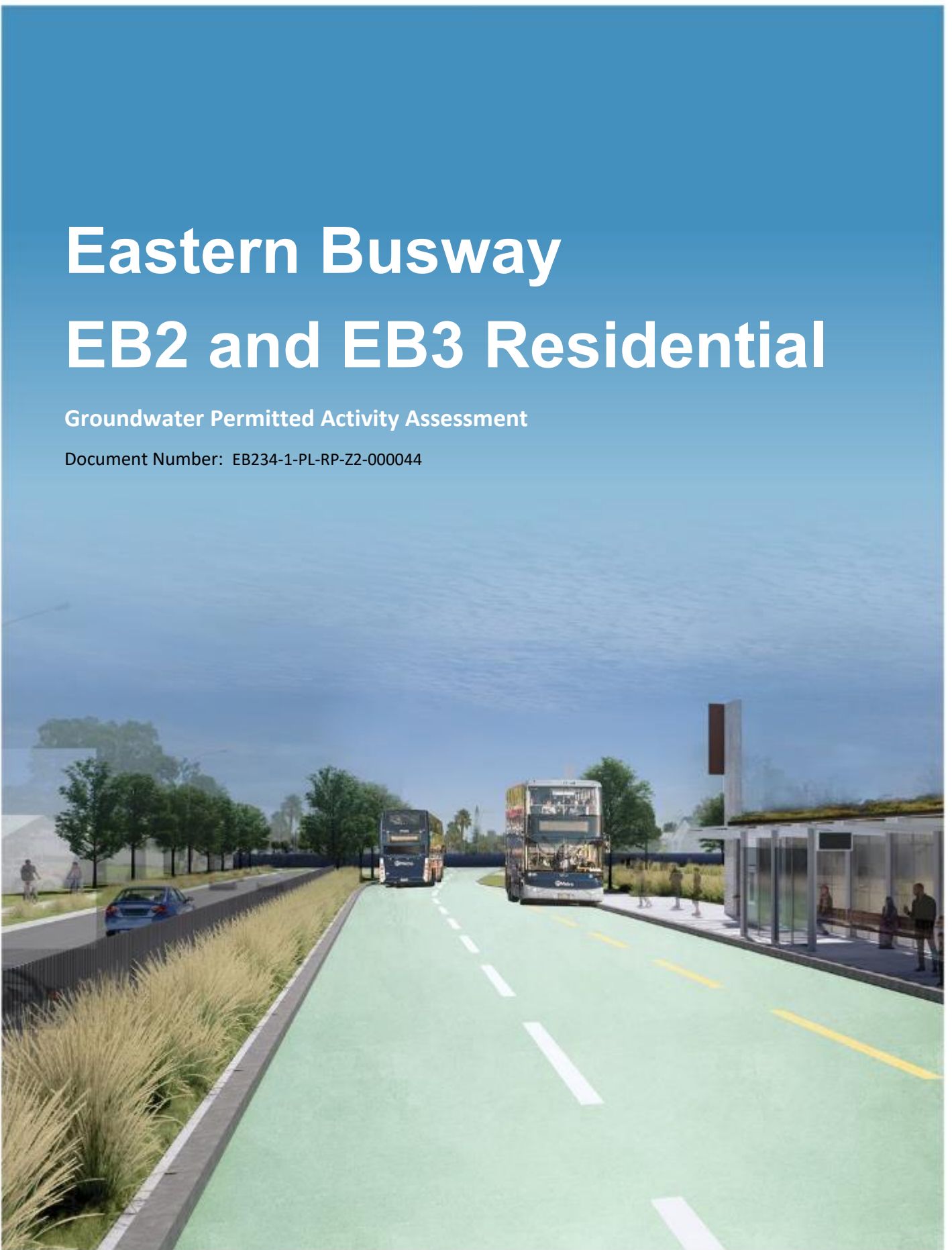


Eastern Busway EB2 and EB3 Residential

Groundwater Permitted Activity Assessment

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Table of Contents

List of Abbreviations and Definitions.....	5
1 Introduction	6
1.1 Overview of the Eastern Busway Project	6
1.2 Project Objectives.....	7
2 Proposal Description	8
2.1 Eastern Busway 2.....	8
2.1.1 Busway and Pakuranga Town Centre Bus Station.....	8
2.1.2 Reeves Road Flyover (RRF)	8
2.1.3 Walking and Cycling Facilities.....	8
2.1.4 Supporting Works.....	9
2.2 Eastern Busway 3 Residential.....	9
2.2.1 Edgewater and Gossamer Intermediate Bus Stations.....	9
2.2.2 Western Bridge Abutment.....	9
2.2.3 Walking and Cycling Facilities.....	9
2.2.4 Associated changes the road network	9
2.2.5 Supporting Works.....	9
3 Specialist Assessment.....	11
3.1 Assessment Content	11
3.2 Specific Project Elements	11
3.3 Construction Approach.....	11
3.3.1 Open Trenching	11
3.3.2 Piling	11
3.3.3 Excavation.....	12
3.3.4 Retaining Wall 214.....	12
4 Methodology and Analysis	13
4.1 Data collection.....	13
4.1.1 Groundwater Data.....	13
4.1.2 Excavation Levels.....	13
4.1.3 Assumptions and Background	13
5 Existing Environment.....	15
5.1 Existing Land Use and Topography.....	15
5.2 Geological Model.....	15
5.3 Natural Groundwater	16
5.3.1 Piezometer levels.....	16
5.3.2 Seasonal Fluctuations	17
5.3.3 Groundwater flow	17
6 Compliance with AUP(OP) Permitted Activity Status	18
6.1 Activity Status	18
7 Recommendations and Conclusions	21

Appendix A – Borehole Logs.....22

Appendix B – Groundwater Graphs23

Appendix C – Flow Maps24

Appendix D – Existing Bores25

Figures

Figure 1. Project alignment..... 7

Figure 2 Project Packages 10

Tables

Table 1. Geotechnical Units 15

Table 2. Standpipe Piezometer Summary (Active) 16

Table 3: Seasonal Variation..... 17

Table 4: Permitted activity criteria for groundwater diversion. 18

List of Abbreviations and Definitions

Abbreviation and Definitions	Description
AEE	Assessment of Effects on the Environment
AUP(OP)	Auckland Unitary Plan (Operative in part) 2016
BPO	Best practicable option
CMA	Coastal Marine Area
EB1	Eastern Busway 1 (Panmure to Pakuranga)
EB2	Eastern Busway 2 (Pakuranga Town Centre)
EB3 Commercial/ EB3C	Eastern Busway 3 (Pakuranga Creek to Botany)
EB3 Residential/ EB3R	Eastern Busway 3 (SEART to Pakuranga Creek)
EB4	Eastern Busway 4 (link between Ti Rakau Drive and Te Irirangi Drive, Botany Town Centre Station)
EBA	Eastern Busway Alliance
km	Kilometre(s)
m	Metre(s)
m ²	Square Metre(s)
m ³	Cubic Metre(s)
NoR	Notice of Requirement
AUP(OP)	Auckland Unitary Plan (Operative in part) 2016
RTN	Rapid Transit Network
RRF	Reeves Road Flyover
RMA	Resource Management Act 1991

1 Introduction

1.1 Overview of the Eastern Busway Project

The Project is a package of works focusing on promoting an integrated, multi-modal transport system to support population and economic growth in southeast Auckland. This involves the provision of a greater number of improved public transport choices and aims to enhance the safety, quality and attractiveness of public transport and walking and cycling environments, and includes:

- 5km of two-lane busway
- New bridge for buses across Pakuranga Creek
- Improved active mode infrastructure (walking and cycling) along the length of the busway
- Three intermediate bus stations
- Two major interchange bus stations.

The Project forms part of the previous Auckland Manukau Eastern Transport Initiative (AMETI) programme (the programme) which includes a dedicated busway and bus stations between Panmure, Pakuranga and Botany town centres. The dedicated busway will provide an efficient rapid transit network (RTN) service between the town centres, while local bus networks will continue to provide more direct local connections within the town centre areas. The Project also includes new walking and cycling facilities, as well as modifications and improvements to the road network.

The programme includes the following works which do not form part of the Eastern Busway Project:

- Panmure Bus and Rail Station and construction of Te Horeta Road (completed)
- Eastern Busway 1 (EB1) – Panmure to Pakuranga (completed).

The Project consists of the following packages:

- Early Works Consents – William Roberts Road (WRR) extension from Reeves Road to Ti Rakau Drive (LUC60401706); and Project Construction Yard at 169 – 173 Pakuranga Road (LUC60403744).
- Eastern Busway 2 (EB2) – Pakuranga Town Centre, including the Reeves Road Flyover (RRF) and Pakuranga Bus Station (**this Assessment**)
- Eastern Busway 3 Residential (EB3R) – Ti Rakau Drive from the South Eastern Arterial (SEART) to Pakuranga Creek, including Edgewater and Gossamer Intermediate Bus Stations (**this Assessment**)
- Eastern Busway 3 Commercial (EB3 Commercial) – Gossamer Drive to Guys Reserve, including two new bridges, and an offline bus route through Burswood
- Eastern Busway 4 – Guys Reserve to a new bus station in the Botany Town Centre, including a link road through Guys Reserve.

The overall Project is shown in Figure 1 below.

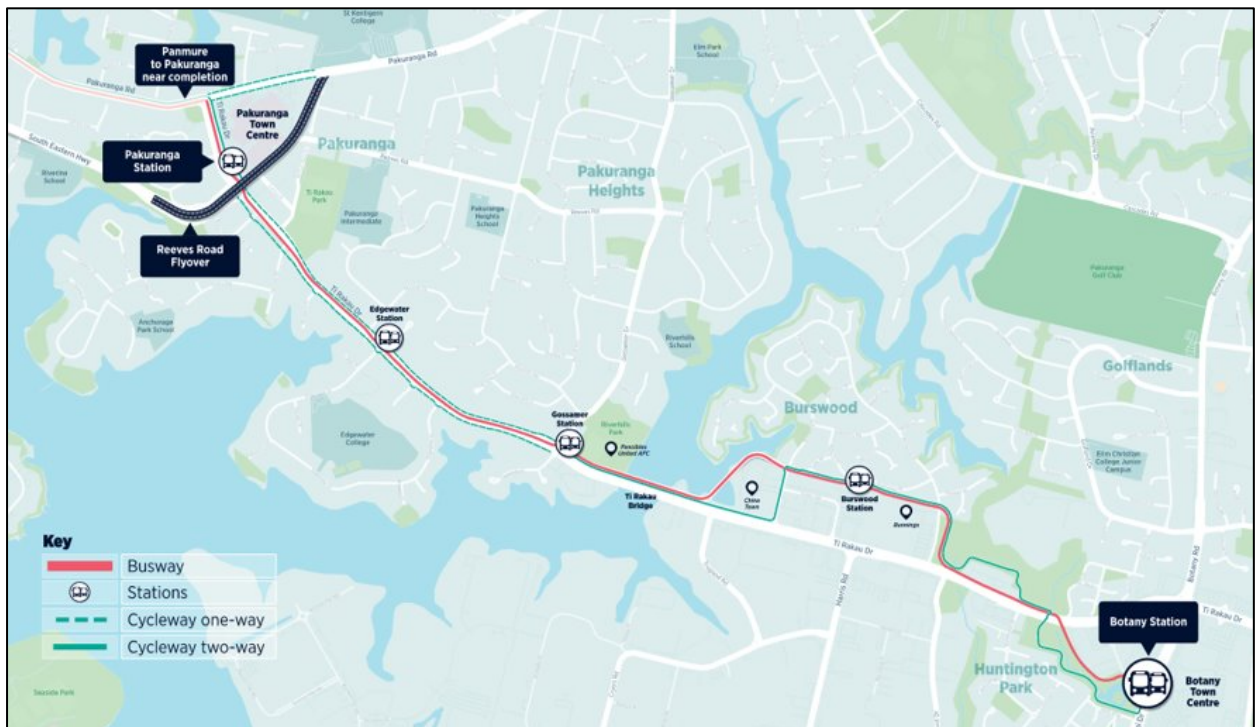


Figure 1. Project alignment

1.2 Project Objectives

The Project objectives are:

1. Provide a multi modal transport corridor that connects Pakuranga and Botany to the wider network and increases access to a choice of transport options
2. Provide transport infrastructure that integrates with existing land use and supports a quality, compact urban form
3. Provide transport infrastructure that improves linkages, journey time and reliability of the public transport network
4. Contribute to accessibility and place shaping by providing better transport connections between, within and to the town centre
5. Provide transport infrastructure that is safe for everyone
6. Safeguard future transport infrastructure required at (or in vicinity of) Botany Town Centre to support the development of a strategic public transport connection to Auckland Airport.

2 Proposal Description

The below is a summary of the works proposed within the EB2 and EB3R packages. Refer to the Assessment of Effects on the Environment (AEE) for additional detail on the works proposed.

2.1 Eastern Busway 2

The EB2 section of the Project commences from the intersection of Ti Rakau Drive and Pakuranga Road, connecting with EB1, and traverses west along Ti Rakau Drive to the intersection of SEART. The north-south extent of EB2 is between SEART and Pakuranga Road along Reeves Road and William Roberts Road. The main components of EB2 are described below.

2.1.1 Busway and Pakuranga Town Centre Bus Station

A segregated dedicated two-way busway is proposed along Ti Rakau Drive to provide prioritised access for bus services between Pakuranga Town Centre and Botany. From Pakuranga Road to SEART, the busway will run on the northern side of Ti Rakau Drive.

The proposed Pakuranga bus station is a key facility for services running to and from the Panmure Station Interchange, Howick, Highland Park, Eastern Beach, Bucklands Beach and Sunnyhills. The bus station will be located along the northern side of Ti Rakau Drive, on land currently occupied for Pakuranga Plaza and 26 Ti Rakau Drive. The bus station will feature two platforms and will contain a mixture of street furniture and structures, including bus shelters, electronic messaging signage and seating. New proposed pedestrian crossings will provide connections to the bus station and Pakuranga Plaza. Modifications to the Ti Rakau Drive median strip, landscaping, and general traffic lane reconfiguration will enable safe and efficient bus movement for the busway once it becomes operative.

2.1.2 Reeves Road Flyover (RRF)

The RRF will provide two general traffic lanes in each direction connecting SEART to Pakuranga Road, to reduce local traffic congestion along Pakuranga Road and Ti Rakau Drive. The RRF will start opposite Paul Place Reserve, pass over Ti Rakau Drive and Reeves Road, before finishing at a new intersection with Pakuranga Road. Traffic lanes for the RRF will be elevated and run through the centre of SEART, requiring the relocation of the SEART off-ramp to the north of the existing off-ramp.

2.1.3 Walking and Cycling Facilities

EB2 includes improvements to active transport infrastructure and connections. This includes a new cycleway, improved footpaths, and new pedestrian crossings. These works will improve the safety and connectivity of walking and cycling links across Pakuranga Town Centre.

2.1.4 Supporting Works

A range of works will be undertaken in support of the EB2 package. This includes the relocation of network utility services, new street lighting, earthworks, removal of vegetation, landscaping, stormwater upgrades, environmental restoration and mitigation and temporary construction sites.

2.2 Eastern Busway 3 Residential

The EB3R section of the busway is a continuation of EB2 from the intersection of SEART and Ti Rakau Drive, with the proposed dedicated busway proceeding centrally along Ti Rakau Drive towards Gossamer Drive and Riverhills Park in the east. EB3R will largely occur within land vested as road or land currently owned by Auckland Transport. The construction of EB3R will take a staged approach to minimize disruption to the existing road network and its users. The main components of EB3R have been described below.

2.2.1 Edgewater and Gossamer Intermediate Bus Stations

EB3R includes two intermediate bus stations on Ti Rakau Drive, located within the vicinity of Edgewater Drive and Gossamer Drive. Both stations will have separate platforms for eastbound and westbound bus movements. A range of street furniture and structures will also be constructed, such as modular bus shelters pedestrian linkages, electronic messaging signage, seating and cycling storage facilities.

2.2.2 Western Bridge Abutment

EB3R includes construction of the western bridge abutment for a new future bridge across Pakuranga Creek. The abutment will be located within the area that is currently the south-eastern section of Riverhills Park. Only the bridge abutment is included in the EB3R package of works. The remaining parts of the bridge will form part of the EB3C approval package.

2.2.3 Walking and Cycling Facilities

Provision has been made for walking and cycling along the route of EB3R. This includes footpaths and uni-directional cycleways located on either side of Ti Rakau Drive from SEART to Gossamer Drive. Signalised pedestrian crossings will be provided at key intersections along Ti Rakau Drive, including adjacent to the proposed Edgewater bus station.

2.2.4 Associated changes the road network

The proposed changes to the road network include lane arrangement and intersection reconfigurations and changes to the parking arrangement and access to Edgewater Drive Shops. Changes are also proposed to the access arrangements for residential properties along the EB3R alignment. New westbound lanes for general traffic will be established within the land which has been acquired by Auckland Transport and will be vested as road once it becomes operative, as the busway alignment replaces the existing westbound lanes.

2.2.5 Supporting Works

A range of works will be undertaken in support of the EB3R package. This includes the relocation of network utility services, new street lighting, removal of vegetation, earthworks, landscaping, stormwater upgrades, environmental restoration and mitigation and temporary construction sites.



Figure 2 Project Packages

3 Specialist Assessment

3.1 Assessment Content

The purpose of this memo is to document the process for assessing groundwater effects associated with the construction of EB2 and EB3R sections of the Eastern Busway (Project) and to demonstrate compliance with the Auckland Unitary Plan Operative in Part (AUP(OP)) rules relating to groundwater.

A high-level conceptual groundwater model has been developed to provide an understanding of the expected groundwater levels across EB2 and EB3R. This model was developed using the geological investigation logs and active groundwater level monitoring piezometers across EB2 and EB3R.

This groundwater assessment involves:

- Creating a hydrogeological flow map model
- Converting the expected maximum trenching/excavation depths into elevations (in m RL) and comparing them to local groundwater elevations
- Assessing if the proposed excavations are likely to extend below the top of the shallow groundwater table.

3.2 Specific Project Elements

The specific Project elements related to this groundwater assessment include the following:

- Stormwater drainage
- Underground utilities
- Road cuts
- Piling
- Ground improvements (if required)
- MSE walls.

This groundwater assessment looks at whether the excavation of trenches for stormwater and utilities along with any excavation of new road levels will impact natural groundwater level.

