

19 August 2026

Proposed Residential Development

Brymer Development

GEOTECHNICAL EFFECTS MANAGEMENT PLAN

Pragma Designer Homes

Job No. HAM2025-0084AI | Version 3



Hamilton
Level 1 | Block C
401 Grey Street
Hamilton 3216
New Zealand
Ph: +64 7 2820 039
www.cmwgeosciences.com

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Job number	HAM2025-0084AI
Prepared by	Mark McVinnie, Project Engineering Geologist 
Reviewed by	David MacPherson, Associate Geotechnical Engineer CMEngNZ, CPEng 
Authorised by	David Sullivan, Principal Engineering Geologist CMEngNZ, CPEng 

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1.0 INTRODUCTION

CMW Geosciences (CMW) was engaged by Pragma Designer Homes to carry out geotechnical engineering services for the proposed Brymer Farms development at Whatawhata, Hamilton. The development covers approximately 81 ha between Brymer Road and Whatawhata Road and is being advanced as a substantive fast track application.

The Brymer Development is an 81Ha site located west of the current Hamilton City limits at Whatawhata, Hamilton, New Zealand, which is being considered for the development of approximately 1,043 lots (refer **Figure 1** right). The site is predominantly underlain by Holocene Swamp deposits in the low-lying areas, flanked by rolling hills to the north and south, comprised of Pleistocene-aged silts and clays.

This geotechnical effects management plan (GEMP) outlines the potential risks, mitigation and contingency measures relating to groundwater drawdown and the potential for load induced ground settlement. This report is based on the information provided in the documents outlined in Table 2.1.

This document has been prepared to support substantive application under the Fast Track Approvals Act 2024. It is considered a live document, and relies on the design and assessment information available at the date of preparation. Consent conditions are yet to be determined, and construction sequencing, temporary works and final structural loads remain subject to detailed design. Accordingly, this GEMP must be reviewed and updated prior to construction. It must not be used to set construction trigger levels without project-geotechnical and hydrogeological certification.

Where this GEMP differs from a subsequently issued consent condition or certified technical design, the more stringent requirement applies until the discrepancy has been resolved and the GEMP formally updated.

2.0 REPORT PURPOSE

The key purpose of this report is to manage the effects of ground settlement and increase in seismic hazard from the increase in the landform levels and formation of the wetlands within the residential development.

This report outlines the potential risks, mitigation and contingency measures relating to groundwater drawdown and the potential for induced ground settlement.

The geotechnical aims of the report are:

- Minimising effects on nearby infrastructure and occupied buildings;
- Implementation of a Trigger Action Response Plan (TARP) to monitor ground settlement in the vicinity of the wetlands; and
- Identifying actions and mitigation measures to rectify any minor or more than minor effects created by ground settlement.

This report is based on the information provided in the documents outlined in **Table 2.1**.

Table 2.1: Project Documentation

Report Type	Reference and/or Comments	Author
Geotechnical Investigation Report (GIR)	HAM2025-0084AC Rev1	CMW, August 2026
Technical Memo	HAM2025-0084AG Rev0	CMW, June 2026
Groundwater Effects Substantive Report	WGA211193-RP-HG-0010_B	WGA, August 2026
Current civil and earthworks drawings	119014 C210	Maven, August 2026

3.0 SITE DESCRIPTION AND LANDFORM

The Site comprises multiple titles held by Brymer Farms Limited and is bounded generally by Brymer Road to the north, Whatawhata Road/State Highway 23 to the south, and the existing Western Heights urban area to the east. Existing land use is predominantly rural, with dwellings, farm buildings, raceways, drains, fencing and troughs.

The landform can be divided into elevated northern and southern ridges and a broad central low-lying area. Ground levels range from approximately RL25 m across the central flats to about RL56 m on the elevated ground. A network of farm drains crosses the low-lying area. Key surrounding infrastructure is described in more detail within the 2026 GIR.

Figure.1: Site Location Plan Depicting Proposed Wetlands (Ref. Brymer Development Groundwater Effects Substantive Report (ref. WGA211193-RP-HG-0010_A, dated August 2026)



Figure.2: Site Location Plan Depicting Proposed Wastewater Pipelines and Pump Stations (Ref. Brymer Development Groundwater Effects Substantive Report (ref. WGA211193-RP-HG-0010_A, dated August 2026)



4.0 PROPOSED DEVELOPMENT

The Brymer Farms Limited development (Brymer) is a comprehensively planned, multi-staged residential development providing for the urbanisation and subdivision of the project site. The Project is the subject of a Notice of Decision by the Minister, dated 4 September 2025, to refer the Project. It seeks the land use, environmental, subdivision and associated infrastructure consents required to enable the development to be delivered progressively and in a coordinated manner.

The Project will provide approximately 1,043 residential units, including approximately 248 apartment units, across a range of housing typologies and densities. Housing will comprise a mix of terraced, duplex and detached dwellings, conventional and compact residential lots, irregular lots, and eight larger rural-residential lots. This range of typologies is intended to provide housing choice while enabling the development pattern to respond appropriately to the physical characteristics, environmental features and constraints of the site.

The master plan also provides for two mixed-use commercial sites, identified as C1 and C2, which will form a neighbourhood scale commercial component within the development. C1 will provide approximately 910 m² of ground-floor commercial gross floor area (GFA), with 24 two bedroom apartments above. C2 will provide approximately 1,274 m² of ground-floor commercial GFA, with 16 two bedroom apartments above. Both sites will incorporate basement car parking, dedicated vehicle access, servicing areas and landscaping. Collectively, C1 and C2 will provide approximately 2,184 m² of commercial GFA and 40 apartments, supporting the day-to-day needs of residents and contributing to a mixed-use neighbourhood environment.

The development will be supported by the necessary transport and three-waters infrastructure. Water supply and wastewater servicing will connect to the IAWAI reticulated networks, with internal reticulation and associated infrastructure established progressively as development is staged. This may include pump stations, storage, reservoirs and mains, where required. Stormwater will be managed through an integrated stormwater management system, with discharge ultimately occurring to the receiving environment within the Waikato District. The stormwater system will incorporate appropriate treatment, attenuation and conveyance measures and will integrate, where appropriate, with proposed wetlands, watercourses, stormwater reserves and other water-sensitive design features throughout the development.

Implementation of the Project will require staged development related earthworks to establish suitable building platforms, a well connected road network, infrastructure corridors, reserves and other components of the master plan. These works will include site formation, cut and fill, retaining, erosion and sediment control, and other enabling works required to facilitate the staged subdivision and development of the site. The proposal will also require the undergrounding of existing power lines within the Applicant's site.

A significant component of the Project is the provision and enhancement of open space and ecological values. The development will provide an integrated network of public and recreational open spaces, pedestrian connections, wetlands, watercourses, stormwater reserves, landscaped areas and retained vegetation. Environmental and ecological mitigation and offsetting will also be provided where required to address effects arising from the development and to support the protection, restoration and enhancement of ecological values across the site and wider receiving environment. Where appropriate, these measures will be integrated with the development's open-space and stormwater networks.

The overall open-space and movement network will connect with the surrounding urban environment and existing reserves, including Rakautahi Park, Brymer Glen Reserve, Brymer Park and Te Kootii Park. These connections will provide links between residential neighbourhoods, commercial and community areas, recreational spaces and the wider transport network.

Overall, Brymer is a large scale, comprehensively planned urban development that will enable approximately 1,043 residential units, including approximately 248 apartments, together with approximately 2,184 m² of commercial GFA. The Project encompasses the subdivision and development of the land and the associated development related earthworks, transport and access infrastructure, water supply and wastewater connections to the IAWAI reticulated networks, stormwater management and discharge, ecological mitigation and offsetting, landscaping, open space, recreation, and other supporting infrastructure necessary to establish the new community.

The Project will be implemented through a multi-staged consenting and development framework, enabling subdivision, land use and infrastructure works to proceed progressively while ensuring that each stage is appropriately serviced and integrated with the wider development and surrounding environment.

The development will be subject to a comprehensive suite of proposed conditions of consent, including a design guide, developed with input from the Applicant's relevant technical and environmental specialists. These conditions will provide the framework for managing the construction, staging, servicing and operation of the development, including earthworks, transport, three-waters infrastructure, stormwater discharges, ecological effects and offsetting, landscaping and open space, and other potential environmental effects associated with the Project.

Collectively, the master plan, supporting technical assessments and proposed conditions of consent provide an integrated framework for the staged delivery and management of Brymer, including measures to avoid, remedy or mitigate adverse environmental effects and, where appropriate, provide environmental offsets.

5.0 POTENTIAL GEOTECHNICAL EFFECTS

Calculation of the drawdown effects has been provided by WGA to inform the writing of this report. The basin specific drawdown analyses have been provided in **Appendix A**.

5.1 Drawdown and Drawdown Induced Ground Settlements

The groundwater modelling carried out as part of the WGA report provides details of potential environmental effects during and following drawdown as part of the formation of the wetlands as well as the construction of the wastewater pump stations (WWPS) and wastewater pipelines required to service the proposed development.

WGA open-pit modelling predicts winter construction inflows ranging from approximately 25 m³/day at Wetland D to 104 m³/day at Wetland F. The modelled 0.25m drawdown radius ranges from about 28m to 90m. The final engineered fill design is expected to materially reduce these inflows and must be incorporated into updated predictions and trigger levels.

Wetland F and Wetland G are situated on the hill slopes and were not assessed as it has been assumed these wetlands will be lined.

The maximum dewatering depth should be in accordance with the WGA HEA. If for any reason an increase is required in the dewatering depth, settlement calculations should be undertaken and this GEMP updated to reflect these changes.

5.1.1 Wastewater Pump Stations

The hydrogeological assessment completed by WGA assumes 3.4 to 4.7m deep wet wells with shallow pumping during construction as required. WWPS A requires an indicative pumping rate of 8.8 L/s for up to 3 days, with an assessed 0.25m drawdown radius of approximately 60m. WWPS B requires an indicative 10.3 L/s, with an assessed drawdown radius of approximately 62m. WWPS D requires an indicative 4.8 L/s, with an assessed drawdown radius of approximately 67m.

5.1.2 Wastewater Pipelines and other Trenches

The construction of the planned wastewater pipeline network requires the excavation of trenches below the water table in some areas.

These wastewater pipelines are expected to be installed progressively in short trench sections. WGA indicates that overlapping operations may create cumulative dewatering rates of approximately 44 m³/day to 62 m³/day. The modelled drawdown radius ranges from about 20m to 25m. The contractor must minimise open length and duration, use trench support, maintain stable drawdown, and backfill promptly with compacted material meeting the approved specification. Dewatering arrangements must not create uncontrolled loss of fines, boiling, base heave or off-site settlement.

5.2 Static and Seismic Slope Stability

Static and seismic analyses were undertaken within the CMW GIR for the proposed wetlands, retaining walls and cut slopes. Results indicate that the proposed designs meet the requisite factor of safety.

Survey monitoring devices will be installed and monitored during construction to monitor the temporary construction stability of the earthfill embankments being constructed on soft soil. The specific layout of these devices will be scheduled during detailed design, however they will likely comprise pins that can be surveyed to monitor vertical and lateral ground movement, and vibrating wire piezometers to monitor pore pressures within the underlying soft soil.

5.3 Load Induced Settlement

Proposed fill is anticipated to depths of up to 4.5m on the low-lying parts of the site. A preliminary settlement analyses was undertaken within the GIR. Results indicated significant load induced settlement is anticipated to occur across the development as a result of bulk earthworks. Specific construction monitoring settlement devices, including settlement plates, vibrating wire piezometers, and extensometers, will be scheduled during detailed design to monitor this settlement. This settlement is predicted to occur within the development area and not have any adverse impacts on neighbouring properties.

The above assessment is subject to review at the detailed design stage.

6.0 MONITORING AND REPORTING REQUIREMENTS

6.1 Instrumentation

Instruments shall be installed and monitored as per the GEMP for the proposed development is listed in **Table 6.1** below and depicted on **Drawing 03**.

Table 6.1: Required Monitoring Instrumentation

Type	Monitoring ID
Groundwater Monitoring Piezometers with standpipes with downhole datalogger (divers) – Cross Boundary Monitoring	Proposed MP01 to MP04 and MP06 to MP07
Groundwater Monitoring Piezometers with standpipes with downhole datalogger (divers) – Wetland monitoring	Proposed MP05
Ground Settlement Markers	Proposed SM01 to SM09

Piezometers will be installed for geotechnical monitoring purposes. Each borehole outlined above will monitor groundwater levels in low-lying areas (anticipated between RL22m and RL32m. These depths are indicative and will be confirmed on site during borehole drilling with screen depths installed to match site conditions encountered. A single barologger should be installed at the site office to compensate all level loggers installed across the project (30km radius).

Monitoring results shall be submitted to Pragma and the Geotechnical Engineer in electronic format (Excel spreadsheet or similar) within 24 hours of the monitoring being undertaken, at the intervals set out herein to confirm compliance with the Resource Consent conditions.

Should any of the monitoring instruments be damaged and become inoperable, then the Geotechnical Engineer, Pragma and HCC are to be informed, and a new monitoring instrument may be required to be installed at a nearby location as agreed in consultation with the Geotechnical Engineer and Asset owner.

6.2 Pre-Condition Surveys

Due to the anticipated negligible groundwater drawdown induced settlements for the existing residential dwellings following the proposed excavations, it is determined that conditional surveys for the adjacent properties are not required.

6.3 Groundwater Level Monitoring

A series of boreholes with standpipe piezometers are to be installed around the perimeter of the site adjacent to existing residential dwellings and near WWPS, with groundwater levels to be monitored during the works. Locations of proposed monitoring sites are presented on **Drawing 03**.

Construction of the wetlands will involve cutting through the engineered fill and into the existing soil profile. Analysis in the GIR indicates settlement effects will be negligible; however, to validate this, we recommend groundwater monitoring is undertaken at an increased frequency during initial construction and then relaxed following observation of the stabilisation of groundwater levels.

Groundwater levels from piezometers with dataloggers will be collected at 15-minute automated intervals. Data will be downloaded and the remaining piezometers manually measured at the monitoring frequency presented in **Table 6.2** and **6.3** below.

Table 6.2: Groundwater Monitoring Frequency – Wetland Monitoring Points

Timeframe	Duration	Frequency
Pre-construction	At least 6 months prior to construction to obtain baseline seasonal fluctuations	Every 4 to 6 weeks
During construction	For the full duration of construction of respective stormwater wetland	Once a week
Post-construction	For 2 years following construction	Every 4 weeks for 6 months and then 6 monthly
Note: The monitoring frequency may be amended should anomalous or concerning data be recorded.		

Table 6.3: Groundwater Monitoring Frequency – WWPS and Service Trench Monitoring Points

Timeframe	Duration	Frequency
Pre-construction	At least 6 months prior to construction to obtain baseline seasonal fluctuations	Every 4 to 6 weeks
During construction	For the full duration of construction of respective stormwater wetland	Once a week
Note: The monitoring frequency may be amended should anomalous or concerning data be recorded.		

6.4 Ground Settlement Monitoring

Settlement monitoring of neighbouring critical infrastructure will be required where any buildings, utilities or assets are present to measure any drawdown induced settlement. A suitably qualified and certified surveyor will be responsible for installing settlement monitoring points and providing survey results at the locations indicated on the plans presented in **Appendix B**.

The proposed monitoring frequency for settlement is presented in **Table 6.5**.

Table 6.4: Settlement Monitoring Frequency

Timeframe	Duration	Frequency
Pre-construction	Minimum of 3 readings for each point to be taken over a 3-week period prior to dewatering	3 readings to obtain baseline
During construction	For the full duration of construction of respective stormwater wetland	Once a week for first 4 weeks, reducing to once every 4 weeks during construction
Post-construction	For 2 years following construction	Every 4 weeks for 6 months and then only when drawdown amber or red triggers are exceeded ⁽²⁾
Notes:		

Timeframe	Duration	Frequency
⁽¹⁾ The frequencies above may be decreased or increased by the Geotechnical Engineer depending on the results of the monitoring.		
⁽²⁾ Six Monthly groundwater monitoring will be undertaken for 2 years post construction, settlement is linked directly to the drawdown, therefore monitoring is only required when drawdowns exceed what is anticipated.		

Required settlement monitoring points are outlined for each respective excavation (construction phase) in Table 7 below and presented on **Drawings 05**.

Table 6.5: Required Settlement Monitoring Points for Each Respective Excavation

Construction Phase	Potentially Affected Structures	Monitoring Points
Preloading Low-Lying Areas (Stage 1 and 2)	Residential dwellings adjacent to the NE subdivision boundary	SM04, SM06 to SM09
Wetland F and/or G	Residential dwellings adjacent to the NW subdivision boundary	SM01 and SM02, MP01 and 02
Wastewater Pipe and WWSP Installation (Stage 1 and 2) and/or Wetland A!, A2, B and C	Either wetland batters or wastewater infrastructure, whichever is constructed last.	SM03 and SM05, MP03 to 05

Settlement markers shall be levelled by precise survey to an accuracy of $\pm 2\text{mm}$ at the frequencies outlined above. All survey data must be provided to the Geotechnical Engineer as soon as possible following completion.

These levels may be amended subject to approval by the relevant party (Pragma, Hamilton City Council, and Waikato Regional Council) as part of the Geotechnical Effects Management Plan (GEMP) approval process, and, after the receipt of pre-dewatering monitoring data, building condition surveys and recommendations from a Suitably Qualified Engineering Professional (SQEP), but only to the extent that avoidance of damage to building, structures and services can still be achieved.

6.5 Post-Construction Monitoring

Following construction of respective wetland structures, monitoring frequencies will shift into those outlined in **Table 6.2 and 6.5**.

6.6 Groundwater Flows and Volume

Where possible, volumes of water abstracted from excavations will be monitored and recorded so that soil permeabilities, inflow rates and volumes can be compared with the estimates outlined within the WGA report.

Pump capacities are to be recorded, and daily pumping records kept by the contractor. These records are to be provided to CMW on a monthly basis for review.

Daily rainfall records are also to be maintained by the contractor and presented with the monthly pumping records.

6.7 Data Processing and Reporting

Groundwater and survey monitoring data will be entered into a database, typically within 24 hours of being provided. The data will be compared to anticipated effects and levels. Any trends will be noted and implications considered with respect to future and current activities and effects.

During construction groundwater monitoring and settlement monitoring, data should be provided to Waikato Regional Council on a fortnightly basis. These results should be presented in a format which shows the monitoring results compared against trigger levels, along with a summary analysis of any data trends and forecasts.

In the event of an alarm level being triggered, the Consent Holder shall notify Waikato Regional Council in writing within 48 hours of the event.

An annual groundwater monitoring report should be prepared by the Consent Holder within one calendar month following completion of construction of each basin for a period of 2 years and provided to Waikato Regional Council and Hamilton City Council.

7.0 TRIGGER ACTION RESPONSE PLAN (TARP)

7.1 Groundwater Monitoring Triggers

The groundwater triggers have been set as:

- Green – drawdown (below baseline) is within predicted range (<80% of predicted)
- Amber – drawdown is at the upper end of the predicted range (within 80% - 100% of predicted)
- Red – drawdown exceeding the predicted range (exceeded 100% of predicted)

Specific trigger levels are to be determined at the detailed design phase.

To better understand the groundwater regime and potential drawdown effects associated with the construction of the wetlands, piezometers are proposed across the site. Trigger levels have been established solely for the shallow piezometers.

7.2 Settlement Monitoring Triggers

The ground settlement triggers have been set as:

- Green – settlement that is within predicted range and is below the threshold for expected damage or loss of service
- Amber – settlement at the upper end of the predicted range
- Red – drawdown exceeding the predicted range, and/or reaching potentially damaging magnitudes

Specific trigger levels are to be determined at the detailed design phase.

Differential settlements across structures should be back calculated where amber trigger levels are exceeded. Red level trigger actions should be followed where any back calculated differential settlement across a platform exceeds 1:300, with structural condition surveys undertaken within 48 hours of exceedance of this differential settlement tolerance.

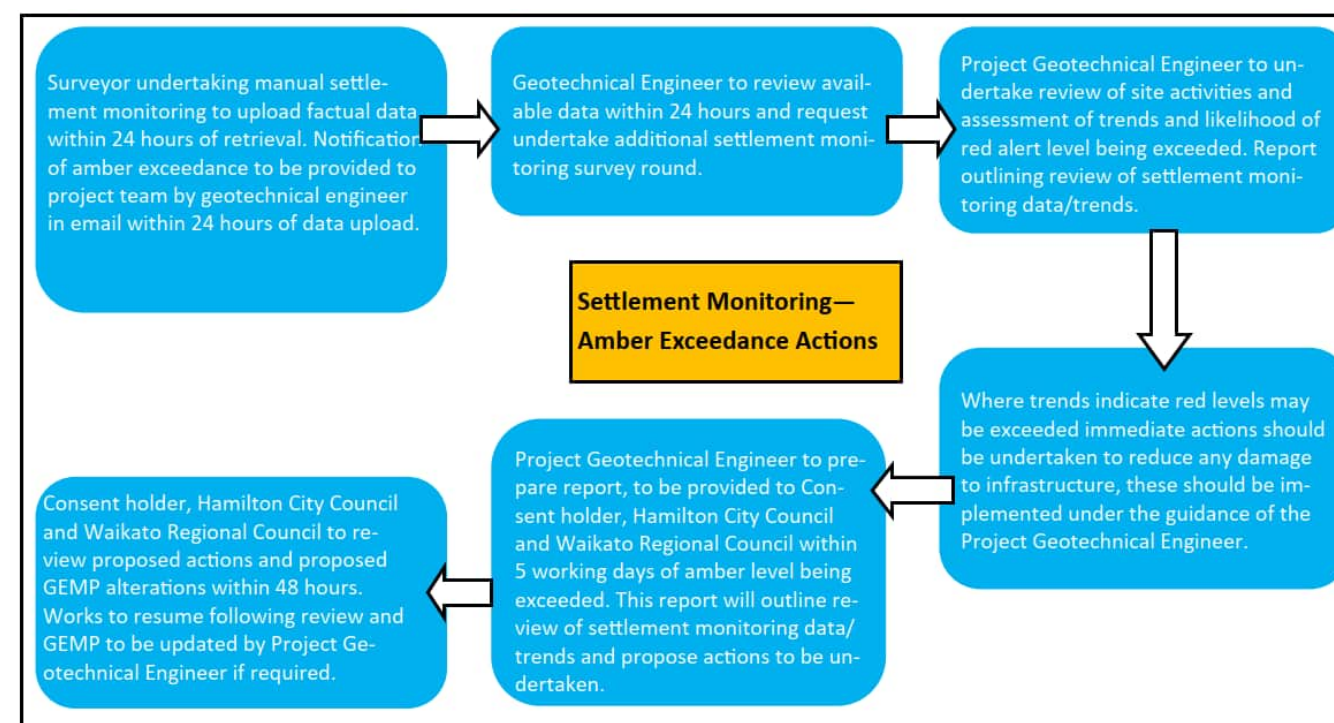
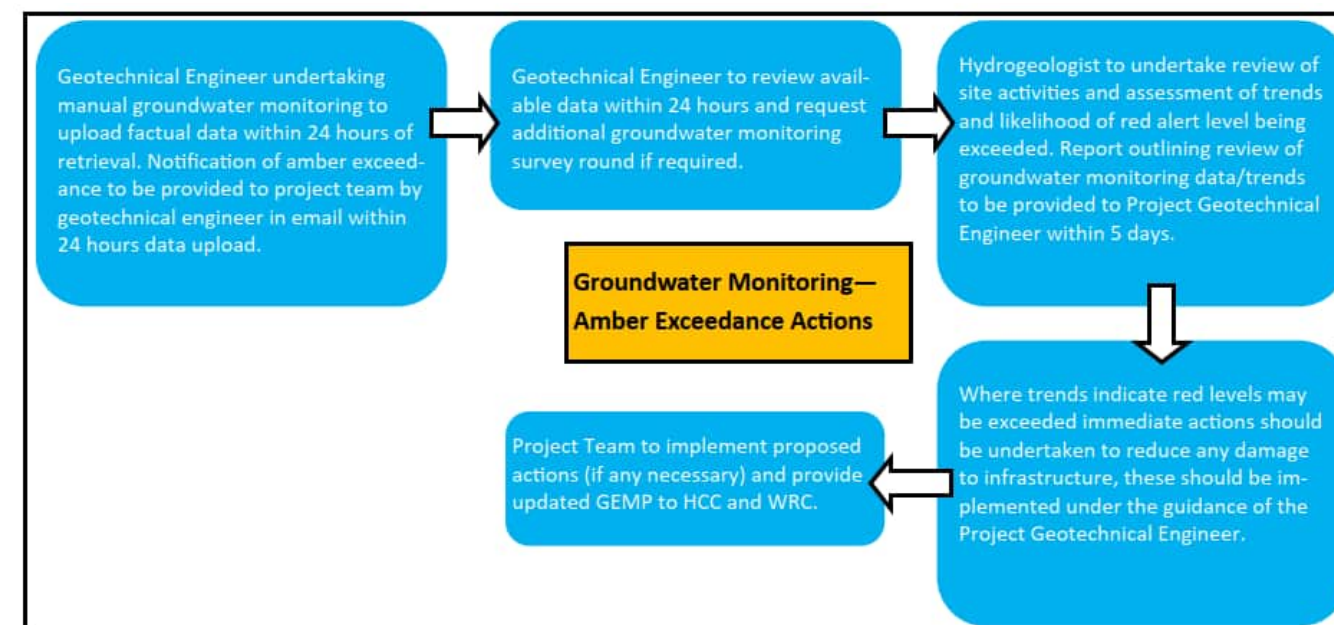
7.3 Contingency Measures

7.3.1 Response Procedure

Any trigger exceedances for Amber and Red Levels, with recommended actions, will be communicated immediately to the project team by either the contractor or the project geotechnical engineer.

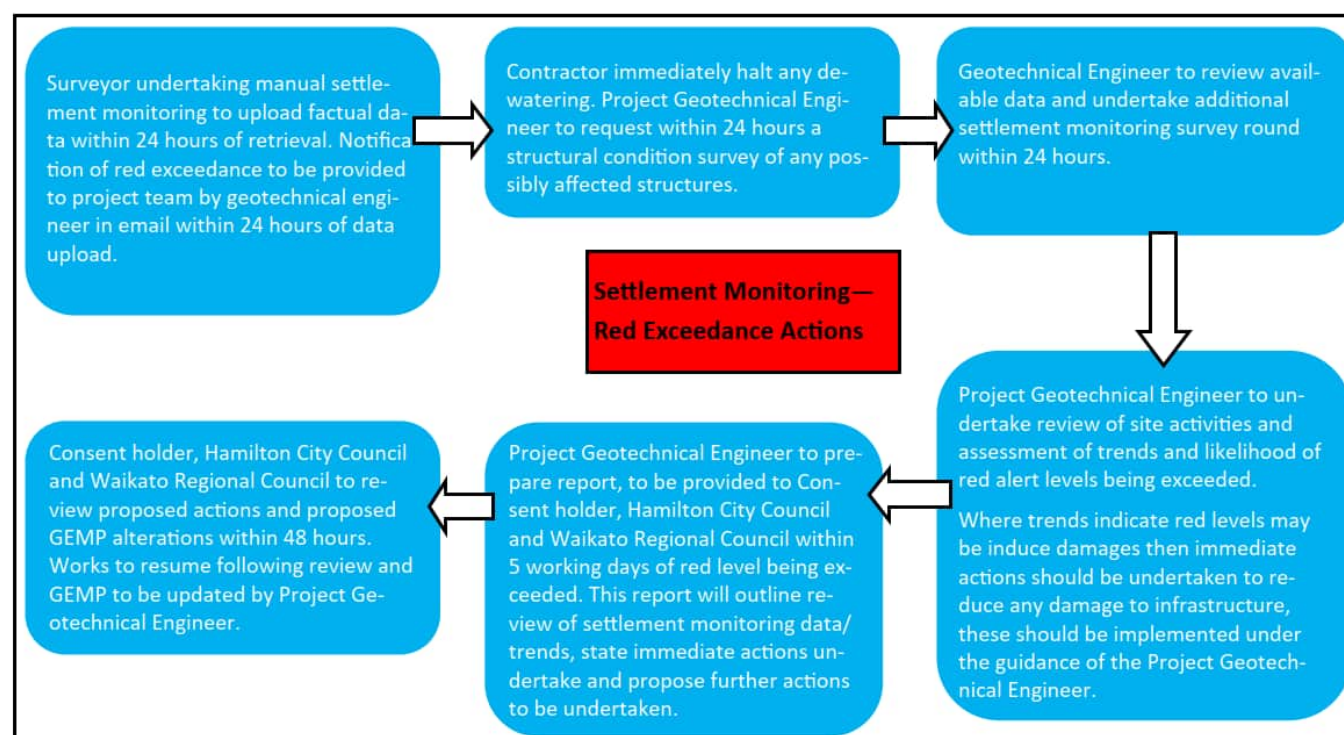
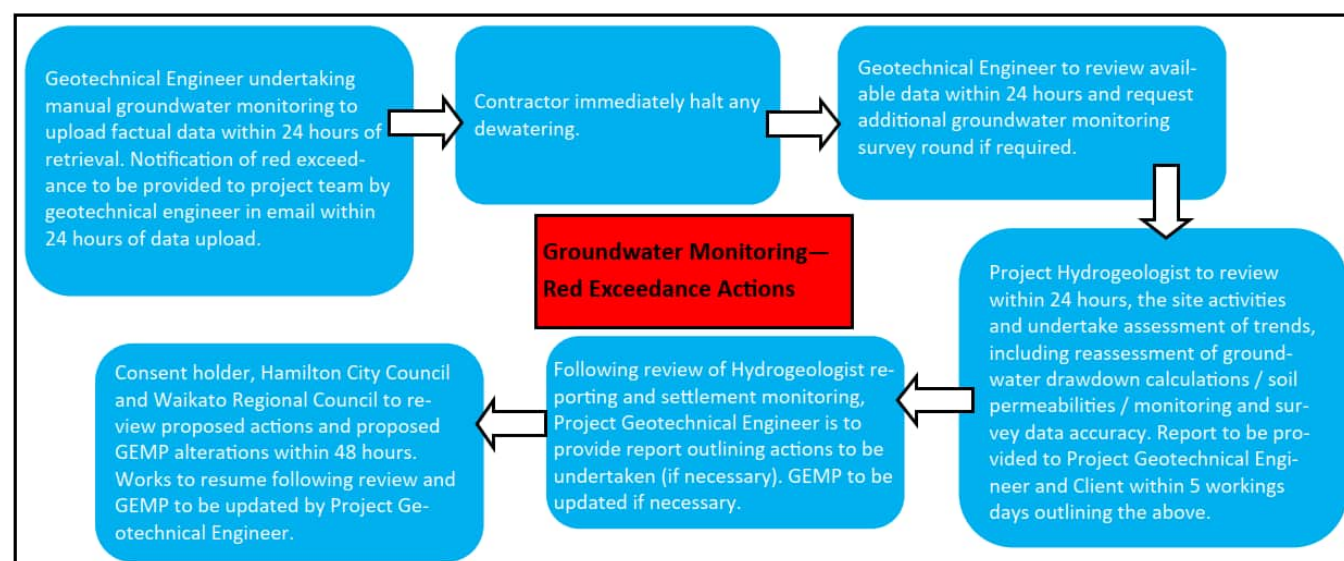
7.3.2 Amber Level Responses

Following exceedance of any Amber Level the actions to be undertaken in steps are outlined in the flowcharts below.



7.3.3 Red Level Responses

Following exceedance of any Red Level the actions to be undertaken in steps are outlined in the flowcharts below.



Red level example actions following review by Project Geotechnical Engineer may involve:

- Alert to contractors to cease or reduce dewatering and/or construction works;
- Further review of construction methodology including reducing areas of excavation / dewatering, potential for groundwater recharge options;
- Possible further geotechnical investigation to confirm ground conditions;
- Revise construction methodology based on appropriate review of data.

7.4 Mitigation Measures

Although not anticipated, if any damage to buildings, road or infrastructure is observed or reported we propose the following:

- A register of notifications/contacts and complaints to be maintained by Pragma (or delegated body) with details of all correspondence regarding issues raised;
- Notification of issues to stakeholders / asset owners as appropriate;
- Appropriate team member to liaise with asset owner, inspect asset and report on findings to Pragma;
- If any issues raised are found to be related to settlement induced damage, then remedial actions to be agreed, final decision to be made by Pragma, and implemented;
- Following construction of each basin, the results from groundwater and settlement monitoring will be reviewed, and the risk to 3rd party assets should be re-assessed.

8.0 ROLES AND RESPONSIBILITIES

A list of key stakeholders, roles and responsibilities in obtaining data, processing the data and alerting the design team and relevant stakeholder to exceedances and trends of concern, instructing and carrying out actions is provided in the below tables.

Table 8.1: Roles and Responsibilities

Stakeholder	Role	Personnel	Responsibility
Pragma Designer Homes	Client / developer	Jay Naidoo [Redacted]	Site ownership, approval for additional works if required.
CMW Geosciences	Geotechnical engineer	Mark McVinnie [Redacted]	Data review, alert/action notifications, proposed additional works as required
Wallbridge Gilbert Aztec (WGA)	Hydrogeologist	Catherine Howell [Redacted]	Data review, review of groundwater drawdown trends following alerts
TBD	Contractor in control of site	Contractor representative	Data review, alert/action notifications, daily pump records, daily rainfall records, proposed additional works as required
TBD	Site surveyor	Surveyor Representative	Settlement monitoring survey
Maven	Civil engineer	Min Shon [Redacted]	Earthworks and civil design inputs if any additional works are required
Hamilton City Council	Governing agency	Project Sponsor or delegate	Approving of monitoring plan, and any modifications if necessary
Waikato Regional Council	Governing agency	Fiona Forrest [Redacted] After Hours – 0800 800 401	Approving of monitoring plan, and any modifications if necessary

Table 8.2: Responsibilities

Stakeholder	Responsibility
Pragma Designer Homes	Site ownership and liaison with Council (HCC & WRC) approval for additional works if required. Instruction to contractor for additional works if required.
CMW Geosciences (CMW)	Data review of groundwater monitoring and settlement monitoring, alert / actions notifications to Pragma, proposed additional works if required following alert / action notifications, review and modifications to GEMP as required.
Wallbridge Gilbert Aztec (WGA)	Data review of groundwater monitoring, re-assessment of groundwater monitoring trends following alert / action notifications.
Contractor	Review of data (groundwater drawdown pumping), daily rainfall monitoring, undertake proposed additional works as required as instructed by Pragma.
Surveyor	Settlement monitoring survey, review of monitoring data, alert / action notifications to CMW and Pragma within 24 hours of taking reading. Set up of groundwater / settlement monitoring systems.
Maven	Earthworks and civil design inputs if any additional works are required.
Hamilton City Council (HCC)	Approval of management plans, approval of any updates to management plans following monitoring, and any modifications if necessary.
Waikato Regional Council (WRC)	Approval of management plans, approval of any updates to management plans following monitoring, and any modifications if necessary.

9.0 GEMP AND TARP REVIEW

Upon completion of detailed design, the GEMP should be revised to reflect the geotechnical effects and proposed construction methodology.

Following construction of each respective basin, this plan will be reviewed and updated prior to construction of the following basin and following analyses of data obtained during the completed phase of works. At that time, the Project Geotechnical Engineer must assess and report predicted groundwater drawdown, predicted ground settlements, and predicted differential settlement gradients. The review of the monitoring results and plan must outline whether the shift from construction monitoring to post construction monitoring frequencies for each piezometer and settlement marker is appropriate at that time.

If any key design elements change, then this plan will require review and updating to ensure it adequately manages the risk to the environment, existing buildings and existing infrastructure.

Following pre-construction monitoring and at least 20 working days prior to the commencement of any construction works in relation to the project site, this GEMP / TARP must be updated with baseline monitoring levels and provided to Waikato Regional Council.

10.0 FUTURE RESIDENTIAL DEVELOPMENT

We recognise that residential development may occur concurrently with, or prior to, the construction of the wetlands. It is important to note that these structures may be impacted by settlement caused by groundwater drawdown. Any future geotechnical assessments for any development within the drawdown effected area must consider cumulative settlements, both drawdown-induced and static settlements, to ensure compliance with NZS 3604 requirements for residential dwellings.

APPENDIX A

WGA Drawdown Calculations and
Contour Plans



Brymer Farms Limited

Brymer Development Groundwater Effects Substantive Report

TECHNICAL ASSESSMENT

WGA211193

WGA211193-RP-HG-0010_B

August 2026



Revision History

REV	DATE	ISSUE	ORIGINATOR	CHECKER	APPROVER
A	15/07/2026	DRAFT	TB/CMH/JFM	BAS	CMH
B	17/08/2026	DRAFT	TB/CMH/JFM	BAS	CMH

AUTHOR	QUALIFICATIONS	EXPERIENCE
Clare Houlbrooke	BSc Earth Sciences MSc (Hons, Tech) Earth Sciences	Hydrogeologist with over 25 years of experience. Clare focuses on sustainable management of groundwater resources and connected surface water systems. She gained broad experience in multiple hydrogeological disciplines during her nine year stint as a Groundwater Scientist in two Regional Councils before becoming a consultant in 2011.
Brett Sinclair	BSc Geology MSc (Hons) Geology Postgraduate Certificate in Hydrogeology and Engineering Geology of Tropical and Subtropical Regions	Brett is a Senior Principal Hydrogeologist with more than 30 years' experience in hydrogeology, geology, water management, water quality assessment and environmental effects mitigation.
Toby Beisly	BSc (Tech), Environmental Sciences and Geology MSc (Research), Environmental Sciences	Toby is a Graduate Hydrogeologist. Toby has been involved in a wide range of projects across the Waikato, ranging from hydrogeological drilling and data analysis, hydraulic testing and analytical modelling.
Catherine Howell	BSc (Hons) Geology with Physical Geography MSciTech (Credit) Groundwater Studies	Hydrogeologist with over 15 years of experience in hydrogeological drilling, conceptualisations and managing large scale groundwater projects in local government and consultancy.
James Manning	BSc Environmental Science and Geography MWaterRM (Research), Master of Water Resource Management	James is a hydrogeologist with over three years of experience. James has been involved in a wide range of projects around Australia and New Zealand ranging from stopbank seepage modelling to water bore drilling in remote communities.

Declaration

I am Catherine Howell, a Senior Hydrogeologist with WGA. I hold a BSc (Hons) in Geology with Physical Geography and a MSciTech. (Credit) in Groundwater Studies and have 20 years of professional experience in hydrogeology. My qualifications and relevant experience are set out in further detail in Appendix I to this report.

I confirm that I have read and understood the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023, and I agree to comply with it.

I acknowledge that, as an expert, I have an overriding duty to assist the decision maker impartially on matters within my area of expertise. In preparing this report, I have exercised my independent professional judgement, and the opinions I express are my own. I understand that my duty as an expert is not to advocate for the interests of the applicant or any other party.

I confirm that the matters addressed in this report are within my area of expertise, except where I expressly state that I am relying on information or opinions provided by another person. I have not omitted to consider any material facts known to me that might alter or detract from the opinions expressed in this report.

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1 INTRODUCTION

1.1 Background

Brymer Farms Limited (Brymer) is planning the Brymer Farms Housing Development (the Development) on 81 hectares (ha) between Brymer Road and Whatawhata Road on the western side of Hamilton. The Development comprises approximately 1,043 residential units, a mixed-use neighbourhood centre, open spaces and supporting infrastructure. A copy of the Brymer Masterplan (B&A 2026) is presented in Figure 1.

The Development has been designed as a connected and diverse residential community, with a north-south spine road, supporting local roads, cycle and pedestrian connections, and a range of housing typologies and densities. Key features include a 0.3 ha mixed-use neighbourhood centre, apartments, lifestyle blocks, open spaces, ecological restoration and wetland creation areas, stormwater and wastewater infrastructure. Proposed earthworks will involve substantial cut and fill across the site, including modification of low hills into terraces and filling of low-lying areas.

Brymer has previously contracted Wallbridge Gilbert Aztec, WGANZ Pty Ltd (WGA) to undertake a hydrogeological assessment of the site. The objective of this assessment was to assess the effects of operating two groundwater bores as a water supply to support the Development. This assessment has been completed and was documented in a technical report by WGA (WGA, 2025a). WGA has also undertaken a hydrological assessment that assessed the effects of abstracting water from the Waikato River to supply the Development (WGA, 2025b).

Brymer subsequently contracted WGA to undertake further hydrogeological assessments focusing on the potential groundwater effects associated with the proposed earthworks and construction and operation of stormwater and wastewater infrastructure at the Development. This report documents these assessments, including effects on existing wetlands, effects of wetland creation, effects on catchment water balance, and proposed monitoring and mitigation measures.

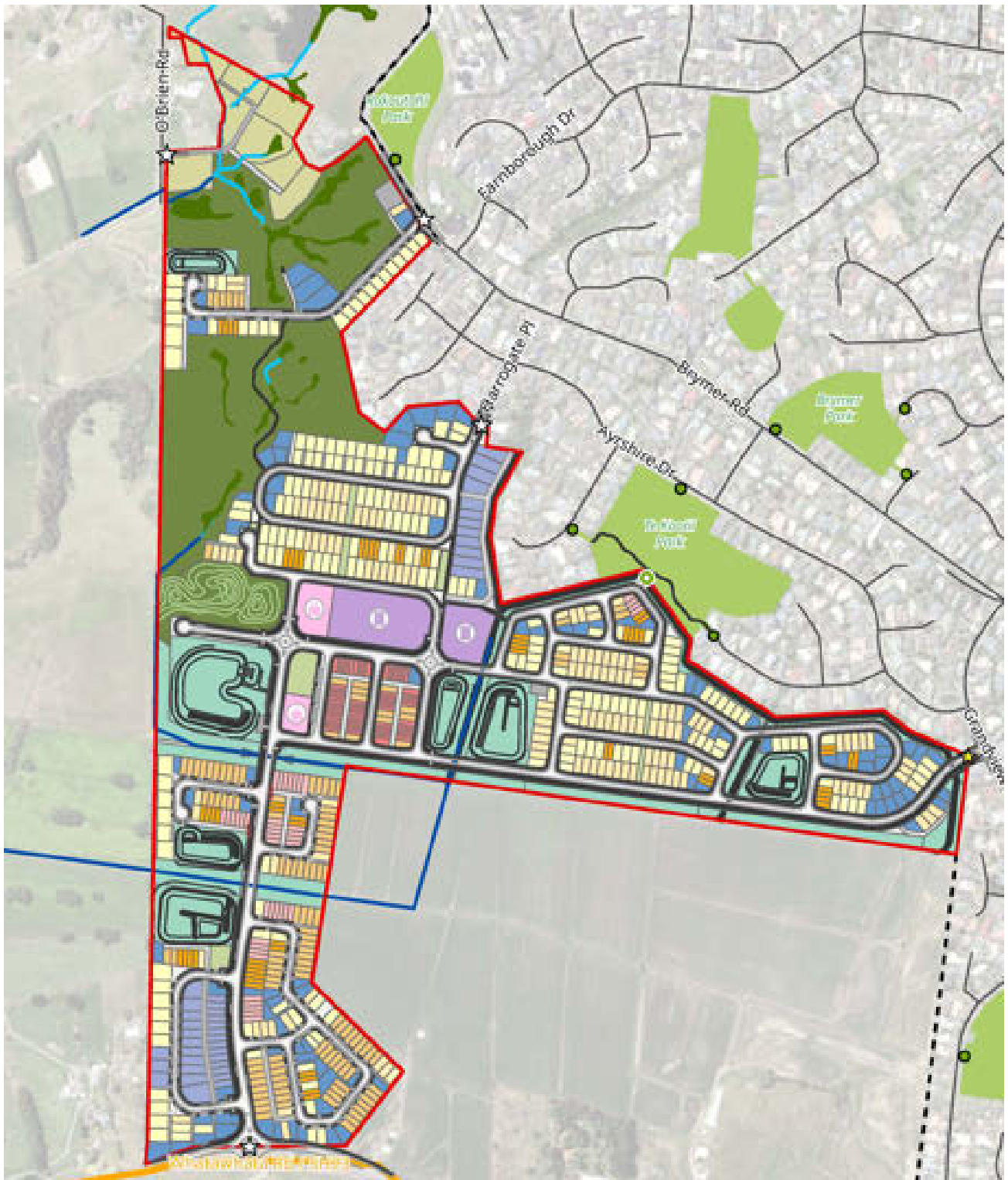


Figure 1: Brymer Masterplan

1.2 Project Description

The Brymer development is a comprehensively planned, multi-staged residential development providing for the urbanisation and subdivision of the project site. The Development is the subject of a Notice of Decision by the Minister, dated 4 September 2025, to refer the Development. It seeks the land use, environmental, subdivision and associated infrastructure consents required to enable the development to be delivered progressively and in a coordinated manner.

The Development will provide approximately 1,043 residential units, including approximately 248 apartment units, across a range of housing typologies and densities. Housing will comprise a mix of terraced, duplex and detached dwellings, conventional and compact residential lots, irregular lots, and eight larger rural-residential lots. This range of typologies is intended to provide housing choice while enabling the development pattern to respond appropriately to the physical characteristics, environmental features and constraints of the site.

The master plan also provides for two mixed-use commercial sites, identified as C1 and C2, which will form a neighbourhood scale commercial component within the development. C1 will provide approximately 910 m² of ground-floor commercial gross floor area (GFA), with 24 two bedroom apartments above. C2 will provide approximately 1,274 m² of ground-floor commercial GFA, with 16 two bedroom apartments above. Both sites will incorporate basement car parking, dedicated vehicle access, servicing areas and landscaping. Collectively, C1 and C2 will provide approximately 2,184 m² of commercial GFA and 40 apartments, supporting the day-to-day needs of residents and contributing to a mixed-use neighbourhood environment.

The development will be supported by the necessary transport and three-waters infrastructure. Water supply and wastewater servicing will connect to the IAWAI reticulated networks, with internal reticulation and associated infrastructure established progressively as development is staged. This may include pump stations, storage, reservoirs and mains, where required. Stormwater will be managed through an integrated stormwater management system, with discharge ultimately occurring to the receiving environment within the Waikato District. The stormwater system will incorporate appropriate treatment, attenuation and conveyance measures and will integrate, where appropriate, with proposed wetlands, watercourses, stormwater reserves and other water-sensitive design features throughout the development.

Implementation of the Development will require staged development related earthworks to establish suitable building platforms, a well-connected road network, infrastructure corridors, reserves and other components of the master plan. These works will include site formation, cut and fill, retaining, erosion and sediment control, and other enabling works required to facilitate the staged subdivision and development of the site. The proposal will also require the undergrounding of existing power lines within the Applicant's site.

A significant component of the Development is the provision and enhancement of open space and ecological values. The Development will provide an integrated network of public and recreational open spaces, pedestrian connections, wetlands, watercourses, stormwater reserves, landscaped areas and retained vegetation. Environmental and ecological mitigation and offsetting will also be provided where required to address effects arising from the development and to support the protection, restoration and enhancement of ecological values across the site and wider receiving environment. Where appropriate, these measures will be integrated with the Development's open-space and stormwater networks.

The overall open-space and movement network will connect with the surrounding urban environment and existing reserves, including Rakautahi Park, Brymer Glen Reserve, Brymer Park and Te Kootii Park. These connections will provide links between residential neighbourhoods, commercial and community areas, recreational spaces and the wider transport network.

Overall, Brymer is a large scale, comprehensively planned urban development that will enable approximately 1,043 residential units, including approximately 248 apartments, together with approximately 2,184 m² of commercial GFA. The Development encompasses the subdivision and development of the land and the associated development related earthworks, transport and access infrastructure, water supply and wastewater connections to the IAWAI reticulated networks, stormwater management and discharge, ecological mitigation and offsetting, landscaping, open space, recreation, and other supporting infrastructure necessary to establish the new community.

The Development will be implemented through a multi-staged consenting and development framework, enabling subdivision, land use and infrastructure works to proceed progressively while ensuring that each stage is appropriately serviced and integrated with the wider development and surrounding environment.

The Development will be subject to a comprehensive suite of proposed conditions of consent, including a design guide, developed with input from the Applicant's relevant technical and environmental specialists. These conditions will provide the framework for managing the construction, staging, servicing and operation of the Development, including earthworks, transport, three-waters infrastructure, stormwater discharges, ecological effects and offsetting, landscaping and open space, and other potential environmental effects associated with the Development.

Collectively, the master plan, supporting technical assessments and proposed conditions of consent provide an integrated framework for the staged delivery and management of Brymer, including measures to avoid, remedy or mitigate adverse environmental effects and, where appropriate, provide environmental offsets.

1.3 Site Description

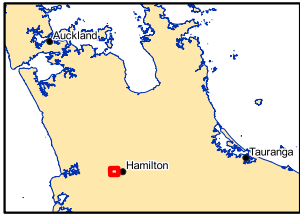
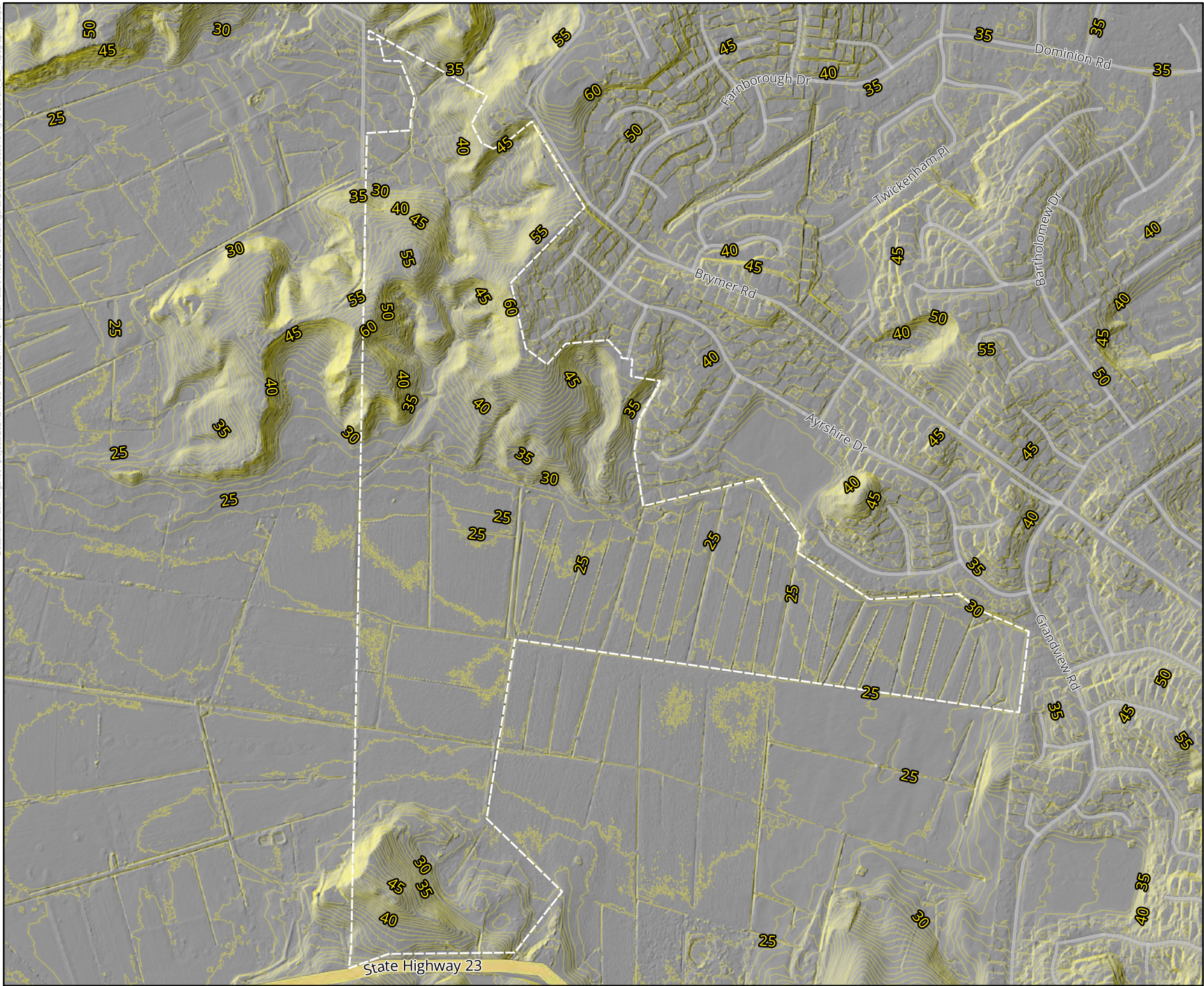
The site landform can be broadly divided into four geomorphic zones. The southern portion, immediately north of Whatawhata Road, comprises an isolated raised knoll forming part of the rolling hill terrain typical of the Hamilton Basin (Figure 2). Ground levels rise from approximately 34 m RL near road level to about 50 m RL, with gentle to moderately steep slopes.

The central part of the site is generally flat and low-lying, at an elevation of approximately 25 m RL. This area is crossed by a network of farm drains running north-south and east-west, with culverts and farm bridge crossings providing access across the drained lowland areas.

The northern portion of the site comprises incised gullies and rolling hill topography, with elevations ranging from approximately 32 m RL in low-lying areas to about 56 m RL on higher ground. Slopes are generally moderate to moderately steep.

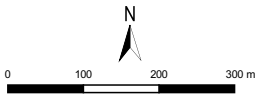
A further low-lying, relatively level area is present at the northern tip of the site, bounded by rolling hill terrain to the north, east and south.

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LEGEND

- Site Boundary
- 1 m Contours



Scale 1:10 000 @A4

Coordinate System: NZGD 2000 New Zealand Transverse Mercator

WGA

Figure 2
Brymer Farms Limited
Current Site Topography

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1.4 Proposed Activities

1.4.1 Introduction

The Development includes the following components that may influence the shallow groundwater system:

- Compaction of soft soils and peat on site due to the placement of engineered fill
- The construction and on-going effects of stormwater management infrastructure
- The construction of wastewater pump stations and pipeline infrastructure
- General earthworks in the vicinity of existing wetlands
- Creation of natural wetland for offsetting purposes

This report has not covered potential effects that may arise from the planned installation of water supply pipelines.

1.4.2 Soil Compaction

Soil compaction has the potential to alter shallow groundwater conditions by reducing soil porosity and hydraulic conductivity. This may reduce rainfall infiltration and distributed groundwater recharge through compacted areas, while also limiting lateral groundwater movement through shallow peat, silt and fill materials. Depending on the location and extent of compaction, these changes may result in localised changes to shallow groundwater levels or pressures.

1.4.3 Stormwater Management and Wastewater Infrastructure

Seven wetlands are proposed to be constructed to manage stormwater in the Development. Additionally, site-wide wastewater pipeline infrastructure needs to be installed to support the Development.

The proposed activity has two main groundwater-related components that have the potential to influence catchment water balances:

1. **Short-term temporary dewatering during construction earthworks**, for proposed stormwater wetlands and wastewater infrastructure (site-wide pipeline and four wastewater pumping stations). Dewatering is anticipated to be localised and temporary, with groundwater managed and discharged in accordance with the site erosion and sediment control framework and any relevant consent requirements.
2. **Long-term groundwater interception and diversion to the proposed stormwater wetlands and existing wetlands**, which will act as persistent hydraulic features within the developed catchment.

1.4.4 Earthworks Around Existing Groundwater Fed Wetlands

Earthworks and the creation of impervious surfaces have the potential to change the amount and timing of groundwater recharge to existing groundwater-fed wetlands. Development may reduce the proportion of rainfall that infiltrates to groundwater, which could reduce shallow groundwater inflows that help sustain wetland baseflows. These effects are expected to vary between wetland catchments depending on the extent of earthworks, the proportion of impervious surface, and whether stormwater is retained or redirected within the local catchment.

1.4.5 Creation of Natural Wetland

The creation of natural wetlands will involve shallow basin excavations that may extend below the groundwater table. The construction process therefore has similar potential effects to other excavations below the groundwater table, including temporary groundwater inflows, localised drawdown and the need for construction water management.

2 EXISTING ENVIRONMENT

2.1 Climate

2.1.1 Rainfall

Rainfall rates are recorded on a daily basis at the Ruakura weather station, which is located approximately 8 km east of the Development. The available record spans from November 2005 to the present (Figure 3).

Analysis of the Ruakura rainfall record indicates that during this period:

- The long-term mean annual rainfall was approximately 1,018 mm.
- The peak daily rainfall recorded was 87.8 mm.

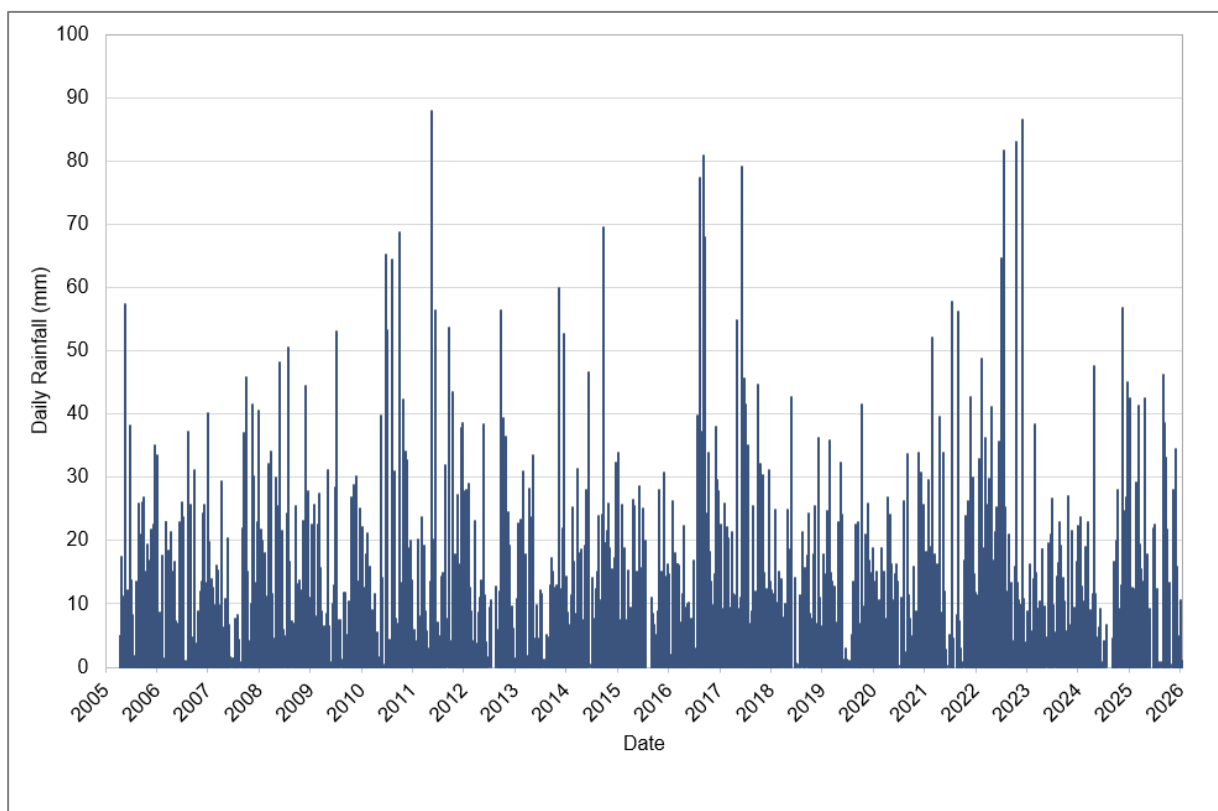


Figure 3: Rainfall Record at Ruakura

2.1.2 Evapotranspiration

Potential evapotranspiration (PET) for the Hamilton Basin has been assessed using the NIWA Ruakura climate station record, located approximately 8 km east of the Development. The available Ruakura dataset includes daily Penman PET from November 2005 to March 2026 and is considered representative of local Hamilton Basin climatic conditions for the purposes of this assessment.

Evapotranspiration demand is strongly seasonal, with higher PET during the warmer summer months when solar radiation and temperatures are greatest, and lower PET during winter. This seasonal pattern is important for the site water balance because summer evapotranspiration reduces the proportion of rainfall available for soil drainage and groundwater recharge, whereas winter rainfall is more likely to contribute to recharge once near-surface soil moisture deficits have been satisfied.

2.2 Hydrological Setting

2.2.1 Catchment

The site is located within the Ohote sub-catchment, which flows into the Waipa River approximately 5 km to the west of the site (Figure 4). The catchment is part of the Waikato Central Drainage Scheme: Ohote Basin. The purpose of this drainage scheme is to:

- Control groundwater levels
- Remove surface ponding from low-lying land
- Convey runoff to receiving river systems

The drainage scheme is designed with an objective of clearing ponded water from rainfall events up to the 10-year AEP event within approximately three days, where downstream water levels permit gravity drainage.

The central section of the site is low-lying, with a shallow surface gradient falling from 31 m RL in the east to 23 m RL in the west. A hill rising to 50 m RL extends into the southern portion of the site. Moderately steep rolling hill terrain rising up to around 60 m RL underlies the northern part of the site. A series of gullies occupied by wetlands bisect this terrain, draining towards the south and west to eventually join the main Ohote Channel.

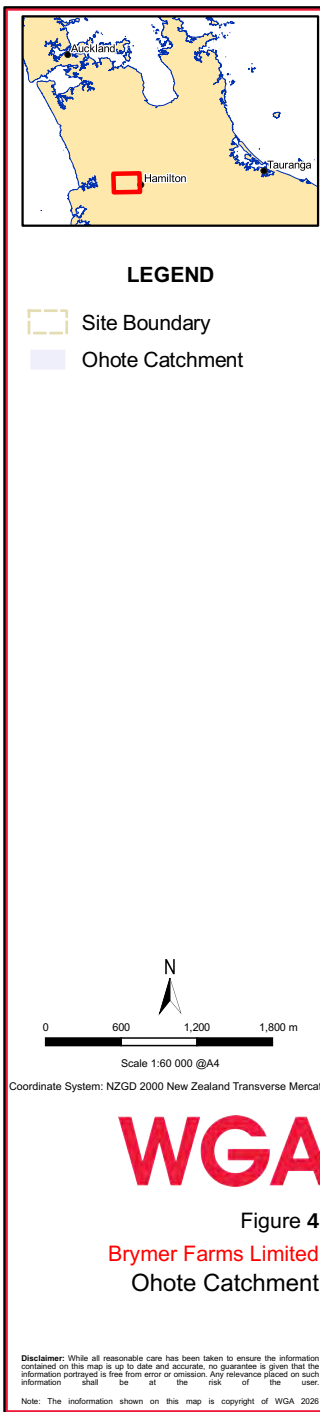
Flood modelling indicates that runoff from upstream residential and rural catchments passes through the Brymer site and accumulates in the low-lying floodplain immediately upstream of Laxon Road. The dominant control on current catchment behaviour is the Laxon Road floodgate system, which, together with Waipā River backwater effects, causes temporary storage and flooding within the Ohote Basin upstream of Laxon Road during large storm events (Maven 2026).

2.2.2 Streams and Drains

The low-lying area of the site has been intensively drained to support pasture development. This low-lying area extends past the Development boundary downstream toward the west (Ohote catchment). The neighbouring property to the southeast also contains a significant low-lying area.

The central drain, which forms part of the site southern boundary, is named the Ohote Channel 01. A second major drain, the Yates Drain, flows into the Ohote Channel 01 from the south, with the confluence located at the southern boundary of the site. The Yates Drain appears to have a larger contributing catchment upstream from the confluence than the Ohote Channel 01. Drains extend southward from the northern boundary of the low-lying areas of the site to drain into Ohote Channel 01.

Peak pre-development flows through the Brymer Ridge portion of the catchment are approximately 24.7 m³/s for the 10-year ARI event and 49.1 m³/s for the 100-year ARI event, based on modelling by Maven (2026).



2.2.3 Wetlands

The proposed Development area was once dominated by wetlands of two different categories (Figure 5; MFE 2015):

1. Ombrotrophic bog; and
2. A fen system consisting of a mosaic of swamp and bog.

The area once dominated by these wetlands is now maintained by drainage for grazing, with peat deposits remaining under the topsoil.

Ombrotrophic bogs are systems that accumulate thick peat layers. They are hydrologically recharged by rainfall only and as a result have low nutrient levels. The groundwater table is at or just below the surface and remains relatively constant.

Fens have a predominantly peat substrate, and the peat is shallower and more decomposed than bog systems. Fens are recharged by both rainfall and groundwater, resulting in low to moderate acidity and nutrient conditions. The water table is just below the peat surface with noticeable fluctuations.

Swamps typically comprise a mixture of mineral soils and well-decomposed peat. Similar to fens, they may be sustained by groundwater and rainfall, with additional inputs from surface water during periods of runoff or inundation. Swamps generally have higher nutrient availability than bogs or fens, often reflecting the accumulation of sediment and nutrients delivered by surface runoff. The water table is commonly at or above the ground surface, although seasonal fluctuations can occur.

2.2.3.1 Existing Wetlands

EcoLogical Solutions has undertaken an assessment of the current wetlands on site and identified 14 natural wetlands within the site, collectively covering approximately 2.3 ha with an average size of 1,189 m² (Figure 6). The wetlands were delineated in accordance with the NPS-FM (2020) and MfE Wetland Delineation Protocols (EcoLogical Solutions 2026).

The wetlands occur within shallow gully systems eroded into low-permeability Walton Subgroup sediments, with Hamilton Ash forming the surrounding hillslopes. The wetlands are interpreted by EcoLogical Solutions to be sustained by a combination of:

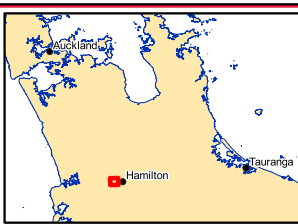
- Groundwater discharging from Walton Subgroup sediments (spring and seepage inputs)
- Rainfall and surface runoff

The EcoLogical Solutions report notes that aerial photography dating back to 1943 indicates persistent wet conditions where wetlands have been identified, suggesting enduring hydrology. Groundwater discharge is considered particularly important during dry summer periods, when runoff inputs to the wetlands decline.

The existing wetlands are described as riverine marsh systems that have been substantially modified by historic and ongoing farming activities. Wetland vegetation is predominantly exotic. As a result, the wetlands are considered to be in poor ecological condition, although they retain wetland hydrology and ecological restoration potential.

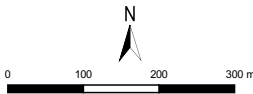
Despite their degraded state, the wetlands are assessed as having moderate ecological value, largely because wetlands are rare within the Hamilton Ecological District. EcoLogical Solutions has assessed the wetlands as significant under the Waikato Regional Policy Statement (WRPS) because they represent an under-represented indigenous habitat type. Although dominated by exotic vegetation, they retain enduring hydrology and have good restoration potential.

It is understood Wetlands K, M and N (Figure 6) will be impacted by the development and will require offsetting. The other identified wetlands are to be retained and restored as part of the development.



LEGEND

-  Site Boundary
-  Ombrotrophic Bog
-  Fen



Scale 1:10 000 @A4

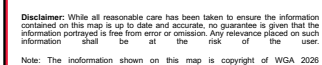
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WGA

Figure 5
Brymer Farms Limited
Pre-Human Wetland Extent
and Type

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2.3 Geology

2.3.1 Regional Geology

The Hamilton Basin, in which the Development is located, is a large tectonic basin centred on Hamilton City with an area of approximately 2,000 km² and traversed by the Waikato River. The basin is surrounded by ranges of Mesozoic (Manaia Hill Group) and Tertiary age (Te Kuiti and Waitemata Groups) rocks. At depth, basement greywacke underlies the sedimentary deposits that infill the basin (GNS, 2005).

The basin is infilled with Tauranga Group alluvial sediments, dating from the Pliocene to the middle Holocene. The Tauranga Group sediments are up to 300 m thick and include gravels, sands, silt, muds and peats of fluvial, lacustrine and distal ignimbritic origin. Underlying the low hills within the basin are older ignimbrites, tephra air-fall deposits and alluvium of the Walton Subgroup (Lowe 2021; Figure 7). The younger Hinuera Formation of the Tauranga Group underlies much of the Hamilton basin. This formation was deposited by braided river systems of the Waikato River, initiated by the supply of large volumes of sediment from volcanism in the Taupo Volcanic Zone (Petch, 1987).

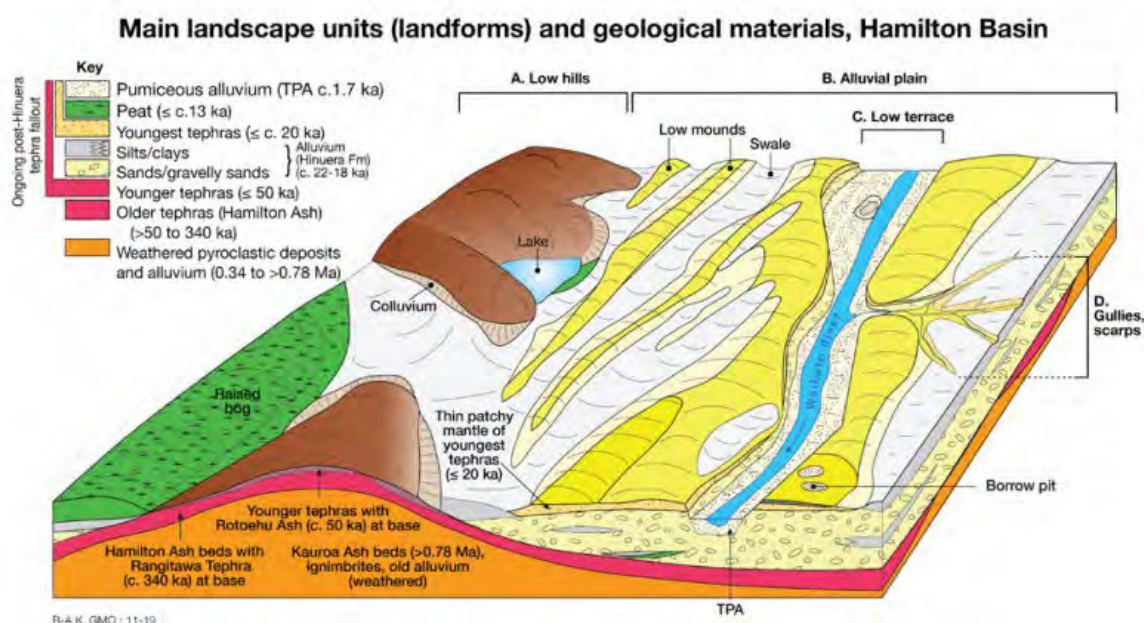
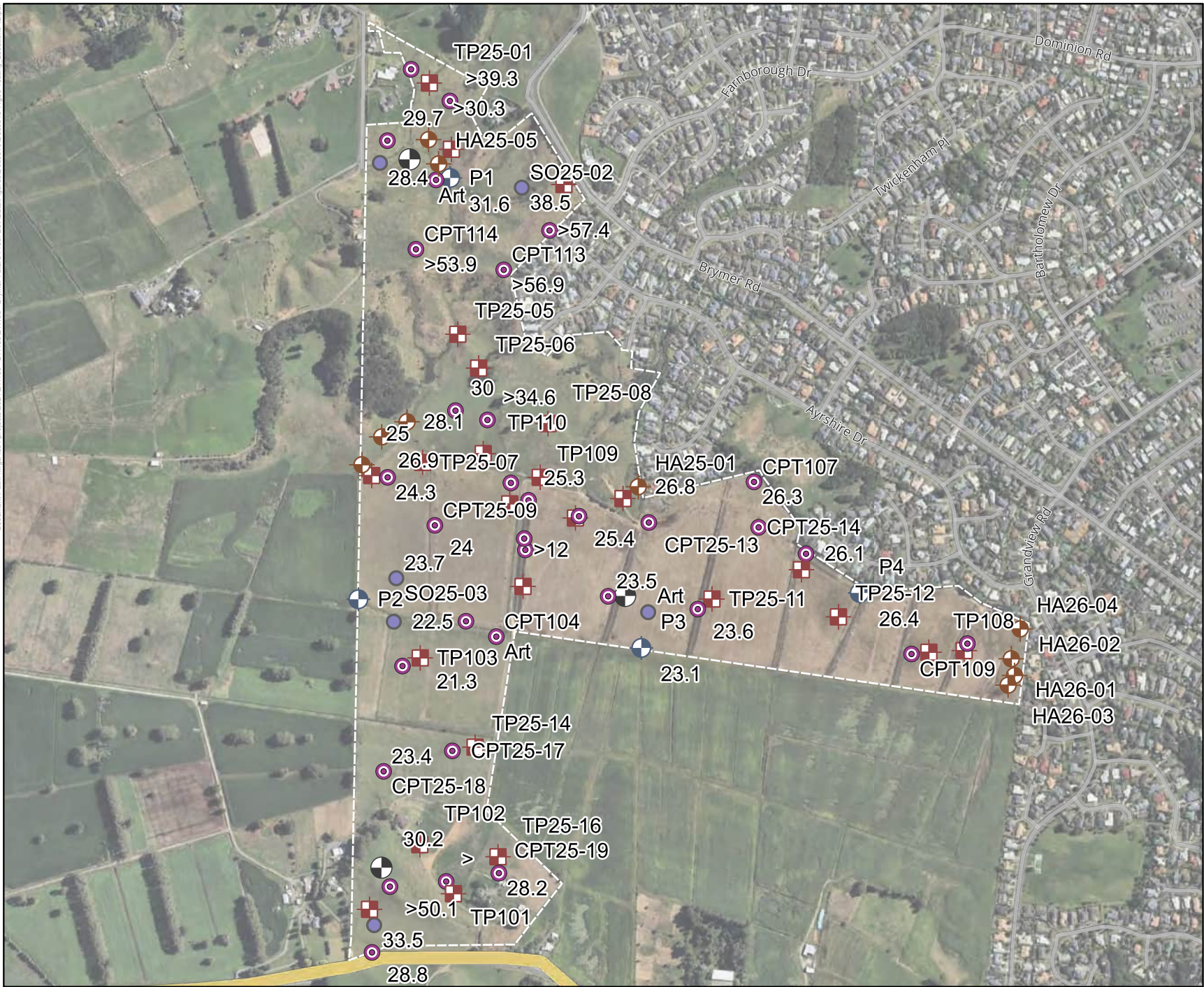


Figure 7: Geological Setting of the Hamilton Basin (Lowe, 2021)

2.3.2 Site Geological Investigations

Three investigations programs have been undertaken to assess the geotechnical behaviour of the soils and the groundwater system underlying the site. These programs are summarised below and the locations of the investigation points are presented in Figure 8.



LEGEND

Site Boundary

Test Type

- Borehole
- Piezometer
- Soakage Test
- Hand Auger
- Test Pit
- CPT

0 100 200 300 m

Scale 1:10 000 @A4

Coordinate System: NZGD 2000 New Zealand Transverse Mercator

WGA

Figure 8

Brymer Farms Limited

Geotechnical and Groundwater Monitoring Locations

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Tonkin and Taylor Investigations 2021

Geotechnical investigations on site carried out by Tonkin and Taylor in 2021 (T&T, 2021) comprised 10 test pits to a maximum depth of 4.4 m below ground level (bgl), 14 Cone Penetration Tests (CPTs) to a maximum depth of 29 m bgl, and three machine boreholes to a maximum depth of 27.45 m bgl.

The results of these investigations indicate the shallow lithology of the site typically consists of recent alluvial and swamp deposits within the lower lying areas. Older ash and fluvial re-worked deposits of the Walton Subgroup underlie the elevated regions of the site. There is a colluvial transition zone between these two zones along the toe of hillslopes.

CMW Investigations 2025

A geotechnical assessment at the site was carried out by CMW in 2025 to inform the Fast Track Application (CMW, 2025). The site investigations were designed to fill gaps in the existing data. The investigations comprised 15 test pits to a maximum depth of 6 m bgl, 20 CPT's to a maximum depth of 20 m bgl, and six soakage tests at between 0.3 m and 1.6 m bgl. The ground conditions encountered were generally consistent with those described by T&T (2021).

WGA Investigations 2025

In 2025, WGA carried out additional drilling using a geoprobe drill rig to enable field testing of the hydraulic parameters of the lithologies intersected. Copies of the drillhole logs are provided in Appendix A. WGA also carried out hand augering to assess potential areas for the creation of wetlands for offsetting.

Materials encountered during drilling comprised peat, clay and silt with some fine sand to approximately 4.7 m to the base of the holes at 6 m. One deeper hole, drilled to 9 m encountered fine sand, silt, pumice gravels and medium sand from 2.2 m. Monitoring wells were installed at each drillhole location (Appendix A). The piezometer well details are provided in Section 2.4.7. The hydraulic tests performed in these are documented in Section 2.4.7.

2.3.3 Inferred Lithological Profiles

Expected ground conditions on site have been summarised based on the information from all available investigation data. The anticipated soil profile below the low-lying areas of the site is summarised in Table 1. The anticipated soil profile below the hilly terrain is summarised in Table 2.

Table 1: Typical Lithological Profile for Low-Lying Flats

UNIT	INFERRED SOIL DESCRIPTION	DEPTH TO TOP LAYER (m bgl)	LAYER THICKNESS (m)
Topsoil	Firm SILT with varying subordinates of clay and sand	0.0	0.1 to 0.4
Colluvium	Firm to very stiff Silty CLAY/Clayey SILT. (Only present in boundary areas between recent and reworked deposits)	0.1 to 0.4	0.8 to 5
Piako Subgroup	Soft to very stiff PEAT (Fibrous and Amorphous)	0.1 to 0.4	0.3 to 2.7
Piako Subgroup	Very soft to stiff clayey SILT interbedded with medium dense SAND, peat and gravels	0.8 to 2.5	0.2 to 12
Hinuera Formation	Loose to dense SAND, interbedded with stiff to very stiff SILT, and lenses of organic silt and gravels	12.3 to 14.5	5+

Note: Sourced from T&T (2021), CMW (2025) and WGA (2025).

Table 2: Typical Lithological Profile for Hilly Terrain

UNIT	INFERRED SOIL DESCRIPTION	DEPTH TO TOP LAYER (m bgl)	LAYER THICKNESS (m)
Topsoil	Firm SILT with varying subordinates of clay and sand	0.0	0.3
Hamilton Ash	Firm to hard Silty CLAY/Clayey SILT	0.3	0.5 to 5
Walton Subgroup	Firm to hard Silty CLAY/Clayey SILT with lenses of sand, silt and peat	0.5 to 4.5	7 to 12
Walton Subgroup	Medium dense to dense SAND	10 to 12	3+

Note: Sourced from T&T (2021), CMW (2025) and WGA (2025).

2.4 Hydrogeology

2.4.1 Regional Hydrogeology

The Hinuera Formation contains the aquifers used most extensively across the Hamilton Basin for water supplies. Within this formation, the most productive aquifers consist of well sorted coarse sands and gravels. Discontinuous sequences of rhyolitic and pumiceous gravelly sands and gravels are interspersed with pumiceous silt, clay and peat. Lithological variability generally results in a number of zones of higher permeability within each of the formations rather than a single, continuous aquifer (Schofield, 1972). The upper layers contain perched aquifers, which can dry out over summer periods and generally drain to the closest gully system.

Literature values for the hydraulic conductivity of sediments in the Hamilton Basin range from 0.5 m/day in the silts and peat layers to 13.5 m/day in the coarse gravelly sands. Aquifer transmissivity values derived from pumping tests range from 10 m²/day to 1,000 m²/day but are usually less than 100 m²/day. The deeper aquifers have variable aquifer properties and local pumping tests have resulted in transmissivities calculated at between 20 m²/day and 300 m²/day. Storativity values vary from 0.001 for deep, confined or semi-confined aquifers to 0.1 for shallow, unconfined aquifers in the Hamilton Basin (Petch and Marshall, 1988). In some areas these discontinuous aquifers may provide bore yields of up to 30 L/s (Petch, 1987).

2.4.2 Local Hydrogeology

Groundwater in the low-lying area of the site has generally been encountered within 1 m bgl during site investigations. This shallow unconfined groundwater is considered to be directly recharged from incipient rainfall. A significant drainage network is present across the low-lying area of the site and extending into neighbouring properties. This drainage system keeps the groundwater table from being at surface across the low-lying areas of the site. Given the shallow groundwater levels in the low-lying areas and the low permeability of underlying shallow sediments, downward soakage is likely to be small.

Groundwater in the hilly areas has been encountered at depths varying from 3.6 m bgl on the flanks of the hills (CPT25-07, CPT25-20), to 15 m bgl on the southern hill crest (BH101). These depths are equivalent to between 29 m RL and 30.5 m RL (T&T 2021, CMW 2025). Several hand augers and test pits undertaken on the hill areas did not encounter groundwater. Seepage discharging to the gully inverts and the presence of an artificial farm pond indicate areas where the groundwater table intersects the surface.

Artesian groundwater pressures, where the measured pressure is above the ground surface, were observed in some of the exploration holes drilled to a depth of 15 m to 18 m bgl. These pressures are considered to arise from the sand aquifer belonging to the Walton Group (Table 2) underlying the surrounding hills being confined by clay-rich layers which restrict the release of groundwater from the aquifer. The hilly area within the site is moderately steep with most rainfall reporting as run-off to local streams and drains.

2.4.3 Groundwater Levels

Groundwater levels have been monitored at the site in four piezometers installed in October 2025 (Figure 8). The monitoring points are located on the hilly area toward the northern end of the site (P1) and on the flats through the middle of the site (P2 to P4). Piezometers P1 to P3 were installed to a shallower depth than P4 (Table 3). Groundwater levels have been monitored in these piezometers using pressure transducers, supported by periodic manual dipping measurements (Appendix B).

Table 3: Piezometer Construction Details

PIEZOMETER (¹)	SCREEN DEPTH (m bgl)	SCREEN LENGTH (m)	EASTING (NZTM)	NORTHING (NZTM)	GROUND ELEVATION (m RL)
P1	4.5 to 6.0	1.5	1795126	5815602	32.36
P2	3.0 to 4.5	1.5	1795589	5815421	23.08
P3	3.1 to 4.6	1.5	1796009	5815506	23.47
P4	7.5 to 9.0	1.5	1795218	5816292	26.96

Note:

(¹) Each piezometer has an internal diameter of 40 mm.

Groundwater level records from the continuous monitoring systems installed on the flats at the site (P2 to P4) covering the period November 2025 to August 2026 (Figure 9) indicate:

- Groundwater levels ranged from approximately 0.05 m to 0.75 m bgl. The total ranges recorded in individual piezometers are approximately 0.35 m, although this differs a little from site to site.
- Groundwater levels responded to rainfall events. As the climate monitoring station providing the rainfall data is not at the site, some of the events recorded may not have generated corresponding rainfall in the site catchment. Therefore, the groundwater records do not show responses to all rainfall events corresponding to the magnitude of the event.
- Piezometers P2 and P4 show no significant change in groundwater levels recorded on 3 November 2025 and 15 June 2026. In contrast, the groundwater level at Piezometer P3 rose by approximately 0.2 m through that period.
- Piezometers P2 and P4 both show smoothed groundwater level responses to rainfall events. In contrast, the groundwater record from Piezometer P3 shows immediate and sharper reactions to rainfall events.
- Taking into account the small distances from each of these piezometers to the nearest drains, it is possible the recorded changes in groundwater levels are not occurring in direct response to rainfall recharge. Changes in water levels in the local drains may be significantly influencing the groundwater levels at these three piezometers.

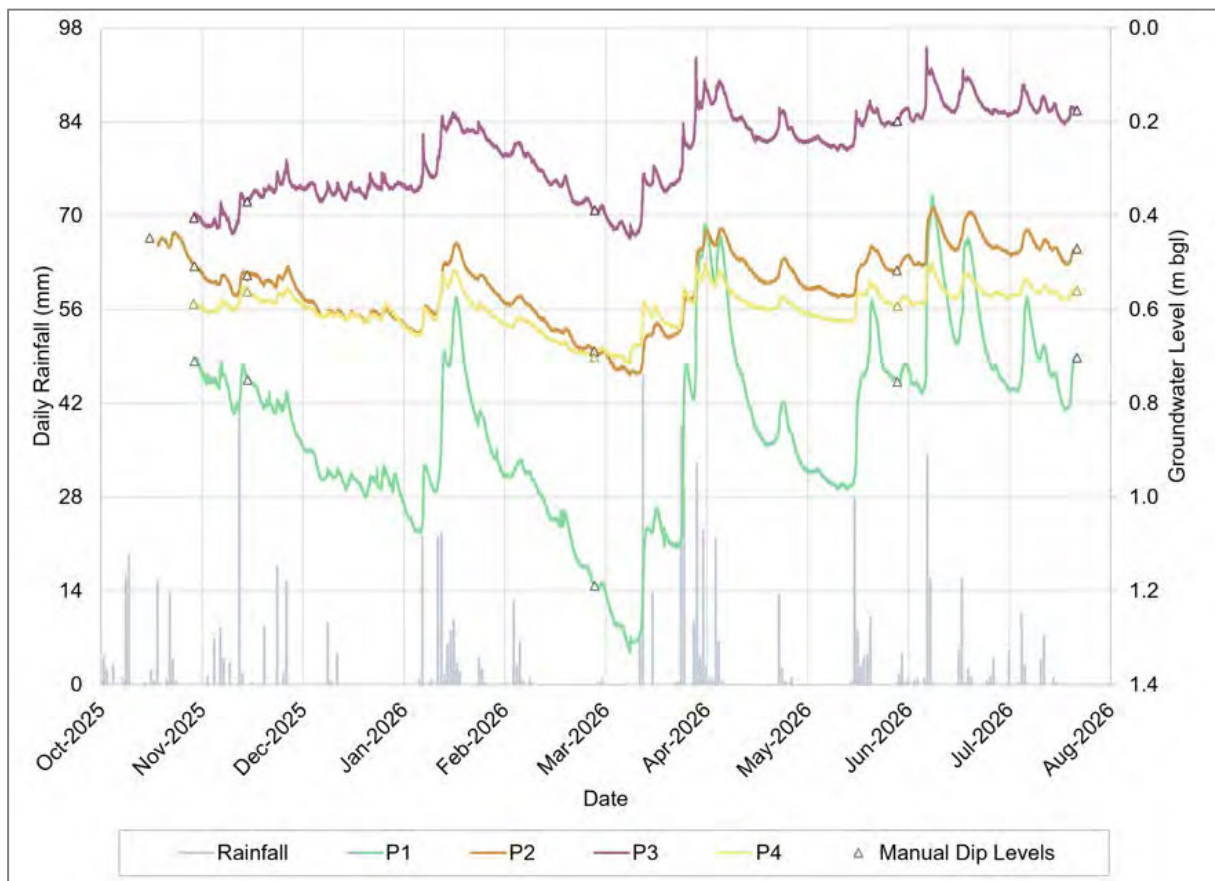


Figure 9: Continuous Groundwater Level Monitoring Records

The groundwater level record from the continuous monitoring system installed in Piezometer P1 (Figure 9) indicates:

- The groundwater level ranged from approximately 0.4 m to 1.3 m bgl, which is deeper than the groundwater levels under the flats. The total range recorded is approximately 0.9 m.
- Groundwater levels responded to rainfall events. The responses are substantially larger than the responses recorded from piezometers on the flats.
- The groundwater level responses to rainfall events at P1 are smoothed, compared to the groundwater level responses at P3.
- Bearing in mind the small size of the surface water catchment upstream from P1, it is unlikely that the recorded range in groundwater levels has occurred in response to changes in surface water levels in the local gully.

All of the groundwater level records (Figure 9) indicate short-term rises in response to rainfall followed by recession curves during intervening drier periods. This response is consistent with a shallow, low-permeability groundwater system in the low-lying areas of the site, where groundwater levels are influenced by direct rainfall recharge, shallow soil storage and drainage to the surrounding farm drain network. Water levels close to the drains are likely to be slightly lower than those in the centre of the fields which is evident by some wetter areas in between drains. As such the water level taken for the drawdown assessments has been considered to be at ground level which is considered conservative as any drawdown from a deeper starting level will be less.

2.4.4 Recharge

The hilly area within the Development is moderately steep with most rainfall expected to report as run-off to local streams and drains.

The shallow groundwater and surface waterbodies of the catchment are predominantly recharged directly by local rainfall and sheet flow runoff.

WRC estimates that annual rainfall recharge (soil drainage) is 22% to 40% of rainfall in the Waikato region¹. Based on an average annual rainfall for Waikato of 1,072 mm, this results in a recharge rate in the range of 235 mm to 428 mm. A recharge value of 400 mm has been used for the drawdown assessments for temporary dewatering during construction of infrastructure as this is conservative for inflow rates and represents existing land use. However, the lower recharge rate of 250 mm was adopted for groundwater effects assessment of the long term drawdown assessments as the proposed Development is expected to reduce the direct recharge to the site.

2.4.5 Piezometric Surface

The piezometric surface represents the interpreted elevation of the free unconfined groundwater table across the site, based on:

- Measured groundwater levels in piezometers and investigation holes
- Surface water levels in streams, drains and ponds
- Elevations of observed springs and seeps

The piezometric surface provides an indication of shallow groundwater conditions and the likely direction of groundwater movement, with groundwater generally flowing from areas of higher hydraulic head toward areas with lower hydraulic head. By extension, the local lowest hydraulic heads are represented by water levels in drains, wetlands and other surface water features. At the Development, the interpreted piezometric surface (Figure 10) reflects both shallow groundwater conditions in the low-lying areas and the inferred groundwater head in the northern hill area.

The piezometric surface represented in Figure 10 should be regarded as an interpreted winter groundwater surface rather than representing a single synoptic event, as the groundwater level data were collected from different investigations and dates. Despite this limitation, the interpreted contours are consistent with the observed hydrogeological setting. Groundwater is shallowest in the low-lying central areas of the site. On the hill slopes, the seepage into gully wetlands has been used to inform groundwater levels which are assumed to follow topography. This interpreted piezometric surface has been used to support the conceptual understanding of local groundwater flow directions and groundwater–surface water interaction across the Development area.

2.4.6 Groundwater Flow Paths

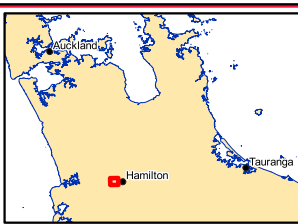
Groundwater within the Ohote catchment is closely connected to surface water bodies, providing sustained flows to drains, wetlands, and streams. In the hilly areas infiltrating rainfall flows toward the gullies and associated wetlands (Figure 10). Across the flats, which are characterised by peat-rich soils, infiltrating rainfall flows to the nearest drains. In each case groundwater provides baseflows to the local surface water features.

¹ [https://www.waikatoregion.govt.nz/environment/water/groundwater-monitoring/flow5a-report/#:~:text=Pr%20%3D%20estimate%20of%20rainfall,percent\)%20in%20the%20Waikato%20region.](https://www.waikatoregion.govt.nz/environment/water/groundwater-monitoring/flow5a-report/#:~:text=Pr%20%3D%20estimate%20of%20rainfall,percent)%20in%20the%20Waikato%20region.)

2.4.7 Local Aquifer and Aquitard Parameters

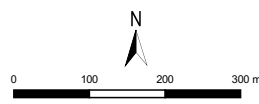
WGA Testing 2025

Hydraulic tests have been performed on the four piezometers installed by WGA on 10 October 2025 (Table 3). Falling and rising head tests were undertaken on each of these piezometers to derive local aquifer and aquitard hydraulic parameters. Data from these hydraulic tests were analysed using the Bouwer and Rice (1976) method. The AQTESOLV Pro v4.5 software package from HydroSolve Inc was used to analyse the datasets. The analysis results are summarised in Table 4 and the analysis sheets are presented in Appendix C.



LEGEND

-  Site Boundary
-  Piezometric Surface



Scale 1:10 000 @A4

Coordinate System: NZGD 2000 New Zealand Transverse Mercator



Figure 10
Brymer Farms Limited
Piezometric Surface

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Table 4: WGA Hydraulic Test Results

PIEZOMETER ID	TESTED INTERVAL (m bgl)	SCREENED LITHOLOGY	HYDRAULIC CONDUCTIVITY ⁽¹⁾ (m/s)
P1	4.5 – 6.0	SILT with minor fine sand	1.3 x 10 ⁻⁶ FHT 1.5 x 10 ⁻⁶ RHT
P2	3.0 – 4.5	Predominantly PEAT, with SILT in basal 0.25 m	4.5 x 10 ⁻⁷ FHT ⁽²⁾
P3	3.1 – 4.6	Clayey SILT, silt with some fine sand/peat	2.0 x 10 ⁻⁶ FHT 1.7 x 10 ⁻⁶ RHT
P4	7.5 – 9.0	GRAVEL, pumiceous with fine sand	1.9 x 10 ⁻⁶ FHT ⁽²⁾

Notes:

⁽¹⁾ All analyses completed using the Bouwer & Rice (1976) method.

⁽²⁾ Results for rising head tests discounted as not being representative of aquifer conditions.

CMW Soakage Testing 2025

Six falling head tests were carried out by CMW in 2025 at depths between 0.3 m and 1.6 m bgl (Table 5). Testing was undertaken in 90 mm diameter hand auger holes, with a slotted pipe installed. Data from these hydraulic tests were analysed using the Ciria 113 (Somerville, 1986) method. The test analysis sheets are presented in Table 5. The final four readings from each test were considered along with WGA slug testing results when adopting local site parameters.

Table 5: CMW Hydraulic Test Results

TEST HOLE ID	HOLE DEPTH (m)	TESTED LITHOLOGY	HYDRAULIC CONDUCTIVITY ⁽¹⁾ (m/s)
SO25-01	0.6	Sandy CLAY	1.7 x 10 ⁻⁵
SO25-02	0.6	Organic SILT/CLAY	6.3 x 10 ⁻⁷
SO25-03	0.3	PEAT/SILT	5.5 x 10 ⁻⁶
SO25-04	0.6	PEAT/SILT	8.6 x 10 ⁻⁶
SO25-05	0.8	PEAT/SILT	6.6 x 10 ⁻⁶
SO25-06	1.6	CLAY	1.1 x 10 ⁻⁶

Notes:

⁽¹⁾ All analyses completed using the Ciria 113 method.

2.4.8 Groundwater Users

A list of water supply bores within 1 km of the site is provided in Appendix D. The locations of these water supply bores are presented in Figure 11.

At the time of writing, according to the WRC consents database, there are two groundwater abstraction consent linked to a bore located within 1 km of the site (Table 6). This resource consent authorises the taking of groundwater to provide for recreation/amenities/sport supply at the Hamilton Zoo. The bore linked to this consent is located up-gradient (to the north) of the proposed site activities (Figure 11). The second consent relates to dewatering and dust suppression for Brymer Heights Limited and is recorded as a zero net take.

Table 6: Groundwater Take Consent Linked to a Bore Within 1 km of the Site

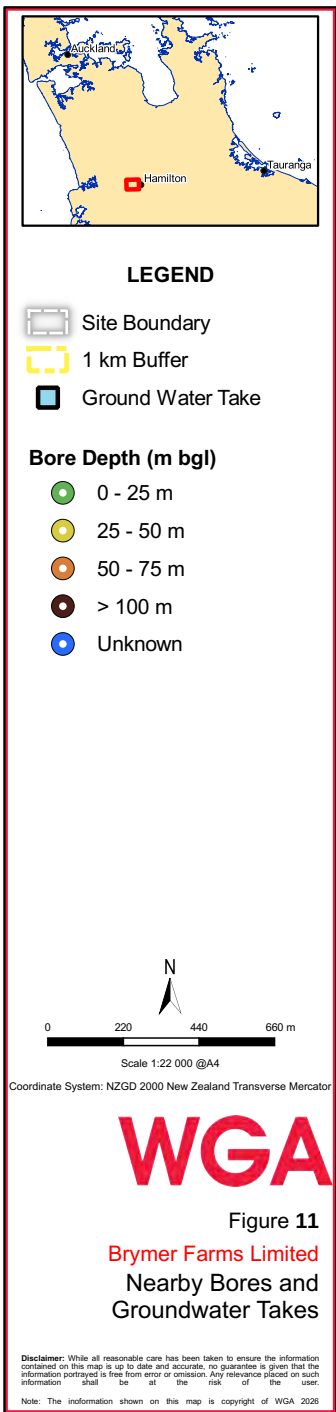
CONSENT NUMBER	CONSENT HOLDER	PERMITTED VOLUME (m ³ /year)	PURPOSE
AUTH133795.01.01	Hamilton City Council	8,030	Recreation/Amenities
AUTH142080.05.01	Brymer Heights Limited	Zero net take	Dewatering and Dust Suppression

2.5 Catchment Water Balance

2.5.1 Surface Water Flows

Surface water flows in the Ohote Catchment are generated by a combination of direct rainfall, runoff, shallow groundwater discharge and artificial drainage of the low-lying former wetland areas. Within and adjacent to the site, flows are conveyed through a modified farm drainage network that discharges to Ohote Channel 01 and the Yates drain. These drains form part of the wider Waikato Central Drainage Scheme and provide the main surface water conveyance pathway from the low-lying central area of the site toward the downstream Ohote Basin and, ultimately, the Waipa River.

Flow conditions are expected to be strongly seasonal. During wetter periods, surface water flows are likely to increase rapidly in response to rainfall runoff from the low-lying pasture areas, hillslopes and connected drains. During drier periods, flows are expected to be lower and more dependent on shallow groundwater discharges. This groundwater contribution is consistent with the shallow groundwater conditions observed across the low-lying parts of the site and the inferred hydraulic connection between the shallow groundwater system, farm drains, gully wetlands and the main Ohote drainage network.



3 EFFECTS OF SOIL COMPACTION

3.1 Introduction

Soils across the low-lying areas of the site, especially the peat deposits, are highly compressible. Due to the risk of long-term ground settlement and the potential for damage to structures during an earthquake, some existing soils are to be compacted prior to construction on top of these soils (Figure 12). Soils beneath the proposed stormwater wetlands excluding the forebay areas are not within the compaction areas. This compaction process is to consist of a series of steps, in the following general sequence:

1. Calculate the degree of compaction required and the necessary lithostatic loading required to achieve this compaction objective.
2. Pre-load a limited area within the overall site using placed fill to achieve the required degree of compaction within a defined timeframe.
3. Once the compaction is achieved, remove any excess fill above the planned final subsoil surface and use this material to pre-load the next area of the site to be compacted. Allowance is to be made to add topsoils to the fill surface where appropriate, thereby achieving the final topographic surface for the site.

The compaction process would result in a reduction of soil porosity. This reduction in porosity would result in a corresponding reduction in the hydraulic conductivity of the compacted soils. The hydraulic behaviour of the compacted soils would differ from the behaviour of the same soils prior to compaction. Depending on the specific location of the soils within the site, this change in soil hydraulic characteristics may result in:

- Reduced rainfall infiltration and therefore groundwater recharge.
- Reduced lateral groundwater transmission through these soils, resulting in locally increased groundwater levels or pressures.

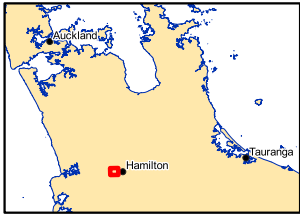
With respect to the latter effect described above, in some areas the placement of fill also results in the infilling of existing drainage systems. Where drainage systems are infilled, it is reasonable to expect that the local groundwater levels will rise within the in-situ soils and potentially into the emplaced fill, even without the additional effects of soils compaction.

3.2 Methodology

Laboratory tests have been conducted on soil samples from site to provide an indication of the magnitude of changes in soil hydraulic characteristics under increasing loads. Samples of silt and peat from the site were tested using a triaxial cell under two different consolidation pressures. The upper consolidation pressure of 80 kPa is equivalent to the maximum lithostatic pre-load planned to be applied at any location on site. The changes in the sample size, pore water content and hydraulic conductivity are monitored and documented on the laboratory analysis sheets (refer to Appendix E).

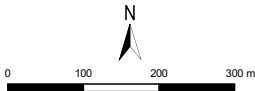
The objective of the laboratory tests is to determine the rate at which the hydraulic conductivity of a sample decreases when compared to the decrease in sample volume. To do this, the sample of known size is installed in a triaxial cell and subjected to an initial consolidation pressure of 20 kPa. The change in sample size is measured by monitoring the amount of water extruded. At this stage the sample is tested to determine its hydraulic conductivity. The consolidation pressure is then increased to 80 kPa and the volume of extruded water monitored. The hydraulic conductivity of the sample is measured again. The analysis data is then presented in a laboratory report.

Silt and peat behave differently on compaction. It was reasonably expected that peat could be compacted to a much greater degree than silt when the same consolidation pressure is applied. The test data were used to develop mathematical relationships between consolidation, expressed as a percentage of the initial sample volume, and hydraulic conductivity. The derived relationships were reviewed by sample type, after which two generalised relationships were adopted: one for silt and one for peat.



LEGEND

- Site Boundary
- Preload Area
- Proposed Stormwater Wetland



Scale 1:10 000 @A4

Coordinate System: NZGD 2000 New Zealand Transverse Mercator

WGA

Figure 12

Brymer Farms Limited
Indicative Preload Area

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The mathematical equations describing the general hydraulic conductivity versus consolidation relationships for these soil types can be used to calculate the original hydraulic conductivity of the sample prior to testing. Similarly, the relationships can be used to estimate the change in hydraulic conductivity in either silt or peat at any point across the site that has been subjected to compaction. If the soil at this point has previously been subjected to hydraulic testing, the final hydraulic conductivity of the soil can be calculated from this starting point. As the final hydraulic conductivity is a function of soil compaction, and therefore degree of preloading, the hydraulic characteristics of the impacted silts and peats across the site can be estimated from the calculated preload pressures.

3.3 Results

Six soil samples (TL-1 to TL-6) were tested using the methodology described in Section 3.2: three peat samples and three silt samples (Table 7). The laboratory test analysis report is presented in Appendix E. A seventh sample (TL-7) was tested for compaction and hydraulic conductivity. However, this material consisted of clayey silt from the Walton Group that is to be used as engineered fill. For that reason, no relationship between compaction and hydraulic conductivity was required.

Table 7: Lithology of Samples Tested for Hydraulic Conductivity and Compaction

SAMPLE ID	LITHOLOGICAL DESCRIPTION ⁽¹⁾
TL-1	PEAT with minor rootlets, spongy, fibrous; dark brown/black.
TL-2	PEAT (organic soil); black to dark brown. Firm, plastic, minor rootlets present. Upper ~1/3 of the sample contains woody material (trunk/wood fragment).
TL-3	PEAT, with minor rootlets; black. Firm, plastic.
TL-4	SILT, with minor clay and sand; dark brown/black. Soft. Minor organic matter present.
TL-5	SILT, with minor sand and a trace of clay; light yellowish brown. Stiff.
TL-6	Sandy SILT; yellowish brown/grey. Soft, moist.
TL-7	Clayey SILT, with minor sand; brown. Stiff, moist.

Note:

⁽¹⁾ Information copied from the Geotechnics laboratory report presented in Appendix E.

The mathematical relationships derived from the laboratory test results are summarised in Figure 13. The key outcomes from the test program are:

1. Two silt samples, TL-5 and TL-6, were not significantly compacted during the laboratory testing. The hydraulic conductivity results from the tests were similar enough that they were effectively the same taking into account the accuracy of the triaxial test methodology.
2. The greatest compaction of a silt sample (TL-4) was 6.1%.
3. Sample TL-2 had a significant wood fraction in the sample and may not be representative of peat in general.

Following review of the results the two general equations to estimate compacted soil hydraulic conductivities are:

- Peat $K_C = K_I \times e^{(compaction\ ratio \times -30)}$
- Silt $K_C = K_I \times e^{(compaction\ ratio \times -7)}$

Where:

- K_C = Compacted hydraulic conductivity
- K_I = Initial hydraulic conductivity
- The compaction ratio is the percentage compaction expressed as a decimal number.
- The -30 and -7 are constants derived from the gradients of best fit lines for TL-1 and TL-2 presented in Figure 13.

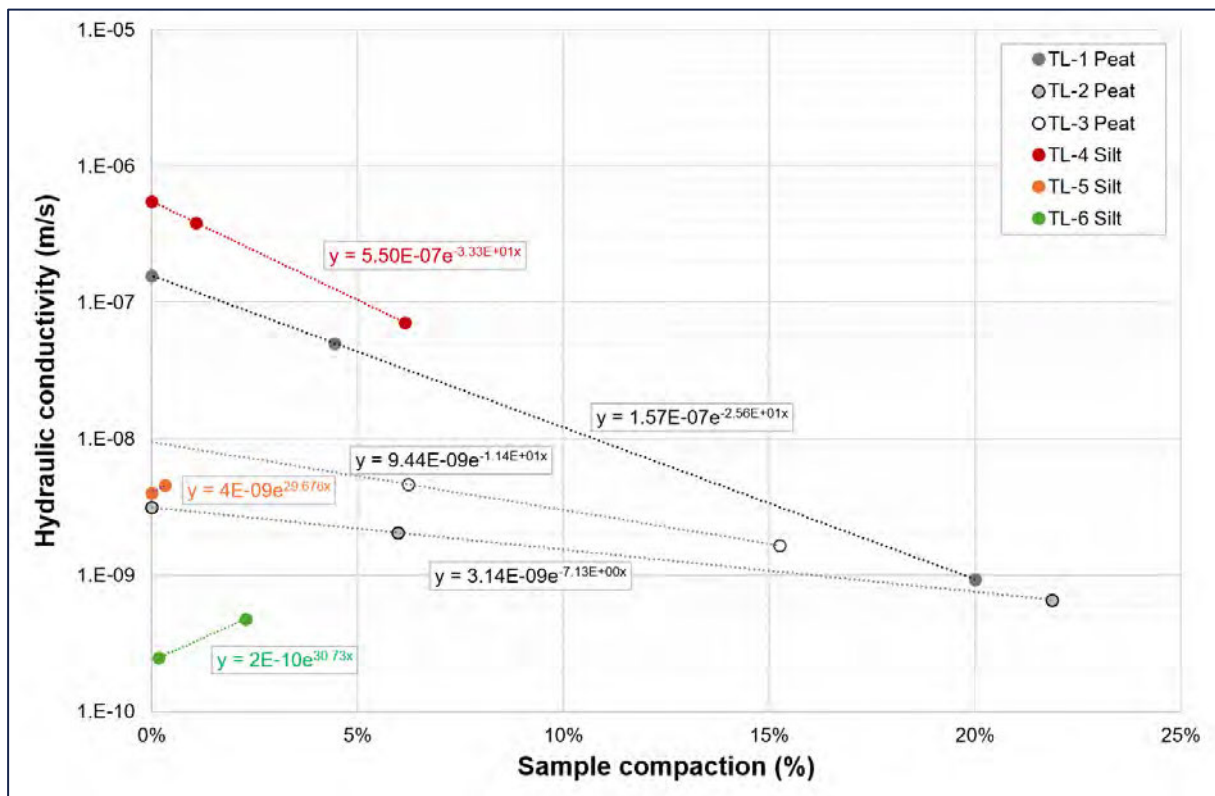


Figure 13: Hydraulic Conductivity Change in Response to Laboratory Soil Sample Compaction

Applying these general equations to the results of the hydraulic tests performed on in-situ peat and silt by WGA (Table 4) and CMW (Table 5) generates the results presented in Figure 14. In summary, the laboratory tests and the implied behaviour of soils to loading and compaction indicates:

1. Silt compaction is likely to result in a reduction in hydraulic conductivity by a factor of up to 2.
2. Peat compaction may result in a reduction in hydraulic conductivity in excess of 3 orders of magnitude, depending on the degree of compaction.

Upper bound and lower bound hydraulic conductivity values for the assessment of groundwater effects were selected using Figure 14 (Table 8). The upper bound value was derived from the silt soils in natural state, and a lower bound value was derived from peat soils compacted to 35%.

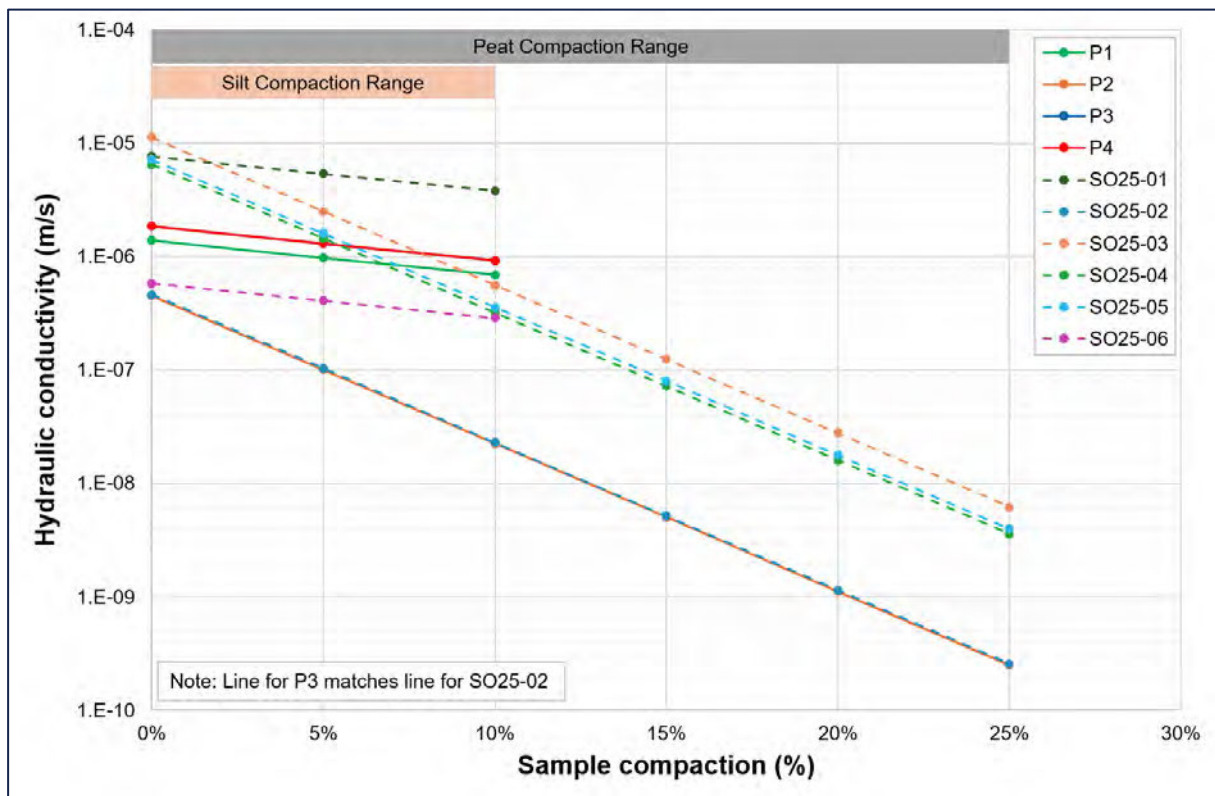


Figure 14: Hydraulic Conductivity Change to Field Test Analysis Results

Table 8: Representative Hydraulic Conductivity Ranges

MATERIAL NAME	HYDRAULIC CONDUCTIVITY RANGE (m/s)	HYDRAULIC CONDUCTIVITY ADOPTED FOR ANALYSES (m/s)
Engineered Fill	3×10^{-8} to 7×10^{-8}	N/A
Compacted SILT	4×10^{-7} to 4×10^{-6} ⁽¹⁾	1.0×10^{-6}
Compacted PEAT	6×10^{-10} to 3×10^{-9} ⁽¹⁾	1.0×10^{-9}
Piako Subgroup - PEAT interbedded with SILT	1.7×10^{-7} to 5×10^{-5} ⁽²⁾	$K_h = 1.9 \times 10^{-6}$ $K_v = 1.9 \times 10^{-7}$ ⁽³⁾
Piako Subgroup – SAND with gravel layers	1.9×10^{-6} ⁽¹⁾	1.9×10^{-6} ⁽¹⁾
Walton Subgroup (silts and clays)	6.3×10^{-7}	6.3×10^{-7}
Walton Subgroup (sands)	1×10^{-7} to 1×10^{-5}	1×10^{-5}

Note:

⁽¹⁾ Refer to Figure 14. Assumes full compaction from pre-loading at 80 kPa. Refer to Figure 14 for hydraulic conductivity at lower pre-loading pressures.

⁽²⁾ Refer to Table 4.

⁽³⁾ K_v (vertical hydraulic conductivity) = K_h (horizontal hydraulic conductivity)/10

4 GROUNDWATER DRAWDOWN AROUND STORMWATER WETLANDS

4.1 Introduction

Some of the proposed stormwater wetlands (Figure 16) are expected to intersect the existing groundwater table. The drawdown effects of the proposed stormwater wetlands have been assessed using analytical methods, drawing on parameters from on-site testing (Section 2.4.7) and the Development design provided by Maven (Drawing nos. C435-1 to C435-16, Rev B and Drawing no. C220, Rev C, from Maven Appendix F). Drawdown calculations are provided in Appendix G. It is noted that for Wetlands A1 to E, the wetlands will be in areas where fill is being placed therefore in some cases, they are designed to be up to 3 m deep but only penetrate slightly into the existing ground level.

4.2 Description of Wetland Excavations

Wetland A1

Wetland A1 is located on the western side of the Development (Figure 16). The nearest piezometer is P2 (Figure 8), which has recorded groundwater levels ranging from 0.38 m to 0.74 m bgl. Wetland A1 is located on peat and, according to the cut and fill map (Appendix F), the wetland area will be cut by between 0 and 2 m. Based on a 1.5 m deep wetland design, and a 1.98 m deep forebay, it is likely that this wetland area would intersect peat and the shallow groundwater table (Figure 15).

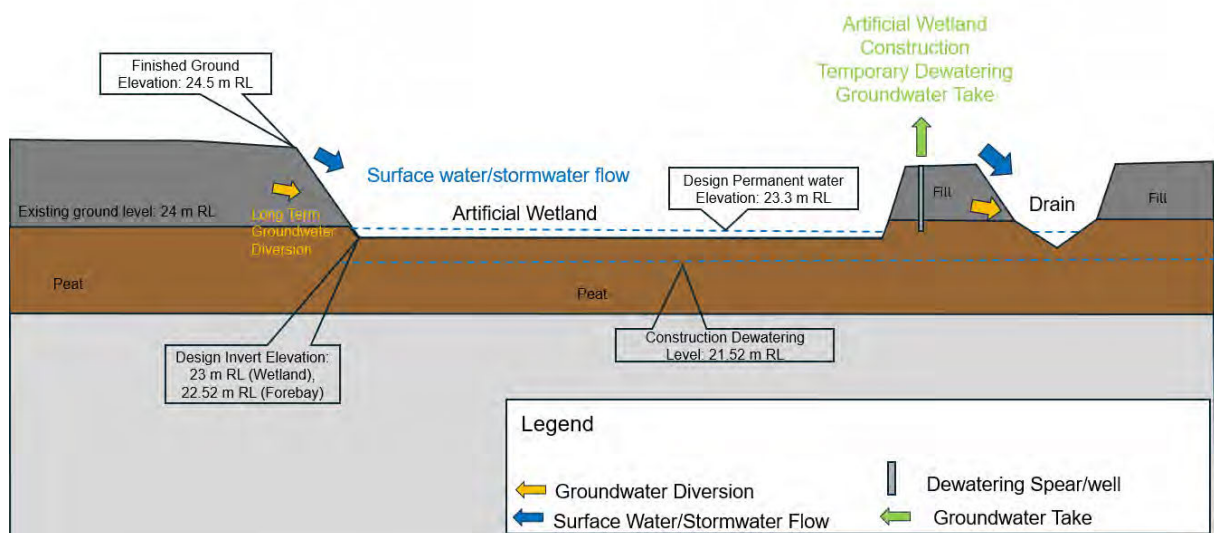
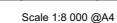


Figure 15: Wetland A1 Schematic (Not Drawn to Scale)



 Proposed Stormwater Wetland



Coordinate System: NZGD 2000 New Zealand Transverse Mercator

WGA

Figure 16
Brymer Farms Limited
Proposed Stormwater
Wetlands

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

Note: The information shown on this map is copyright of WGA 2026

Wetland A2

Wetland A2 is located in the middle of the Development. The nearest piezometer is P3, which has recorded groundwater levels ranging from 0.04 m to 0.45 m bgl. Wetland A2 is located on peat and, according to the cut and fill map, the area surrounding the wetland will be raised by between 0 and 1 m. Based on a 1.8 m deep wetland design, and a 3 m deep forebay there is a possibility that this wetland area would intersect peat and the shallow groundwater table (Figure 17).

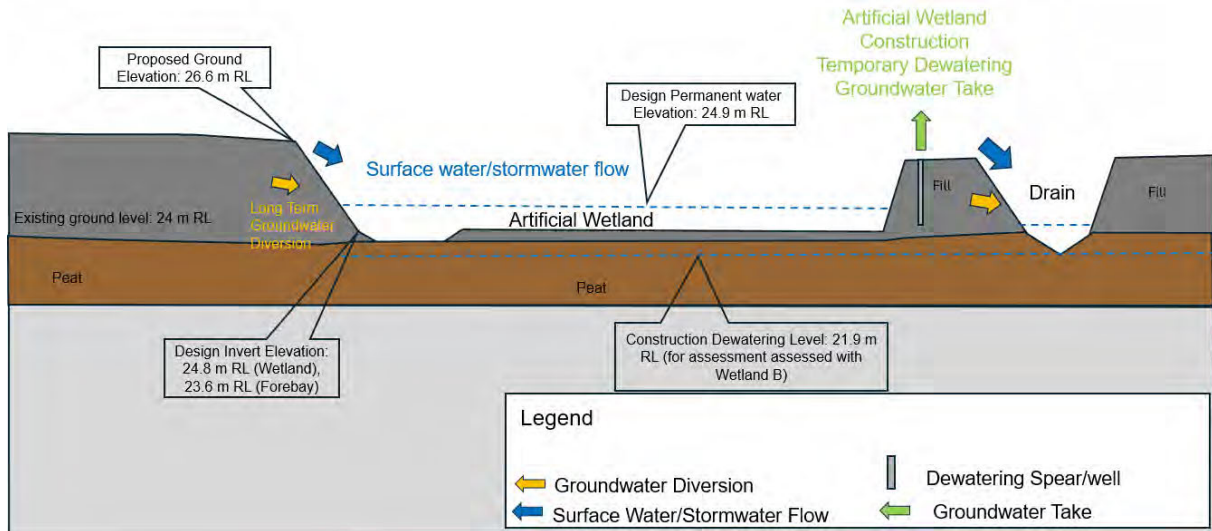


Figure 17: Wetland A2 Schematic (Not Drawn to Scale)

Wetland B

Wetland B is located in the middle of the Development, immediately to the east of Wetland A2. The two wetlands are separated by a planned swale, following the line of an existing drain. The nearest piezometer is P3, which has recorded groundwater levels ranging from 0.04 m to 0.45 m bgl. Wetland B is located on peat and, according to the cut and fill map, the wetland area will be cut by between 0 and 1.5 m. Based on a 2.5 m deep wetland design there is a possibility that this wetland area would intersect peat and the shallow groundwater table (Figure 18).

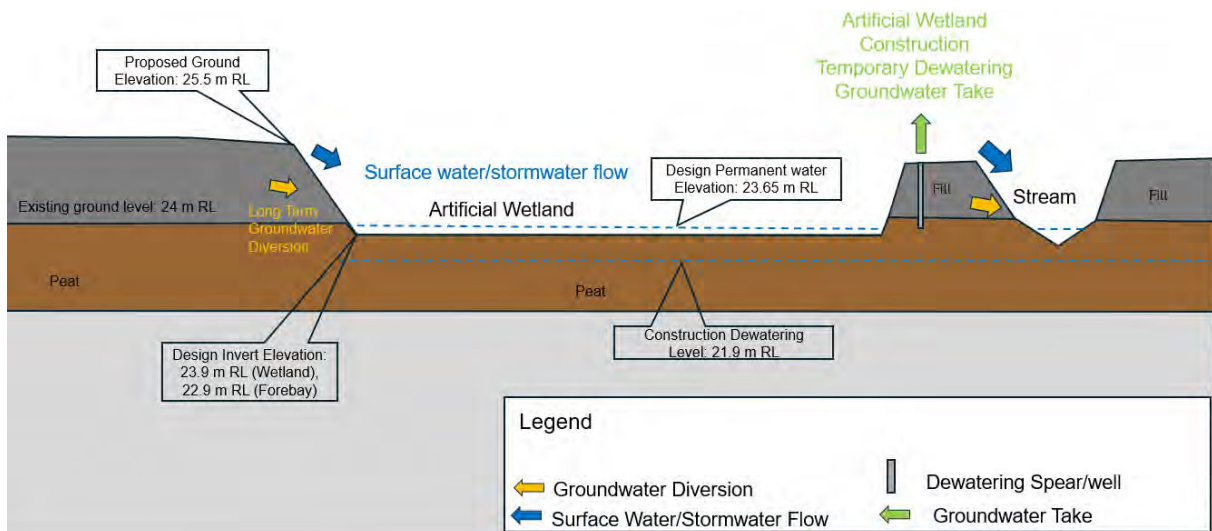


Figure 18: Wetland B Schematic (Not Drawn to Scale)

Wetland C

Wetland C is located in the middle of the Development, to the east of Wetland B. The nearest piezometer is P4, which has recorded groundwater levels ranging from 0.51 m to 0.71 m bgl. Wetland C is located on peat and, according to the cut and fill map, the wetland area will be cut by between 0 to 1 m. Based on a 1.3 m wetland design, and a 2.3 m deep forebay, there is a possibility that this wetland area intersects peat and the shallow groundwater table (Figure 19).

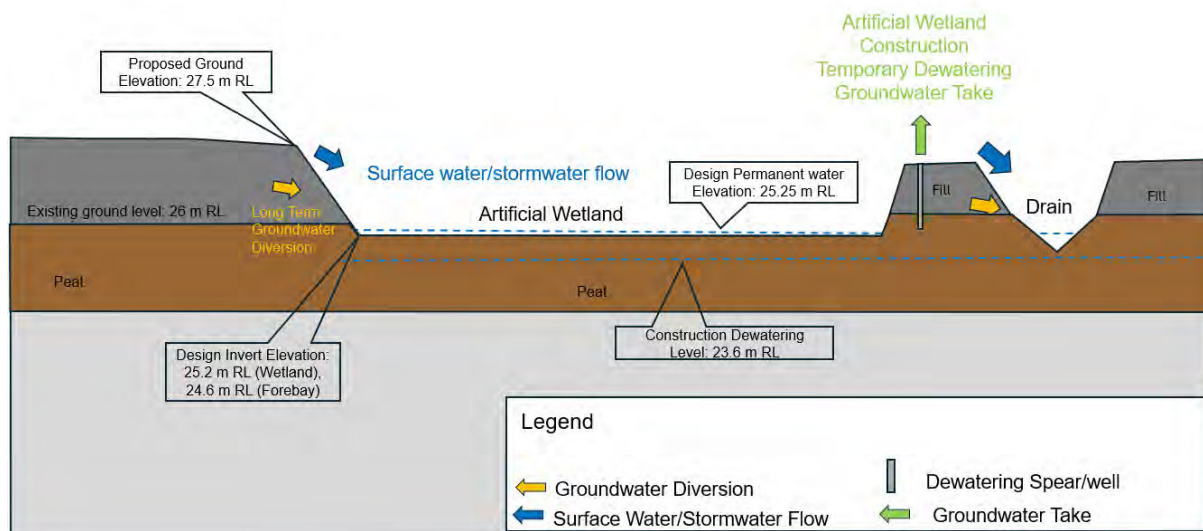


Figure 19: Wetland C Schematic (Not Drawn to Scale)

Wetland D

Wetland D is located south of Wetland A1 on the western side of the Development. The nearest piezometer is P2, which has recorded groundwater levels ranging from 0.43 m to 0.57 m bgl. Wetland D is located on peat and, according to the cut and fill map, the wetland area will be cut by between 0 and 0.5 m. Based on a 1.7 m deep wetland design and a 2.3 m deep forebay, this wetland may intersect peat and the shallow groundwater table (Figure 20).

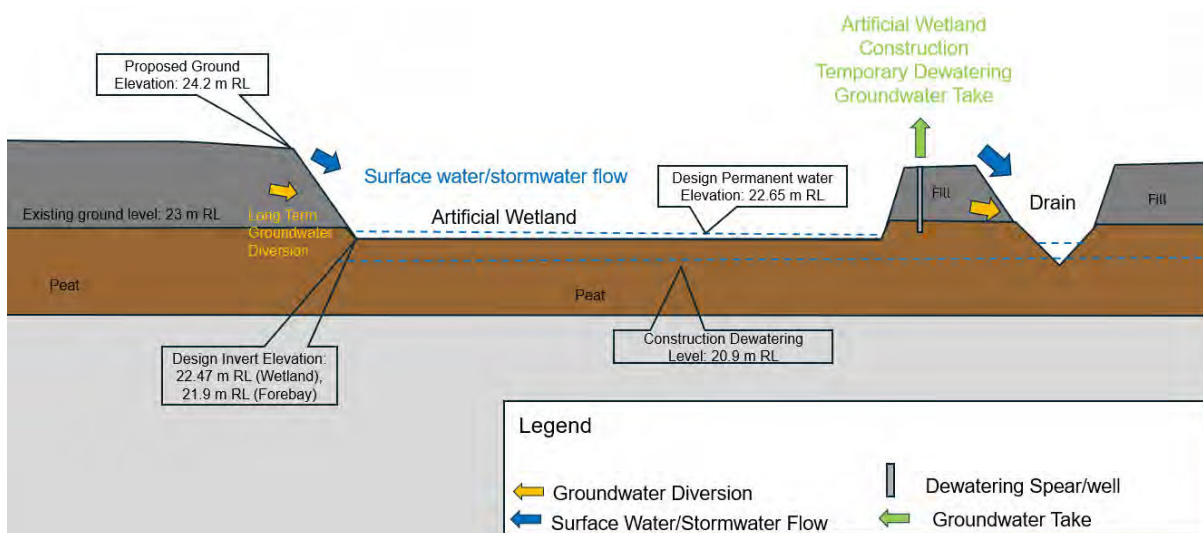


Figure 20: Wetland D Schematic (Not Drawn to Scale)

Wetland E

Wetland E is located in the southernmost portion of the Development. The nearest groundwater monitoring piezometer is P2, which has recorded groundwater levels ranging from 0.43 m to 0.57 m bgl. Wetland E is located on peat and peaty loam and, according to the cut and fill map, the wetland area will be cut by between 0 to 1.5 m. Based on a 2.25 m deep wetland design and a 2.9 m deep forebay, this wetland may intersect peat and the shallow groundwater table (Figure 21).

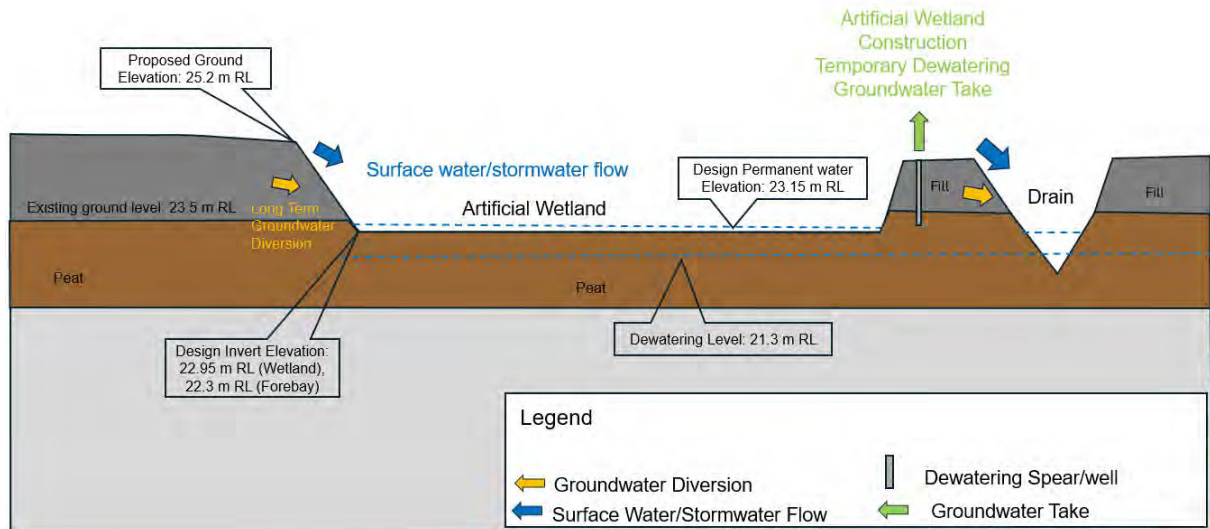


Figure 21: Wetland E Schematic (Not Drawn to Scale)

Wetland F

Wetland F is located on a broad ridge within the northernmost section of the Development. The nearest groundwater monitoring piezometer is P1, which has recorded groundwater levels ranging from 0.36 to 1.33 m bgl (31 to 32 m RL). The piezometer is located in the gully below the proposed wetland.

Wetland F is located on Walton Subgroup deposits. According to the cut and fill map the wetland area will be recontoured to approximately 43.5 m RL on the upper side of the wetland. The proposed wetland depth is 42.0 m RL. Tonkin and Taylor CPT114 located at the top of the hill on which Wetland F is located indicates there are clays to a depth of approximately 10 m underlain by sands associated with the Walton Subgroup to the base of the CPT at 16.64 m bgl (41.36 m RL). It is likely that this wetland intersects the sand layer within the Walton Subgroup. Given the hill which Wetland F is situated on is relatively isolated and surrounded by gully seepage features at or below 39 m RL, it is unlikely groundwater will be encountered during excavations (Figure 22).

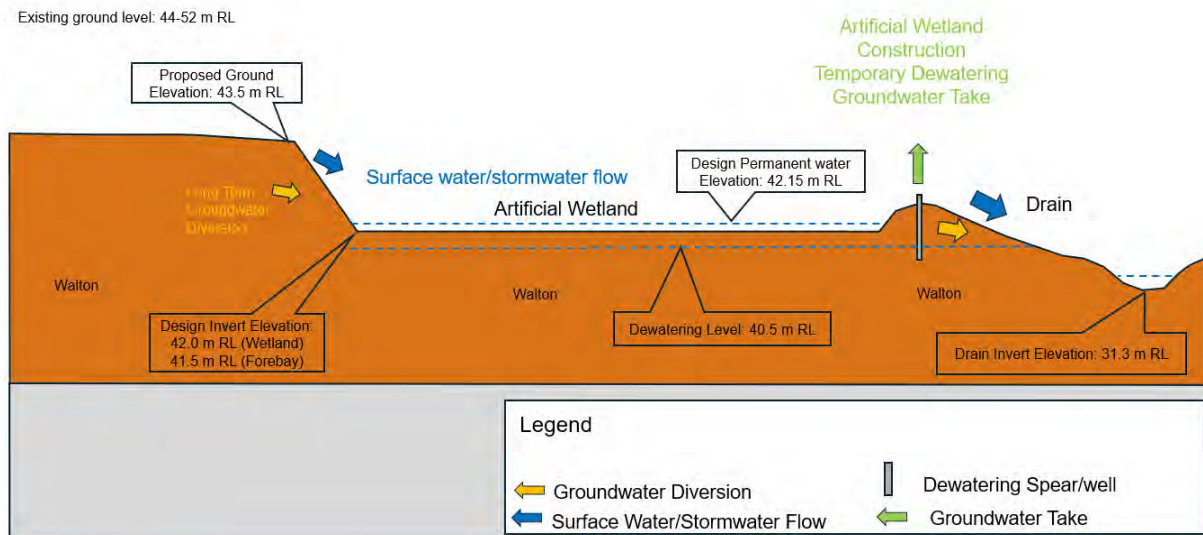


Figure 22: Wetland F Schematic (Not Drawn to Scale)

Wetland G

Wetland G is located on a narrow ridge underlain by the Walton Subgroup within the northern most section of the Development, bordered by existing gully wetlands. The nearest groundwater monitoring piezometer is P1, which has recorded levels ranging from 0.36 to 1.33 m bgl (31 to 32 m RL). The piezometer is located within the gully below the proposed wetland. Towards the downward slope of the wetland, the ground will be filled with a slight cut into the natural ground on the upstream side of the wetland (Figure 23). There is potential some groundwater seepage may be encountered during earthworks associated with the construction of Wetland G.

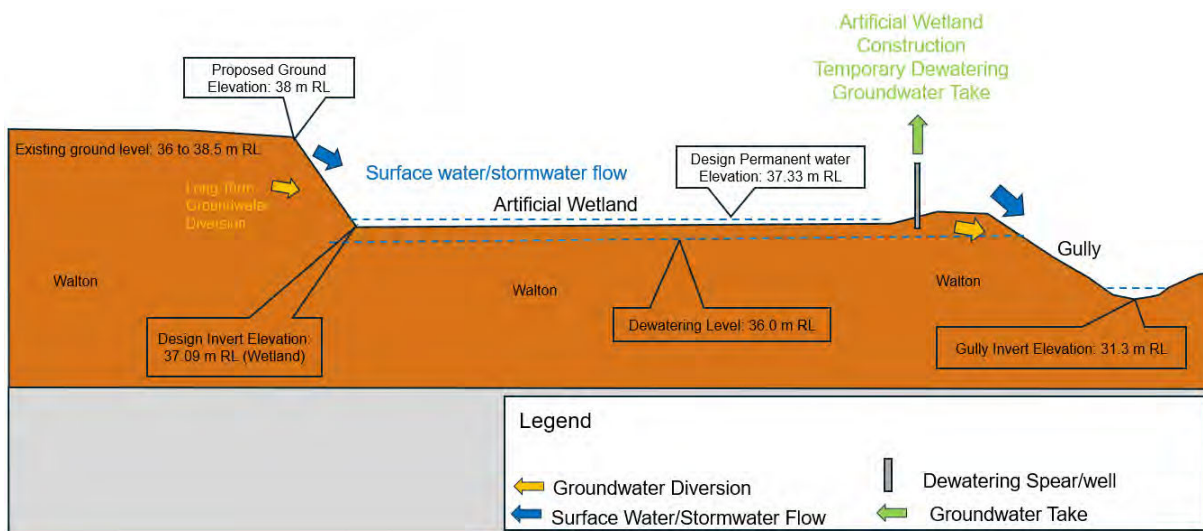


Figure 23: Wetland G Schematic (Not Drawn to Scale)

4.3 Methodology

An assessment of potential groundwater drawdowns and inflows to each of the planned stormwater wetlands in low-lying areas within the site has been undertaken using a published method of estimating groundwater inflows to open-cut pits (Marinelli & Niccoli 2000).

The methodology has been applied to calculate drawdown and flows for short-term temporary dewatering during construction earthworks for proposed stormwater wetlands and long-term groundwater interception and diversion to the proposed stormwater wetlands.

This methodology uses analogue equations to approximate horizontal groundwater inflows through the sides of the pit and vertical groundwater inflows through the floor of the pit. Wetlands F and G are situated on the hill slopes and were not assessed for long-term effects, as it has been assumed that these wetlands will be lined.

The equations used by this methodology assume laterally radial groundwater flows toward a circular pit. In applying this methodology to the proposed stormwater wetlands, their layouts needed to be simplified by converting them to equivalent circular ponds. This has been done by taking the full footprint area of each wetland, including forebays and rain gardens, assuming the area is circular and calculating the radius of the “equivalent” area. The effective radii for the wetlands derived using this “equivalent” calculation are presented in Table 9, along with the other inputs to the inflow equations.

Table 9: Inputs for Pit Models Representing the Stormwater Wetlands Including Forebay

WETLAND NUMBER	A1	A2 AND B	C	D	E	F	G
Existing ground elevation (m RL) ⁽¹⁾	24.0	24.0	26.0	23.0	23.5	44.0 to 52.0	36.0 to 38.5
Existing winter groundwater level (m RL)	24.0	24.0	26.0	23.0	23.5	43.5	38
Design invert elevation ⁽¹⁾	Wetland 23.0 Forebay 22.52	Wetland B 23.90 Forebay 22.9	Wetland 25.2 Forebay 24.6	Wetland 22.47 Forebay 21.9	Wetland 22.95 Forebay 22.3	Wetland 42.00 Forebay 41.5	Wetland 37.0
Dewatering level (1 m below final invert level)	21.52	21.9	23.6	20.9	21.3	40.5	36.0
Design permanent water elevation (m RL) ⁽¹⁾	23.3	23.65	25.25	22.65	23.15	42.15	37.33
Design area at rim elevation (m ²) ⁽¹⁾	12,410	17,328	5,635	5,227	9,250	2,510	1,380
Effective radius at rim elevation (m) ⁽²⁾	62.9	74.3	42.4	40.8	54.3	28.3	21.0

Notes:

⁽¹⁾ Existing and deepest design levels provided by Maven cross sections 08/2626 (Appendix D)

⁽²⁾ Assuming wetland area is treated as a circle.

Wetland A2 and B are located 40 m apart, with a modified swale between. These wetlands have been grouped and treated as a single entity in the analysis, with the combined area converted into an effective radius. The dewatering level of the deeper Wetland B has been applied to both wetlands and is therefore a conservative assessment of drawdown expected from Wetland A2.

It is expected that, under long-term operating conditions, the wetlands will receive seepage from groundwater where they intersect the shallow groundwater system. To assess the long-term effects of the wetlands on the groundwater regime, the wetlands have been modelled as operational pit lakes representing the permanent water level. For wetlands on the flat area of the site (Wetlands A1 to E), groundwater levels were assumed to be at ground level.

The same method described above has been used to calculate potential inflows to the stormwater wetlands during their construction phase. In this scenario, the base of each stormwater wetland has been modelled as being one metre below the design basin invert to allow the base of the excavation to be dry. Due to shallow existing groundwater levels, the surrounding groundwater levels were modelled at the ground surface for the short-term construction analysis to identify peak potential inflow rates (Table 9).

Whilst it is unlikely groundwater will be encountered during excavations for Wetland F; a conservative assessment has been undertaken assuming the groundwater is at the top of the wetland (43.5 m RL). Soakage tests have not been conducted in the deeper sand layers of the Walton Subgroup on site. The soakage testing undertaken at SO25-02 in the upper silty clays of the Walton Subgroup indicated a hydraulic conductivity of 6.3×10^{-7} . The sand layers are likely to have a higher hydraulic conductivity than the silts and clays, therefore a range of hydraulic conductivities has been considered for this wetland assessment.

This analysis method assumes steady state drawdown conditions develop during the construction period. If the planned construction period is shorter than the time required for steady-state conditions to develop, the instantaneous inflow rates requiring management may be greater than those calculated, and the extent of groundwater drawdown may be less. The overall volume of groundwater discharged during wetland development is also proportional to the time required for the wetland to be maintained in a dry condition. Reducing that period reduces the total volume of groundwater abstracted and discharged.

4.4 Results

The projected groundwater drawdown effects have been evaluated for each of the stormwater wetlands, as detailed in Table 10 and provided in Appendix G. The groundwater inflows at each of the stormwater wetlands have been calculated assuming the drawdowns generated by each of the wetlands do not intersect during individual construction, noting that Wetlands A2 and B have been treated as a single wetland. The radius of groundwater drawdown and the groundwater inflows during both the construction period (dry pit) and under long-term conditions are presented in Table 10.

Table 10: Projected Effects of Proposed Stormwater Wetlands

STORMWATER WETLAND	SCENARIO	INITIAL SATURATED THICKNESS ABOVE BASIN INVERT (m) ⁽¹⁾	RADIUS OF DRAWDOWN (m) ^{(2) (3)}	CALCULATED GROUNDWATER INFLOW (m ³ /day) ^{(2) (4)}
A1	Construction	2.48	80	45
	Permanent	1.48	69	15
A2 and B	Construction	2.1	90	44
	Permanent	1.1	76	10
C	Construction	2.4	58	30
	Permanent	1.4	48	11
D	Construction	2.1	54	25
	Permanent	1.1	43	5

STORMWATER WETLAND	SCENARIO	INITIAL SATURATED THICKNESS ABOVE BASIN INVERT (m) ⁽¹⁾	RADIUS OF DRAWDOWN (m) ^{(2) (3)}	CALCULATED GROUNDWATER INFLOW (m ³ /day) ^{(2) (4)}
E	Construction	2.2	69	34
	Permanent	1.2	56	7
F	Construction	2.7	64	104
G	Construction	2	28	5

Notes:

⁽¹⁾ Saturated thickness during construction taken from ground surface to 1 m below basin invert level.

⁽²⁾ Drawdown extents and inflows do not take account of changes in soil permeability resulting from compaction.

⁽³⁾ Radius of drawdown taken from centre point of excavation and extends to 0.25 m drawdown.

⁽⁴⁾ Values reported to two significant figures.

Sensitivity analyses were conducted using a range of hydraulic conductivities, based on the results of field and laboratory testing of the soil types likely to be encountered during wetland construction, and used as fill, as outlined in Section 2.4.7. The results indicating the most extensive drawdown radius and inflows for each wetland have been presented in Table 10 and all modelled results are included in Appendix G. The hydraulic conductivity values adopted for the drawdown assessments are based on a limited number of site-specific tests and should be interpreted as representative values rather than precise material constants. The sensitivity analyses in Appendix G are therefore important because the calculated drawdown extent and inflow rates are directly dependent on hydraulic conductivity.

Due to the generally low hydraulic conductivity of the peats and silts underlying and surrounding the wetlands, the projected radius of groundwater drawdown is small.

The key points arising out of this drawdown assessment are:

1. The calculated drawdown relating to both the construction and the long-term operation of each wetland does not extend outward far enough to significantly impact the nearest buildings.
2. The projected drawdown at the building located approximately 20 m to the west of Wetland F is 0.34 m. This is based on a conservative assessment assuming a higher than expected water table and is within the natural fluctuation of groundwater observed in the groundwater monitoring at the site.
3. The calculated groundwater inflow for each of the scenarios considered is less than 105 m³/day (1.2 L/s).
4. Stormwater Wetlands A1, B and C are expected to temporarily cause stream depletion effects during construction due to the expected excavation levels being lower than the surveyed bed level of the adjacent farm drain (Table 11). Interception of shallow groundwater contributions to the neighbouring drains/stream baseflow is also anticipated during construction of the remaining stormwater wetlands. However, to a lesser extent, because the remaining stormwater wetlands do not extend deeper than the drains/stream (Table 11). It is considered any intercepted groundwater from these works can be temporarily diverted back to the local drainage network or stream.
5. The drawdown assessments were conducted using groundwater levels from ground surface as a starting condition to provide estimates of inflows and drawdown extents. Therefore, the calculated results are considered to represent conservatively large outcomes.
6. It is likely that wetland construction would occur during a summer period when earthmoving operations and construction water management would be easier. Groundwater levels are reasonably expected to be lower during such periods, with correspondingly reduced groundwater drawdown requirements and abstraction rates.

Table 11: Existing and Design Elevations of Stormwater Wetlands Compared to Neighbouring Stream/Drain Heights

STORM-WATER WETLAND	EXISTING GROUND ELEVATION (m RL)	DESIGN INVERT ELEVATION (m RL) ⁽¹⁾	DESIGN EXCAVATION DEPTH (m RL) ⁽²⁾	DESIGN PERMANENT WATER ELEVATION (m RL) ⁽³⁾	STREAM/DRAIN INVERT (m RL) ⁽⁴⁾	DEPTH FROM DESIGN INVERT TO STREAM/DRAIN INVERT (m)
A1	24.0	Wetland 23.0 Forebay 22.52	22.0	23.3	22.6	-0.6
A2	24.0	Wetland 24.8 Forebay 23.6	23.1	24.9	23.0 to 23.2	0.1 to -0.1
B	24.0	Wetland 23.9 Forebay 22.9	22.4	23.65	23.0 to 23.2	-0.6 to -0.8
C	26.0	Wetland 25.2 Forebay 24.6	24.1	25.25	24.2	-0.1
D	23.0	Wetland 22.47 Forebay 21.9	21.4	22.65	20.8 to 21.6	0.6 to -0.2
E	23.5	Wetland 22.95 Forebay 22.3	21.8	23.15	20.8 to 21.6	1.0 to 0.2
F	44.0 to 52.0	Wetland 42.0 Forebay 41.5	41.0	42.15	31.3	9.7
G	36.0 to 38.5	Wetland 37.0	36.5	37.33	31.3	5.2

Notes:

⁽¹⁾ Existing and deepest design levels provided by Maven cross sections 08/2026.

⁽²⁾ Excavation depth based on 0.5 m over excavation during construction.

⁽³⁾ Wetland permanent water levels provided by Maven cross sections, 08/2026.

⁽⁴⁾ Drain invert levels provided by Maven survey, 03/06/2026.

5 GROUNDWATER DRAWDOWN FROM WASTEWATER INFRASTRUCTURE CONSTRUCTION

5.1 Wastewater Pipelines

5.1.1 Introduction

The majority of the proposed wastewater pipelines will be constructed in engineered fill, or through the hilly terrain areas of the Development. Construction of pipelines in these areas is considered to have a limited impact on the existing groundwater regime as the pipeline trench inverts will generally be above the existing groundwater table.

Drawdown extent and magnitude have been calculated for the dewatering required for construction of the wastewater pipeline network below the existing groundwater table. The calculations used hydrogeological parameters derived from on-site testing (Section 2.4.7) and the network design provided by Maven (Drawing No. C500-1 to C500-15 Rev B, from Maven Appendix F, Figure 24).

As documented in Section 3.1, the placement of engineered fill on the existing ground surface may result in the groundwater phreatic surface rising to be within the fill. An accurate estimate of the eventual groundwater level within the fill has not been evaluated for the purposes of this assessment. However, the new phreatic surface would be above the existing measured or interpreted surface level. Therefore, trenches that would intersect the groundwater table in the engineered fill but are not deep enough to intersect the existing groundwater level would have no drawdown and ground settlement effect on nearby structures. The groundwater abstracted to support trench construction would be discharged to the stream or drain that would otherwise have received this groundwater seepage as a direct discharge. Therefore, the water balance for the receiving surface water body would not be substantially changed.

5.1.2 Modelling Methodology

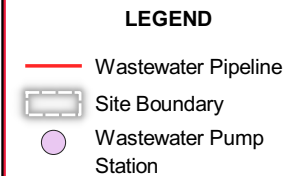
The construction of the planned wastewater pipeline network requires the excavation of trenches below the water table in some areas. Construction requires that these trenches are maintained in a dry state until backfilling starts. WGA understands that the wastewater pipeline is likely to be constructed in 20 m sections, and that each section will be completed within a period of 10 days. This dewatering schedule has been used as the basis of the groundwater drawdown and inflow calculations. The trench excavation depths have been provided by Maven (Drawing No. C520-0 to C520-28, Rev A, from Maven Appendix F).

An analytical approach has been used to calculate temporary groundwater drawdown curves and expected inflows to the trenches. The analysis uses equations from McWhorter and Sunada (1977), which estimate transient drawdown and groundwater inflows into trenches.

WGA understands that the wastewater pipelines are to be constructed at varying depths across the Site. Two critical scenarios were selected for consideration of drawdown effects:

- A 400 m long section of Pipeline Section 2A, which will be excavated up to 2.7 m depth.
- A 125 m long section of Pipeline Section 3A, which will be excavated up to 2.1 m depth.

Input parameters for the drawdown calculations are provided in Table 12.



Coordinate System: NZGD 2000 New Zealand Transverse Mercator

Figure 24
Brymer Farms Limited
Proposed Wastewater
Infrastructure

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

Note: The information shown on this map is copyright of WGA 2026

Table 12: Input Parameters for Wastewater Pipeline Analytical Modelling

WASTEWATER PIPELINE	AQUIFER HYDRAULIC CONDUCTIVITY (m/s)	AQUIFER SPECIFIC YIELD	NUMBER OF DAYS TRENCH OPEN	RECHARGE (mm/year) ⁽¹⁾	DRAWDOWN REQUIRED (m)
Section 2A	1.9×10^{-6}	0.2	10	250	2.7
Section 3A	1.9×10^{-6}	0.2	10	250	2.1

Notes:

⁽¹⁾ Refer to Section 2.4.4.

5.1.3 Results

Projected drawdowns and inflows expected to arise from the excavation of the planned wastewater pipelines are summarised in Table 13, Figure 25 and Figure 26. Projected groundwater inflows are shown in Figure 27 and Figure 28.

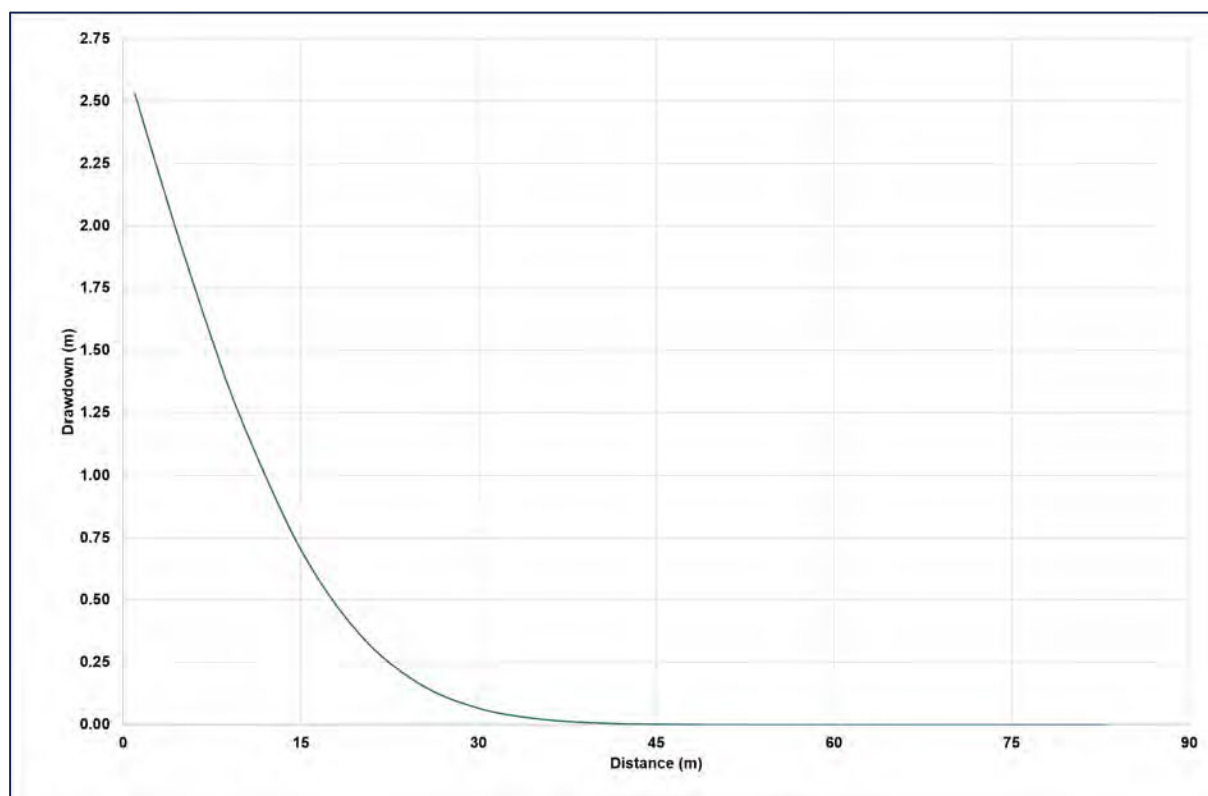
Table 13: Wastewater Trench Projected Distances of Influence and Inflow Rates

WASTEWATER PIPELINE	DISTANCE OF INFLUENCE (m) ⁽¹⁾	INFLOWS (m ³ /day) ⁽²⁾
2A	25	61.9
3A	20	44.0

Notes:

⁽¹⁾ Distance of influence considered to be defined at 0.25 m drawdown.

⁽²⁾ Values reported to two significant figures.

**Figure 25: Projected Drawdown from Wastewater Pipeline 2A**

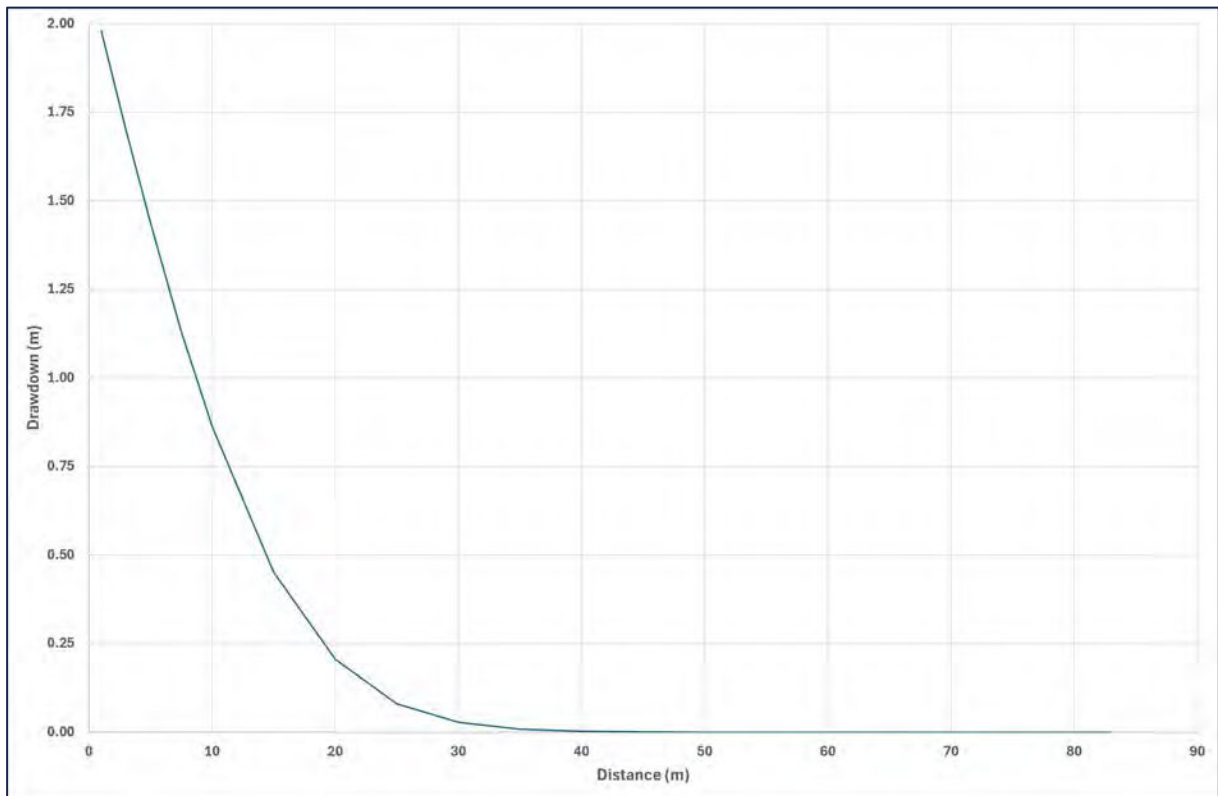


Figure 26: Projected Drawdown from Wastewater Pipeline 3A

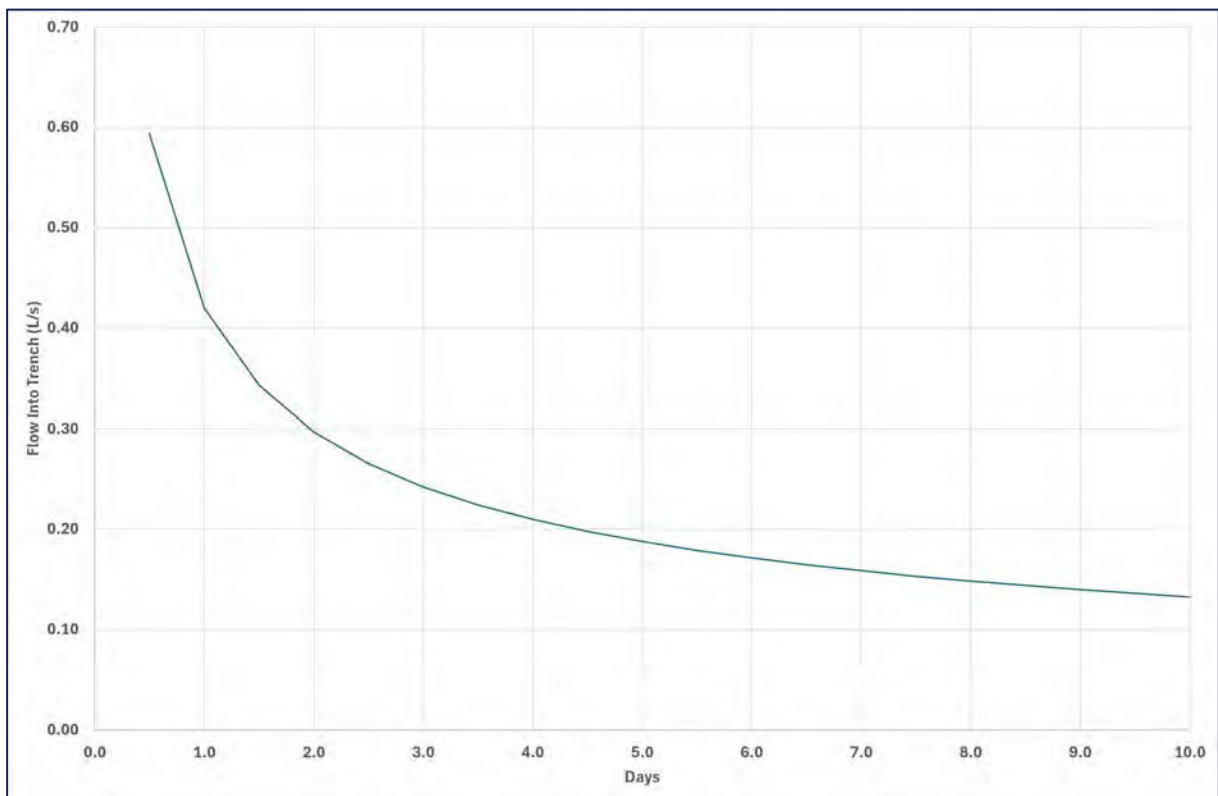


Figure 27: Projected Groundwater Inflows Over Time into a 20 m Trench in Pipeline 2A

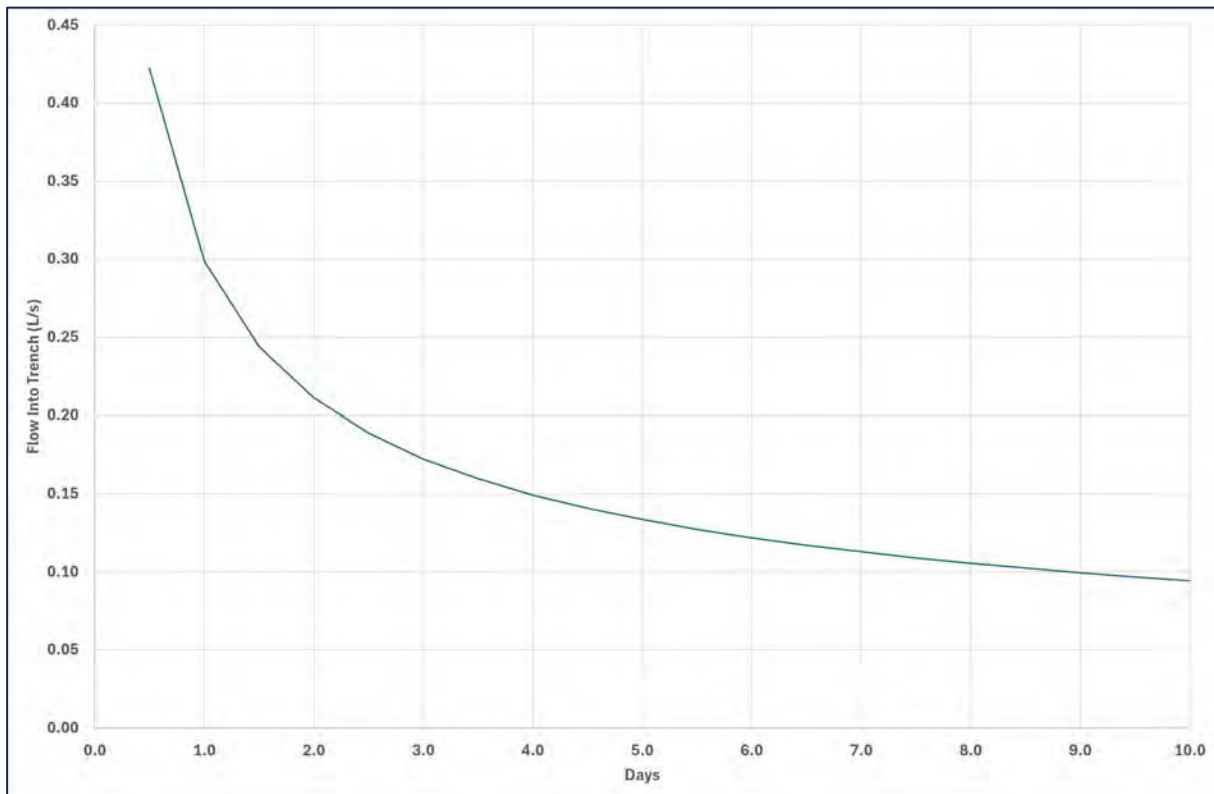


Figure 28: Projected Groundwater Inflows over Time into a 20 m Trench in Pipeline 3A

5.2 Wastewater Pump Station Installation

5.2.1 Introduction

Three wastewater pumping stations (WWPS) named A, B and D are planned for construction (Figure 24). WWPS A and B are located on the flat central area of the site adjacent to Wetlands A1 and B respectively. WWPS D is located in the northern portion of the site in an area of proposed cut adjacent to Wetland F. Engineering designs for each WWPS are provided in Appendix F.

5.2.2 Modelling Methodology

WGA has made the following assumptions to support an assessment of the dewatering required to support construction of each WWPS and the associated drawdown:

- WWPS A requires excavation to a depth of 3.96 m below existing ground level and a width of approximately 19.6 m.
- WWPS B requires excavation to a depth of 4.69 m below existing ground level and a width of approximately 19.9 m.
- The area in which WWPS D is located is being cut to approximately 44 m RL. Therefore, the excavation depth for the purposes of constructing WWPS D is considered to be from the proposed ground level. WWPS D requires excavation to a depth of 3.34 m below proposed ground level and a width of approximately 16.4 m.
- The excavations assume:
 - An additional 1 m dewatering radius for bore offset distance from excavation width.
 - 0.5 m of dewatering will be achieved below the excavation invert for construction purposes.

- Groundwater is assumed to be at existing ground surface for WWPS A and B. Groundwater level is assumed to be approximately 43.5 m RL at WWPS D.
- Excavations will require 10 days until the well is fully sealed and active dewatering can cease. For groundwater drawdown assessment purposes, dewatering has been modelled to be achieved within three days. The targeted dewatering depth is assumed to increase through the 10-day dewatering and construction period, consistent with the progressive increase in the excavation depth.

5.2.3 Dewatering Analytical Model

The excavation dewatering has been assessed using the published Theis model to calculate drawdown from a pumping well under unconfined aquifer conditions. Calculation sheets are included in Appendix H. A hydraulic conductivity of 1.9×10^{-6} m/s, is considered conservative for WWPS A and B. For WWPS A and B an assumed aquifer thickness of 30 m was used to derive a transmissivity of $5 \text{ m}^2/\text{day}$ for this assessment. WWPS D is located on the Walton Subgroup hill adjacent to Wetland F and is assumed to be in the sand layer therefore a hydraulic conductivity of 1×10^{-5} m/s along with an aquifer thickness of 10 m has been used to derive a transmissivity of $8.6 \text{ m}^2/\text{day}$ for the assessment.

A storativity of 0.1 has also been assumed for the assessment of all WWPS.

The dewatering model applied in this assessment functions on a transient basis. The pumping rate identified in Table 14 is defined to achieve the dewatering target within three days. After that time, the pumping rate would be reduced to a rate sufficient to simply maintain the level of drawdown through the wet well construction period. On that basis:

1. The pumping rate required has been calculated based on achieving the drawdown target within three days.
2. The calculated drawdown effects in Table 14 have been assessed based on an assumed constant flow rate that would achieve the targeted drawdown over 10 days.

Table 14: Projected Effects of WWPS Dewatering

PARAMETER	PUMP STATION A	PUMP STATION B	PUMP STATION D
Existing Ground Level (m RL)	24.0	25.0	53.0
Groundwater Depth (m RL)	24.0	25.0	43.2
Modelled Excavation Depth Below Groundwater (m)	3.96	4.69	2.54
Modelled Excavation Width (m)	19.6	19.9	16.4
Targeted drawdown (m) ⁽¹⁾	4.96	5.69	3.54
Pumping rate to achieve dewatering within three days (L/s)	8.8	10.3	4.8
Pumping rate to achieve dewatering within 10 days (L/s)	2.9	3.4	2.4
Calculated radius of influence after 10 days pumping (m) ⁽²⁾	60	62	67
Distance to nearest building (m)	431	137	60.4
Calculated drawdown at nearest building after 10 days (m) ⁽²⁾	<0.25	<0.25	0.38

Note:

⁽¹⁾ Radius of influence is based on calculated drawdown of 0.25 m of the piezometric surface, on the assumption that pumping is continuous at a constant rate over a 10 day period.

The key points arising out of this drawdown assessment are:

1. The calculated drawdown relating to the construction of each WWPS does not extend outward far enough to significantly impact the nearest buildings.
2. The projected drawdown at the building located approximately 60.4 m to the west of WWPS D is 0.38 m. This is based on a conservative assessment assuming a higher than expected water table and is within the natural fluctuation of groundwater observed in the groundwater monitoring at the site.
3. Pumping rates to achieve drawdown at each WWPS are between 2 and 11 L/s.
4. WWPS A is expected to temporarily cause stream depletion effects during construction due to the expected excavation levels being lower than the surveyed bed level of the adjacent farm drain. Interception of shallow groundwater contributions to the neighbouring drains/stream baseflow is also anticipated during construction of the remaining WWPS, however, to a lesser extent. It is considered any intercepted groundwater from these works can be temporarily diverted back to the local drainage network or stream.
5. The drawdown assessments were conducted using groundwater levels from ground surface (WWPS A and B) and higher than anticipated groundwater levels (WWPS D) as a starting condition. Therefore, the calculated results are considered to represent conservatively large outcomes.
6. It is likely construction would occur during a summer period when earthmoving operations and water management would be easier. The groundwater levels are reasonably expected to be lower during such periods, with correspondingly reduced requirements for reduced requirements for groundwater drawdown and abstraction rates.
7. The construction of the WWPSs will occur after cut and fill activities and for the WWPS A and B following compaction of the soft sediments. As demonstrated in Section 3, the compaction of these soils will reduce the hydraulic conductivity of the sediments which would in turn reduce the drawdown effects from construction dewatering.

6 ASSESSMENT OF GENERAL EARTHWORKS

6.1 Introduction

Earthworks and the creation of impervious surfaces as part of the Development have the potential to change the amount of rainfall recharge to the groundwater system. This cumulative change to recharge may consequently affect the rate and timing of groundwater discharges to existing groundwater-fed wetlands. Therefore, the Development may reduce existing baseflows through the existing wetlands that support the wetland ecology. These effects are expected to vary between wetland catchments depending on the extent of earthworks, the proportion of impervious surface coverage within the catchment once development is complete, and whether stormwater runoff is retained or redirected within the local catchment.

The earthworks associated with the construction of wetlands for offsetting have also been assessed in terms of excavation beneath the water table and effects of drawdown during these construction works.

6.2 Earthworks in the Northern Slope Area

6.2.1 Introduction

To assess the effects of earthworks and development on the existing gully wetlands, a soil moisture water balance has been applied for each catchment on site feeding groundwater to a wetland to estimate groundwater recharge pre and post development (Figure 29). Groundwater recharge upstream of each wetland is largely considered responsible for base groundwater inflows into each wetland.

6.2.2 Methodology

A rainfall and potential evapotranspiration (PET) dataset has been obtained from the NIWA climate station located at the Ruakura Research Centre. The record extends over 20 years from 2005 to 2026. Gaps in the PET record were filled with the average PET for the full time period.

The soil moisture balances were assessed using the three-step calculation described by Rushton et al. (2006).

1. Infiltration and Near-Surface Soil Storage:
 - Infiltration to the soil zone and the water storage in the topsoil at the end of each day were calculated. Infiltration includes not only rainfall minus runoff, but also residual soil moisture carried over from the previous day.
2. Estimation of Actual Evapotranspiration (AET):
 - Actual evapotranspiration was calculated on a daily basis using total available water (TAW) and readily available water (RAW), derived from values for the soil field capacity, wilting point, and rooting depth (Allen et al., 1998). Seasonal variation in rooting depth was considered, which was assumed at 500 mm. The depletion factor, which defines the fraction of TAW that can be depleted before AET is reduced, was set to 0.5 for typical New Zealand conditions. Near-surface soil retention (Fracstor) values were assigned based on a soil texture at 0.5 (Rushton et al., 2006).
3. Soil Moisture Deficit and Groundwater Recharge:
 - Soil moisture deficit and potential groundwater recharge were calculated based on the water balance. Recharge was assumed to occur only when the soil moisture reservoir exceeded its capacity (i.e., when the soil moisture deficit became negative).

An average annual groundwater recharge was calculated using this method for three SCS curve numbers (Maven pers comms); 89 for pre-development pervious surfaces, 98 for impermeable surfaces post-development, and 84 for reworked permeable surfaces post-development.

For the purpose of the moisture balance calculation the site has been categorised into three types of development:

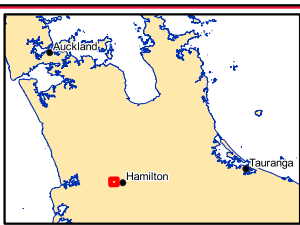
- **Undeveloped:** Calculated as 100% pre-development surfaces (SCS curve number 89).
- **High Density:** Calculated as 80% Impermeable surfaces (SCS curve number 98) and 20% reworked surfaces (SCS curve number 84).
- **Low Density:** Calculated as 10% Impermeable surfaces (SCS curve number 98), 45% reworked surfaces (SCS curve number 84) and 45% pre-development surfaces (SCS curve number 89).

Recharge has been calculated for each catchment before development (100% undeveloped surfaces) and after development.

6.2.3 Results

The estimated reduction in groundwater recharge to each catchment varied significantly across the site depending on the proportion of catchment being developed. The greatest reduction was 56% for catchment Southern 20.

The reduction in recharge to the catchments would result in a corresponding reduction in baseflow to the receiving gully wetlands and streams. The reduction in recharge has been built into the Maven stormwater plans which have been adapted to ensure at least the equivalent recharge loss is being returned to the upper reaches of the natural wetlands through treatment Wetland G.

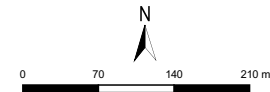


LEGEND

- Site Boundary
- Existing Wetlands

Catchment Name

- Northern 10
- Northern 20
- Northern 30
- Northern 40
- Northern 41
- Northern 42
- Northern 43
- Northern 50
- Southern 10
- Southern 11
- Southern 12
- Southern 20
- Southern 30



Scale 1:7 000 @A4

Coordinate System: NZGD 2000 New Zealand Transverse Mercator

WGA

Figure 29
Brymer Farms Limited
Existing Wetland
Catchment Boundaries

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Any reliance placed on such information shall be at the risk of the user.
Note: The information shown on this map is copyright of WGA 2026

Table 15: Potential Loss of Recharge to Existing Wetlands per Catchment.

Name	Order	Total Area (m ²)	High Density Developed Surface Area (m ²)	Percentage High Density Developed (%)	Low Density Developed Surface Area (m ²)	Percentage Low Density Developed (%)	Total Recharge Pre-Development (m ³ /year)	Total Recharge Post-Development (m ³ /year)	Percentage Recharge Reduction (%)
Northern 10	No change to catchment								
Northern 20	No change to catchment								
Northern 30	1	8,471	0	0.0%	967	11.4%	2,133	2,136	0%
Northern 40	1	74,460	22,559	30.3%	13,480	18.1%	18,752	14,551	22%
Northern 41	2	17,794	3,982	22.4%	1,469	8.3%	4,481	3,737	17%
Northern 42	2	23,982	11,164	46.6%	0	0.0%	6,040	3,939	35%
Northern 43	2	14,405	6,562	45.6%	0	0.0%	3,628	2,393	34%
Northern 50	1	15,658	846	5.4%	1,423	9.1%	3,943	3,789	4%
Southern 10	1	77,085	9,770	12.7%	0	0.0%	19,413	17,575	9%
Southern 11	2	21,236	2,162	10.2%	0	0.0%	5,348	4,941	8%
Southern 12	2	30,320	3,794	12.5%	0	0.0%	7,636	6,922	9%
Southern 20	1	43,956	33,215	75.6%	0	0.0%	11,070	4,821	56%
Southern 30	1	57,534	12,169	21.2%	0	0.0%	14,489	12,200	16%

6.3 Earthworks Associated with Offsetting Wetland Creation

6.3.1 Introduction

One wetland will be created to offset the loss of current natural wetlands through the development. EcoLogical Solutions have calculated that 0.75 Ha of wetland are required for offsetting requirements. Figure 31 shows the proposed concept for the wetland and Figure 32 shows the proposed contouring.

The offset is located on the western side of the Development. The nearest piezometer is P2 (Figure 8), which has recorded groundwater levels ranging from 0.43 m to 0.57 m bgl. Wetland A1 is located on peat and, according to the cut and fill map (Appendix F), the wetland area will be cut by between 0 and 1.5 m. Based on a 2.5 m deep wetland design, this wetland area would intersect peat and the shallow groundwater and will therefore require dewatering during construction. Following construction, the groundwater levels will be allowed to rise to natural levels within the newly formed wetland therefore long-term drawdown from the feature is not expected.

6.3.2 Methodology

An assessment of potential groundwater drawdown and inflows at the constructed offset wetland, has been undertaken using the same method (Marinelli & Niccoli, 2000) as outlined in Section 4. Inputs used for the pit model are provided in Table 16.

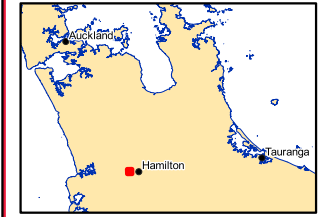
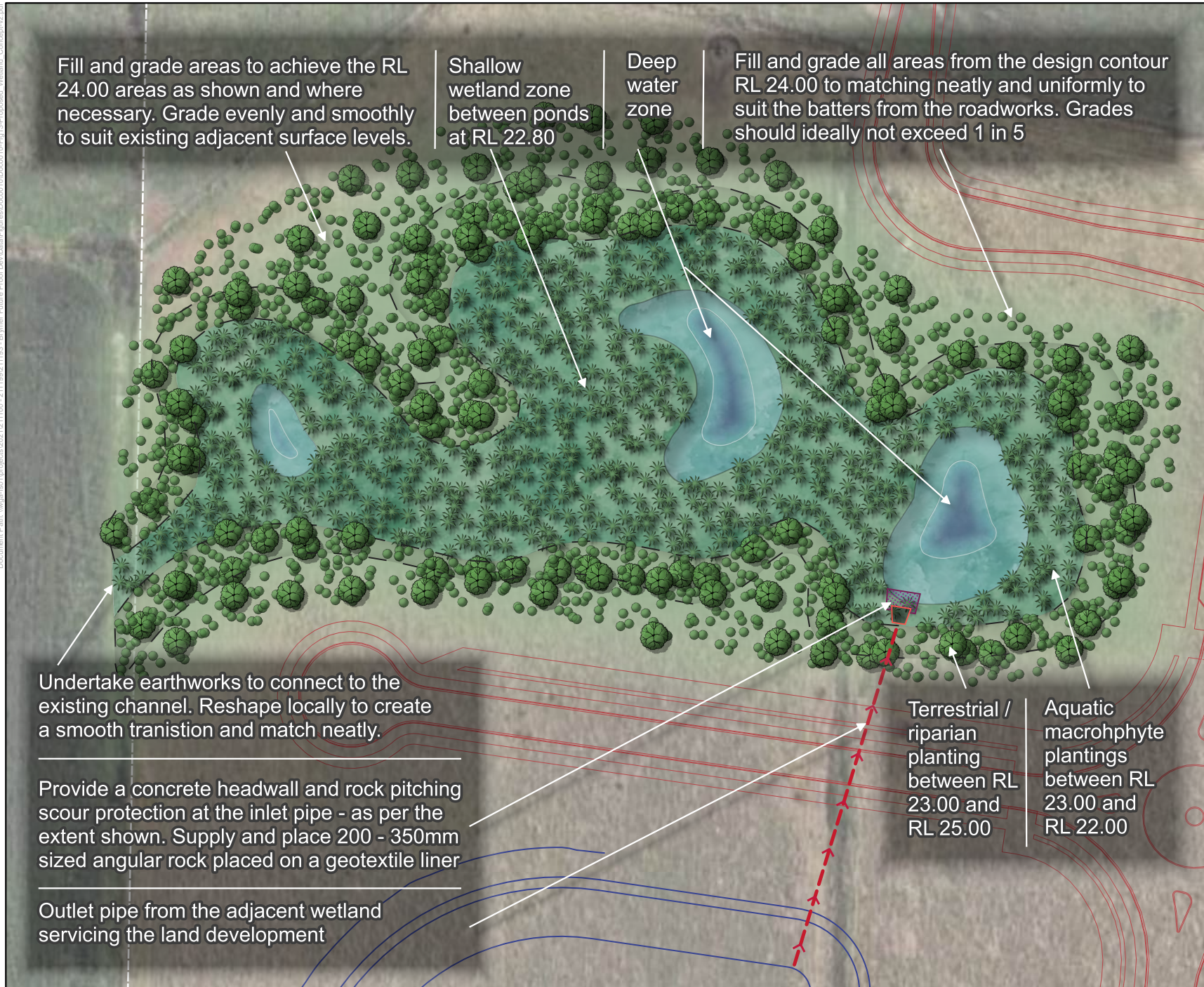
Table 16: Offset Wetland Pit Model Input Parameters

MODEL INPUTS	
Existing ground elevation (m RL) ⁽¹⁾	24.0
Existing winter groundwater level (m RL) ⁽¹⁾	24.0
Design invert elevation ⁽¹⁾	21.5
Dewatering level (1 m below final invert level)	20.5
Design area at rim elevation (m ²)	11,500
Effective radius at rim elevation (m) ⁽²⁾	61

Notes:

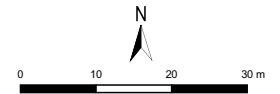
⁽¹⁾ Note that groundwater level is assumed to be at ground surface for modelling of short-term construction inflows.

⁽²⁾ Assuming wetland area is treated as a circle.



LEGEND

- Aquatic Macrophyte Zone
- Deeper Wetland Pools
- Riparian Planting
- Shallow Wetland Zone
- Site Boundary
- Proposed Stormwater Wetland
- Proposed Roading
- Potential Outlet From Stormwater Wetland



Scale 1:1 000 @A4

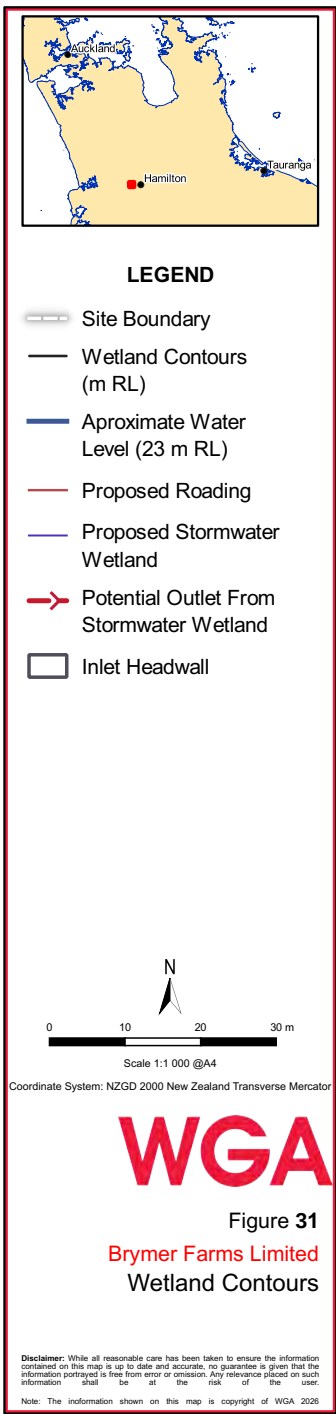
Coordinate System: NZGD 2000 New Zealand Transverse Mercator

WGA

Figure 30

Brymer Farms Limited
Proposed Wetland Concept

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Any reliance placed on such information shall be at the risk of the user.
Note: The information shown on this map is copyright of WGA 2020



6.3.3 Results

The projected groundwater drawdown effects have been evaluated for the offset wetland, (as detailed in Table 10 and provided in Appendix F. The groundwater inflows at the offset wetland have been calculated assuming the drawdown generated does not intersect other stormwater wetlands during individual construction. The radius of groundwater drawdown and the groundwater inflows during both the construction period (dry pit) are presented in Table 17.

Table 17: Projected Effects of Proposed Offset Wetland

SCENARIO	INITIAL SATURATED THICKNESS ABOVE BASIN INVERT (m) ⁽¹⁾	RADIUS OF DRAWDOWN (m) ^{(2) (3)}	CALCULATED GROUNDWATER INFLOW (m ³ /day) ^{(2) (4)}
Construction	3.5	87	62

Notes:

- (1) Saturated thickness during construction taken from ground surface to 1 m below basin invert level.
- (2) Drawdown extents and inflows do not take account of changes in soil permeability resulting from compaction.
- (3) Radius of drawdown taken from centre point of excavation.
- (4) Values reported to two significant figures.

The key points arising out of this drawdown assessment are:

1. The calculated drawdown relating to the construction of the wetland does not extend outward far enough to impact the nearest buildings.
2. The calculated groundwater inflow for each of the scenarios considered is less than 60 m³/day (0.7 L/s).
3. Excavation for the wetland is expected to temporarily cause stream depletion effects during construction due to the expected excavation levels being lower than the surveyed bed level of the adjacent farm drain (Table 18). It is considered any intercepted groundwater from these works can be temporarily diverted back to the local drainage network or stream.
4. The drawdown assessments were conducted using groundwater levels from ground surface as a starting condition to provide estimates of inflows and drawdown extents. Therefore, the calculated results are considered to represent conservatively large outcomes.
5. It is likely wetland construction would occur during a summer period when earthmoving operations and water management would be easier. The groundwater levels are reasonably expected to be lower during such periods, with correspondingly reduced requirements for reduced requirements for groundwater drawdown and abstraction rates.

Table 18: Existing and Design Elevations of Offset Wetland Compared to Neighbouring Stream/Drain Heights

EXISTING GROUND ELEVATION (m RL)	DESIGN INVERT ELEVATION (m RL)	DESIGN EXCAVATION DEPTH (m)	STREAM/DRAIN INVERT (m RL) ⁽¹⁾	DEPTH FROM DESIGN INVERT TO STREAM/DRAIN INVERT (m)
24.0	Wetland 21.5	21.0	23.5	-2.5

Notes:

- (1) Drain invert levels provided by Maven survey, 03/06/2026.

7 GROUNDWATER EFFECTS ASSESSMENT

7.1 Effects Overview on Catchment Water Balance

The proposed Brymer development includes:

- Pre-construction pre-loading of peat in the low-lying areas of the site, except for where wetland construction is proposed to help stabilise the ground surface in these areas.
- Construction of wastewater infrastructure and stormwater management features.
- Construction and excavations in areas adjacent to existing wetlands.
- Construction of a wetland for offsetting purposes.

These activities have the potential to influence shallow groundwater conditions locally during construction and over the long term. However, no long-term adverse effects on the catchment-scale groundwater balance are anticipated. The conceptual site models are presented in Figure 32 to Figure 33 and indicate how the above activities will interact with the site environment on both the flat portion of the site and the sloped areas.

Groundwater conditions across the site are characterised by shallow groundwater within the peat and silts in the low-lying areas. The phreatic surface largely follows topography in the hilly areas of the site, providing seepage to gullies and associated wetlands. Groundwater flow across the flat areas of the Site is generally directed toward drains, which act as key discharge features, particularly during wetter conditions. The proposed development is not expected to alter this overall flow regime or materially affect discharge to these drains.

Recharge to the shallow groundwater system is primarily rainfall-driven. Sealing and reworking of ground surfaces as a result of the Development is expected to reduce groundwater recharge. These reductions and reductions in evapotranspiration will continue following development, although these will be offset and redistributed spatially through engineered drainage, fill placement, and stormwater management features which will provide reliable base flows to the drains.

Laboratory analysis has indicated that peat and silt compaction associated with pre-loading will reduce the storage capacity and hydraulic conductivity of peat and silt soils within treated areas. The groundwater assessments presented in this report have been undertaken assuming a range of parameters representative of both pre compaction and post compaction scenarios.

Overall, the Development is not expected to result in a measurable long-term change to the catchment water balance as stormwater wetlands will act to divert groundwater flows but will not change the water budgets significantly.

Note: not drawn to scale

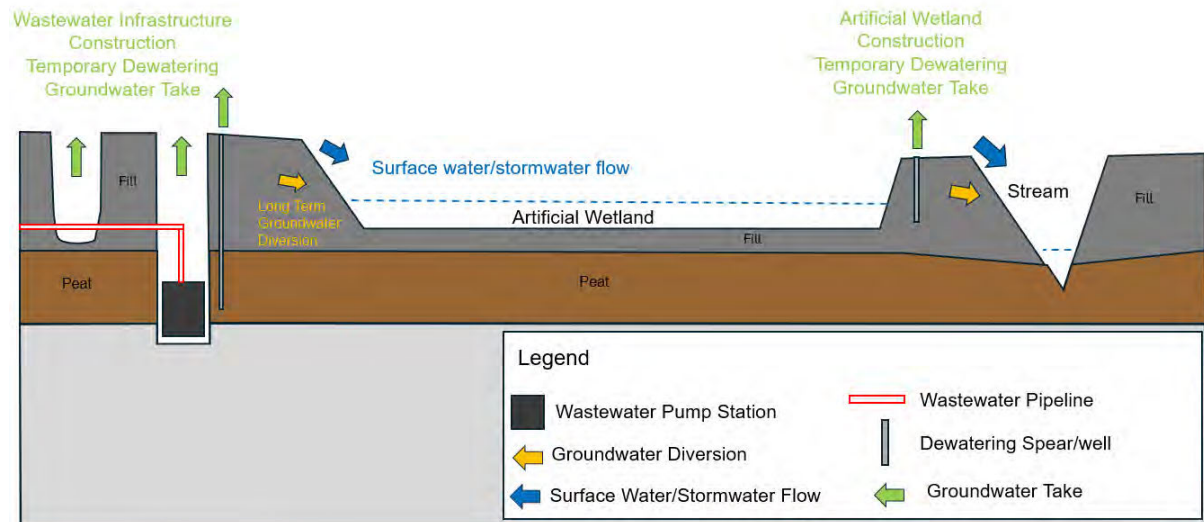


Figure 32: Conceptual Schematic of Water Interactions of the Combined Proposed Activities (Excavations in Fill)

Note: not drawn to scale

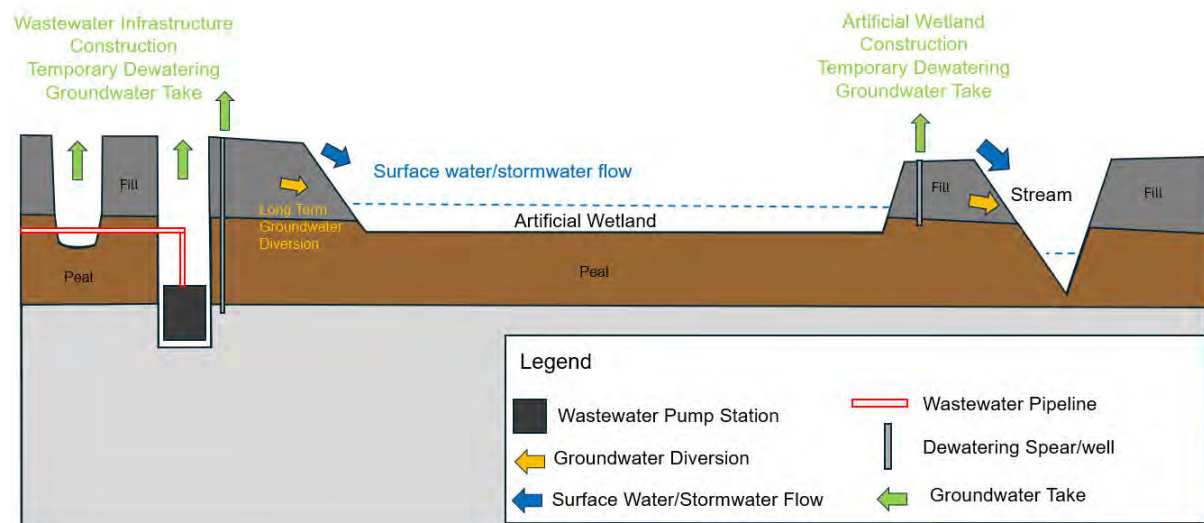


Figure 33: Conceptual Schematic of Water Interactions of the Combined Proposed Activities (Excavations in Peat)

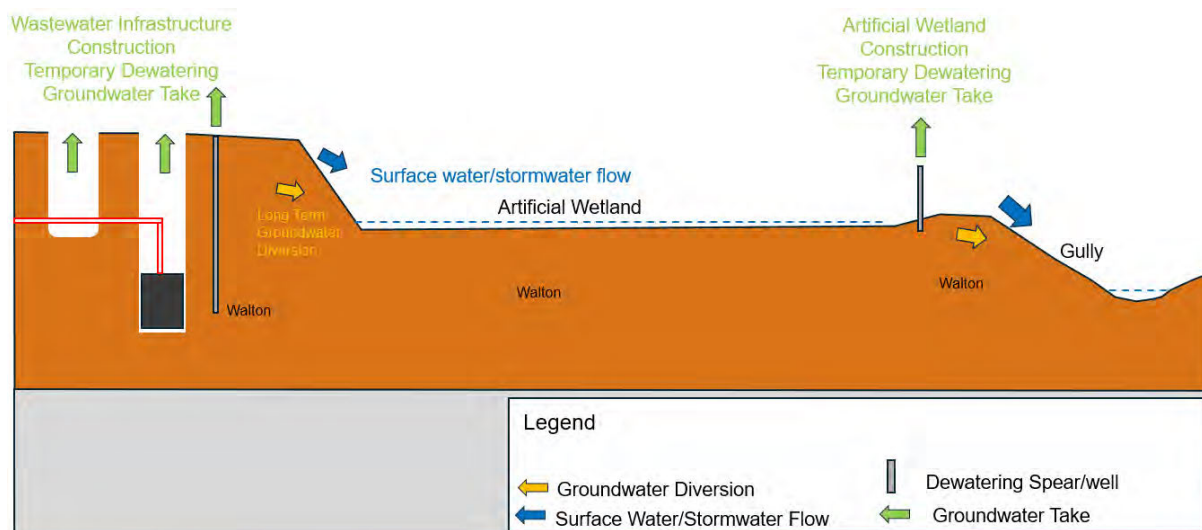


Figure 34: Conceptual Schematic of Water Interactions of the Combined Proposed Activities (Excavations in Walton)

7.2 Dewatering Effects Assessment

Stormwater wetland construction is planned to be staged. The combined rate of groundwater abstraction during the construction phase is expected to vary as each wetland is excavated and brought online. Conservative dewatering assessments were undertaken by considering the groundwater table exists at ground level. Based on current design and staging, the largest construction groundwater abstraction is expected to be approximately 104 m³/day during construction. Pumped groundwater (where required during construction) and diverted inflows will be managed under a water management plan and an erosion and sediment control plan for the project. Groundwater pumped during earthworks will be discharged upstream of the works to maintain the flow regimes in the neighbouring drains

Wastewater infrastructure may be planned to be constructed progressively or overlapping, based on the installation of consecutive 20 m lengths of pipeline in similar dewatered trench sections. The WWPS's will be constructed separately, with construction schedules that will probably overlap the construction schedule for the pipelines. The largest abstraction for pipeline and drain installations is expected to occur for the deepest sections, at < 0.6 L/s (Figure 25 to 28) However, it is understood overlapping construction operations may increase cumulative dewatering rates for pipeline installation. The largest flows are expected during dewatering for the deeper excavations of the WWPS's where flows of up to approximately 900 m³/day may occur. Therefore, to accommodate initial higher flow rates and multiple pipelines being installed simultaneously a daily maximum abstraction rate of 1,500 m³/day is proposed.

Table 19: Summary of Construction Dewatering Flow Rates and Operational Cumulative Groundwater Diversions

EXCAVATION TYPE	TOTAL INFLOW CONSTRUCTION (m ³ /day) ⁽¹⁾	TOTAL INFLOW (WINTER) OPERATIONAL GROUNDWATER DIVERSION (m ³ /day)	CUMULATIVE OPERATIONAL GROUNDWATER DIVERSION (m ³ /day)
See Section 4			
Stormwater Wetland A1	45	15	48
Stormwater Wetland A2 and B	44	10	
Stormwater Wetland C	30	11	
Stormwater Wetland D	25	5	
Stormwater Wetland E	34	7	

EXCAVATION TYPE	TOTAL INFLOW CONSTRUCTION (m³/day) ⁽¹⁾	TOTAL INFLOW (WINTER) OPERATIONAL GROUNDWATER DIVERSION (m³/day)	CUMULATIVE OPERATIONAL GROUNDWATER DIVERSION (m³/day)
Stormwater Wetland F	104	N/A	
Stormwater Wetland G	5	N/A	
See Section 5			
20 m Trench for Wastewater Pipeline	62	N/A	N/A
See Section 5			
WWPS A	<767	N/A	
WWPS B	<890		
WWPS D	<415		
See Section 6			
Natural Wetland	62	N/A	

Notes: The largest flows are expected during dewatering for the deeper excavations of the WWPS's where flows of up to approximately 900 m³/day may occur. Therefore, to accommodate initial higher flow rates and multiple pipelines being installed simultaneously a daily maximum abstraction rate of 1,500 m³/day is proposed.

Table 19 combines results from different groundwater assessment methods, including steady state and transient dewatering analyses. These values are not directly comparable and should be interpreted with reference to the relevant methodology in Sections 4 to 6. Those listed with "<" are the max starting rates for dewatering analyses.

7.2.1 Effects on Nearby Bores

Of the surrounding groundwater users, there are only two current groundwater take consents within 1 km of the Site (Table 6 and Figure 11). The furthest radial extent of dewatering impacts from proposed site activities assessed in this report did not extend to the distance of any of the existing groundwater takes or nearby bores.

7.2.2 Effects on Nearby Surface Water Features

Excavation of Stormwater Wetlands A1, B, C, the natural wetland and WWPS A are expected to temporarily cause stream depletion effects during construction due to their design base levels being lower than the surveyed bed level of the adjacent farm drain. Groundwater intercepted during construction will be discharged to the receiving drain upstream of the works, as proposed through the Residential Development consent conditions. This measure will maintain continuity of surface water flows and mitigate temporary stream depletion effects during construction. For the remaining stormwater wetlands, intercepted groundwater may be discharged in accordance with the construction management framework, as stream depletion effects are not predicted to occur. With these measures in place, no sustained reduction in surface water flows or material changes to downstream hydrology are anticipated, and effects on stream flows are assessed to be minor and temporary.

Compaction of the soft sediments across the flats and subsequent site development are expected to reduce infiltration and groundwater recharge to the underlying sediments. This may result in a reduction in groundwater throughflow from the flat portion of the site to the drains. However, the stormwater system has been designed such that runoff from developed areas will be collected and conveyed to the stormwater basins, with subsequent discharge to the receiving streams (Maven, 2026). Accordingly, while groundwater contributions to the drains may decrease, no material reduction in overall stream flows is anticipated because rainfall that would otherwise infiltrate and contribute to groundwater flow will remain within the catchment and be redirected to the streams via the stormwater network.

7.2.3 Effects on Natural Wetlands

The results of the assessment on the proposed earthworks and development in the northern slope area indicated development would result in the loss of recharge and therefore potential baseflows to the existing wetlands which are being maintained and restored as part of the Development. This has been mitigated by redesign of the stormwater network to redirect treated stormwater flows into the upper reaches of the gully wetlands and streams through Wetland G.

7.2.4 Effects on Ground Subsidence

In the low lying areas of the site assessments of the construction and operation of proposed infrastructure indicated that drawdown would not extend to the nearest buildings.

Wetland F and WWPS in the northern slope area are 20 m and 60.4 m from the nearest building respectively. The projected drawdown at the building during construction of Wetland F and WWPS D is 0.34 m and 0.38 m respectively. This is within the natural fluctuation of groundwater observed in the groundwater monitoring at the site.

The groundwater drawdown predictions presented in Sections 4, 5 and 6 have been provided to CMW for assessment of potential settlement and other geotechnical effects associated with the proposed construction and operational dewatering activities. Assessment of ground settlement, including any implications for existing and proposed buildings and infrastructure, falls outside the scope of this hydrogeological assessment and is addressed in the accompanying Geotechnical Assessment (CMW, 2026).

7.3 Anticipated Implications for Water Quality

The change in land use from farming to industrial activity, together with the introduction of stormwater wetlands, is expected to reduce nutrient inputs to shallow groundwater. However, measures such as bunding and other site controls will be required to prevent industrial contaminants from entering drainage systems and surrounding water catchments. Construction activities may temporarily increase sediment-related risks, but these will be managed through the implementation of an erosion and sediment control plan.

8 MONITORING AND MITIGATION

8.1 Groundwater Monitoring

Groundwater levels across the site have been characterised using four piezometers installed in October 2025 and monitored since then. This monitoring period captured both summer and winter groundwater conditions. The resulting groundwater level dataset is sufficient to define potential seasonal groundwater level variability and baseline groundwater conditions for the purposes of the effects assessment.

The investigations and modelling completed for this assessment indicate that the predicted groundwater drawdown effects associated with construction dewatering and long-term operation of the proposed stormwater wetlands are localised, temporary (during construction), and have been conservatively assessed using site-specific hydraulic parameters. Groundwater drawdown effects do not impact the availability of water at nearby groundwater abstraction bores. The long-term groundwater diversion to the stormwater wetlands represents a redistribution of groundwater discharge within the Development site catchment rather than a net loss.

Based on the investigations, monitoring and assessments completed for this report, no additional permanent groundwater monitoring sites are considered necessary to manage or verify effects from the proposed development. WGA recommend continuing to monitor the existing piezometers established on site with level loggers recording water levels at 15-minute intervals and downloaded every three months. Additional monitoring will inform detailed design.

WGA understands that CMW may require targeted short-term groundwater level monitoring to support the identification and mitigation of potential ground settlement effects during construction to confirm groundwater behaviour remains consistent with predictions.

8.2 Surface Water Monitoring

Surface water features within and downstream of the Development consist of farm drains that, during wet periods, are likely to discharge to the boundary drains and the headwaters of the Ohote catchment. Potential effects on surface waters include interception of groundwater contributions during construction dewatering for stormwater wetlands and wastewater infrastructure. With the proposed management measures, these effects have been assessed as minor and temporary (i.e. they will be appropriately managed through the proposed construction methodology and the placement of temporary water discharge points).

In the above context, including the short duration of dewatering activities, the absence of predicted long-term surface water effects, and the implementation of erosion and sediment control measures under the Development's construction management framework (namely, the ESCP), additional surface water flow or level monitoring is not considered necessary for the operational phase of the development. Visual inspections of drains and stream reaches during construction, undertaken as part of standard environmental compliance checks and incorporated into proposed consent conditions, are considered sufficient to confirm expected performance.

8.3 Wetland Monitoring

Wetland monitoring will be undertaken by a suitably qualified ecologist to confirm there is no degradation to the existing wetlands and to monitor the ongoing performance of the constructed natural wetland.

9 CONCLUSIONS

The assessment concludes that the proposed Brymer development works are expected to result in temporary and localised groundwater effects that are no more than minor and can be appropriately managed. Construction-related effects are expected to be temporary and localised. Operational effects are expected to comprise minor localised groundwater redistribution rather than any material long-term reduction in catchment groundwater resources.

Site investigations and groundwater monitoring confirm that the contains a shallow groundwater system within the peat. Groundwater conditions are controlled by rainfall recharge, artificial drainage, and the low permeability of peat, resulting in a shallow phreatic surface which is close to ground surface between the drains. Hill slopes are characterised by low permeability Walton Subgroup and Hamilton Ash sediments.

The assessment is based on site-specific investigations, monitoring data, and conservative analytical methods, and assesses both existing pre-compaction conditions and expected conditions post peat and soft soil compaction. The values presented throughout the report represent the pre-compaction conditions which provides a conservative basis for evaluating groundwater drawdown and inflows with the proposed works.

The assessment indicates that groundwater effects during construction will be temporary, localised, or within the range of natural seasonal fluctuations, with negligible effects on nearby bores, surface water features, and surrounding land. During operation, the stormwater wetlands will act as persistent hydraulic features within the catchment.

Overall, our assessment indicates that actual effects are likely to be equal to or less than those predicted including conservative assumptions of groundwater at surface during wet conditions and pre-compaction hydraulic parameters. Potential risks associated with groundwater drawdown and mounding can be managed through standard construction practices, erosion and sediment controls, and targeted monitoring where required. On this basis, the proposed works are considered acceptable and consistent with the sustainable management of groundwater resources within the catchment.

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APPENDIX A

LITHOLOGICAL LOGS



Tonkin and Taylor (2021) Investigations

BOREHOLE LOG

BOREHOLE No.: **BH101**

Hole Location: Southern hill

SHEET: 1 OF 6

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5814995.96 mN (NZTM2000) 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
R.L.: 45.24m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL		ENGINEERING DESCRIPTION																
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations		
Weathered Volcanic Ash (HAMILTON ASH)			100	HQTT		● 86/39 kPa 1/2 2/2 2/2 N=8			45		M	F				0.00m: Clayey SILT, trace organics and trace sand; dark brown. Firm, moist, low plasticity. Sand, fine; organics, rootlets. Topsoil.		
											0.5		St				0.30m: Clayey SILT; brown. Stiff, moist, low plasticity. Suspected small fragments of charcoal.	
											1.0							1.00m: Silty CLAY; brown. Stiff, moist, medium plasticity.
			100	SPT							1.5							1.60m: Clayey SILT; brown. Stiff, moist, low plasticity. Silt, slow dilatancy.
											2.0							1.95m: CORE LOSS. 1.95 - 2.25.
			80	HQTT							2.5							2.25m: Clayey SILT; brown. Stiff, moist, low plasticity.
											3.0			VSt				2.60m: Clayey SILT; yellowish brown. Very stiff, moist, low to medium plasticity.
			100	SPT							4.2							3.30m: Clayey SILT; light brown. Very stiff, moist, medium plasticity. Suspected small fragments of charcoal.
											3.5							
			100	HQTT							4.0							
Walton Subgroup						● 33/11 kPa 1/1 0/1 0/2 N=3			4.5			F				4.50m: Silty CLAY; light brown mottled black. Firm, moist, medium plasticity. Suspected small fragments of charcoal.		

COMMENTS: Hole backfilled with bentonite

Hole Depth
27.45m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH101**

Hole Location: Southern hill

SHEET: 2 OF 6

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5814995.96 mN (NZTM2000) 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
R.L.: 45.24m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL		ENGINEERING DESCRIPTION														
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (kPa)	DEFECT SPACING (cm)	Description and Additional Observations
Walton Subgroup			100	HQTT		● 75/25 kPa 1/1 1/1 1/2 N=5		40			M	Fr				5.00m: Silty CLAY; light brown mottled black. Firm, moist, medium plasticity. Suspected small fragments of charcoal.
			100	SPT				5.5			St				5.30 - 5.40m: Minor sand, fine to coarse.	
			100	SPT			6.0							5.40m: Silty CLAY; reddish brown mottled black. Stiff, moist, medium plasticity. Suspected small fragments of charcoal.		
			100	SPT			39							5.70 - 5.90m: Becomes wet, very soft. light greyish brown. Grades to stiff.		
			100	HQTT			6.5							6.40m: Silty CLAY; brownish orange mottled black. Stiff, moist, medium plasticity. Suspected small fragments of charcoal.		
			100	HQTT			7.0									
			100	SPT		● 42/14 kPa 0/0 0/0 0/0 N=0	7.5			S-F				7.50m: Clayey SILT; yellowish brown mottled black. Soft to firm, moist, low plasticity. Suspected small fragments of charcoal.		
			100	HQTT			8.0									
			100	HQTT			8.5			F				8.50m: Sandy SILT, minor clay; light brown mottled black. Firm, moist, low plasticity.		
			100	PT			9.0			St				8.90m: Clayey SILT; light brown mixed with some black. Stiff, moist, low plasticity. Suspected small fragments of charcoal.		
			100	SPT		2/1 2/2 1/3 N=8	36						9.00m: Pushtube. Material observed as Clayey SILT as above.			
					9.5								9.50m: Silty CLAY; light yellowish brown. Stiff, moist, high plasticity.			

COMMENTS: Hole backfilled with bentonite

Hole Depth
27.45m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH101**

Hole Location: Southern hill

SHEET: 3 OF 6

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5814995.96 mN (NZTM2000) 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
R.L.: 45.24m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL		ENGINEERING DESCRIPTION																																																																															
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)		WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations																																																																
	15 min	30 min												10 25 50 100 200	1 20 50 100 250	20 50 100 200 500																																																																	
Walton Subgroup	Box 3, 7.1-11.4m			100	HQTT		● 56/28 kPa 1/1 1/1 0/2 N=4		35	10.5		M	St				10.00m: Silty CLAY; light brown. Stiff, moist, high plasticity.																																																																
				100	SPT														11.0		F				10.95m: Silty CLAY; light brown mottled orange. Firm, moist, medium plasticity.																																																								
				100	HQTT																						11.5						11.70m: Clayey SILT; light brown mottled orange. Firm, moist, medium plasticity.																																																
				100	SPT																														12.0		St				12.00m: SILT, some clay, minor sand; brown mixed with some greyish red. Stiff, moist, low plasticity.																																								
				66	HQTT																																						12.5						12.45m: CORE LOSS. 12.45 - 12.80.																																
				100	PT																																														13.0		MD				12.80m: SILT, some clay, minor sand; brown mixed with some greyish red. Stiff, moist, low plasticity.																								
				77	SPT																																																						13.5						13.40m: Sandy SILT; dark brown. Medium dense, moist, dilatant - rapid. Sand, fine to coarse. 13.50m: Pushtube, Material observed to be Sandy SILT as above.																
				100	HQTT																																																														14.0						14.00m: CORE LOSS. 14.0 - 14.1m.								
																																																																																	14.10m: Sandy SILT; brown. Medium dense, moist, dilatant - rapid. Sand, fine to coarse.

COMMENTS: Hole backfilled with bentonite

Hole Depth
27.45m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH101**

Hole Location: Southern hill

SHEET: 4 OF 6

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5814995.96 mN (NZTM2000) 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
R.L.: 45.24m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL										ENGINEERING DESCRIPTION																																			
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION										Description and Additional Observations																																			
Walton Subgroup										FLUID LOSS (%)		WATER		CORE RECOVERY (%)		METHOD		CASING		TESTS		SAMPLES		DEPTH (m)		GRAPHIC LOG		MOISTURE CONDITION		WEATHERING		STRENGTH/DENSITY CLASSIFICATION		SHEAR STRENGTH (kPa)		COMPRESSION STRENGTH (kPa)		DEFECT SPACING (mm)							
										25 50 75 100		100		100		PT				1/1 0/1 2/2 N=5		30		15.5		W		F		1 25 50 75 100 200		1 25 50 75 100 200		25 50 75 100 200		25 50 75 100 200									
Box 4, 11.4-16.3m														100		SPT				1/1 3/0 1/1 N=5		15.5																		15.00m: Pushtube, Material observed to be SILT, some clay, minor sand; light brown mottled black. Moist, low plasticity.					
														100		SPT						16.0																				15.50m: SILT, some clay, minor sand; greyish white mottled black. Firm, wet, low plasticity. Suspected small fragments of charcoal.			
														100		HQTT						16.5																				16.50m: CORE LOSS. 16.5 - 16.9m.			
														11		SPT						17.0																				16.90m: SILT, minor sand; light brown mottled black. Loose, wet, dilatant - rapid. Sand, fine. Suspected small fragments of charcoal.			
														100		HQTT						17.5																						17.70m: SILT, some clay, minor sand; greyish white mottled black. Firm, wet, low plasticity. Suspected small fragments of charcoal.	
														100		SPT				● 39/6 kPa 0/0 0/0 0/0 N=0		18.0																				17.80m: Clayey SILT; greyish white mottled black. Firm, wet, medium plasticity. Silt, slow dilatancy.			
														100		SPT						18.5																				18.10m: SILT, some clay, minor sand; brown. Soft to firm, wet, medium plasticity. Sand, fine to coarse. Pumiceous.			
														100		HQTT						19.0																						19.40m: Clayey SILT; greyish white mottled black. Stiff, wet, medium plasticity.	
														100		SPT				● 98/25 kPa 1/2 2/2 2/5 N=11		19.5																						19.60m: SILT, some clay, minor sand; light brown mottled black. Medium dense, wet, dilatant - rapid. Sand, fine to coarse, pumiceous.	
														100		SPT						19.5																							

COMMENTS: Hole backfilled with bentonite

Hole Depth
27.45m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH101**

Hole Location: Southern hill

SHEET: 5 OF 6

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5814995.96 mN (NZTM2000) 1795095.18 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 18/05/2021
R.L.: 45.24m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL		ENGINEERING DESCRIPTION																	
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)		COMPRESSIVE STRENGTH (kPa)		DEFECT SPACING (cm)	Description and Additional Observations	
													1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30					
Walton Subgroup			100	HQTT		● 64/11 kPa 2/3 2/3 5/7 N=17		25			W	St						20.00m: SILT, some clay, trace sand; greyish white mottled black. Stiff, wet, low plasticity. Sand, fine to coarse. Pumiceous.	
			100	HQTT				20.5				F						20.40m: SILT, some clay; greyish white mottled with some black. Firm, wet, low plasticity.	
			100	SPT				21.0				St						21.00m: SILT, some clay; grey. Stiff, wet, low plasticity.	
			100	HQTT				21.5											
			100	HQTT				22.0											
			100	SPT			● 84/14 kPa 1/1 0/0 0/0 N=0	22.5				M						22.10m: SILT, minor sand; light brown mottled orange. Stiff, moist, low plasticity. Silt, rapid dilatancy; sand, fine to coarse, pumiceous.	
			100	SPT				23.0										22.50m: CORE LOSS. 22.5 - 22.8m.	
			85	HQTT				23.5				W	VS					22.80m: SILT, minor sand and minor gravel; light brown mottled orange. Very soft, wet, low plasticity. Silt, rapid dilatancy; sand, fine to coarse, pumiceous; gravel, fine, sub-rounded to sub-angular.	
			100	SPT				24.0											22.95m: CORE LOSS. 22.95 - 23.1m.
			100	HQTT				24.5					F						23.10m: SILT, trace sand; light brown mottled orange. Very soft, wet, low plasticity. Silt, rapid dilatancy; sand, fine, pumiceous.
					1/0 0/0 0/0 N=0		21										23.50m: SILT, minor sand, trace gravel; light brown mottled orange. Firm, wet, low plasticity. Silt, rapid dilatancy; sand, fine to coarse, pumiceous; gravel, fine, sub-rounded to sub-angular.		
								24.5										24.50 - 24.70m: Becomes sandy.	

COMMENTS: Hole backfilled with bentonite

Hole Depth
27.45m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH101**

Hole Location: Southern hill

SHEET: 6 OF 6

PROJECT: Brymer Farms Subdivision				LOCATION: 584 Whatawhata Rd, Temple View				JOB No.: 1017355.0000																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
CO-ORDINATES:		5814995.96 mN (NZTM2000) 1795095.18 mE		DRILL TYPE: Tractor Rig		HOLE STARTED: 18/05/2021																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
R.L.:		45.24m		DRILL METHOD: RC		HOLE FINISHED: 19/05/2021																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
DATUM:		NZVD2016		DRILL FLUID: WATER		LOGGED BY: CAND		CHECKED: RWOT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.		FLUID LOSS (%)		WATER		CORE RECOVERY (%)		METHOD		CASING		TESTS		SAMPLES		RL (m)		DEPTH (m)		GRAPHIC LOG		MOISTURE CONDITION		WEATHERING		STRENGTH/DENSITY CLASSIFICATION		SHEAR STRENGTH (kPa)		COMPRESSION STRENGTH (MPa)		DEFECT SPACING (cm)		Description and Additional Observations																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
Walton Subgroup		Box 7, 23.5-27.0m		100		HOTT		44		SPT		4/6 6/4 5/5 N=20		20		25.5		26.0		19		26.5		27.0		18		27.5		28.0		28.5		29.0		29.5		27.45m: Target depth																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
		Box 8, 27.0-27.5m		77		SPT		4/3 5/5 5/5 N=20		17		16		29.5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							

BOREHOLE LOG

BOREHOLE No.: **BH102**

Hole Location: Central lying low lands

SHEET: 1 OF 4

PROJECT: Brymer Farms Subdivision				LOCATION: 584 Whatawhata Rd, Temple View				JOB No.: 1017355.0000							
CO-ORDINATES: 5815510.15 mN (NZTM2000) 1795556.13 mE				DRILL TYPE: Tractor Rig				HOLE STARTED: 17/05/2021							
R.L.: 26.99m				DRILL METHOD: RC				HOLE FINISHED: 18/05/2021							
DATUM: NZVD2016				DRILL FLUID: WATER				DRILLED BY: Drillcore							
								LOGGED BY: CAND							
								CHECKED: RWOT							
GEOLOGICAL				ENGINEERING DESCRIPTION											
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.				Description and Additional Observations											
Piako Subgroup				0.00m: SILT, minor organics and minor sand, trace gravel; dark brown. Loosely packed, moist to wet, dilatant - rapid. Sand, fine; gravel, fine, sub-rounded to sub-angular; organics, rootlets. Topsoil.											
				0.10m: CORE LOSS. 0.1 - 1.5m.											
				1.50m: NOT LOGGED. Attempted push tube. No Recovery.											
				2.00m: CORE LOSS. 2.0 - 2.1m.											
				2.10m: PEAT (FIBROUS); dark brownish black. Very soft, saturated. Organics, wood fragments.											
				2.40m: Sandy SILT; light greenish grey. Very loose, wet, dilatant - rapid. Sand, fine to coarse, well graded.											
				2.60 - 2.90m: Minor clay, low plasticity.											
				2.80 - 2.90m: Minor organics; light greenish grey. Medium plasticity. Organics, wood fragments.											
				2.90m: SILT, trace organics; grey. Very loose, wet, dilatant - rapid.											
				3.00m: NOT LOGGED - Push tube.											
				3.50m: Silty CLAY, trace organics; grey. Very soft, wet, medium plasticity. Organics, wood fragments.											
				4.50 - 4.90m: Becomes very stiff.											
COMMENTS: Low pressure aquifer with flowing water encountered in BH at 16.mgl. Water pressure measured to at approximately 1m above ground level.															
Hole Depth 18.45m															

BOREHOLE LOG

BOREHOLE No.: **BH102**

Hole Location: Central lying low lands

SHEET: 2 OF 4

PROJECT: Brymer Farms Subdivision				LOCATION: 584 Whatawhata Rd, Temple View												JOB No.: 1017355.0000																									
CO-ORDINATES: 5815510.15 mN (NZTM2000) 1795556.13 mE				DRILL TYPE: Tractor Rig								HOLE STARTED: 17/05/2021																													
R.L.: 26.99m				DRILL METHOD: RC								HOLE FINISHED: 18/05/2021																													
DATUM: NZVD2016				DRILL FLUID: WATER								DRILLED BY: Drillcore				LOGGED BY: CAND				CHECKED: RWOT																					
GEOLOGICAL				ENGINEERING DESCRIPTION																																					
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.				FLUID LOSS (%)		WATER		CORE RECOVERY (%)		METHOD		CASING		TESTS		SAMPLES		RL (m)		DEPTH (m)		GRAPHIC LOG		MOISTURE / WEATHERING CONDITION		STRENGTH/DENSITY CLASSIFICATION		SHEAR STRENGTH (kPa)		COMPRESSIVE STRENGTH (MPa)		DEFECT SPACING (cm)		Description and Additional Observations							
Piako Subgroup				0.0-5.5m				100		HQTT				● 86/25 kPa						5.5				W		VSt								5.00m: Clayey SILT; light greenish grey. Very stiff, wet, medium to high plasticity.							
								100		HQTT										21		6.0				MD								5.50m: SILT, minor sand; light greenish grey. Medium dense to dense, wet, dilatant - rapid. Sand, fine.							
								100		SPT												6.5														6.60m: Fine to coarse SAND, minor silt; light greenish grey. Medium dense to dense, wet. Sand, well graded.					
								100		HQTT												20		7.0				VSt								7.00m: SILT, minor sand; light grey. Medium dense to dense, wet, dilatant - rapid. Sand, fine.					
																										MD										7.10m: PEAT (AMORPHOUS); dark brownish black. Very stiff, wet. Organics, wood fragments.					
																																				7.30m: SILT, trace sand; light grey. Medium dense to dense, wet, dilatant - rapid. Sand, fine.					
																												D								7.50m: CORE LOSS. 7.5 - 7.65m.					
																																				7.65m: SILT, minor sand; light grey. Dense, wet, dilatant - rapid. Sand, fine.					
																																						8.10m: Clayey SILT, minor organics; dark brownish black. Very stiff, wet, low to medium plasticity. Organics, wood fragments. Amorphous.			
																																						8.50m: PEAT (AMORPHOUS); dark brownish black. Very stiff, wet. Fine to coarse sand observed at top and bottom of layer. Brown in colour.			
Hinuera Formation				5.5-8.8m				100		HQTT				7/11 11/11 11/11 N=44						19		8.0				VSt								8.70m: SILT, minor sand; light grey. Dense, moist, dilatant - rapid. Sand, fine.							
								100		SPT														18		W										9.00m: SILT, some organics, minor sand; dark brownish black. Dense, wet, dilatant - rapid. Sand, fine to medium; organics, wood fragments. Amorphous.					
																										VSt										9.30m: PEAT (AMORPHOUS); dark brownish black. Very stiff, wet. Organics, wood fragments. F-C Sand observed at top and bottom of layer. Brown.					
																												D								9.50m: SILT, minor sand; light grey. Dense, wet, non-plastic. Silt, rapid dilatancy; sand, fine.					
														● 150/28 kPa						9.5				M		VSt								9.70m: Clayey SILT; light greenish grey. Very stiff, moist, medium plasticity.							
COMMENTS: Low pressure aquifer with flowing water encountered in BH at 16.mgl. Water pressure measured to at approximately 1m above ground level.																																									
Hole Depth 18.45m																																									

COMMENTS: Low pressure aquifer with flowing water encountered in BH at 16.mgl. Water pressure measured to at approximately 1m above ground level.

Hole Depth
18.45m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH102**

Hole Location: Central lying low lands

SHEET: 3 OF 4

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5815510.15 mN (NZTM2000) 1795556.13 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 17/05/2021
R.L.: 26.99m	DRILL METHOD: RC	HOLE FINISHED: 18/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL		ENGINEERING DESCRIPTION																																	
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.		FLUID LOSS (%)		WATER		CORE RECOVERY (%)		METHOD		CASING		TESTS		SAMPLES		RL (m)		DEPTH (m)		GRAPHIC LOG		MOISTURE CONDITION WEATHERING		STRENGTH/DENSITY CLASSIFICATION		SHEAR STRENGTH (kPa)		COMPRESSION STRENGTH (kPa)		DEFECT SPACING (cm)		Description and Additional Observations			
Hinuera Formation	Box 3, 8.8-12.5m	0-5		0-5		0-5		0-5		0-5		0-5		0-5		0-5		0-5		0-5		0-5		0-5		0-5		0-5		0-5		0-5		10.00m: SILT, minor sand; light grey. Dense, wet, dilatant - rapid. Sand, fine.	
		5-10		5-10		5-10		5-10		5-10		5-10		5-10		5-10		5-10		5-10		5-10		5-10		5-10		5-10		5-10		10.40m: Clayey SILT; light grey. Very stiff, wet, medium plasticity.			
		10-15		10-15		10-15		10-15		10-15		10-15		10-15		10-15		10-15		10-15		10-15		10-15		10-15		10-15		10-15		10.50m: Sandy SILT; light grey. Dense, wet, dilatant - rapid. Sand, fine.			
		15-20		15-20		15-20		15-20		15-20		15-20		15-20		15-20		15-20		15-20		15-20		15-20		15-20		15-20		15-20		11.10 - 11.50m: Minor sand, fine.			
		20-25		20-25		20-25		20-25		20-25		20-25		20-25		20-25		20-25		20-25		20-25		20-25		20-25		20-25		20-25		11.50m: SILT, some clay; light grey. Very stiff, wet, medium plasticity.			
		25-30		25-30		25-30		25-30		25-30		25-30		25-30		25-30		25-30		25-30		25-30		25-30		25-30		25-30		25-30		12.45m: CORE LOSS. 12.45 - 12.70m.			
		30-35		30-35		30-35		30-35		30-35		30-35		30-35		30-35		30-35		30-35		30-35		30-35		30-35		30-35		30-35		12.70m: Fine to coarse SAND, minor silt. Medium dense, wet. Sand, well graded.			
		35-40		35-40		35-40		35-40		35-40		35-40		35-40		35-40		35-40		35-40		35-40		35-40		35-40		35-40		35-40		13.95m: Silty fine to coarse SAND. Medium dense, wet. Sand, well graded.			
		40-45		40-45		40-45		40-45		40-45		40-45		40-45		40-45		40-45		40-45		40-45		40-45		40-45		40-45		40-45		14.20 - 14.50m: Sand grades to fine. Poorly graded.			
		45-50		45-50		45-50		45-50		45-50		45-50		45-50		45-50		45-50		45-50		45-50		45-50		45-50		45-50		45-50		45-50		14.50m: Clayey SILT; light grey. Stiff, wet, medium plasticity.	
Walton Subgroup																																14.90 - 15.00m: Colour changes to greyish black, organics, wood fragments (decomposed).			

COMMENTS: Low pressure aquifer with flowing water encountered in BH at 16.mgl. Water pressure measured to at approximately 1m above ground level.

Hole Depth
18.45m

Scale 1:25

Rev.: A

Rev.: A

CORE PHOTOS

BOREHOLE No.: BH102
Hole Location: Central lying low lands
SHEET: 1 OF 3

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5815510.15 mN (NZTM2000) 1795556.13 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 17/05/2021
R.L.: 26.99m	DRILL METHOD: RC	HOLE FINISHED: 18/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT



0.00-5.50m



5.50-8.80m

BOREHOLE LOG

BOREHOLE No.: **BH103**

Hole Location: Northern end of site

SHEET: 1 OF 3

PROJECT: Brymer Farms Subdivision				LOCATION: 584 Whatawhata Rd, Temple View				JOB No.: 1017355.0000																									
CO-ORDINATES: 5816337.35 mN (NZTM2000) 1795146.62 mE				DRILL TYPE: Tractor Rig				HOLE STARTED: 19/05/2021																									
R.L.: 30.74m				DRILL METHOD: RC				HOLE FINISHED: 19/05/2021																									
DATUM: NZVD2016				DRILL FLUID: WATER				LOGGED BY: CAND				CHECKED: RWOT																					
GEOLOGICAL		ENGINEERING DESCRIPTION																															
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION		Description and Additional Observations																															
Colluvium Deposits		FLUID LOSS (%)		CORE RECOVERY (%)		METHOD		CASING		TESTS		SAMPLES		RL (m)		DEPTH (m)		GRAPHIC LOG		MOISTURE CONDITION		WEATHERING		STRENGTH/DENSITY CLASSIFICATION		SHEAR STRENGTH (kPa)		COMPRESSION STRENGTH (kPa)		DEFECT SPACING (cm)			
		100		100		HQTT				45/17 kPa				30		0.5		TS		M		F								0.00m: Clayey SILT, minor organics; dark brown. Firm, moist, low plasticity. Organics, rootlets.			
																														0.30m: Clayey SILT, minor sand, trace gravel; brown. Firm, moist, medium plasticity. Sand, fine to coarse; gravel, fine.			
																														0.70m: Silty CLAY; brown mottled grey. Firm, moist, high plasticity.			
																														0.80 - 1.50m: Grades to low plasticity, some sand. Sand is fine to coarse.			
																														1.40 - 1.50m: Observed as minor clay, wet, rapid dilatancy. Grades to very soft.			
																														1.50m: Pushtube. Material observed as Silty CLAY as above.			
																														1.80m: CORE LOSS. 1.8m - 2.0m.			
																														2.00m: Clayey SILT, minor sand; grey. Very soft, wet, medium plasticity. Sand, fine to medium.			
																														2.60 - 2.80m: Grades to greenish grey.			
																												2.80m: Clayey SILT, trace sand; greenish grey. Firm, wet, low to medium plasticity. Sand, fine to coarse.					
																												3.80m: Silty CLAY; greenish grey. Firm, moist, medium to high plasticity.					
																												4.50 - 5.00m: Becomes stiff.					
COMMENTS: Low pressure aquifer with flowing water encountered in BH at 15.mgl. Water pressure measured to at approximately 1m above ground level. Hole Backfilled and sealed with bentonite.																																	
Hole Depth 15m																																	

Hole Depth
15m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH103**

Hole Location: Northern end of site

SHEET: 2 OF 3

PROJECT: Brymer Farms Subdivision				LOCATION: 584 Whatawhata Rd, Temple View				JOB No.: 1017355.0000																											
CO-ORDINATES:		5816337.35 mN (NZTM2000) 1795146.62 mE		DRILL TYPE: Tractor Rig				HOLE STARTED: 19/05/2021																											
R.L.:		30.74m		DRILL METHOD: RC				HOLE FINISHED: 19/05/2021																											
DATUM:		NZVD2016		DRILL FLUID: WATER				LOGGED BY: CAND		CHECKED: RWOT																									
GEOLOGICAL								ENGINEERING DESCRIPTION																											
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.		20 FLUID LOSS (%) 75		WATER		CORE RECOVERY (%)		METHOD		CASING		TESTS		SAMPLES		RL (m)		DEPTH (m)		GRAPHIC LOG		MOISTURE CONDITION		WEATHERING		STRENGTH/DENSITY CLASSIFICATION		SHEAR STRENGTH (kPa)		COMPRESSION STRENGTH (MPa)		DEFECT SPACING (cm)		Description and Additional Observations	
Piako Subgroup						100		HQTT				1/1 3/4 3/5 N=15				5.5		25				W		VL										5.00m: Sandy SILT; light greenish grey. Very loose, wet. Silt, rapid dilatancy; sand, fine to medium.	
						100		SPT																										6.00m: Becomes medium dense.	
						100		HQTT																										6.20m: Fine to coarse SAND, trace silt; light greenish grey. Medium dense, wet. Sand, well graded.	
						100		SPT																										7.20m: Sandy SILT; greenish grey. Dense, wet. Silt, rapid dilatancy; sand, fine to coarse, well graded.	
Hinuera Formation						100		HQTT				3/6 8/8 14/15 N=45				7.5		23				D										7.80m: Sandy fine GRAVEL; light greenish grey. Dense, wet. Gravel, sub-rounded to sub-angular, green; sand, medium to coarse.			
						100		HQTT																								8.80 - 9.00m: Becomes brown, pumiceous.			
						100		HQTT																								9.00m: CORE LOSS. 9.0m - 9.1m.			
						77		SPT																								9.10m: Sandy fine GRAVEL; brown. Medium dense, wet. Gravel, sub-rounded to sub-angular, green; sand, medium to coarse. Pumiceous.			
												4/5 6/5 5/6 N=22				9.0						MD								9.45m: CORE LOSS. 9.45m - 9.7m.					
																9.5														9.70m: Sandy fine GRAVEL; brown. Medium dense, wet. Gravel, sub-rounded to sub-angular, green; sand, medium to coarse. Pumiceous.					
COMMENTS: Low pressure aquifer with flowing water encountered in BH at 15.mgl. Water pressure measured to at approximately 1m above ground level. Hole Backfilled and sealed with bentonite.																																			
Hole Depth 15m																																			

BOREHOLE LOG

BOREHOLE No.: **BH103**

Hole Location: Northern end of site

SHEET: 3 OF 3

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5816337.35 mN (NZTM2000) 1795146.62 mE	DRILL TYPE: Tractor Rig	HOLE STARTED: 19/05/2021
R.L.: 30.74m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM: NZVD2016	DRILL FLUID: WATER	DRILLED BY: Drillcore
		LOGGED BY: CAND
		CHECKED: RWOT

GEOLOGICAL		ENGINEERING DESCRIPTION																
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING / MOISTURE CONDITION	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)		COMPRESSIVE STRENGTH (MPa)		DEFECT SPACING (m)	Description and Additional Observations
													15	30	1	50		
Hinuera Formation	Box 3, 6, 9-11.0m		76	HQTT		4/7 8/8 8/8 N=32					W	MD						10.00m: Sandy fine GRAVEL; brown. Medium dense, wet. Gravel, sub-rounded to sub-angular, green; sand, medium to coarse. Pumiceous.
			100	SPT					D								10.50 - 10.90m: Becomes Dense.	
									VSt								10.90m: SILT, some clay; green. Very stiff, wet, low plasticity.	
																	10.95m: CORE LOSS. 10.95m - 11.2m.	
																	11.20m: SILT, some clay; green. Very stiff, wet, low plasticity.	
			76	HQTT					M	D							11.40m: SILT; light grey. Dense, moist, dilatant - rapid. Weakly cemented.	
																		12.00m: Becomes medium dense.
			100	SPT									W					12.30m: Sandy fine GRAVEL; brown. Medium dense, wet. Gravel, sub-rounded to sub-angular, green; sand, medium to coarse. Pumiceous.
																		12.45m: CORE LOSS. 12.45m - 12.65m.
																		12.65m: Sandy fine GRAVEL; brown. Medium dense, wet. Gravel, sub-rounded to sub-angular, green; sand, medium to coarse. Pumiceous.
		80	HQTT													12.85m: Fine to coarse SAND, some gravel; brown. Medium dense, wet. Gravel, fine to medium, sub-rounded to sub-angular. Pumiceous.		
						4/4 6/7 8/10 N=31						D					13.50 - 13.95m: Becomes dense.	
	100	SPT															13.95m: CORE LOSS. 13.95m - 15.00m.	
			0	HQTT														15m: Target depth

COMMENTS: Low pressure aquifer with flowing water encountered in BH at 15.mgl. Water pressure measured to at approximately 1m above ground level. Hole Backfilled and sealed with bentonite.

Hole Depth
15m

Scale 1:25

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP101**
Hole Location: Southern foot hills
 SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision LOCATION: 584 Whatawhata Rd, Temple View JOB No.: 1017355.0000
 CO-ORDINATES: 5814947.62 mN EXPOSURE METHOD: TP EXCAV. STARTED: 28/05/2021
 (NZTM2000) 1795230.76 mE EQUIPMENT: 8T Digger EXCAV. FINISHED: 28/05/2021
 R.L.: 28.14m OPERATOR: Drillcore LOGGED BY: CAND
 DATUM: NZVD2016 DIMENSIONS: 4.7m by 1.9m CHECKED BY: RWOT

EXCAVATION TESTS				ENGINEERING DESCRIPTION				GEOLOGICAL						
PENETRATION -1 -2 -3	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT

SKETCH / PHOTO:



COMMENTS:

Hole Depth
4.3m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP102**

Hole Location: Southern foot hills

SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision LOCATION: 584 Whatawhata Rd, Temple View JOB No.: 1017355.0000

CO-ORDINATES: 5815039.72 mN EXPOSURE METHOD: TP EXCAV. STARTED: 28/05/2021
(NZTM2000) 1795167.56 mE EQUIPMENT: 8T Digger EXCAV. FINISHED: 28/05/2021
R.L.: 28.14m OPERATOR: Drillcore LOGGED BY: CAND
DATUM: NZVD2016 DIMENSIONS: 4.7m by 1.9m CHECKED BY: RWOT

EXCAVATION TESTS				ENGINEERING DESCRIPTION				GEOLOGICAL					
PENETRATION -1 -2 -3	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT

SKETCH / PHOTO:



COMMENTS:

Hole Depth
4.4m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP103**
Hole Location: Central low lying lands
SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5815393.95 mN (NZTM2000) 1795147.06 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 28/05/2021
R.L.: 23.24m	EQUIPMENT: 8T Digger	EXCAV. FINISHED: 28/05/2021
DATUM: NZVD2016	OPERATOR: Drillcore	LOGGED BY: CAND
	DIMENSIONS: 4m by 1.9m	CHECKED BY: RWOT

EXCAVATION TESTS				ENGINEERING DESCRIPTION						GEOLOGICAL				
PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
1 2 3														
	No Support Required													

SKETCH / PHOTO:



COMMENTS: Hole in danger of collapse. Excess water ponding at the base.

Hole Depth
3.4m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP104**

Hole Location: Northern foot hills

SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision

LOCATION: 584 Whatawhata Rd, Temple View

JOB No.: 1017355.0000

CO-ORDINATES: 5815738.07 mN
(NZTM2000) 1795075.30 mE

EXPOSURE METHOD: TP

EXCAV. STARTED: 28/05/2021

EQUIPMENT: 8T Digger

EXCAV. FINISHED: 28/05/2021

R.L.: 25.24m

OPERATOR: Drillcore

LOGGED BY: CAND

DATUM: NZVD2016

DIMENSIONS: 4.7m by 1.9m

CHECKED BY: RWOT

EXCAVATION TESTS				ENGINEERING DESCRIPTION				GEOLOGICAL						
PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3														
	No Support Required		● 67/45 kPa		25	0.00m		0.00m: SILT, some clay, minor sand; dark brown. Firm, moist, low plasticity. Sand, fine. Topsoil.	M		F	10		
			● 106/28 kPa		0.5	0.30m		0.30m: Silty CLAY; light brown mottled orange. Stiff, moist, medium to high plasticity.			St	25		
					1.0									
					24	1.20m		1.20m: Becomes very stiff.			St-VSt	200		
					1.5									
					23	1.70m		1.70m: Sandy SILT; light greenish grey. Loosely packed, wet, dilatant - rapid. Sand, fine to coarse, pumiceous. Interbedded clay lenses up 100mm	W		L			
			● 137/53 kPa		2.5	2.10m		2.10m: Silty CLAY; light grey. Very stiff, wet, medium plasticity.			VSt			
					3.0	2.60m		2.60m: Sandy SILT; light greenish grey. Loosely packed, wet, dilatant - rapid. Sand, fine to coarse, pumiceous. Interbedded clay lenses up 100mm			L			
					22									
					3.5	3.5m		3.5m: Target depth						
					21	4.0								
						4.5								

SKETCH / PHOTO:



COMMENTS:

Hole Depth
3.5m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP105**
Hole Location: Central low lying lands
SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5815685.10 mN (NZTM2000) 1795337.69 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 28/05/2021
R.L.: 25.84m	EQUIPMENT: 8T Digger	EXCAV. FINISHED: 28/05/2021
DATUM: NZVD2016	OPERATOR: Drillcore	LOGGED BY: CAND
	DIMENSIONS: 4m by 1.9m	CHECKED BY: RWOT

EXCAVATION TESTS								ENGINEERING DESCRIPTION				GEOLOGICAL			
PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT	
1 2 3												10 25 50 100 200			
	No Support Required	8/05/2021	● 31/25 kPa		25	0.5		0.00m: Sandy SILT, some clay, minor organics; dark brown. Firm, moist, low plasticity. Sand, fine; organics, rootlets. Topsoil. 0.40m: PEAT (FIBROUS AND AMORPHOUS); dark brownish black. Soft to firm, wet. Tree Branches up to 300mm in diameter. 1.60m: SILT, some sand, minor organics; light grey. Loosely packed, saturated, dilatant - rapid. Sand, fine to medium; organics, rootlets.	M		F				
			● 53/28 kPa		24	2.0		1.8m: Other - see notes	W		S-F		0.80m: , Rapid water seepage observed 1.10m: , Rapid water seepage observed.	Piako Subgroup	
					24	2.5			S		L				
					23	3.0									
					22	4.0									
					21	4.5									

SKETCH / PHOTO:



COMMENTS: Target stratum reached. Excess water ponding at the base of hole.

Hole Depth
1.8m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP106**

Hole Location: Central eastern low lying lands

SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision LOCATION: 584 Whatawhata Rd, Temple View JOB No.: 1017355.0000

CO-ORDINATES: 5815694.55 mN EXPOSURE METHOD: TP EXCAV. STARTED: 01/06/2021
(NZTM2000) 1795552.22 mE EQUIPMENT: 8T Digger EXCAV. FINISHED: 01/06/2021
R.L.: 27.24m OPERATOR: Drillcore LOGGED BY: CAND
DATUM: NZVD2016 DIMENSIONS: 4.5m by 1.9m CHECKED BY: RWOT

EXCAVATION TESTS				ENGINEERING DESCRIPTION				GEOLOGICAL						
PENETRATION -1 -2 -3	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT

SKETCH / PHOTO:



COMMENTS:

Hole Depth
3.5m

Scale 1:42

Rev.: A

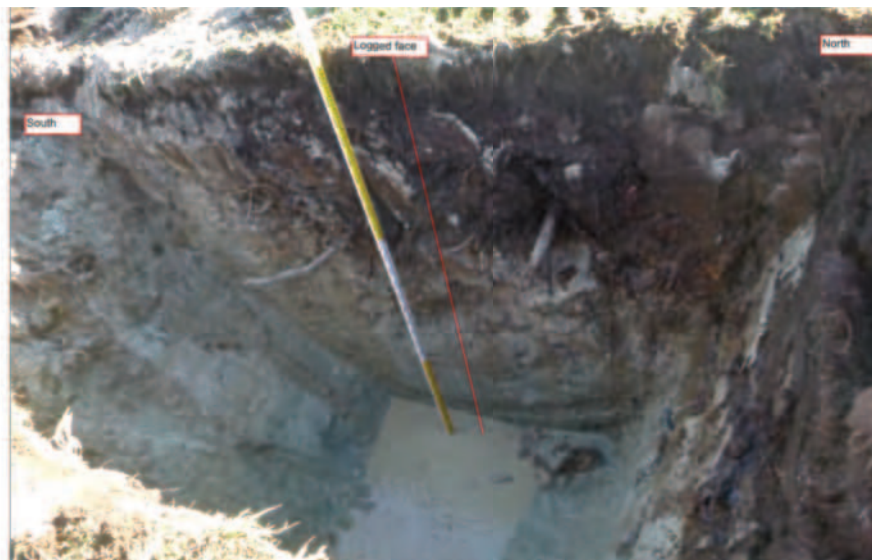
EXCAVATION LOG

Excavation Id.: **TP107**
Hole Location: Eastern low lying lands
SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision LOCATION: 584 Whatawhata Rd, Temple View JOB No.: 1017355.0000
CO-ORDINATES: 5815568.47 mN EXPOSURE METHOD: TP EXCAV. STARTED: 01/06/2021
(NZTM2000) 1795891.13 mE EQUIPMENT: 8T Digger EXCAV. FINISHED: 01/06/2021
R.L.: 26.64m OPERATOR: Drillcore LOGGED BY: CAND
DATUM: NZVD2016 DIMENSIONS: 4.7m by 2m CHECKED BY: RWOT

EXCAVATION TESTS					ENGINEERING DESCRIPTION					GEOLOGICAL				
PENETRATION -1 -2 -3	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT

SKETCH / PHOTO:



COMMENTS:

Hole Depth
3m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP108**
Hole Location: Eastern low lying lands
SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision	LOCATION: 584 Whatawhata Rd, Temple View	JOB No.: 1017355.0000
CO-ORDINATES: 5815403.99 mN (NZTM2000) 1796130.68 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 01/06/2021
R.L.: 26.99m	EQUIPMENT: 8T Digger	EXCAV. FINISHED: 01/06/2021
DATUM: NZVD2016	OPERATOR: Drillcore	LOGGED BY: CAND
	DIMENSIONS: 4.7m by 2m	CHECKED BY: RWOT

EXCAVATION TESTS				ENGINEERING DESCRIPTION				GEOLOGICAL					
PENETRATION +1 +2 +3	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE / WEATHERING CONDITION	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
	No Support Required	01/08/2021	● 28/19 kPa		26	0.00		0.00m: SILT, some clay, minor organics; dark brown. Firm, moist, low plasticity. Organics, rootlets. Topsoil.	M	F	10	0.70m: , Water seepage observed.	
					0.5		0.30m: PEAT (FIBROUS AND AMORPHOUS); dark greyish black. Soft, wet. Organics, wood fragments. Spongy, tree branches up to 300mm diameter.	W	S	25			
			● 72/16 kPa		1.0		1.10m: Silty CLAY, minor organics; light greenish grey. Stiff, wet, medium to high plasticity. Organics, rootlets.		St	100			
			● 125/34 kPa		1.5		1.80 - 2.30m: Grades to very stiff.		VSt	200			
			● 97/44 kPa		2.0		2.30m: Tree branches up to 50mm diameter observed.						
					2.5		2.80m: Sandy SILT, minor gravel; light greenish grey, bedded. Loosely packed, wet, dilatant - rapid. Sand, fine to coarse, well graded; gravel, fine, sub-rounded to sub-angular, pumiceous.		L				
					3.0		3.30m: Gravel becomes trace gravel.		L				
					3.5		4.3m: Target depth						
					4.0								
					4.5								

SKETCH / PHOTO:



COMMENTS:

Hole Depth
4.3m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP109**
Hole Location: Northern foot hills
SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision LOCATION: 584 Whatawhata Rd, Temple View JOB No.: 1017355.0000
CO-ORDINATES: 5815735.93 mN EXPOSURE METHOD: TP EXCAV. STARTED: 01/06/2021
(NZTM2000) 1795395.12 mE EQUIPMENT: 8T Digger EXCAV. FINISHED: 01/06/2021
R.L.: 26.99m OPERATOR: Drillcore LOGGED BY: CAND
DATUM: NZVD2016 DIMENSIONS: 4.7m by 1.9m CHECKED BY: RWOT

EXCAVATION TESTS				ENGINEERING DESCRIPTION				GEOLOGICAL						
PENETRATION -1 -2 -3	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT

SKETCH / PHOTO:



COMMENTS:

Hole Depth
3.3m

Scale 1:42

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP110**

Hole Location: Northern foot hills

SHEET: 1 OF 1

PROJECT: Brymer Farms Subdivision

LOCATION: 584 Whatawhata Rd, Temple View

JOB No.: 1017355.0000

CO-ORDINATES: 5815779.66 mN
(NZTM2000) 1795287.86 mE

EXPOSURE METHOD: TP

EXCAV. STARTED: 01/06/2021

EQUIPMENT: 8T Digger

EXCAV. FINISHED: 01/06/2021

R.L.: 27.74m

OPERATOR: Drillcore

LOGGED BY: CAND

DATUM: NZVD2016

DIMENSIONS: 4.8m by 1.9m

CHECKED BY: RWOT

EXCAVATION TESTS

ENGINEERING DESCRIPTION

GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
1 2 3								0.00m: SILT, some clay, minor organics; dark brown. Firm, moist, low plasticity. Organics, rootlets.	M		F			
			● 94/38 kPa			0.5		0.30m: Silty CLAY, minor organics; light grey mottled orange. Stiff, moist, medium plasticity. Organics, wood fragments. Tree branches up to 50mm in diameter.			St			
			● 113/44 kPa		27			0.70 - 0.90m: Becomes brownish orange, very stiff.			VSt			
			● 213/44 kPa			1.0		0.90m: SILT, some clay, minor organics; grey mottled brown. Very stiff to hard, moist, low plasticity. Organics, wood fragments.			VSt-H			
			● 169/32 kPa			1.5		1.40m: Grades to very stiff.			VSt			
					26			1.50m: Sandy SILT; light greenish grey mottled brown. Loosely packed, wet, dilatant - rapid. Sand, fine to coarse, well graded.	W		L			
						2.0		2.00m: Colour changes to light brown mottled orange. Interbedded silt lenses.						
						2.5							2.50m: , Water seepage observed.	
						3.0								
						3.5		3.10 - 3.60m: Colour changes to brown.					3.10m: , Water seepage observed.	
					24									
						4.0		3.8m: Target depth						
						4.5								
					23									

SKETCH / PHOTO:



COMMENTS:

Hole Depth
3.8m

Scale 1:42

Rev.: A

CMW Investigations

TEST PIT LOG - TP25-01

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 03/10/2025



Test Pit Location: Refer to Site Plan Logged by: AN Checked by: MM Scale: 1:30 Sheet 1 of 1
Position: 439830.3mE; 700197.7mN Projection: Mount Eden 2000 Pit Dimensions: 4.2m by 1.5m
Elevation: 34.00m Datum: NZVD2016 Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)					Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
	Depth	Type & Results												
									5	10	15	20		
	0.3	Peak = 106kPa Residual = 24kPa	34.0		OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	M	VSt					1		
			33.8		MH: Clayey SILT: brown. High plasticity. Moderately sensitive to sensitive. (Colluvium)							2		
	0.6	Peak = 103kPa Residual = 27kPa										2		
												2		
	1.0	Peak = 139kPa Residual = 27kPa										2		
												2		
	1.5	Peak = 114kPa Residual = 14kPa	32.7		SW: Fine to coarse SAND: orange brown mottled black and brown. Well graded. (Piako Subgroup)	S	MD					3		
			32.6		CH: Silty CLAY: Orange brown. High plasticity. Sensitive to extra sensitive. (Piako Subgroup)							3		
	2.0	Peak = 112kPa Residual = 16kPa				W	VSt to H					3		
												3		
	2.5	Peak = 114kPa Residual = 16kPa										3		
												3		
	3.0	Peak = 117kPa Residual = 22kPa										4		
												4		
	3.5											4		
												4		
	4.0		30.5		SP: Silty fine to medium SAND: bluish grey. Poorly graded. (Hinuera Formation)		MD to D					5		
												5		
	4.5		30.0		SW: Silty fine to coarse SAND: blue. Well graded. (Hinuera Formation)		D					6		
												6		
	5.0					TP					9			
											9			
	5.5										10			
											10			
	6.0										10			
											10			
	6.5										11			
											11			
	7.0													
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48.5														

TEST PIT PHOTOGRAPHS: TP25-01

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	5.3



Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 03/10/2025



Position: 439874.5mE; 700073.6mN	Projection: Mount Eden 2000	Pit Dimensions: 4.2m by 1.5m
Elevation: 35.20m	Datum: NZVD2016	Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
	Depth	Type & Results								
			35.2			OL: Organic SILT: dark brown. Low plasticity. (Topsoil)				
	0.3	Peak = 112kPa Residual = 33kPa	35.0			MH: SILT: with some clay. Light grey. High plasticity. Moderately sensitive. (Hamilton Ash)				
	0.6	Peak = UTP								
	1.0	Peak = >191kPa								
			34.4			CH: CLAY: with some silt and minor fine sand. Light brown mottled white. High plasticity. (Walton Subgroup)				
			33.7			SP: Silty fine to medium pumiceous SAND: light brown. Poorly graded. (Walton Subgroup)				
			32.8			SP: Clayey fine to medium SAND: with some silt. Light grey mottled orange and white. Poorly graded. (Walton Subgroup)				
			30.9			CH: CLAY: with some silt and minor fine to coarse sand. Light grey mottled yellowish brown. High plasticity. (Walton Subgroup)				
			30.1			SW: Silty fine to coarse SAND: yellowish brown mottled brown. Well graded. (Walton Subgroup)				
			6			Test pit terminated at 6.00 m				

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 5 - August 2024.

TEST PIT PHOTOGRAPHS: TP25-02

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	6.0m



Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 03/10/2025



Position: 440088.7mE; 700010.6mN	Projection: Mount Eden 2000	Pit Dimensions: 4.2m by 1.5m
Elevation: 50.00m	Datum: NZVD2016	Survey Source: Hand-held GPS

[illegible]

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 5 - August 2024.

TEST PIT PHOTOGRAPHS: TP25-04

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	5.2m



TEST PIT LOG - TP25-05

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 02/10/2025



Test Pit Location: Refer to Site Plan Logged by: AN Checked by: MM Scale: 1:25 Sheet 1 of 1

Position: 439892.3mE; 699723.6mN Projection: Mount Eden 2000 Pit Dimensions: 4.2m by 1.5m
Elevation: 33.60m Datum: NZVD2016 Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
	Depth	Type & Results								
	0.3	Peak = 169kPa Residual = 35kPa	33.6		OL: Organic SILT: dark brown. Low plasticity. (Topsoil)				1	
	0.6	Peak = 191kPa Peak = >191kPa	33.4		MH: Clayey SILT: with some fine to medium sand. Orange brown. High plasticity. Sensitive. (Colluvium)				2	
			32.6	1	SW: Fine to coarse SAND: with some silt. Orange. Well graded. (Colluvium)	M	VSt		4	
			32.1		ML: Sandy SILT: with some clay. White mottled brown. High Plasticity. Sand; fine to medium. (Colluvium)		MD		5	
	2.0	Peak = 150kPa Residual = 27kPa	31.6	2	SW: Gravelly fine to coarse pumiceous SAND: with some silt. White mottled dark orange brown, red and white. Well graded. Gravel; fine to medium. (Colluvium)	S	MD to D		6	
			29.1	3					8	
			29.0	4					8	
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									16	
									18	
									17	
									15	
									1	
									9	
									18	
									17	
									2	
									0	
				5	Test pit terminated at 5.00 m					

Termination Reason: Target depth reached.
Shear Vane No: 3434 DCP No: 07
Remarks: Groundwater encountered at 2m depth.

TEST PIT PHOTOGRAPHS: TP25-05

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	5.0m



Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 02/10/2025



Position: 439933.5mE; 699660.1mN	Projection: Mount Eden 2000	Pit Dimensions: 4.2m by 1.5m
Elevation: 45.60m	Datum: NZVD2016	Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks		
	Depth	Type & Results										
	0.3	Peak = 84kPa Residual = 27kPa	45.6			OL: Organic SILT: dark brown. Low plasticity. (Topsoil)				1		
			45.4			ML: Clayey SILT: light orange brown. Low plasticity. Moderately sensitive. (Hamilton Ash)		St			1	
	0.6	Peak = 150kPa Residual = 57kPa	45.0			CH: Sandy CLAY: with some silt. Light yellowish brown. High plasticity. Moderately sensitive to sensitive. Sand; fine. (Hamilton Ash)					2	
											1	
	1.0	Peak = 177kPa Residual = 38kPa		1							2	
											4	
											5	
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											13	
			40.9			SP: Fine SAND: with some silt. White mottled red. Poorly graded. (Hamilton Ash)						
			40.8			GC: CLAY: Orange. Highly iron stained. Banded (Hamilton Ash)						
			40.7			SP: Silty fine SAND: White mottled light brown and red. Poorly graded. (Walton Subgroup)						
			5									

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 5 - August 2024.

TEST PIT PHOTOGRAPHS: TP25-06

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	5.0m



TEST PIT LOG - TP25-07

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 02/10/2025
Test Pit Location: Refer to Site Plan



Logged by: AN Checked by: MM Scale: 1:25 Sheet 1 of 1

Position: 439831.0mE; 699479.6mN Projection: Mount Eden 2000 Pit Dimensions: 4.2m by 1.5m
Elevation: 25.90m Datum: NZVD2016 Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)				Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks		
	Depth	Type & Results							5	10	15	20			
	0.3	Peak = 44kPa Residual = 19kPa	25.9			OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	M	F to St						1	
			25.7			ML: Clayey SILT: orange brown. Low plasticity. Moderately sensitive to sensitive. (Piako Subgroup)								2	
	0.6	Peak = 87kPa Residual = 16kPa												2	
														1	
														1	
														1	
														1	
														3	
	24.9	1				SW: Silty fine to coarse SAND: Light blue. Well graded. (Piako Subgroup)	S	MD						3	
														5	
24.1					SW: Fine to coarse pumiceous SAND: with some fine to medium pumiceous gravel. Greenish blue. Well graded. (Piako Subgroup)		D						7		
													7		
													6		
													7		
													7		
													7		
23.7					SW: Gravelly fine to coarse pumiceous SAND: light bluish grey. Well graded. Gravel; fine to medium. (Piako Subgroup)								9		
													9		
22.4					SW: Silty fine to coarse pumiceous SAND: grey. Well graded. (Piako Subgroup)		TP						10		
													12		
													2		
													0		
5					Test pit terminated at 5.00 m										

TEST PIT PHOTOGRAPHS: TP25-07

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	5.0m



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Sheet 1 of 1

Survey Source: Hand-held GPS

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 5 - August 2024.

TEST PIT PHOTOGRAPHS: TP25-08

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	5.0m



TEST PIT LOG - TP25-09

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 02/10/2025



Test Pit Location: Refer to Site Plan Logged by: AN Checked by: MM Scale: 1:25 Sheet 1 of 1

Position: 440025.0mE; 699249.0mN Projection: Mount Eden 2000 Pit Dimensions: 4.2m by 1.5m
Elevation: 24.50m Datum: NZVD2016 Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
	Depth	Type & Results								
			24.5			Pt: Fibrous PEAT: black. Low plasticity. (Piako Subgroup)				
	0.3	Peak = 44kPa Residual = 11kPa								
	0.6	Peak = 27kPa Residual = 5kPa								
	1.0	Peak = 41kPa Residual = 16kPa		1						
	1.5	Peak = 44kPa Residual = 14kPa				... at 1.50m, containing some wood fragments.				
	2.0	Peak = 35kPa Residual = 11kPa		2						
	2.5	Peak = 71kPa Residual = 30kPa		22.2		OL: Organic SILT: with trace wood fragments. Grey mottled brown. Low plasticity. Moderately sensitive to sensitive. (Piako Subgroup)				
	3.0	Peak = 68kPa Residual = 27kPa		3						
						Test pit terminated at 3.50 m				
				4						
				5						

Termination Reason: Refusal due to groundwater.

Shear Vane No: 3434 DCP No: 07

Remarks: Groundwater encountered at 2.7m depth

TEST PIT PHOTOGRAPHS: TP25-09

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	3.5m



Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 02/10/2025



Position: 440123.1mE; 699379.9mN	Projection: Mount Eden 2000	Pit Dimensions: 4.2m by 1.5m
Elevation: 25.90m	Datum: NZVD2016	Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks						
	Depth	Type & Results														
											5	10	15	20		
	0.3	Peak = 54kPa Residual = 14kPa	25.9		OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	M	F			1						
			25.7		ML: SILT: with some clay, Light yellowish brown. Low plasticity. Moderately sensitive. (Piako Subgroup)					1						
										1						
		0.6	Peak = 136kPa Residual = 27kPa	25.3						MH: Sandy SILT: with some clay. Bluish grey. High plasticity. Sand; fine. (Piako Subgroup)						2
																1
																3
																3
																3
																3
	1.2	Peak = 103kPa Residual = 54kPa	24.5		SP: Silty fine to medium SAND: with minor fine pumiceous gravel. Orange brown. Poorly graded. (Piako Subgroup)	S				4						
										4						
										5						
										6						
										7						
										6						
										4						
										4						
	2		23.6		SW: Gravelly fine to coarse pumiceous SAND: light orange brown. Well graded. (Piako Subgroup)	MD				5						
										6						
										7						
										7						
										7						
										8						
										8						
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Test pit terminated at 5.00 m																

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 5 - August 2024.

TEST PIT PHOTOGRAPHS: TP25-10

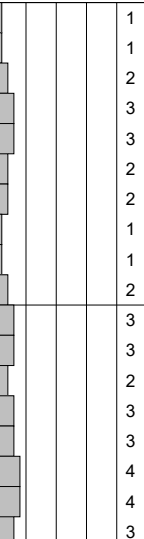
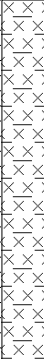
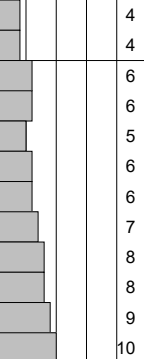
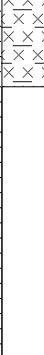
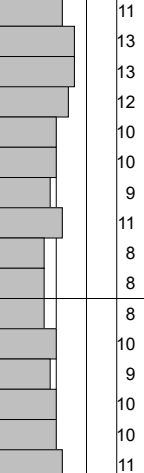
Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	5.0m



Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 02/10/2025



Position: 440383.7mE; 699232.8mN	Projection: Mount Eden 2000	Pit Dimensions: 4.2m by 1.5m
Elevation: 24.30m	Datum: NZVD2016	Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
	Depth	Type & Results							5 10 15 20	
	0.3 0.6 1.0 1.5 1.8	Peak = 27kPa Residual = 14kPa Peak = 19kPa Residual = 11kPa Peak = 22kPa Residual = 5kPa Peak = 14kPa Residual = 3kPa Peak = 8kPa Residual = 3kPa	24.3		OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	M	S to F		1	
			24.1		Pt: Fibrous PEAT: black. Low plasticity. Insensitive. (Piako Subgroup)				1	
									2	
									3	
									3	
									2	
									2	
									1	
									1	
									2	
									3	
									3	
	2.5 3.0	Peak = 19kPa Residual = 3kPa Peak = 95kPa Residual = 14kPa	22.5		ML: Clayey SILT: light bluish grey. Low plasticity. Moderately sensitive to sensitive. (Piako Subgroup)	S	VS to S		4	
			2						4	
									6	
									6	
									5	
									6	
4 5		21.3		ML: Clayey SILT: with some fine sand. Greenish blue. High plasticity. Sensitive. (Piako Subgroup)	W to S	St		11		
								13		
								13		
								12		
								10		
								10		
								9		
								11		
								8		
								8		
		8								
		10								
		9								
		10								
		10								
		11								

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 5 - August 2024.

TEST PIT PHOTOGRAPHS: TP25-11

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	3.3m



TEST PIT LOG - TP25-12

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 02/10/2025



Test Pit Location: Refer to Site Plan Logged by: AN Checked by: MM Scale: 1:25 Sheet 1 of 1

Position: 440624.6mE; 699203.2mN Projection: Mount Eden 2000 Pit Dimensions: 4.2m by 1.5m
Elevation: 26.60m Datum: NZVD2016 Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks																																																											
	Depth	Type & Results																																																																			
	0.3	Peak = 27kPa Residual = 11kPa	26.6		OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	M	F		<table><tr><td></td><td></td><td></td><td></td><td></td><td>1</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>2</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>2</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>2</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>3</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>2</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>1</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>1</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>2</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>3</td></tr></table>						1						2						2						2						3						2						1						1						2						3
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26.4	Pt: Fibrous PEAT: black. Low plasticity. Moderately sensitive. (Piako Subgroup)																																																																				
0.6	Peak = 24kPa Residual = 8kPa																																																																				
1.0	Peak = 33kPa Residual = 14kPa																																																																				
1.2	Peak = 30kPa Residual = 14kPa	25.4	OL: Organic SILT: with trace wood. Brown. Low plasticity. (Piako Subgroup)	S																																																																	
		25.2	SW: Fine to coarse SAND: with some silt. Brown mottled greyish brown. Well graded. (Piako Subgroup)	W	MD																																																																
1.9	Peak = 98kPa Residual = 46kPa																																																																				
		24.7	MH: Sandy SILT: light grey. Low plasticity. Moderately sensitive. Sand; fine. (Piako Subgroup)			St																																																															
		24.5	SP: Fine SAND: some silt. Light yellowish brown. Poorly graded. (Piako Subgroup)			VD																																																															

TEST PIT PHOTOGRAPHS: TP25-12

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	5.0m



Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 02/10/2025



Position: 440863.1mE; 699143.5mN	Projection: Mount Eden 2000	Pit Dimensions: 4.2m by 1.5m
Elevation: 26.80m	Datum: NZVD2016	Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
	Depth	Type & Results								
	0.3	Peak = 68kPa Residual = 22kPa	26.8		OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	M	F to St			
			26.6		Pt: Fibrous PEAT: black. Low plasticity. Moderately sensitive. (Piako Subgroup)					
	0.6	Peak = 44kPa Residual = 16kPa	25.8		OL: Organic SILT: with trace wood fragments. Brown. Low plasticity. Sensitive. (Piako Subgroup)	S	F			
	1.0	Peak = 68kPa Residual = 14kPa	2		SP: Silty fine to medium SAND: Light bluish grey. Poorly graded. (Piako Subgroup)	W	F to St			
	1.5	Peak = 71kPa Residual = 14kPa	3		ML: Sandy SILT: with some clay. Grey. Low plasticity. Insensitive to moderately sensitive. (Piako Subgroup)	W	F to St			
	2.0	Peak = 82kPa Residual = 22kPa	4		ML: Sandy SILT: with some clay. Grey. Low plasticity. Insensitive to moderately sensitive. (Piako Subgroup)	W	F to St			
	2.5	Peak = 82kPa Residual = 24kPa	4.5		ML: Sandy SILT: with some clay. Grey. Low plasticity. Insensitive to moderately sensitive. (Piako Subgroup)	W	F to St			
	3.5	Peak = 84kPa Residual = 19kPa	5		ML: Sandy SILT: with some clay. Grey. Low plasticity. Insensitive to moderately sensitive. (Piako Subgroup)	W	F to St			
	4.0	Peak = 33kPa Residual = 24kPa	6		ML: Sandy SILT: with some clay. Grey. Low plasticity. Insensitive to moderately sensitive. (Piako Subgroup)	W	F to St			
	4.5	Peak = UTP	6		ML: Sandy SILT: with some clay. Grey. Low plasticity. Insensitive to moderately sensitive. (Piako Subgroup)	W	F to St			
	5.0	Peak = UTP	6		ML: Sandy SILT: with some clay. Grey. Low plasticity. Insensitive to moderately sensitive. (Piako Subgroup)	W	F to St			
5.5	Peak = UTP	6		ML: Sandy SILT: with some clay. Grey. Low plasticity. Insensitive to moderately sensitive. (Piako Subgroup)	W	F to St				
										6
6.0	Peak = UTP	6		ML: Sandy SILT: with some clay. Grey. Low plasticity. Insensitive to moderately sensitive. (Piako Subgroup)	W	F to St				
										6
Test pit terminated at 6.00 m										

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 5 - August 2024.

TEST PIT PHOTOGRAPHS: TP25-13

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	6.0m



TEST PIT LOG - TP25-14

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 03/10/2025



Test Pit Location: Refer to Site Plan Logged by: AN Checked by: MM Scale: 1:30 Sheet 1 of 1
Position: 439940.4mE; 698943.7mN Projection: Mount Eden 2000 Pit Dimensions: 4.2m by 1.5m
Elevation: 23.50m Datum: NZVD2016 Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)				Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks	
	Depth	Type & Results							5 10 15 20					
	0.3	Peak = 109kPa Residual = 27kPa	23.5			Pt: Fibrous PEAT: black. Low plasticity. Sensitive. (Piako Subgroup)	M to W	VSt					1	
													2	
	0.6	Peak = 41kPa Residual = 38kPa	22.7			... at 0.60m, Becoming insensitive.		F					1	
													1	
	1.0	Peak = 52kPa Residual = 27kPa	1			OL: Organic sandy SILT: light grey mottled brown. Low plasticity. Insensitive. Sand; fine to medium. (Piako Subgroup)		F to St					1	
													2	
	1.5	Peak = 41kPa Residual = 27kPa					S						3	
													4	
	2.0	Peak = 68kPa Residual = 30kPa	2			CL: Silty CLAY: with some fine sand. Dark bluish grey. Low plasticity. Moderately sensitive to sensitive. (Piako Subgroup)							2	
													2	
	2.5	Peak = 95kPa Residual = 27kPa											2	
													2	
	3.0	Peak = 84kPa Residual = 33kPa	3										2	
													2	
	3.5	Peak = 109kPa Residual = 27kPa											2	
													2	
	4.0	Peak = 103kPa Residual = 30kPa	4										1	
													1	
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Termination Reason: Target depth reached.
Shear Vane No: 3434 DCP No: 07
Remarks: Groundwater encountered at 0.8m depth.

TEST PIT PHOTOGRAPHS: TP25-14

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	5.5m



TEST PIT LOG - TP25-15

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 03/10/2025



Test Pit Location: Refer to Site Plan Logged by: AN Checked by: MM Scale: 1:25 Sheet 1 of 1
Position: 439746.6mE; 698632.9mN Projection: Mount Eden 2000 Pit Dimensions: 4.2m by 1.5m
Elevation: 36.80m Datum: NZVD2016 Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
	Depth	Type & Results								
			36.8			OL: Organic SILT: dark brown. Low plasticity. (Topsoil)				
	0.3	Peak = 125kPa Residual = 27kPa	36.6			MH: Clayey SILT: with some fine to coarse sand. Orange brown. High plasticity. Moderately sensitive to sensitive. (Walton Subgroup)	M	VSt		
	0.7	Peak = 163kPa Residual = 52kPa								
	1.0	B Peak = 191kPa Peak = >191kPa	1							
	1.0									
			35.5			CH: Silty CLAY: Light brown mottled orange. High plasticity. (Walton Subgroup)	S			
	1.5	Peak = 191kPa Peak = >191kPa								
	2.0	Peak = UTP	2							
	2.5	Peak = UTP					M to W			
	3.0	Peak = 191kPa Peak = >191kPa	3			... at 2.80m, becoming orange brown mottled red and black.				
			33.7			SP: Silty fine to medium pumiceous SAND: with minor clay. Orange brown. High plasticity. (Walton Subgroup)	VSt to H			
	4.0	Peak = 191kPa Peak = >191kPa	4			... at 4.00m, becoming light brown mottled grey, orange and red.	S			
	4.4	Peak = UTP								
			5			Test pit terminated at 5.00 m				

Termination Reason: Target depth reached.
Shear Vane No: 3434 DCP No: 07
Remarks: Groundwater encountered at 3.1m depth.

TEST PIT PHOTOGRAPHS: TP25-15

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	5.0m



Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 03/10/2025



Position: 439987.6mE; 698737.2mN	Projection: Mount Eden 2000	Pit Dimensions: 4.2m by 1.5m
Elevation: 26.20m	Datum: NZVD2016	Survey Source: Hand-held GPS

20kg bulk sample for solid density and standard compaction lab tests.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 5 - August 2024.

TEST PIT PHOTOGRAPHS: TP25-16

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	5.5m



HAND AUGER BOREHOLE LOG - SO25-01

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 06/10/2025
Borehole Location: Refer to Site Plan



Logged by: AN Checked by: MM Scale: 1:25 Sheet 1 of 1

Position: 439739.2mE; 700045.0mN Projection: Mount Eden 2000
Elevation: 28.60m Datum: NZVD2016 Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)		
	Depth	Type & Results									
			28.6		OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	M to W					
			28.4		MH: Organic clayey SILT: brownish grey. Low plasticity. (Piako Subgroup)						
			28.2		MH: Sandy CLAY: Light brown mottled orange. High plasticity. Sand; fine to coarse (Piako Subgroup)	S					
			Borehole terminated at 0.6 m								
			1								
			2								
			3								
			4								
			5								

Termination Reason: Target depth reached.
Shear Vane No: DCP No:
Remarks: Groundwater originally not encountered, rose to 0.3m during soakage testing set up.

HAND AUGER BOREHOLE LOG - SO25-02

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 06/10/2025
Borehole Location: Refer to Site Plan



Logged by: WD Checked by: MM Scale: 1:25 Sheet 1 of 1

Position: 440008.4mE; 700003.2mN Projection: Mount Eden 2000
Elevation: 38.60m Datum: NZVD2016 Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)		
	Depth	Type & Results							5	10	15
▼			38.6			OL: Organic SILT: brown. No plasticity. (Topsoil)	M				
			38.3			OH: Organic Silty CLAY: dark brownish grey. High plasticity. (Piako Subgroup)	W				
						... at 0.60m, becoming light grey, containing minor fine sand.	S				
					Borehole terminated at 0.6 m						
				1							
				2							
				3							
				4							
				5							

Termination Reason: Target depth reached.
Shear Vane No: DCP No:
Remarks: Groundwater originally encountered at 0.6m, rose to 0.3m during soakage testing set up.

HAND AUGER BOREHOLE LOG - SO25-03

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 06/10/2025
Borehole Location: Refer to Site Plan



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Logged by: WD Checked by: MM Scale: 1:25 Sheet 1 of 1

Position: 439785.2mE; 699260.6mN Projection: Mount Eden 2000 Survey Source: Hand-held GPS
Elevation: 23.80m Datum: NZVD2016

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)		
	Depth	Type & Results									
									5	10	15
			23.8			Pt: Fibrous PEAT: black. No plasticity. Containing some roots and wood fragments. (Piako Subgroup)	W				
						Borehole terminated at 0.3 m	S				
				1							
				2							
				3							
				4							
				5							

Termination Reason: Target depth reached.
Shear Vane No: DCP No:
Remarks: Groundwater encountered at 0.2m

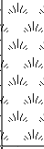
HAND AUGER BOREHOLE LOG - SO25-04

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 06/10/2025
Borehole Location: Refer to Site Plan


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Logged by: AN Checked by: MM Scale: 1:25 Sheet 1 of 1

Position: 439781.9mE; 699178.0mN Projection: Mount Eden 2000
Elevation: 23.10m Datum: NZVD2016 Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Dynamic Cone Penetrometer (Blows/100mm)		
	Depth	Type & Results									
									5	10	15
▼			23.1			OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	W to S				
			23.0		Pt: Fibrous PEAT: black. No plasticity. Containing some roots and wood fragments. (Piako Subgroup)						
					Borehole terminated at 0.6 m						
				1							
				2							
				3							
				4							
				5							

Termination Reason: Target depth reached.
Shear Vane No: DCP No:
Remarks: Groundwater originally not encountered, rose to 0.5m during soakage testing set up.

HAND AUGER BOREHOLE LOG - SO25-05

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 06/10/2025
Borehole Location: Refer to Site Plan



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Logged by: WD Checked by: MM Scale: 1:25 Sheet 1 of 1

Position: 440263.9mE; 699205.3mN Projection: Mount Eden 2000
Elevation: 24.20m Datum: NZVD2016 Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)		
	Depth	Type & Results									
									5	10	15
			24.2		Pt: Fibrous PEAT: black. No plasticity. Containing some roots. (Piako Subgroup)		M				
							W				
							S				
					... at 0.80m, becoming black with brown. Containing some roots and minor wood fragments						
					Borehole terminated at 0.8 m						
				1							

Termination Reason: Target depth reached.
Shear Vane No: DCP No:
Remarks: Groundwater originally encountered at 0.85m, rose to 0.3m during soakage testing set up.

HAND AUGER BOREHOLE LOG - SO25-06

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 06/10/2025
Borehole Location: Refer to Site Plan



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Logged by: WD Checked by: MM Scale: 1:25 Sheet 1 of 1

Position: 439755.3mE; 698602.9mN Projection: Mount Eden 2000
Elevation: 34.90m Datum: NZVD2016 Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Dynamic Cone Penetrometer (Blows/100mm)		
	Depth	Type & Results									
									5	10	15
			34.9		OL: Organic SILT: brown. No plasticity. (Topsoil)		M				
			34.6		CH: CLAY: greyish brown. High plasticity. (Walton Subgroup)						
					... at 0.50m, becoming orange brown mottled black, containing trace fine gravels, manganese nodules.						
			34.2		CH: CLAY: orange brown streaked light grey. High plasticity. (Walton Subgroup)						
				1	... at 1.00m, becoming orange brown streaked reddish brown and light grey. Containing minor silt.						
			33.6		CH: CLAY: with some silt. Light grey streaked reddish brown and light orange brown. High plasticity. (Walton Subgroup)		W				
					... at 1.50m, becoming light grey streaked brown. ... at 1.55m, containing minor fine sand. Becoming brown streaked light grey mottled black.		S				
					Borehole terminated at 1.6 m						
				2							
				3							
				4							
				5							

Termination Reason: Target depth reached.
Shear Vane No: DCP No:
Remarks: Groundwater encountered at 1.55m

WGA Investigations

Table A1: Lithological Log for Piezometer P1

FROM (m)	TO (m)	LITHOLOGICAL DESCRIPTION
0	0.2	Topsoil, dark brown to black
0.2	2.3	Clay, light grey, orange mottling, stiff, plastic
2.3	2.55	Clay, white to cream, orange mottles, stiff, plastic
2.55	3.84	Clay with silt and sand, grey, poorly sorted
3.84	4.04	Clay, white, stiff
4.04	4.8	Silt with minor fine sand, grey to cream, soft
4.8	4.95	Silt with some clay, dry, crusty
4.95	5.2	Silt with minor fine sand, grey to cream, soft
5.2	6	Silt with some sand, light brown to orange, very wet

Table A2: Lithological Log for Piezometer P2

FROM (m)	TO (m)	LITHOLOGICAL DESCRIPTION
0	4.25	Core compression, some black organic material (peat) recovered.
4.25	4.5	Silt with some clay, dark grey, soft, wet
4.5	6	Silt with some sand, light grey, wet, soft, low plasticity

Table A3: Lithological Log for Piezometer P3

FROM (m)	TO (m)	LITHOLOGICAL DESCRIPTION
0	1.35	Organic matter (peat), black, rooted
1.35	2.13	Organic material, timber
2.13	2.5	Silt with some sand, light grey, very soft
2.5	3.5	Clayey silt, grey brown, minor plasticity
3.5	5.7	Silt with some fine sand, light grey, very soft, wet
5.7	6	Organic matter (peat), black

Table A4: Lithological Log for Piezometer P4

FROM (m)	TO (m)	LITHOLOGICAL DESCRIPTION
0	0.15	Topsoil, brown
0.15	1.5	Clayey coarse sand, yellowy brown, inclusions of dark organic matter
1.5	1.6	Organic matter (peat), black
1.6	1.75	Silt with some fine sand, grey
1.75	2.6	Silt with minor clay, light grey, well sorted
2.6	4.15	Silty sand, light yellowy brown, poorly sorted
4.15	4.6	Coarse sand with some silt, whitey yellow, poorly sorted, some gravels toward bottom.
4.6	4.7	Clayey silt with minor sand, light grey, orange mottling
4.7	5.8	Gravel with coarse sand, light brownish grey, orange mottling, pumice

FROM (m)	TO (m)	LITHOLOGICAL DESCRIPTION
5.8	6	Fine sand with silt, light grey, orange mottling, dry
6	6.05	Sandy silt, light grey, pumice gravels
6.05	7.08	Coarse gravel with some silt and sand, pumice, very wet
7.08	7.3	Coarse sand with gravel, dark orangey brown, pumice gravels, dry
7.3	7.5	Medium sand, orangey brown, moderately sorted, dry
7.5	8.95	Gravel, light grey to light brown, pumice gravels, moderately sorted, wet
8.95	9	Fine sand, orange, dry

APPENDIX B GROUNDWATER LEVEL RECORDS



Table B1: Groundwater Measurements Taken By WGA

PIEZOMETER ID	DEPTH TO GROUNDWATER (m bgl)	MEASUREMENT DATE
P1	0.6	6/10/2025
	0.735	21/10/2025
	1.445	21/11/2025
	1.189	11/03/2026
	0.754	15/06/2026
P2	1	6/10/2025
	0.689	11/03/2026
	0.549	21/10/2025
	1.295	21/11/2025
	0.517	15/06/2026
P3	0.5	6/10/2025
	0.318	21/10/2025
	1.098	21/11/2025
	0.358	11/03/2026
	0.198	15/06/2026
P4	1.7	6/10/2025
	0.58	21/10/2025
	1.29	21/11/2025
	0.705	11/03/2026
	0.592	15/06/2026

Table B2: Groundwater Measurements Taken from CMW

INVESTIGATION SITE ID	DEPTH TO GROUNDWATER (m bgl)
CPT25-03	0.1
CPT25-04	0.6
CPT25-07	3.6
CPT25-08	1.0
CPT25-09	0.4
CPT25-10	1.0
CPT25-11	0.5
CPT25-12	0.4
CPT25-13	0.1
CPT25-14	0.1
CPT25-15	0.2
CPT25-16	0.3
CPT25-18	0.5
CPT25-19	0.5
CPT25-20	3.7
SO25-01	0.3
SO25-02	0.3
SO25-03	0.2
SO25-04	0.5
SO25-05	0.3
SO25-06	1.5
TP103	2.5
TP104	3.5
TP105	1.2
TP106	3.5
TP107	3.0
TP25-11	1.8
TP25-12	1.2
TP25-13	1.0
TP25-14	0.8
TP25-15	3.1
TP25-16	1.3

Table B3: Groundwater Measurements Taken by Tonkin and Taylor

INVESTIGATION SITE ID	DEPTH TO GROUNDWATER (m bgl)
CPT102	Collapsed 0.35
CPT103	Artesian
CPT104	Artesian
CPT105	0.7
CPT106	0.45
CPT107	0.5
CPT108	0.54
CPT109	0
CPT110	0.48
CPT111	Collapsed 12.8
BH102	Artesian
BH103	Artesian
BH101	15.01
CPT101	Collapsed 0.25
CPT112	Collapsed 1.8
CPT113	Collapsed 0.67
CPT114	Collapsed 2.4

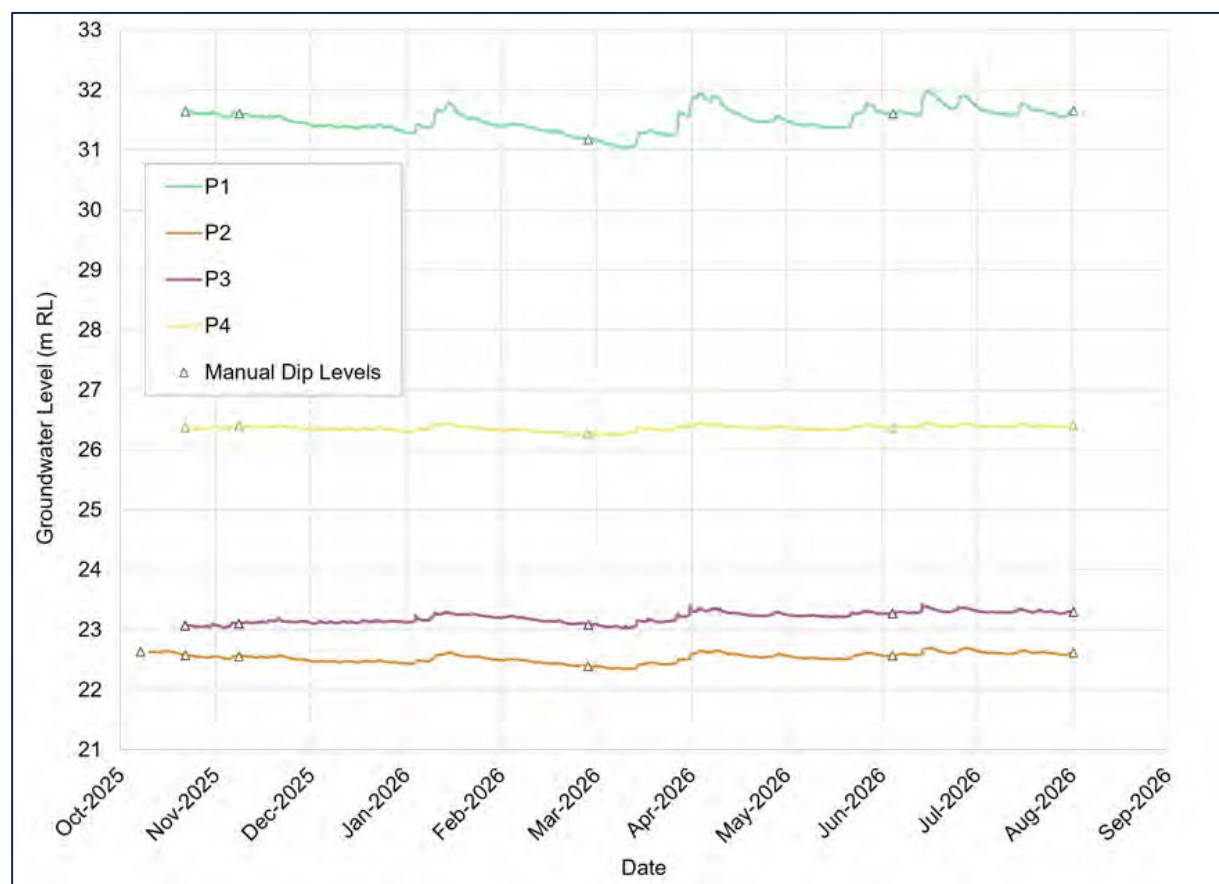


Figure B1: Continuous Groundwater Level Monitoring

APPENDIX C

HYDRAULIC TESTS



WGA HYDRAULIC TESTS

Hydraulic tests have been performed by WGA on four piezometers installed within the Development area. The tables below summarise the test locations (Table E1), the materials tested (Table E2) and the test data analysis results (Table E3). All of the tests undertaken by WGA were slug tests, with one falling and one rising head test performed in each of the piezometers. All of the tests were analysed using the Bouwer and Rice (1976) method, which is widely used and accepted for this purpose. Copies of the hydraulic test analysis sheets are provided below.

Table C1: Hydraulic Test Piezometer Locations

PIEZOMETER	EASTING (NZTM)	NORTHING (NZTM)	TEST INTERVAL (m bgl)
P1	1795224	5816302	4.5 – 6.0
P2	1795050	5815504	3.0 – 4.5
P3	1795586	5815412	3.1 – 4.6
P4	1796000	5815516	7.5 – 9.0

Table C2: Hydraulic Test Lithologies

PIEZOMETER	TEST INTERVAL (m bgl)	LITHOLOGY TESTED
P1	4.5 – 6.0	SILT
P2	3.0 – 4.5	Predominantly PEAT, with SILT in bottom 0.25 m
P3	3.1 – 4.6	SILT
P4	7.5 – 9.0	Pumice GRAVELS

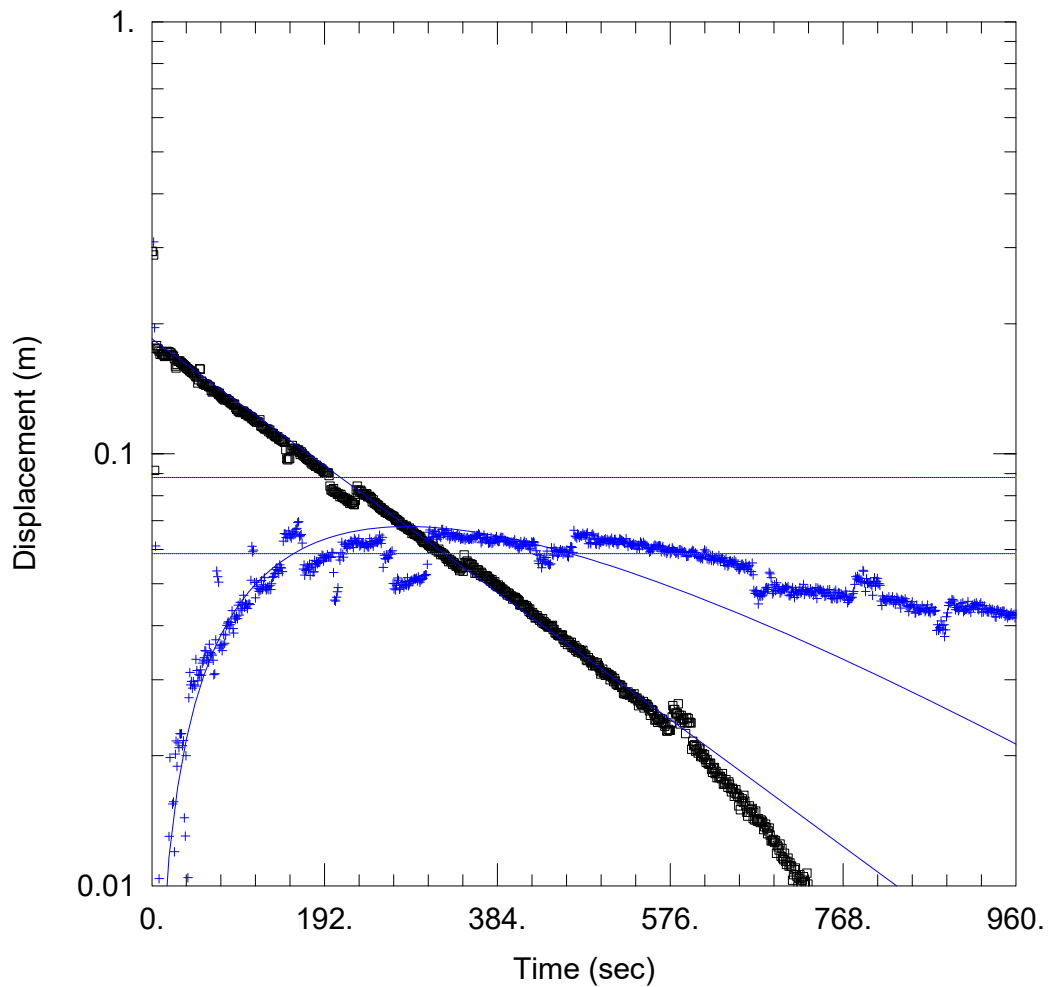
Table C3: Hydraulic Test Analysis Results

PIEZOMETER	HYDRAULIC CONDUCTIVITY (m/day) ⁽¹⁾		
	Falling Head	Rising Head	Average
P1	0.11	0.13	0.12
P2	0.039	0.0005 ⁽²⁾	0.039
P3	0.17	0.15	0.16
P4	0.16	0.00033 ⁽²⁾	0.16

Notes:

⁽¹⁾ All analyses completed using the Bouwer & Rice (1976) method.

⁽²⁾ Concerns with dataset and analysis led to result being discounted.



WELL TEST ANALYSIS

Data Set: V:\...\P1 - Bouwer - Falling Head.aqt

Date: 04/19/26

Time: 19:55:21

PROJECT INFORMATION

Company: WGA

Client: Brymer Farms Ltd

Project: 211193

Location: Hamilton

Test Well: P1

Test Date: 04/11/2025

AQUIFER DATA

Saturated Thickness: 15.34 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P1)

Initial Displacement: 0.2938 m

Total Well Penetration Depth: 5.29 m

Casing Radius: 0.02 m

Static Water Column Height: 5.29 m

Screen Length: 1.5 m

Well Radius: 0.0375 m

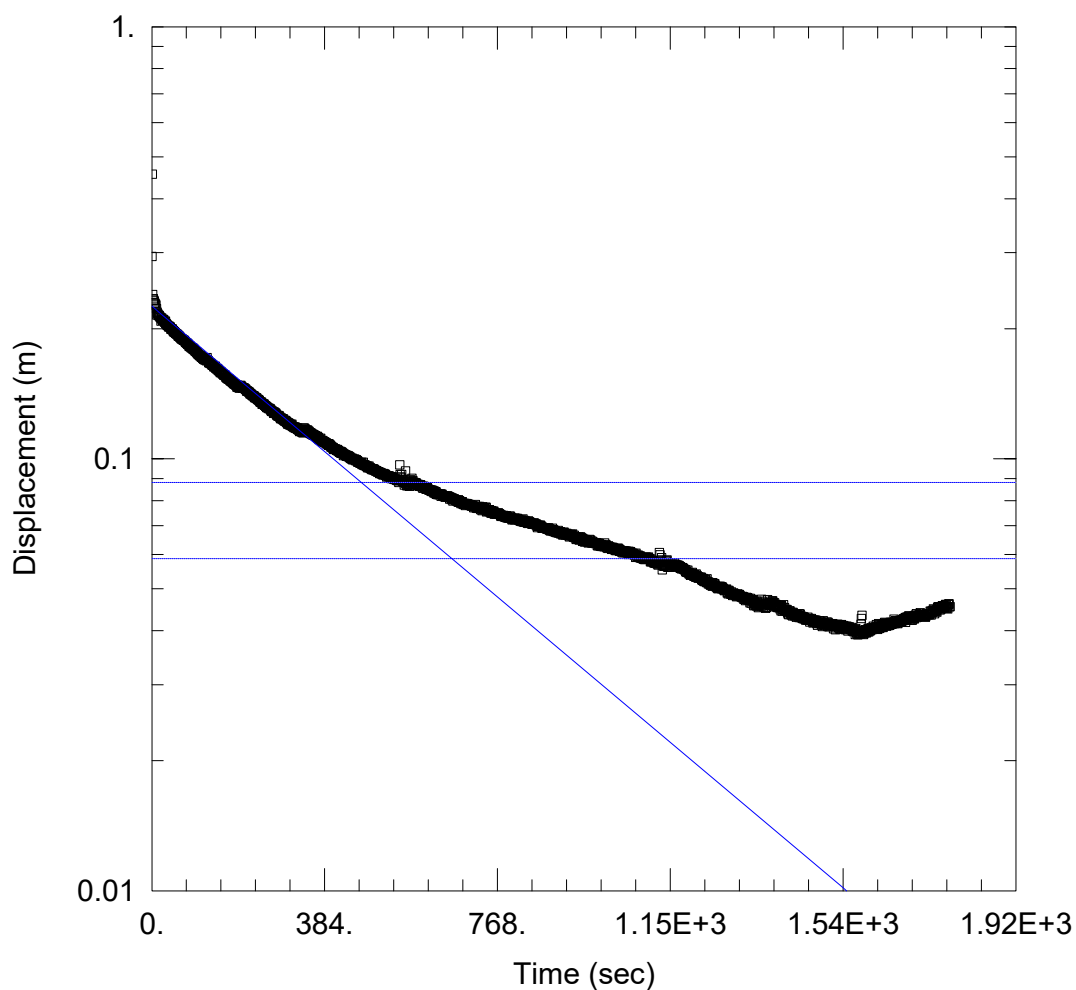
SOLUTION

Aquifer Model: Unconfined

$K = 0.1147$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1845$ m



WELL TEST ANALYSIS

Data Set: V:\...\P1 - Bouwer - Rising Head.aqt

Date: 04/19/26

Time: 20:02:47

PROJECT INFORMATION

Company: WGA

Client: Brymer Farms Ltd

Project: 211193

Location: Hamilton

Test Well: P1

Test Date: 04/11/2025

AQUIFER DATA

Saturated Thickness: 15.34 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P1)

Initial Displacement: 0.2938 m

Total Well Penetration Depth: 5.29 m

Casing Radius: 0.05 m

Static Water Column Height: 5.29 m

Screen Length: 1.5 m

Well Radius: 0.06 m

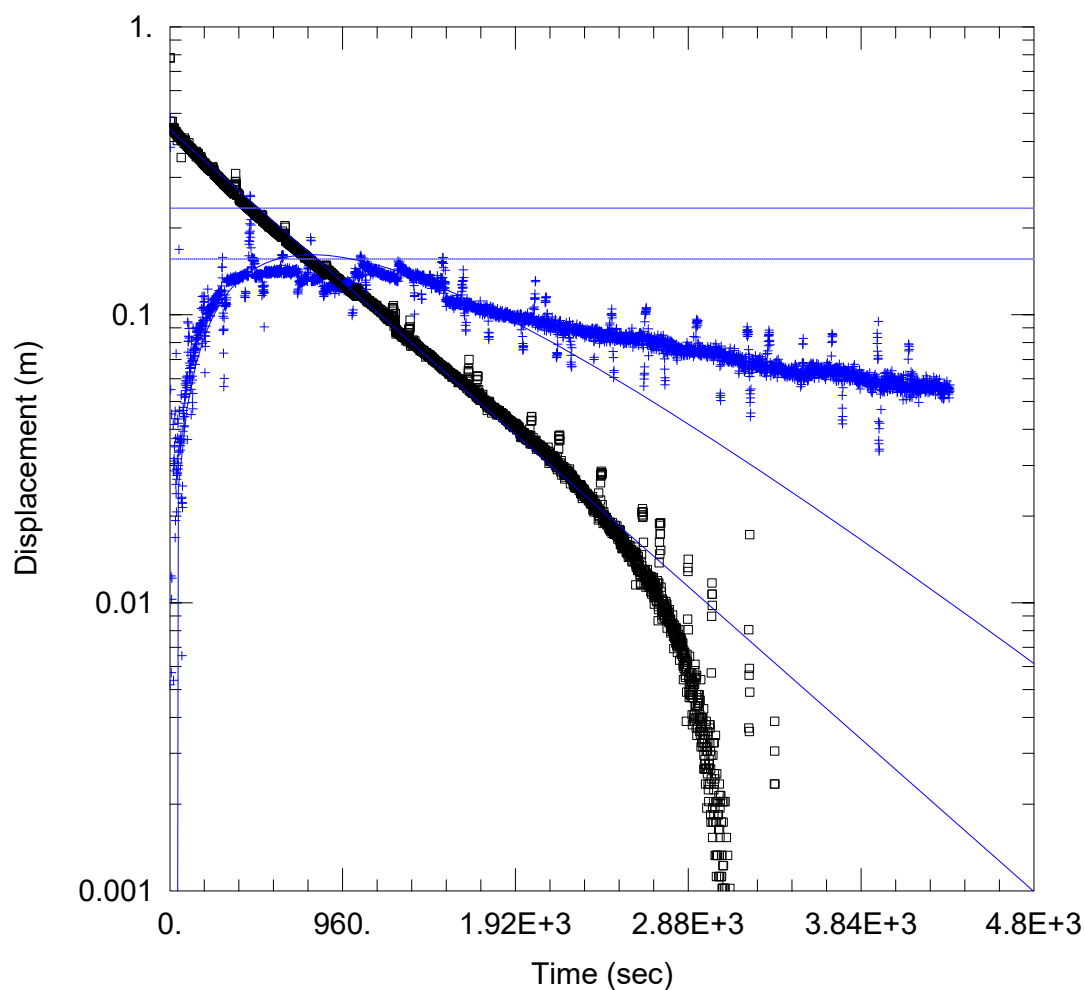
SOLUTION

Aquifer Model: Unconfined

K = 0.1267 m/day

Solution Method: Bouwer-Rice

y0 = 0.2257 m



WELL TEST ANALYSIS

Data Set: V:\...\P2 - Bouwer - Falling Head.aqt

Date: 04/19/26

Time: 20:15:23

PROJECT INFORMATION

Company: WGA

Client: Brymer Farms Ltd

Project: 211193

Location: Hamilton

Test Well: P2

Test Date: 21/10/2025

AQUIFER DATA

Saturated Thickness: 14.88 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P2)

Initial Displacement: 0.7818 m

Static Water Column Height: 4.103 m

Total Well Penetration Depth: 4.103 m

Screen Length: 1.55 m

Casing Radius: 0.02 m

Well Radius: 0.0375 m

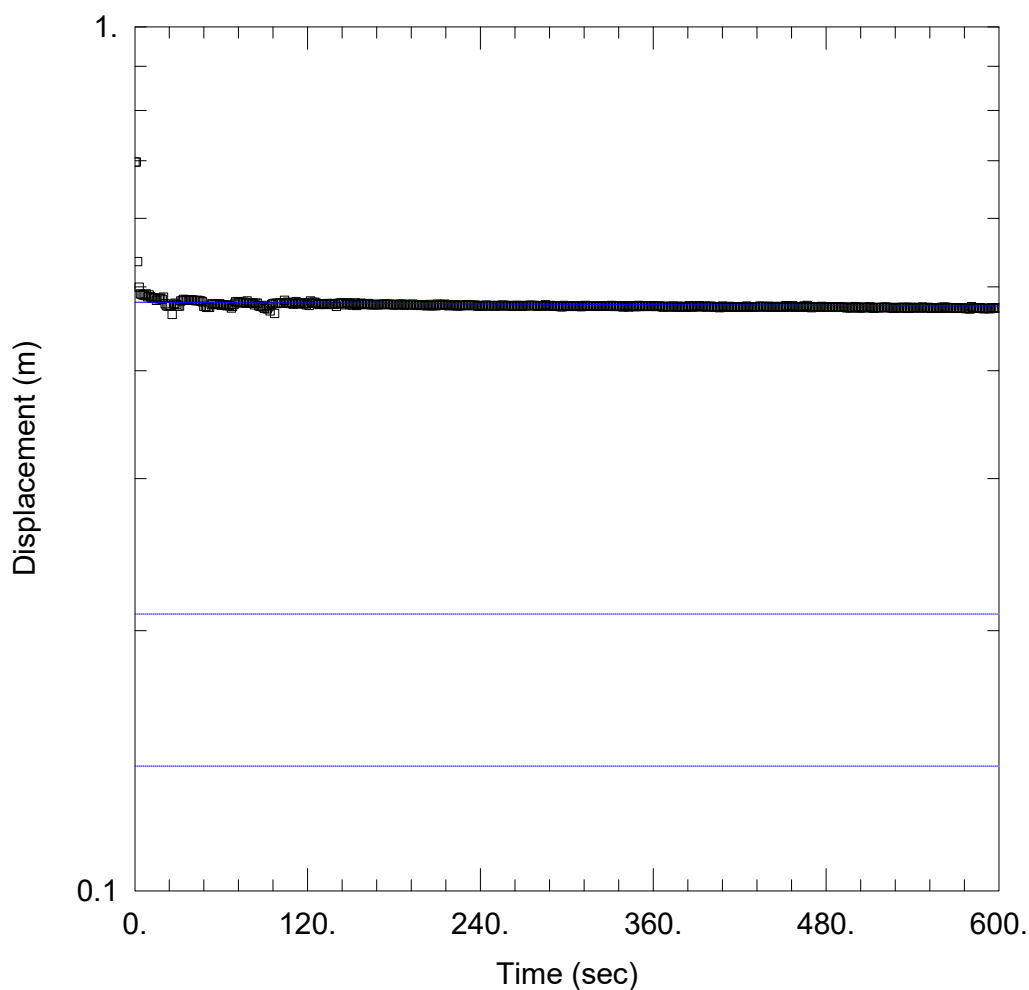
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.03883$ m/day

$y_0 = 0.4393$ m



WELL TEST ANALYSIS

Data Set: V:\...\P2 - Bouwer - Rising Head.aqt

Date: 04/19/26

Time: 20:20:47

PROJECT INFORMATION

Company: WGA

Client: Brymer Farms Ltd

Project: 211193

Location: Hamilton

Test Well: P2

Test Date: 21/10/2025

AQUIFER DATA

Saturated Thickness: 14.88 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P2)

Initial Displacement: 0.6971 m

Static Water Column Height: 4.103 m

Total Well Penetration Depth: 4.103 m

Screen Length: 1.55 m

Casing Radius: 0.02 m

Well Radius: 0.0375 m

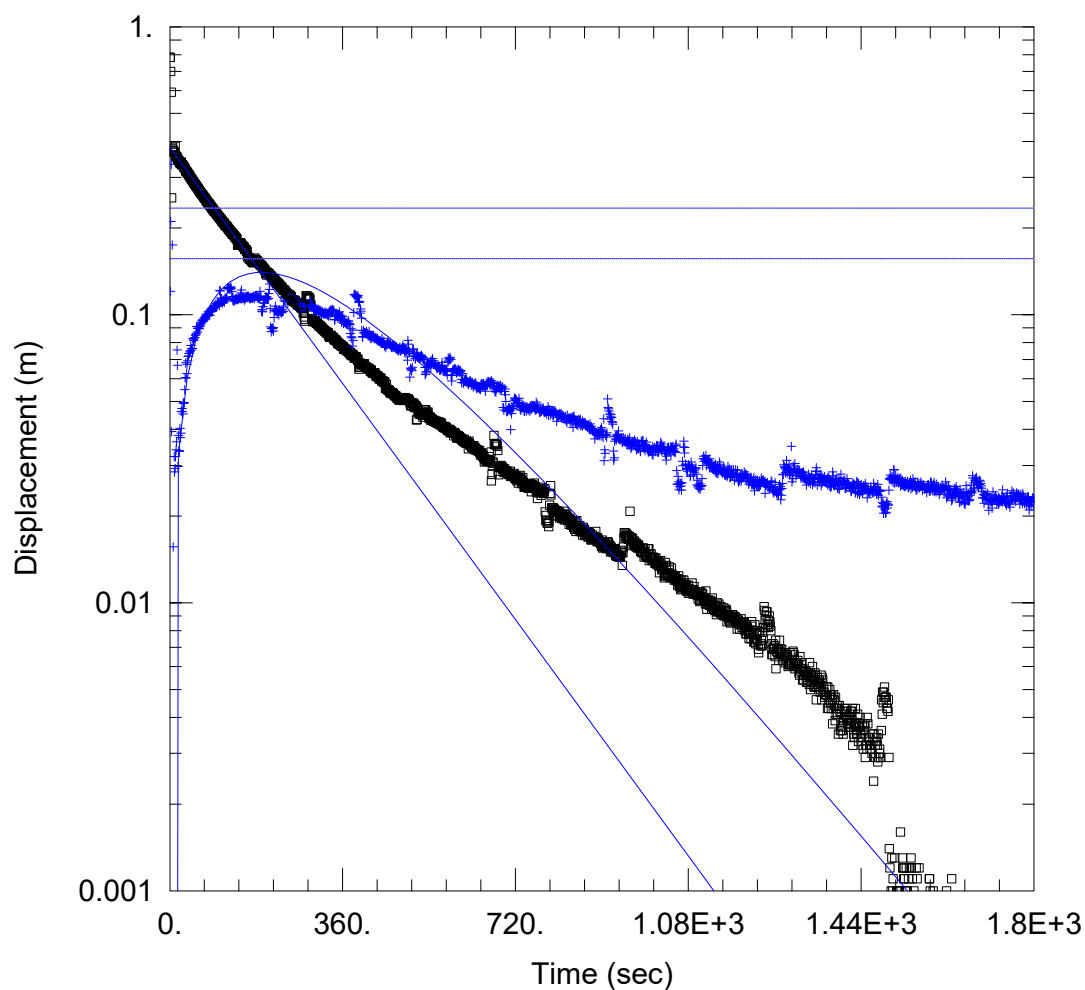
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 0.0005365 m/day

y0 = 0.4799 m



WELL TEST ANALYSIS

Data Set: V:\...\P3 - Bouwer - Falling Head.aqt

Date: 04/19/26

Time: 20:26:38

PROJECT INFORMATION

Company: WGA

Client: Brymer Farms Ltd

Project: 211193

Location: Hamilton

Test Well: P3

Test Date: 04/11/2025

AQUIFER DATA

Saturated Thickness: 14.43 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (New Well)

Initial Displacement: 0.7825 m

Static Water Column Height: 4.16 m

Total Well Penetration Depth: 4.16 m

Screen Length: 1.435 m

Casing Radius: 0.02 m

Well Radius: 0.0375 m

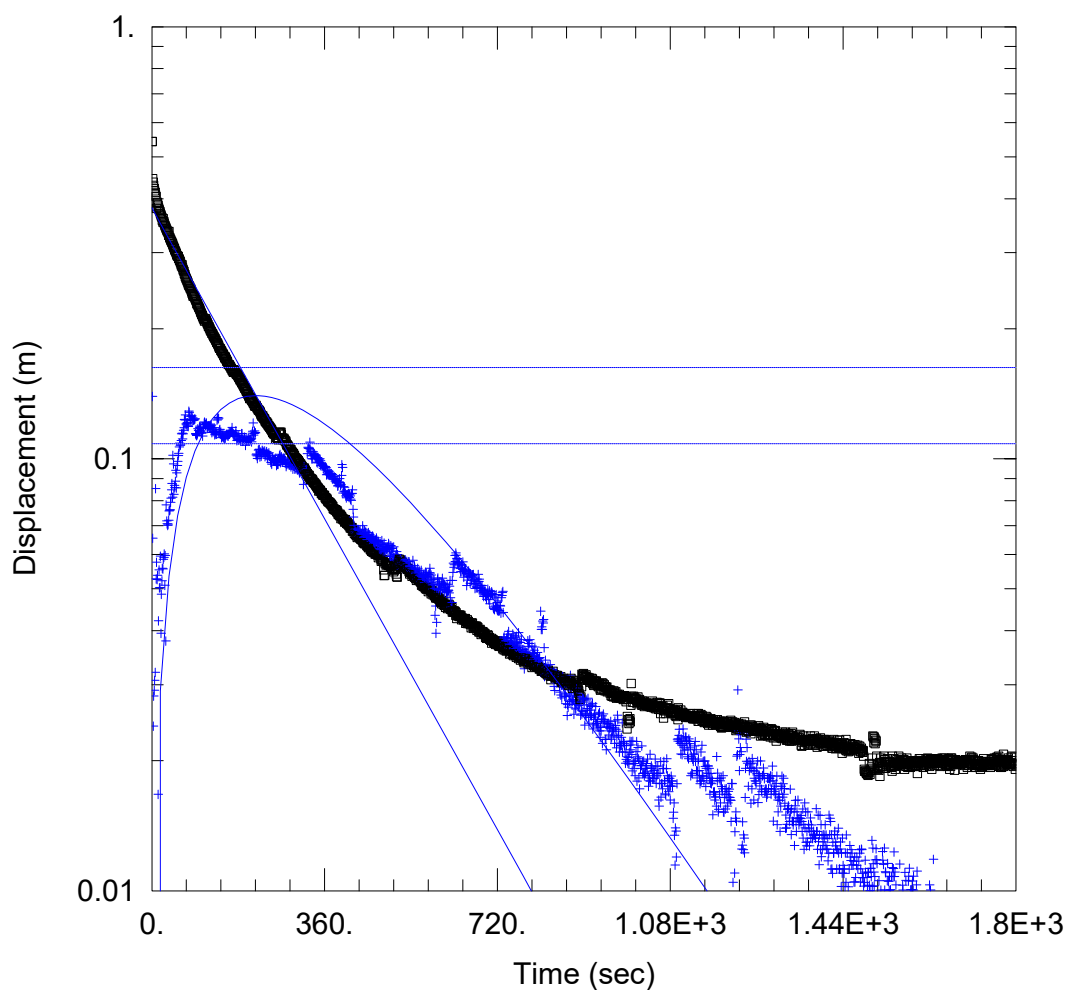
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.1713$ m/day

$y_0 = 0.3818$ m



WELL TEST ANALYSIS

Data Set: V:\...\P3 - Bouwer - Rising Head.aqt

Date: 04/19/26

Time: 20:29:57

PROJECT INFORMATION

Company: WGA

Client: Brymer Farms Ltd

Project: 211193

Location: Hamilton

Test Well: P3

Test Date: 04/11/2025

AQUIFER DATA

Saturated Thickness: 14.43 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P3)

Initial Displacement: 0.5421 m

Static Water Column Height: 4.16 m

Total Well Penetration Depth: 4.16 m

Screen Length: 1.435 m

Casing Radius: 0.02 m

Well Radius: 0.0375 m

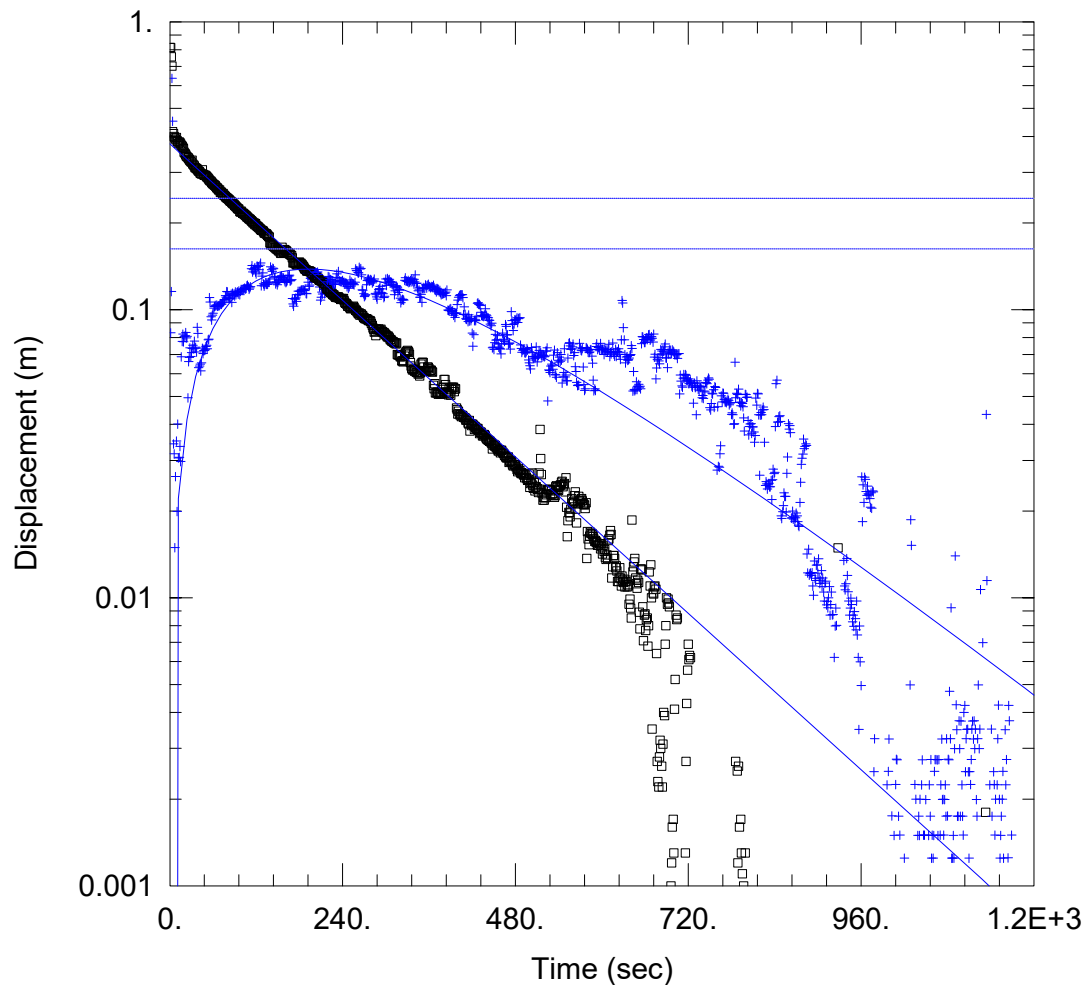
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.1503$ m/day

$y_0 = 0.3809$ m



WELL TEST ANALYSIS

Data Set: V:\...\P4 - Bouwer - Falling Head.aqt

Date: 04/19/26

Time: 20:32:18

PROJECT INFORMATION

Company: WGA

Client: Brymer Farms Ltd

Project: 211193

Location: Hamilton

Test Well: P4

Test Date: 4/10/2025

AQUIFER DATA

Saturated Thickness: 15.36 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P4)

Initial Displacement: 0.8136 m

Static Water Column Height: 8.314 m

Total Well Penetration Depth: 8.314 m

Screen Length: 1.805 m

Casing Radius: 0.02 m

Well Radius: 0.0375 m

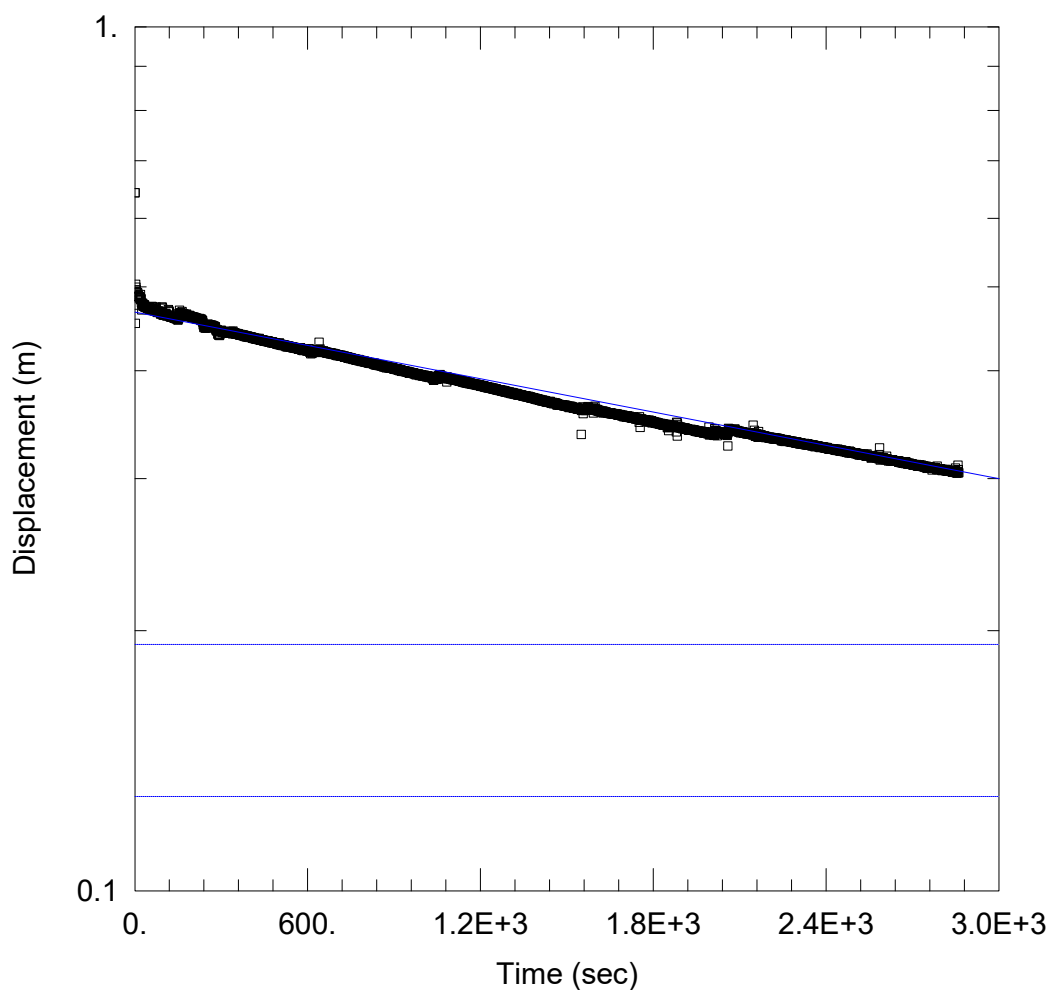
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.1564$ m/day

$y_0 = 0.3767$ m



WELL TEST ANALYSIS

Data Set: V:\...\P4 - Bouwer - Rising Head.aqt

Date: 04/19/26

Time: 20:33:19

PROJECT INFORMATION

Company: WGA

Client: Brymer Farms Ltd

Project: 211193

Location: Hamilton

Test Well: P4

Test Date: 4/10/2025

AQUIFER DATA

Saturated Thickness: 15.36 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P4)

Initial Displacement: 0.6426 m

Static Water Column Height: 8.314 m

Total Well Penetration Depth: 8.314 m

Screen Length: 1.805 m

Casing Radius: 0.02 m

Well Radius: 0.03 m

SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 0.003287 m/day

y0 = 0.4675 m

CMW FALLING HEAD TESTS

Hydraulic tests have been performed by CMW in six shallow open hand-auger holes drilled within the Development area. The tables below summarise the test locations (Table E4), the materials tested (Table E5) and the test data analysis results (Table E6). All of the tests undertaken by CMW were falling head tests. These tests were analysed by CMW using the CIRIA (1986) and the Hvorslev (1951) methods, both of which are widely used and accepted for this purpose. Copies of the hydraulic test analysis sheets are provided below.

Table C4: Falling Head Test Locations

TEST HOLE ID	TEST INTERVAL (m bgl)
SO25-01	0 – 0.6
SO25-02	0 – 0.6
SO25-03	0 – 0.6
SO25-04	0 – 0.6
SO25-05	0 – 0.8
SO25-06	0 – 1.6

Table C5: Lithologies Intersected in Hand Auger Drillholes

TEST HOLE ID	TEST INTERVAL (m bgl)	LITHOLOGY TESTED
SO25-01	0 – 0.6	Sandy CLAY
SO25-02	0 – 0.6	Organic SILT/CLAY
SO25-03	0 – 0.6	PEAT/SILT
SO25-04	0 – 0.6	PEAT/SILT
SO25-05	0 – 0.8	PEAT/SILT
SO25-06	0 – 1.6	CLAY

Table C6: Falling Head Test Analysis Results

TEST HOLE ID	HYDRAULIC CONDUCTIVITY (m/day) ⁽¹⁾	
	CIRIA 113 ⁽²⁾	HVORSLEV ⁽³⁾
SO25-01	2.16	0.66
SO25-02	0.13	0.04
SO25-03	2.08	0.97
SO25-04	1.74	0.56
SO25-05	2.47	0.62
SO25-06	0.38	0.05

Notes:

⁽¹⁾ Data sourced from CMW.

⁽²⁾ Analysis using the CIRIA (1986) method.

⁽³⁾ Analysis using the Hvorslev (1951) method.

CLIENT: **Maven Ltd**

PROJECT: **Brymer Development**

TITLE: **SO25-01 Falling Head Permeability Test**

DESIGNER: **AN**

CHECKED: **MM**

REVISION: **0**

DATE: **29/10/2025**

PROJECT: **HAM2025-0084**

Specifications - Open-Ended Tube

Length L_1 : 0.6 m
 Diameter: 90 mm
 Non-Perm L_2 : 0 m
 Above Gnd L_3 : 0 m

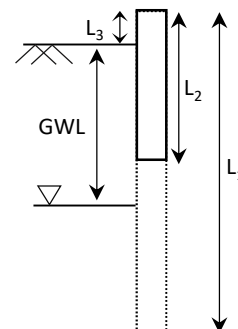
Ground Conditions

GWL: 0.31 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

$m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 0.60 m BGL



Hydraulic Conductivity (k)

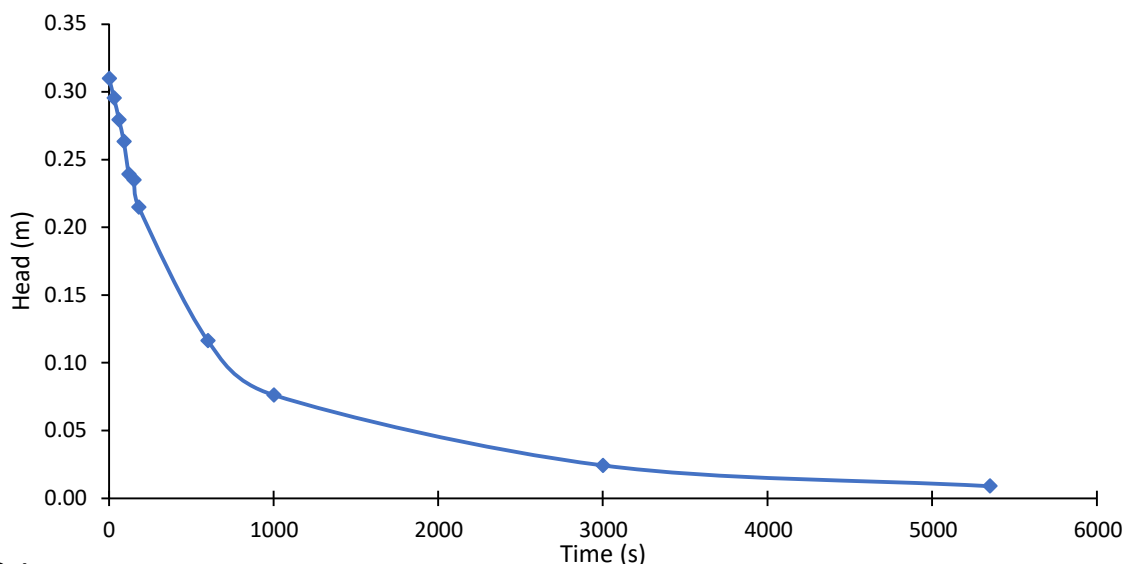
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 2.50\text{E-}05 \text{ ms}^{-1} = 2.16 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 7.62\text{E-}06 \text{ ms}^{-1} = 0.66 \text{ m/day}$$



STRATIGRAPHIC LOG

Organic Silt

Sandy Clay

EOH @ 0.6m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	0.310			
30	0.014	0.296	0.593	7.00E-06	2.70E-05
60	0.031	0.279	0.577	8.43E-06	3.18E-05
90	0.047	0.263	0.561	9.03E-06	3.32E-05
120	0.071	0.239	0.541	1.49E-05	5.29E-05
150	0.075	0.235	0.527	2.87E-06	9.93E-06
180	0.095	0.215	0.515	1.43E-05	4.86E-05
600	0.194	0.116	0.456	7.55E-06	2.35E-05
1000	0.234	0.076	0.386	5.97E-06	1.43E-05
3000	0.286	0.024	0.340	3.49E-06	6.41E-06
5350	0.301	0.009	0.307	2.70E-06	2.27E-06

CLIENT: **Maven Ltd**

PROJECT: **Brymer Development**

TITLE: **SO25-02 Falling Head Permeability Test**

DESIGNER: **AN**

CHECKED: **MM**

REVISION: **0**

DATE: **29/10/2025**

PROJECT: **HAM2025-0084**

Specifications - Open-Ended Tube

Length L_1 : 0.6 m
Diameter: 90 mm
Non-Perm L_2 : 0 m
Above Gnd L_3 : 0 m

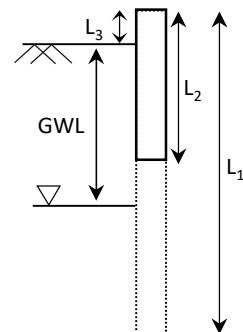
Ground Conditions

GWL: 0.3 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m : 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 0.60 m BGL



Hydraulic Conductivity (k)

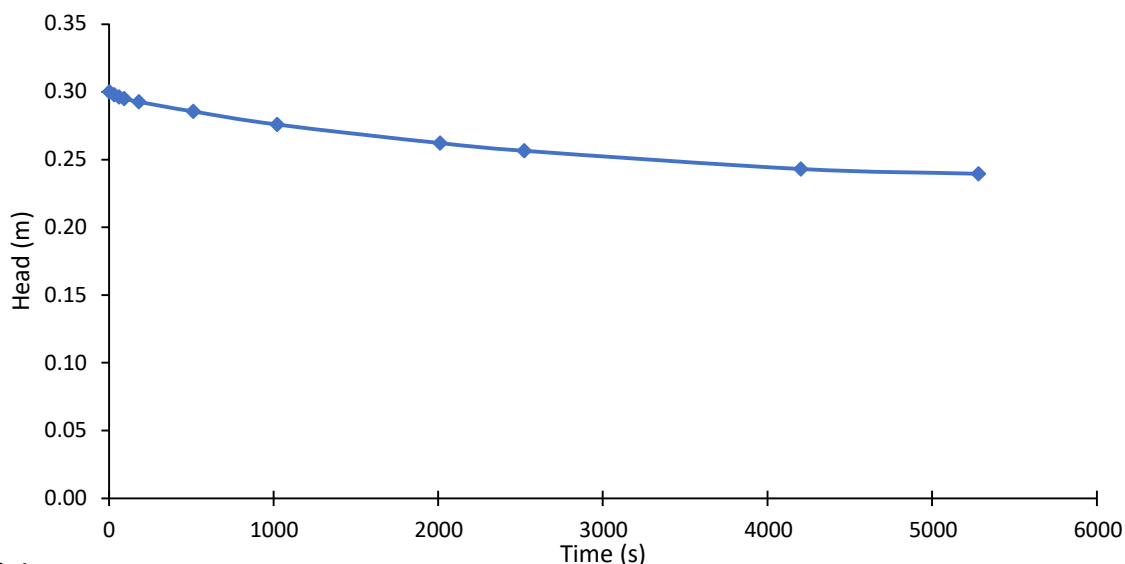
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 1.56\text{E-}06 \text{ ms}^{-1} = 0.13 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 4.08\text{E-}07 \text{ ms}^{-1} = 0.04 \text{ m/day}$$



STRATIGRAPHIC LOG

Organic Silt/Clay

EOH @ 0.6m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	0.300			
30	0.002	0.298	0.599	1.03E-06	3.98E-06
60	0.004	0.296	0.597	8.38E-07	3.24E-06
90	0.005	0.295	0.596	5.46E-07	2.10E-06
180	0.007	0.293	0.594	4.00E-07	1.54E-06
510	0.014	0.286	0.589	3.30E-07	1.26E-06
1020	0.024	0.276	0.581	3.00E-07	1.13E-06
2010	0.038	0.262	0.569	2.34E-07	8.68E-07
2520	0.043	0.257	0.559	1.94E-07	7.05E-07
4200	0.057	0.243	0.550	1.49E-07	5.33E-07
5280	0.060	0.240	0.541	6.44E-08	2.28E-07

CLIENT: **Maven Ltd**

PROJECT: **Brymer Development**

TITLE: **SO25-03 Falling Head Permeability Test**

DESIGNER: **AN**

CHECKED: **MM**

REVISION: **0**

DATE: **29/10/2025**

PROJECT: **HAM2025-0084**

Specifications - Open-Ended Tube

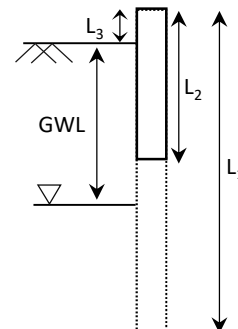
Length L_1 : **0.3 m**
 Diameter: **90 mm**
 Non-Perm L_2 : **0 m**
 Above Gnd L_3 : **0 m**

Ground Conditions

GWL: **0.2 m BGL** (Blank = Bottom of hole)

Permeability Anisotropy
 m : **1** $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: **0.60 m BGL**



Hydraulic Conductivity (k)

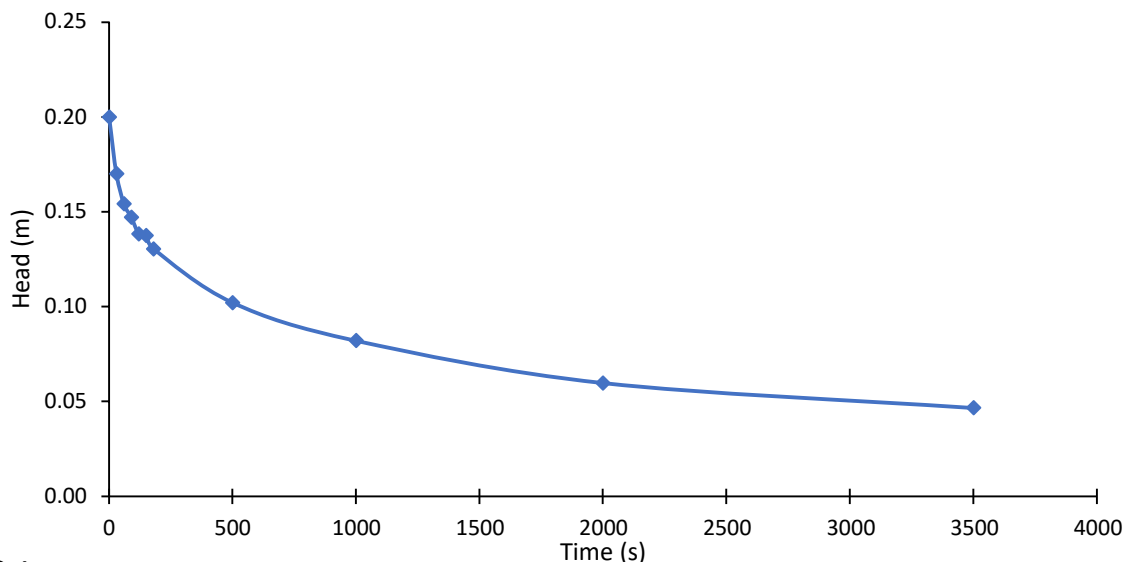
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 2.40\text{E-}05 \text{ ms}^{-1} = 2.08 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 1.12\text{E-}05 \text{ ms}^{-1} = 0.97 \text{ m/day}$$



STRATIGRAPHIC LOG

Peat/Silt

EOH @ 0.3m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	0.200			
30	0.030	0.170	0.285	3.60E-05	8.54E-05
60	0.046	0.154	0.262	2.25E-05	4.98E-05
90	0.053	0.147	0.251	1.11E-05	2.37E-05
120	0.062	0.138	0.243	1.46E-05	3.02E-05
150	0.063	0.137	0.238	1.75E-06	3.56E-06
180	0.070	0.130	0.234	1.27E-05	2.55E-05
500	0.098	0.102	0.216	5.77E-06	1.08E-05
1000	0.118	0.082	0.192	3.45E-06	5.75E-06
2000	0.140	0.060	0.171	2.64E-06	3.84E-06
3500	0.153	0.047	0.153	1.42E-06	1.76E-06

CLIENT: **Maven Ltd**

PROJECT: **Brymer Development**

TITLE: **SO25-04 Falling Head Permeability Test**

DESIGNER: **AN**

CHECKED: **MM**

REVISION: **0**

DATE: **29/10/2025**

PROJECT: **HAM2025-0084**

Specifications - Open-Ended Tube

Length L_1 : 0.6 m
Diameter: 90 mm
Non-Perm L_2 : 0 m
Above Gnd L_3 : 0 m

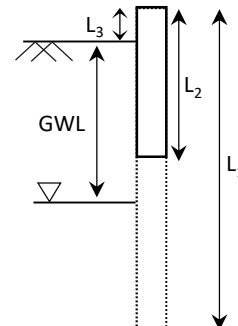
Ground Conditions

GWL: 0.5 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m : 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 0.60 m BGL



Hydraulic Conductivity (k)

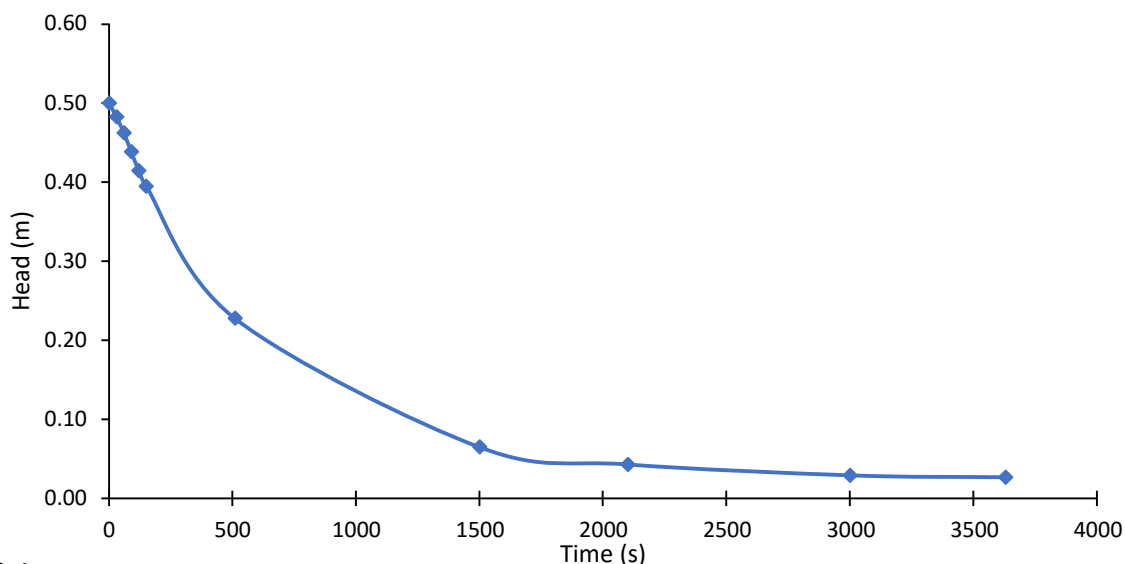
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 2.01\text{E-}05 \text{ ms}^{-1} = 1.74 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 6.51\text{E-}06 \text{ ms}^{-1} = 0.56 \text{ m/day}$$



STRATIGRAPHIC LOG

Peat/Silt

EOH @ 0.6m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	0.500	0.591	5.22E-06	2.11E-05
30	0.017	0.483	0.572	6.46E-06	2.56E-05
60	0.038	0.462	0.550	8.14E-06	3.13E-05
90	0.062	0.438	0.527	8.86E-06	3.30E-05
120	0.085	0.415	0.505	7.89E-06	2.85E-05
150	0.105	0.395	0.411	8.37E-06	2.72E-05
510	0.272	0.228	0.246	9.03E-06	2.22E-05
1500	0.435	0.065	0.154	6.00E-06	7.52E-06
2100	0.457	0.043	0.136	3.81E-06	3.72E-06
3000	0.471	0.029	0.128	1.35E-06	1.11E-06
3630	0.474	0.026			

CLIENT: **Maven Ltd**

PROJECT: **Brymer Development**

TITLE: **SO25-05 Falling Head Permeability Test**

DESIGNER: **AN**

CHECKED: **MM**

REVISION: **0**

DATE: **29/10/2025**

PROJECT: **HAM2025-0084**

Specifications - Open-Ended Tube

Length L_1 : **0.8 m**
 Diameter: **90 mm**
 Non-Perm L_2 : **0 m**
 Above Gnd L_3 : **0 m**

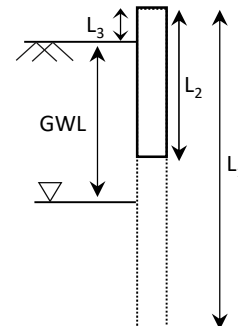
Ground Conditions

GWL: **0.3 m BGL** (Blank = Bottom of hole)

Permeability Anisotropy

m : **1** $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: **0.80 m BGL**



Hydraulic Conductivity (k)

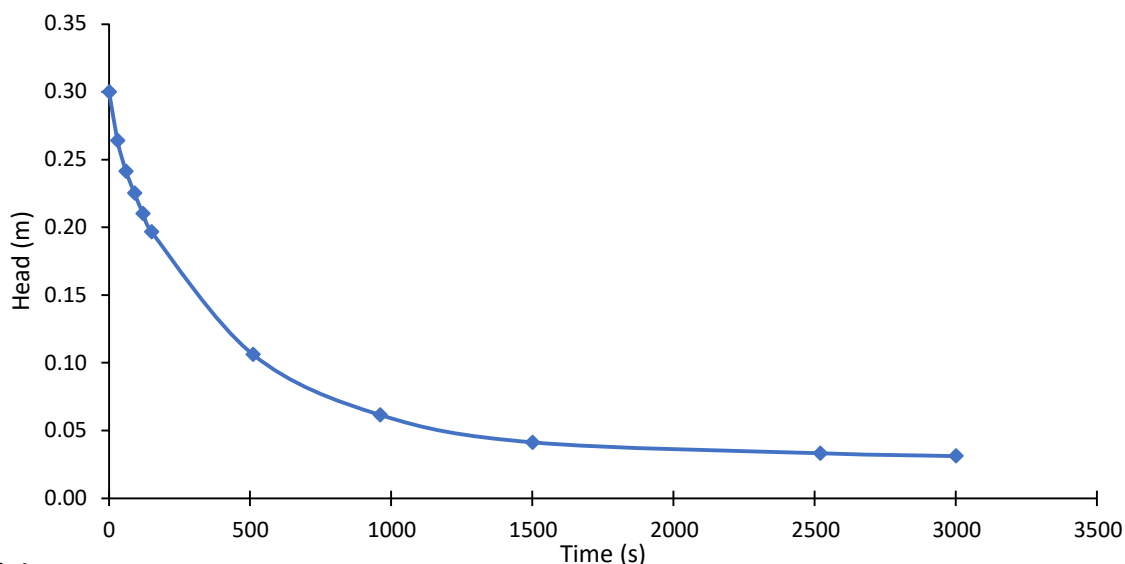
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 2.85E-05 \text{ ms}^{-1} = 2.47 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 7.13E-06 \text{ ms}^{-1} = 0.62 \text{ m/day}$$



STRATIGRAPHIC LOG

Peat/Silt

EOH @ 0.8m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	0.300	0.782	1.57E-05	7.18E-05
30	0.036	0.264	0.753	1.14E-05	4.98E-05
60	0.059	0.241	0.733	8.88E-06	3.77E-05
90	0.075	0.225	0.718	9.05E-06	3.75E-05
120	0.090	0.210	0.703	8.70E-06	3.52E-05
150	0.103	0.197	0.651	7.14E-06	2.70E-05
510	0.194	0.106	0.584	5.38E-06	1.58E-05
960	0.238	0.062	0.551	3.42E-06	7.80E-06
1500	0.259	0.041	0.537	1.00E-06	1.90E-06
2520	0.267	0.033	0.532	6.10E-07	1.06E-06
3000	0.269	0.031			

CLIENT: **Maven Ltd**

PROJECT: **Brymer Development**

TITLE: **SO25-06 Falling Head Permeability Test**

DESIGNER: **AN**

CHECKED: **MM**

REVISION: **0**

DATE: **29/10/2025**

PROJECT: **HAM2025-0084**

Specifications - Open-Ended Tube

Length L_1 : **1.6 m**
 Diameter: **90 mm**
 Non-Perm L_2 : **0 m**
 Above Gnd L_3 : **0 m**

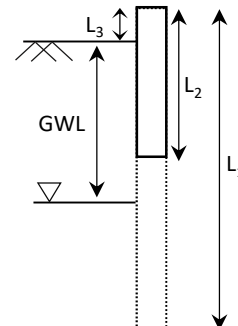
Ground Conditions

GWL: **1.55 m BGL** (Blank = Bottom of hole)

Permeability Anisotropy

m : **1** $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: **1.60 m BGL**



Hydraulic Conductivity (k)

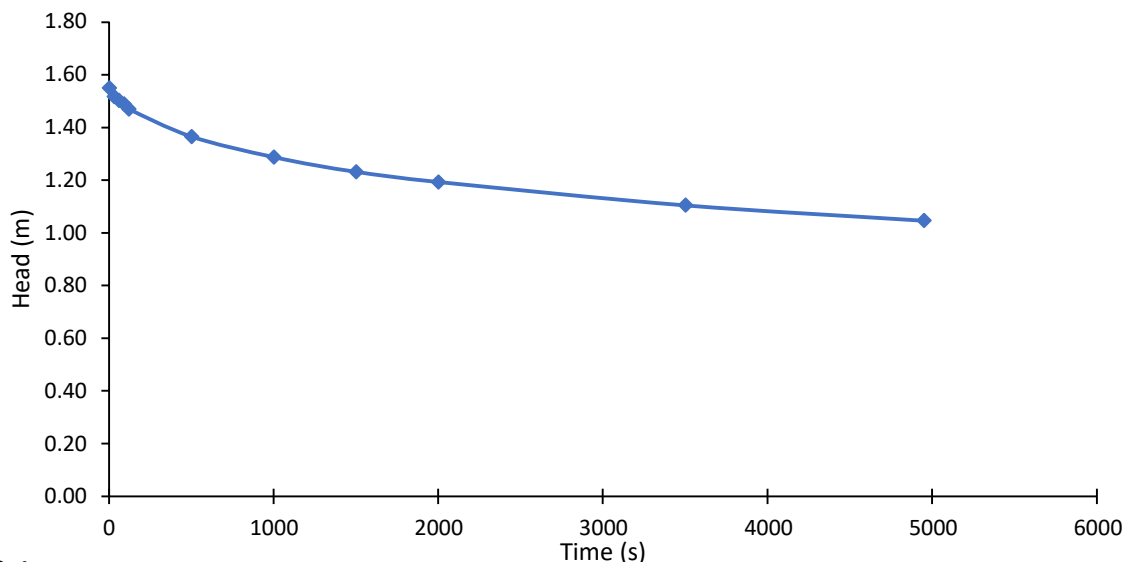
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 4.40\text{E-}06 \text{ ms}^{-1} = 0.38 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 5.49\text{E-}07 \text{ ms}^{-1} = 0.05 \text{ m/day}$$



STRATIGRAPHIC LOG

Clay

EOH @ 1.6m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	1.550				
30	0.033	1.517	1.584		1.63E-06	1.36E-05
60	0.047	1.503	1.560		7.17E-07	5.91E-06
90	0.061	1.489	1.546		7.12E-07	5.83E-06
120	0.080	1.470	1.530		1.01E-06	8.20E-06
500	0.184	1.366	1.468		4.66E-07	3.67E-06
1000	0.262	1.288	1.377		2.96E-07	2.22E-06
1500	0.318	1.232	1.310		2.32E-07	1.68E-06
2000	0.357	1.193	1.263		1.69E-07	1.19E-06
3500	0.445	1.105	1.199		1.42E-07	9.66E-07
4950	0.503	1.047	1.126		1.08E-07	7.02E-07