Matamata Developments Limited

Ashbourne Development
Hydrogeological Effects Assessment

ASSESSMENT OF EFFECTS

WGA241087

WGA241087-RP-HG-0002_C

June 2025

Revision History

REV	DATE	ISSUE	ORIGINATOR	CHECKER	APPROVER
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B	29/05/2025	Draft to Client	TDB/JFM	CMH/BAS	CHO
C	18/6/2025	Draft to Client	TDB	CAJ	CHO

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1 INTRODUCTION

1.1 Background

Matamata Developments Limited (Matamata Developments) is planning to establish a residential development, retirement village, and solar farm at Station Road, Matamata. The Ashbourne Development is expected to consist of 1,000 residential dwellings, a retirement village with 220 villas, and a 37.5 ha solar farm. Matamata Developments is now intending to apply for resource consents authorising the Ashbourne Development.

Matamata Developments 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 evaluate the potential for groundwater to supply the water requirements for the development. This assessment has been completed and was documented in a technical report (WGA, 2024).

Matamata Developments subsequently contracted WGA to undertake a further hydrogeological assessment focusing on the potential effects on groundwater associated with the construction and operation of a proposed greenway, stormwater infiltration basins, a wastewater disposal field with a system of pipelines and pumpstations, and a water supply bore. These hydrogeological assessments have also been completed. This report documents the assessments undertaken by WGA and summarises the results.

1.2 Scope of Services

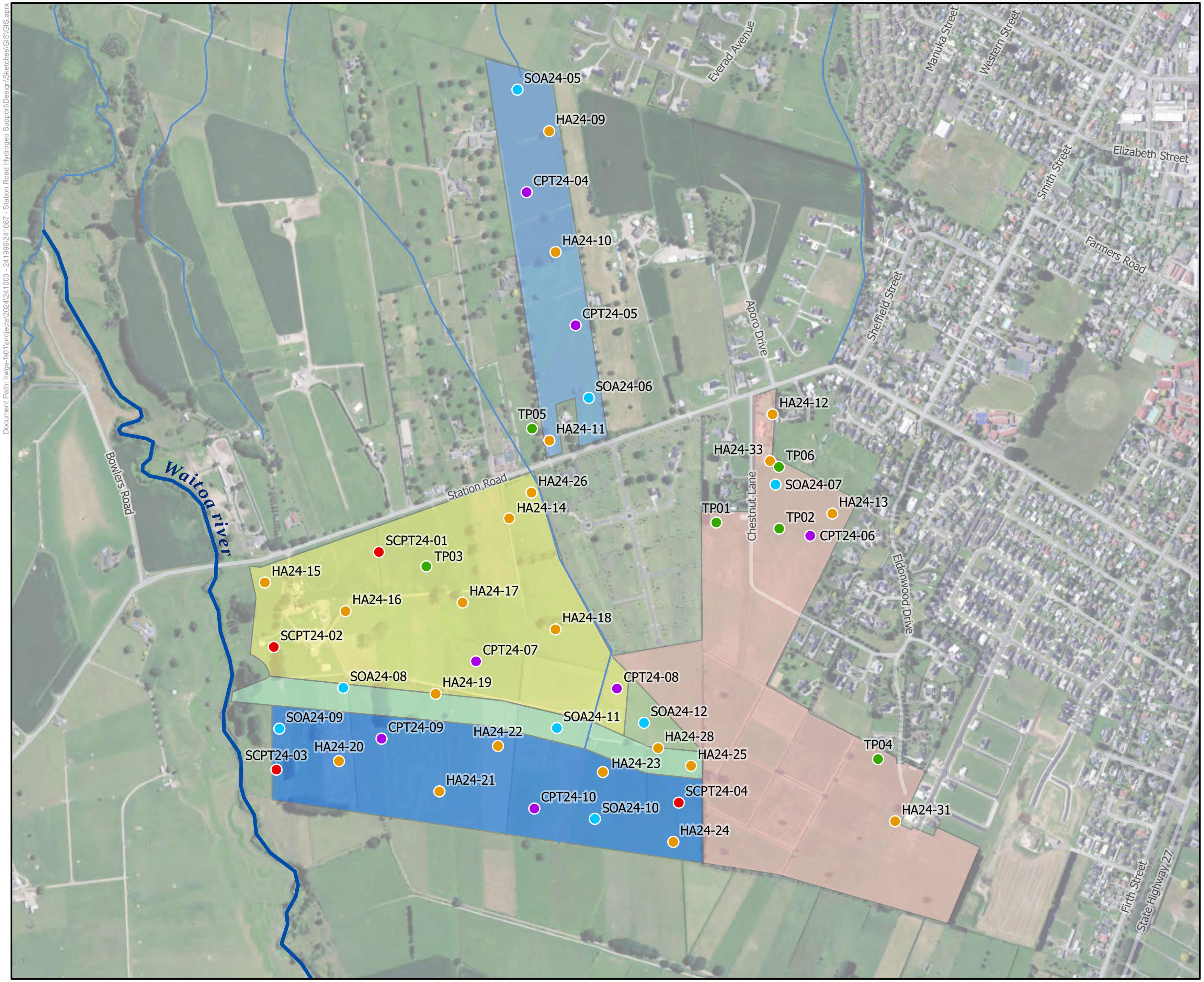
WGA was retained to provide hydrogeological support by undertaking the following tasks:

- Assessment of the local shallow hydrogeological conditions based on current information.
- Review of groundwater level data from piezometers.
- Analyse hydraulic testing datasets and determine aquifer parameters.
- Carry out a groundwater drawdown and discharge flow assessment the proposed greenway based on the hydraulic test results.
- Undertake assessments of groundwater mounding resulting from infiltration through the floors of the proposed stormwater basins.
- Assess the effects of dewatering required for the installation of the proposed wastewater pipelines and pumpstations.
- Undertake contaminate attenuation assessments in areas of the proposed wastewater disposal field.
- Support the installation and testing of the water supply bore and assess the potential effects from groundwater abstraction for potable and irrigation supply to the development.
- Prepare a report documenting the assessments and summarising the results. The report is to be suitable for lodging with the Waikato Regional Council (WRC) in support of the application for resource consents.

1.3 Site Description

The site is located on the western edge of the Matamata township on a gently sloping area (Figure 1). The site topography is gently undulating at an elevation between 66 m RL and 71 m RL. The western edge of the site drops more steeply down to 59 m RL, to meet the northward flowing Waitoa River. The Waitoa River flows into the Piako River approximately 45 km northwest of the development site.

The site currently comprises an active dairy farm, with associated infrastructure including a production bore and water storage. Drainage has been installed to help maintain the site in pasture. These drains form part of the Hauraki Plains drainage network.



LEGEND

Geotech Investigation Sites
- CPT
- Hand Auger
- SCPT
- Soakage Test
- Test Pit
- Drains
- Waitoa river

Proposed Development Area
- Proposed Greenway
- Residential Development Area 1
- Retirement Village
- SW and WW Reserve
- Stage 1 Solar Farm
- Stage 2 and 3 Solar Farm

N

0 100 200 300 400 m

Scale 1:12,500 @ A4

Coordinate System: NZGD 2000 New Zealand Transverse Mercator

Figure 1

Station Rd Hydrogeo Support

Site Location Map

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.

1.4 Proposed Activity

The Ashbourne Development has the following components that may impact on the groundwater system.

1. Matamata Developments plans to manage stormwater at the site through the installation of stormwater infiltration basins. The discharge of stormwater to ground via these basins will result in mounding of the underlying groundwater table. An assessment of the acceptance capacity of these basins and the extent of groundwater mounding beneath and around the basins is required. Groundwater mounding is addressed in Section 3 of this report.
2. A greenway is proposed extending westward from the proposed residential section of the development to the Waitoa River. The greenway is to enable excess stormwater from the residential area to be discharged to the river. The greenway is likely to be excavated below the groundwater table for at least some of its length. An assessment of the extent and magnitude of the groundwater drawdown and the consequent groundwater discharges into the greenway is required. Groundwater drawdown around the greenway is addressed in Section 4 of this report.
3. Temporary dewatering is required for the installation of the proposed wastewater pipelines and pumpstations. Potential effects resulting from the construction phase dewatering are presented in Sections 5 and 7.
4. Treated wastewater is to be discharged to a purpose-built wastewater disposal field. Shallow groundwater bores in the area of the proposed development may be impacted by changes in groundwater quality arising from the operation of the wastewater disposal field. An assessment of the consequent effects on groundwater quality at any receiving points, with specific reference to pathogens, is required. The effects of the proposed treated wastewater discharge are addressed in Section 6 of this report.
5. Potable and irrigation groundwater source supply for the development is sought from an onsite bore. Testing from this onsite bore (Production Bore 72_12812) has been used to assess potential effects related to the proposed groundwater abstraction (Section 8).

2 EXISTING ENVIRONMENT

2.1 Rainfall

Rainfall data has been obtained from the WRC at a monitoring station (site #: 1345) approximately 9.5 km north of the development site. Site investigations were carried out by CMW during May and June of 2024. Groundwater heights have been derived from these investigations to create a winter groundwater surface. Monthly rainfall during these May and June 2024 investigations was 85 mm and 82 mm respectively.

2.2 Surface Water Bodies

2.2.1 Waitoa River

The Waitoa River borders the site to the west (Figure 1) and flows northward, eventually joining the Piako River which discharges into the Firth of Thames. Flow data for the Waitoa River has been obtained from a WRC monitoring station (Site #: 1249), which monitors flows arising from a catchment approximately 122.5 km^2 in area. This monitoring station is located approximately 7 km north of the development site.

The Waitoa River level lies on average between 45.6 and 45.6 m RL at the monitoring station. The river has an annual average flow rate of 1.49 m^3/s and average annual flood flow of 21 m^3/s. Groundwater from the site is interpreted to feed into the Waitoa river. The minimum recorded flow at the station is 0.1 m^3/s and the lowest 10^{th} percentile between July 2023 and 2025 is 0.2 m^3/s. This indicates that river baseflows that are fed by groundwater are approximately 0.2 m^3/s (200 L/s).

2.2.2 Drainage System

Water drains off the site to the north via open farm drains systems. A minor ridge of elevated terrain in the western section of the site separates surface water from the Waitoa River gully. Drains near the site are presented in Figure 1.

2.2.3 Wetlands

EcoResto has identified an area of wetland on western edge of the site (Figure 6), bordering the Waitoa river (EcoResto, 2024). This wetland is situated on a lowered terrace that lies within the floodable area of the river. No other wetlands have been identified on or near the site. Interpreted groundwater elevation contours suggest shallow groundwater may be at the level of the wetland area during winter months.

2.3 Geology and Hydrogeology

2.3.1 Regional Geology and Hydrogeology

The site lies on the Hauraki Plains, which form part of a young continental rift structure bounded by major normal faults. A large thickness of predominantly Tauranga Group sediments deposited by the ancient Waikato River infills the structural depression to a depth of up to 3 km. The volcanogenic alluvial deposits form a sequence of sand, gravel, silt, clay, and peat layers.

The alluvial sediments beneath the plains can be described collectively as a large leaky hydraulic system comprising numerous lensoidal aquifers. Groundwater in the shallow aquifers is recharged primarily from rainfall and discharges predominantly as baseflows to incised streams (Hadfield, 2001). In the shallow aquifers, groundwater levels can be high in low lying areas during winter. Therefore, it is expected that a significant proportion of winter rainfall to low lying areas will be discharged directly as runoff or indirectly via drainage, rather than recharge.

Deeper groundwater flows generally northward under the Hauraki Plains toward the Firth of Thames (Hadfield, 2001). There is evidence of upwelling groundwater toward the coast. This upwelling groundwater supports springs and wetlands, such as the Kopuatai Peat dome (White et al, 2018).

The sand and gravel aquifers are utilised widely across the plains for potable and irrigation water supply purposes. The variability of paleochannel alluvial sediments in the basin results in a large range of transmissivities, ranging from less than 5 m^2/day up to 25,000 m^2/day (Hadfield, 2001).

2.3.2 Local Shallow Lithology

The site is predominantly underlain by sediments of the Hinuera Formation, one component of the Tauranga Group. The Hinuera Formation consists of Late Pleistocene River deposits including cross-bedded pumice sand, silt and gravel with interbedded peat. Sedimentary deposits of the older Walton Subgroup outcrop along the eastern side of the stream gully to the west of the site (Figure 2).

Geotechnical investigations to determine near surface lithologies across the site have been conducted by CMW Geosciences (CMW) and documented in a separate report (CMW 2024). The locations and nature of the investigation points are presented in Figure 1. A summary of the underlying geology based on the relevant investigation sites near the planned stormwater basins, greenway and wastewater treatment plant is presented in Table 1. Copies of the investigation hole logs (CMW 2024) are provided in Appendix A along with geological summaries for the investigation sites (Appendix A, Table A1).

Table 1: Lithological Units of the Station Road Site

UNIT	DEPTH TO BASE (m)		THICKNESS (m)	
	Min	Max	Min	Max
Topsoil/Fill	0.1	0.5	0.1	0.5
Stiff to very stiff SILT (Hinuera Formation)	1.0	1.1	0.5	1
Dense to very dense SAND with interbedded SILT (Hinuera Formation)	5.9	17.3	4.9	16.3
Very stiff to hard SILT/CLAY (Walton Subgroup)	0.1	18.1	9 (2,3)	18
Very dense silty SAND (Walton Subgroup)	-	-	Undefined (3)	Undefined (3)

Notes:
(1) Source: (CMW 2024).
(2) Strata were not encountered at all test locations.
(3) Thicknesses were only recorded where the base of the strata was confirmed.

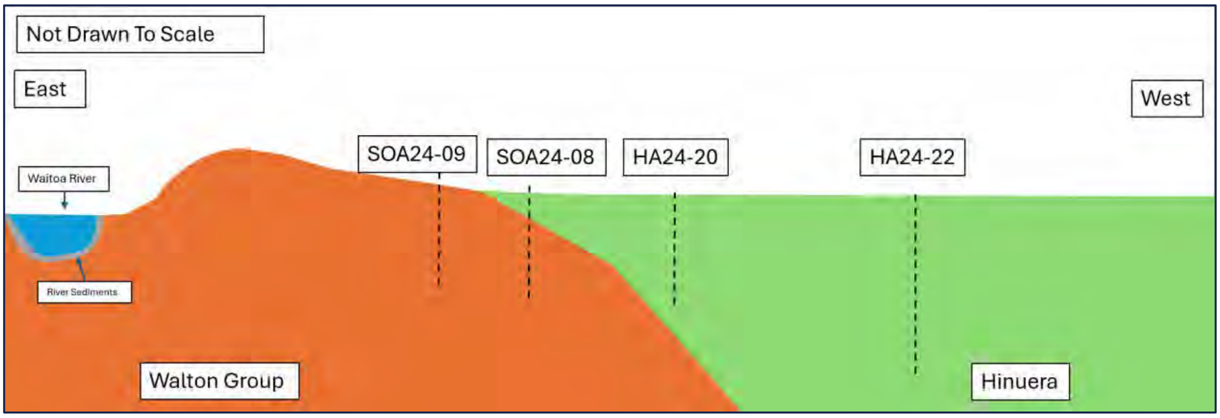


Figure 2: Conceptual Geological Cross Section

2.3.3 Local Deeper Lithology

The lithological log of the Production Bore 72_12812 indicated this bore intersected thick layers of gravels and sands, separated by thinner layers of silty clay, from the surface down to a drilling termination depth of 173 m below ground level (bgl). WGA has interpreted this lithological sequence as representing four thick aquifers separated by thinner fine-grained aquitards (Table I2 in Appendix I)

Although the Production Bore was drilled to a depth of 173 m, the screened section of the bore was installed at a depth of 107.6 m to 120 m bgl (Table I1). The well screen intersected approximately 12.3 m of coarse gravelly sand and gravels (Table I2), which was interpreted by the drillers at the time of installation as representing the most prospective water bearing layer intersected. The source aquifer is interpreted as having a total thickness of approximately 20 m and is overlain and underlain by fine grained silty clay layers each approximately 10 m in thickness.

Lithologically, it is likely the fine-grained deposits identified in the drillhole log would act as hydraulic confining layers (aquitards). WGA considers that the overlying silty clay layers recorded between 90.5 and 100 m bgl in the lithological log is likely to have a confining effect on the underlying screened aquifer for Production Bore 72_12812. Furthermore, WGA considers that these clay layers will also function as a hydraulic barrier, separating the deep aquifer (in which the Production Bore is screened) from the overlying aquifers.

2.4 Groundwater Levels

Water level measurements were made by CMW at numerous investigation sites during May and June 2021 (Table 2). LIDAR survey elevations sourced from WRC have been used to convert the groundwater depths to groundwater elevations. These elevations have been interpolated to produce an interpreted shallow groundwater piezometric map for the site (Figure 4).

Table 2: Groundwater Levels Recorded in June 2021

SITE NUMBER	BORE DEPTH (m)	GROUNDWATER LEVEL (m bgl)	GROUNDWATER LEVEL (m RL)
HA24-09	1.9	1.8	62.2
HA24-10	2.5	2	63.4
HA24-11	4.6	4.2	63.5
HA24-12	2.7	3.4	63.3
HA24-13	3.0	2.6	63.0
HA24-14	1.7	1.6	64.8
HA24-17	3.8	2.6	65.8
HA24-18	1.7	1.6	65.1
HA24-19	2.4	1.6	66.0
HA24-21	1.8	1.3	66.4
HA24-22	1.3	3.6	66.5
HA24-23	3.6	3.5	64.5
HA24-24	3.3	3.6	64.5
HA24-25	3.8	4.0	64.1
SOA24-10	1.8	1.8	65.9
SOA24-11	1.6	1.4	66.1

Notes:
(1) Source CMW (2024)

Interpreted shallow groundwater flows within the Hinuera Formation beneath the site are predominantly toward the northeast (Figure 4). It is likely that the shallow groundwater will flow towards and discharge to the nearest drains to the north of the site (Figure 4). The elevated areas of Walton Subgroup strata outcropping at the western edge of the site appear to act as a groundwater flow divide. To the west of these outcrops, the groundwater table is interpreted to slope with the land surface downward to the Waitoa River and surrounding wetland area. The Interpreted winter groundwater elevation surface is estimated to be at approximately the same level as the land elevation of the wetland area.

2.4.1 WRC Water Level Monitoring

Regional groundwater level data is available on WRC's Environmental Data Hub. The closest bore to the site with available groundwater level data is bore 64_831 located near Matamata, screened from 3 m to 9 m bgl. The graph for the bore (Figure 3) shows a rising trend since the beginning of 2022. Site Investigations were undertaken by CMW during May and June of 2024. The groundwater records from the WRC monitoring bore 64_831 show that groundwater was elevated during that period.

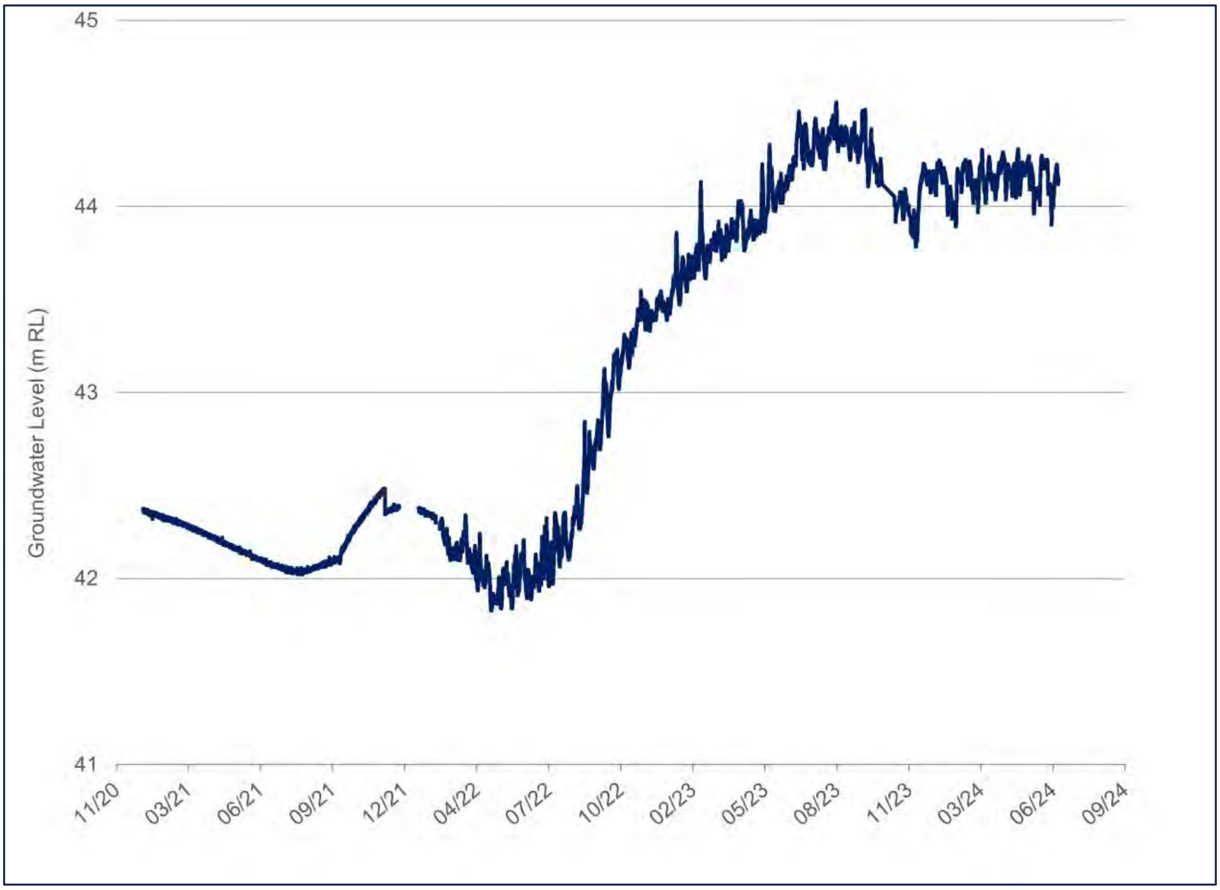
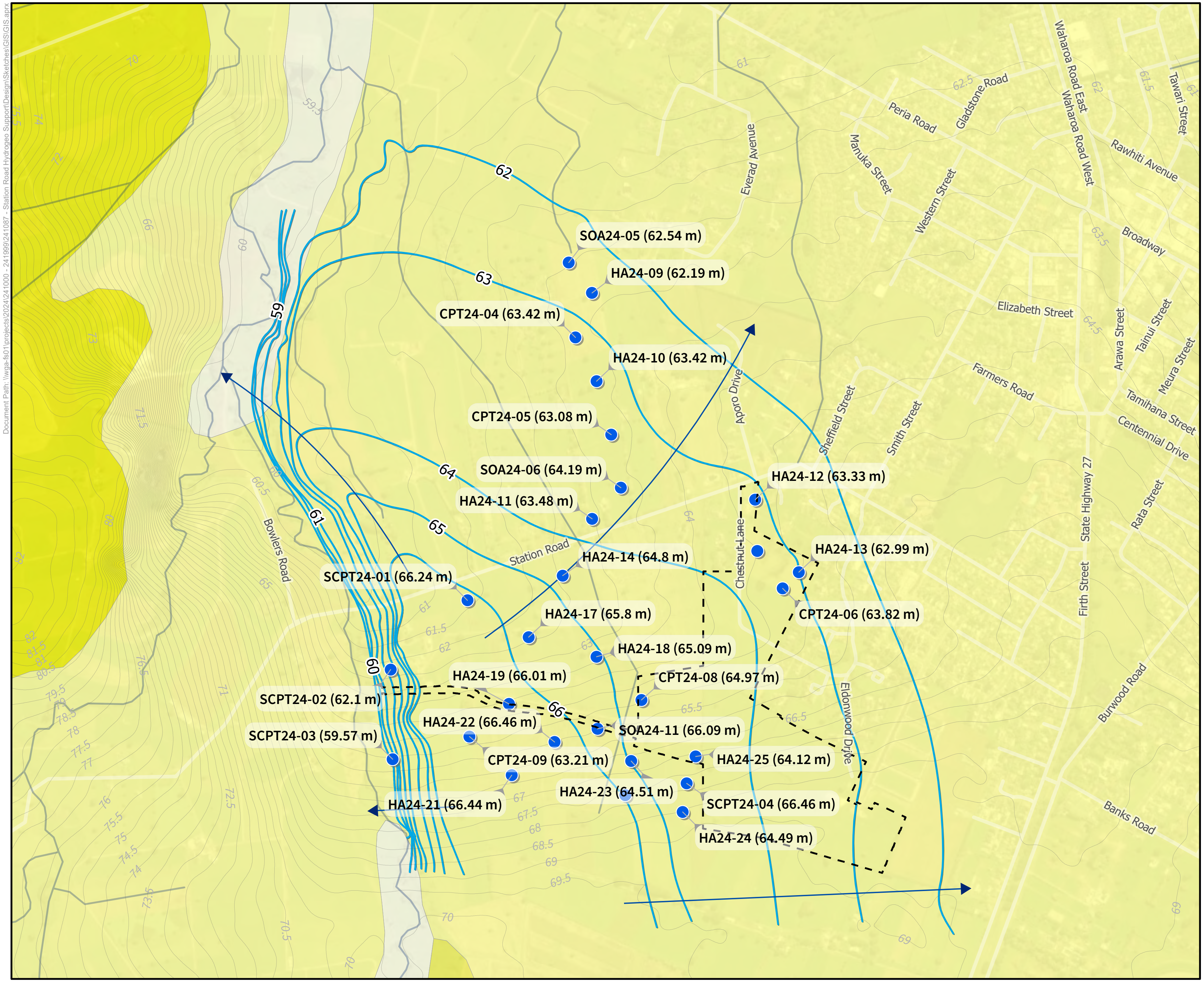


Figure 3: Groundwater Levels Recorded at WRC Monitoring Bore 64_831 in from January 2022 to July 2024



LEGEND

- Testing Locations
- Groundwater Flow Arrows
- Site Boundary
- Watercourses
- Winter Groundwater Contours

Surface Geological Units

- Early Pleistocene river deposits
- Middle Pleistocene river deposits
- OIS1 (Holocene) river deposits
- OIS3-OIS2 (Late Pleistocene) river deposits (Hinuera Formation)

N

0 100 200 300 400 m

Scale 1:17,110 @ A4

Coordinate System: NZGD 2000 New Zealand Transverse Mercator

WGA

Figure 4

Station Rd Hydrogeo Support

Winter Groundwater Contours

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.

2.5 Hydrogeological Parameters

Transmissivity and storativity have been assessed for a number of bores in the area. Table 3 summarises tests within a 5.5 km radius of the site.

Table 3: Summary of Reported Hydrogeological Parameters from Nearby Testing

BORE NUMBER	DEPTH (m)	TRANSMISSIVITY (m^2/DAY)	STORATIVTY
72_448	90	120	
64_511	21.5	780	0.0005
72_6680	73.5	676	
72_4434	21.77	730	0.0002
72_4432	82	850	0.0175
64_515	67	362	
64_49	13.1	632	
72_7181	57	-	
64_5	15.2	681.7	0.684
64_507	274	350	

Notes:
(1) Data sourced from WRC

2.5.1 Hydraulic Conductivity

Falling head permeability tests have been undertaken by CMW at the site. The tests have been analysed by CMW using both the CIRIA 113 and Hvorslev methods (reference). CMW notes that the CIRIA 113 method is considered the most appropriate analysis method. Derived hydraulic conductivity estimates from the analyses are summarised in Table 1. Copies of the analysis sheets are provided in Appendix B.

Petch & Marshall (1988) indicate the hydraulic conductivity of Tauranga Group sediments, which include the Walton Subgroup, ranges from 6.9 x 10^{-6} m/day for silts and fine sands to 1 x 10^{-5} m/day for coarse sands.

Table 4: Hydraulic Conductivity Test Results

INVESTIGATION SITE NUMBER	BORE DEPTH (m)	HYDRAULIC CONDUCTIVITY (m/s)	
		Ciria 113 Method	Hvorslev Method
SOA24-05	1.4	3.6 x 10^{-6}	6.5 x 10^{-7}
SOA24-06	2.3	2.4 x 10^{-5}	2.8 x 10^{-6}
SOA24-07	1.5	2.8 x 10^{-5}	4.9 x 10^{-6}
SOA24-08	3.0	2.0 x 10^{-5}	1.8 x 10^{-6}
SOA24-09	3.0	2.9 x 10^{-5}	2.9 x 10^{-6}
SOA24-10	1.8	5.8 x 10^{-5}	7.0 x 10^{-6}
SOA24-11	1.6	2.3 x 10^{-6}	2.8 x 10^{-7}
SOA24-12	3.0	1.7 x 10^{-4}	1.6 x 10^{-5}
SO13	1.5	6.0 x 10^{-7}	8.0 x 10^{-8}
SO14	2.1	1.4 x 10^{-5}	1.6 x 10^{-6}
SO15	3.1	8.6 x 10^{-6}	6.8 x 10^{-7}
SO16	3.3	2.2 x 10^{-5}	1.6 x 10^{-6}
SO23	3.5	9.6 x 10^{-5}	2.5 x 10^{-5}
SO24	3.5	4.9 x 10^{-5}	4.6 x 10^{-6}

The soakage tests provided by CMW were typically screened in the unsaturated zone immediately above the underlying aquifer. This method is likely overestimate transmissivity in the saturated zone due to a rapid initial water level loss as the unsaturated zone immediately surrounding the drillhole becomes saturated. WGA has calculated transmissivity as the average of the last four values of any given soakage test. The last four values were used in order to isolate soakage into the aquifer and reduce the effects of flow into the unsaturated zone on the soakage results.

2.5.2 Storage

Storativity values for the deeper confined aquifer system are expected to be in the order of 1 x 10-4. Observed values from nearby tests targeting the deep aquifer system (Table 3) were typically on this order of magnitude excluding that of bore 72_4432 which was significantly higher. One nearby test was identified that targeted the shallow aquifer system, that of bore 64_5 (Table 3) which reported a storativity of 0.68, a typical value for an unconfined system.

2.5.3 Groundwater Recharge

Based on the nationwide model of groundwater recharge for NZ (GNS Science, 2019) groundwater recharge in the area is estimated to be approximately 150 mm/year.

2.6 Existing Water Users

2.6.1 Surrounding Groundwater Users

Table 5 shows nearby groundwater takes are generally located beyond 2 km of the development site. This indicates that achieving high volumes from a few bores is possible in the local area, but there is some uncertainty about it being possible on-site. The benefit of the greater distance to the large groundwater takes is reduced interference effects and less potentially affected nearby bores.

The Highgrove Subdivision at 173 Station Road is a direct neighbour enclosed on all sites by the assessment area. Therefore, this neighbouring groundwater take yields the best information on surrounding geology and water quality. The Highgrove Subdivision with 34 lots has a consent to take 150 m^3 per day from two bores (72_10566 and 72_10565). WGA note that the drilling of two bores for a relatively small take of 150 m^3 per day indicates relatively low yields at the depth 68 to 80 m bgl near the site. Drill logs and water quality have not been transmitted to the database of the Waikato Regional Council, but the Highgrove Website states that water quality information can be requested.

Other smaller groundwater takes close by are from shallow depths of up to 25 m bgl. Dewatering and mounding of first encountered groundwater at the Ashbourne Development is not expected to have direct hydraulic connection to the deeper aquifer strata targeted by small groundwater takes in the wider area around the site.

Table 5: Nearby Groundwater Takes

BORE NUMBER	USER	SCREEN (m BGL)	CASING DIAMETER (mm)	PERMITTED VOLUME (m^3/day)	TRANSMISSIVITY (m^2/day)	PURPOSE
72_10565	Highgrove Development	68 - 80	100	75		Domestic supply
72_10566	Highgrove Development	71 – 74.5	100	75	-	Domestic supply
72_5506	Balle Bros Growers Limited	47 - 62	200	2,400	450 - 886	Horticulture
72_4548	Matamata Racing Club	78 - 91	150	714	305	Irrigation
64_5189, 64_1002	Matamata District Council	-	-	2,500	-	Domestic supply
72_448	Matamata District Council	16 - 90	150	1,500	120 - 141	Domestic supply
72_11269 72_11270 72_11271 72_11272	Matamata Country Club	~23 - 29	100	200	17 – 20	Domestic supply and irrigation

3 MOUNDING EFFECTS ASSESSMENT

3.1 Introduction

Stormwater runoff from much of the proposed residential area and retirement village is to be directed into one of five stormwater basins (Figure 5) as indicated by plans provided by Maven Associates (Maven 2025b, Maven 2025c). Groundwater mounding simulations have been undertaken to evaluate potential mounding in the surrounding area as a result of the operation of stormwater basins A, C and D in the residential area, and RV1 and RV2 in the retirement village. WGA understands that basin B will be designed to drain into the Waitoa River via the greenway and as such will not retain water or cause mounding. The analysis methodology and results are presented in this section of the report.

Stormwater basin designs for the Ashbourne Development have been provided by Maven (2025). A copy of the design drawings for the proposed basins is presented in Appendix C.

3.2 Methodology

Mounding assessments documented in this report have been performed using MOUNDSOLV software package, Version v3.0, developed by HydroSOLVE, Inc. MOUNDSOLV calculates the transient response of an unconfined groundwater table beneath a rectangular recharge source to a defined recharge event. The package applies a simulation methodology published by Zlotnik et al. (2017) for this purpose. The use of the MOUNDSOLV package is widely accepted by professional hydrogeologists for the assessment of groundwater mounding.

For the mounding assessments undertaken at each site, two scenarios were modelled. The first scenario simulated a continuous recharge period of three days followed by a 47-day recovery period to assess the effects of a one-off storm event. The second scenario simulated a continuous recharge period of 36 days followed by a 164-day recovery period to simulate the cumulative mounding effects over a full winter.

Assumptions applied in each simulation with respect to the aquifer characteristics for the transient solutions are:

- Aquifer properties (horizontal hydraulic conductivity, specific yield, and dip) are homogeneous and isotropic, and remain constant over time.
- Saturated thickness of the aquifer is uniform and constant prior to the start of the recharge event.
- There is no potential confining layer above the receiving aquifer.
- The infiltration rate over the rectangular recharge source is uniform and constant.
- The aquifer base has a constant slope.

For the purposes of the modelling for both short term and long-term scenarios, it has been assumed that levels within the basin do not exceed the rim of the basin or in the case of RV1 and RV2, the full design water level (overflow invert elevation).

For the purposes of the longer-term winter scenario, a recharge duration of 36 days has been applied as this is the average number of rain days over the winter months recorded in the long-term climate station at Hamilton (NIWA Hamilton, AWS rainfall station 2112). The model assumes all of the winter rainfall for an average season occurs within one 36-day period. This is a conservative assumption as it assumes a high frequency of rain events and does not allow time for levels to drop in the pond between rainfall events. In reality, water levels in the pond will fluctuate and the ponds will often fully drain between rainfall events resulting in less mounding from the pond at neighbouring property boundaries.

The infiltration rate applied to each model is the rate that results in the mounding reaching the stormwater basin spillway elevation (Appendix C) by the end of the storm event. In considering the winter scenarios, the infiltration rates would initially be substantially higher. However, these rates will drop off substantially as the groundwater mounding starts to reach the floor of the basin. Consequently, the Scenario 2 (winter season) infiltration rates are much lower than the Scenario 1 (three-day event) infiltration rates.

The hydraulic conductivity values used for the simulations have been calculated as the average of the last four values from CMW's falling head soakage tests conducted nearby. This is to reduce the effect of the unsaturated zone on the soakage test, instead focusing on soakage into the saturated aquifer which is what is important for the simulations. These hydraulic conductivity values are considered representative of the geology encountered in the area of the proposed basins.

3.3 Mounding Assessment Results

Two scenarios were modelled in the groundwater mounding assessments undertaken at each of the stormwater basins (A, C, D, RV1, and RV2). Results for each basin and scenario are presented in Appendix C. The first scenario applied a transient model with a simulated continuous recharge period of three days and a 47-day recovery period to assess the effects of a large one-off storm event. The second scenario applied a transient model run for 36 days with a 164-day recovery period to simulate the cumulative mounding effects over a full winter period. Modelled mounding was generally less than 1 m at the nearest structure with the exception of basin A which indicated mounding could be up to between 1 and 2 m at the buildings adjacent to the basin: equivalent to a mounded groundwater depth ranging between 1.5 to 2.5 m below ground level (Figure 5 and Appendix C).

LEGEND

- Basin Mounding
- Watercourses
- Site Boundary
- Stormwater Basins

N

0 50 100 150 200 m

Scale 1:6,000 @ A4

Coordinate System: NZGD 2000 New Zealand Transverse Mercator

WGA

Figure 5

Station Rd Hydrogeo Support

Stormwater Basin Locations

4 GREENWAY DEWATERING EFFECTS ASSESSMENT

4.1 Introduction

An assessment of potential steady state groundwater inflows into the proposed greenway (Figure 6) and the resulting groundwater drawdown is documented in this section of the report. Design drawings for the greenway provided by Maven are presented in Appendix D.

4.2 Methodology

Steady state groundwater inflows to the Greenway have been calculated using a method presented in Cashman & Preene (2001). This methodology is an industry standard method of estimating steady state groundwater inflows to trenches.

A 646 m long section of the greenway invert was found to intersect the 2024 winter water table (Figure 4). As the groundwater table is expected to be at its highest during winter, only this section was considered as relevant to the dewatering assessment. Additionally, this assessment simulated the potential maximum drawdown extents from dewatering over a one-year period.

The proposed greenway predominantly intersects sediments of the Hinuera Formation. Some lower permeability Walton Subgroup sediments would also be intersected at the western end of the greenway. As the Walton Subgroup is only intersected by a small section of the greenway, for the purposes of his assessment, the whole greenway was considered to be in Hinuera Formation. This is considered to represent a conservative approach to the assessment.

The hydraulic conductivity applied to the drawdown and inflow evaluation was calculated as the average of the last four values from CMW's soakage test at SOA24-12. The last four values were used in order to isolate soakage into the aquifer and reduce the effects of flow into the unsaturated zone on the soakage results. A calculated hydraulic conductivity was 3.5 x 10-5 m/s has been applied to the Hinuera Formation in the vicinity of the greenway.

The vertical hydraulic conductivity of the sediments represented in the area is expected to be lower than the horizontal hydraulic conductivity. As such, vertical flows upward into the trench are considered to be substantially lower than the lateral inflows. It has been assumed for this assessment that the vertical inflows to the greenway are insignificant compared to the lateral inflows.

Groundwater depth below ground was taken as 1.6 m, based on measurements made during a nearby CMW hand auger soakage test (HA24-19). The maximum penetration of the trench below the groundwater table was estimated to be 1.5 m during winter.

Applying the above parameters, inflow to the trench and drawdown around the trench at the point where the maximum groundwater penetration by the greenway occurs has been calculated using a cross-section profile perpendicular to the greenway. The calculated inflow for this profile represents the flows to a one-metre-long section of the trench. This calculated inflow was then extrapolated linearly out to the points where the trench invert crossed the groundwater table at each end. These points indicate no drawdown would occur and correspondingly no inflow to the greenway. The calculated inflows were then totalled for the full length of greenway that would intersect the groundwater table.

4.3 Results

The calculated extent of groundwater drawdown reaches a maximum of 15.5 m from the edge of the greenway. Aside from a farm shed located within the development area, there are no existing structures that are within the projected drawdown extent (Figure 7). Furthermore, this drawdown is based on a winter groundwater level starting condition. During summer, when background groundwater levels are lower, the extent and magnitude of groundwater drawdown resulting from the greenway would be substantially less.

The total inflow to the trench from the aquifer during winter is calculated to be approximately 135.4 m^3/day (1.6 L/s). The calculation sheet is presented in Appendix E.

Groundwater at the site flows in a north-easterly direction within the Hinuera Formation (Section 2.4). The construction of the Greenway will intercept some of this groundwater flow and will re-direct it in a westerly direction, into the Waitoa River. As this is the same groundwater that is already discharging into the Waitoa River further north, more westerly conveyance of groundwater will make no material difference to the overall flow of the river. The average river flow as discussed in section 2.2.1 is 1.49 m^3/s (1,490 L/s) compared to which, inflow from the greenway is insignificant.

LEGEND

- Testing Locations
- Winter Groundwater Contours
- Site Boundary
- Greenway
- Greenway Intersecting Water Table

N

0 50 100 150 200 m

Scale 1:8,500 @ A4

Coordinate System: NZGD 2000 New Zealand Transverse Mercator

WGA

Figure **6**

Station Rd Hydrogeo Support

Greenway Location

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LEGEND

- Greenway Drawdown
- Site Boundary
- Greenway Intersecting Water Table
- Greenway

N

0 25 50 75 100 m

Scale 1:3,000 @ A4

Coordinate System: NZGD 2000 New Zealand Transverse Mercator

WGA

Figure 7

Station Rd Hydrogeo Support

Greenway Drawdown

5 WASTEWATER PIPELINE DEWATERING

5.1 Introduction

As part of the development a number of trenches will need to be excavated to allow for the installation of wastewater pipelines. The trenches will be temporary excavations to be filled once pipelines have been installed. In some locations on the site trenches will be dug such that they may intersect the groundwater table. In this case the trenches may need to be dewatered to allow for pipeline installation. WGA has assessed a “worst case” dewatering scenario related to the potential depth of groundwater intercepted by a section of trench.

5.2 Methodology

Steady state groundwater inflows to the pipeline trenches have been calculated using a method presented in Cashman & Preene (2001). This methodology is an industry standard method of estimating steady state groundwater inflows to trenches.

Design plans for the trenches have been provided by Maven and indicate that the pipelines will penetrate a maximum of 1.45 m into the water table (Appendix J). To account for any additional depth that may be required during pipeline installation, 0.2 m has been added to depth of the trench. For this assessment the groundwater level provided on the Maven plans of 65.31 m RL (Appendix J) has been used as it agrees well with the 2024 winter water table presented in Figure 4. Maven has advised that a maximum of 150 m of trench will be open at any one time. To assess a “worst case” scenario inflow into a 150 m section of trench penetrating 1.65 m into the groundwater table has been assessed.

A hydraulic conductivity of 3.84×10^{-6} m/s has been calculated from CMW’s soakage test at SOA24-21 using the method outlined in Section 4.2. This value is assessed as representative of the Hinuera formation silts and fine sands found across the proposed wastewater pipeline area and consistent with Petch & Marshall (1988) plus other hydraulic conductivity tests in the vicinity of the proposed trenching (Section 2.5.1, Table 4).

5.3 Results

Inflows into the trench are calculated to reach a maximum of 138 m^3/day or 0.9 m^3/day for each 1 m section of trench (Appendix J). WGA notes that this estimate is highly conservative as it is unlikely that 150 m of trench will be excavated simultaneously, and that the full length of trench will intersect the water table. It is assumed that dewatered groundwater will be discharged into the Waitoa river to the west of the site. As this is the same groundwater that is already discharging into the Waitoa River further north, more westerly conveyance of groundwater is expected to result in a negligible difference to the overall flow of the river.

The calculated extent of groundwater drawdown reaches a maximum of 5 m length of influence from the edge of the trench (Appendix J). No existing structures that may be affected by groundwater drawdown exist within a 5 m boundary of any pipeline.

6 WASTEWATER DISCHARGE EFFECTS ASSESSMENT

6.1 Wastewater Treatment Facilities

Matamata Development's proposed wastewater treatment plant is to treat domestic wastewater from the retirement village and the villas. Wastewater is to be treated by primary, secondary, and tertiary treatment facilities. Treated wastewater is to be discharged to a wastewater disposal field (Figure 8), which provides a final polishing stage for the treatment. The layout of the proposed wastewater disposal system is presented in Appendix F.

WGA has been advised by Maven (pers. comm. 2025) that the wastewater treatment at the development will comprise of the following:

"Primary Treatment

- 3 10m^3 grease traps to separate solids from the wastewater

Secondary and Tertiary Treatment

- A pump station which will pump wastewater to the secondary and tertiary treatment facilities.
- 12 septic tanks with a volume of 25 m^3 each where solids and organics fall out of suspension and are decomposed in an anerobic environment.
- 6 pre-anoxic tanks with a volume of 25 m^3 each and effluent return pumps.
- Recirculation tanks with dosing pumps and AX100 packed bed reactor pods for both stage 1 and stage 2 of the retirement village. Wastewater is run through a textile media which acts to remove contaminants such as nitrogen. Treated wastewater is recirculated and mixed with untreated wastewater to dilute the inflow making treatment more effective.
  - Stage 1: 5 recirculation tanks of 25m^3 each and 10 AX100 reactor pods.
  - Stage 2: 2 recirculation tanks of 25m^3 each and 3 AX100 reactor pods.
    - 5 treated effluent tanks of 25 m3 in volume with irrigation pumps that pump wastewater into the drip irrigation system.
    - A UV disinfection unit to remove bacteria and viruses before land dosing.

Dripline Irrigation System

- Treated Wastewater is pumped into 24,184 m of dripline irrigation where it is discharged to ground over 1,343 m^2 Maven Pers Comms (2025)".

WGA understands that the maximum wastewater discharge will be 120,920 L/day during peak wet weather flows.

6.2 Receiving Environment

The two nearby water bores (64_629 and 64_628) are located 60 m and 160 m from the discharge area. Both of these bores are within the development boundary and are to be removed during construction of Stage 2 of the retirement village. The nearest offsite bore (64_613) is located approximately 227 m to the northeast of wastewater disposal field. Bore 64_613 is hydraulically down-gradient from the wastewater disposal field (Figure 8).

The onsite Production Bore (72_12812) is about 50 m from proposed disposal field area and screened within deep aquifer strata (from about 108 to 120 m below ground level) below a significant thickness/sequence of confining aquifer and aquitard strata. Potential effects on the Production Bore (72_12812) are also estimated and presented in the following sections. There are no nearby surface water bodies down-gradient from the wastewater disposal field.

6.3 Attenuation Modelling Methodology

6.3.1 Wastewater Quality

Typical abundances of faecal coliforms in raw sewage are in the range of 1 x 10^6 to 1 x 10^8 cfu/100 mL (Blanch et al 2003). WGA has been advised by Maven (pers comms, 2025), that effluent discharged from the proposed wastewater treatment facility is to have faecal coliform counts below 200 cfu/100mL.

6.3.2 Faecal Coliform Attenuation Factors

The digital soil map for New Zealand (S-Map) indicates that the soil in the planned discharge area is an allophanic soil. Based on the geological log from test pit TP03, WGA considers that the topsoil around the wastewater dispersal zone will have a thickness of approximately 0.3 m. WGA has been advised that the wastewater drip irrigation lines will be buried to a depth of between 0.1 and 0.15 m, leaving at least 0.15 m of topsoil below the drip lines. While soil thickness is relatively uniform across the development, a more conservative 0.1 m of soil was used in our assessment of coliform attenuation to account for any irregularity in soil thickness and pipe depth.

Pang (2009) reports a mean faecal coliform attenuation rate of 5.48 log/m in water passing through allophanic soils. This attenuation rate has been applied for treated wastewater seepage through the 0.1 m thickness of topsoil before the seepage enters the vadose zone.

For this assessment the vadose zone underlying the topsoil has been taken to be the depth between the soil horizon and highest measured groundwater table level. The depth to the groundwater table at the wastewater disposal field was taken from a measurement at SCPT24-01. As SCPT24-01 was drilled in winter, WGA considers that the depth to the water table is representative of the seasonal maximum groundwater level (Table 2). The vadose zone at that time was approximately 1.3 m thick.

For conservatism, the Hinuera Formation under the wastewater disposal field has been defined as a sand, rather than a silty sand or silt. A coliform attenuation rate for vertical water seepage through a fine sand vadose zone has been defined as 0.84 log/m (Pang 2009). This attenuation rate has been applied for treated wastewater seepage through the 1.3 m thickness of topsoil before the seepage enters the saturated aquifer zone.

After reaching the groundwater table, the infiltrated water would be transported laterally in a northeast direction, with the faecal coliforms being further attenuated during this groundwater movement. The Hinuera Formation in the saturated zone has been interpreted as being primarily fine sands, for the purpose of this assessment. The attenuation rate for faecal coliforms in the saturated zone of a fine sand aquifer has been defined as 0.05 log/m (Pang 2009). This attenuation rate has also been conservatively applied for vertical movement through saturated strata to the Production Bore 72_12812.

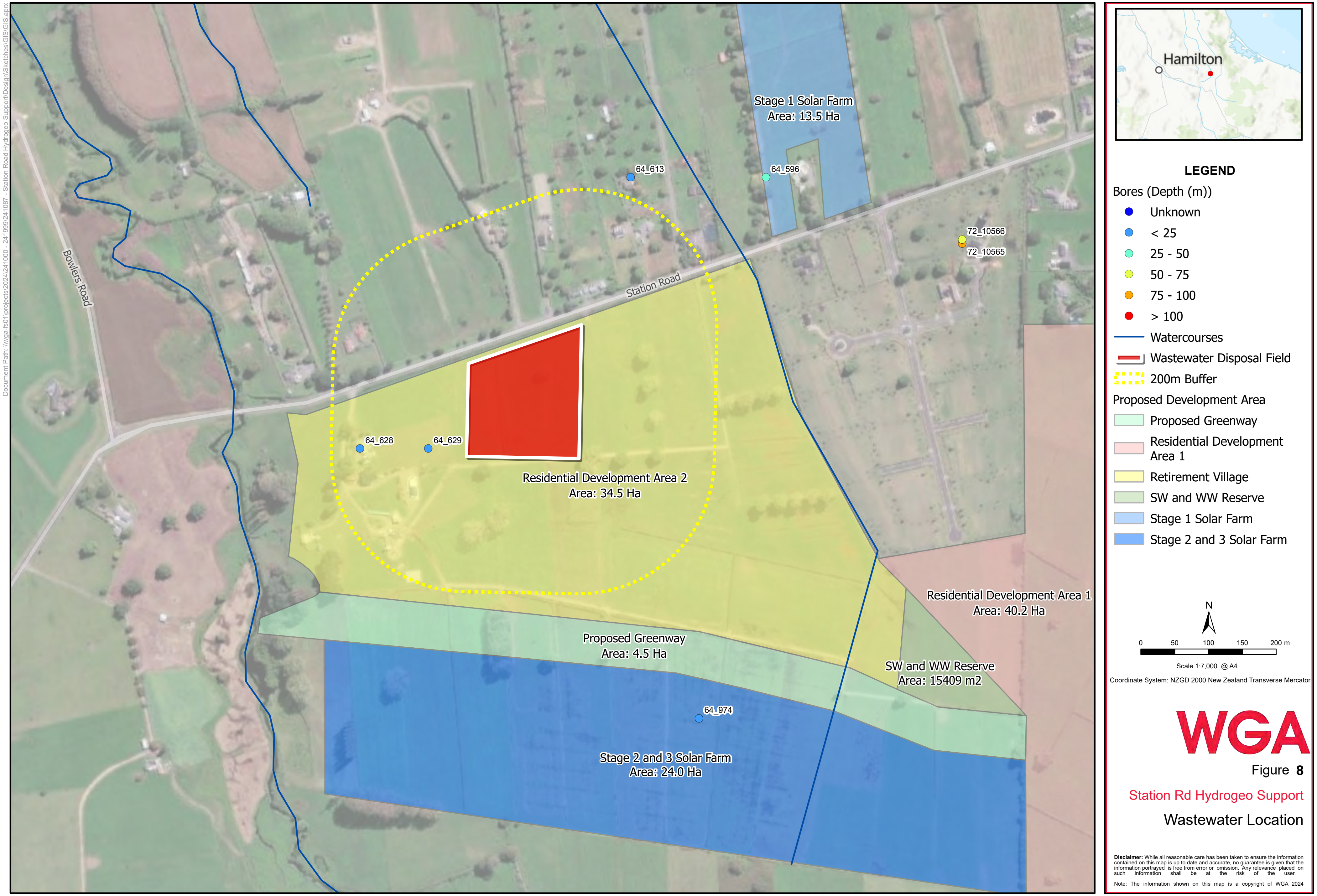

Figure 8

Station Rd Hydrogeo Support

Wastewater Location

6.4 Results

Faecal coliform attenuation calculations (Table 6) indicate that coliform counts in the discharged treated wastewater become negligible shortly after it reaches the saturated zone of the shallow aquifer. The lateral distance from the discharge site at which faecal coliform counts drop below 1 cfu/100mL is calculated to be approximately 13 m from the point of discharge. At a distance of 200 m from the discharge field, counts were calculated to be effectively zero (4.58 x 10^{-10} cfu/100 mL). For faecal coliform concentrations to exceed the New Zealand drinking water standard of 1 cfu/100 mL at a distance of 200 m from the disposal field, a source concentration in the order of 4 x 10^{10} cfu/100 mL would be required. This value is far in excess of faecal colliform counts expected in raw wastewater, as indicated in Section 6.3.1.

All shallow bores located within a 200 m buffer of the disposal field are owned by Matamata Developments Ltd, and their use can be managed appropriately. There are no shallow bores or other potential receiving surface water systems located close enough to the discharge field to receive groundwater discharges carrying faecal coliform counts in excess of 1 cfu/100mL. Therefore, the effects of the operation of the wastewater disposal site are considered less than minor in terms of lateral movement to nearby potential receptors.

The Production Bore 72_12812 outlined in Section 8 will be located near the disposal zone. To assess any effects on the production bore, faecal coliform attenuation has been modelled vertically to the depth of the screen. The screen for the production bore is located 92.75 m below the top of the saturated zone. Over this distance there are multiple clay aquitards, therefore, log removal rates are expected to potentially be significantly higher than the rate applied. To be conservative, an attenuation rate of 0.05 representative of fine sands has been applied for the assessment of potential effects on the Production Bore 72_12812. Results for the assessment for Production Bore 72_12812 show less than minor effects on Table 6 (< 1.5 x 10^{-4} cfu/100 mL).

A copy of the faecal coliform attenuation analysis sheets applied to these assessments are presented in Appendix G.

Table 6: Faecal Coliform Attenuation

ATTENUATION COMPONENT	ATTENUATION FACTOR	FAECAL COLIFORM COUNT cfu/100 mL
Raw wastewater	N/A	1 x 10^6 to 1 x 10^8
Wastewater treatment plant discharge	N/A	< 200
Topsoil seepage horizon	0.1 m at 5.48 log/m	< 57
Vadose zone	1.3 m at 0.84 log/m	< 4.6
Saturated zone	200 m at 0.05 log/m	< 5 x 10^{-10}
Saturated zone (vertical assessment for Production Bore 72_12812)	90 m at 0.05 log/m	< 1.5 x 10^{-4}

7 WASTEWATER PUMP STATION EFFECTS ASSESSMENT

7.1 Background

Three wastewater pump stations are to be constructed within the development area (Figure 9), two within the residential development and one in the retirement village. The designs each pump stations provided by Maven (2025a) include the installation of a wet well (Appendix H). Installation of each pump station wet well is likely to require drawdown of the local groundwater table to a level at or below the level of wet well floor. The methodology by which this groundwater drawdown is to be achieved is not yet finalised. However, we have assumed that dewatering will need to draw the groundwater table down below the base of the wet well to provide a dry working surface during construction.

The dewatering process at each site would lead to a groundwater drawdown cone extending outward from the excavation. This section of the report documents the methodology used to analyse the extent and magnitude of groundwater drawdown. This section also documents the analysis outcomes regarding the extent and magnitude of drawdown around the pump stations during the construction period.

7.2 Description of Works

The designs provided by Maven (2025a) indicate:

- The central pump station will include a wet well installed to a depth of 7.9 m below ground level.
- The northern pump station will include a wet well installed to a depth of 4.1 m below ground level.
- The Retirement Village station will include a wet well installed to a depth of 4.6 m below ground level.
- The northern and central wet well excavation is to be 4.7 m in diameter.
- The retirement village wet well excavation is to be 7.2 m in diameter.

Preliminary guidance on the installation of the pump stations provided by Maven indicates an open pit is to be excavated at each pump station site. The base of the excavation is to be at the terminal depth of the planned wet well. The sides of the excavation are to be terraced for stability purposes, with an overall batter angle of 1:1. This wet well installation methodology is subject to review.

The timing and duration of earthworks are not yet known. Likewise, the construction method has not yet been determined. The excavations required to install said wet wells will most likely extend below the groundwater table in both circumstances and cause both inflow into the excavations and drawdown in the surrounding groundwater table.

7.3 Analysis Methodology

Groundwater inflows and drawdown extents around both pump station excavations have been evaluated using a published method for estimating groundwater inflows into opencut pits (Marinelli & Niccoli 2000). 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. The pit model accounts for two zones of groundwater flow (shallow and deep) with a no-flow boundary between them at a level equivalent to the floor of the pit (Figure 10, Figure 11 and Figure 12).

Due to the unknown duration of the excavations, the calculations assume a steady state drawdown has been reached. Consequently, groundwater taken out of storage is not included in the calculated flow rates.

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LEGEND

- Well Drawdown Contours
- Site Boundary
- Wet Wells

N

0 50 100 150 200 m

Scale 1:6,000 @ A4

Coordinate System: NZGD 2000 New Zealand Transverse Mercator

WGA

Figure 9

Station Rd Hydrogeo Support

Proposed Wet Well Locations and Drawdown

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.

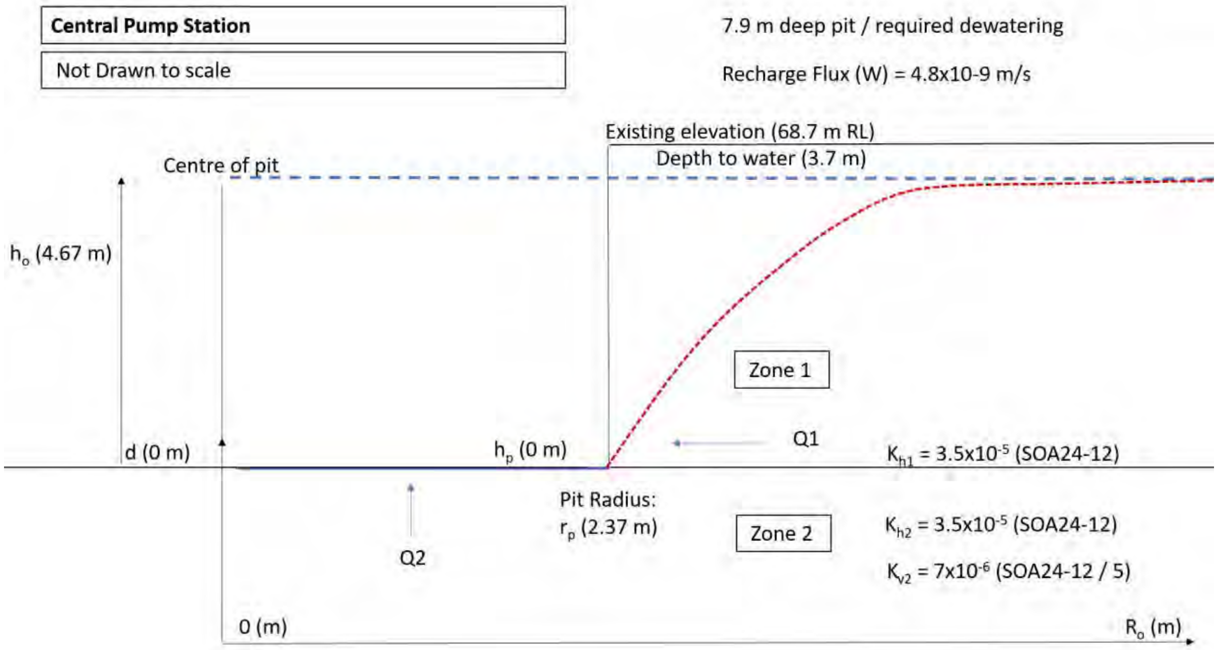

Figure 10: Inputs for Pit Model Assessing Dewatering of Planned Central Wet Well Install

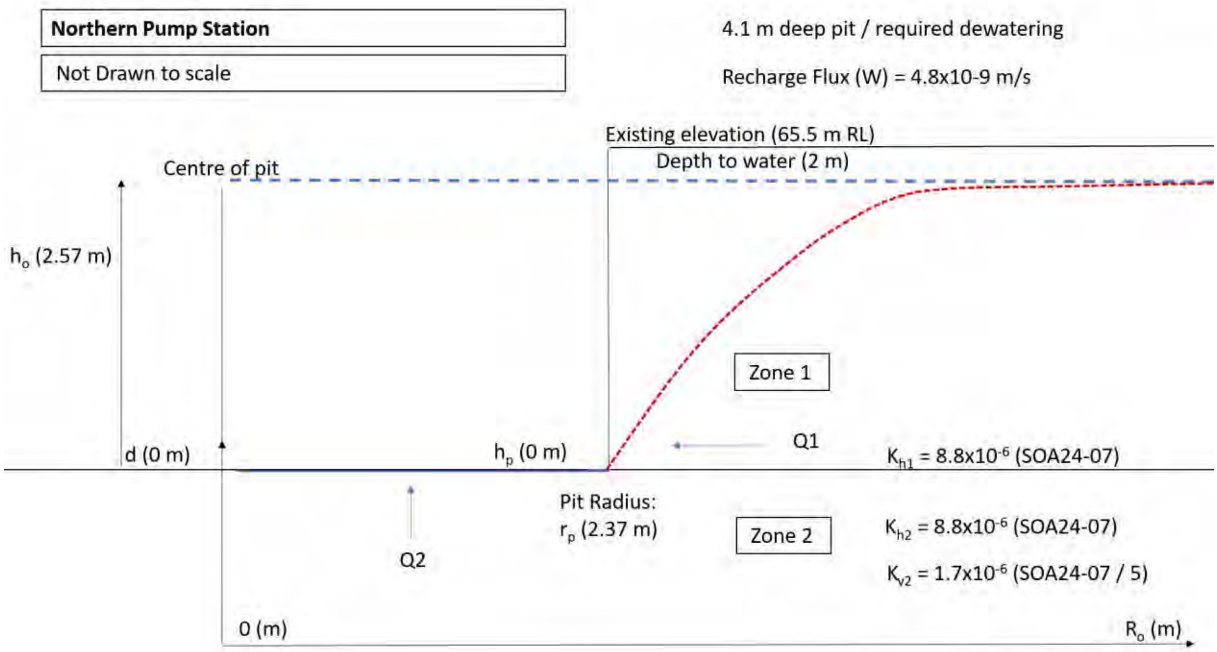

Figure 11: Inputs for Pit Model Assessing Dewatering of Planned Northern Wet Well Install

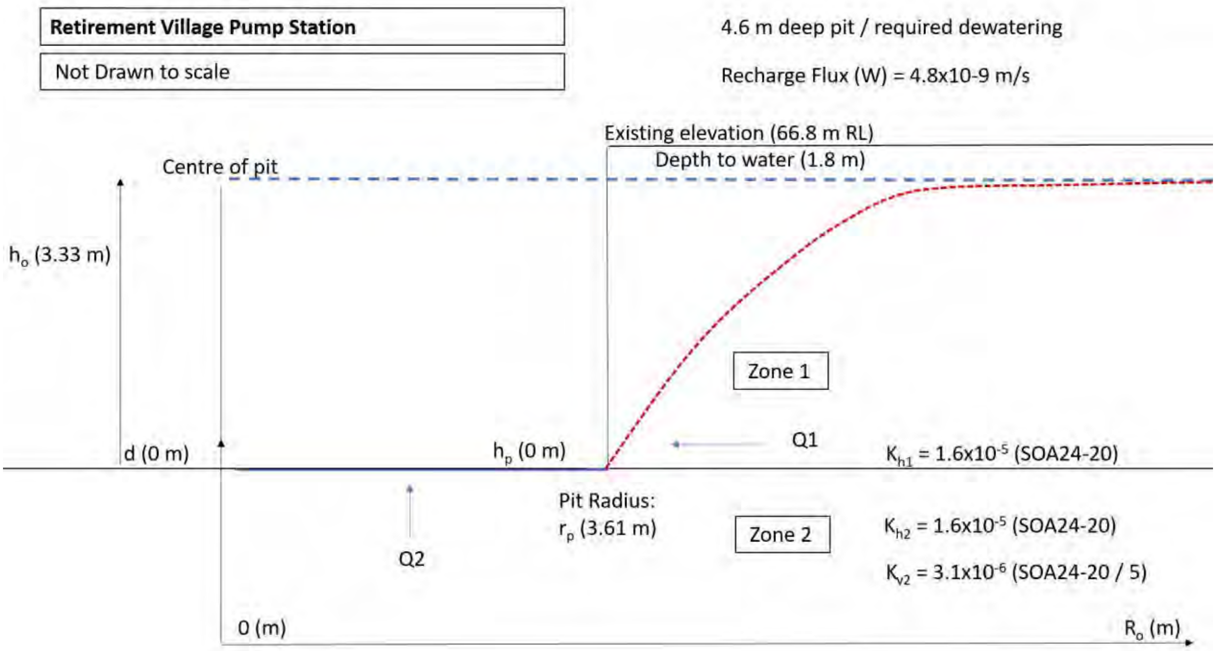

Figure 12:Input for Pit Model Assessing Dewatering of Planned Retirement Village Wet Well Install

As all pits likely terminate in sand layers, the same hydraulic conductivity has been applied to Zone 1 and Zone 2. The hydraulic conductivity applied to the drawdown and inflow evaluations was calculated as the last 4 values from CMW's nearby soakage tests as discussed in Section 2.5.1. A hydraulic conductivity of 3.5×10^{-5} m/s calculated from soakage test SOA24-12 has been applied to the aquifer at the central pit. A hydraulic conductivity of 8.8×10^{-6} m/s calculated from soakage test SOA24-07 has been applied to the aquifer at the northern pit. A hydraulic conductivity of 1.6×10^{-5} m/s calculated from soakage test SOA24-20 has been applied to the aquifer at the retirement village pit. Vertical hydraulic conductivity is expected to be lower than horizontal due to the depositional environment and anisotropy of the underlying Hinuera formation. Vertical conductivity is therefore estimated to be five times lower than horizontal.

Recharge for the site was obtained from the GNS Groundwater Recharge Model (GNS Science, 2019) as approximately 150 mm/yr. Groundwater levels were estimated from the 2024 winter water table (Figure 3). This represents a conservative estimate as the groundwater table is expected to be at its highest during winter, and as such, during this time inflow and drawdown will be at their greatest. The groundwater level at the central pit was estimated to be 65 m RL with the base of the pit at 60.83 m RL. The groundwater level at the northern pit was estimated to be 63.5 m RL with the base of the pit at 61.43 m RL. The groundwater level at the retirement village pit was estimated to be 65 m RL with the base of the pit at 62.17 m RL.

To be conservative 0.5 m was added to the depth of each pit to account for any additional drawdown that may be required during installation.

7.4 Results

During wet well construction, the central pit is projected to draw groundwater down 4.7 m from the interpreted winter groundwater level adjacent to the pit. This drawdown may be locally exceeded depending on the dewatering method applied. The nearest structure to the central pit is approximately 350 m away which is significantly further than the drawdown extent. WGA does not expect there to be any effect on nearby structures from groundwater drawdown.

During wet well construction, the northern pit is projected to draw groundwater down a maximum of 2.6 m adjacent to the pit. The nearest structure to the northern pit is approximately 40 m away at which point drawdown will be 0.08 m. Potential effects on this structure from a geotechnical perspective will depend on findings by CMW.

During wet well construction, the retirement village pit is projected to draw groundwater down a maximum of 3.3 m adjacent to the pit. The nearest structure to the retirement village pit is approximately 155 m away which is further than the drawdown extent. WGA does not expect there to any effect on nearby structures from groundwater drawdown.

The results of the pit modelling are summarised in Table 7.

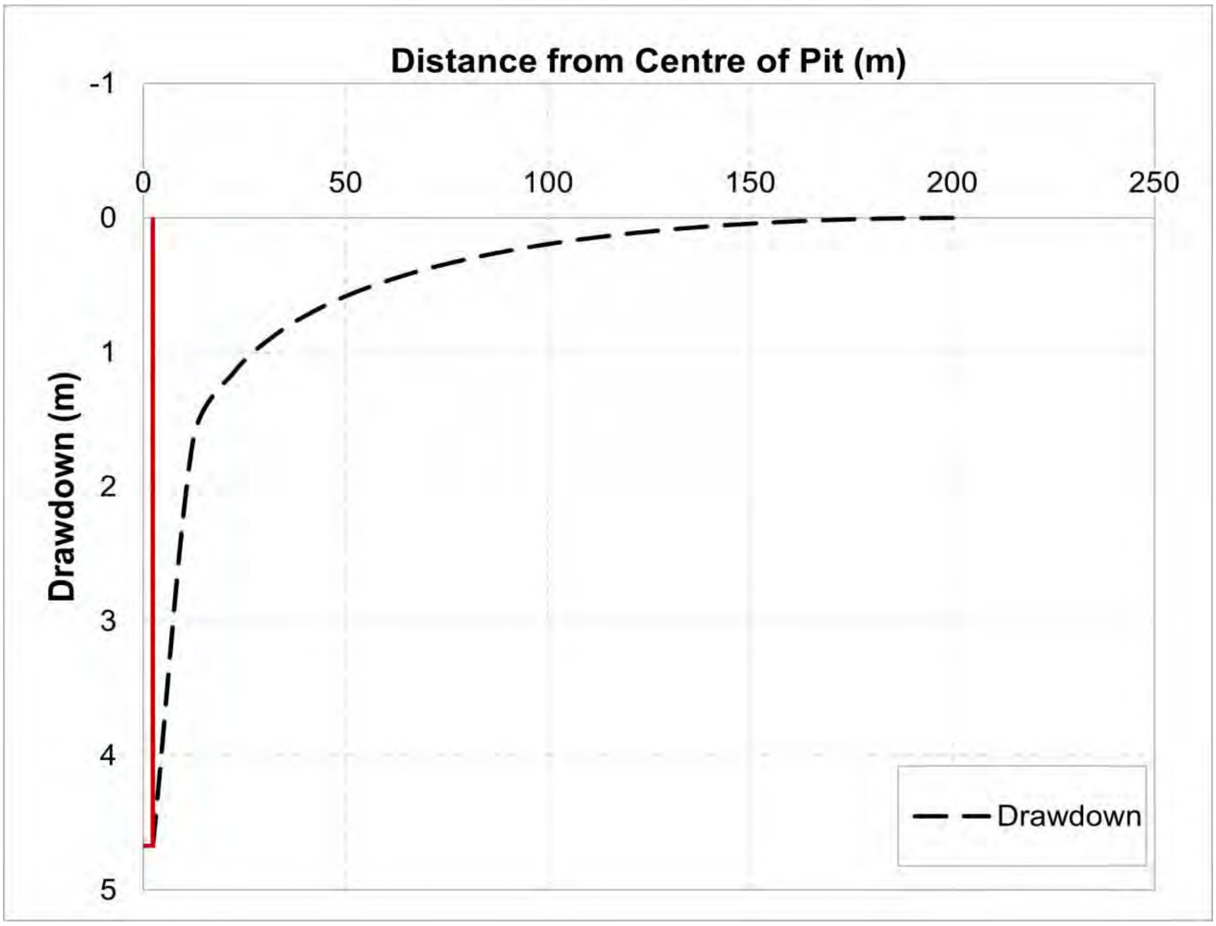

Figure 13: Drawdown Against Distance for the Central Pit

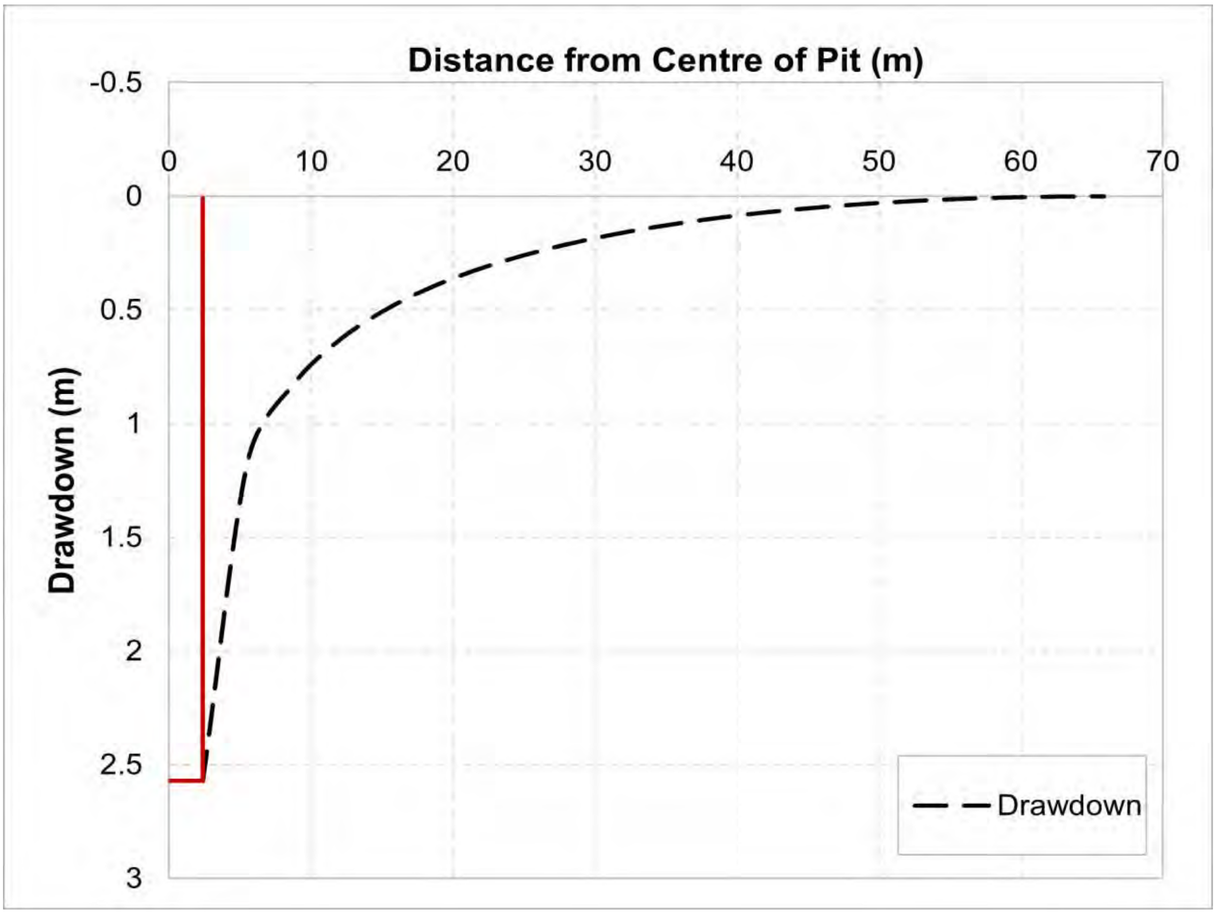

Figure 14: Drawdown Against Distance for the Northern Pit

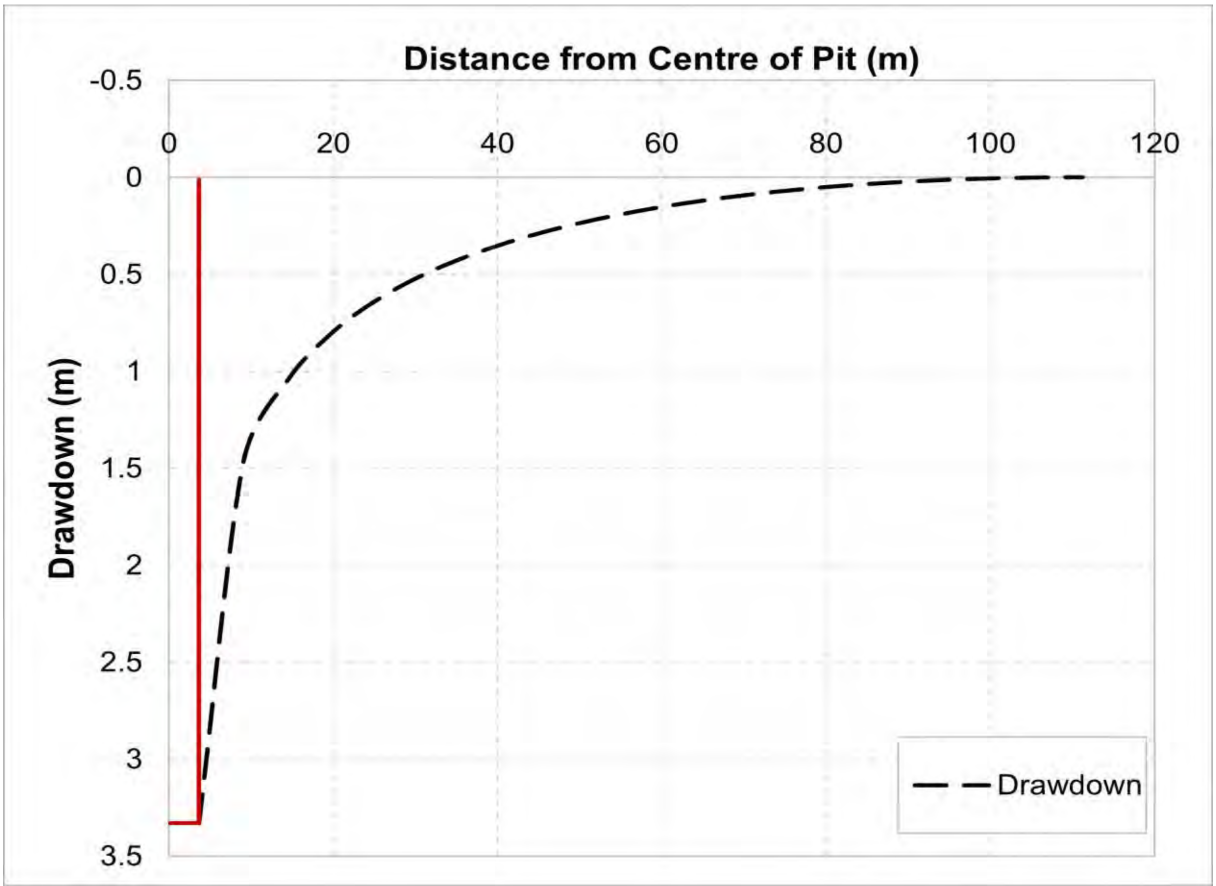

Figure 15: Drawdown Against Distance for the Retirement Village Pit

Table 7: Projected Effects of Wet Well Excavation

SITE	INITIAL SATURATED CUT DEPTH – EQUIVALENT TO MAX DRAWDOWN (m)	RADIUS OF INFLUENCE (m) [1]	CALCULATED GROUNDWATER INFLOW	
			m^3/day	L/s
Central	4.67	98	145	1.7
Northern	2.57	26	14	0.16
Retirement Village	3.33	49	45	0.52

Notes:
(1) Radius of influence defined as 0.25 m drawdown extent.

8 GROUNDWATER TAKE EFFECTS ASSESSMENT

8.1 Water Requirements and Use

A consent is being sought by Matamata Developments Limited for the abstraction of groundwater from a Production Bore (72_12812) located at Station Road, Matamata. The bore is proposed to be used for dust suppression during construction, irrigation of landscaped areas in the Retirement Village (10.73 ha) and a potable supply to the village. The abstraction rates being sought are:

- Abstraction for irrigation and retirement village supply:
  - A maximum daily volume of 336 m3
  - An irrigation annual maximum volume of 56,333 m3
  - A total annual maximum volume of 92,308 m3

Initially, water from the bore will be used for dust suppression for development of 10 to 15 ha at a rate of up to 336 m^3/day for up to 168 days. The total annual irrigation volume has been calculated using the online tool, IrriCalc, which models annual requirements for 9 out of 10 years. The potable water supply requirements for the retirement village are understood to be up to 182.3 m^3/day based on a total of 220 villas, aged care, and other facilities.

Groundwater quality from the Production Bore was sampled at the time of the constant rate test (14 May 2025). The results from the groundwater quality testing are provided in Appendix I and show excellent quality suitable for treatment and potable supply with tested parameters below aesthetic and maximum acceptable values. Nitrate was notably tested below laboratory detection limit of < 0.05 mg/L (Appendix I). The groundwater quality results in Appendix I indicate the groundwater is relatively soft with low risk of scaling.

The total annual volume for all uses is based on 168 days pumping at the maximum daily volume of 336 m^3/day to achieve the maximum irrigation volume and the remaining 197 days of the year pumping at 182.3 m^3/day for potable supply only. WGA notes that the bore can only achieve a maximum daily rate of 336 m^3/day. Therefore, any potable use during the irrigation period will reduce the availability for irrigation supply.

8.2 Pumping Test Analysis

A pumping test has been performed on the Production Bore (72_12812) and data analysed in Appendix I. The analysis results can be used to provide an estimate of the effects of the proposed abstraction on water levels in nearby bore. Analysis of the pumping test data indicates an appropriate estimate for transmissivity of the aquifer in the area of the Production Bore is 74.1 m^2/day.

8.3 Assessment of Effects

A comprehensive assessment of effects has been carried out and detailed in Appendix I for a groundwater take from the Production Bore. There are 28 nearby bores within a two-kilometre radius of the Production Bore. WGA have carried out modelled projected drawdown under two scenarios and concluded that potential drawdown interference on the nearby bores is less than minor. Based on a two-layer stream depletion model the proposed abstraction is considered to have a less than minor effect on the flow in the nearest stream. WGA concluded that the proposed abstraction is considered to have a less than minor effect on nearby wetlands which are located at a significant distance from the location of the bore.

WGA concludes that there is sufficient water available for allocation in the source aquifer to support the proposed abstraction and the requested volume is expected to have less than a minor effect on aquifer sustainability.

9 MONITORING AND MITIGATION

Given the relatively small and contained drawdown and mounding effects from the proposed works a full groundwater monitoring plan is considered to be not needed for the site. WGA do recommend reinstating groundwater level monitoring in the shallow aquifer beside basin A of the residential development given the relatively close proximity to houses and a 1 to 2 m modelled groundwater level rise.

The temporary dewatering for the wastewater pumping stations may require groundwater level monitoring as part the geotechnical monitoring plan. This will depend on findings by CMW on the effects of the projected drawdowns.

WGA also recommends standard flow monitoring conditions and reporting for the groundwater take consent for the onsite Production Bore 72_12812. A water management plan is required for the supply of potable water from the Production Bore to the retirement village.

10 CONCLUSIONS

Matamata Developments Limited (Matamata Developments) is planning to establish a residential development, retirement village, and solar farm at Station Road, Matamata. The Ashbourne Development is expected to consist of 1,000 residential dwellings, a retirement village with 220 villas, and a 37.5 ha solar farm. Matamata Developments is now intending to apply for resource consents authorising the Ashbourne Development.

Matamata Developments contracted WGA to undertake a further hydrogeological assessment focusing on the potential effects on groundwater associated with the construction and operation of a proposed greenway, stormwater infiltration basins and a wastewater disposal field including wastewater pipelines and pumpstations.

The site is located on the edge of the Waitoa River and currently comprises an active dairy farm. Drainage has been installed to help maintain the site in pasture. These drains form part of the Hauraki Plains drainage network.

The site is predominantly underlain by sediments of the Hinuera Formation, one component of the Tauranga Group. The Hinuera Formation consists of Late Pleistocene River deposits including cross-bedded pumice sand, silt, and gravel with interbedded peat. Sedimentary deposits of the older Walton Subgroup outcrop along the eastern side of the stream gully to the west of the site.

Two scenarios were modelled in the groundwater mounding assessments undertaken at each of the stormwater basins. The first scenario applied a transient model with a simulated continuous recharge period of three days and a 50-day recovery period to assess the effects of a large one-off storm event. The second scenario applied a transient model run for 36 days with a 200-day recovery period to simulate the cumulative mounding effects over a full winter period. Modelled mounding was generally less than 1 m at the nearest structure with the exception of Basin A which indicated mounding could be up to between 1 to 2 m at the building adjacent to the basin to the east of the proposed basin.

An assessment was undertaken to determine the expected inflows and resulting drawdown from the construction and operation of the proposed greenway. The drawdown influence from the simulation is modelled to reach a maximum extent of 15.5 m from the trench with an associated inflow of 135 m^3/day. The modelled scenarios used very conservative parameters, and WGA considers it is unlikely that the higher calculated drawdown and inflows from the assessment will be observed.

Assessments of drawdown resulting from the construction dewatering of the central and retirement village pumping station wet wells show no drawdown effect at existing structures. The northern pit results show a small drawdown effect of 0.08 m at the closest structure. Potential effects on this structure from a geotechnical perspective will depend on findings by CMW.

An assessment was also undertaken to assess groundwater quality effects from the disposal of treated wastewater. Attenuation modelling shows that at a distance of 200 m from the discharge site; concentrations were calculated to be near zero (5×10^{-10} cfu/100 mL). Attenuation modelling also shows near-zero results for the deep onsite Production Bore 72_12812 (< 1.5×10^{-4} cfu/100 mL).

The Production Bore 72_12812 has been drilled in the location of the proposed Retirement Village for dust suppression water, potable water supply to residents, and irrigation of landscaped areas. The proposed take has been modelled and resulted in less than minor effects on nearby bores and surface water bodies. Groundwater sampled and tested from the Production Bore shows excellent quality suitable for treatment and potable supply.

11 LIMITATIONS

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

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APPENDIX A
LITHOLOGICAL LOGS

Table A1: Geological Summary in the Vicinity of Stormwater Basins, Excavation Areas and the Wastewater Treatment Location

SITE NUMBER	DEPTH (m)	GEOLOGICAL SUMMARY
TPO3	2.6	From ground surface, 0.3 m of organic SILT (topsoil) changing to 0.3 m of Silt. Underlain by 1.1 m of fine to medium sandy SILT changing to 0.2 m of SILT. This is then followed by 1.2 m of Fine to coarse SAND which is underlain by 0.4 m of clayey SILT. Groundwater at 2.6 m.
TPO4	5	From ground surface, 0.4 m of Organic SILT (topsoil) changing to 0.8 m of SILT. Underlain by 0.2 m of Silty fine to medium SAND and 3.7 m of Fine to Coarse SAND.
HA24-19	2.4	From ground surface, 0.2 m of Organic SILT (topsoil) changing to 0.4 m of Silty Fine SAND and Fine sandy SILT. Underlain by 0.9 m of Silty Fine SAND. This is followed by 0.1 m of SILT and 0.6 m of Silty Fine to medium SAND. This is then followed by 0.2 m of SILT and Silty fine SAND.
SCPT24-01	22.64	From ground surface, 0.5 m of Clay, changing to approximately 2.5 m of Sand, Silty sand and sandy silt. Underlain by a 7.0 m mixture of Clay and Silty clay, Clay and Silty sand and Sandy silt. This is then followed by approximately 12.64 m of Sand and silty sand. Groundwater at 1.5 m.
SCPT24-04	28.31	From ground surface, 1 m of Clay and silty clay, changing to approximately 13 m of Sand and silty sand. This is underlain by approximately 4.5 m Clay and silty clay changing to approximately 2 m of Silty sand and sand followed by approximately 7.5 m of Silty sand, clay, silty clay with occasional layers of sand and silty sand.
CPT24-06	30.06	From ground surface, 1 m of clay changing to 4.5 m of various layers of Silty sand, clay and silty clay and sandy silt. Underlain by 11 m of Sand and silty sand changing to approximately 8 m of Silty sand. This is then followed by approximately 5.5 m of Sand & Silty sand.
CPT24-07	30.07	From ground surface, 1.5 m of Organic soil, changing to 12 m of Sand and Silty sand with some Silty sand. This is underlain by approximately 2.5 m of Silty sand and Sandy silt which is underlain by 14 m of Silty sand and sandy silt. Groundwater at 1.5 m.
SOA24-12	3.0	From ground surface, 0.2 m of Organic SILT (topsoil) changing to 0.5 m of SILT. Underlain by 2.3 m of Fine to coarse SAND. Groundwater was not encountered.
SOA24-08	3.0	From ground surface, 0.3 m of Organic SILT (topsoil), changing to 1.6 m of SILT. Underlain by 1.1 m of Silty CLAY. Groundwater was not encountered.

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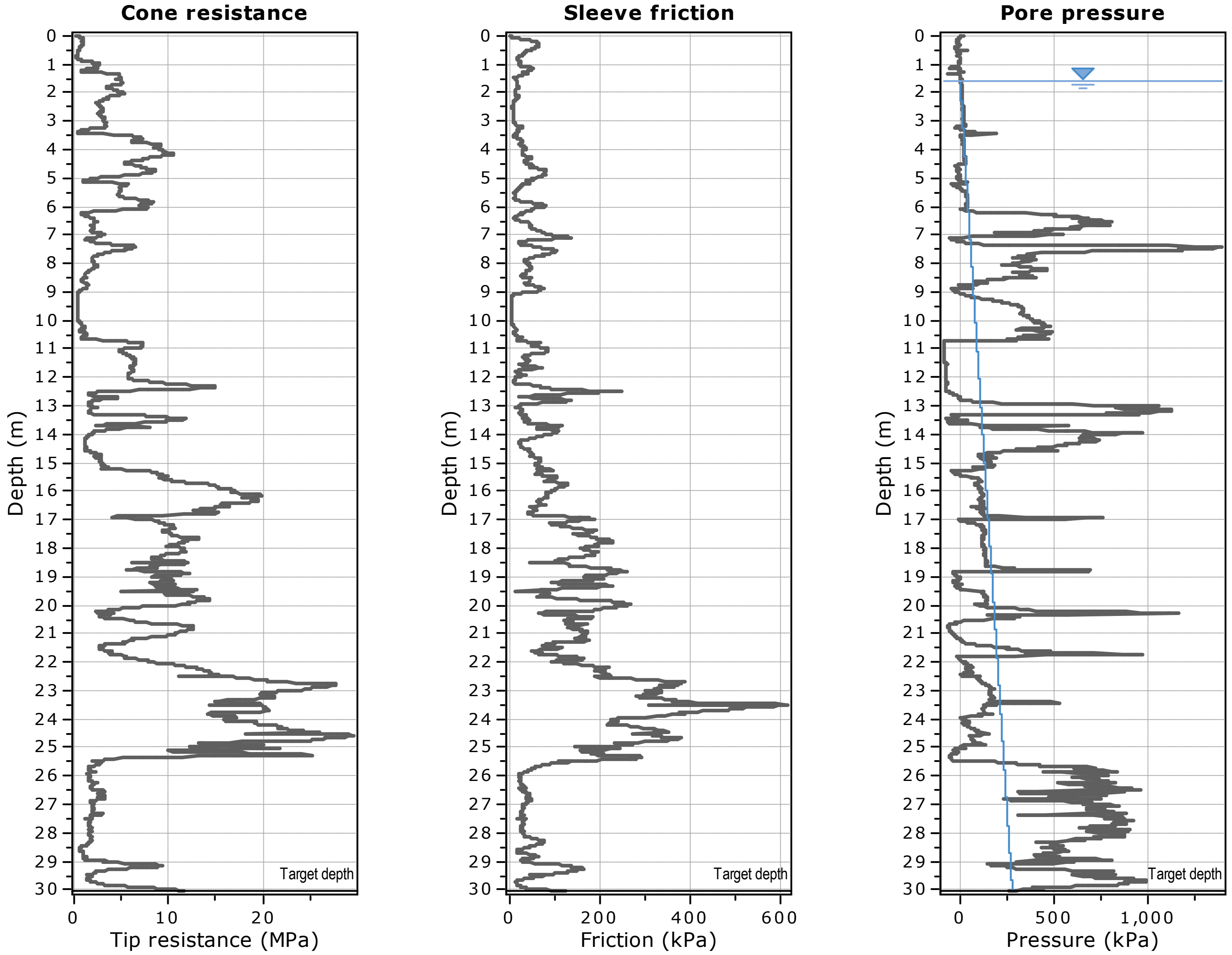
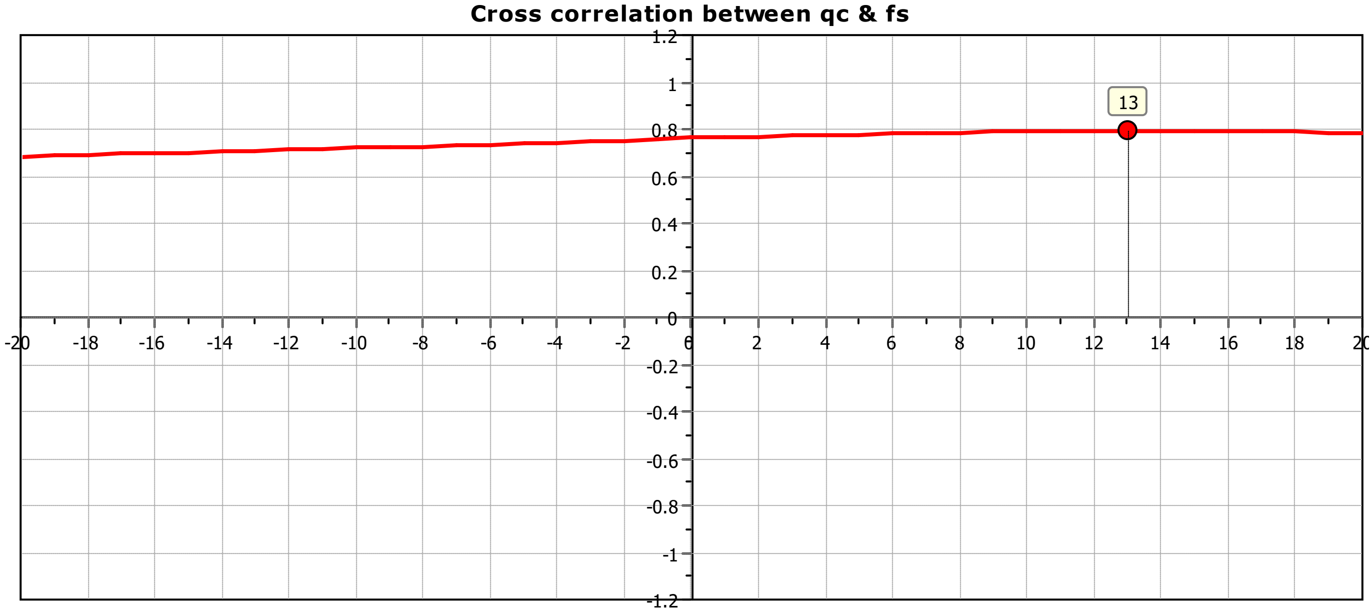
CPT: 24-04

Total depth: 30.04 m, Date: 4/06/2024
Coords: lat -37.812787° lon 175.751857°
Cone Type: DC10

Project: **CMW Geosciences | HAM2023-0124 | GDS NZ Ltd**
Location: **127 Station Road, Matamata | Holes dipped onsite using Dipmeter**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).



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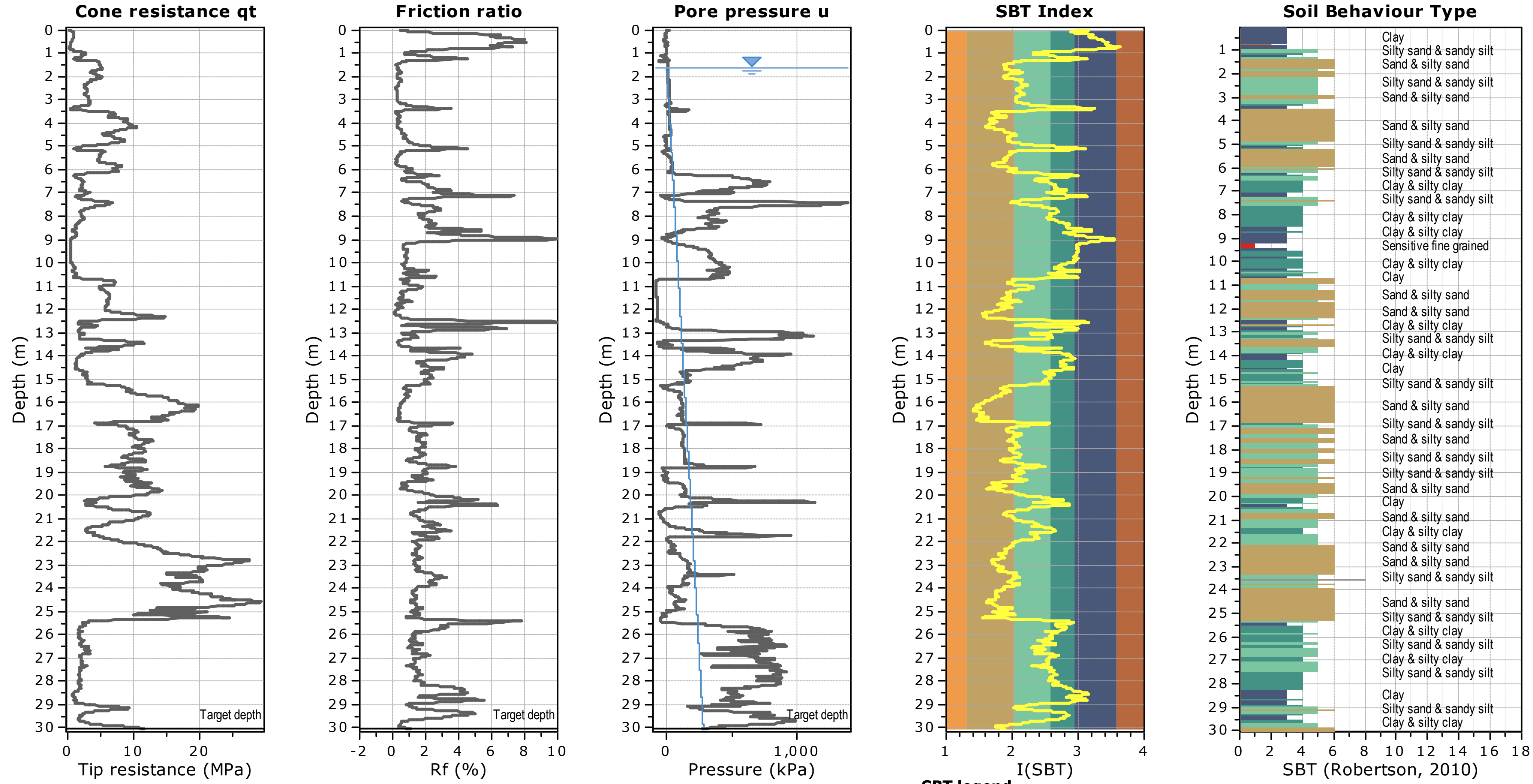
CPT: 24-04
Total depth: 30.04 m, Date: 4/06/2024
Coords: lat -37.812787° lon 175.751857°
Cone Type: DC10

Project: **CMW Geosciences | HAM2023-0124 | GDS NZ Ltd**
Location: **127 Station Road, Matamata | Holes dipped onsite using Dipmeter**



SBT legend

- 1. Sensitive fine grained
- 2. Organic material
- 3. Clay to silty clay
- 4. Clayey silt to silty clay
- 5. Silty sand to sandy silt
- 6. Clean sand to silty sand
- 7. Gravely sand to sand
- 8. Very stiff sand to clayey sand
- 9. Very stiff fine grained

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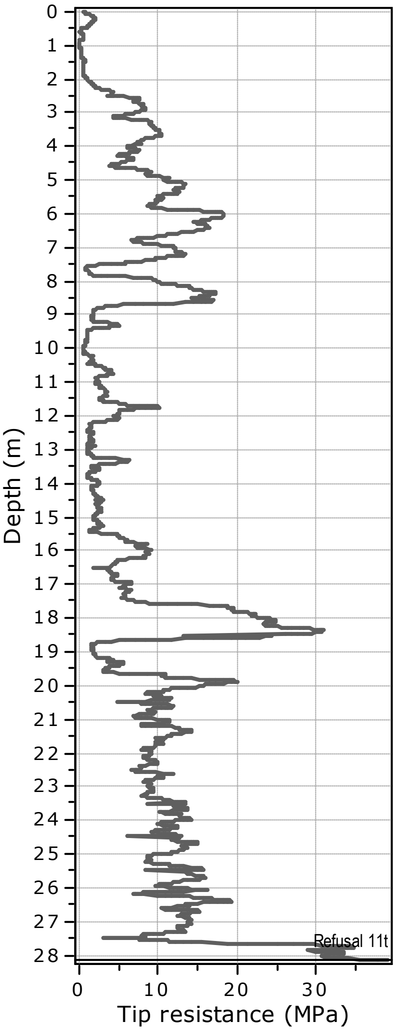
CPT: 24-05

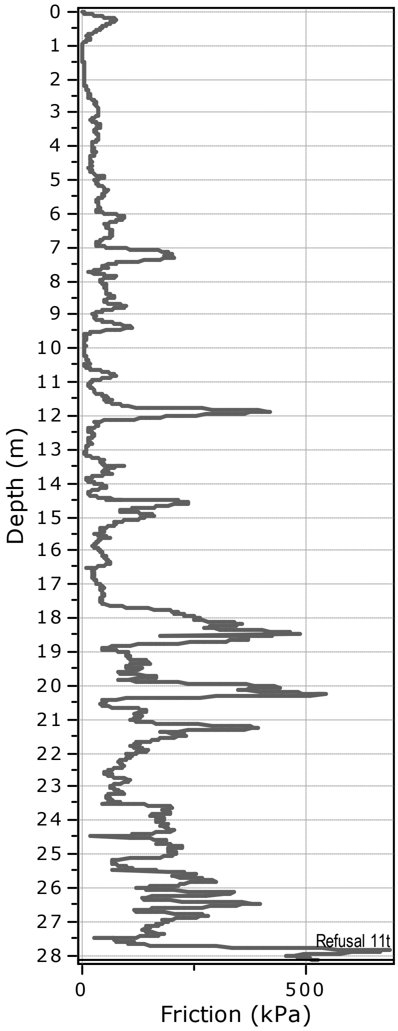
Total depth: 28.14 m, Date: 4/06/2024
Coords: lat -37.815987° lon 175.753168°
Cone Type: DC10

Project: **CMW Geosciences | HAM2023-0124 | GDS NZ Ltd**
Location: **127 Station Road, Matamata | Holes dipped onsite using Dipmeter**

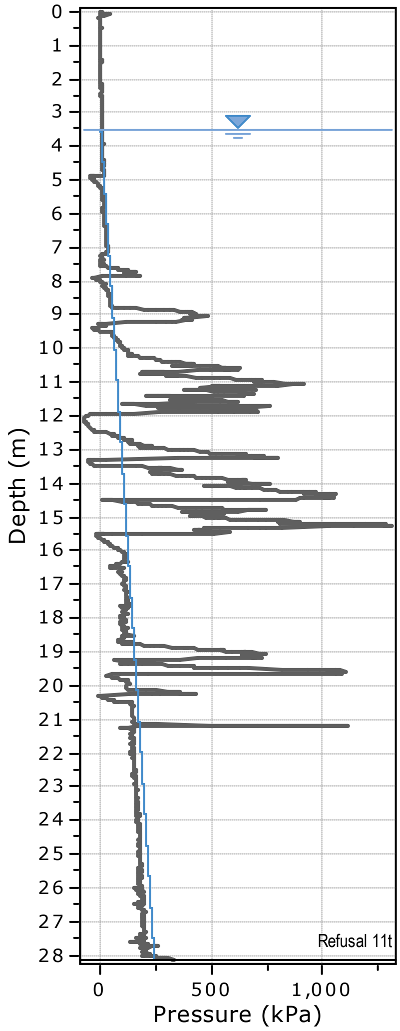
Cone resistance



Sleeve friction

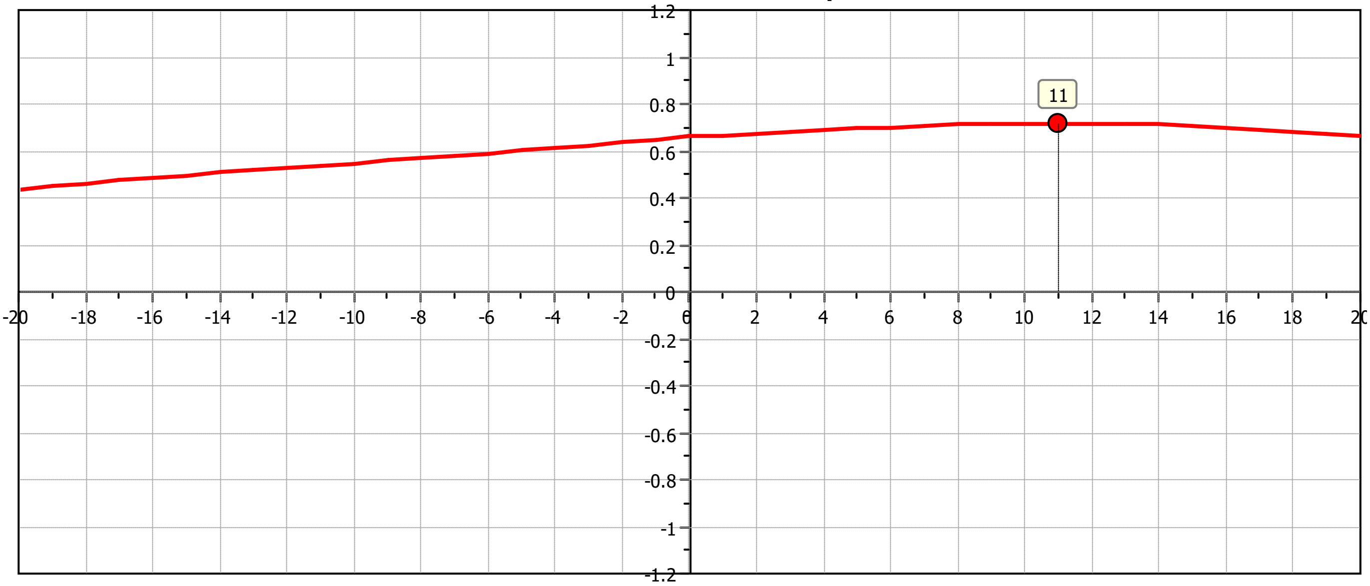


Pore pressure



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

Cross correlation between qc & fs



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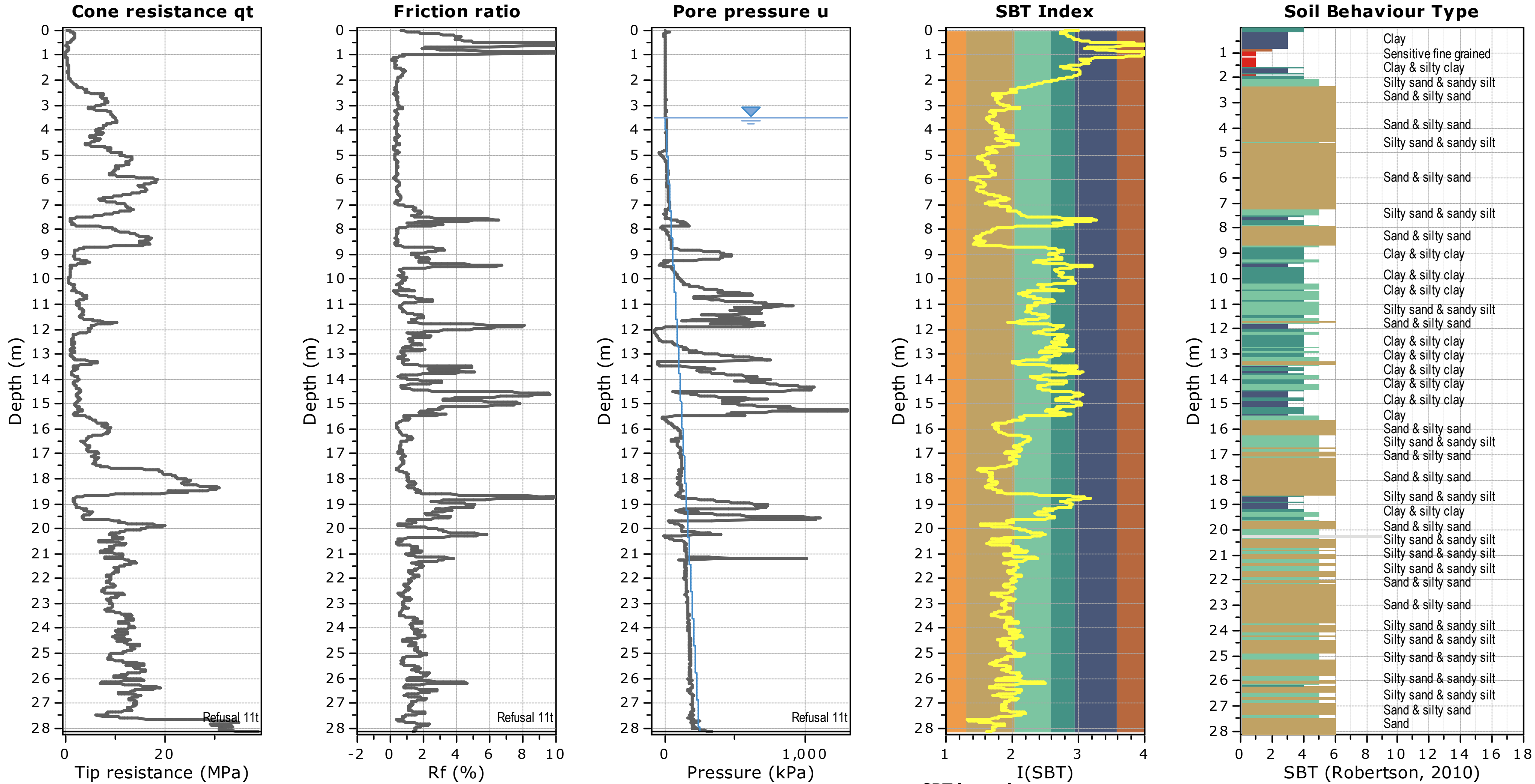
CPT: 24-05

Total depth: 28.14 m, Date: 4/06/2024
Coords: lat -37.815987° lon 175.753168°
Cone Type: DC10

Project: CMW Geosciences | HAM2023-0124 | GDS NZ Ltd
Location: 127 Station Road, Matamata | Holes dipped onsite using Dipmeter



SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

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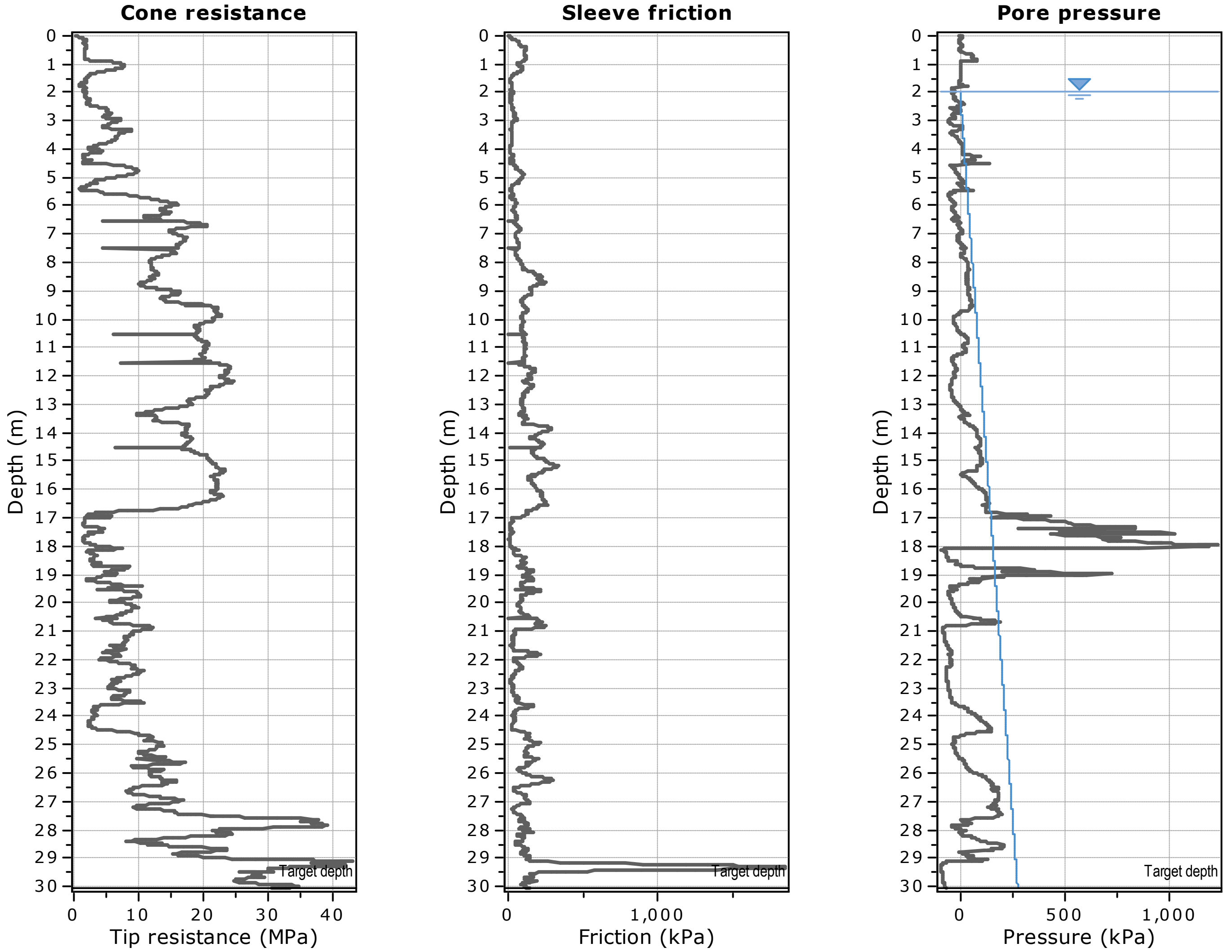
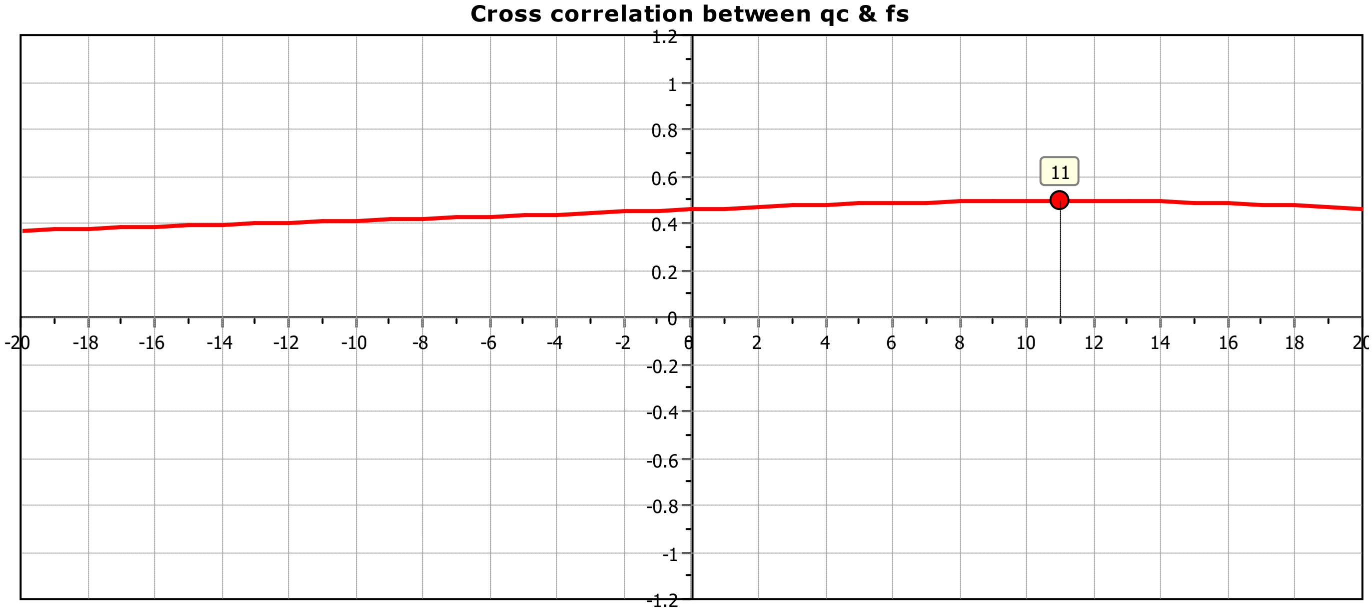
CPT: 24-06
Total depth: 30.06 m, Date: 4/06/2024
Coords: lat -37.820042° lon 175.759802°
Cone Type: DC10

Project: **CMW Geosciences | HAM2023-0124 | GDS NZ Ltd**
Location: **127 Station Road, Matamata | Holes dipped onsite using Dipmeter**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).