3.3 Construction Approach

3.3.1 Open Trenching

Open trenching will be used for the installation and relocation of underground services and utilities, including stormwater pipes. There are several deep trench stormwater and water lines to be installed (<5m BGL), primarily as part of the EB2 works. The trenching operations will be staged operations and will comprise a cut to waste trenching excavation, civil works and a stabilised backfill. A detailed methodology for these works can be found in the construction methodology appended to the Assessment of Environmental Effects. Water diversion for trenching associated with utility relocation is expected to take no more than 10 days.

3.3.2 Piling

Piling works greater than 1.5m in diameter are to be undertaken for the Reeves Road flyover (RRF), and a detailed methodology for these works can be found in the construction methodology. Piling works are

to be conducted using drilling fluid, maintaining a positive pressure head inside the pile bore, and with no dewatering expected. Therefore, groundwater inflow will not be an issue during construction. Based on this methodology, this groundwater memo will not consider the effects piling will have on natural groundwater.

3.3.3 Excavation

The expected earthworks are largely at or above grade with limited cuts comprising approximately 30,000m³ for EB2 and 20,000m³ for EB3R of approximately <1.5m BGL. Further details on the estimated earthworks areas and volumes are detailed in the Erosion and Sediment Control Report. Due to the gentle slopes of the Project area, the relatively small area of earthworks proposed for a project of this scale, and the staged nature of the works, these works are considered very unlikely to have an effect on the groundwater system. Further to this, any excavation that is expected to extend below the natural groundwater surface is expected to take no more than 10 days.

3.3.4 Retaining Wall 214

A retaining wall (RW214) is planned near the Ti Rakau Drive bridge adjacent to Riverhills Park. The design details include a typical section. This drawing details a mechanically stabilised earth (MSE) wall with a maximum embedment of 0.6m BGL. Both the shallow foundation of this MSE wall, and the included subsoil drain design, indicate that groundwater is unlikely to be impacted.

4 Methodology and Analysis

4.1 Data collection

4.1.1 Groundwater Data

Groundwater flow maps are created to determine the direction of groundwater flow within an aquifer (a water bearing geological formation). To create a groundwater flow map, first the depths to water measured in each piezometer installed within the same aquifer across the site area are converted into elevations relative to a consistent datum ($\text{Depth to water [m RL]} = \text{collar elevation [m RL]} - \text{depth to water [m BGL]}$). Then the groundwater elevations are posted and contoured on a site plan (see Appendix C - Flow Maps for these groundwater levels). These contours infer lines of equal hydraulic head. Groundwater flow lines can then be drawn perpendicular to these hydraulic head contours, to infer groundwater flow direction.

The data considered in this groundwater flow map (Appendix C – Flow Maps) was collected from the six piezometers installed in 2021, and two historical piezometers installed in 2018. These piezometers were selected as they contained groundwater data that had been collected over the same week, reducing the impact of climate variability. These piezometers have been surveyed using the Auckland 2016 Vertical Datum. A summary of these piezometers can be found in Table 2 with graphs presented in Appendix B.

Information regarding existing bores within EB2 and EB3R was requested from Auckland Council in 2021 (Appendix D – Existing Bores). There are no known current consents for groundwater takes in the EB2 or EB3R area.

4.1.2 Excavation Levels

To determine the maximum excavation depth across EB2 and EB3R, the following reference design drawings were reviewed:

- For permanent excavations:
 - Geometric Reference Design.
- For temporary excavations:
 - Utilities Reference Design
 - Stormwater Design.

The geometric reference design drawings for EB2 and EB3R show that the road is to be constructed on fill or at grade with minor cuts of approximately <1.5m BGL. The excavations required for the utilities trenches are expected to be shallower than the excavations required for the stormwater lines. Therefore, this groundwater model has been developed using stormwater invert levels (IL) as the maximum excavation trench depths expected during construction (<5m BGL). The excavation depths were converted to relative elevations and posted on the groundwater flow map. This was done to assess whether the excavations extend below the top of the shallow groundwater table. Note that these excavations are temporary and will be backfilled after the stormwater line has been installed or upgraded.

4.1.3 Assumptions and Background

- To assess the annual groundwater fluctuation, two piezometers from historic investigations have been used (DH18_103 and DH18_104)

- The levels for the road extension have been taken from appended geometric drawings, dated 13/08/2021
- Stormwater has been assumed to be the deepest underground installation and therefore will have the deepest associated trenches
- The pipe levels have been taken from the appended stormwater drawings, dated 13/08/2021 (EB2) and 17/08/2021 (EB3R).

5 Existing Environment

5.1 Existing Land Use and Topography

The land use surrounding Ti Rakau Drive in the EB2 and EB3R areas is a mixture of predominately low-rise one to two storey residential properties, with occasional Council reserves which are recorded as being landfill (inert) and commercial properties near Edgewater Drive. Within the EB2/ EB3 project areas the elevation of the existing Ti Rakau Drive varies from approximately RL 8.5 m in the west to RL 9.5 m (min) the east (Mt Eden 2000). To the south, the elevation reduces to about RL 5 m towards Tamaki River. To the north, the topography rises to Pakuranga Heights at approximately RL 20 m.

5.2 Geological Model

The published geological map for the area, Kermode 1992, suggests the site is underlain by Tauranga Group (alluvium) over Waitemata Group East Coast Bays Formation (ECBF). The ground conditions across this section of the Project are well understood and comprise a mixture of fine-grained soils, mainly clays, silts and sands, with a less than 0.5 m thick peat layer at about 16 m depth (RL -5 m), over rock. The geological model, presented in the Geotechnical Interpretative Report –(EB-2-D-2-GT-RP-000001), is based on site investigation data and indicates an approximately 20 m thick sequence of alluvium overlying weathered ECBF bedrock.

Near surface the soils are firm to stiff overlying a layer of saturated dense pumiceous silty fine and medium sand underlain by firm locally low strength silts and clays with sand lenses.

Below the superficial deposits, at about 20 m depth (RL -8.9 m) extremely weak to weak alternating mudstones, siltstones and fine sandstone were proven to at least 27 m depth (RL--18.9 m). The interpretation of the available geotechnical information from both the 2021 ground investigations and historic data led to the differentiation of the soils into the following layers (Table 1):

Table 1. Geotechnical Units

Geotechnical Unit			Material Description
Existing Fill	Uncontrolled	Fx	Uncontrolled Fill (silt, clay sand and gravel). Soft to firm or loose.
	Stiff Cohesive	Fc	Cohesive Fill (silt and clay). Stiff.
	Compacted Granular	Fg	Granular Fill (including volcanic boulder fill). Dense.
Tauranga Group (TG)	Cohesive Soils	T3	Clay and silt. Very soft to soft.
		T2	Clay and silt. Firm to stiff.
		T1	Clay and silt. Very stiff.
	Granular Soils	Tg	Silty sand. Loose to very dense.
	Organic Soils	To	Organic clay and silt. Firm to stiff.

Geotechnical Unit			Material Description
	Peat	Tp	Peat. Fibrous, amorphous and spongy. Also includes very soft to soft organic silt and clays.
East Coast Bays Formation (ECBF)	Residual Soil / Completely Weathered	Er	Clay, silt and sand. Stiff to very stiff & medium dense to very dense.
	Highly / Moderately Weathered	Ew	Highly to moderately weathered, Muddy Sandstone and Siltstone. Extremely weak.
	Slightly Weathered / Un-weathered	Eu	Slightly to un-weathered interbedded Muddy Sandstone and Siltstone. Very weak to weak.
	Parnell Grit	Eg	Moderately to un-weathered Volcaniclastic Sandstone. Weak.

5.3 Natural Groundwater

5.3.1 Piezometer levels

Standpipe piezometers were installed in six drillholes during the 2021 investigations to monitor groundwater levels. Two historical piezometers DH18_103 and DH18_104, installed by the EBA in 2018 are operational in 2022 and have been included in this flow map.

Of the piezometers listed in Table 2, seven are screened within alluvial material of the Tauranga Group and one extends within the top of the East Coast Bays Formation (ECBF).

Table 2. Standpipe Piezometer Summary (Active)

Drillhole ID	Collar Elevation [m RL]	Top of Slotted Screen (m RL)	Base of Slotted Screen (m RL)	Piezometer Base (m RL) (manual dip)	Response Zone (m RL)	Depth to water (m RL) <i>Included in the flow maps</i>	Depth to water (m BGL)	Date of Recorded Depth to water	Screened Geology
DH18_103	11.66	8.16	3.66	3.58	3.0-8.5	6.58	5.08	09/02/22	Completely to Slightly Weathered Sandstone and Siltstone [ECBF]
DH18_104	4.85	3.35	1.35	1.53	1.0-4.0	4.05	0.80	09/02/22	Clayey SILT, Silty CLAY [Fill]
DH204_P	8.14	1.14	-1.86	-2.20	6.2-10.5	5.64	2.50	09/02/22	Silty Clay [Alluvium]
DH205_P	7.68	3.68	1.68	1.58	3.5-6.5	5.48	2.20	09/02/22	Sandy CLAY [Alluvium]

Drillhole ID	Collar Elevation [m RL]	Top of Slotted Screen (m RL)	Base of Slotted Screen (m RL)	Piezometer Base (m RL) (manual dip)	Response Zone (m RL)	Depth to water (m RL) <i>Included in the flow maps</i>	Depth to water (m BGL)	Date of Recorded Depth to water	Screened Geology
DH210_P	11.82	9.82	6.82	6.77	1.5-5.3	8.55	3.27	10/02/22	Silty CLAY, Silty SAND, Organic CLAY [Alluvium]
DH212_P	15.87	11.37	8.37	8.12	3.8-8.2	13.71	2.16	09/02/22	SAND, Organic CLAY [Alluvium]
WB203_P	6.56	0.56	-2.44	-2.62	5.5-9.5	1.76	4.80	09/02/22	CLAY [Alluvium]
WB213_P	17.12	11.12	9.12	8.98	5.5-8.5	13.66	3.46	09/02/22	SAND [Alluvium]

5.3.2 Seasonal Fluctuations

One historic piezometer (DH18_103) was actively recording groundwater levels between 11 June 2018 and 4 November 2019 in the EB3R area (Table 3). Groundwater levels showed a variability of approximately +0.9m in the winter and -0.7m in the summer months from the median. Using this data, we expect to see seasonal variations in groundwater of approximately $\pm 1.0\text{m}$. Groundwater from the piezometers listed in Table 2 are expected to be retrieved monthly to confirm the seasonal groundwater variations across EB2 and EB3R. To date, the manual depth to ground water levels fall within the variability noted above.

Table 3: Seasonal Variation

Drillhole ID	Date Range	Collar Elevation [m RL]	Maximum Water Level [m RL]	Minimum Water Level [m RL]	Average Water Level [RL]
DH18_103	11/06/2018 to 4/11/2019	11.66	7.99	6.36	7.06

5.3.3 Groundwater flow

The maps in **Error! Reference source not found.** show the inferred direction of the shallow groundwater flow and that the excavations are unlikely to extend below the top of the groundwater table for the majority of the area covered by EB2 and EB3R. For the areas where groundwater is likely to sit above trench depths, this is likely to be by $<1.0\text{m}$. It should be noted that these flow maps were constructed using the available data collected during summer 2021/2022 and therefore the seasonal fluctuations described above should also be taken into account.

6 Compliance with AUP(OP) Permitted Activity Status

6.1 Activity Status

Chapter E7 of the AUP (OP) sets out criteria under which the diversion of groundwater is considered a Permitted Activity. Table 4 provides a comparison of the proposed activity against the permitted activity standards set out in Rules E7.6.1.6 and E7.6.1.10.

Groundwater flow within EB2 and EB3R is summarised in **Error! Reference source not found.**. However, as the stormwater excavations are a road network linear trenching activity, where no one part of the trench will be open for more than 10 days, this is considered permitted activity. The piling works will involve piles with an external diameter of greater than 1.5m, which will be drilled into rock head. However, these do not exceed 1 hectare in total area and do not impede the flow of groundwater over a length of more than 20 m. Therefore, these are also considered a permitted activity.

Table 4: Permitted activity criteria for groundwater diversion.

Rule	Complies	Notes
Rule E7.6.1.6 – water take for dewatering or groundwater level control associated with a groundwater diversion permitted under standard E7.6.1.10		
(1) Water take must not be geothermal water	✓	No geothermal water take is anticipated
(2) Water take must not be for a period of more than 10 days where it occurs in peat soils, or 30 days in other types of soils or rock	✓	Water take will only occur during pipe or service trench installation for no more than 10 days.
(3) The water take must only occur during construction	✓	Construction only.
Rule E7.6.1.10 – diversion of groundwater caused by any excavation, including trench or tunnel		
(1) All of the following activities are exempt from the standards E7.6.1.10 (2-6):		
a. Pipes, cables, or tunnels which are drilled or thrust and are up to 1.2m in external diameter	N/A	N/A network utility are exempt as per (d & e).
b. Pipes including associated structures up to 1.5m in external diameter where a closed faced or earth pressure balanced machine is used	N/A	N/A network utility are exempt as per (d & e).

Rule	Complies	Notes
c. Piles up to 1.5m in external diameter are exempt from this standard	×	Piles up to 3m diameter, no diversion anticipated.
d. Diversion for no longer than 10 days; Or	✓	Diversions not expected to take longer than 10 days, utility trenches are therefore exempt.
e. Diversion for network utilities and road network linear trenching activities that are progressively opened, closed and stabilised where the part of the trench that is open at any given time is no longer than 10 days.	✓	Diversions for utility trenches will not be open for more than 10 days.
(2) Any excavation that extends below natural ground level, must not exceed:		
a. 1 hectare in total area; and	✓	Piles will be socketed into rock (>6m), however only cover a 3m diameter.
b. 6 m depth below the natural surface		
(3) Natural groundwater level must not be reduced by more than 2 m on the boundary of any adjoining site	✓	No groundwater takes expected during piling.
(4) Any structure, excluding sheet piling that remains in place for more than 30 days, that physically impedes the flow of groundwater through the site must not:		
a. Impede the flow of groundwater over a length of more than 20 m; and	✓	Piles have a diameter of 3m and will not impede the flow of groundwater for more than 20m but will extend to more than 2m below natural GWL.
b. Extend more than 2 m below natural groundwater level		
(5) The distance to any existing building or structure, excluding timber fences and small structures on the boundary, on an adjoining site from the edge of any:		
a. Trench or open excavation that extends below natural groundwater level must be at least equal to the depth of the excavation.	✓	No open trenches, excavations, tunnels or pipes involved with

Rule	Complies	Notes
b. Tunnel or pipe with an external diameter of 0.2 m – 1.5m that extends below groundwater level must be 2m or greater, or	✓	piling work. Service trenches exempt as per E7.6.1.10, 1 (d & e).
c. Tunnel or pipe with an external diameter of up to 0.2 m that extends below groundwater level has no separation requirement.	✓	
(6) The distance from the edge of any excavation that extends below natural groundwater level, must not be less than:		
a. 50 m from a Wetland Management Areas Overlay (WMAO)	✓	Greater than 50 m from WMAO
b. 10 m from a scheduled Historic Heritage Overlay (HHO)	✓	Greater than 10m from HHO
c. 10 m from a lawful groundwater take	✓	Greater than 10 m from groundwater take

Based on the above, the works fully comply with the **permitted activity** rules and related standards.

7 Recommendations and Conclusions

To conclude, the construction process is likely to have little to no effects on the natural groundwater or geology of the areas within and surrounding EB2 and EB3R. In any event the works required are permitted activities.

Appendix A – Borehole Logs

TERMINOLOGY AND SYMBOLS

Drilling / Investigation Methods

CFHSA	- Continuous Flight Hollow Stem Auger.
CFSSA	- Continuous Flight Solid Stem Auger.
DC	- Dynamic Coring (eg Terrier Rig).
DCP	- Dynamic Cone Penetrometer.
HA	- Hand Auger.
HQ3	- HQ Triple Tube.
HQWL	- HQ Wire Line.
HWOB	- Heavy Weight Open Barrel.
NQ3	- NQ Triple Tube.
NQWL	- NQ Wire Line.
OB	- 100mm diameter Open Barrel.
OB70	- 70mm diameter Open Barrel.
PERC	- Percussion.
PS	- Piston Sample.
PQ3	- PQ Triple Tube.
PQWL	- PQ Wire Line.
RC	- Reverse Circulation.
RCDHH	- Reverse Circulation Down Hole Hammer.
SPT	- Standard Penetration Test.
SPERC	- Sonic Percussion.
PT	- Push Tube Sample
VAC EX	- Vacuum Excavation.
WASH	- Wash Drilling.

Test Results

SPT "N" value; uncorrected blow count for 300 mm penetration
 # / # / # / # / # / # blows per 75 mm penetration

ss - Standard Penetration Test - split spoon
 sc - Standard Penetration Test - solid cone (no sample recovery)
 SUOW - Sunk Under Own Weight

Vane Shear Strength Tests

/ # Vane shear strength test results given as peak / remoulded shear strengths (kPa). Test as per NZGS Guideline, 2001.

= Vane test performed on core recovered prior to extrusion from core barrel.
 * = Vane test performed on excavated material of suitable size.

UTP - Unable to penetrate.

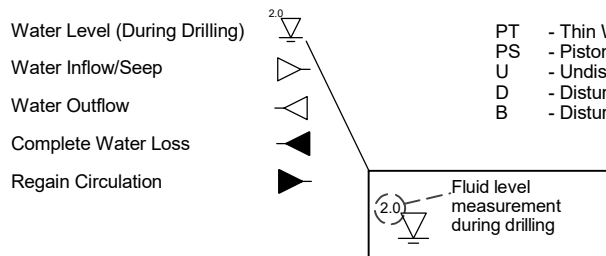
Unit/Geological Boundary Lines

———— Known
 - - - - Inferred/Unknown

Installation & Backfill

Standpipe		Grout	
Slotted Standpipe		Cement	
Collapse/Cuttings /Spoil		Gravel Pack Filter	
Bentonite		Sand Pack Filter	
Inclinometer		Gravel Backfill	

Groundwater Records



Samples

PT	- Thin Wall Push Sample
PS	- Piston Sample
U	- Undisturbed
D	- Disturbed (Core)
B	- Disturbed (Pit)

Rock Descriptions

Relative Strength

ES	- Extremely strong	> 250
VS	- Very Strong	100 - 250
S	- Strong	50 - 100
MS	- Moderately Strong	20 - 50
W	- Weak	5 - 20
VW	- Very Weak	1 - 5
EW	- Extremely Weak	< 1

Weathering

UW	- Unweathered
SW	- Slightly Weathered
MW	- Moderately Weathered
HW	- Highly Weathered
CW	- Completely Weathered

Soil Descriptions

Consistency Cohesive Soils

Very Soft	Su (kPa) < 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	200 - 500

Relative Density Non-cohesive soils

Very Loose	SPT "N" Value (uncorrected) < 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

Rock Defect Abbreviations

Defect Type

BP	= Bedding Plane Defect
CZ	= Crush Zone
DB	= Drilling Break
FZ	= Fracture Zone
HJ	= Healed Joint
J	= Joint
SZ	= Shear Zone
Ve	= Vein

Defect Aperture

T	= Tight (Nil)
VN	= Very Narrow (>0-2mm)
N	= Narrow (2-6mm)
MN	= Moderately Narrow (6-20mm)
MW	= Moderately Wide (20-60mm)
W	= Wide (60-200mm)
VW	= Very Wide (>200mm)

Defect Roughness

Pl	= Planar
St	= Stepped
Ud	= Undulating
Ro	= Rough
Sm	= Smooth
Slk	= Slickensided
	= Parallel
Po	= Polished

Infill Thickness

Sn	= Stained
Vn	= Veneer (<0.5mm)
Cg	= Coating
P	= Partially infilled
C	= Completely infilled

Infill Colour

bl	= Blue
bn	= Brown
bk	= Black
gn	= Green
gy	= Grey
or	= Orange
pk	= Pink
rd	= Red
wh	= White
ye	= Yellow

Infill Material

Calc	= Calcareous
Cb	= Carbonaceous
Cc	= Calcite
Cl	= Clay
Fe	= Iron Oxide
Mn	= Manganese
NF	= No Infill
Py	= Pyrite
Qtz	= Quartz
S	= Sand
Slt	= Silt

Graphic Log (typical symbols)

	Peat		Mudstone
	Clay		Siltstone
	Silt		Sandstone
	Sand		Basalt
	Gravel / Cobbles		No recovery
	Welded Tuff		

Core Measurements

TCR	= Total Core Recovery
RQD	= Rock Quality Designation

Soil and rock descriptions generally as in "Guidelines for the Field Description of Soil and Rock for Engineering Purposes" by the NZ Geotechnical Society Inc, December 2005.

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409363.21mE 796020.82mN
 Orientation -90° Elevation 6.54m
 Location Opposite 10 Seven Oaks Drive
 Feature Fill slope/MSE wall

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0-100%</small>	Relative Strength <small>MS MSW VW W</small>	Rock Weathering <small>SW MW HW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES <small>Subordinate MAJOR minor; colour, structure. Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation
	Shear Vane/ SPT	SPT N Values <small>0 - 50</small>									DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>	
0.0m: FILL comprising asphalt road surface and clayey gravel subgrade.			VAC EX				0		0		0.0m: Asphalt. 0.08m: Clayey fine to coarse GRAVEL; yellowish brown.	
1.5m: ALLUVIUM comprising clay, organic clay and pumiceous sand.	SS 1,2,2, 2,3,3 N=10		SPT				100		100		1.5m: Pumiceous silty fine SAND; brownish grey. Medium dense, moist, uniformly graded.	
			HQ3				100		100		1.65m: Silty CLAY; dark brown. Firm to stiff, moist, high plasticity. 1.68 to 2.0m: Brown. 2.0 to 2.6m: Trace fine sand and grey with orange staining.	
	SS 1,1,1, 1,2,2 N=6		SPT				100		100		2.6m: CLAY with trace silt and fine mica sand; bluish grey with orange staining. Stiff, moist, high plasticity.	2.8
			HQ3				100		100		3.65 to 3.7m: Very soft. 3.7 to 4.2m: With some fine micaceous sand lenses.	3.6
	SS 0,0,0, 0,1,1 N=2		SPT				100		100		4.2 to 5.45m: Trace rootlets. 4.5m: 114mm diameter, HWT casing to 4.5m depth.	3.95
			PT				100		100		4.6 to 5.0m: With some fine micaceous sand lenses, dark bluish grey. Organics include decomposed rootlets. Overall still behaving as clay but lenses behave as fine sand.	
			HQ3				100		100		5.45 to 18.02m: Trace decomposed wood.	
	SS 0,0,0, 0,0,0 N=0 SUOW		SPT				100		100			
			HQ3				100		100			
SS 57/19 0,0,0, 0,0,0 N=0 SUOW		SPT				100		100				
		PT				100		100				
		HQ3				100		100				
SS 22/5 0,0,0, 0,0,0 N=0 SUOW		SPT				100		100				
		HQ3				100		100				

For explanation of symbols and observations, see key sheet

FLUID DEPTHS AND DRILLING PROGRESS (m)			
Date Time	Drilled Depth	Casing Depth	Fluid Depth
16/08/2021 17:00	15.45	3.0	3.95
17/08/2021 08:00	15.45	3.0	2.8
17/08/2021 13:00	24.00	4.5	3.6

RELATIVE STRENGTH

VS - Very strong
 S - Strong
 MS - Moderately strong
 W - Weak
 VW - Very weak
 EW - Extremely weak

WEATHERING

UW - Unweathered
 SW - Slightly weathered
 MW - Moderately weathered
 HW - Highly weathered
 CW - Completely weathered

Date logged 17/08/2021

Logged SK
 Checked GP

Driller McMillan
 Started 16/08/2021
 Finished 17/08/2021

Drill Rig N119
 Core Boxes 8

Remarks

Hole backfilled with 0.0 to 0.2m: Cold mix asphalt, 0.2 to 2.0m: Gravel, 2.0 to 24.0m: Grout.

Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016

Hand Held Shear Vane
 DR2272: 19mm blade: Correction Factor = 1.572
 vane shear strength per NZGS guideline

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409363.21mE 796020.82mN
 Orientation -90° Elevation 6.54m
 Location Opposite 10 Seven Oaks Drive
 Feature Fill slope/MSE wall

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>MS MS W VW</small>	Rock Weathering <small>SW MW HW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm) <small>500 100 50 10</small>	SOIL PROPERTIES <small>Subordinate MAJOR minor; colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation
	Shear Vane/ SPT	SPT N Values <small>0 - 50</small>									DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>	
TAURANGA GROUP			HQ3						100		2.6m: CLAY with trace silt and fine mica sand; bluish grey with orange staining. Stiff, moist, high plasticity. (continued) 10.2 to 10.95m: With some fine micaceous sand lenses. 10.95 to 12.3m: With trace fine micaceous sand lenses. 12.3 to 12.7m: With some fine micaceous sand lenses. 12.7 to 18.02m: With trace fine micaceous sand. 13.8m: Organic silty CLAY; black. Soft to firm, moist, high plasticity. Spongy. 14.0m: CLAY with trace silt; bluish grey. Stiff to very stiff, moist, high plasticity.	
		77/20 SS 0,0,0, 1,1,1 N=3	SPT				11		100			
		94/28 SS 0,0,1, 0,1,1 N=3	SPT				12		100			
			HQ3				13		100			
		SS 0,0,0, 0,1,2 N=3	SPT				14		100			
			HQ3				15		100			
		SS 1,2,2, 3,2,3 N=10	SPT				16		100			
			HQ3				17		100			
		SS 0,0,0, 0,0,0 N=9 SUOW	SPT				18		100			
			HQ3				19		100 [85]			
18.02m: HW, medium SANDSTONE. EW.			SPT			18		100	18.02m: Silty medium SAND; grey. Very dense, moist.			
18.33m: HW, SILTSTONE. Extremely weak.									18.33m: CLAY; grey. Very Stiff, moist, high plasticity.			
18.55m: Unweathered, grey, fine to medium SANDSTONE. Weak			HQ3						18.55 to 18.67m: Dark brown, gently inclined, thin carbonaceous laminations. 18.99 to 19.08m: J, 60°, Pl, Sm, Vn, Qtz, opened up through drilling			
19.05m: Unweathered, grey SILTSTONE. Weak. Moderately thinly bedded.			SPT						19.2 to 19.36m: Gently inclined light and dark laminations. 19.36 to 19.41m: Sandstone. 19.41 to 19.5m: Steeply inclined light and dark laminations.			
For explanation of symbols and observations, see key sheet			RELATIVE STRENGTH		WEATHERING		Date logged 17/08/2021		Driller McMillan			
FLUID DEPTHS AND DRILLING PROGRESS (m) Date Time Drilled Depth Casing Depth Fluid Depth			VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak		UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered		Logged SK Checked GP		Started 16/08/2021 Finished 17/08/2021 Drill Rig N119 Core Boxes 8			
Hand Held Shear Vane DR2272: 19mm blade: Correction Factor = 1.572 vane shear strength per NZGS guideline			Remarks Hole backfilled with 0.0 to 0.2m: Cold mix asphalt, 0.2 to 2.0m: Gravel, 2.0 to 24.0m: Grout.		Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016				Page 2 of 7			

2021 EB DRILLHOLE LOG 2021-11-17 SBS MASTER.GPJ BASE.GDT 17/11/21

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409363.21mE 796020.82mN
 Orientation -90° Elevation 6.54m
 Location Opposite 10 Seven Oaks Drive
 Feature Fill slope/MSE wall

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc.)</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>MS MSW MW VW EW</small>	Rock Weathering <small>SW MW HW CW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES <small>Subordinate MAJOR minor; colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation
	Shear Vane/ SPT	SPT N Values									DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>	
EAST COAST BAYS FORMATION 19.7m: Unweathered, grey, fine to medium SANDSTONE. Very weak. Thickly bedded. (continued) 22.7 to 23.2m: Fine sandstone. 23.2 to 23.6m: Slightly weathered. 23.6m: Moderately weathered, grey, fine to medium SANDSTONE. Extremely weak.	N>50	0 - 50	HQ3		MS	SW	21		100 [100]	100	19.8 to 22.75m: Trace fine gravel, white, subangular. 20.26m: DB, 30° 21.42m: DB, 10° 22.41m: DB, 0° 22.71m: J, 30°, Pl, Sm, Cg, Slt 23.26m: J, 25°, Pl, Sm, NF 23.31m: J, 30°, Pl, Sm, NF 23.35 to 23.41m: Drilling disturbed, recovered as gravel. 23.55m: DB, 0°	
	ss 12.38 for 70mm N>50		SPT		MSW	MW	22		28	100 [100]		
			HQ3		MS	SW	23		100 [100]	100 [97]		
			HQ3		MS	SW	24					23.6m: Silty fine to medium SAND; grey. Core sample dropped out of barrel, was re-cored and recovered as silty sand and gravel. DH203 terminated at 24.0m Depth Criteria Achieved
For explanation of symbols and observations, see key sheet FLUID DEPTHS AND DRILLING PROGRESS (m) Date Time Drilled Depth Casing Depth Fluid Depth			RELATIVE STRENGTH VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak		WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered		Date logged 17/08/2021 Logged SK Checked GP		Driller McMillan Started 16/08/2021 Finished 17/08/2021 Drill Rig N119 Core Boxes 8			
Hand Held Shear Vane DR2272: 19mm blade: Correction Factor = 1.572 vane shear strength per NZGS guideline			Remarks Hole backfilled with 0.0 to 0.2m: Cold mix asphalt, 0.2 to 2.0m: Gravel, 2.0 to 24.0m: Grout.					Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016			Page 3 of 7	

2021 EB DRILLHOLE LOG 2021-11-17 SBS MASTER.GPJ BASE.GDT 17/11/21



Box: 1 of 8 - Depth: 00.00m to 04.50m of 24.00m
 Date Drilled 16/08/2021 to 17/08/2021 - Date Photographed: 16/08/2021



Box: 2 of 8 - Depth: 04.50m to 07.70m of 24.00m
 Date Drilled 16/08/2021 to 17/08/2021 - Date Photographed: 16/08/2021



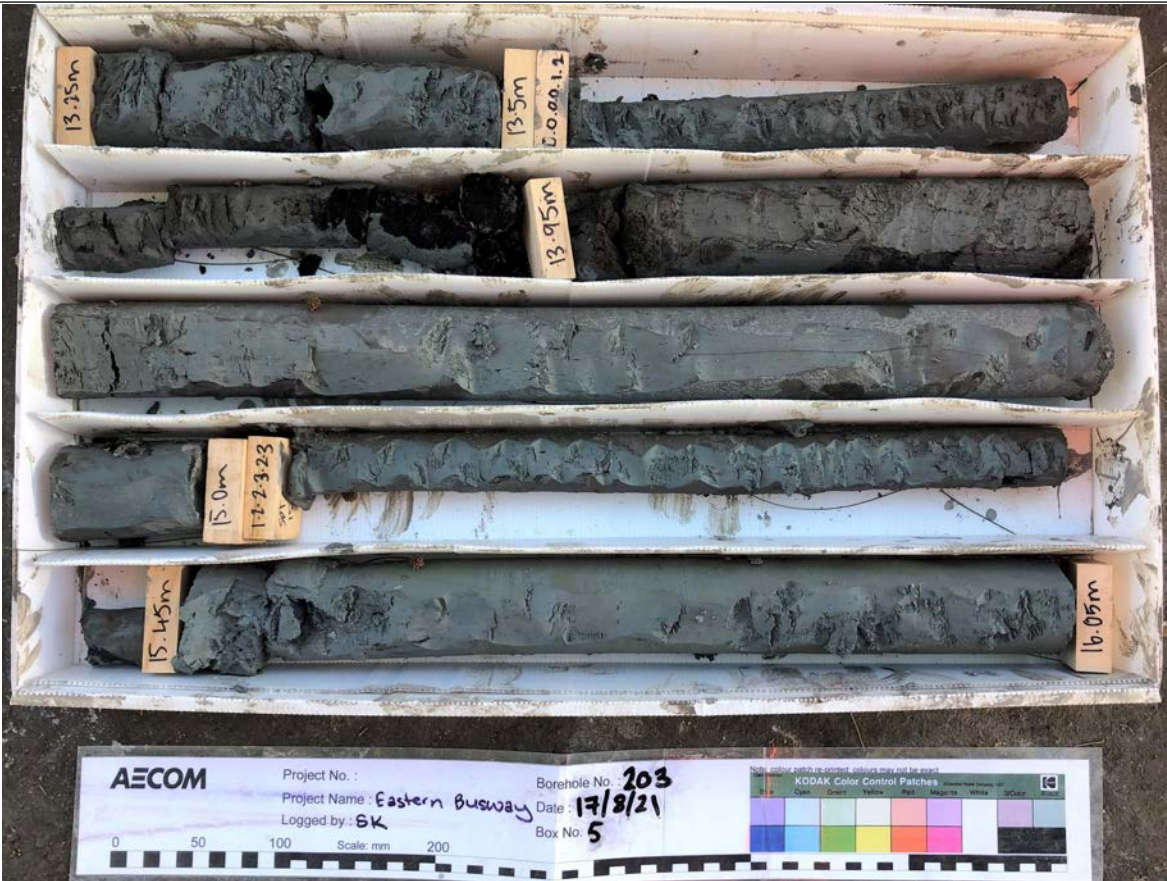
Box: 3 of 8 - Depth: 07.70m to 10.80m of 24.00m

Date Drilled 16/08/2021 to 17/08/2021 - Date Photographed: 16/08/2021



Box: 4 of 8 - Depth: 10.80m to 13.25m of 24.00m

Date Drilled 16/08/2021 to 17/08/2021 - Date Photographed: 17/08/2021



Box: 5 of 8 - Depth: 13.25m to 16.05m of 24.00m

Date Drilled 16/08/2021 to 17/08/2021 - Date Photographed: 17/08/2021



Box: 6 of 8 - Depth: 16.05m to 18.65m of 24.00m

Date Drilled 16/08/2021 to 17/08/2021 - Date Photographed: 17/08/2021



Box: 7 of 8 - Depth: 18.65m to 21.65m of 24.00m
 Date Drilled 16/08/2021 to 17/08/2021 - Date Photographed: 17/08/2021



Box: 8 of 8 - Depth: 21.65m to 24.00m of 24.00m
 Date Drilled 16/08/2021 to 17/08/2021 - Date Photographed: 17/08/2021

TERMINOLOGY AND SYMBOLS

Drilling / Investigation Methods

CFHSA	- Continuous Flight Hollow Stem Auger.
CFSSA	- Continuous Flight Solid Stem Auger.
DC	- Dynamic Coring (eg Terrier Rig).
DCP	- Dynamic Cone Penetrometer.
HA	- Hand Auger.
HQ3	- HQ Triple Tube.
HQWL	- HQ Wire Line.
HWOB	- Heavy Weight Open Barrel.
NQ3	- NQ Triple Tube.
NQWL	- NQ Wire Line.
OB	- 100mm diameter Open Barrel.
OB70	- 70mm diameter Open Barrel.
PERC	- Percussion.
PS	- Piston Sample.
PQ3	- PQ Triple Tube.
PQWL	- PQ Wire Line.
RC	- Reverse Circulation.
RCDHH	- Reverse Circulation Down Hole Hammer.
SPT	- Standard Penetration Test.
SPERC	- Sonic Percussion.
PT	- Push Tube Sample
VAC EX	- Vacuum Excavation.
WASH	- Wash Drilling.

Test Results

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 # / # / # / # / # / # blows per 75 mm penetration

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 sc - Standard Penetration Test - solid cone (no sample recovery)
 SUOW - Sunk Under Own Weight

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/ # Vane shear strength test results given as peak / remoulded shear strengths (kPa). Test as per NZGS Guideline, 2001.

= Vane test performed on core recovered prior to extrusion from core barrel.
 * = Vane test performed on excavated material of suitable size.

UTP - Unable to penetrate.

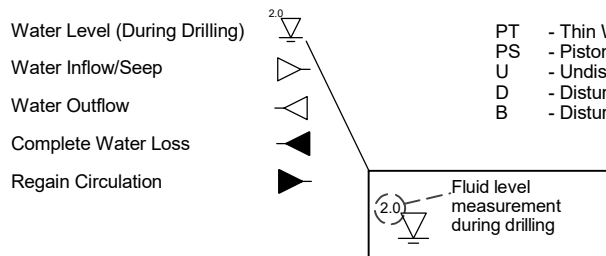
Unit/Geological Boundary Lines

———— Known
 - - - - - Inferred/Unknown

Installation & Backfill

Standpipe		Grout	
Slotted Standpipe		Cement	
Collapse/Cuttings /Spoil		Gravel Pack Filter	
Bentonite		Sand Pack Filter	
Inclinometer		Gravel Backfill	

Groundwater Records



Samples

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U	- Undisturbed
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Soil Descriptions

Consistency Cohesive Soils

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Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	200 - 500

Relative Density Non-cohesive soils

Very Loose	SPT "N" Value (uncorrected) < 4
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Very Dense	> 50

Rock Defect Abbreviations

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DB	= Drilling Break
FZ	= Fracture Zone
HJ	= Healed Joint
J	= Joint
SZ	= Shear Zone
Ve	= Vein

Defect Aperture

T	= Tight (Nil)
VN	= Very Narrow (>0-2mm)
N	= Narrow (2-6mm)
MN	= Moderately Narrow (6-20mm)
MW	= Moderately Wide (20-60mm)
W	= Wide (60-200mm)
VW	= Very Wide (>200mm)

Defect Roughness

Pl	= Planar
St	= Stepped
Ud	= Undulating
Ro	= Rough
Sm	= Smooth
Slk	= Slickensided
	= Parallel
Po	= Polished

Infill Thickness

Sn	= Stained
Vn	= Veneer (<0.5mm)
Cg	= Coating
P	= Partially infilled
C	= Completely infilled

Infill Colour

bl	= Blue
bn	= Brown
bk	= Black
gn	= Green
gy	= Grey
or	= Orange
pk	= Pink
rd	= Red
wh	= White
ye	= Yellow

Infill Material

Calc	= Calcareous
Cb	= Carbonaceous
Cc	= Calcite
Cl	= Clay
Fe	= Iron Oxide
Mn	= Manganese
NF	= No Infill
Py	= Pyrite
Qtz	= Quartz
S	= Sand
Slt	= Silt

Graphic Log (typical symbols)

	Peat		Mudstone
	Clay		Siltstone
	Silt		Sandstone
	Sand		Basalt
	Gravel / Cobbles		No recovery
	Welded Tuff		

Core Measurements

TCR	= Total Core Recovery
RQD	= Rock Quality Designation

Soil and rock descriptions generally as in "Guidelines for the Field Description of Soil and Rock for Engineering Purposes" by the NZ Geotechnical Society Inc, December 2005.

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409410.83mE 796033.07mN
 Orientation -90° Elevation 8.14m
 Location SEART, Ti Rakau Dr Intersection
 Feature MSE Wall/Abutment piles

GEOLOGICAL DESCRIPTION		Test Records		Drilling Method	Core Loss/Lift	Relative Strength	Rock Weathering	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES	Instrumentation	
Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).		Shear Vane/ SPT	SPT N Values	Casing remarks	0-100%	MS S W	SW MW HW				0-100	Subordinate MAJOR minor: colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, subordinate information, etc		
		0-50										DEFECT DESCRIPTION		
												(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)		
FILL	0.0m: TOPSOIL.											0.0m: CLAY with some rootlets; dark brown. Very stiff, moist, high plasticity.		
	0.25m: FILL comprising clay and gravel.	148/62										0.25m: CLAY with some fine to medium gravel and trace rootlets; dark brown mottled orange. Very stiff, moist, high plasticity. Gravel is basalt.	0.4	
TAURANGA GROUP	0.6m: ALLUVIUM comprising clay, silt, organic clay and sandy silt.	121/61										0.3 to 0.6m: Trace fine gravel. Light brown mottled orange. Iron oxide bands.		
		126/64		HA				1		100		0.6m: CLAY with some rootlets; light grey mottled orange. Very stiff, moist, high plasticity.		
		109/58											1.2 to 1.6m: Some silt and minor fine sand.	
		132/50											1.6m: Silty CLAY with trace indistinct organics; light grey mottled orange and flecked black. Stiff, moist, high plasticity.	1.95
		148/47		SPT					2		100		2.2 to 2.6m: White mottled yellow flecked black.	
		0.1,1, 2,2,2 N=7											2.6m: Silty fine to coarse SAND; light yellowish white. Tightly packed, moist. Sand is pumiceous.	
		SS		HQ3									3.0m: 114mm diameter, HWT casing to 3.0m depth.	
		1,2,2, 2,2,1 N=7		SPT						3		100	3.2m: Organic CLAY with some silt; dark brown. Stiff, moist, high plasticity. Organics are indistinct.	3.4
		SS		HQ3									3.5m: Silty CLAY with minor indistinct organics and trace fine micaceous sand; dark grey speckled black. Firm, moist, high plasticity.	
37/15											4.5 to 5.55m: Trace indistinct organics.			
											5.25 to 5.55m: Minor fine micaceous sand.			
											5.5 to 6.0m: High water loss.			
											5.55m: Fine sandy SILT with some clay and trace indistinct organics; dark grey. Soft, moist, low plasticity. Sand is micaceous.			
											5.65 to 5.75m: Silty SAND. Loosely packed, moist, dilatant.			
											6.1m: Silty CLAY with trace fine micaceous sand and indistinct organics; grey speckled black. Stiff, moist, high plasticity.			
											8.9 to 9.2m: Firm.			
											9.2 to 9.8m: Soft.			
For explanation of symbols and observations, see key sheet				RELATIVE STRENGTH		WEATHERING		Date logged 8/10/2021		Driller				
FLUID DEPTHS AND DRILLING PROGRESS (m)				VS - Very strong		UW - Unweathered		Logged GS		McMillan				
Date Time Drilled Depth Casing Depth Fluid Depth				S - Strong		SW - Slightly weathered		Checked GP		Started				
06/10/2021 16:40 15.45 3.0 3.4				MS - Moderately strong		MW - Moderately weathered				6/10/2021				
07/10/2021 08:25 15.45 3.0 1.95				W - Weak		HW - Highly weathered				Finished				
07/10/2021 16:20 25.50 3.0 2.15				VW - Very weak		CW - Completely weathered				8/10/2021				
08/10/2021 08:30 25.50 3.0 3.3				EW - Extremely weak						Drill Rig				
08/10/2021 13:40 25.50 0.0 0.4										N118				
				Remarks						Core Boxes		11		
				50 mm standpipe piezometer installed upon completion.										
				Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016										
Hand Held Shear Vane														
GEOVANE1179: 19mm blade: Cal. 10/21: Correction Factor = 1.478														
vane shear strength per NZGS guideline														
Page 1 of 10														

2021 EB DRILLHOLE LOG 2021-12-21 SBS MASTER.GPJ BASE.GDT 21/12/21

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409410.83mE 796033.07mN
 Orientation -90° Elevation 8.14m
 Location SEART, Ti Rakau Dr Intersection
 Feature MSE Wall/Abutment piles

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>MS MS W VW EW</small>	Rock Weathering <small>SW MW HW CW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES <small>Subordinate MAJOR minor: colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, subordinate information, etc</small>	Instrumentation	
	Shear Vane/ SPT	SPT N Values <small>0 - 50</small>									DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>		
TAURANGA GROUP	30/6		PT						100		9.8m: Silty CLAY with trace fine micaceous sand and indistinct organics; grey speckled black. Firm, moist, high plasticity. (continued)		
	SS 1,0,0, 1,1,1, N=3		SPT						100		10.5m: Reamed 122mm PQ3 to 10.5m post drilling for piezometer installation.		
			HQ3						100		10.95 to 13.0m: Stiff.		
	62/15		SPT						100				
	SS 1,0,1, 2,2,2, N=7		HQ3						100				
			SPT						100				
	62/12		SPT						100			13.0m: Silty CLAY; light grey. Firm, moist, moderate plasticity. Interbedded with sub-horizontal thinly laminated to thinly bedded, silty fine micaceous SAND.	
	SS 1,1,2, 2,1,2, N=7		HQ3						57			14.05 to 14.48m: Damaged removing from splits.	
	UTP		SPT						100			14.48m: PEAT; dark brownish black. Very stiff, moist. Fibrous, highly decomposed wood fragments. No material or water released when squeezed. Friable.	
	SS 1,1,1, 2,2,3, N=8		HQ3						100			14.55 to 15.0m: Core Loss: Infer peat washed out.	
		SPT						100			15.0m: CLAY with some silt and trace fine micaceous sand and indistinct organics; light grey speckled black. Very stiff, moist, high plasticity.		
		HQ3						67			15.0 to 15.3m: Light brownish grey.		
		SPT						100			16.8 to 16.95m: Core Loss: Unknown.		
		HQ3						100			17.85m: CLAY with some silt and trace fine micaceous sand; light grey. Firm, moist, high plasticity.		
		SPT						76			18.7m: J, 35°, Ud, Ro		
18.7m: Highly weathered, grey, fine to coarse SANDSTONE. Extremely weak.		HQ3						98			18.7m: Silty fine to coarse SAND with minor organics; light grey speckled black. Dense, moist. Sand includes pink and grey siltstone clasts.		
19.5 to 19.91m: Fine SANDSTONE.		SPT									18.74 to 19.0m: Sub-horizontal carbonaceous laminations.		
		UTP									19.25 to 19.5m: Core Loss: Infer weak material washed away.		
		SPT									19.5 to 21.0m: Added drilling mud to help water return.		

For explanation of symbols and observations, see key sheet

FLUID DEPTHS AND DRILLING PROGRESS (m)
 Date Time Drilled Depth Casing Depth Fluid Depth

RELATIVE STRENGTH
 VS - Very strong
 S - Strong
 MS - Moderately strong
 W - Weak
 VW - Very weak
 EW - Extremely weak

WEATHERING
 UW - Unweathered
 SW - Slightly weathered
 MW - Moderately weathered
 HW - Highly weathered
 CW - Completely weathered

Date logged 8/10/2021
 Logged GS
 Checked GP

Driller McMillan
 Started 6/10/2021
 Finished 8/10/2021
 Drill Rig N118
 Core Boxes 11

Remarks
 50 mm standpipe piezometer installed upon completion.

Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016

Hand Held Shear Vane
 GEOVANE1179: 19mm blade: Cal. 10/21: Correction Factor = 1.478
 vane shear strength per NZGS guideline

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409410.83mE 796033.07mN
 Orientation -90° Elevation 8.14m
 Location SEART, Ti Rakau Dr Intersection
 Feature MSE Wall/Abutment piles

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc.)</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift	Relative Strength	Rock Weathering	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES	Instrumentation
	Shear Vane/ SPT	SPT N Values									Subordinate MAJOR minor: colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc	
<p>EAST COAST BAYS FORMATION</p> <p>19.91m: Slightly weathered, grey fine SANDSTONE. Very weak. (continued)</p> <p>20.64m: Slightly weathered, grey, fine to coarse SANDSTONE. Very weak. With subangular fine to medium gravel sized clasts, dark grey, brown, pink and orange clasts.</p> <p>20.95m: Slightly weathered, grey, fine to coarse SANDSTONE. Very weak. With a trace of dark grey fine gravel size clasts. Moderately thickly bedded.</p> <p>23.0 to 24.0m: Moderately thin, sub-horizontal beds of coarse gravel SILTSTONE clasts (<50mm). Grey and pink. 23.00 to 23.08m, 23.16 to 23.17m, 23.44 to 23.50m, 23.80 to 24.00m.</p> <p>24.0 to 25.95m: Thickly bedded.</p> <p>25.8m: Moderately weathered grey matrix supported CONGLOMERATE. Very weak. Clasts subrounded fine to coarse gravel, grey, pink and white. Matrix fine to coarse sand.</p> <p>26.34m: Slightly weathered, grey, fine to coarse SANDSTONE. Very weak. With a trace of dark grey fine gravel sized clasts. Thickly bedded.</p> <p>28.35 to 28.9m: Gently inclined moderately thickly bedded.</p> <p>28.9m: Slightly weathered grey fine to coarse SANDSTONE with some subangular fine gravel size clasts, light and dark grey. Gently inclined moderately thickly bedded.</p>	N>50	0 - 50	HQ3					100 [41]		19.91 to 20.8m: Extremely closely to closely spaced, gently inclined and sub-vertical joints and drilling breaks. Recovered as fragments, 20mm to 100mm. 20.04 to 20.31m: J, 5°, Ud, Ro, 3 no. at 20.04, 20.1 & 20.31m. 20.7 to 20.77m: J, 85°, C		
	sc 15,35 for 60mm N>50		SPT				21		96		21.14 to 21.33m: J, 45°, Ud, Ro 21.14 to 21.35m: Core damaged by drilling, closely spaced sub-horizontal and sub-vertical breaks. 21.55m: J, 5°, Ud, Ro 21.5 to 22.13m: Core broken by extremely closely to closely spaced, gently inclined and sub-vertical defects. 21.85 to 22m: J, 75°, Ud, Ro 22.07m: J, 5°, Ud, Ro	
	sc 6,44 for 65mm N>50		SPT				22		94 [37]			
				HQ3			23		99 [99]		23.22m: J, 0°, Ud, Ro 23.48m: HJ, 5° 23.64m: J, 5°, Ud, Ro	
	sc 14,36 for 30mm N>50		SPT				24		95		24.11 to 25.5m: Drilling breaks, 0°, 24.18, 24.31 & 25.18m.	
				HQ3			25		97 [97]			
				HQ3			26		100 [80]		25.21m: HJ, 10°, VN, C, Cc 25.24m: HJ, 10°, VN, C, Cc 25.95 to 26.23m: J, 5°, 3 No. 25.85 to 26.34m: Extremely to very closely spaced, gently to moderately inclined joints and drill breaks. Recovered as coarse angular gravel and fragments (<80mm). 26.11m: HJ, 10° 26.1 to 26.29m: Drilling breaks, 0° at 26.12, 26.17, 26.20 & 26.29m.	
				HQ3			27		100 [93]		26.55m: J, 30°, Ud, Ro 26.76m: HJ, 10°, VN, C, Cc, 2 No. 27.0 to 28.5m: Drilling breaks, 0° at 27.35, 27.60 and 27.63m.	
				HQ3			28		100 [81]		27.4m: HJ, 0°, VN, C, Cc 27.8m: J, 20°, Ud, Ro 28.15 to 28.35m: Extremely to closely spaced, gently inclined joints at 28.15, 28.25, 28.33 & 28.35m.	
				HQ3			29				28.37 to 28.39m: HJ, 10°, Ud, Ro, 2 No. 28.55 to 28.85m: J, 20°, Ud, Ro, 2 No. 28.65 to 29m: J, 20°, Ud, Ro, P, Cc, 2 No. 29.01 to 29.17m: HJ, 20°, C, Cc, 8 No. 29.26 to 29.32m: J, 10°, Ud, Ro, 2 No. 29.35 to 29.58m: J, 20°, Ud, Ro, 7 No. 28.5 to 30.0m: Extremely to closely to moderately widely, gently to moderately inclined joints and healed joints. Drilling breaks, 0° at 29.79, 29.82 & 29.85m. 29.8m: HJ, 0°, C, Cc, 4 No.	
<p>For explanation of symbols and observations, see key sheet</p> <p>FLUID DEPTHS AND DRILLING PROGRESS (m) Date Time Drilled Depth Casing Depth Fluid Depth</p>			<p>RELATIVE STRENGTH</p> <p>VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak</p>		<p>WEATHERING</p> <p>UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered</p>		<p>Date logged 8/10/2021</p> <p>Logged GS</p> <p>Checked GP</p>		<p>Driller McMillan</p> <p>Started 6/10/2021</p> <p>Finished 8/10/2021</p> <p>Drill Rig N118</p> <p>Core Boxes 11</p>			
<p>Hand Held Shear Vane</p> <p>GEOVANE1179: 19mm blade: Cal. 10/21: Correction Factor = 1.478</p> <p>vane shear strength per NZGS guideline</p>			<p>Remarks</p> <p>50 mm standpipe piezometer installed upon completion.</p>		<p>Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016</p>		<p>Page 3 of 10</p>					

2021 EB DRILLHOLE LOG 2021-12-21 SBS MASTER.GPJ BASE.GDT 21/12/21

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

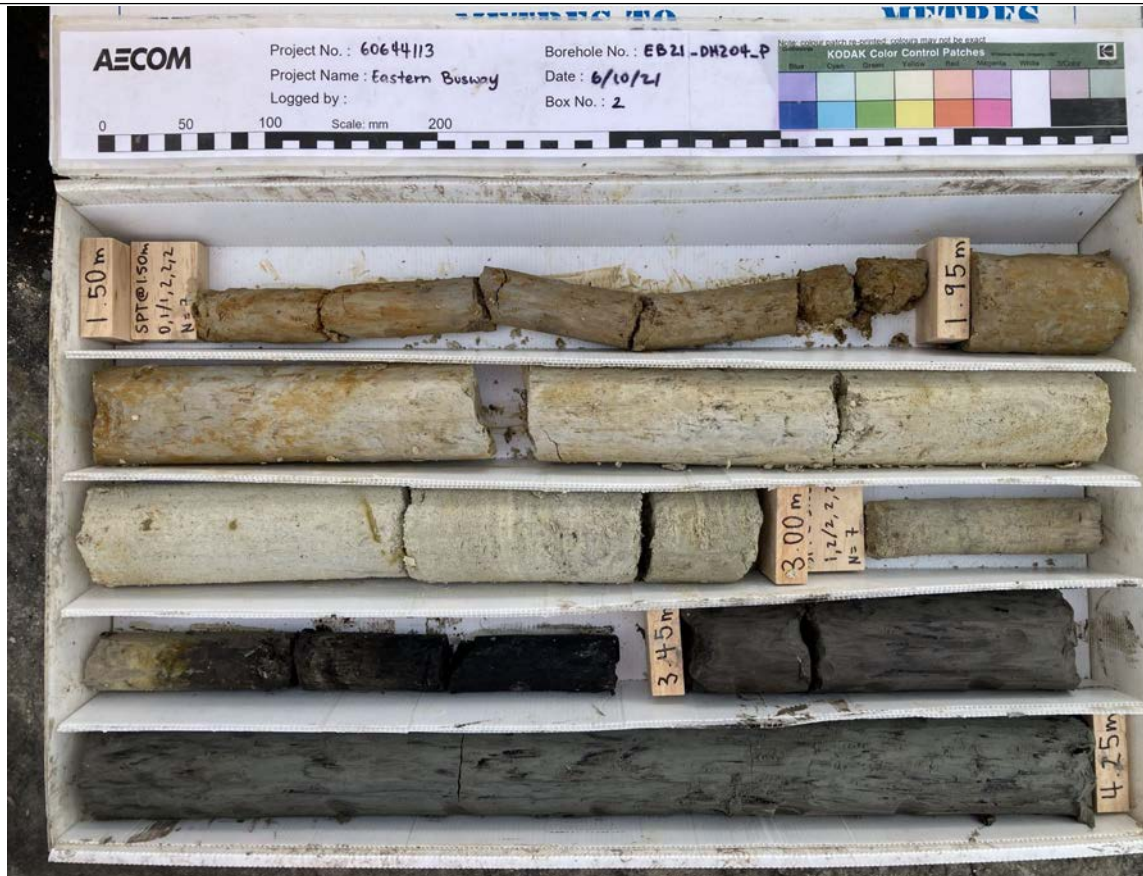
Co-ordinates 409410.83mE 796033.07mN
 Orientation -90° Elevation 8.14m
 Location SEART, Ti Rakau Dr Intersection
 Feature MSE Wall/Abutment piles

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records Shear Vane/ SPT SPT N Values 0 - 50	Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>VS MS W VW EW</small>	Rock Weathering <small>SW MW HW CW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects <small>0 50 100 150 200</small>	SOIL PROPERTIES <small>Subordinate MAJOR minor: colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation
										DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>	
	sc 40,10 for 5mm N>50	SPT				31 32 33 34 35 36 37 38 39		0		DH204_P terminated at 30.13m Depth Criteria Achieved	
<i>For explanation of symbols and observations, see key sheet</i> FLUID DEPTHS AND DRILLING PROGRESS (m) Date Time Drilled Depth Casing Depth Fluid Depth		RELATIVE STRENGTH VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak		WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered		Date logged 8/10/2021 Logged GS Checked GP		Driller McMillan Started 6/10/2021 Finished 8/10/2021 Drill Rig N118 Core Boxes 11			
Hand Held Shear Vane GEOVANE1179: 19mm blade: Cal. 10/21: Correction Factor = 1.478 <i>vane shear strength per NZGS guideline</i>		Remarks 50 mm standpipe piezometer installed upon completion. Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016		Page 4 of 10							

2021 EB DRILLHOLE LOG 2021-12-21 SBS MASTER.GPJ BASE.GDT 21/12/21



Box: 1 of 11 - Depth: 00.00m to 01.50m of 30.13m
 Date Drilled 6/10/2021 to 8/10/2021



Box: 2 of 11 - Depth: 01.50m to 04.25m of 30.13m
 Date Drilled 6/10/2021 to 8/10/2021



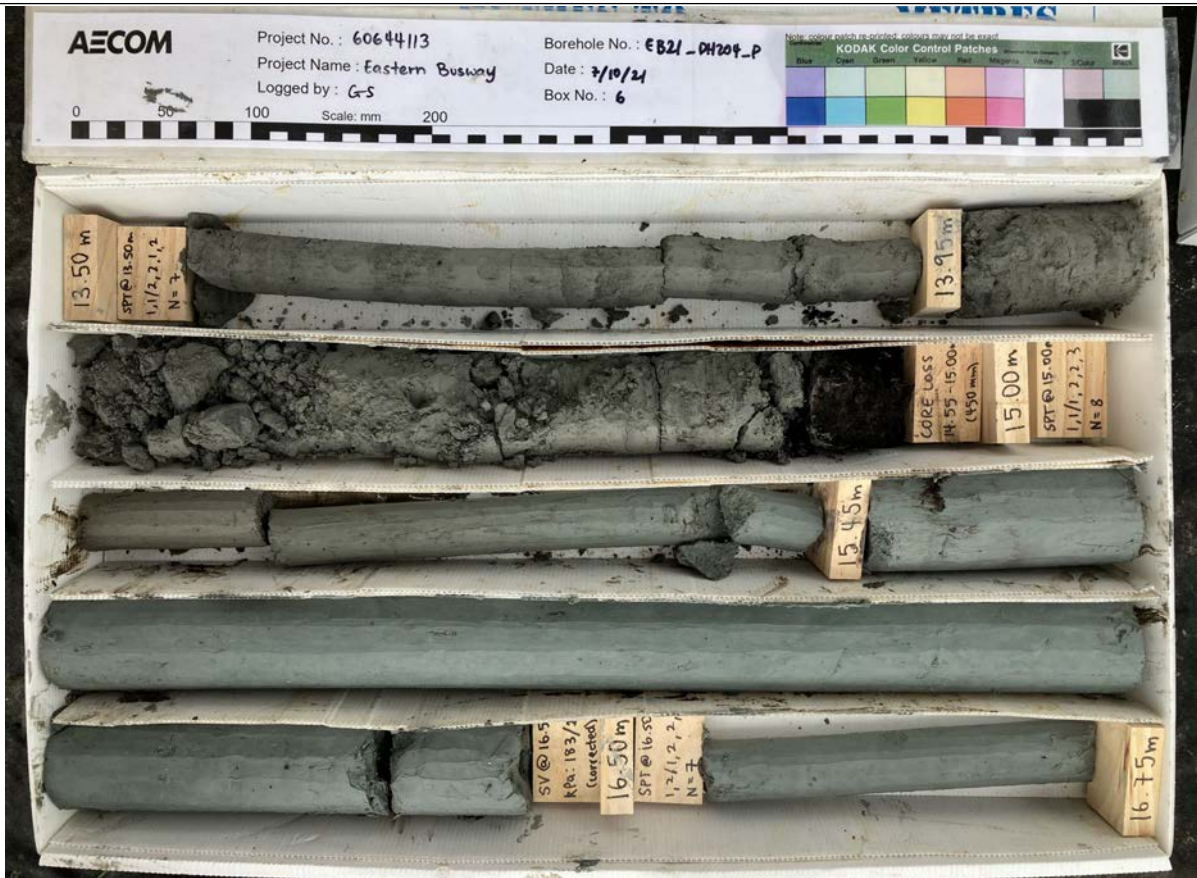
Box: 3 of 11 - Depth: 04.25m to 07.50m of 30.13m
 Date Drilled 6/10/2021 to 8/10/2021



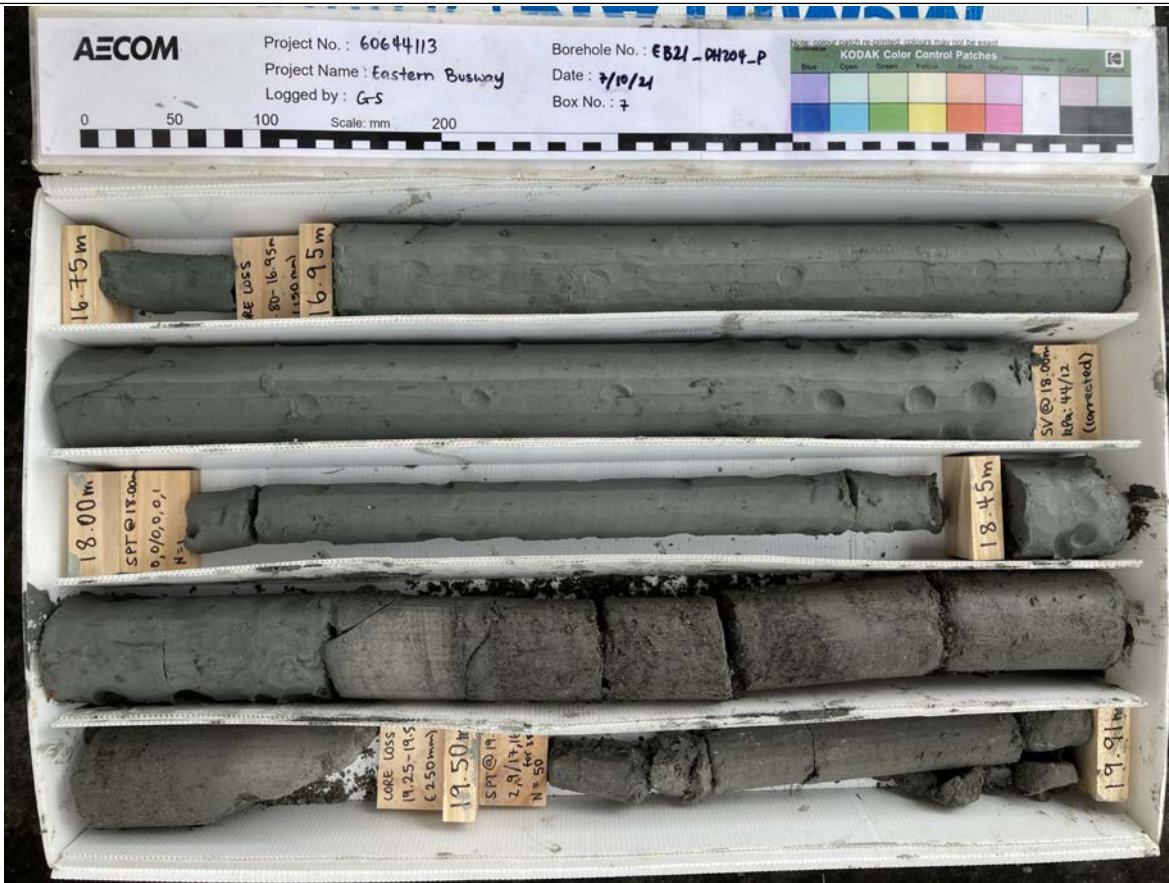
Box: 4 of 11 - Depth: 07.50m to 10.65m of 30.13m
 Date Drilled 6/10/2021 to 8/10/2021



Box: 5 of 11 - Depth: 10.65m to 13.50m of 30.13m
 Date Drilled 6/10/2021 to 8/10/2021



Box: 6 of 11 - Depth: 13.50m to 16.75m of 30.13m
 Date Drilled 6/10/2021 to 8/10/2021



Box: 7 of 11 - Depth: 16.75m to 19.91m of 30.13m
 Date Drilled 6/10/2021 to 8/10/2021



Box: 8 of 11 - Depth: 19.91m to 22.64m of 30.13m
 Date Drilled 6/10/2021 to 8/10/2021



Box: 9 of 11 - Depth: 22.64m to 25.50m of 30.13m
 Date Drilled 6/10/2021 to 8/10/2021



Box: 10 of 11 - Depth: 25.50m to 28.15m of 30.13m
 Date Drilled 6/10/2021 to 8/10/2021

PHOTOGRAPHIC LOG OF DRILLHOLE

Project Eastern Busway
Location SEART, Ti Rakau Dr Intersection

HOLE IDENTIFICATION	DH204_P
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Box: 11 of 11 - Depth: 28.15m to 30.13m of 30.13m
Date Drilled 6/10/2021 to 8/10/2021

TERMINOLOGY AND SYMBOLS

Drilling / Investigation Methods

CFHSA	- Continuous Flight Hollow Stem Auger.
CFSSA	- Continuous Flight Solid Stem Auger.
DC	- Dynamic Coring (eg Terrier Rig).
DCP	- Dynamic Cone Penetrometer.
HA	- Hand Auger.
HQ3	- HQ Triple Tube.
HQWL	- HQ Wire Line.
HWOB	- Heavy Weight Open Barrel.
NQ3	- NQ Triple Tube.
NQWL	- NQ Wire Line.
OB	- 100mm diameter Open Barrel.
OB70	- 70mm diameter Open Barrel.
PERC	- Percussion.
PS	- Piston Sample.
PQ3	- PQ Triple Tube.
PQWL	- PQ Wire Line.
RC	- Reverse Circulation.
RCDHH	- Reverse Circulation Down Hole Hammer.
SPT	- Standard Penetration Test.
SPERC	- Sonic Percussion.
PT	- Push Tube Sample
VAC EX	- Vacuum Excavation.
WASH	- Wash Drilling.

Test Results

SPT "N" value; uncorrected blow count for 300 mm penetration
 # / # / # / # / # / # blows per 75 mm penetration

ss - Standard Penetration Test - split spoon
 sc - Standard Penetration Test - solid cone (no sample recovery)
 SUOW - Sunk Under Own Weight

Vane Shear Strength Tests

/ # Vane shear strength test results given as peak / remoulded shear strengths (kPa). Test as per NZGS Guideline, 2001.

= Vane test performed on core recovered prior to extrusion from core barrel.
 * = Vane test performed on excavated material of suitable size.

UTP - Unable to penetrate.

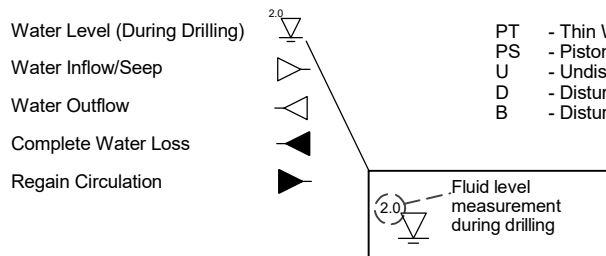
Unit/Geological Boundary Lines

———— Known
 - - - - - Inferred/Unknown

Installation & Backfill

Standpipe		Grout	
Slotted Standpipe		Cement	
Collapse/Cuttings /Spoil		Gravel Pack Filter	
Bentonite		Sand Pack Filter	
Inclinometer		Gravel Backfill	

Groundwater Records



Samples

PT	- Thin Wall Push Sample
PS	- Piston Sample
U	- Undisturbed
D	- Disturbed (Core)
B	- Disturbed (Pit)

Rock Descriptions

Relative Strength

ES	- Extremely strong	> 250
VS	- Very Strong	100 - 250
S	- Strong	50 - 100
MS	- Moderately Strong	20 - 50
W	- Weak	5 - 20
VW	- Very Weak	1 - 5
EW	- Extremely Weak	< 1

Weathering

UW	- Unweathered
SW	- Slightly Weathered
MW	- Moderately Weathered
HW	- Highly Weathered
CW	- Completely Weathered

Soil Descriptions

Consistency Cohesive Soils

Very Soft	Su (kPa) < 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	200 - 500

Relative Density Non-cohesive soils

Very Loose	SPT "N" Value (uncorrected) < 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

Rock Defect Abbreviations

Defect Type

BP	= Bedding Plane Defect
CZ	= Crush Zone
DB	= Drilling Break
FZ	= Fracture Zone
HJ	= Healed Joint
J	= Joint
SZ	= Shear Zone
Ve	= Vein

Defect Aperture

T	= Tight (Nil)
VN	= Very Narrow (>0-2mm)
N	= Narrow (2-6mm)
MN	= Moderately Narrow (6-20mm)
MW	= Moderately Wide (20-60mm)
W	= Wide (60-200mm)
VW	= Very Wide (>200mm)

Defect Roughness

Pl	= Planar
St	= Stepped
Ud	= Undulating
Ro	= Rough
Sm	= Smooth
Slk	= Slickensided
	= Parallel
Po	= Polished

Infill Thickness

Sn	= Stained
Vn	= Veneer (<0.5mm)
Cg	= Coating
P	= Partially infilled
C	= Completely infilled

Infill Colour

bl	= Blue
bn	= Brown
bk	= Black
gn	= Green
gy	= Grey
or	= Orange
pk	= Pink
rd	= Red
wh	= White
ye	= Yellow

Infill Material

Calc	= Calcareous
Cb	= Carbonaceous
Cc	= Calcite
Cl	= Clay
Fe	= Iron Oxide
Mn	= Manganese
NF	= No Infill
Py	= Pyrite
Qtz	= Quartz
S	= Sand
Slt	= Silt

Graphic Log (typical symbols)

	Peat		Mudstone
	Clay		Siltstone
	Silt		Sandstone
	Sand		Basalt
	Gravel / Cobbles		No recovery
	Welded Tuff		

Core Measurements

TCR	= Total Core Recovery
RQD	= Rock Quality Designation

Soil and rock descriptions generally as in "Guidelines for the Field Description of Soil and Rock for Engineering Purposes" by the NZ Geotechnical Society Inc, December 2005.

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409468.12mE 796009.94mN
 Orientation -90° Elevation 7.68m
 Location Berm, SEART SB
 Feature MSE Abutment Wall

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0-100%</small>	Relative Strength <small>MS MS W VW</small>	Rock Weathering <small>SW MW HW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm) <small>400 300 200 100 0</small>	SOIL PROPERTIES <small>Subordinate MAJOR minor: colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation
	Shear Vane/ SPT	SPT N Values <small>0 - 50</small>									DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>	
0.0m: TOPSOIL.											0.0m: Sandy SILT; dark brown. Soft, dry, low plasticity.	
0.2m: FILL comprising silty clay, sand and gravel.			HA				1	[Cross-hatched pattern]	100		0.2m: Silty CLAY with some fine to coarse sand and minor fine to medium subangular gravel; light brown and grey. Stiff, moist, high plasticity.	0.53
1.95m: ALLUVIUM comprising clay with sand and silt, organic clay and peat.	ss 0,0,2 2,2,2 N=8		SPT				2	[Horizontal line pattern]	100		1.95m: Fine sandy CLAY with some silt; light grey. Stiff, moist, high plasticity.	1.5
	104/27 0,0,1 1,1,1 N=4		SPT				3	[Horizontal line pattern]	100		2.6m: Organic CLAY; black. Stiff, moist, high plasticity.	1.6
	63/19		HQ3				4	[Horizontal line pattern]	100		3.25m: Fine micaceous sandy CLAY with some silt and minor organics; bluish grey. Firm, moist, high plasticity.	2.05
			HQ3				5	[Horizontal line pattern]	100			
	ss 0,1,0 1,1,1 N=3		SPT				6	[Horizontal line pattern]	100			
	47/9 ss 0,0,0 1,0,1 N=2		SPT				7	[Horizontal line pattern]	100			
	33/6		PT				8	[Horizontal line pattern]	100			
	ss 0,1,0 1,0,1 N=2		SPT				9	[Horizontal line pattern]	100			
	ss 0,1,0 1,1,1 N=3		SPT				9	[Horizontal line pattern]	100			6.45m: Silty CLAY with minor fine micaceous sand; bluish grey. Firm, moist, high plasticity.
		HQ3				9	[Horizontal line pattern]	100			9.0 to 13.0m: Stiff.	

2021 EB DRILLHOLE LOG 2022-01-24 SBS MASTER.GPJ BASE.GDT 24/01/22

For explanation of symbols and observations, see key sheet

FLUID DEPTHS AND DRILLING PROGRESS (m)			
Date Time	Drilled Depth	Casing Depth	Fluid Depth
01/11/2021 15:30	09.45	-	2.1
02/11/2021 09:30	09.45	-	0.53
02/11/2021 15:00	19.50	-	1.7
03/11/2021 09:10	19.50	-	1.65
05/11/2021 09:15	20.60	-	1.76
05/11/2021 12:40	24.00	-	2.05
24/11/2021 14:00	28.00	-	1.5

Hand Held Shear Vane
 DR2272: 19mm blade: Correction Factor = 1.572
 vane shear strength per NZGS guideline

RELATIVE STRENGTH	WEATHERING	Date logged	Driller
VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak	UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	25/11/2021	McMillan
Remarks 50 mm standpipe piezometer installed upon completion of drilling. Piezometer developed by air lift.		Logged SK Checked GP	Started 1/11/2021 Finished 24/11/2021 Drill Rig N118 Core Boxes 11
Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016			Page 1 of 9

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409468.12mE 796009.94mN
 Orientation -90° Elevation 7.68m
 Location Berm, SEART SB
 Feature MSE Abutment Wall

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records <small>Shear Vane/ SPT SPT N Values 0 - 50</small>	Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>MS VS W VW EW</small>	Rock Weathering <small>SW MW HW CW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES <small>Subordinate MAJOR minor: colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation
										DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>	
TAURANGA GROUP	93/17 SS 1,1,1, 1,2,2 N=6	HQ3				11		100		6.45m: Silty CLAY with minor fine micaceous sand; bluish grey. Firm, moist, high plasticity. (continued)	
		SPT						100			
		HQ3				12		100			
	SS 1,2,2, 3,4,5 N=14	SPT						100			
		HQ3				13		100			
		HQ3				14		100			
		PT						100			
		HQ3				15		100			
	SS 55/8 2,2,3, 2,4,3 N=12	SPT						100			
		HQ3				16		100			
	HQ3				17		100				
	SPT						100				
	HQ3				18		100 [48]		17.55m: DB, 0° 17.75 to 17.81m: J, 60°, St, Sm 18.0 to 18.09m: J, 70°, Ud, Ro 18.17 to 18.54m: J, 70°, Ud, Sm, VN, NF 18.27m: DB, 0° 18.54 to 19.36m: Core broken into coarse gravel and cobble sized fragments by several sub-vertical and closely spaced sub-horizontal joints, undulose rough. 19.37m: J, 30°, Ud, Sm 19.5 to 20.14m: Recovered as coarse gravel, drilling issues.		
	SPT						100				
	HQ3				19		100 [42]				
EAST COAST BAYS FORMATION	sc 45.5 for 5mm N>50	SPT						100			
		HQ3						100			
	sc 11,13,20, 30 for 10mm	SPT						100			

For explanation of symbols and observations, see key sheet

FLUID DEPTHS AND DRILLING PROGRESS (m)
 Date Time Drilled Depth Casing Depth Fluid Depth

RELATIVE STRENGTH
 VS - Very strong
 S - Strong
 MS - Moderately strong
 W - Weak
 VW - Very weak
 EW - Extremely weak

WEATHERING
 UW - Unweathered
 SW - Slightly weathered
 MW - Moderately weathered
 HW - Highly weathered
 CW - Completely weathered

Date logged 25/11/2021
 Logged SK
 Checked GP

Driller McMillan
 Started 1/11/2021
 Finished 24/11/2021
 Drill Rig N118
 Core Boxes 11

Remarks
 50 mm standpipe piezometer installed upon completion of drilling. Piezometer developed by air lift.

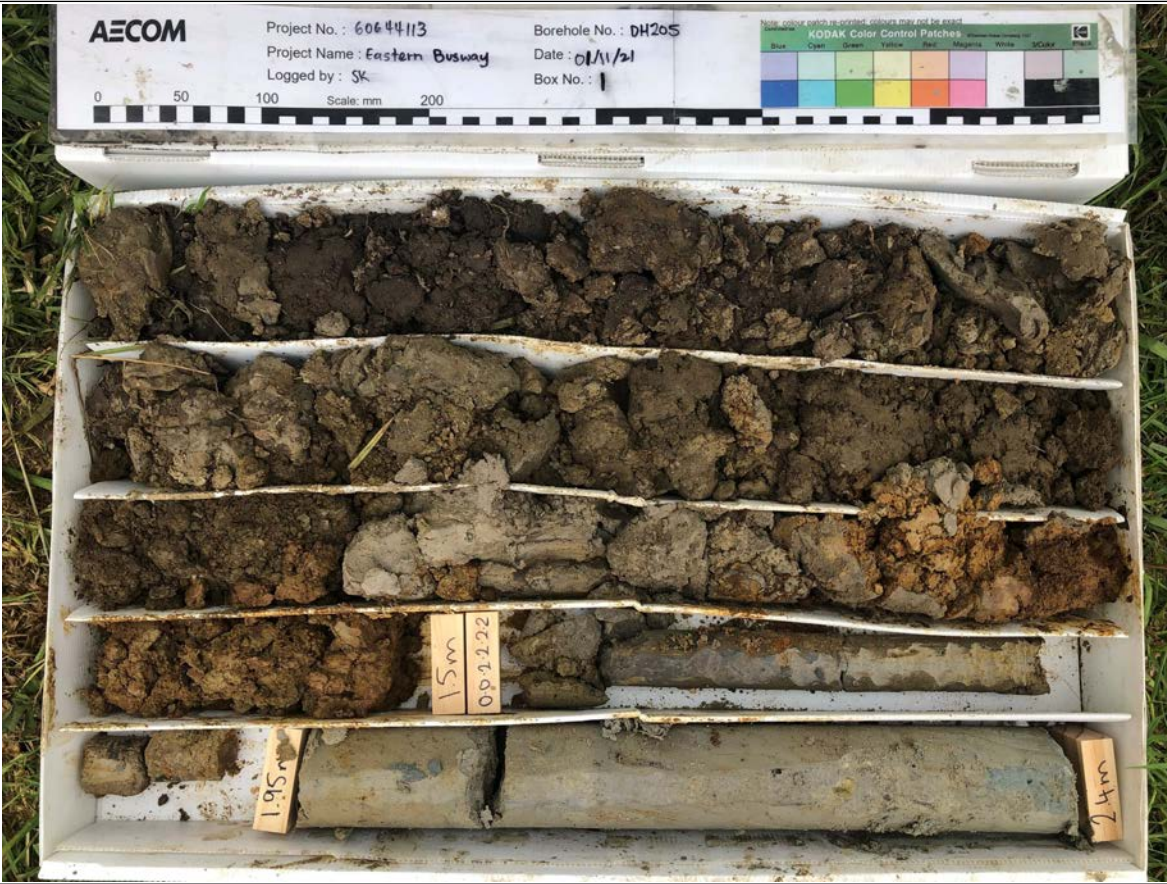
Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016

Hand Held Shear Vane
 DR2272: 19mm blade: Correction Factor = 1.572
 vane shear strength per NZGS guideline

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409468.12mE 796009.94mN
 Orientation -90° Elevation 7.68m
 Location Berm, SEART SB
 Feature MSE Abutment Wall

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME, Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc.)</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift	Relative Strength	Rock Weathering	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES	Instrumentation
	Shear Vane/ SPT	SPT N Values									Subordinate MAJOR minor: colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, subordinate information, etc	
<p>17.5m: Slightly weathered, grey, volcaniclastic fine to coarse SANDSTONE. Moderately strong. Containing subrounded and subangular fine gravel, light grey, dark grey and red. Very thickly bedded. (continued)</p> <p>21.0 to 21.24m: Fine SANDSTONE, light grey.</p> <p>22.0 to 22.25m: Apparent channel of fine sandstone.</p> <p>22.85 to 22.9m: Fining downwards at base of bed.</p> <p>22.9m: Slightly weathered, grey, fine to medium SANDSTONE. Weak.</p> <p>24.0m: Slightly weathered, grey, SILTSTONE. Very weak. 24.06 to 24.11m: Sandstone. 24.25 to 24.44m: Fine to medium SANDSTONE.</p> <p>25.2m: Slightly weathered, grey, fine to medium SANDSTONE. Weak.</p> <p>25.65m: Slightly weathered, grey, SILTSTONE. Very weak.</p> <p>26.0m: Slightly weathered, grey, fine to medium SANDSTONE. Extremely weak, weakly cemented.</p>	N>50	0 - 50	HQ3				21	99 [99]		20.28 to 20.6m: J, 70°, Ud, Sm 20.6 to 20.74m: J, 70°, Ud, Sm, VN, C, Cc, & Ve, 85°, Ud, Cc 20.81m: DB, 0° 20.86 to 21m: J, 65°, Ud, Sm, N, C, Cc, Joint defines base of sandstone bed 21.16 to 21.33m: J, 70°, Ud, Sm 21.51m: DB, 0°		
				HQ3				22	100 [100]			22.25m: DB, 0° 22.5 to 22.8m: Core Loss.
				HQ3				23	100 [89]			22.8 to 22.86m: J, 60°, Ud, Sm 22.88 to 22.96m: J, 70°, Ud, Sm 22.96m: DB, 0° 23.15 to 23.2m: Recovered as siltstone gravel.
		sc 21,29 for 35mm N>50		SPT				24	0			23.95m: DB, 0° 24.11 to 24.88m: Drilling Breaks: 0°, at 24.11, 24.23, 24.37, 24.42 & 24.88m.
				HQ3				25	100 [100]			24.77m: J, 5°, Ud, Ro
				HQ3				26	100 [67]			25.29 to 26.15m: Drilling Breaks: 0°, at 25.29, 25.36, 25.4, 25.47, 26.1 & 26.15m.
				HQ3				27	100 [0]			26.0m: Silty fine to medium SAND; grey.
<p>DH205_P terminated at 28.0m Depth Criteria Achieved</p>												
<p>For explanation of symbols and observations, see key sheet</p>					<p>RELATIVE STRENGTH</p> <p>VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak</p>		<p>WEATHERING</p> <p>UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered</p>		<p>Date logged 25/11/2021 Logged SK Checked GP</p>		<p>Driller McMillan Started 1/11/2021 Finished 24/11/2021 Drill Rig N118 Core Boxes 11</p>	
<p>FLUID DEPTHS AND DRILLING PROGRESS (m)</p> <p>Date Time Drilled Depth Casing Depth Fluid Depth</p>					<p>Remarks</p> <p>50 mm standpipe piezometer installed upon completion of drilling. Piezometer developed by air lift.</p>							
<p>Hand Held Shear Vane DR2272: 19mm blade: Correction Factor = 1.572 vane shear strength per NZGS guideline</p>					<p>Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016</p>							
<p>2021 EB DRILLHOLE LOG 2022-01-24 SBS MASTER.GPJ BASE.GDT 24/01/22</p>											<p>Page 3 of 9</p>	



Box: 1 of 11 - Depth: 00.00m to 02.40m of 28.00m

Date Drilled 1/11/2021 to 24/11/2021 - Date Photographed: 1/11/2021

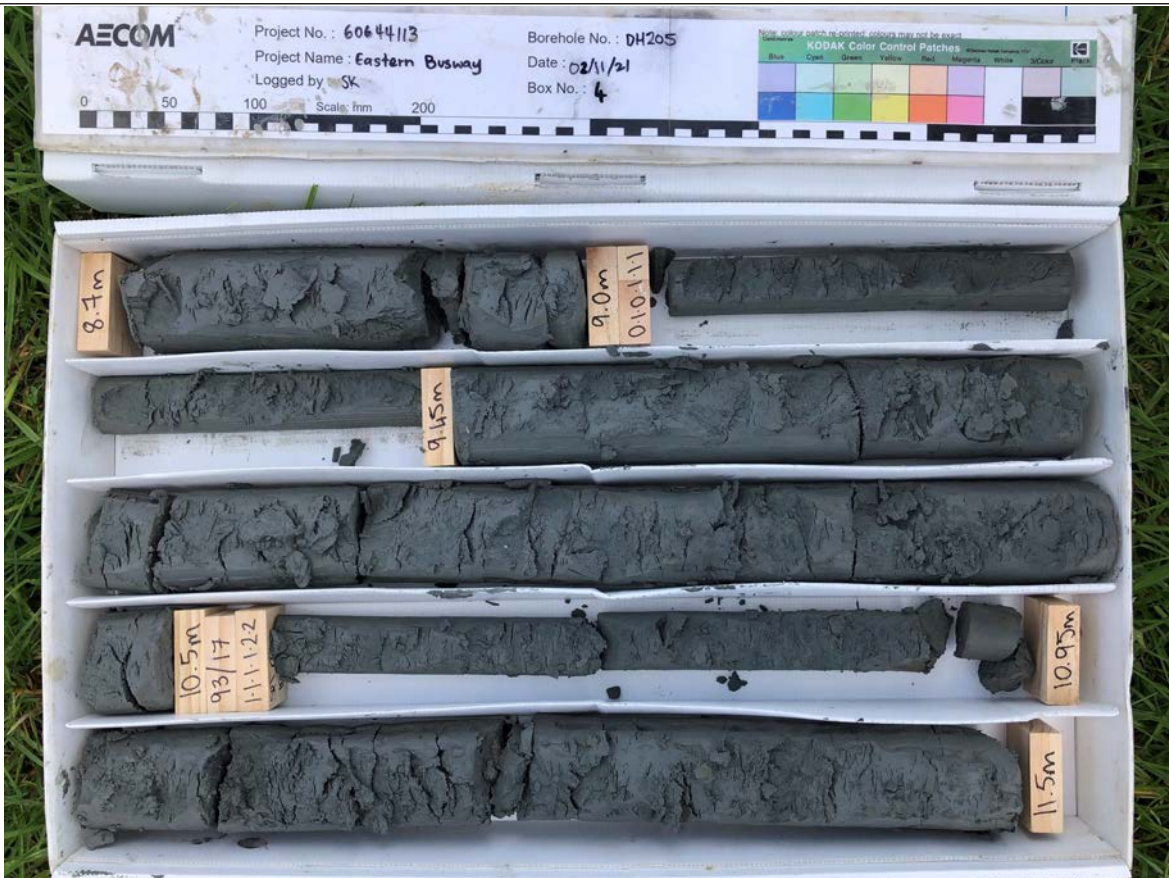


Box: 2 of 11 - Depth: 02.40m to 05.60m of 28.00m

Date Drilled 1/11/2021 to 24/11/2021 - Date Photographed: 1/11/2021



Box: 3 of 11 - Depth: 05.60m to 08.70m of 28.00m
 Date Drilled 1/11/2021 to 24/11/2021 - Date Photographed: 1/11/2021



Box: 4 of 11 - Depth: 08.70m to 11.50m of 28.00m
 Date Drilled 1/11/2021 to 24/11/2021 - Date Photographed: 2/11/2021



Box: 5 of 11 - Depth: 11.50m to 14.70m of 28.00m
 Date Drilled 1/11/2021 to 24/11/2021 - Date Photographed: 2/11/2021



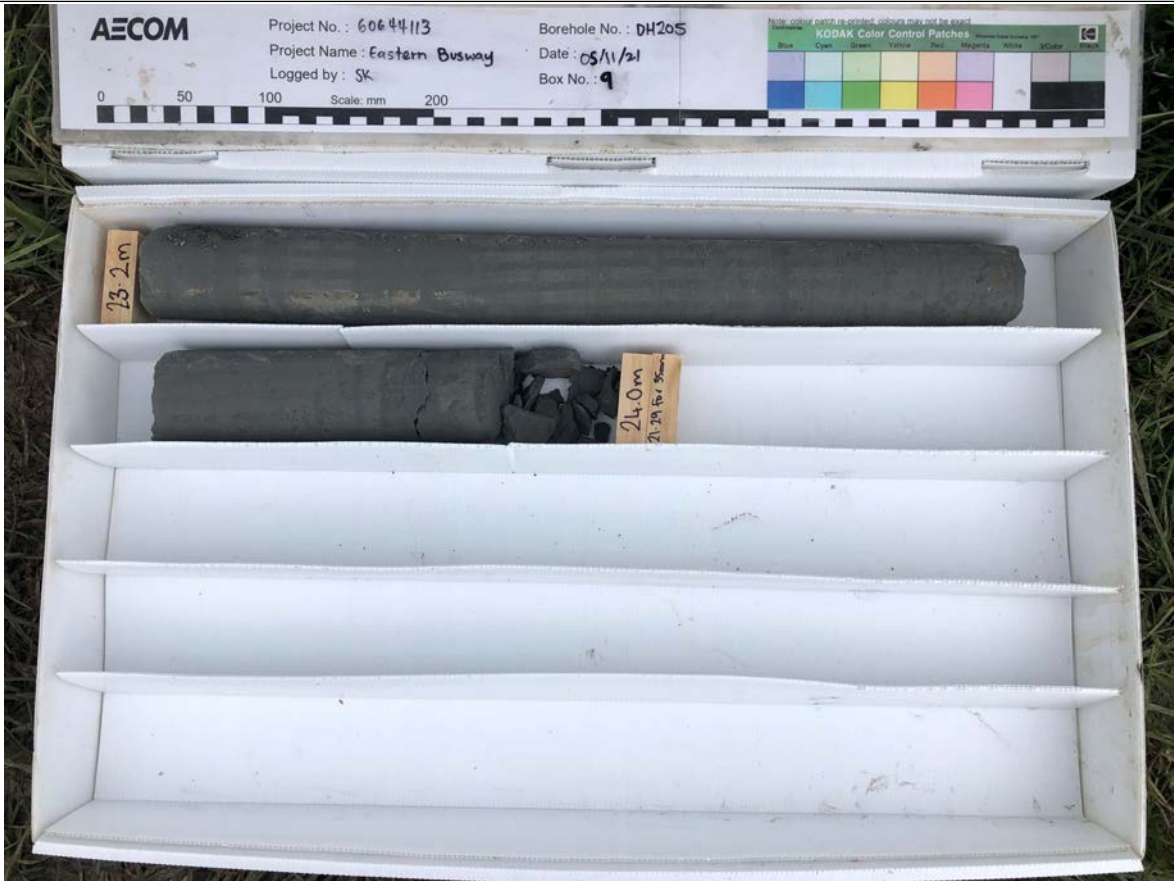
Box: 6 of 11 - Depth: 14.70m to 17.40m of 28.00m
 Date Drilled 1/11/2021 to 24/11/2021 - Date Photographed: 2/11/2021



Box: 7 of 11 - Depth: 17.40m to 20.60m of 28.00m
 Date Drilled 1/11/2021 to 24/11/2021 - Date Photographed: 3/11/2021



Box: 8 of 11 - Depth: 20.60m to 23.20m of 28.00m
 Date Drilled 1/11/2021 to 24/11/2021 - Date Photographed: 5/11/2021



Box: 9 of 11 - Depth: 23.20m to 24.00m of 28.00m
 Date Drilled 1/11/2021 to 24/11/2021 - Date Photographed: 5/11/2021



Box: 10 of 11 - Depth: 24.00m to 26.10m of 28.00m
 Date Drilled 1/11/2021 to 24/11/2021 - Date Photographed: 24/11/2021

Project Eastern Busway

Location Berm, SEART SB

HOLE IDENTIFICATION

DH205_P



Box: 11 of 11 - Depth: 26.10m to 28.00m of 28.00m

Date Drilled 1/11/2021 to 24/11/2021 - Date Photographed: 24/11/2021

TERMINOLOGY AND SYMBOLS

Drilling / Investigation Methods

CFHSA	- Continuous Flight Hollow Stem Auger.
CFSSA	- Continuous Flight Solid Stem Auger.
DC	- Dynamic Coring (eg Terrier Rig).
DCP	- Dynamic Cone Penetrometer.
HA	- Hand Auger.
HQ3	- HQ Triple Tube.
HQWL	- HQ Wire Line.
HWOB	- Heavy Weight Open Barrel.
NQ3	- NQ Triple Tube.
NQWL	- NQ Wire Line.
OB	- 100mm diameter Open Barrel.
OB70	- 70mm diameter Open Barrel.
PERC	- Percussion.
PS	- Piston Sample.
PQ3	- PQ Triple Tube.
PQWL	- PQ Wire Line.
RC	- Reverse Circulation.
RCDHH	- Reverse Circulation Down Hole Hammer.
SPT	- Standard Penetration Test.
SPERC	- Sonic Percussion.
PT	- Push Tube Sample
VAC EX	- Vacuum Excavation.
WASH	- Wash Drilling.

Test Results

SPT "N" value; uncorrected blow count for 300 mm penetration
 # / # / # / # / # / # blows per 75 mm penetration

ss - Standard Penetration Test - split spoon
 sc - Standard Penetration Test - solid cone (no sample recovery)
 SUOW - Sunk Under Own Weight

Vane Shear Strength Tests

/ # Vane shear strength test results given as peak / remoulded shear strengths (kPa). Test as per NZGS Guideline, 2001.

= Vane test performed on core recovered prior to extrusion from core barrel.
 * = Vane test performed on excavated material of suitable size.

UTP - Unable to penetrate.

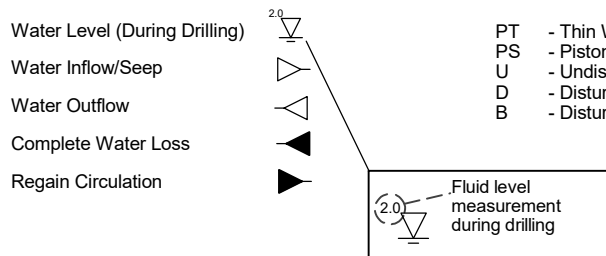
Unit/Geological Boundary Lines

———— Known
 - - - - Inferred/Unknown

Installation & Backfill

Standpipe		Grout	
Slotted Standpipe		Cement	
Collapse/Cuttings /Spoil		Gravel Pack Filter	
Bentonite		Sand Pack Filter	
Inclinometer		Gravel Backfill	

Groundwater Records



Samples

PT	- Thin Wall Push Sample
PS	- Piston Sample
U	- Undisturbed
D	- Disturbed (Core)
B	- Disturbed (Pit)

Rock Descriptions

Relative Strength

ES	- Extremely strong	> 250
VS	- Very Strong	100 - 250
S	- Strong	50 - 100
MS	- Moderately Strong	20 - 50
W	- Weak	5 - 20
VW	- Very Weak	1 - 5
EW	- Extremely Weak	< 1

Weathering

UW	- Unweathered
SW	- Slightly Weathered
MW	- Moderately Weathered
HW	- Highly Weathered
CW	- Completely Weathered

Soil Descriptions

Consistency Cohesive Soils

Very Soft	Su (kPa) < 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	200 - 500

Relative Density Non-cohesive soils

Very Loose	SPT "N" Value (uncorrected) < 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

Rock Defect Abbreviations

Defect Type

BP	= Bedding Plane Defect
CZ	= Crush Zone
DB	= Drilling Break
FZ	= Fracture Zone
HJ	= Healed Joint
J	= Joint
SZ	= Shear Zone
Ve	= Vein

Defect Aperture

T	= Tight (Nil)
VN	= Very Narrow (>0-2mm)
N	= Narrow (2-6mm)
MN	= Moderately Narrow (6-20mm)
MW	= Moderately Wide (20-60mm)
W	= Wide (60-200mm)
VW	= Very Wide (>200mm)

Defect Roughness

Pl	= Planar
St	= Stepped
Ud	= Undulating
Ro	= Rough
Sm	= Smooth
Slk	= Slickensided
	= Parallel
Po	= Polished

Infill Thickness

Sn	= Stained
Vn	= Veneer (<0.5mm)
Cg	= Coating
P	= Partially infilled
C	= Completely infilled

Infill Colour

bl	= Blue
bn	= Brown
bk	= Black
gn	= Green
gy	= Grey
or	= Orange
pk	= Pink
rd	= Red
wh	= White
ye	= Yellow

Infill Material

Calc	= Calcareous
Cb	= Carbonaceous
Cc	= Calcite
Cl	= Clay
Fe	= Iron Oxide
Mn	= Manganese
NF	= No Infill
Py	= Pyrite
Qtz	= Quartz
S	= Sand
Slt	= Silt

Graphic Log (typical symbols)

	Peat		Mudstone
	Clay		Siltstone
	Silt		Sandstone
	Sand		Basalt
	Gravel / Cobbles		No recovery
	Welded Tuff		

Core Measurements

TCR	= Total Core Recovery
RQD	= Rock Quality Designation

Soil and rock descriptions generally as in "Guidelines for the Field Description of Soil and Rock for Engineering Purposes" by the NZ Geotechnical Society Inc, December 2005.

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409737.34mE 796330.84mN
 Orientation -90° Elevation 11.82m
 Location 19 Williams Roberts Rd
 Feature Reeves Rd Flyover Pier

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0-100%</small>	Relative Strength <small>MS, S, W, VW, EW</small>	Rock Weathering <small>SW, MW, HW, CW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES <small>Subordinate MAJOR minor: colour, structure. Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation	
	Shear Vane/ SPT	SPT N Values <small>0 - 50</small>									DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>		
FILL 0.0m: ASPHALT. 0.2m: FILL comprising gravel and clay.			VAC EX				0				0.0m: ASPHALT. 0.2m: Sandy fine to coarse GRAVEL with some cobbles. Gravel comprises sandstone [Greywacke], basalt and concrete with basalt cobbles. 0.7m: Silty CLAY with minor fine sand; grey. Very stiff, moist, high plasticity.		
		SS 0.1,1, 2,3,2 N=8	SPT				100				1.5 to 1.55m: Dark grey, soft. 1.55 to 3.1m: Trace decomposed wood, light brownish grey mottled orange, firm	0.7	
TAURANGA GROUP 3.1m: ALLUVIUM comprising clay, peat and sand.		46/3 2,5,9, 11,13,10 N=43	HWT SPT				100				3.0m: 114mm diameter, HWT casing to 3.0m depth. 3.1m: Silty fine SAND with trace clay; light grey. Medium dense, moist, uniformly graded. Pumice sand. 3.45 to 3.55m: Clay ceases, dilatant behaviour.	2.2 2.3 2.65	
			HQ3				100				3.6m: Organic CLAY with flecks of decomposed wood; dark brown. Soft, moist, high plasticity. Extremely sticky.		
		25 SS 0,0,1, 1,2,1 N=5	SPT				100						
			PT				100						
			HQ3				100						
		57/6 SS 0,0,0, 0,1,1 N=2	SPT				100					5.45m: Bottom of push tube has trace fine sand. 5.6 to 6.45m: Brownish grey streaked dark brown.	4.8
			HQ3				100					6.45m: CLAY with trace silt and organics; bluish grey. Stiff, moist, high plasticity. Organics are decomposed wood streaks. Gradational change from 6.45-6.65 m. 6.45 to 6.65m: Gradational change from 6.45-6.65m.	
	UTP SS 3,3,4, 4,4,4 N=16	SPT				100							
		HQ3				100							
	60/13 SS 0,1,0, 1,1,1 N=3	SPT				100					9.25 to 9.45m: Increased organic content to minor.		

For explanation of symbols and observations, see key sheet

FLUID DEPTHS AND DRILLING PROGRESS (m)			
Date Time	Drilled Depth	Casing Depth	Fluid Depth
06/08/2021 14:30	06.45	-	0.7
09/08/2021 08:30	06.45	-	2.2
09/08/2021 16:30	22.50	-	4.8
10/08/2021 08:30	22.50	-	2.4
10/08/2021 16:50	33.00	-	2.3
11/08/2021 08:30	33.00	-	2.65

Hand Held Shear Vane
 DR2272: 19mm blade: Correction Factor = 1.572
 vane shear strength per NZGS guideline

RELATIVE STRENGTH	WEATHERING	Date logged	Driller
VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak	UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	10/08/2021 Logged SK Checked GP	McMillan Started 6/08/2021 Finished 10/08/2021 Drill Rig N119 Core Boxes 12
Remarks 50 mm standpipe piezometer installed upon completion of drilling. Piezometer developed by air lift.			
Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016			
			Page 1 of 10

Client Auckland Transport
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										DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>	
TAURANGA GROUP	66/14 SS 0,0,0, 1,1,0 N=2	HQ3				11		100		6.45m: CLAY with trace silt and organics; bluish grey. Stiff, moist, high plasticity. Organics are decomposed wood streaks. Gradational change from 6.45-6.65 m. (continued)	[Pattern]
		SPT						100			
		HQ3						100			
	108/11 SS 0,0,0, 1,1,0 N=2	SPT				12		100		11.7 to 11.9m: Drilling disturbed. 11.9 to 12.1m: Very stiff.	
		PT						100			
		HQ3						100			
	50/13 SS 0,1,0, 2,1,2 N=5	SPT				14		100			
		HQ3						100			
	52/6 SS 0,0,0, 2,1,1 N=4	SPT				15		100		15.0 to 17.5m: With some fine micaceous sand lenses ~8 mm thick and ~5 mm apart.	
		HQ3						100			
UTP/0 SS 2,1,1, 2,1,2 N=6	SPT				17		100		17.3m: Spongy PEAT; dark brown. Firm, moist, high plasticity.		
	HQ3						100				
91/16 SS 0,1,1, 2,2,4 N=9	SPT				18		100		18.15m: CLAY with trace silt and organics; bluish grey. Stiff, moist, high plasticity. Organics are decomposed wood streaks. 18.4 to 20.5m: Becomes very stiff. 18.5m: Trace organics cease.		
	HQ3						100				
SS 0,0,0, 0,1,1 N=2	SPT				19		100		19.6m: Trace fine micaceous sand lenses ~8 mm thick and ~5 mm apart.		

For explanation of symbols and observations, see key sheet

FLUID DEPTHS AND DRILLING PROGRESS (m)
 Date Time Drilled Depth Casing Depth Fluid Depth

RELATIVE STRENGTH
 VS - Very strong
 S - Strong
 MS - Moderately strong
 W - Weak
 VW - Very weak
 EW - Extremely weak

WEATHERING
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 SW - Slightly weathered
 MW - Moderately weathered
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 CW - Completely weathered

Date logged 10/08/2021
 Logged SK
 Checked GP

Driller McMillan
 Started 6/08/2021
 Finished 10/08/2021
 Drill Rig N119
 Core Boxes 12

Remarks
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Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016

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 DR2272: 19mm blade: Correction Factor = 1.572
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GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records <small>Shear Vane/ SPT SPT N Values 0 - 50</small>	Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>MS W VW EW</small>	Rock Weathering <small>SW MW HW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES <small>Subordinate MAJOR minor: colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation
										DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>	
EAST COAST BAYS FORMATION 20.5m: Highly weathered, grey, fine SANDSTONE. Extremely weak. 20.7m: Slightly weathered, grey, fine SANDSTONE. Weak. Gravel inclusions, subangular dark grey fine to medium. 20.9m: Unweathered, grey, fine SANDSTONE. Weak. Some fine subangular dark grey gravel inclusions. 22.35m: Unweathered, grey, fine to coarse volcanoclastic SANDSTONE. Moderately strong. Gravel fine to coarse subangular, light grey and dark grey, thickly bedded. 25.3m: Unweathered, grey, medium SANDSTONE. Weak. Some fine subangular dark grey gravel inclusions. 26.4m: Unweathered, grey, volcanoclastic SANDSTONE. Moderately strong. Gravel fine to coarse subangular, dark grey.	sc 11,39 for 65mm N>50 sc 30,20 for 60mm N>50 sc 7,43 for 30mm N>50	HQ3		MS	SW	20.5	[Pattern]	100 [19]	400	20.5m: Silty fine SAND; grey. Tightly packed, moist. 20.5 to 21.0m: Drilling breaks, sub-horizontal, at 20.67, 20.74 & 20.87m. 21.0 to 21.14m: Recovered as medium to coarse, subrounded gravel. 21.14 to 22.5m: Drilling breaks, sub-horizontal, at 21.29, 21.37, 21.6, 21.84, 21.93, 22.07 & 22.35m. 21.21 to 21.44m: J, 70°, Ro, T, Cg, gy Slt 21.41 to 21.56m: Ve, 65°, Ro, T, Qtz, <1mm 21.67 to 21.96m: J, 70°, Ro, T, NF 21.87 to 22.08m: J, 70°, Ro, T, NF 21.98 to 22.28m: J, 80°, Ro, T, NF 22.5 to 22.6m: Recovered as medium subrounded gravel. 22.9 to 23.1m: Drilling breaks, 0°, at 22.9, 22.93, 22.96 & 23.1m. 23.4 to 23.6m: HJ, 60°, Sm, NF, Opened up through drilling. 23.85 to 23.9m: HJ, 45°, Sm, NF, Opened up through drilling. 23.95 to 24m: HJ, 45°, Sm, NF, Opened up through drilling. 24.11 to 25.5m: Drilling breaks, sub-horizontal, at 24.3, 24.44, 24.8, 24.9, 24.95, 25.05 & 25.28m. 24.65 to 24.68m: HJ, 25°, Ro, Calc, Opened up through drilling. 24.8 to 24.9m: Extremely closely spaced sub-horizontal incipient joints, undulating. 25.5 to 27.0m: Drilling breaks, sub-horizontal, at 26.24, 26.47, 26.61, 26.63, 26.71, 26.73 & 26.75m. 26.15 to 26.25m: HJ, 60°, Ro, Qtz, Opened up through drilling. 26.55 to 26.63m: HJ, 65°, Ro, NF, Opened up through drilling. 26.63 to 26.7m: HJ, 70°, Ro, Qtz, Opened up through drilling. 27.01m: DB, 0° 28.9 to 29.13m: HJ, 60°, Ro, T, Qtz, <1mm 29.39m: DB, 0° 29.52m: Ve, 5°, Ro, Qtz, 5mm	
		SPT		MS	SW	21	[Pattern]	0	400		
			HQ3		MS	SW	22	[Pattern]	100 [100]		400
			SPT		MS	SW	23	[Pattern]	0		400
			HQ3		MS	SW	24	[Pattern]	100 [100]		400
			SPT		MS	SW	25	[Pattern]	0		400
			HQ3		MS	SW	26	[Pattern]	100 [100]		400
			HQ3		MS	SW	27	[Pattern]	100 [100]		400
			HQ3		MS	SW	28	[Pattern]	100 [100]		400
			HQ3		MS	SW	29	[Pattern]	100 [100]		400
For explanation of symbols and observations, see key sheet FLUID DEPTHS AND DRILLING PROGRESS (m) Date Time Drilled Depth Casing Depth Fluid Depth		RELATIVE STRENGTH VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak		WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered		Date logged 10/08/2021 Logged SK Checked GP		Driller McMillan Started 6/08/2021 Finished 10/08/2021 Drill Rig N119 Core Boxes 12			
Hand Held Shear Vane DR2272: 19mm blade: Correction Factor = 1.572 vane shear strength per NZGS guideline		Remarks 50 mm standpipe piezometer installed upon completion of drilling. Piezometer developed by air lift.		Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016		Page 3 of 10					

2021 EB DRILLHOLE LOG 2021-12-20 SBS MASTER.GPJ BASE.GDT 20/12/21

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409737.34mE 796330.84mN
 Orientation -90° Elevation 11.82m
 Location 19 Williams Roberts Rd
 Feature Reeves Rd Flyover Pier

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>VS S Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak</small>	Rock Weathering <small>SW Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm) <small>0 50 100 200 300 400 500</small>	SOIL PROPERTIES <small>Subordinate MAJOR minor: colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, subordinate information, etc</small>	Instrumentation
	Shear Vane/ SPT	SPT N Values <small>0 - 50</small>									DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>	
EAST COAST BAYS FORMATION 26.4m: Unweathered, grey, volcanoclastic SANDSTONE. Moderately strong. Gravel fine to coarse subangular, dark grey. (continued) 31.41m: Unweathered, grey, fine SANDSTONE. Moderately strong. 31.58m: Unweathered grey SILTSTONE. Very weak.			HQ3				31		100 [100]		29.9 to 30.15m: HJ, 65°, Ro, T, Qtz, <1mm, Partially opened up through drilling.	
			HQ3				32		100 [100]		30.91 to 30.93m: HJ, 30°, Ro, T, Qtz, <1mm 30.97 to 31.2m: HJ, 60°, Ro, T, Qtz, <1mm 31.21 to 31.3m: HJ, 60°, Ro, T, Qtz, <1mm 31.5 to 33.0m: 15+ drilling/manual handling breaks, core largely returned as gravel. 32.26 to 32.3m: HJ, 30°, Sm, NF, Opened up through drilling. 32.32 to 32.42m: HJ, 70°, Sm, NF, Opened up through drilling. 31.78m: HJ, 60°, Sm, NF, 3no. at 31.78-31.95. 31.84-31.95 & 32.0-32.11m, opened up through drilling. 32.42 to 33.0m: Recovered as gravel.	
							33				DH210_P terminated at 33.0m Target Depth	
							34					
							35					
							36					
							37					
							38					
							39					
For explanation of symbols and observations, see key sheet					RELATIVE STRENGTH		WEATHERING		Date logged 10/08/2021		Driller McMillan	
FLUID DEPTHS AND DRILLING PROGRESS (m) Date Time Drilled Depth Casing Depth Fluid Depth					VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak		UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered		Logged SK		Started 6/08/2021	
					Remarks				Checked GP		Finished 10/08/2021	
Hand Held Shear Vane DR2272: 19mm blade: Correction Factor = 1.572 vane shear strength per NZGS guideline					50 mm standpipe piezometer installed upon completion of drilling. Piezometer developed by air lift.						Drill Rig N119	
					Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016						Core Boxes 12	
											Page 4 of 10	

2021 EB DRILLHOLE LOG 2021-12-20 SBS MASTER.GPJ BASE.GDT 20/12/21



Box: 1 of 12 - Depth: 00.00m to 04.20m of 33.00m
 Date Drilled 6/08/2021 to 10/08/2021 - Date Photographed: 6/08/2021



Box: 2 of 12 - Depth: 04.20m to 07.00m of 33.00m
 Date Drilled 6/08/2021 to 10/08/2021 - Date Photographed: 9/08/2021



Box: 3 of 12 - Depth: 07.00m to 09.50m of 33.00m
 Date Drilled 6/08/2021 to 10/08/2021 - Date Photographed: 9/08/2021



Box: 4 of 12 - Depth: 09.50m to 12.10m of 33.00m
 Date Drilled 6/08/2021 to 10/08/2021 - Date Photographed: 9/08/2021



Box: 5 of 12 - Depth: 12.10m to 15.00m of 33.00m
 Date Drilled 6/08/2021 to 10/08/2021 - Date Photographed: 9/08/2021



Box: 6 of 12 - Depth: 15.00m to 17.45m of 33.00m
 Date Drilled 6/08/2021 to 10/08/2021 - Date Photographed: 9/08/2021



Box: 7 of 12 - Depth: 17.45m to 19.95m of 33.00m
 Date Drilled 6/08/2021 to 10/08/2021 - Date Photographed: 9/08/2021



Box: 8 of 12 - Depth: 19.95m to 22.60m of 33.00m
 Date Drilled 6/08/2021 to 10/08/2021 - Date Photographed: 10/08/2021



Box: 9 of 12 - Depth: 22.60m to 25.50m of 33.00m
 Date Drilled 6/08/2021 to 10/08/2021 - Date Photographed: 10/08/2021



Box: 10 of 12 - Depth: 25.50m to 27.95m of 33.00m
 Date Drilled 6/08/2021 to 10/08/2021 - Date Photographed: 10/08/2021



Box: 11 of 12 - Depth: 27.95m to 30.50m of 33.00m
 Date Drilled 6/08/2021 to 10/08/2021 - Date Photographed: 10/08/2021



Box: 12 of 12 - Depth: 30.50m to 33.00m of 33.00m
 Date Drilled 6/08/2021 to 10/08/2021 - Date Photographed: 10/08/2021

TERMINOLOGY AND SYMBOLS

Drilling / Investigation Methods

CFHSA	- Continuous Flight Hollow Stem Auger.
CFSSA	- Continuous Flight Solid Stem Auger.
DC	- Dynamic Coring (eg Terrier Rig).
DCP	- Dynamic Cone Penetrometer.
HA	- Hand Auger.
HQ3	- HQ Triple Tube.
HQWL	- HQ Wire Line.
HWOB	- Heavy Weight Open Barrel.
NQ3	- NQ Triple Tube.
NQWL	- NQ Wire Line.
OB	- 100mm diameter Open Barrel.
OB70	- 70mm diameter Open Barrel.
PERC	- Percussion.
PS	- Piston Sample.
PQ3	- PQ Triple Tube.
PQWL	- PQ Wire Line.
RC	- Reverse Circulation.
RCDHH	- Reverse Circulation Down Hole Hammer.
SPT	- Standard Penetration Test.
SPERC	- Sonic Percussion.
PT	- Push Tube Sample
VAC EX	- Vacuum Excavation.
WASH	- Wash Drilling.

Test Results

SPT "N" value; uncorrected blow count for 300 mm penetration
 # / # / # / # / # / # blows per 75 mm penetration

ss - Standard Penetration Test - split spoon
 sc - Standard Penetration Test - solid cone (no sample recovery)
 SUOW - Sunk Under Own Weight

Vane Shear Strength Tests

/ # Vane shear strength test results given as peak / remoulded shear strengths (kPa). Test as per NZGS Guideline, 2001.

= Vane test performed on core recovered prior to extrusion from core barrel.
 * = Vane test performed on excavated material of suitable size.

UTP - Unable to penetrate.

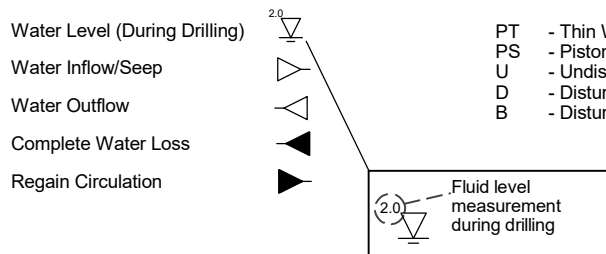
Unit/Geological Boundary Lines

———— Known
 - - - - - Inferred/Unknown

Installation & Backfill

Standpipe		Grout	
Slotted Standpipe		Cement	
Collapse/Cuttings /Spoil		Gravel Pack Filter	
Bentonite		Sand Pack Filter	
Inclinometer		Gravel Backfill	

Groundwater Records



Samples

PT	- Thin Wall Push Sample
PS	- Piston Sample
U	- Undisturbed
D	- Disturbed (Core)
B	- Disturbed (Pit)

Rock Descriptions

Relative Strength

ES	- Extremely strong	> 250
VS	- Very Strong	100 - 250
S	- Strong	50 - 100
MS	- Moderately Strong	20 - 50
W	- Weak	5 - 20
VW	- Very Weak	1 - 5
EW	- Extremely Weak	< 1

Weathering

UW	- Unweathered
SW	- Slightly Weathered
MW	- Moderately Weathered
HW	- Highly Weathered
CW	- Completely Weathered

Soil Descriptions

Consistency Cohesive Soils

Very Soft	Su (kPa) < 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	200 - 500

Relative Density Non-cohesive soils

Very Loose	SPT "N" Value (uncorrected) < 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

Rock Defect Abbreviations

Defect Type

BP	= Bedding Plane Defect
CZ	= Crush Zone
DB	= Drilling Break
FZ	= Fracture Zone
HJ	= Healed Joint
J	= Joint
SZ	= Shear Zone
Ve	= Vein

Defect Aperture

T	= Tight (Nil)
VN	= Very Narrow (>0-2mm)
N	= Narrow (2-6mm)
MN	= Moderately Narrow (6-20mm)
MW	= Moderately Wide (20-60mm)
W	= Wide (60-200mm)
VW	= Very Wide (>200mm)

Defect Roughness

Pl	= Planar
St	= Stepped
Ud	= Undulating
Ro	= Rough
Sm	= Smooth
Slk	= Slickensided
	= Parallel
Po	= Polished

Infill Thickness

Sn	= Stained
Vn	= Veneer (<0.5mm)
Cg	= Coating
P	= Partially infilled
C	= Completely infilled

Infill Colour

bl	= Blue
bn	= Brown
bk	= Black
gn	= Green
gy	= Grey
or	= Orange
pk	= Pink
rd	= Red
wh	= White
ye	= Yellow

Infill Material

Calc	= Calcareous
Cb	= Carbonaceous
Cc	= Calcite
Cl	= Clay
Fe	= Iron Oxide
Mn	= Manganese
NF	= No Infill
Py	= Pyrite
Qtz	= Quartz
S	= Sand
Slt	= Silt

Graphic Log (typical symbols)

	Peat		Mudstone
	Clay		Siltstone
	Silt		Sandstone
	Sand		Basalt
	Gravel / Cobbles		No recovery
	Welded Tuff		

Core Measurements

TCR	= Total Core Recovery
RQD	= Rock Quality Designation

Soil and rock descriptions generally as in "Guidelines for the Field Description of Soil and Rock for Engineering Purposes" by the NZ Geotechnical Society Inc, December 2005.

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409778.86mE 796356.53mN
 Orientation -90° Elevation 15.87m
 Location 15 William Roberts Rd
 Feature MSE Abutment Wall

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>MS MS W VW HW EW</small>	Rock Weathering <small>SW MW HW EW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES <small>Subordinate MAJOR minor: colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation	
	Shear Vane/ SPT	SPT N Values									DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>		
0.0m: TOPSOIL comprising clayey silt.											0.0m: Clayey SILT; dark brown. Soft, moist, low plasticity.		
0.4m: ALLUVIUM comprising clay, silt and sand, in places pumiceous or organic.	76/42		HA				1		100		0.4m: Silty CLAY; light grey with orange staining/mottling. Stiff to very stiff, moist, high plasticity.	0.5	
	120/46											0.9	
	151/60		SPT				2		100		1.5 to 3.2m: Orange staining lessens.	1.52	
	0.1, 1, 2, 2, 3 N=8		HQ3								2.4 to 2.6m: Firm. 2.6 to 2.8m: Soft. 2.8 to 4.15m: Very soft.		
	0.0, 0.0, 0.0, 0.0 N=0 SUOW		SPT				3		100		3.0m: 114mm diameter, HWT casing to 3.0m depth. 3.2 to 4.15m: Grades to dark grey.		
			PT				4		100		3.9 to 4.0m: Push Tube: SILT.		
			HQ3								4.15m: Fine to medium SAND with trace silt, fine subrounded pumice gravel and organics; grey. Dense, moist to wet, poorly graded.		
	2.3, 3.3, 4.6, 6.6 N=19		SPT				5		100				
			HQ3										5.7
	4.6, 9.9, 8.9, 9.9 N=35		SPT				6		100				6.5
		HQ3											
6/0		SPT				8		100			7.35m: Organic CLAY; dark brown to black. Very soft, moist, high plasticity.		
0.0, 0.0, 1.0, 1.1 N=2		PT											
		HQ3											
		SPT				9		100			8.7m: Fine SAND with some silt and trace organics; brown. Dense, dry to moist, uniformly graded. Organics are decomposed black streaks.		
2.2, 2.2, 1.1, 1.1 N=5		SPT									9.1m: Organic CLAY; dark brown. Soft, moist, high plasticity.		
											9.5m: CLAY with trace silt and wood; bluish grey. Soft, moist, high plasticity.		
For explanation of symbols and observations, see key sheet			RELATIVE STRENGTH		WEATHERING		Date logged 3/08/2021		Driller				
FLUID DEPTHS AND DRILLING PROGRESS (m)			VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak		UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered		Logged SK Checked GP		McMillan				
Date Time	Drilled Depth	Casing Depth	Fluid Depth	Remarks									
29/07/2021 17:00	04.50	3.0	0.5	50 mm standpipe piezometer installed upon completion of drilling. Piezometer developed by air lift.									
30/07/2021 08:20	04.50	3.0	1.52										
30/07/2021 15:45	22.50	3.0	0.9										
02/08/2021 08:45	22.50	3.0	6.5										
03/08/2021 08:15	34.00	3.0	9.9										
03/08/2021 17:00	35.00	-	5.7	Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016									
Hand Held Shear Vane DR2272: 19mm blade: Correction Factor = 1.572 vane shear strength per NZGS guideline			Date logged 3/08/2021		Driller		Finished		Drill Rig				
							3/08/2021		N119				
							Core Boxes		13				
							Page 1 of 11						

2021 EB DRILLHOLE LOG 2021-12-21 SBS MASTER.GPJ BASE.GDT 2/12/21

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409778.86mE 796356.53mN
 Orientation -90° Elevation 15.87m
 Location 15 William Roberts Rd
 Feature MSE Abutment Wall

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records <small>Shear Vane/ SPT N Values</small>	Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>MS MS W VW EW</small>	Rock Weathering <small>SW MW HW CW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES <small>Subordinate MAJOR minor: colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation
										DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>	
TAURANGA GROUP	SS 0,1,1, 2,1,2 N=6	HQ3				11		100		9.6 to 9.8m: With some fine to medium sand. 9.8 to 11.0m: Firm. 9.5m: CLAY with trace silt and wood; bluish grey. Soft, moist, high plasticity. (continued)	
		SPT						100			
		HQ3				12		100		11.0 to 11.4m: Stiff. 11.4 to 12.75m: Very stiff.	
	SS 1,1,1, 1,2,2 N=6	SPT						100			
		HQ3				13		100		12.7 to 12.75m: Large chunk of decomposing wood takes up whole core. 12.75 to 13.95m: Soft with small organic streaks.	
		SPT						100			
		HQ3				14		100		13.95 to 16.0m: Firm.	
		SPT						100			
		HQ3				15		100		16.0 to 19.3m: Stiff.	
		SPT						100			
	HQ3				16		100				
	SPT						100				
	HQ3				17		100				
	SPT						100				
	HQ3				18		100			18.2 to 19.3m: Trace fine micaceous sand lenses.	
	SPT						100				
	HQ3				19		100				
	SPT						100			19.3m: Fine SAND with some clay; bluish grey. Medium dense, moist, uniformly graded. 19.35m: CLAY with trace silt and fine micaceous sand lenses; bluish grey. Stiff, moist, high plasticity.	
For explanation of symbols and observations, see key sheet				RELATIVE STRENGTH		WEATHERING		Date logged 3/08/2021		Driller McMillan	
FLUID DEPTHS AND DRILLING PROGRESS (m) Date Time Drilled Depth Casing Depth Fluid Depth				VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak		UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered		Logged SK Checked GP		Started 29/07/2021	
Hand Held Shear Vane DR2272: 19mm blade: Correction Factor = 1.572 vane shear strength per NZGS guideline				Remarks 50 mm standpipe piezometer installed upon completion of drilling. Piezometer developed by air lift.		Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016				Finished 3/08/2021	
										Drill Rig N119 Core Boxes 13	
										Page 2 of 11	

2021 EB DRILLHOLE LOG 2021-12-21 SBS MASTER.GPJ BASE.GDT 21/12/21

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409778.86mE 796356.53mN
 Orientation -90° Elevation 15.87m
 Location 15 William Roberts Rd
 Feature MSE Abutment Wall

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>MS VS VW EW</small>	Rock Weathering <small>SW MW HW CW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES <small>Subordinate MAJOR minor: colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation
	Shear Vane/ SPT	SPT N Values <small>0 - 50</small>									DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>	
TAURANGA GROUP			HQ3						100		19.35m: CLAY with trace silt and fine micaceous sand lenses; bluish grey. Stiff, moist, high plasticity. (continued)	[Pattern]
		102/16 SS 0,0,0 0,0,0 N=0 SUOW	SPT				21		100		20.95m: Trace sand ceases. 21.3 to 21.6m: Trace organic flecks.	
			HQ3				22		100		21.6m: Organic silty CLAY with some wood fibres; black. Firm, moist, low plasticity. (Bordering on fibrous peat)	
		SS 1,1,1 2,1,1 N=5	SPT				23		100		22.0m: CLAY with trace silt; bluish grey. Stiff, moist, high plasticity.	
			HQ3				23.5		100		23.5 to 24.07m: Trace organic flecks and wood.	
		71/14 SS 13,23,31 19 for 25mm N>50	SPT				24		100		23.8 to 24.07m: Firm with trace fine sand. 24.25 to 25.5m: Drilling breaks, 0°, at 24.5, 24.7, 24.8 & 25.0m.	
			HQ3				25		100 [7]		24.85m: HJ, 45°, PI, Ro, NF 24.95m: HJ, 45°, PI, Ro, NF 25.0m: Coarse gravel cease.	
		SC 40,10 for 5mm N>50	SPT				26		6		25.5 to 27.0m: Drilling breaks, 0°, at 25.7, 25.9, 26.4, 26.55, 26.7 & 26.9m.	
			HQ3				26.15		97 [92]		26.15m: J, 60°, PI, Ro, NF 26.23m: J, 45°, PI, Ro, NF 26.34m: J, 30°, PI, Ro, NF	
		SC 28,22 for 20mm N>50	SPT				27		95		26.6m: J, 50°, PI, Ro, NF 26.77m: J, 30°, PI, Ro, NF 27.05m: J, 10°, PI, Ro, NF 27.13m: J, 25°, PI, Ro, NF	
EAST COAST BAYS FORMATION			HQ3				27.46		94 [88]		27.46m: J, 65°, PI, Ro, NF 27.54m: J, 30°, PI, Ro, NF 27.0 to 28.5m: Drilling breaks, 0°, at 27.2, 27.6, 27.7, 28.05, 28.1 & 28.2m.	[Pattern]
			HQ3				28.2				28.2m: HJ, 25°, Ro, NF	
			HQ3				28.5				28.5 to 30.0m: Drilling breaks, 0°, at 28.65, 28.8, 28.9, 29.25, 29.4 & 29.65m.	
			HQ3				28.91		100 [100]		28.91m: J, 60°, PI, Ro, NF 29.0m: HJ, 5°, Ro, VN, S, filled with sandstone material 29.2m: J, 70°, Ud, Ro, N, S, filled with grit material 29.27m: Ve, 80°, Ro, T, Cc 29.75m: Ve, 20°, Ro, T, Cc	
For explanation of symbols and observations, see key sheet			RELATIVE STRENGTH		WEATHERING		Date logged 3/08/2021		Driller McMillan			
FLUID DEPTHS AND DRILLING PROGRESS (m) Date Time Drilled Depth Casing Depth Fluid Depth			VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak		UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered		Logged SK Checked GP		Started 29/07/2021			
Hand Held Shear Vane DR2272: 19mm blade: Correction Factor = 1.572 vane shear strength per NZGS guideline			Remarks 50 mm standpipe piezometer installed upon completion of drilling. Piezometer developed by air lift.		Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016		Finished 3/08/2021		Drill Rig N119			
							Core Boxes 13		Page 3 of 11			

2021 EB DRILLHOLE LOG 2021-12-21 SBS MASTER.GPJ BASE.GDT 21/12/21

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409778.86mE 796356.53mN
 Orientation -90° Elevation 15.87m
 Location 15 William Roberts Rd
 Feature MSE Abutment Wall

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>VS S Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak</small>	Rock Weathering <small>SW Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES <small>Subordinate MAJOR minor: colour, structure. Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation
	Shear Vane/ SPT	SPT N Values									DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>	
EAST COAST BAYS FORMATION 29.3m: Unweathered, grey, volcaniclastic, fine to coarse SANDSTONE. Moderately strong, gently inclined thickly bedded. Containing fine to coarse subangular to angular gravel, red and dark grey in color. <i>(continued)</i> 31.1m: Unweathered, grey, fine SANDSTONE. Weak. Subhorizontal, moderately thin to thickly bedded with indistinct laminations. 31.5 to 31.7m: Trace carbonaceous laminations.			HQ3				31		100 [100]		29.84m: Ve, 30°, Ro, T, Cc 29.97m: Ve, 30°, Ro, T, Cc 30.0 to 31.5m: Drilling breaks, 0°, at 30.45, 30.65, 31.3 & 31.4m. 31.0m: HJ, 45°, Ud, Ro, NF 31.03m: Ve, 10°, Sm, T, Cc 31.05 to 31.1m: Inverse grading at base of bed. 31.1m: BP, 10°, Pl, Sm, NF	
			HQ3				32		100 [100]		31.7m: HJ, 20°, Pl, Sm, NF 31.5 to 33.0m: Drilling breaks, 0°, at 31.55, 31.6, 32.15, 32.55, 32.6, 32.71, 32.76, 32.79, 31.87 & 31.9m.	
			HQ3				33		75 [75]		33.0 to 33.75m: Drilling breaks, 0°, at 33.15, 33.25, 33.35, 33.4 & 33.45m.	
			HQ3				34				33.75 to 34.0m: Core Loss: Damaged during drilling.	
							34				DH212_P terminated at 34.0m Target Depth	
							35					
							36					
							37					
							38					
							39					
For explanation of symbols and observations, see key sheet FLUID DEPTHS AND DRILLING PROGRESS (m) Date Time Drilled Depth Casing Depth Fluid Depth			RELATIVE STRENGTH VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak		WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered		