. SWL 2m on morning of 18/3/04. - irregular veins (<5mm, quartz) spaced <20mm apart 10.3-10.7m.
			11		- less weathered [verging FW], occasional limonite-stained joints and veins (<2mm, quartz, some voids <20mm) spaced 50-200mm apart below 10.7m.			
			12		- irregular elongated patches (disrupted NV seam <50mm) of dark grey, S, siltstone between 11.55-11.85m.			- discontinuous veins (<2mm, quartz, some voids (<15mm)) spaced <20mm apart 11.5-12m.
			13			RSWc		Core broken along joints coated by orange-brown, non-plastic, sandy silt (<3mm) and partly weathered <3mm into the adjacent rock 13.05-13.25m.
			14		- discoloured grey, MS-S and moderately altered between 14.45-14.8m.			
			15					- 55° joint partly weathered <2mm into the adjacent rock. - 15° joint partly weathered <2mm into the adjacent rock. - 40° joint partly weathered <2mm into the adjacent rock.
			16					
			17					- 35° vuggy (<30 by 10mm) band (<25mm) with some remnant veins (<2mm, calcite). 10° joint partly weathered <2mm into the adjacent rock at 17.6m.
			18					
			19		- grey with irregular discoloured (brown tint) seams, MS-VS and slightly altered [FW <75%] between 19-20.6m. Brownish red staining along defects and in rock (upper half) above 20.5m.			Core broken along NV joint-weathered veins partly altered <20mm into the adjacent rock 19.14-20.77m. Irregular NV band of altered

PIEZOA_HUN.GPJ G_FISHER.GDT 23/4/04

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Drilling Methods	Casing Depths	Hole Diameters
HQ Core to EOH.	Temporary HW casing to 3.7m.	123mm to 3.7m. 96mm to EOH.

BOREHOLE No. HUN04/12

LOCATION: HUNUA QUARRY | GRID REF: 320907.74E 676685.37N

CLIENT: Winstone Aggregates LTD | COLLAR ALTITUDE: 139.34m | SHEET 2 OF 5

JOB No. WAL04/1 | DATUM: Geodetic 1949 (Mt Eden Circuit)

DATE STARTED: 17-3-04 | DRILLER: Brown Bros (NZ) LTD | STAND PIPE: 0.64m

DATE FINISHED: 25-3-04 | TYPE OF DRILLING RIG: Rig 8 SIMCO 5000 TR3 | ORIENTATION: | PLUNGE: 90°

LOGGED BY: GDF

Recovery (%)	Core >100mm (%)	Samples	Depth (m)	Legend	LITHOLOGY DESCRIPTION (Name, colour, strength, grain size, [moisture] miscellaneous)	Ref Code	Piezometer Construction	Comments
25 50 75	0 5 2 10 50 100						32	← Piezometer Diameters in mm
			21		- clean joints-broken veins spaced 100-600mm apart. Fine-grained with some irregular dark grey, NV, laminations (<2mm) between 20.8-21.4m.			rock-sandy silt (<10mm) 20.2-20.3m. - irregular off-white, weathered veins (<5mm, some vuggy voids (<10mm)) spaced <20mm apart 20.25-20.8m. - 20° vuggy (<10 by 5mm) band (<30mm) with some remnant veins (<5mm, quartz).
			22					- 45° network (<100mm) of irregular off-white veins (<3mm, quartz, common voids (<15 by 5mm)) spaced <20mm apart 21.95-22.05m.
			23		- veins (<3mm, quartz, occasional voids <10mm) spaced 20-100mm apart below 23.3m. Irregular NV seam (<25mm) of dark grey, MS-S, siltstone 24.1-24.95m.			
			24		- patchy discoloured grey, MS-S, moderately altered [FW <50%] and fractured (spacing <20mm) 24.3-24.85m.	RSWg		Interval (<50mm) of shattered core with some dark greenish grey (brown tint) to grey, silty sand fines near 23.75m. Core broken along irregular NV joint coated by dark greenish grey (brown tint), silt-sand (<3mm) 24.3-24.85m.
			25					
			26		- irregular veins (<3mm, quartz) spaced <15mm apart 24.75-26.35m.			
			27		- variable discoloured grey (brown-tint) with some irregular brownish red bands (<3mm), WK-S, moderately altered between 26.3-26.55m. Partly altered <20mm along joint(s) to 27.1m. Veins (<3mm, quartz, some voids <10mm) spaced 10-75mm apart below 26.35m. - irregular NV seam (<20mm) of grey to dark grey, MS-VS, siltstone between 27.25-27.55m.			Core broken along irregular NV joint(s) 26.05-27.1m. Joint coated by gray (green tint), silt-sand (<2mm) 26.7-27m.
			28	28.2m	- discoloured grey, MS, moderately altered patches at 27.9-28.01 & 28.1-28.16m. Calcareous rock below 28m. GREYWACKE SANDSTONE [FW]; grey, VS, fresh. Defects as above.	---		18/3/04.
			29		- veins (<3mm, quartz) spaced 5-30mm apart between 29.15-30.75m. Discoloured grey (green-tint) rock 29.5-29.8m. - irregular patchy seam (<30mm, dip 70°) of dark grey, MS-S, siltstone between 29.65-29.8m. Minor elongated siltstone patches (<30mm, disrupted bands) below 29.8m. - disrupted siltstone bands (<30mm, dip 70°) between 30.25-31.12m.			- 25° vuggy (<30mm) vein (<5mm, remnant quartz).
			30					
			31					- irregular 65° joint partly altered <3mm into the adjacent rock. - 65° joint coated by dark greenish grey, non-plastic silt (<2mm). - irregular NV band (<3mm) of dark grey, VWK, altered rock 31-31.2m. - 30° network (<200mm) of irregular veins (<3mm, quartz, some voids (<5mm)) spaced <10mm apart 31.65-31.85m.
			32		- disrupted siltstone bands (<20mm, NV) between 31.65-32.05m. Fine-grained sandstone 32.05-35.1m.			
			33		- veins (<3mm, quartz, few voids) spaced 20-100mm apart below 32.5m.			
			34		- some indistinct dark grey laminations (dip 70°) between 34.1-35.1m.	RFW		- NV network (>65mm) of irregular veins (<3mm, quartz) spaced <15mm apart 33.8-33.8m.
			35					- 60° network (<150mm) of irregular veins (<3mm, quartz, some voids (<10mm)) spaced <15mm apart 35.05-35.25m. Broken core 35.05-35.3m. - 60° network (<200mm) of irregular veins (<3mm, quartz) spaced <20mm apart 35.95-36.3m. - 70° joint-vein (<2mm, zeolite?) 36.3-36.5m. - NV network (<65mm) of irregular veins (<5mm, calcite, common voids (<30mm) above 36.12m) spaced <50mm apart 36.9-37.55m.
			36					
			37					
			38		- veins (<2mm, quartz) spaced 20-150mm apart below 37.55m.			- 35° vein (<5mm, quartz). Circulation lost at 38.6m. Petraseal used to regain circulation.
			39					

Drilling Methods	Casing Depths	Hole Diameters
HQ Core to EOH.	Temporary HW casing to 3.7m.	123mm to 3.7m. 96mm to EOH.

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PIEZOA HUN.GPJ G_FISHER.GDT 25/4/04

BOREHOLE No. **HUN04/12**

LOCATION: HUNUA QUARRY | GRID REF: 320907.74E 676685.37N | SHEET 3 OF 5

CLIENT: Winstone Aggregates LTD | COLLAR ALTITUDE: 139.34m

JOB No. WAL04/1 | DATUM: Geodetic 1949 (Mt Eden Circuit)

DATE STARTED: 17-3-04 | DRILLER: Brown Bros (NZ) LTD | STAND PIPE: 0.64m

DATE FINISHED: 25-3-04 | TYPE OF DRILLING RIG: Rig 6 SIMCO 5000 TR3 | ORIENTATION: | PLUNGE: 90°

LOGGED BY: GDF

Recovery (%)	Core >100mm (%)	Sample	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Rel Code	Piezometer Construction	Comments
25 50 75	0 5 2 10 50 100 / 1 5 20						32 ← Piezometer Diameters in mm	
			41		- mainly fine sandstone between 40-42.1m.			
					- veins (<4mm, quartz, some voids (<5mm)) spaced 10-75mm apart below 40.7m.			
			42		- veins as above spaced <15mm apart 41.85-42.75m. Joints-broken veins spaced 50-200mm apart by 41.95m.			Core broken along NV joint-vein (<1mm, quartz) 41.95-42.5m.
			43		- irregular NV seam (<65mm) of indistinctly banded grey to dark grey, S, siltstone between 42.55-43.75m. Some indistinct fine-grained bands (<15mm, dip 70°) continuing to 43.95m.			Core broken along irregular NV joint coated by off-white to pale grey, non-plastic silt (<1mm) 42.7-43.15m.
			44					- voids (<25mm) along some veins (<2mm, remnant quartz) 43.95-44.05m.
			45					
			46		- fine sandstone crisscrossed by irregular veins (<3mm, quartz, some voids (<10mm)) spaced <15mm apart between 45.5-45.8m.			Crystal-rain used to maintain circulation. 22/3/04.
			47		- occasional joints below 46.5m. Irregular veins (<10mm, calcite & quartz, occasional voids (<15mm)) spaced <15mm apart between 46.75-47.25m.			- 20° composite vein (<10mm, quartz, minor voids) to vein network (<20mm).
			48		- irregular veins (<4mm, calcite) spaced <20mm apart between 48-48.4m.			
			49					
			50			RFW		- 65° joint coated by off-white to pale grey, non-plastic silt (<2mm). Vuggy void (<25 by 5mm) along discontinuous 70° vein(s) near 50.7m.
			51		- disrupted bands (<20mm, dip 70°) of dark grey, MS-S, siltstone between 50.2-50.8m. Some elongated siltstone patches (disrupted NV bands (<5mm)) above to 49.85m.			
			52		- veins (<2mm, calcite) spaced 25-100mm apart below 52.35m.			
			53					- two <10° joints <10mm apart and slightly altered (discoloured grey, weakened) <10mm into the adjacent rock. Circulation lost at 53.1m. Attempted to regain circulation using "crystal-rain" and "petraseal".
			54					
			55					- 15° joint-vein (<1mm, calcite) coated by light grey, silty sand (drilling fines?) (<1mm).
			56					
			57		- elongated patches (disrupted 70° bands (<25mm)) of dark grey, S, siltstone between 56.45-56.95m. Seam (<25mm, dip 70°) of banded (<10mm) sandstone and siltstone between 57.3-57.65m.			- 20° network (<20mm) of veins (<3mm, calcite & quartz) with common voids (<30mm). 15° joint coated by light grey, low-plasticity clay (<3mm) at 56.65m. Core broken along >60° joints-veins 56.85-57.6m. - 40° vein (<5mm, quartz, minor voids (<5mm)). Irregular 70° seam (<15mm) of brecciated rock and vein material (calcite & quartz) associated with siltstone bands 57.3-57.63m. Vuggy void (>50 by 25 by 10mm) along above seam near 57.5m.
			58					
			59		- trace siltstone patches (clasts <10mm) and joints-broken veins spaced 50-300mm apart below 59.2m. Veins (<3mm, quartz, occasional voids (<5mm)) spaced 50-200mm apart below 59.7m.			SWL 22.7m on morning of 23/3/04.

Drilling Methods	Casing Depths	Hole Diameters
HQ Core to EOH.	Temporary HW casing to 3.7m.	123mm to 3.7m. 98mm to EOH.

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PIEZOA_HUN.GPJ G_FISHER.GDT 25/4/04

BOREHOLE No. **HUN04/12**

LOCATION: HUNUA QUARRY | GRID REF: 320907.74E 678685.37N

CLIENT: Winstone Aggregates LTD | COLLAR ALTITUDE: 139.34m | SHEET 4 OF 5

JOB No. WAL04/1 | DATUM: Geodetic 1949 (Mt Eden Circuit)

DATE STARTED: 17-3-04 | DRILLER: Brown Bros (NZ) LTD | STAND PIPE: 0.64m

DATE FINISHED: 25-3-04 | TYPE OF DRILLING RIG: Rig 8 SIMCO 5000 TR3 | ORIENTATION: | PLUNGE: 90°

LOGGED BY: GDF

Recovery (%)	Core >100mm (%)	Sample	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref Code	Piezometer Construction	Comments
25 50 75	0.5 2 10 50 100 (1 5 20)						32 ← Piezometer Diameters in mm	
			61		- veins (<3mm, quartz) spaced 5-40mm apart between 60.9-61.45m.			- 70° composite vein (<10mm, quartz, minor voids (<10mm)) and associated light grey rock above to 60.97m.
			62		- discoloured grey, MS and moderately altered between 61.85-62.05m. Some voids (<15 by 4mm) within upper 50mm. Conglomeratic interval (>65mm, dip 70°) with grey to dark grey, S-VS, siltstone patches (clasts <10mm) between 61.95-62.4m.			- irregular 40° joint coated by white-pale grey, low-plasticity clay (<2mm) and associated vein network (<10mm) with central streaky band (<8mm) of black material-pyrite. 35° joint coated by light grey fines (silt-sand) and vein material (<2mm) at 61.85m.
			63		- occasional joints-broken veins below 63.1m.			- elongated siltstone patch (disrupted 60° band (<20mm)) 62.15-62.2m. Core broken along irregular NV joints coated by light grey, low-plasticity clay (<2mm) 62.8-63.1m.
			64					- NV joint coated by pale grey (brown tint), low-plasticity clay (<1mm).
			65		- veins (<3mm, quartz, occasional voids (<10mm)) spaced 10-50mm apart below 65.45m.			
			66		- discoloured grey, WK-MS (green tint) and moderately altered between 66-66.55m. Slightly altered (<10mm along joints) between 66.55-66.65m & 67-67.7m.	RFW		- 55° vein network (<25mm) with common voids (<10 by 3mm) and associated light grey rock within 100mm. Core broken to shattered along defects 65.8-66.35m.
			67		- patchy bands (<30mm, dip 70°) of dark grey, S, siltstone between 66.65-67m.			- drilling disturbed NV seam (<20mm) of light grey, plastic clay with altered rock fragments to brecciated rock cemented by vuggy vein material (<3mm, remnant quartz) between 66.1-66.35m. Core broken along NV joint-vein(s) (<3mm, zeolite) 66.85-67.7m.
			68		- veins (<2mm, quartz) spaced 25-150m apart below 68.2m.			- 70° vuggy void (<30 by 6mm) with some remnant vein material (quartz) 67.8-68m. Irregular 20° joint at 68m coated by brownish green material (<1mm) with some orangish brown specks.
			69		- elongated siltstone patch (disrupted 70° band (<5mm)) near 68.65m.			Core broken along NV joints coated by pale grey, non-plastic silt (<1mm) 68.55-68.95m. Intersecting 15° joint (and above joints within 50mm) coated by dark green to orange-brown (limonite-stained), non-plastic silt (<1mm) at 68.7m.
			70		- joints spaced 50-300mm apart below 69.8m.			- 70° elongated void (35 by <3mm).
			71		- patchy siltstone bands (<30mm, dip 75°) between 71.05-71.5m.			- intersecting >40° & NV (to 70.15m) joints coated by pale green material (<1mm). Core broken along NV joint(s) coated (below 70.6m) by orange-brown (limonite-stained) to dark green, non-plastic silt (<1mm) 70.35-71.05m.
			72	72m	Veined GREYWACKE SANDSTONE [SA]; discoloured grey to grey, MS-S, partly to slightly altered (weakened). Joints-broken veins spaced 25-200mm apart. Crisscrossed by irregular white veins (<3mm, quartz, common voids (<20mm)) spaced <20mm apart.			- irregular NV joint (unbroken) partly altered (discoloured & weakened) <5mm into the adjacent rock 71.5-71.9m.
			73		- irregular pyrite patch (<70mm) at 73.05m.			- 35° off-white to light grey, composite vein (<50mm, quartz & zeolite?). Core broken along defects 72.3-73.6m.
			74		- less altered (FW >75%) and veins (<3mm, quartz, common voids (<15mm)) spaced 10-50mm apart below 73.7m.			- 40° slickensided defect-vein (<2mm, quartz) coated by light grey fines (sand-silt) (<1mm). Core broken along joints 74.15-74.45m. 50° slickensided defect-vein (<2mm, quartz) at 74.5m.
			75			RSW		- 30° composite vein (<8mm, quartz, common voids <2mm). 60° slickensided defect at 74.8m.
			76					- 30° vein network (<15mm, quartz) with common voids (<10 by 3mm). SWL 20.3m after drilling at 75.8m. Petraseal used to maintain circulation. SWL 19.8m on morning of 24/3/04. 70° slickensided defect-vein (<2mm, quartz) and intersecting 65° joint 75.85-76m.
			77		- moderately altered and veins (<5mm, quartz, common voids (<10mm)) spaced <20mm apart between 76.55-77m.			- >60° irregular joint(s) coated by pale grey, non-plastic silt (<3mm) 76.5-77.3m. Core broken along defects 77-77.3 & 77.35-77.55m. Core broken along defects 77.9-78.5m.
			78		- slickensided defects spaced 25-150mm apart and coated by calcite and/or chloritic material (<1mm) below 77.35m.			- 45° off-white to light grey, composite vein (60mm, quartz) with associated intensely veined rock below to 78.5m. Core broken along NV joint-vein (<1mm,
			79	78.6m	- veins (<3mm, quartz) spaced 5-20mm apart below 78.4m. GREYWACKE SANDSTONE [FW]; grey, VS, fresh. Slickensided defects spaced 50-200mm apart coated by calcite and/or dark green, chloritic material (<1mm). Crisscrossed by irregular white veins (<3mm, calcite) spaced 10-50mm apart. Some pyrite specks on defect surfaces.	RFW		

Drilling Methods	Casing Depths	Hole Diameters
HQ Core to EOH.	Temporary HW casing to 3.7m.	123mm to 3.7m. 96mm to EOH.

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PIEZOA_HUN.GPJ G_FISHER.GDT 25/4/04

BOREHOLE No. HUN04/12

LOCATION: HUNUA QUARRY | GRID REF: 320907.74E 676685.37N

CLIENT: Winstone Aggregates LTD | COLLAR ALTITUDE: 139.34m | SHEET 5 OF 5

JOB No. WAL04/1 | DATUM: Geodetic 1949 (MI Eden Circuit)

DATE STARTED: 17-3-04 | DRILLER: Brown Bros (NZ) LTD | STAND PIPE: 0.64m

DATE FINISHED: 25-3-04 | TYPE OF DRILLING RIG: Rig 8 SIMCO 5000 TR3

LOGGED BY: GDF | ORIENTATION: | PLUNGE: 90°

Recovery (%)	Core >100mm (%)	Sample	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref Code	Piezometer Construction	Comments
25 50 75	0.5 2 10 50 100 / 1 5 20						32 ← Piezometer Diameters in mm	
			81		- veins (<15mm, calcite & quartz) spaced <20mm apart below 81.25m.			calcite) 79.05-79.35m. - 25° slickensided defect coated by pale to light grey, muddy crushed rock-vein material (<5mm, calcite). Core broken along defects 81.3-81.8m.
			82					
			83		- discontinuous band (<10mm, dip 55°) of dark, S, siltstone near 82.75m. - joints-broken veins spaced 100-300mm apart and veins (<3mm, calcite & quartz) spaced <10-50mm apart below 83m. Indistinct zones containing minor siltstone patches (clasts <10mm) by 83.45m.			- <20° network of irregular veins (<20mm, quartz) spaced <10mm apart 82.55-82.65m.
			84					- 60° joint filled by light grey, silty crushed rock-vein material (<5mm, zeolite?).
			85					
			86		- mostly NV veins (<5mm, calcite & quartz) spaced <10-100mm apart below 86.25m.	RFW		
			87		- occasional joints-broken veins below 87m. Fine-grained sandstone 87.4-89.7m.			Core broken along NV joint-veins (<2mm, quartz) 86.6-87m.
			88					
			89					
			90					Core broken along NV joint-vein(s) (<1mm, calcite) 90.05-90.7m.
			91					- 50° vein (<5mm, calcite). Installing piezometer 24/3/04 & 25/3/04.
					91.8m			
			92		EOH @ 91.8m			
			93					
			94					
			95					
			96					
			97					
			98					
			99					

PIEZOA_HUN.GPJ G_FISHER.GDT 25/4/04

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Drilling Methods	Casing Depths	Hole Diameters
HQ Core to EOH.	Temporary HW casing to 3.7m.	123mm to 3.7m. 96mm to EOH.

BOREHOLE No. **HUN18/2**

LOCATION: HUNUA QUARRY **GRID REF:** 421404.90E 776755.09N

CLIENT: Winstone Aggregates **COLLAR ALTITUDE:** 150.50m **SHEET** 1 **OF** 7

JOB No. WAL18/6 **DATUM:** Mean Sea Level. Mt Eden 2000 Circuit.

DATE STARTED: 13-11-18 **DRILLER:** Drill Force LTD **STAND PIPE:** 1.407m

DATE FINISHED: 6-12-18 **TYPE OF DRILLING RIG:** Rig 5 Cortex

LOGGED BY: GDF **ORIENTATION:** **PLUNGE:** 90°

Recovery (%) 25 50 75	Sample	Reduced Level (m)	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref. Code	Piezometer Construction	Comments
							32 20 ← Piezometer Diameters in mm	
		150	0		0.4m Aggregate FILL; mostly moderately weathered to slightly weathered/altered greywacke fragments (<40mm) partly coated by light brown (orange-tint), non-plastic, sand-silt.	OF		NZTM location (GPS within 3m) of 1778194mE & 5893378mN. Adjacent batter exposes top soil (<0.3m), residual soils (0.7-1.2m) to weathered greywacke (<4.5m). RQD entered into penetration field in database from 10.5m. Core boxes photographed. Box 1: 0-5.6m.
		149	1		UNCERTAIN [Track Fill to As Below]; no core recovery by 0.4m.	O		
					1.8m SILT with some to common sand; patchy pale brown to orangish brown with some irregular black mottles to streaks, very soft (disturbed) to stiff, non-plastic. Remnant fractured texture (<50mm, indistinct). [CW Greywacke].			- maximum depth of natural ground. Mostly intact core.
		148	2					
		147	3			ORC		
		146	4		- becoming as below. Hard by 5.63m [HW].			
		145	5		5.7m Silty SAND with some gravel; light brown with some orange-brown streaks, disturbed to tightly packed (stiff). Irregular limonite-stained remnant joints spaced 10-50mm apart. Gravel (mostly <50mm) is variably weathered greywacke (Sst) from corestones. [HW Greywacke].			Box 2: 5.6-10.5m. Joints have variable dip. Shattered core (<25mm, mixed) 5.7-6m.
		144	6		- minimal core recovery (mostly gravel <65mm) between 6.75-9m.			14-15/11/18 (breakdown). Cased to 6m. Core run 6-7.5m has 70mm of probable uphole rock (<30mm, some sandy mud) at top.
		143	7			ORH		
		142	8					
		141	9		- more gravel by 9m.			
		140	10		9.9m Weathered GREYWACKE (Sst) [HW-MW]; patchy light brown to orangish brown, VWK to MS, weathered to limonite-cement. Occasional discoloured grey, less weathered patches (<60mm). Crisscrossed by irregular limonite-stained to black joints spaced 10-50mm apart. Occasional remnant veins (<1mm).			- 45° contact along joint. Fine-medium grained greywacke. Veins mostly dip 50°-NV.
		139	11		- more weathered between 10.47-10.6m (55°). Crisscrossed by irregular remnant veins (<5mm) spaced 10-100mm apart by 10.6m.	ORH		- no grey patches 10.4-12m. Disturbed band (<60mm) of light orangish brown, silty sand near 10.47m. Box 3: 10.5-13.3m. Veins have variable dip by 10.6m. Band (<50mm) of gravelly (<10mm) sand with some silt between 12.4 (15°)-12.45m (30°) [Minor Fault?].
		138	12		- becoming harder by 12m. Common less weathered/altered to fresh patches (some >65mm) between 12-12.4m.			
		137	13		12.7m GREYWACKE SANDSTONE [MW]; patchy brown to light brown and grey (<65mm, some discoloured), WK to VS, variably weathered [FW <25%]. Crisscrossed by irregular limonite-stained to black mottled joints spaced 10-50mm apart and irregular remnant veins (<2mm) spaced 20-100mm.		SWL 13.35m (17/12/18)	- irregular contact. Some joints coated by light brown to orange-brown, non-plastic silt (<2mm). Veins mostly dip 45°-NV near 12.7-15.25m.
		136	14		- fewer grey patches below 13.3m.	ORM		Box 4: 13.3-16.1m. Broken core with some intact intervals (<200mm) from 13.9m. 60° white vein (<4mm, weathered) at 14.35m. Becoming finer greywacke. SWL 2.4m on morning 16/11/18.
		135	15		- harder by 14.35m.			
		134	16		15.25m GREYWACKE SILTSTONE with some argillite [MW]; patchy brown to light brown with some dark grey-brown intervals (<200mm), WK to MS, partly weathered. Crisscrossed by irregular limonite-stained joints to remnant veins spaced 5-35mm apart.	ORM		- 45° contact along joint-vein coated by off-white, non-plastic silt (<2mm). Indistinctly banded (<20mm, 40°-NH). Broken joints often coated by off-white to orange-brown, non-plastic silt (<3mm) 15.25-17.7 & 18.75-20.9m.
		133	17		- some disrupted bands to patches (<65mm, 40-50°) of greywacke sandstone between 16.8-17.4m.			Box 5: 16.1-18.85m. Mostly intact core from 16.1m.
		132	18		17.7m - dark grey to black with some dark brown seams (<50mm), MS to S, slightly weathered [FW <65%], argillaceous rock below 17.4m.	RSWb		- 45° band (<10mm) of off-white, non-plastic silt (vein material) at 16.8m. Broken core (<100mm pieces) 17.55-18.25m.
		131	19		18.25m Fractured GREYWACKE SANDSTONE [SW/SA]; grey, S, slightly weathered/altered (pervasive). Crisscrossed by irregular (<70°) limonite-stained, dark green to clean joints spaced 10-30mm apart. Irregular white veins (<1mm, weathered/zeolite) spaced 10-50mm apart.	RSW		- medium grained greywacke.
					18.75m Veined ARGILLACEOUS ROCK [MW-SW]; dark grey with irregular variable brown seams, MS to S, partly weathered (<30mm from joints) to fresh (50%). Crisscrossed by limonite-stained joint-fractures spaced	RSWb		- 60° contact. Indistinctly banded (<20mm, 60°) 18.25-18.35m. Broken joints spaced 50-150mm apart. Veins mostly dip 45°-NV near 18.25-18.75m.
						RMW		- contact along 50° joint-vein (<1mm). Indistinctly banded (<30mm, 60-80°).

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Drilling Methods	Casing Depths	Hole Diameters
HQ Core to EOH.	Temporary HW casing to 9m.	123mm to 9m. 96mm to EOH.

BOREHOLE No. **HUN18/2**

LOCATION: HUNUA QUARRY **GRID REF:** 421404.90E 776755.09N

CLIENT: Winstone Aggregates **COLLAR ALTITUDE:** 150.50m **SHEET** 2 **OF** 7

JOB No. WAL18/6 **DATUM:** Mean Sea Level. Mt Eden 2000 Circuit.

DATE STARTED: 13-11-18 **DRILLER:** Drill Force LTD **STAND PIPE:** 1.407m

DATE FINISHED: 6-12-18 **TYPE OF DRILLING RIG:** Rig 5 Cortex

LOGGED BY: GDF **ORIENTATION:** **PLUNGE:** 90°

Recovery (%) 25 50 75	Sample	Reduced Level (m)	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref. Code	Piezometer Construction (32 20 ← Piezometer Diameters in mm)	Comments
		130	21		10-50mm apart to white veins (<3mm, weathered) spaced <40mm apart.	RMW		Irregular NV seam (<65mm) of brown to light brown, greywacke sandstone between 18.8-20m.
					20.9m Veined GREYWACKE SILTSTONE with some argillite [MW]; mostly dark brown to brown with some dark grey to black patches (<100mm), WK to S, partly weathered to fresh (<25%). Crisscrossed by irregular limonite-stained joints spaced <100mm apart to white veins (<3mm, weathered) spaced <40mm apart.			Box 6: 18.85-21.5m. Irregular NV joint(s) filled by light orangish brown, non-plastic silt (<4mm) 18.85-19.8m.
		129			- becoming less weathered [FW <50%].			- irregular 70° band (<10mm) of black argillaceous material.
			22		Veined GREYWACKE SILTSTONE with some argillite [MW-SW]; dark grey to black with irregular dark brown seams (<65mm), MS to S, partly weathered (<20mm from joints) to fresh (>50%). Crisscrossed by limonite-stained joint-fractures spaced <50mm apart to white veins (<2mm, weathered/zeolite) spaced <20mm apart.			- NH contact along joint. Indistinctly banded (<30mm, 50-70°). Defects have variable dip. Broken joints (often coated by orange-brown, non-plastic silt <1mm) spaced 10-200mm apart.
		128						
			23					
		127			- less weathered [FW 75%] near 22.75-24.6m. Fractures to joints spaced 5-75mm apart and partly weathered <10mm into the adjacent rock. Veins (<3mm, quartz & weathered) spaced <30mm apart.	RSWb		Box 7: 21.5-24.4m. Intact core 22.2-22.6m.
			24					- fewer joints coated by silt (<1mm) by 22.75m.
		126						Broken core (<150mm pieces) 23.25-24.8m.
			25		- veins (<3mm, weathered/zeolite) spaced <30mm apart below 24.6m.			Box 8: 24.4-26.9m. Broken joints spaced 25-300mm apart below 24.6m.
		125						- 50° vein (<10mm, weathered/zeolite) to vein network (<15mm) partly weathered <30mm into the adjacent rock. Associated 55° band (<5mm) of black, WK, argillaceous rock.
			26		26m Veined GREYWACKE SILTSTONE with some argillite [SW-FW]; dark grey to black with some irregular brown seams, MS to S, partly weathered (<10mm from joints) to fresh (>75%). Crisscrossed by limonite-stained joint-fractures spaced 10-75mm apart to white veins (<3mm, weathered/zeolite) spaced <30mm apart.			SWL 6.62m on morning 19/11/18.
		124						- contact along irregular NV joint partly weathered <20mm into the adjacent rock. Indistinctly banded (mostly <30mm, 55°). Broken joints (some coated by silt <1mm) spaced 10-350mm apart. Veins mostly dip 45°-NV.
			27					
		123						
			28			RSWg		Box 9: 26.9-29.85m.
		122						
			29		- more irregular bands to seams (<50mm, 70-NV°) of argillaceous rock below 29m.			
		121			29.9m			
			30		Veined GREYWACKE SANDSTONE with some argillaceous rock [MW-SA]; mostly grey with some irregular brown seams, MS to S, partly weathered (<10mm from joints) to slightly altered (<75%, pervasive). Crisscrossed by limonite-stained joints spaced 10-75mm apart to white veins (<2mm, weathered/zeolite) spaced <40mm apart.			Box 10: 29.85-32.6m. Contact along 50° joint-vein (<5mm, weathered) at 29.9m. Medium grained greywacke. Some dark grey-black patches to 30.3m. Defects have variable dip. Joints often coated by orange-brown, non-plastic silt (<3mm).
		120			- no argillaceous rock below 30.3m.			- irregular NV joint-vein (<3mm, weathered) and associated seam (<65mm) of partly weathered rock. Fewer joints coated by silt (<1mm) from 30.9m.
			31					
		119			- less weathered/altered [FW >75%] between 30.9-32.54m. Harder (mostly VS). Joints spaced 20-100mm apart and partly weathered <5mm into the adjacent rock. Veins (<3mm, quartz & weathered) spaced 10-40mm apart.			
			32					- 30° joint (coated by silt <1mm) and partly weathered <5mm into the adjacent rock. Associated white-transparent to mottled dark grey vein (<10mm, quartz) with minor voids (5 by 2mm).
		118			- some irregular bands to patches (<20mm, 70°-NV) of black argillite between 32.54-33.8m. Joints spaced 5-50mm apart and partly weathered <20mm into the adjacent rock from 32.54m. Veins (<3mm, quartz & weathered with some narrow voids) spaced <20mm apart.			- 30° network of off-white veins (<5mm, quartz & weathered) spaced 5mm apart and associated partly weathered rock 32.54-32.57m. Joint coated by silt (<1mm) along bottom. Fine grained greywacke near 32.54-33.8m. Box 11: 32.6-35.45m.
			33					
		117						
			34		- less weathered [SA >75%] between 33.85-34.5m. Joints spaced 20-100mm apart and partly weathered <10mm into the adjacent rock. Fractures to veins (<3mm) spaced 10-40mm apart.			
		116				RSWb		
			35		- more weathered [SA >50%] below 34.9m.			Core broken (<75mm pieces) along 70°-NV joint(s) coated by pale brown, low-plasticity clay to orange-brown, non-plastic sand-silt (<4mm) 33.3-33.85m. Associated seam (<65mm) of partly weathered rock
		115						
			36					
		114						- some joints coated by light brown to orange-brown, non-plastic silt (<2mm) below 33.85m. Broken 35° orangish green joint at 33.95m.
			37		- verging on moderately weathered [MW] below 36.9m. Veins spaced <40mm apart. Light brown-brown, partly weathered seam (<160mm, 65°) between 36.9-37.4m.			
		113						Core broken (<100mm pieces) along irregular NV joint(s) partly coated by orange-brown, non-plastic silt (<1mm) 34.5-35m.
			38		- some irregular bands to patches (<40mm, 45°-NV) of dark grey to black, argillaceous rock below 38m.			
		112						Box 12: 35.45-38.0m. Irregular seam (<160mm, 65°) of partly weathered rock associated with joints between 36.9-37.4m.
			39		- brown with some discoloured grey and partly weathered between 38.95-39.1m.			- 65° joint filled by orange-brown, silty
		111			39.4m Veined GREYWACKE SANDSTONE (Fine) to ARGILLACEOUS ROCK [SW-FW]; grey to black with some irregular brown to dark brown	RSWg		

Drilling Methods	Casing Depths	Hole Diameters
HQ Core to EOH.	Temporary HW casing to 9m.	123mm to 9m. 96mm to EOH.

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BOREHOLE No. **HUN18/2**

LOCATION: HUNUA QUARRY **GRID REF:** 421404.90E 776755.09N

CLIENT: Winstone Aggregates **COLLAR ALTITUDE:** 150.50m **SHEET** 3 **OF** 7

JOB No. WAL18/6 **DATUM:** Mean Sea Level. Mt Eden 2000 Circuit.

DATE STARTED: 13-11-18 **DRILLER:** Drill Force LTD **STAND PIPE:** 1.407m

DATE FINISHED: 6-12-18 **TYPE OF DRILLING RIG:** Rig 5 Cortex

LOGGED BY: GDF **ORIENTATION:** **PLUNGE:** 90°

Recovery (%) 25 50 75	Sample	Reduced Level (m)	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref. Code	Piezometer Construction 32 20 ← Piezometer Diameters in mm	Comments
		110	41		seams, MS to VS, partly weathered (<10mm from joints) to fresh (>75%). Crisscrossed by limonite-stained joints spaced 10-100mm apart to white veins (<3mm, quartz & weathered) spaced <40mm apart.			sand (<10mm). Broken parallel joint coated by silt (<3mm, as above) at 37.1m. Box 13: 38-40.9m. Shattered core (<50mm pieces) 39-39.1m. SWL 7.48m on morning 20/11/18. Irregular NV seam (<50mm) of dark grey-black, S, argillaceous rock near 39.1-39.35m. - irregular 50° bedding contact. Indistinctly banded (<50mm, 40-70°). Defects have variable dip. Broken joints (some coated by orange-brown, non-plastic silt <1mm) spaced 30-300mm apart. Box 14: 40.9-43.5m. - intersecting 70° off-white veins (<5mm, quartz & weathered). Box 15: 43.5-46.3m. - disrupted band (<30mm, 50°) of greywacke sandstone. Core split along irregular NV joint(s) coated by light brown to orange-brown, non-plastic silt (<2mm) 44.4-46.4m.
		109	42		- irregular seam (<50mm, 60°-NV) of coarser greywacke sandstone between 41.45-41.7m.			
		108	43		- dominantly dark grey to black with dark brown seams (<30mm), MS to S, argillaceous rock below 42.35m (50°). Veins (<3mm) spaced <20mm apart.			
		107	44					
		106	45		- more weathered [FW <75%] between 44.4 (NV) & 46.2m (NV-55°).	RSWg		
		105	46		- interval (<100mm) of discoloured grey with light brown-brown seams, MS to S, slightly weathered/altered, greywacke sandstone between 45.8 (60°) & 46.0m.			Box 16: 46.3-49.0m. Minimal silt on joints by 46.6m.
		104	47					
		103	48		- partly weathered seam (<100mm) along subparallel 55° joints spaced <20mm apart between 47.5-47.7m.			
		102	49					- 55° argillaceous band (<20mm). Box 17: 49.0-51.45m.
			49.25m		Veined GREYWACKE SANDSTONE [MW-SW]; grey with brown intervals (<200mm), MS to VS, partly weathered (<30mm from defects) to fresh (>50%). Crisscrossed by irregular limonite-stained joints spaced 10-100mm apart to mostly white veins (<3mm, quartz & weathered) spaced 5-50mm apart.			Medium grained greywacke. Defects have variable dip. Some joints partly coated by orange-brown, non-plastic silt (<1mm).
		101	50					
		100	51					Core broken (<125mm pieces) along intersecting joints 50.8-51.45m. Box 18: 51.45-54.2m.
		99	52		- less weathered [FW >75%] between 51.55-52.2m. Partly weathered <10mm from joints. Veins (<10mm, quartz) spaced <30mm apart.			- fine grained greywacke 51.55 (50°)-52.2m. Minor irregular black flecked bands (<20mm, 50°).
		98	53		- veins (<3mm, quartz & weathered) spaced <40mm apart by 52.2m.			
		97	54					SWL 8.35m on morning 21/11/18.
		96	55		- verging on moderately weathered below 54.2m.	RSWb		Box 19: 54.2-57.3m. Irregular 60° network (<20mm) of off-white veins (<5mm, quartz with voids <60 by 10mm) spaced <10mm apart at 54.4m. Core broken (<100mm pieces) along mostly 45°-NV joints some coated by light brown, low-plasticity clay to non-plastic sandy silt (<3mm) 55.1-56.3m.
		95	56					
		94	57					Core dropped from run 55.3-56.3m. New drilling bit. Casing deepened to 9m. - discontinuous 40° vein (<7mm, quartz). Splaying 40° white-transparent vein (<12mm, quartz) with some rock fragments (<15 by 3mm) at 57.1m. Box 20: 57.3-59.9m.
		93	58					
		92	59		- moderately weathered [MW] between 58.75 (60°) & 59.05m. Brown with some grey patches (<40mm).			- broken 75° vein (<4mm, quartz). 60° joint coated by light brown, non-plastic, sandy silt (<3mm) at 58.45m. 60° joint coated by light brown, low-plasticity clay (<2mm) at 58.75m. - indistinct patch (>60 by 20mm, 50°) of conglomeratic greywacke near 59m. Core
		91						

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Drilling Methods	Casing Depths	Hole Diameters
HQ Core to EOH.	Temporary HW casing to 9m.	123mm to 9m. 96mm to EOH.

BOREHOLE No. **HUN18/2**

LOCATION: HUNUA QUARRY **GRID REF:** 421404.90E 776755.09N

CLIENT: Winstone Aggregates **COLLAR ALTITUDE:** 150.50m **SHEET** 4 **OF** 7

JOB No. WAL18/6 **DATUM:** Mean Sea Level. Mt Eden 2000 Circuit.

DATE STARTED: 13-11-18 **DRILLER:** Drill Force LTD **STAND PIPE:** 1.407m

DATE FINISHED: 6-12-18 **TYPE OF DRILLING RIG:** Rig 5 Cortex

LOGGED BY: GDF **ORIENTATION:** **PLUNGE:** 90°

Recovery (%) 25 50 75	Sample	Reduced Level (m)	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref. Code	Piezometer Construction 32 20	Comments
							← Piezometer Diameters in mm	
		90	61		- moderately weathered [MW] between 60.35 & 60.6m (NV). Brown with minor grey patches (<25mm). - less weathered [FW <75%] by 61.2m. Partly weathered <15mm from defects.	RSWb		broken (<100mm pieces) along irregular (mostly 45°-NV) joints 59-60.6m. Intersecting 60° joints coated by clay (<3mm, as above) at 59.05m. Minimal silt on joints below 59.05m. Core disturbed by drillers between 59.3-59.9m. Box 21: 59.9-62.65m. - 40° off-white vein (<7mm, quartz) with some voids (<5 by 3mm). 55° joint coated by light brown, non-plastic sandy silt (<2mm) at 60.9m. SWL 7.82m on morning 22/11/18. 70° joint-vein (<1mm, weathered) at 61.2m. - 65° joint coated by vein material (<2mm, weathered). Associated white-transparent vein (<10mm, quartz) with grey flecks to mottles. - irregular 40° bedding contact. Indistinctly banded (<50mm, 55°). Defects have variable dip. Broken joints (some partly coated by pale brown to off-white, non-plastic silt <1mm) spaced 50-200mm apart. Box 22: 62.65-65.35m. - 55° contact along joint-vein (<2mm, weathered). Fine-medium grained greywacke. Some indistinct dark grey to black bands (<40mm, 55°). Some joints coated by pale brown to orange-brown, non-plastic silt (<2mm). Occasional voids after veins (<40 by 4mm). Core broken (<100mm pieces) along irregular NV joints 64.8-65.35m. Disturbed vein(s) (<10mm, weathered) near 65.1m. Box 23: 65.35-68.15m. - irregular NV joint-veins (<2mm, weathered) 66.1-67.35m (Core split 66.3-67.2m). - coarser greywacke below 67m. Minimal silt on joints. Broken 30° white vein (<5mm, quartz) at 67.35m. - irregular 80° bedding contact. Indistinctly banded (<50mm, 55-80°). Broken joints (minimal silt) spaced 30-280mm apart. Box 24: 68.15-71.0m. - irregular 80° bedding contact below 68.7m. Minor indistinct bands to patches (<50mm, 55°) of dark grey to black, argillaceous rock. Defects have variable dip. Occasional voids after veins (<10 by 5mm). - irregular 55° network (<10mm) of white veins (<3mm, quartz) spaced <5mm apart. Box 25: 71.0-73.8m. - irregular 50° bedding contact. Indistinctly banded (<100mm, 30-60°). Defects have variable dip. SWL 9.75m on morning 23/11/18. Box 26: 73.8-76.55m. - indistinct band (<30mm) of mottled (<5mm, brecciated?) rock below 50° joint. 55° off-white composite vein (<10mm, quartz) with some voids (<15 by 5mm) at 75.25m. - medium grained greywacke. Vuggy void (50 by 30mm) at 75.8m. Core split along NV joint(s) 76.4-77.2m. Box 27: 76.55-79.2m. - pyrite patches on broken defect surfaces near 76.7m. - 50° white-transparent composite vein (<7mm, quartz) with some voids (<7 by 2mm). Box 28: 79.2-81.8m.
		89	62					
		88	63		62.25m Veined ARGILLACEOUS ROCK [SW-FW]; dark grey to black with some irregular dark brown seams, MS to S, partly weathered (<10mm from joints) to fresh (75%). Crisscrossed by limonite-stained joints spaced 10-100mm apart to mostly white veins (<3mm, quartz & weathered) spaced <40mm apart. - irregular seam (<40mm, NV) of grey with some brown seams (<30mm), more weathered [FW >50%], greywacke sandstone between 63.0-63.6m.	RSWg		
		87	64		63.9m Veined GREYWACKE SANDSTONE with some argillaceous rock [Variable SW]; mostly grey with some irregular brown seams, S to VS, partly weathered (<10mm from joints) to fresh (>75%). Crisscrossed by limonite-stained joints spaced 10-150mm apart to white veins (<3mm, quartz & weathered) spaced <40mm apart. - more weathered/altered [SA >50%] below 64.8m. Softer (MS to S). Partly weathered <40mm from defects. - less weathered [FW >75%] between 66.1 (55°) & 67.0m. Common indistinct argillaceous patches (<50mm) near 66.1-66.8m. - verging on moderately weathered below 67.0m.	RSW		
		86	65					
		85	66					
		84	67					
		83	68		67.8m Veined ARGILLACEOUS ROCK with some greywacke sandstone [MW-SW]; grey to black with irregular dark brown seams, mostly S, partly weathered (<15mm from joints) to fresh (<75%). Crisscrossed by limonite-stained joint-fractures spaced 10-50mm apart to white veins (<3mm, quartz & weathered) spaced <40mm apart.	RSWb		
		82	69		68.7m Veined GREYWACKE SANDSTONE to SILTSTONE [SW-FW]; grey to dark grey with some irregular brown seams (<50mm), S to VS, partly weathered (<20mm from joints) to fresh (>75%). Crisscrossed by limonite-stained joints spaced 10-100mm apart to white veins (<3mm, quartz & weathered) spaced <50mm apart. - veins spaced <40mm apart by 70.5m.	RSWg		
		81	70					
		80	71		71.5m Veined ARGILLACEOUS ROCK [SW-FW]; dark grey to black with some irregular brown to dark brown seams (<50mm), MS-S, partly weathered (<20mm from joints) to fresh (>75%). Crisscrossed by limonite-stained joints spaced 20-200mm apart to white veins (<3mm, quartz) spaced <40mm apart.	RSWg		
		79	72					
		78	73					
		77	74					
		76	75		75.5m - partly weathered rock seam (<100mm) associated with subparallel 60-50° joints (<4) between 75.0-75.2m.			
		75	76		GREYWACKE SANDSTONE [SW-FW]; grey with some irregular brownish grey (indistinct) to brown seams, S to VS, partly weathered (<10mm from joints) to fresh (>75%). Crisscrossed by limonite-stained joints spaced 10-300mm apart to white veins (<4mm, quartz) spaced <5-75mm apart. - dark grey to black with some dark brown seams, mostly S, argillaceous rock between 76.4 (65°) & 77.15m (35°). - occasional bands to patches (<10mm, 50-60°) of argillaceous rock near 77.15-78.7m. Veins (<4mm, occasional voids) spaced <40mm by 77.15m. - minor black, S, argillite clasts (mostly <5mm) by 78.1m. - less weathered [FW <90%] by 79.2m. Partly weathered <5mm from joints. Few argillite clasts between 79.2-79.8m.	RSWg		
		74	77					
		73	78					
		72	79					
		71						

Drilling Methods	Casing Depths	Hole Diameters
HQ Core to EOH.	Temporary HW casing to 9m.	123mm to 9m. 96mm to EOH.

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BOREHOLE No. **HUN18/2**

LOCATION: HUNUA QUARRY **GRID REF:** 421404.90E 776755.09N

CLIENT: Winstone Aggregates **COLLAR ALTITUDE:** 150.50m **SHEET** 5 **OF** 7

JOB No. WAL18/6 **DATUM:** Mean Sea Level. Mt Eden 2000 Circuit.

DATE STARTED: 13-11-18 **DRILLER:** Drill Force LTD **STAND PIPE:** 1.407m

DATE FINISHED: 6-12-18 **TYPE OF DRILLING RIG:** Rig 5 Cortex

LOGGED BY: GDF **ORIENTATION:** **PLUNGE:** 90°

Recovery (%) 25 50 75	Sample	Reduced Level (m)	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref. Code	Piezometer Construction	Comments
							32 20 ← Piezometer Diameters in mm	
		70	81		- larger argillite clasts (<10mm) below 79.8m.			Core split to broken (>80.7m, <150mm) along irregular NV joint(s) partly coated by off-white vein material to orange-brown, non-plastic silt (<2mm) 80.2-81.8m.
		69	82					Box 29: 81.8-84.6m. Defects have variable dip.
		68	83		- few argillite clasts (<5mm) below 82.4m.			Core split to broken (<150mm) along irregular 70°-NV joints some coated by vein material (<2mm, weathered) to light brown, non-plastic silt (<2mm) 82.3-84.05m.
		67	84					
		66	85			RSWg		Core split along irregular 45°-NV intersecting joints coated by off-white vein material to orange-brown, non-plastic silt (<2mm) 84.4-85.2m. Box 30: 84.6-87.45m.
		65	86		- more argillite clasts (<7mm) near 85.95-86.7m.			- crisscrossed by irregular indistinct defects ("shear bands") (<10mm, mostly 20-60°) spaced <50mm apart near 85.75-87.3m.
		64	87		- partly weathered seam (<50mm) along NV joints between 86.4-86.75m.			
		63	88		- more weathered [FW 75%] below 87.3m. Grey with some light brown-brown seams. Limonite-stained joints spaced 10-75mm apart to white veins (<4mm, quartz & weathered) spaced <40mm apart. Partly weathered <15mm from defects.			- 25° shear band (<15mm). Indistinctly banded (<50mm, 55°) finer greywacke 87.3-87.55m. Core split along irregular NV joint(s) coated by vein material (<2mm, weathered) and partly weathered <15mm into the adjacent rock 87.3-88.95m. Box 31: 87.45-90.0m.
		62	89		- dark brown with some grey patches (<30mm), mostly S, moderately weathered [FW <35%], argillaceous rock between 88.65 (55°) & 88.95m (30°). Partly weathered [FW <50%] by 90.05m.			SWL 10.5m on morning 26/11/18.
		61	90		90.1m			- 30° white composite vein (<5mm, quartz) offset 10mm.
		60	91		Veined ARGILLACEOUS ROCK [FW]; dark grey to black, mostly S, fresh (>95%). Crisscrossed by irregular mostly white veins (<4mm, quartz) spaced <30mm apart and limonite-stained joints to broken veins spaced 10-300mm apart. Some joints partly weathered <3mm into the adjacent rock.		SWL 10.45m (11/12/18)	- 25° white-transparent composite vein (<12mm, quartz). - 20° white composite vein (<5mm, quartz). Box 32: 90.0-92.6m. - broken white to light grey-transparent composite vein (<10mm, quartz) near 90.1m. Associated broken 60° band (<10mm) of light brown, muddy sand with some rock fragments (<5mm) [Minor Fault]. Indistinctly banded (<100mm, 45°-NV). - pyrite specks to patches on some defect surfaces by 90.9m. Joints mostly dip 45°-NV. Box 33: 92.6-95.4m.
		59	92					
		58	93					
		57	94					
		56	95		- slightly weathered [FW <95%] along NV joint-veins partly weathered <5mm into the adjacent rock between 94.7-95.4m.	RFW		Core split along irregular 70°-NV joints to broken limonite-stained (<98.6m) to white veins (<3mm, weathered/zeolite) 94.55-99.1m. Box 34: 95.4-98.2m.
		55	96					
		54	97					- minor loss of drilling circulation near 97-113.3m (Driller's comment).
		53	98		- more weathered [FW 95%] along NV joint(s) partly weathered <5mm into the adjacent rock near 97.1-98.4m. Irregular patch (<50mm) of grey, VS, greywacke sandstone between 97.45-97.5m. - grey with minor brown seams (<20mm), mostly VS, slightly weathered [FW 95%], greywacke sandstone between 97.7 (55°) & 98.4m (45°).			Broken core (<50mm pieces, some light brown silty sand near 98.1m) 98.05-98.25m. Box 35: 98.2-100.95m. - generally coarser below 98.4m. Defects have variable dip. Pyrite specks to patches on many broken defect surfaces.
		52	99		- unweathered below 98.4m. Greywacke sandstone between 98.45 (55°) & 98.7m (55°). Irregular patch (<100 by 20mm, NV) near 99-99.1m. Veins (<4mm, quartz) spaced <40mm apart. Clean joints to broken veins spaced 40-400mm apart.			
		51						

Drilling Methods	Casing Depths	Hole Diameters
HQ Core to EOH.	Temporary HW casing to 9m.	123mm to 9m. 96mm to EOH.

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BOREHOLE No. **HUN18/2**

LOCATION: HUNUA QUARRY **GRID REF:** 421404.90E 776755.09N

CLIENT: Winstone Aggregates **COLLAR ALTITUDE:** 150.50m **SHEET** 6 **OF** 7

JOB No. WAL18/6 **DATUM:** Mean Sea Level. Mt Eden 2000 Circuit.

DATE STARTED: 13-11-18 **DRILLER:** Drill Force LTD **STAND PIPE:** 1.407m

DATE FINISHED: 6-12-18 **TYPE OF DRILLING RIG:** Rig 5 Cortex

LOGGED BY: GDF **ORIENTATION:** **PLUNGE:** 90°

Recovery (%) 25 50 75	Sample	Reduced Level (m)	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref. Code	Piezometer Construction 32 20 ← Piezometer Diameters in mm	Comments
		50	101					Core split along irregular NV clean (<100.5m, some pyrite) to limonite-stained joint(s) coated by light brown, non-plastic silt (<1mm) 100.3-101.25m. Box 36: 100.95-103.8m.
		49	102					Core split along irregular NV limonite-stained (<102.1m) joint-vein (<2mm, weathered/zeolite) with occasional pyrite patches 101.6-102.7m. SWL 24.1m on morning 27/11/18.
		48	103		- no limonite-stained joints below 102.1m.	RFW		
		47	104					Box 37: 103.8-106.5m.
		46	105					
		45	106		106.05m			Core split along irregular NV joint (clean) to white vein (<1mm, zeolite) with some pyrite as above 105.5-107.25m. Irregular 60° joint coated by pale grey, non-plastic silt to white vein material (<5mm, zeolite) with some pyrite specks at 105.65m.
		44	107		Veined GREYWACKE SILTSTONE with some argillite [FW]; dark grey with some black, S to VS, fresh. Crisscrossed by irregular mostly white veins (<4mm, quartz) spaced <40mm apart. Irregular clean joints to broken veins spaced 25-250mm apart.	RFW		- 55° contact along indistinct defect. Indistinct irregular argillite patches to bands (<50mm, 45°-NV). Defects have variable dip. Pyrite specks to patches on many broken defect surfaces. Box 38: 106.5-109.25m.
		43	108					- broken 60° white vein (<2mm, calcite).
		42	109		108.55m			- irregular 30° contact. Fine to medium grained greywacke. Irregular argillaceous patches to bands (<100mm, 45°-NV). Box 39: 109.25-111.8m.
		41	110		Veined GREYWACKE SANDSTONE with some argillaceous rock [FW]; grey with some dark grey to black, S to VS, fresh. Crisscrossed by irregular mostly white veins (<4mm, calcite & quartz) spaced <40mm apart. Irregular clean joints to broken veins spaced 10-300mm apart.	RFW		- broken 75° white to light grey vein(s) (<5mm, calcite).
		40	111					
		39	112		112.2m			Box 40: 111.8-114.45m.
		38	113		Veined ARGILLACEOUS ROCK [FW]; dark grey to black, mostly S, fresh. Crisscrossed by irregular mostly white veins (<4mm, calcite & quartz) spaced <40mm apart. Broken veins spaced 40-400mm apart.			- irregular 25° contact. Indistinctly banded (<50mm, 45°-NV). Defects have variable dip. Pyrite specks to patches on many broken defect surfaces. Core bound run 112.6-113.3m.
		37	114		- veins (<4mm) spaced <20mm apart between 113.3-114.2m.			SWL 18.6m on morning 28/11/18. 10° white-transparent composite vein (<10mm, calcite & quartz) at 113.4m.
		36	115					Box 41: 114.45-117.05m.
		35	116		- grey, VS, greywacke sandstone between 114.95 (55°) & 115.1m (40°)	RFW		Core broken (<150mm) along intersecting white-transparent veins (<4mm, calcite & quartz) spaced <20mm apart 115.4-116.1m. Broken 40° white-transparent to light grey composite vein (<15mm, quartz) with common rock fragments (mostly <5mm) at 115.85m. Box 42: 117.05-120.0m.
		34	117					
		33	118					
		32	119		- dominantly argillite between 118.75 (60°) & 120.35m (75°). Softer (MS-S). Veins (<5mm, quartz) spaced <20mm apart. Broken veins spaced 50-400mm apart.			- indistinctly banded (<100mm, 40°-NV) below 118.75m.
		31						

Drilling Methods	Casing Depths	Hole Diameters
HQ Core to EOH.	Temporary HW casing to 9m.	123mm to 9m. 96mm to EOH.

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BOREHOLE No. **HUN18/2**

LOCATION: HUNUA QUARRY **GRID REF:** 421404.90E 776755.09N

CLIENT: Winstone Aggregates **COLLAR ALTITUDE:** 150.50m **SHEET** 7 **OF** 7

JOB No. WAL18/6 **DATUM:** Mean Sea Level. Mt Eden 2000 Circuit.

DATE STARTED: 13-11-18 **DRILLER:** Drill Force LTD **STAND PIPE:** 1.407m

DATE FINISHED: 6-12-18 **TYPE OF DRILLING RIG:** Rig 5 Cortex

LOGGED BY: GDF **ORIENTATION:** **PLUNGE:** 90°

Recovery (%) 25 50 75	Sample	Reduced Level (m)	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref. Code	Piezometer Construction	Comments
							32 20 ← Piezometer Diameters in mm	
		30	121		- mostly white veins (<4mm, calcite & quartz) spaced <40mm apart by 120m. Broken veins spaced 20-400mm apart from 120.35m.			Box 43: 120.0-123.05m. Indistinctly banded (<100mm, 60°-NV) below 120.35m. Defects have variable dip. Pyrite specks on many broken defect surfaces. Core split along irregular NV joint-vein (<1mm, zeolite) 120.7-122.2m.
		29	122					
		28	123		- narrower veins (<3mm) by 122.45m. Broken veins spaced 20-500mm apart.	RFW		- broken 75° vein (<2mm, zeolite). Generally finer below 122.45m (20°). Indistinctly banded (<100mm, 55°-NV). Box 44: 123.05-125.55m. 70° pyritized streak (<3mm with specks within 20mm) along bedding lamination at 123.65m.
		27	124					
		26	125					Core from run 122.0-124.3m stuck in barrel. New drilling bit. 60° white-transparent composite vein network (<5mm, calcite & quartz) at 125.25m. Core split along irregular NV limonite-stained joint(s) below 125.25m. Box 45: 125.55-126.0m.
		25	126		126m			
		24	127		EOH @ 126m			- broken 70° limonite-stained to white vein (<3mm, calcite) at 125.8m. Stuck in hole 29-30/11/18. Lost 3.23m of drilling rods in hole. Installed piezometers 1-6/12/18.
		23	128					
		22	129					
		21	130					
		20	131					
		19	132					
		18	133					
		17	134					
		16	135					
		15	136					
		14	137					
		13	138					
		12	139					
		11						

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Drilling Methods	Casing Depths	Hole Diameters
HQ Core to EOH.	Temporary HW casing to 9m.	123mm to 9m. 96mm to EOH.

BOREHOLE No. **HUN25/1**

LOCATION: HUNUA QUARRY **GRID REF:** 420862.29E 776908.68N

CLIENT: Winstone Aggregates **COLLAR ALTITUDE:** 108.58m **SHEET** 1 **OF** 6

JOB No. WAL25/3 **DATUM:** Mean Sea Level (AVD 1946). Mt Eden 2000 Circuit.

DATE STARTED: 16-5-25
DATE FINISHED: 19-6-25
LOGGED BY: GDF/DRILLER

DRILLER: Drill Force Ltd
TYPE OF DRILLING RIG: Rig 2: Cortech Drilling Equipment LTD, YDX-3L

STAND PIPE: 0.977m
ORIENTATION: **PLUNGE:** 90°

Recovery (%) 25 50 75	Sample	Reduced Level (m)	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref. Code	Piezometer Construction (32 25 ← Piezometer Diameters in mm)	Comments
		108	1		OVERBURDEN MATERIALS; yellow/pink "clay". [Soils to HW Argillaceous Rock].			Adjacent batter exposes mostly residual soils (<1.25m) to CW argillaceous rock (<2.75m). Logged by drillers to 28.85m (No retained samples). RQD entered into penetration field in database from 28.85m. Core boxes photographed. Cased hole at 28.85m.
		107	2					
		106	3					
		105	4					
		104	5		- light brown/yellow from 4.7m.	O		
		103	6					
		102	7					
		101	8		- becoming as below?			
		100	9					
		99	10					
		98	11		- light grey, "weathered siltstone" by 10.7m. [HW/MW Argillaceous Rock].			
		97	12			ORH		
		96	13					
		95	14		- brown, "extremely weathered sandstone" between 13.7 & 16.7m.			
		94	15			ORH		
		93	16					
		92	17		- grey from 16.7m. [Probably MW Greywacke Siltstone].			
		91	18			ORM		
		90	19					
		89			19.7m GREYWACKE SILTSTONE [Uncertain Below]; dark grey, "fractured	RSW		

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Drilling Methods	Casing Depths	Hole Diameters
Wash drill (blade) to 28.85m. HQ Core 28.85m to EOH.	Temporary HWT casing to <28.85m.	121mm to <28.85m. 96mm to EOH.

BOREHOLE No. **HUN25/1**

LOCATION: HUNUA QUARRY **GRID REF:** 420862.29E 776908.68N

CLIENT: Winstone Aggregates **COLLAR ALTITUDE:** 108.58m **SHEET** 2 **OF** 6

JOB No. WAL25/3 **DATUM:** Mean Sea Level (AVD 1946). Mt Eden 2000 Circuit.

DATE STARTED: 16-5-25 **DRILLER:** Drill Force Ltd **STAND PIPE:** 0.977m

DATE FINISHED: 19-6-25 **TYPE OF DRILLING RIG:** Rig 2: Cortech Drilling Equipment LTD, YDX-3L

LOGGED BY: GDF/DRILLER **ORIENTATION:** **PLUNGE:** 90°

Recovery (%) 25 50 75	Sample	Reduced Level (m)	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref. Code	Piezometer Construction	Comments
							32 25 ← Piezometer Diameters in mm	
		88	21		siltstone".	RSW		
		87	22					
		86	23					
		85	24					
		84	25					
		83	26					
		82	27					
		81	28					
		80			28.85m			
		79	29		GREYWACKE SILTSTONE [SW/FW to MW]; mostly dark grey, S, fresh (95%). Crisscrossed by irregular limonite-stained joints spaced <100mm apart. Occasional white veins (<2mm, WK to MS).	RSW		17/05/25. Box 1: 28.85-31.49m. Full recovery of broken core (<150mm pieces). Greywacke siltstone-argillite. Defects mostly dip 45°-NV. Some joints coated by light brown to orange-brown, non-plastic silt (<2mm). Pyrite specks on some joint surfaces.
		78	30		- variable light greyish brown, WK to MS, moderately weathered, argillaceous rock [MW] below 30.15m (70°).			Irregular 65° seam (<20mm) of dark greyish brown, MS, partly weathered rock along joint(s) to 29.0m. Lowered casing at 29.5m. Core run 29.5-30.29m has 0.1m of probable uphole material (rock gravel <60mm, some twice cored) at top.
					30.75m			- joints often coated by orange-brown, non-plastic silt (<3mm) below 30.15m. Pyrite specks on occasional joint surfaces.
		77	31		GREYWACKE SILTSTONE [SW-FW]; dark grey with occasional irregular brownish grey seams (<20mm along joints), S, fresh (95%). Crisscrossed by limonite-stained to dark green-black joints spaced <100mm apart. Occasional white veins (<2mm, WK to MS).	RSWg		- 70° contact along joint(s). Defects have variable dip. Joints often coated by silt (<3mm, as above). Pyrite specks on some joint surfaces. Box 2: 31.49-33.75m.
		76	32		- fractures to veins spaced <40mm apart by 31.6m.			- irregular 70° seam (<20mm) of brownish grey, WK-MS, partly weathered/altered rock 32.15-32.35m.
		75	33		- few limonite-stained joints by 33.25m.			More broken core (<100mm pieces) 32.7-36.15m. Core run 32.93-33.75m stuck in barrel.
		74	34		- variable light grey to greyish brown, disturbed, sandy gravel consisting of moderated altered/weathered rock fragments (<40mm, limonite-stained) near 34.5 (70°)-34.8m [Minor Fault?]. Joint-fractures spaced <65mm apart below 34.8m. Few obvious veins.			- minimal silt on joints by 33.25m. Pyrite specks on many joint surfaces. Broken NV seam (<20mm) of discoloured grey, WK-MS, partly altered rock 33.4-33.6m. SWL 23m on morning 18/05/24. Box 3: 33.75-36.5m. Broken 60°-NV joint filled by light grey, disturbed, non-plastic, gravelly silt-sand (<10mm). Shattered core (<40mm, variable silt) 34.5-34.8m.
		73	35					Core run depth incorrectly recorded in drillers log (not 34.7m, block 34.8m).
			36		- light brownish grey, WK to MS, moderately weathered/altered, argillaceous rock below 35.7m. Joint-fractures spaced <40mm apart.			- broken 70°-NV contact. Pyrite specks on many joint surfaces. Box 4: 36.5-39.11m. Irregular 70° seam (<15mm) of brownish grey, MS, partly weathered/altered rock 36.75-36.9m. Box 5: 39.11-41.4m.
		72			36.2m GREYWACKE SILTSTONE [FW]; dark grey, S, mostly fresh (>95%). Crisscrossed by irregular fractures to joints spaced <65mm apart. Occasional white veins (<2mm, WK to MS).			- irregular NV contact. Defects mostly dip 60°-NV. Pyrite specks on many joint
		71	37			RFW		
		70	38		- occasional limonite-stained joints below 38.25m.			
		69	39		39.3m GREYWACKE SILTSTONE [SW]; dark grey with some irregular dark greyish brown seams, MS to S, partly weathered/altered to fresh	RSWb		

BHFORM3 HUN GPJ G_FISHER.GDT 13/10/25

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Drilling Methods	Casing Depths	Hole Diameters
Wash drill (blade) to 28.85m. HQ Core 28.85m to EOH.	Temporary HWT casing to <28.85m.	121mm to <28.85m. 96mm to EOH.

BOREHOLE No. **HUN25/1**

LOCATION: HUNUA QUARRY **GRID REF:** 420862.29E 776908.68N

CLIENT: Winstone Aggregates **COLLAR ALTITUDE:** 108.58m **SHEET** 3 **OF** 6

JOB No. WAL25/3 **DATUM:** Mean Sea Level (AVD 1946). Mt Eden 2000 Circuit.

DATE STARTED: 16-5-25
DATE FINISHED: 19-6-25
LOGGED BY: GDF/DRILLER

DRILLER: Drill Force Ltd
TYPE OF DRILLING RIG: Rig 2: Cortech Drilling Equipment LTD, YDX-3L

STAND PIPE: 0.977m
ORIENTATION: **PLUNGE:** 90°

Recovery (%) 25 50 75	Sample	Reduced Level (m)	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref. Code	Piezometer Construction	Comments
							32 25 ← Piezometer Diameters in mm	
		68	41		(>50%). Crisscrossed by joint-fractures spaced <50mm apart.	RSWb		surfaces. Irregular NV seam(s) (<40mm) of dark greyish brown, MS, partly weathered, coarser rock (<20mm wide) to siltstone near top (39.3->40.0m).
		67	42		- less weathered/altered rock [FW >75%] below 40.4m.			- irregular NV limonite-stained joint(s) 40.0-41.0m. Defects mostly dip 45°-NV below 40.4m.
		66	43		- occasional white veins (<2mm, MS) by 41.75m.	RSWg	SWL 22.41m (19/07/25)	- irregular 60° seam (<25mm) of dark grey-brown, MS, partly weathered/altered rock 40.9-41.05m. Box 6: 41.4-43.8m. Broken 70°-NV seam(s) (<50mm) of partly weathered/altered rock 41.4-42.2m. Core run 41.98-42.82m has excessive length (0.08m assumed from previous run).
		65	44					Broken 30° band (<50mm) of partly weathered/altered rock 43.6-43.65m. Box 7: 43.8-46.4m. Broken 60° seam (<25mm along joint) of partly weathered/altered rock 43.8-44.0m. Broken 60° seam (<20mm) of partly weathered/altered rock 44.0-44.15m.
		64	45					- broken 75°-NV seam (<20mm along joints) of partly weathered/altered rock 44.4-45.0m.
			45.2m					- broken 60° contact along joint. Longer lengths of intact core (<250mm) from 45.2m. Defects have variable dip. Some joints coated by pale brown, non-plastic silt (<1mm). Pyrite specks on many joint surfaces.
		63	46		GREYWACKE SILTSTONE [FW]; dark grey, S, mostly fresh (>95%). Crisscrossed by irregular fractures to joints spaced <100mm apart.			Box 8: 46.4-48.97m. Irregular 60° seam (<30mm) of dark greyish brown, MS, partly weathered/altered rock 46.5-46.65m.
		62	47		- occasional white veins (<3mm, WK to MS) below 46.55m. Broken interval of brown-grey, WK, altered rock between 46.7 (60°) & 46.8m (25°).			- broken 60° seam (<50mm) of partly weathered/altered rock with grey, WK, altered fine sandstone (<15mm along top) 47.2-47.4m.
		61	48					Incorrect details on block. 70° transparent light brown to limonite-stained vein (<3mm, MS) 48.2-48.4m.
		60	49					- irregular seam (<15mm, 70°) of partly weathered/altered, sandstone-siltstone 48.8-48.9m. Box 9: 48.97-51.33m.
		59	50			RFW	SWL 50.83m (30/7/25)	- 60° vein (<7mm, MS) at 50.75. Veins mostly dip 45°-NV 50.75-51.3m. Minimal silt on joint surfaces by 50.75m. Fewer pyrite specks. Box 10: 51.33-53.85m.
		58	51		- crisscrossed by veins (mostly <3mm) spaced <150mm apart between 50.75 & 51.3m. Joints spaced <200mm apart by 50.75m.			Two parallel 65° seams (<10mm along joints 25mm apart) of partly weathered/altered rock 51.33-51.5m.
		57	52					
		56	53					- broken NV, transparent to light grey, vein (<5mm, WK) near 53.0-53.3m. Core run 53.35-54.49m has excessive length (0.07m assumed from previous run). 75° limonite-stained joint(s) 53.6-53.85m. Box 11: 53.85-56.9m.
		55	54					
			54.45m					
		54	55		GREYWACKE SILTSTONE [MW-SW]; dark grey with irregular dark grey-brown seam(s) (<65mm, NV), MS to S, partly weathered/altered to fresh (>50%). Crisscrossed by fractures to joints spaced <100mm apart. Occasional mostly white veins (<2mm, WK to MS).			- broken NV contact. Some joints coated by pale brown to light orange, non-plastic silt (<2mm). Pyrite specks on some joint surfaces. Irregular NV transparent dark grey vein (<3mm, MS) to fracture partly weathered <35mm into the adjacent rock to 56.35m.
		53	56			RSWb		
		52	57		- mostly fresh rock between 56.35 & 57.0m.			Core run 54.49-56.35m has twice cored rock (<60mm piece) at top (Probable uphole material) and unrecorded core loss (<0.46m). Broken core (<100mm pieces) near 56.1-57.05m.
			57.55m					SWL 23.5m on morning 19/05/25. Rod count. Box 12: 56.9-59.68m.
		51	58		GREYWACKE SILTSTONE [FW]; dark grey, S, mostly fresh (>95%). Crisscrossed by irregular joints spaced <200mm apart. Occasional white veins (<2mm, MS to S).			- 65° white to light grey vein (<2mm, MS) with associated seam (<65mm) of partly weathered siltstone to fine sandstone (<25mm below) 57.0-57.25m. Broken 70° vein (<10mm, as above) with associated seam (<30mm) of partly weathered rock 57.4-57.55m.
		50	59		- irregular seam (<15mm, 50°) of brown (oxidized) to grey, WK, weathered/altered rock at 58.7m. Irregular band (<20mm, 35°) of dark grey-brown, MS, partly weathered rock at 59.05m.	RFW		- broken 70° contact along fracture-vein.
		49						

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Drilling Methods	Casing Depths	Hole Diameters
Wash drill (blade) to 28.85m. HQ Core 28.85m to EOH.	Temporary HWT casing to <28.85m.	121mm to <28.85m. 96mm to EOH.

BHFORM3 HUN.GPJ G_FISHER.GDT 13/10/25

BOREHOLE No. **HUN25/1**

LOCATION: HUNUA QUARRY **GRID REF:** 420862.29E 776908.68N

CLIENT: Winstone Aggregates **COLLAR ALTITUDE:** 108.58m **SHEET** 4 **OF** 6

JOB No. WAL25/3 **DATUM:** Mean Sea Level (AVD 1946). Mt Eden 2000 Circuit.

DATE STARTED: 16-5-25 **DRILLER:** Drill Force Ltd **STAND PIPE:** 0.977m

DATE FINISHED: 19-6-25 **TYPE OF DRILLING RIG:** Rig 2: Cortech Drilling Equipment LTD, YDX-3L

LOGGED BY: GDF/DRILLER **ORIENTATION:** **PLUNGE:** 90°

Recovery (%) 25 50 75	Sample	Reduced Level (m)	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref. Code	Piezometer Construction	Comments
							32 25 ← Piezometer Diameters in mm	
		48	61		- crisscrossed by veins (<2mm) spaced <100mm apart below 60.0m.			Veins mostly dip 45°-NV 57.55-60.0m. Pyrite specks on many joint surfaces. Box 13: 59.68-62.38m.
		47	62		- irregular seam (<10mm, 65°) of greyish brown, WK-MS, partly weathered/altered rock at 61.2m. Joint-fractures spaced <100mm apart below 61.2m. Irregular seam (<30mm, 65°) of brown to dark greyish brown, MS, partly weathered rock at 61.7m.	RFW		Broken core (<100mm pieces) 61.3-62.4m. Shattered core (mostly <30mm) 61.9-62.05m.
		46	63		- fractures spaced <50mm apart below 62.55m.			SWL 32.7m on morning 20/05/25. Box 14: 62.38-65.1m. Defects mostly dip 60°-NV 62.55-64.1m.
		45	64		63m GREYWACKE SILTSTONE [MW-SW]; dark grey with irregular dark greyish brown seam(s) (<40mm, 70°-NV), MS to S, partly weathered to fresh (>50%). Crisscrossed by fractures spaced <50mm apart and white to transparent grey veins (<3mm, WK to MS) spaced <100mm apart.	RSWb		- irregular 70° contact along joint. Broken joint-fractures spaced <125mm apart. Pyrite specks on many joint surfaces. Elongated patch (<20 by 10mm, 45°) of black, MS-S, argillite near 63.33m.
		44	65		64.1m GREYWACKE SILTSTONE [FW]; dark grey, S, mostly fresh (>95%). Crisscrossed by irregular limonite-stained joints spaced <200mm apart and white veins (<2mm, WK to S) spaced <100mm apart. Occasional seams (<15mm along defects) of dark brownish grey, MS-S, partly weathered rock.			- irregular 80° contact along vein(s) (<2mm). Veins mostly dip 45°-NV 64.1-67.1m. Pyrite specks on some joint surfaces. Box 15: 65.1-68.0m. Broken core (<150mm pieces) from 67.3m.
		43	66			RFW		
		42	67		67.4m - fractures to veins (<3mm) spaced <40mm apart below 67.1m.			
		41	68		67.75m FAULT ZONE [MW/SW]; patchy light greyish brown to dark brownish grey, disturbed (loose), sandy gravel (<30mm fragments as below) with some silt.	RW		- broken contact. Shattered core (<30mm, some silt) 67.4-67.75m. Disturbed (mixed) light brown to light grey, muddy seam (<30mm along base) 67.55-67.75m [Minor Fault].
		40	69		Fractured GREYWACKE SILTSTONE [MW/SW]; dark greyish brown to dark grey, MS to S, pervasive moderately weathered to fresh (50%). Crisscrossed irregular fractures spaced <30mm apart and white to transparent grey veins (<4mm, WK to MS) spaced <100mm apart.	RSWb		- broken 50° contact. Broken fractures to limonite-stained joints spaced <125mm apart. Some joints coated by light orange-brown, non-plastic silt (<1mm). Pyrite specks on many joint surfaces. Box 16: 68.0-70.75m.
		39	70		69.8m GREYWACKE SILTSTONE [SW-FW]; dark grey with minor irregular dark brown-grey seams (<100mm), MS to S, partly weathered to fresh (<95%). Crisscrossed by fractures to dark green-black joints (polished shear defects) spaced <150mm apart.			- broken contact. Pyrite specks on many joint surfaces. Corrected depth from core measurements (not 70.46m). More intact core (<250mm lengths) from 70.0m. Box 17: 70.75-73.35m.
		38	71		- broken seam (<50mm) of light brown to dark brownish grey, WK to MS, weathered to partly weathered rock below associated band (<15mm) of light red-brown, VS, vein material between 71.0 & 71.1m (55°).			- broken 70° seam (<7mm) of light brown to light grey, slightly plastic, sandy mud and partly weathered <20mm into the adjacent rock.
		37	72					- 55° joint coated by pale brown, non-plastic silt (<3mm) and partly weathered <15mm into the adjacent rock.
		36	73		- irregular seam (<20mm, 65°) of black, VS, siliceous argillite at 72.4m. Irregular seam (<50mm, 65°) of light brown (orange-tint), VWK to WK, weathered rock between 72.5 & 72.75m.	RSWg		
		35	74		- fracture-joints spaced <50mm apart below 73.3m.			Box 18: 73.35-75.9m (excluding 0.5m lost). 60° joint partly weathered <20mm into the adjacent rock at 73.5m.
		34	75		75.2m - fracture-joints spaced <30mm apart by 74.8m.			Broken core (<100mm pieces) near 74.2-77.4m. Core run 75.2-77.5 has 0.07m of probable uphole material (rock gravel <50mm) at top and unrecorded core loss (<0.5m).
		33	76		Fractured ARGILLITE [MW-SA]; brown to green-grey, WK to S, weathered to pervasive slightly altered (50%). Crisscrossed by irregular fractures spaced <20mm apart and joints spaced <100mm apart. Occasional white veins (<2mm, WK to MS). - variable greyish brown to greenish grey with occasional brownish red streaks, MS to S, less weathered/altered rock [MW-SA] below 75.85m.	RSWb		- broken contact. Finer argillite. Defects mostly dip 45°-NV. Some joints coated by pale brown to light orange, non-plastic silt (<2mm). Pyrite specks on some joint surfaces. Irregular NV-50° seam (<20mm) of light grey, plastic clay 75.7-75.85m. Box 19: 75.9-79.3m.
		32	77					
		31	78		- occasional irregular red to dark brownish red bands (<15mm, 45-55°) by 77.35m.			- 45° band (<15mm) of reddish brown to red, MS, partly altered, greywacke siltstone at 77.55m. 55° band (<20mm) of reddish greywacke siltstone (as above) at 77.6m. Longer lengths of intact core (<350mm) from 78.15m.
		30	79		78.2m 78.6m Fractured CHERT-ARGILLITE [SA]: dark brownish red, S pervasive slightly altered. Crisscrossed by irregular fractures spaced <40mm apart. Occasional white veins (<2mm, WK to MS). Interbanded (<20mm, 70°) with below argillite along base (<0.1m).	RSW		- irregular 70° contact between 78.1-78.3m. Minimal silt on joint surfaces. Core split along irregular 70°-NV joint(s)
		29			ARGILLITE [SW/SA]; variable dark brownish grey to dark greenish grey, mostly S, pervasive slightly weathered/altered to fresh (50%). Crisscrossed by irregular fractures spaced <50mm apart and white	RSW		

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Drilling Methods	Casing Depths	Hole Diameters
Wash drill (blade) to 28.85m. HQ Core 28.85m to EOH.	Temporary HWT casing to <28.85m.	121mm to <28.85m. 96mm to EOH.

BHFORM3 HUN.GPJ G_FISHER.GDT 13/10/25

BOREHOLE No. **HUN25/1**

LOCATION: HUNUA QUARRY **GRID REF:** 420862.29E 776908.68N

CLIENT: Winstone Aggregates **COLLAR ALTITUDE:** 108.58m **SHEET** 5 **OF** 6

JOB No. WAL25/3 **DATUM:** Mean Sea Level (AVD 1946). Mt Eden 2000 Circuit.

DATE STARTED: 16-5-25 **DRILLER:** Drill Force Ltd **STAND PIPE:** 0.977m

DATE FINISHED: 19-6-25 **TYPE OF DRILLING RIG:** Rig 2: Cortech Drilling Equipment LTD, YDX-3L

LOGGED BY: GDF/DRILLER **ORIENTATION:** **PLUNGE:** 90°

Recovery (%) 25 50 75	Sample	Reduced Level (m)	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref. Code	Piezometer Construction	Comments
							32 25 ← Piezometer Diameters in mm	
		28	81		veins (<2mm, WK to MS) spaced <100mm apart. - irregular seam (<30mm, 60°) of dark grey (red-brown tint) with brownish grey streaks to elongated patches (<25 by 3mm) and greywacke siltstone along base (<10mm) between 79.7 & 79.85m.			with pyrite specks 78.5-78.8m. - irregular 70° contact between 78.55-78.7m. Broken fracture-joints spaced <350mm apart. Pyrite specks on many joint surfaces. Box 20: 79.3-81.5m.
		27	82		- mostly variable dark greenish grey (brown-tint) to dark grey, S, pervasive slightly altered rock [SA] below 81.85m.	RSW		- two subparallel 65° limonite-stained joints (<15mm apart) partly weathered <20mm into the adjacent rock near 80.0m. Broken seam (<20mm) of partly weathered rock at 80.45m.
		26	83					Box 21: 81.5-84.2m. Irregular 50° seam (<7mm) of greyish brown, MS, partly altered rock at 81.85m. Aligned irregular patches (<25 by 6mm, 30°) of black, MS-S, argillite near 81.95m.
		25	84		83.35m Fractured ARGILLITE [MW-SA]; variable dark greenish grey with some irregular brown to dark brownish grey and greyish green seams (<50mm), MS to S, partly weathered to pervasive slightly altered (<75%). Crisscrossed by fractures to white veins (<3mm, WK to S) spaced <30mm apart.			- indistinctly banded (<25mm, 30°) 82.7-82.9m. - irregular 30° contact along band (<7mm) of partly altered rock. Occasional irregular reddish brown to red bands (<10mm, mostly 25-60°). Broken fracture-joints spaced <200mm apart. Pyrite specks to patches (<20mm) on many joint surfaces. Box 22: 84.2-86.9m. 50° vein(s) (<10mm) with some red to dark greenish grey, host rock remnants (<15 by 3mm) near 84.9m.
		24	85			RSWb		
		23	86		85.8m Fractured ARGILLITE [SA-FW]; dark grey with some irregular dark brownish grey to dark greenish grey seams (<75mm), mostly S, pervasive slightly altered to fresh (>75%). Crisscrossed by fractures spaced <40mm apart and white veins (<3mm, WK to S) spaced <100mm apart. - defects spaced <20mm apart below 87.0m. Irregular NV seam(s) (<65mm) of brecciated rock (<20mm fragments with some light brownish grey, silty sand fines) along core between 87.45 & 88.85m [Minor Fault].			Drilling circulation lost by 85.8m. Two 25° bands (<10 & <20mm, 15mm apart) of black, S, argillite 86.0-86.05m. - broken contact. Broken fracture-joints spaced <200mm apart. Pyrite specks on many joint surfaces. SWL 57.0m on morning 5/06/25. Change of drilling crew. No block at 86.5m (Drilling marks near 85.9m). Box 23: 86.9-89.9m (excluding 0.25m lost). Defects mostly dip 60°-NV 87.0-88.85m.
		22	87			RSWg		
		21	88					
		20	89		- shattered to broken patches (<65mm) of dark red-brown, S, cherty argillite near 88.4-88.75m. 88.85m Fractured ARGILLITE [MA-SA]; variable greyish green to dark grey with some irregular brown seams (mostly <100mm), MS to S, partly weathered/altered (25%), pervasive slightly altered to fresh (50%). Crisscrossed by fractures spaced <30mm apart. Red-tint near 89.55-89.9m. - red tinted rock near 89.55-89.9m. - broken interval (<200mm) of light brown, WK-MS partly weathered/altered rock near 90.05-90.25m.			Broken core (<125mm pieces) near 87.6-92.35m. Broken band(s)(<10mm) of red rock near 88.2m. - broken 50° contact. Occasional irregular red to dark reddish brown, streaks to disrupted bands (<15mm). Broken fracture-joints spaced <125mm apart. Pyrite specks on many joint surfaces. Box 24: 89.9-93.0m.
		19	90					
		18	91					
		17	92		- occasional white veins (<3mm, MS to S) by 91.4m. Irregular seam (<50mm, 45°) of dark reddish brown, cherty argillite between 91.45 & 91.50m.			- broken 70° vein(s) (<6mm, S) at 91.8m. Broken 70° seam (<50mm) of brecciated rock (<20mm fragments with some light grey, silty sand fines) 91.85-92.0m.
		16	93			RSWb		Broken fracture-joints spaced <350mm apart by 92.35m. - coarser texture 92.95 (30°)-96.1m (40°). Box 25: 93.0-95.5m.
		15	94		- broken band (<30mm) of dark reddish brown, MS-S, rock at 94.1m. Broken seam (<15mm, 50°) of brownish red, MS-S, partly altered, greywacke siltstone at 94.6m.			
		14	95					
		13	96		- irregular seams (<65mm) of reddish brown to red, WK to MS, partly altered rock between 95.5 (75°) & 95.9m (50°). More altered rock [MA/SA].			SWL 51.0m on morning 6/06/25. Box 26: 95.5-98.1m. Broken core (<150mm pieces) 96.9-99.5m. 45° polished defect with associated seam (<5mm) of light brown to light grey, plastic clay at 97.05m.
		12	97		97.1m - interval (<75mm, 45°) of light grey, tightly packed (hard), silty sand with some rock fragments (<10mm) below 97.0m [Minor Fault].			
		11	98		Fractured ARGILLITE with some chert [SA]; variable dark greenish grey with some irregular greyish brown-green with red streaks to seams (<40mm, 45°-NV), MS to S, partly altered to pervasive slightly altered (>75%). Fractures spaced <30mm and white veins (<3mm, MS to S) spaced <50mm apart.	RSW		- broken 45° contact. Broken fracture-joints spaced <150mm apart. Pyrite specks on many joint surfaces. - broken 30° band (<15mm) of red, MS, partly altered, greywacke siltstone near 98.05m. Box 27: 98.1-101.0m.
		10	99					
		9			- broken interval(s) of dark brownish red, S-VS, argillaceous chert between 99.45 & 99.75m. Some indistinct dark grey-red seams			- coarser argillite near 99.75-102.3m.

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Drilling Methods	Casing Depths	Hole Diameters
Wash drill (blade) to 28.85m. HQ Core 28.85m to EOH.	Temporary HWT casing to <28.85m.	121mm to <28.85m. 96mm to EOH.

BOREHOLE No. **HUN25/1**

LOCATION: HUNUA QUARRY **GRID REF:** 420862.29E 776908.68N

CLIENT: Winstone Aggregates **COLLAR ALTITUDE:** 108.58m **SHEET** 6 **OF** 6

JOB No. WAL25/3 **DATUM:** Mean Sea Level (AVD 1946). Mt Eden 2000 Circuit.

DATE STARTED: 16-5-25
DATE FINISHED: 19-6-25
LOGGED BY: GDF/DRILLER

DRILLER: Drill Force Ltd
TYPE OF DRILLING RIG: Rig 2: Cortech Drilling Equipment LTD, YDX-3L

STAND PIPE: 0.977m
ORIENTATION: **PLUNGE:** 90°

Recovery (%) 25 50 75	Sample	Reduced Level (m)	Depth (m)	Legend	LITHOLOGY DESCRIPTION Name, colour, strength, grain size, (moisture) miscellaneous	Ref. Code	Piezometer Construction	Comments
							32 25	← Piezometer Diameters in mm
		8	101		(<50mm) and occasional disrupted bands (<15mm, mostly 40-60°) of brownish red, MS-S, partly altered rock below 99.75m.	RSW		
		7	102		- dark brownish red with irregular dark reddish grey to dark greenish grey seams (<60mm), S, argillaceous chert with argillite seams between 101.0 & 101.65m. - dark greenish grey with red streaks and minor irregular greyish brown-green seams (<30mm, 40-60°) below 101.65m (20°). Occasional pyrite patches (<5mm) below 102.6m.	RSW RSW		Box 28: 101.0-104.05m (excluding 0.55m lost). Core run 101.3-102.6m has excessive length (0.05m assumed from previous run). Broken core (<100mm pieces) 102.2-103.8m.
		6	102.7m		FAULT ZONE [SA]; dark greenish grey, disturbed (loose) to tightly packed (very stiff), fractured/brecciated rock (<15mm fragments as below). Occasional discernable white veins (<3mm, WK).	RW		- 40° contact along band (<10mm) of light grey, slightly plastic, sandy mud. Pyrite specks on many defect surfaces. 40° polished defect at 103.45m. Shattered to broken core (<65mm pieces) 103.8-105.55m.
		5	103		- interval (<75mm, 45°) of light brownish grey, very stiff to hard, slightly plastic, sandy silt with some rock fragments (<5mm) between <103.3 & 103.45m [Fault].			
		4	103.8m 104		Fractured ARGILLITE [SA]; dark green-grey with some red to dark reddish brown streaks to disrupted bands (<15mm), mostly S, pervasive slightly altered. Crisscrossed by irregular fractures spaced <20mm. Occasional discernable white veins (<2mm, WK).	RSW		- broken contact. Pyrite specks on many joint surfaces. Box 29: 104.05-107.48m.
		3	105					
		2	105.55m 106		Fractured ARGILLITE to Argillaceous CHERT [SA]; variable dark greenish grey to dark grey (green-tint) with irregular red streaks to dark reddish brown seams (<100mm, 45°-NV), S, pervasive slightly altered. Crisscrossed by fractures spaced <30mm. Occasional discontinuous white veins (<2mm, MS to S).	RSW		- broken contact. Broken fracture-joints spaced <300mm apart. Pyrite specks on many joint surfaces. Core run 105.6-107.9m has excessive length (0.05m assumed from previous run). Box 30: 107.48-110.2m.
		1	107		- interval of dark reddish brown, argillaceous chert between 107.15 (45°) & 107.45m (55°). Irregularly banded (<30mm, 40-60°) argillite and argillaceous chert below 107.45m.	RSW		
		0	107.75m 108		Fractured ARGILLITE [SA/FW]; dark grey with minor irregular dark reddish brown seams (<100mm, 40-60°) and occasional greyish brown-green seams (<30mm), mostly S, fresh (95%). Crisscrossed by fractures spaced <40mm. Occasional discontinuous white veins (<3mm, MS to S).			- irregular 65° contact along joint. Broken fracture-joints spaced <250mm apart. Pyrite specks to patches (<10mm) on many joint surfaces. SWL 51.7m on morning 7/06/25. Installing piezometer to 19/06/25. SWL 51.3 & 51.8m on mornings 9-10/06/25.
		-1	109		- irregular seam (<100mm, 45°) of dark reddish brown, argillaceous chert between 109.5 & 109.65m. Fewer dark reddish brown seams below 110.0m.			
		-2	110		- broken seam (<65mm, 45°) of greyish green, MS, partly altered rock between 110.7 & 110.9m.	RSWg		Box 31: 110.2-113.0m (EOH).
		-3	111		- variable greyish brown-green to dark greenish grey with occasional irregular brownish red streaks to bands (<5mm), MS to S, slightly altered rock [SA] between 112.0 & 112.5m. - variable dark grey to black with minor irregular greyish brown-green seams (<30mm, 40-60°) below 112.5m.			
		-4	112					
		-5	113m 114		EOH @ 113m			
		-6	115					
		-7	116					
		-8	117					
		-9	118					
		-10	119					
		-11						

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Drilling Methods	Casing Depths	Hole Diameters
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BHFORM3 HUN.GPJ G_FISHER.GDT 13/10/25

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-2

SHEET: 1 OF 16

PROJECT: Project Mahitahi Geotech	CO-ORDINATES: 776445.75 mN (EDENTM2000) 421455.79 mE	R.L. GROUND: 191.00m
JOB No.: 1099889.1000	DIRECTION: 0°	R.L. COLLAR:
LOCATION: At top of access track along boundary	ANGLE FROM HORIZ.: -90°	DATUM: AUCKHT1946
		SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT: Waipapa Group

MATERIAL DESCRIPTION
SOIL: Classification, colour, consistency / density, moisture, plasticity
ROCK: Weathering, colour, fabric, name, strength, cementation

0.00m: Silty CLAY, minor organics; grey streaked white, spotted black. Soft, moist, medium plasticity; organics, rootlets (partially decomposed).
0.00 - 0.40m Becomes light greyish brown mottled orange.

1.80m: SILT, minor clay; grey streaked yellow, mottled orange. Soft to firm, moist, low plasticity.

3.00m: Completely weathered, light grey, GREYWACKE. Extremely weak. Highly fractured. Very close to closely spaced defects. Soil description: clayey SILT. Firm, moist, low to medium plasticity.

Rock Weathering: XW SW MW HW CW RS
Rock Strength: VS+ S MS W VW EW
Sampling Method: HQTT
Core Recovery (%): 100
Testing: 27/9 kPa In barrel; 48/14 kPa In barrel; 52/19 kPa In barrel
RL (m): 190, 189, 188, 187
Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5
Graphic Log

ROCK MASS DISCONTINUITIES
Defect Log
Fracture Spacing (mm): 2000, 600, 200, 60, 20
RQD (%)
Description & Additional Observations

Water Level / Fluid Loss (%): RS 15/12/2025
Casing
Installation
Core Box No: Box 0.00-3.00m

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-2

SHEET: 2 OF 16

PROJECT: Project Mahitahi Geotech
JOB No.: 1099889.1000
LOCATION: At top of access track along boundary

CO-ORDINATES: (EDENTM2000) 776445.75 mN 421455.79 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 191.00m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering (UW SW MW HW VW RS)	Rock Strength (VS+ S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%) (25 50 75)	Casing	Installation	Core Box No
Waipapa Group	[CONT] *3.00m:* Completely weathered, light grey, GREYWACKE. Extremely weak. Highly fractured. Very close to closely spaced defects. Soil description: clayey SILT. Firm, moist, low to medium plasticity.			HQTT	100	58/21 kPa In barrel	185	6.0									Box 3.00-5.80m
	5.45 - 5. 80m Becomes greyish orange.							5.5									
	6.45 - 7. 50m FeST along relict defect.			HQTT	100			6.5									
	6.60 - 7. 50m Relict rock fabric present.						184	7.0									
						127/52 kPa In barrel		7.5									
				HQTT	100		183	8.0									Box 5.80-8.50m
	8.70 - 8. 80m Becomes wet, FeST. *9.00 - 10.20m:* Some gravel up to 15 mm, angular, greywacke.					62/17 kPa In barrel	182	9.0									
	9.10 - 9. 45m Relict rock fabric present.			HQTT	87			9.5									

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-2

SHEET: 3 OF 16

PROJECT: Project Mahitahi Geotech	CO-ORDINATES: (EDENTM2000) 776445.75 mN 421455.79 mE	R.L. GROUND: 191.00m
JOB No.: 1099889.1000		R.L. COLLAR:
LOCATION: At top of access track along boundary	DIRECTION: 0°	DATUM: AUCKHT1946
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW DW RS)	Rock Strength (VS+ s ms w vw EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%) (25 50 75)	Casing	Installation	Core Box No
Waipapa Group	[CONT] *3.00m:* Completely weathered, light grey, GREYWACKE. Extremely weak. Highly fractured. Very close to closely spaced defects. Soil description: clayey SILT. Firm, moist, low to medium plasticity. *10.10 - 11.90m* Mottled orange, minor gravel, up to 5-10mm, angular, greywacke. *11.70 - 16.60m* Gravel, up to 15mm, angular, greywacke. Carbonaceous material present. *12.00 - 13.50m* Black and orange staining on faces. *13.50 - 16.50m* Orange staining on faces.			HQTT	87		180	10.5									
				HQTT	100			11.0									Box 8.50-11.23m
							179	11.5									
								12.0									
				HQTT	100		178	12.5									
								13.0									
								13.5									
				HQTT	100		177	14.0									Box 11.23-14.10m
								14.5									

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-2

SHEET: 4 OF 16

PROJECT: Project Mahitahi Geotech
JOB No.: 1099889.1000
LOCATION: At top of access track along boundary

CO-ORDINATES: (EDENTM2000) 776445.75 mN 421455.79 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 191.00m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering (UW SW MW HW CW RS)	Rock Strength (VS+ S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%) (25 50 75)	Casing	Installation	Core Box No
Waipapa Group	[CONT] *3.00m:* Completely weathered, light grey, GREYWACKE. Extremely weak. Highly fractured. Very close to closely spaced defects. Soil description: clayey SILT. Firm, moist, low to medium plasticity.			HQTT	100		175	15.5									
	16.50 - 18.00m Mottled orange, black staining on faces, gravel, up to 5-10mm, angular, greywacke.							16.0									
	17.00 - 17.60m With grey, black and orange staining on faces.						174	16.5									
	17.65 - 17.90m Gravelly SILT, minor sand, non-plastic; gravel, up to 10mm, angular, greywacke; sand, fine.			HQTT	100			17.0									
	18.00 - 18.95m Orange staining on faces, gravel, up to 5-10mm, angular, greywacke.							17.5									
	18.95m: CORE LOSS.			HQTT	63		173	18.0					*18.00 - 39.30m* Short runs undertaken to reduce core loss due to core bound				
	19.50m: Highly weathered, greyish brown with black and orange staining on faces, GREYWACKE. Very weak. Highly fractured, Very closely to closely spaced defects. Recovered as fine to coarse GRAVEL in places.							18.5									
	19.90m: CORE LOSS.			HQTT	27		172	19.0				0		14/12/2025			
								19.5									Box 14.10-16.85m

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-2

SHEET: 5 OF 16

PROJECT: Project Mahitahi Geotech	CO-ORDINATES: 776445.75 mN (EDENTM2000) 421455.79 mE	R.L. GROUND: 191.00m
JOB No.: 1099889.1000		R.L. COLLAR:
LOCATION: At top of access track along boundary	DIRECTION: 0°	DATUM: AUCKHT1946
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	UW SW MW HW DW EW RS	VS+ S MS W VW EW								2000 600 200 60 20			25 50 75			
Waipapa Group	[CONT] *19.90m:* CORE LOSS.			HQTT	27			20.5				0					
	21.00m: Highly weathered, grey with black and brown staining on faces, GREYWACKE. Very weak. Highly fractured, Very closely to closely spaced defects. Recovered as fine to coarse GRAVEL in places.			HQTT	100		170	21.0				0					Box 16.85-21.25m
	21.75 - 24.00m Core stones of moderately weathered greywacke recovered.			HQTT	73			21.5				0					
				HQTT	100		169	22.0				0					
				HQTT	60			22.5				26	*22.50m:* switch to using diamond drill bits *22.50-22.65m:* DD				
							168	23.0					*22.85-23.20m:* BZ, gravel up to 20 mm *22.95m:* J, 42°, PL, SM, N, Fe, FeST along relict joint				
								23.5				0	*23.25-23.70m:* BZ, gravel up to 40 mm				
	24.00m: Moderately weathered, brownish grey with orange and brown staning on faces, GREYWACKE. Very weak. Highly fractured, closely spaced defects.			HQTT	62		167	24.0				23	*24.30m:* J, 53°, PL, SM, N, Fe, FeST along relict joint	16/12/2025			Box 21.25-24.30m
				HQTT	100			24.5				40	*24.85m:* J, 25°, PL, SM, N, Fe, FeST along relict joint				

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-2

SHEET: 6 OF 16

PROJECT: Project Mahitahi Geotech	CO-ORDINATES: (EDENTM2000) 776445.75 mN 421455.79 mE	R.L. GROUND: 191.00m
JOB No.: 1099889.1000		R.L. COLLAR:
LOCATION: At top of access track along boundary	DIRECTION: 0°	DATUM: AUCKHT1946
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	UW SW MW HW CW DW RS	VS+ S MS W VW EW								2000 600 200 60 20			25 50 75			
Waipapa Group	[CONT] *24.00m:* Moderately weathered, brownish grey with orange and brown staning on faces, GREYWACKE. Very weak. Highly fractured, closely spaced defects.			HQTT	100							40	*25.00m:* J, 46°, PL, SM, N, Fe, FeST along relict joint *25.05m:* J, 63°, PL, SM, N, Fe, FeST along relict joint *25.25m:* J, 43°, PL, SM, N, Fe, FeST along relict joint				
				HQTT	100			25.5				50	*25.50m:* J, 55°, PL, SM, N, Fe, FeST along relict joint				
	26.30 - 26.75m Recovered as fine to coarse gravel, up to 30mm, angular, greywacke.			HQTT	80		165	26.0					*25.75m:* J, 27°, PL, SM, N, Fe, FeST along relict joint *25.85m:* J, 15°, PL, SM, N, Fe, FeST along relict joint *26.00m:* J, 66°, PL, SM, N, Fe, FeST along relict joint *26.10m:* J, 43°, PL, SM, N, Fe, FeST along relict joint *26.25m:* J, 29°, PL, SM, N, Fe, FeST along relict joint				
								26.5				32	*26.30-26.75m:* BZ, gravel up to 30 mm				Box 24.30-27.00m
	27.45m: Moderately weathered, grey with brown and orange staning on faces, GREYWACKE. Weak. Highly fractured, very closely to closely spaced defects.			HQTT	100		164	27.0					*27.05m:* J, 12°, PL, R, N, Fe, FeST along relict joint				
	27.80 - 28.25m Carbonaceous banding present.							27.5				22	*27.20m:* J, 26°, ST, R, N, Fe, FeST along relict joint *27.30-27.35m:* DD				
				HQTT	100								*27.50m:* J, 42°, PL, SM, N, Fe, FeST along relict joint *27.60m:* J, 26°, PL, SM, N, Fe, FeST along relict joint				
							163	28.0				71	*27.85m:* J, 48°, PL, SM, N, Fe, FeST along relict joint				
								28.5					*28.20m:* J, 38°, PL, SM, N, Fe, FeST along relict joint *28.30m:* J, 32°, PL, R, N, Fe, FeST along relict joint				
	29.15 - 29.40m Recovered as sandy, coarse Gravel. Sand breaks into chunks and disintegrates into finer material under pressure between fingers.			HQTT	100		162	29.0				52	*28.75m:* J, 22°, ST, R, N, Fe, FeST along relict joint *28.90m:* J, 44°, PL, R, N, Fe, FeST along relict joint *29.05m:* J, 43°, PL, R, N, Fe, Silt infill,				
								29.5					*29.20-29.40m:* BZ, gravel up to 15 mm. Relict defects observed				Box 27.00-29.70m
				HQTT	100							68	*29.55m:* J, 42°, PL, SM, N, Fe *29.65-29.75m:* BZ, gravel up to 5 mm				

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-2

SHEET: 7 OF 16

PROJECT: Project Mahitahi Geotech
JOB No.: 1099889.1000
LOCATION: At top of access track along boundary

CO-ORDINATES: (EDENTM2000) 776445.75 mN 421455.79 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 191.00m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
Waipapa Group	[CONT] *27.45m:* Moderately weathered, grey with brown and orange staning on faces, GREYWACKE. Weak. Highly fractured, very closely to closely spaced defects.			HQTT	100							68	*30.00m:* J, 51°, PL, SM, N, Fe, FeST along relict joint *30.15m:* J, 48°, ST, R, N, Fe, FeST along relict joint				
	30.35m: Slightly weathered, grey with brown staining on defect faces. GREYWACKE. Strong. Highly fractured, very closely to closely spaced, gently to steeply inclined microfracturing of rock mass also present. Iron staining along fractures.							30.5					*30.40m:* J, 17°, PL, SM, N, Clay gouge *30.55m:* J, 50°, PL, SM, N				
				HQTT	100		160	31.0				56	*30.75m:* J, 53°, PL, SM, N *30.80m:* J, 58°, PL, SM, N, silt infill *30.95m:* J, 68°, PL, R, N, silty sand infill				
								31.5									
				HQTT	100		159	32.0				50	*31.00-32.50m:* BZ, gravel up to 40 mm. Relict defect observed within crushed zone *31.35-31.40m:* DD *31.60m:* J, 13°, ST, R, N *31.70m:* J, 6°, ST, R, N *32.10m:* J, 68°, PL, SM, N *32.20m:* J, 22°, ST, R, N, clay gouge				Box 29.70-32.25m
								32.5					*32.35m:* J, 30°, UN, R, MN, Fe				
				HQTT	100		158	33.0				73	*32.80m:* J, 39°, PL, SM, N, Fe *33.10m:* J, 58°, UN, R, MN, Fe *33.25m:* J, 15°, R, Fe *33.35m:* J, 23°, UN, R, MN, Fe				
								33.5									
				HQTT	100		157	34.0				52	*33.80m:* J, 51°, UN, R, MN, Fe *33.95m:* J, 41°, UN, R, MN, Fe *34.15m:* J, 32°, UN, R, MN, clay gouge *34.20m:* J, 21°, ST, R, N, CN *34.35m:* J, 16°, ST, R, N, CN				
								34.5									
				HQTT	100							76	*34.65m:* J, 34°, PL, SM, N, Fe				Box 32.25-34.70m

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-2

SHEET: 8 OF 16

PROJECT: Project Mahitahi Geotech
JOB No.: 1099889.1000
LOCATION: At top of access track along boundary

CO-ORDINATES: (EDENTM2000) 776445.75 mN 421455.79 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 191.00m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering (UW SW MW HW DW RS)	Rock Strength (VS+ S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%) (25 50 75)	Casing	Installation	Core Box No
Waipapa Group	[CONT] *30.35m:* Slightly weathered, grey with brown staining on defect faces. GREYWACKE. Strong. Highly fractured, very closely to closely spaced, gently to steeply inclined microfracturing of rock mass also present. Iron staining along fractures.			HQTT	100		155	35.5				76	*35.00m:* J, 18°, PL, SM, N, Fe *35.30m:* J, 58°, UN, R, N, CN *35.70m:* J, 51°, UN, R, N, CN				
							154	36.0				73	*36.20m:* J, 28°, PL, SM, N, CN *36.55m:* J, 73°, PL, SM, N, Fe *36.65m:* J, 52°, PL, SM, MN, Fe *36.80m:* J, 61°, N, cn *37.00m:* J, 62°, PL, R, N, cn				Box 34.70-37.30m
							153	37.0				33	*37.40m:* J, 32°, PL, SM, N, CN *37.60m:* J, 54°, PL, SM, N, CN *37.70m:* J, 42°, PL, N, CN *37.90m:* J, 53°, PL, SM, N, CN *38.30m:* J, 42°, PL, SM, N, CN				
	38.50m: CORE LOSS.			HQTT	19		152	38.5				18	*38.50m:* J, 42°, PL, SM, N, silt infill				
	39.15m: Slightly weathered, bluish grey, GREYWACKE. Strong. Highly fractured, very closely to closely spaced, gently to steeply inclined microfracturing of rock mass also present. Recovered as fine to coarse GRAVEL. Gravel up to 20 mm. *39.30m:* CORE LOSS.							39.0									
	39.60m: Slightly weathered, bluish grey. GREYWACKE. Strong. Highly fractured, very closely to closely spaced, gently to steeply inclined microfracturing of rock mass also present. Recovered as fine to coarse GRAVEL. Gravel up to 30 mm.			HQTT	100			39.5				53	*39.60-39.61m:* BZ, gravel up to 10 mm *39.75m:* J, 42°, PL, SM, N, CN *39.76-39.85m:* BZ, gravel up to 30 mm				

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-2

SHEET: 9 OF 16

PROJECT: Project Mahitahi Geotech
JOB No.: 1099889.1000
LOCATION: At top of access track along boundary

CO-ORDINATES: (EDENTM2000) 776445.75 mN 421455.79 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 191.00m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
Waipapa Group	[CONT] *39.60m:* Slightly weathered, bluish grey. GREYWACKE. Strong. Highly fractured, very closely to closely spaced, gently to steeply inclined microfracturing of rock mass also present. Recovered as fine to coarse GRAVEL. Gravel up to 30 mm.			HQTT	100			40.5				53	*40.00-40.10m:* BZ, gravel up to 10 mm *40.40m:* J, 48°, PL, SM, N, CN				Box 37.30-40.80m
	40.80m: CORE LOSS.			HQTT	30		150	41.0				0	*40.55-40.80m:* BZ, gravel up to 30 mm *40.60m:* J, 61°, UN, R, N, CN				
	41.15m: Slightly weathered, bluish grey. GREYWACKE. Strong. Highly fractured, very closely to closely spaced, steeply inclined microfracturing of rock mass also present. Recovered as fine to coarse GRAVEL. Gravel up to 15 mm.							41.5					*41.50m:* J, 32°, PL, R, N, CN				
	41.60m: Unweathered, bluish grey. GREYWACKE. Strong. Highly fractured, very closely to closely spaced, gently to steeply inclined defects. Criss crossed white veins.			HQTT	100		149	42.0				80	*41.90m:* J, 42°, PL, SM, N, silt infill				
								42.5					*42.40m:* J, 24°, PL, R, N, CN				
				HQTT	100		148	43.0				63	*43.30m:* J, 72°, PL, SM, CN				
								43.5					*43.50m:* J, 52°, PL, R, CN				Box 40.80-43.80m
	43.80m: Unweathered, bluish grey. GREYWACKE. Strong. Very closely to closely spaced, gently to steeply inclined defects. Criss crossed white veins.							44.0					*43.90m:* J, 32°, PL, SM, N, CN *44.00m:* J, 30°, PL, SM, N, CN *44.10-44.15m:* J, 38°, PL, SM, N, CN				
				HQTT	100		147	44.5				76	*44.40m:* J, 28°, PL, R, MN, CN *44.60m:* J, 26°, PL, SM, MN, CN				

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-2

SHEET: 10 OF 16

PROJECT: Project Mahitahi Geotech
JOB No.: 1099889.1000
LOCATION: At top of access track along boundary

CO-ORDINATES: (EDENTM2000) 776445.75 mN 421455.79 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 191.00m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
Waipapa Group	[CONT] *43.80m:* Unweathered, bluish grey. GREYWACKE. Strong. Very closely to closely spaced, gently to steeply inclined defects. Criss crossed white veins.			HQTT	100			45.5				76	*45.30m:* J, 42°, PL, SM, N, CN *45.50m:* J, 48°, PL, SM, CN				
				HQTT	100		145	46.0				86	*45.90m:* J, 76°, CN *46.00m:* J, 32°, PL, SM, CN				
								46.5					*46.50m:* J, 35°, PL, SM, CN *46.65-46.75m:* DD *46.80m:* J, 15°, PL, R, CN *46.90m:* J, 22°, ST, R, CN				Box 43.80-46.60m
							144	47.0					*47.20m:* J, 62°, PL, SM, CN *47.30m:* J, 72°, PL, R, CN				
				HQTT	100			47.5				73	*47.60m:* J, 23°, PL, SM, clay gouge (altered calcite along defect faces) *47.80m:* J, 36°, PL, SM, clay gouge (altered calcite along defect faces)				
							143	48.0					*48.00m:* J, 15°, PL, SM, CN				
								48.5					*48.50m:* J, 17°, PL, R, CN				
				HQTT	100		142	49.0				80	*48.90m:* J, 13°, ST, R, clay gouge (altered calcite along defect faces)				Box 46.60-49.40m
								49.5					*49.30m:* J, 42°, PL, SM, CN *49.55m:* J, 28°, PL, R, CN				
				HQTT	100							70					

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-2

SHEET: 11 OF 16

PROJECT: Project Mahitahi Geotech
JOB No.: 1099889.1000
LOCATION: At top of access track along boundary

CO-ORDINATES: 776445.75 mN, 421455.79 mE (EDENTM2000)
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 191.00m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
Waipapa Group	[CONT] *43.80m:* Unweathered, bluish grey. GREYWACKE. Strong. Very closely to closely spaced, gently to steeply inclined defects. Criss crossed white veins.			HQTT	100		140	50.5				70	*50.10m:* J, 72°, PL, SM, clay gouge (altered calcite along defect faces) *50.15m:* J, 52°, PL, SM, clay gouge (altered calcite along defect faces) *50.40m:* J, 35°, PL, SM, clay gouge (altered calcite along defect faces)				
				HQTT	100		139	51.0 51.5 52.0				62	*51.52m:* J, 51°, PL, SM, clay gouge (altered calcite along defect faces) *51.72m:* J, 35°, PL, SM, clay gouge (altered calcite along defect faces) *51.92m:* J, 64°, PL, SM, clay gouge (altered calcite along defect faces)				Box 49.40-52.15m
				HQTT	100		138	52.5 53.0				80	*52.27m:* J, 40°, PL, SM, clay gouge (altered calcite along defect faces) *52.41m:* J, 53°, PL, SM, clay gouge (altered calcite along defect faces) *52.90m:* J, 88°, PL, SM, clay gouge (altered calcite along defect faces) *52.96m:* J, 75°, PL, SM, clay gouge (altered calcite along defect faces) *53.20m:* J, 24°, PL, SM, clay gouge (altered calcite along defect faces)				
				HQTT	100		137	53.5 54.0				80	*53.60m:* J, 24°, PL, SM, clay gouge (altered calcite along defect faces) *53.93m:* J, 22°, PL, SM, clay gouge (altered calcite along defect faces) *54.25m:* J, 72°, PL, SM, clay gouge (altered calcite along defect faces) *54.27m:* J, 70°, PL, SM, clay gouge (altered calcite along defect faces) *54.40m:* J, 69°, PL, SM, clay gouge (altered calcite along defect faces) *54.60m:* J, 46°, PL, SM, clay gouge (altered calcite along defect faces) *54.75m:* J, 49°, PL, SM, clay gouge (altered calcite along defect faces) *54.85m:* J, 55°, PL, SM, clay gouge (altered calcite along defect faces)				Box 52.15-54.75m
								54.5									

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: HUN25-2

SHEET: 12 OF 16

Tonkin+Taylor

PROJECT: Project Mahitahi Geotech
JOB No.: 1099889.1000
LOCATION: At top of access track along boundary

CO-ORDINATES: 776445.75 mN, 421455.79 mE (EDENTM2000)
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 191.00m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
Waipapa Group	[CONT] *43.80m:* Unweathered, bluish grey. GREYWACKE. Strong. Very closely to closely spaced, gently to steeply inclined defects. Criss crossed white veins.			HQTT	100		135	55.5				80	*55.20m:* J, 16°, PL, SM, clay gouge (altered calcite along defect faces),				
													55.50m: J, 36°, PL, SM, clay gouge (altered calcite along defect faces) , *55.60m:* J, 31°, PL, SM, clay gouge (altered calcite along defect faces) *55.68m:* J, 58°, PL, SM, CN *55.76m:* J, 46°, PL, SM, CN				
								56.0					*55.88-55.95m:* BZ, gravel up to 30 mm				
				HQTT	100							63	*56.35m:* J, 66°, PL, SM, CN				
								56.5					*56.50-57.10m:* BZ, clay gouge				
							134	57.0									Box 54.75-57.10m
								57.5					*57.30m:* J, 72°, PL, SM, CN				
													57.60m: J, 32°, PL, SM, CN				
				HQTT	100							76	*57.80m:* J, 42°, PL, SM, CN *57.90m:* J, 41°, PL, SM, clay gouge				
							133	58.0					*58.10m:* J, 73°, PL, SM				
													58.30m: J, 65°, PL, SM				
								58.5					*58.50m:* J, 62°, PL, SM				
													58.80m: J, 22°, PL, SM				
							132	59.0					*59.00m:* J, 17°, PL, SM				
				HQTT	100							80	*59.25m:* J, 42°, PL, SM, clay gouge				
								59.5					*59.50m:* J, 38°, PL, R, clay gouge				
													59.65m: J, 53°, PL, R, clay gouge *59.75m:* J, 62°, PL, R, clay gouge *59.80m:* J, 58°, PL, R, CN				Box 57.10-59.75m

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

TTNZ_20251211 - GeneralLog - 29/01/2026 1:20:24 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-2

SHEET: 13 OF 16

PROJECT: Project Mahitahi Geotech	CO-ORDINATES: (EDENTM2000) 776445.75 mN 421455.79 mE	R.L. GROUND: 191.00m
JOB No.: 1099889.1000		R.L. COLLAR:
LOCATION: At top of access track along boundary	DIRECTION: 0°	DATUM: AUCKHT1946
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
Waipapa Group	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	HW SW MW HW DW CW RS	VS+ S MS W VW EW	HQTT	100		130	60.5			2000 600 200 60 20	80	[CONT] *43.80m:* Unweathered, bluish grey. GREYWACKE. Strong. Very closely to closely spaced, gently to steeply inclined defects. Criss crossed white veins.	25 50 75			
				HQTT	100			61.0				76	*60.00m:* J, 36°, PL, R, CN *60.30m:* J, 21°, PL, R, CN *60.50m:* J, 32°, PL, R, CN *60.80m:* J, 43°, PL, R, CN *60.95m:* J, 25°, PL, R, CN *61.00m:* J, 31°, PL, R, CN				
				HQTT	100		129	61.5				80	*61.20m:* J, 73°, PL, R, CN *61.40m:* J, 36°, PL, R, CN *61.45m:* J, 41°, PL, R, CN *61.50m:* J, 52°, PL, R, CN *61.50-61.60m:* BZ, , gravel up to 40 mm *61.65m:* J, 28°, PL, SM				Box 59.75-62.00m
				HQTT	100			62.0					*61.93m:* J, 21°, PL, SM, CN				
				HQTT	100		128	62.5				80	*62.25m:* J, 52°, PL, SM, CN *62.40m:* J, 72°, PL, SM, CN *62.50m:* J, 42°, PL, SM, CN *62.65m:* J, 44°, PL, SM, CN *62.75m:* J, 63°, PL, SM, clay gouge *62.80m:* J, 67°, PL, SM, CN *62.90m:* J, 28°, PL, SM, CN				
				HQTT	100			63.0					*63.10m:* J, 23°, PL, SM, CN *63.20m:* J, 38°, PL, SM, CN				
				HQTT	100		127	63.5				80	*63.40m:* J, 72°, PL, SM, CN *63.80m:* J, 22°, PL, SM, CN				
				HQTT	100			64.0					*63.95m:* J, 58°, PL, SM, CN				
				HQTT	100			64.5				80	*64.20m:* J, 26°, PL, SM, CN *64.40m:* J, 42°, PL, SM, CN *64.50m:* J, 61°, PL, SM, CN *64.60m:* J, 35°, PL, SM, CN *64.70m:* J, 68°, PL, SM, CN *64.80m:* J, 62°, PL, SM, CN *64.90m:* J, 15°, PL, SM, CN				Box 62.00-64.95m

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-2

SHEET: 14 OF 16

PROJECT: Project Mahitahi Geotech	CO-ORDINATES: (EDENTM2000) 776445.75 mN 421455.79 mE	R.L. GROUND: 191.00m
JOB No.: 1099889.1000		R.L. COLLAR:
LOCATION: At top of access track along boundary	DIRECTION: 0°	DATUM: AUCKHT1946
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	UW SW MW HW DW RS	VS+ S MS W VW EW								2000 600 200 60 20			25 50 75			
Waipapa Group	[CONT] *43.80m:* Unweathered, bluish grey. GREYWACKE. Strong. Very closely to closely spaced, gently to steeply inclined defects. Criss crossed white veins.			HQTT	100			65.5				80	*65.20m:* J, 75°, PL, SM, CN *65.35-65.40m:* BZ, gravel up to 10 mm *65.50m:* J, 42°, PL, SM *65.65m:* J, 62°, PL, SM, CN				
							125	66.0					*65.90m:* J, 41°, PL, SM, CN *66.00m:* J, 60°, PL, SM, clay gouge, quartz vein along defect face				
				HQTT	100			66.5				86	*66.50m:* J, 18°, PL, SM, CN *66.60m:* J, 12°, PL, R, gravel up to 6 mm *66.77m:* J, 48°, PL, SM, CN				
							124	67.0					*67.00m:* J, 10°, PL, SM, CN *67.25m:* J, 22°, PL, SM, CN, quartz vein along defect face				
								67.5									Box 64.95-67.60m
				HQTT	100								*67.75m:* J, 12°, PL, SM, CN *67.80m:* J, 14°, PL, SM, CN				
							123	68.0					*67.85-68.15m:* BZ,				
								68.5				76	*68.30m:* J, 43°, PL, SM, CN *68.70m:* J, 72°, PL, SM, CN				
				HQTT	100		122	69.0					*69.25m:* J, 32°, PL, SM, CN				
								69.5				93	*69.50m:* J, 18°, PL, SM, CN *69.80-69.83m:* BZ, gravel up to 10 mm *69.85m:* J, 44°, PL, SM, CN				

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: HUN25-2

SHEET: 15 OF 16

Tonkin+Taylor

PROJECT: Project Mahitahi Geotech
JOB No.: 1099889.1000
LOCATION: At top of access track along boundary

CO-ORDINATES: (EDENTM2000) 776445.75 mN 421455.79 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 191.00m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
Waipapa Group	[CONT] *43.80m:* Unweathered, bluish grey. GREYWACKE. Strong. Very closely to closely spaced, gently to steeply inclined defects. Criss crossed white veins.	UW SW MW HW DW RS	VS+ S MS W VW EW	HQTT	100		120	70.5			2000 600 200 60 20	93	*70.40m:* J, 36°, PL, SM, CN *70.45m:* J, 48°, PL, SM, CN *70.45-70.55m:* BZ, PL, SM, gravelup to 20 mm	25 50 75			Box 67.60-70.45m
								71.0					*70.80m:* J, 8°, PL, R, CN *71.00m:* J, 43°, PL, R, CN *71.10m:* J, 22°, PL, R, CN				
				HQTT	100			71.5				76	*71.25m:* J, 21°, PL, R, CN *71.30m:* J, 72°, PL, R, CN *71.40m:* J, 68°, PL, R, CN *71.60m:* J, 62°, PL, R, CN				
							119	72.0					*71.95m:* J, 76°, PL, R, CN *72.00m:* J, 73°, PL, R, CN *72.10m:* J, 33°, PL, SM, CN				
				HQTT	100			72.5				66	*72.40m:* J, 28°, PL, SM, CN *72.50m:* J, 56°, PL, SM, quartz vein along defect face *72.60m:* J, 25°, PL, SM, CN *72.70m:* J, 6°, PL, R, CN *72.85m:* J, 15°, PL, R, CN				Box 70.45-73.00m
							118	73.0					*73.00m:* J, 52°, PL, R, CN *73.10m:* J, 73°, PL, R, CN *73.20m:* J, 78°, PL, R, CN *73.30m:* J, 62°, PL, R, CN *73.40m:* J, 20°, PL, R, CN				
								73.5					*73.50-73.55m:* BZ, gravel up to 10 mm *73.70m:* J, 43°, PL, SM *73.80m:* J, 72°, PL, SM, CN				
				HQTT	100		117	74.0				73	*74.00m:* J, 38°, PL, SM, quartz vein along defect face *74.10m:* J, 28°, PL, SM, CN				
								74.5					*74.50m:* J, 26°, PL, R, clay gouge *74.60m:* J, 68°, PL, SM, CN *74.80m:* J, 52°, PL, SM, CN *74.90m:* J, 32°, PL, SM, CN				

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-2

SHEET: 16 OF 16

PROJECT: Project Mahitahi Geotech	CO-ORDINATES: (EDENTM2000) 776445.75 mN 421455.79 mE	R.L. GROUND: 191.00m
JOB No.: 1099889.1000		R.L. COLLAR:
LOCATION: At top of access track along boundary	DIRECTION: 0°	DATUM: AUCKHT1946
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: GAAB
CHECKED: PRMM
START DATE: 10/12/2025
FINISH DATE: 15/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering (UW SW MW HW DW CW RS)	Rock Strength (VS+ S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%) (25 50 75)	Casing	Installation	Core Box No
Waipapa Group	[CONT] *43.80m:* Unweathered, bluish grey. GREYWACKE. Strong. Very closely to closely spaced, gently to steeply inclined defects. Criss crossed white veins.			HQTT	100		115	76.0				73	*74.92-74.95m:* BZ, gravel up to 20 mm				Box 73.00-75.40m
								75.5					*75.40m:* J, 36°, PL, SM				
													75.60m: J, 32°, PL, SM, CN				
													75.80m: J, 52°, PL, SM, CN				
													75.90m: J, 64°, PL, SM, CN				
													76.00m: J, 32°, PL, SM, CN				
													76.20m: J, 56°, PL, SM, CN				
								76.5					*76.40m:* J, 48°, PL, SM, CN				
													76.50m: J, 23°, PL, SM, CN				
				HQTT	100		114	77.0				63	*76.60m:* J, 18°, PL, SM, CN *76.65m:* J, 72°, PL, SM, CN				
													76.85m: J, 10°, PL, R, CN				
													77.00m: J, 38°, PL, SM, CN				
													77.10m: J, 38°, PL, R, silty sand infill				
													77.20m: J, 72°, PL, SM, silty sand infill				
								77.5					*77.40m:* J, 15°, PL, SM, CN				
													77.50m: J, 43°, PL, SM, CN				
													77.60m: J, 52°, PL, SM, CN				
													77.70m: J, 56°, PL, SM, CN				
													77.80m: J, 41°, PL, SM, CN				
													77.90m: J, 62°, PL, SM, CN *77.95m:* J, 53°, PL, SM, CN				Box 75.40-78.05m
							113	78.0					*78.00-78.10m:* BZ, SM, gravel up to 10 mm				
													78.20m: J, 32°, PL, SM, CN				
								78.5					*78.40m:* J, 42°, PL, SM, CN				
													78.50m: J, 38°, PL, SM, clay gouge				
													78.65m: J, 33°, PL, R, gravel along defect face up to 8 mm				
												60	*78.80m:* J, 48°, PL, SM, clay gouge *78.85m:* J, 42°, ST, SM, clay gouge				
							112	79.0					*79.00m:* J, 32°, PL, SM, CN				
													79.10m: J, 53°, PL, SM, clay gouge				
													79.20m: J, 65°, PL, SM, clay gouge				
													79.30m: J, 51°, PL, SM, clay gouge				
								79.5					*79.45m:* J, 64°, ST, SM				
													79.50-79.57m: BZ, gravel up to 50 mm *79.60m:* J, 34°, PL, R, CN				
				HQTT	100							62	*79.80m:* J, 47°, PL, SM, CN *79.85m:* J, 12°, PL, R, CN *79.95m:* J, 43°, PL, SM, CN				Box 78.05-80.00m
	80m: Target depth																

COMMENTS: Groundwater reading measured at the start and each of each day. Piezometer installed in borehole 16/12/2025. Raised PVC cover installed

Hole Depth 80m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-3

SHEET: 1 OF 7

PROJECT: Project Mahitahi Geotech
JOB No.: 1099889.1000
LOCATION: In clearing on E side of access track.

CO-ORDINATES: (EDENTM2000) 776624.30 mN 421468.90 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 150.00m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: JOWI
CHECKED: PRMM
START DATE: 03/12/2025
FINISH DATE: 05/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
Waipapa Group	*0.00m:* CORE LOSS. Likely drilling induced.																
	0.40m: Silty CLAY; light brownish grey streaked orange. Stiff, moist, moderate plasticity.			HQTT	73			0.5									
	1.00m: CLAY, some silt; light grey and orange. Stiff, moist, high plasticity. *1.20 - 1.80m* Orange with light grey streaks. *1.80 - 2.00m* Light grey.						149	1.0									
	2.00m: Completely weathered, light grey and orange mottled GREYWACKE. Extremely weak, highly fractured, very closely to closely spaced defects. Soil Description: Clayey SILT. Stiff, moist, moderate plasticity.			HQTT	73		148	1.5 2.0									
	2.60m: CORE LOSS. Likely drilling induced.							2.5									
	3.00m: Completely weathered, light brownish grey mottled orange GREYWACKE. Extremely weak, highly fractured, very closely to closely spaced defects. Soil Description: Clayey SILT. Stiff, moist, moderate plasticity.			HQTT	50		147	3.0 3.5									Box 0.00-3.60m
	3.80m: CORE LOSS. Likely drilling induced.						146	4.0									
	4.50m: Completely weathered, brownish orange mottled grey GREYWACKE. Extremely weak, highly fractured, very closely to closely spaced defects. Soil Description: SILT, some clay and sand. Very stiff, moist, low plasticity. Sand, fine.			HQTT	100	UTP		4.5									

Water Level / Fluid Loss (%): 25, 50, 75
03/12/2025 5:PM
04/12/2025 5:PM

COMMENTS: Groundwater reading measured at the start and each of each day. Dual Nested Piezometer installed in borehole 8/12/2025. Raised PVC cover installed.

Hole Depth 35m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-3

SHEET: 2 OF 7

PROJECT: Project Mahitahi Geotech

JOB No.: 1099889.1000

LOCATION: In clearing on E side of access track.

CO-ORDINATES: (EDENTM2000) 776624.30 mN 421468.90 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 150.00m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce

LOGGED BY: JOWI

CHECKED: PRMM

START DATE: 03/12/2025

FINISH DATE: 05/12/2025

CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
Waipapa Group	[CONT] *4.50m:* Completely weathered, brownish orange mottled grey GREYWACKE. Extremely weak, highly fractured, very closely to closely spaced defects. Soil Description: SILT, some clay and sand. Very stiff, moist, low plasticity. Sand, fine. *5.25 - 6. 00m* Relic rock fabric present.			HQTT	100			5.5									
	6.00 - 6. 75m Becoming clayey SILT, some sand, trace gravel. Very stiff, moist, low plasticity. Sand, fine; Gravel, greywacke, angular, 5-10mm.			HQTT	80		144	6.0									
	6. 75m: CORE LOSS. Likely drilling induced.			HQTT	100			6.5						04/12/2026 AM			
	7. 15m: Completely weathered, brownish orange mottled grey GREYWACKE. Extremely weak, highly fractured, very closely to closely spaced defects. Soil Description: Clayey SILT, some sand and trace gravel. Very stiff, moist, low plasticity. Sand, fine; Gravel, greywacke, angular, 5-10mm.			HQTT	33		143	7.0									
	7. 50m: CORE LOSS.			HQTT	0			7.5						05/12/2026 AM			
				HQTT	0		142	8.0									
	9. 00m: Completely weathered, brownish orange mottled grey GREYWACKE. Extremely weak, highly fractured, very closely to closely spaced defects. Soil Description: Clayey SILT, some sand and trace gravel. Very stiff, moist, low plasticity. Sand, fine; Gravel, greywacke, angular, 5-10mm.			HQTT	13			8.5									
	9. 20m: CORE LOSS. Likely drilling induced.						141	9.0									
	9. 75m: Completely weathered, brownish orange mottled grey GREYWACKE. Extremely weak, highly fractured, very closely to closely spaced defects. Soil Description: Silty SAND, some			HQTT	53			9.5									

COMMENTS: Groundwater reading measured at the start and each of each day. Dual Nested Piezometer installed in borehole 8/12/2025. Raised PVC cover installed.

Hole Depth 35m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: HUN25-3

SHEET: 3 OF 7

Tonkin+Taylor

PROJECT: Project Mahitahi Geotech
JOB No.: 1099889.1000
LOCATION: In clearing on E side of access track.

CO-ORDINATES: (EDENTM2000) 776624.30 mN 421468.90 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 150.00m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: JOWI
CHECKED: PRMM
START DATE: 03/12/2025
FINISH DATE: 05/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
Waipapa Group	clay. Loosely packed, moist, non plastic. Sand, fine to medium.																
	10.00m: Completely weathered, orange and light grey GREYWACKE. Extremely weak, highly fractured, very closely to closely spaced defects. Soil Description: Silty CLAY. Very stiff, dry to moist, moderate plasticity.			HQTT	53												
	10.15m: CORE LOSS. Likely drilling induced.			HQTT	33			10.5									Box 3.60-10.50m
	11.00m: Completely weathered, orange and light grey GREYWACKE. Extremely weak, highly fractured, very closely to closely spaced defects. Soil Description: Silty CLAY. Very stiff, dry to moist, moderate plasticity.						139	11.0									
	11.25m: CORE LOSS.			HQTT	0			11.5									
				HQTT	0		138	12.0									
	12.75m: Completely weathered, light grey and orange mottled GREYWACKE. Extremely weak, highly fractured, very closely to closely spaced defects. Soil Description: Sandy SILT, some clay and gravel. Loose, moist, low plasticity. Sand, fine to medium; Gravel, fine, angular, greywacke.							12.5					*12.75m:* Switched to using extended catcher.				
	12.95m: Highly Weathered, light brown with black and orange staining on faces GREYWACKE. Very weak, highly fractured, very closely to closely spaced defects. Recovered as: fine to coarse, angular GRAVEL.			HQTT	100		137	13.0					*12.95m:* J, 70°, PL, SM, N, Fe *13.00m:* J, 20°, PL, SM, N, Fe				
													13.20m: J, 15°, PL, SM, N, Fe				
								13.5					*13.40m:* J, 60°, PL, SM, N, Fe				
				HQTT	100		136	14.0				0	*13.90m:* J, 20°, PL, SM, N, Fe *14.10m:* J, 20°, PL, SM, N, Fe *14.30m:* J, 70°, PL, SM, N, Fe				
	14.60m: CORE LOSS. Loss considered drilling-induced; interval likely comprised highly fractured material (based on adjacent recovered core).			HQTT	0			14.5				0					

COMMENTS: Groundwater reading measured at the start and each of each day. Dual Nested Piezometer installed in borehole 8/12/2025. Raised PVC cover installed.

Hole Depth 35m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-3

SHEET: 4 OF 7

PROJECT: Project Mahitahi Geotech

JOB No.: 1099889.1000

LOCATION: In clearing on E side of access track.

CO-ORDINATES: (EDENTM2000) 776624.30 mN, 421468.90 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 150.00m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce

LOGGED BY: JOWI

CHECKED: PRMM

START DATE: 03/12/2025

FINISH DATE: 05/12/2025

CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
Waipapa Group	[CONT] *14.60m:* CORE LOSS. Loss considered drilling-induced; interval likely comprised highly fractured material (based on adjacent recovered core).			HQTT	0							0					
	15.20m: Highly weathered, light brown with black and orange staining on faces GREYWACKE. Very weak, highly fractured, very closely spaced defects. Recovered as: fine-coarse GRAVEL core stones of moderately weathered, greywacke.			HQTT	100		134	15.5				0					Box 10.50-15.80m
								16.0									
								16.5					*16.60m:* J, 90°, PL, SM, N, Fe				
													16.80m: J, 30°, PL, SM, N, Fe				
				HQTT	100		133	17.0				0	*17.20m:* J, 40°, PL, SM, N, Fe *17.25m:* J, 45°, PL, SM, N, Fe				
								17.5					*17.60m:* J, 30°, PL, SM, N, Fe				
													17.80m: J, 60°, PL, SM, N, Fe				
				HQTT	100		132	18.0				0	*18.30m:* J, 20°, PL, R, N, Fe				
								18.5					*18.50m:* J, 70°, PL, R, N, Fe				Box 15.80-18.80m
													18.70m: J, 40°, PL, R, N, Fe				
				HQTT	100		131	19.0				0	*19.20m:* J, 50°, PL, R, Fe				
								19.5									

COMMENTS: Groundwater reading measured at the start and each of each day. Dual Nested Piezometer installed in borehole 8/12/2025. Raised PVC cover installed.

Hole Depth 35m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-3

SHEET: 5 OF 7

PROJECT: Project Mahitahi Geotech	CO-ORDINATES: (EDENTM2000) 776624.30 mN 421468.90 mE	R.L. GROUND: 150.00m
JOB No.: 1099889.1000		R.L. COLLAR:
LOCATION: In clearing on E side of access track.	DIRECTION: 0°	DATUM: AUCKHT1946
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: JOWI
CHECKED: PRMM
START DATE: 03/12/2025
FINISH DATE: 05/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
Waipapa Group	*20.00m:* Moderately weathered, grey with brown and orange staining on faces GREYWACKE. Moderately strong, closely spaced, steep to very steep defects.			HQTT	82			20.5				0	*20.00m:* Removed extended catcher due to rock strength. *20.20m:* J, 40°, UN, N, Fe *20.30m:* BZ *20.30-20.50m:* J, 90°, UN, N, Fe *20.50-20.70m:* BZ				
	20.85m: CORE LOSS. Loss considered drilling-induced; interval likely comprised highly fractured material (based on adjacent recovered core).						129	21.0									
	21.25m: Moderately weathered, grey with brown and orange staining on faces and around joints GREYWACKE. Moderately strong, closely spaced, steep to very steep joints.			HQTT	69			21.5				0	*21.40m:* J, 10°, UN, R, Fe *21.50m:* J, 10°, UN, R, Fe *21.80m:* J, 10°, UN, R, Fe				
	22.00 - 22.40m Highly fractured, closely spaced, steep to very steep defects.						128	22.0					*22.00m:* J, 40°, UN, R, Fe				Box 18.80-22.45m
	23.50 - 23.60m Highly fractured. Recovered as sandy, coarse GRAVEL.			HQTT	71			22.5				25	*22.60m:* J, 5°, ST, SM, N *22.65m:* BZ				
	23.60m: CORE LOSS. Loss considered drilling-induced; interval likely comprised highly fractured material (based on adjacent recovered core).							23.0					*23.00-23.10m:* BZ				
	24.00m: Moderately weathered, brown grey GREYWACKE. Moderately strong, sub-horizontal to sub- vertical, very closely to closely spaced joints.						127	23.5					*23.80m:* , BZ				
	24.40 - 24.50m Highly fractured, closely spaced, gently to steeply inclined.			HQTT	33			24.0				15	*24.00m:* J, 80°, UN, MN, Fe *24.20m:* BZ				
	24.50m: CORE LOSS. Loss considered drilling-induced; interval likely comprised highly fractured material (based on adjacent recovered core).						126	24.5									

COMMENTS: Groundwater reading measured at the start and each of each day. Dual Nested Piezometer installed in borehole 8/12/2025. Raised PVC cover installed.

Hole Depth 35m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-3

SHEET: 6 OF 7

PROJECT: Project Mahitahi Geotech
JOB No.: 1099889.1000
LOCATION: In clearing on E side of access track.

CO-ORDINATES: (EDENTM2000) 776624.30 mN 421468.90 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 150.00m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce
LOGGED BY: JOWI
CHECKED: PRMM
START DATE: 03/12/2025
FINISH DATE: 05/12/2025
CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
Waipapa Group	[CONT] *24.50m:* CORE LOSS. Loss considered drilling-induced; interval likely comprised highly fractured material (based on adjacent recovered core).			HQTT	33			25.5				15					
	25.50m: Moderately weathered, brown grey GREYWACKE. Moderately strong, very closely to closely spaced. Recovered as fine to coarse GRAVEL.			HQTT	30		124	26.0				0					
	25.80m: CORE LOSS. Loss considered drilling-induced; interval likely comprised highly fractured material (based on adjacent recovered core). *25.81 - 26.50m* Driller's note: due to drillbit grinding away on gravels due to hard rock above.			HQTT	0			26.5				0					
	27.20m: Moderately weathered, brown grey GREYWACKE. Moderately strong, very closely to closely spaced. Recovered as fine to coarse GRAVEL.			HQTT	33		123	27.0				0					
	27.30m: CORE LOSS.							27.5				0					
	27.50m: Moderately weathered, brown grey GREYWACKE. Moderately strong, very closely to closely spaced. Recovered as fine to coarse GRAVEL.			HQTT	25							0					
	27.70m: CORE LOSS.						122	28.0				0					
	28.10m: Moderately weathered, brown grey GREYWACKE. Moderately strong, sub-horizontal to sub- vertical, very closely to closely spaced joints. Recovered as fine to coarse GRAVEL.			HQTT	100			28.5				0	*28.20m:* J, 20°, UN, MN, Fe *28.50m:* BZ				Box 22.45-28.60m
	28.60m: Moderately weathered, brown grey GREYWACKE. Moderately strong, closely spaced joints, joints iron stained.			HQTT	57		121	29.0				20	*28.70m:* J, 10° *28.80m:* J, 40°, UN, N, Fe *29.10m:* J, 70°, UN, N, Fe *29.20m:* J, 60°, UN, R, MN, Fe *29.30m:* BZ				
	29.30m: CORE LOSS. Loss considered drilling-induced. Interval likely comprised highly fractured material (based on adjacent recovered core).							29.5									

COMMENTS: Groundwater reading measured at the start and each of each day. Dual Nested Piezometer installed in borehole 8/12/2025. Raised PVC cover installed.

Hole Depth 35m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HUN25-3

SHEET: 7 OF 7

PROJECT: Project Mahitahi Geotech

JOB No.: 1099889.1000

LOCATION: In clearing on E side of access track.

CO-ORDINATES: (EDENTM2000) 776624.30 mN, 421468.90 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 150.00m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Drillforce

LOGGED BY: JOWI

CHECKED: PRMM

START DATE: 03/12/2025

FINISH DATE: 05/12/2025

CONTRACTOR: Drillforce Ltd

GEOLOGICAL UNIT	MATERIAL DESCRIPTION (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK MASS DISCONTINUITIES: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Level / Fluid Loss (%)	Casing	Installation	Core Box No
Waipapa Group	*30.00m:* Moderately weathered, brown grey GREYWACKE. Moderately strong, sub-horizontal to sub- vertical, very closely to closely spaced. Recovered as fine to coarse GRAVEL.												*30.20m:* J, 60°, UN, R, N, Fe				
	30.20m: Moderately weathered; grey with brown on faces GREYWACKE. Moderately Strong, very closely to closely spaced joints. Very closely spaced microfractures present in rock mass.							30.5					*30.65m:* J, 10°, UN, R, N, Fe *30.70m:* J, 15°, UN, R, Fe *30.80m:* BZ *30.90m:* BZ				
				HQTT	93		119	31.0				30	*31.10m:* J, 15°, ST, R				
	31.50 - 32.50m Gently to moderately inclined, very tight spaced joints. Very closely spaced microfractures present in rock mass.							31.5					*31.40m:* BZ *31.60m:* J, 20°, SM, VN, Fe *31.70m:* BZ				
				HQTT	67		118	32.0				0	*31.90m:* BZ *32.20m:* BZ				Box 28.60-32.00m
	32.50m: CORE LOSS. Loss considered drilling-induced. Interval likely comprised highly fractured material (based on adjacent recovered core).							32.5					*32.40m:* BZ, gravels				
	33.00m: Slightly to moderately weathered, grey brown GREYWACKE. Moderately Strong, highly fractured, very closely to closely spaced, gently to steeply inclined joints. Very closely spaced microfractures present in rock mass. Iron staining along fractures.			HQTT	67		117	33.0				0					
								33.5					*33.50m:* J, 40°, SM, N, Fe				
	34.00m: CORE LOSS. Loss considered drilling-induced; interval likely comprised highly fractured material (based on adjacent recovered core).						116	34.0									
	34.50m: Slightly to moderately weathered, grey brown GREYWACKE. Moderately Strong, highly fractured, very closely to closely spaced, gently to steeply inclined joints. Very closely spaced microfractures present in rock mass. Iron staining along fractures.			HQTT	100			34.5				0					Box 32.00-35.00m
	35m: EOBH. Target depth																

COMMENTS: Groundwater reading measured at the start and each of each day. Dual Nested Piezometer installed in borehole 8/12/2025. Raised PVC cover installed.

Hole Depth 35m

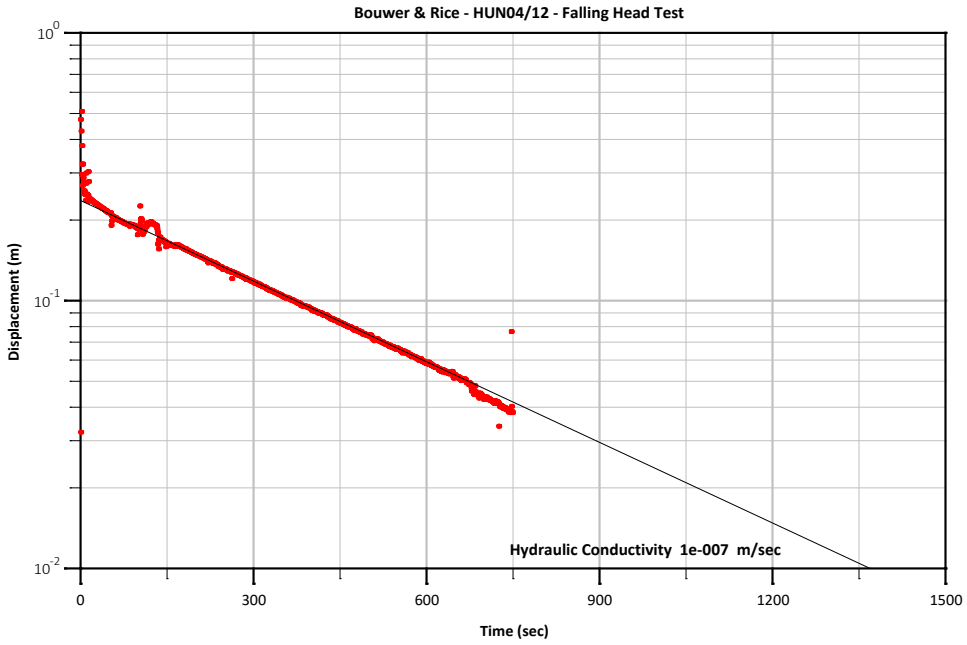
Scale 1:25

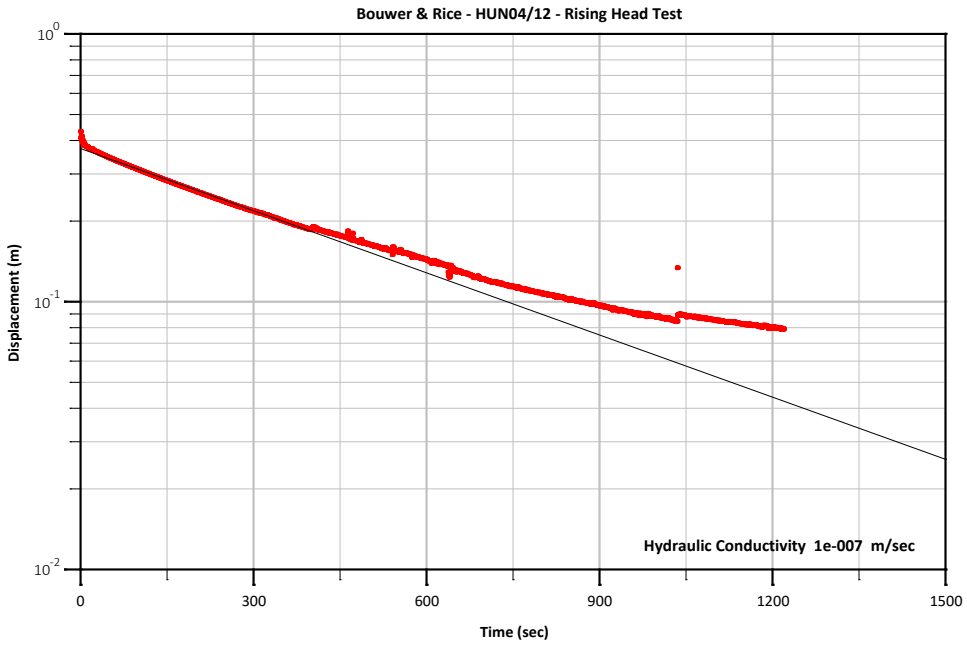
Rev.: A

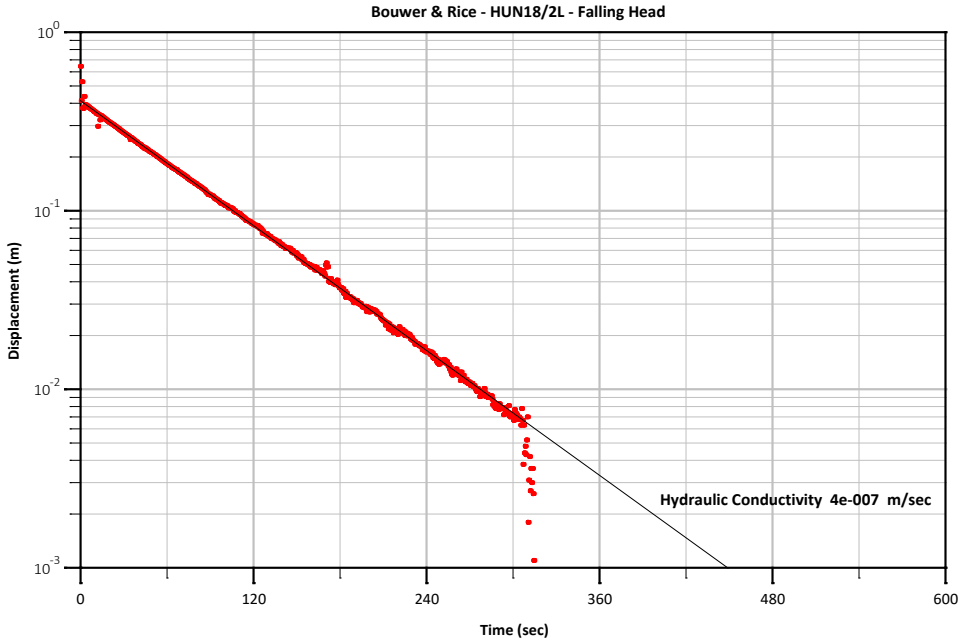
Appendix E: Pumping Test (2022) and Field Permeability Tests HUN4/12 and HUN18/2

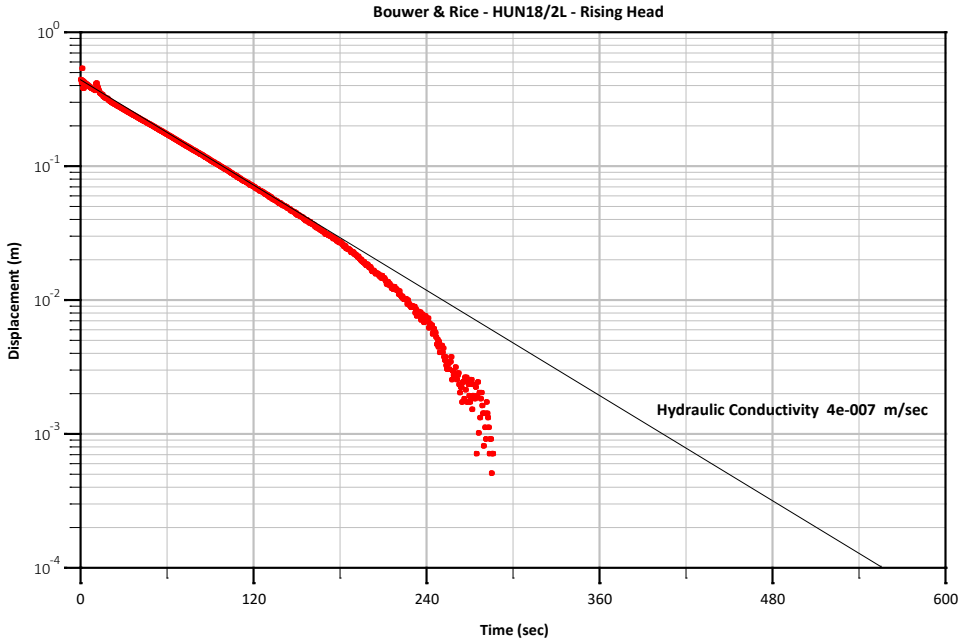
Table E-1: Hydraulic Conductivity Results (16 May 2019)

Bore	Coordinates		Ground Elevation (m, RL)	Piezo ID (mm)	Bore ID (mm)	Bore Depth (m, bgl)	Open Hole (Effective screen), m	SWL (m, bgl)	Analysis Method	Hydraulic Conductivity (m/s)		
	Easting	Northing								Falling Head	Rising Head	Geomean
HUN4/12	1777731	5893502	139.34	32	100	91.80	22	81.63	Bouwer & Rice	1×10^{-7}	1×10^{-7}	2×10^{-7}
HUN18/2	1778194	5893379	150.50	32	100	126	21	93.9	Bouwer & Rice	4×10^{-7}	4×10^{-7}	


Bouwer & Rice - HUN04/12 - Falling Head Test
Displacement (m)
10^{0}
10^{-1}
10^{-2}
Hydraulic Conductivity 1e-007 m/sec
0
300
600
900
1200
1500
Time (sec)


Bouwer & Rice - HUN04/12 - Rising Head Test
Displacement (m)
10^{0}
10^{-1}
10^{-2}
Hydraulic Conductivity 1e-007 m/sec
0
300
600
900
1200
1500
Time (sec)


Bouwer & Rice - HUN18/2L - Falling Head
Displacement (m)
10^{0}
10^{-1}
10^{-2}
10^{-3}
0
120
240
360
480
600
Time (sec)
Hydraulic Conductivity 4e-007 m/sec


Bouwer & Rice - HUN18/2L - Rising Head
Displacement (m)
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
0
120
240
360
480
600
Time (sec)
Hydraulic Conductivity 4e-007 m/sec

Pumping Test on HUN14/8 (2022)

The recent pumping test programme was carried out between 11 and 20 October 2021 to complement the available data on the aquifer hydraulic properties and to use the results to assess effects of the proposed take on the groundwater and surface water.

The existing pumping bore (HUN14/8) was used as the pumping test bore. The bore is equipped with a 6inch pump (KNB-WS-14) with a maximum efficient capacity of 1,400m^3/d. The discharge to Mangapū Stream during the pumping test was via an existing 30m pipe between the pump and the stream.

The test was consisted of a step discharge test and a 7-day constant discharge test and subsequent recovery test. A step-drawdown test was undertaken at the site on the 11 October 2021 followed by a 7-day constant rate test from 13 October 2021 to 20 October 2021.

Step Discharge Test

The step discharge test was carried out to assess the pumping well performance and well losses on 11 October 2021. The test consisted of four steps, with pumping rates of 317, 718, 1053 and 1,395m^3/d. For the first three steps the discharge was kept constants at 120 min and for the fourth step the test continued for 180 min.

The Eden and Hazel method was used to determine well losses and aquifer transmissivity. The test analysis and well equation are presented in Appendix B. Using the well equation, for the proposed pumping rate of 1,400m^3/d, the total calculated drawdown (including the well loss) after 6 months of pumping (under no recharge conditions) is about 8.8m. This includes the turbulent well loss of about 3.9m. Considering the open hole nature of the bore, the head loss may have been caused by both frictional and turbulent losses. Friction losses can be caused by insufficient clearance between the casing and pump intake and turbulence losses can occur if the pump is positioned in the well with one side against the casing. The well losses in open hole may have also been caused by flow through fractured zones.

Constant Rate and Recovery Tests

The constant rate test followed the step test (after the bore was allowed to recover) to assess the aquifer properties. The 7-day test began on 13 October 2021, at a pumping rate of 994m^3/d, which was sustained throughout the test. Water levels were monitored at eight monitoring bores and also in the Mangapū Stream above the discharge point. The monitoring bores utilised for the test are presented in Table 1 and their locations are shown in Appendix A.

The monitoring bores located between 50m and 1.3km from the pumping bore. The groundwater and stream water levels hydrographs before and during the pumping test are shown in Figures E-1 to E-4.

Minor drawdown effects are detected in the two farm wells (830 and 4320) and also in the monitoring bore HUN05/3, 50m from the pumping bore. No drawdowns are detected in Symonds Pit (HUN04/12) and other monitoring bore (HUN04/12, HUN05/1L, HUN12/1L, HUN12/1U and HUN07/8).

Minor drawdowns of 0.2m in 4320 and 0.1m in 830 were detected during the 7-day test. The water levels in these bores may have also been affected by local pumping and regional groundwater trend. The apparent drawdowns in these bores were too small to be used for any accurate interpretation of the aquifer properties.

Table E-2: Groundwater Monitoring Bores in Greywacke for the Pumping Test

Monitoring Bores and Piezometers	Ground Level (m, RL)	Borehole Depth (m, RL)	Borehole Depth (mbgl)	Distance to Pumping Bore (m)	Current Groundwater Level (13 Oct 2019) (m, RL)	Formation
HUN05/1L	82.03	-8.27	90.3	1320	49.62	Greywacke
HUN05/3	44.21	12.21	32	50	46.25	
HUN07/8	150.16	-0.44	150.6	1100	49.88	
HUN04/12	139.34	47.54	91.80	1000	65.03	
HUN12/1L	149.8	5.76	144.04	880	49.04	
HUN12/1U	149.8	129.8	19.96	880	141.36	
830	62.12	-34	96	764	46.96	
4320	87	37	113	386	49.13	
HUN14/8 (Pumping Test Bore)	**46.85**	**-13.15**	**60**	**-**	**47.18**	

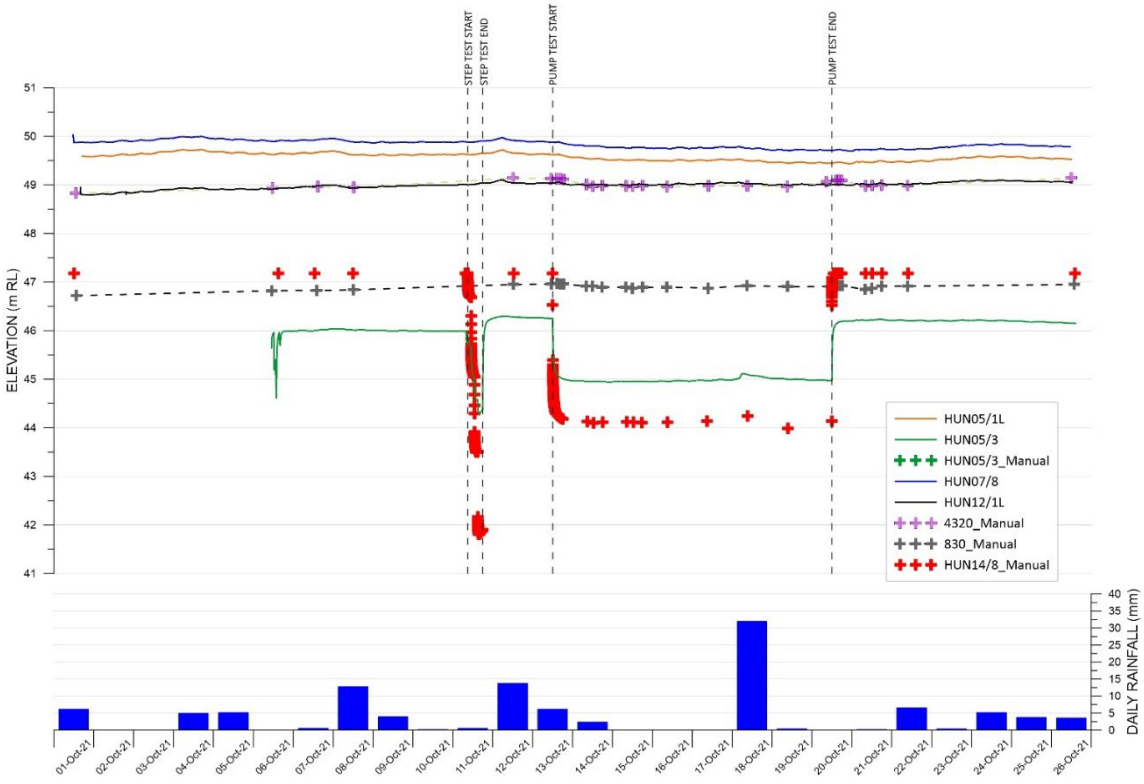


Figure E-1: Hydrographs for Deep Monitoring Bores (excluding HUN04/12)

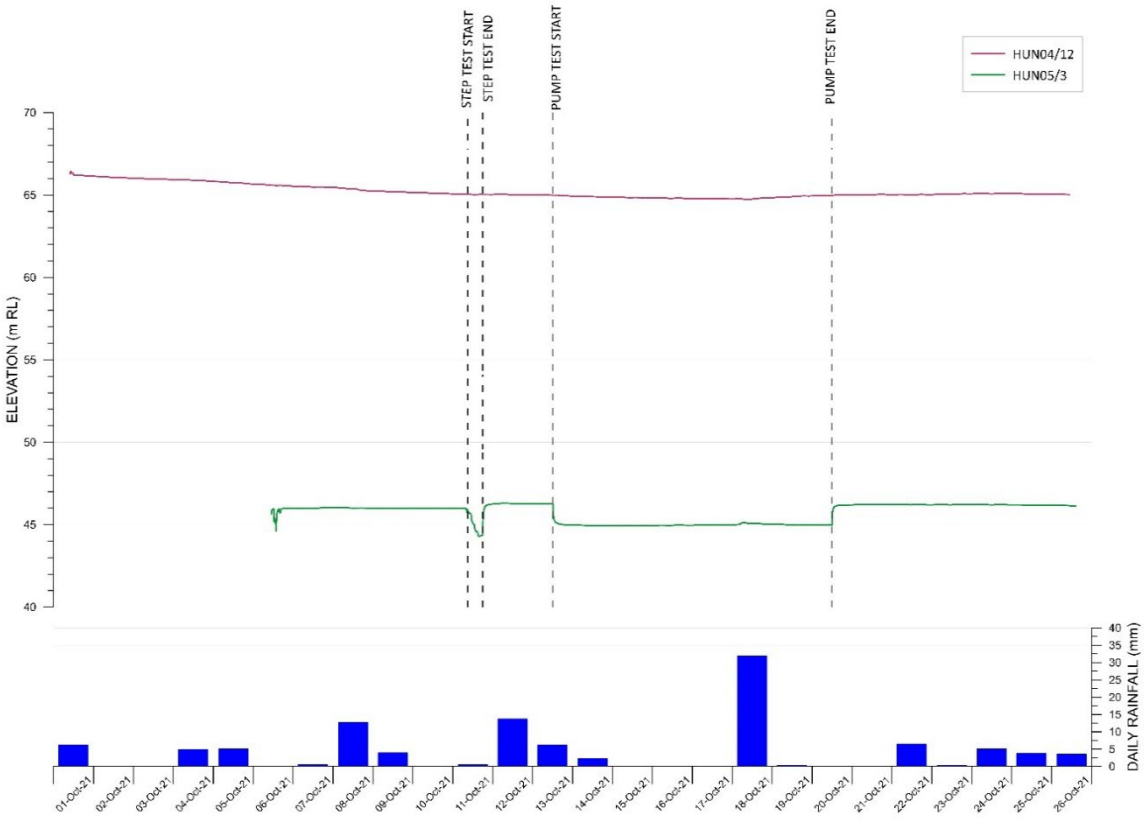


Figure E-2: Hydrographs for Deep Monitoring Bores HUN04/12 and HUN05/3

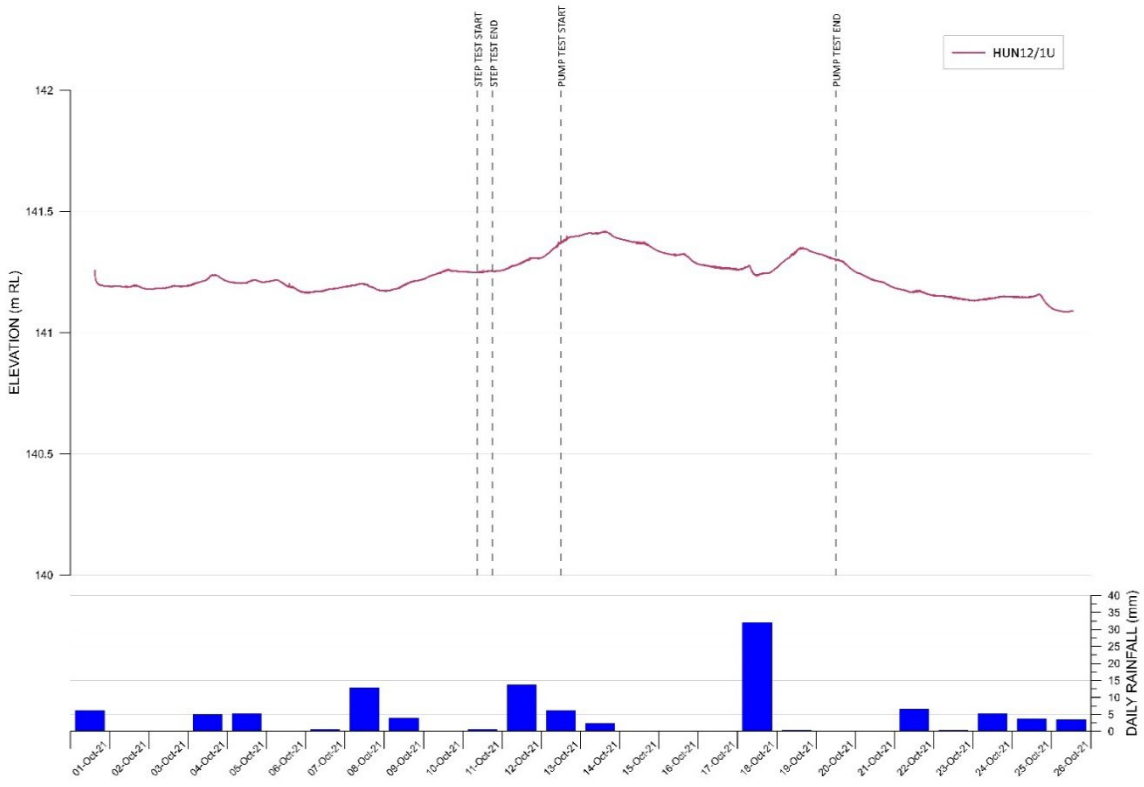


Figure E-3: Hydrographs for Shallow Monitoring Bore HUN12/1U

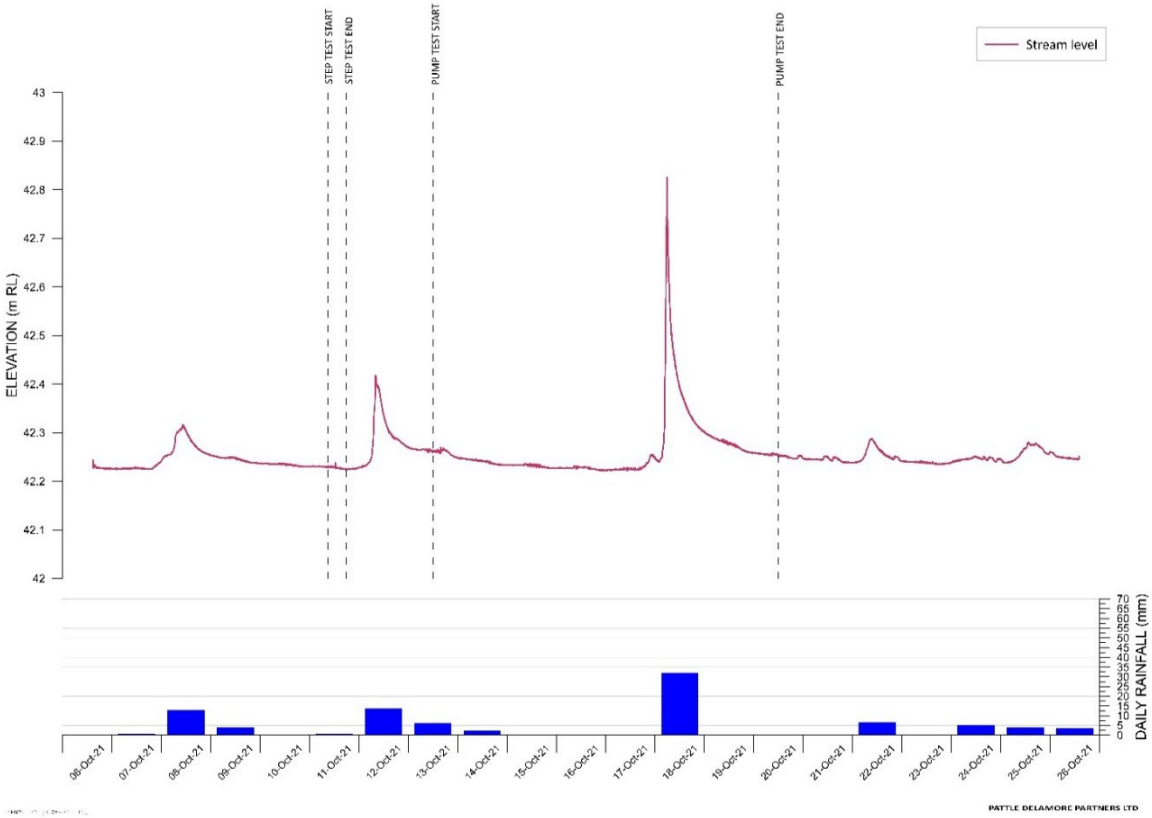


Figure E-4: Hydrographs for Mangapū Stream

Based on the pump test data, there is a gradual reduction in drawdowns after approximately 2 hours. This may be due to double porosity effects which is common in fractured rocks. The initial portion of the drawdown curve may be due to flow through fractures with lower porosity. The flatter portion of the curve (after two hours) may be due to higher flow contribution or recharge from more permeable fractured zones with higher storage (forming a recharge boundary). The conservative steeper portion of the curve (lower hydraulic conductivity) has been used for the interpretation in this study.

The storage coefficient of 0.0004 is calculated based on the data from the monitoring bore (HUN05/3).