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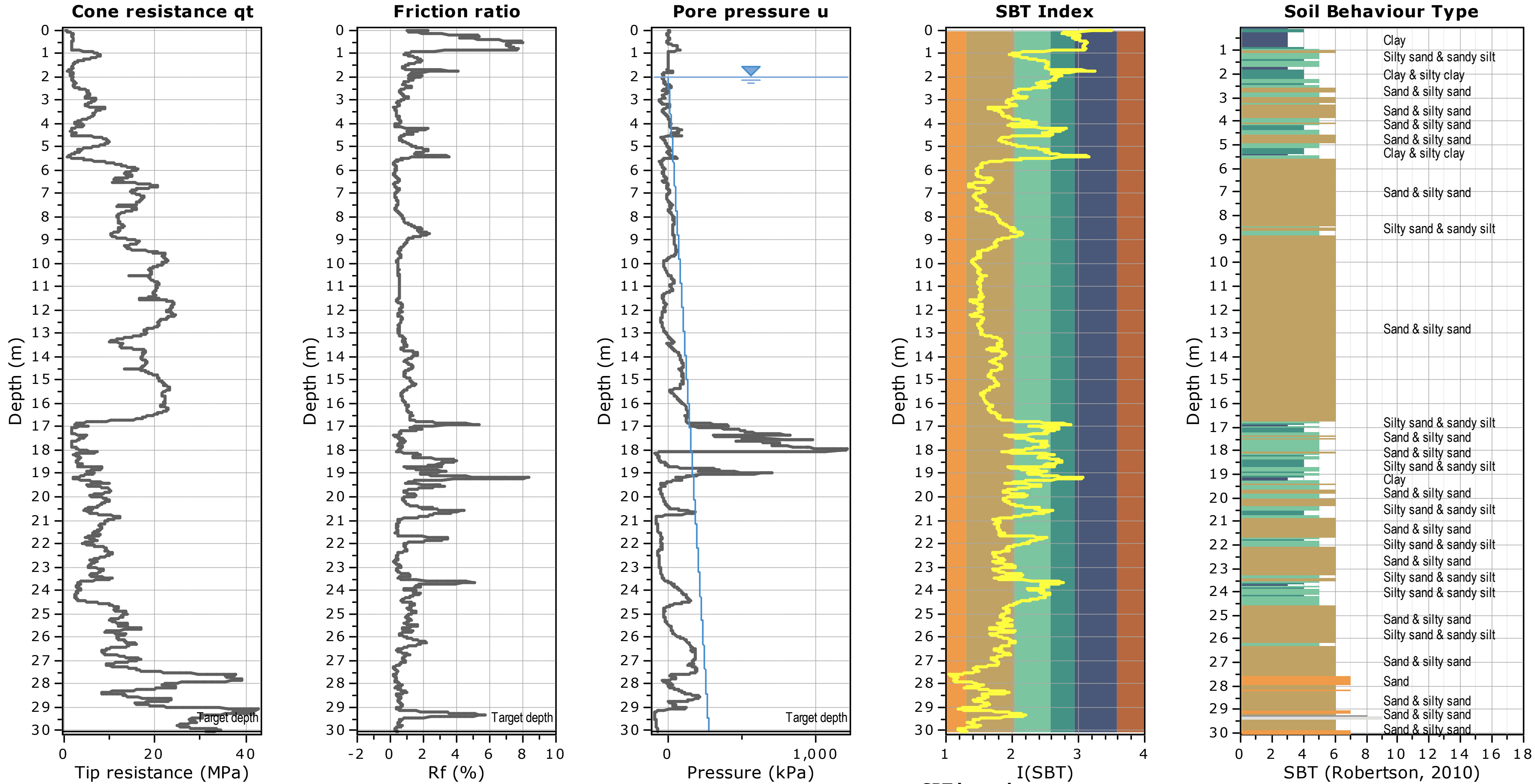
CPT: 24-06

Total depth: 30.06 m, Date: 4/06/2024
Coords: lat -37.820042° lon 175.759802°
Cone Type: DC10

Project: CMW Geosciences | HAM2023-0124 | GDS NZ Ltd
Location: 127 Station Road, Matamata | Holes dipped onsite using Dipmeter



SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

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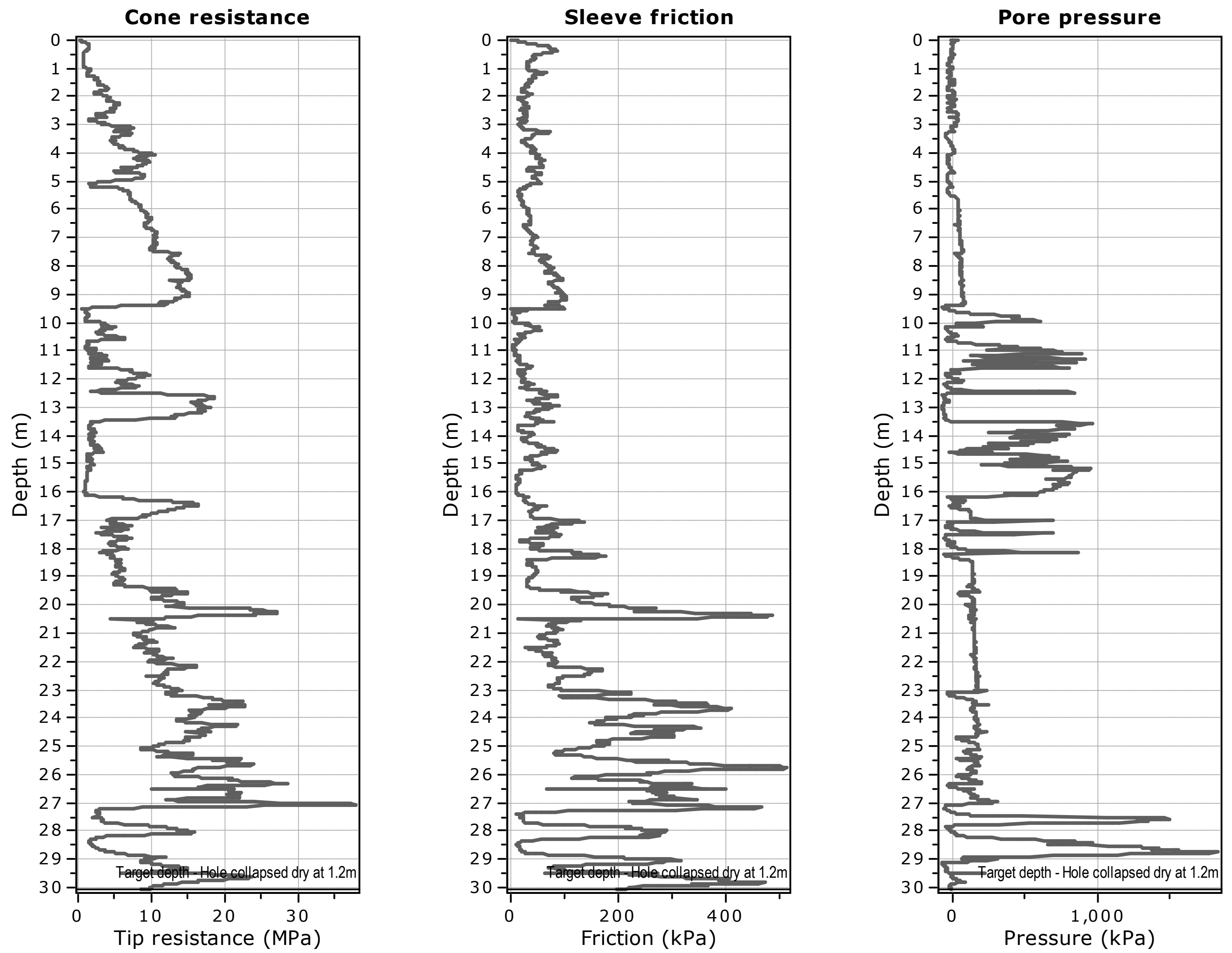
CPT: 24-07

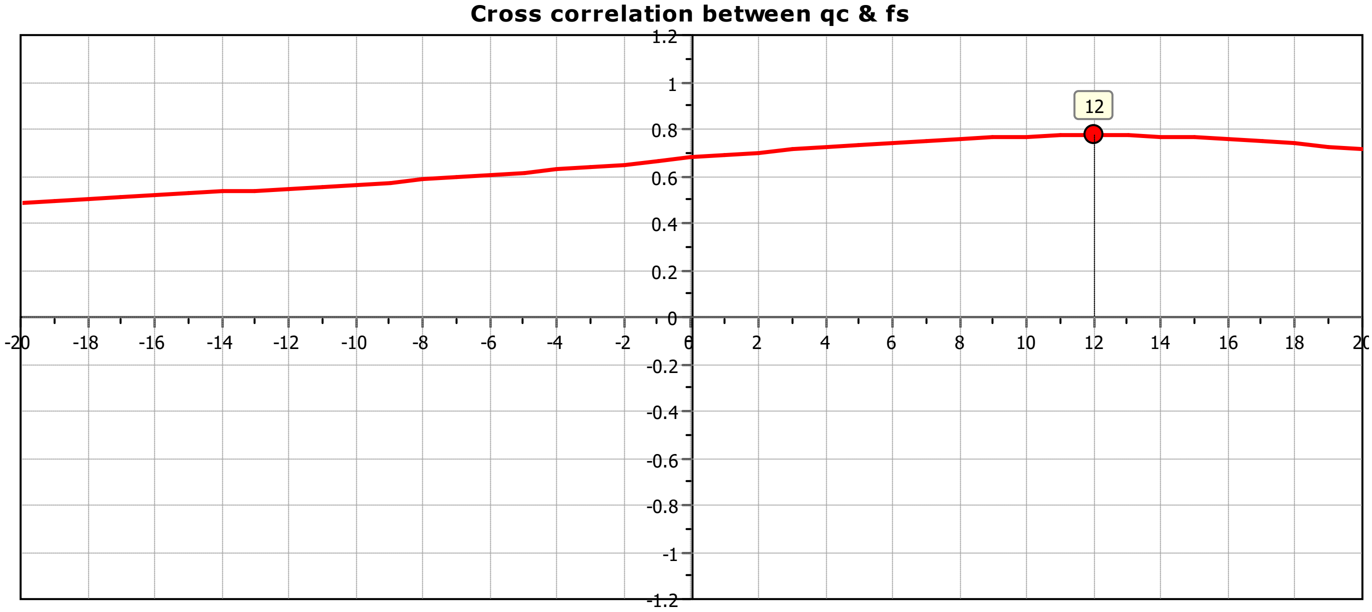
Total depth: 30.07 m, Date: 4/06/2024
Coords: lat -37.82305° lon 175.750916°
Cone Type: DC10

Project: CMW Geosciences | HAM2023-0124 | GDS NZ Ltd
Location: 127 Station Road, Matamata | Holes dipped onsite using Dipmeter



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

Cross correlation between qc & fs



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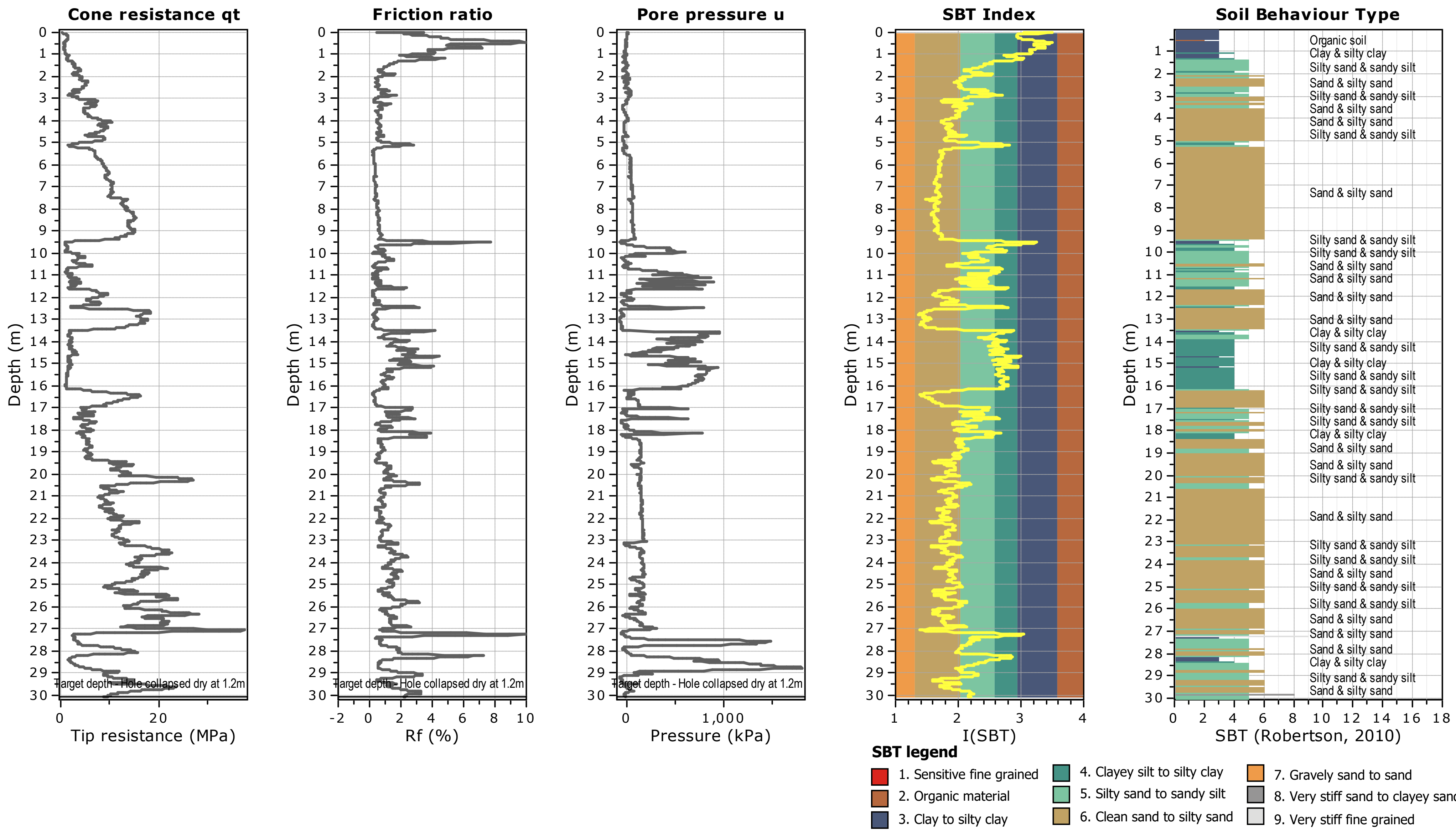
CPT: 24-07

Total depth: 30.07 m, Date: 4/06/2024
Coords: lat -37.82305° lon 175.750916°
Cone Type: DC10

Project: CMW Geosciences | HAM2023-0124 | GDS NZ Ltd
Location: 127 Station Road, Matamata | Holes dipped onsite using Dipmeter



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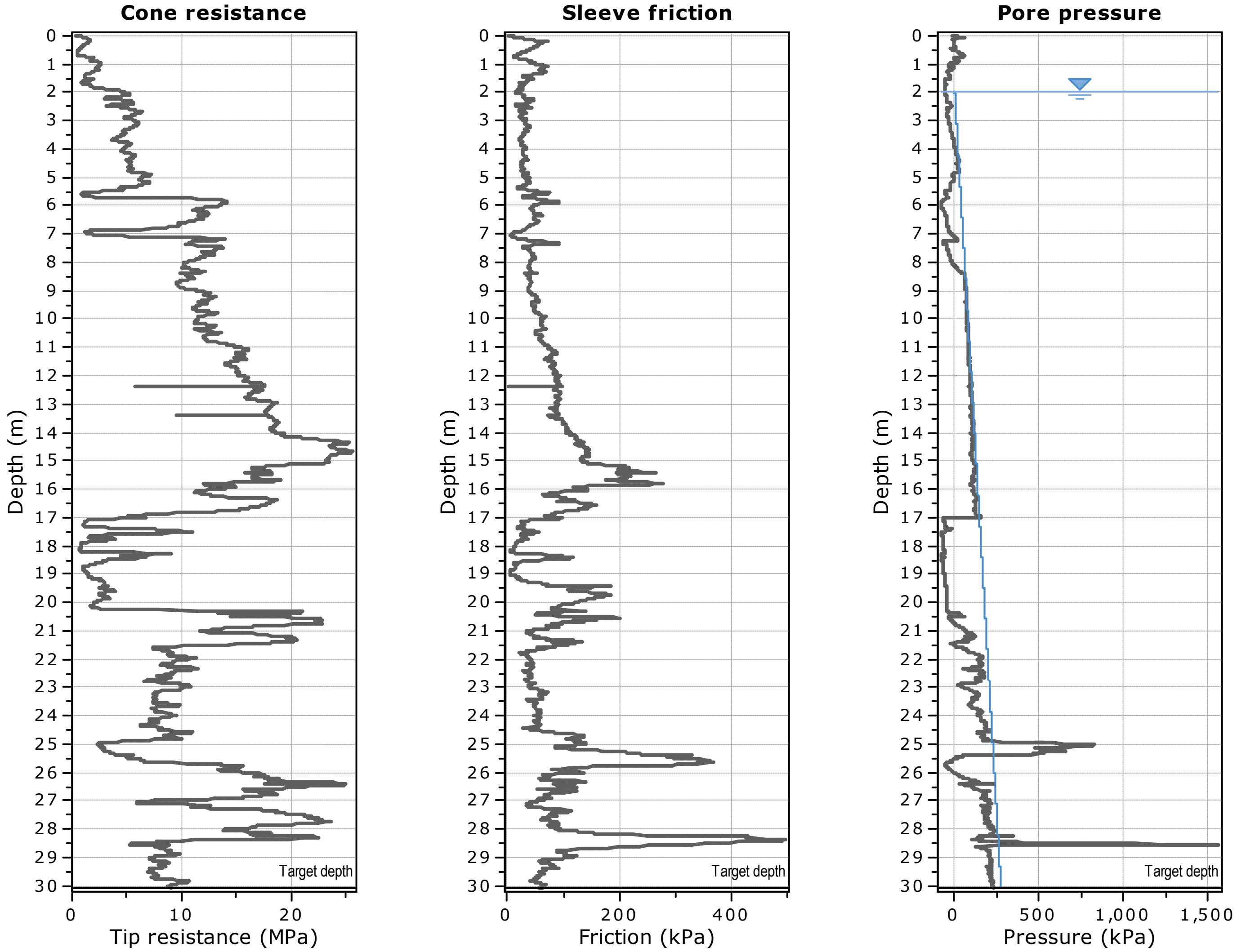
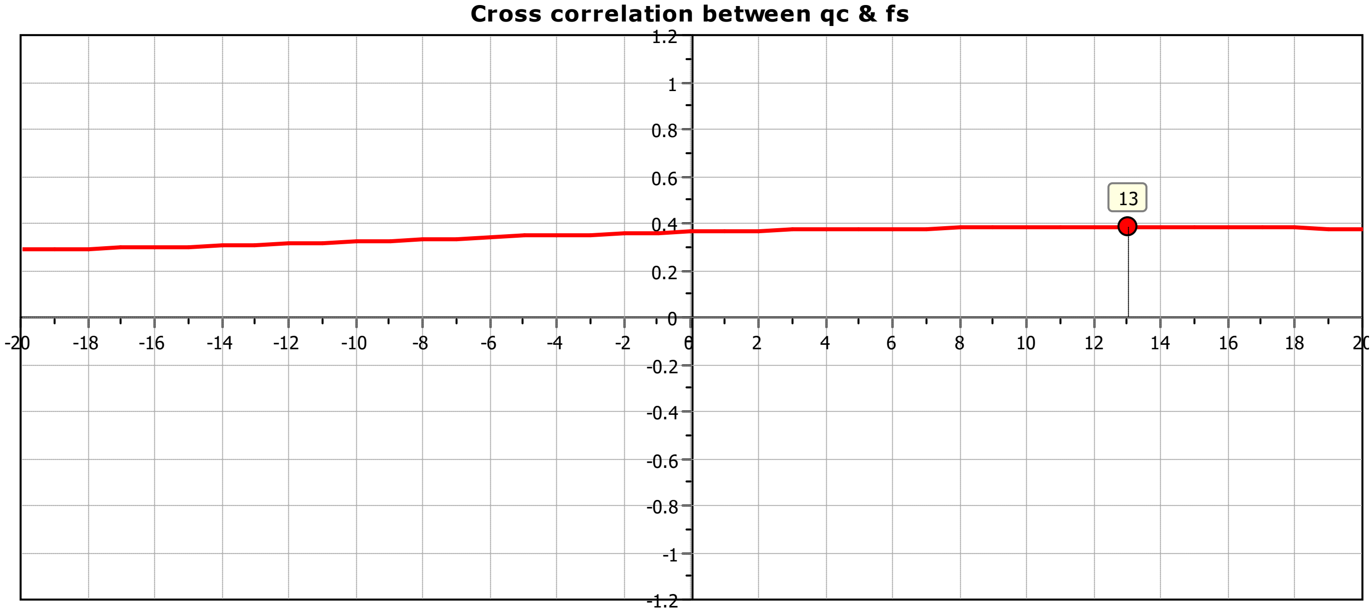
CPT: 24-08

Total depth: 30.08 m, Date: 4/06/2024
Coords: lat -37.82359° lon 175.754635°
Cone Type: DC10

Project: CMW Geosciences | HAM2023-0124 | GDS NZ Ltd
Location: 127 Station Road, Matamata | Holes dipped onsite using Dipmeter



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).



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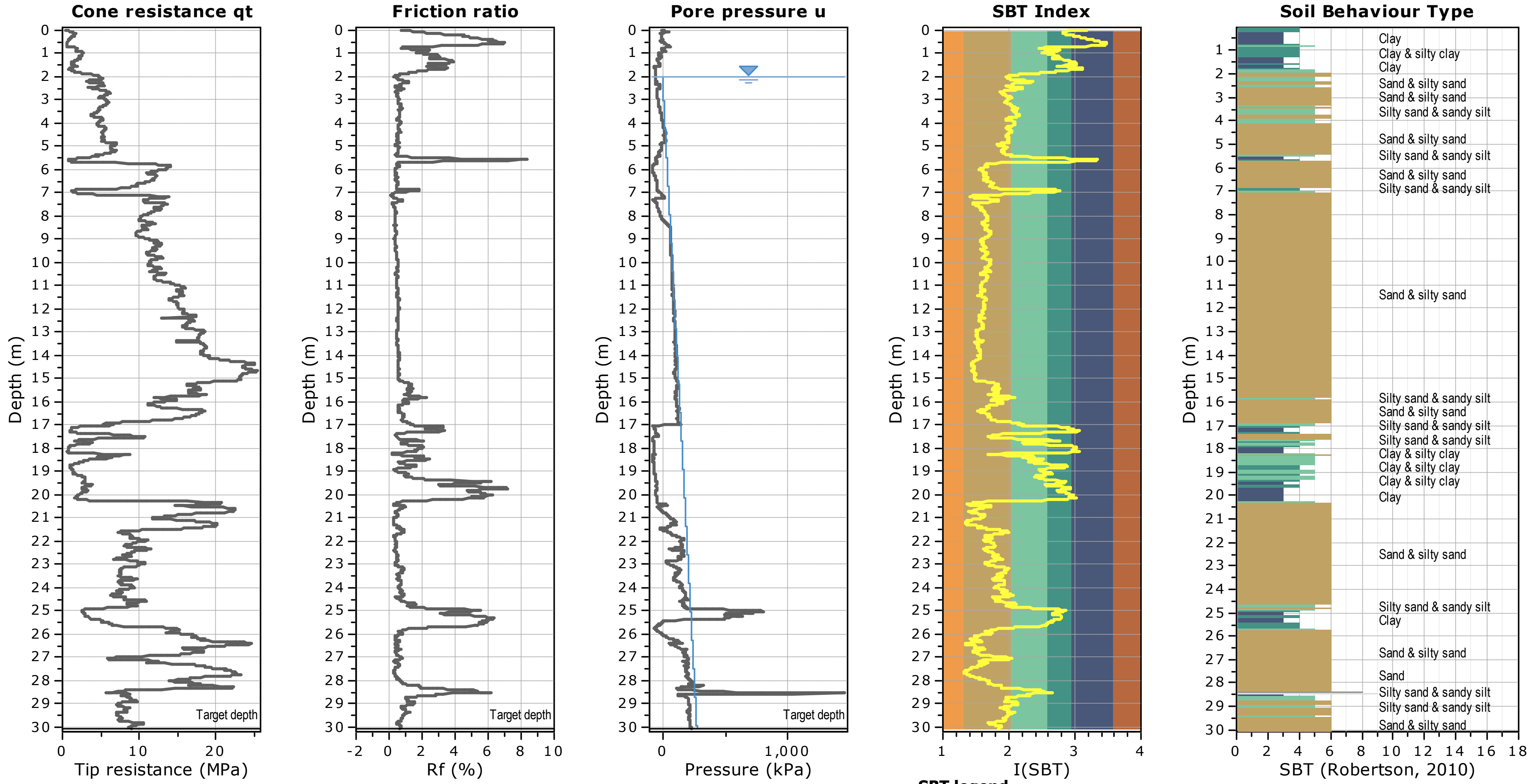
CPT: 24-08

Total depth: 30.08 m, Date: 4/06/2024
Coords: lat -37.82359° lon 175.754635°
Cone Type: DC10

Project: CMW Geosciences | HAM2023-0124 | GDS NZ Ltd
Location: 127 Station Road, Matamata | Holes dipped onsite using Dipmeter



SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

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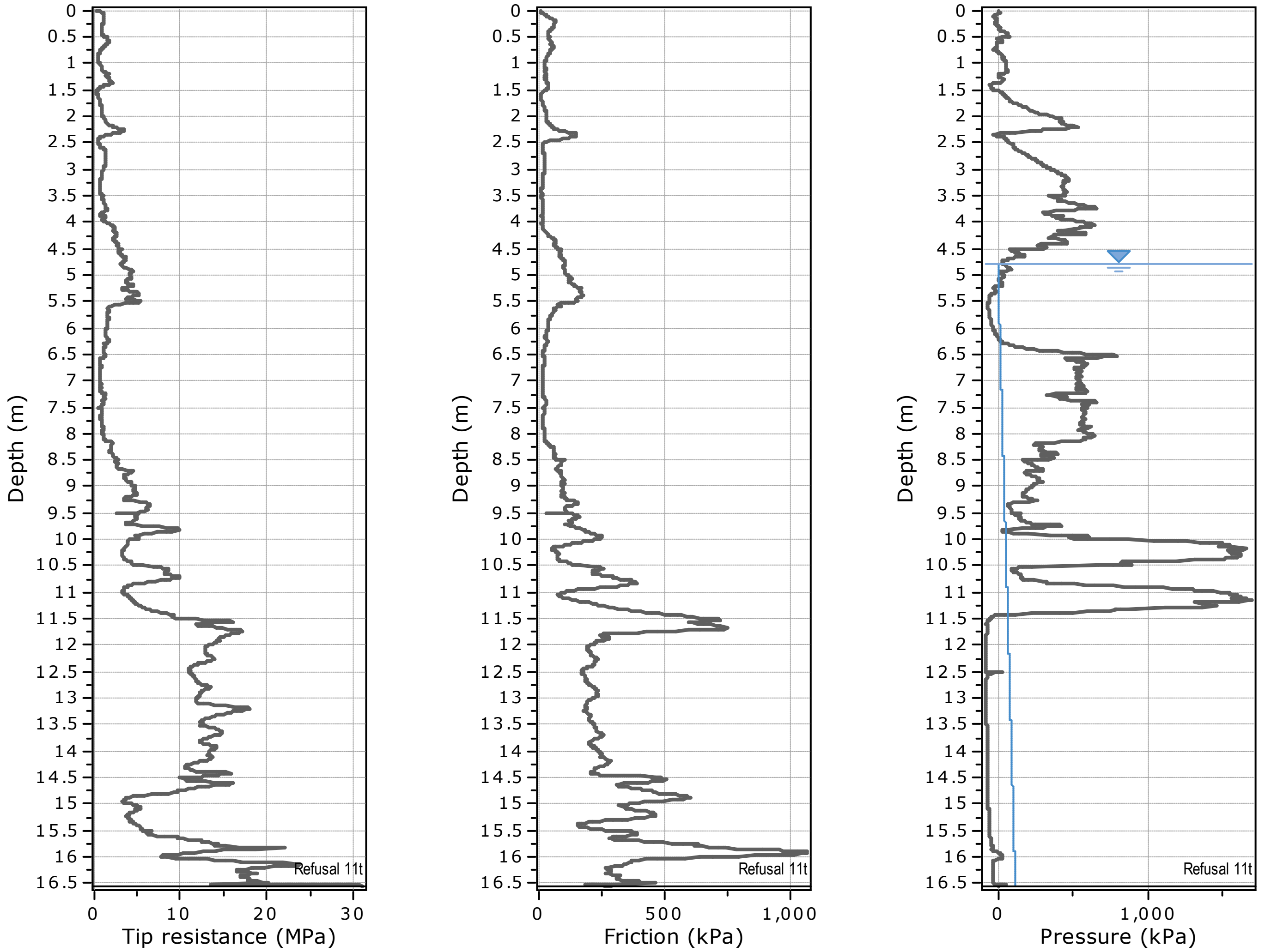
CPT: 24-09

Total depth: 16.56 m, Date: 4/06/2024
Coords: lat -37.824685° lon 175.748286°
Cone Type: DC10

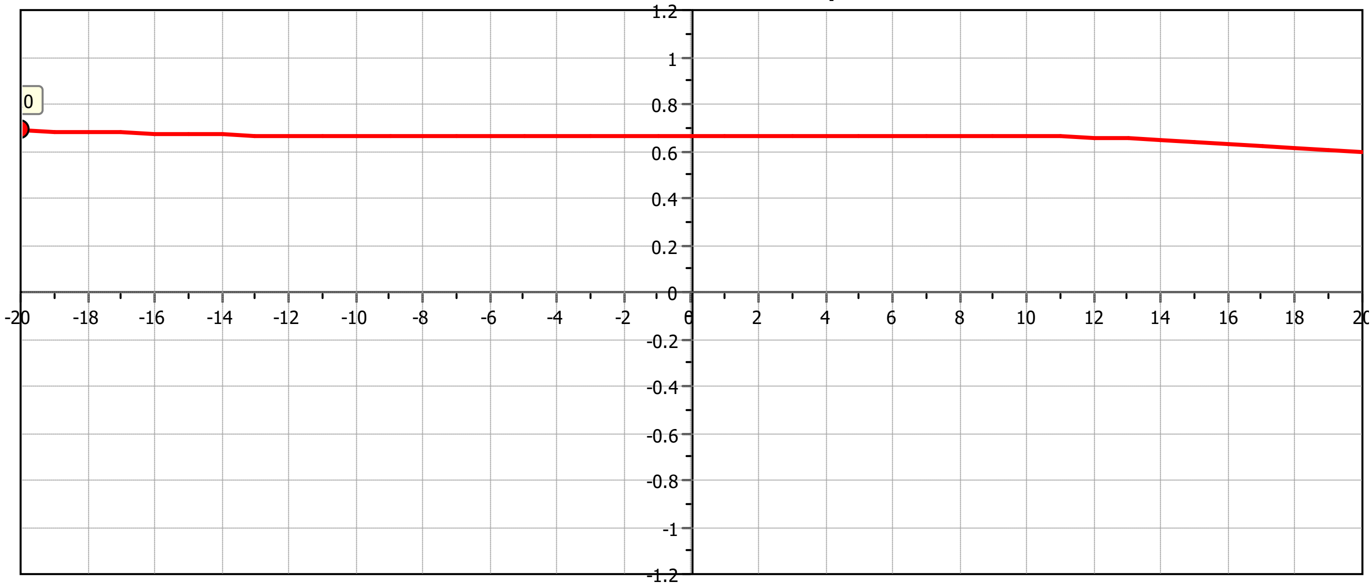
Project: **CMW Geosciences | HAM2023-0124 | GDS NZ Ltd**
Location: **127 Station Road, Matamata | Holes dipped onsite using Dipmeter**

Cone resistance **Sleeve friction** **Pore pressure**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

Cross correlation between qc & fs



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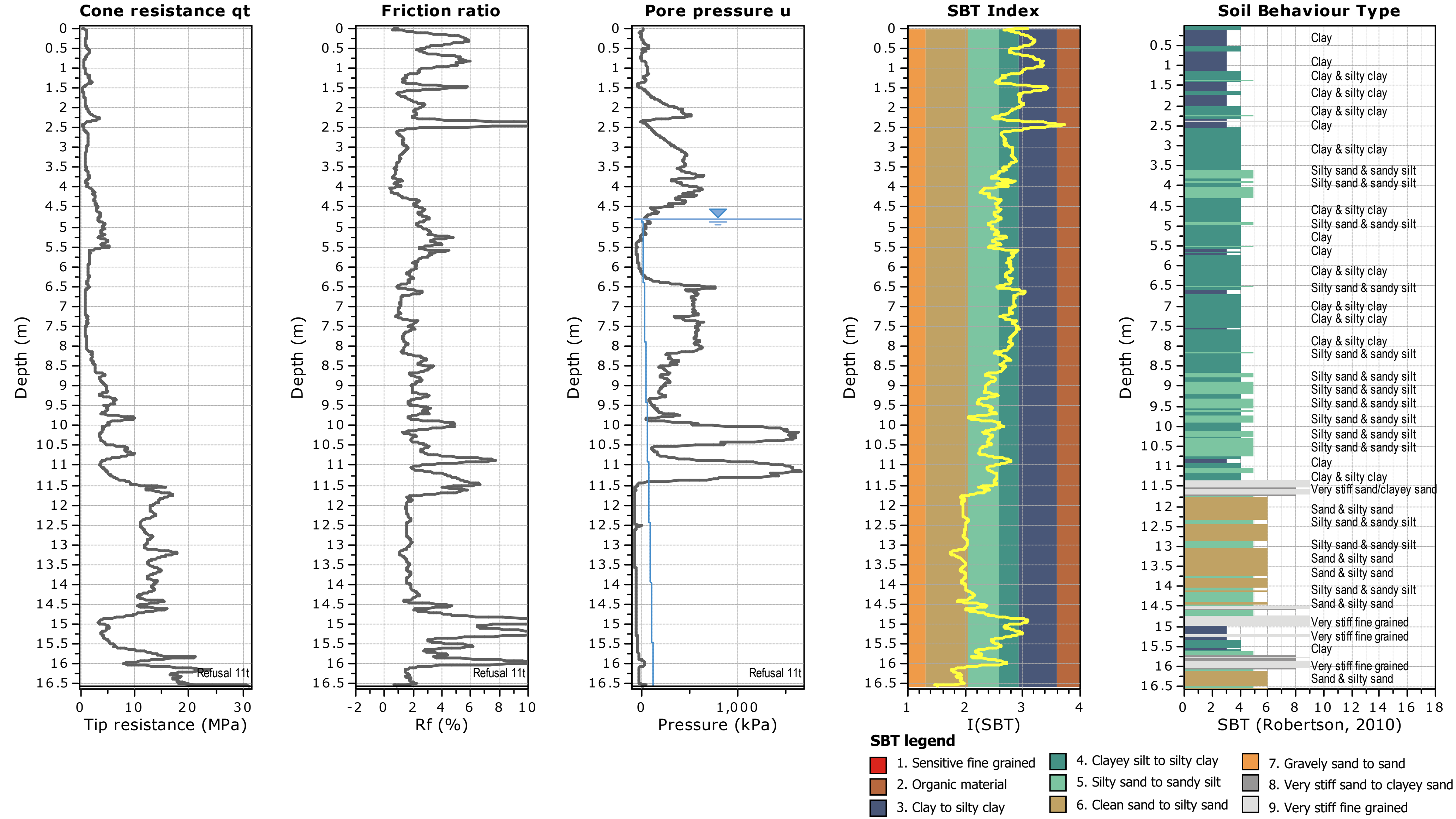
CPT: 24-09
Total depth: 16.56 m, Date: 4/06/2024
Coords: lat -37.824685° lon 175.748286°
Cone Type: DC10

Project: **CMW Geosciences | HAM2023-0124 | GDS NZ Ltd**
Location: **127 Station Road, Matamata | Holes dipped onsite using Dipmeter**



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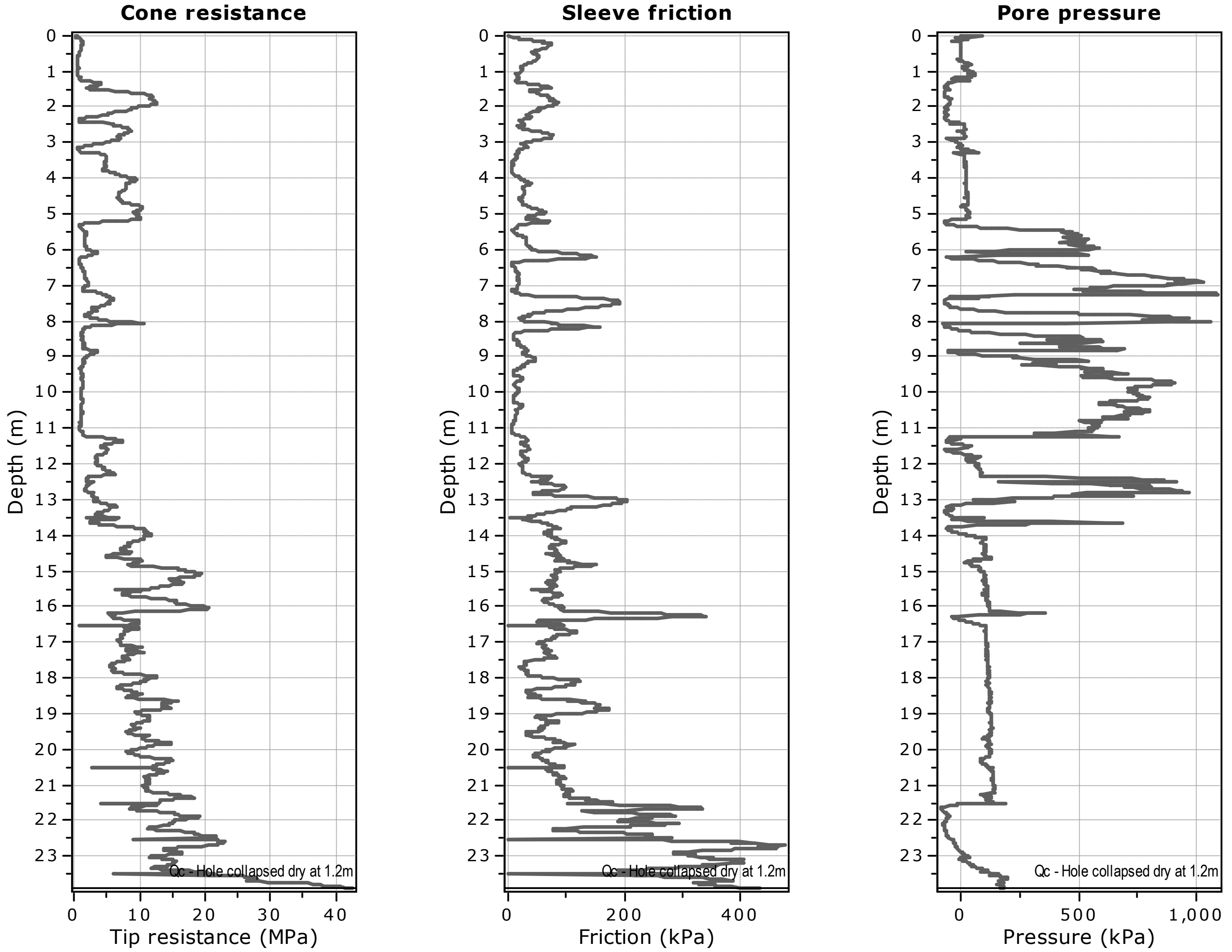
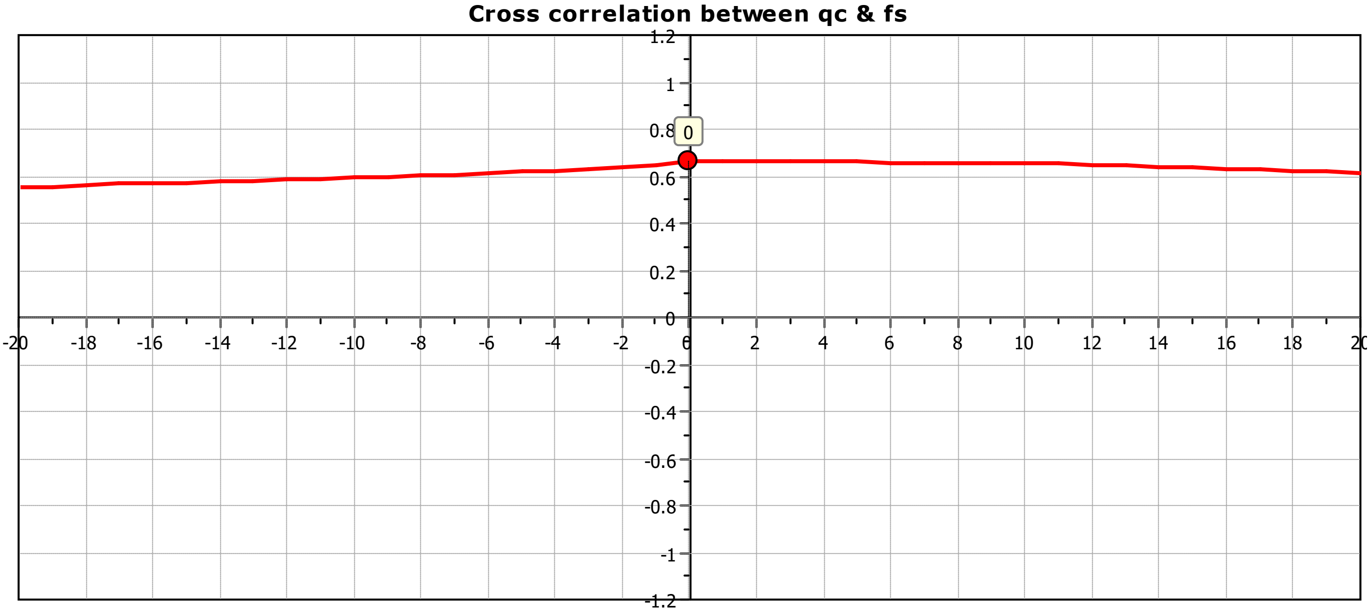
CPT: 24-10
Total depth: 23.89 m, Date: 4/06/2024
Coords: lat -37.82614° lon 175.752408°
Cone Type: DC10

Project: **CMW Geosciences | HAM2023-0124 | GDS NZ Ltd**
Location: **127 Station Road, Matamata | Holes dipped onsite using Dipmeter**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).



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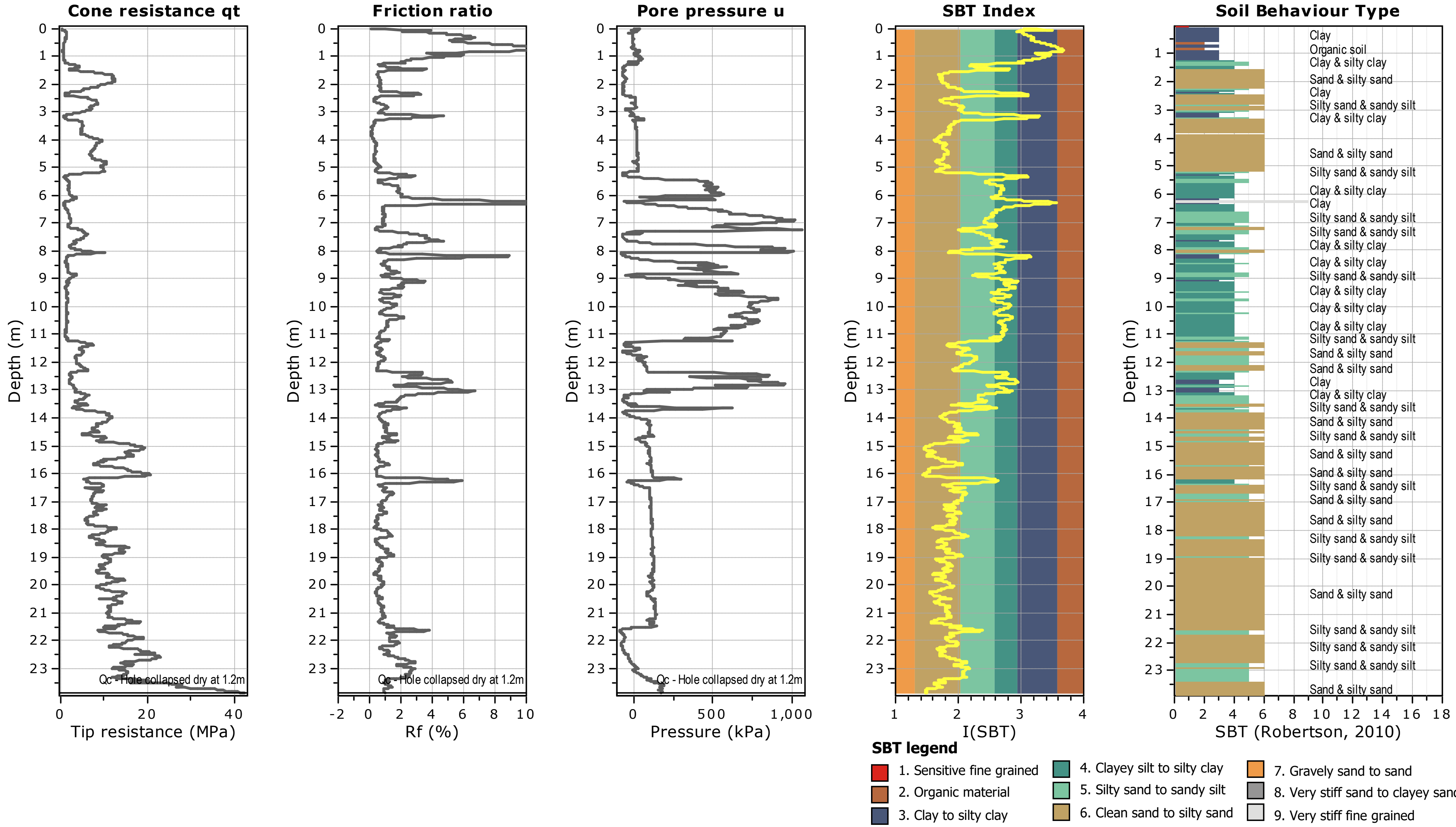
CPT: 24-10

Total depth: 23.89 m, Date: 4/06/2024
Coords: lat -37.82614° lon 175.752408°
Cone Type: DC10

Project: CMW Geosciences | HAM2023-0124 | GDS NZ Ltd
Location: 127 Station Road, Matamata | Holes dipped onsite using Dipmeter



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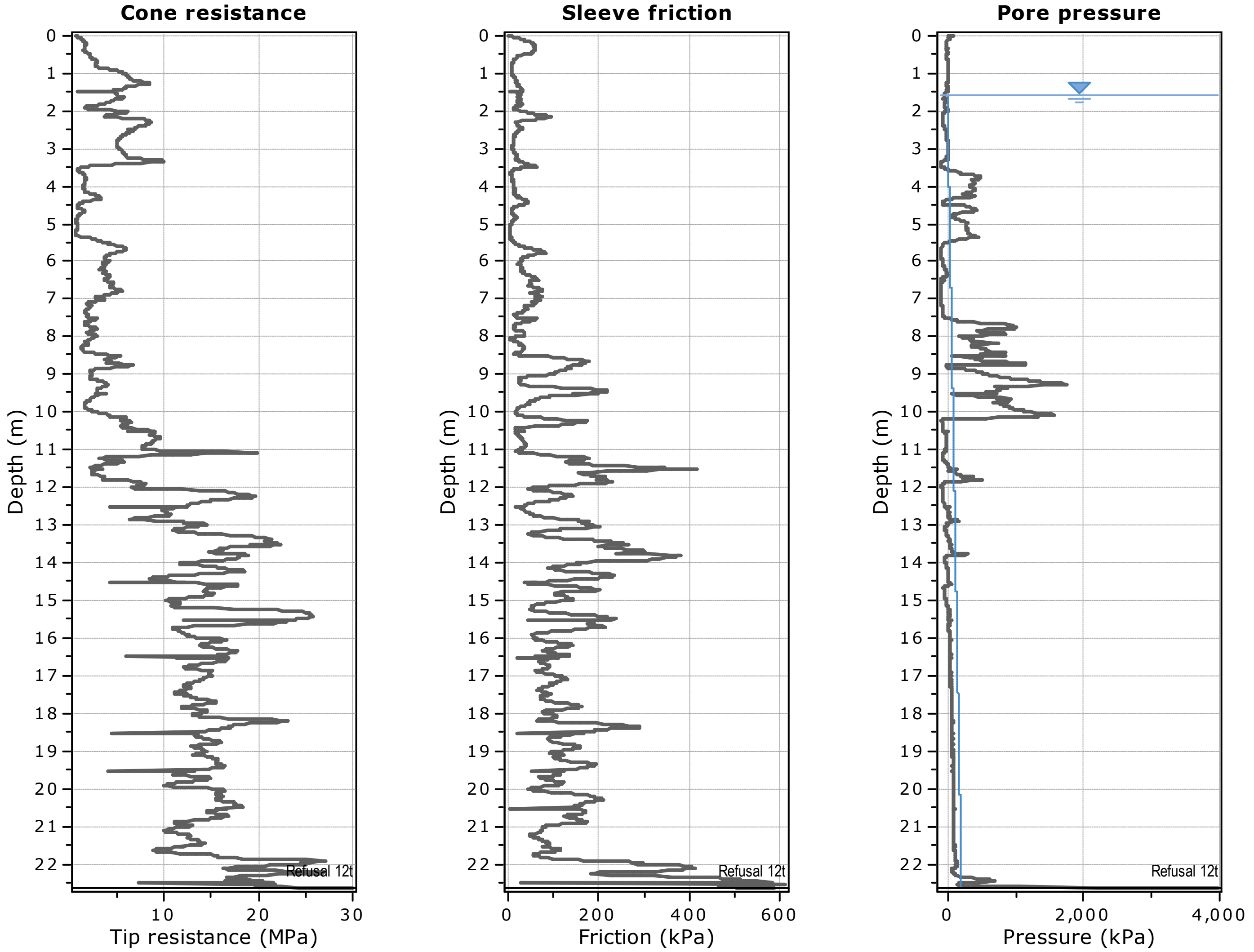
Email: Josh@gdsnz.co. nz
www.gdsnz.co.nz

CPT: SCPT24-01

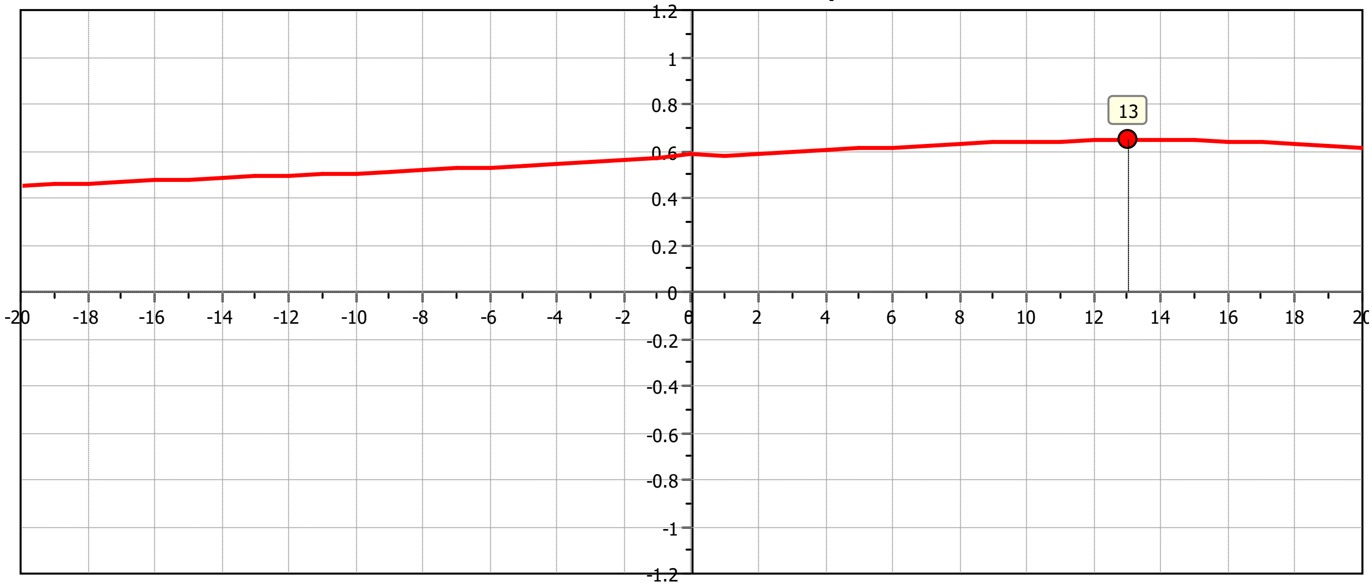
Total depth: 22.64 m, Date: 4/06/2024
Coords: lat -37.820766° lon 175.747979°
Cone Type: DC10

Project: **CMW Geosciences | HAM2023-0124 | GDS NZ Ltd**
Location: **127 Station Road, Matamata | Holes dipped onsite using Dipmeter**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

Cross correlation between qc & fs



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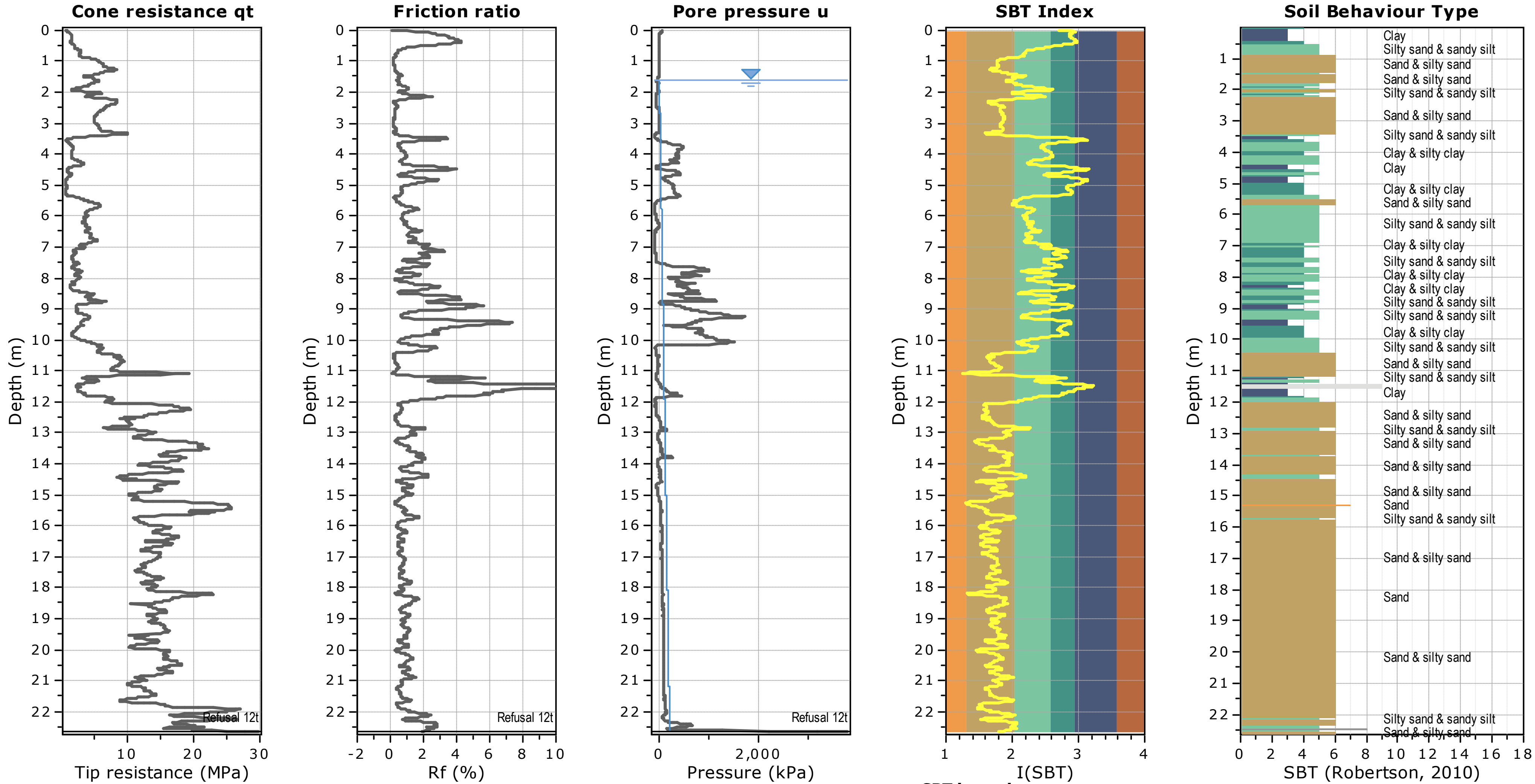
CPT: SCPT24-01
Total depth: 22.64 m, Date: 4/06/2024
Coords: lat -37.820766° lon 175.747979°
Cone Type: DC10

Project: CMW Geosciences | HAM2023-0124 | GDS NZ Ltd
Location: 127 Station Road, Matamata | Holes dipped onsite using Dipmeter



SBT legend

- 1. Sensitive fine grained
- 2. Organic material
- 3. Clay to silty clay
- 4. Clayey silt to silty clay
- 5. Silty sand to sandy silt
- 6. Clean sand to silty sand
- 7. Gravely sand to sand
- 8. Very stiff sand to clayey sand
- 9. Very stiff fine grained

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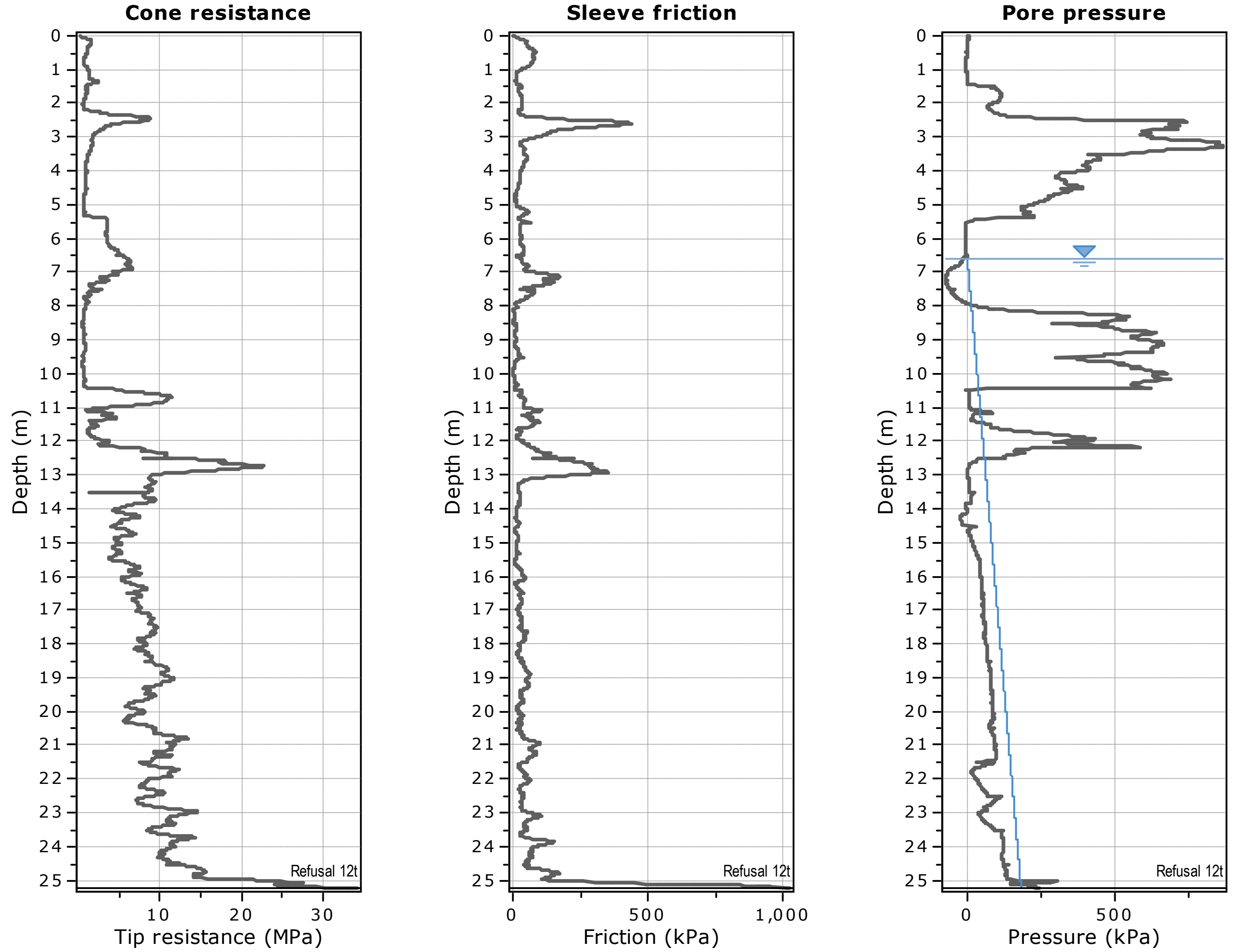
CPT: SCPT24-02

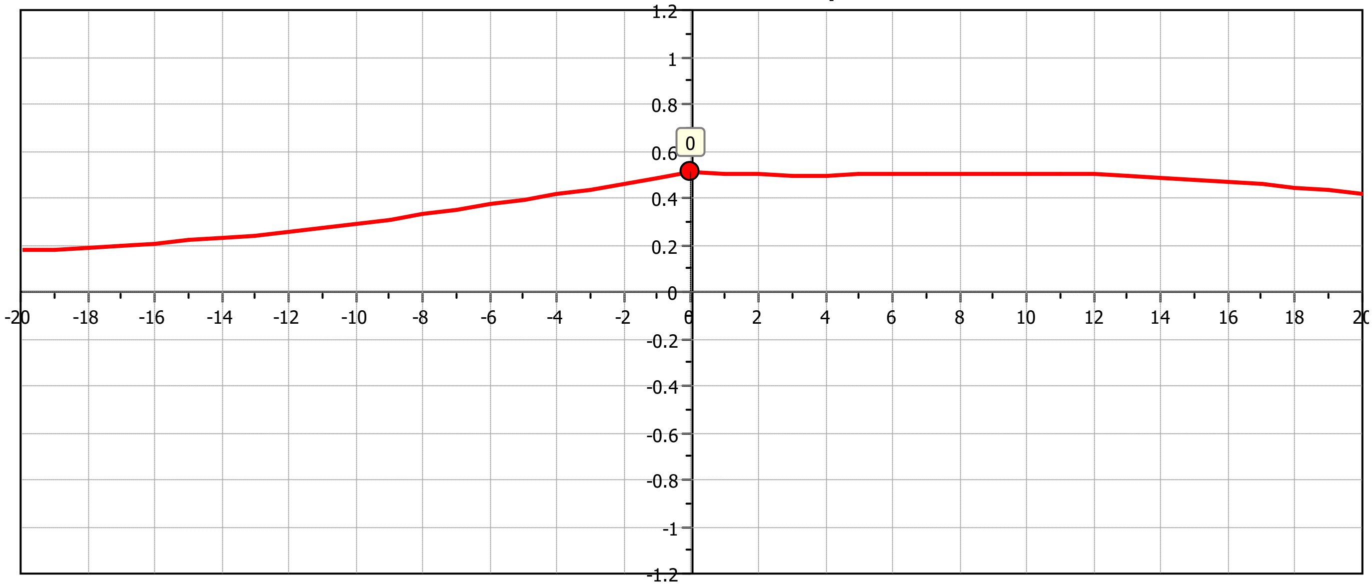
Total depth: 25.23 m, Date: 4/06/2024
Coords: lat -37.822827° lon 175.745404°
Cone Type: DC10

Project: **CMW Geosciences | HAM2023-0124 | GDS NZ Ltd**
Location: **127 Station Road, Matamata | Holes dipped onsite using Dipmeter**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

Cross correlation between qc & fs



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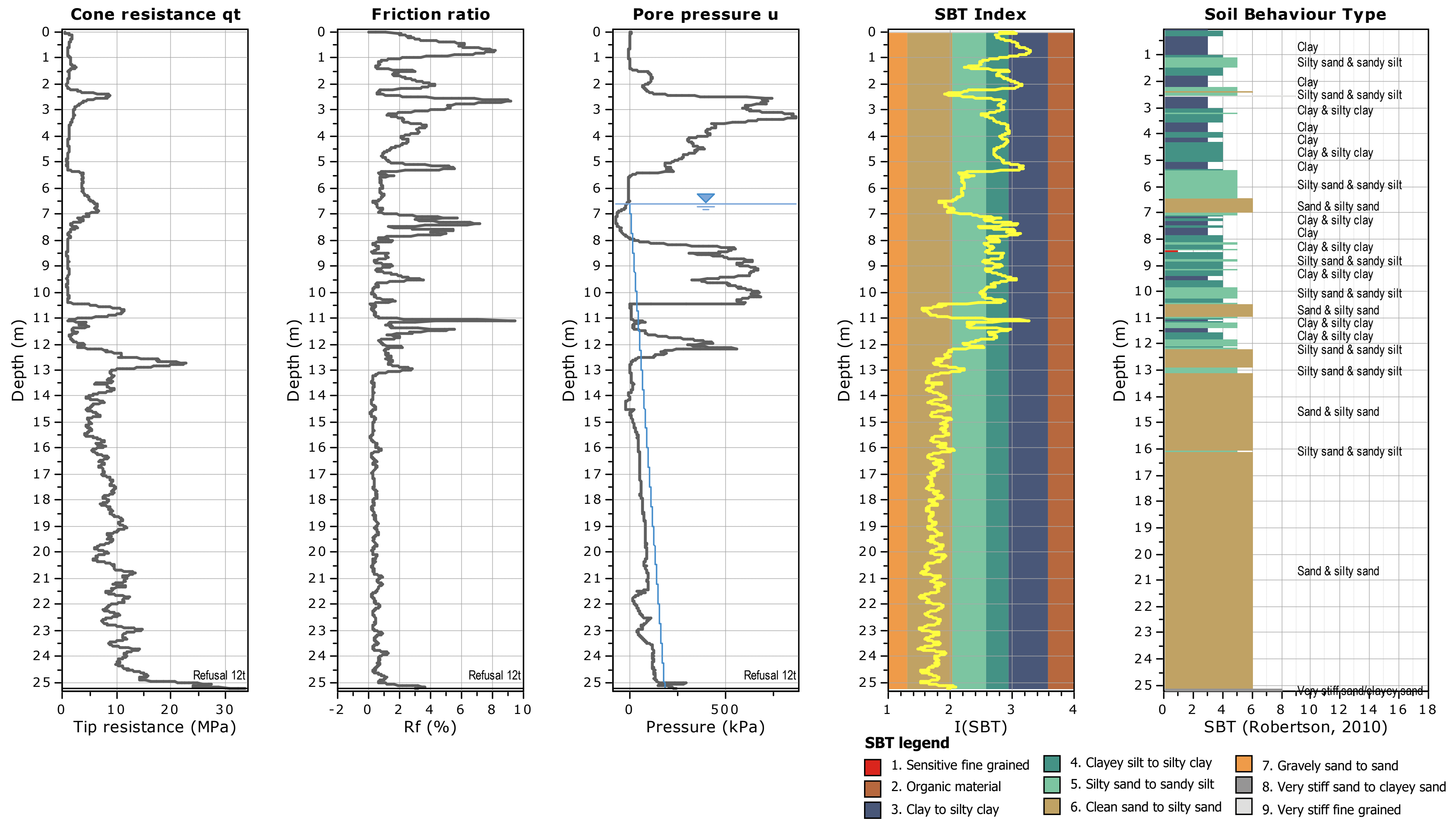
www.gdsnz.co.nz

CPT: SCPT24-02

Total depth: 25.23 m, Date: 4/06/2024
Coords: lat -37.822827° lon 175.745404°
Cone Type: DC10

Project: CMW Geosciences | HAM2023-0124 | GDS NZ Ltd

Location: 127 Station Road, Matamata | Holes dipped onsite using Dipmeter



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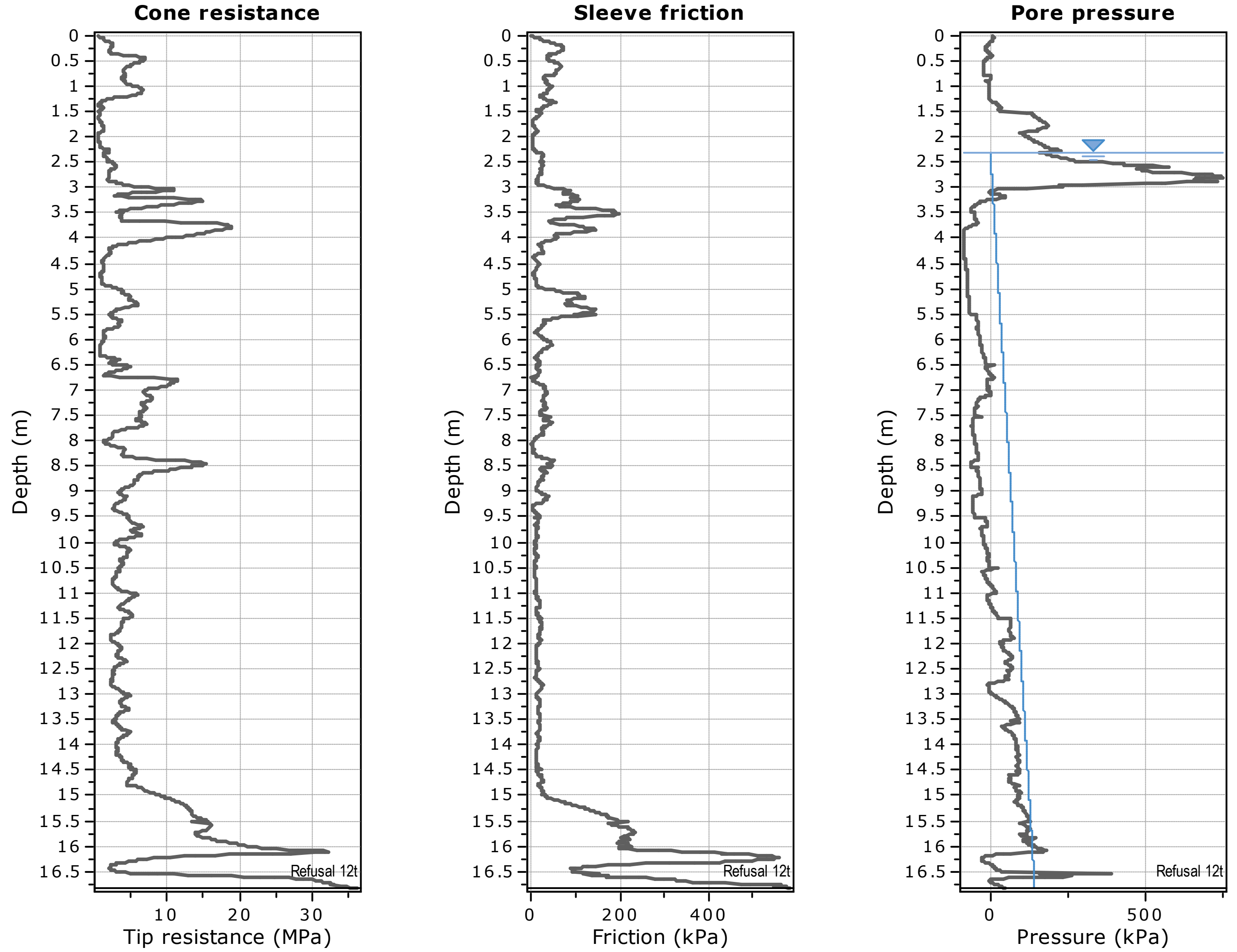
www.gdsnz.co.nz

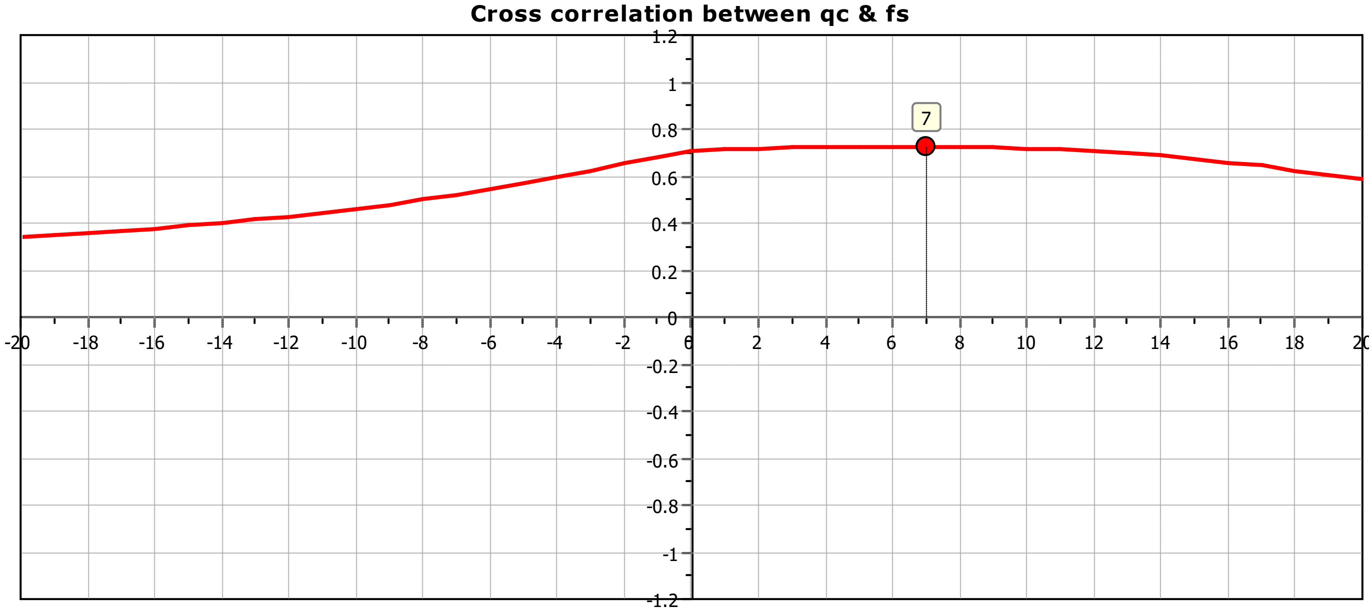
CPT: SCPT24-03

Total depth: 16.83 m, Date: 4/06/2024
Coords: lat -37.825528° lon 175.745502°
Cone Type: DC10

Project: **CMW Geosciences | HAM2023-0124 | GDS NZ Ltd**
Location: **127 Station Road, Matamata | Holes dipped onsite using Dipmeter**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

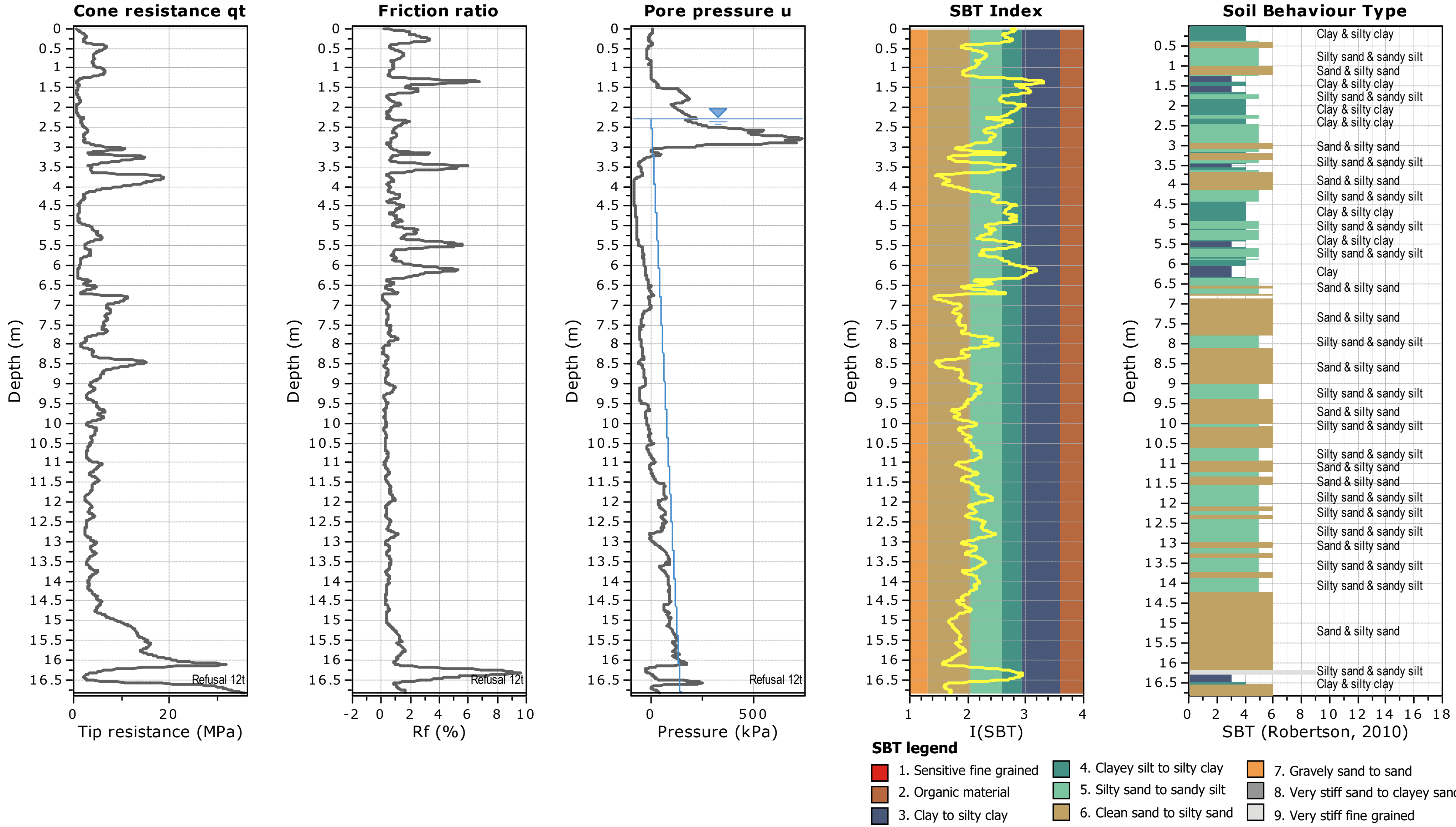


Geo Data Solutions (GDS) NZ Ltd.
Email: Josh@gdsnz.co. nz
www.gdsnz.co.nz

CPT: SCPT24-03

Total depth: 16.83 m, Date: 4/06/2024
Coords: lat -37.825528° lon 175.745502°
Cone Type: DC10

Project: CMW Geosciences | HAM2023-0124 | GDS NZ Ltd
Location: 127 Station Road, Matamata | Holes dipped onsite using Dipmeter



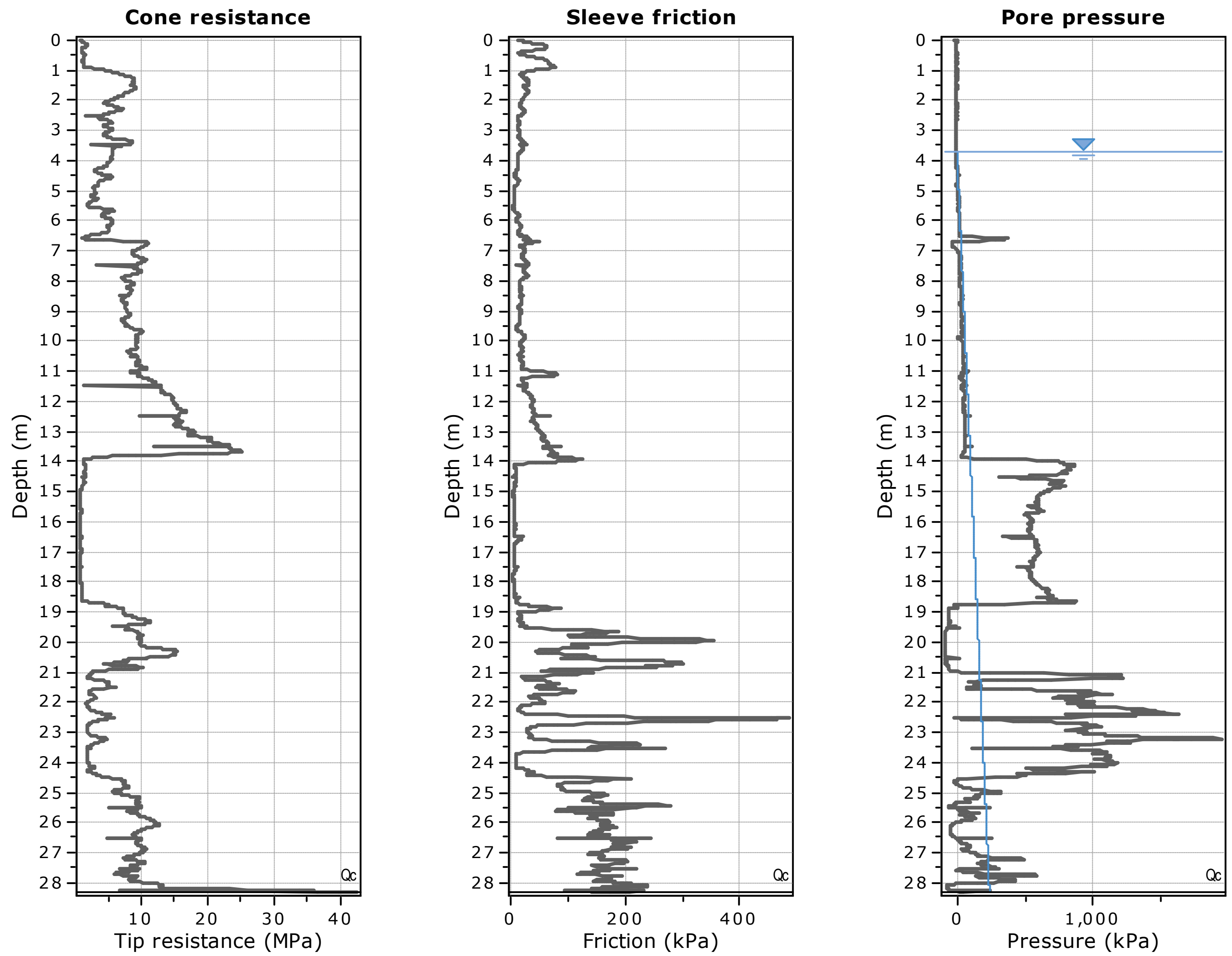
Geo Data Solutions (GDS) NZ Ltd.
Email: Josh@gdsnz.co. nz
www.gdsnz.co.nz

CPT: SCPT24-04

Total depth: 28.31 m, Date: 4/06/2024
Coords: lat -37.825977° lon 175.756443°
Cone Type: DC10

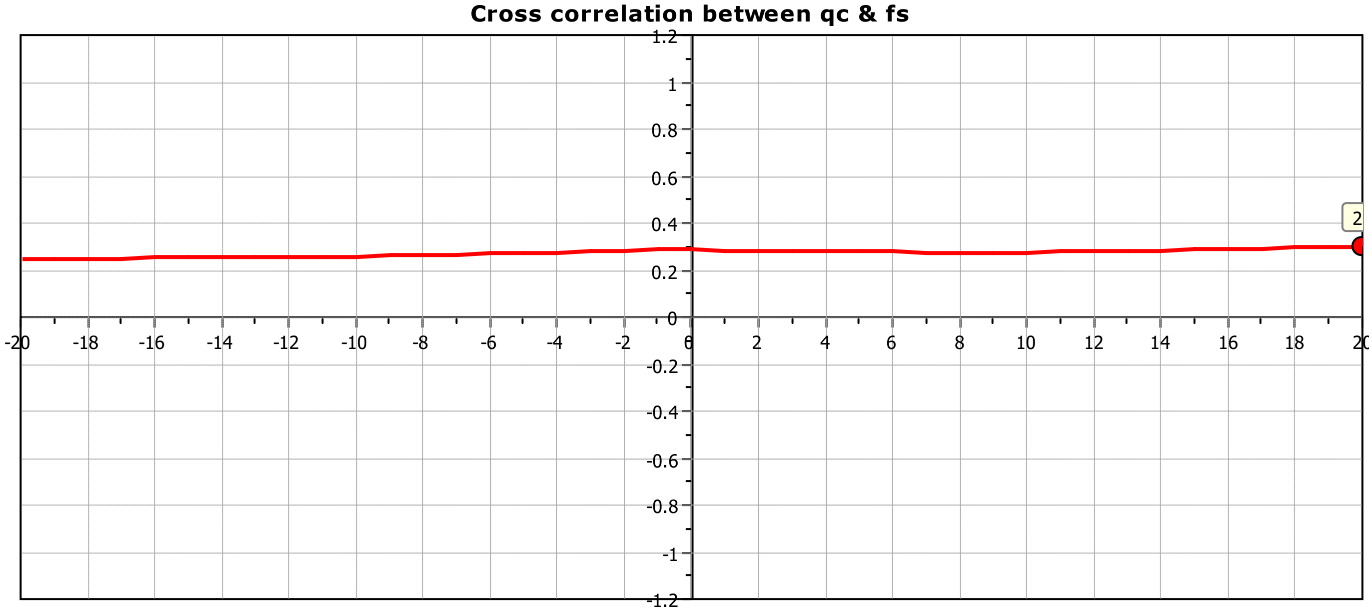
Project: CMW Geosciences | HAM2023-0124 | GDS NZ Ltd

Location: 127 Station Road, Matamata | Holes dipped onsite using Dipmeter



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

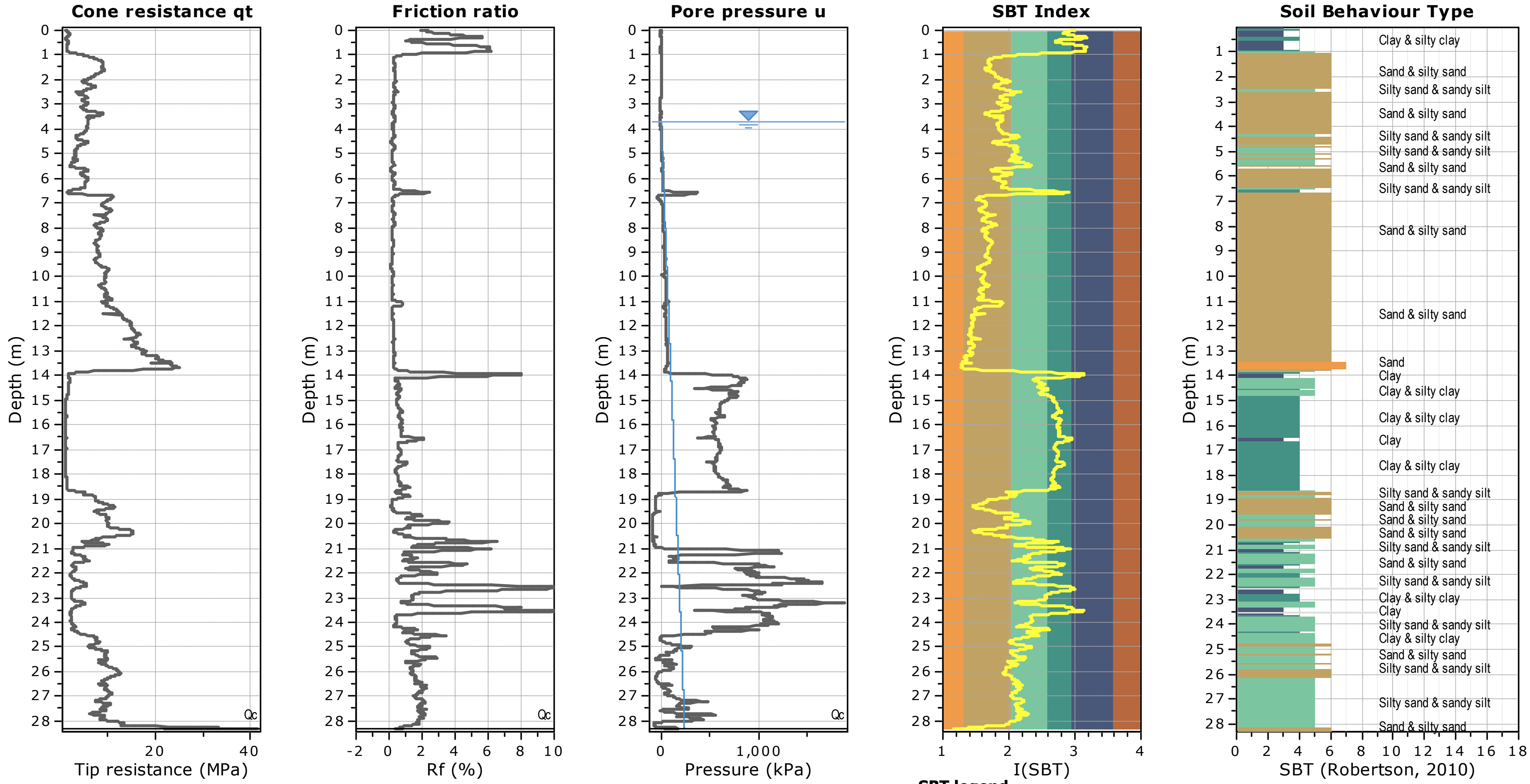
Cross correlation between qc & fs



Geo Data Solutions (GDS) NZ Ltd.
Email: Josh@gdsnz.co. nz
www.gdsnz.co.nz

CPT: SCPT24-04
Total depth: 28.31 m, Date: 4/06/2024
Coords: lat -37.825977° lon 175.756443°
Cone Type: DC10

Project: **CMW Geosciences | HAM2023-0124 | GDS NZ Ltd**
Location: **127 Station Road, Matamata | Holes dipped onsite using Dipmeter**



SBT legend

- 1. Sensitive fine grained
- 2. Organic material
- 3. Clay to silty clay
- 4. Clayey silt to silty clay
- 5. Silty sand to sandy silt
- 6. Clean sand to silty sand
- 7. Gravely sand to sand
- 8. Very stiff sand to clayey sand
- 9. Very stiff fine grained

HAND AUGER BOREHOLE LOG - HA24-09

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 05/06/2024
Borehole Location: Refer to site plan | Logged by: PM | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position: | Projection: | Datum: | Survey Source: Site Plan

Depth (m)	Material Description	Moisture Condition	Consistency/Relative Density
0.0–0.5	OL: Organic SILT: dark brown. No plasticity. (Topsoil)	M	
0.5–0.9	ML: SILT: grey mottled orange. Low plasticity. (Hinuera Formation)	M	H
0.9–1.2	SM: Silty fine to medium SAND: light brownish grey. Poorly graded, sub rounded. (Hinuera Formation)	M to W	D
1.2–1.7	SP: Fine SAND: light grey streaked orange. Poorly graded, sub rounded. (Hinuera Formation)	M to W / W	MD to D
1.7–1.8	ML: SILT: grey. Low plasticity. (Hinuera Formation)	W	St
1.8–1.9	SW: Fine to coarse SAND: grey. Well graded, sub rounded. (Hinuera Formation)	S	D

Borehole terminated at 1.9 m

Samples & Insitu Tests: Depth 0.6 — Peak = UTP

Groundwater: 05-06-2024 (at 1.8 m)

Dynamic Cone Penetrometer (Blows/100mm):

Depth interval (m)	Blows
0.0–0.1	2
0.1–0.2	2
0.2–0.3	2
0.3–0.4	3
0.4–0.5	4
0.5–0.6	5
0.6–0.7	4
0.7–0.8	5
0.8–0.9	6
0.9–1.0	10
1.0–1.1	9
1.1–1.2	13
1.2–1.3	5
1.3–1.4	9
1.4–1.5	13
1.5–1.6	13
1.6–1.7	12
1.7–1.8	9
1.8–1.9	8
1.9–2.0	8
2.0–2.1	7
2.1–2.2	9
2.2–2.3	8
2.3–2.4	5
2.4–2.5	8
2.5–2.6	6
2.6–2.7	7
2.7–2.8	8
2.8–2.9	7
2.9–3.0	6
3.0–3.1	6
3.1–3.2	5
3.2–3.3	4
3.3–3.4	4
3.4–3.5	7
3.5–3.6	12
3.6–3.7	10
3.7–3.8	10
3.8–3.9	13
3.9–4.0	5
4.0–4.1	4
4.1–4.2	4
4.2–4.3	10
4.3–4.4	12
4.4–4.5	10
4.5–4.6	10
4.6–4.7	14
4.7–4.8	10
4.8–4.9	12

Termination Reason: No retrieval.
Shear Vane No: 2087 | DCP No: 25
Remarks: Groundwater encountered at 1.8m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - HA24-10

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 05/06/2024
Borehole Location: Refer to site plan | Logged by: WD | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position:
Projection:
Datum:
Survey Source: Site Plan

Groundwater: 05-06-2024 (water level marker at approx. 2.0 m)

Samples & Insitu Tests

Depth	Type & Results
0.6	Peak = 178kPa Residual = 39kPa
0.9	Peak = 192kPa Residual = 36kPa
1.3	Peak = 92kPa Residual = 44kPa
1.8	Peak = 111kPa Residual = 42kPa

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)

Depth (m)	Material Description	Moisture Condition	Consistency/ Relative Density
0.0 – 0.4	OL: Organic SILT: dark brown. No plasticity. (Topsoil)	M	
0.4 – 0.7	ML: Fine to medium Sandy SILT: light grey streaked orange brown. Low plasticity. Sensitive. (Hinuera Formation)	M	St to VSt
0.7 – 1.4	CH: Silty CLAY: with trace fine sand; light grey streaked dark orange brown. High plasticity. Moderately sensitive. (Hinuera Formation) *... at 1.00m, becoming light grey.*	M	St to VSt
1.4 – 1.7	SW: Fine to coarse SAND: with minor silt; light grey. Well graded. (Hinuera Formation)	M	MD
1.7 – 2.0	ML: SILT: with some fine to coarse sand; light grey. Low plasticity. Moderately sensitive. Dilatant. (Hinuera Formation)	W	VSt
2.0 – 2.5	SW: Fine to coarse SAND: with some silt; grey. Well graded. (Hinuera Formation) *... at 2.20m, becoming greyish brown, poor retention.* *... at 2.40m, becoming brown fine to medium sand.*	S	MD to D
2.5	Borehole terminated at 2.5 m		

Dynamic Cone Penetrometer (Blows/100mm)

Depth (m)	Blows
0.0–0.1	1
0.1–0.2	2
0.2–0.3	2
0.3–0.4	3
0.4–0.5	3
0.5–0.6	3
0.6–0.7	2
0.7–0.8	1
0.8–0.9	1
0.9–1.0	2
1.0–1.1	5
1.1–1.2	5
1.2–1.3	4
1.3–1.4	4
1.4–1.5	4
1.5–1.6	5
1.6–1.7	4
1.7–1.8	3
1.8–1.9	4
1.9–2.0	5
2.0–2.1	10
2.1–2.2	8
2.2–2.3	7
2.3–2.4	5
2.4–2.5	5
2.5–2.6	3
2.6–2.7	4
2.7–2.8	4
2.8–2.9	4
2.9–3.0	5
3.0–3.1	7
3.1–3.2	5
3.2–3.3	4
3.3–3.4	4
3.4–3.5	10
3.5–3.6	8
3.6–3.7	11
3.7–3.8	10
3.8–3.9	10
3.9–4.0	12
4.0–4.1	12
4.1–4.2	13
4.2–4.3	9
4.3–4.4	8
4.4–4.5	10
4.5–4.6	9
4.6–4.7	10
4.7–4.8	12

Termination Reason: Hole collapse/no retrieval
Shear Vane No: 2560 | DCP No: 34
Remarks: Groundwater encountered at 2.0m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - HA24-11

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 05/06/2024
Borehole Location: Refer to site plan | Logged by: WD | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position:
Projection:
Datum:
Survey Source: Site Plan

Groundwater	Samples & Insitu Tests – Depth	Type & Results	RL (m)	Depth (m)	Material Description	Moisture Condition	Consistency/ Relative Density
				0.0	OL: Organic SILT: brown. No plasticity. (Topsoil)		
	0.3	Peak = 120kPa Residual = 25kPa			ML: SILT: orange brown. Low plasticity. Moderately sensitive to sensitive. (Hinuera Formation)	M	St to VSt
	0.6	Peak = 78kPa Residual = 17kPa					
	0.9	Peak = 58kPa Residual = 19kPa					
				1.2	SM: Silty Fine to medium SAND: orange brown. Well graded. (Hinuera Formation)	M to W	
				1.3	SW: Fine to coarse SAND: with trace fine gravel; greyish brown. Well graded. Gravel; subangular. (Hinuera Formation)	M	MD to D
					... at 1.40m, thin lens of silty fine sand.		
					... at 2.20m, becoming brownish grey.		
					... from 2.50m to 2.60m, mottled black.		
					... at 2.80m, becoming dark orange brown.		
					... at 3.10m, becoming greyish brown with grey.		
					... at 3.80m, with trace silt.	W	
					... at 3.90m, becoming dark brown with brownish grey.		
05-06-2024 ▼ (4.2 m)							
					... at 4.40m, becoming dark reddish brown, with some silt.	S	
				4.6	Borehole terminated at 4.6 m		

Dynamic Cone Penetrometer (Blows/100mm), from 0.0 m in 100 mm steps:
2, 3, 1, 3, 2, 1, 2, 1, 1, 2, 3, 3, 4, 3, 5, 6, 4, 3, 2, 6, 6, 5, 6, 8, 7, 8, 7, 7, 5, 5, 8, 8, 8, 9, 9, 9, 13, 15, 14, 15, 20

Termination Reason: Hole collapse
Shear Vane No: 2560 DCP No: 34
Remarks: Groundwater encountered at 4.2m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - HA24-12

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 05/06/2024
Borehole Location: Refer site plan. Logged by: PM Checked by: DM Scale: 1:25 Sheet 1 of 1

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Position: Projection:
Datum: Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	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
				0.0 – 0.2		OL: Organic SILT: with some medium gravel; dark brown. No plasticity. (Topsoil)	M	
				0.2 – 0.3		SW: Fine to coarse SAND: light brown. Well graded, sub angular. (Possible Fill)	M	MD
	0.4	Peak = 129kPa Residual = 26kPa		0.3 – 1.1		ML: SILT: with minor fine sand; brownish orange. Low plasticity. Sensitive. (Hinuera Formation)	M	VSt to H
	0.7	Peak = 167kPa Residual = 29kPa						
	1.0	Peak = UTP		1				
				1.1 – 1.7		SM: Silty fine to coarse SAND: light yellowish brown. Well graded, sub rounded. (Hinuera Formation)	M / W	MD
	1.8	Peak = 205kPa		1.7 – 1.8		ML: SILT: grey mottled orange. Low plasticity. (Hinuera Formation)	W	H
				1.8 – 2.7		SW: Fine to coarse SAND: light brown mottled grey and streaked dark red. Well graded, sub rounded. (Hinuera Formation) *... at 2.10m, Becomes grey.*	W / S	L to MD
05-06-2024 (2.6 m)				2.7		Borehole terminated at 2.7 m		

Dynamic Cone Penetrometer (Blows/100mm)

Depth (m)	Blows per 100mm
0.0 – 1.0	4, 7, 7, 6, 2, 2, 2, 2, 2, 2
1.0 – 2.0	4, 5, 7, 5, 5, 3, 3, 3, 2, 3
2.0 – 3.0	2, 5, 5, 5, 4, 3, 3, 4, 3, 4
3.0 – 4.0	5, 5, 5, 6, 6, 8, 9, 9, 10, 12
4.0 – 4.9	13, 13, 13, 10, 13, 10, 10, 9, 10

Termination Reason: Hole Collapse
Shear Vane No: 2087 DCP No: 25
Remarks: Groundwater encountered at 2.6m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - HA24-13

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 05/06/2024
Borehole Location: Refer to site plan Logged by: WD Checked by: DM Scale: 1:25 Sheet 1 of 1

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Position: Projection:
Datum: Survey Source: Site Plan

Groundwater	Samples & Insitu Tests – Depth	Samples & Insitu Tests – Type & Results	RL (m)	Depth (m)	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
				0.0–0.25	OL: Organic SILT: brown. No plasticity. (Topsoil)		
	0.3	Peak = 167kPa Residual = 28kPa		0.25–0.9	ML: SILT: orange brown. Low plasticity. Moderately sensitive to sensitive. (Hinuera Formation)	D to M	VSt
	0.6	Peak = 133kPa Residual = 22kPa			... at 0.60m, becoming light orange brown.		
	0.9	Peak = 111kPa Residual = 39kPa		0.9–1.4	SM: Silty Fine to medium SAND: with trace fine pumiceous gravel; light orange brown. Well graded. (Hinuera Formation)	M	MD
					... at 1.20m, becoming fine sand.		
	1.4	Peak = 108kPa Residual = 53kPa		1.4–1.5	CH: Silty CLAY: light grey. High plasticity. Moderately sensitive. (Hinuera Formation)	M	VSt
				1.5–1.7	SM: Silty Fine SAND: grey. Poorly graded. (Hinuera Formation)	M	MD
				1.7–2.1	SW: Fine to medium SAND: with some silt and minor fine gravel; brownish grey with grey. Well graded. Gravel; subangular. (Hinuera Formation)	M	MD
				2.1–3.0	SW: Fine to coarse SAND: with some silt and trace fine gravel; grey. Well graded. Gravel; subangular. (Hinuera Formation)	W	MD
05-06-2024 (2.6 m)					... at 2.60m, poor retention.	S	
				3.0	Borehole terminated at 3.0 m		

Dynamic Cone Penetrometer (Blows/100mm)

Depth (m)	Blows
0.0–0.1	2
0.1–0.2	2
0.2–0.3	2
0.3–0.4	2
0.4–0.5	1
0.5–0.6	2
0.6–0.7	2
0.7–0.8	2
0.8–0.9	3
0.9–1.0	5
1.0–1.1	7
1.1–1.2	7
1.2–1.3	4
1.3–1.4	4
1.4–1.5	4
1.5–1.6	4
1.6–1.7	4
1.7–1.8	4
1.8–1.9	3
1.9–2.0	4
2.0–2.1	6
2.1–2.2	4
2.2–2.3	3
2.3–2.4	3
2.4–2.5	4
2.5–2.6	4
2.6–2.7	4
2.7–2.8	3
2.8–2.9	3
2.9–3.0	4
3.0–3.1	4
3.1–3.2	5
3.2–3.3	4
3.3–3.4	4
3.4–3.5	6
3.5–3.6	7
3.6–3.7	4
3.7–3.8	6
3.8–3.9	5
3.9–4.0	5
4.0–4.1	6
4.1–4.2	6
4.2–4.3	7
4.3–4.4	5
4.4–4.5	7
4.5–4.6	8
4.6–4.7	7
4.7–4.8	5
4.8–4.9	9

Termination Reason: Hole collapse/no retrieval
Shear Vane No: 2560 DCP No: 34
Remarks: Groundwater encountered at 2.6m.

HAND AUGER BOREHOLE LOG - HA24-14

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 06/06/2024
Borehole Location: Refer to site plan | Logged by: PM | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position:
Projection:
Datum:
Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	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
				0.0–0.12		OL: Organic SILT: dark brown. No plasticity. (Topsoil)	M	
				0.12–0.5		SM: Silty fine to medium SAND: light grey mottled dark orange. Poorly graded, rub rounded. (Hinuera Formation)	M	L to MD
				0.5–0.9		SM: Silty fine SAND: brownish orange mottled dark brown. Poorly graded, sub rounded. (Hinuera Formation)	M	MD
06-06-2024 (groundwater at 1.6 m)				0.9–1.7		SW: Fine to medium SAND: grey. Well graded, sub rounded. (Hinuera Formation) *... at 1.50m, Becomes blueish grey.*	W (S from 1.6 m)	MD to D
				1.7		Borehole terminated at 1.7 m		

Dynamic Cone Penetrometer (Blows/100mm)

Depth (m)	Blows/100mm
0.0–0.1	1
0.1–0.2	3
0.2–0.3	2
0.3–0.4	4
0.4–0.5	7
0.5–0.6	5
0.6–0.7	3
0.7–0.8	3
0.8–0.9	3
0.9–1.0	4
1.0–1.1	4
1.1–1.2	5
1.2–1.3	10
1.3–1.4	11
1.4–1.5	11
1.5–1.6	8
1.6–1.7	3
1.7–1.8	3
1.8–1.9	3
1.9–2.0	4
2.0–2.1	9
2.1–2.2	8
2.2–2.3	8
2.3–2.4	9
2.4–2.5	8
2.5–2.6	6
2.6–2.7	5
2.7–2.8	2
2.8–2.9	2
2.9–3.0	5
3.0–3.1	8
3.1–3.2	8
3.2–3.3	7
3.3–3.4	7
3.4–3.5	10
3.5–3.6	11
3.6–3.7	10
3.7–3.8	9
3.8–3.9	10
3.9–4.0	10
4.0–4.1	12
4.1–4.2	11
4.2–4.3	9
4.3–4.4	12
4.4–4.5	10
4.5–4.6	10
4.6–4.7	11
4.7–4.8	9
4.8–4.9	13

Termination Reason: Hole Collapse
Shear Vane No: DCP No: 34
Remarks: Groundwater encountered at 1.6m.

HAND AUGER BOREHOLE LOG - HA24-15

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 05/06/2024
Borehole Location: Refer to site plan | Logged by: PM | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position: | Projection: | Datum: | Survey Source: Site Plan

Groundwater | Samples & Insitu Tests (Depth; Type & Results) | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm)

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)

Depth	Type & Results
0.4	Peak = 59kPa Residual = 15kPa
0.7	Peak = 59kPa Residual = 15kPa
1.0	Peak = 105kPa Residual = 15kPa
2.5	Peak = 167kPa Residual = 59kPa
2.7	Peak = UTP
3.0	Peak = UTP

Material Description	Moisture Condition	Consistency/ Relative Density
OL: Organic SILT: dark brown. No plasticity. (Topsoil)	M	
ML: SILT: light brown. Low plasticity. Moderately sensitive to sensitive. (Hinuera Formation) *... at 0.90m, Becoming a light greyish brown.*	M	St to VSt
SM: Silty fine SAND: light brown. Poorly graded, sub rounded. Dilatant. (Hinuera Formation) *... at 1.40m, Becoming a light grey streaked yellow.*	M; W; M to W	MD
ML: SILT: grey streaked yellow. Low plasticity. Moderately sensitive. (Hinuera Formation)	M to W	VSt
ML: Clayey SILT: brown. Low plasticity. (Walton Subgroup)	M to W; M	H
Borehole terminated at 3.0 m		

Dynamic Cone Penetrometer (Blows/100mm), 0.0 m to 3.0 m:

Depth interval (m)	Blows
0.0-0.1	2
0.1-0.2	2
0.2-0.3	1
0.3-0.4	1
0.4-0.5	2
0.5-0.6	2
0.6-0.7	1
0.7-0.8	1
0.8-0.9	2
0.9-1.0	1
1.0-1.1	2
1.1-1.2	4
1.2-1.3	4
1.3-1.4	3
1.4-1.5	4
1.5-1.6	4
1.6-1.7	5
1.7-1.8	4
1.8-1.9	4
1.9-2.0	4
2.0-2.1	4
2.1-2.2	5
2.2-2.3	6
2.3-2.4	10
2.4-2.5	4
2.5-2.6	9
2.6-2.7	10
2.7-2.8	12
2.8-2.9	17
2.9-3.0	20

Termination Reason: Refusal on hard material.
Shear Vane No: 2087 | DCP No: 25
Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - HA24-16

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 06/06/2024
Borehole Location: Refer to site plan — Logged by: WD — Checked by: DM — Scale: 1:25 — Sheet 1 of 1

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Position: — Projection: — Datum: — Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	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) 5 10 15
						OL: Organic SILT: dark brown. No plasticity. (Topsoil)	M		
	0.3	Peak = 100kPa Residual = 23kPa				ML: SILT: orange brown. Low plasticity. Sensitive. (Walton Subgroup)	M	VSt to H	
						... at 0.40m, becoming light orange brown, with some clay.			
	0.6	Peak = 160kPa Residual = 30kPa				CH: Silty CLAY: light orange brown. High plasticity. Sensitive. (Walton Subgroup)			
	0.9	Peak = 123kPa Residual = 28kPa							
				1		... at 1.00m, becoming light orange grey.			
						ML: SILT: light orange grey. Low plasticity. (Walton Subgroup)			
	1.3	Peak = UTP				SM: Silty Fine SAND: light brownish grey. Poorly graded. (Walton Subgroup)			
	1.6	Peak = 150kPa Residual = 28kPa				CH: Silty CLAY: light brownish grey. High plasticity. Sensitive. (Walton Subgroup)	W	St to VSt	
	1.9	Peak = 85kPa Residual = 20kPa							
				2		... at 2.00m, becoming light grey, with trace fine sand.			
						... at 2.10m, becoming light brown grey.			
						... at 2.20m, becoming light greyish brown.			
	2.3	Peak = UTP				ML: SILT: with some clay; greyish brown. Low plasticity. (Walton Subgroup)	D to M	VSt to H	
	2.6	Peak = 175+				CH: Silty CLAY: greyish brown. High plasticity. Moderately sensitive. (Walton Subgroup)	M		
	2.9	Peak = 160kPa Residual = 43kPa							
				3			M to W		
	3.3	Peak = 158kPa Residual = 45kPa							
	3.6	Peak = 125kPa Residual = 33kPa							
						... at 3.80m, becoming light orange brown.			
	3.9	Peak = 125kPa Residual = 35kPa							
				4					
	4.3	Peak = 175+				ML: Clayey SILT: orange brown mottled black. Low plasticity. (Walton Subgroup)			
	4.6	Peak = 50kPa Residual = 25kPa				CH: Silty CLAY: light greyish brown. High plasticity. Insensitive to moderately sensitive. (Walton Subgroup)		St	
	4.9	Peak = 60kPa Residual = 50kPa							
				5		Borehole terminated at 5.0 m			

Termination Reason: Target Depth Reached
Shear Vane No: 3434 — DCP No:
Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - HA24-17

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 06/06/2024
Borehole Location: Refer to site plan | Logged by: WD | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position:
Projection:
Datum:
Survey Source: Site Plan

Samples & Insitu Tests: Depth	Type & Results
0.3	Peak = 63kPa Residual = 20kPa
0.6	Peak = 108kPa Residual = 25kPa
0.9	Peak = 160kPa Residual = 35kPa
3.1	Peak = 158kPa Residual = 60kPa
3.7	Peak = UTP

Depth (m)	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
0.0–0.2	OL: Organic SILT: dark brown. No plasticity. (Topsoil)	M	
0.2–1.1	ML: SILT: orange brown. Low plasticity. (Hinuera Formation) ... at 0.70m, with some clay. ... at 1.00m, with trace fine sand.	M	St to VSt
1.1–3.0	SW: Fine to coarse SAND: minor fine gravel. orange brown. Well graded. Gravel; black, subangular. (Hinuera Formation) ... at 1.30m, becoming dark orange brown. ... at 1.40m, becoming orange brown with yellow grey. ... at 1.60m, becoming dark reddish brown, with some fine gravel; highly iron stained. ... at 2.00m, becoming brownish grey with grey. ... at 2.10m, becoming dark reddish brown. ... at 2.30m, becoming dark reddish dark brown, with trace medium gravel. ... at 2.70m, with some silt.	M (to 2.4 m); W (2.4–2.6 m); S (below 2.6 m)	D to VD (1.1–1.6 m)
3.0–3.8	ML: SILT: light grey. Low plasticity. Moderately sensitive. (Hinuera Formation)	S	VSt to H
3.8	Borehole terminated at 3.8 m		

Groundwater: 06-06-2024 (water level marked at approx. 2.6 m)

Dynamic Cone Penetrometer (Blows/100mm)

Depth interval (m)	Blows
0.0–0.1	2
0.1–0.2	2
0.2–0.3	1
0.3–0.4	2
0.4–0.5	2
0.5–0.6	2
0.6–0.7	2
0.7–0.8	1
0.8–0.9	1
0.9–1.0	3
1.0–1.1	6
1.1–1.2	8
1.2–1.3	13
1.3–1.4	17
1.4–1.5	24
1.5–1.6	22

Termination Reason: No retrieval
Shear Vane No: 3434 DCP No: 34
Remarks: Groundwater encountered at 2.6m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - HA24-18

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 06/06/2024
Borehole Location: Refer to site plan. Logged by: PM Checked by: DM Scale: 1:25 Sheet 1 of 1

Position:
Projection:
Datum:
Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	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
				0.0–0.2	OL: Organic SILT: dark brown. No plasticity. (Topsoil)	M	
	0.3	Peak = 83kPa Residual = 19kPa		0.2–0.5	ML: Sandy SILT: greyish brown. Low plasticity. Moderately sensitive. (Hinuera Formation)	M to W	St
	0.6	Peak = 97kPa Residual = 28kPa		0.5–0.8	ML: SILT: light grey streaked orange. Low plasticity. Moderately sensitive. (Hinuera Formation)	M to W	St
				0.8–1.4	SM: Silty fine SAND: light grey streaked yellow. Poorly graded, sub rounded. (Hinuera Formation)	M to W	MD to D
06-06-2024 ▼ (1.6 m)				1.4–1.7	SW: Fine to medium SAND: grey. Well graded, sub rounded. (Hinuera Formation)	W / S	D
				1.7	Borehole terminated at 1.7 m		

Dynamic Cone Penetrometer (Blows/100mm)

Depth (m)	Blows/100mm
0.0–0.1	2
0.1–0.2	2
0.2–0.3	2
0.3–0.4	2
0.4–0.5	2
0.5–0.6	2
0.6–0.7	2
0.7–0.8	3
0.8–0.9	5
0.9–1.0	5
1.0–1.1	7
1.1–1.2	9
1.2–1.3	7
1.3–1.4	9
1.4–1.5	7
1.5–1.6	10
1.6–1.7	7
1.7–1.8	7
1.8–1.9	8
1.9–2.0	7
2.0–2.1	7
2.1–2.2	8
2.2–2.3	9
2.3–2.4	8
2.4–2.5	5
2.5–2.6	7
2.6–2.7	5
2.7–2.8	4
2.8–2.9	5
2.9–3.0	7
3.0–3.1	10
3.1–3.2	10
3.2–3.3	12
3.3–3.4	12
3.4–3.5	6
3.5–3.6	5
3.6–3.7	10
3.7–3.8	9
3.8–3.9	11
3.9–4.0	10
4.0–4.1	12
4.1–4.2	12
4.2–4.3	13
4.3–4.4	15
4.4–4.5	16
4.5–4.6	12
4.6–4.7	10
4.7–4.8	11
4.8–4.9	12

Termination Reason: Hole Collapse
Shear Vane No: 2560 DCP No: 34
Remarks: Groundwater encountered at 1.6m.

HAND AUGER BOREHOLE LOG - HA24-19

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 06/06/2024
Borehole Location: Refer to site plan | Logged by: WD | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

Position:
Projection:
Datum:
Survey Source: Site Plan

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
OL: Organic SILT: dark brown. No plasticity. (Topsoil)	M to W	
ML: SILT: with some clay; light brown. (Hinuera Formation)	M to W	
SM: Silty Fine SAND: light grey streaked light orange brown. Poorly graded. (Hinuera Formation)	M to W	MD
ML: Fine SAndy SILT: light grey streaked light orange brown. Low plasticity. (Hinuera Formation)	M to W	St
SM: Silty Fine SAND: light grey streaked light orange brown. Poorly graded. (Hinuera Formation) *... at 0.90m, light yellowish grey with brown grey.* *... at 1.20m, becoming light grey.*	M to W / W	MD
ML: SILT: light grey. Low plasticity. Dilatant. (Hinuera Formation)	W	VSt
SM: Silty Fine to medium SAND: light grey. Well graded. Pumiceous. (Hinuera Formation) *... at 2.00m, poor retention.*	S	MD to D
ML: SILT: with some fine sand; light grey. Low plasticity. (Hinuera Formation)	S	H
SM: Silty Fine SAND: light grey. Poorly graded. (Hinuera Formation)	S	D

Borehole terminated at 2.4 m

Groundwater: 06-06-2024 (▼ at approx. 1.6 m)

Dynamic Cone Penetrometer (Blows/100mm), in order of depth from 0 m:

1	2	3	3	4	4	3	3	5	4
6	5	4	5	6	6	5	6	5	5
8	7	14	9	13	12	6	4	5	5
6	8	8	14	17	14	13	12	14	17
14	13	17	16	20	17	17	16	15	

Termination Reason: No retrieval
Shear Vane No: DCP No: 34
Remarks: Groundwater encountered at 1.6m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - HA24-20

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 06/06/2024
Borehole Location: Refer to site plan | Logged by: PM | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position: | Projection:
Datum: | Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Type & Results	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
						OL: Organic SILT: dark brown. No plasticity. (Topsoil)	M	
	0.4	Peak = 97kPa Residual = 19kPa				ML: SILT: light brown. Low plasticity. Sensitive. (Hinuera Formation)	M	St to VSt
	0.7	Peak = 89kPa Residual = 19kPa						
	1.0	Peak = 181kPa Residual = 28kPa		1				
	1.5	Peak = 97kPa Residual = 36kPa				... *at 1.30m, Becomes light greyish brown.*	M to W	
				2		SM: Silty fine to coarse SAND: light greyish yellow. Well graded, sub rounded to sub angular. (Hinuera Formation)		MD
	2.3	Peak = UTP				CH: Sandy CLAY: brown. High plasticity. (Walton Subgroup)	M	H
				3		SW: Fiine to coarse SAND: with minor clay and trace fine gravel; Brownish orange mottled black and speckled grey. Well graded sub angular. (Walton Subgroup)	M	D
						Borehole terminated at 3.4 m		
				4				
				5				

Dynamic Cone Penetrometer (Blows/100mm)

Interval	Blows
1	2
2	2
3	2
4	1
5	1
6	1
7	2
8	2
9	2
10	3
11	4
12	4
13	2
14	3
15	3
16	3
17	3
18	3
19	3
20	4
21	4
22	5
23	6
24	7
25	7
26	10
27	13
28	12
29	12
30	13
31	14
32	12
33	16
34	15
35	18
36	13
37	17
38	20

Termination Reason: Hard Material.
Shear Vane No: 2560 | DCP No: 34
Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - HA24-21

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 06/06/2024
Borehole Location: Refer to site plan | Logged by: PM | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position:
Projection:
Datum:
Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	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
				0.0 – 0.7		OL: Organic SILT: dark brown. No plasticity. (Topsoil)	M	
06-06-2024 (at 1.3 m)	0.8	Peak = 97kPa Residual = 14kPa		0.7 – 1.5		ML: Sandy SILT: light brownish grey. Low plasticity. Sensitive. (Hinuera Formation)	W	St
				1.5 – 1.8		SM: Silty fine SAND: light grey. Poorly graded, sub rounded. (Hinuera Formation)	S	MD
				1.8		Borehole terminated at 1.8 m		

Depth scale: 1, 2, 3, 4, 5

Dynamic Cone Penetrometer (Blows/100mm), scale 5, 10, 15 — values in sequence from surface:
2, 2, 1, 1, 2, 1, 1, 1, 2, 2, 2, 2, 3, 3, 4, 3, 4, 4, 3, 4, 4, 4, 6, 6, 4, 3, 3, 2, 2, 3, 3, 4, 4, 6, 8, 7, 8, 3, 3, 3, 3, 5, 5, 5, 4, 3, 3, 3, 3

Termination Reason: Hole collapse
Shear Vane No: 2560 DCP No: 34
Remarks: Groundwater encountered at 1.3m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - HA24-22

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 06/06/2024
Borehole Location: Refer to site plan Logged by: WD Checked by: DM Scale: 1:25 Sheet 1 of 1

CMW Geosciences
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Position:
Projection:
Datum:
Survey Source: Site Plan

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
OL: Organic SILT: dark brown. No plasticity. (Topsoil)	M	
CH: Silty CLAY: brown. High plasticity. Sensitive. (Hinuera Formation)	M to W	St to VSt
ML: Clayey SILT: light brown. Low plasticity. Sensitive. (Hinuera Formation) *... at 1.00m, becoming light grey streaked orange brown.*	W	St to VSt
SM: Silty Fine SAND: light grey. Poorly graded. (Hinuera Formation) *... at 1.60m, poor retention.*	S	MD to D
ML: SILT: with some organic silt; light grey with greyish brown. Low plasticity. Insensitive. Dilatant. (Hinuera Formation)	S	St
SM: Silty Fine SAND: light grey. Poorly graded. (Hinuera Formation) *... at 2.60m, poor retention.* *... at 2.70m, with trace fine sand.*	S	MD to D
OL: Organic SILT: with some silt; dark greyish brown with light grey. Low plasticity. Insensitive. (Hinuera Formation)	S	F to St
SM: Silty Fine to medium SAND: dark grey. Well graded. (Hinuera Formation)	S	D
Borehole terminated at 4.3 m		

Groundwater: 06-06-2024 (at approx. 1.3 m)

Samples & Insitu Tests

Depth	Type & Results
0.3	Peak = 108kPa Residual = 20kPa
0.6	Peak = 55kPa Residual = 13kPa
0.9	Peak = 110kPa Residual = 20kPa
2.5	Peak = 65kPa Residual = 38kPa
3.3	Peak = 50kPa Residual = 40kPa
4.0	Peak = 60kPa Residual = 33kPa

Dynamic Cone Penetrometer (Blows/100mm)

Depth (m)	Blows/100mm
0.0–1.0	1, 3, 1, 2, 1, 2, 1, 1, 2, 2
1.0–2.0	6, 5, 8, 8, 9, 6, 12, 16, 15, 6
2.0–3.0	4, 5, 7, 8, 16, 11, 8, 9, 8, 5
3.0–4.0	8, 6, 7, 7, 10, 10, 8, 11, 12, 11
4.0–4.6	10, 11, 10, 13, 17, 20

Termination Reason: No retrieval
Shear Vane No: 3434 DCP No: 34
Remarks: Groundwater encountered at 1.3m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - HA24-23

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 06/06/2024
Borehole Location: Refer to site plan   Logged by: PM   Checked by: DM   Scale: 1:25   Sheet 1 of 1

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Position: Projection:
Datum: Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	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
				0.0–0.3	OL: Organic SILT: dark brown. No plasticity. (Topsoil)	M	
	0.4	Peak = 153kPa Residual = 33kPa		0.3–0.9	ML: SILT: light greyish brown. Low plasticity. Sensitive. (Hinuera Formation)	M	St to VSt
	0.7	Peak = 89kPa Residual = 19kPa					
	1.0	Peak = 181kPa Residual = 28kPa		0.9–1.3	ML: Sandy SILT: light grey mottled black and streaked yellow. Low plasticity. Sensitive. (Hinuera Formation)	M	VSt
				1.3–1.7	SW: Fine to coarse SAND: brown. Well graded, sub rounded. (Hinuera Formation)	M	L to MD
				1.7–3.5	SM: Silty fine SAND: light brownish grey. Poorly graded, sub rounded. (Hinuera Formation) ... from 2.00m to 2.05m, Silt. ... from 2.80m to 2.90m, Silt	W	MD
06-06-2024 ▼				3.5–3.6	SW: Fine to coarse SAND : light brown. Well graded, sub rounded. (Hinuera Formation)	S	
					Borehole terminated at 3.6 m		

Dynamic Cone Penetrometer (Blows/100mm):

Depth interval	Blows
0.0–0.1	2
0.1–0.2	2
0.2–0.3	2
0.3–0.4	2
0.4–0.5	1
0.5–0.6	1
0.6–0.7	1
0.7–0.8	1
0.8–0.9	2
0.9–1.0	2
1.0–1.1	2
1.1–1.2	6
1.2–1.3	4
1.3–1.4	4
1.4–1.5	2
1.5–1.6	3
1.6–1.7	2
1.7–1.8	3
1.8–1.9	2
1.9–2.0	3
2.0–2.1	4
2.1–2.2	4
2.2–2.3	4
2.3–2.4	5
2.4–2.5	4
2.5–2.6	5
2.6–2.7	5
2.7–2.8	5
2.8–2.9	5
2.9–3.0	4
3.0–3.1	5
3.1–3.2	4
3.2–3.3	5
3.3–3.4	5
3.4–3.5	6
3.5–3.6	6
3.6–3.7	5
3.7–3.8	6
3.8–3.9	6
3.9–4.0	5
4.0–4.1	6
4.1–4.2	6
4.2–4.3	7
4.3–4.4	6
4.4–4.5	6
4.5–4.6	5
4.6–4.7	7
4.7–4.8	6
4.8–4.9	6

Termination Reason: No Retrieval.
Shear Vane No: 2560   DCP No: 34
Remarks: Groundwater encountered at 3.5m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - HA24-24

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 04/06/2024
Borehole Location: Refer to site plan | Logged by: PM | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position: | Projection: | Datum: | Survey Source: Site Plan

Depth (m)	Graphic Log / Material Description	Moisture Condition	Consistency/ Relative Density
0.0 – 0.3	OL: Organic SILT: dark brown. No plasticity. (Topsoil)		
0.3 – 0.5	ML: SILT: brown. Low plasticity. Moderately sensitive. (Hinuera Formation)	M	St
0.5 – 1.5	ML: SILT: light brown streaked orange. Low plasticity. Sensitive. (Hinuera Formation) ... *at 1.10m, Becoming grey mottled orange.*	M (to 0.8); M to W	VSt to H
1.5 – 1.7	SP: Fine SAND: with some silt; grey mottled orange. Poorly graded, sub rounded. (Hinuera Formation)	W	L
1.7 – 1.8	ML: SILT: light grey. Low plasticity. Sensitive. (Hinuera Formation)	W	VSt
1.8 – 2.8	SM: Silty fine to medium SAND: grey. Poorly graded, sub rounded. (Hinuera Formation)	W	L to MD
2.8 – 3.6	SW: Fine to medium SAND: with minor silt; grey. Well graded, sub rounded. (Hinuera Formation)	W to S (to 3.3); S	MD
3.6	Borehole terminated at 3.6 m		

Groundwater: 04-06-2024 (at 3.3 m)

Samples & Insitu Tests

Depth	Type & Results
0.4	Peak = 74kPa Residual = 18kPa
0.6	Peak = UTP
1.0	Peak = 133kPa Residual = 18kPa
1.2	Peak = 166kPa Residual = 33kPa
1.8	Peak = 178kPa Residual = 33kPa

Dynamic Cone Penetrometer (Blows/100mm), from surface in 100 mm increments:

2, 1, 1, 1, 2, 2, 1, 1, 2, 2, 2, 3, 3, 2, 4, 2, 2, 3, 2, 2, 4, 3, 2, 2, 4, 4, 4, 3, 4, 5, 5, 5, 5, 5, 5, 6, 6, 6, 6, 3, 7, 6, 8, 7, 8, 7, 7, 8, 8

Termination Reason: Hole Collapse.
Shear Vane No: 2955 DCP No: 34
Remarks: Groundwater encountered at 3.3m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - HA24-25

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 04/06/2024
Borehole Location: Refer to site plan | Logged by: WD | Checked by: DM | Scale: 1:25 |

Position: | Projection: | Datum: | Survey Source: Site Plan

Groundwater	Samples & Insitu Tests Depth	Type & Results	RL (m)	Depth (m)	Material Description	Moisture Condition	Consistency/Relative Density
				0.0–0.2	OL: Organic SILT: dark brown. No plasticity. (Topsoil)		
	0.3	Peak = 109kPa Residual = 25kPa		0.2–0.8	ML: Clayey SILT: orange brown. Low plasticity. Moderately sensitive to sensitive. (Hinuera Formation)		VSt
	0.6	Peak = 109kPa Residual = 31kPa			*... at 0.50m, becoming light orange brown.*		
					... at 0.70m, with some fine to coarse sand.		
				0.8–4.0	SW: Fine to coarse SAND: with minor fine gravel; brownish grey. Well graded. Gravel; subangular, pumiceous and rhyolitic. (Hinuera Formation)	M	MD to D
					... at 1.80m, becoming light greyish brown.		
					... at 2.20m, becoming orange brown with trace silt.		
					... from 2.40m to 2.45m, thin band of grey silty fine sand.		
					... at 2.50m, becoming greyish brown.		
					... from 3.20m to 3.40m, becoming grey with greyish brown.	M to W	
04-06-2024 (▼ 3.8m)					*... at 3.80m, becoming medium to coarse; grey with brownish grey.*	W / S	
				4.0	Borehole terminated at 4.0 m		

Dynamic Cone Penetrometer (Blows/100mm)
2, 3, 1, 1, 2, 1, 1, 2, 3, 6, 6, 6, 6, 5, 5, 6, 5, 4, 5, 5, 7, 7, 5, 5, 6, 7, 8, 5, 4, 5, 6, 7, 6, 6, 5, 7, 5, 5, 4, 4, 7, 5, 7, 5, 5, 5, 6, 5, 7

Termination Reason: Hole collapse/no retrieval
Shear Vane No: 2993 DCP No: 34
Remarks: Groundwater encountered at 3.8m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - SOA24-05

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 31/05/2024
Borehole Location: Refer to site plan | Logged by: NK | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position: | Projection: | Datum: | Survey Source: Site Plan

Depth (m)	Material Description	Moisture Condition	Consistency/ Relative Density
0.0–0.3	OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	M	
0.3–0.7	SM: Silty fine SAND: light grey. Poorly graded. (Hinuera Formation)	M	MD
0.7–1.0	SM: Silty fine to coarse SAND: with minor fine gravel; brownish grey. Well graded, subrounded. (Hinuera Formation) ... *at 0.90m, thin band of iron staining fine sand.*	M	MD
1.0–1.2	ML: SILT: light grey. Low plasticity. Dilatant. (Hinuera Formation)	M	F
1.2–1.4	SM: Silty fine SAND: light grey. Poorly graded. Dilatant. (Hinuera Formation)	M to W	MD
1.4	Borehole terminated at 1.4 m		

Dynamic Cone Penetrometer (Blows/100mm), from 0.2 m: 6, 7, 5, 5, 5, 4, 3, 5, 3, 3, 3, 3, 4, 5, 4, 5, 3, 3, 6, 6, 3, 4, 4, 3, 5, 5, 5

Termination Reason: Target Depth Reached
Shear Vane No: | DCP No: 34
Remarks: Groundwater encountered at 1.4m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - SOA24-06

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 31/05/2024
Borehole Location: Refer to site plan | Logged by: NK | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position:
Projection:
Datum:
Survey Source: Site Plan

Groundwater	Samples & Insitu Tests – Depth	Type & Results	RL (m)	Depth (m)	Material Description	Moisture Condition	Consistency/ Relative Density
					OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	M	
	0.3	Peak = 121kPa Residual = 41kPa			ML: SILT: brown. Low plasticity. Moderately sensitive to sensitive. (Hinuera Formation)	M	VSt
	0.6	Peak = 148kPa Residual = 36kPa					
				1	SM: Silty fine to coarse SAND: with minor fine gravel; brown. Well graded, subrounded. (Hinuera Formation)	M	MD
					SM: Silty fine SAND: light grey. Poorly graded. Dilatant. (Hinuera Formation)	M to W	L to MD
	1.8	Peak = UTP			ML: SILT: light grey. Low plasticity. (Hinuera Formation)	M	H
				2	SW: Fine to coarse SAND: brown. Well graded, subrounded. (Hinuera Formation)	M / S	MD
					Borehole terminated at 2.3 m		
				3			
				4			
				5			

Dynamic Cone Penetrometer (Blows/100mm) (scale 5, 10, 15):

Blows/100mm
2
2
1
1
1
1
1
1
3
3
3
3
4
3
3
4
2
4
4
6
6
5
4
6
4
3
2
4
4

Termination Reason: Target Depth Reached
Shear Vane No: 2955 DCP No: 34
Remarks: Groundwater encountered at 2.2m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - SOA24-07

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 31/05/2024
Borehole Location: Refer to site plan | Logged by: NK | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position:
Projection:
Datum:
Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	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
				0.0–0.2	OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	M	
	0.3	Peak = 193kPa Residual = 44kPa		0.2–0.6	ML: SILT: light brown mottled orange. Low plasticity. (Hinuera Formation)	M	VSt
				0.6–0.8	SM: Silty fine to medium SAND: light grey mottled orange. Well graded, subrounded. (Hinuera Formation)	M	L to MD
				0.8–1.5	SW: Fine to coarse SAND: with minor fine pumice gravel; light grey. Well graded, subrounded. (Hinuera Formation)	M (to 1.2 m); W to S (1.2–1.5 m)	MD
				1.5	Borehole terminated at 1.5 m		

Dynamic Cone Penetrometer (Blows/100mm), per 100 mm from surface:

1, 1, 1, 2, 2, 2, 2, 3, 3, 4, 3, 3, 3, 3, 4, 3, 4, 4, 5, 3, 3, 4, 13, 8, 7, 9, 6, 8, 9

Termination Reason: Target Depth Reached
Shear Vane No: 2955 | DCP No: 34
Remarks: Groundwater encountered at 1.4m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - SOA24-08

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 31/05/2024
Borehole Location: Refer to site plan | Logged by: PM | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position:
Projection:
Datum:
Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	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) 5 10 15
						OL: Organic SILT: dark brown. No plasticity. (Topsoil)	M		
	0.4	Peak = 89kPa Residual = 30kPa				ML: SILT: with some clay; light brown. Low plasticity. Moderately sensitive. (Walton Subgroup)	M	St	
	0.6	Peak = 44kPa Residual = 21kPa				ML: SILT: with some fine to medium sand; greyish brown. Low plasticity. Moderately sensitive. (Walton Subgroup)	M to W	F	
	1.0	Peak = 133kPa Residual = 44kPa		1				VSt	
	1.5	Peak = 119kPa Residual = 44kPa							
	2.0	Peak = UTP		2		CH: Silty CLAY: dark brown. High plasticity. (Walton Subgroup) *... from 1.90m to 2.00m, Becomes mottled black.*	M	H	
	2.5	Peak = UTP							
	3.0	Peak = 208kPa		3		Borehole terminated at 3.0 m			
				4					
				5					

Termination Reason: Target Depth Reached
Shear Vane No: 2993 DCP No:
Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - SOA24-09

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 31/05/2024
Borehole Location: Refer to site plan | Logged by: NK | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position: | Projection: | Datum: | Survey Source: Site Plan

Depth (m)	Material Description	Moisture Condition	Consistency/ Relative Density
0.0–0.2	OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	M	
0.2–0.8	ML: SILT: brown. Low plasticity. (Walton Subgroup)	M	VSt to St
0.8–1.2	ML: Sandy SILT: with trace fine pumice gravel. Low plasticity. (Walton Subgroup)	M	VSt to H
1.2–1.6	SM: Silty fine to coarse SAND: with trace fine gravel; reddish brown. Well graded, subrounded. (Walton Subgroup)	M	
1.6–1.9	ML: Sandy SILT: light yellow mottled orange. Low plasticity. (Walton Subgroup)	M	
1.9–2.6	ML: SILT: light grey. Low plasticity. (Walton Subgroup)	M	
2.6–3.0	CH: Silty CLAY: brown. High plasticity. (Walton Subgroup)	M	
3.0	Borehole terminated at 3.0 m		

Samples & Insitu Tests

Depth	Type & Results
0.3	Peak = 89kPa Residual = 21kPa
0.6	Peak = 160kPa Residual = 30kPa
0.9	Peak = 121kPa Residual = 24kPa
1.2	Peak = UTP
1.6	Peak = 148kPa Residual = 33kPa
2.0	Peak = 136kPa Residual = 24kPa
2.3	Peak = 178kPa Residual = 24kPa
2.6	Peak = UTP
3.0	Peak = 207kPa

Dynamic Cone Penetrometer (Blows/100mm)

Depth interval (m)	Blows
0.0–0.1	2
0.1–0.2	1
0.2–0.3	1
0.3–0.4	1
0.4–0.5	1
0.5–0.6	1
0.6–0.7	1
0.8–0.9	1
0.9–1.0	1
1.0–1.1	3
1.1–1.2	6
1.2–1.3	13
1.3–1.4	18
1.4–1.5	20

Termination Reason: Target Depth Reached
Shear Vane No: 2955 | DCP No: 34
Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - SOA24-10

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 04/06/2024
Borehole Location: Refer to site plan | Logged by: WD | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position:
Projection:
Datum:
Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Type & Results	RL (m)	Depth (m)	Material Description	Moisture Condition	Consistency/ Relative Density
				0.0	OL: Organic SILT: dark brown with dark orange brown. No plasticity. (Topsoil)		
	0.3	Peak = 101kPa Residual = 15kPa			OH: Organic CLAY: dark brown. High plasticity. Sensitive. (Hinuera Formation)	M	St to VSt
	0.6	Peak = 89kPa Residual = 21kPa			CH: Silty CLAY: dark brown. High plasticity. Sensitive. (Hinuera Formation) ... *at 0.80m, becoming yellowish grey.*	M	St to VSt
	1.0	Peak = 127kPa Residual = 30kPa		1	*... from 1.20m to 1.25m, lens of silty fine sand.* *... from 1.25m to 1.30m, thin lens of silt.*	M	St to VSt
					SM: Silty Fine to medium SAND: light grey streaked orange brown. Well graded. (Hinuera Formation)	M	MD to D
04-06-2024 (1.8 m)					SW: Fine to coarse SAND: with some silt and minor fine pumiceous gravel; light grey. Well graded. (Hinuera Formation) ... *at 1.70m, becoming grey.*	W	MD to D
				1.8	Borehole terminated at 1.8 m		

Dynamic Cone Penetrometer (Blows/100mm), per 100 mm from surface: 2, 2, 2, 1, 1, 1, 1, 3, 5, 4, 4, 4, 5, 8, 4, 6, 5, 6, 3, 5, 3, 3, 3, 5, 5, 4, 5

Termination Reason: Target Depth Reached
Shear Vane No: 2993 DCP No: 34
Remarks: Groundwater encountered at 1.8m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - SOA24-11

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 04/06/2024
Borehole Location: Refer to site plan | Logged by: WD | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

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Position:
Projection:
Datum:
Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Type & Results	RL (m)	Depth (m)	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
				0.0–0.4	OL: Organic SILT: dark brown. No plasticity. (Topsoil)	M	
				0.4–1.2	CH: Silty CLAY: brown. High plasticity. (Hinuera Formation) ... at 0.60m, becoming light brownish grey. ... at 0.70m, becoming light grey streaked light orange brown.	M	St
04-06-2024 (1.4 m)				1.2–1.6	SM: Silty Fine SAND: light grey. Poorly graded. Pumiceous. (Hinuera Formation) ... from 1.20m to 1.30m, becoming fine to coarse with trace fine pumiceous gravel.	W (1.2–1.4); S (1.4–1.6)	MD to D

Borehole terminated at 1.6 m

Dynamic Cone Penetrometer (Blows/100mm)

Depth (m)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9
Blows	1	3	2	1	2	1	3	2	2	2	5	7	7	5	6	8	6	8	9	5	3	4	5	5	7	6	5	6	7

Termination Reason: Target Depth Reached
Shear Vane No: DCP No: 34
Remarks: Groundwater encountered at 1.4m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

HAND AUGER BOREHOLE LOG - SOA24-12

Client: Maven Associates Ltd
Project: Station Road, Matamata
Site Location: 127-247A Station Road, Matamata, 3400
Project No.: HAM2023-0124
Date: 31/05/2024
Borehole Location: Refer to site plan | Logged by: PM | Checked by: DM | Scale: 1:25 | Sheet 1 of 1

Position: | Projection:
Datum: | Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Type & Results	RL (m)	Depth (m)	Material Description	Moisture Condition	Consistency/ Relative Density
				0.0–0.2	OL: Organic SILT: dark brown. No plasticity. (Topsoil)	M	
	0.3	Peak = 104kPa Residual = 30kPa		0.2–0.7	ML: SILT: brown. Low plasticity. Moderately sensitive. (Hinuera Formation)	M	St to VSt
	0.6	Peak = 74kPa Residual = 44kPa					
				0.7–3.0	SW: Fine to coarse SAND: light brown. Well graded, sub rounded. (Hinuera Formation)	M	VL
							MD to D
				2.5	*... at 2.50m, Becoming light grey.*	W	
				3.0	Borehole terminated at 3.0 m		

Dynamic Cone Penetrometer (Blows/100mm): 2, 2, 2, 2, 2, 2, 2, 1, 3, 6, 8, 8, 10, 8, 8, 8, 8, 6, 6, 8, 10, 8, 11, 8, 6, 6, 8, 7

Termination Reason: Target Depth Reached
Shear Vane No: 2993 | DCP No: 34
Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 4 - April 2023.

TEST PIT LOG - TP01

Client: Maven Associates Ltd
Project: Station Road
Site Location: Station Road, Matamata
Project No.: HAM2023-0124
Date: 17/12/2024
Test Pit Location: Refer to Site Plan | Logged by: LA | Checked by: MM | Scale: 1:25 | Sheet 1 of 2

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Position: 487431.4mE; 695205.7mN | Projection: Mt Eden 2000 | Pit Dimensions: m by m
Datum: Moturiki 1953 | Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	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) 5 10 15 20	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
						OL: Organic SILT: black. No plasticity. (Topsoil)	M to W			
						SW: Silty SAND: light brownish grey mottled orange brown. Low plasticity. (Hinuera Formation)		TP		
				1		SW: Silty fine to coarse SAND: orange brown mottled light brownish grey. Well graded (Hinuera Formation)				
						SW: Fine to coarse SAND: light brownish grey. Well graded (Hinuera Formation)				
				2		ML: SILT: light grey. low plasticity, (Hinuera Formation)				
▼ (3.1 m)				3		SW: Silty SAND: dark orange brown (Hinuera Formation)	S			
				4		Test pit terminated at 4.00 m				
				5						

Termination Reason: Test pit collapse due to groundwater
Shear Vane No: DCP No:
Remarks: Groundwater encountered at 3.1m

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

PHOTOGRAPH SHEET - TP01

Client: Maven Associates Ltd
Project: Station Road
Location: Station Road, Matamata
Project ID: HAM2023-0124
Date:17/12/2024

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TEST PIT LOG - TP02

Client: Maven Associates Ltd
Project: Station Road
Site Location: Station Road, Matamata
Project No.: HAM2023-0124
Date: 17/12/2024
Test Pit Location: Refer to Site Plan | Logged by: LA | Checked by: MM | Scale: 1:25 | Sheet 1 of 2

Great People | Practical Solutions

Position: 487583.2mE; 695193.8mN | Projection: Mt Eden 2000 | Pit Dimensions: m by m
Datum: Moturiki 1953 | Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	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	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
						OL: Organic SILT: black. No platsicity. (Topsoil)			
						ML: SILT: light brownish grey mottled orange brown. Low plasticity. (Hinuera Formation)	M to W	St	
				1		SW: Fine to coarse SAND : brownish grey mottled orange brown. Well graded (Hinuera Formation)	M to W	MD	
				2		ML: fine sandy SILT : light brownish grey. low plasticity, (Hinuera Formation)	M to W	St	
▼				3		SW: fine to coarse SAND : dark orange brown. Well graded. (Hinuera Formation) *... at 2.80m, becoming dark grey streaked orange brown*	M to W / S	MD to D	
				4			S	MD to D	
				5		Test pit terminated at 5.00 m			

Dynamic Cone Penetrometer (Blows/100mm) — scale 5, 10, 15, 20:

1, 3, 3, 3, 4, 5, 5, 6, 6, 6, 6, 6, 4, 4, 3, 3, 3, 3, 3, 6, 4, 5, 4, 7, 7, 6, 5, 5, 5, 5, 6, 6, 6, 6, 8, 6, 6, 6, 6, 6, 10, 10, 10, 9, 11, 12, 20

Termination Reason: Test pit collapse due to groundwater
Shear Vane No: | DCP No: 34
Remarks: Groundwater encountered at 2.5m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

PHOTOGRAPH SHEET - TP02

Client: Maven Associates Ltd
Project: Station Road
Location: Station Road, Matamata
Project ID: HAM2023-0124
Date:17/12/2024

CMW Geosciences
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TEST PIT LOG - TP03

Client: Maven Associates Ltd
Project: Station Road
Site Location: Station Road, Matamata
Project No.: HAM2023-0124
Date: 17/12/2024

CMW Geosciences
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Test Pit Location: Refer to Site Plan | Logged by: LA | Checked by: MM | Scale: 1:25 | Sheet 1 of 2

Position: 486735.6mE; 695086.9mN | Projection: Mt Eden 2000 | Pit Dimensions: m by m
Datum: Moturiki 1953 | Survey Source: Hand Held GPS

Depth (m)	Material Description	Moisture Condition	Consistency/ Relative Density
0.0–0.3	OL: Organic SILT: black. No plasticity. (Topsoil)	M	
0.3–0.6	ML: SILT: light orange brown. Low plasticity. (Hinuera Formation)	M	F to St
0.6–1.7	ML: Fine to medium sandy SILT: light brownish grey mottled orange brown. Low plasticity. (Hinuera Formation)	M	F to St / VSt
1.7–1.9	ML: SILT: with some rootlets. Dark brown. Low plasticity. (Hinuera Formation)	M	VSt
1.9–3.1	SW: Fine to coarse SAND: dark grey. Well graded. (Hinuera Formation)	W / S	MD to D
3.1–3.5	ML: Clayey SILT: dark brownish grey. Low plasticity. (Hinuera Formation)	M	St to VSt
3.50	Test pit terminated at 3.50 m		

Groundwater: ▼ at approx. 2.6 m

Dynamic Cone Penetrometer (Blows/100mm), from top: 1, 2, 2, 2, 2, 2, 1, 3, 2, 1, 6, 2, 2, 3, 2, 6, 8, 8, 8, 5, 5, 4, 2, 4, 8, 9, 8, 11, 10, 8, 11, 6, 2, 4, 6, 8, 9, 10, 10, 11, 12, 7, 6, 7, 7, 7, 7, 9, 9

Structure & Other Observations: Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks

Termination Reason: Hole collapse due to groundwater.

Shear Vane No: | DCP No: 34

Remarks: Perched Groundwater encountered at 2.6m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

PHOTOGRAPH SHEET - TP03

Client: Maven Associates Ltd
Project: Station Road
Location: Station Road, Matamata
Project ID: HAM2023-0124
Date:17/12/2024

CMW Geosciences
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TEST PIT LOG - TP04

Client: Maven Associates Ltd
Project: Station Road
Site Location: Station Road, Matamata
Project No.: HAM2023-0124
Date: 17/12/2024
Test Pit Location: Refer to Site Plan | Logged by: LA | Checked by: MM | Scale: 1:25 | Sheet 1 of 2

CMW Geosciences
Great People | Practical Solutions

Position: 487831.5mE; 694643.5mN | Projection: Mt Eden 2000 | Datum: Moturiki 1953
Pit Dimensions: m by m | Survey Source: Hand Held GPS

Depth (m)	Material Description	Moisture Condition	Consistency/ Relative Density
0.00–0.20	OL: Organic SILT: black. No plasticity. (Topsoil)	M	
0.20–1.10	ML: SILT: orange brown. Low plasticity. (Hinuera Formation)	M	St
1.10–1.30	SW: Silty fine to medium SAND: light orange brown. Well graded. (Hinuera Formation)	M	D
1.30–5.00	SW: Fine to coarse SAND: dark grey mottled light grey and orange. Well graded. (Hinuera Formation)	M	D to VD

Test pit terminated at 5.00 m

Dynamic Cone Penetrometer (Blows/100mm):

Depth (m)	Blows/100mm
0.0–0.1	1
0.1–0.2	3
0.2–0.3	2
0.3–0.4	2
0.4–0.5	3
0.5–0.6	3
0.6–0.7	4
0.7–0.8	4
0.8–0.9	2
0.9–1.0	4
1.0–1.1	5
1.1–1.2	7
1.2–1.3	9
1.3–1.4	7
1.4–1.5	12
1.5–1.6	10
1.6–1.7	9
1.7–1.8	12
1.8–1.9	20

Termination Reason: Target Depth Reached
Shear Vane No: | DCP No: 34
Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

PHOTOGRAPH SHEET - TP04

Client: Maven Associates Ltd
Project: Station Road
Location: Station Road, Matamata
Project ID: HAM2023-0124
Date:17/12/2024

CMW Geosciences
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TEST PIT LOG - TP05

Client: Maven Associates Ltd
Project: Station Road
Site Location: Station Road, Matamata
Project No.: HAM2023-0124
Date: 17/12/2024

CMW Geosciences
Great People | Practical Solutions

Test Pit Location: Refer to Site Plan | Logged by: LA | Checked by: MM | Scale: 1:25 | Sheet 1 of 2

Position: 486983.7mE; 695423.4mN | Projection: Mt Eden 2000 | Pit Dimensions: m by m
Datum: Moturiki 1953 | Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests – Depth	Samples & Insitu Tests – Type & Results	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	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
				0.0–0.3		OL: Organic SILT: black. No plasticity. (Topsoil)	M		
				0.3–1.3		ML: SILT: with minor medium sand. Light orange brown mottled light brownish grey. Low plasticity. (Hinuera Formation)	M	St to VSt	
				1.3–2.0		ML: SILT: with some rootlets. Dark grey. Low plasticity. (Hinuera Formation)	M	St to VSt	
▼ (2.2 m)				2.0–3.2		SW: Fine to coarse SAND: dark orange brown. Well graded, (Hinuera Formation) *... at 2.20m, becoming dark grey mottled dark orange brown.*	M / S	MD to D	
				3.2–5.0		ML: Clayey SILT: dark greyish brown. Low plasticity. (Hinuera Formation)	M	VSt to H	
				5.00		Test pit terminated at 5.00 m			

Dynamic Cone Penetrometer (Blows/100mm) — scale 5, 10, 15, 20:

1, 2, 2, 2, 4, 4, 4, 5, 3, 4, 4, 7, 5, 6, 7, 6, 7, 4, 4, 10, 16, 13, 16, 12, 8, 12, 14, 12, 6, 4, 8, 8, 8, 8, 11, 20

Termination Reason: Target Depth Reached
Shear Vane No: DCP No: 34
Remarks: Perched groundwater encountered at 2.2m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

PHOTOGRAPH SHEET - TP05

Client: Maven Associates Ltd
Project: Station Road
Location: Station Road, Matamata
Project ID: HAM2023-0124
Date:17/12/2024

CMW Geosciences
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TEST PIT LOG - TP06

Client: Maven Associates Ltd
Project: Station Road
Site Location: Station Road, Matamata
Project No.: HAM2023-0124
Date: 20/12/2024

CMW Geosciences
Great People | Practical Solutions

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

Position: 487579.6mE; 695342.4mN | Projection: Mt Eden 2000 | Pit Dimensions: 3.0m by 1.5m
Datum: Moturiki 1953 | Survey Source: Hand-held GPS

Samples & Insitu Tests

Depth	Type & Results
0.4	Peak = 135kPa Residual = 9kPa
1.8	Peak = 87kPa Residual = 38kPa
2.4	Peak = 69kPa Residual = 26kPa

Groundwater: 20-12-2024 (▼)

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)

Material Description	Moisture Condition	Consistency/ Relative Density
OL: Organic SILT: brown. Low plasticity. (Topsoil)	M	
ML: SILT: with trace clay and fine sand. Light greyish brown. Low plasticity. Extra sensitive. (Hinuera Formation)	M	VSt
SW: Fine to coarse SAND: with trace silt. Light grey. Well graded. (Hinuera Formation) *... at 1.40m, some seepage.*	M	L to MD
SP: Silty fine SAND: light grey. Poorly graded. Contains minor roots. (Hinuera Formation) *... at 1.70m, becoming fine sandy silt.*	W	L to MD
ML: Clayey SILT: with trace fine sand. Light yellowish grey. Low plasticity. (Hinuera Formation)	M	St
OL: Organic SILT: dark brown. No plasticity. Fibrous. (Hinuera Formation)	M	St
ML: Clayey SILT: light yellowish grey. Low plasticity. Moderately sensitive. (Hinuera Formation)	M	St
SW: Fine to coarse SAND: grey. Well graded. (Hinuera Formation) *... at 2.90m, becoming grey streaked orange.*	M / S	MD to D

Test pit terminated at 4.00 m

Depth (m): 1, 2, 3, 4, 5

Dynamic Cone Penetrometer (Blows/100mm) (scale 5 10 15 20)

2, 3, 2, 2, 3, 2, 2, 3, 4, 4, 4, 5, 4, 2, 2, 2, 3, 3, 2, 3, 2, 6, 5, 6, 6, 5, 7, 7, 7, 7, 7, 10, 8, 7, 7, 6, 7, 6, 7

Structure & Other Observations
Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks

Termination Reason: Pit collapse due to groundwater.
Shear Vane No: 1911 | DCP No: 27

Remarks: Groundwater encountered at 2.8m. Perched groundwater encountered at 1.4m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

PHOTOGRAPH SHEET - TP06

Client: Maven Associates Ltd
Project: Station Road
Location: Station Road, Matamata
Project ID: HAM2023-0124
Date:20/12/2024

CMW Geosciences
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APPENDIX B
SOAKAGE TEST ANALYSIS SHEETS

CMW Geosciences	CLIENT:	DESIGNER: NK
	PROJECT: **124 Station Road, Matamata**	CHECKED: DM
		REVISION: 0
	TITLE: **HAS24-05 Falling Head Permeability Test**	DATE: 10/06/2024
		PROJECT: HAM2023-0124

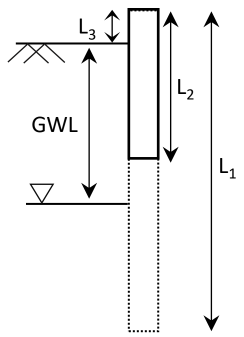
Specifications - Open-Ended Tube

Length L_1: 1.4 m
Diameter: 90 mm
Non-Perm L_2: 0.5 m
Above Gnd L_3: 0 m

Ground Conditions

GWL: 1.4 m BGL (Blank = Bottom of hole)
Permeability Anisotropy
m: 1 $m = \sqrt{k_h / k_v}$

Bottom of Test Hole: 1.40 m BGL



Hydraulic Conductivity (k)

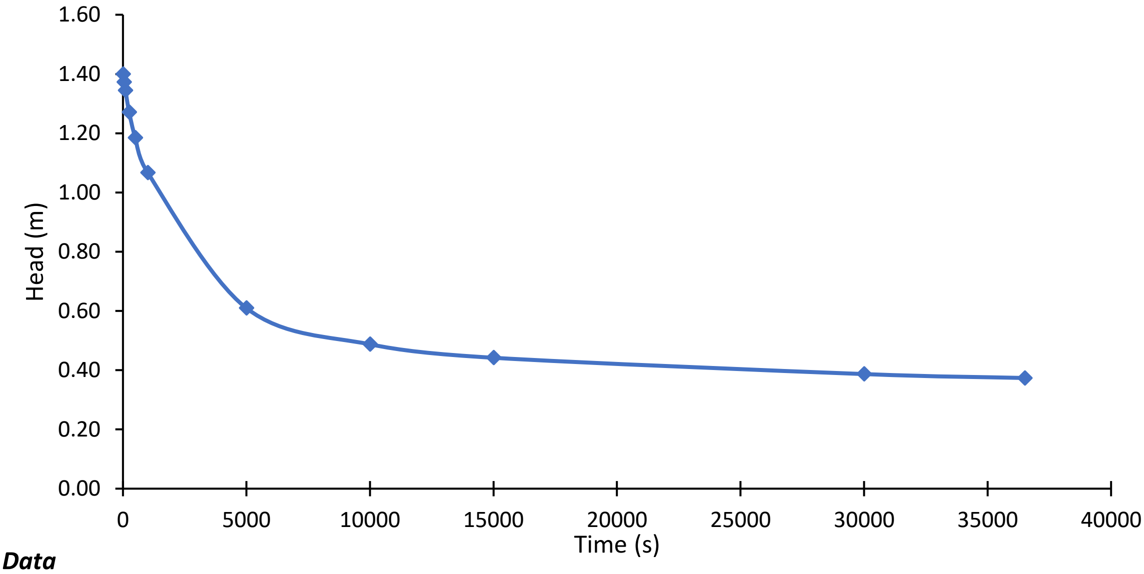
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

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

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1+d}{2h_2+d}\right)\cdot\frac{(h_1+h_2)}{2(t_2-t_1)} =$$ 3.58E-06 ms^{-1} = 0.31 m/day

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

$$k = \frac{d^2\, ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2-t_1)}\, ln\frac{H_1}{H_2} =$$ 6.54E-07 ms^{-1} = 0.06 m/day



STRATIGRAPHIC LOG
Silt
Sand
Silt
Sand
EOH @ 1.4m

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	1.400				
50	0.027	1.373	0.900		1.32E-06	7.40E-06
100	0.056	1.344	0.900		1.42E-06	7.97E-06
250	0.129	1.271	0.900		1.26E-06	7.04E-06
500	0.216	1.184	0.900		9.56E-07	5.35E-06
1000	0.333	1.067	0.900		7.05E-07	3.93E-06
5000	0.791	0.609	0.838		4.95E-07	2.72E-06
10000	0.913	0.487	0.548		2.07E-07	8.13E-07
15000	0.958	0.442	0.465		9.99E-08	3.49E-07
30000	1.013	0.387	0.414		4.83E-08	1.57E-07
36510	1.026	0.374	0.380		3.07E-08	9.39E-08

CMW Geosciences	CLIENT:	DESIGNER:	NK
	PROJECT: **124 Station Road, Matamata**	CHECKED:	DM
		REVISION:	0
	TITLE: **HAS24-06 Falling Head Permeability Test**	DATE:	10/06/2024
		PROJECT:	HAM2023-0124

Specifications - Open-Ended Tube

Length L_1: 2.3 m

Diameter: 90 mm

Non-Perm L_2: 0 m

Above Gnd L_3: 0 m

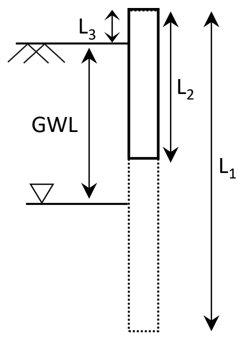
Ground Conditions

GWL: 2.2 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

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

Bottom of Test Hole: 2.30 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

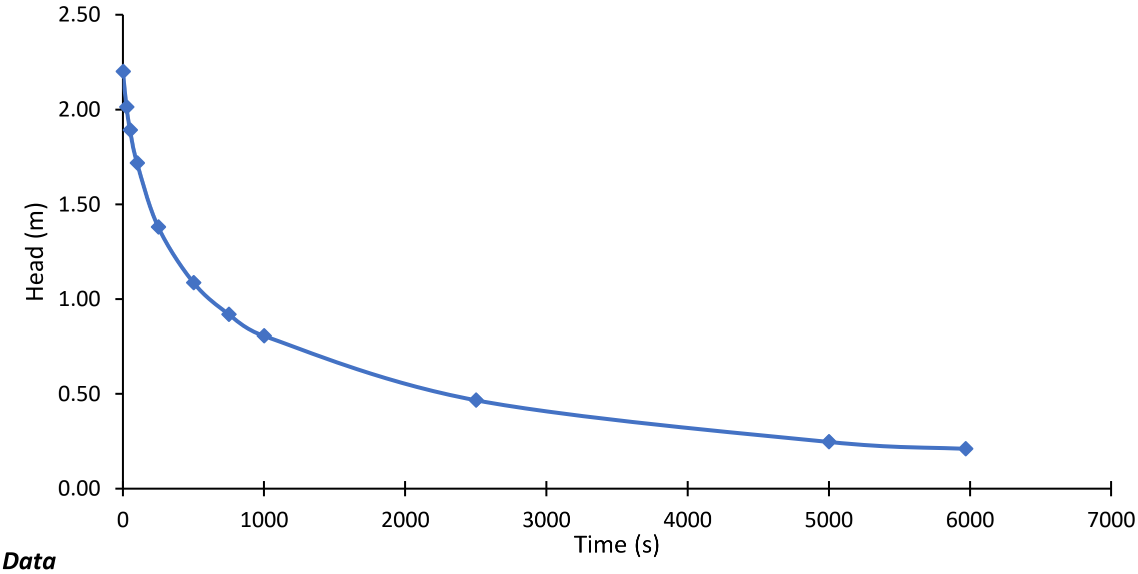
$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$

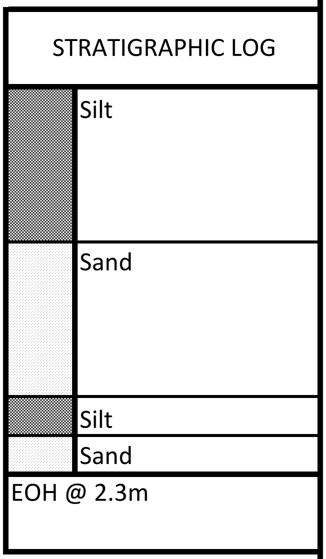
2.35E-05 ms^{-1} = 2.03 m/day

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

$$k = \frac{d^2 \, ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$

2.80E-06 ms^{-1} = 0.24 m/day





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	2.200				
25	0.186	2.014	2.207		6.32E-06	6.78E-05
50	0.308	1.892	2.053		4.71E-06	4.77E-05
100	0.483	1.718	1.905		3.85E-06	3.69E-05
250	0.820	1.380	1.649		3.23E-06	2.80E-05
500	1.114	1.086	1.333		2.46E-06	1.82E-05
750	1.280	0.920	1.103		1.96E-06	1.25E-05
1000	1.395	0.805	0.963		1.71E-06	9.90E-06
2500	1.734	0.466	0.736		1.40E-06	6.95E-06
5000	1.954	0.246	0.456		1.32E-06	4.68E-06
5970	1.990	0.210	0.328		1.03E-06	2.72E-06

CMW Geosciences	CLIENT:	DESIGNER: NK
	PROJECT: **124 Station Road, Matamata**	CHECKED: DM
		REVISION: 0
	TITLE: **HAS24-07 Falling Head Permeability Test**	DATE: 10/06/2024
		PROJECT: HAM2023-0124

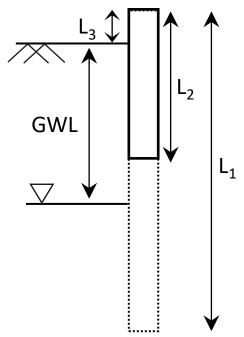
Specifications - Open-Ended Tube

Length L_1: 1.5 m
Diameter: 90 mm
Non-Perm L_2: 0.5 m
Above Gnd L_3: 0 m

Ground Conditions

GWL: 1.4 m BGL (Blank = Bottom of hole)
Permeability Anisotropy
m: 1 $m = \sqrt{k_h / k_v}$

Bottom of Test Hole: 1.50 m BGL



Hydraulic Conductivity (k)

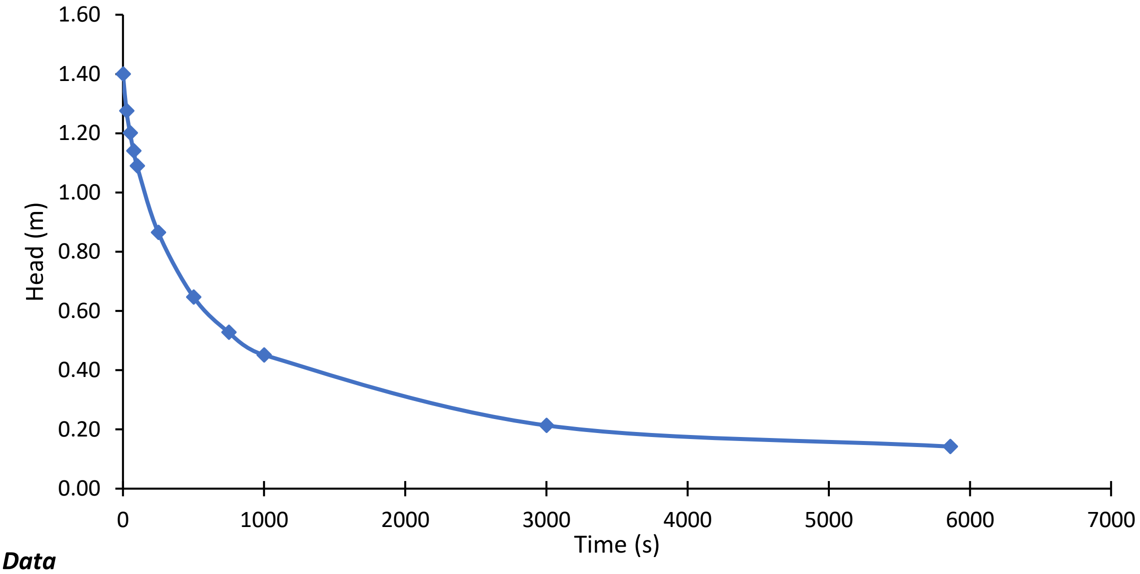
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

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

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 2.76E-05 ms^{-1} = 2.38 m/day

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

$$k = \frac{d^2 \ ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1} \right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 4.94E-06 ms^{-1} = 0.43 m/day



STRATIGRAPHIC LOG
Silt
Sand
EOH @ 1.5m

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	1.400				
25	0.125	1.275	1.000		1.17E-05	7.07E-05
50	0.199	1.201	1.000		7.58E-06	4.55E-05
75	0.260	1.140	1.000		6.49E-06	3.89E-05
100	0.311	1.089	1.000		5.79E-06	3.46E-05
250	0.535	0.865	1.000		4.83E-06	2.90E-05
500	0.753	0.647	0.856		4.04E-06	2.17E-05
750	0.873	0.527	0.687		3.29E-06	1.49E-05
1000	0.949	0.451	0.589		2.76E-06	1.12E-05
3000	1.187	0.213	0.432		1.99E-06	6.94E-06
5860	1.258	0.142	0.278		9.56E-07	2.26E-06

CLIENT:		DESIGNER:	NK
PROJECT:	124 Station Road, Matamata	CHECKED:	DM
		REVISION:	0
TITLE:	HAS24-08 Falling Head Permeability Test	DATE:	10/06/2024
		PROJECT:	HAM2023-0124

Specifications - Open-Ended Tube

Length L_1: 3 m

Diameter: 90 mm

Non-Perm L_2: 0 m

Above Gnd L_3: 0 m

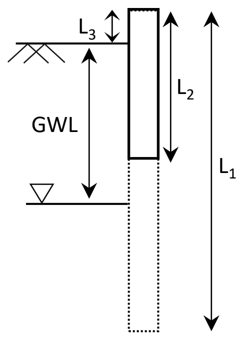
Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

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

Bottom of Test Hole: 3.00 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

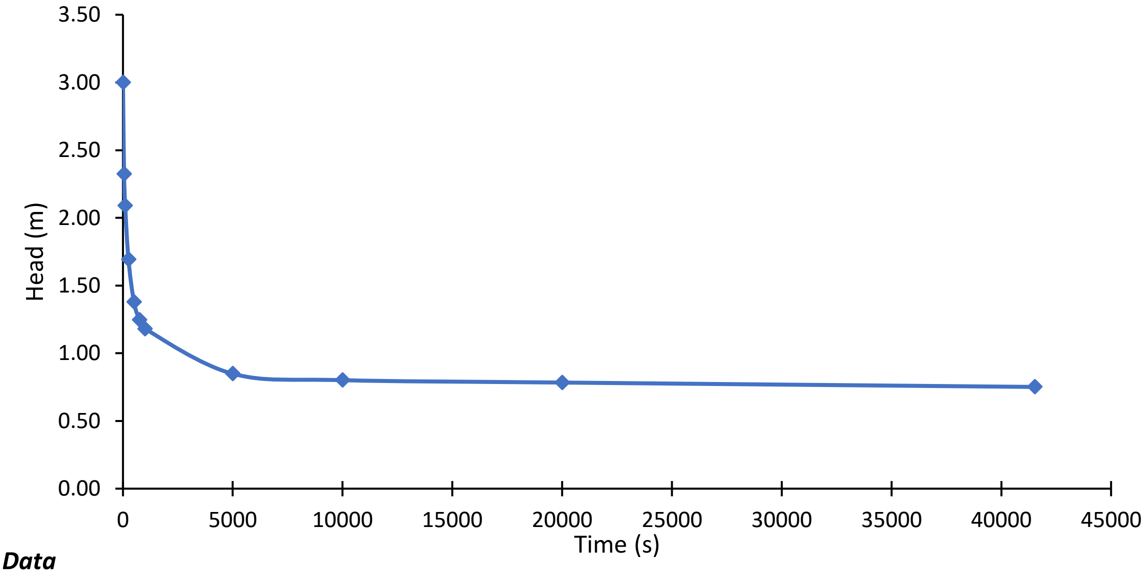
$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_2 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$

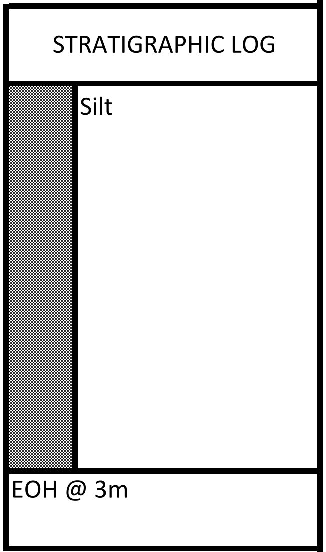
1.96E-05 ms^{-1} = 1.69 m/day

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

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} \ln\frac{H_1}{H_2} =$$

1.84E-06 ms^{-1} = 0.16 m/day





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	3.000				
50	0.676	2.325	2.662		7.92E-06	9.91E-05
100	0.909	2.091	2.208		3.78E-06	4.06E-05
250	1.307	1.693	1.892		2.82E-06	2.71E-05
500	1.621	1.379	1.536		1.91E-06	1.57E-05
750	1.754	1.246	1.312		1.06E-06	7.70E-06
1000	1.819	1.181	1.213		5.84E-07	4.00E-06
5000	2.151	0.849	1.015		2.57E-07	1.57E-06
10000	2.199	0.801	0.825		4.12E-08	2.14E-07
20000	2.216	0.784	0.792		8.10E-09	4.08E-08
41530	2.249	0.751	0.768		7.32E-09	3.61E-08

CMW Geosciences

CLIENT:		DESIGNER:	NK
PROJECT:	124 Station Road, Matamata	CHECKED:	DM
		REVISION:	0
TITLE:	HAS24-09 Falling Head Permeability Test	DATE:	10/06/2024
		PROJECT:	HAM2023-0124

Specifications - Open-Ended Tube

Length L_1: 3 m

Diameter: 90 mm

Non-Perm L_2: 0 m

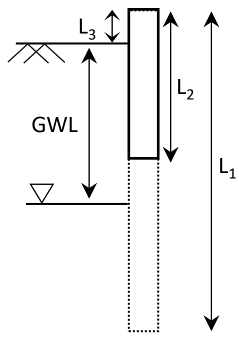
Above Gnd L_3: 0 m

Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

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



Bottom of Test Hole: 3.00 m BGL

Hydraulic Conductivity (k)

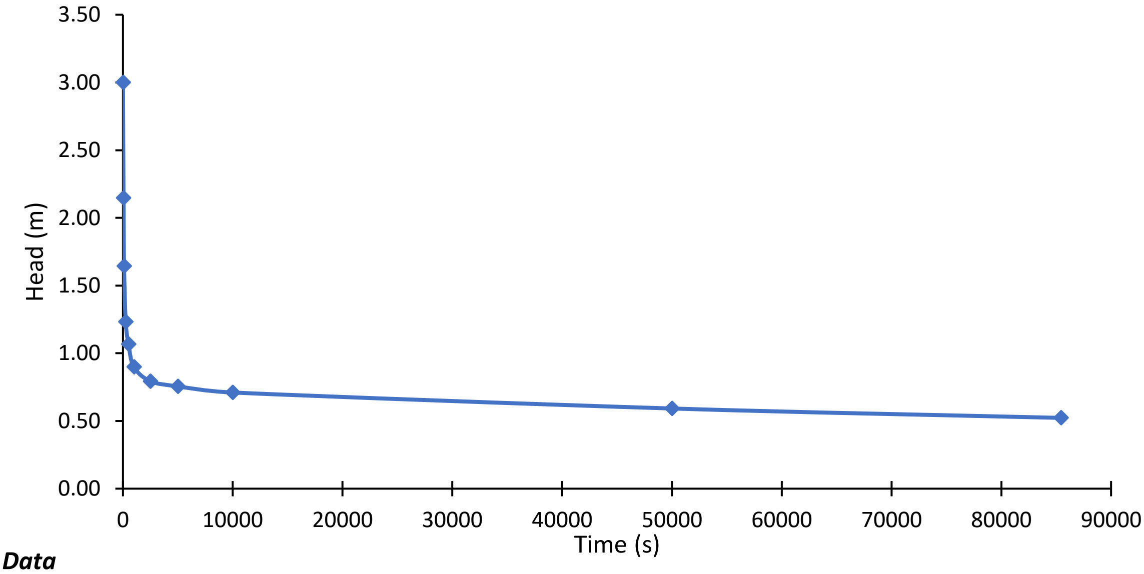
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

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

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right)\cdot\frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 2.91E-05 ms^{-1} = 2.51 m/day

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

$$k = \frac{d^2\, ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)}\, ln\frac{H_1}{H_2} =$$ 2.92E-06 ms^{-1} = 0.25 m/day



STRATIGRAPHIC LOG

Silt

Sand

Silt

EOH @ 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	3.000				
50	0.853	2.147	2.573		1.07E-05	1.31E-04
100	1.357	1.644	1.895		1.07E-05	1.03E-04
250	1.767	1.233	1.438		4.68E-06	3.68E-05
500	1.934	1.066	1.149		1.66E-06	1.10E-05
1000	2.102	0.898	0.982		1.09E-06	6.43E-06
2500	2.207	0.793	0.846		2.91E-07	1.54E-06
5000	2.245	0.756	0.774		7.29E-08	3.62E-07
10000	2.290	0.710	0.733		4.80E-08	2.29E-07
50000	2.408	0.592	0.651		1.89E-08	8.35E-08
85440	2.477	0.523	0.557		1.61E-08	6.38E-08

CLIENT:		DESIGNER:	NK
PROJECT:	**124 Station Road, Matamata**	CHECKED:	DM
		REVISION:	0
TITLE:	**HAS24-10 Falling Head Permeability Test**	DATE:	10/06/2024
		PROJECT:	HAM2023-0124

Specifications - Open-Ended Tube

Length L_1:	1.8	m
Diameter:	90	mm
Non-Perm L_2:	0	m
Above Gnd L_3:	0	m

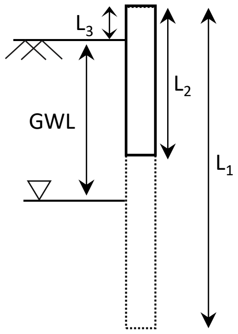
Ground Conditions

GWL: 1.8 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

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

Bottom of Test Hole: 1.80 m BGL



Hydraulic Conductivity (k)

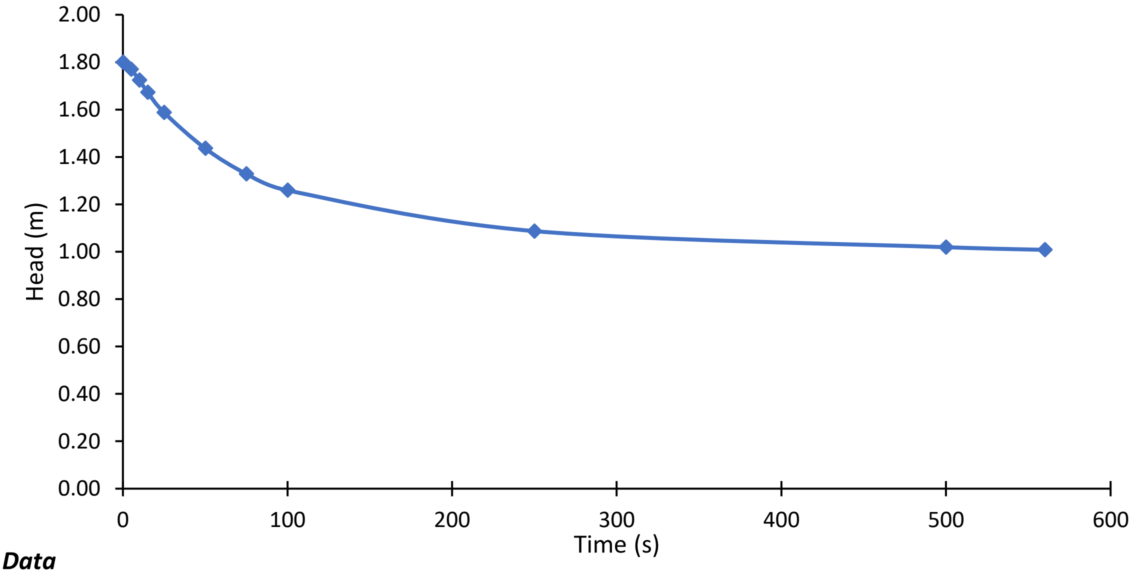
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

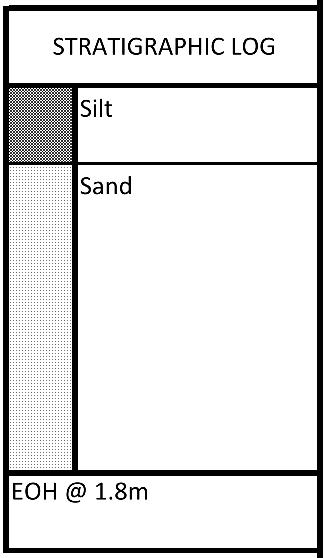
CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 5.82E-05 ms^{-1} = 5.03 m/day

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

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} \ln\frac{H_1}{H_2} =$$ 7.00E-06 ms^{-1} = 0.60 m/day





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	1.800				
5	0.031	1.769	1.785		7.19E-06	6.56E-05
10	0.077	1.723	1.746		1.12E-05	1.00E-04
15	0.127	1.673	1.698		1.30E-05	1.14E-04
25	0.213	1.587	1.630		1.17E-05	9.97E-05
50	0.364	1.436	1.511		9.45E-06	7.63E-05
75	0.472	1.328	1.382		7.81E-06	5.89E-05
100	0.541	1.259	1.293		5.67E-06	4.07E-05
250	0.713	1.087	1.173		2.75E-06	1.85E-05
500	0.781	1.019	1.053		7.83E-07	4.84E-06
560	0.792	1.008	1.013		5.74E-07	3.45E-06

CLIENT:		DESIGNER: NK
PROJECT:	124 Station Road, Matamata	CHECKED: DM
		REVISION: 0
TITLE:	HAS24-11 Falling Head Permeability Test	DATE: 10/06/2024
		PROJECT: HAM2023-0124

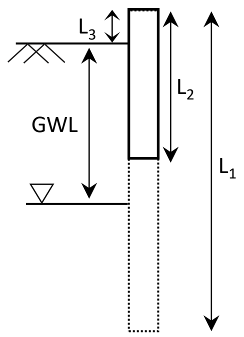
Specifications - Open-Ended Tube

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

Ground Conditions

GWL: 1.4 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)

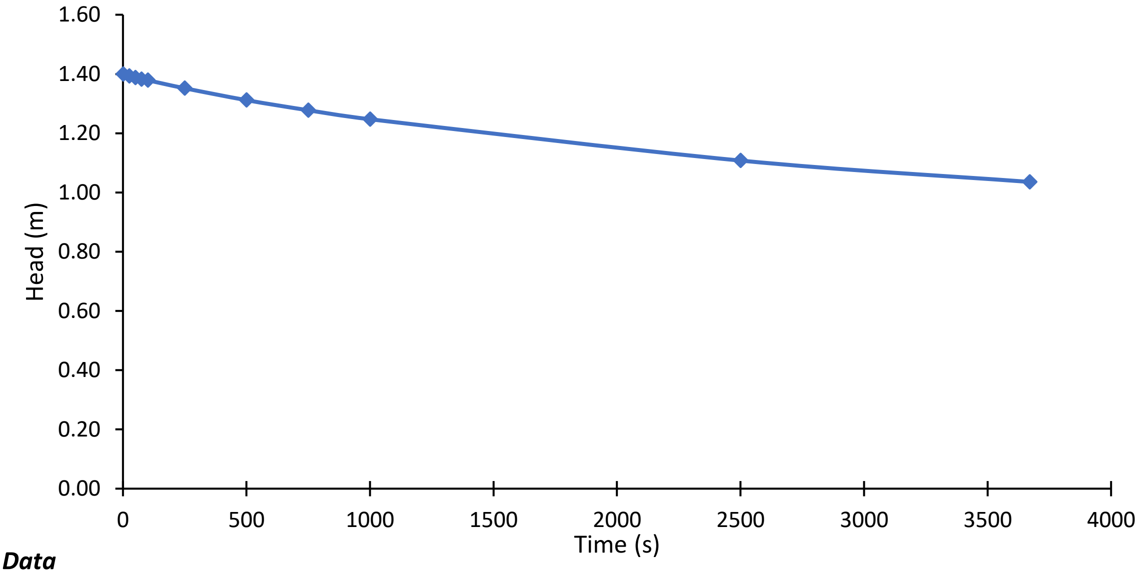
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

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

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 2.27E-06 ms^{-1} = 0.20 m/day

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

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 2.80E-07 ms^{-1} = 0.02 m/day



STRATIGRAPHIC LOG
Sand
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	1.400				
25	0.007	1.393	1.597		4.41E-07	3.69E-06
50	0.013	1.387	1.590		3.99E-07	3.32E-06
75	0.018	1.383	1.585		3.02E-07	2.52E-06
100	0.021	1.379	1.581		2.44E-07	2.03E-06
250	0.048	1.352	1.565		3.03E-07	2.49E-06
500	0.088	1.312	1.532		2.82E-07	2.28E-06
750	0.122	1.278	1.495		2.49E-07	1.98E-06
1000	0.153	1.247	1.462		2.32E-07	1.82E-06
2500	0.292	1.108	1.377		1.99E-07	1.49E-06
3670	0.364	1.036	1.272		1.53E-07	1.08E-06

CLIENT:		DESIGNER:	NK
PROJECT:	124 Station Road, Matamata	CHECKED:	DM
		REVISION:	0
TITLE:	HAS24-12 Falling Head Permeability Test	DATE:	10/06/2024
		PROJECT:	HAM2023-0124

CMW Geosciences

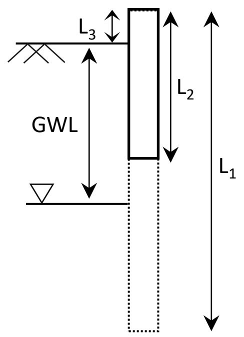
Specifications - Open-Ended Tube

Length L_1: 3 m
Diameter: 90 mm
Non-Perm L_2: 0 m
Above Gnd L_3: 0 m

Ground Conditions

GWL: 3 m BGL (Blank = Bottom of hole)
Permeability Anisotropy
m: 1 $m = \sqrt{k_h / k_v}$

Bottom of Test Hole: 3.00 m BGL



Hydraulic Conductivity (k)

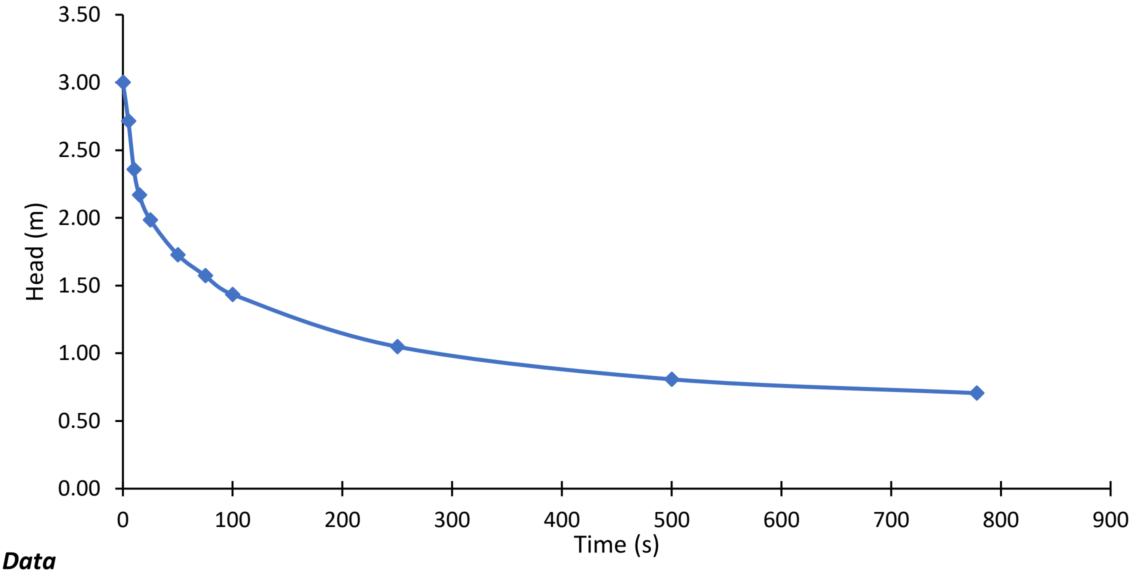
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

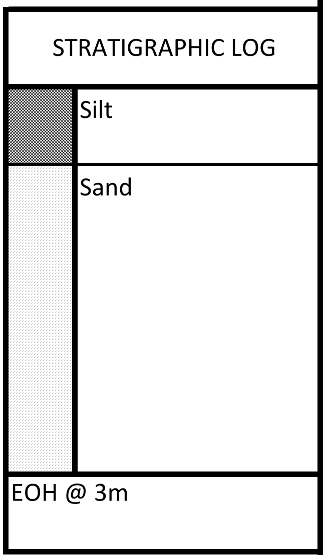
CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 1.74E-04 ms^{-1} = 15.00 m/day

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

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 1.60E-05 ms^{-1} = 1.38 m/day





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	3.000				
5	0.287	2.713	2.857		2.96E-05	3.87E-04
10	0.643	2.357	2.535		4.53E-05	5.42E-04
15	0.832	2.168	2.262		2.93E-05	3.21E-04
25	1.016	1.984	2.076		1.65E-05	1.70E-04
50	1.273	1.727	1.855		1.13E-05	1.06E-04
75	1.427	1.574	1.650		8.22E-06	7.08E-05
100	1.566	1.434	1.504		8.78E-06	7.06E-05
250	1.951	1.049	1.241		5.65E-06	4.00E-05
500	2.193	0.807	0.928		3.45E-06	1.97E-05
778	2.295	0.705	0.756		1.84E-06	9.01E-06

CMW Geosciences	CLIENT: **Maven Associates Ltd**	DESIGNER: LA
	PROJECT: **Station Road**	CHECKED: NK
		REVISION: 0
	TITLE: **SO13 Falling Head Permeability Test**	DATE: 9/12/2024
		PROJECT: HAM2023-0124

Specifications - Open-Ended Tube

Length L_1: 1.5 m

Diameter: 90 mm

Non-Perm L_2: 0 m

Above Gnd L_3: 0 m

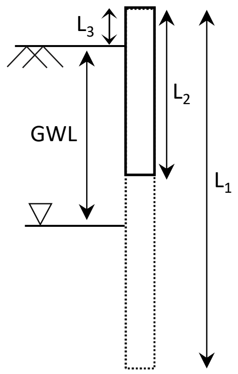
Ground Conditions

GWL: 1.2 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

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

Bottom of Test Hole: 1.50 m BGL



Hydraulic Conductivity (k)

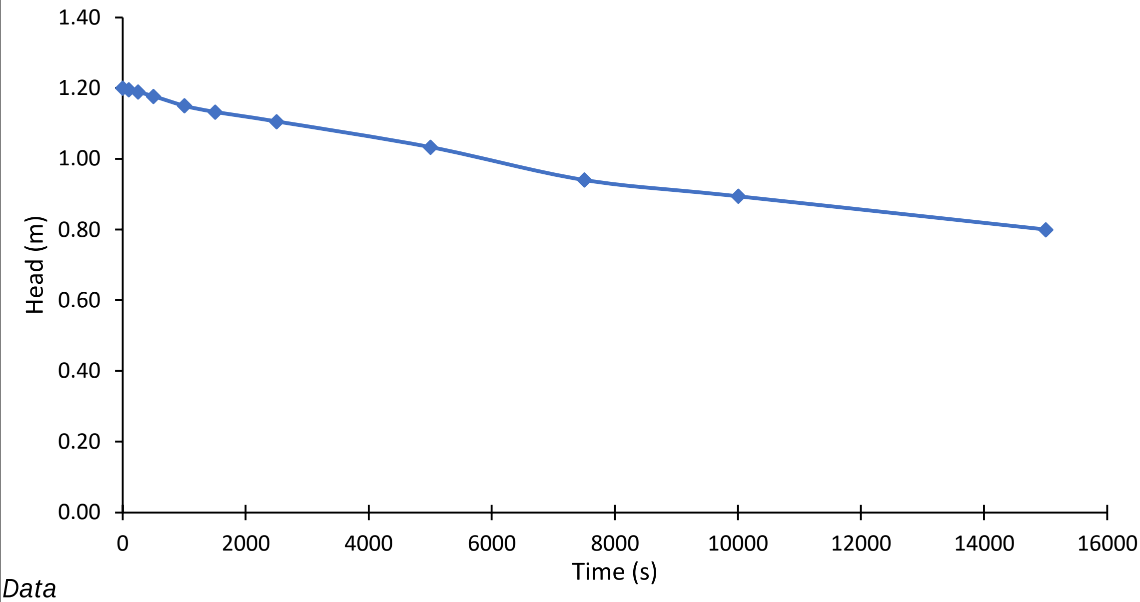
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

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

$$k = \left(\log\frac{h_1}{h_2} - \log\frac{2h_1+d}{2h_2+d}\right)\cdot\frac{(h_1+h_2)}{2(t_2-t_1)} =$$ 6.00E-07 ms^{-1} = 0.05 m/day

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

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{\ldots}\ln\frac{H_1}{\ldots} =$$ 7.97E-08 ms^{-1} = 0.01 m/day



STRATIGRAPHIC LOG
Sandy Silt
Sand
EOH @ 1.5m

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	1.200				
100	0.004	1.196	1.498		7.52E-08	5.97E-07
250	0.011	1.189	1.493		9.03E-08	7.16E-07
500	0.023	1.177	1.483		1.00E-07	7.89E-07
1000	0.050	1.151	1.464		1.10E-07	8.57E-07
1500	0.067	1.133	1.442		7.51E-08	5.80E-07
2500	0.094	1.106	1.419		5.99E-08	4.57E-07
5000	0.167	1.033	1.369		6.85E-08	5.09E-07
7500	0.259	0.941	1.287		9.90E-08	7.02E-07
10000	0.306	0.894	1.218		5.55E-08	3.77E-07
15000	0.400	0.800	1.147		6.37E-08	4.14E-07

	CLIENT: Maven Associates Ltd	DESIGNER: LA
CMW Geosciences	PROJECT: Station Road	CHECKED: NK
		REVISION: 0
	TITLE: SO14 Falling Head Permeability Test	DATE: 9/12/2024
		PROJECT: HAM2023-0124

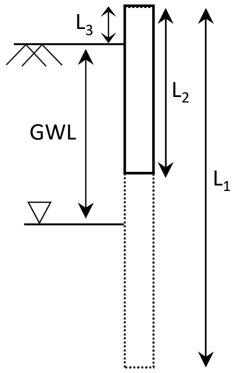
Specifications - Open-Ended Tube

Length L_1: 2.1 m
Diameter: 90 mm
Non-Perm L_2: 0 m
Above Gnd L_3: 0 m

Ground Conditions

GWL: 1.7 m BGL (Blank = Bottom of hole)
Permeability Anisotropy
m: 1 $m = \sqrt{k_h / k_v}$

Bottom of Test Hole: 2.10 m BGL



Hydraulic Conductivity (k)

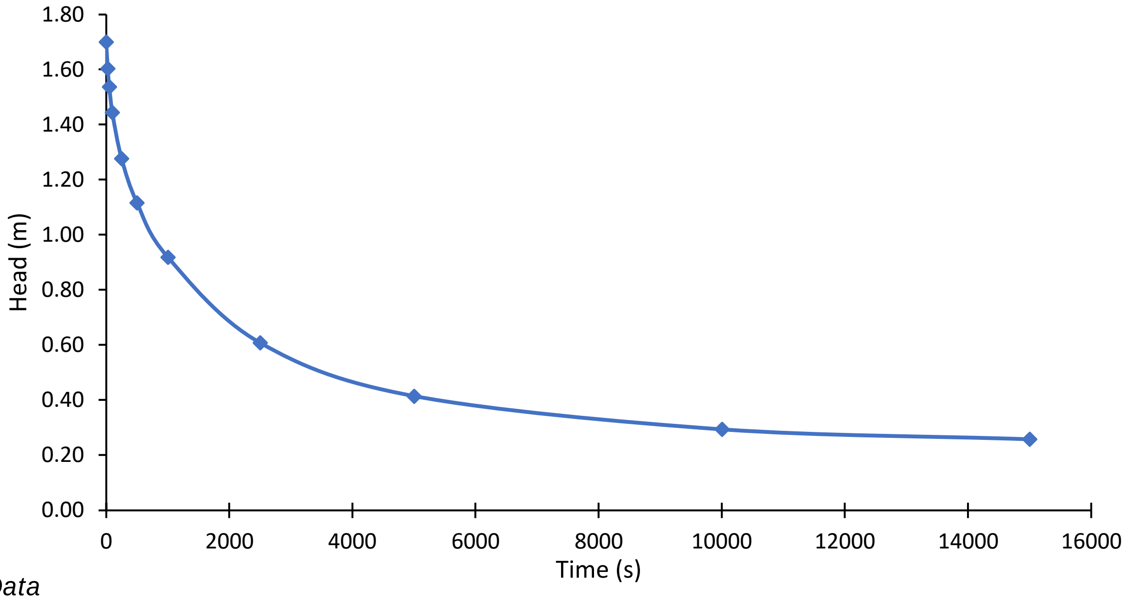
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

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

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 1.43E-05 ms^{-1} = 1.23 m/day

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

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{\ldots} \ln\frac{H_1}{\ldots} =$$ 1.57E-06 ms^{-1} = 0.14 m/day



STRATIGRAPHIC LOG
Silt
Sand
EOH @ 2.1m

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	1.700				
25	0.097	1.603	2.052		4.41E-06	4.45E-05
50	0.162	1.538	1.971		3.25E-06	3.18E-05
100	0.256	1.444	1.891		2.51E-06	2.38E-05
250	0.423	1.277	1.761		1.73E-06	1.56E-05
500	0.583	1.117	1.597		1.21E-06	1.01E-05
1000	0.781	0.919	1.418		9.58E-07	7.32E-06
2500	1.092	0.608	1.164		7.80E-07	5.22E-06
5000	1.285	0.415	0.911		5.12E-07	2.81E-06
10000	1.406	0.295	0.755		2.59E-07	1.21E-06
15000	1.442	0.259	0.677		1.06E-07	4.39E-07

CLIENT:	Maven Associates Ltd	DESIGNER:	LA
PROJECT:	Station Road	CHECKED:	NK
		REVISION:	0
TITLE:	SO15 Falling Head Permeability Test	DATE:	9/12/2024
		PROJECT:	HAM2023-0124

CMW Geosciences

Specifications - Open-Ended Tube

Length L_1: 3.1 m

Diameter: 90 mm

Non-Perm L_2: 0 m

Above Gnd L_3: 0 m

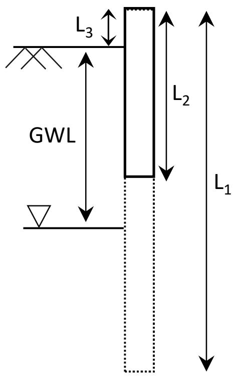
Ground Conditions

GWL: 1.5 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

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

Bottom of Test Hole: 2.10 m BGL



Hydraulic Conductivity (k)

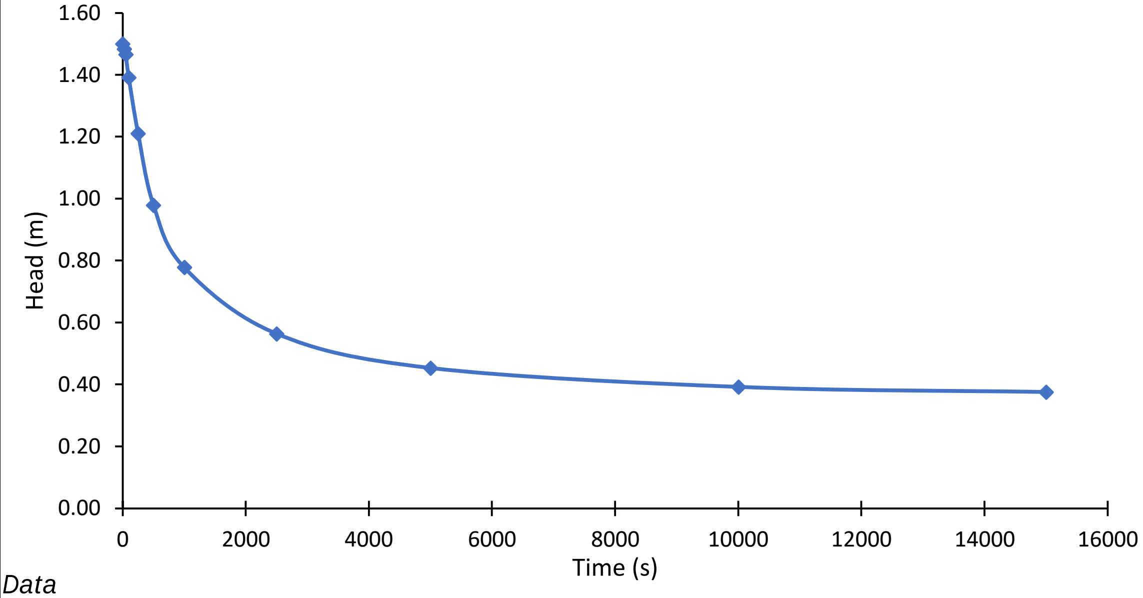
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

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

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 8.57E-06 ms^{-1} = 0.74 m/day

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

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{\ldots} \ln\frac{H_1}{\ldots} =$$ 6.76E-07 ms^{-1} = 0.06 m/day



STRATIGRAPHIC LOG
Silt
Sand
Silt
Sand
EOH @ 3.1m

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	1.500				
25	0.016	1.484	3.092		6.05E-07	8.29E-06
50	0.034	1.466	3.075		6.79E-07	9.26E-06
100	0.108	1.392	3.029		1.46E-06	1.96E-05
250	0.290	1.210	2.901		1.35E-06	1.76E-05
500	0.521	0.979	2.695		1.30E-06	1.60E-05
1000	0.722	0.778	2.479		7.52E-07	8.61E-06
2500	0.936	0.564	2.271		3.76E-07	4.00E-06
5000	1.046	0.454	2.109		1.61E-07	1.57E-06
10000	1.108	0.393	2.023		5.51E-08	5.13E-07
15000	1.124	0.376	1.984		1.69E-08	1.53E-07

CMW Geosciences	CLIENT: **Maven Associates Ltd**	DESIGNER: LA
	PROJECT: **Station Road**	CHECKED: NK
		REVISION: 0
	TITLE: **SO16 Falling Head Permeability Test**	DATE: 9/12/2024
		PROJECT: HAM2023-0124

Specifications - Open-Ended Tube

Length L_1:	3.3	m
Diameter:	90	mm
Non-Perm L_2:	0	m
Above Gnd L_3:	0	m

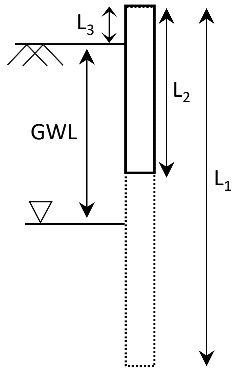
Ground Conditions

GWL: 1 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

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

Bottom of Test Hole: 3.30 m BGL



Hydraulic Conductivity (k)

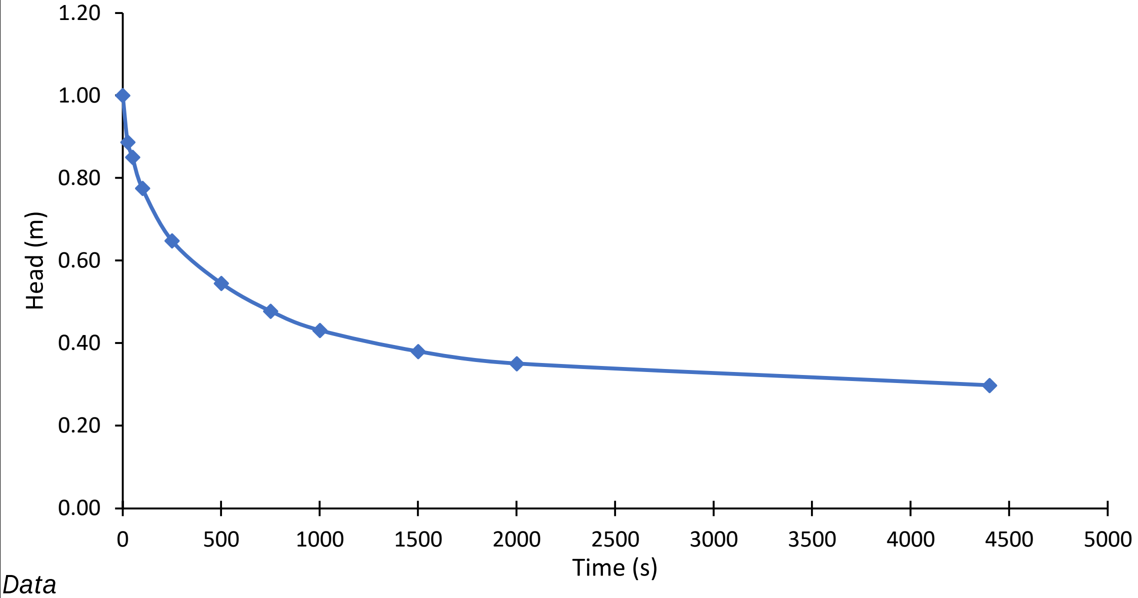
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

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

$$k = \left(\log\frac{h_1}{h_2} - \log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 2.15E-05 ms^{-1} = 1.86 m/day

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

$$k = \frac{d^2 \ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{\ldots} \ln\frac{H_1}{\ldots} =$$ 1.61E-06 ms^{-1} = 0.14 m/day



STRATIGRAPHIC LOG

Silt
Sand
Silt
Sand
EOH @ 3.3m

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	1.000				
25	0.113	0.887	3.244		6.41E-06	8.97E-05
50	0.149	0.851	3.169		2.26E-06	3.09E-05
100	0.225	0.775	3.113		2.57E-06	3.46E-05
250	0.352	0.648	3.012		1.69E-06	2.21E-05
500	0.455	0.545	2.897		1.01E-06	1.26E-05
750	0.522	0.478	2.812		7.83E-07	9.47E-06
1000	0.569	0.431	2.755		6.22E-07	7.32E-06
1500	0.620	0.380	2.706		3.87E-07	4.45E-06
2000	0.649	0.351	2.666		2.48E-07	2.78E-06
4400	0.702	0.298	2.625		1.07E-07	1.17E-06

CLIENT:	**Maven Associates Ltd**	DESIGNER:	LA
PROJECT:	**Station Road**	CHECKED:	NK
		REVISION:	0
TITLE:	**SO23 Falling Head Permeability Test**	DATE:	9/12/2024
		PROJECT:	HAM2023-0124

Specifications - Open-Ended Tube

Length L_1:	3.5	m
Diameter:	90	mm
Non-Perm L_2:	3	m
Above Gnd L_3:	0	m

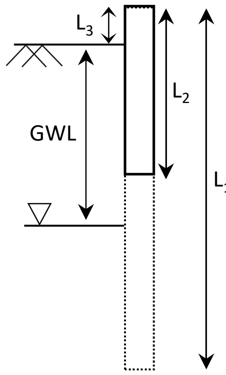
Ground Conditions

GWL: m BGL (Blank = Bottom of hole)

Permeability Anisotropy

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

Bottom of Test Hole: 3.50 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

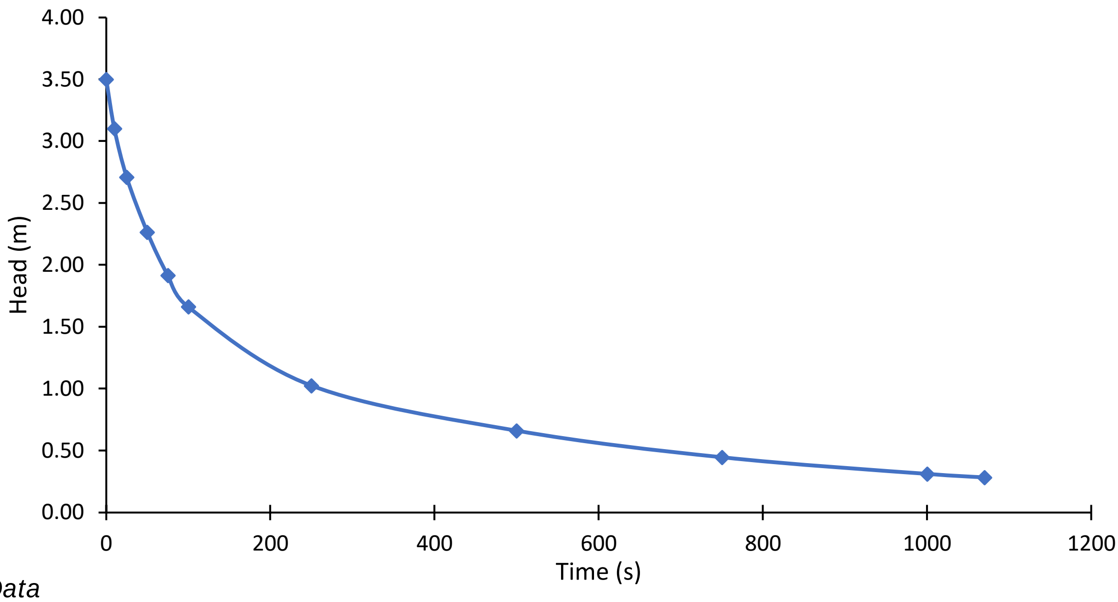
$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$

9.58E-05 ms^{-1} = 8.28 m/day

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

$$k = \frac{d^2\, ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{\ldots}\, ln\frac{H_1}{\ldots} =$$

2.48E-05 ms^{-1} = 2.14 m/day



STRATIGRAPHIC LOG
Silt
Sandy Silt
Sand
EOH @ 3.5m

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	3.500				
10	0.398	3.102	0.500		5.91E-05	2.33E-04
25	0.792	2.708	0.500		4.43E-05	1.75E-04
50	1.236	2.264	0.500		3.50E-05	1.38E-04
75	1.583	1.917	0.500		3.26E-05	1.28E-04
100	1.839	1.661	0.500		2.80E-05	1.10E-04
250	2.475	1.025	0.500		1.58E-05	6.32E-05
500	2.839	0.661	0.500		8.57E-06	3.35E-05
750	3.053	0.447	0.500		7.68E-06	2.90E-05
1000	3.188	0.312	0.379		8.24E-06	2.56E-05
1070	3.216	0.284	0.298		8.71E-06	2.28E-05

CLIENT: Maven Associates Ltd	DESIGNER: LA
PROJECT: Station Road	CHECKED: NK
	REVISION: 0
TITLE: SO24 Falling Head Permeability Test	DATE: 9/12/2024
	PROJECT: HAM2023-0124

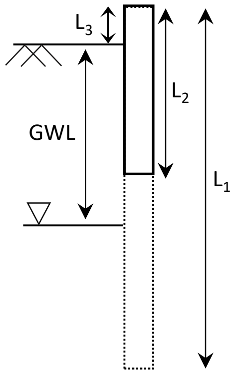
CMW Geosciences

Specifications - Open-Ended Tube

Length L_1: 3.5 m
Diameter: 90 mm
Non-Perm L_2: 0 m
Above Gnd L_3: 0 m

Ground Conditions

GWL: m BGL (Blank = Bottom of hole)
Permeability Anisotropy
m: 1 $m = \sqrt{k_h / k_v}$



Bottom of Test Hole: 3.50 m BGL

Hydraulic Conductivity (k)

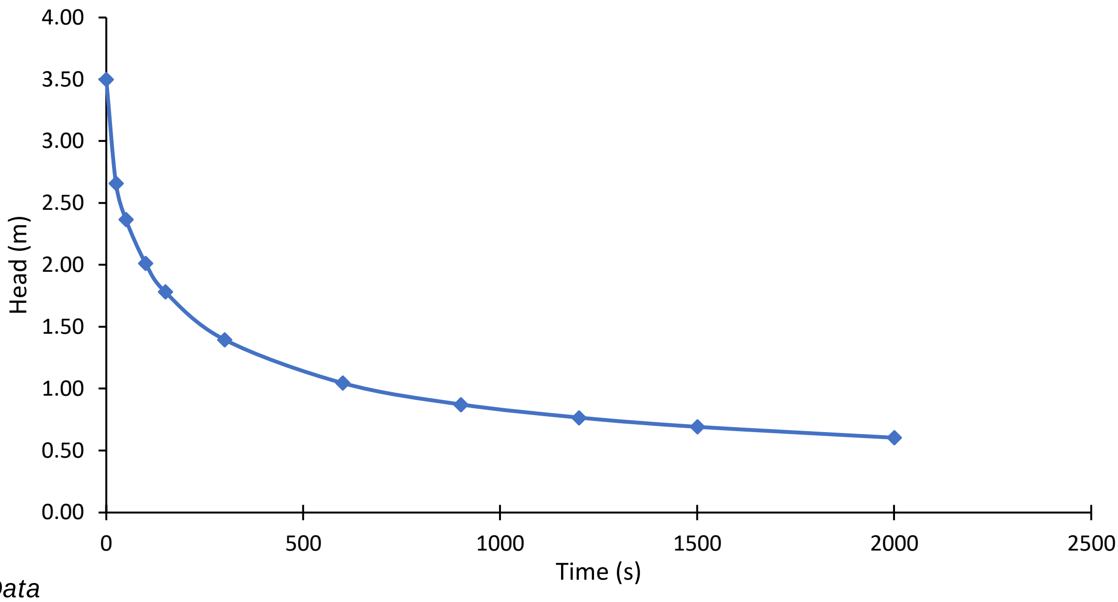
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

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

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 4.93E-05 ms^{-1} = 4.26 m/day

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

$$k = \frac{d^2 \, ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{\ldots} \, ln\frac{H_1}{\ldots} =$$ 4.58E-06 ms^{-1} = 0.40 m/day



STRATIGRAPHIC LOG
Silt
Sandy Silt
Sand
EOH @ 3.5m

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	3.500				
25	0.839	2.661	3.080		1.52E-05	2.14E-04
50	1.133	2.367	2.514		7.58E-06	9.00E-05
100	1.487	2.013	2.190		5.82E-06	6.23E-05
150	1.717	1.783	1.898		4.86E-06	4.65E-05
300	2.103	1.397	1.590		3.69E-06	3.12E-05
600	2.453	1.047	1.222		2.63E-06	1.84E-05
900	2.627	0.873	0.960		1.95E-06	1.14E-05
1200	2.733	0.767	0.820		1.55E-06	8.03E-06
1500	2.807	0.693	0.730		1.32E-06	6.27E-06
2000	2.895	0.605	0.649		1.13E-06	4.97E-06

APPENDIX C
MOUNDING ASSESSMENT AND STORMWATER BASIN DESIGNS

APPENDIX C

MOUNDING ASSESSMENT AND STORMWATER BASIN DESIGNS

C1 MOUNDING ASSESSMENT AND STORMWATER BASIN DESIGNS

1.1 Basin A

1.1.1 Model Inputs

The site-specific input values for the Basin A groundwater mounding assessment presented in Table 1. The groundwater flow direction in relation to the orientation of Basin A is presented in Figure 1 with the location of the nearest buildings to the site.

Table 1: Inputs for Mounding Assessment – Basin A

MODEL INPUT PARAMETER	SCENARIO 1: SHORT DURATION STORM	SCENARIO 2: WINTER SEASON	INFORMATION SOURCE
Length (m)	100		Maven basin design cross sections
Width (m)	43.5		
Event Duration (days)	3	36	Scenario 1: 3-day 100-year ARI storm event duration. Scenario 2: Number of average winter rain days. (NIWA Hamilton, AWS rainfall station 2112).
Maximum Acceptable Groundwater Mounding Height (m)	3.5		Taken as the distance from the winter water table (derived from the piezometric surface) to the top of the basin specified in Maven basin design plans.
Aquifer Specific Yield (m^3/m^3)	0.22		Typical for aquifer type (Morris and Johnson 1967).
Aquifer Hydraulic Conductivity (m/day)	1.53		Calculated as the average of the last 4 values from CMW's soakage tests undertaken at SOA23 and SOA24 (CIRIA method.)
Aquifer Hydraulic Gradient (m/m)	-0.0022		Calculated from interpreted winter piezometric surface.
Aquifer Dip Direction (degrees)	30		
Aquifer Saturated Thickness (m)	11		Average aquifer thickness from CPT24-06 and SCPT24-04

MODEL INPUT PARAMETER	SCENARIO 1: SHORT DURATION STORM	SCENARIO 2: WINTER SEASON	INFORMATION SOURCE
Rotation of the Infiltration Basin Length (degrees)	36.3		From Maven basin design plans

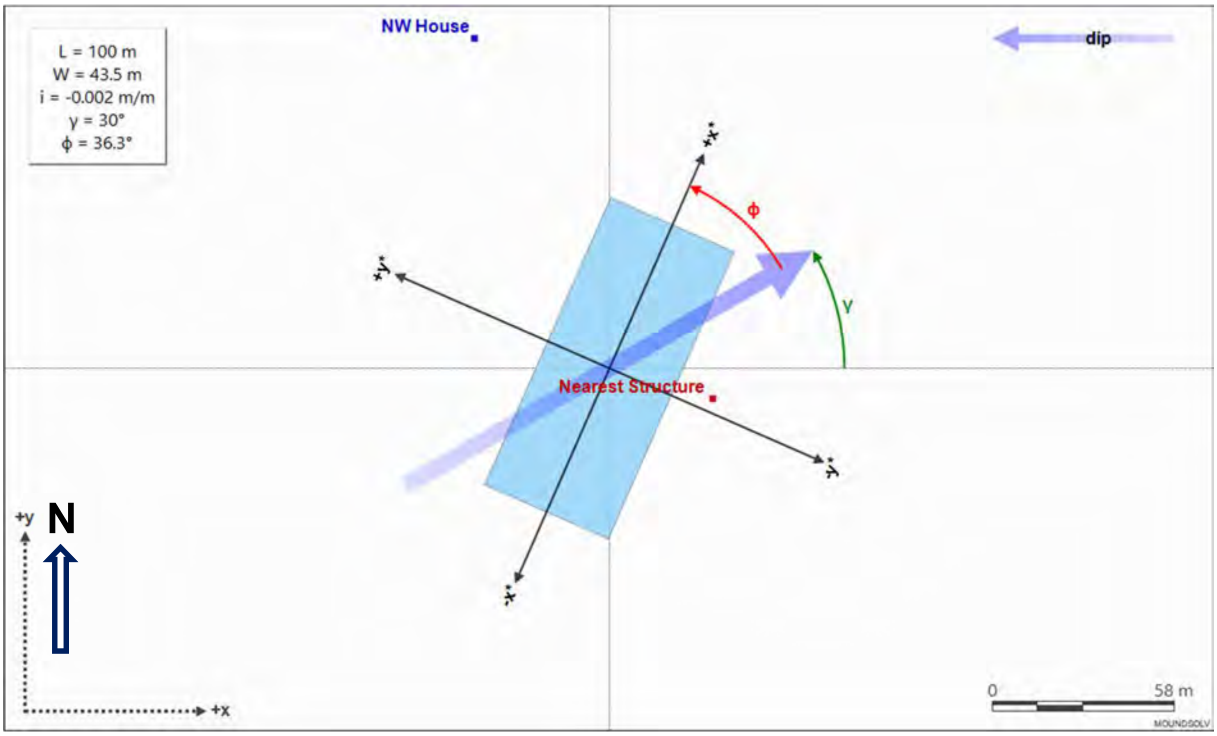


Figure 1: Basin A and Closest Structures Relative to Groundwater Flow Direction

1.1.2 Mounding Assessment Results

The results derived from the modelling of the two scenarios for Basin A are summarised in Table 2 with details in the following sections.

Modelled infiltration rates (Table 2) are considered to represent an average over the duration of the simulated rainfall event (3 days and 36 days). The water storage capacity of the stormwater pond has not been taken into account in the mounding assessment.

Table 2: Summary of Mounding Assessment Results for Basin A

MODEL OUTPUT	SCENARIO 1: SHORT DURATION STORM	SCENARIO 2: WINTER SEASON	NOTES
Modelled Infiltration Rate (m/d)	0.29	0.06 (1)	Modelled with water levels in the basin reaching the basin rim.
Maximum Modelled Mounding at Neighbouring Property Boundary (m)	1.1	2	Nearest Structure
	0.15	0.39	NW House

Note: 1) The initial infiltration rate would be closer to the value indicated for Scenario 1. However, recharge rates would decrease toward the value indicated for Scenario 2.

1.1.2.1 Basin A Scenario 1

The calculated mounding contours (Figure 2) and profiles (Figure 3 and Figure 4) indicate groundwater mounding would not extend beyond 55 m from the basin edge by the end of the 3-day rainfall event. Following the storm event, the groundwater levels beneath the basin decline by approximately 3.1 m over a period of 47 days (Figure 5, Figure 6). This decline in groundwater level beneath the basin is matched by an expansion of the area affected by groundwater mounding (Figure 5). A peak increase in groundwater level of 1.1 m is modelled at the nearest structure and a mounding of 0.15 m at the house to the northwest (Figure 6).

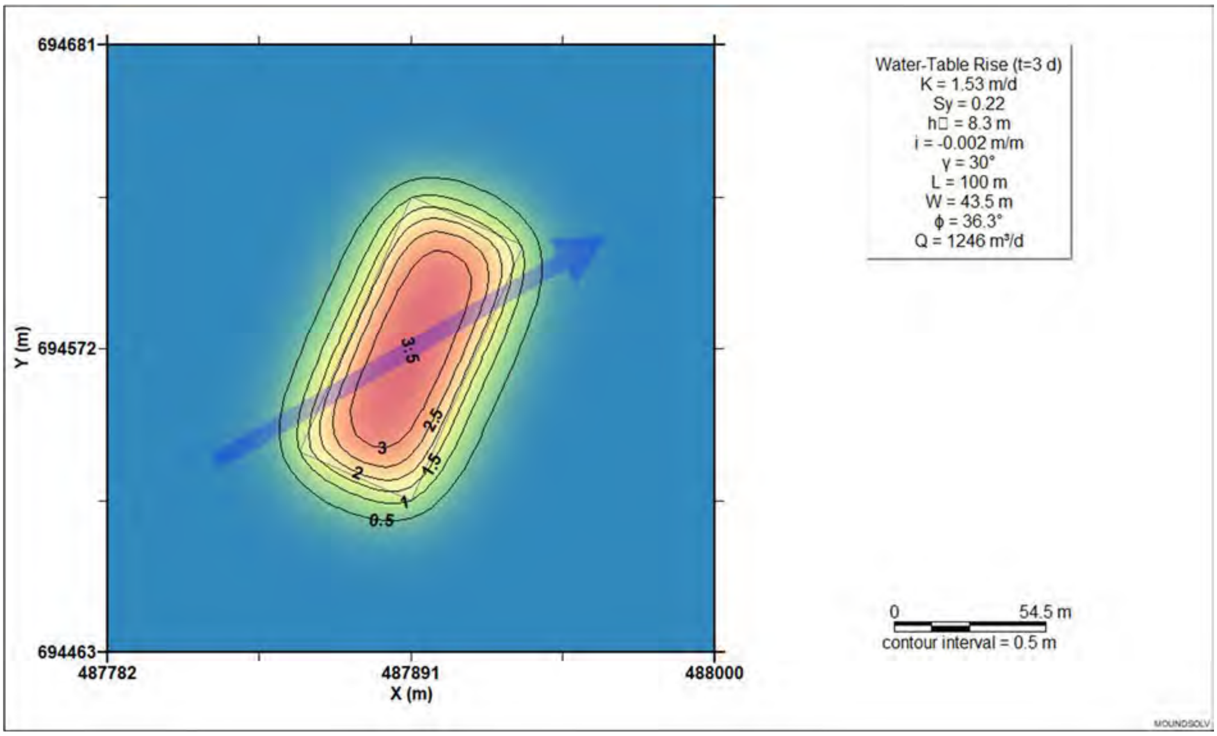


Figure 2: Calculated Mounding Contours at Basin A at the End of a 3-day Storm Event

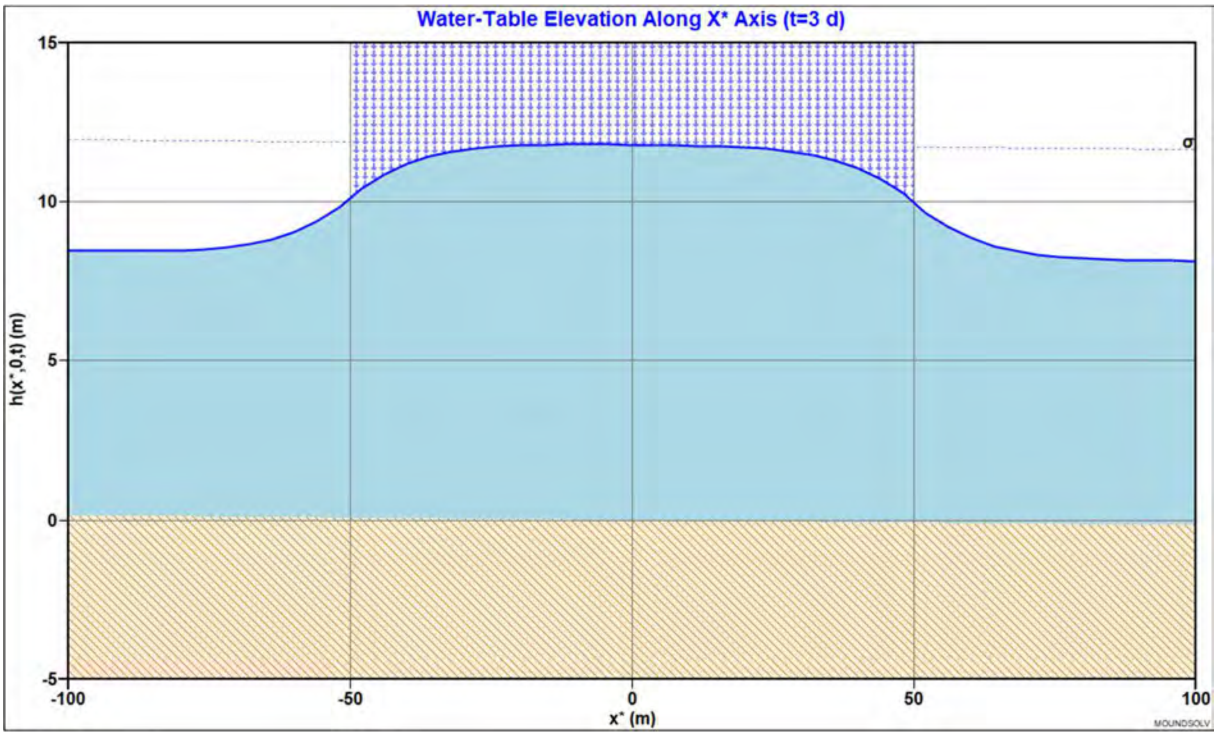


Figure 3: Calculated Mounding, Basin A, X-Axis Visualisation, Following a 3-day Storm Event

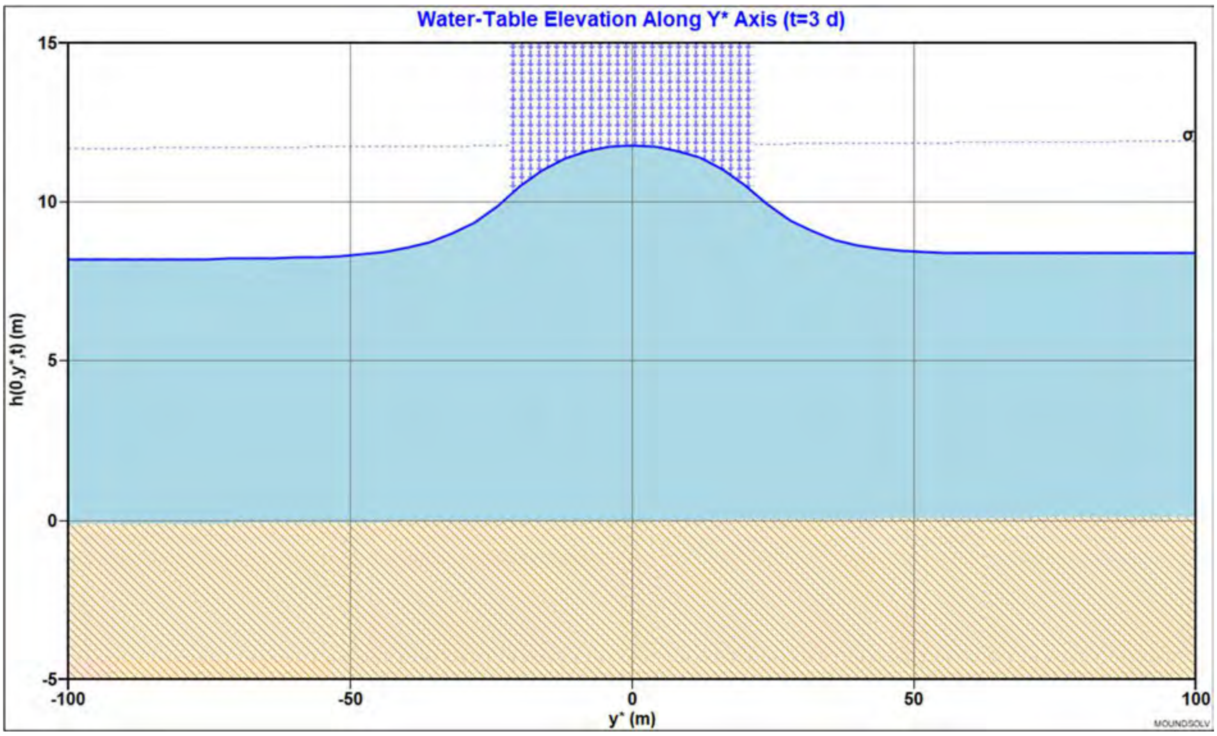


Figure 4: Calculated Mounding, Basin A, Y-Axis Visualisation, Following a 3-day Storm Event

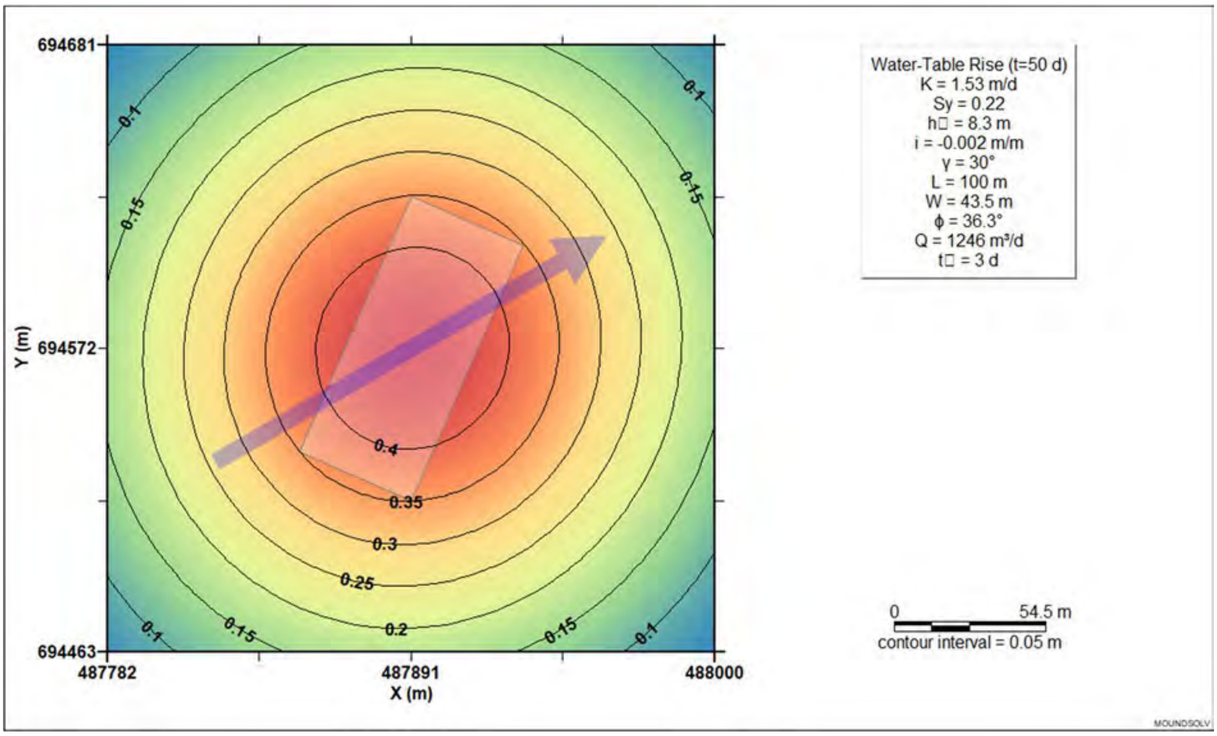


Figure 5: Calculated Mounding Contours at Basin A, 47 days After a 3-day Storm Event

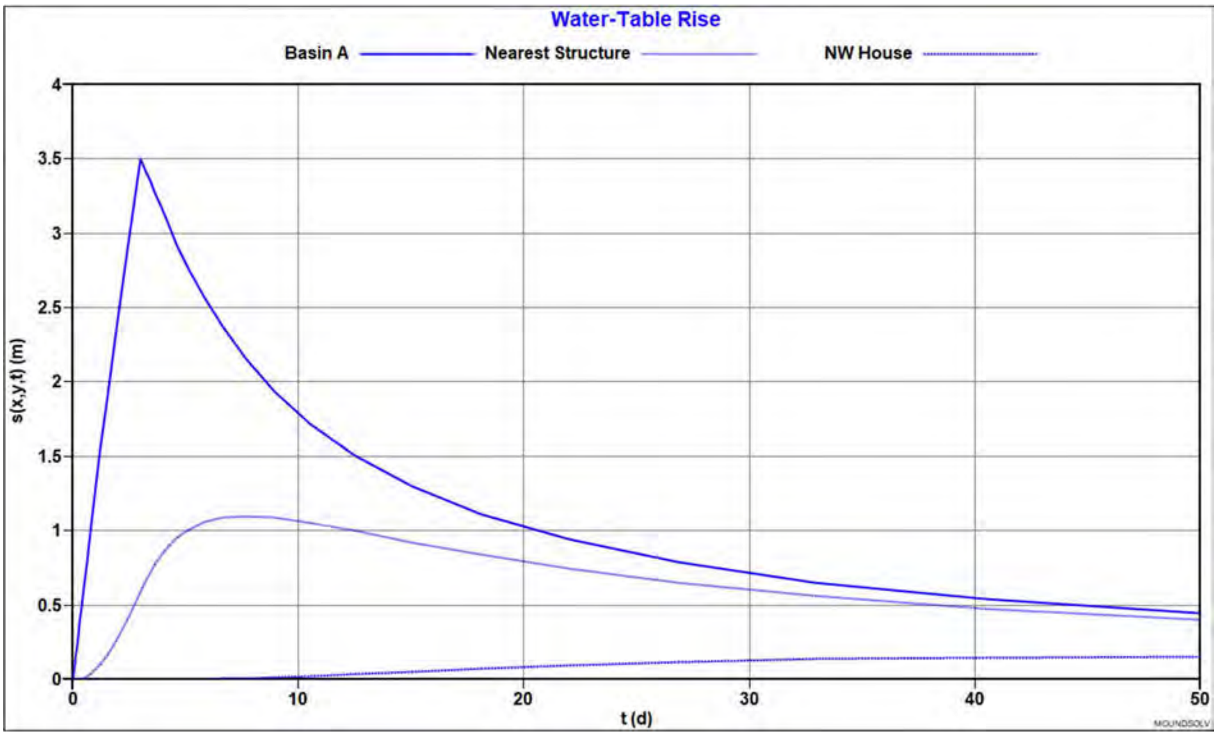


Figure 6: Groundwater Table Hydrographs at Basin A in Response to 3 Day Event

1.1.2.2 Basin A Scenario 2

The calculated mounding contours (Figure 7) and profiles (Figure 8 and Figure 9) indicate groundwater mounding would not extend beyond 100 m from the basin edge by the end of the simulated winter rainfall season. Following the storm event, the groundwater levels beneath the basin decline by approximately 3.18 m over a period of 164 days (Figure 10, Figure 11). This decline in groundwater level beneath the basin is matched by an expansion of the area affected by groundwater mounding (Figure 10). A peak increase in groundwater level of 2 m is modelled at the nearest structure and a mounding of 0.39 m at the house to the northwest (Figure 11).

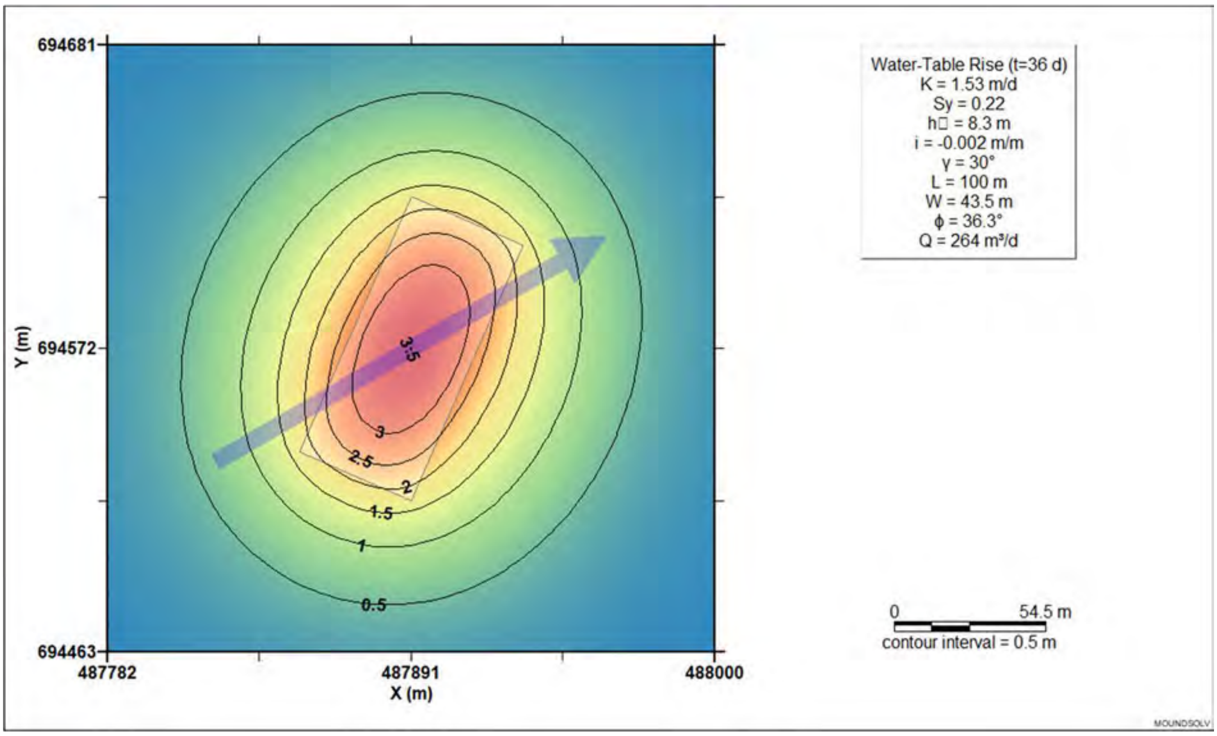


Figure 7: Calculated Mounding Contours at Basin A at the End of a Winter Season

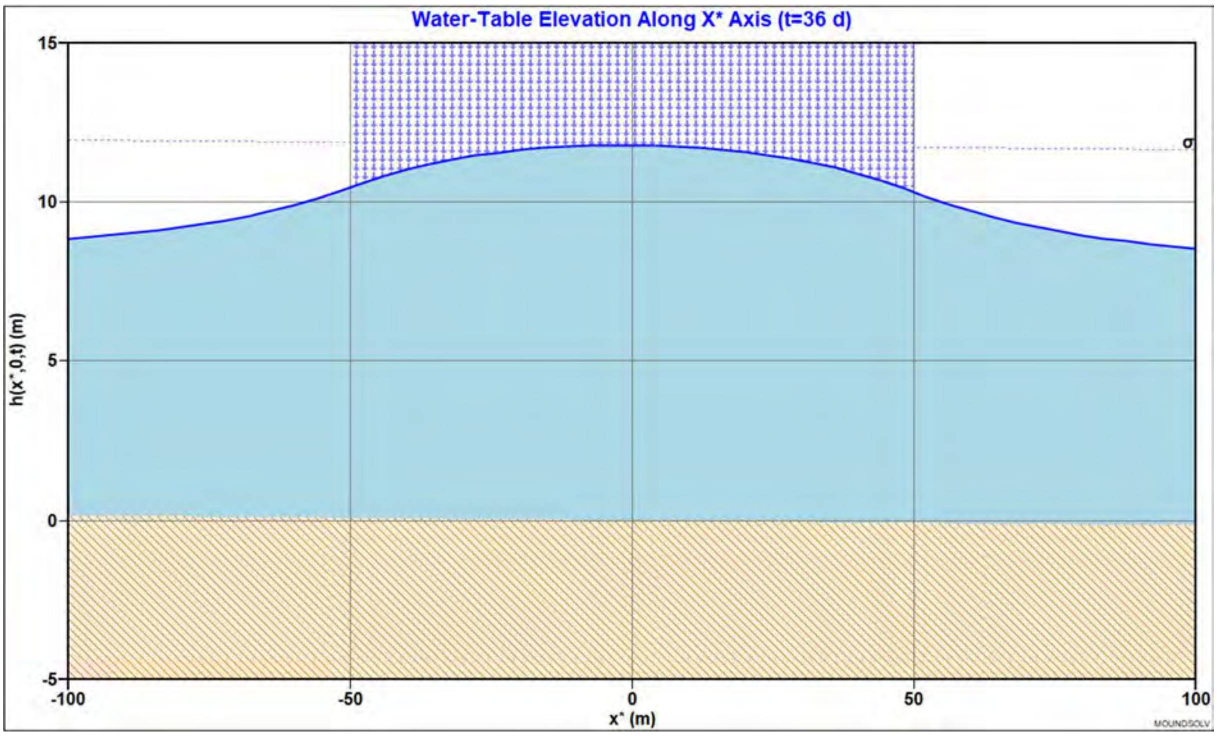


Figure 8: Calculated Mounding, Basin A, X-Axis Visualisation, Following a Winter Season

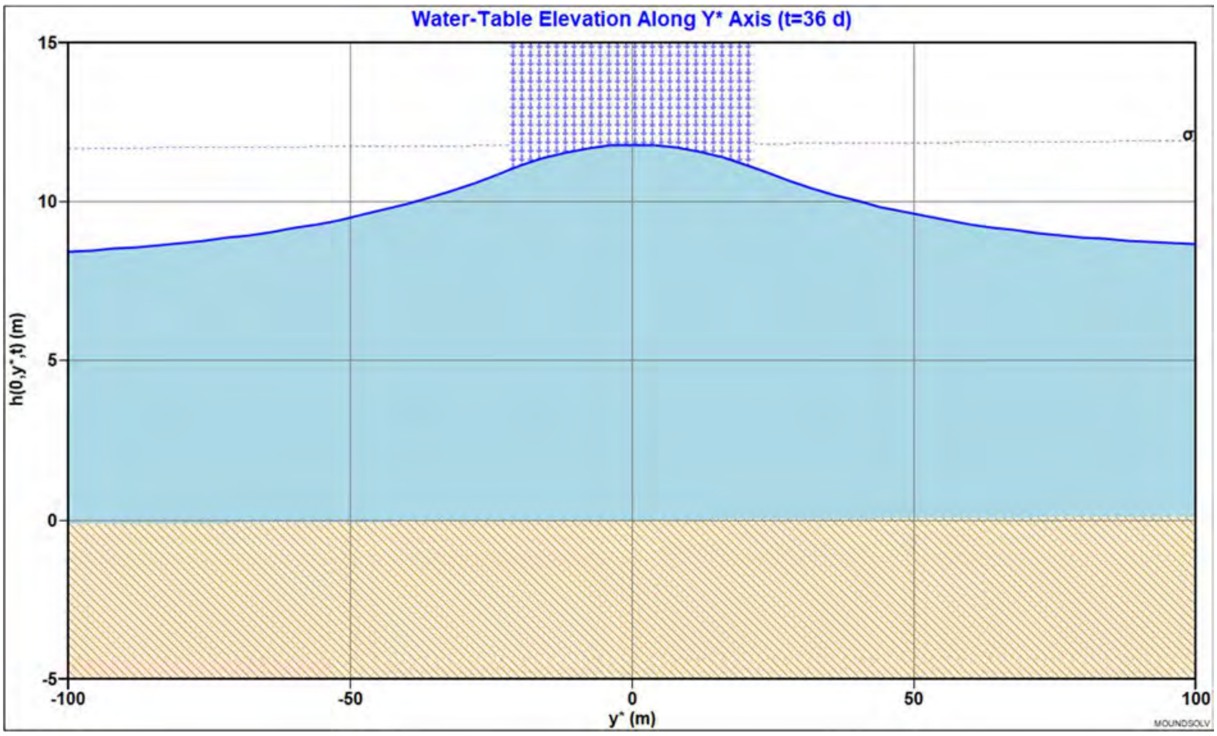


Figure 9: Calculated Mounding, Basin A, Y-Axis Visualisation, Following a Winter Season

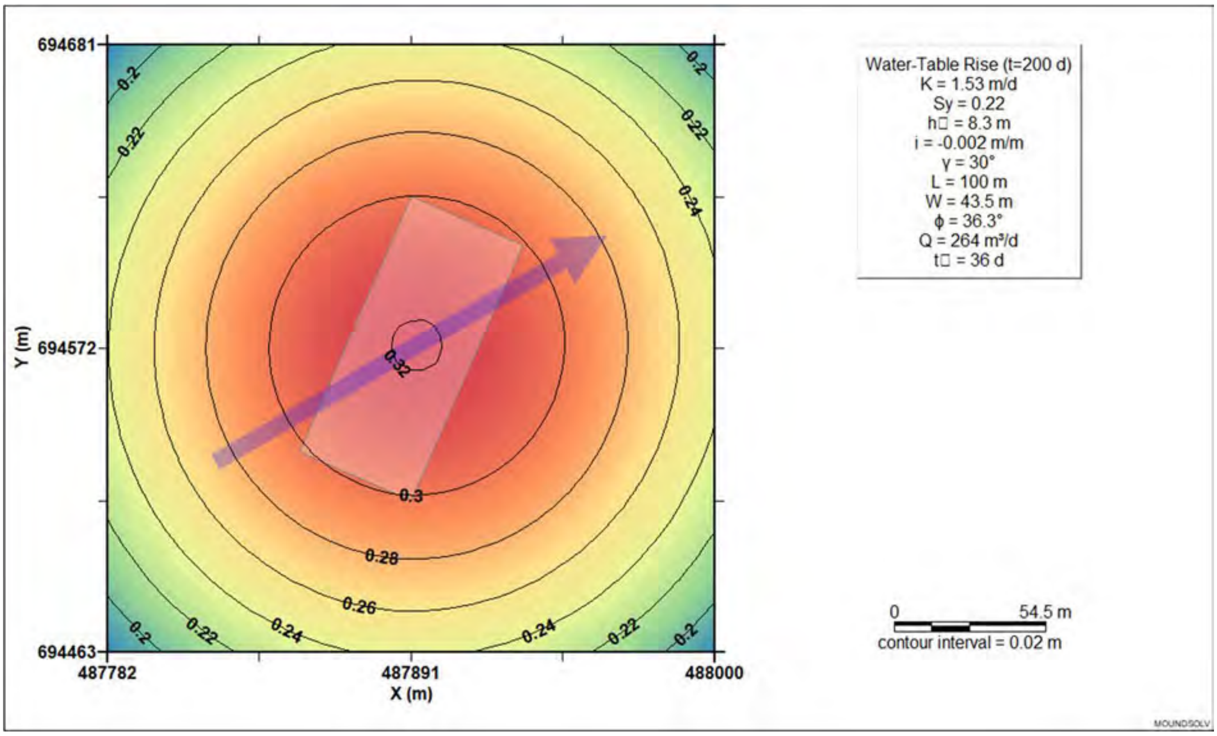


Figure 10: Calculated Mounding Contours at Basin A 164 days after a Winter Season

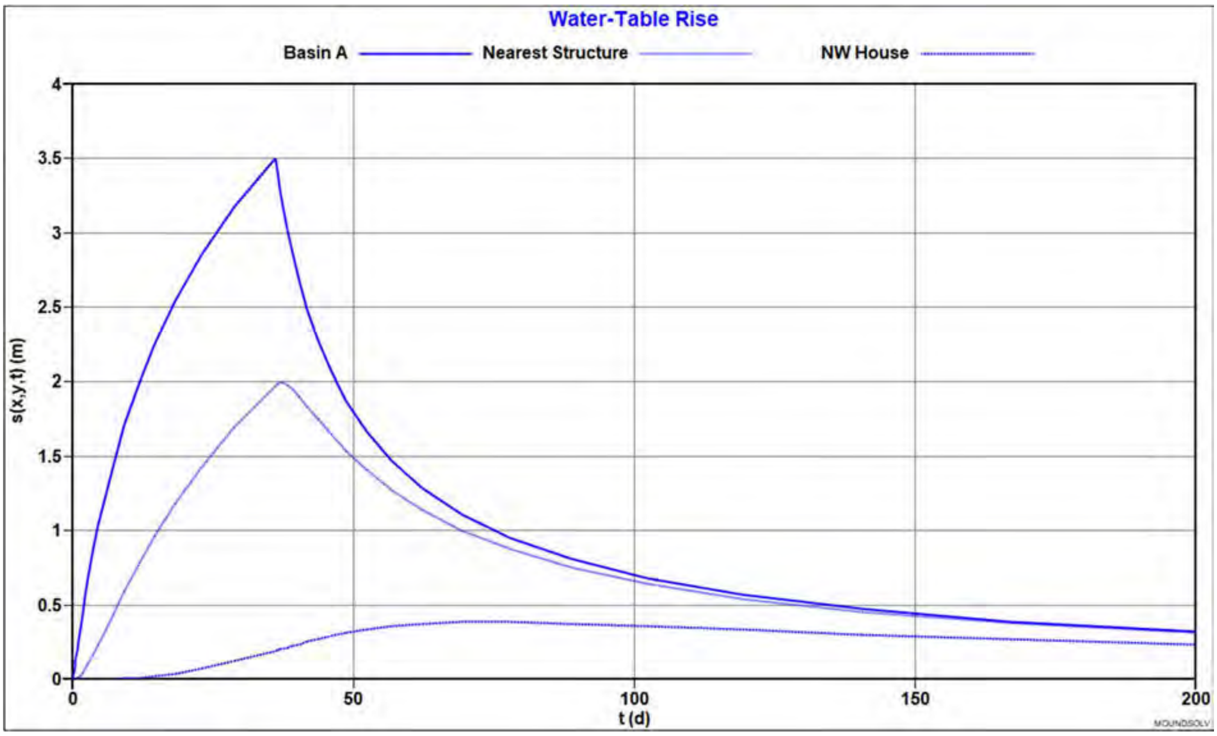


Figure 11: Groundwater Table Hydrographs at Basin A in Response to Winter Season

1.2 Basin C

1.2.1 Model Inputs

The site-specific input values for the mounding assessment for Basin C are presented in Table 3. The groundwater flow direction in relation to the orientation of Basin C is presented in Figure 12 with the location of the nearest structure to the site.

Table 3: Inputs for Mounding Assessment – Basin C

MODEL INPUT PARAMETER	SCENARIO 1: SHORT DURATION STORM	SCENARIO 2: WINTER SEASON	INFORMATION SOURCE
Length (m)	109		Maven basin design cross sections.
Width (m)	28		
Event Duration (days)	3	36	Scenario 1: 3-day 100 year ARI storm event duration. Scenario 2: Number of average winter rain days. (NIWA Hamilton, AWS rainfall station 2112).
Maximum Acceptable Groundwater Mounding Height (m)	2.0		Taken as the distance from the winter water table (derived from the piezometric surface) to the top of the basin specified in Maven basin design plans.
Aquifer Specific Yield (m^3/m^3)	0.22		Typical for aquifer type (Morris and Johnson 1967).
Aquifer Hydraulic Conductivity (m/day)	0.13		Calculated as the average of the last 4 values from CMW's soakage tests undertaken at SOA13 and SOA14 (CIRIA method).
Aquifer Gradient (m/m)	-0.0022		Calculated from interpreted winter piezometric surface.
Aquifer Dip Direction (degrees)	30		
Aquifer Saturated Thickness (m)	15		Estimated from CPT24-06.
Rotation of the Infiltration Basin Length (degrees)	-28.4		Taken from Maven basin design plans.

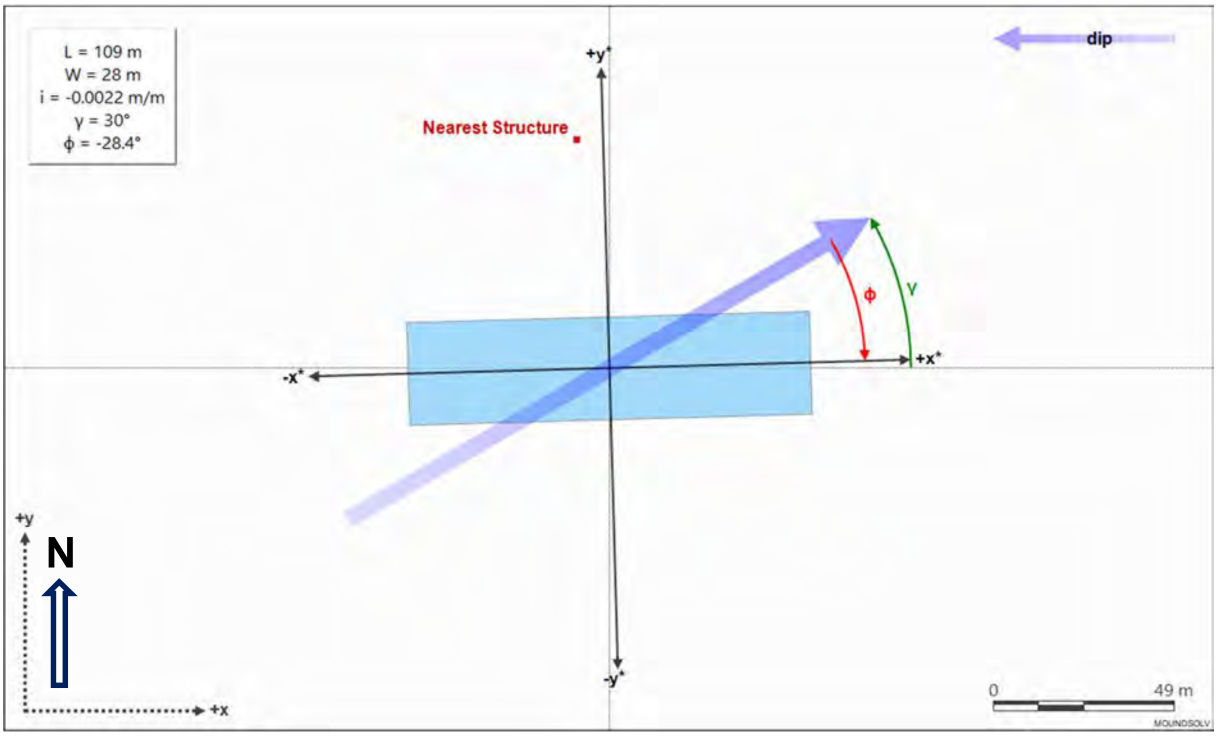


Figure 12: Basin C and Closest Structures Relative to Groundwater Flow Direction

1.2.2 Mounding Assessment Results

The results derived from the modelling of the two scenarios for Basin C are summarised in Table 4 with details in the following sections.

Modelled infiltration rates (Table 4) are considered to represent an average over the duration of the simulated rainfall event (3 days and 36 days). The water storage capacity of the stormwater pond has not been taken into account in the mounding assessment.

Table 4: Summary of Mounding Assessment Results for Basin C

MODEL OUTPUT	SCENARIO 1: SHORT DURATION STORM	SCENARIO 2: WINTER SEASON	NOTES
Modelled Infiltration Rate (m/d)	0.15	0.03 (1)	Modelled with water levels in the basin reaching the basin rim.
Maximum Modelled Mounding at Neighbouring Property Boundary (m)	0.08	0.39	Nearest Structure

Note: 1) The initial infiltration rate would be closer to the value indicated for Scenario 1. However, recharge rates would decrease toward the value indicated for Scenario 2.

1.2.2.1 Basin C Scenario 1

The calculated mounding contours Figure 13) and profiles (Figure 14 and Figure 15) indicate groundwater mounding would not extend beyond 25 m from the basin edge by the end of the 3-day rainfall event, with water levels in the pond not exceeding the 100 year ARI water level. Following the storm event, the groundwater levels beneath the basin decline by approximately 1.3 m over a period of 47 days (Figure 16, Figure 17). This decline in groundwater level beneath the basin is matched by an expansion of the area affected by groundwater mounding (Figure 16). A peak increase in groundwater level of 0.08 m is modelled at the nearest structure (Figure 17).

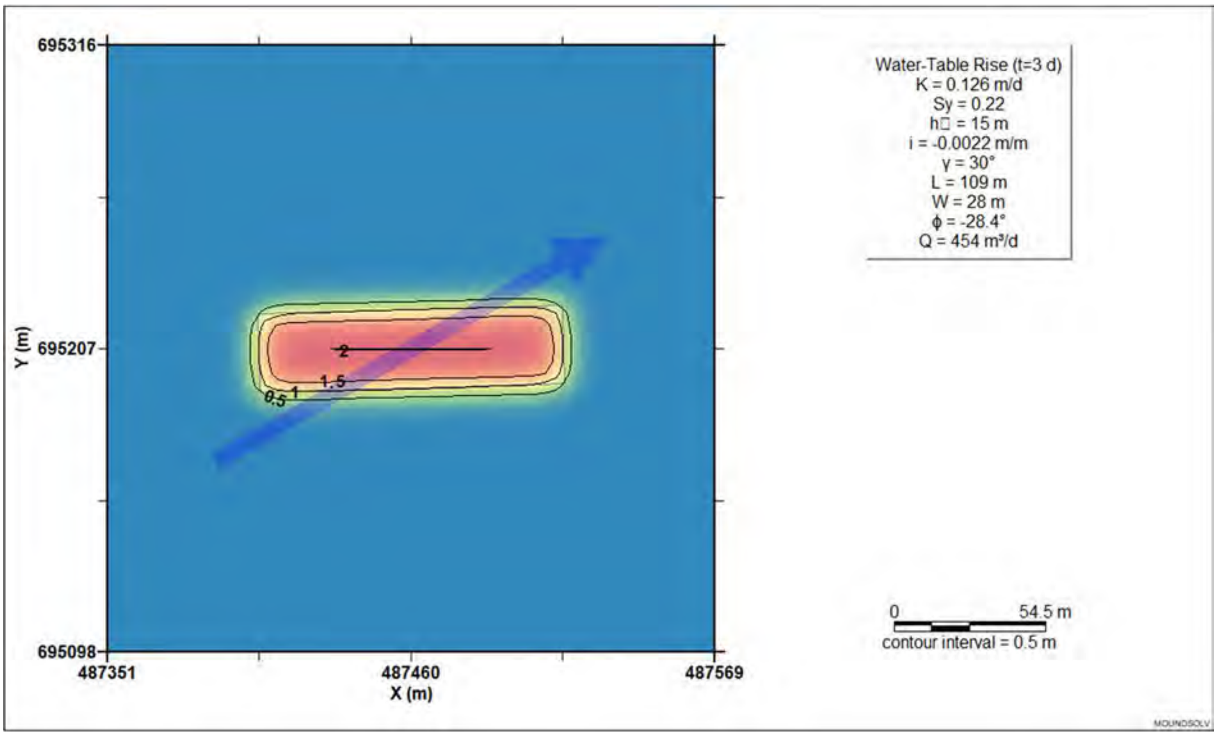


Figure 13: Calculated Mounding Contours at Basin C at the End of a 3-day Storm Event

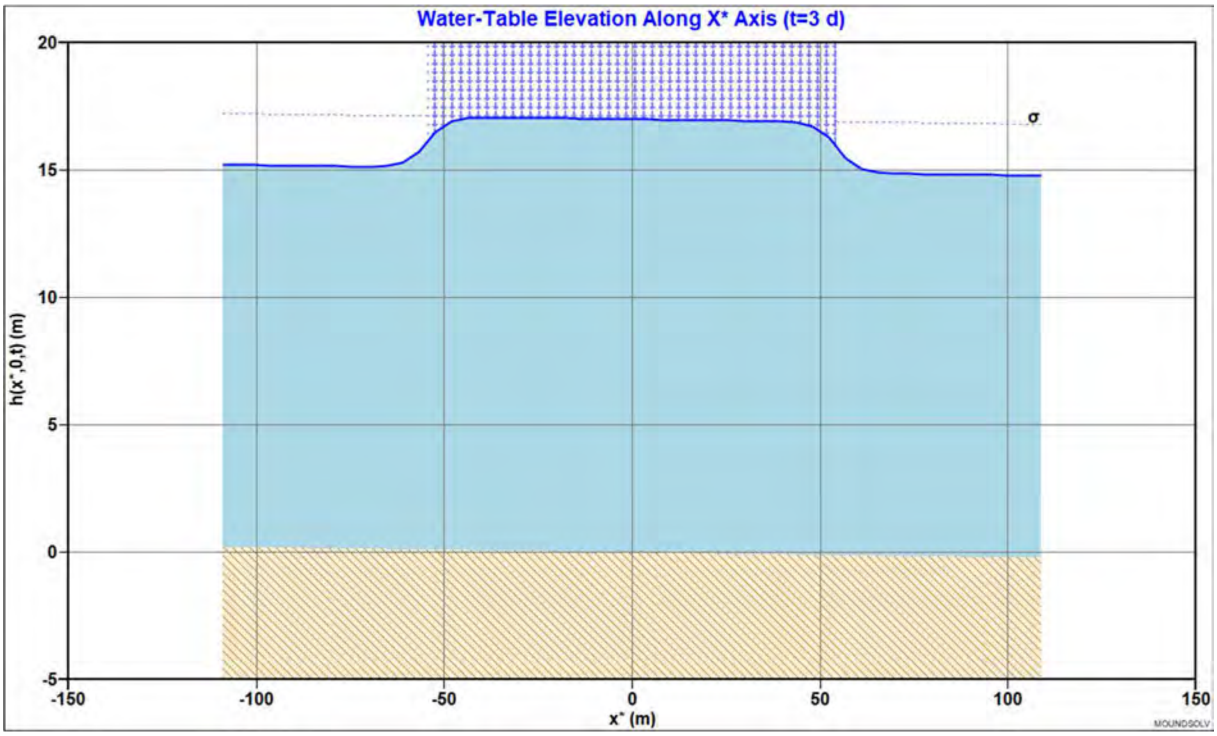


Figure 14: Calculated Mounding, Basin C, X-Axis Visualisation, Following a 3-day Storm Event

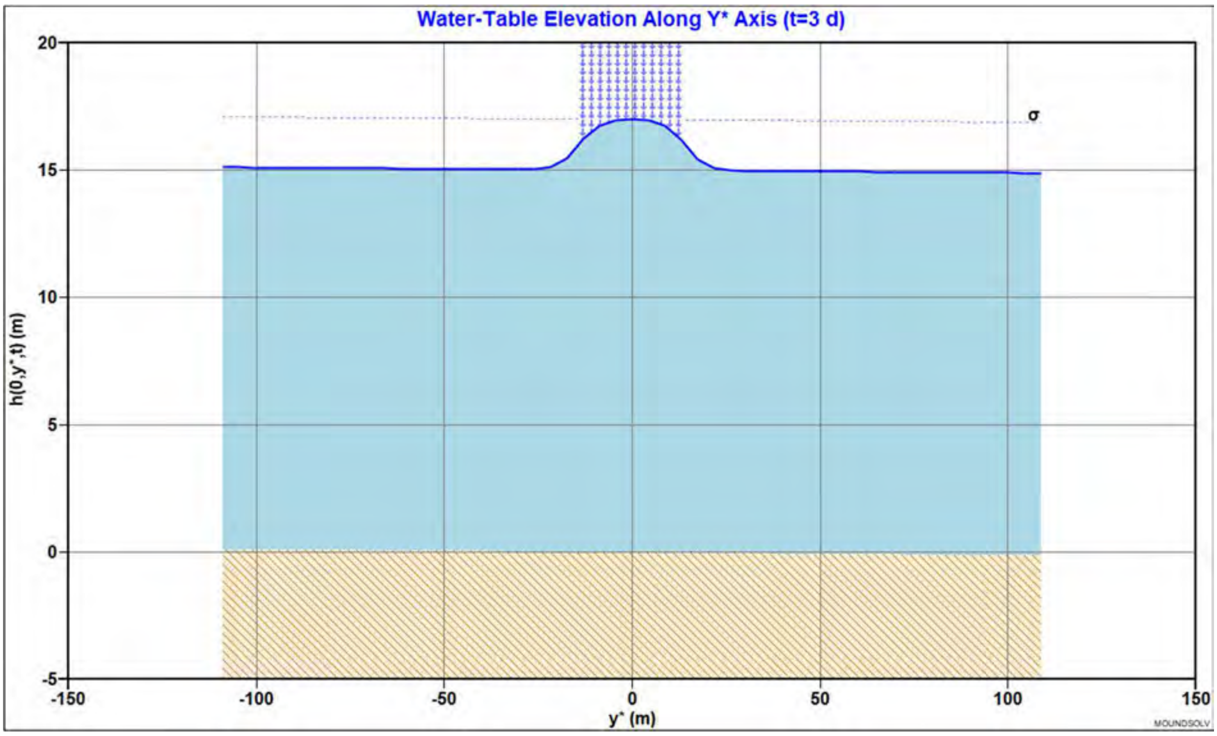


Figure 15: Calculated Mounding, Basin C, Y-Axis Visualisation, Following a 3-day Storm Event

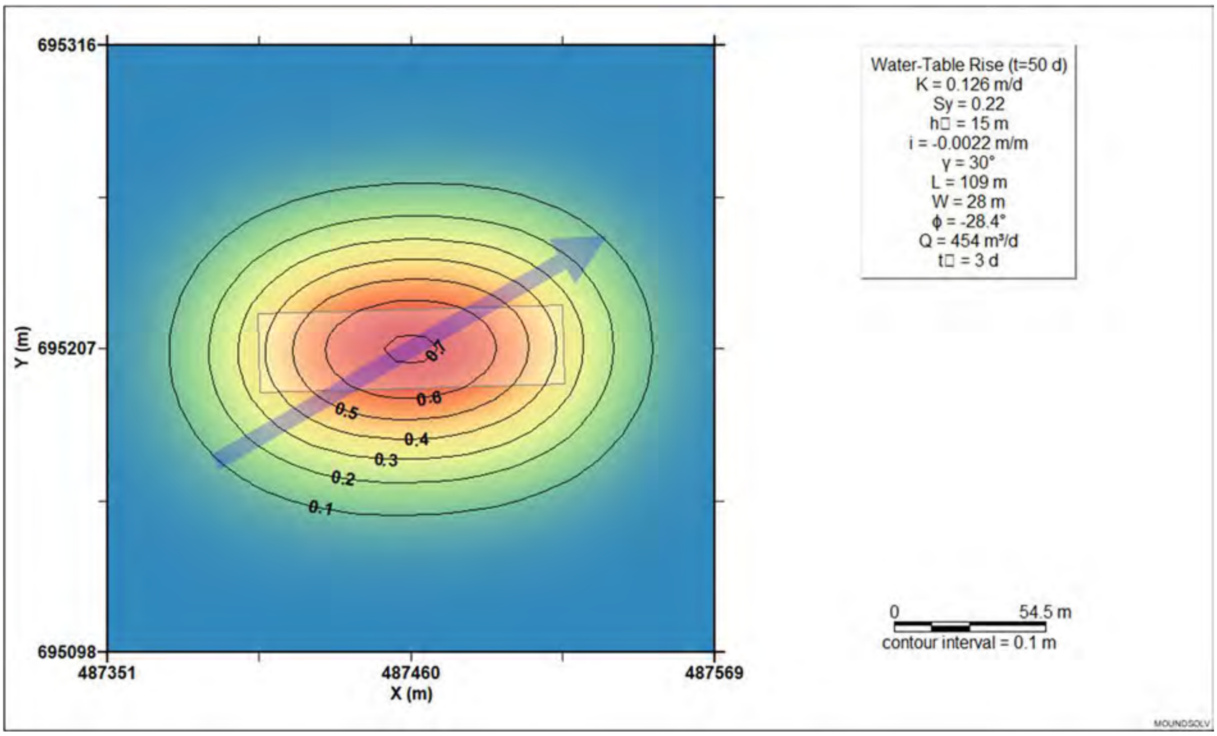


Figure 16: Calculated Mounding Contours at Basin C, 47 days After a 3-day Storm Event

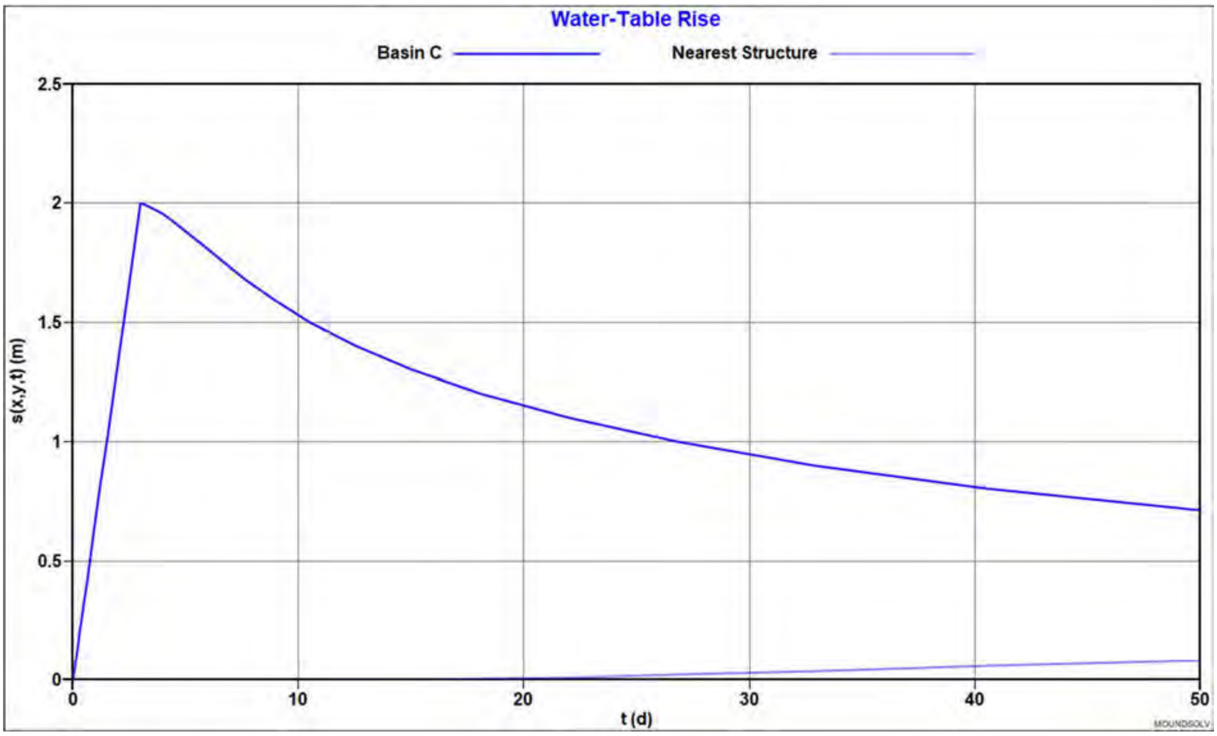


Figure 17: Groundwater Table Hydrographs at Basin C in Response to 3 Day Event

1.2.2.2 Basin C Scenario 2

The calculated mounding contours (Figure 18) and profiles (Figure 19 and Figure 20) indicate groundwater mounding would not extend beyond 150 m from the basin edge by the end of the simulated winter rainfall season. Following the storm event, the groundwater levels beneath the basin decline by approximately 1.65 m over a period of 164 days (Figure 21, Figure 22). This decline in groundwater level beneath the basin is matched by an expansion of the area affected by groundwater mounding (Figure 21). A peak increase in groundwater level of 2 m is modelled at the nearest structure and a mounding of 0.39 m at the nearest structure (Figure 22).

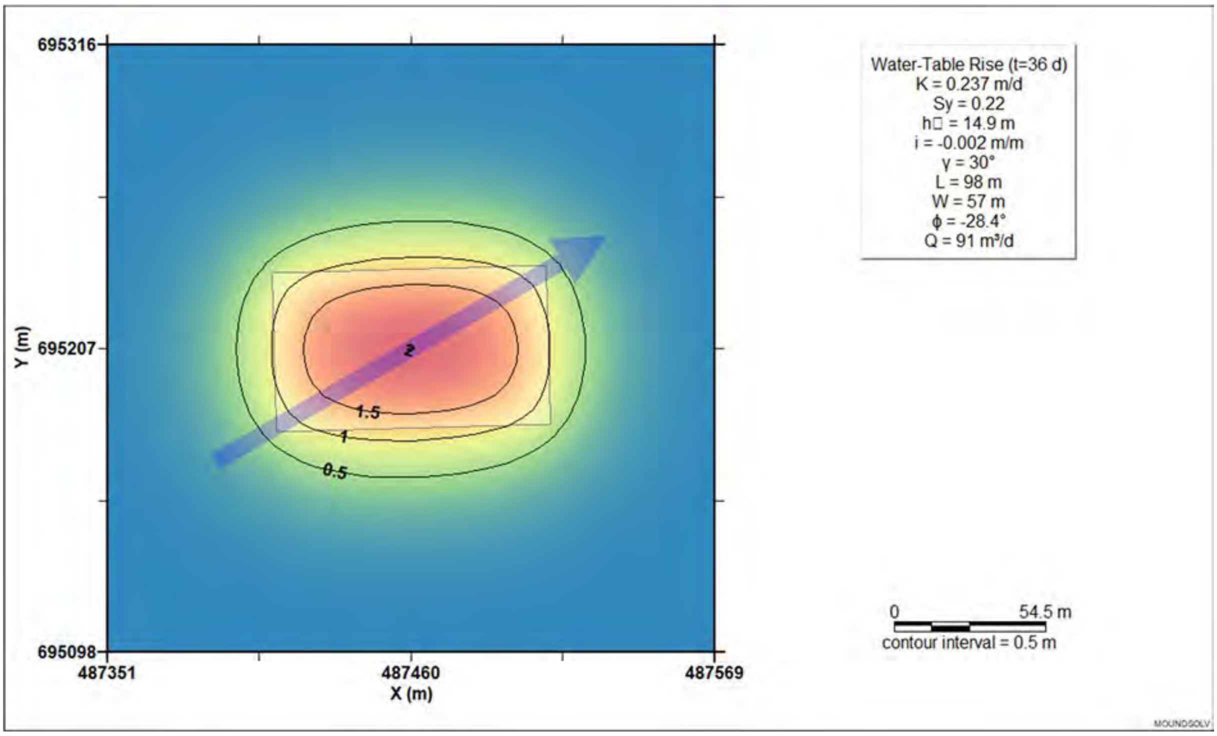


Figure 18: Calculated Mounding Contours at Basin C at the End of a Winter Season

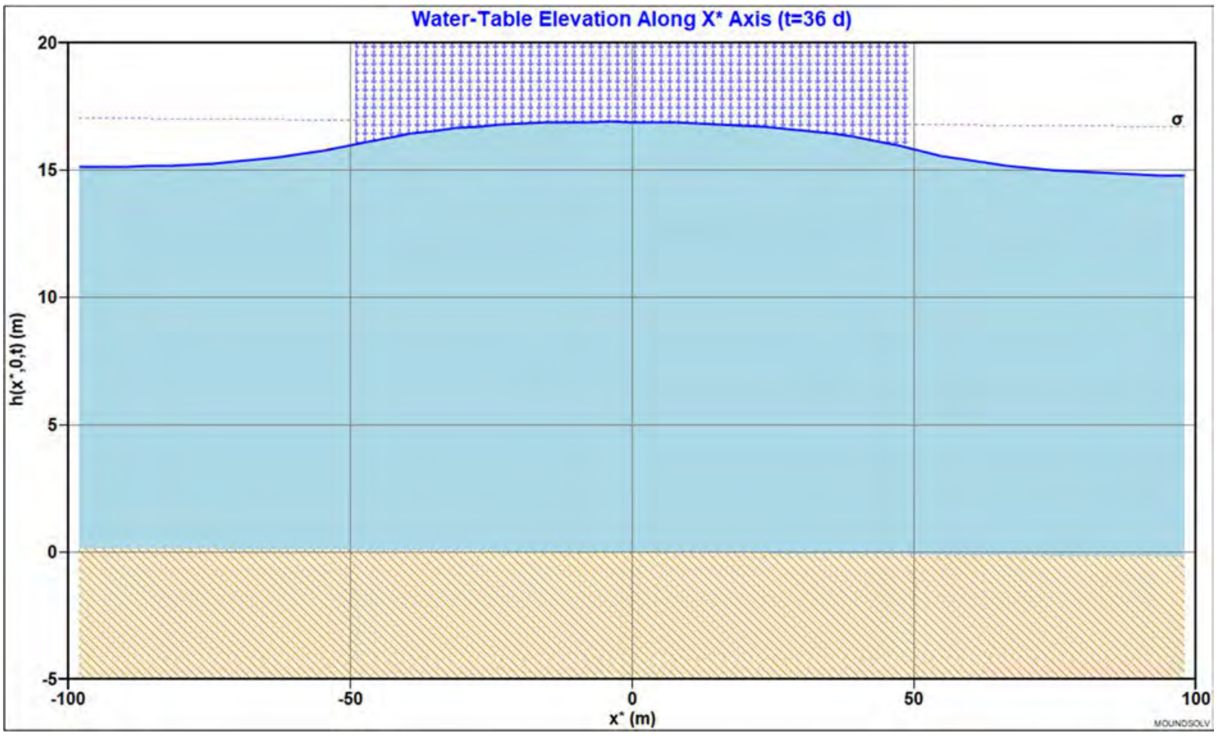


Figure 19: Calculated Mounding, Basin C, X-Axis Visualisation, Following a Winter Season

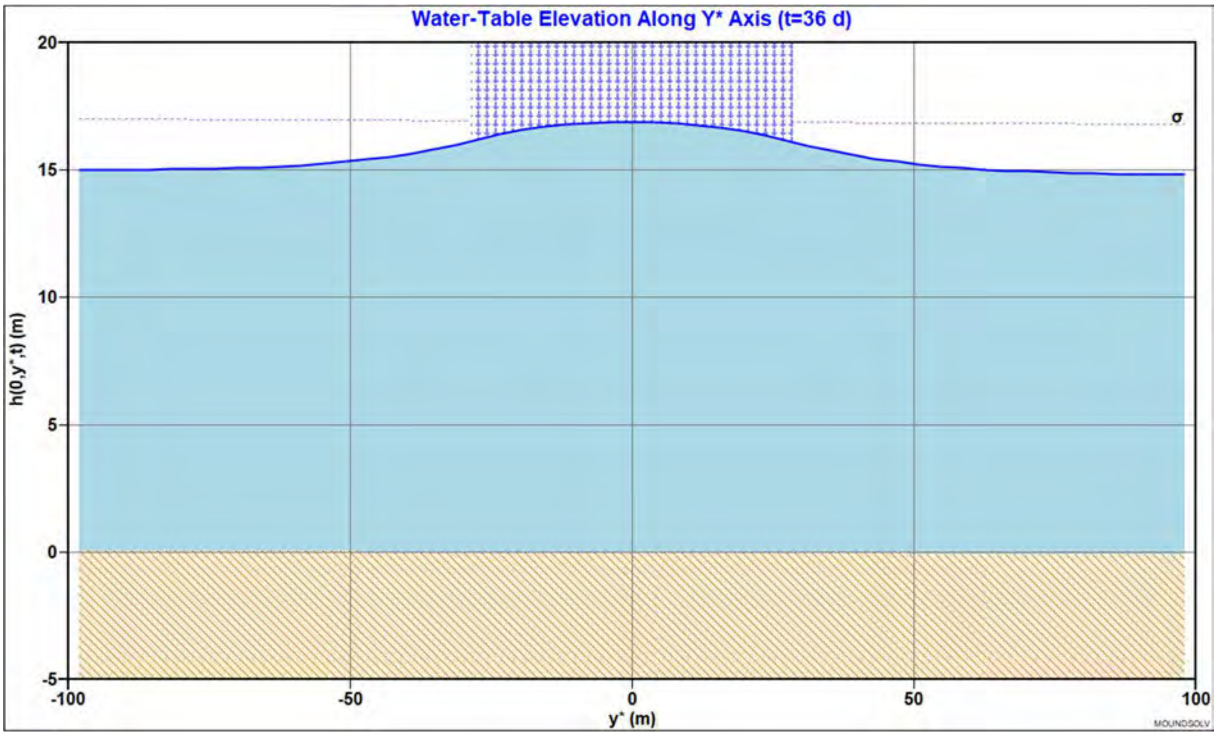


Figure 20: Calculated Mounding, Basin C, Y-Axis Visualisation, Following a Winter Season

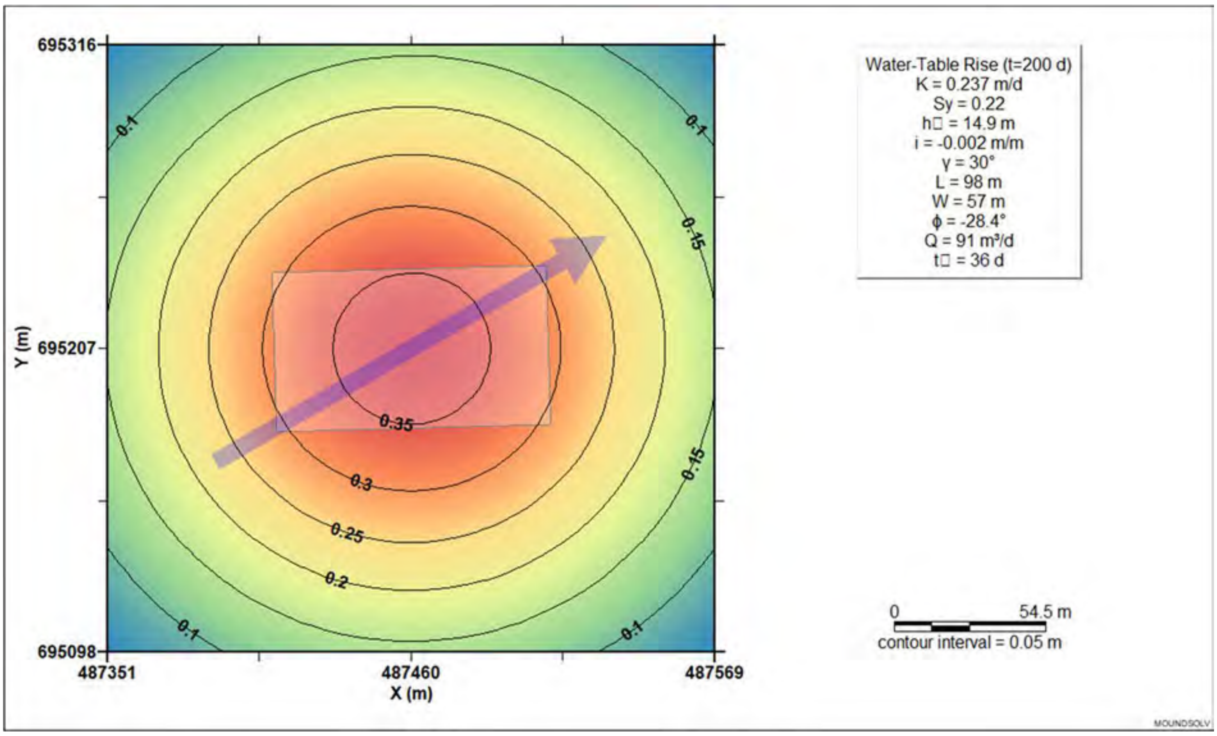


Figure 21: Calculated Mounding Contours at Basin C 164 days after a Winter Season

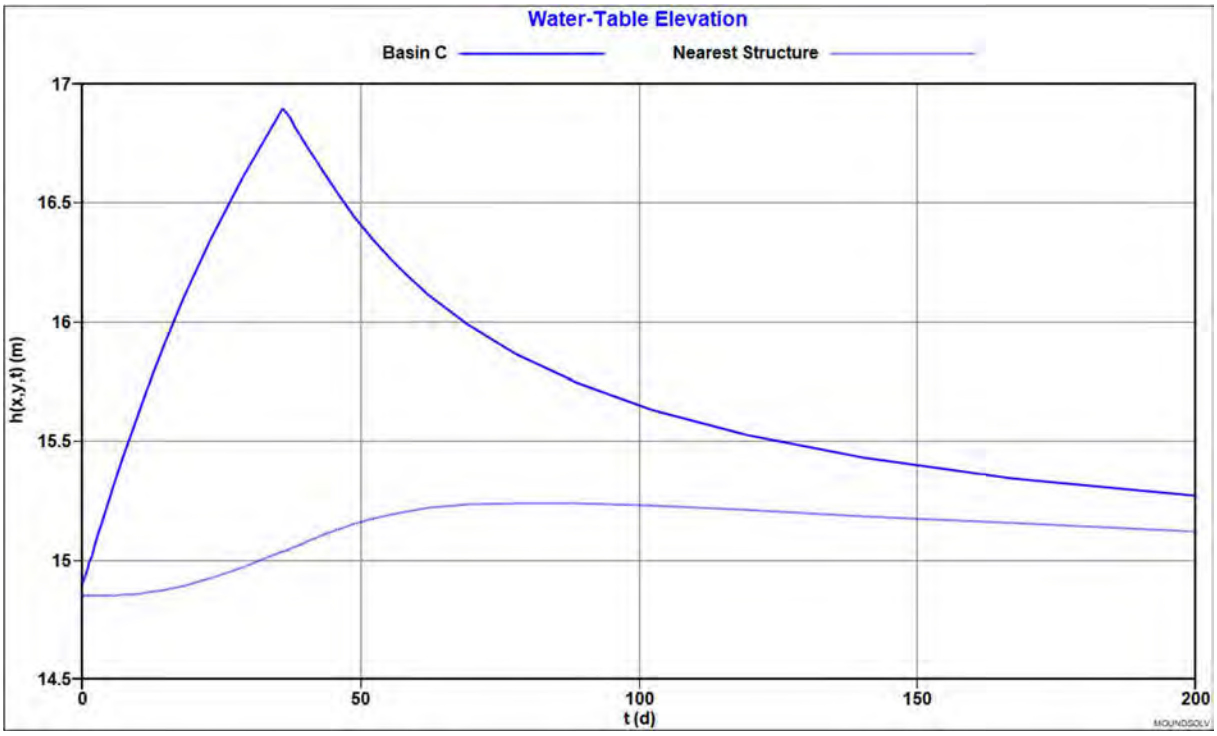


Figure 22: Groundwater Table Hydrographs at Basin C in Response to Winter Season

1.3 Basin D

1.3.1 Model Inputs

The site-specific input values for the mounding assessment for Basin D are presented in Table 5. The groundwater flow direction in relation to the orientation of Basin D is presented in Figure 23 with the location of the 3 nearest buildings to the site. Due to its non-rectangular shape basin D was modelled as a rectangle with roughly the same dimensions as basin D and equal surface area.

Table 5: Inputs for Mounding Assessment – Basin D

MODEL INPUT PARAMETER	SCENARIO 1: SHORT DURATION STORM	SCENARIO 2: WINTER SEASON	INFORMATION SOURCE
Length (m)	107		Maven basin design cross sections
Width (m)	59		
Event Duration (days)	3	36	Scenario 1: 3-day 100 year ARI storm event duration. Scenario 2: Number of average winter rain days. (NIWA Hamilton, AWS rainfall station 2112).
Maximum Acceptable Groundwater Mounding Height (m)	2		Taken as the distance from the winter water table (derived from the piezometric surface) to the top of the basin specified in Maven basin design plans.
Aquifer Specific Yield (m^3/m^3)	0.22		Typical for aquifer type (Morris and Johnson 1967)
Aquifer Hydraulic Conductivity (m/day)	0.24		Calculated as the average of the last 4 values from CMW's soakage tests undertaken at SOA15 and SOA16 (CIRIA method).
Aquifer Gradient (m/m)	-0.0022		Calculated from interpreted winter piezometric surface.
Aquifer Dip Direction (degrees)	30		
Aquifer Saturated Thickness (m)	15		Estimated from CPT24-06
Rotation of the Infiltration Basin Length (degrees)	-55		Taken from Maven basin design plans
Hydraulic Conductivity (m/day)	0.24		Calculated as the average of the last 4 values from CMW's soakage tests undertaken at SOA15 and SOA16 (CIRIA method).

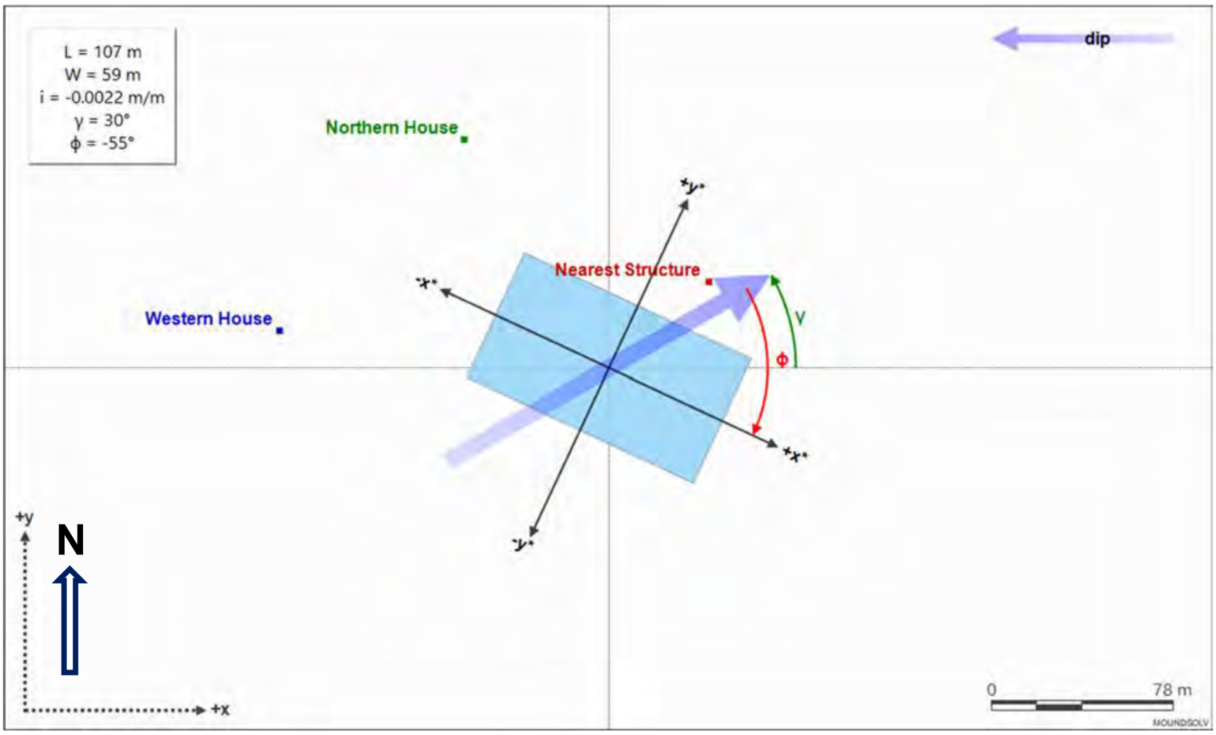


Figure 23: Basin D and Closest Structures Relative to Groundwater Flow Direction

1.3.2 Mounding Assessment Results

The results derived from the modelling of the two scenarios for Basin D are summarised in Table 6 with details in the following sections.

Modelled infiltration rates (Table 6) are considered to represent an average over the duration of the simulated rainfall event (3 days and 36 days). The water storage capacity of the stormwater pond has not been taken into account in the mounding assessment.

Table 6: Summary of Mounding Assessment Results for Basin D

MODEL OUTPUT	SCENARIO 1: SHORT DURATION STORM	SCENARIO 2: WINTER SEASON	NOTES
Modelled Infiltration Rate (m/d)	0.15	0.02 (1)	Modelled with water levels in the basin reaching the basin rim.
Maximum Modelled Mounding at Neighbouring Property Boundary (m)	0.4	0.52	Nearest Structure
	0.05	0.15	Northern House
	0.01	0.09	Western House

Note: 1) The initial infiltration rate would be closer to the value indicated for Scenario 1. However, recharge rates would decrease toward the value indicated for Scenario 2.

1.3.2.1 Basin D Scenario 1

The calculated mounding contours (Figure 24) and profiles (Figure 25 and Figure 26) indicate groundwater mounding would not extend beyond 100 m from the basin edge by the end of the 3-day rainfall event. Following the storm event, the groundwater levels beneath the basin decline by approximately 3.1 m over a period of 47 days (Figure 27, Figure 28). This decline in groundwater level beneath the basin is matched by an expansion of the area affected by groundwater mounding
(Figure 27). A peak increase in groundwater level of 0.4 m is modelled at the nearest structure, an increase of 0.05 m at the house to the northwest and an increase of 0.01 m at the house to the west (Figure 28).

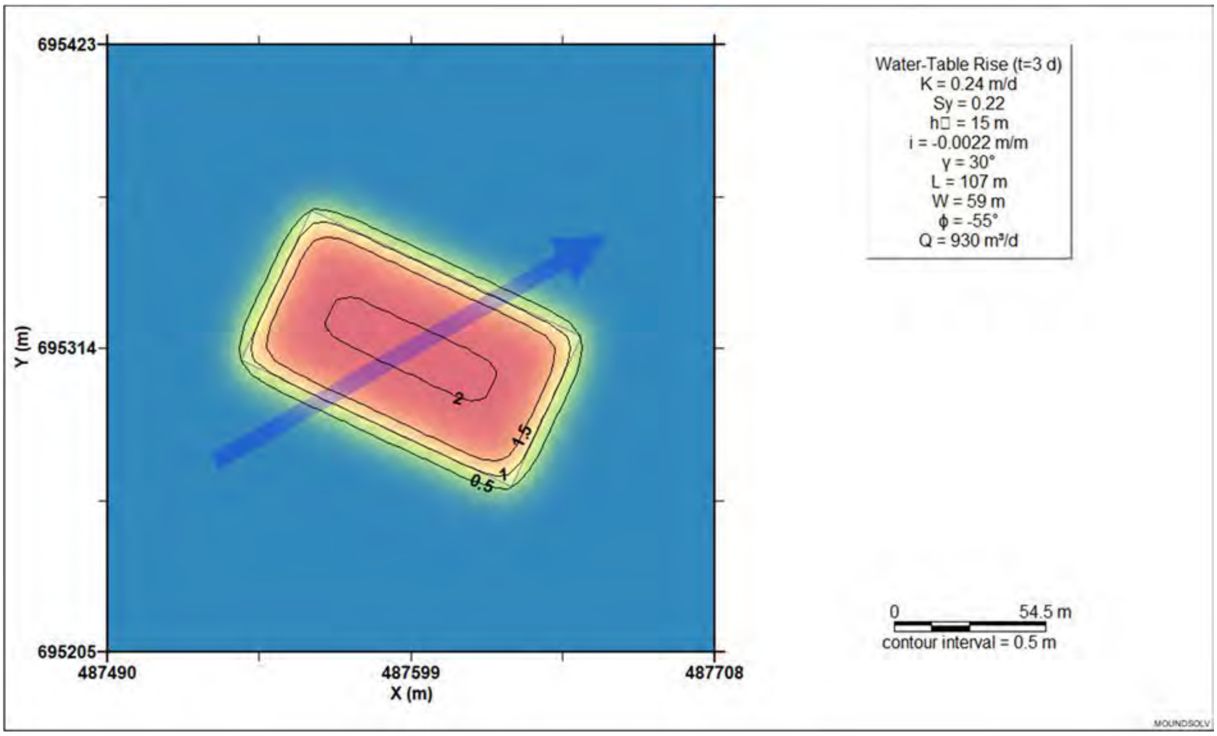


Figure 24: Potential Mounding Contours at Basin D at the End of a 3-day Storm Event

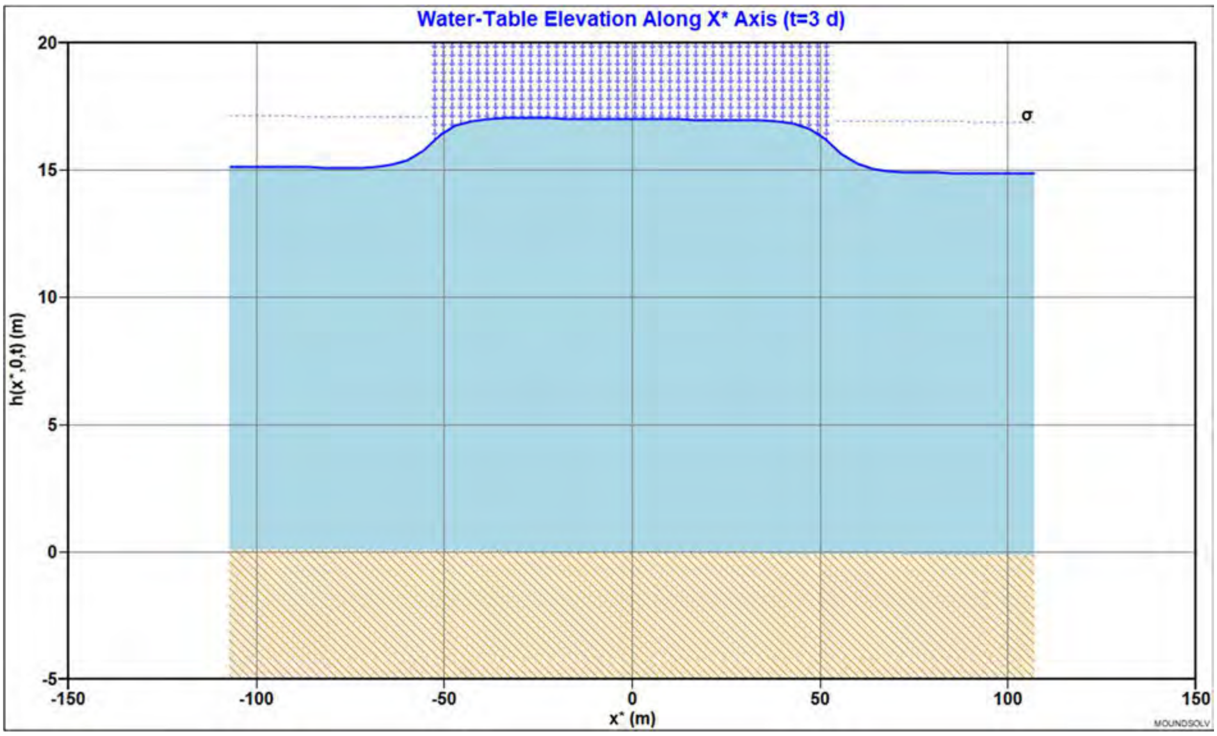


Figure 25: Calculated Mounding, Basin D, X-Axis Visualisation Following a 3-day Storm Event

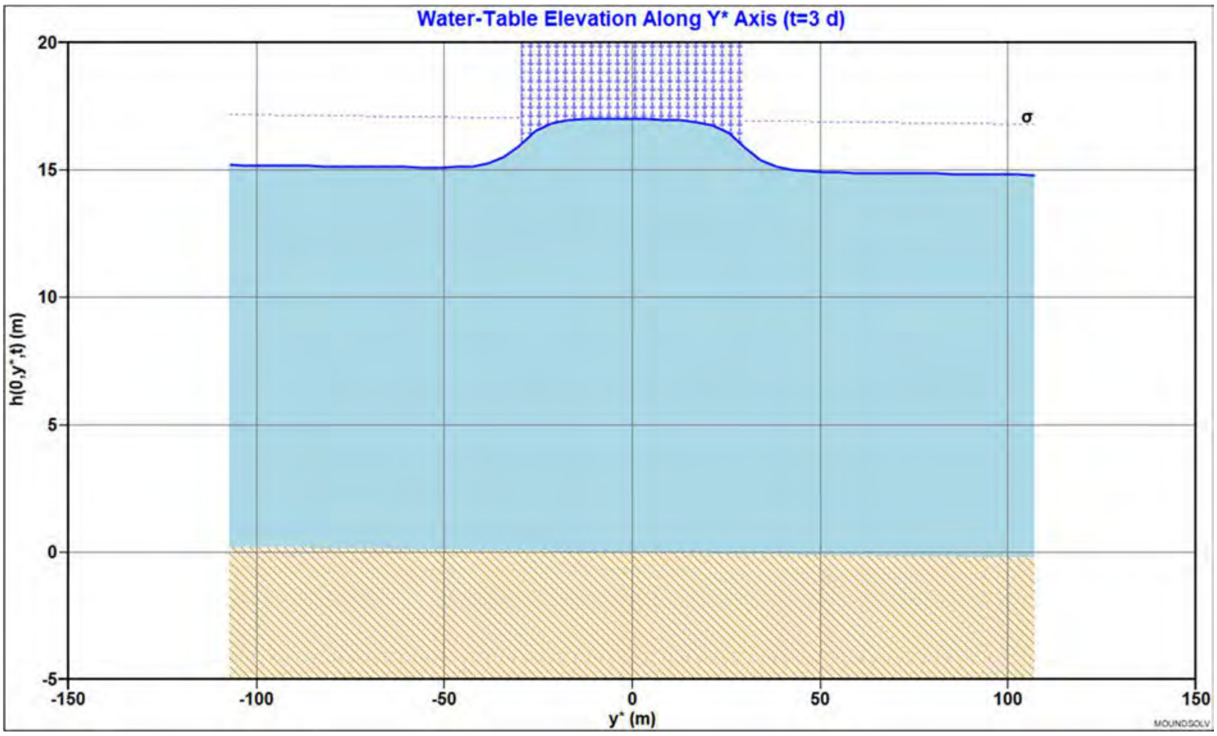


Figure 26: Calculated Mounding, Basin D, Y-Axis Visualisation Following a 3-day Storm Event

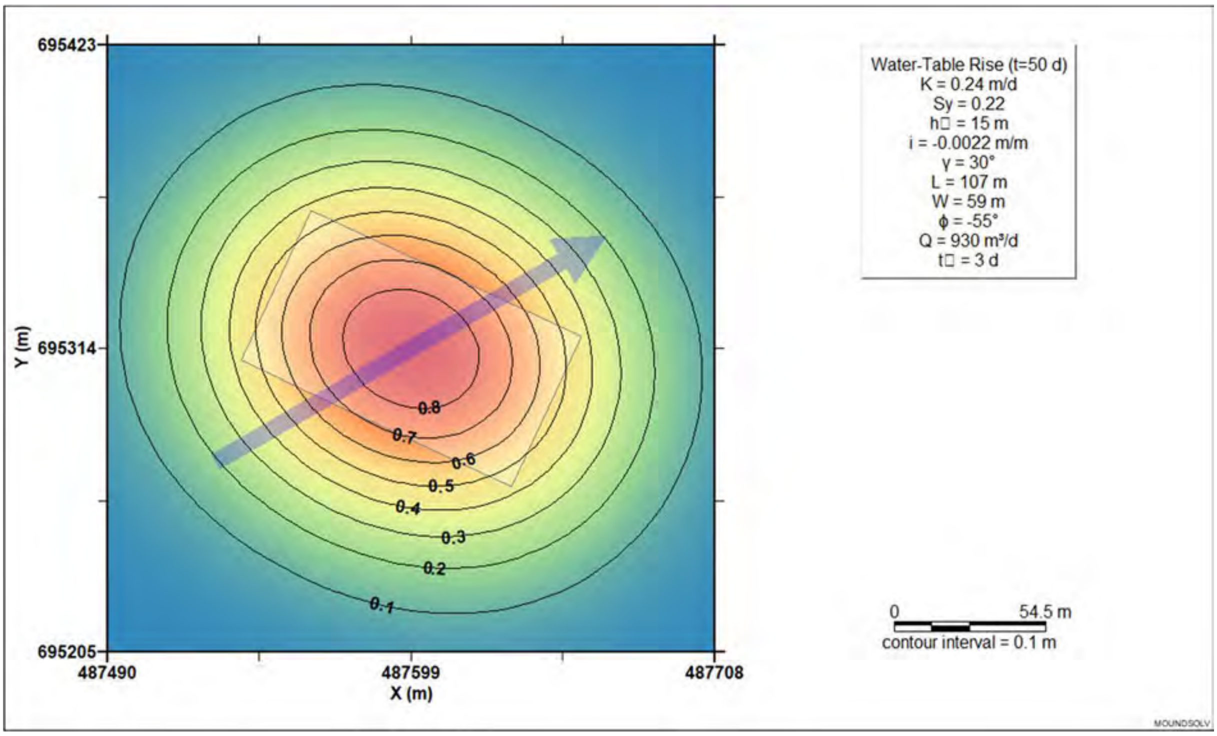


Figure 27: Calculated Mounding Contours at Basin D, 47 days After a 3-day Storm Event

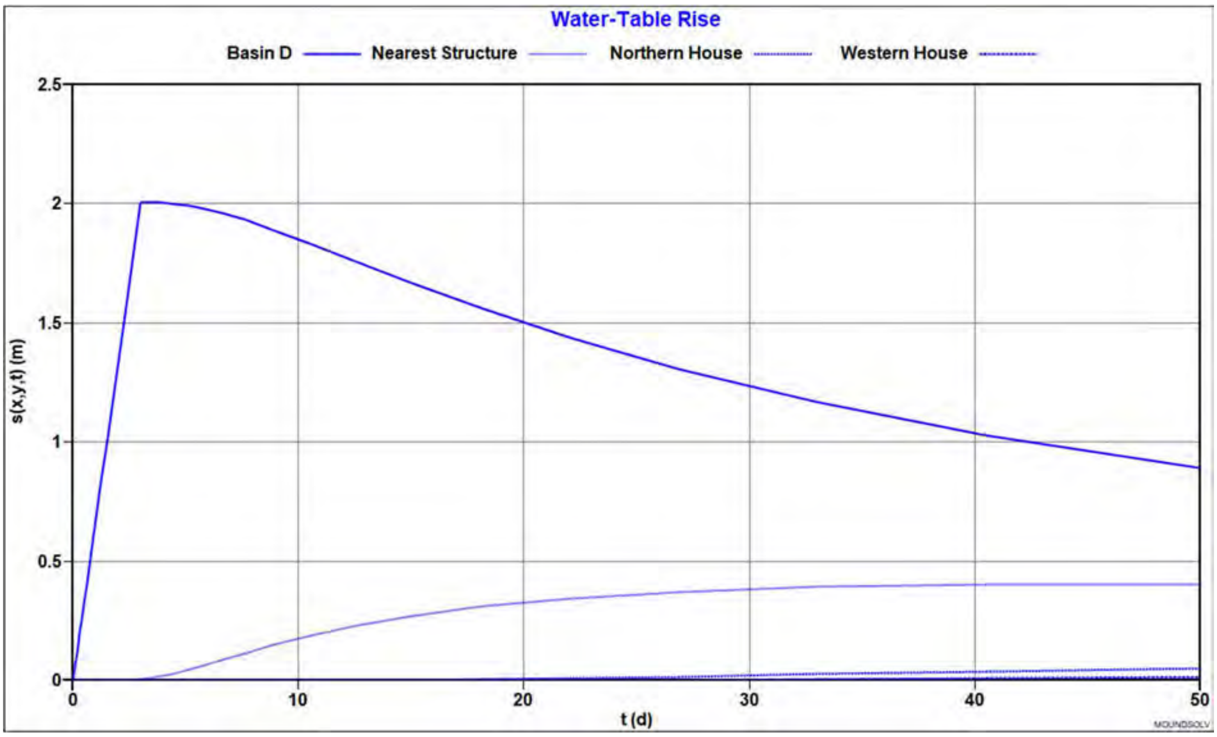


Figure 28: Groundwater Table Hydrographs at Basin D in Response to 3 Day Event

1.3.2.2 Basin D Scenario 2

The calculated mounding contours (Figure 29) and profiles (Figure 30 and Figure 31) indicate groundwater mounding would not extend beyond 200 m from the basin edge by the end of the simulated winter rainfall season. Following the storm event, the groundwater levels beneath the basin decline by approximately 1.65 m over a period of 164 days (Figure 32, Figure 33). This decline in groundwater level beneath the basin is matched by an expansion of the area affected by groundwater mounding (Figure 32). A peak increase in groundwater level of 0.52 m is modelled at the nearest structure, an increase of 0.15 m at the house to the north and an increase of 0.09 m at the house to the west (Figure 33).

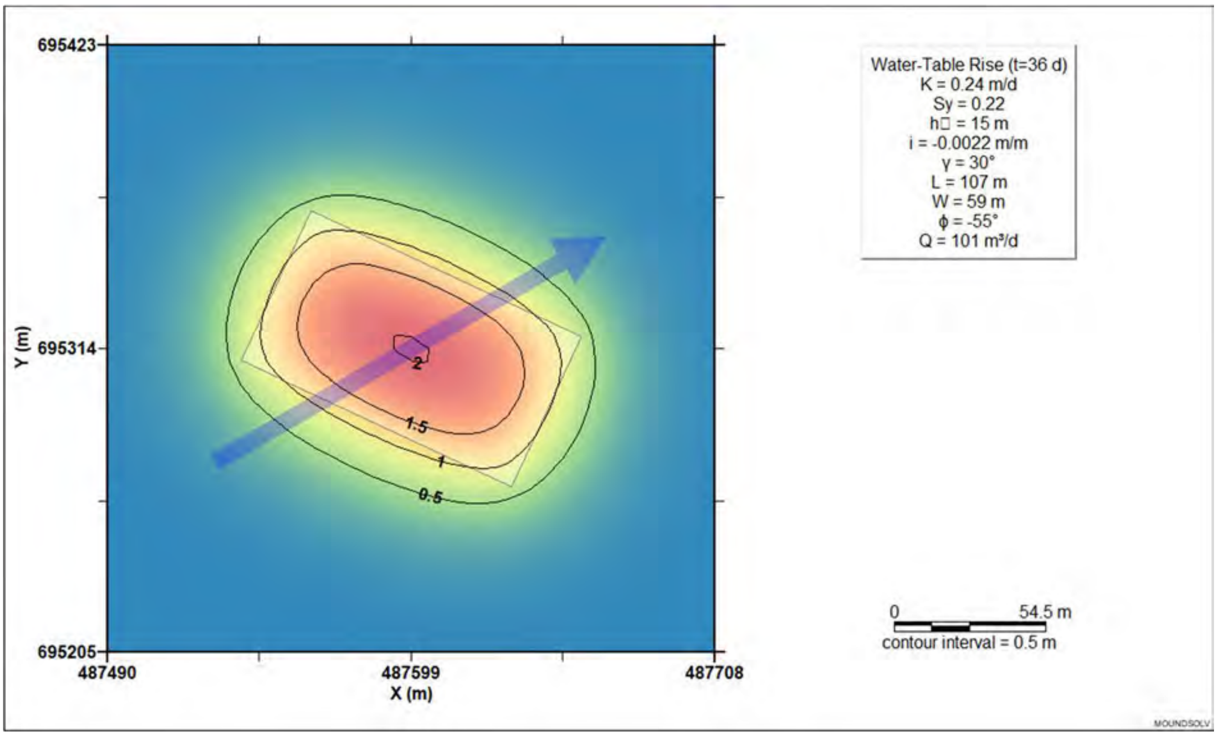


Figure 29: Calculated Mounding Contours at Basin D at the End of a Winter Season

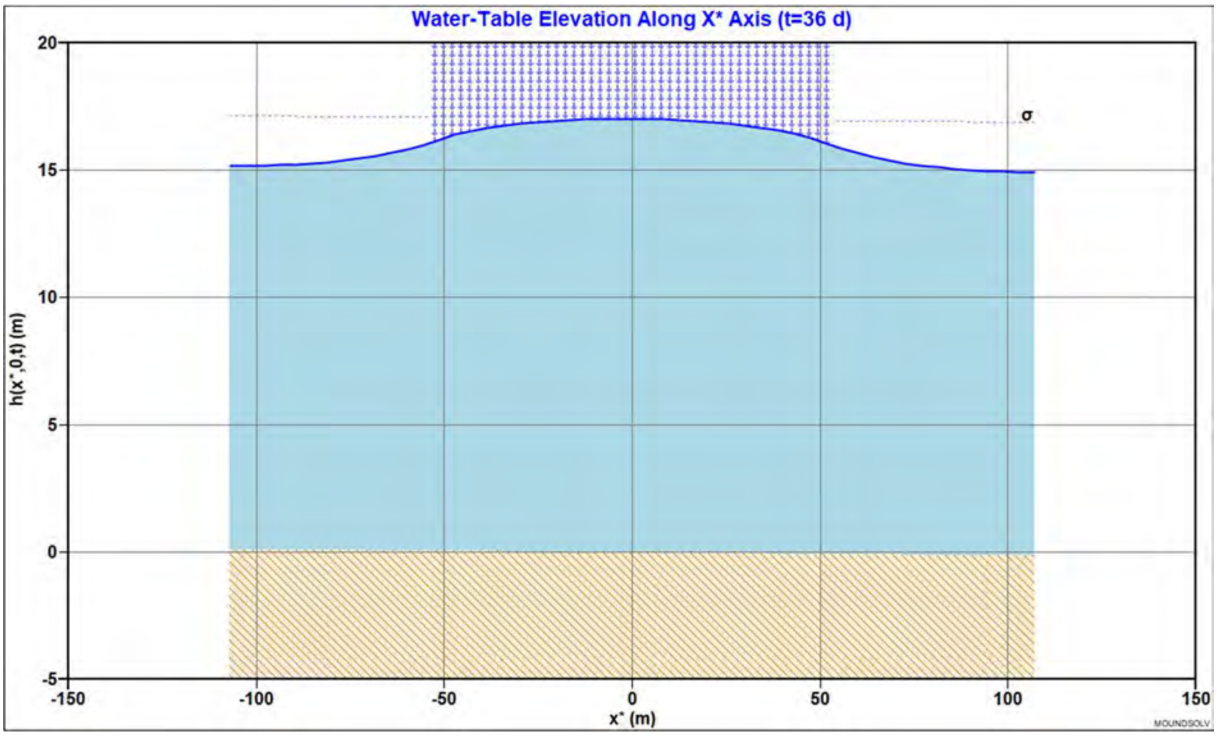


Figure 30: Calculated Mounding, Basin D, X-Axis Visualisation, Following a Winter Season

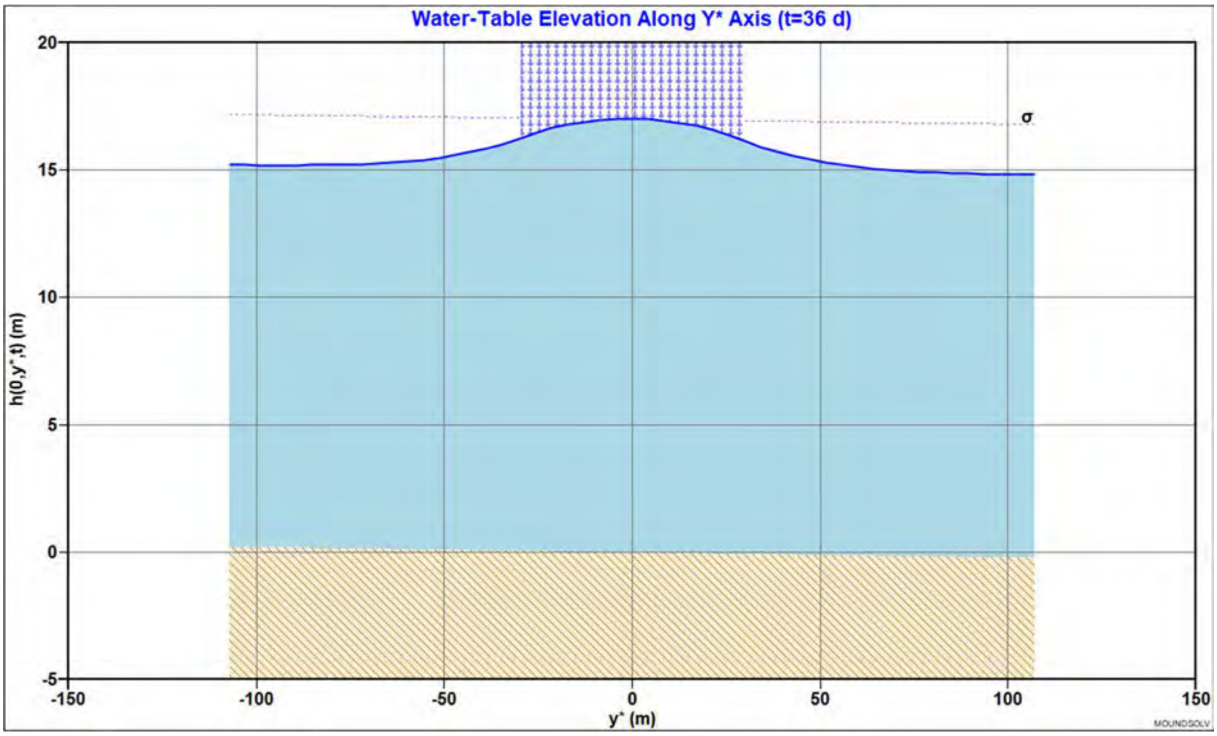


Figure 31: Calculated Mounding, Basin D, Y-Axis Visualisation, Following a Winter Season

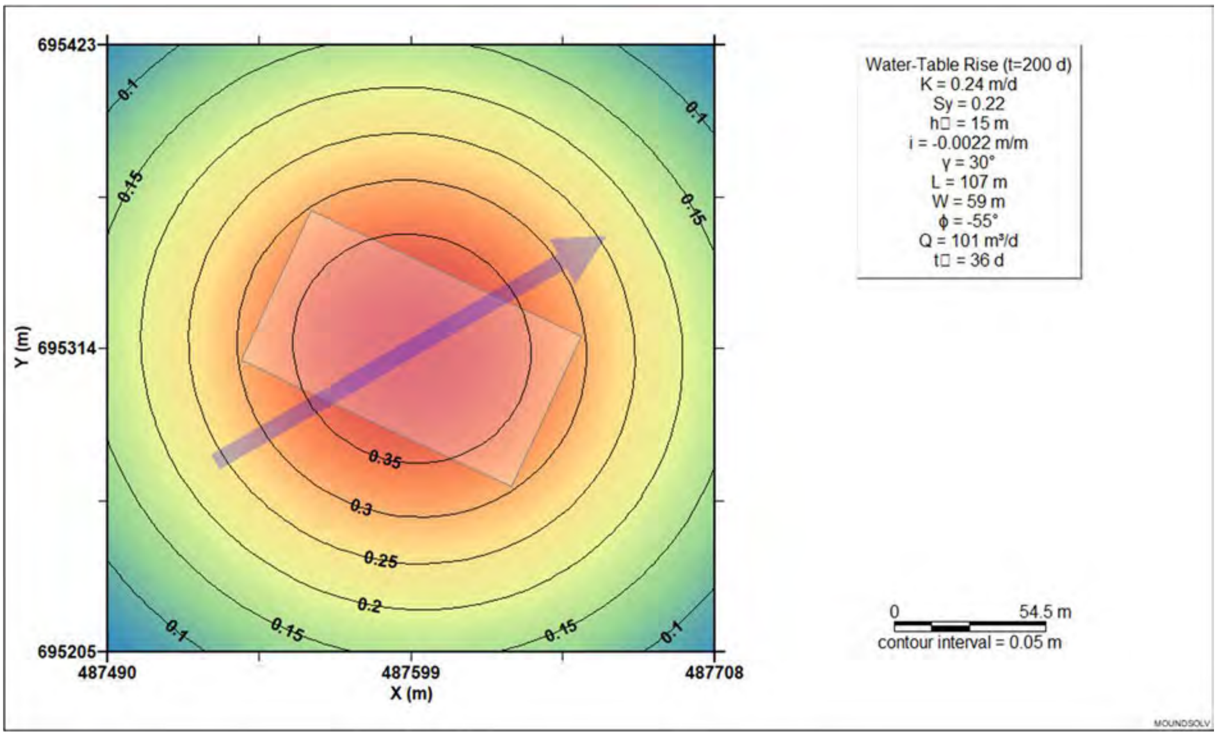


Figure 32: Calculated Mounding Contours at Basin D 164 days after a Winter Season

Figure 33: Groundwater Table Hydrographs at Basin D in Response to Winter Season

1.4 Basin RV1

1.4.1 Model Inputs

The site-specific input values for the Basin RV1 groundwater mounding assessment presented in Table 7. The groundwater flow direction in relation to the orientation of Basin RV1 is presented in Figure 34 with the location of the nearest buildings to the site.

Table 7: Inputs for Mounding Assessment – Basin RV1

MODEL INPUT PARAMETER	SCENARIO 1: SHORT DURATION STORM	SCENARIO 2: WINTER SEASON	INFORMATION SOURCE
Length (m)	160		Maven basin design cross sections
Width (m)	40		
Event Duration (days)	3	36	Scenario 1: 3-day 100-year ARI storm event duration. Scenario 2: Number of average winter rain days. (NIWA Hamilton, AWS rainfall station 2112).
Maximum Acceptable Groundwater Mounding Height (m)	1.18		Taken as the distance from the winter water table (derived from the piezometric surface) to the full water level of the basin specified in Maven basin design plans.
Aquifer Specific Yield (m^3/m^3)	0.22		Typical for aquifer type (Morris and Johnson 1967).
Aquifer Hydraulic Conductivity (m/day)	0.33		Calculated as the average of the last 4 values from CMW's soakage tests undertaken at SOA24-21 (CIRIA method.)
Aquifer Hydraulic Gradient (m/m)	-0.005		Calculated from interpreted winter piezometric surface.
Aquifer Dip Direction (degrees)	25		
Aquifer Saturated Thickness (m)	6.35		Average aquifer thickness from CPT24-07
Rotation of the Infiltration Basin Length (degrees)	-19.2		From Maven basin design plans

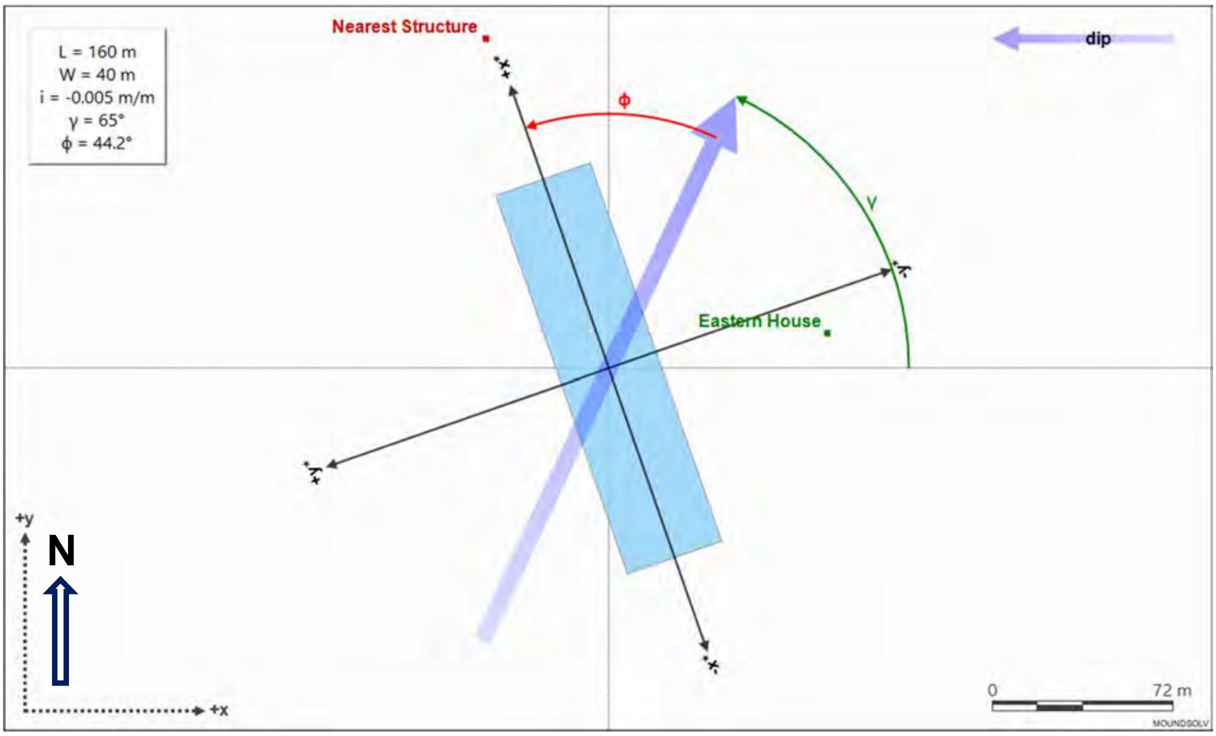


Figure 34: Basin RV1 and Closest Structures Relative to Groundwater Flow Direction

1.4.2 Mounding Assessment Results

The results derived from the modelling of the two scenarios for Basin RV1 are summarised in Table 8 with details in the following sections.

Modelled infiltration rates (Table 8) are considered to represent an average over the duration of the simulated rainfall event (3 days and 36 days). The water storage capacity of the stormwater pond has not been taken into account in the mounding assessment.

Table 8: Summary of Mounding Assessment Results for Basin RV1

MODEL OUTPUT	SCENARIO 1: SHORT DURATION STORM	SCENARIO 2: WINTER SEASON	NOTES
Modelled Infiltration Rate (m/d)	0.09	0.01 (1)	Modelled with water levels in the basin reaching the full water level provided by Maven.
Maximum Modelled Mounding at Neighbouring Property Boundary (m)	0.01	0.07	Nearest Structure
	0.02	0.12	Eastern House

Note: 1) The initial infiltration rate would be closer to the value indicated for Scenario 1. However, recharge rates would decrease toward the value indicated for Scenario 2.

1.4.2.1 Basin RV1 Scenario 1

The calculated mounding contours (Figure 35) and profiles (Figure 36 and Figure 37) indicate groundwater mounding would be 0.28 m 3.2 m from the basin edge by the end of the 3-day rainfall event. Following the storm event, the groundwater levels beneath the basin decline by approximately 0.6 m over a period of 47 days (Figure 38, Figure 39). This decline in groundwater level beneath the basin is matched by an expansion of the area affected by groundwater mounding (Figure 38). A peak increase in groundwater level of 0.01 m is modelled at the nearest structure and a mounding of 0.02 m at the house to the northeast (Figure 39).

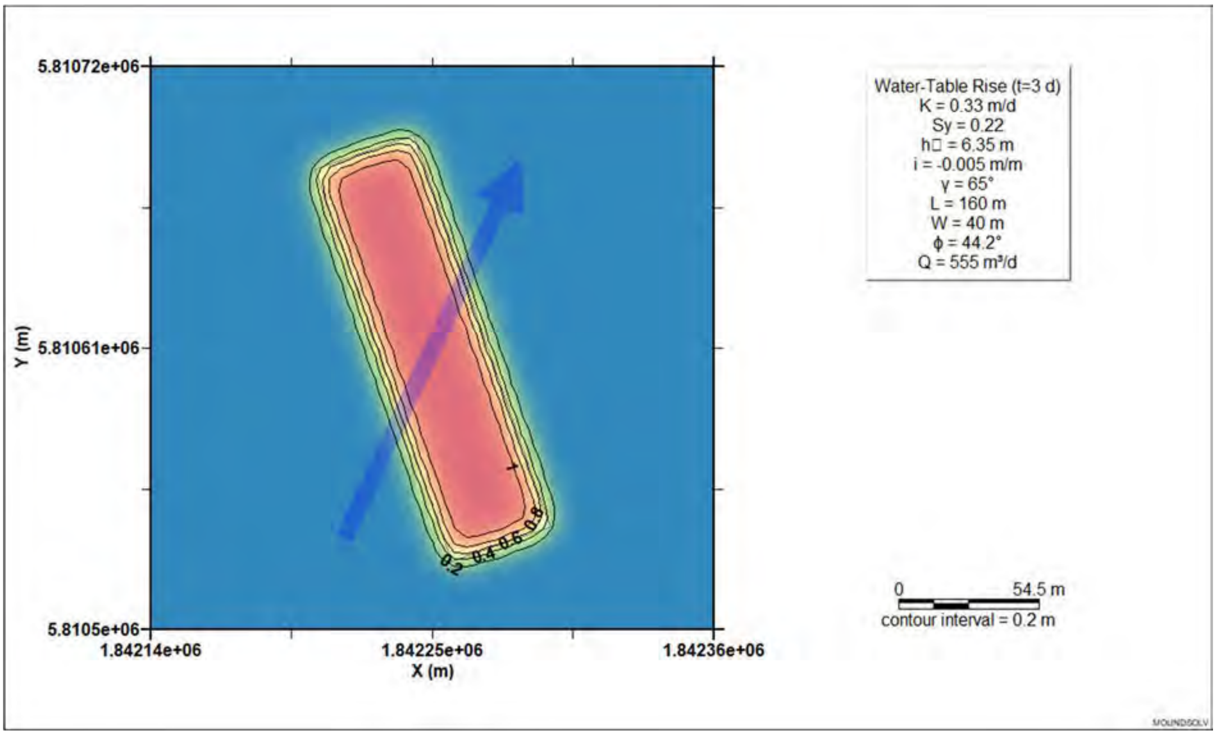


Figure 35: Calculated Mounding Contours at Basin RV1 at the End of a 3-day Storm Event

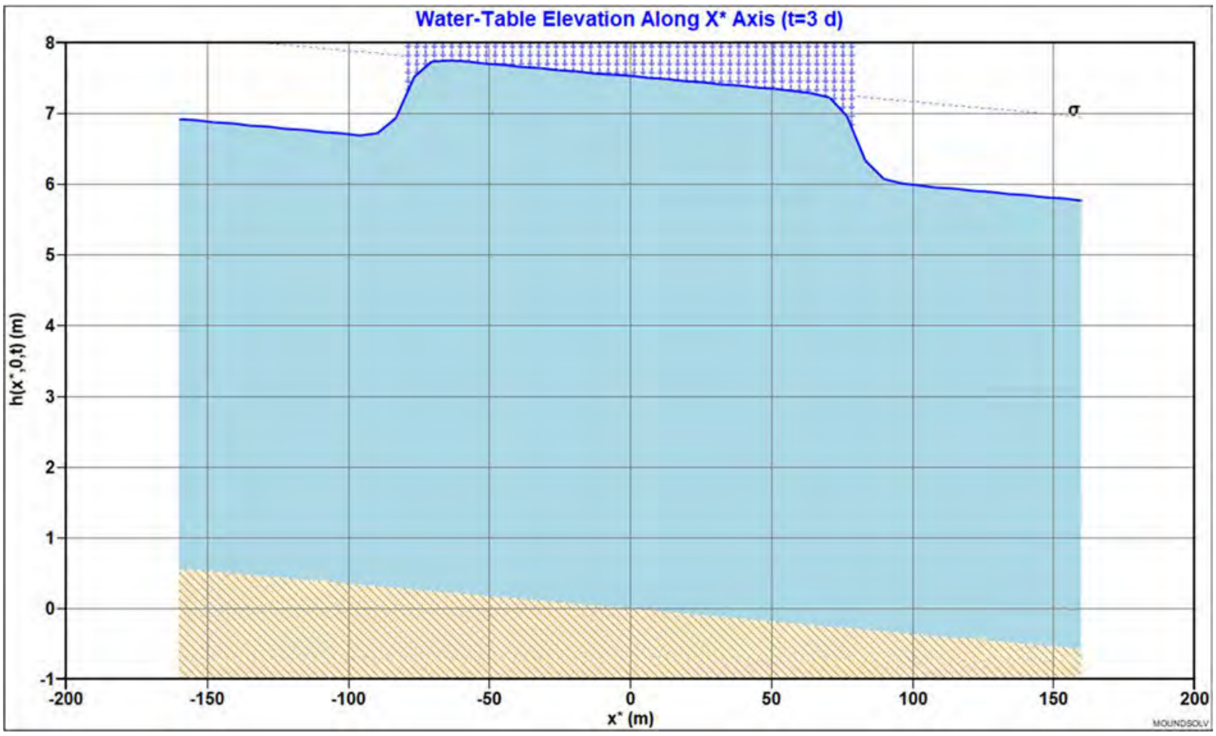


Figure 36: Calculated Mounding, Basin RV1, X-Axis Visualisation, Following a 3-day Storm Event

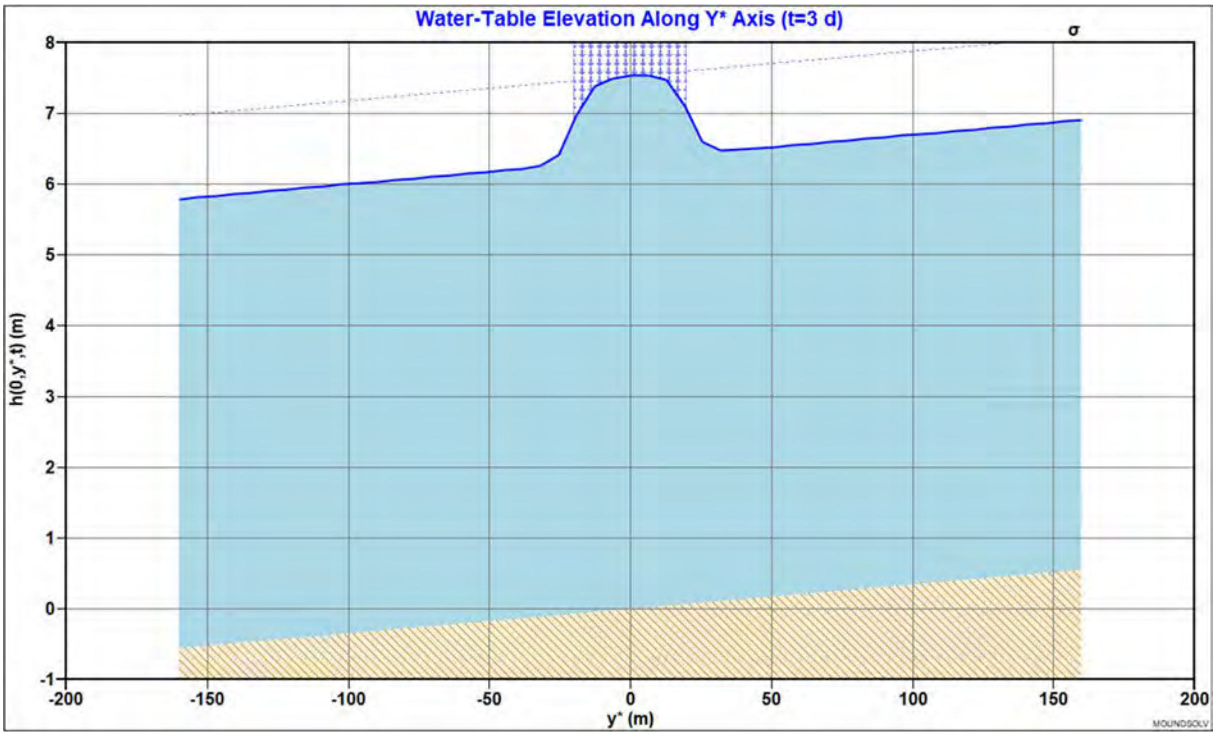


Figure 37: Calculated Mounding, Basin RV1, Y-Axis Visualisation, Following a 3-day Storm Event

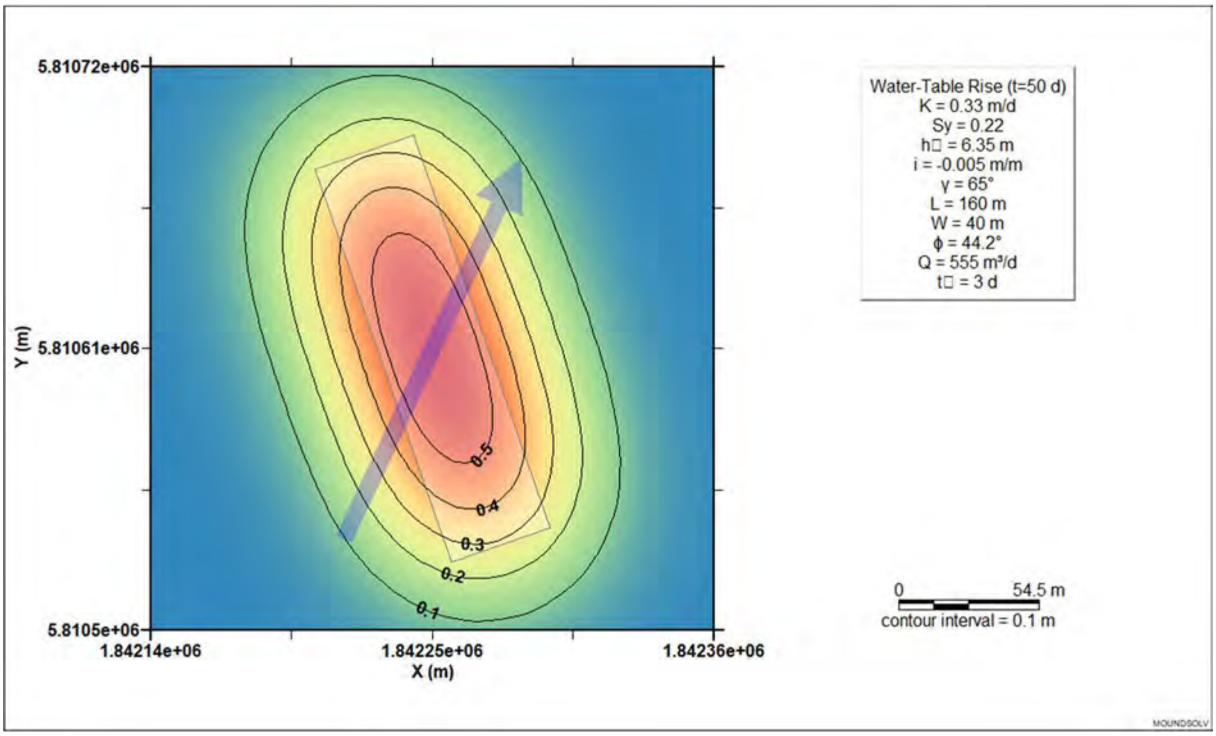


Figure 38: Calculated Mounding Contours at Basin RV1, 47 days After a 3-day Storm Event

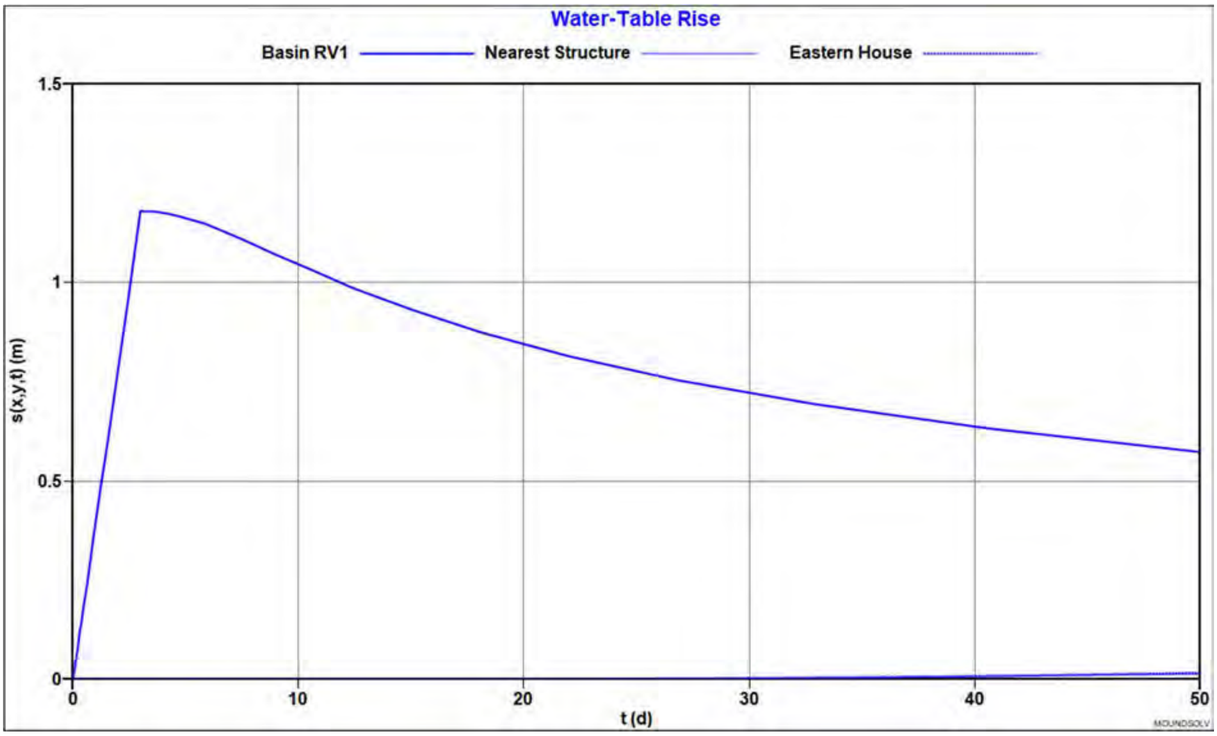


Figure 39: Groundwater Table Hydrographs at Basin RV1 in Response to 3 Day Event

1.4.2.2 Basin RV1 Scenario 2

The calculated mounding contours (Figure 40) and profiles (Figure 41 and Figure 42) indicate groundwater mounding would be 0.18 m 16 m from the basin edge by the end of the simulated winter rainfall season. Following the season, the groundwater levels beneath the basin decline by approximately 0.84 m over a period of 164 days (Figure 43, Figure 44). This decline in groundwater level beneath the basin is matched by an expansion of the area affected by groundwater mounding (Figure 43). A peak increase in groundwater level of 0.07 m is modelled at the nearest structure and a mounding of 0.12 m at the house to the east (Figure 44).

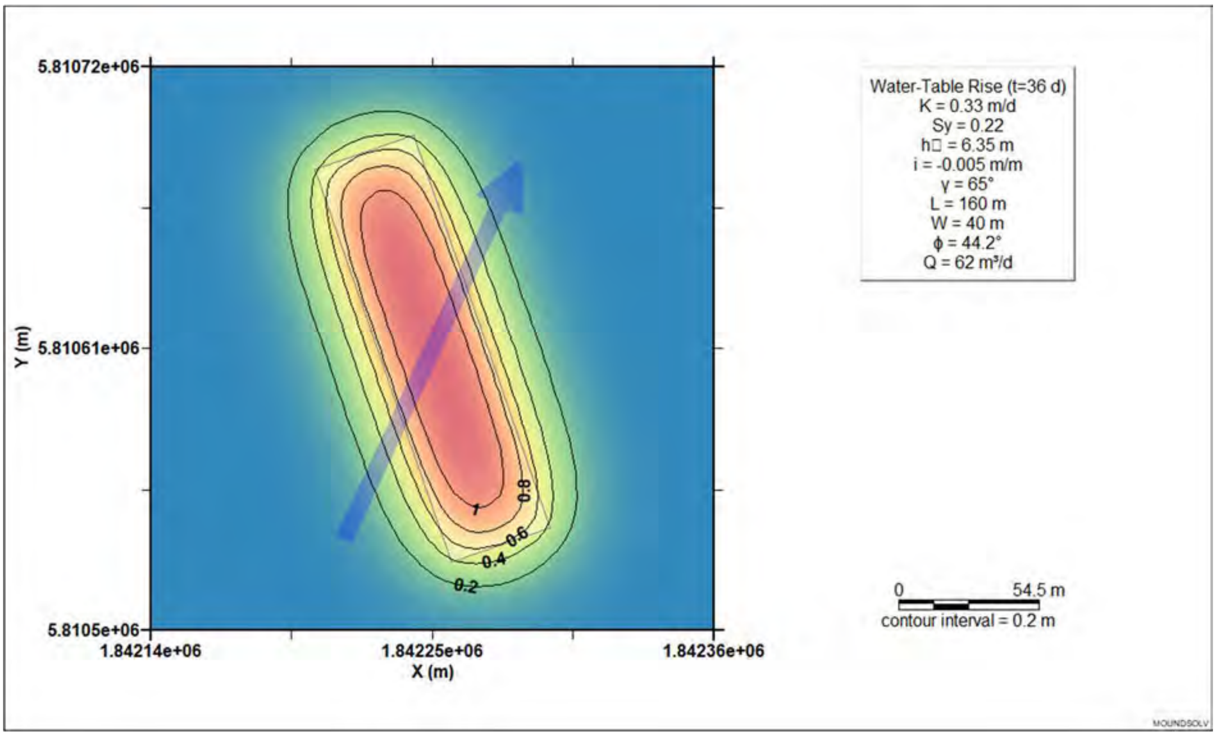


Figure 40: Calculated Mounding Contours at Basin RV1 at the End of a Winter Season

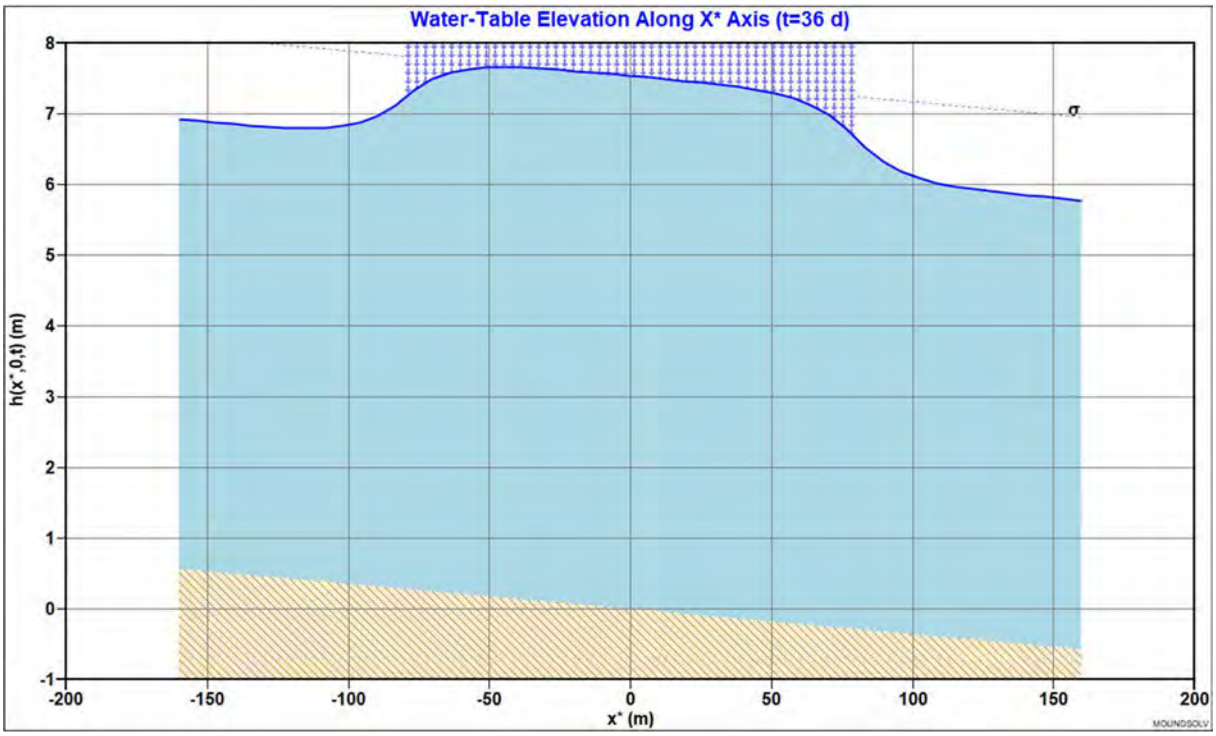


Figure 41: Calculated Mounding, Basin RV1, X-Axis Visualisation, Following a Winter Season

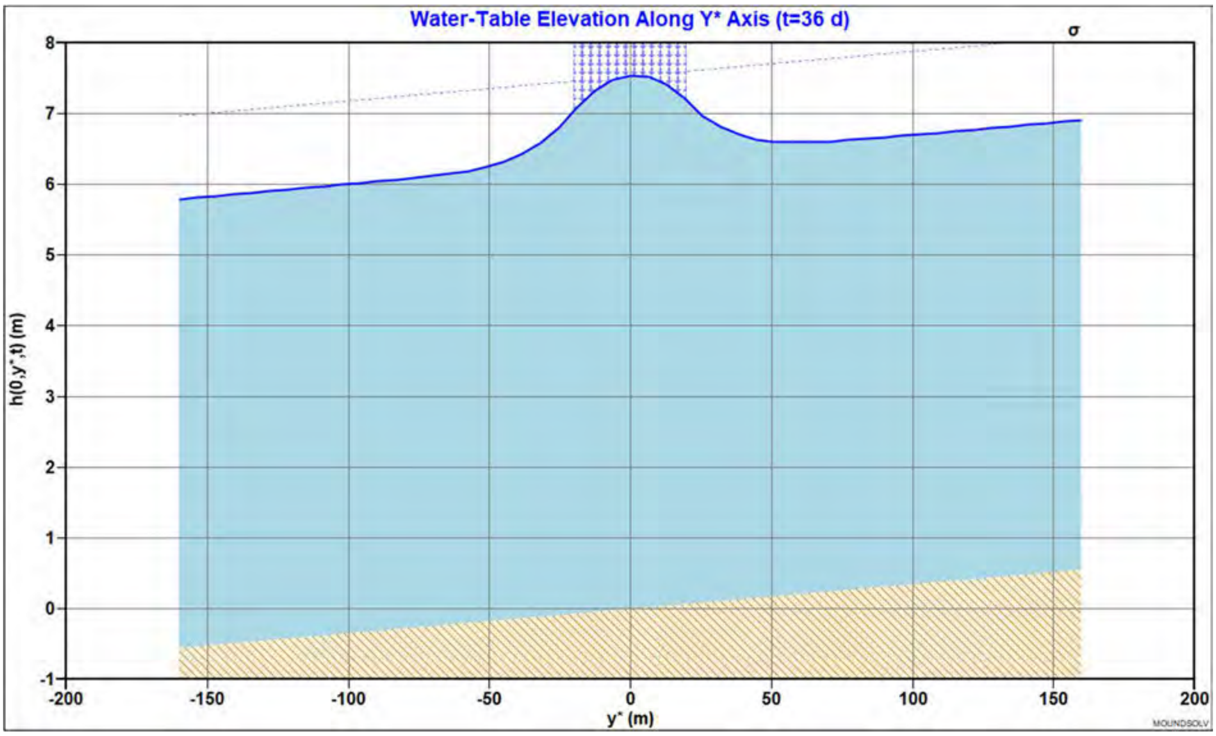


Figure 42: Calculated Mounding, Basin RV1, Y-Axis Visualisation, Following a Winter Season

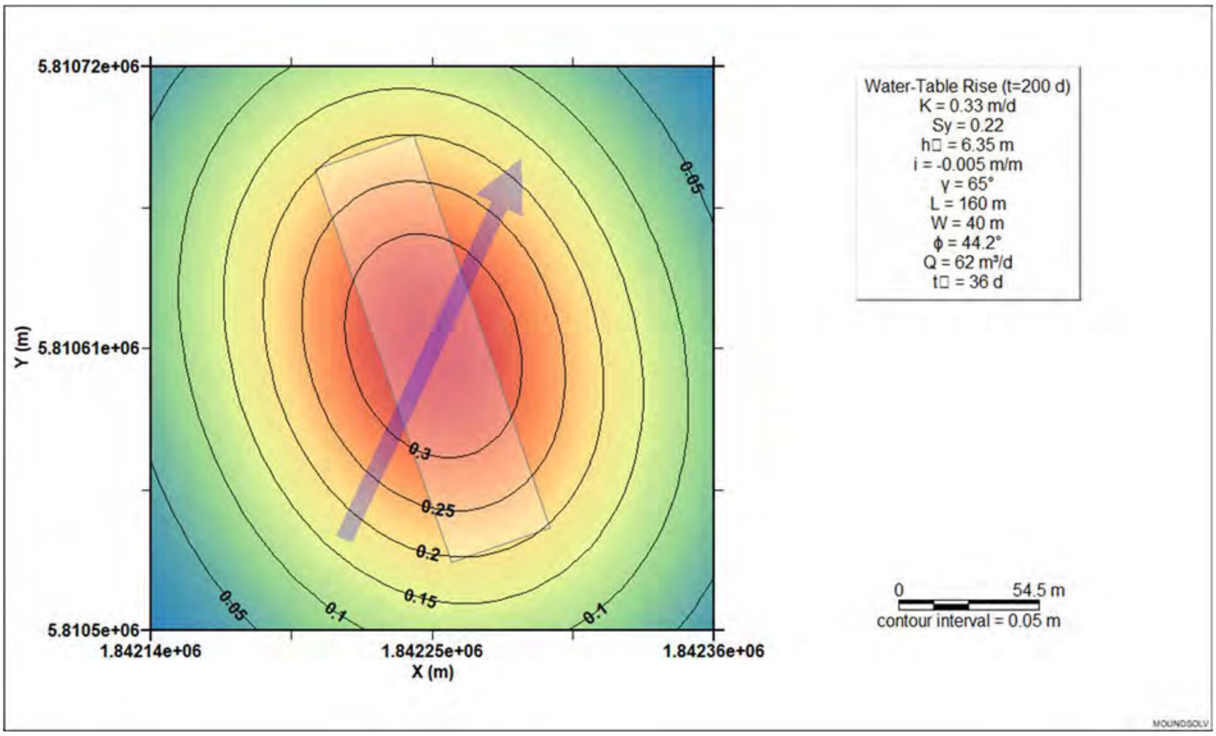


Figure 43: Calculated Mounding Contours at Basin RV1 164 days after a Winter Season

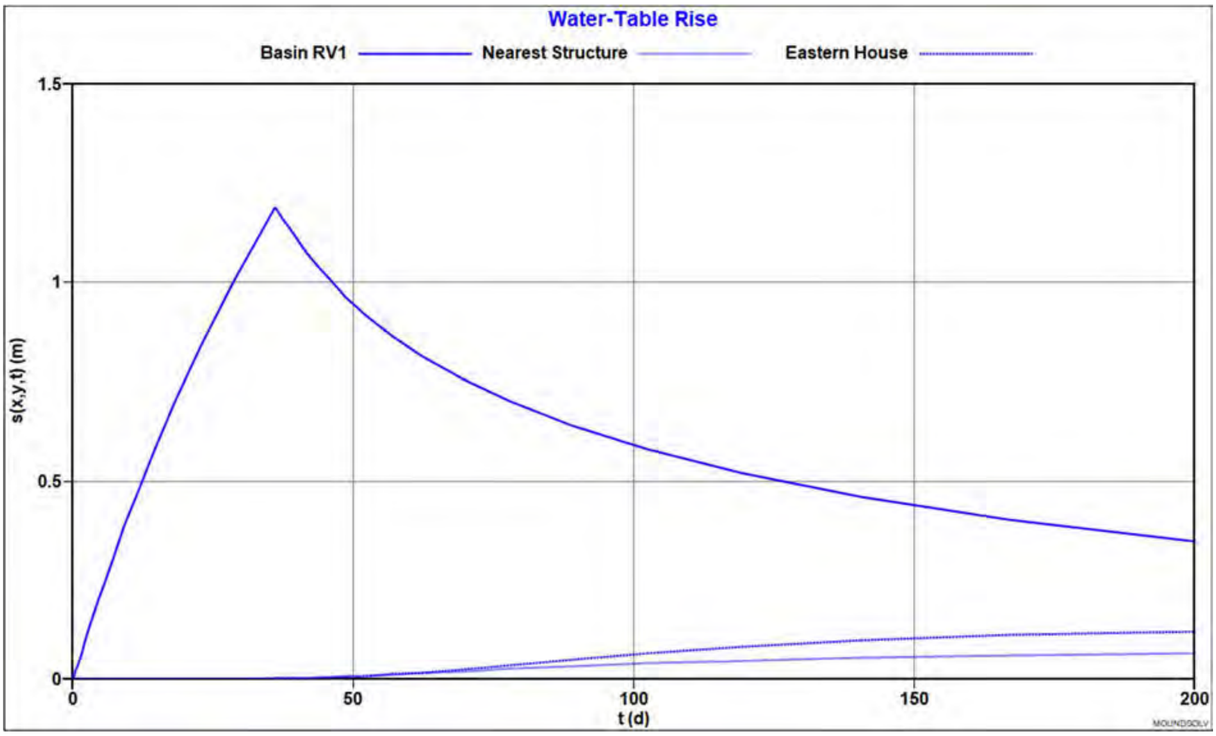


Figure 44: Groundwater Table Hydrographs at Basin RV1 in Response to Winter Season

1.5 Basin RV2

1.5.1 Model Inputs

The site-specific input values for the Basin RV2 groundwater mounding assessment presented in Table 9. The groundwater flow direction in relation to the orientation of Basin RV2 is presented in Figure 45 with the location of the nearest buildings to the site.

Table 9: Inputs for Mounding Assessment – Basin RV2

MODEL INPUT PARAMETER	SCENARIO 1: SHORT DURATION STORM	SCENARIO 2: WINTER SEASON	INFORMATION SOURCE
Length (m)	110		Maven basin design cross sections
Width (m)	45		
Event Duration (days)	3	36	Scenario 1: 3-day 100-year ARI storm event duration. Scenario 2: Number of average winter rain days. (NIWA Hamilton, AWS rainfall station 2112).
Maximum Acceptable Groundwater Mounding Height (m)	0.7		Taken as the distance from the winter water table (derived from the piezometric surface) to the full water level of the basin specified in Maven basin design plans.
Aquifer Specific Yield (m^3/m^3)	0.22		Typical for aquifer type (Morris and Johnson 1967).
Aquifer Hydraulic Conductivity (m/day)	0.33		Calculated as the average of the last 4 values from CMW's soakage tests undertaken at SOA24-21 (CIRIA method.)
Aquifer Hydraulic Gradient (m/m)	-0.005		Calculated from interpreted winter piezometric surface.
Aquifer Dip Direction (degrees)	65		
Aquifer Saturated Thickness (m)	7.55		Average aquifer thickness from CPT24-07
Rotation of the Infiltration Basin Length (degrees)	36.3		From Maven basin design plans

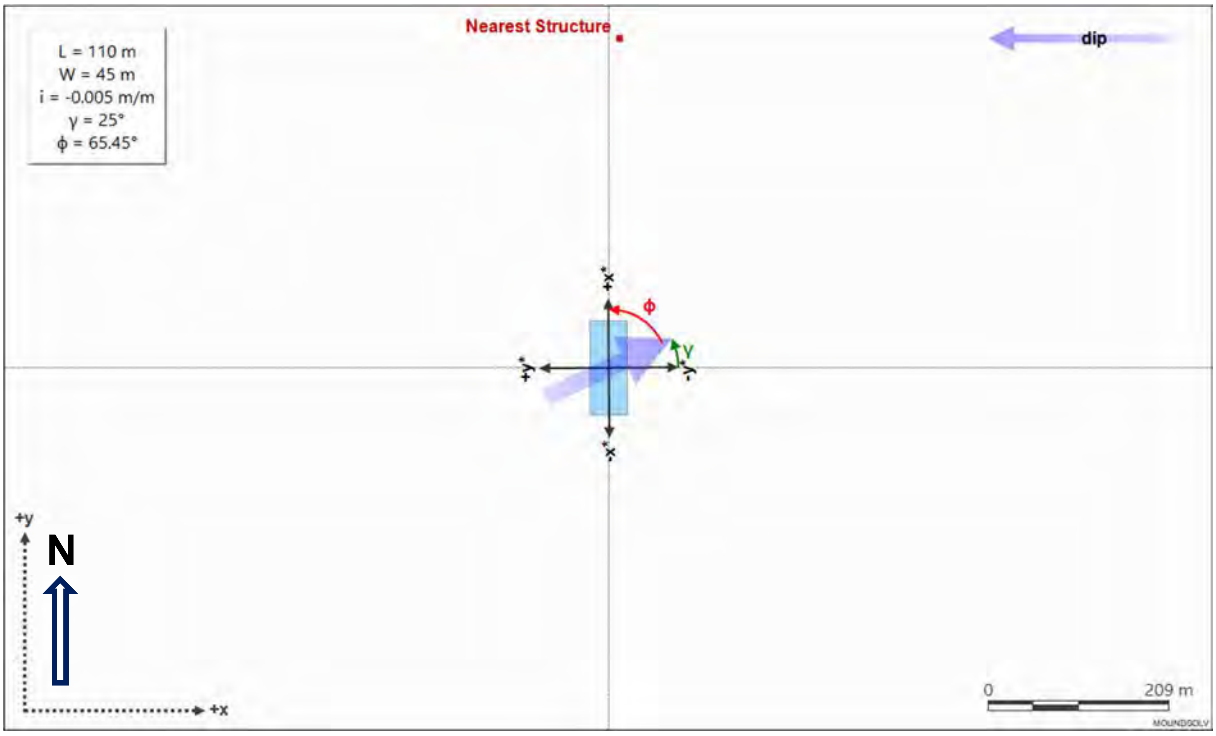


Figure 45: Basin RV2 and Closest Structures Relative to Groundwater Flow Direction

1.5.2 Mounding Assessment Results

The results derived from the modelling of the two scenarios for Basin RV2 are summarised in Table 10 with details in the following sections.

Modelled infiltration rates (Table 10) are considered to represent an average over the duration of the simulated rainfall event (3 days and 36 days). The water storage capacity of the stormwater pond has not been taken into account in the mounding assessment.

Table 10: Summary of Mounding Assessment Results for Basin RV2

MODEL OUTPUT	SCENARIO 1: SHORT DURATION STORM	SCENARIO 2: WINTER SEASON	NOTES
Modelled Infiltration Rate (m/d)	0.05	0.01 (1)	Modelled with water levels in the basin reaching the basin rim.
Maximum Modelled Mounding at Neighbouring Property Boundary (m)	0	7×10^{-8}	Nearest Structure

Note: 1) The initial infiltration rate would be closer to the value indicated for Scenario 1. However, recharge rates would decrease toward the value indicated for Scenario 2.

1.5.2.1 Basin RV2 Scenario 1

The calculated mounding contours (Figure 46) and profiles (Figure 47 and Figure 48) indicate groundwater mounding would be 0.23 m 2.2 m from the basin edge by the end of the 3-day rainfall event. Following the storm event, the groundwater levels beneath the basin decline by approximately 0.38 m over a period of 47 days (Figure 49, Figure 50). This decline in groundwater level beneath the basin is matched by an expansion of the area affected by groundwater mounding (Figure 49). No increase in groundwater level of is modelled at the nearest structure (Figure 50).

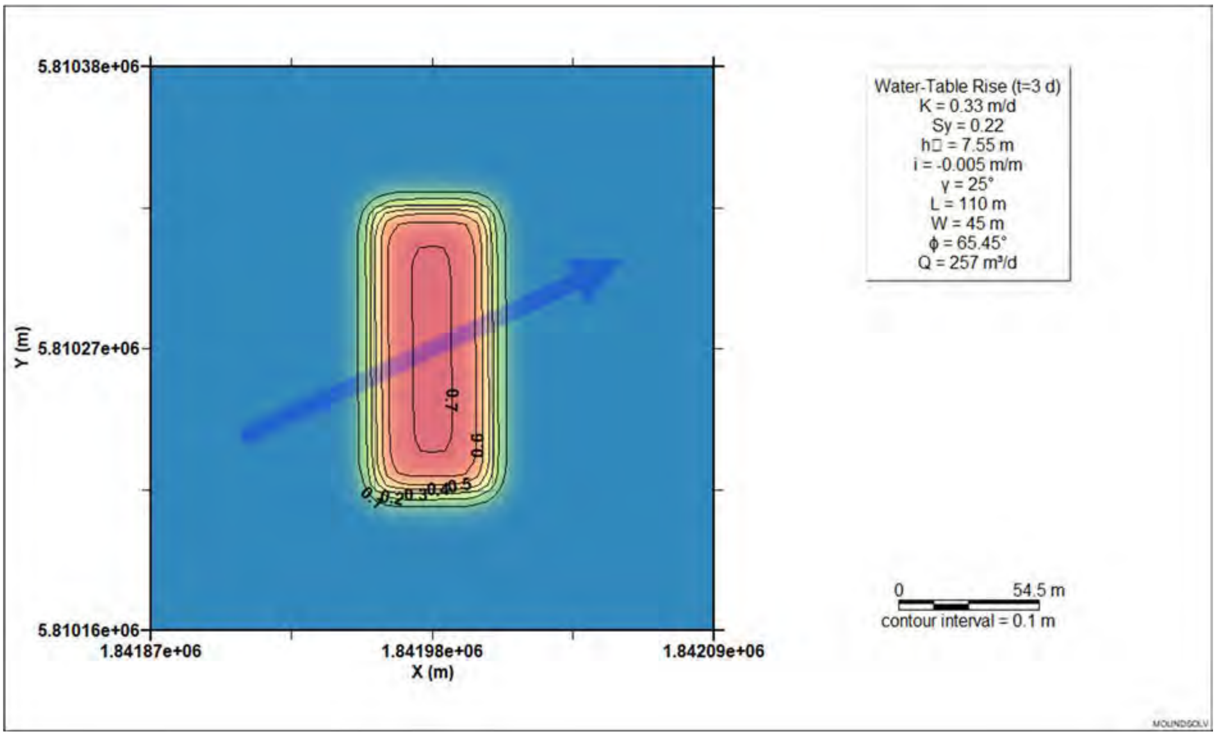


Figure 46: Calculated Mounding Contours at Basin RV2 at the End of a 3-day Storm Event

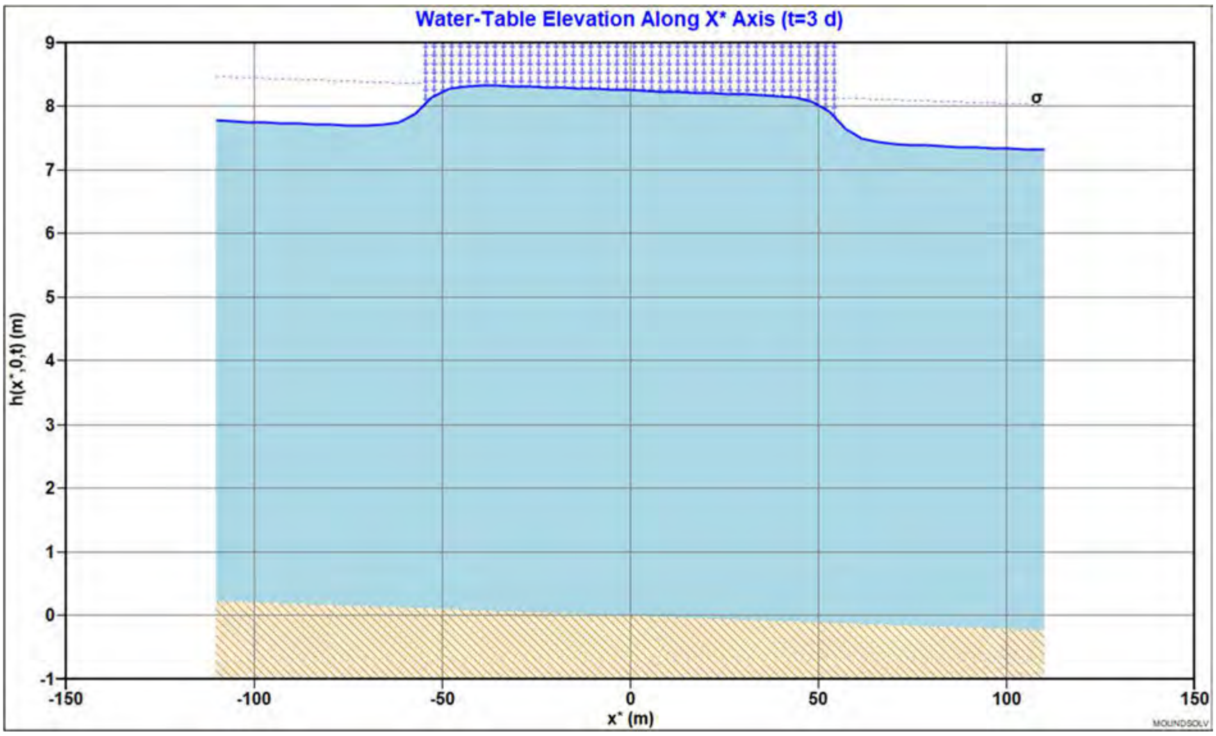


Figure 47: Calculated Mounding, Basin RV2, X-Axis Visualisation, Following a 3-day Storm Event

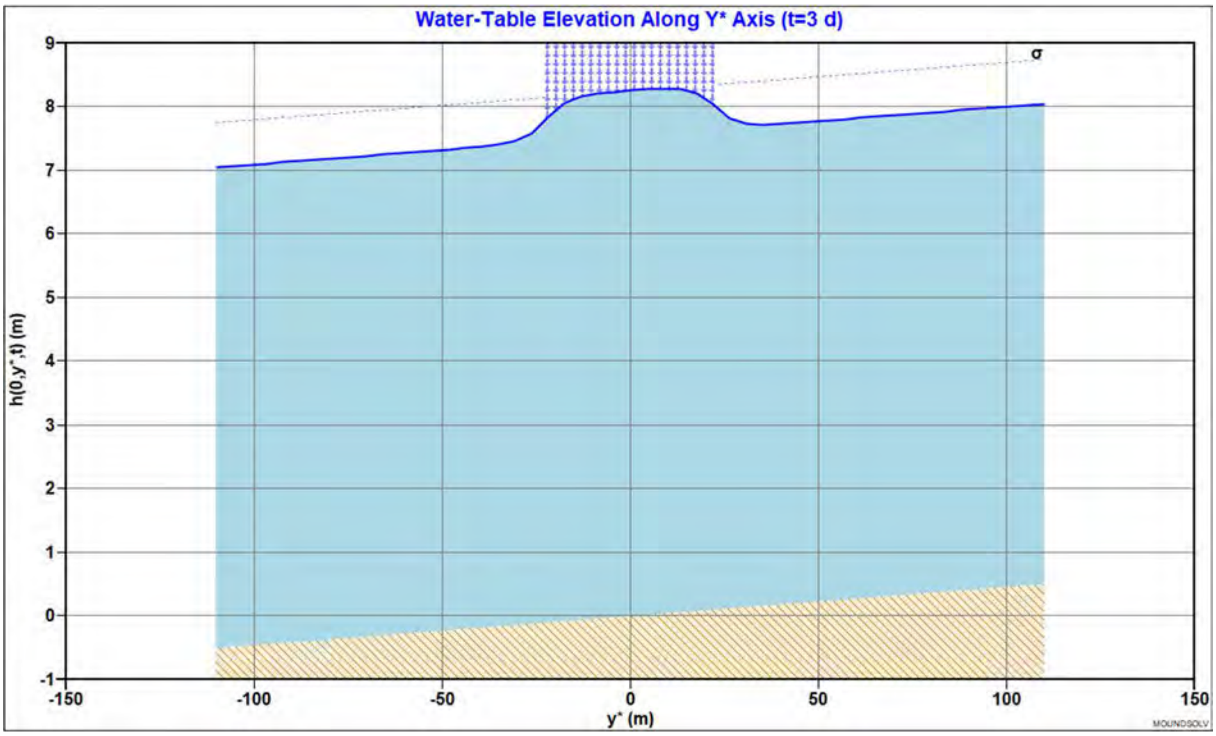


Figure 48: Calculated Mounding, Basin RV2, Y-Axis Visualisation, Following a 3-day Storm Event

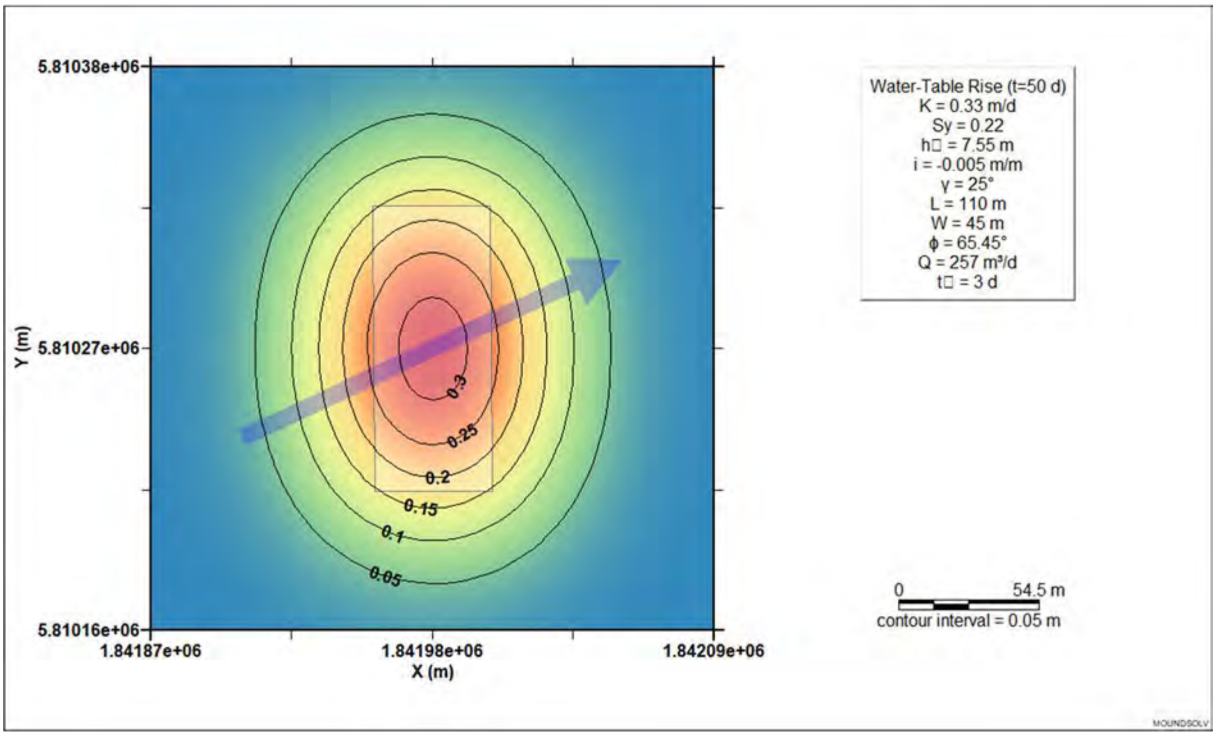


Figure 49: Calculated Mounding Contours at Basin RV2, 47 days After a 3-day Storm Event

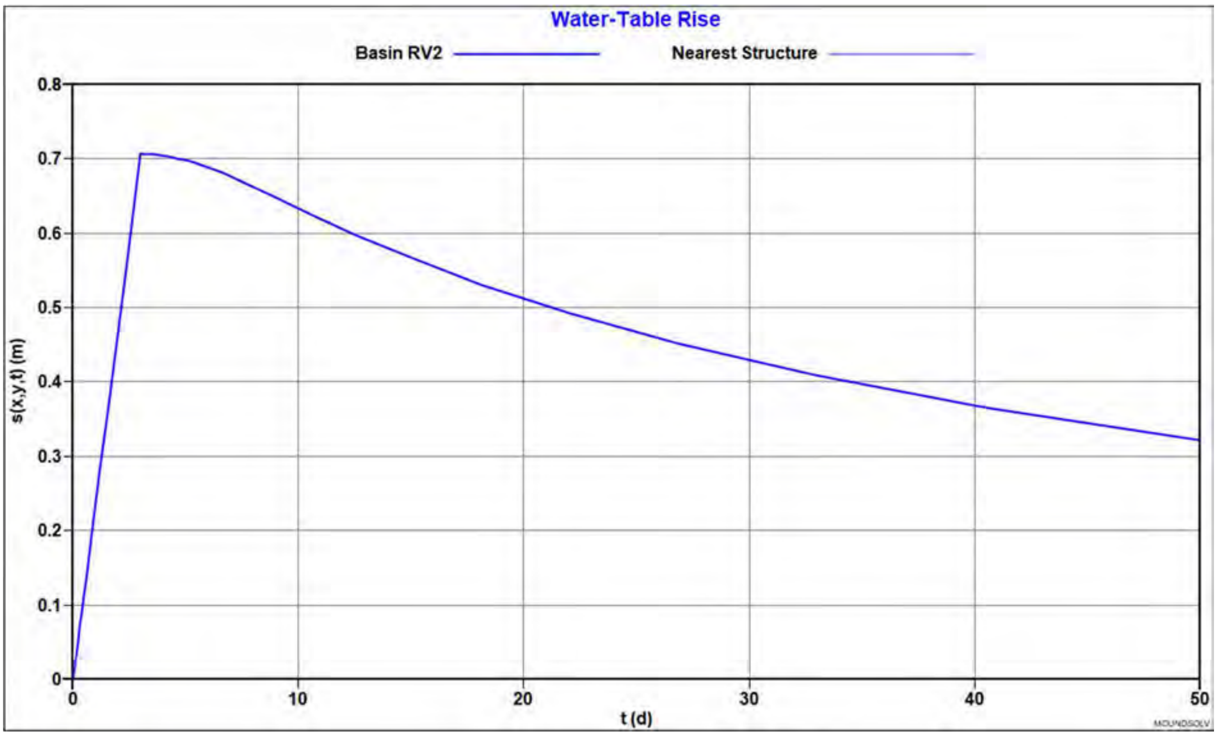


Figure 50: Groundwater Table Hydrographs at Basin RV2 in Response to 3 Day Event

1.5.2.2 Basin RV2 Scenario 2

The calculated mounding contours (Figure 51) and profiles (Figure 52 and Figure 53) indicate groundwater mounding would be 0.24 m at 6.6 m from the basin edge by the end of the simulated winter rainfall season. Following the storm event, the groundwater levels beneath the basin decline by approximately 0.56 m over a period of 164 days (Figure 54, Figure 55). This decline in groundwater level beneath the basin is matched by an expansion of the area affected by groundwater mounding (Figure 54). No increase in groundwater level of is modelled at the nearest structure (Figure 55).

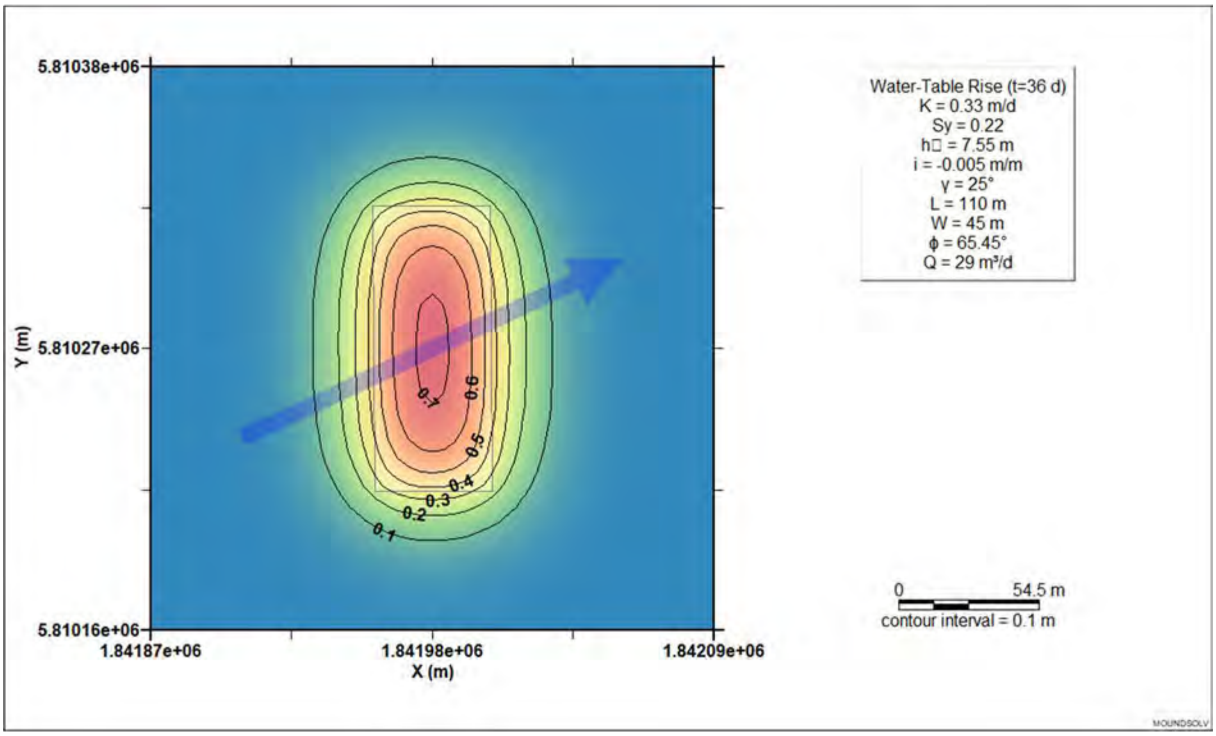


Figure 51: Calculated Mounding Contours at Basin RV2 at the End of a Winter Season

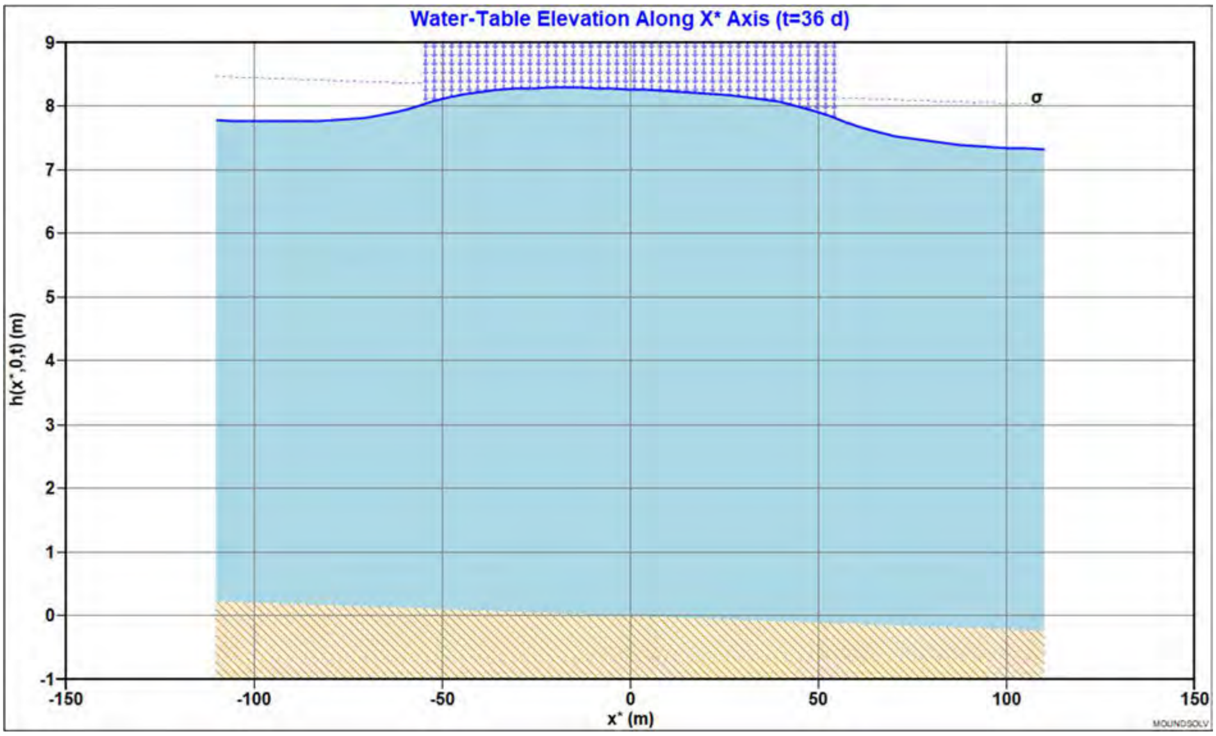


Figure 52: Calculated Mounding, Basin RV2, X-Axis Visualisation, Following a Winter Season

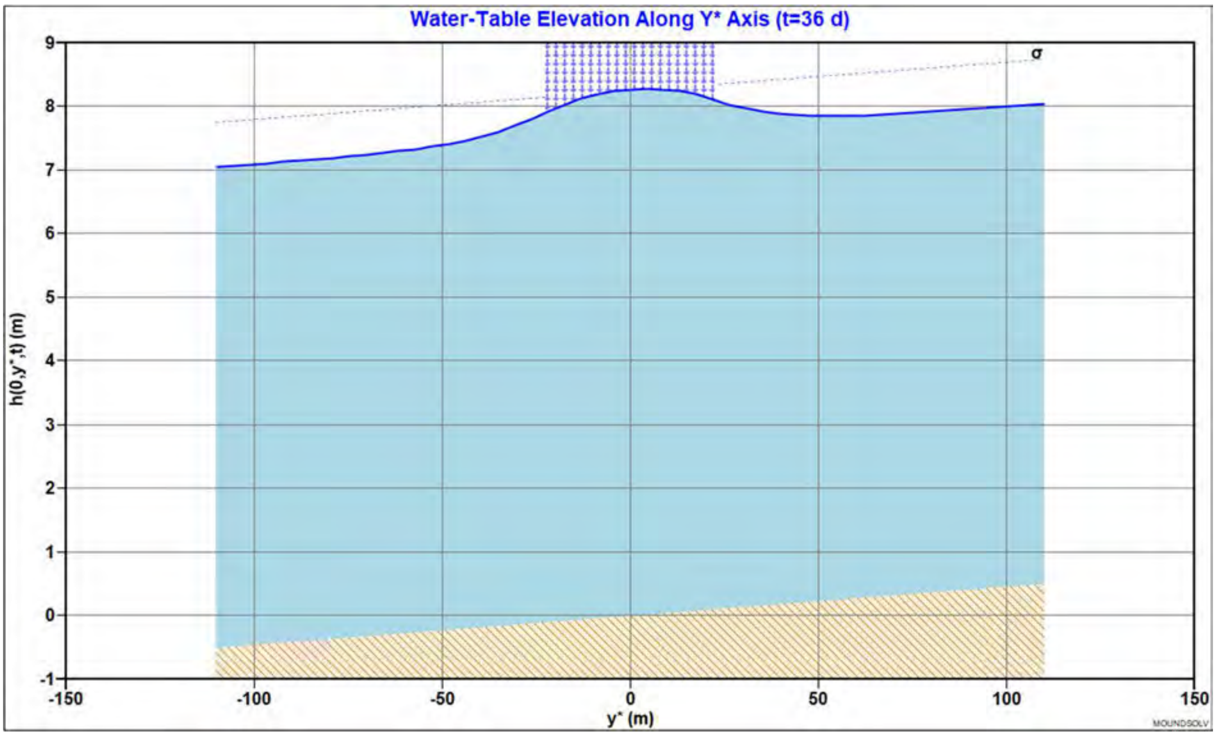


Figure 53: Calculated Mounding, Basin RV2, Y-Axis Visualisation, Following a Winter Season

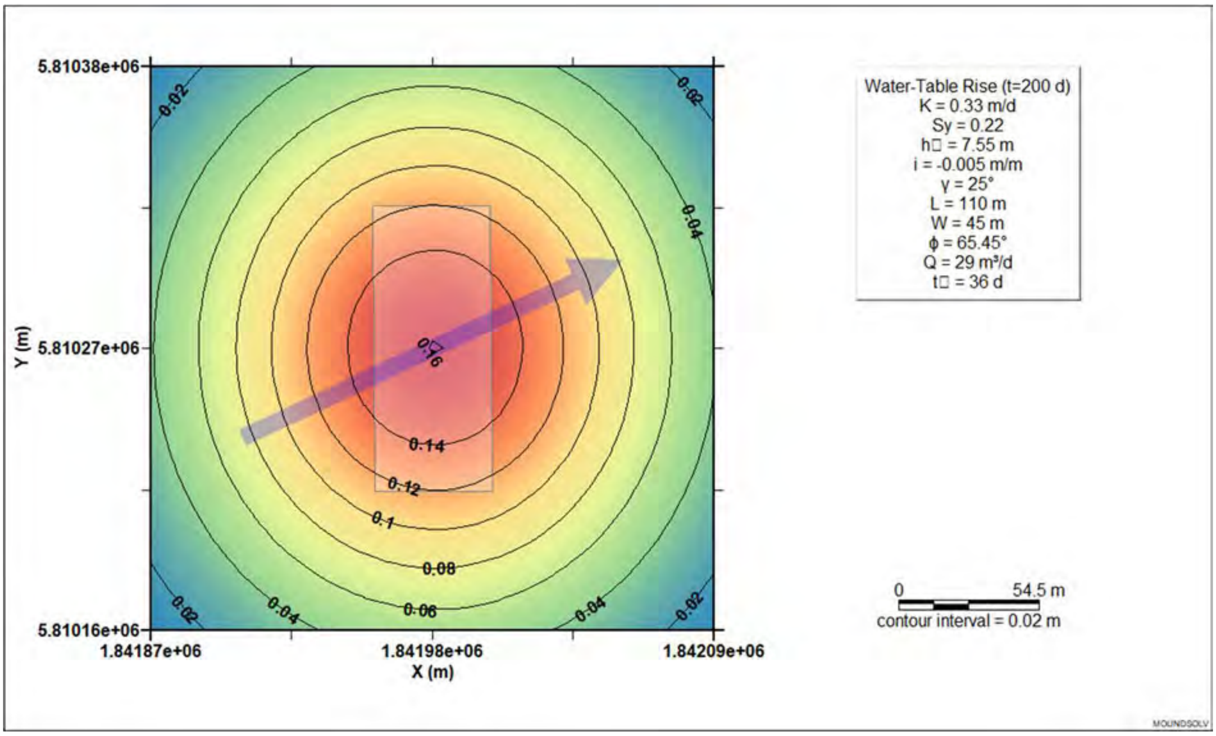


Figure 54: Calculated Mounding Contours at Basin RV2 164 days after a Winter Season

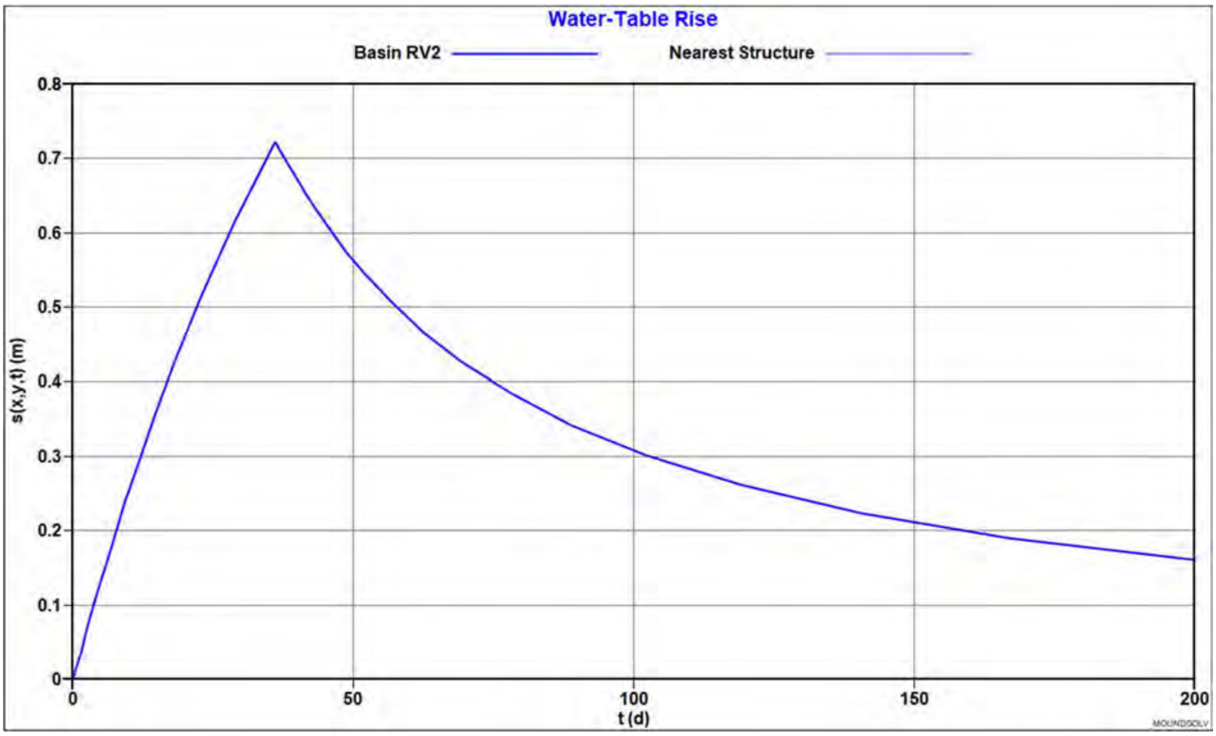


Figure 55: Groundwater Table Hydrographs at Basin RV2 in Response to Winter Season

Notes

1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mount Eden 2000.
3. Levels in terms of the New Zealand Vertical Datum 2016.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. Approved hardfill is to be used in backfilling of all stormwater lines within the road reserve.
6. All catchpit leads shall be laid at 1% unless otherwise specified.
7. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with council staff.

Legend

- EX BOUNDARY
- EX STORMWATER
- PROP LOT BOUNDARY
- PROP SITE BOUNDARY
- PROP SW BASIN
- PROP SHARED PATH / MAINTENANCE TRACK

Rev	Description	By	Date
C	DRAFT	MKS	02/2025
B	DRAFT	MKS	12/2024
A	DRAFT	MKS	12/2024

	By	Date
Survey	MAVEN	05/2024
Design	MKS	12/2024
Drawn	MKS	12/2024
Checked	DJM	12/2024

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www.maven.co.nz
5 Owens Road, Epsom
Auckland 1023

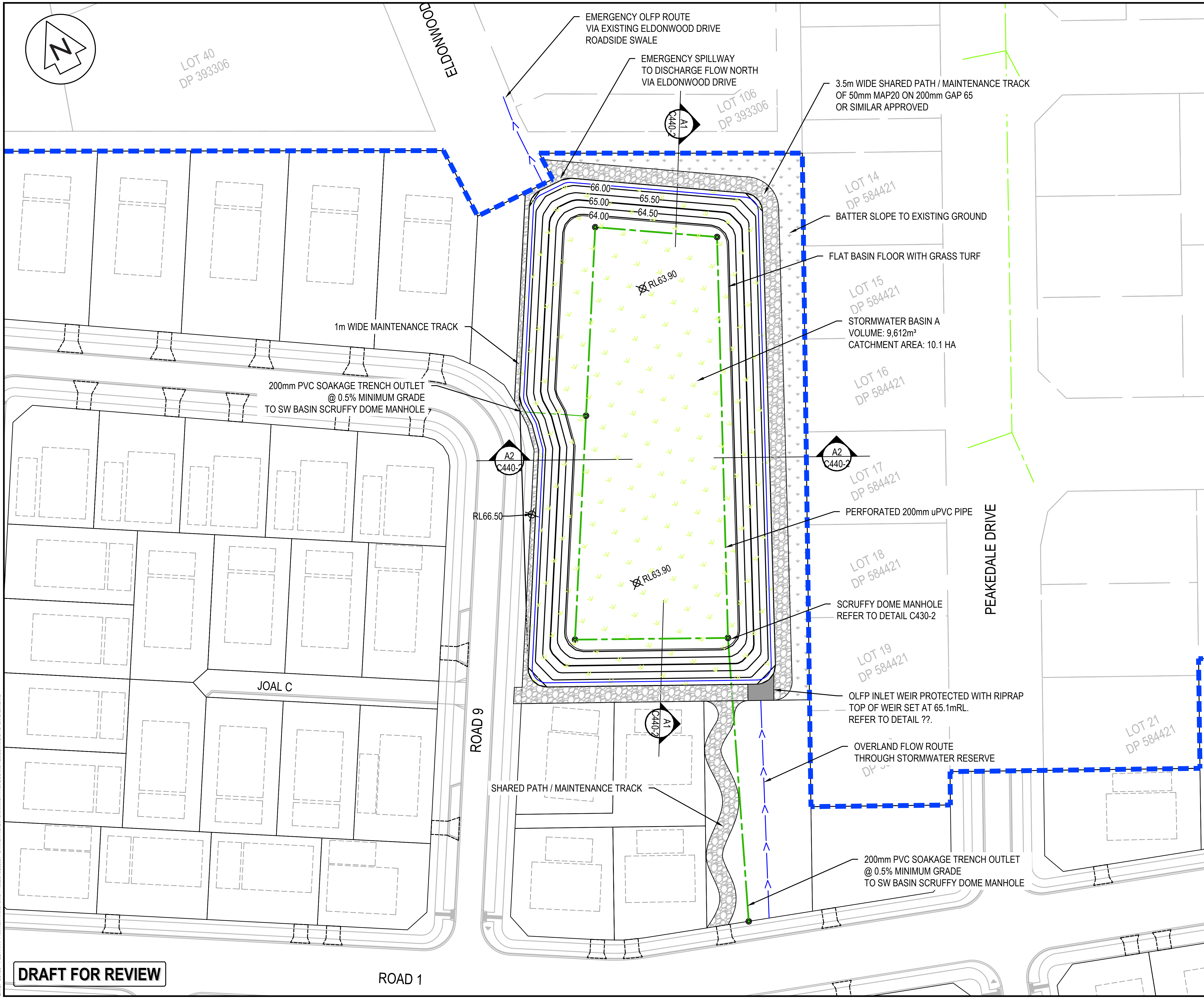
Project

ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS LTD

Title

PROPOSED STORMWATER BASIN OVERVIEW PLAN

Project no.	289001
Scale	1:5000 @ A3
Cad file	C440- SW BASIN.DWG
Drawing no.	C440
Rev	C



DRAFT FOR REVIEW

Notes

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Legend

- EX BOUNDARY
- EX STORMWATER
- PROP LOT BOUNDARY
- PROP SITE BOUNDARY
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Rev	Description	By	Date
C	DRAFT	MKS	02/2025
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A	DRAFT	MKS	12/2024

	By	Date
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Design	MKS	12/2024
Drawn	MKS	12/2024
Checked	DJM	12/2024

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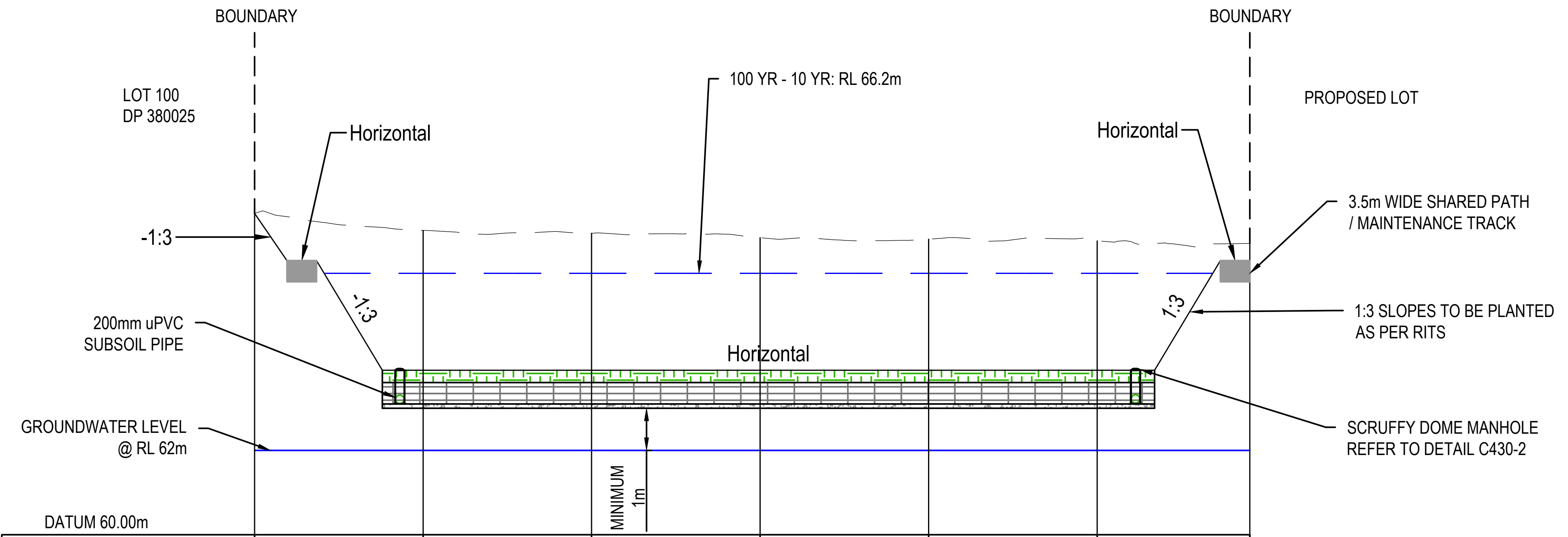
Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS LTD

Title
PROPOSED STORMWATER BASIN A PLAN

Project no.	289001
Scale	1:750 @ A3
Cad file	C440- SW BASIN.DWG
Drawing no.	C440-1
Rev	C



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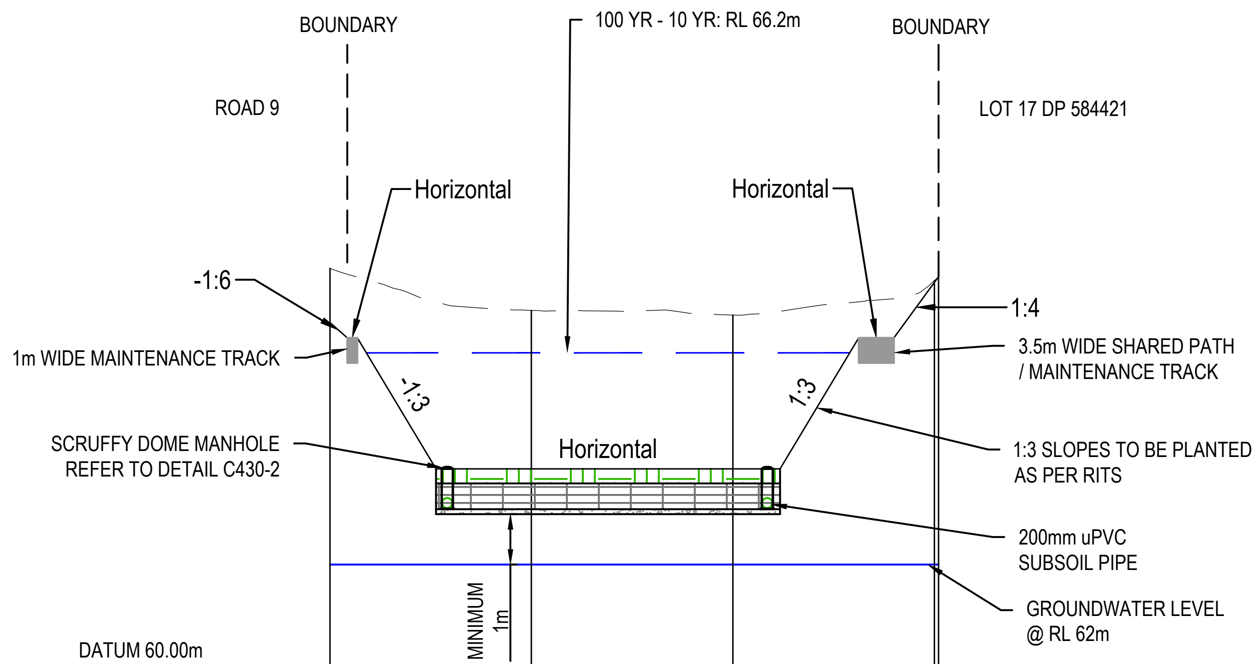
DESIGN LEVELS	67.62	63.90	63.90	63.90	63.90	63.90	66.50
CUT/FILL	0.00	-3.32	-3.25	-3.14	-3.11	-3.07	-0.41
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	118.12

A1
SCALE: HORI 1:750 VERT 1:150



EXISTING LEVELS	67.88	67.04	66.95	67.63	67.71
DESIGN LEVELS	67.88	67.04	66.95	67.63	67.71
CUT/FILL	0.00	0.00	0.00	0.00	0.00
CHAINAGE	0.00	20.00	40.00	60.00	60.41

A2
SCALE: HORI 1:750 VERT 1:150

DRAFT FOR REVIEW

Notes
1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mount Eden 2000.
3. Levels in terms of the New Zealand Vertical Datum 2016.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
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6. All catchpit leads shall be laid at 1% unless otherwise specified.
7. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with council staff.
8. Flood levels are per stromwater modelling dated 10/02/2025.
9. Groundwater levels provided by CMW per testpit logs dated 17/12/2024.
10. Batter slopes to be verified by Geotechnical Engineer.

Legend
- EX GROUND LEVEL
- PROP GROUND LEVEL
- 100YR - 10 YR LEVEL
- GROUNDWATER LEVEL

Rev	Description	By	Date
C	DRAFT	MKS	02/2025
B	DRAFT	MKS	12/2024
A	DRAFT	MKS	12/2024

	By	Date
Survey	MAVEN	05/2024
Design	MKS	12/2024
Drawn	MKS	12/2024
Checked	DJM	12/2024

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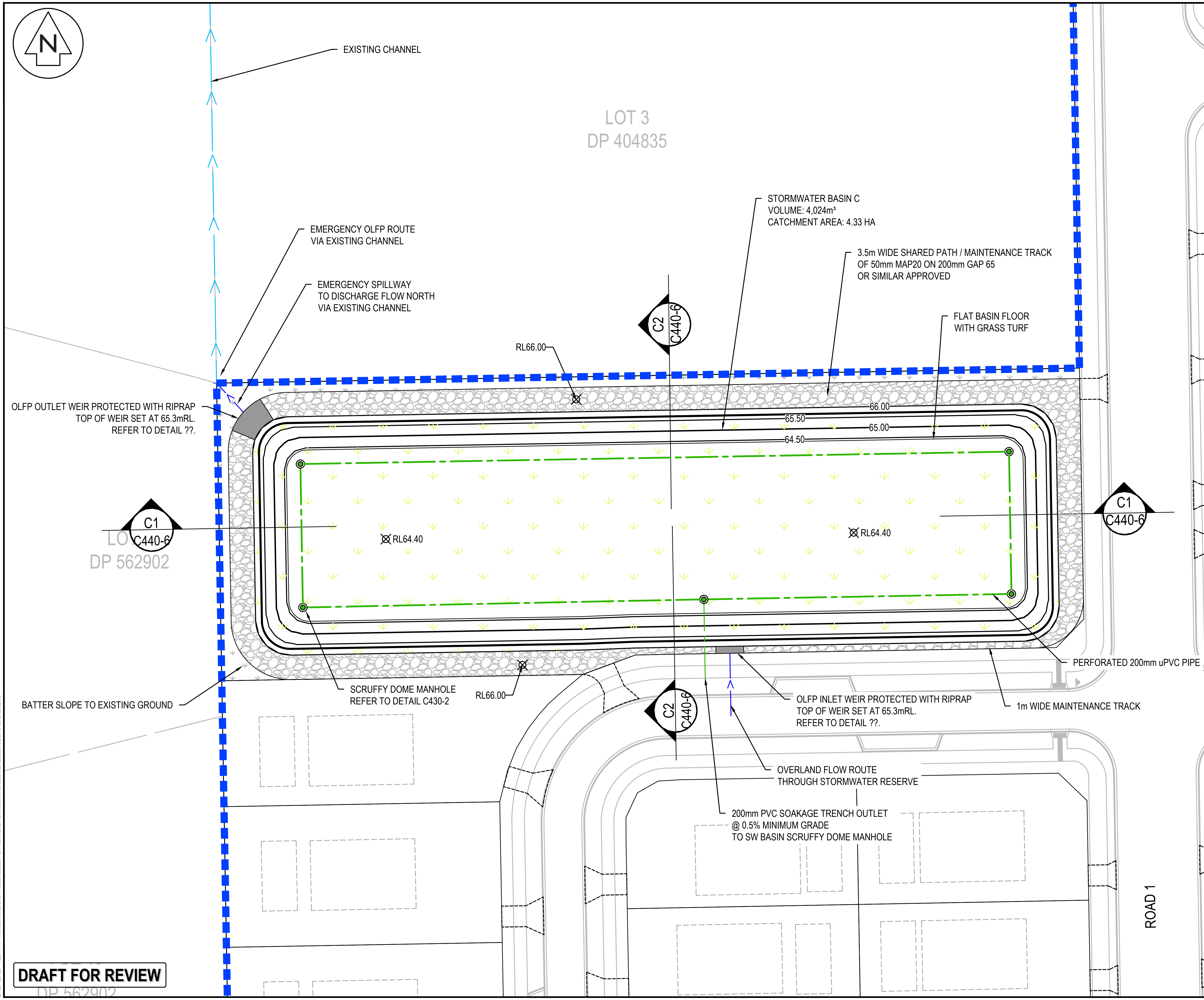
Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS LTD

Title
PROPOSED STORMWATER BASIN A DETAILS

Project no.	289001
Scale	AS SHOWN
Cad file	C440- SW BASIN.DWG
Drawing no.	C440-2
Rev	C



Notes

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Legend

- EX BOUNDARY
- EX STORMWATER
- PROP LOT BOUNDARY
- PROP SITE BOUNDARY
- EX CHANNEL
- PROP SW BASIN
- PROP SHARED PATH / MAINTENANCE TRACK

Rev	Description	By	Date
C	DRAFT	MKS	02/2025
B	DRAFT	MKS	12/2024
A	DRAFT	MKS	12/2024

	By	Date
Survey	MAVEN	05/2024
Design	MKS	12/2024
Drawn	MKS	12/2024
Checked	DJM	12/2024

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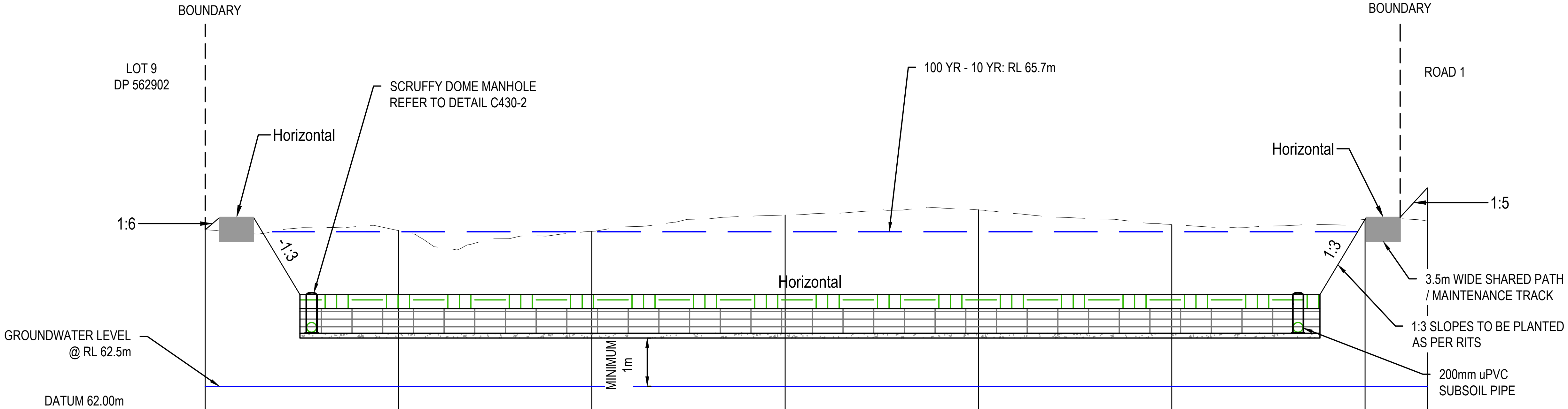
Project

ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS LTD

Title

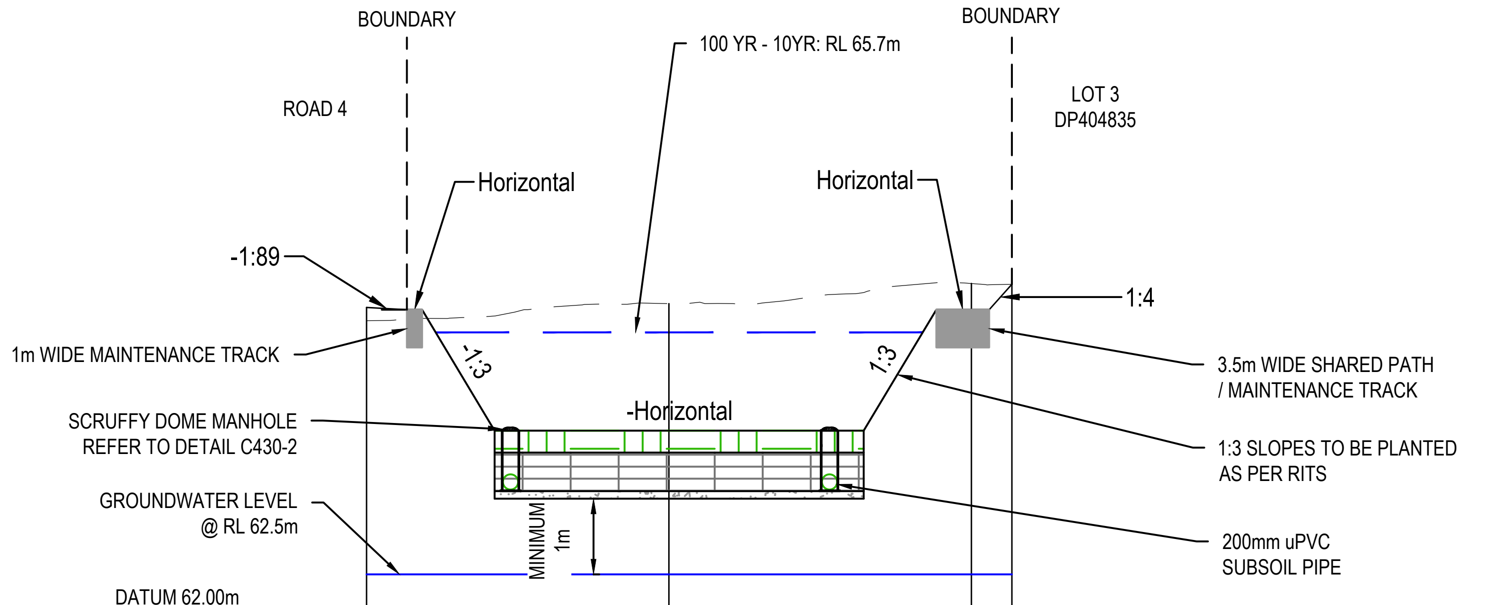
PROPOSED STORMWATER BASIN C PLAN

Project no.	289001
Scale	1:500 @ A3
Cad file	C440- SW BASIN.DWG
Drawing no.	C440-5
Rev	C



EXISTING LEVELS	65.74	65.72	65.71	66.05	66.15	65.85	65.96	65.92
DESIGN LEVELS	65.74	64.40	64.40	64.40	64.40	64.40	65.96	66.61
CUT/FILL	0.00	-1.32	-1.31	-1.65	-1.75	-1.45	0.00	0.69
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	126.43

C1
SCALE: HORI 1:500 VERT 1:100



EXISTING LEVELS	65.85	66.08	66.35	66.34
DESIGN LEVELS	66.03	64.40	66.00	66.34
CUT/FILL	0.18	-1.68	-0.35	0.00
CHAINAGE	0.00	20.00	40.00	42.67

C2
SCALE: HORI 1:500 VERT 1:100

DRAFT FOR REVIEW

Notes
1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mount Eden 2000.
3. Levels in terms of the New Zealand Vertical Datum 2016.
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9. Groundwater levels provided by CMW per testpit logs dated 17/12/2024.
10. Batter slopes to be verified by Geotechnical Engineer.

Legend
- EX GROUND LEVEL
- PROP GROUND LEVEL
- 100YR - 10 YR LEVEL
- GROUNDWATER LEVEL

Rev	Description	By	Date
C	DRAFT	MKS	02/2025
B	DRAFT	MKS	12/2024
A	DRAFT	MKS	12/2024

	By	Date
Survey	MAVEN	05/2024
Design	MKS	12/2024
Drawn	MKS	12/2024
Checked	DJM	12/2024

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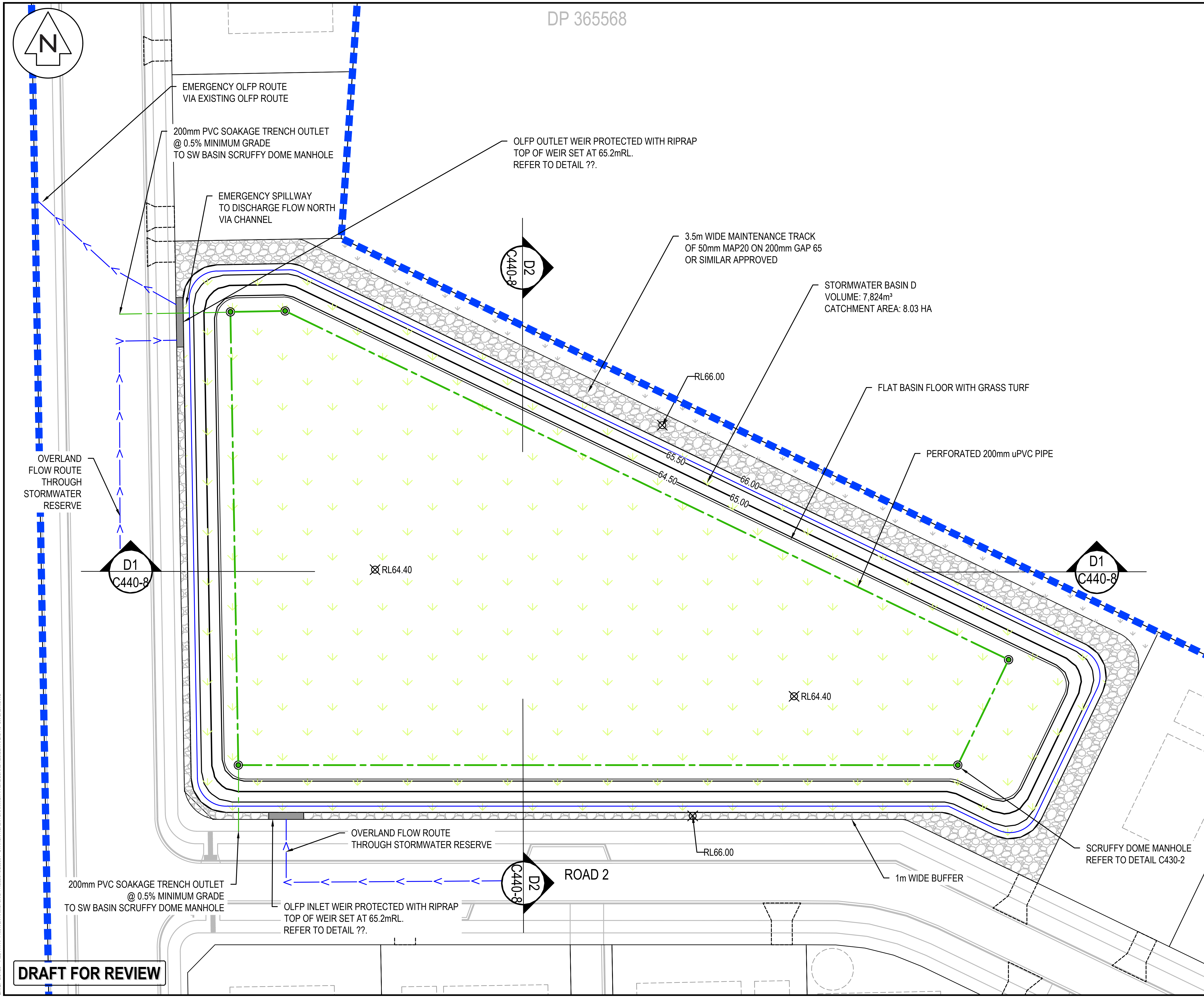
Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS LTD

Title
PROPOSED STORMWATER BASIN C DETAILS

Project no.	289001
Scale	AS SHOWN
Cad file	C440- SW BASIN.DWG
Drawing no.	C440-6 — Rev C



Notes
1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mount Eden 2000.
3. Levels in terms of the New Zealand Vertical Datum 2016.
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Legend
- EX BOUNDARY
- EX STORMWATER
- PROP LOT BOUNDARY
- PROP SITE BOUNDARY
- PROP SW BASIN
- PROP SHARED PATH / MAINTENANCE TRACK

Rev	Description	By	Date
C	DRAFT	MKS	02/2025
B	DRAFT	MKS	12/2024
A	DRAFT	MKS	12/2024

	By	Date
Survey	MAVEN	05/2024
Design	MKS	12/2024
Drawn	MKS	12/2024
Checked	DJM	12/2024

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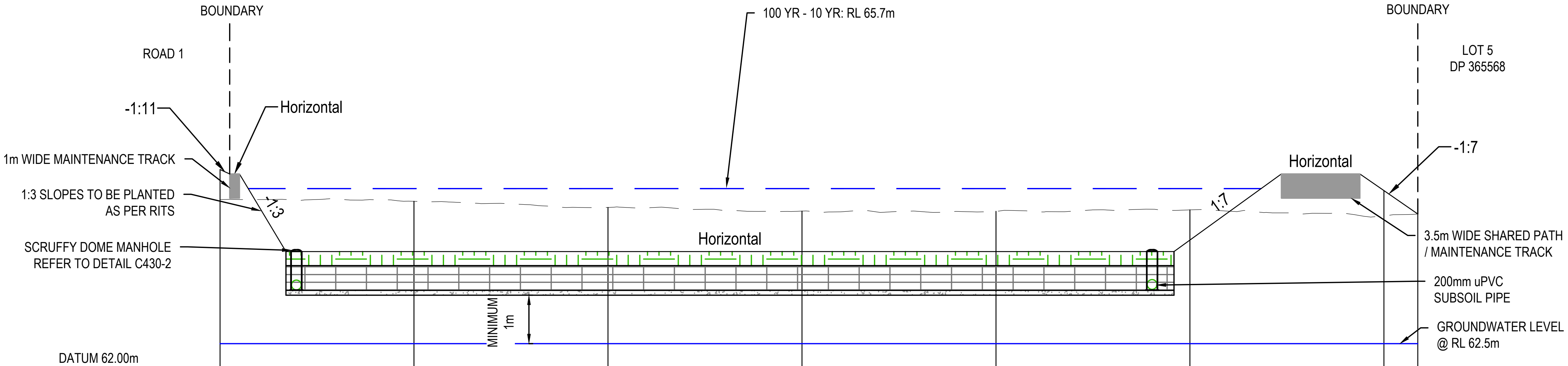
Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS LTD

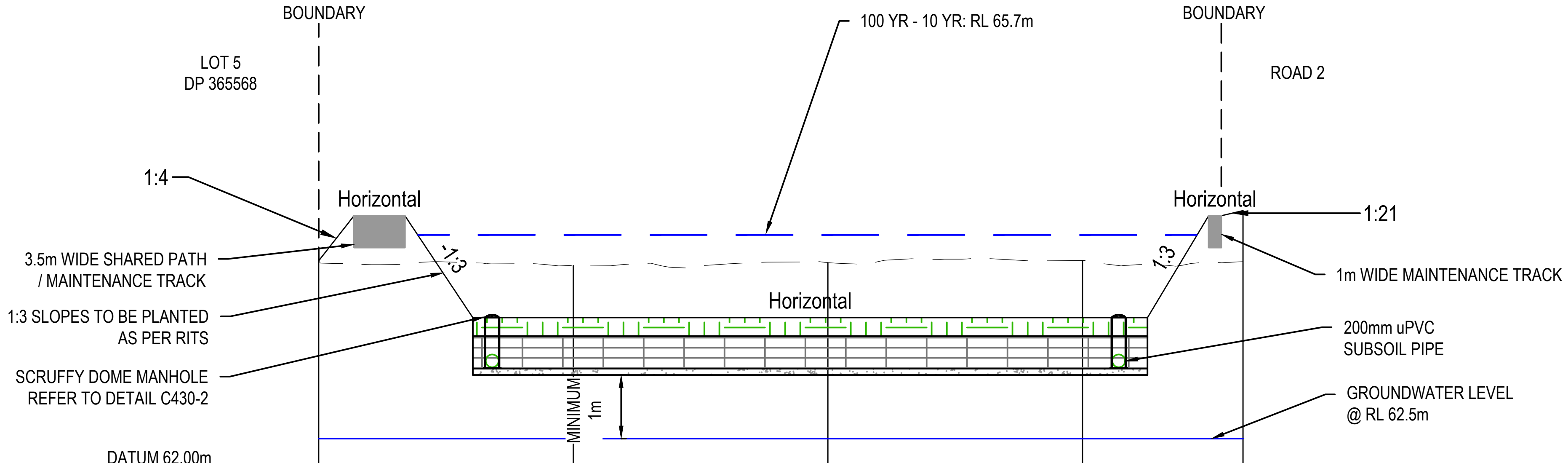
Title
PROPOSED STORMWATER BASIN D PLAN

Project no.	289001
Scale	1:500 @ A3
Cad file	C440- SW BASIN.DWG
Drawing no.	C440-7 · Rev C



EXISTING LEVELS	65.47	65.44	65.31	65.23	65.23	65.26	65.13	65.17
DESIGN LEVELS	66.09	64.40	64.40	64.40	64.40	64.64	65.66	65.17
CUT/FILL	0.62	-1.04	-0.91	-0.83	-0.83	-0.62	0.52	0.00
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	123.49

D1
SCALE: HORI 1:500 VERT 1:100



EXISTING LEVELS	65.29	65.22	65.26	65.30	65.28
DESIGN LEVELS	65.29	64.40	64.40	64.40	66.08
CUT/FILL	0.00	-0.82	-0.86	-0.90	0.80
CHAINAGE	0.00	20.00	40.00	60.00	72.60

D2
SCALE: HORI 1:500 VERT 1:100

DRAFT FOR REVIEW

Notes
1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
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Legend
- EX GROUND LEVEL
- PROP GROUND LEVEL
- 100YR - 10 YR LEVEL
- GROUNDWATER LEVEL

Rev	Description	By	Date
C	DRAFT	MKS	02/2025
B	DRAFT	MKS	12/2024
A	DRAFT	MKS	12/2024

	By	Date
Survey	MAVEN	05/2024
Design	MKS	12/2024
Drawn	MKS	12/2024
Checked	DJM	12/2024

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Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS LTD

Title
PROPOSED STORMWATER BASIN D DETAILS

Project no.	289001
Scale	AS SHOWN
Cad file	C440- SW BASIN.DWG
Drawing no.	C440-8
Rev	C

SOAKAGE DEVICE's

GRAVEL SOAKAGE UNDER ROAD	DEPTH=0.8m
VILLA SOAKAGE DEVICE (5.72m x 4.40m)	DEPTH=0.44m VOLUME=10.52m³ COUNT=220
FACILITY SOAKAGE DEVICE (13.59m x 3.20m)	DEPTH=0.44m VOLUME=18.17m³ COUNT=2
AGE CARE SOAKAGE (20.02m x 9.00m)	DEPTH=0.44m VOLUME=75.31m³ COUNT=2

FOR CONSENT

Notes

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6. Approved hardfill is to be used in backfilling of all road crossings and vehicle crossings to council standards.
7. Heavy duty manhole lids and frames to be used in trafficked areas.
8. All cesspit leads shall have min cover 0.9m.
9. All lines to be abandoned shall be sealed at each end. timing of all sealing to be coordinated with council staff.
10. Refer to C4700 for Soakage Trench details.
10. Refer to C4703 for Soakage Device details.
11. Preliminary Soakage design is based on the rate of 100mm/h for a 10 year event.

Legend

- EX BDY
- PROP BDY
- STAGING BDY
- EX STORMWATER
- PR STORMWATER
- EX SW SWALE
- EX/PROP SWMH
- PROP SWCP SINGLE
- RAINGARDENS

Rev	Description	By	Date
B	FOR CONSENT	MS	04/25
A	FOR REVIEW	DP	01/25

	By	Date
Survey	MAVEN	10/2024
Design	DP	12/2024
Drawn	DP	12/2024
Checked	SB	12/2024

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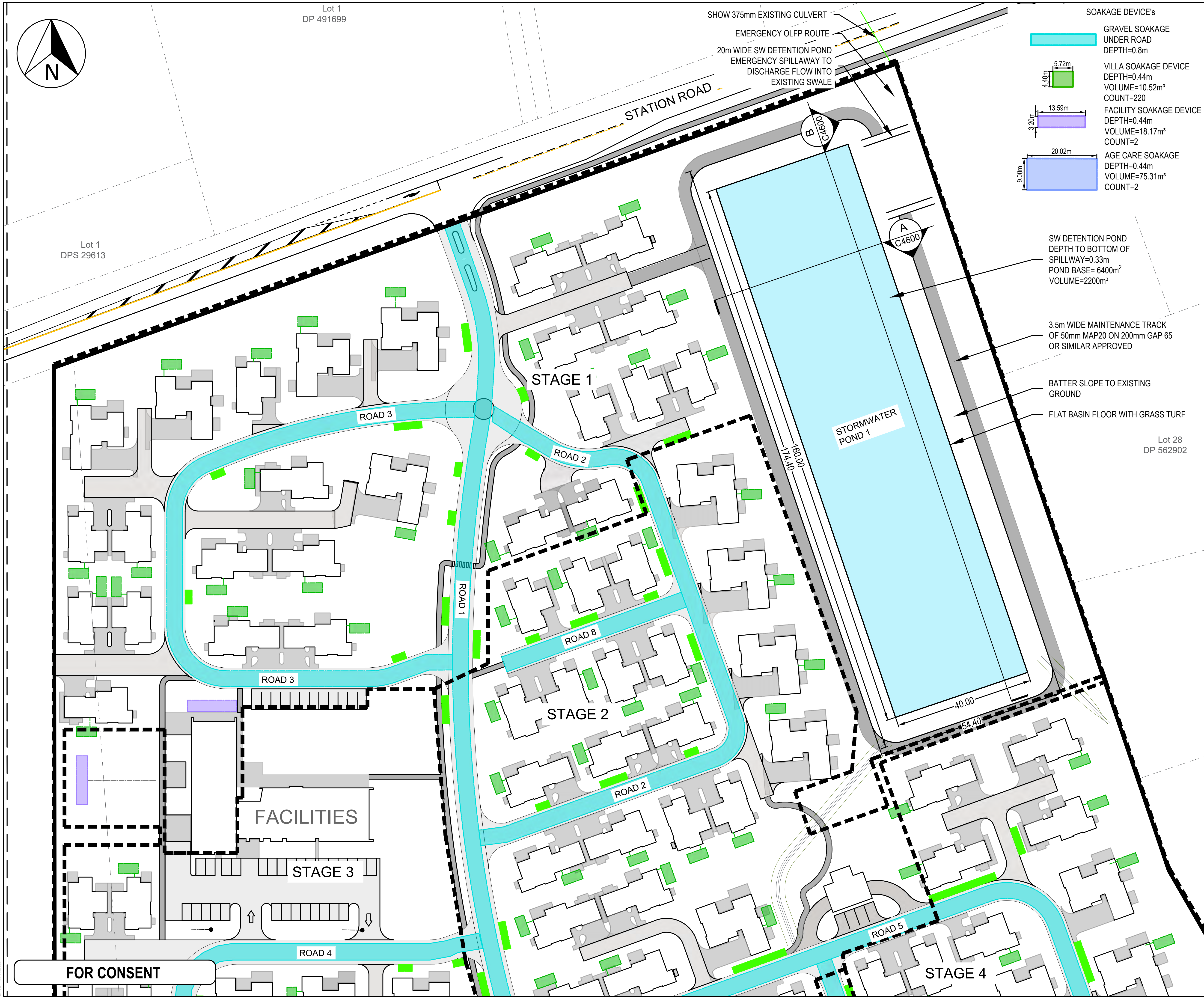
Project
ASHBOURNE RETIREMENT VILLAGE MATAMATA FOR UNITY DEVELOPMENT LTD

Title
PROPOSED STORMWATER OVERVIEW PLAN

Project no.	J00606
Scale	1:2500@A3
Cad file	C4000 - SW.DWG
Drawing no.	C4000
Rev	B

DATE: 05.06.2025
FILE: F:\MAVEN MATAMATA\1. Projects\J00606 UDL - Hemmings Station Rd\8. Drawing\2. CAD\3. Design\C4000 - SW.dwg

ORIGINAL SIZE: A3



FOR CONSENT

Notes
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Legend
- EX BDY
- PROP BDY
- STAGING BDY
- EX STORMWATER
- PR STORMWATER
- EX SW SWALE
- EX/PROP SWMH
- PROP SWCP SINGLE
- RAINGARDENS

Rev	Description	By	Date
B	FOR CONSENT	MS	04/25
A	FOR REVIEW	DP	01/25

	By	Date
Survey	MAVEN	10/2024
Design	DP	12/2024
Drawn	DP	12/2024
Checked	SB	12/2024

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8 Tainui Street, Matamata
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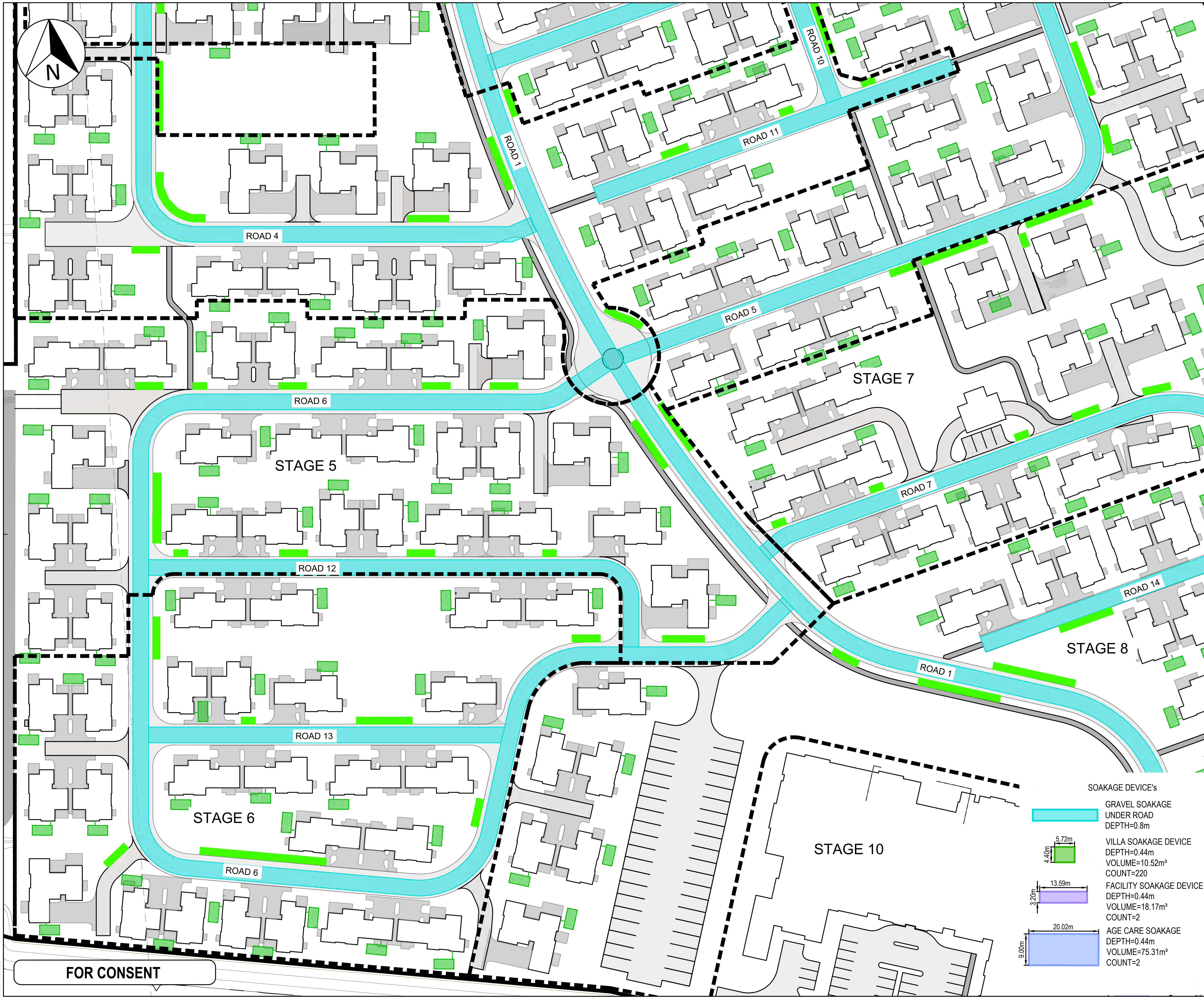
Project
ASHBOURNE RETIREMENT VILLAGE MATAMATA FOR UNITY DEVELOPMENT LTD

Title
PROPOSED STORMWATER LAYOUT PLAN(1 OF 4)

Project no.	J00606
Scale	1:1000@A3
Cad file	C4000 - SW.DWG
Drawing no.	C4001
Rev	B

DATE: 05.06.2025
FILE: F:\MAVEN MATAMATA\1. Projects\J00606 UDL - Hemmings Station Rd\8. Drawing\2. CAD\3. Design\C4000 - SW.dwg



Notes

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Legend

- EX BDY
- PROP BDY
- STAGING BDY
- EX STORMWATER
- PR STORMWATER
- EX SW SWALE
- EX/PROP SWMH
- PROP SWCP SINGLE
- RAINGARDENS

Rev	Description	By	Date
B	FOR CONSENT	MS	04/25
A	FOR REVIEW	DP	01/25

	By	Date
Survey	MAVEN	10/2024
Design	DP	12/2024
Drawn	DP	12/2024
Checked	SB	12/2024

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Project
ASHBOURNE RETIREMENT VILLAGE MATAMATA FOR UNITY DEVELOPMENT LTD

Title
PROPOSED STORMWATER LAYOUT PLAN(2 OF 4)

Project no.	J00606
Scale	1:1000@A3
Cad file	C4000 - SW.DWG
Drawing no.	C4002
Rev	B

DATE: 05.06.2025

FILE: F:\MAVEN MATAMATA\1. Projects\J00606 UDL - Hemmings Station Rd\8. Drawing\2. CAD\3. Design\C4000 - SW.dwg

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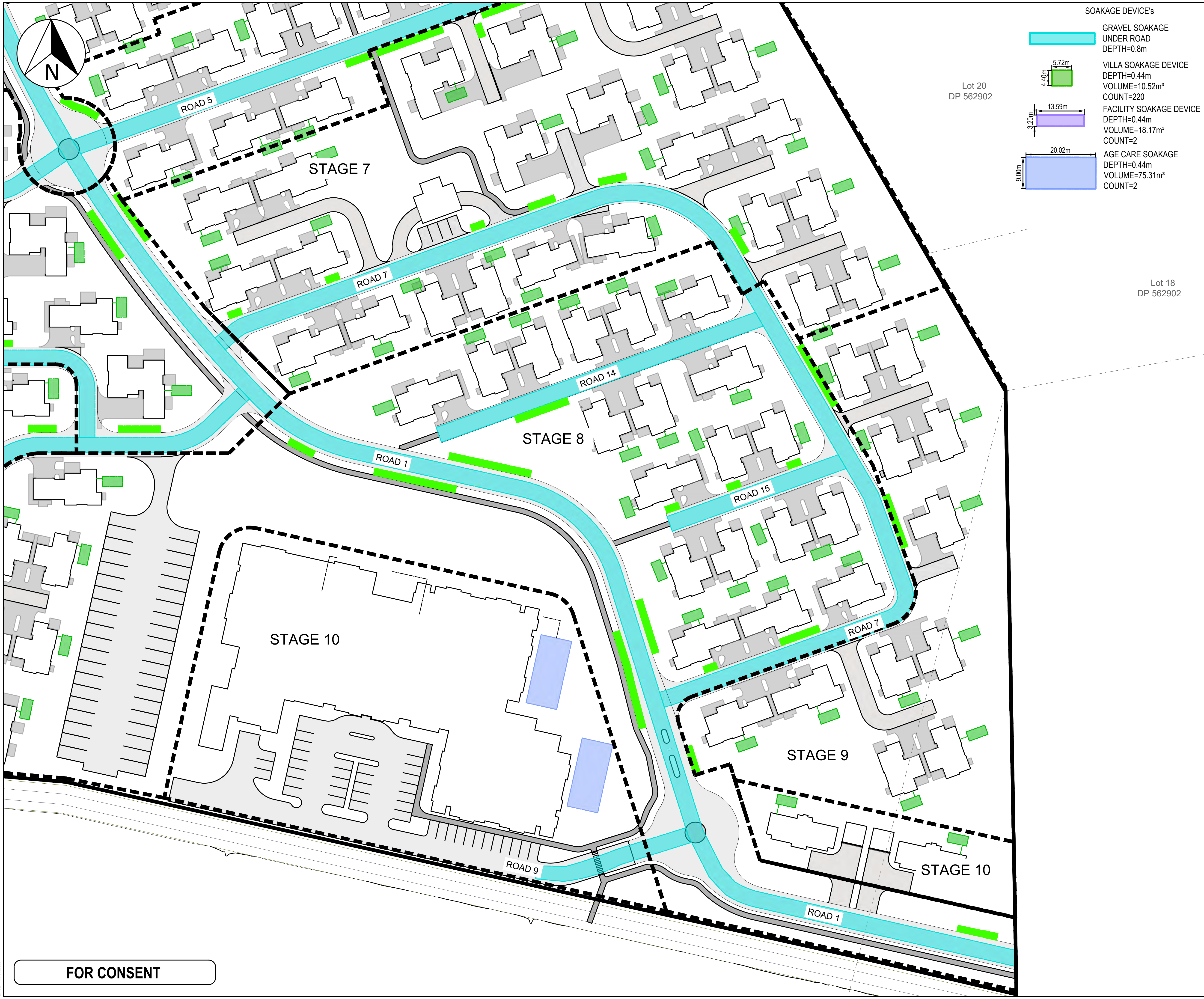

FOR CONSENT

Notes

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Legend

- EX BDY
- PROP BDY
- STAGING BDY
- EX STORMWATER
- PR STORMWATER
- EX SW SWALE
- EX/PROP SWMH
- PROP SWCP SINGLE
- RAINGARDENS

Rev	Description	By	Date
B	FOR CONSENT	MS	04/25
A	FOR REVIEW	DP	01/25

	By	Date
Survey	MAVEN	10/2024
Design	DP	10/2024
Drawn	DP	11/2024
Checked	SB	11/2024

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Project
ASHBOURNE RETIREMENT VILLAGE MATAMATA FOR UNITY DEVELOPMENT LTD

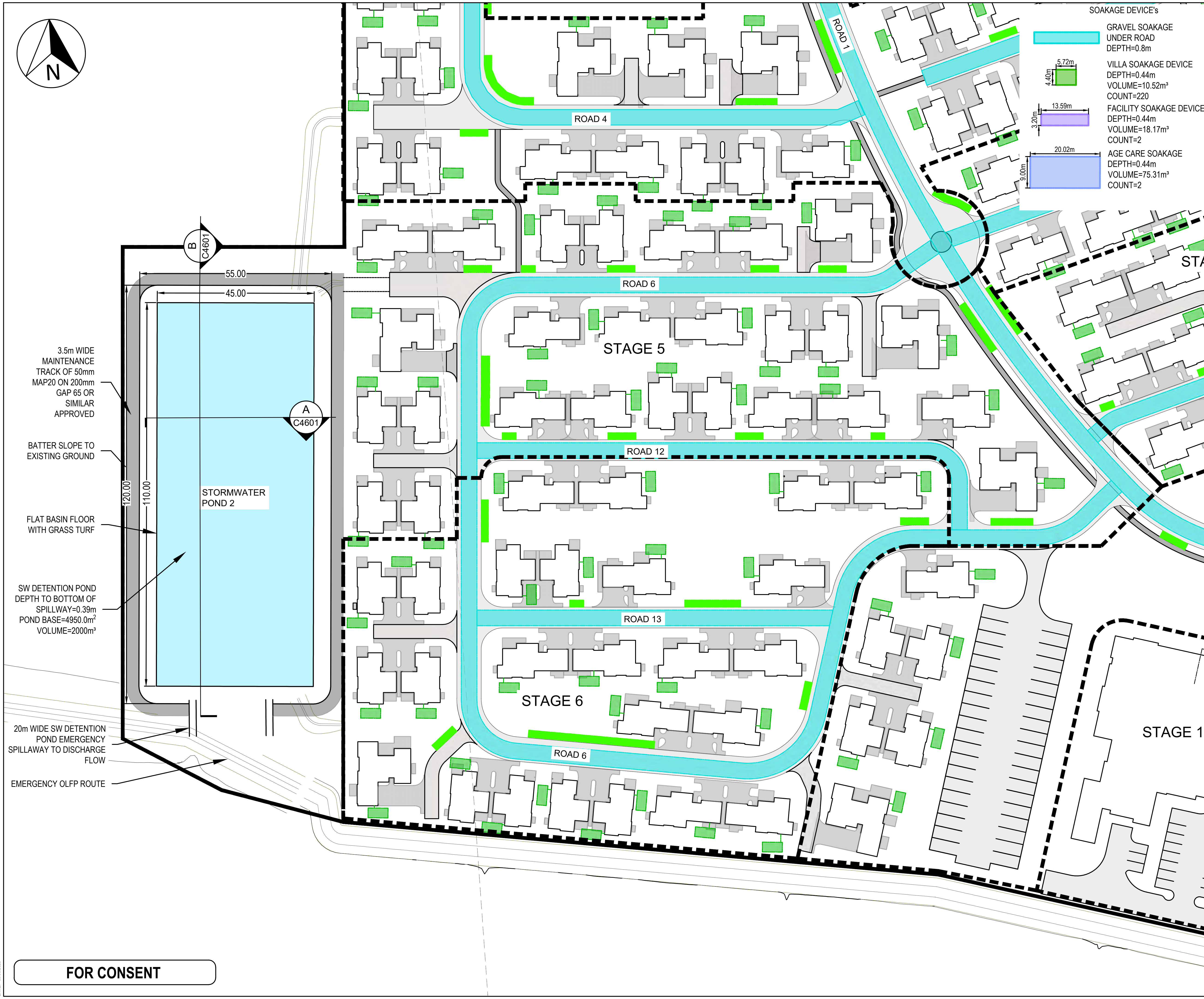
Title
PROPOSED STORMWATER LAYOUT PLAN(3 OF 4)

Project no.	J00606
Scale	1:1000@A3
Cad file	C4000 - SW.DWG
Drawing no.	C4003
Rev	B

DATE: 05.06.2025

FILE: F:\MAVEN MATAMATA\1. Projects\J00606 UDL - Hemmings Station Rd\8. Drawing\2. CAD\3. Design\C4000 - SW.dwg

ORIGINAL SIZE: A3



FOR CONSENT

Notes

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10. Refer to C4703 for Soakage Device details.
11. Preliminary Soakage design is based on the rate of 100mm/h for a 10 year event.

Legend

- EX BDY
- PROP BDY
- STAGING BDY
- EX STORMWATER
- PR STORMWATER
- EX SW SWALE
- EX/PROP SWMH
- PROP SWCP SINGLE
- RAINGARDENS

Rev	Description	By	Date
B	FOR CONSENT	MS	04/25
A	FOR REVIEW	DP	01/25

	By	Date
Survey	MAVEN	10/2024
Design	DP	10/2024
Drawn	DP	11/2024
Checked	SB	11/2024

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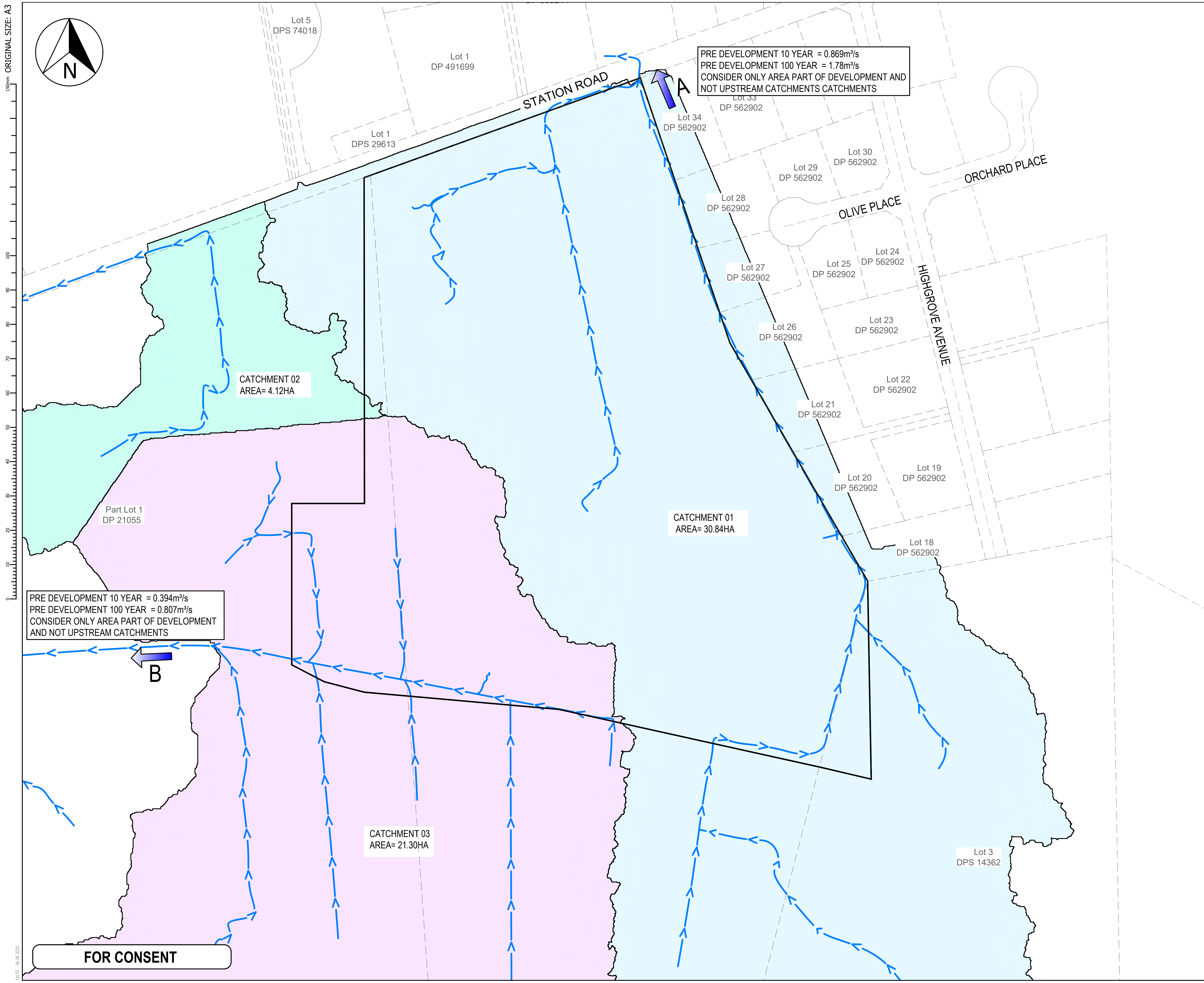
Project
ASHBOURNE RETIREMENT VILLAGE MATAMATA FOR UNITY DEVELOPMENT LTD

Title
PROPOSED STORMWATER LAYOUT PLAN(4 OF 4)

Project no.	J00606
Scale	1:1000@A3
Cad file	C4000 - SW.DWG
Drawing no.	C4004 — Rev B



NOTES
1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications (RITS)
2. Refer to stormwater calculations within infrastructure reporting.

Legend
- EX BDY
- PROP BDY
- OVERLAND FLOW

Rev	Description	By	Date
B	FOR CONSENT	MS	04/25
A	FOR REVIEW	DP	01 /25

	By	Date
Survey	MAVEN	10/2024
Design	DP	12/2024
Drawn	DP	12/2024
Checked	SB	12/2024

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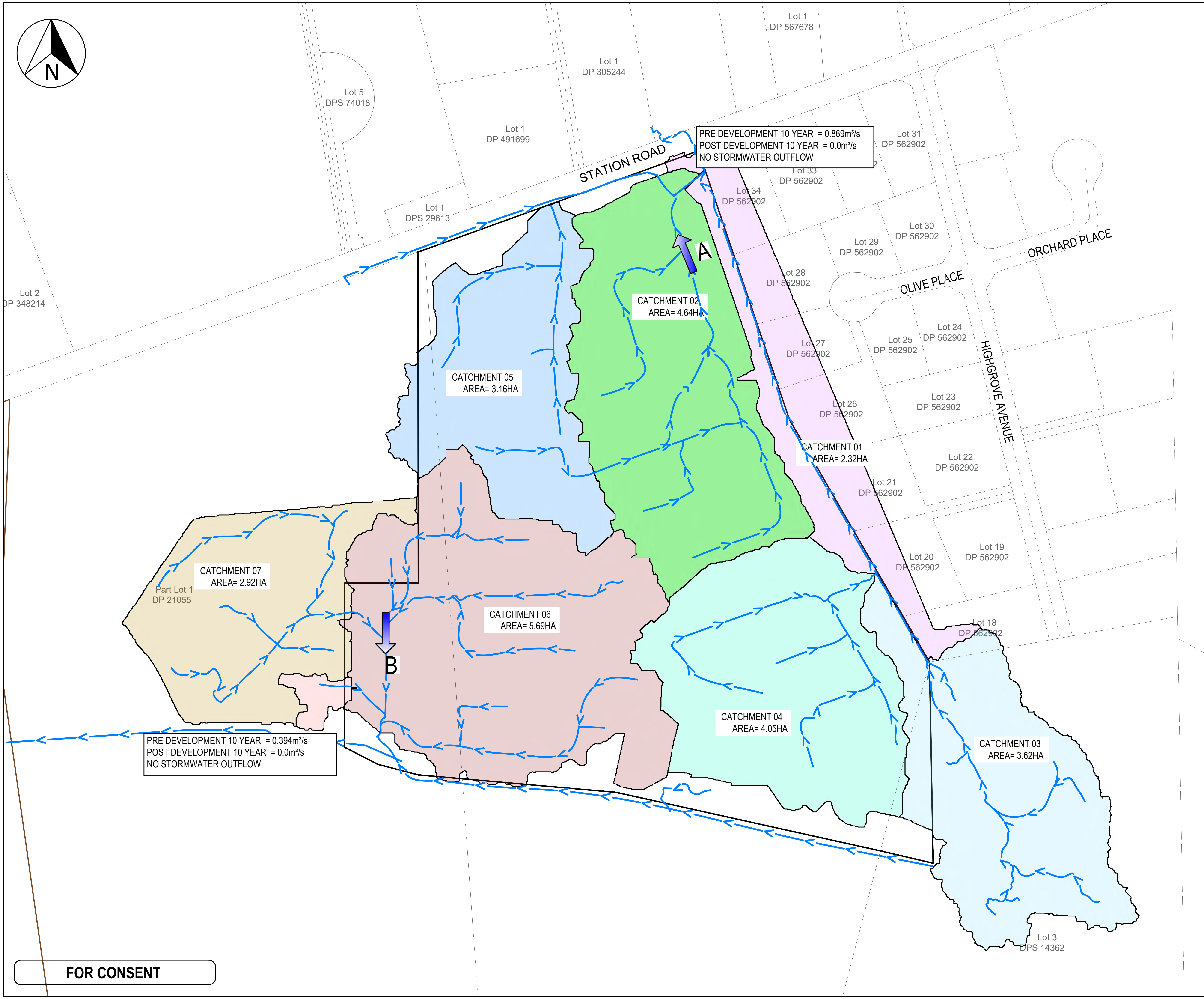
Project
ASHBOURNE RETIREMENT VILLAGE MATAMATA FOR UNITY DEVELOPMENT LTD

Title
EXISTING STORMWATER CATCHMENT PLAN

Project no.	J00606
Scale	1:3000@A3
Cad file	C4050 - SW EX.CATCH.DWG
Drawing no.	C4050 — Rev B

FILE: F:\MAVEN MATAMATA\1. Projects\J00606 UDL - Hemmings Station Rd\8. Drawing\2. CAD\3. Design\C4050 - SW EX.CATCH.dwg

ORIGINAL SIZE: A3



NOTES

1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications (RITS)
2. refer to stormwater calculations within infrastructure reporting.

Legend

- EX BDY
- PROP BDY
- STAGING BDY
- OVERLAND FLOW

Rev	Description	By	Date
B	FOR CONSENT	MS	04/25
A	FOR REVIEW	DP	01/25

	By	Date
Survey	MAVEN	10/2024
Design	DP	12/2024
Drawn	DP	12/2024
Checked	SB	12/2024

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8 Tainui Street, Matamata
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Project
ASHBOURNE RETIREMENT VILLAGE MATAMATA FOR UNITY DEVELOPMENT LTD

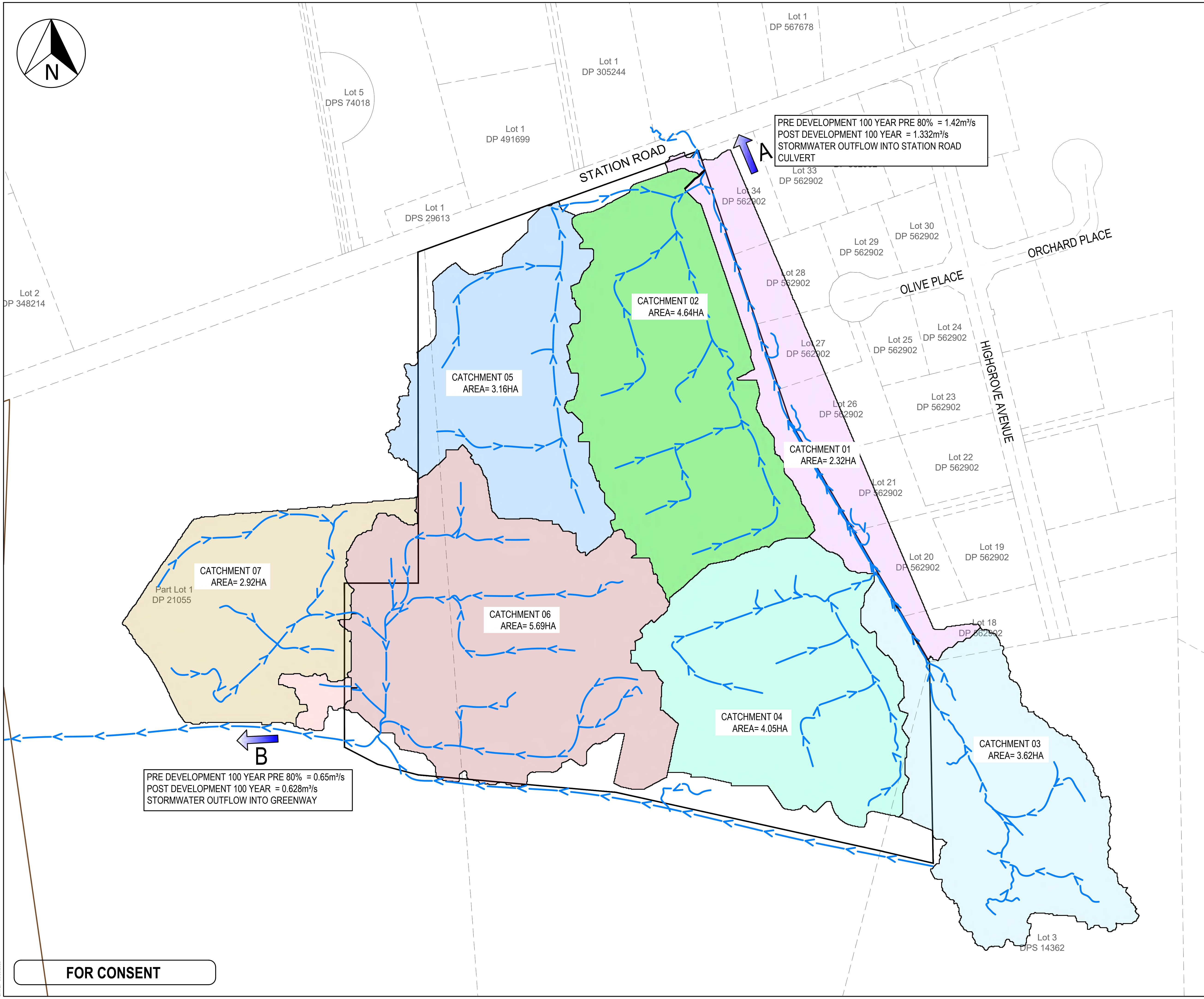
Title
PROPOSED 10 YEAR STORMWATER CATCHMENT PLAN

Project no.	J00606
Scale	1:3000@A3
Cad file	C4051 - SW PR.CATCH.DWG
Drawing no.	C4051
Rev	B

DATE: 06.06.2025

FILE: F:\MAVEN MATAMATA\1. Projects\J00606 UDL - Hemmings Station Rd\8. Drawing\2. CAD\3. Design\C4051 - SW PR.CATCH.dwg

NOTES
1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications (RITS)
2. refer to stormwater calculations within infrastructure reporting.



Rev	Description	By	Date
B	FOR CONSENT	MS	04/25
A	FOR REVIEW	DP	01/25

	By	Date
Survey	MAVEN	10/2024
Design	DP	12/2024
Drawn	DP	12/2024
Checked	SB	12/2024

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Project
ASHBOURNE RETIREMENT VILLAGE MATAMATA FOR UNITY DEVELOPMENT LTD

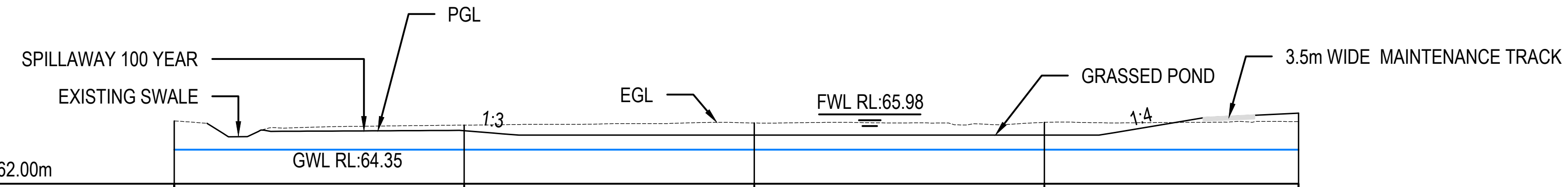
Title
PROPOSED 100 YEAR STORMWATER CATCHMENT PLAN

Project no.	J00606
Scale	1:3000@A3
Cad file	C4051 - SW PR.CATCH.DWG
Drawing no.	C4052 Rev B

FOR CONSENT

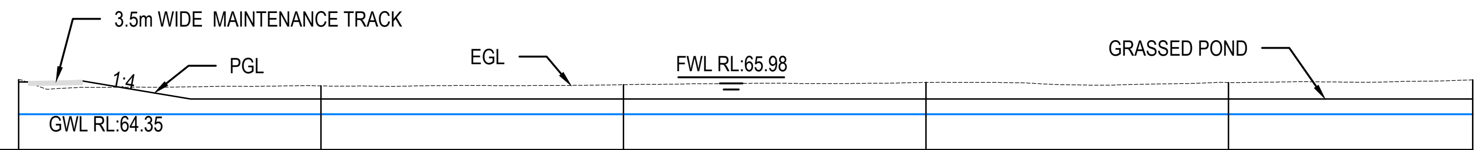
ORIGINAL SIZE: A3

ORIGINAL SIZE: A3



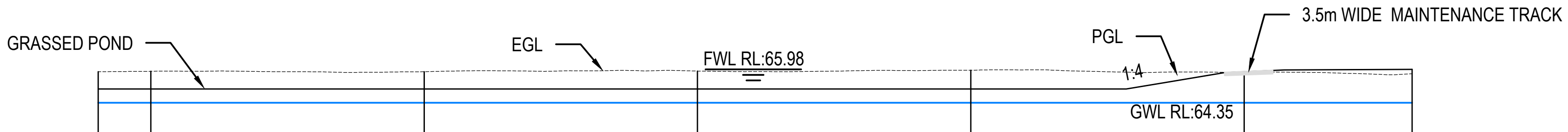
EXISTING LEVELS	66.33	66.04	66.19	66.23	66.28
DESIGN LEVELS		65.65	65.35	65.35	66.87
CUT/FILL		-0.39	-0.84	-0.88	0.59
CHAINAGE	0.00	20.00	40.00	60.00	77.53

Pond 1 (North East) A-A
SCALE: HORI 1:100 VERT 1:100



EXISTING LEVELS	66.62	66.22	66.30	66.44	66.44	66.61
DESIGN LEVELS	66.47	65.35	65.35	65.35	65.35	65.35
CUT/FILL	-0.15	-0.87	-0.95	-1.09	-1.09	-1.26
CHAINAGE	0.00	20.00	40.00	60.00	80.00	96.14

Pond 1 (North East) B-B
SCALE: HORI 1:100 VERT 1:100



EXISTING LEVELS	66.61	66.64	66.61	66.66	66.72	66.58	66.46
DESIGN LEVELS	65.35	65.35	65.35	65.35	65.35	66.61	66.78
CUT/FILL	-1.26	-1.29	-1.26	-1.31	-1.37	0.02	0.32
CHAINAGE	96.14	100.00	120.00	140.00	160.00	180.00	192.29

Pond 1 (North East) B-B
SCALE: HORI 1:100 VERT 1:100

FOR CONSENT

Notes
1. All works to be in accordance with RITS standards.
2. Co-ordinates in terms of Mount Eden 2000.
3. Reduced Levels are in terms of NZVD 2016.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. Pipe bedding: 0 - 10% granular bedding,10 - 20% weak concrete bedding.greater than 20% weak concrete bedding (7mpa plus anti scour blocks at 6m crs).
6. Approved hardfill is to be used in backfilling of all road crossings and vehicle crossings to council standards.
7. Heavy duty manhole lids and frames to be used in trafficked areas.
8. All cesspit leads shall have min cover 0.9m.
9. All lines to be abandoned shall be sealed at each end. timing of all sealing to be coordinated with council staff.
10. Refer to C4700 for Soakage Tank details.

Rev	Description	By	Date
B	FOR CONSENT	MS	04/25
A	FOR REVIEW	DP	01/25

	By	Date
Survey	MAVEN	10/2024
Design	KQ	12/2024
Drawn	DP	12/2024
Checked	SB	12/2024

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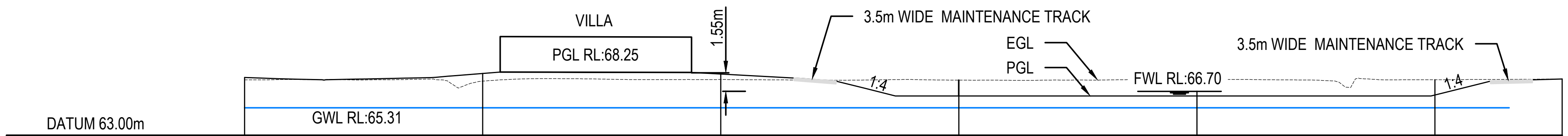
Project
ASHBOURNE RETIREMENT VILLAGE MATAMATA FOR UNITY DEVELOPMENT LTD

Title
PROPOSED STORMWATER POND 1 CROSS SECTION PLAN

Project no.	J00606
Scale	AS SHOWN
Cad file	C4600 - SW POND.DWG
Drawing no.	C4600 Rev B

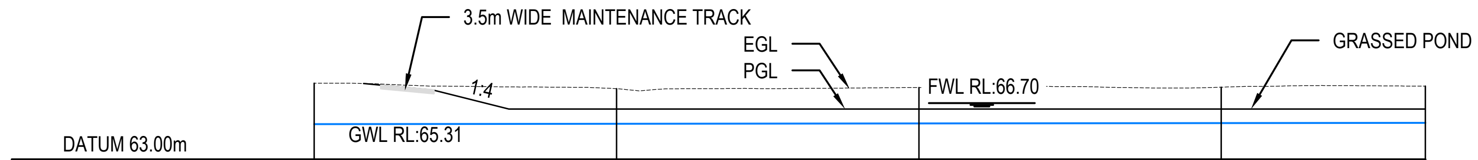
DATE: 05.06.2025
FILE: F:\MAVEN MATAMATA\1. Projects\J00606 UDL - Hemmings Station Rd\8. Drawing\2. CAD\3. Design\C4600 - SW POND.dwg

ORIGINAL SIZE: A3



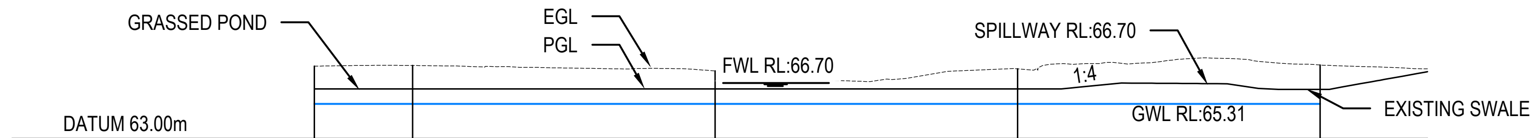
EXISTING LEVELS	67.66	67.55	67.69	67.64	67.70	67.67	67.74
DESIGN LEVELS	67.86	68.20	68.15	66.31	66.31	66.39	67.74
CUT/FILL	0.20	0.65	0.46	-1.33	-1.39	-1.28	0.00
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	110.69

Pond 2 (South West) A-A
SCALE: HORI 1:100 VERT 1:100



EXISTING LEVELS	68.01	67.65	67.73	67.75	67.82
DESIGN LEVELS		66.31	66.31	66.31	66.31
CUT/FILL		-1.34	-1.42	-1.44	-1.51
CHAINAGE	0.00	20.00	40.00	60.00	73.50

Pond 2 (South West) B-B
SCALE: HORI 1:100 VERT 1:100



EXISTING LEVELS	67.82	67.86	67.51	67.64	67.90	
DESIGN LEVELS	66.31	66.31	66.31	66.31	66.28	
CUT/FILL	-1.51	-1.55	-1.20	-1.33	-1.62	
CHAINAGE	73.50	80.00	100.00	120.00	140.00	147.10

Pond 2 (South West) B-B (1)
SCALE: HORI 1:100 VERT 1:100

FOR CONSENT

Notes
1. All works to be in accordance with RITS standards.
2. Co-ordinates in terms of Mount Eden 2000.
3. Reduced Levels are in terms of NZVD 2016.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. Pipe bedding: 0 - 10% granular bedding,10 - 20% weak concrete bedding.greater than 20% weak concrete bedding (7mpa plus anti scour blocks at 6m crs).
6. Approved hardfill is to be used in backfilling of all road crossings and vehicle crossings to council standards.
7. Heavy duty manhole lids and frames to be used in trafficked areas.
8. All cesspit leads shall have min cover 0.9m.
9. All lines to be abandoned shall be sealed at each end. timing of all sealing to be coordinated with council staff.
10. Refer to C4700 for Soakage Tank details.

Rev	Description	By	Date
B	FOR CONSENT	MS	04/25
A	FOR REVIEW	DP	01/25

	By	Date
Survey	MAVEN	10/2024
Design	KQ	11/2024
Drawn	DP	12/2024
Checked	SB	12/2024

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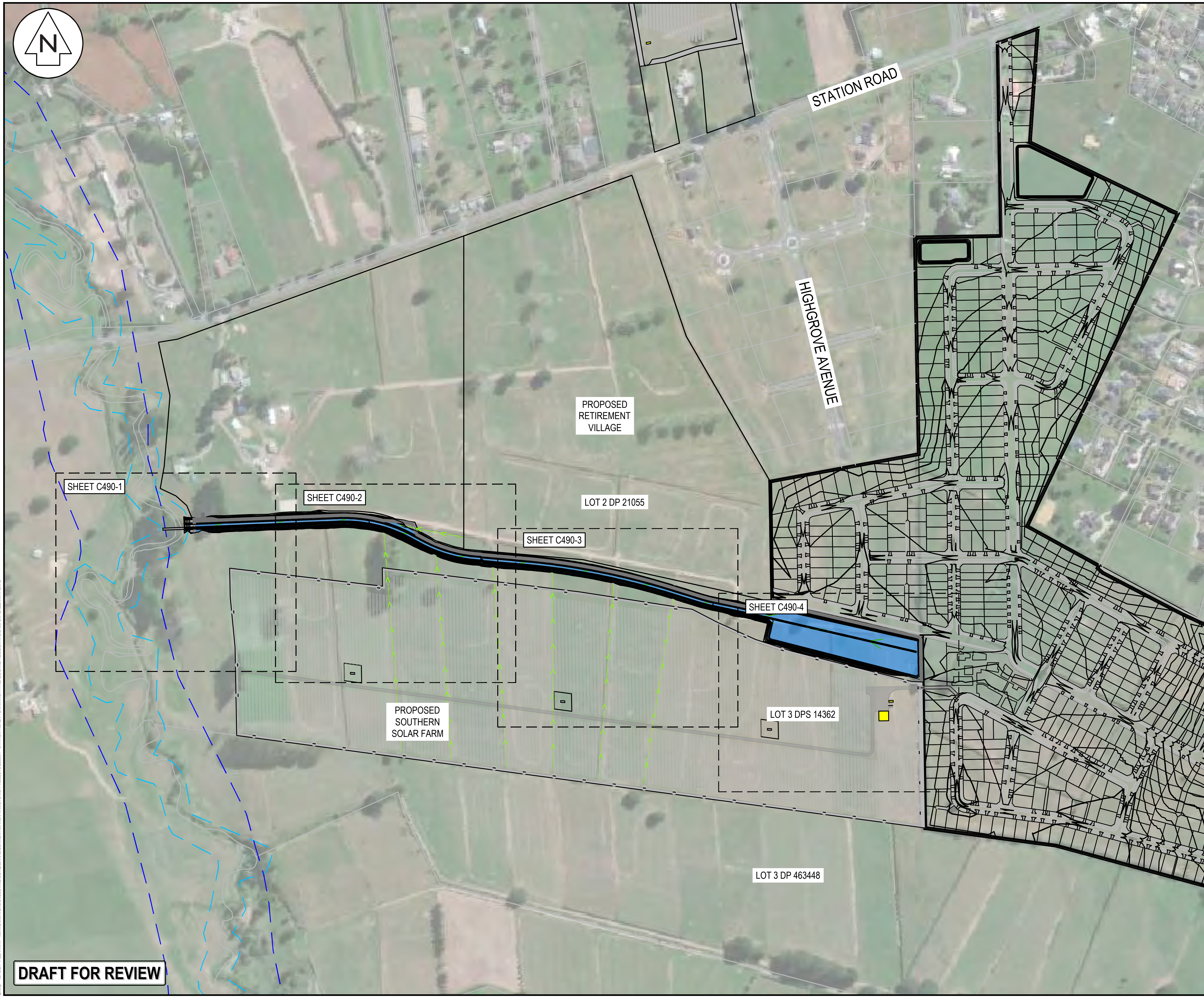
Project
ASHBOURNE RETIREMENT VILLAGE MATAMATA FOR UNITY DEVELOPMENT LTD

Title
PROPOSED STORMWATER POND 2 CROSS SECTION PLAN

Project no.	J00606
Scale	AS SHOWN
Cad file	C4600 - SW POND.DWG
Drawing no.	C4601 — Rev B

DATE: 05.06.2025
FILE: F:\MAVEN MATAMATA\1. Projects\J00606 UDL - Hemmings Station Rd\8. Drawing\2. CAD\3. Design\C4600 - SW POND.dwg

APPENDIX D
GREENWAY DESIGN



Notes

1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mount Eden 2000.
3. Levels in terms of the New Zealand Vertical Datum 2016.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. All concrete SW pipe to be installed in accordance with AS/NZS 3725:2007 for buried concrete pipes and AS/NZ 4058:2007 for precast concrete pipes (pressure and non-pressure) as stipulated in the RITS 2018
6. Approved hardfill is to be used in backfilling of all stormwater lines within the road reserve.
7. Heavy duty manhole lids and frames to be used in trafficked areas.
8. All catchpit leads shall be laid at 1% unless otherwise specified.
9. All concrete lines are to be Class 4 RCRRJ unless otherwise specified.
10. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with council staff.
11. Pipe lengths shown on plan are from upstream pipe invert to downstream pipe invert.

Legend

- EX BOUNDARY
- PROP LOT BOUNDARY
- EX STORMWATER
- PROP STORMWATER
- PROP WASTEWATER
- EX/PROP SWMH
- EX/PROP WWMH
- PROP SW LOT CON
- PROP SWCP SINGLE
- PROP LOW FLOW CHANNEL
- PROP FLOOD ZONE

Rev	Description	By	Date
A	DRAFT	MKS	11/2024

	By	Date
Survey	LINZ	10/2023
Design	MHS	10/2024
Drawn	RJM	11/2024
Checked	DJM	11/2024

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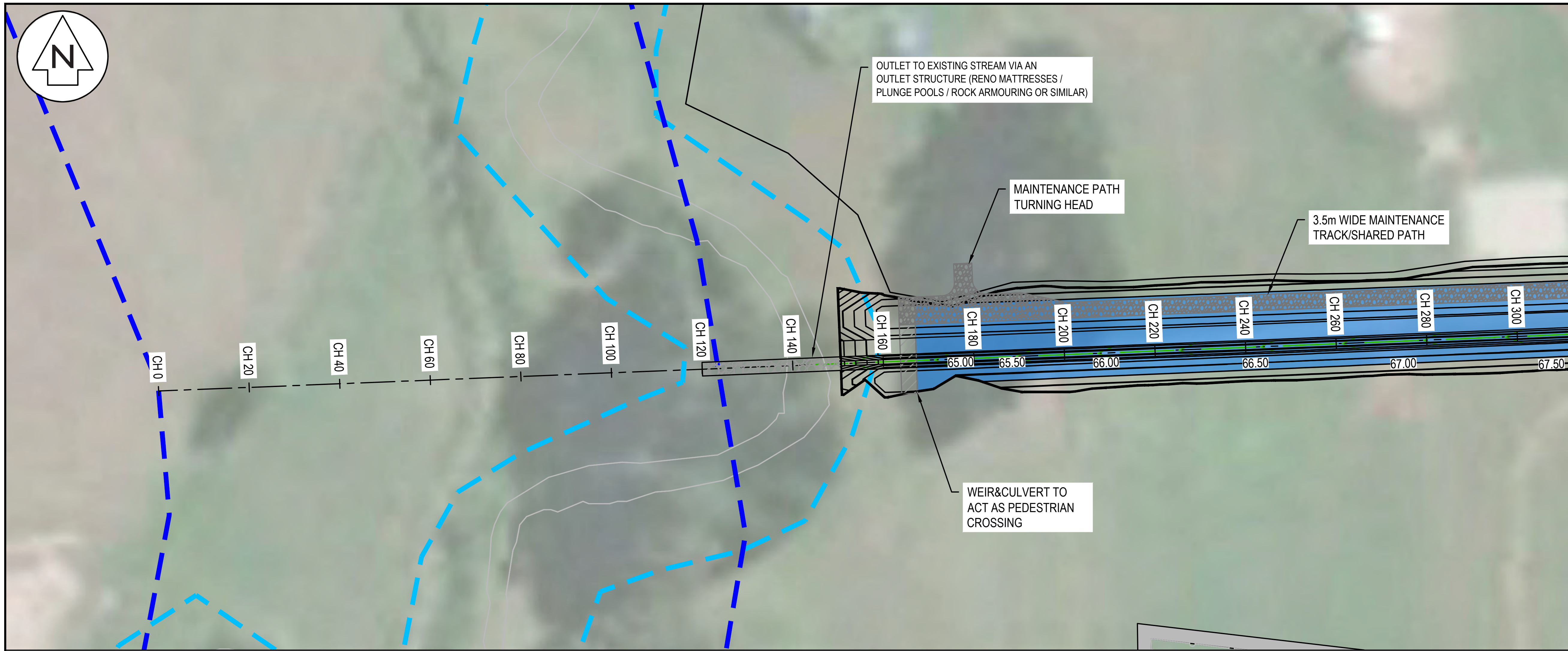
Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS

Title
PROPOSED STORMWATER GREENWAY OVERVIEW

Project no.	289001
Scale	1:5000 @ A3
Cad file	C490-SW GREENWAY.DWG
Drawing no.	C490
Rev	A

DATE: 12/19/24 FILE PATH: \\MAVEN.MAVENCONSULTING.CO.NZ\SHARE\CURRENT\MAVEN HAMILTON\6. PROJECTS\289001 - STATION ROAD\7. DRAWING\11. ASHBOURNE RESIDENTIAL\C490-SW GREENWAY.DWG



Notes

1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mount Eden 2000.
3. Levels in terms of the New Zealand Vertical Datum 2016.
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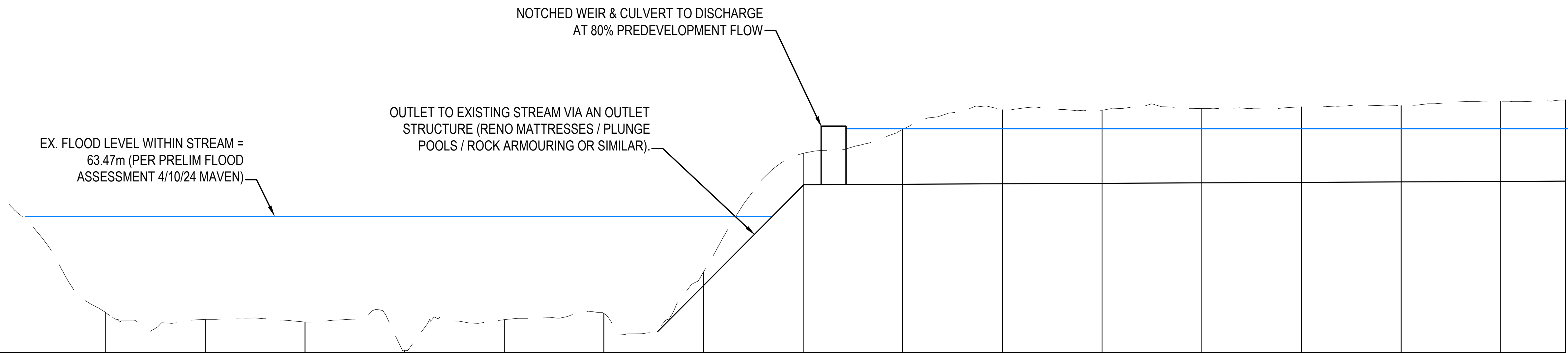
Legend

- EX BOUNDARY
- PROP LOT BOUNDARY
- EX STORMWATER
- PROP STORMWATER
- PROP WASTEWATER
- EX/PROP SWMH
- EX/PROP WWMH
- PROP SW LOT CON
- PROP SWCP SINGLE
- PROP LOW FLOW CHANNEL
- PROP FLOOD ZONE



ATUM 58.00m

EXISTING LEVELS		59.62	59.34	59.24	58.09	59.33	59.58	61.25	66.01	66.97	67.75	67.75	67.82	67.87	67.93	68.11	68.15
DESIGN LEVELS									64.72	64.77	64.79	64.81	64.83	64.85	64.87	64.89	64.90
CUT/FILL									-1.29	-2.20	-2.96	-2.94	-2.99	-3.03	-3.06	-3.22	-3.25
VERTICAL GEO								9.53 20.1%	1075.68 0.1%								
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	300.00	313.00
HORIZONTAL GEO	372.77m 87°42'07"																

DRAFT FOR REVIEW

GREENWAY LONGSECTION CH 0-313
SCALE: HORI 1:500 VERT 1:100

Rev	Description	By	Date
A	DRAFT	MKS	11/2024

	By	Date
Survey	LINZ	10/2023
Design	MHS	10/2024
Drawn	RJM	11/2024
Checked	DJM	11/2024

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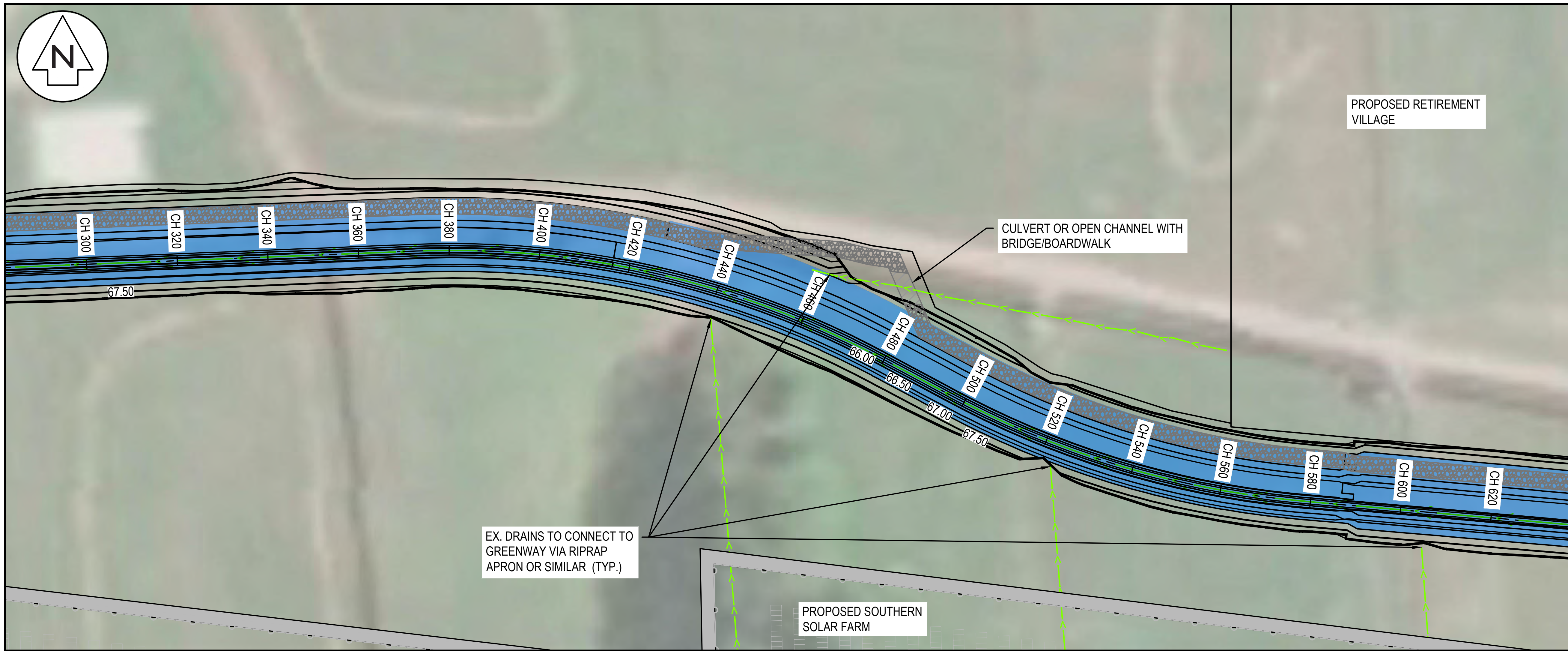
New Zealand

Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS

Title
PROPOSED STORMWATER GREENWAY PLAN

Project no.	289001
Scale	1:1000 @ A3
Cad file	C490-SW GREENWAY.DWG
Drawing no.	C490-1
Rev	A



Notes

1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mount Eden 2000.
3. Levels in terms of the New Zealand Vertical Datum 2016.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. All concrete SW pipe to be installed in accordance with AS/NZS 3725:2007 for buried concrete pipes and AS/NZ 4058:2007 for precast concrete pipes (pressure and non-pressure) as stipulated in the RITS 2018
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11. Pipe lengths shown on plan are from upstream pipe invert to downstream pipe invert.

Legend

- EX BOUNDARY
- PROP LOT BOUNDARY
- EX STORMWATER
- PROP STORMWATER
- PROP WASTEWATER
- EX/PROP SWMH
- EX/PROP WWMH
- PROP SW LOT CON
- PROP SWCP SINGLE
- PROP LOW FLOW CHANNEL
- PROP FLOOD ZONE

A	DRAFT	MKS	11/2024
Rev	Description	By	Date

	By	Date
Survey	LINZ	10/2023
Design	MHS	10/2024
Drawn	RJM	11/2024
Checked	DJM	11/2024

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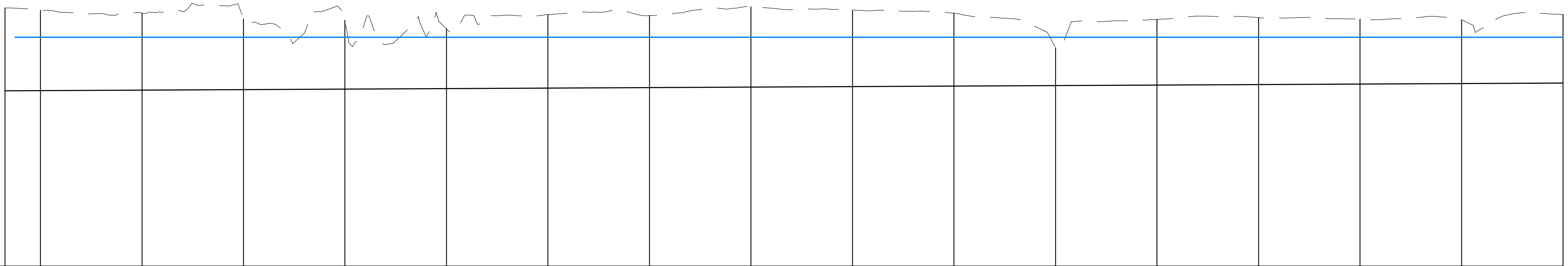
Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS

Title
PROPOSED STORMWATER GREENWAY PLAN

Project no.	289001
Scale	1:1000 @ A3
Cad file	C490-SW GREENWAY.DWG
Drawing no.	C490-2
Rev	A



DATUM 58.00m

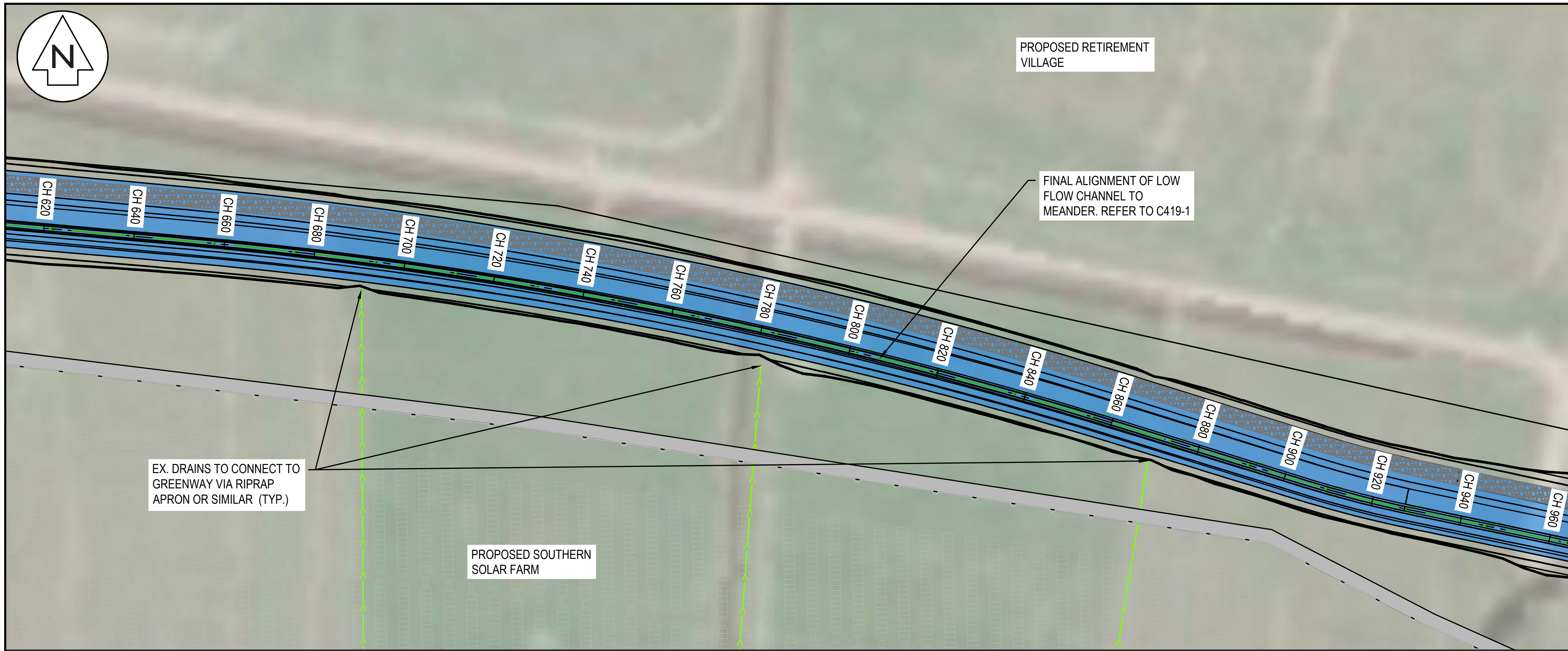
EXISTING LEVELS	68.15	68.06	67.95	67.73	67.68	67.33	67.90	67.86	68.20	68.07	67.95	66.59	67.71	67.77	67.72	67.69	67.90
DESIGN LEVELS	64.90	64.91	64.93	64.94	64.96	64.98	65.00	65.02	65.04	65.06	65.08	65.10	65.12	65.14	65.16	65.18	65.20
CUT/FILL	-3.25	-3.16	-3.03	-2.78	-2.71	-2.35	-2.89	-2.83	-3.15	-3.01	-2.87	-1.49	-2.59	-2.63	-2.55	-2.51	-2.70
CHAINAGE	313.00	320.00	340.00	360.00	380.00	400.00	420.00	440.00	460.00	480.00	500.00	520.00	540.00	560.00	580.00	600.00	620.00

VERTICAL GEO: 1075.68 / 0.1%

HORIZONTAL GEO: 372.77m / 87°42'07" — R 200.00 / A 106.26 — 18.57m / 118°08'33" — R 200.00 / A 80.60 — 71.85m / 95°03'06"

DRAFT FOR REVIEW

GREENWAY LONGSECTION CH 313-620
SCALE: HORI 1:500 VERT 1:100



Notes
1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mount Eden 2000.
3. Levels in terms of the New Zealand Vertical Datum 2016.
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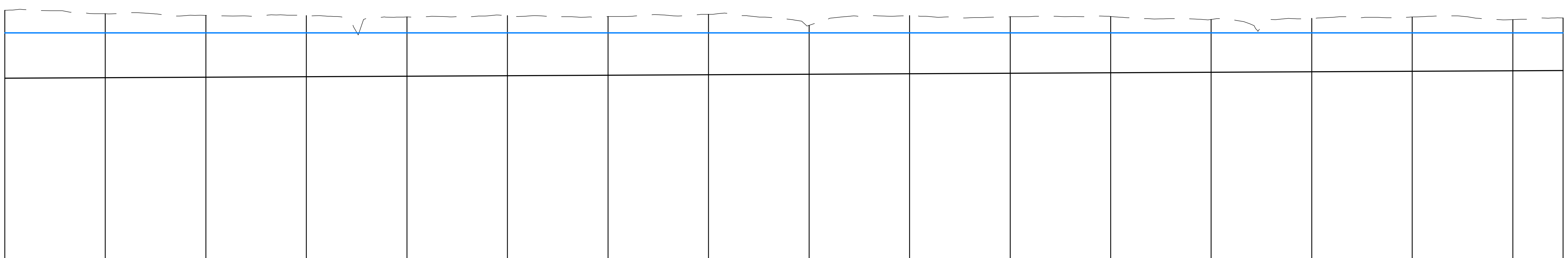
Legend
- EX BOUNDARY
- PROP LOT BOUNDARY
- EX STORMWATER
- PROP STORMWATER
- PROP WASTEWATER
- EX/PROP SWMH
- EX/PROP WWMH
- PROP SW LOT CON
- PROP SWCP SINGLE
- PROP LOW FLOW CHANNEL
- PROP FLOOD ZONE



DATUM 58.00m

EXISTING LEVELS	67.90	67.76	67.69	67.69	67.63	67.69	67.65	67.74	67.30	67.69	67.65	67.65	67.53	67.58	67.63	67.53	67.60
DESIGN LEVELS	65.20	65.22	65.24	65.26	65.28	65.30	65.32	65.34	65.36	65.38	65.40	65.41	65.43	65.45	65.47	65.49	65.50
CUT/FILL	-2.70	-2.54	-2.46	-2.43	-2.36	-2.39	-2.33	-2.40	-1.94	-2.31	-2.25	-2.24	-2.10	-2.12	-2.16	-2.04	-2.10
VERTICAL GEO									1075.68 0.1%								
CHAINAGE	620.00	640.00	660.00	680.00	700.00	720.00	740.00	760.00	780.00	800.00	820.00	840.00	860.00	880.00	900.00	920.00	930.00
HORIZONTAL GEO		71.85m 95°03'06"						R 1000.00 A 212.05						42.89m 107°12'05"		R 250.00 A 23.31	78.87 101°51

DRAFT FOR REVIEW

GREENWAY LONGSECTION CH 620-930
SCALE: HORI 1:500 VERT 1:100

Rev	Description	By	Date
A	DRAFT	MKS	11/2024

	By	Date
Survey	LINZ	10/2023
Design	MHS	10/2024
Drawn	RJM	11/2024
Checked	DJM	11/2024

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Level 1 286 Victoria Street, Hamilton
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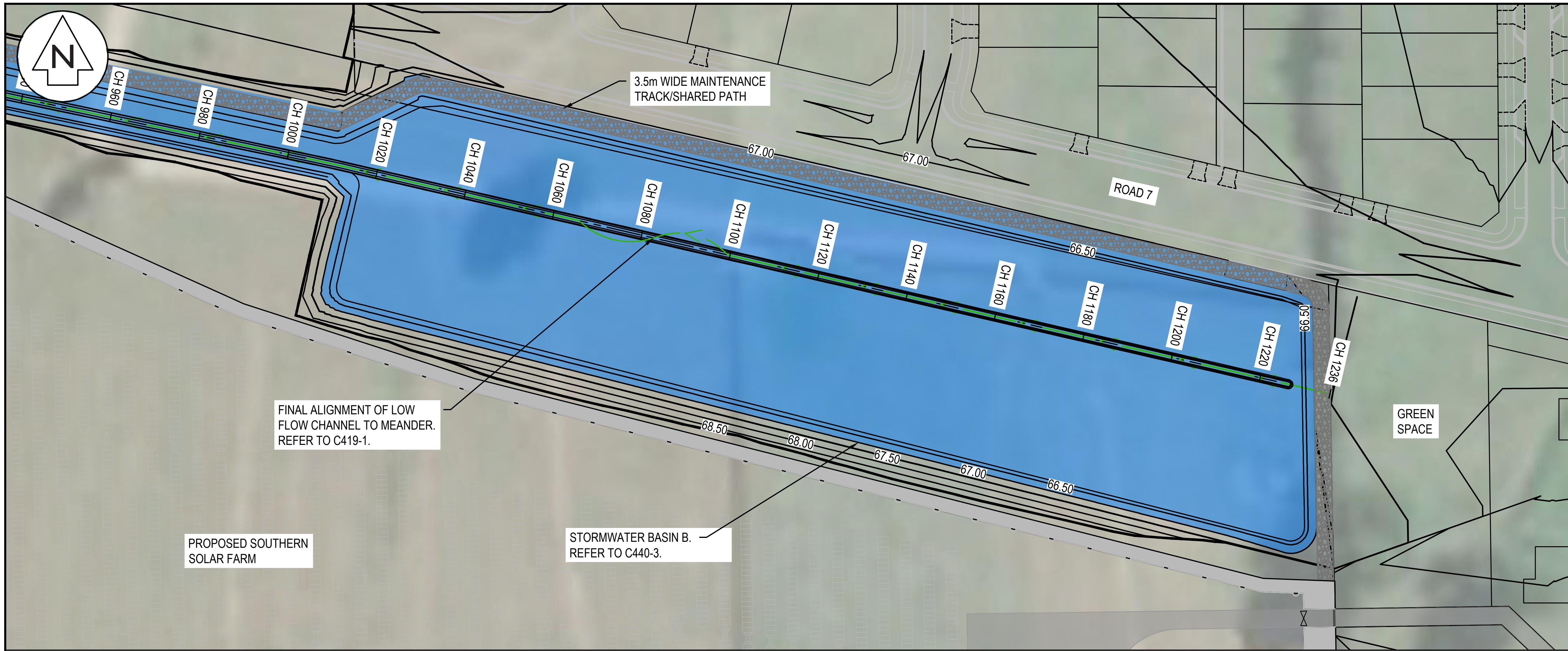
Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS

Title
PROPOSED STORMWATER GREENWAY PLAN

Project no.	289001
Scale	1:1000 @ A3
Cad file	C490-SW GREENWAY.DWG
Drawing no.	C490-3
Rev	A

DATE: 12/19/24 FILE PATH: \\MAVEN.MAVENCONSULTING.CO.NZ\SHARE\CURRENT\MAVEN HAMILTON\6. PROJECTS\289001 - STATION ROAD\7. DRAWINGS\11. ASHBOURNE RESIDENTIAL\C490-SW GREENWAY.DWG

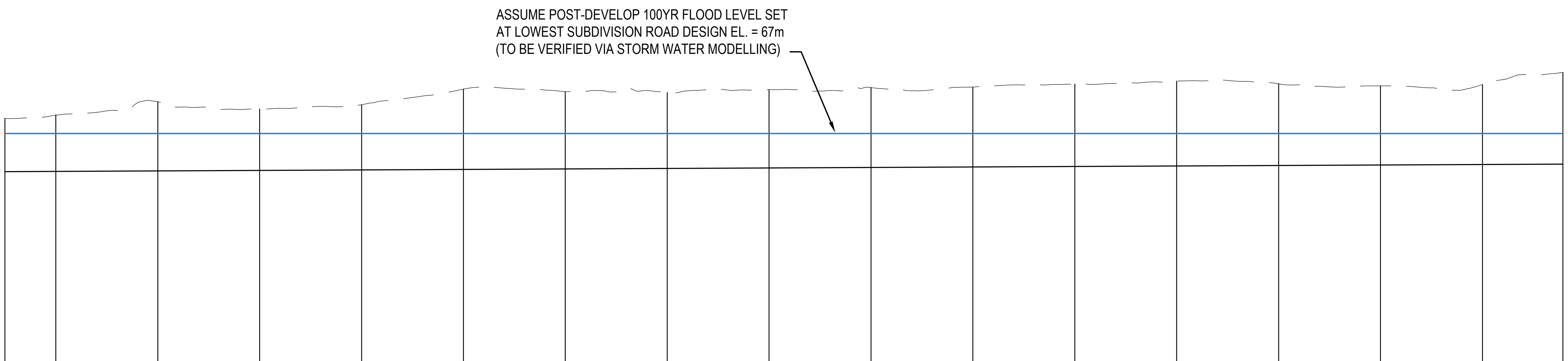


Notes

1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mount Eden 2000.
3. Levels in terms of the New Zealand Vertical Datum 2016.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. All concrete SW pipe to be installed in accordance with AS/NZS 3725:2007 for buried concrete pipes and AS/NZ 4058:2007 for precast concrete pipes (pressure and non-pressure) as stipulated in the RITS 2018
6. Approved hardfill is to be used in backfilling of all stormwater lines within the road reserve.
7. Heavy duty manhole lids and frames to be used in trafficked areas.
8. All catchpit leads shall be laid at 1% unless otherwise specified.
9. All concrete lines are to be Class 4 RCRRJ unless otherwise specified.
10. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with council staff.
11. Pipe lengths shown on plan are from upstream pipe invert to downstream pipe invert.

Legend

- EX BOUNDARY
- PROP LOT BOUNDARY
- EX STORMWATER
- PROP STORMWATER
- PROP WASTEWATER
- EX/PROP SWMH
- EX/PROP WWMH
- PROP SW LOT CON
- PROP SWCP SINGLE
- PROP LOW FLOW CHANNEL
- PROP FLOOD ZONE



DATUM 58.00m

EXISTING LEVELS	67.60	67.73	68.25	67.97	68.13	68.75	68.65	68.62	68.73	68.81	68.83	68.95	69.06	68.96	68.88	68.93	69.40
DESIGN LEVELS	65.50	65.51	65.53	65.55	65.57	65.59	65.61	65.63	65.65	65.67	65.69	65.71	65.73	65.75	65.77	65.79	65.80
CUT/FILL	-2.10	-2.22	-2.72	-2.42	-2.56	-3.16	-3.04	-2.99	-3.08	-3.14	-3.14	-3.24	-3.33	-3.21	-3.11	-3.14	-3.59
VERTICAL GEO	1075.68 0.1%																
CHAINAGE	930.00	940.00	960.00	980.00	1000.00	1020.00	1040.00	1060.00	1080.00	1100.00	1120.00	1140.00	1160.00	1180.00	1200.00	1220.00	1235.82
HORIZONTAL GEO	78.87m 101°51'34"				R 250.00 A 4.85						223.80m 102°58'14"						

DRAFT FOR REVIEW

GREENWAY LONGSECTION CH 930-1236
SCALE: HORI 1:500 VERT 1:100

Rev	Description	By	Date
A	DRAFT	MKS	11/2024

	By	Date
Survey	LINZ	10/2023
Design	MHS	10/2024
Drawn	RJM	11/2024
Checked	DJM	11/2024

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Maven Waikato
07 242 0601
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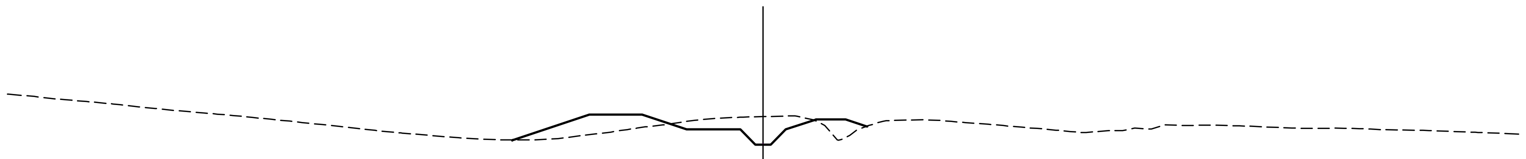
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS

Title
PROPOSED STORMWATER GREENWAY PLAN

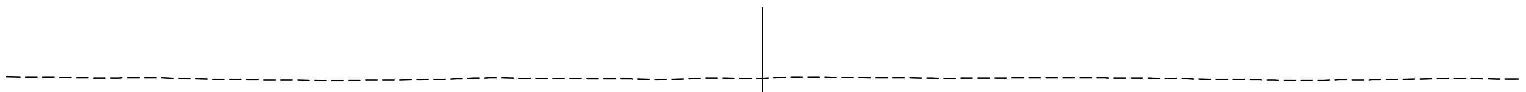
Project no.	289001
Scale	1:1000 @ A3
Cad file	C490-SW GREENWAY.DWG
Drawing no.	C490-4
Rev	A



DATUMN 60.00

EXISTING LEVELS	66.23	66.05	65.84	65.67	65.47	65.25	65.07	64.90	64.71	64.51	64.30	64.10	63.87	63.66	63.50	63.34	63.23	63.21	63.27	63.49	63.73	64.03	64.28	64.54	64.68	64.74	64.80	64.21	63.69	64.45	64.52	64.46	64.30	64.14	63.97	63.78	63.74	63.86	64.02	64.16	64.17	64.11	64.03	63.97	63.97	63.92	63.86	63.82	63.75	63.67	63.57
DESIGN LEVELS																		63.38	64.05	64.72	64.88	64.88	64.22	63.89	63.89	62.89	64.06	64.55	64.38																						
OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00

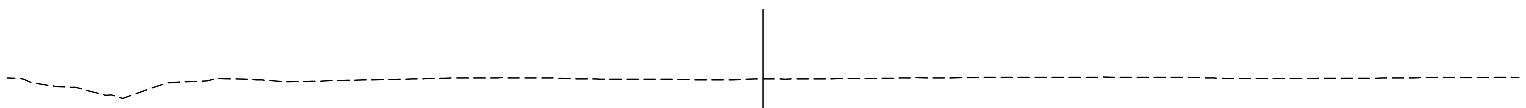
CH 150.91m



DATUMN 56.00

EXISTING LEVELS	59.43	59.41	59.38	59.35	59.36	59.36	59.31	59.26	59.24	59.22	59.20	59.18	59.21	59.22	59.25	59.30	59.36	59.33	59.31	59.32	59.29	59.27	59.27	59.33	59.33	59.33	59.40	59.40	59.38	59.38	59.35	59.32	59.35	59.35	59.36	59.36	59.36	59.34	59.33	59.30	59.26	59.25	59.20	59.19	59.23	59.22	59.26	59.30	59.33	59.30	59.28
DESIGN LEVELS																																																			
OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00

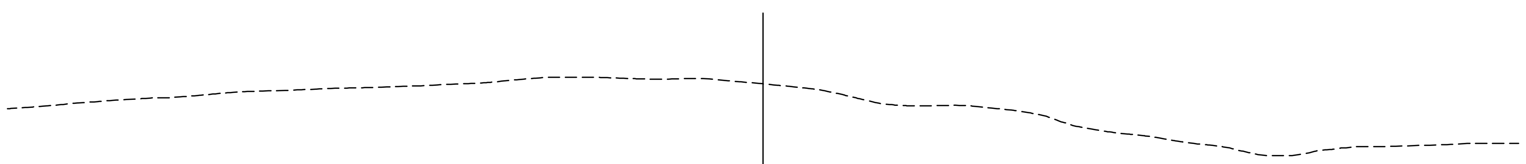
CH 100.00m



DATUMN 56.00

EXISTING LEVELS	59.47	59.10	58.87	58.46	58.25	58.95	59.22	59.43	59.37	59.25	59.24	59.31	59.34	59.38	59.43	59.47	59.48	59.46	59.46	59.41	59.39	59.39	59.38	59.34	59.35	59.40	59.39	59.41	59.42	59.44	59.48	59.47	59.50	59.51	59.52	59.51	59.52	59.51	59.52	59.50	59.46	59.42	59.43	59.43	59.45	59.45	59.47	59.49	59.50	59.50	59.50
DESIGN LEVELS																																																			
OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00

CH 50.00m



DATUMN 56.00

EXISTING LEVELS	61.69	61.83	62.00	62.16	62.30	62.41	62.52	62.69	62.83	62.89	62.97	63.05	63.09	63.16	63.23	63.33	63.44	63.63	63.76	63.77	63.73	63.65	63.65	63.67	63.51	63.33	63.14	62.89	62.44	62.01	61.88	61.90	61.85	61.64	61.35	60.75	60.31	60.03	59.80	59.47	59.24	58.83	58.60	58.76	59.06	59.20	59.23	59.28	59.37	59.40	59.40
DESIGN LEVELS																																																			
OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00

CH 4.09m

DRAFT FOR REVIEW

Rev	Description	By	Date
A	DRAFT	MKS	11/2024

	By	Date
Survey	LINZ	10/2023
Design	MHS	10/2024
Drawn	RJM	11/2024
Checked	DJM	11/2024

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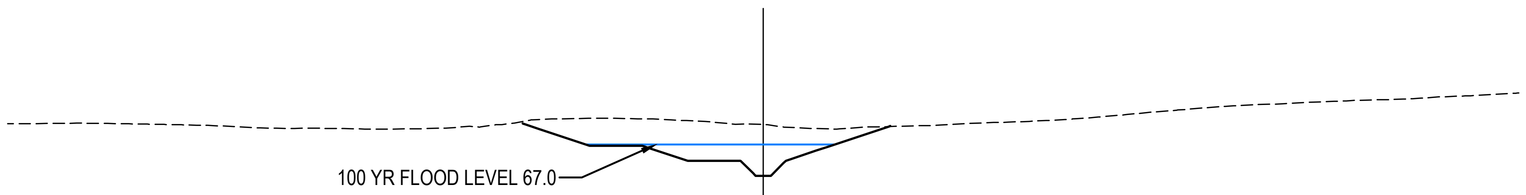
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS

Title
PROPOSED GREENWAY CROSS SECTIONS

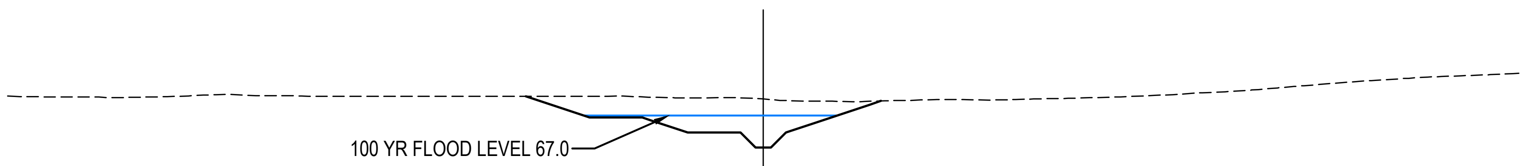
Project no.	289001
Scale	1:500 @ A3
Cad file	C490-SW GREENWAY.DWG
Drawing no.	C490-10
Rev	A



DATUMN 62.00

OFFSETS	EXISTING LEVELS	DESIGN LEVELS
-50.00	68.39	
-48.00	68.39	
-46.00	68.41	
-44.00	68.41	
-42.00	68.38	
-40.00	68.34	
-38.00	68.30	
-36.00	68.24	
-34.00	68.14	
-32.00	68.07	
-30.00	68.08	
-28.00	68.06	
-26.00	68.03	
-24.00	68.04	
-22.00	68.07	
-20.00	68.17	
-18.00	68.27	
-16.00	68.51	
-14.00	68.69	67.76
-12.00	68.73	67.09
-10.00	68.75	66.93
-8.00	68.70	66.93
-6.00	68.63	66.27
-4.00	68.53	65.94
-2.00	68.35	65.94
0.00	68.33	64.94
2.00	68.13	66.10
4.00	68.05	66.76
6.00	68.11	67.43
8.00	68.18	68.10
10.00	68.24	
12.00	68.31	
14.00	68.41	
16.00	68.48	
18.00	68.56	
20.00	68.66	
22.00	68.81	
24.00	68.99	
26.00	69.17	
28.00	69.33	
30.00	69.49	
32.00	69.61	
34.00	69.69	
36.00	69.79	
38.00	69.87	
40.00	69.95	
42.00	69.99	
44.00	70.10	
46.00	70.20	
48.00	70.31	
50.00	70.42	

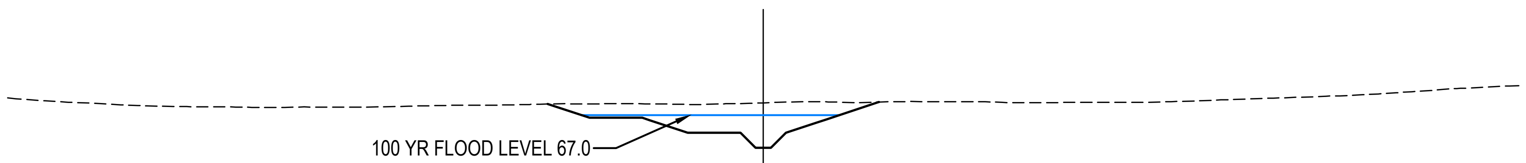
CH 350.00m



DATUMN 62.00

OFFSETS	EXISTING LEVELS	DESIGN LEVELS
-50.00	68.29	
-48.00	68.25	
-46.00	68.24	
-44.00	68.23	
-42.00	68.21	
-40.00	68.25	
-38.00	68.31	
-36.00	68.39	
-34.00	68.35	
-32.00	68.33	
-30.00	68.29	
-28.00	68.28	
-26.00	68.28	
-24.00	68.28	
-22.00	68.28	
-20.00	68.28	
-18.00	68.28	
-16.00	68.28	
-14.00	68.28	67.71
-12.00	68.28	67.04
-10.00	68.29	66.88
-8.00	68.24	66.88
-6.00	68.19	66.22
-4.00	68.18	65.89
-2.00	68.19	65.89
0.00	68.11	64.89
2.00	67.99	66.05
4.00	67.96	66.71
6.00	67.93	67.38
8.00	67.99	
10.00	68.02	
12.00	68.07	
14.00	68.05	
16.00	68.05	
18.00	68.11	
20.00	68.14	
22.00	68.20	
24.00	68.26	
26.00	68.34	
28.00	68.45	
30.00	68.55	
32.00	68.67	
34.00	68.83	
36.00	69.00	
38.00	69.16	
40.00	69.31	
42.00	69.43	
44.00	69.55	
46.00	69.63	
48.00	69.71	
50.00	69.80	

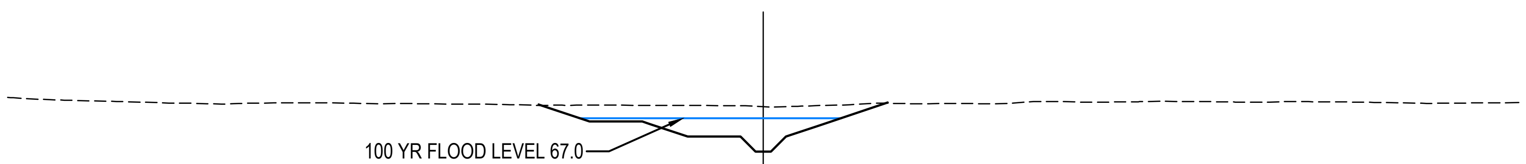
CH 300.00m



DATUMN 62.00

OFFSETS	EXISTING LEVELS	DESIGN LEVELS
-50.00	68.14	
-48.00	67.99	
-46.00	67.85	
-44.00	67.77	
-42.00	67.67	
-40.00	67.60	
-38.00	67.57	
-36.00	67.56	
-34.00	67.52	
-32.00	67.51	
-30.00	67.54	
-28.00	67.53	
-26.00	67.54	
-24.00	67.58	
-22.00	67.63	
-20.00	67.66	
-18.00	67.66	
-16.00	67.70	
-14.00	67.74	67.66
-12.00	67.75	66.99
-10.00	67.77	66.83
-8.00	67.76	66.83
-6.00	67.73	66.17
-4.00	67.71	65.84
-2.00	67.77	65.84
0.00	67.82	64.84
2.00	67.88	66.00
4.00	67.89	66.66
6.00	67.83	67.33
8.00	67.88	
10.00	67.91	
12.00	67.89	
14.00	67.89	
16.00	67.84	
18.00	67.83	
20.00	67.85	
22.00	67.85	
24.00	67.85	
26.00	67.87	
28.00	67.93	
30.00	68.00	
32.00	68.07	
34.00	68.14	
36.00	68.21	
38.00	68.28	
40.00	68.37	
42.00	68.50	
44.00	68.63	
46.00	68.77	
48.00	68.86	
50.00	68.96	

CH 250.00m



DATUMN 62.00

OFFSETS	EXISTING LEVELS	DESIGN LEVELS
-50.00	68.36	
-48.00	68.25	
-46.00	68.19	
-44.00	68.13	
-42.00	68.08	
-40.00	68.02	
-38.00	67.98	
-36.00	67.93	
-34.00	67.99	
-32.00	68.01	
-30.00	68.01	
-28.00	68.00	
-26.00	67.96	
-24.00	67.97	
-22.00	67.94	
-20.00	67.93	
-18.00	67.92	
-16.00	67.87	
-14.00	67.85	67.61
-12.00	67.86	66.95
-10.00	67.86	66.78
-8.00	67.85	66.78
-6.00	67.84	66.12
-4.00	67.83	65.79
-2.00	67.82	65.79
0.00	67.75	64.79
2.00	67.78	65.95
4.00	67.84	66.62
6.00	67.91	67.28
8.00	67.98	67.95
10.00	67.95	
12.00	67.97	
14.00	67.97	
16.00	67.96	
18.00	68.09	
20.00	68.09	
22.00	68.06	
24.00	68.07	
26.00	68.10	
28.00	68.10	
30.00	68.09	
32.00	68.06	
34.00	68.08	
36.00	68.09	
38.00	68.07	
40.00	68.05	
42.00	68.01	
44.00	67.97	
46.00	68.00	
48.00	68.01	
50.00	68.02	

CH 200.00m

DRAFT FOR REVIEW

Rev	Description	By	Date
A	DRAFT	MKS	11/2024

	By	Date
Survey	LINZ	10/2023
Design	MHS	10/2024
Drawn	RJM	11/2024
Checked	DJM	11/2024

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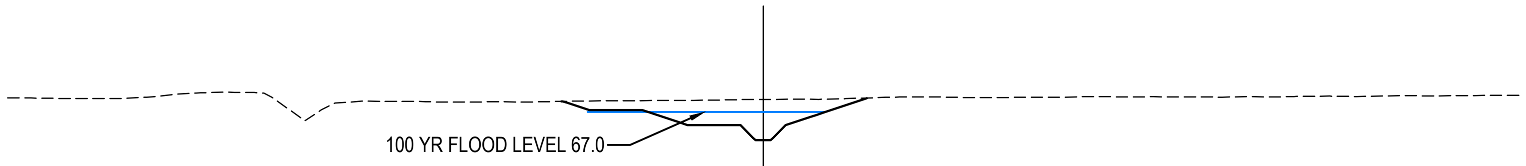
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS

Title
PROPOSED GREENWAY CROSS SECTIONS

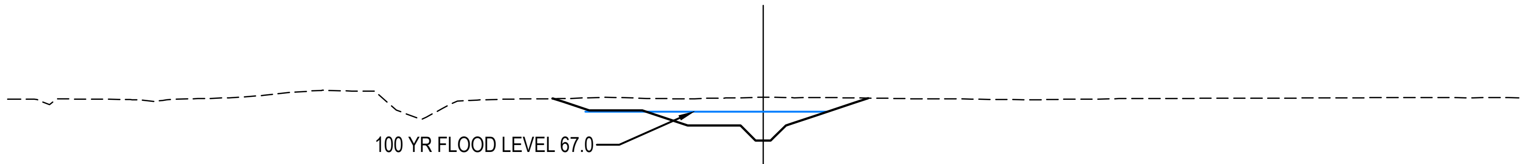
Project no.	289001
Scale	1:500 @ A3
Cad file	C490-SW GREENWAY.DWG
Drawing no.	C490-11
Rev	A



DATUMN 62.00

EXISTING LEVELS	67.94	67.92	67.89	67.89	67.92	68.05	68.23	68.30	68.29	67.61	66.63	67.61	67.71	67.71	67.68	67.66	67.68	67.66	67.69	67.73	67.74	67.75	67.77	67.78	67.81	67.83	67.85	67.85	67.90	67.97	68.00	67.99	67.96	67.97	67.98	67.98	68.02	68.01	68.01	68.00	67.99	68.01	68.00	68.05	68.04	68.04	68.07	68.07	68.08	68.10	68.10
DESIGN LEVELS																				67.28	67.12	67.12	66.46	66.13	66.13	65.13	66.30	66.96	67.63																						
OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00

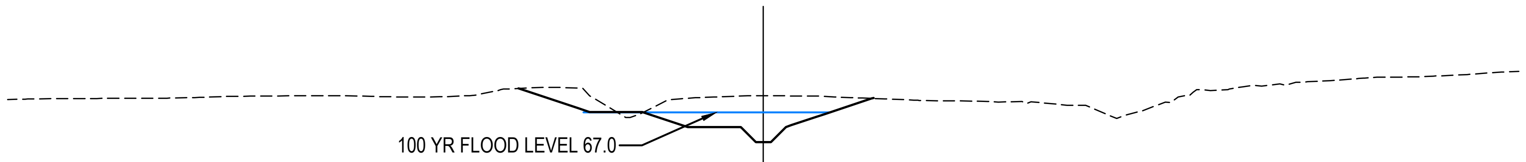
CH 550.00m



DATUMN 62.00

EXISTING LEVELS	67.83	67.77	67.84	67.82	67.79	67.72	67.84	67.89	68.00	68.19	68.35	68.38	68.36	67.00	66.79	67.72	67.80	67.84	67.85	67.90	67.94	67.88	67.85	67.87	67.90	67.95	67.92	67.93	67.91	67.88	67.85	67.85	67.82	67.80	67.78	67.82	67.82	67.86	67.86	67.87	67.88	67.88	67.89	67.90	67.91	67.92	67.93	67.93	67.92	67.92	67.91
DESIGN LEVELS																				67.24	67.07	67.07	66.41	66.08	66.08	65.08	66.25	66.91	67.58																						
OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00

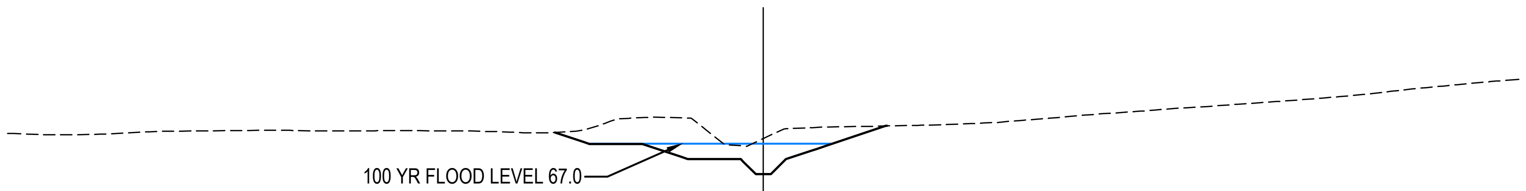
CH 500.00m



DATUMN 62.00

EXISTING LEVELS	67.84	67.89	67.91	67.92	67.92	67.93	67.97	68.04	68.07	68.09	68.10	68.09	68.06	68.02	68.02	68.08	68.35	68.59	68.64	68.61	67.20	66.96	67.85	67.98	68.06	68.10	68.08	68.05	67.96	67.89	67.81	67.75	67.75	67.69	67.67	67.48	67.17	66.82	67.44	68.13	68.47	68.73	68.86	69.02	69.13	69.28	69.33	69.38	69.47	69.60	69.71
DESIGN LEVELS																		68.53	67.86	67.19	67.02	67.02	66.37	66.03	66.03	65.03	66.20	66.86	67.52																						
OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00

CH 450.00m



DATUMN 62.00

EXISTING LEVELS	67.68	67.61	67.59	67.62	67.72	67.81	67.84	67.86	67.88	67.88	67.86	67.85	67.85	67.86	67.86	67.84	67.80	67.73	67.72	67.89	68.53	68.72	68.73	68.09	66.90	67.33	68.01	68.09	68.13	68.17	68.21	68.26	68.34	68.45	68.61	68.78	68.95	69.08	69.23	69.38	69.50	69.65	69.79	69.93	70.10	70.28	70.51	70.72	70.91	71.09	71.26
DESIGN LEVELS																				67.14	66.97	66.97	66.32	65.98	65.98	64.98	66.15	66.81	67.47	68.14																					
OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00

CH 400.00m

DRAFT FOR REVIEW

Rev	Description	By	Date
A	DRAFT	MKS	11/2024

	By	Date
Survey	LINZ	10/2023
Design	MHS	10/2024
Drawn	RJM	11/2024
Checked	DJM	11/2024

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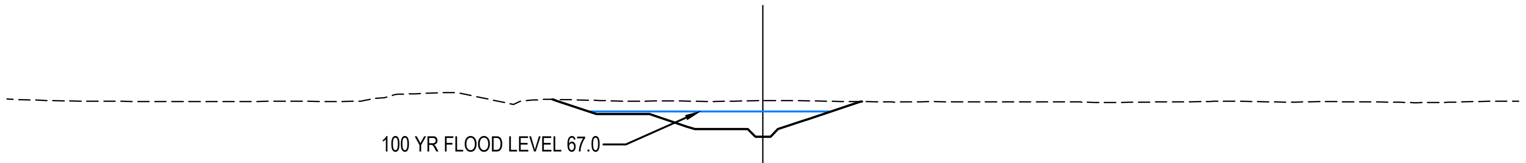
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS

Title
PROPOSED GREENWAY CROSS SECTIONS

Project no.	289001
Scale	1:500 @ A3
Cad file	C490-SW GREENWAY.DWG
Drawing no.	C490-12
Rev	A

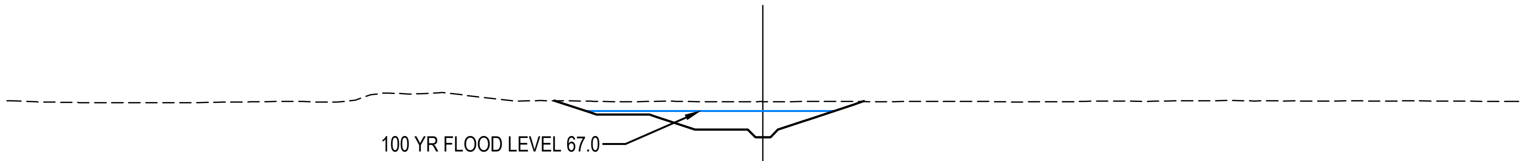


DATUMN 62.00

EXISTING LEVELS	67.81	67.75	67.69	67.67	67.66	67.66	67.65	67.65	67.65	67.68	67.67	67.65	67.80	68.15	68.21	68.19	67.78	67.67	67.80	67.75	67.69	67.68	67.69	67.65	67.68	67.72
DESIGN LEVELS																				67.15	66.82	66.82	66.32	65.83	65.83	65.33
OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00

EXISTING LEVELS	67.71	67.68	67.66	67.63	67.63	67.64	67.64	67.64	67.64	67.63	67.59	67.60	67.62	67.63	67.67	67.66	67.63	67.63	67.64	67.63	67.61	67.58	67.61	67.67	67.66
DESIGN LEVELS	66.16	66.82	67.49																						
OFFSETS	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00

CH 750.00m

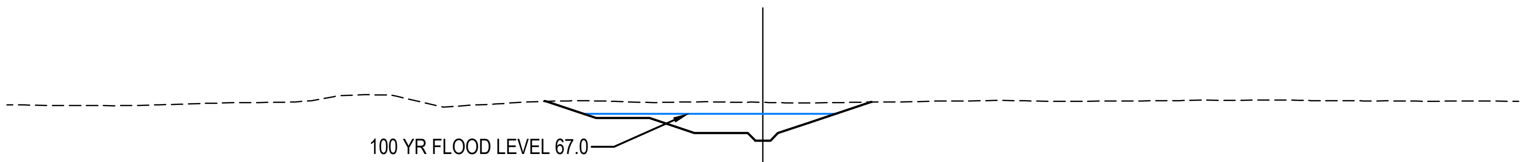


DATUMN 62.00

EXISTING LEVELS	67.69	67.61	67.58	67.56	67.55	67.56	67.57	67.60	67.61	67.65	67.62	67.62	68.07	68.16	68.19	68.09	67.85	67.68	67.69	67.67	67.63	67.63	67.66	67.63	67.63	67.63
DESIGN LEVELS																				67.10	66.77	66.77	66.27	65.78	65.78	65.28
OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00

EXISTING LEVELS	67.63	67.64	67.64	67.63	67.64	67.64	67.65	67.62	67.62	67.63	67.67	67.66	67.66	67.69	67.70	67.68	67.68	67.67	67.67	67.67	67.67	67.67	67.66	67.65	67.65
DESIGN LEVELS	66.11	66.77	67.44																						
OFFSETS	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00

CH 700.00m

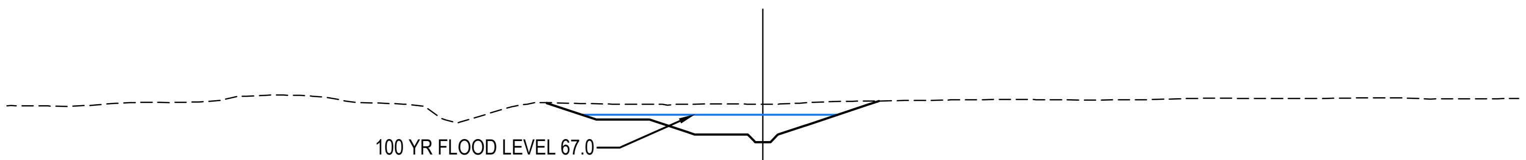


DATUMN 62.00

EXISTING LEVELS	67.60	67.57	67.54	67.55	67.55	67.59	67.65	67.71	67.74	67.76	67.86	68.20	68.26	68.11	67.65	67.52	67.63	67.76	67.84	67.86	67.83	67.76	67.77	67.80	67.77	67.76
DESIGN LEVELS																			67.72	67.05	66.72	66.72	66.22	65.73	65.73	65.23
OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00

EXISTING LEVELS	67.73	67.73	67.76	67.77	67.80	67.85	67.86	67.88	67.85	67.82	67.84	67.85	67.86	67.88	67.90	67.90	67.91	67.88	67.88	67.86	67.85	67.84	67.85	67.85	67.83
DESIGN LEVELS	66.06	66.72	67.39																						
OFFSETS	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00

CH 650.00m



DATUMN 62.00

EXISTING LEVELS	67.59	67.59	67.54	67.66	67.78	67.81	67.83	67.94	68.23	68.30	68.24	67.98	67.79	67.71	67.28	66.51	67.11	67.66	67.80	67.74	67.70	67.69	67.67	67.70	67.71	67.69
DESIGN LEVELS																			67.67	67.00	66.67	66.67	66.17	65.68	65.68	65.18
OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00

EXISTING LEVELS	67.75	67.85	67.89	67.91	67.95	67.97	67.99	68.01	68.00	67.98	67.97	67.98	68.01	68.07	68.09	68.08	68.08	68.08	68.09	68.11	68.11	68.04	68.05	68.05	68.08
DESIGN LEVELS	66.01	66.67	67.34																						
OFFSETS	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00

CH 600.00m

DRAFT FOR REVIEW

Rev	Description	By	Date
A	DRAFT	MKS	11/2024

	By	Date
Survey	LINZ	10/2023
Design	MHS	10/2024
Drawn	RJM	11/2024
Checked	DJM	11/2024

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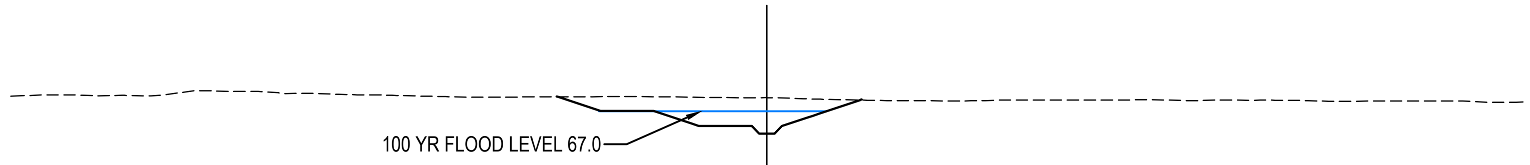
New Zealand

Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS

Title
PROPOSED GREENWAY CROSS SECTIONS

Project no.	289001
Scale	1:500 @ A3
Cad file	C490-SW GREENWAY.DWG
Drawing no.	C490-13
Rev	A



DATUMN 62.00

OFFSETS	EXISTING LEVELS	DESIGN LEVELS
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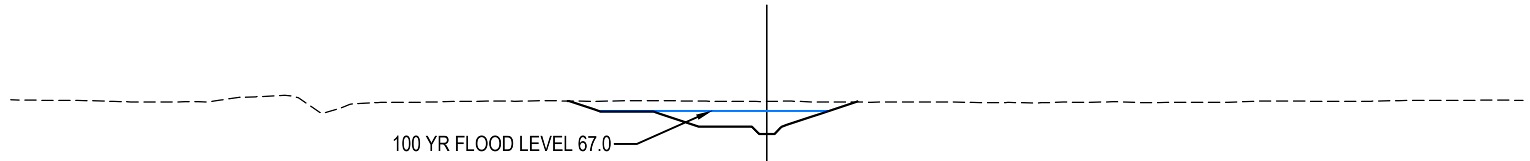
-48.00	68.06	
-46.00	68.07	
-44.00	68.02	
-42.00	68.03	
-40.00	68.06	
-38.00	68.33	
-36.00	68.32	
-34.00	68.31	
-32.00	68.17	
-30.00	68.17	
-28.00	68.10	
-26.00	68.07	
-24.00	68.02	
-22.00	67.98	
-20.00	67.93	
-18.00	67.93	
-16.00	67.94	
-14.00	67.94	
-12.00	67.95	67.35
-10.00	67.97	67.01
-8.00	67.96	67.01
-6.00	67.94	66.52
-4.00	67.91	66.02
-2.00	67.89	66.02
0.00	67.89	65.52
2.00	67.84	66.35
4.00	67.78	67.02
6.00	67.73	67.68
8.00	67.70	
10.00	67.70	
12.00	67.67	
14.00	67.69	
16.00	67.74	
18.00	67.73	
20.00	67.74	
22.00	67.73	
24.00	67.74	
26.00	67.74	
28.00	67.70	
30.00	67.74	
32.00	67.72	
34.00	67.72	
36.00	67.69	
38.00	67.65	
40.00	67.67	
42.00	67.67	
44.00	67.67	
46.00	67.68	
48.00	67.58	
50.00	67.61	

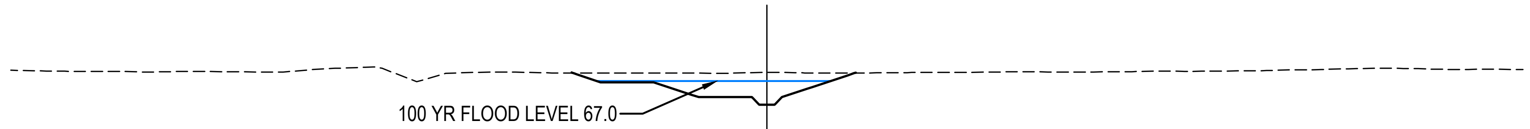
CH 950.00m



DATUMN 62.00

OFFSETS	EXISTING LEVELS	DESIGN LEVELS
-50.00	67.73	
-48.00	67.71	
-46.00	67.70	
-44.00	67.65	
-42.00	67.60	
-40.00	67.60	
-38.00	67.61	
-36.00	67.74	
-34.00	67.93	
-32.00	68.02	
-30.00	67.20	
-28.00	67.27	
-26.00	67.54	
-24.00	67.57	
-22.00	67.60	
-20.00	67.64	
-18.00	67.65	
-16.00	67.66	
-14.00	67.67	
-12.00	67.65	67.30
-10.00	67.67	66.96
-8.00	67.68	66.96
-6.00	67.67	66.47
-4.00	67.65	65.97
-2.00	67.64	65.97
0.00	67.63	65.47
2.00	67.64	66.30
4.00	67.59	66.97
6.00	67.59	
8.00	67.59	
10.00	67.60	
12.00	67.59	
14.00	67.56	
16.00	67.56	
18.00	67.54	
20.00	67.58	
22.00	67.59	
24.00	67.59	
26.00	67.56	
28.00	67.58	
30.00	67.58	
32.00	67.64	
34.00	67.66	
36.00	67.65	
38.00	67.63	
40.00	67.65	
42.00	67.69	
44.00	67.71	
46.00	67.71	
48.00	67.72	
50.00	67.70	

CH 900.00m



DATUMN 62.00

OFFSETS	EXISTING LEVELS	DESIGN LEVELS
-50.00	67.71	
-48.00	67.67	
-46.00	67.63	
-44.00	67.62	
-42.00	67.61	
-40.00	67.60	
-38.00	67.62	
-36.00	67.61	
-34.00	67.59	
-32.00	67.59	
-30.00	67.75	
-28.00	67.85	
-26.00	67.91	
-24.00	67.27	
-22.00	67.28	
-20.00	67.54	
-18.00	67.58	
-16.00	67.57	
-14.00	67.52	
-12.00	67.51	67.25
-10.00	67.52	66.91
-8.00	67.52	66.91
-6.00	67.51	66.42
-4.00	67.50	65.92
-2.00	67.52	65.92
0.00	67.56	65.42
2.00	67.54	66.25
4.00	67.52	66.92
6.00	67.52	
8.00	67.53	
10.00	67.56	
12.00	67.57	
14.00	67.57	
16.00	67.60	
18.00	67.60	
20.00	67.58	
22.00	67.59	
24.00	67.60	
26.00	67.65	
28.00	67.63	
30.00	67.65	
32.00	67.67	
34.00	67.71	
36.00	67.74	
38.00	67.79	
40.00	67.83	
42.00	67.82	
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46.00	67.75	
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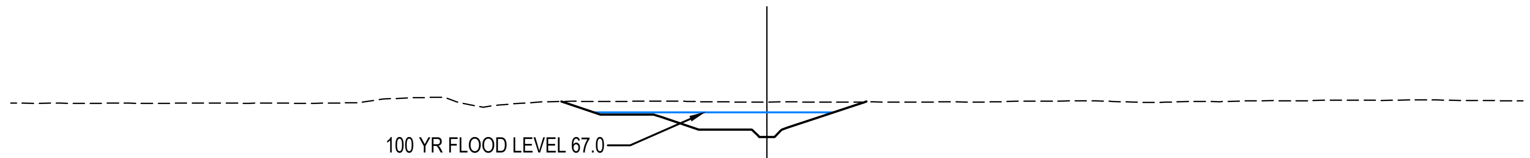
50.00	67.76	

CH 850.00m



DATUMN 62.00

OFFSETS	EXISTING LEVELS	DESIGN LEVELS
-50.00	67.62	
-48.00	67.61	
-46.00	67.61	
-44.00	67.61	
-42.00	67.61	
-40.00	67.61	
-38.00	67.63	
-36.00	67.61	
-34.00	67.61	
-32.00	67.62	
-30.00	67.61	
-28.00	67.63	
-26.00	67.79	
-24.00	67.95	
-22.00	68.00	
-20.00	67.59	
-18.00	67.46	
-16.00	67.62	
-14.00	67.72	
-12.00	67.73	67.20
-10.00	67.73	66.87
-8.00	67.75	66.87
-6.00	67.75	66.37
-4.00	67.70	65.88
-2.00	67.69	65.88
0.00	67.69	65.38
2.00	67.70	66.20
4.00	67.68	66.87
6.00	67.69	67.53
8.00	67.69	
10.00	67.69	
12.00	67.71	
14.00	67.68	
16.00	67.73	
18.00	67.75	
20.00	67.76	
22.00	67.76	
24.00	67.69	
26.00	67.67	
28.00	67.73	
30.00	67.72	
32.00	67.78	
34.00	67.77	
36.00	67.78	
38.00	67.81	
40.00	67.81	
42.00	67.82	
44.00	67.83	
46.00	67.80	
48.00	67.78	
50.00	67.77	

CH 800.00m

DRAFT FOR REVIEW

Rev	Description	By	Date
A	DRAFT	MKS	11/2024

	By	Date
Survey	LINZ	10/2023
Design	MHS	10/2024
Drawn	RJM	11/2024
Checked	DJM	11/2024

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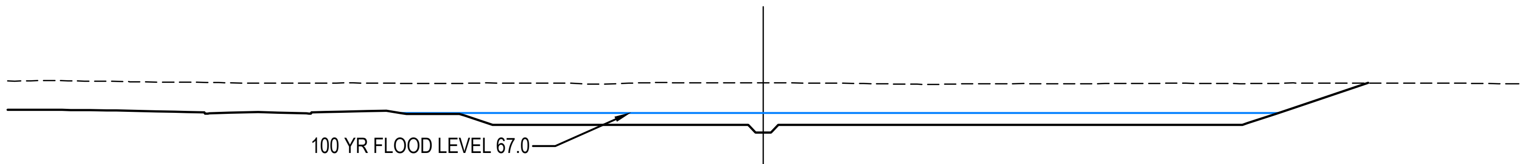
New Zealand

Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS

Title
PROPOSED GREENWAY CROSS SECTIONS

Project no.	289001
Scale	1:500 @ A3
Cad file	C490-SW GREENWAY.DWG
Drawing no.	C490-14
Rev	A

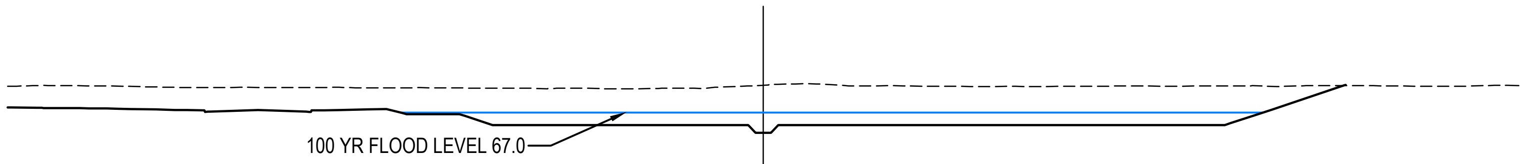


DATUMN 62.00

OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00
EXISTING LEVELS	69.11	69.13	69.13	69.09	69.07	69.04	69.03	69.00	68.97	68.97	68.96	68.98	68.97	68.96	68.94	68.95	68.98	68.96	68.97	68.93	68.92	68.99	69.00	68.98	68.99	68.99
DESIGN LEVELS															66.94	66.91	66.25	66.22	66.22	66.22	66.22	66.22	66.22	66.22	66.22	65.72

OFFSETS	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00
EXISTING LEVELS	68.98	68.96	68.95	68.92	68.90	68.90	68.93	68.93	68.93	68.92	68.93	68.94	68.95	68.96	68.95	68.94	68.95	68.98	68.97	68.97	68.96	68.97	68.97	68.94	68.93
DESIGN LEVELS	66.22	66.22	66.22	66.22	66.22	66.22	66.22	66.22	66.22	66.22	66.22	66.22	66.22	66.22	66.22	66.32	66.98	67.64	68.31	68.98					

CH 1150.00m

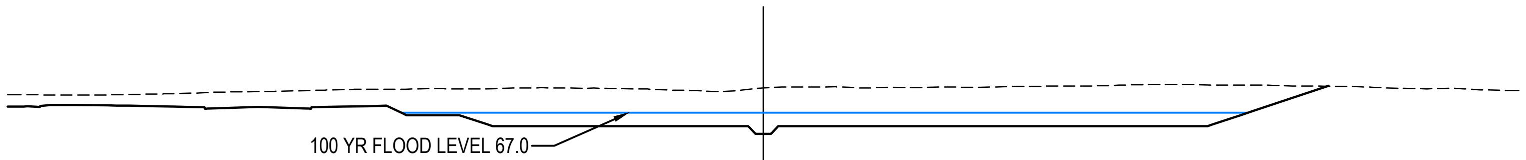


DATUMN 62.00

OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00
EXISTING LEVELS	68.73	68.78	68.78	68.76	68.72	68.68	68.65	68.65	68.66	68.65	68.65	68.66	68.63	68.63	68.63	68.62	68.60	68.61	68.58	68.60	68.56	68.57	68.61	68.59	68.71	68.81
DESIGN LEVELS															66.89	66.86	66.20	66.17	66.17	66.17	66.17	66.17	66.17	66.17	66.17	65.67

OFFSETS	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00
EXISTING LEVELS	68.88	68.88	68.75	68.77	68.75	68.73	68.72	68.72	68.72	68.73	68.74	68.75	68.74	68.74	68.75	68.76	68.72	68.77	68.78	68.77	68.75	68.73	68.74	68.78	68.78
DESIGN LEVELS	66.17	66.17	66.17	66.17	66.17	66.17	66.17	66.17	66.17	66.17	66.17	66.17	66.17	66.17	66.17	66.65	67.31	67.98	68.65						

CH 1100.00m

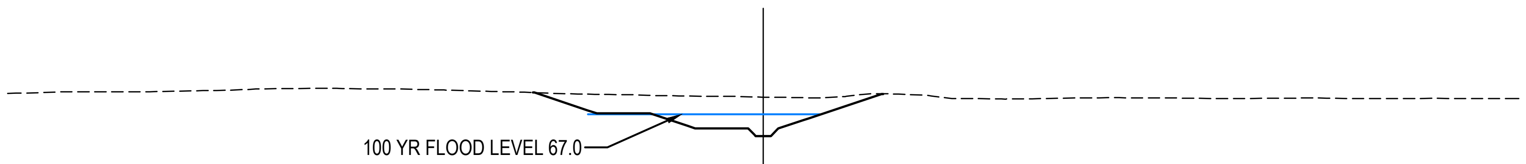


DATUMN 62.00

OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00
EXISTING LEVELS	68.19	68.19	68.18	68.18	68.21	68.24	68.29	68.37	68.39	68.42	68.48	68.52	68.56	68.56	68.60	68.57	68.59	68.64	68.64	68.63	68.60	68.57	68.50	68.45	68.45	68.64
DESIGN LEVELS															66.85	66.81	66.15	66.12	66.12	66.12	66.12	66.12	66.12	66.12	66.12	65.62

OFFSETS	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00
EXISTING LEVELS	68.70	68.71	68.66	68.67	68.66	68.70	68.68	68.72	68.75	68.76	68.78	68.84	68.88	68.87	68.83	68.83	68.81	68.77	68.75	68.70	68.62	68.58	68.60	68.50	68.46
DESIGN LEVELS	66.12	66.12	66.12	66.12	66.12	66.12	66.12	66.12	66.12	66.12	66.12	66.12	66.12	66.12	66.32	66.98	67.65	68.32							

CH 1050.00m



DATUMN 62.00

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EXISTING LEVELS	68.38	68.43	68.49	68.49	68.49	68.51	68.55	68.58	68.65	68.70	68.71	68.71	68.68	68.67	68.62	68.57	68.51	68.47	68.39	68.34	68.31	68.27	68.22	68.19	68.19	68.13
DESIGN LEVELS																			68.06	67.39	67.06	67.06	66.57	66.07	66.07	65.57

OFFSETS	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00
EXISTING LEVELS	68.11	68.11	68.25	68.36	68.29	68.11	68.04	68.01	68.03	68.07	68.09	68.09	68.09	68.07	68.04	68.05	68.06	68.08	68.06	68.05	68.05	68.05	68.04	68.04	68.04
DESIGN LEVELS	66.40	67.06	67.73																						

CH 1000.00m

DRAFT FOR REVIEW

Rev	Description	By	Date
A	DRAFT	MKS	11/2024

	By	Date
Survey	LINZ	10/2023
Design	MHS	10/2024
Drawn	RJM	11/2024
Checked	DJM	11/2024

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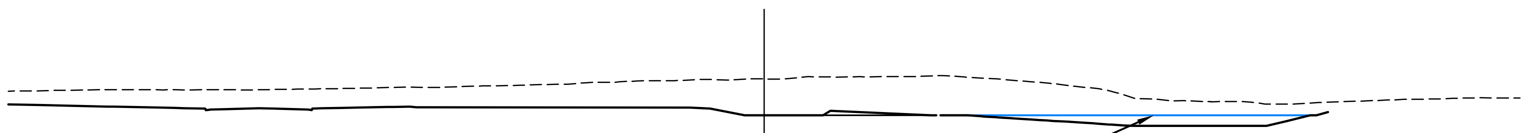
Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS

Title
PROPOSED GREENWAY CROSS SECTIONS

Project no.	289001
Scale	1:500 @ A3
Cad file	C490-SW GREENWAY.DWG
Drawing no.	C490-15
Rev	A



OFFSETS	-50.00	-48.00	-46.00	-44.00	-42.00	-40.00	-38.00	-36.00	-34.00	-32.00	-30.00	-28.00	-26.00	-24.00	-22.00	-20.00	-18.00
EXISTING LEVELS	68.59	68.61	68.65	68.68	68.69	68.68	68.67	68.69	68.67	68.70	68.73	68.76	68.80	68.85	68.83	68.90	68.94
DESIGN LEVELS																	

OFFSETS	-16.00	-14.00	-12.00	-10.00	-8.00	-6.00	-4.00	-2.00	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00
EXISTING LEVELS	68.98	69.03	69.13	69.17	69.27	69.28	69.36	69.34	69.40	69.46	69.53	69.54	69.55	69.56	69.61	69.48	69.35
DESIGN LEVELS									67.00	67.00	67.00	67.00	67.00	67.00	67.00	66.95	66.82

OFFSETS	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00
EXISTING LEVELS	69.18	68.98	68.76	68.27	68.05	67.95	67.89	67.87	67.73	67.80	67.89	67.95	68.02	68.06	68.12	68.14	68.13
DESIGN LEVELS	66.69	66.57	66.44	66.31	66.29	66.29	66.29	66.29	66.48	66.97							

CH 1235.59m

DRAFT FOR REVIEW

Rev	Description	By	Date
A	DRAFT	MKS	11/2024

	By	Date
Survey	LINZ	10/2023
Design	MHS	10/2024
Drawn	RJM	11/2024
Checked	DJM	11/2024

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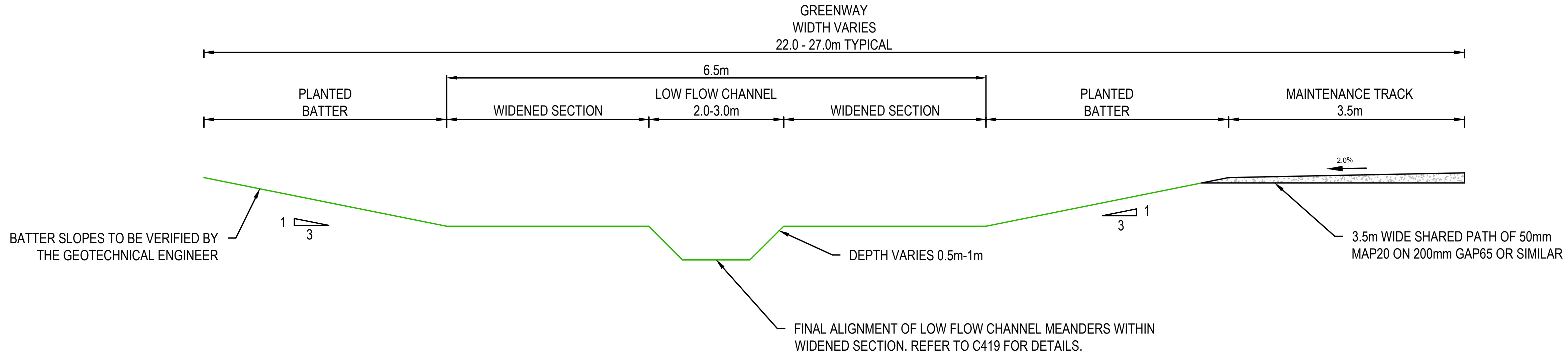
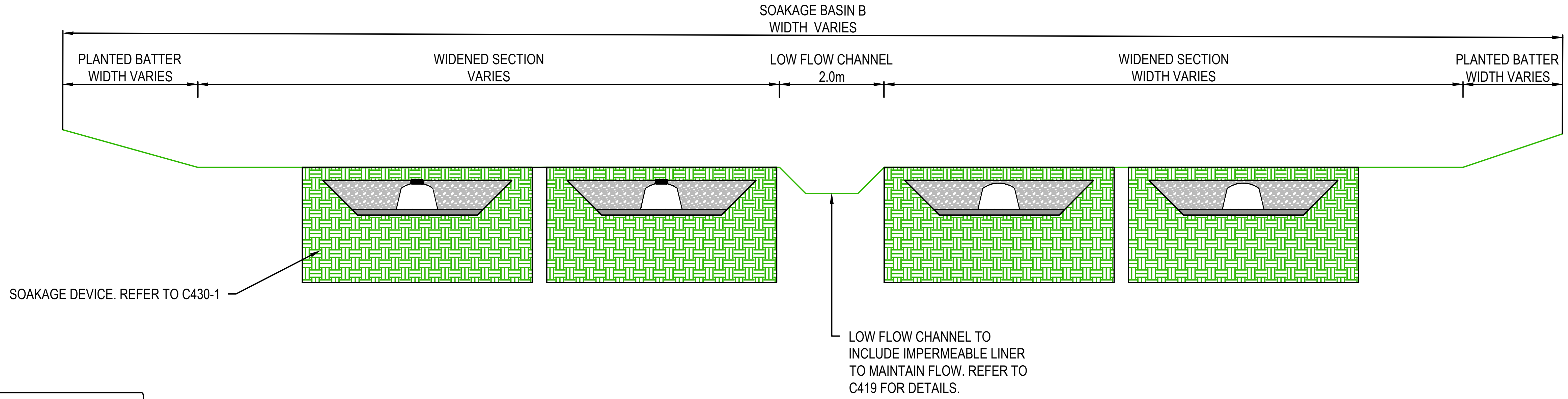
Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS

Title
PROPOSED GREENWAY CROSS SECTIONS

Project no.	289001
Scale	1:500 @ A3
Cad file	C490-SW GREENWAY.DWG
Drawing no.	C490-16 — Rev A





DRAFT FOR REVIEW

Notes
1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mount Eden 2000.
3. Levels in terms of the New Zealand Vertical Datum 2016.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. All concrete SW pipe to be installed in accordance with AS/NZS 3725:2007 for buried concrete pipes and AS/NZ 4058:2007 for precast concrete pipes (pressure and non-pressure) as stipulated in the RITS 2018
6. Approved hardfill is to be used in backfilling of all stormwater lines within the road reserve.
7. Heavy duty manhole lids and frames to be used in trafficked areas.
8. All catchpit leads shall be laid at 1% unless otherwise specified.
9. All concrete lines are to be Class 4 RCRRJ unless otherwise specified.
10. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with council staff.
11. Pipe lengths shown on plan are from upstream pipe invert to downstream pipe invert.
12. Final Greenway cross section subject to detailed design.

Legend
EX GROUND LEVEL
PR GROUND LEVEL

Rev	Description	By	Date
A	DRAFT	MKS	11/2024

	By	Date
Survey	MAVEN	05/2024
Design	MHS	11/2024
Drawn	RJM	11/2024
Checked	DJM	11/2024

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Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS

Title
PROPOSED STORMWATER GREENWAY DETAILS

Project no.	289001
Scale	AS SHOWN
Cad file	C490-SW GREENWAY.DWG
Drawing no.	C420-1
Rev	A

APPENDIX E
GREENWAY GROUNDWATER DRAWDOWN AND INFLOW CALCULATIONS

DEWATERING - PARTIALLY PENETRATING TRENCH

WGA

CLIENT:	Matamata Developments Limited
PROJECT:	Ashbourne Development
Project #:	WGA 241087
Location:	Station Rd, Matamata
Date:	15 April 2025
Document #:	WGA241087-RP-HG-0002_A

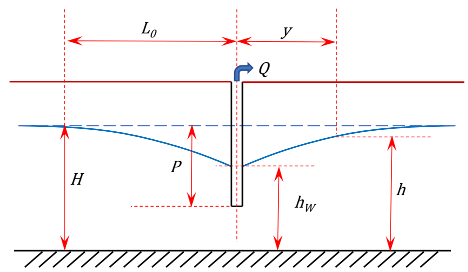
References:

Cashman P. M. & Preene M. 2001. Groundwater lowering in construction. A practical guide. Spon Press, London.

US Departments of the Army, the Navy and the Air Force. 1983. Dewatering and Groundwater Control. US Army TM 5-818-5

Analysed by: Toby Beisly
Checked by: Brett Sinclair

H = Initial height of water table above aquifer base (m)
h_W = Lowered height of water in equivalent slot (m)
P = Penetration of trench below initial water table (m)
y = Distance from center of trench
h = Lowered height of water at distance y from trench (m)
k = Horizontal hydraulic conductivity of soil (m/s)
L_0 = Distance of influence (m)
Q_{ss} = Steady state inflow rate per unit length of trench (L/s)
x = Linear length of drain / trench (m)
Q_T = Total groundwater inflow to trench (L/s)
SWL = Static groundwater level (m BGL)



Initial ground elevation	67.61	m RL
Depth to base of aquifer	3.10	m BGL
Depth to static groundwater table	1.60	m
Static groundwater table elevation	66.01	m RL
SWL height above base of aquifer (H):	1.50	m
Trench penetration (P)	1.50	m
Lowered WL above base of aquifer (h_w)	0.00	m
Length of trench (m)	646	m
Period Trench open	1.0	days
Horizontal hydraulic conductivity (k)	3.48E-05	m/s
Soil specific yield (S_y)	0.00	m^3/m^3
Distance of influence (L_0)	15.50	m
SS inflow per metre of trench (Q_s)	0.005	L/s
Transient inflow per metre (Q_t)	0.000	L/s
Total inflow to trench (Q_T)	1.57	L/s
	135.44	m^3/day

$$L_0 = 1{,}750(H - h_W)\sqrt{k}$$

$$Q_{ss} = [0.73 + 0.23(P/H)]\frac{k(H^2 - h_W^2)}{L_0}$$

$$H^2 - h^2 = \frac{L_0 - y}{L_0}(H^2 - h_w^2)$$

$$h^2 = H^2 - \left(\frac{L_0 - y}{L_0}\right)(H^2 - h_w^2)$$

$$Q_t = \frac{L_0(H - h_W)S_Y}{t}$$

y (m)	h (m)	h (mRL)	dh (m)	Initial GL (mRL)	Profile (mRL)
0	0.00	64.51	1.50	67.61	64.51
0.5	0.27	64.78	1.23	67.61	64.51
0.5	0.27	64.78	1.23	67.61	67.61
1	0.38	64.89	1.12	67.61	67.61
2	0.54	65.05	0.96	67.61	67.61
3	0.66	65.17	0.84	67.61	67.61
4	0.76	65.27	0.74	67.61	67.61
6	0.93	65.44	0.57	67.61	67.61
8	1.08	65.59	0.42	67.61	67.61
10	1.20	65.72	0.30	67.61	67.61
12	1.32	65.83	0.18	67.61	67.61
14	1.43	65.94	0.07	67.61	67.61
16	1.50	66.01	0.00	67.61	67.61
18	1.50	66.01	0.00	67.61	67.61
20	1.50	66.01	0.00	67.61	67.61
25	1.50	66.01	0.00	67.61	67.61
30	1.50	66.01	0.00	67.61	67.61

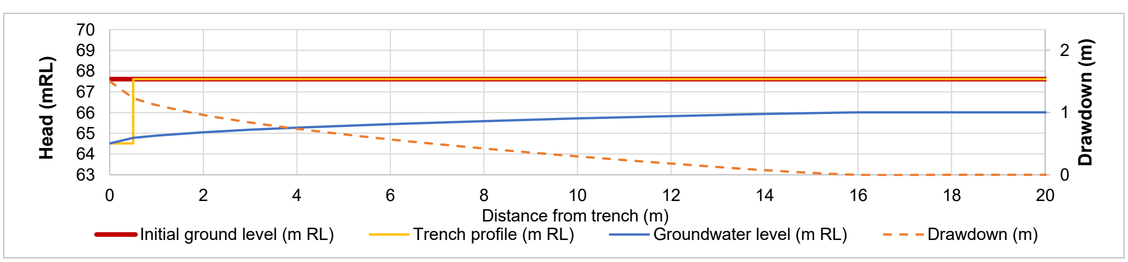
Notes:

Calculated inflows assume equal inflows from line sources on both sides of the trench.

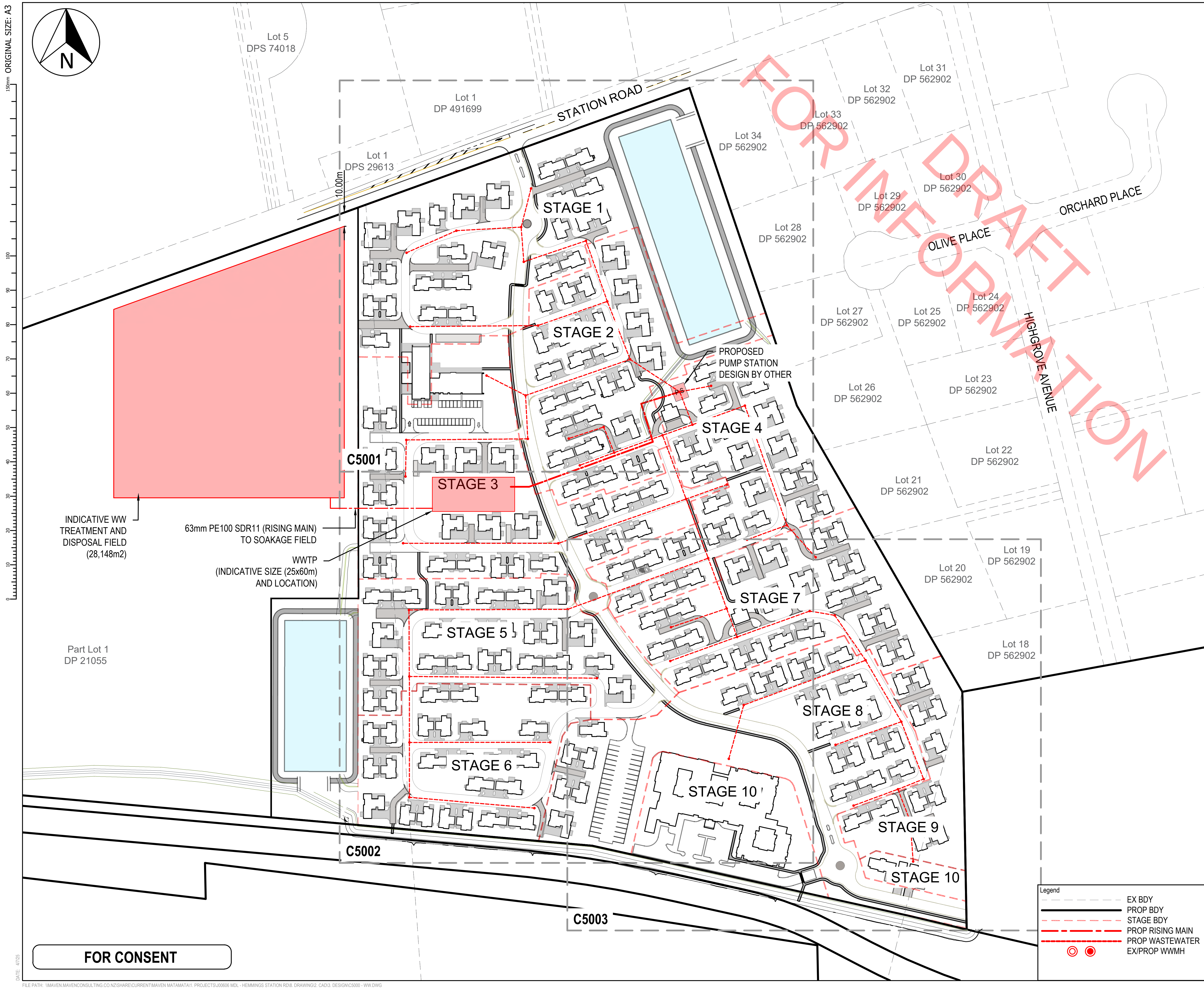
The transient inflow rate calculation assumes dewatering will progress through to a steady state during the period that the trench is open. This assumption needs to be reviewed on a case by case basis. The transient inflow rate calculation is sensitive to the length of time the trench is open. Applied value should not be less than one day.

Calculated transient inflows do not vary over time. They are simply averaged over the time the trench remains open.

Calculated inflows exclude radial inflows to ends of trench.



APPENDIX F
PROPOSED WASTEWATER DISPOSAL SYSTEM LAYOUT



Notes

1. All works to be in accordance with Local Council standards.
2. Co-ordinates in terms of Mount Eden 2000.
3. Reduced Levels are in terms of NZVD 2016.
4. It is the contractors responsibility to locate all services that may be affected by their operations.
5. The contractor shall comply with all relevant OSH and Health & Safety requirements.
6. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
7. Minimum clearances & cover shall be in accordance with Local Council standards.
8. Pipe bedding: 0 - 10% = granular bedding,10 - 20% = weak concrete bedding, greater than 20% = weak concrete bedding (7mpa plus anti scour blocks at 6m crs).
9. Each connection shall be marked by a 50mm x 50mm treated pine stake extending 600mm above ground level with the top painted. This marker post shall be placed alongside a timber marker installed at the time of pipelaying and extending from the connection to 150mm below finished ground level. Connections shall be accurately indicated on "as built" plans.
10. Approved hardfill to be used in backfilling of all road crossings and vehicle crossings to Local Council standards.
11. Heavy duty manhole lids and frames to be used in trafficked areas.
12. All lines are to be 150mmØ PVC SN16, unless shown otherwise.
13. 150mmØ pipes that do not terminate in a manhole must be terminated with a 100mmØ on a 150mmØ london junction and blank cap.
14. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be co-ordinated with Local Council staff.

Rev	Description	By	Date
B	FOR CONSENT	MS	04/25
A	FOR REVIEW	MS	01/25

	By	Date
Survey	MAVEN	10/2024
Design	SB	12/2024
Drawn	MS	12/2024
Checked	NP	12/2024

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Project
ASHBOURNE RETIREMENT VILLAGE MATAMATA FOR UNITY DEVELOPMENT LTD

Title
PROPOSED WASTEWATER OVERALL LAYOUT PLAN OPTION A

Project no.	J00606
Scale	1:2500 @ A3
Cad file	C5000 - WW.DWG
Drawing no.	C5000A
Rev	B

APPENDIX G

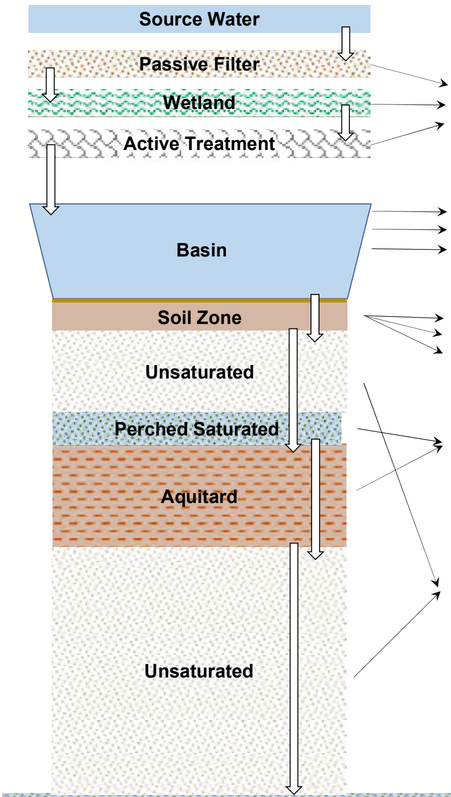
FAECAL COLIFORM ATTENUATION ANALYSIS SHEETS

INFILTRATION BASIN - PATHOGEN ATTENUATION ESTIMATION

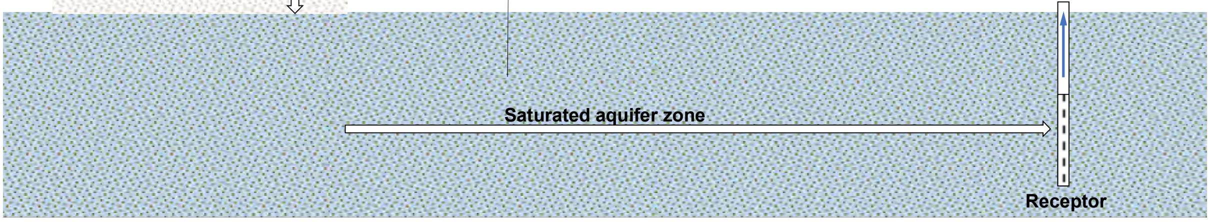
WGA

PROJECT: Ashbourne Development
Job Number: WGA 241087
Date: 24/04/2025
Document #: WGA241087-RP-HG-0002_A

Notes:



	Value	Units	Ref
Source water quality	**4.37E+11**	MPN/100mL	
Pre-treatment attenuation			
Passive filter log attenuation	0	log reduction	
Pre-treatment wetland	0	log reduction	
Active treatment log attenuation	0	log reduction	
Treated water quality	**4.37E+11**	MPN/100mL	
Basin contamination			
Introduced pathogen load	0	log increase/day	
UV / dieback attenuation	0	log reduction/day	
Water retention time in basin	0	days	
Water quality in basin	**4.37E+11**		
Soil Aquifer Treatment			
Schmutzdecke attenuation factor	0	log reduction	1
Soil horizon attenuation factor	5.48	log reduction/m	2
Soil horizon thickness	0.1	m	
Soil horizon attenuation	0.548	log reduction	
Total SAT attenuation	0.548	log reduction	
Seepage water quality beneath soil horizon	**1.24E+11**	MPN/100mL	
Vertical saturated flow beneath soil horizon			
Infiltration rate	0	m/day	
Vertical flow distance	0	m	
Effective porosity	0	m3/m3	
Flow time	0	days	
Daily attenuation factor	0	log/day	3
Vertical saturated flow attenuation	0	log reduction	
Vertical unsaturated flow (vadose zone)			
Vadose zone vertical thickness	1.3	m	
Vadose zone attenuation factor	0.84	log reduction/m	2, 4
Vertical unsaturated flow attenuation	1.092	log reduction	
Seepage water quality entering saturated groundwater system	**1.00E+10**	MPN/100mL	
Lateral groundwater flow within aquifer			
Receiver distance from MAR site	200	m	
Attenuation per metre	0.050	log/m	2
Aquifer saturated flow attenuation	10.00	log reduction	
Groundwater quality at receiving point	**1.00**	MPN/100mL	



References:

1 Pfannes, K.R., Langenbach, K.M., Pilloni, G., Stührmann, T., Euringer, K., Lueders, T., Neu, T.R., Müller, J.A., Kästner, M. and Meckenstock, R.U., 2015. Selective elimination of bacterial faecal indicators in the Schmutzdecke of slow sand filtration columns. Applied microbiology and biotechnology, 99(23), pp.10323-10332.

2 Pang, L., 2009, Microbial removal rates in subsurface media estimated from published studies of field experiments and large intact soil cores. J. Environ. Qual., 38: 1531-1559.

3 John, D. E. & Rose, J. B. 2005. Review of factors affecting microbial survival in groundwater. Environmental Science & Technology 39 (19): 7345 – 7356.

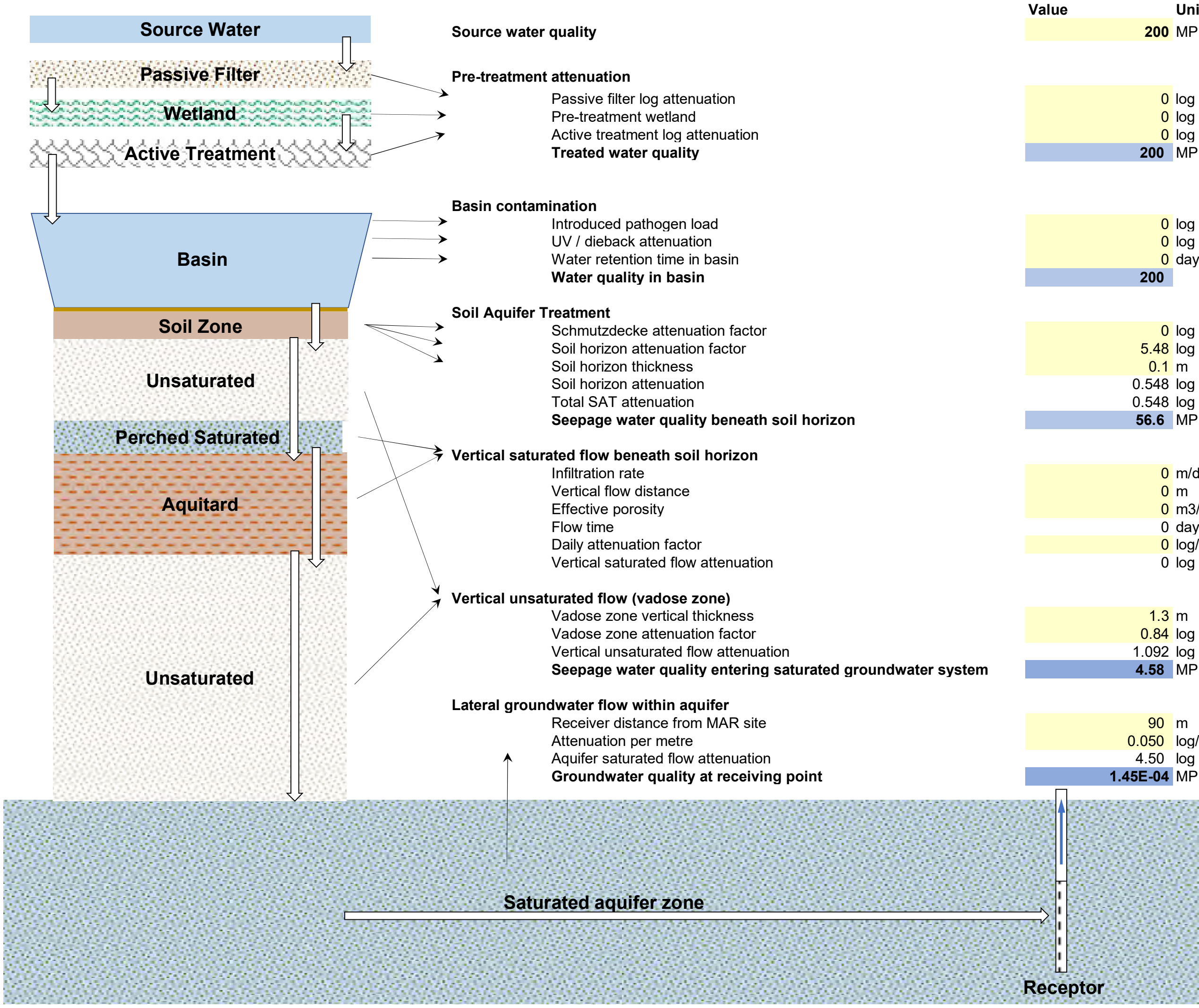
4 Sinton, L. W. 1986. Microbial contamination of alluvial gravel aquifers by septic tank effluent. Water Air Soil Pollution 28: 407 – 425.

5 Schijven, J., Pang, L. and Ying, G.G., 2017. Evaluation of subsurface microbial transport using microbial indicators, surrogates and tracers. Global water pathogen project.

INFILTRATION BASIN - PATHOGEN ATTENUATION ESTIMATION

PROJECT: Ashbourne Development
Job Number: WGA 241087
Date: 24/04/2025
Document #: WGA241087-RP-HG-0002_C

Notes:



	Value	Units	Ref
Source water quality	200	MPN/100mL	
Pre-treatment attenuation			
Passive filter log attenuation	0	log reduction	
Pre-treatment wetland	0	log reduction	
Active treatment log attenuation	0	log reduction	
Treated water quality	**200**	MPN/100mL	
Basin contamination			
Introduced pathogen load	0	log increase/day	
UV / dieback attenuation	0	log reduction/day	
Water retention time in basin	0	days	
Water quality in basin	**200**		
Soil Aquifer Treatment			
Schmutzdecke attenuation factor	0	log reduction	1
Soil horizon attenuation factor	5.48	log reduction/m	2
Soil horizon thickness	0.1	m	
Soil horizon attenuation	0.548	log reduction	
Total SAT attenuation	0.548	log reduction	
Seepage water quality beneath soil horizon	**56.6**	MPN/100mL	
Vertical saturated flow beneath soil horizon			
Infiltration rate	0	m/day	
Vertical flow distance	0	m	
Effective porosity	0	m3/m3	
Flow time	0	days	
Daily attenuation factor	0	log/day	3
Vertical saturated flow attenuation	0	log reduction	
Vertical unsaturated flow (vadose zone)			
Vadose zone vertical thickness	1.3	m	
Vadose zone attenuation factor	0.84	log reduction/m	2, 4
Vertical unsaturated flow attenuation	1.092	log reduction	
Seepage water quality entering saturated groundwater system	**4.58**	MPN/100mL	
Lateral groundwater flow within aquifer			
Receiver distance from MAR site	90	m	
Attenuation per metre	0.050	log/m	2
Aquifer saturated flow attenuation	4.50	log reduction	
Groundwater quality at receiving point	**1.45E-04**	MPN/100mL	

References:

1 Pfannes, K.R., Langenbach, K.M., Pilloni, G., Stührmann, T., Euringer, K., Lueders, T., Neu, T.R., Müller, J.A., Kästner, M. and Meckenstock, R.U., 2015. Selective elimination of bacterial faecal indicators in the Schmutzdecke of slow sand filtration columns. Applied microbiology and biotechnology, 99(23), pp.10323-10332.

2 Pang, L., 2009, Microbial removal rates in subsurface media estimated from published studies of field experiments and large intact soil cores. J. Environ. Qual., 38: 1531-1559.

3 John, D. E. & Rose, J. B. 2005. Review of factors affecting microbial survival in groundwater. Environmental Science & Technology 39 (19): 7345 – 7356.

4 Sinton, L. W. 1986. Microbial contamination of alluvial gravel aquifers by septic tank effluent. Water Air Soil Pollution 28: 407 – 425.

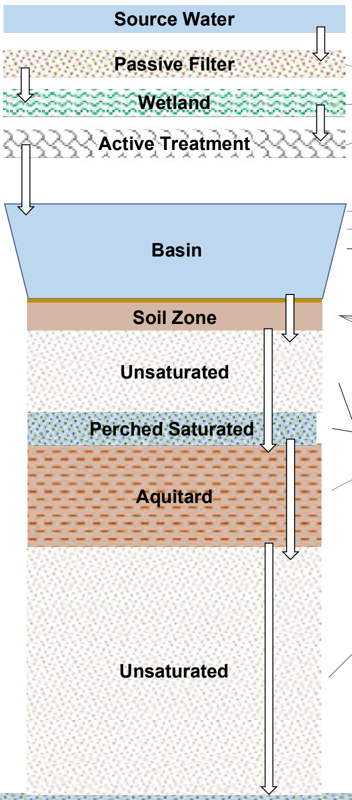
5 Schijven, J., Pang, L. and Ying, G.G., 2017. Evaluation of subsurface microbial transport using microbial indicators, surrogates and tracers. Global water pathogen project.

INFILTRATION BASIN - PATHOGEN ATTENUATION ESTIMATION

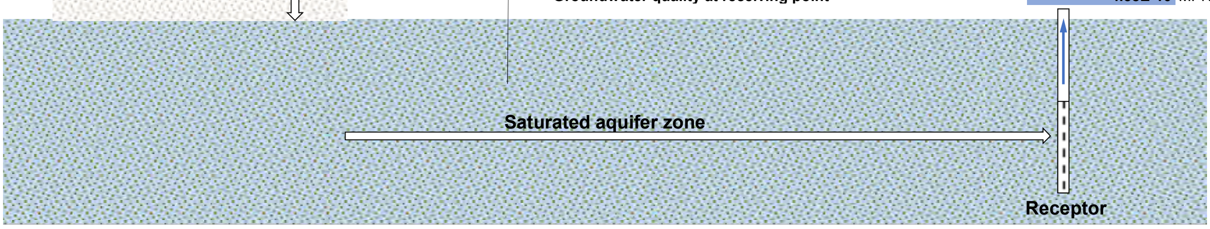
WGA

PROJECT: Ashbourne Development
Job Number: WGA 241087
Date: 24/04/2025
Document #: WGA241087-RP-HG-0002_A

Notes:



		Value	Units	Ref
Source water quality		**200**	MPN/100mL	
Pre-treatment attenuation				
	Passive filter log attenuation	0	log reduction	
	Pre-treatment wetland	0	log reduction	
	Active treatment log attenuation	0	log reduction	
	Treated water quality	**200**	MPN/100mL	
Basin contamination				
	Introduced pathogen load	0	log increase/day	
	UV / dieback attenuation	0	log reduction/day	
	Water retention time in basin	0	days	
	Water quality in basin	**200**		
Soil Aquifer Treatment				
	Schmutzdecke attenuation factor	0	log reduction	1
	Soil horizon attenuation factor	5.48	log reduction/m	2
	Soil horizon thickness	0.1	m	
	Soil horizon attenuation	0.548	log reduction	
	Total SAT attenuation	0.548	log reduction	
	Seepage water quality beneath soil horizon	**56.6**	MPN/100mL	
Vertical saturated flow beneath soil horizon				
	Infiltration rate	0	m/day	
	Vertical flow distance	0	m	
	Effective porosity	0	m3/m3	
	Flow time	0	days	
	Daily attenuation factor	0	log/day	3
	Vertical saturated flow attenuation	0	log reduction	
Vertical unsaturated flow (vadose zone)				
	Vadose zone vertical thickness	1.3	m	
	Vadose zone attenuation factor	0.84	log reduction/m	2, 4
	Vertical unsaturated flow attenuation	1.092	log reduction	
	Seepage water quality entering saturated groundwater system	**4.58**	MPN/100mL	
Lateral groundwater flow within aquifer				
	Receiver distance from MAR site	200	m	
	Attenuation per metre	0.050	log/m	2
	Aquifer saturated flow attenuation	10.00	log reduction	
	Groundwater quality at receiving point	**4.58E-10**	MPN/100mL	



References:

1 Pfannes, K.R., Langenbach, K.M., Pilloni, G., Stührmann, T., Euringer, K., Lueders, T., Neu, T.R., Müller, J.A., Kästner, M. and Meckenstock, R.U., 2015. Selective elimination of bacterial faecal indicators in the Schmutzdecke of slow sand filtration columns. Applied microbiology and biotechnology, 99(23), pp.10323-10332.

2 Pang, L., 2009, Microbial removal rates in subsurface media estimated from published studies of field experiments and large intact soil cores. J. Environ. Qual., 38: 1531-1559.

3 John, D. E. & Rose, J. B. 2005. Review of factors affecting microbial survival in groundwater. Environmental Science & Technology 39 (19): 7345 – 7356.

4 Sinton, L. W. 1986. Microbial contamination of alluvial gravel aquifers by septic tank effluent. Water Air Soil Pollution 28: 407 – 425.

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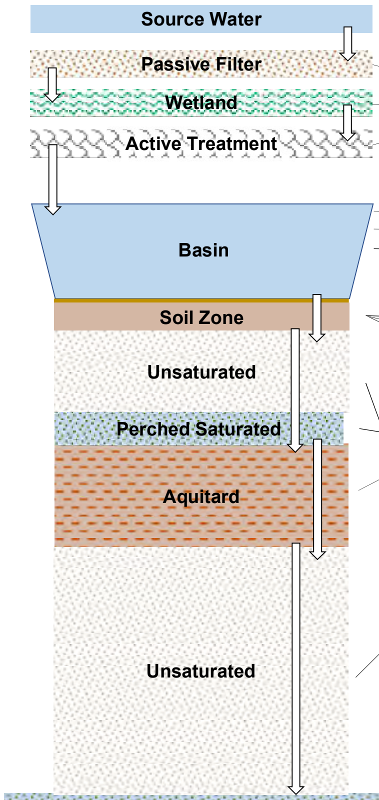
INFILTRATION BASIN - PATHOGEN ATTENUATION ESTIMATION

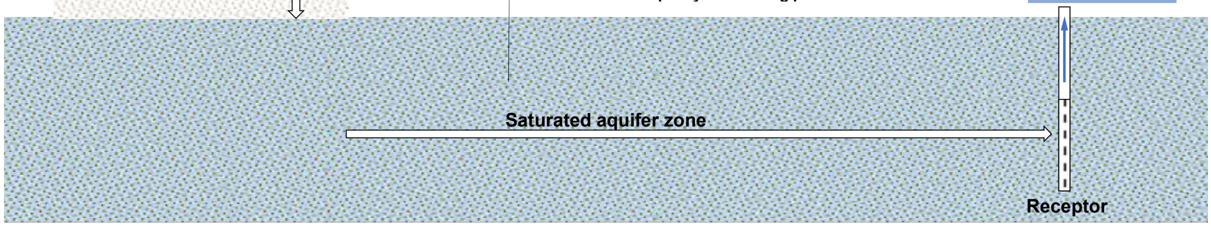
WGA

PROJECT: Ashbourne Development
Job Number: WGA 241087
Date: 24/04/2025
Document #: WGA241087-RP-HG-0002_A

Notes:



	Value	Units	Ref
Source water quality	**200**	MPN/100mL	
Pre-treatment attenuation			
Passive filter log attenuation	0	log reduction	
Pre-treatment wetland	0	log reduction	
Active treatment log attenuation	0	log reduction	
Treated water quality	**200**	MPN/100mL	
Basin contamination			
Introduced pathogen load	0	log increase/day	
UV / dieback attenuation	0	log reduction/day	
Water retention time in basin	0	days	
Water quality in basin	**200**		
Soil Aquifer Treatment			
Schmutzdecke attenuation factor	0	log reduction	1
Soil horizon attenuation factor	5.48	log reduction/m	2
Soil horizon thickness	0.1	m	
Soil horizon attenuation	0.548	log reduction	
Total SAT attenuation	0.548	log reduction	
Seepage water quality beneath soil horizon	**56.6**	MPN/100mL	
Vertical saturated flow beneath soil horizon			
Infiltration rate	0	m/day	
Vertical flow distance	0	m	
Effective porosity	0	m3/m3	
Flow time	0	days	
Daily attenuation factor	0	log/day	3
Vertical saturated flow attenuation	0	log reduction	
Vertical unsaturated flow (vadose zone)			
Vadose zone vertical thickness	1.3	m	
Vadose zone attenuation factor	0.84	log reduction/m	2, 4
Vertical unsaturated flow attenuation	1.092	log reduction	
Seepage water quality entering saturated groundwater system	**4.58**	MPN/100mL	
Lateral groundwater flow within aquifer			
Receiver distance from MAR site	227	m	
Attenuation per metre	0.050	log/m	2
Aquifer saturated flow attenuation	11.35	log reduction	
Groundwater quality at receiving point	**2.05E-11**	MPN/100mL	



References:

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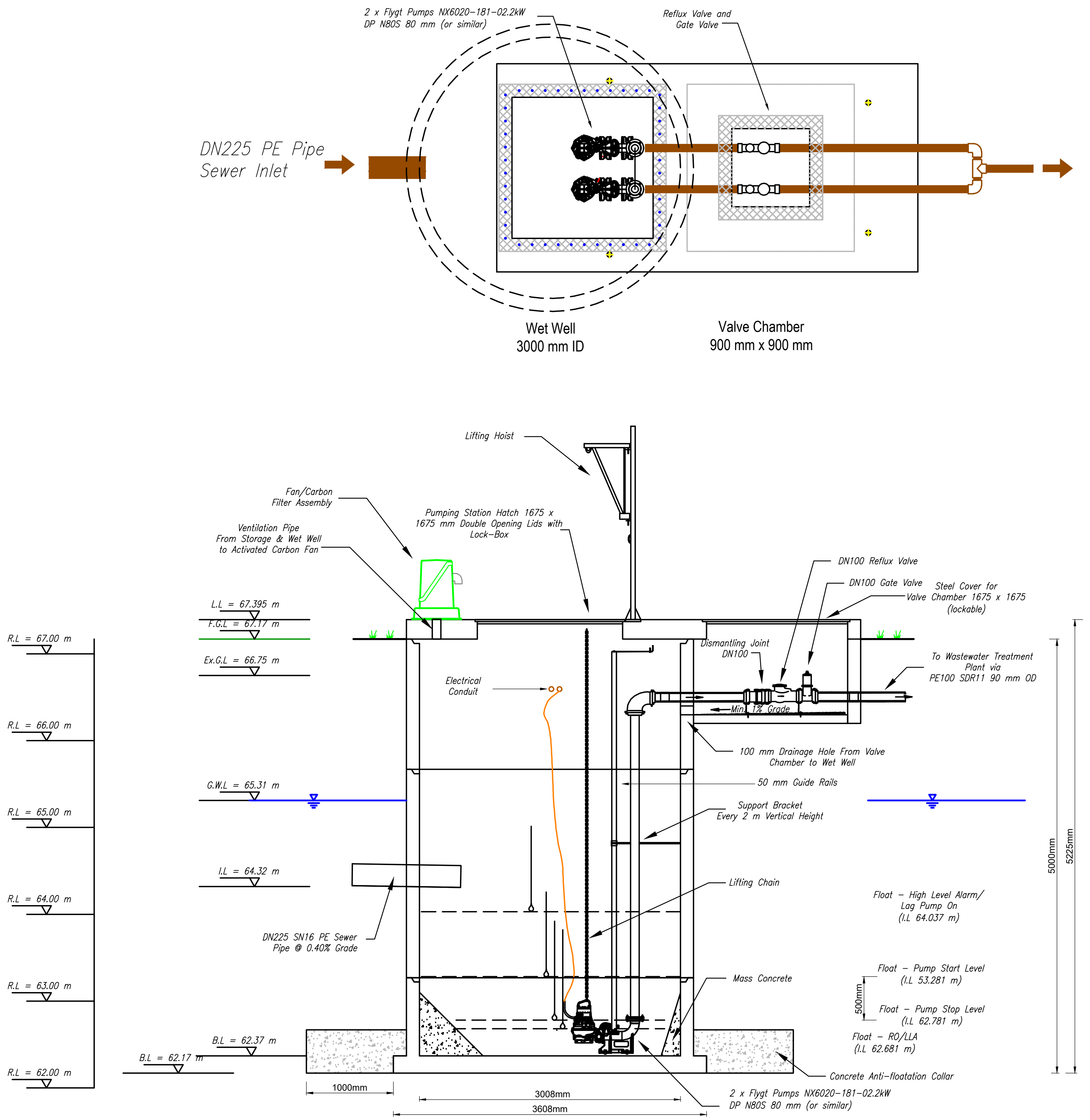
APPENDIX H
WASTEWATER PUMP STATION DRAWDOWN ANALYSIS SHEETS

NOT FOR CONSTRUCTION



Pump Station Wet Well & Valve Chamber Details

0 1 2 3 4 5

SCALE BAR 1:30

REV.	DESCRIPTION	DATE
–	–	–

DATE: 6th June 2025

SCALE: 1 : 30 (A1)

APPROVED
CHECKED
DESIGNED
STATUS: Design

innoflow wastewater specialists
www.innoflowtechnologies.com

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North Shore City 0752
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P.O. Box 263
Ormeau
Queensland 4208
Australia
Freephone 0800 innoflow
Ph: + 61 7 5549 2416
Fax: + 61 7 5549 2416

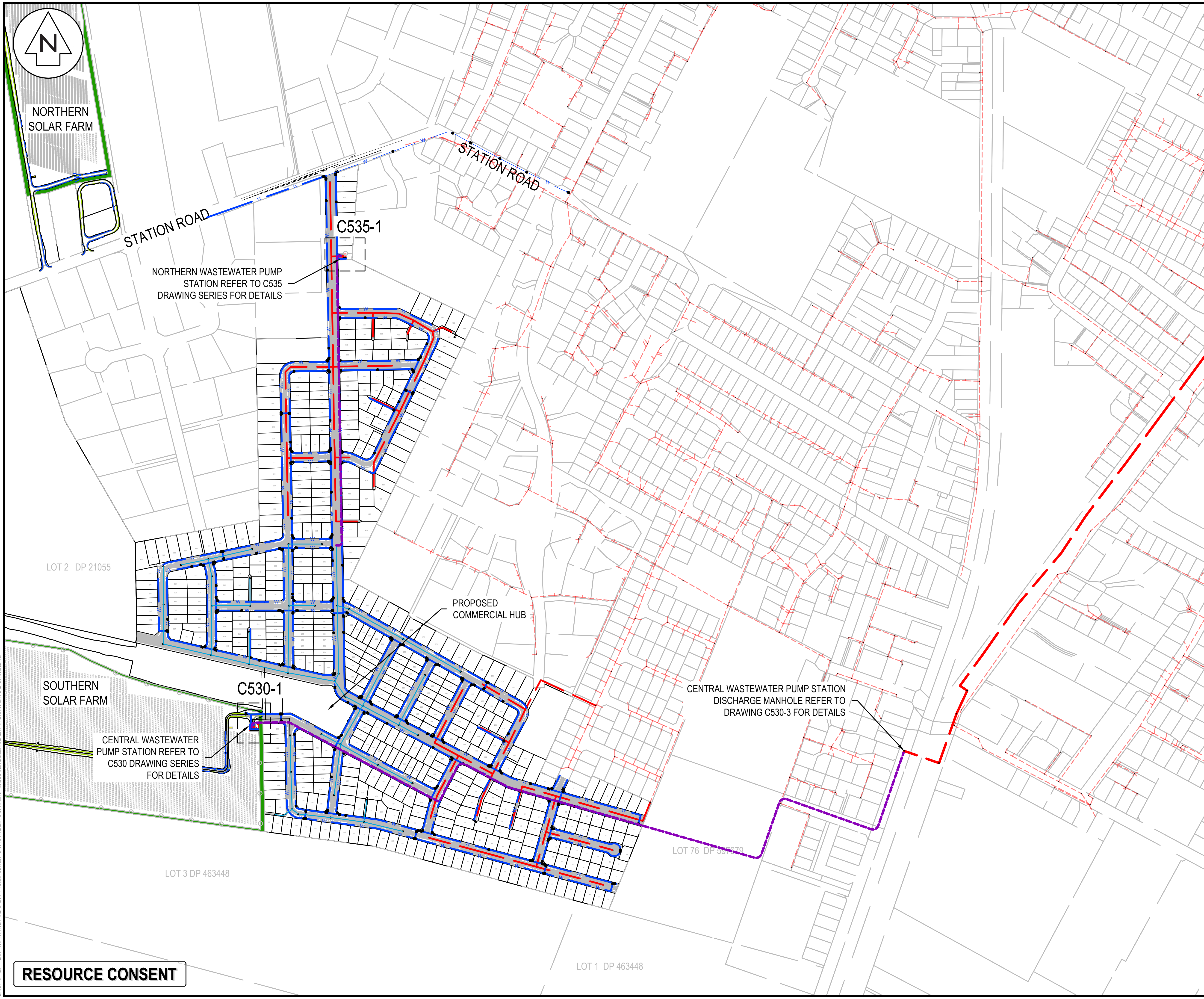
CLIENT: Maven

PROJECT: ASHBOURNE RETIREMENT VILLAGE

TITLE: Pump Station Typical Detail

DRAWING No.: 7760-9

REVISION: -



Notes

1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mount Eden 2000.
3. Levels in terms of the New Zealand Vertical Datum 2016.
4. It is the Contractors responsibility to locate all services that may be affected by his operations.
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7. All lines are to be 150mmØ PVC Class SN16 unless shown otherwise.
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10. Manhole diameters shown on structure label are internal diameter.
11. Measurements shown on the lot connections are the distance from the centre of the downstream manhole to the lot connection position within the lot boundary.
12. Manhole slab and cover to be rotated to avoid the footpath edge for manholes on footpath.
13. Pipe lengths shown on plan are from upstream pipe invert to downstream pipe invert.

Legend

- EX BOUNDARY
- PROP BOUNDARY
- EX WASTEWATER
- PR WASTEWATER
- EX/PROP WWMH
- WW LOT CONNECTION

Rev	Description	By	Date
A	FAST TRACK APP	TCH	04/2025

	By	Date
Survey	MAVEN	05/2024
Design	TCH	04/2025
Drawn	TCH	04/2025
Checked	DJM	04/2025

MAVEN

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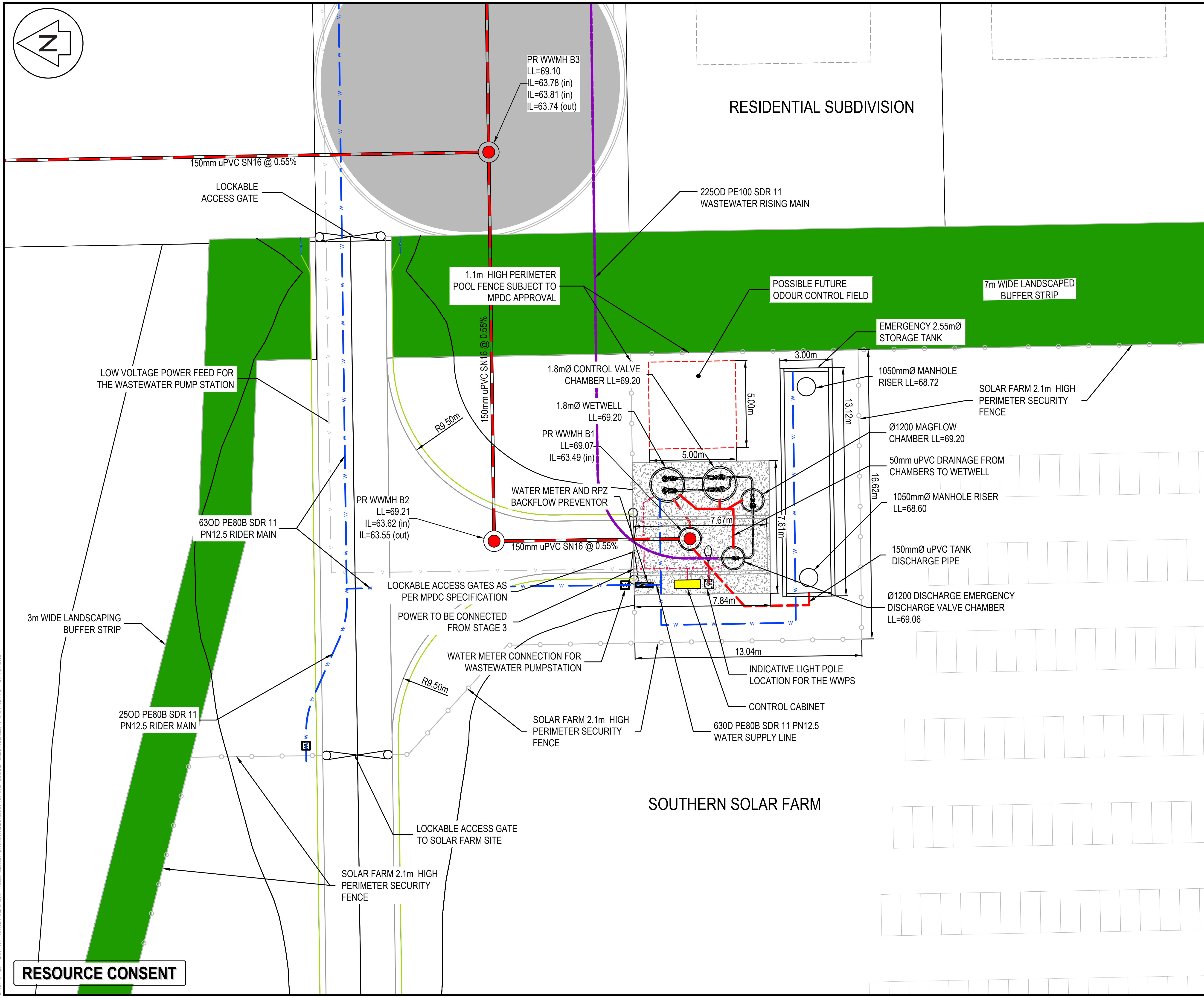
Auckland 1023

Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS LTD

Title
PROPOSED WASTEWATER PUMP STATIONS OVERVIEW PLAN

Project no.	289001
Scale	1:6000 @ A3
Cad file	C530-WASTEWATER-PUMP STATION.DWG
Drawing no.	C530
Rev	A



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- PROP BOUNDARY
- EX WASTEWATER
- PR WASTEWATER
- PR STORMWATER
- EX/PROP WWMH
- EX/PROP SWMH
- WW LOT CONNECTION

Rev	Description	By	Date
A	FAST TRACK APP	TCH	04/2025

	By	Date
Survey	MAVEN	05/2024
Design	TCH	04/2025
Drawn	TCH	04/2025
Checked	DJM	04/2025

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Title
PROPOSED CENTRAL WASTEWATER PUMP STATION LAYOUT PLAN

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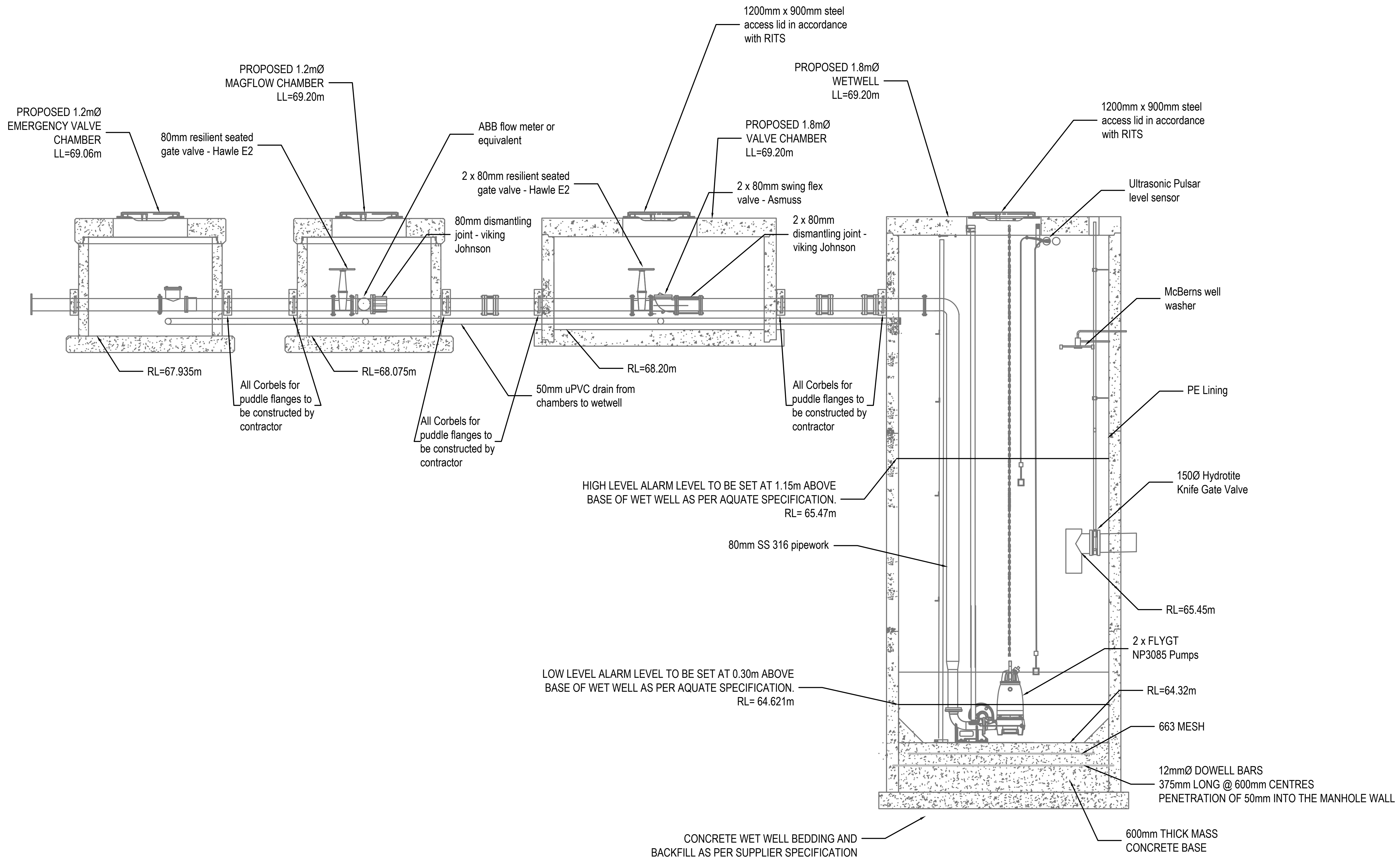
Drawing no.	C530-1
Rev	A



WASTEWATER PUMP STATION TYPICAL CROSS SECTION

SCALE: NTS

RESOURCE CONSENT

NOTES
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7. REFER TO AQUATE SPECIFICATION FOR RELEVANT WASTEWATER PUMP STATION SPECS AND INSTALLATION PROCESS.
8. ALL PIPELINES SHALL HAVE A FLEXIBLE JOINT ADJACENT TO THE MANHOLE ON ALL INCOMING AND OUTGOING PIPES NOT MORE THAN 600mm AWAY FROM THE MANHOLE WALL.

Rev	Description	By	Date
A	FAST TRACK APP	TCH	04/2025

	By	Date
Survey	MAVEN	05/2024
Design	TCH	04/2025
Drawn	TCH	04/2025
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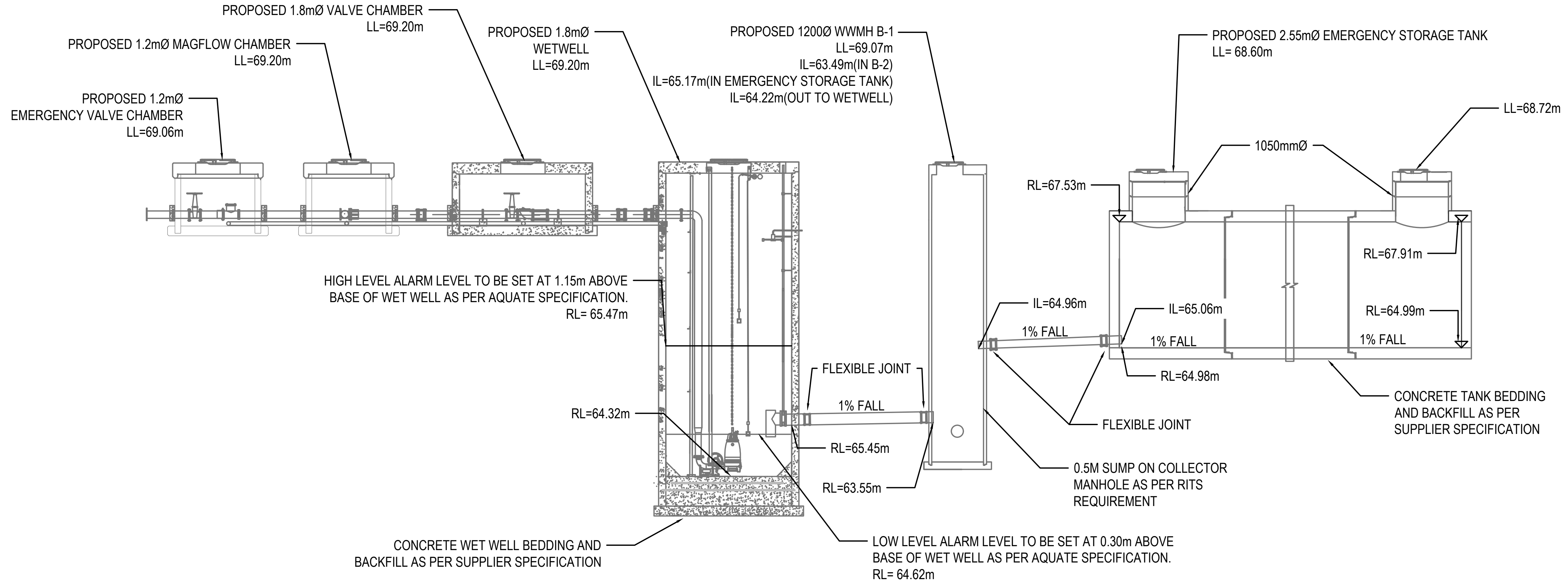
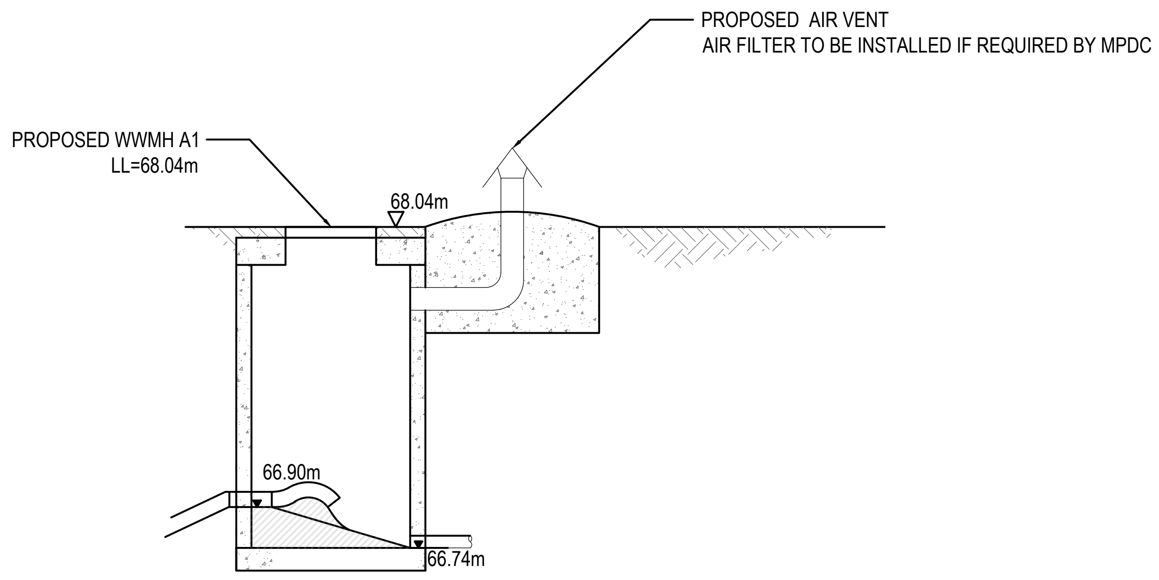
Title
PROPOSED CENTRAL WASTEWATER PUMP TYPICAL CROSS SECTION

Project no.	289001
Scale	NTS @ A3
Cad file	C530-WASTEWATER-PUMP STATION.DWG
Drawing no.	C530-2
Rev	A



WASTEWATER PUMP STATION TYPICAL CROSS SECTION

SCALE: NTS



WASTEWATER PUMP STATION DISCHARGE MANHOLE TYPICAL CROSS SECTION

SCALE: NTS

RESOURCE CONSENT

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Rev	Description	By	Date
A	FAST TRACK APP	TCH	04/2025

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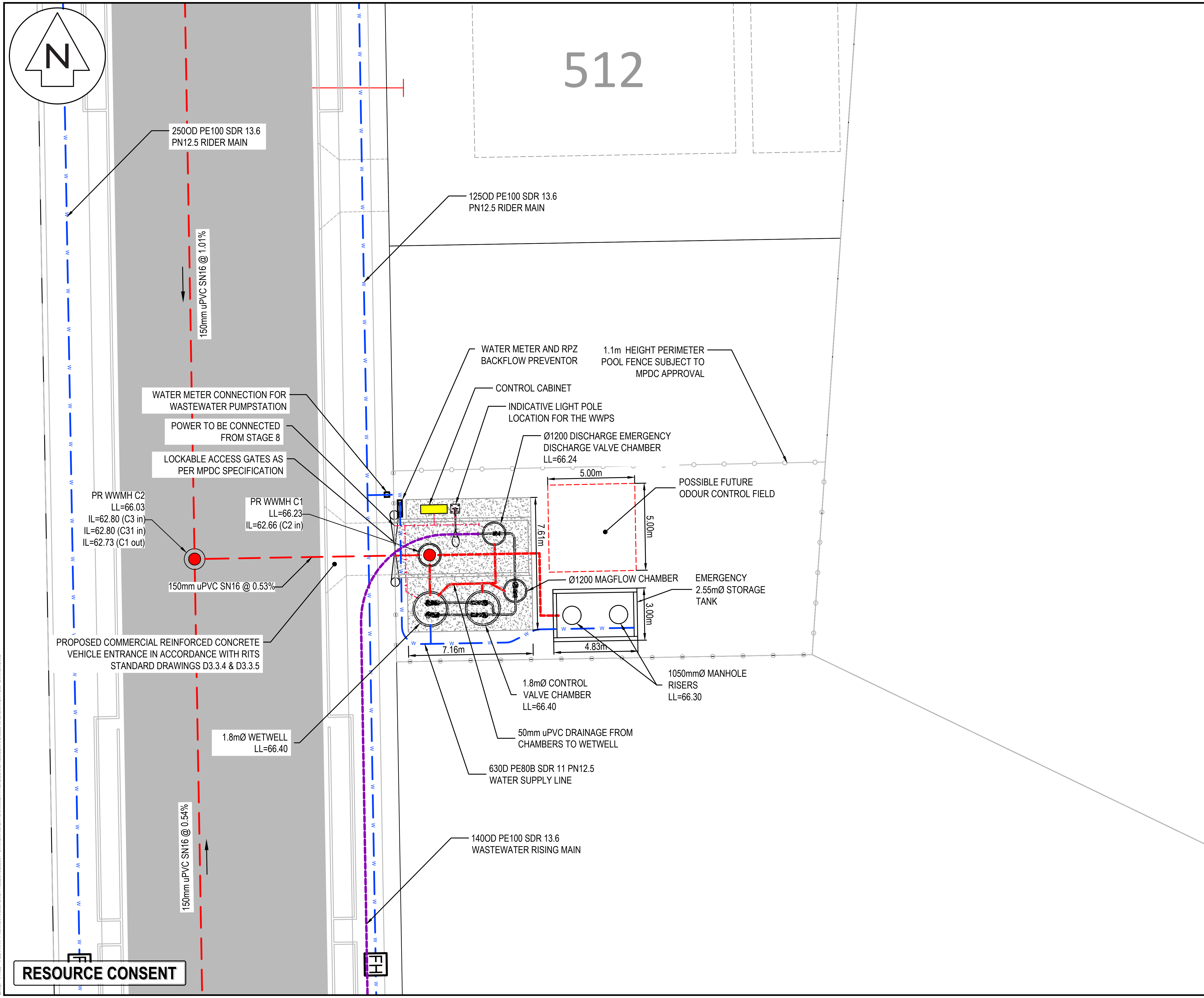
PROPOSED CENTRAL WASTEWATER PUMP TYPICAL SECTIONS

Project no.	289001
Scale	NTS @ A3
Cad file	C530-WASTEWATER-PUMP STATION.DWG
Drawing no.	C530-3
Rev	A



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- PROP BOUNDARY
- EX WASTEWATER
- PR WASTEWATER
- PR STORMWATER
- EX/PROP WWMH
- EX/PROP SWMH
- WW LOT CONNECTION

Rev	Description	By	Date
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	By	Date
Survey	MAVEN	05/2024
Design	TCH	04/2025
Drawn	TCH	04/2025
Checked	DJM	04/2025

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Title

PROPOSED NORTHERN WASTEWATER PUMP DRAINAGE PLAN

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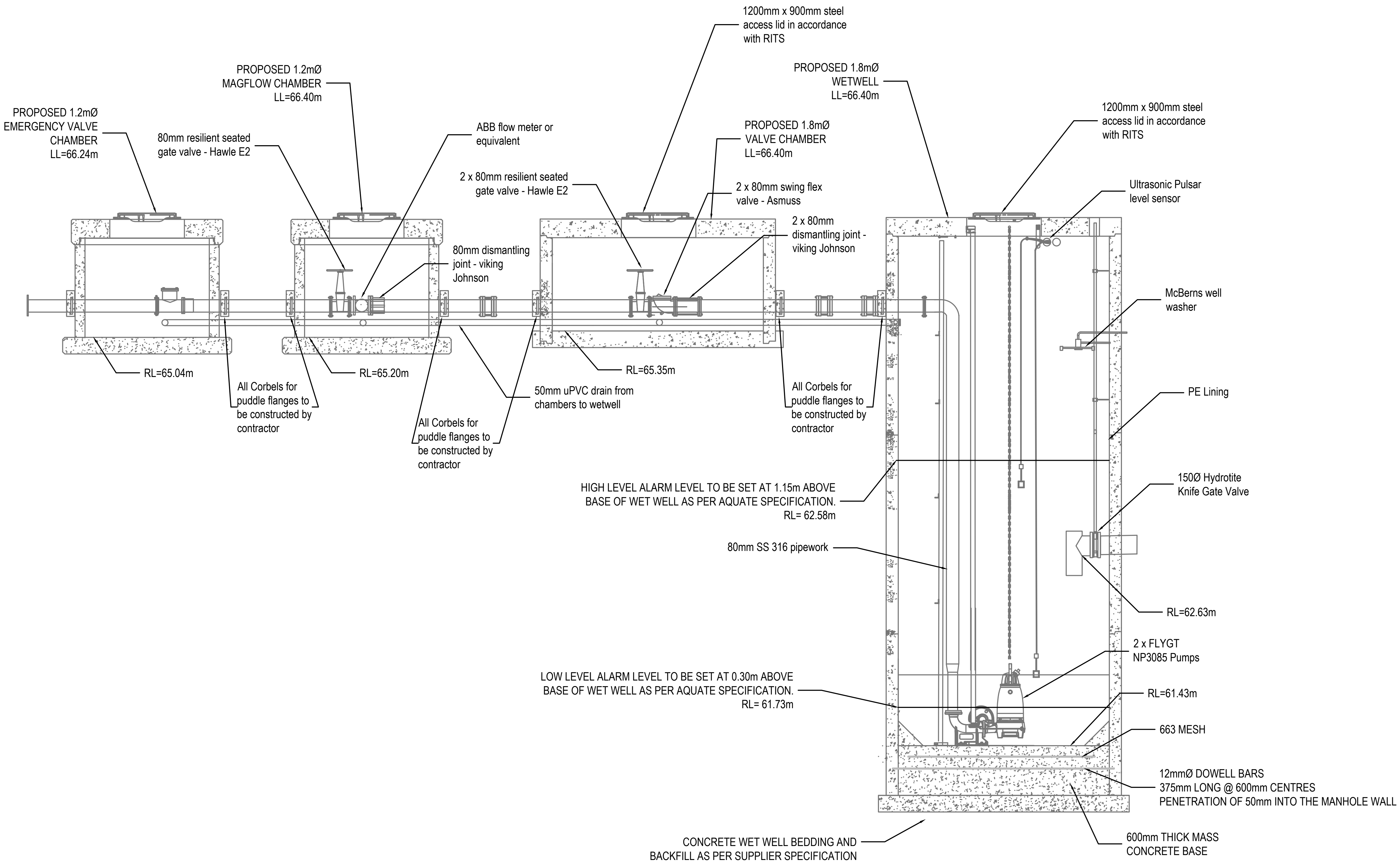
Drawing no.	C535-1
Rev	A



WASTEWATER PUMP STATION TYPICAL CROSS SECTION

SCALE: NTS

NOTES
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Rev	Description	By	Date
A	FAST TRACK APP	TCH	04/2025

	By	Date
Survey	MAVEN	05/2024
Design	TCH	04/2025
Drawn	TCH	04/2025
Checked	DJM	04/2025

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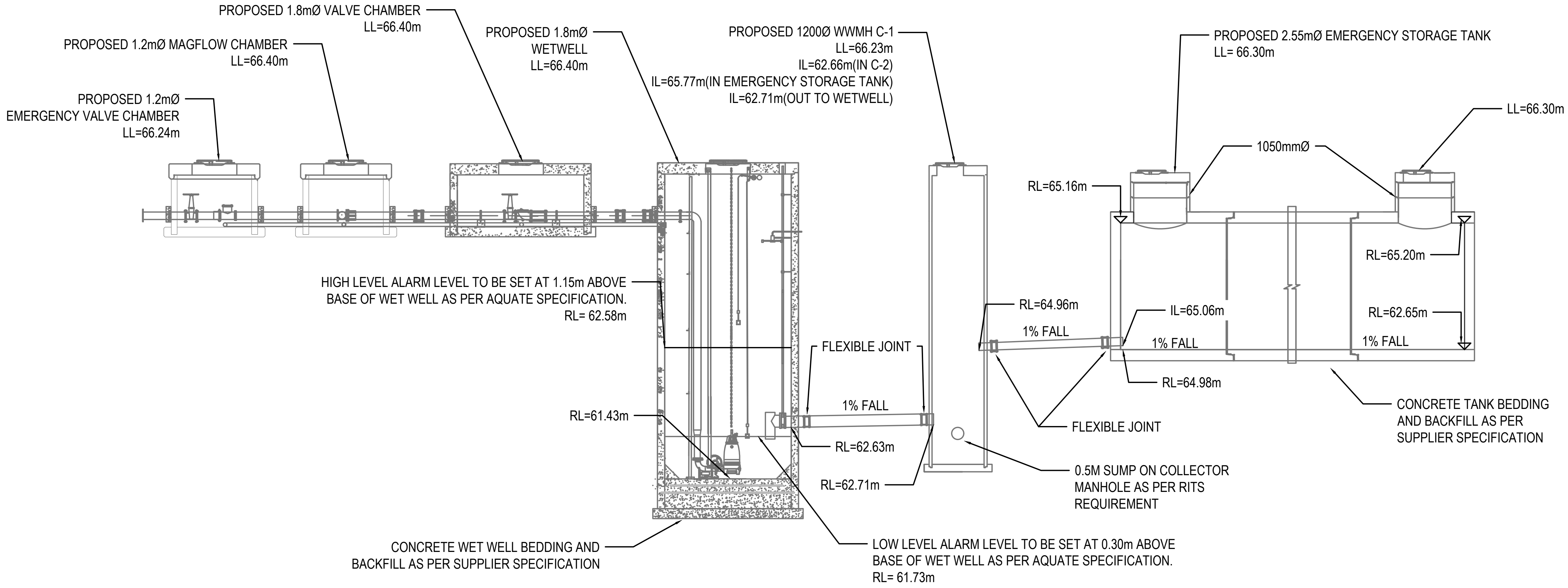
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS LTD

Title
PROPOSED NORTHERN WASTEWATER PUMP TYPICAL CROSS SECTION

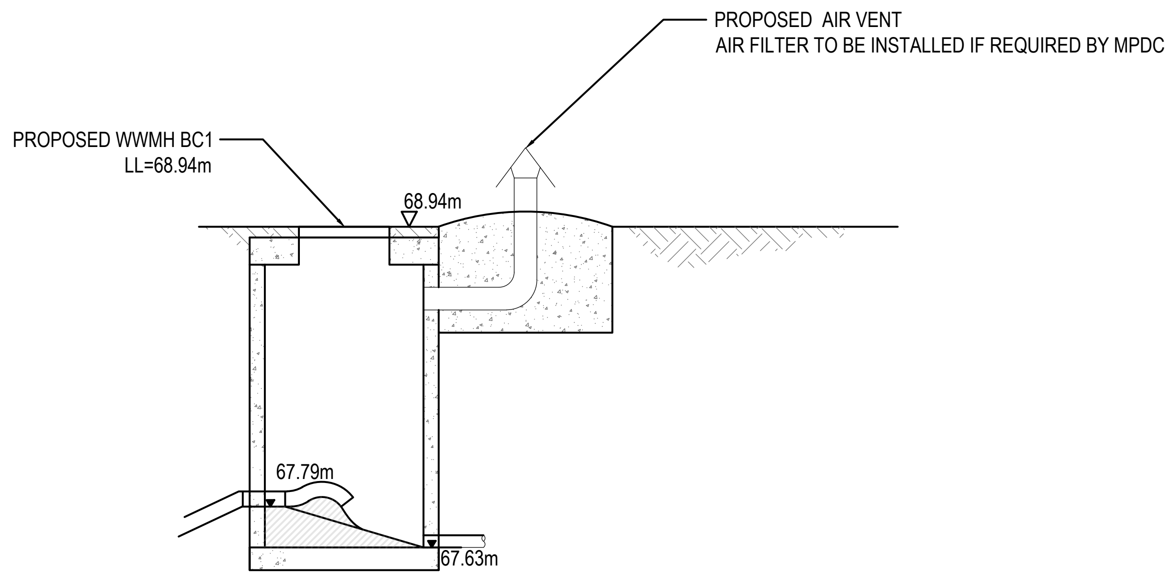
Project no.	289001
Scale	NTS @ A3
Cad file	C530-WASTEWATER-PUMP STATION.DWG
Drawing no.	C535-2
Rev	A

RESOURCE CONSENT



WASTEWATER PUMP STATION TYPICAL CROSS SECTION

SCALE: NTS



WASTEWATER PUMP STATION DISCHARGE MANHOLE TYPICAL CROSS SECTION

SCALE: NTS

RESOURCE CONSENT

NOTES

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A	FAST TRACK APP	TCH	04/2025

	By	Date
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Drawn	TCH	04/2025
Checked	DJM	04/2025

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Auckland 1023

Project
ASHBOURNE RESIDENTIAL FOR MATAMATA DEVELOPMENTS LTD

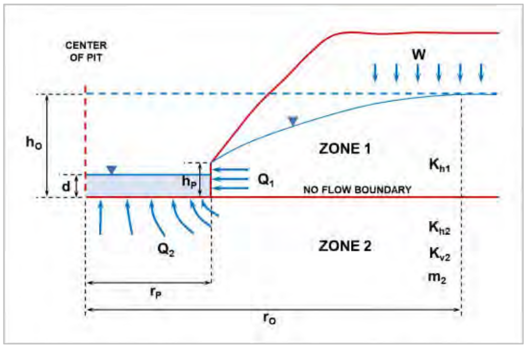
Title
PROPOSED NORTHERN WASTEWATER PUMP TYPICAL CROSS SECTION

Project no.	289001
Scale	NTS @ A3
Cad file	C530-WASTEWATER-PUMP STATION.DWG
Drawing no.	C535-3
Rev	A

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT:	Matamata Developments Limited
PROJECT:	Ashbourne Development
Project #:	WGA 241087
Location:	Station Rd, Matamata
Date:	1 May 2025
Document #:	WGA241087-RP-HG-0002_ B



A $$h_o = \sqrt{h_p^{\,2} + \frac{W}{K_{h1}}\left[r_o^2 \ln\left(\frac{r_o}{r_p}\right) - \frac{\left(r_o^2 - r_p^2\right)}{2}\right]},$$

B $$Q_1 = W\pi\left(r_o^2 - r_p^2\right),$$

C $$Q_2 = 4r_p\left(\frac{K_{h2}}{m_2}\right)\left(h_0 - d\right),$$

D $$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	4.76E-09	**m/s**	recharge flux
K_{h1}	3.48E-05	**m/s**	horizontal hydraulic conductivity in Zone 1
K_{h2}	3.48E-05	**m/s**	horizontal hydraulic conductivity in Zone 2
K_{v2}	6.97E-06	**m/s**	vertical hydraulic conductivity in Zone 2
h_o	4.67	**m**	initial saturated thickness above the base of Zone 1
h_p	0	**m**	saturated thickness at the pit wall
r_p	3.5	**m**	effective pit radius
d	0	**m**	depth of the pit lake

r_O is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A	211	m
Known h_O	4.67	m
h_O calculated using Equation A	4.67	m
Q_1	6.6E-04	m^3/s
	5.7E+01	m^3/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D	2.236068	
Q_2	1.0E-03	m^3/s
	8.8E+01	m^3/day

Total Pit Inflow

Q_{TOT}	1.7E-03	m^3/s
	145.27	m^3/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
Simple analytical equations for estimating ground water inflow to a mine pit. Ground Water 38, no. 2: 311-314.

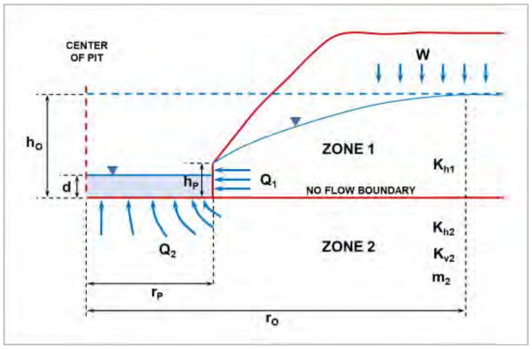
Analysed by: Toby Beisly
Checked by: Brett Sinclair

Notes:

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT:	Matamata Developments Limited
PROJECT:	Ashbourne Development
Project #:	WGA 241087
Location:	Station Rd, Matamata
Date:	1 May 2025
Document #:	WGA241087-RP-HG-0002_ B



$$dH_{Zone\,1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}}\left[r_0^2 Ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2}\right]}$$

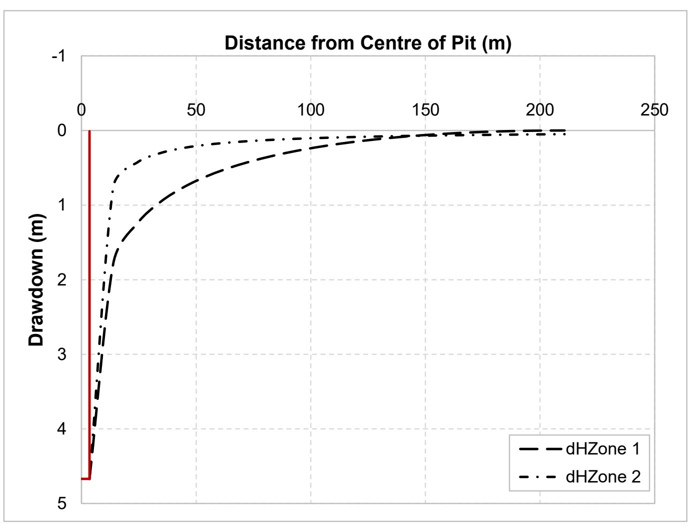
$$dH_{Zone2} = \frac{2(h_0 - d)}{\pi} sin^{-1}\left(\frac{r_p}{r}\right)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	4.76E-09	**m/s**	recharge flux
K_{h1}	3.48E-05	**m/s**	horizontal hydraulic conductivity in Zone 1
K_{h2}	3.48E-05	**m/s**	horizontal hydraulic conductivity in Zone 2
K_{v2}	6.97E-06	**m/s**	vertical hydraulic conductivity in Zone 2
h_o	4.67	**m**	initial saturated thickness above the base of Zone 1
h_p	0	**m**	saturated thickness at the pit wall
r_p	3.5	**m**	effective pit radius
d	0	**m**	depth of the pit lake

r_O is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_o calculated by iterating equation A in analysis sheet 1 211 m



Drawdown curves

r	$dH_{Zone\,1}$	$dH_{Zone\,2}$
3.5	4.67	4.7
13.9	1.8	0.8
24.2	1.3	0.4
34.6	1.0	0.3
44.9	0.8	0.2
55.3	0.6	0.2
65.7	0.5	0.2
76.0	0.4	0.1
86.4	0.3	0.1
96.7	0.3	0.1
107.1	0.2	0.1
117.4	0.2	0.1
127.8	0.1	0.1
138.2	0.09	0.1
148.5	0.06	0.1
158.9	0.04	0.1
169.2	0.03	0.1
179.6	0.01	0.1
190.0	0.01	0.1
200.3	0.00	0.1
210.7	0.00	0.0

Reference: Marinelli, F. & Niccoli W. L. 2000.
Simple analytical equations for estimating ground water inflow to a mine pit. Ground Water 38, no. 2: 311-314.

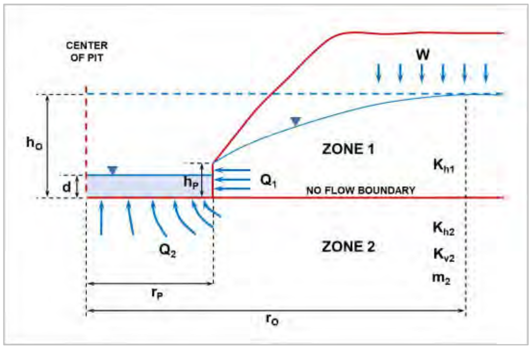
Analysed by: Toby Beisly
Checked by: Brett Sinclair

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
The dH_{Zone2} line does not take into account recharge from above.
Drawdown projections are initial approximations only.

GROUNDWATER DRAWDOWN AT BORES LOCATED CLOSE TO OPEN PIT - APPROXIMATION

WGA

CLIENT:	Matamata Developments Limited
PROJECT:	Ashbourne Development
Project #:	WGA 241087
Location:	Station Rd, Matamata
Date:	1 May 2025
Document #:	WGA241087-RP-HG-0002_ B



$$dH_{Zone\,1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}}\left[r_0^2 Ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2}\right]}$$

$$dH_{Zone2} = \frac{2(h_0 - d)}{\pi} sin^{-1}\left(\frac{r_p}{r}\right)$$

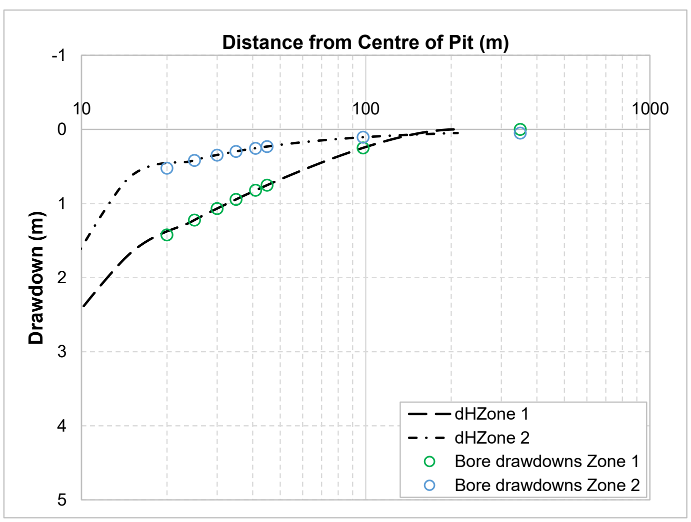
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	4.76E-09	**m/s**	recharge flux
K_{h1}	3.48E-05	**m/s**	horizontal hydraulic conductivity in Zone 1
K_{h2}	3.48E-05	**m/s**	horizontal hydraulic conductivity in Zone 2
K_{v2}	6.97E-06	**m/s**	vertical hydraulic conductivity in Zone 2
h_o	4.67	**m**	initial saturated thickness above the base of Zone 1
h_p	0	**m**	saturated thickness at the pit wall
r_p	3.5	**m**	effective pit radius
d	0	**m**	depth of the pit lake

r_O is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_o calculated by iterating equation A in analysis sheet 1 211 m

Radial distance of nearby bore from centre of pit = r.



Drawdown in bores

r	$dH_{Zone\ 1}$	$dH_{Zone\ 2}$
20	1.4	0.5
25.0	1.2	0.4
30.0	1.1	0.3
35.0	0.9	0.3
41.0	0.8	0.3
45.0	0.8	0.2
98.0	0.2	0.1
350.0	0.0	0.0

Reference: Marinelli, F. & Niccoli W. L. 2000. Simple analytical equations for estimating ground water inflow to a mine pit. Ground Water 38, no. 2: 311-314.

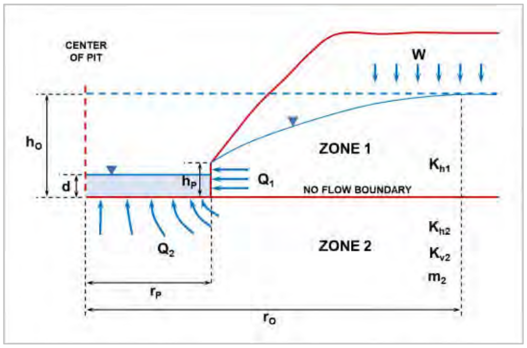
Analysed by: Toby Beisly
Checked by: Brett Sinclair

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
The dH_{Zone2} line does not take into account recharge from above.
Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Matamata Developments Limited
PROJECT: Ashbourne Development
Project #: WGA 241087
Location: Station Rd, Matamata
Date: 1 May 2025
Document #: WGA241087-RP-HG-0002_ B



A $$h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}}\left[r_o^2 \ln\left(\frac{r_o}{r_p}\right) - \frac{(r_o^2 - r_p^2)}{2}\right]},$$

B $$Q_1 = W\pi(r_o^2 - r_p^2),$$

C $$Q_2 = 4r_p\left(\frac{K_{h2}}{m_2}\right)(h_0 - d),$$

D $$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	4.76E-09	**m/s**	recharge flux
K_{h1}	8.83E-06	**m/s**	horizontal hydraulic conductivity in Zone 1
K_{h2}	8.83E-06	**m/s**	horizontal hydraulic conductivity in Zone 2
K_{v2}	1.77E-06	**m/s**	vertical hydraulic conductivity in Zone 2
h_o	2.57	**m**	initial saturated thickness above the base of Zone 1
h_p	0	**m**	saturated thickness at the pit wall
r_p	2.366	**m**	effective pit radius
d	0	**m**	depth of the pit lake

r_O is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A	66	m
Known h_O	2.57	m
h_O calculated using Equation A	2.57	m
Q_1	6.5E-05	m^3/s
	5.6E+00	m^3/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D	2.236068	
Q_2	9.6E-05	m^3/s
	8.3E+00	m^3/day

Total Pit Inflow	**Q_{TOT}**	1.6E-04	m^3/s
		13.88	m^3/day

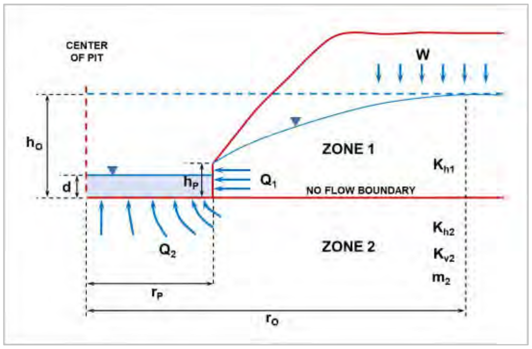
Reference: Marinelli, F. & Niccoli W. L. 2000.
Simple analytical equations for estimating ground water inflow to a mine pit. Ground Water 38, no. 2: 311-314.

Analysed by: Toby Beisly
Checked by: Brett Sinclair

Notes:

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

CLIENT:	Matamata Developments Limited
PROJECT:	Ashbourne Development
Project #:	WGA 241087
Location:	Station Rd, Matamata
Date:	1 May 2025
Document #:	WGA241087-RP-HG-0002_ B



$$dH_{Zone\,1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}}\left[r_0^2 Ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2}\right]}$$

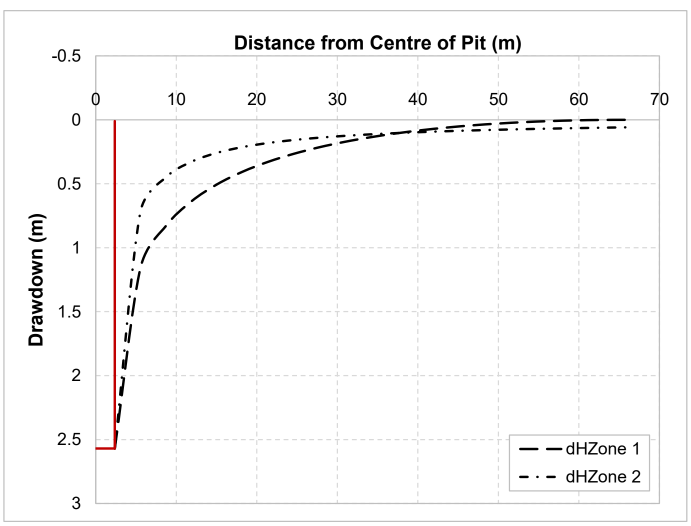
$$dH_{Zone2} = \frac{2(h_0 - d)}{\pi} sin^{-1}\left(\frac{r_p}{r}\right)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	4.76E-09	**m/s**	recharge flux
K_{h1}	8.83E-06	**m/s**	horizontal hydraulic conductivity in Zone 1
K_{h2}	8.83E-06	**m/s**	horizontal hydraulic conductivity in Zone 2
K_{v2}	1.77E-06	**m/s**	vertical hydraulic conductivity in Zone 2
h_o	2.57	**m**	initial saturated thickness above the base of Zone 1
h_p	0	**m**	saturated thickness at the pit wall
r_p	2.366	**m**	effective pit radius
d	0	**m**	depth of the pit lake

r_O is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_o calculated by iterating equation A in analysis sheet 1 66 m



Drawdown curves

r	$dH_{Zone\,1}$	$dH_{Zone\,2}$
2.366	2.57	2.6
5.5	1.2	0.7
8.7	0.8	0.5
11.9	0.6	0.3
15.1	0.5	0.3
18.2	0.4	0.2
21.4	0.3	0.2
24.6	0.3	0.2
27.8	0.2	0.1
30.9	0.2	0.1
34.1	0.1	0.1
37.3	0.1	0.1
40.5	0.1	0.1
43.6	0.06	0.1
46.8	0.04	0.1
50.0	0.03	0.1
53.1	0.02	0.1
56.3	0.01	0.1
59.5	0.00	0.1
62.7	0.00	0.1
65.8	0.00	0.1

Reference: Marinelli, F. & Niccoli W. L. 2000.
Simple analytical equations for estimating ground water inflow to a mine pit. Ground Water 38, no. 2: 311-314.

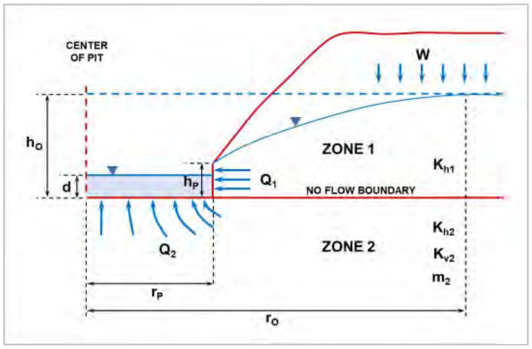
Analysed by: Toby Beisly
Checked by: Brett Sinclair

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
The dH_{Zone2} line does not take into account recharge from above.
Drawdown projections are initial approximations only.

GROUNDWATER DRAWDOWN AT BORES LOCATED CLOSE TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Matamata Developments Limited
PROJECT: Ashbourne Development
Project #: WGA 241087
Location: Station Rd, Matamata
Date: 1 May 2025
Document #: WGA241087-RP-HG-0002_ B



$$dH_{Zone\,1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}}\left[r_0^2 Ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2}\right]}$$

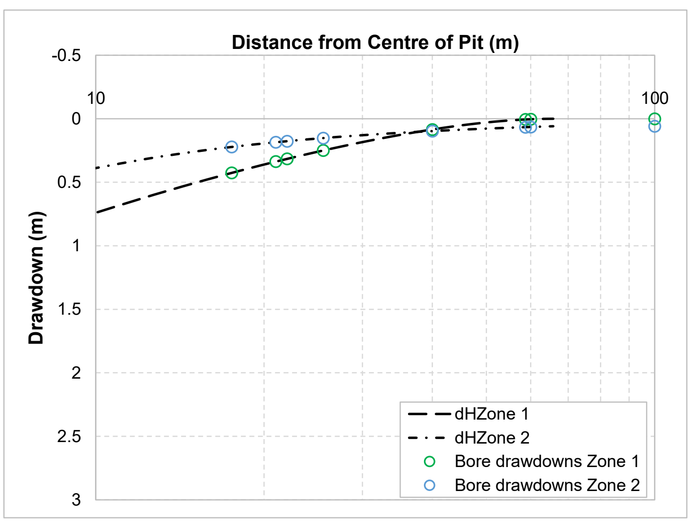
$$dH_{Zone2} = \frac{2(h_0 - d)}{\pi} sin^{-1}\left(\frac{r_p}{r}\right)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	4.76E-09	**m/s**	recharge flux
K_{h1}	8.83E-06	**m/s**	horizontal hydraulic conductivity in Zone 1
K_{h2}	8.83E-06	**m/s**	horizontal hydraulic conductivity in Zone 2
K_{v2}	1.77E-06	**m/s**	vertical hydraulic conductivity in Zone 2
h_o	2.57	**m**	initial saturated thickness above the base of Zone 1
h_p	0	**m**	saturated thickness at the pit wall
r_p	2.366	**m**	effective pit radius
d	0	**m**	depth of the pit lake

r_O is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_o calculated by iterating equation A in analysis sheet 1 66 m
Radial distance of nearby bore from centre of pit = r.



Drawdown in bores

r	$dH_{Zone\,1}$	$dH_{Zone\,2}$
17.5	0.4	0.2
21.0	0.3	0.2
22.0	0.3	0.2
25.5	0.2	0.2
40.0	0.1	0.1
58.7	0.0	0.1
60.0	0.0	0.1
100.0	0.0	0.1

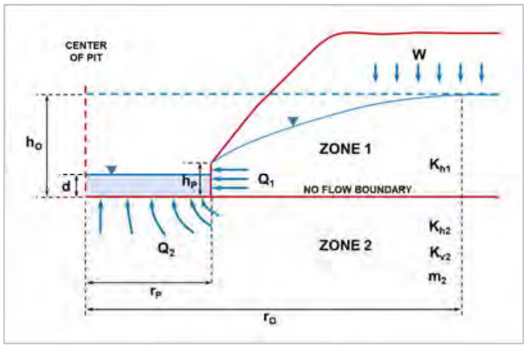
Reference: Marinelli, F. & Niccoli W. L. 2000.
Simple analytical equations for estimating ground water inflow to a mine pit. Ground Water 38, no. 2: 311-314.

Analysed by: Toby Beisly
Checked by: Brett Sinclair

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
The dH_{Zone2} line does not take into account recharge from above.
Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

CLIENT:	Matamata Developments Limited
PROJECT:	Ashbourne Development
Project #:	WGA 241087
Location:	Station Rd, Matamata
Date:	12 June 2025
Document #:	WGA241087-RP-HG-0002_ B



A $$h_o = \sqrt{h_p{}^2 + \frac{W}{K_{h1}}\left[r_o^2 \ln\left(\frac{r_o}{r_p}\right) - \frac{\left(r_o^2 - r_p^2\right)}{2}\right]},$$

B $$Q_1 = W\pi\left(r_o^2 - r_p^2\right),$$

C $$Q_2 = 4r_p\left(\frac{K_{h2}}{m_2}\right)\left(h_0 - d\right),$$

D $$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	4.76E-09	**m/s**	recharge flux
K_{h1}	1.55E-05	**m/s**	horizontal hydraulic conductivity in Zone 1
K_{h2}	1.55E-05	**m/s**	horizontal hydraulic conductivity in Zone 2
K_{v2}	3.11E-06	**m/s**	vertical hydraulic conductivity in Zone 2
h_o	3.33	**m**	initial saturated thickness above the base of Zone 1
h_p	0	**m**	saturated thickness at the pit wall
r_p	3.608	**m**	effective pit radius
d	0	**m**	depth of the pit lake

r_O is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A	111	m
Known h_O	3.33	m
h_O calculated using Equation A	3.33	m
Q_1	1.8E-04	m^3/s
	1.6E+01	m^3/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D	2.236068	
Q_2	3.3E-04	m^3/s
	2.9E+01	m^3/day

Total Pit Inflow

Q_{TOT}	5.2E-04	m^3/s
	44.82	m^3/day

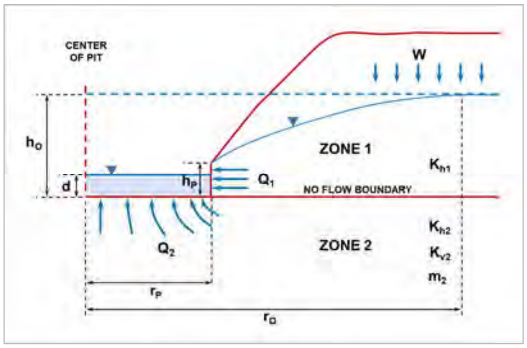
Reference: Marinelli, F. & Niccoli W. L. 2000.
Simple analytical equations for estimating ground water inflow to a mine pit. Ground Water 38, no. 2: 311-314.

Analysed by: Toby Beisly
Checked by: Brett Sinclair

Notes:

INFLOW TO OPEN PIT - APPROXIMATION

CLIENT: Matamata Developments Limited
PROJECT: Ashbourne Development
Project #: WGA 241087
Location: Station Rd, Matamata
Date: 12 June 2025
Document #: WGA241087-RP-HG-0002_ B



A $$h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}}\left[r_o^2 \ln\left(\frac{r_o}{r_p}\right) - \frac{(r_o^2 - r_p^2)}{2}\right]},$$

B $$Q_1 = W\pi(r_o^2 - r_p^2),$$

C $$Q_2 = 4r_p\left(\frac{K_{h2}}{m_2}\right)(h_0 - d),$$

D $$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	4.76E-09	**m/s**	recharge flux
K_{h1}	1.55E-05	**m/s**	horizontal hydraulic conductivity in Zone 1
K_{h2}	1.55E-05	**m/s**	horizontal hydraulic conductivity in Zone 2
K_{v2}	3.11E-06	**m/s**	vertical hydraulic conductivity in Zone 2
h_o	3.33	**m**	initial saturated thickness above the base of Zone 1
h_p	0	**m**	saturated thickness at the pit wall
r_p	3.608	**m**	effective pit radius
d	0	**m**	depth of the pit lake

r_O is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A	111	m
Known h_O	3.33	m
h_O calculated using Equation A	3.33	m
Q_1	1.8E-04	m^3/s
	1.6E+01	m^3/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D	2.236068	
Q_2	3.3E-04	m^3/s
	2.9E+01	m^3/day

Total Pit Inflow

Q_{TOT}	5.2E-04	m^3/s
	44.82	m^3/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
Simple analytical equations for estimating ground water inflow to a mine pit. Ground Water 38, no. 2: 311-314.

Analysed by: Toby Beisly
Checked by: Brett Sinclair

Notes:

INFLOW TO OPEN PIT - APPROXIMATION

CLIENT: Matamata Developments Limited
PROJECT: Ashbourne Development
Project #: WGA 241087
Location: Station Rd, Matamata
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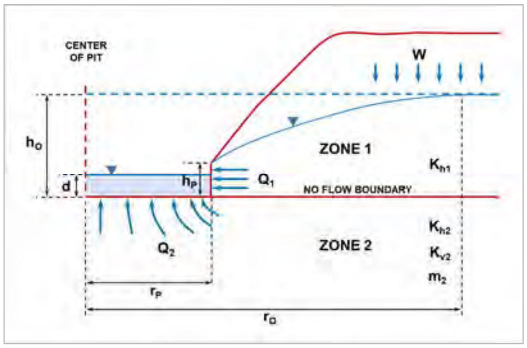
Document #: WGA241087-RP-HG-0002_ B



A $$h_o = \sqrt{h_p^{\,2} + \frac{W}{K_{h1}}\left[r_o^2 \ln\left(\frac{r_o}{r_p}\right) - \frac{\left(r_o^2 - r_p^2\right)}{2}\right]},$$

B $$Q_1 = W\pi\left(r_o^2 - r_p^2\right),$$

C $$Q_2 = 4r_p\left(\frac{K_{h2}}{m_2}\right)\left(h_0 - d\right),$$

D $$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	4.76E-09	**m/s**	recharge flux
K_{h1}	1.55E-05	**m/s**	horizontal hydraulic conductivity in Zone 1
K_{h2}	1.55E-05	**m/s**	horizontal hydraulic conductivity in Zone 2
K_{v2}	3.11E-06	**m/s**	vertical hydraulic conductivity in Zone 2
h_o	3.33	**m**	initial saturated thickness above the base of Zone 1
h_p	0	**m**	saturated thickness at the pit wall
r_p	3.608	**m**	effective pit radius
d	0	**m**	depth of the pit lake

r_O is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A	111	m
Known h_O	3.33	m
h_O calculated using Equation A	3.33	m
Q_1	1.8E-04	m^3/s
	1.6E+01	m^3/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D	2.236068	
Q_2	3.3E-04	m^3/s
	2.9E+01	m^3/day

Total Pit Inflow

Q_{TOT}	5.2E-04	m^3/s
	44.82	m^3/day

Reference: Marinelli, F. & Niccoli W. L. 2000. Simple analytical equations for estimating ground water inflow to a mine pit. Ground Water 38, no. 2: 311-314.

Analysed by: Toby Beisly
Checked by: Brett Sinclair

Notes:

APPENDIX I

GROUNDWATER TAKE FOR RETIREMENT VILLAGE

I1 INTRODUCTION

I1.1 Background

Matamata Developments Limited (Matamata Developments) seek to abstract groundwater from bore 72_12812 (the Production Bore) located at Station Road, Matamata (Figure I1). The abstracted water is to be used for dust suppression and fire countermeasures, followed by, potable water supply and lawn Irrigation for a retirement village. To support the application, a 9-hour constant rate pumping test was undertaken on the Production Bore. During the test, groundwater levels were monitored in the Production Bore.

I1.2 Water Requirements and Use

Matamata Developments is seeking to abstract groundwater, initially, for dust suppression during their construction of a residential development, solar farm, and retirement village located at Station Road, Matamata. After construction, water will be used to irrigate approximately 10.73 ha of land in the retirement village and be used for supply to the retirement village. The water requirements are:

- Abstraction for irrigation and retirement village supply:
  - A maximum daily volume of 336 m^3.
  - An irrigation annual maximum volume of 56,333 m^3.
  - A total annual maximum volume of 92,308 m^3.

Initially, water from the bore will be used for dust suppression for development of 10 to 15 ha at any one time at a rate of up to 336 m^3/day for up to 168 days.

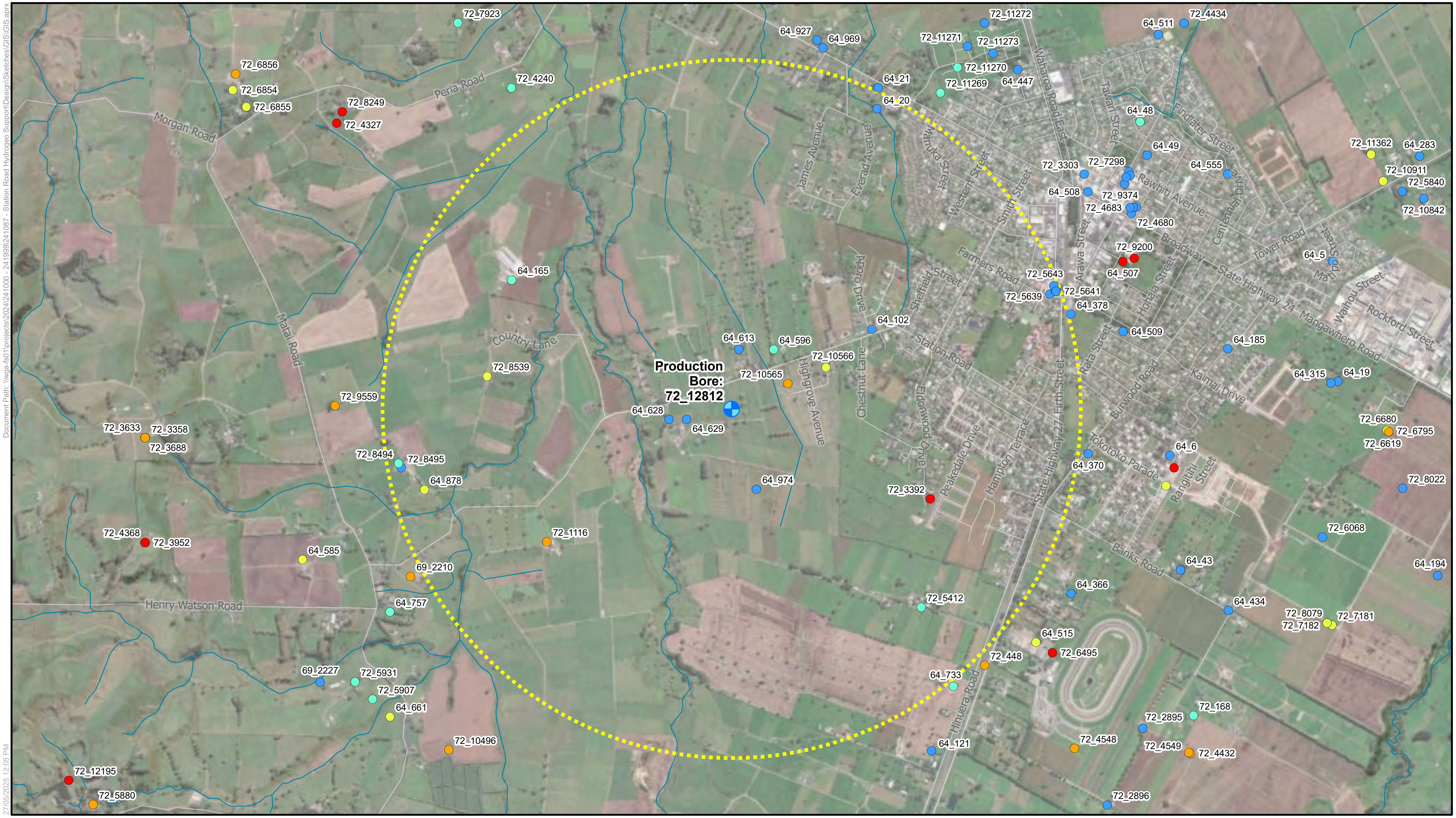
The total annual irrigation volume has been calculated using the online tool, Irricalc (https://mycatchment.info/), accounting for a 80% efficiency application rate, local climate and soil conditions, and irrigation requirements for 9 out of 10 years.

The potable water supply requirements for the retirement village have been provided by Maven Associates (Maven, pers comm. Stoffle Bakkes, dated 20 May 2025; Table I1). Based on this information, the village will require a total of 182.3 m^3/day based on a total of 220 villas when completed.

The total annual volume is based on 168 days pumping at the maximum daily volume of 336 m^3/day to achieve the maximum irrigation volume and the remaining 197 days of the year pumping at 182.3 m^3/day.

Table I1: Potable Water Demand Breakdown of the Retirement Village (Maven 2025).

STAGE	TOTAL NO. OF VILLAS	VILLAS	FACILITY	AGE CARE	WATER USEAGE	FIRE DEMAND
1	25	13.0 m^3/day	7.5 m^3/day	0.0 m^3/day	20.5 m^3/day	90.0 m^3
2	52	27.0 m^3/day	7.5 m^3/day	0.0 m^3/day	34.5 m^3/day	
3	80	41.6 m^3/day	15.0 m^3/day	0.0 m^3/day	56.6 m^3/day	
4	107	55.6 m^3/day	15.0 m^3/day	0.0 m^3/day	70.6 m^3/day	
5	133	69.2 m^3/day	15.0 m^3/day	0.0 m^3/day	84.2 m^3/day	
6	158	82.2 m^3/day	15.0 m^3/day	0.0 m^3/day	97.2 m^3/day	
7	182	94.6 m^3/day	22.5 m^3/day	0.0 m^3/day	117.1 m^3/day	
8	207	107.6 m^3/day	22.5 m^3/day	0.0 m^3/day	130.1 m^3/day	
9	218	113.4 m^3/day	22.5 m^3/day	0.0 m^3/day	135.9 m^3/day	
10	220	114.4 m^3/day	22.5 m^3/day	45.4 m^3/day	182.3 m^3/day	



N

0 200 400 600 800 m

Scale 1:30,000 @ A4

Coordinate System: NZGD 2000 New Zealand Transverse Mercator

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 a copyright of WGA 2025

LEGEND

Production Bore | Buffer (1km) | Roads | Watercourse

Nearby Bores (Depth (m))

Unknown | 25 - 50 | 75 - 100

< 25 | 50 - 75 | > 100

WGA

Figure I1

Station Road

Location of Production Bore: 72_12812 and Surrounding Bores

I1.3 Bore Construction

The bore construction details for the Production Bore are listed in Table I2.

Table I2: Construction Details for the Production Bore

PARAMETER [1]	PRODUCTION BORE
Bore Number	72_12812
Address	Station Road, Matamata
Easting NZTM	1842037
Northing NZTM	5810493
Ground Elevation (m RL) [2]	68.2
Bore Depth (m)	120
Base of Bore (m RL) [2]	-51.8
Casing Depth (m)	109
Base of Casing (m RL) [2]	-40.8
Casing Diameter (mm)	100
Top of Screen (m)	107.6
Top of Screen (m RL) [2]	-39.4
Bottom of Screen (m)	120
Bottom of Screen (m RL) [2]	-51.8
Screen Diameter	80
Static Water Level (m btoc)	6.83
Static Water Level (m RL) [2]	61.37

Notes: (1) Data provided from the drillers log unless otherwise stated.
(2) RL is Relative Level in metres above mean sea level.

I1.4 Local Aquifer Definition

I1.4.1 Lithology

The exploration bore was drilled to a depth of 173 m to determine the optimal layer to screen for the proposed water supply. The drillers description has been provided in Table I3 and indicates various layers of higher and lower permeability sediments.

The lithological log of Production Bore 72_12812 describes the screened section intersecting approximately 12.3 m of dark grey and brown gravelly sand. The screened section of the bore is overlain by several layers of gravely sand, silty clay and clay.

Table I3: Lithological Log for the Matamata Developments Production Bore (72_12812)

DEPTH (m bgl) [(1)]		DESCRIPTION	HYDROGEOLOGICAL CHARACTERISTICS
From	**To**		
0	4	Orange brown sandy gravel	Aquifer 1
4	8.5	Grey brown silty pumice gravel with sand	
8.5	22.5	Light grey silty pumice sand	
22.5	27	Grey gravely sand with pumice	
27	35.5	Grey sandy silt	
35.5	41	Orange grey clay with some sand	Aquitard
41	46	Orange brown poorly sorted coarse sand to sandy gravel	Aquifer 2
46	47	light brown clay with some sand	Aquitard
47	57	Grey pumice coarse sand to gravel	Aquifer 2
57	59	Dark grey coarse sand to gravel, poorly sorted, greywacke clasts	
59	70	Grey coarse sand to gravelly sand, high pumice content	
70	74.5	Grey coarse sand with gravelly sand, some pumice, moderately sorted	
74.5	81.5	Grey coarse sand with gravel and pumice	
81.5	86.5	Grey coarse sand, some pumice slightly less gravel	
86.5	90.5	Dark grey coarse sand with gravel and silt	
90.5	100	Light grey silty clay, aquitard	Aquitard
100	102	Dark green grey coarse gravelly sand with small amount of pumice, target aquifer	**Aquifer 3 (Screened)** Screen
102	108	Dark brown coarse gravelly sand	
108	115	Brown grey coarse gravelly sand, larger gravels	
115	120.5	Brown grey coarse gravelly sand	
120.5	130	light brown silty clay with some sand, aquitard	Aquitard
130	140	light brown moderately well sorted coarse sand	Aquifer 4
140	150	Light brown gravelly coarse sand	
150	159	Light brown coarse sand with small amount of gravel, silica	
159	173	Light brown coarse sand, well sorted, silica	

Note: (1). Information sourced from Brown Bros Drilling

I1.4.2 Local Hydraulic Characteristics

The Production Bore taps into the Southern Hauraki Aquifer for groundwater allocation purposes. The management level for the Southern Hauraki is 335,000,000 m^3/year according to Table 3-6 of the Waikato Regional Plan (WRC 2012). WGA understands that currently, less than 10% of the available volume is allocated, so groundwater is available for the development if surface water interaction can be avoided.

I1.4.3 Conceptual Aquifer System

Based on the lithological log of the Production Bore (Table I3) WGA consider that the site is underlain by at least four aquifers. For the purposes of this report, they have been given conceptual numbers 1 - 4. Aquifer 1 is interpreted to be unconfined, from the ground surface to approximately 32.7 m RL (35.5 m bgl). Aquifer 1 is underlain by approximately 5.5 m of lower permeability material that is assumed to act as an aquitard as shown in the lithological log for the Production Bore (Table I3). Below the aquitard is the semiconfined or confined aquifer, Aquifer 2, which extends to a depth of -22.3 m RL (90.5 m bgl). Underlying Aquifer 2 is Aquifer 3 to a depth of -52.3 m RL (120.5 m bgl). Aquifer 2 is separated from Aquifer 3 by a 9.5 m thick clay aquitard. Aquifer 3 is underlaid by an additional 9.5 m thick silty clay aquitard which separates it from Aquifer 4.

WGA considers that the Production Bore taps into Aquifer 3. WGA also consider that the presence of low permeability materials overlying each of the identified conceptual aquifer units will impede the hydraulic interaction between bores screened in different aquifers. Therefore, the test data is to be analysed through comparison with analytical curves for a confined aquifer.

For the purposes of analysing the constant rate pumping test, a conceptual aquifer thickness of 20.5 m has been considered appropriate. This is based upon the inferred aquifer unit between 100 to 120.5 m bgl consisting of gravel and sand which is overlain by clay. A conceptual aquitard thickness of 9.5 m has been chosen for the analysis which corresponds to the thickness of the clay layer from 90.5 to 100 m bgl.

I2 PUMPING TEST ANALYSIS

I2.1 Overview

A constant rate pumping test was performed on the Matamata Developments Production Bore. The pumping test methodologies and results are discussed in this section.

I2.2 Review of Constant rate Pumping Test Performance

The constant rate pumping test was performed at a flow rate of 3.9 L/s (14 m^3/hour) over a pumping period of 9 hours (540 Minutes). Monitoring of groundwater drawdown in the Production Bore was undertaken using a pressure transducer installed in the bore, recording at one-minute intervals (Figure I2). Additionally, manual groundwater level measurements were taken in the bore throughout the test.

Following the cessation of pumping, monitoring of the groundwater level recovery was undertaken for 15 hours using a pressure transducer recording at one-minute intervals. Manual groundwater level measurements were taken for the first 2 hours of the recovery period.

I2.2.1 Observed Drawdown and Recovery

Pumping commenced at 8:00 am on 14 May 2025. The static water level (SWL) in the Production Bore at the start of the test was 6.83 m bgl. The maximum drawdown relative to this SWL was 6.09 m occurring 446 minutes after pumping commenced (Figure I2).

Extrapolation of the drawdown curve (Figure I3) indicates drawdown in the Production Bore would be approximately 8.4 m after a year of continuous pumping at 3.9 L/s. This drawdown does not reflect the planned pumping schedule and is instead a projection of drawdown if the pump was run continuously for an extended period at the pumping test flow rate. This drawdown projection also takes no account of external influences on water levels in the Production Bore.

The water level in the Production Bore had recovered to 95% of the SWL approximately 400 minutes following the cessation of pumping (Figure I4). Within the monitoring period of 900 minutes following cessation of pumping the water level recovered to 97% of the original SWL.

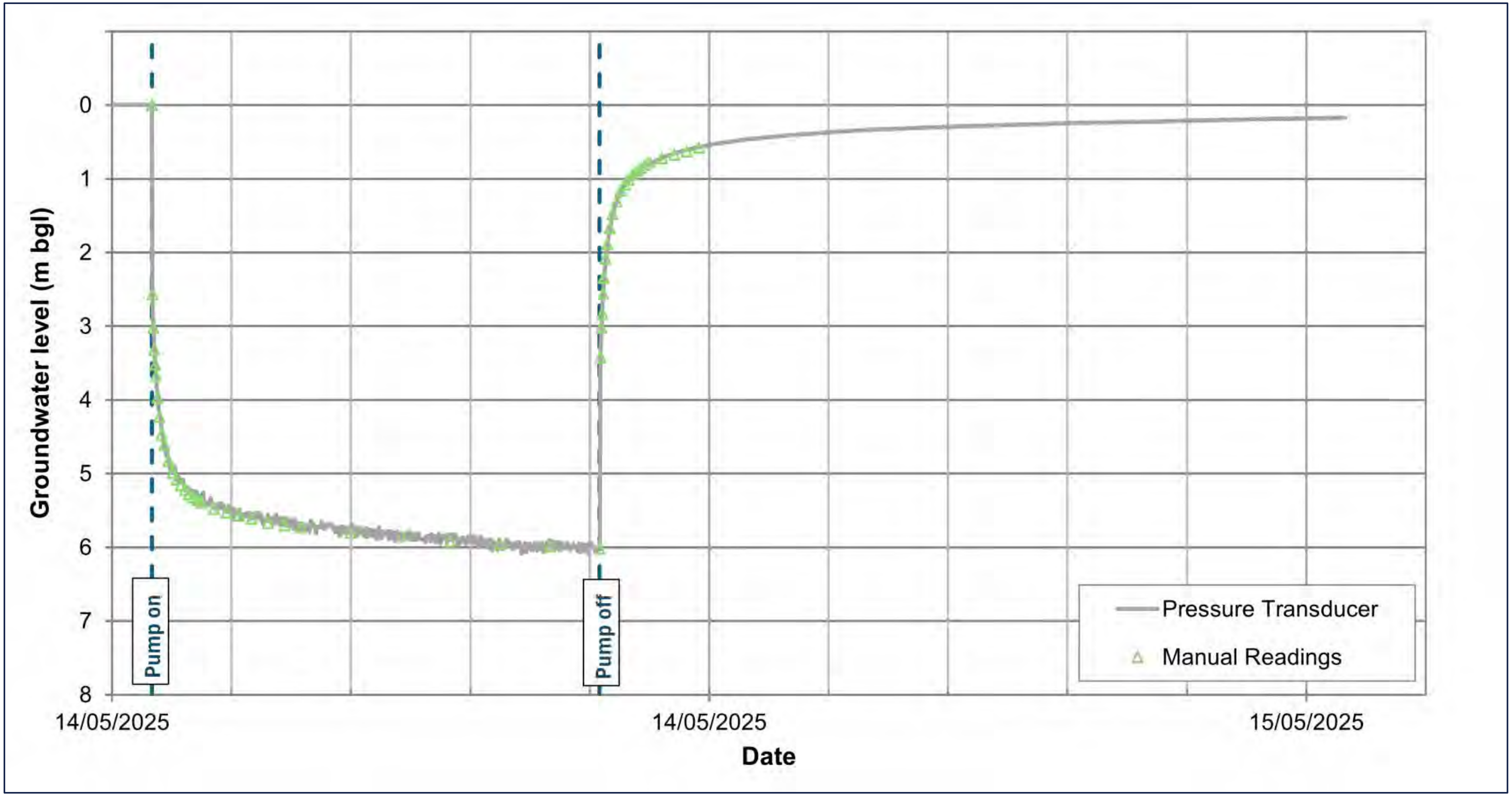


Figure I2: Calibrated Transducer Water Level and Manual Levels

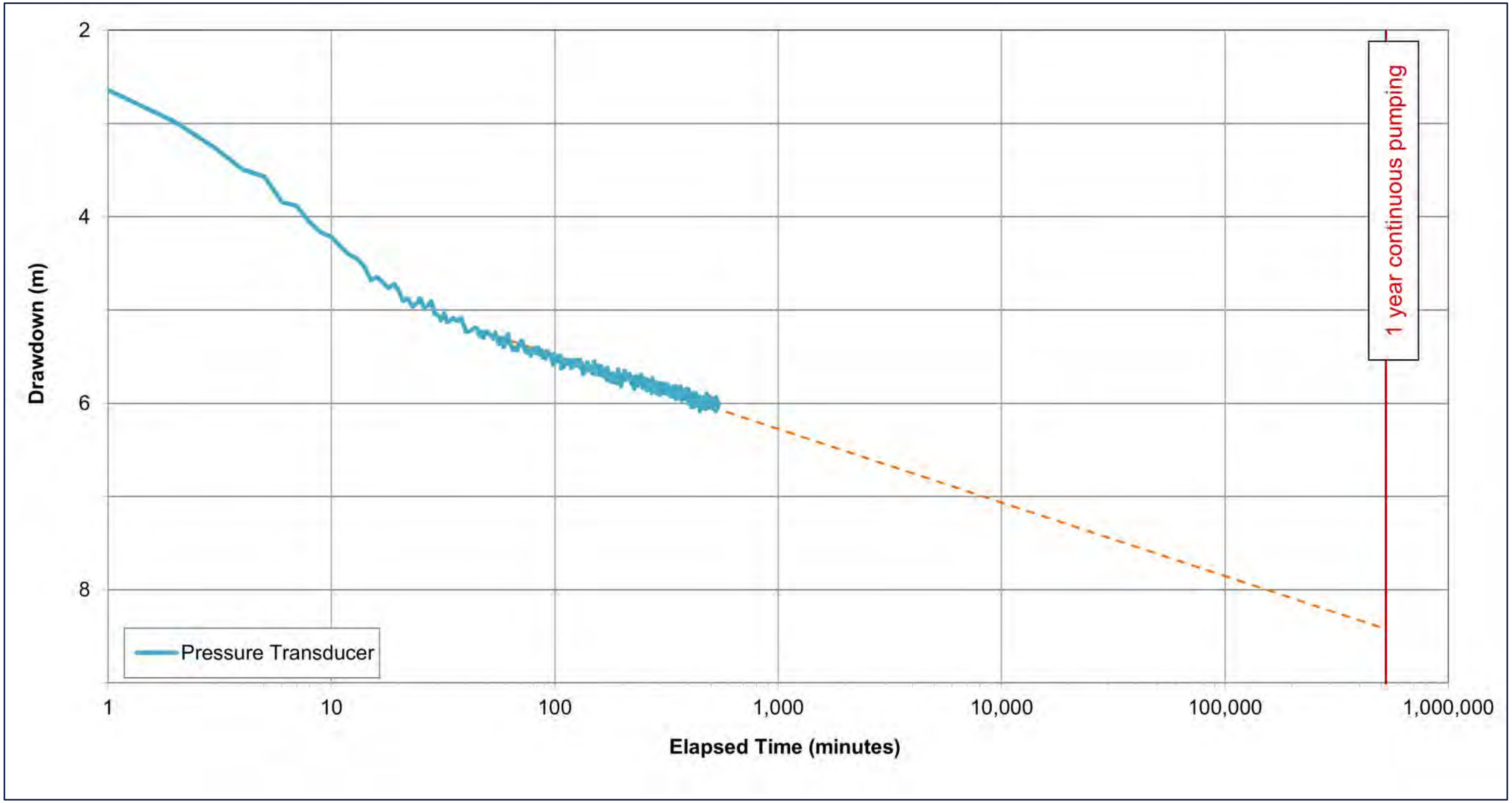


Figure I3: Transducer Data Extrapolated 1 Year Forward

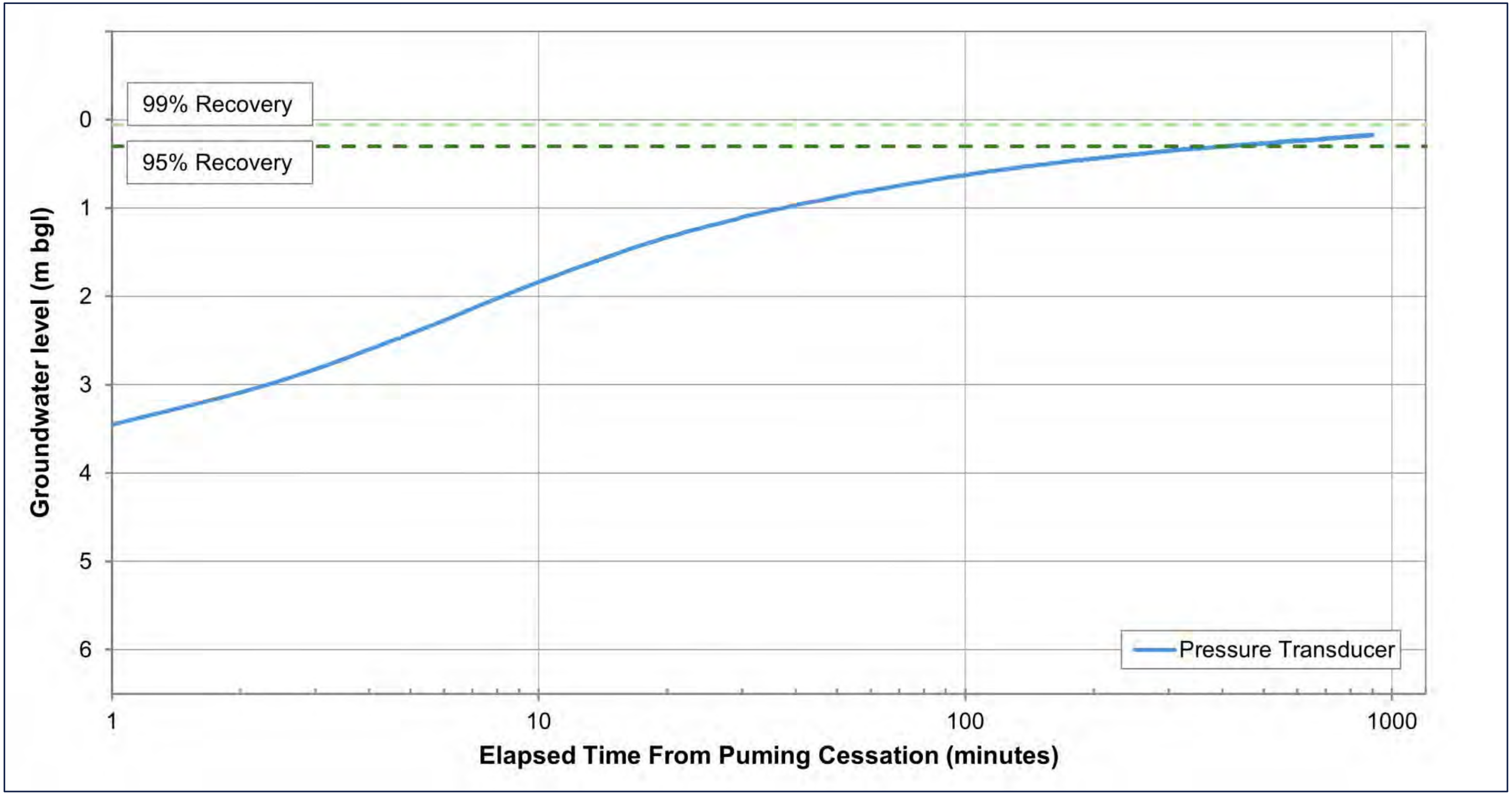


Figure I4: Recovery as Measured by the Pressure Transducer With 95% and 99% Recovery Indicated

I2.3 Data Analysis Methods

The measured drawdown curves were matched against type curves for a confined aquifer. A confined aquifer was chosen as the bore log for the Production Bore described in Section I1.4.1 has a 9.5 m layer of silty clay overlying the screened section of the bore, which WGA consider is having a confining effect on the pumped aquifer. Data analysis was undertaken on the constant rate pumping test data using the AQTESOLV Pro v4.5 software package from HydroSolve Inc., which is an industry standard pumping test analysis package.

The Theis (1935) solution is a common analytical method to determine aquifer properties of a confined aquifer. The following standard set of assumptions is incorporated in the Theis (1935) solution:

1. Aquifer has infinite areal extent.
2. Aquifer is homogeneous and of uniform thickness.
3. Control well is fully or partially penetrating.
4. Flow to control well is horizontal when control well is fully penetrating.
5. Aquifer is nonleaky confined.
6. Flow is unsteady.
7. Water is released instantaneously from storage with decline of hydraulic head.
8. Diameter of a pumping well is very small so that storage in the well can be neglected.

The Theis analytical solution closely matched the drawdown observations in the Production Bore during both the pumping and recovery phase of the test (Figure I5 and Figure I6).

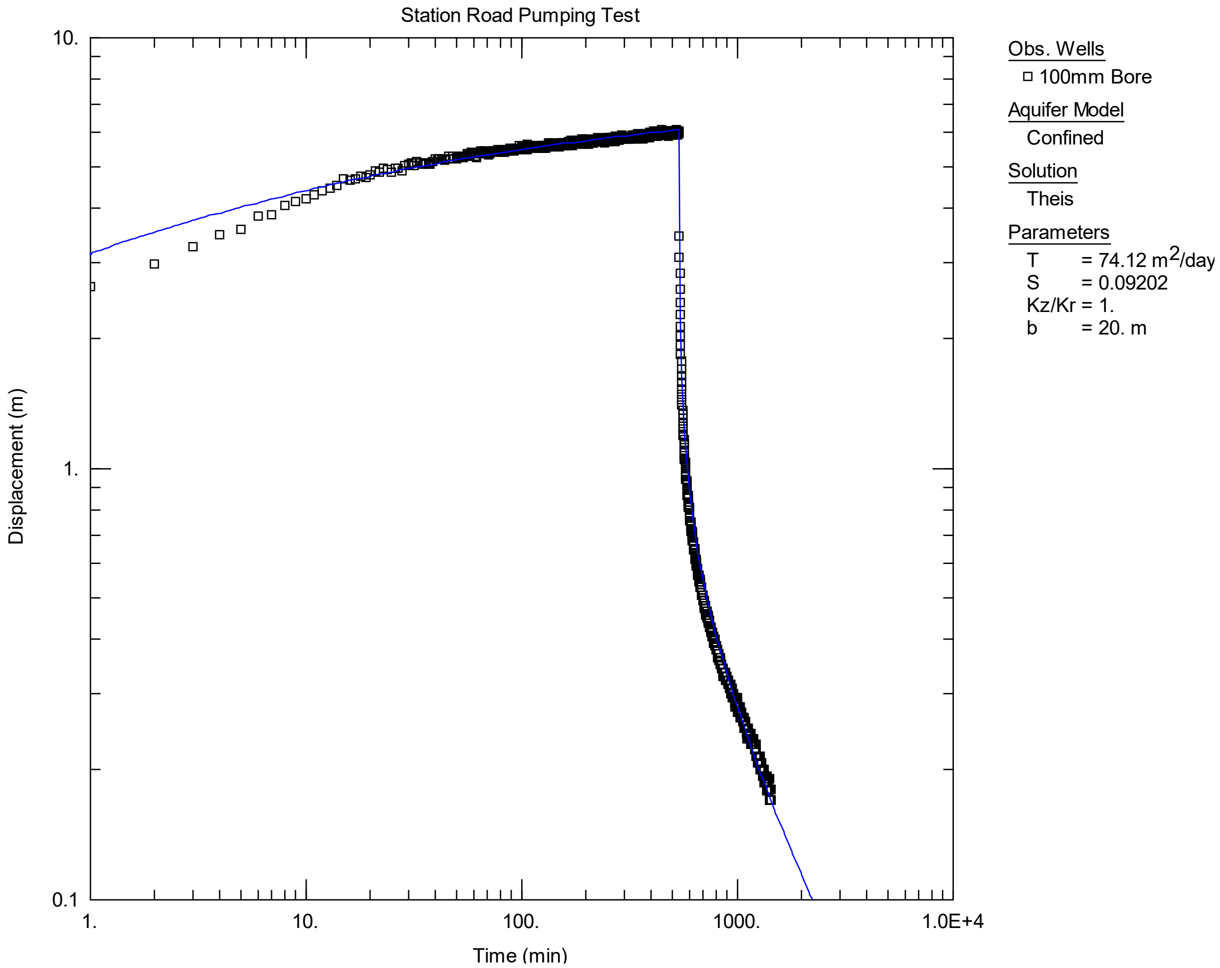


Figure I5: Drawdown Observations Fit to Theis Solution with Log x Log Scale Axes

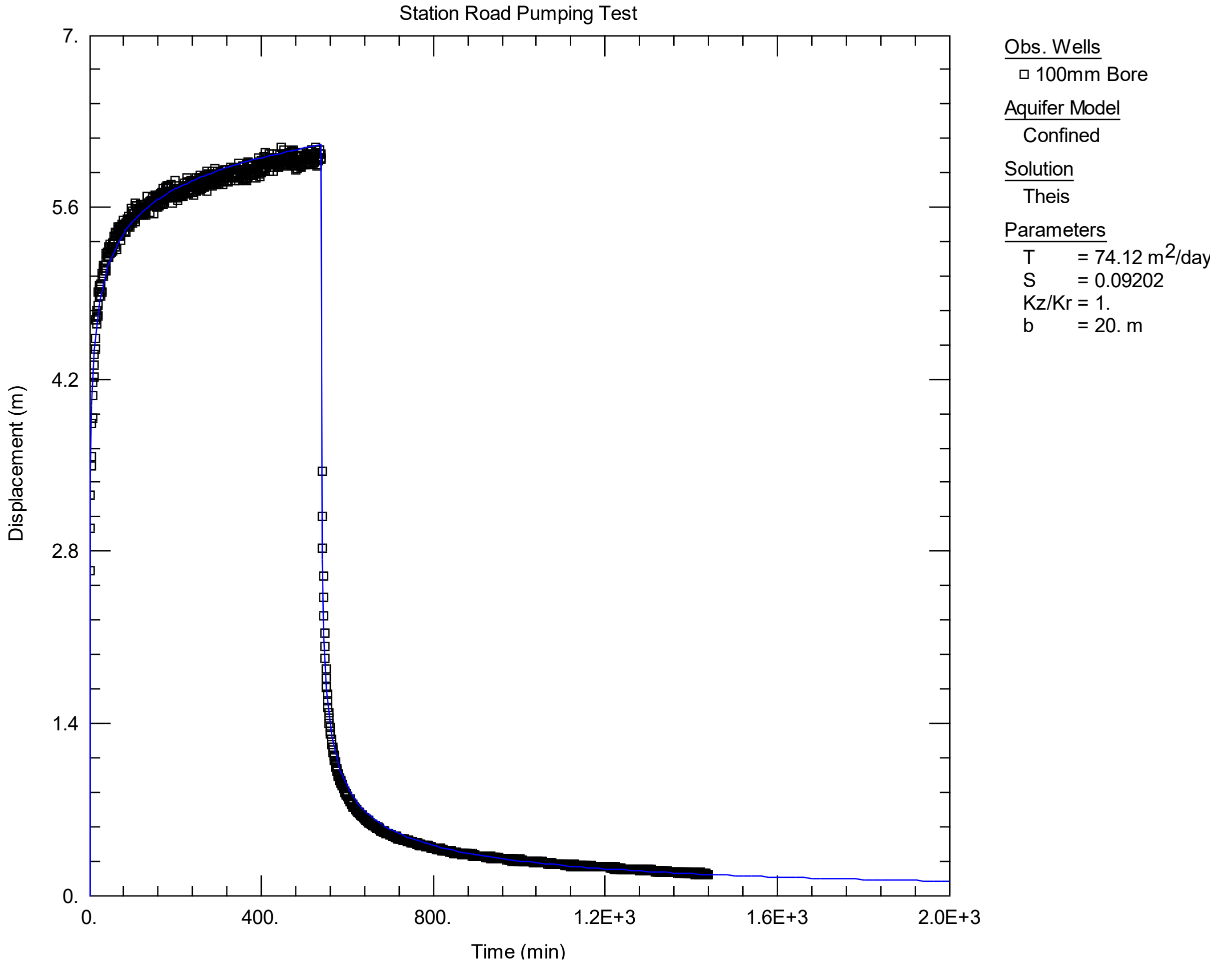


Figure I6: Drawdown Observations Fit to Theis Solution with Normal x Normal Scale Axes

I2.4 Pumping Test Analysis Results

Aquifer transmissivity derived from the pumping test drawdown and recovery using methods described in Section I2.3 is summarised below. As there was no observation bore monitored during the pumping test, storativity could not be derived. As such, a conservative value representative of a semi confined to confined aquifer have been applied to the assessment of effects.

- Transmissivity: 74.1 m^2/day
- Storativity: 0.0001 (conservative estimate)

I3 ASSESSMENT OF EFFECTS

I3.1 Projected Drawdown

A projected drawdown assessment has been undertaken using the transmissivity obtained from the aquifer test analyses and a conservative estimate of storativity. Two consumption scenarios have been assessed which are summarised in Table I4. The first scenario simulates an irrigation season by pumping at the maximum daily volume of 336 m^3/day (3.89 L/s) continuously for 168 days. 168 days are required to reach the target yearly irrigation requirement of 56,333 m^3 at the maximum daily pumping rate.

The second scenario simulates 10 years of taking the maximum annual volume of 92,308m^3/year at an average rate of 253 m^3/day.

It is unlikely that the bore will be pumped continuously for 10 years given the need for maintenance and other operations. Therefore, this represents a worst-case scenario when assessing effects on nearby bores.

Table I4. Summary of Consumption Scenarios

SCENARIO	AVERAGE DAILY DEMAND (m^3)	AVERAGE FLOW RATE (L/s)
Pumping at 3.89 L/s for 168 Days	336	3.89
Pumping at 2.92 L/s for 10 Years	253	2.92

I3.2 Effects on Neighbouring Bores

I3.2.1 Drawdown Projection Methodology

According to the WRC database, there are 28 bores within two kilometres of the Production Bore which are summarised in Table I6 and Table I7. Several gaps in data were identified and needed to be assumed.

- Where casing depth was not available it was assumed to be positioned 4 m above the total depth of the bore allowing for a 1 m sump and 3 m long screen.
- Where no pump information was available, shallow bores (targeting aquifer 1) were assumed to have surface pumps while deep bores (targeting aquifers 2 to 4) were assumed to have submerged pumps.
- Where static water level data was not present for bores targeting the confined aquifers (aquifers 2, 3 and 4), it was assumed to be at the same depth as in nearby bores targeting the same aquifer.
- Where static water level data was not present for shallow bores targeting aquifer 1, it was assumed to be 3 m bgl, a conservative estimate based on the average observed winter levels for the site presented in Section 2.4 of main report.

Available water column was taken as the casing depth minus the static water level. For bores with submerged pumps a further 2 m was deducted to account for pump operations.

Of the 28 bores, 10 have not been assessed for effects due to being owned by the applicant, presumed to be unused geotechnical bores, or decommissioned (Table I7).

The Hunt and Scott (2007) solution has been used to calculate potential drawdown in both the pumped aquifer and overlying aquifers. The parameters used for each target aquifer are summarized in Table I5: Input Parameters for the Hunt and Scott (2007) model.

Table I5: Input Parameters for the Hunt and Scott (2007) model

PARAMETER	AQUIFER 1 DRAWDOWN		AQUIFER 2/3 DRAWDOWN	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Transmissivity of Pumped Aquifer (m^2/d)	74.1	74.1	74.1	74.1
Storativity of Pumped Aquifer	0.0001	0.0001	0.0001	0.0001
Aquitard Thickness (m) (1)	15	15	9.5	9.5
Aquitard Vertical Hydraulic Conductivity (m/day)	8.6×10^{-4}	8.6×10^{-4}	8.6×10^{-4}	8.6×10^{-4}
Transmissivity of Overlying Aquifer (m^2/day)	50	50	50	50
Storativity of Overlying Aquifer	0.1	0.1	0.0001	0.0001
Pumping rate (L/s)	3.9	2.9	3.9	2.9
Simulation time (days)	168	3,650	168	3,650

Note: (1). Thickness between pumped aquifer and assessed aquifer based on lithological log.

I3.2.2 Drawdown Effects on Aquifer 1 Bores

Projected drawdowns in Aquifer 1 bores are presented in Table I6, Figure I7 and Figure I8. Drawdown is predicted to be very small in the Aquifer 1 bores. Even under the 10-year pumping scenario drawdown does not exceed 0.5 m for any of the bores. Given the separation of Aquifer 1 bores from the production bore by multiple low permeability layers it's highly likely that predicted drawdown has been overestimated and realistically no drawdown would be detectable. Projected reductions in water columns for all aquifer 1 bores are less than 10% and as such, drawdown effects on these bores are considered to be less than minor.

I3.2.3 Drawdown Effects on Aquifer 2 and Aquifer 3 Bores

Projected drawdowns in Aquifer 2 and 3 bores are presented in Table I6 Figure I9 and Figure I10. Projected reduction in available water columns for all other bores in Aquifer 2 and Aquifer 3 is less 10%. Therefore, the effect of the proposed abstraction on nearby deep bores is considered to be less than minor.

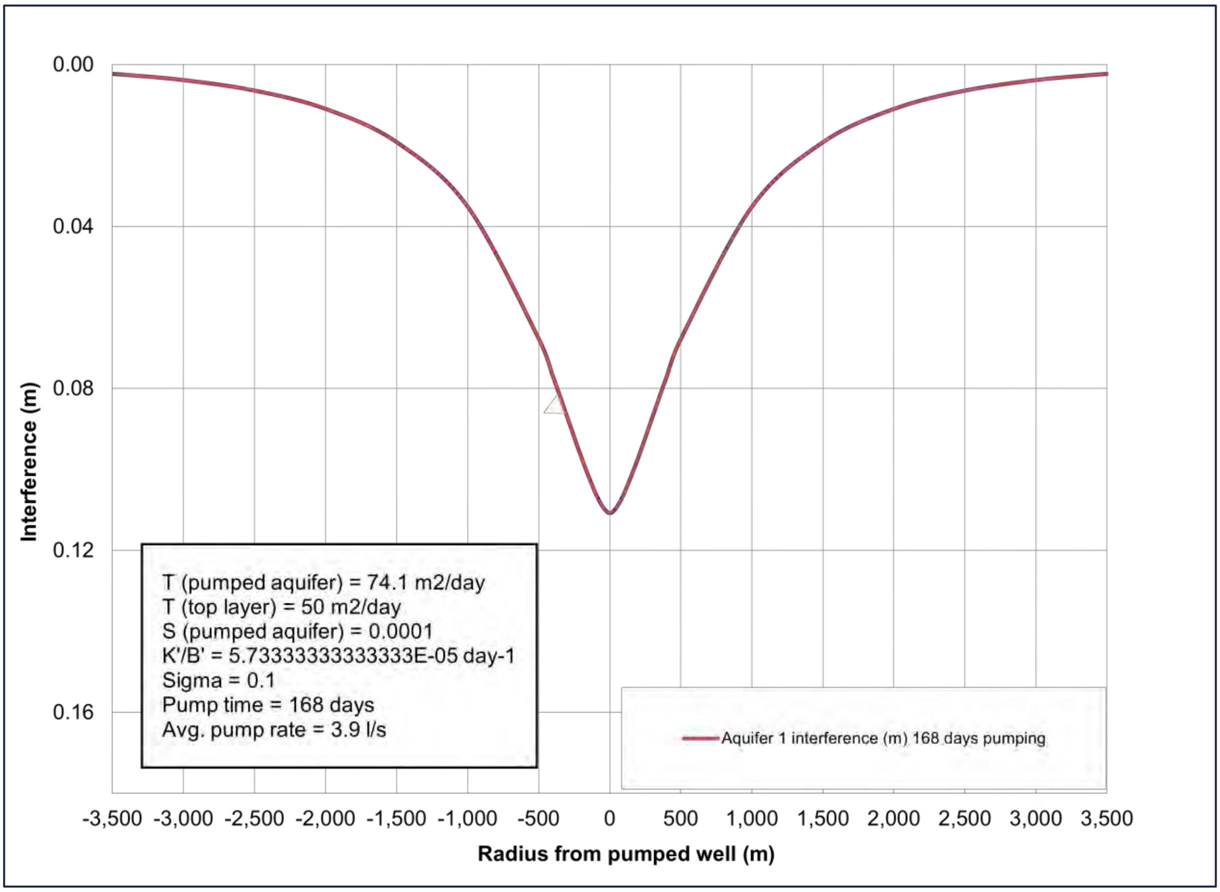


Figure I7: Drawdown in Pumped Aquifer and Aquifer 1 Under Scenario 1

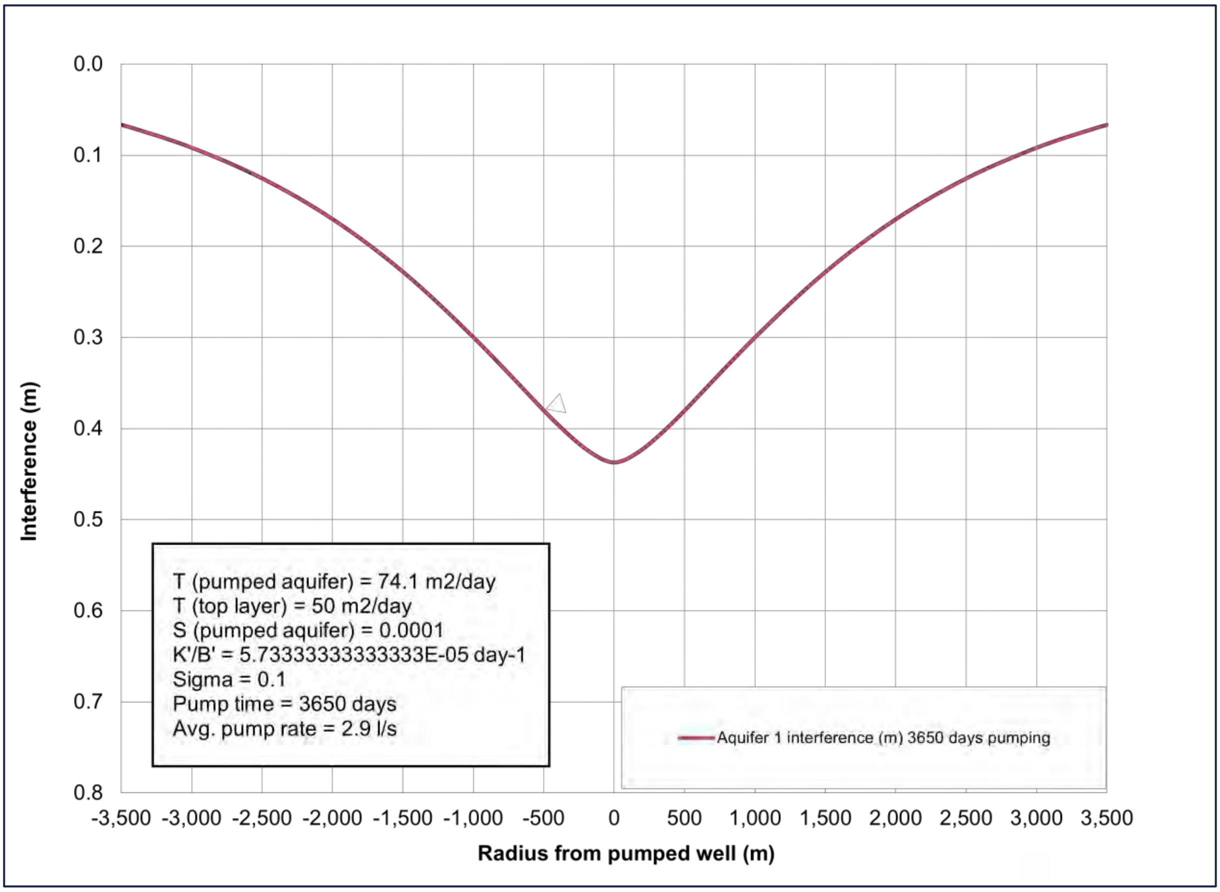


Figure I8: Drawdown in Pumped Aquifer and Aquifer 1 Under Scenario 2

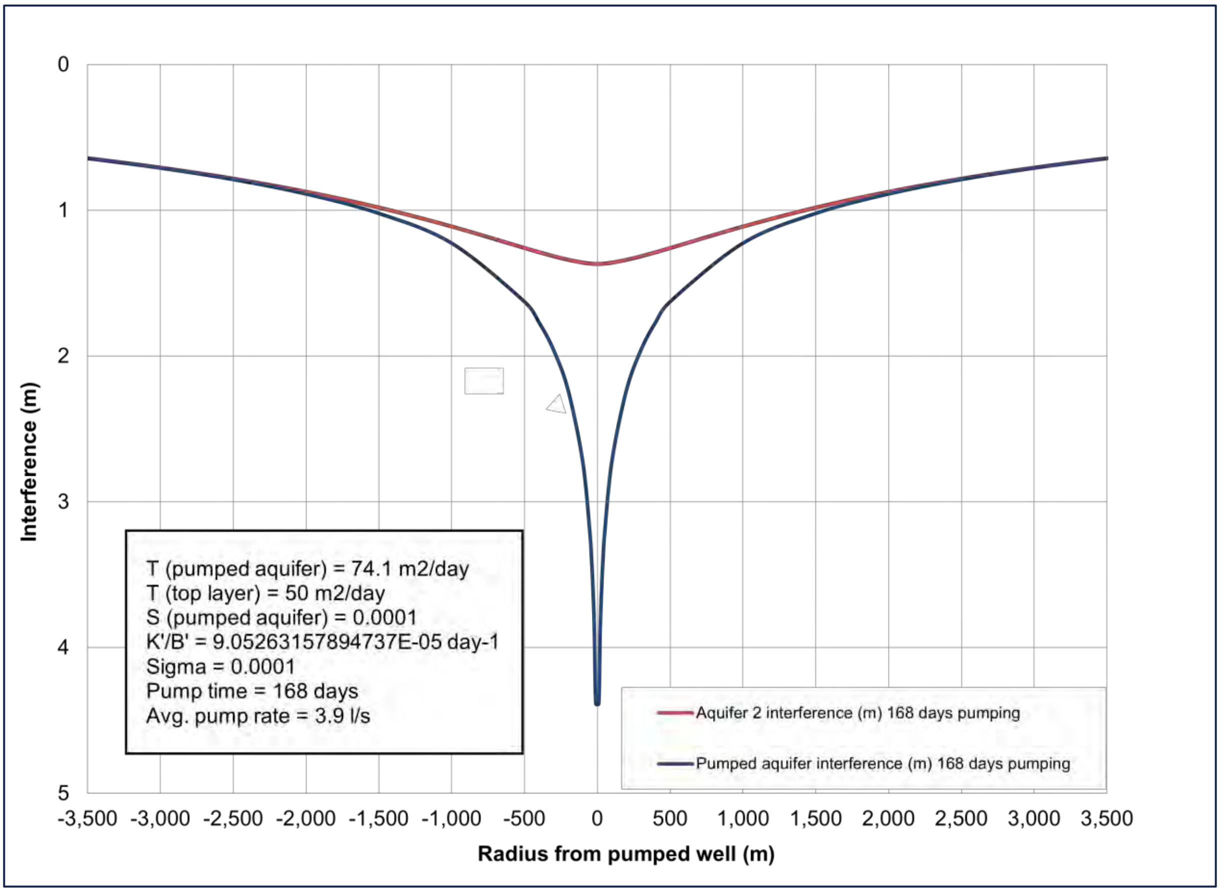


Figure I9: Drawdown in Pumped Aquifer and Aquifer 2 Under Scenario 1

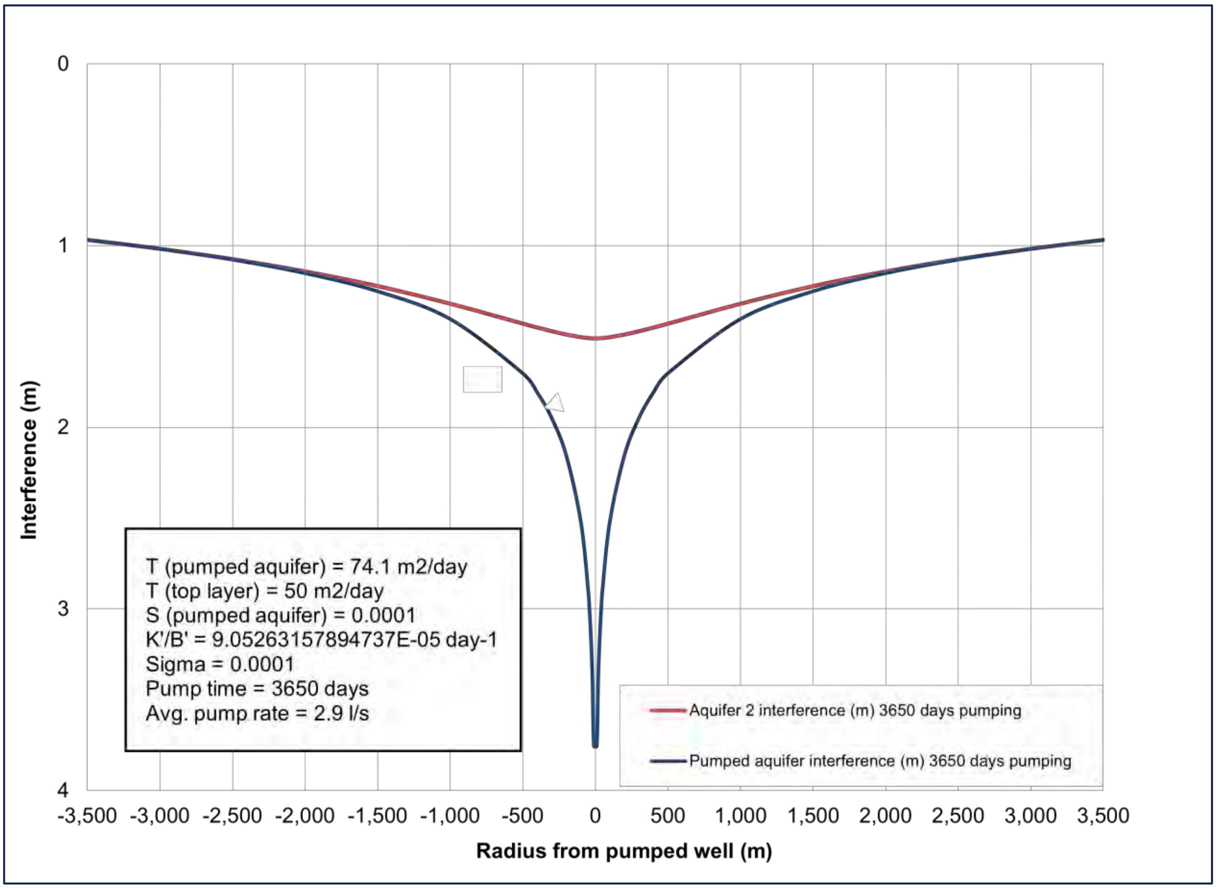


Figure I10: Drawdown in Pumped Aquifer and Aquifer 2 Under Scenario 2

Table I6: Projected Drawdown in Bores Within a 2 km Radius of the Production Bore

BORE ID	EASTING (NZTM)	NORTHING (NZTM)	BORE DEPTH (m)	CASING DEPTH (m)	AQUIFER UNIT	STATIC WATER LEVEL (m bgl)	DISTANCE FROM PRODUCTION BORE (m)	AVAILABLE BORE WATER COLUMN (m)	PROJECTED DRAWDOWN (m)		PROJECTED CHANGE IN AVAILABLE WATER COLUMN (%)	
									SC1(1)	SC2(2)	SC1(1)	SC2(2)
64_102	1842840	5810949	15.5	12.5(4)	1	3(5)	924	8.5	0.04	0.36	0%	4%
64_378	1843979	5811036	12.45	9.45(4)	1	3(5)	2017	5.45	0.01	0.17	0%	3%
64_165	1840777	5811231	40	34.2	1	3(5)	1461	30.2	0.02	0.25	0%	1%
64_596	1842278	5810833	30	19.5	1	3(5)	417	15.5	0.08	0.47	1%	3%
64_878	1840278	5810030	57	39	1	16	1819	22	0.01	0.20	0%	1%
64_20	1842870	5812212	9	5.2	1	2	1911	2.2	0.01	0.19	1%	9%
72_5412	1843123	5809356	30	27(4)	1	3(5)	1572	23	0.02	0.24	0%	1%
72_8539	1840637	5810680	53	50(4)	1	3(5)	1413	46	0.02	0.26	0%	1%
72_8495	1840145	5810156	24	21(4)	1	3(5)	1922	17	0.01	0.19	0%	1%
72_8494	1840129	5810181	45	42(4)	1	3(5)	1933	38	0.01	0.18	0%	0%
72_1116	1840979	5809731	84	54	2	12	1304	39	1.20	1.48	3%	4%
72_10565	1842360	5810638	80	69.5	2	12(6)	354	54.5	1.57	1.76	3%	3%
72_10566	1842577	5810730	74.5	71.5	2	12(6)	590	56.5	1.47	1.68	3%	3%
72_6864	1840979	5809731	113.5	110.5(4)	3	6.83(7)	1304	100.67	1.24	1.33	1%	1%
64_27	1843979	5811036	103.31	100.31(4)	3	6.83(7)	2017	90.48	1.00	2.24	1%	2%
72_5413	1843183	5809508	106.5	103.5(4)	3	6.83(7)	1511	93.67	1.16	1.51	1%	2%
72_6865	1841375	5809963	105.5	102.5(4)	3	6.83(7)	848	92.67	1.48	1.69	2%	2%
72_8688	1843123	5809356	107.5	104.5(4)	3	6.83(7)	1572	94.67	1.13	1.43	1%	2%

Notes: (1). Scenario 1: 168 Days pumping 336 m^3/day simulating the worst-case scenario irrigation season.
(2). Scenario 2: 10 years of pumping at the maximum yearly volume of 92,308 m^3/day.
(3). Bore depth unknown. Bore has been assumed to be in the same aquifer as the production bore to get the most conservative estimates of drawdown.
(4). Casing depth unknown. Casing depth is assumed from bore depth, accounting for a 3 m screen and 1 m sump.
(5). Static water level unknown. Static water level is assumed to be 3 m bgl based on site observations summarised in Section 2.4 of main report.
(6). Static water level unknown. Static water level is assumed to be at the same depth as nearby bore 72_1116 which targets the same aquifer.
(7). Static water level unknown. Static water level is assumed to be at the same depth as the production bore.
(9). Data Sourced from WRC.

Table I7: Geotechnical Bores, Decommissioned Bores and Bores Owned by Applicant.

Bore ID	Easting (NZTM)	Northing (NZTM)	Bore Depth (m)	Casing Depth (m)	Aquifer Unit	Static Water Level (m bgl)	Distance from Production Bore (m)	Available Bore Water Column (m)	Projected Drawdown (m)	
									SC1(1)	SC2(2)
64_613(6)	1842078	5810833	10	6	1	3(4)	343	2	0.09	0.49
64_628(9)	1841678	5810432	16	12	1	3(4)	364	8	0.08	0.48
64_629(9)	1841779	5810432	16	12	1	3(4)	265	8	0.10	0.50
64_974(9)	1842179	5810033	8.25	8	1	3(4)	481	4	0.07	0.46
72_5639(7)	1843861	5811151	7.5	4.5	1	3(4)	1,939	0.5	0.01	0.18
72_5642(7)	1843890	5811173	7.5	4.5	1	3(4)	1,974	0.5	0.01	0.18
72_5643(7)	1843883	5811199	7.5	4.5(3)	1	3(4)	1,977	0.5	0.01	0.18
72_5641(7)	1843895	5811167	7.5	4.5	1	3(4)	1,977	0.5	0.01	0.18
72_3392(8)	1843175	5809977	214.4	45.5	2	12(5)	1,249	30.5	1.22	1.49
64_63(9)	1841779	5810432	107.9	104.9	3	6.83(6)	265	95.07	2.22	1.45

Notes: (1). Scenario 1: 168 Days pumping 336 m^3/day simulating the worst-case scenario irrigation season.
(2). Scenario 2: 10 years of pumping at the maximum yearly volume of 92,308 m^3/day.
(3). Casing depth unknown. Casing depth is assumed from bore depth, accounting for a 3 m screen.
(4). Static water level unknown. Static water level is assumed to be 3 m bgl based on site observations summarised in Section 2.4.
(5). Static water level unknown. Static water level is assumed to be at the same depth as nearby bore 72_1116 which targets the same aquifer.
(6). Static water level unknown. Static water level is assumed to be at the same depth as the production bore.
(7). Bore is assumed to be a geotechnical survey bore and not in use. The assumption is made on the basis that the bores are very shallow and 50 mm in diameter which is too small for water extraction purposes.
(8). Bore is decommissioned.
(9). Bore is owned by applicant and located within development area.
(10). Data Sourced from WRC.

I3.3 Effects on Surface Water

The proposed abstraction is from a deep confined aquifer, located in the Southern Hauraki Aquifer Management Zone. The closest waterbody to the Production Bore is the Waitoa River, located approximately 545 m to the west. At this distance, the Waitoa River is at an elevation of 58 m RL. Given the geological log and geotechnical data from site investigations, WGA consider that the stream is separated from the deep confined aquifer by lower permeability sediments.

The Production Bore is screened at an elevation of -39.4 m RL. Therefore, the Production Bore is screened approximately 97.4 m below the Waitoa River. As discussed in Section 1.4.3, WGA considers that the D2 Production Bore will be hydraulically disconnected from the overlying aquifer given the various layers of clay overlying the screened section of the bore.

Given the presence of lower permeability layers of clay described in the Production Bore log, a stream depletion analysis has been undertaken using the Hunt (2003) method. This method takes into account the hydraulic properties of the lower permeability sediments acting as an aquitard and the following parameters were used:

- Distance of 545 m from the abstraction bore
- Streambed width of 5 m (from satellite imagery)
- Aquitard thickness of 15 m (conservative estimate from bore lithological log)
- Aquitard hydraulic conductivity of 8.6 x 10^{-4} m/day (Freeze and Cherry, 1979)
- Storativity of the pumped aquifer of 1 x 10^{-4} (conservative estimate)
- Transmissivity of the pumped aquifer of 74.1 m^2/day
- A pumping rate of 3.9 L/s for scenario 1 and 2.9 L/s for scenario 2
- A simulation time of 168 days for scenario 1 and 3650 days for scenario 2

The results of this analysis indicate the potential stream depletion resulting from the proposed take would be less than 0.01 L/s (0.7 m^3/day) over an irrigation season (scenario 1) and less than 0.02 L/s (0.9 m^3/day) over 10 years pumping (scenario 2). WGA therefore considers that the proposed take would have a less than minor effect on flows in the closest nearby stream.

From satellite imagery, there appears to be a wetland, approximately 450 m west of the Production bore, along the Waitoa River at the same elevation (58 m RL). WGA consider that the potential wetlands are not connected to the deep confined aquifer tapped by the D2 Production Bore. As mentioned previously, the Production Bore is screened, 97.4 m below the Waitoa River. As discussed in Section 1.4.3, WGA considers that the Production Bore is hydraulically disconnected form the overlying aquifer given the various layers of clay overlying the screened section of the bore. The effect of the water take on the river and nearby wetlands is considered to be less than minor.

I3.4 Aquifer Sustainability

The WRC's Waikato Regional Plan defines the aquifer in the area of the proposed groundwater abstraction to be the Southern Hauraki Aquifer. This aquifer is not currently fully allocated. Therefore, WGA concludes that this proposed take will not cause any long-term sustainability issues.

I3.5 Other Matters

As part of the consideration of the effects Policy 12 of the Waikato Regional plan outlines aspects to consider in addition to the effects detailed and modelled above. These include the following:

- Saline water intrusion – not an issue for this proposed abstraction given the bore is located inland and not associated with a coastal aquifer.
- Water quality – The proposed take is not expected to cause movement of groundwater with lower quality into the aquifer.
- Aquifer compression – the stability of the confined aquifer sediments are such that aquifer compression is not expected to result from this proposed take.

I4 CONCLUSIONS

A consent is being sought by Matamata Developments Limited for the abstraction of groundwater from a Production Bore (72_12812) located at Station Road, Matamata. The abstraction rates being sought are:

- Abstraction for irrigation and retirement village supply:
  - A maximum daily volume of 336 m^3
  - An irrigation annual maximum volume of 56,333 m^3
  - A total annual maximum volume of 92,308 m^3

The pumping test performed on the Production Bore (72_12812) has produced data sufficient to enable the analysis of the hydraulic behaviour of the source aquifer. The analysis results can be used to provide an estimate of the effects of the proposed abstraction on water levels in nearby bore.

Analysis of the pumping test data indicates an appropriate estimate for transmissivity of the aquifer in the area of the Production Bore is 74.1 m^2/day.

There are 28 nearby bores within a 2-kilometre radius of the Production Bore. Potential interference is considered to be less than minor.

The proposed abstraction is considered to have a less than minor effect on the flow in the nearest stream or other streams.

The proposed abstraction is considered to have a less than minor effect on nearby wetlands.

There is sufficient water available for allocation in the source aquifer to support the proposed abstraction. The requested volume is expected to have less than a minor effect on aquifer sustainability.

Hill Labs

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

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Certificate of Analysis

Client:	Brown Bros. (NZ) Limited	**Lab No:**	3890664	DWAPv1
Contact:	K Brown	**Date Received:**	16-May-2025	
	C/- Brown Bros. (NZ) Limited	**Date Reported:**	23-May-2025	
	PO Box 10183	**Quote No:**		
	Te Rapa	**Order No:**	33811	
	Hamilton 3241	**Client Reference:**	14/333 Unity Mgmt Ltd	
		Submitted By:	K Brown	

Sample Type: Aqueous

Sample Name:		14/333 Unity Mgmt Ltd 14-May-2025 5:00 pm	**Aesthetic Values**	**Maximum Acceptable Values (MAV)**
Lab Number:		3890664.1		
Routine Water Profile				
Turbidity	NTU	0.16	≤ 5	-
pH	pH Units	7.7	7.0 - 8.5	-
Total Alkalinity	g/m³ as $CaCO_3$	67	-	-
Free Carbon Dioxide	g/m³ at 25°C	2.6	-	-
Total Hardness	g/m³ as $CaCO_3$	40	≤ 200	-
Electrical Conductivity (EC)	mS/m	15.5	-	-
Electrical Conductivity (EC)	µS/cm	155	-	-
Approx Total Dissolved Salts	g/m³	104	≤ 1000	-
Total Arsenic	g/m³	0.0020	-	0.01
Total Boron	g/m³	0.0182	-	2.4
Total Calcium	g/m³	4.8	-	-
Total Copper	g/m³	< 0.00053	≤ 1	2
Total Iron	g/m³	0.099	≤ 0.3	-
Total Lead	g/m³	< 0.00011	-	0.01
Total Magnesium	g/m³	6.7	-	-
Total Manganese	g/m³	0.0174	≤ 0.04 (Staining) ≤ 0.10 (Taste)	0.4
Total Potassium	g/m³	2.9	-	-
Total Sodium	g/m³	16.9	≤ 200	-
Total Zinc	g/m³	0.029	≤ 1.5	-
Chloride	g/m³	8.4	≤ 250	-
Nitrate-N	g/m³	< 0.05	-	11.3
Sulphate	g/m³	1.8	≤ 250	-

Note: The Maximum Acceptable Values (MAV) are taken from the 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022', published under the authority of the New Zealand Government-2022. Copies of this publication are available from: https://www.legislation.govt.nz/regulation/public/2022/0168/latest/whole.html

The standards set limits for the concentration of determinands in drinking water. The Maximum Acceptable Values (MAVs) for any determinand must not be exceeded at any time.

The Aesthetic Values are taken the publication, 'Aesthetic Values for Drinking Water Notice 2022' issued by the Water Services Regulator ("Taumata Arowai"). Aesthetic values specify or provide minimum or maximum values for substances and other characteristics that relate to the acceptability of drinking water to consumers (such as appearance, taste or odour).

Note that the units: g/m³ are the same as mg/L and ppm.

Routine Water Assessment for Sample No 3890664.1 - 14/333 Unity Mgmt Ltd

pH/Alkalinity and Corrosiveness Assessment
The pH of a water sample is a measure of its acidity or basicity. Waters with a low pH can be corrosive and those with a high pH can promote scale formation in pipes and hot water cylinders.
The guideline level for pH in drinking water is 7.0-8.5. Below this range the water will be corrosive and may cause problems with disinfection if such treatment is used.

The alkalinity of a water is a measure of its acid neutralising capacity and is usually related to the concentration of carbonate, bicarbonate and hydroxide. Low alkalinities (25 g/m^3) promote corrosion and high alkalinities can cause problems with scale formation in metal pipes and tanks.

The pH of this water is within the NZ Drinking Water Guidelines, the ideal range being 7.0 to 8.0.
With the pH and alkalinity levels found, it is unlikely this water will be corrosive towards metal piping and fixtures.

Hardness/Total Dissolved Salts Assessment
The water contains a low amount of dissolved solids and would be regarded as being soft.

Nitrate Assessment
Nitrate-nitrogen at elevated levels is considered undesirable in natural waters as this element can cause a health disorder called methaemaglobinaemia. Very young infants (less than six months old) are especially vulnerable. The 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022' sets a maximum permissible level of 11.3 g/m^3 as Nitrate-nitrogen (50 g/m^3 as Nitrate).

Nitrate-nitrogen was not found in this water.

For household use, it is important that the water is not contaminated with human or animal wastes (e.g. from septic tanks or effluent ponds). Bacteriological analyses may be required if such contamination could exist. For further details, please contact this laboratory.

Boron Assessment
Boron may be present in natural waters and if present at high concentrations can be toxic to plants.
Boron was found at a low level in this water but would not give any cause for concern.

Metals Assessment
Iron and manganese are two problem elements that commonly occur in natural waters. These elements may cause unsightly stains and produce a brown/black precipitate. Iron is not toxic but manganese, at concentrations above 0.5 g/m^3, may adversely affect health. At concentrations below this it may cause stains on clothing and sanitary ware.

Iron was found in this water at a low level.
Manganese was found in this water at a low level.
Treatment to remove iron and/or manganese should not be necessary.

Final Assessment
All parameters tested for meet the guidelines laid down in the 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022' and the 'Aesthetic Values for Drinking Water Notice 2022' issued by the Water Services Regulator ("Taumata Arowai") for water which is suitable for drinking purposes.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Routine Water Profile		-	1
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1
pH	pH meter. APHA 4500-H^+ B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) : Online Edition.	1.0 g/m^3 as $CaCO_3$	1
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO_2 D : Online Edition.	1.0 g/m^3 at 25°C	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	1 µS/cm	1
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m^3	1
Total Arsenic	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0011 g/m^3	1
Total Boron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0053 g/m^3	1
Total Calcium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.053 g/m^3	1
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00053 g/m^3	1
Total Iron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.021 g/m^3	1
Total Lead	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00011 g/m^3	1
Total Magnesium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.021 g/m^3	1
Total Manganese	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00053 g/m^3	1
Total Potassium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.053 g/m^3	1
Total Sodium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.021 g/m^3	1
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0011 g/m^3	1
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m^3	1
Nitrate-N	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.05 g/m^3	1
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m^3	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 17-May-2025 and 23-May-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

APPENDIX J

WASTEWATER PIPELINE TRENCH INFLOW

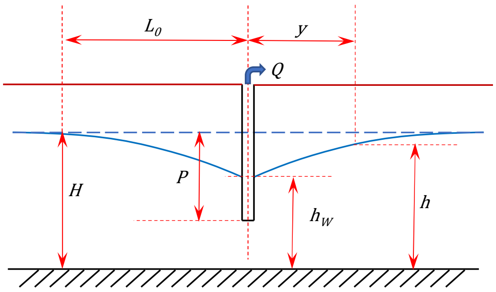
DEWATERING - PARTIALLY PENETRATING TRENCH

CLIENT:	Matamata Developments Limited
PROJECT:	Ashbourne Development
Project #:	WGA 241087
Location:	Station Rd, Matamata
Date:	Friday, 13 June 2025
Document #:	WGA241087-RP-HG-0002_C

References:
Cashman P. M. & Preene M. 2001. Groundwater lowering in construction. A practical guide. Spon Press, London.
US Departments of the Army, the Navy and the Air Force. 1983. Dewatering and Groundwater Control. US Army TM 5-818-5

Analysed by: Toby Beisly
Checked by: Cameron Jasper

H = Initial height of water table above aquifer base (m)
h_W = Lowered height of water in equivalent slot (m)
P = Penetration of trench below initial water table (m)
y = Distance from center of trench
h = Lowered height of water at distance y from trench (m)
k = Horizontal hydraulic conductivity of soil (m/s)
L_0 = Distance of influence (m)
Q_{ss} = Steady state inflow rate per unit length of trench (L/s)
x = Linear length of drain / trench (m)
Q_T = Total groundwater inflow to trench (L/s)
SWL = Static groundwater level (m BGL)



Initial ground elevation	66.75	m RL
Depth to base of aquifer	8.30	m BGL
Depth to static groundwater table	1.44	m
Static groundwater table elevation	65.31	m RL
SWL height above base of aquifer (H):	6.86	m
Trench penetration (P)	1.45	m
Lowered WL above base of aquifer (h_w)	5.41	m
Length of trench (m)	150	m
Period Trench open	1.0	days
Horizontal hydraulic conductivity (k)	3.84E-06	m/s
Soil specific yield (S_y)	0.00	m^3/m^3
Distance of influence (L_0)	5.00	m
SS inflow per metre of trench (Q_s)	0.011	L/s
Transient inflow per metre (Q_t)	0.000	L/s
Total inflow to trench (Q_T)	1.60	L/s
	137.97	m^3/day

$$L_0 = 1{,}750(H - h_W)\sqrt{k}$$

$$Q_{ss} = [0.73 + 0.23(P/H)]\frac{k(H^2 - h_W^2)}{L_0}$$

$$H^2 - h^2 = \frac{L_0 - y}{L_0}(H^2 - h_W^2)$$

$$h^2 = H^2 - \left(\frac{L_0 - y}{L_0}\right)(H^2 - h_W^2)$$

$$Q_t = \frac{L_0(H - h_W)S_Y}{t}$$

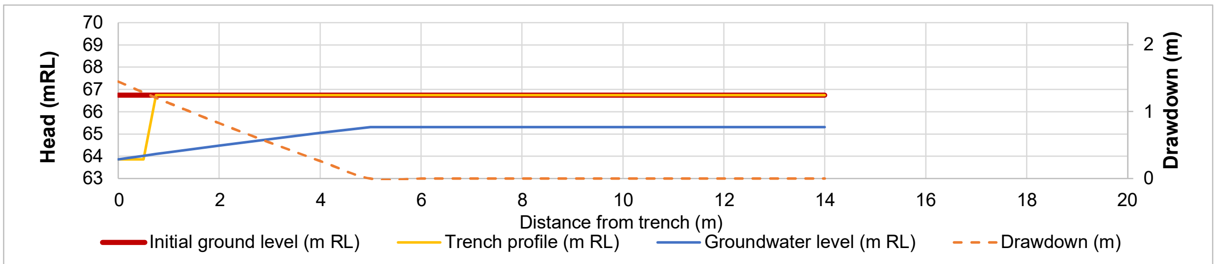
y (m)	h (m)	h (mRL)	dh (m)	Initial GL (mRL)	Profile (mRL)
0	5.41	63.86	1.45	66.75	63.86
0.5	5.57	64.02	1.29	66.75	63.86
0.75	5.65	64.10	1.21	66.75	66.75
1	5.73	64.18	1.13	66.75	66.75
2	6.03	64.48	0.83	66.75	66.75
3	6.32	64.77	0.54	66.75	66.75
4	6.60	65.05	0.26	66.75	66.75
5	6.86	65.31	0.00	66.75	66.75
6	6.86	65.31	0.00	66.75	66.75
7	6.86	65.31	0.00	66.75	66.75
8	6.86	65.31	0.00	66.75	66.75
9	6.86	65.31	0.00	66.75	66.75
10	6.86	65.31	0.00	66.75	66.75
11	6.86	65.31	0.00	66.75	66.75
12	6.86	65.31	0.00	66.75	66.75
13	6.86	65.31	0.00	66.75	66.75
14	6.86	65.31	0.00	66.75	66.75

Notes:
Calculated inflows assume equal inflows from line sources on both sides of the trench.

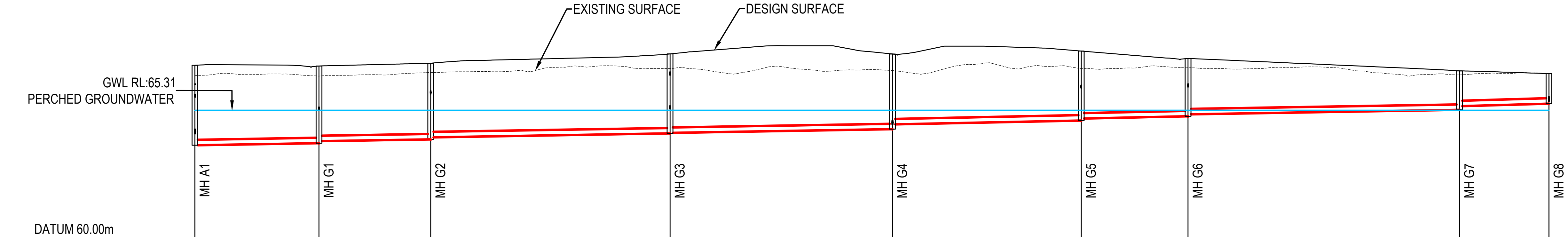
The transient inflow rate calculation assumes dewatering will progress through to a steady state during the period that the trench is open. This assumption needs to be reviewed on a case by case basis. The transient inflow rate calculation is sensitive to the length of time the trench is open. Applied value should not be less than one day.

Calculated transient inflows do not vary over time. They are simply averaged over the time the trench remains open.

Calculated inflows exclude radial inflows to ends of trench.



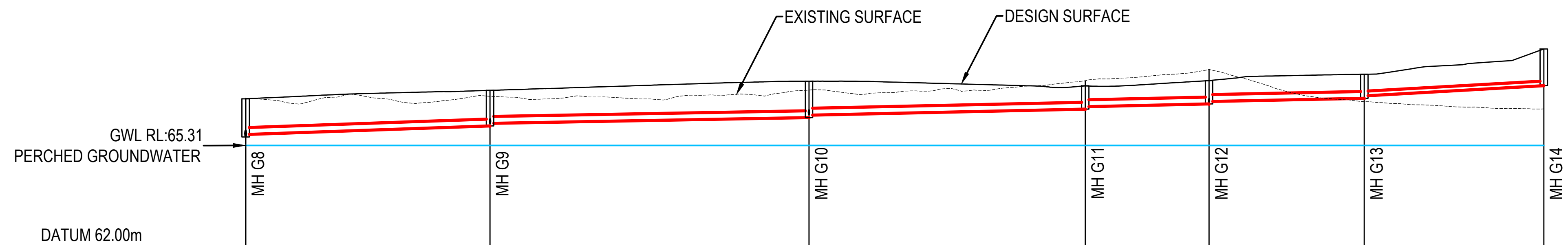
ORIGINAL SIZE: A3



	MH A1	MH G1	MH G2	MH G3	MH G4	MH G5	MH G6	MH G7	MH G8
EXISTING LEVELS	66.75	66.72	66.87	67.04	66.95	67.03	67.07	66.77	66.84
DESIGN LEVELS	67.17	67.14	67.25	67.64	67.64	67.76	67.46	66.94	66.83
PIPE INVERT	63.86	63.95 / 64.03	64.11 / 64.19	64.35 / 64.38	64.53 / 64.72	64.88 / 64.96	65.06 / 65.14	65.33 / 65.48	65.58
DEPTH INVERT (m)	3.31	3.19	3.15	3.29	3.11	2.87	2.39	1.61	1.24
CHAINAGE	0.00	25.65	48.76	98.26	144.27	183.31	205.40	261.54	280.05

PIPE GRADE	MH A1–G1	MH G1–G2	MH G2–G3	MH G3–G4	MH G4–G5	MH G5–G6	MH G6–G7	MH G7–G8
	225mm uPVC SN16 Ø @ 0.34%	225mm uPVC SN16 Ø @ 0.33%	225mm uPVC SN16 Ø @ 0.33%	225mm uPVC SN16 Ø @ 0.33%	225mm uPVC SN16 Ø @ 0.41%	225mm uPVC SN16 Ø @ 0.44%	225mm uPVC SN16 Ø @ 0.33%	225mm uPVC SN16 Ø @ 0.57%

LINE A1-G8
SCALE: HORI 1:1000 VERT 1:200



	MH G8	MH G9	MH G10	MH G11	MH G12	MH G13	MH G14
EXISTING LEVELS	66.84	66.90	67.11	67.41	67.78	66.73	66.50
DESIGN LEVELS	66.83	67.10	67.40	67.24	67.42	67.62	68.44
PIPE INVERT	65.66	65.94 / 66.02	66.21 / 66.29	66.49 / 66.57	66.66 / 66.74	66.84 / 66.92	67.25
DEPTH INVERT (m)	1.24	1.15	1.18	0.76	0.76	0.78	1.19
CHAINAGE	280.05	319.71	371.47	416.31	436.39	461.58	490.71

PIPE GRADE	MH G8–G9	MH G9–G10	MH G10–G11	MH G11–G12	MH G12–G13	MH G13–G14
	225mm uPVC SN16 Ø @ 0.71%	225mm uPVC SN16 Ø @ 0.36%	225mm uPVC SN16 Ø @ 0.44%	225mm uPVC SN16 Ø @ 0.45%	225mm uPVC SN16 Ø @ 0.40%	150mm uPVC SN16 Ø @ 1.13%

LINE G8-G14
SCALE: HORI 1:1000 VERT 1:200

FOR CONSENT

Notes

1. All works to be in accordance with Local Council standards.
2. Co-ordinates in terms of Mount Eden 2000.
3. Reduced Levels are in terms of NZVD 2016.
4. It is the contractors responsibility to locate all services that may be affected by their operations.
5. The contractor shall comply with all relevant OSH and Health & Safety requirements.
6. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
7. Minimum clearances & cover shall be in accordance with Local Council standards.
8. Pipe bedding: 0 - 10% = granular bedding,10 - 20% = weak concrete bedding, greater than 20% = weak concrete bedding (7mpa plus anti scour blocks at 6m crs).
9. Each connection shall be marked by a 50mm x 50mm treated pine stake extending 600mm above ground level with the top painted. This marker post shall be placed alongside a timber marker installed at the time of pipelaying and extending from the connection to 150mm below finished ground level. Connections shall be accurately indicated on "as built" plans.
10. Approved hardfill to be used in backfilling of all road crossings and vehicle crossings to Local Council standards.
11. Heavy duty manhole lids and frames to be used in trafficked areas.
12. All lines are to be 150mmØ PVC SN16, unless shown otherwise.
13. 150mmØ pipes that do not terminate in a manhole must be terminated with a 100mmØ on a 150mmØ london junction and blank cap.
14. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be co-ordinated with Local Council staff.

Rev	Description	By	Date
B	FOR CONSENT	MS	04/25
A	FOR REVIEW	MS	01/25

	By	Date
Survey	MAVEN	10/2024
Design	SB	12/2024
Drawn	MS	12/2024
Checked	NP	12/2024

MAVEN
Maven Matamata
matamatainfo@maven.co.nz
www.maven.co.nz
8 Tainui Street, Matamata
New Zealand

Project
ASHBOURNE RETIREMENT VILLAGE MATAMATA FOR UNITY DEVELOPMENT LTD

Title
PROPOSED WW LONGSECTION PLAN SHEET 3 OF 9

Project no.	J00606
Scale	AS SHOWN
Cad file	C5200 - WW LS.DWG
Drawing no.	C5202 — Rev B

WGA

FOR FURTHER INFORMATION CONTACT:

Catherine Howell
Senior Hydrogeologist, Project Manager

[redacted]

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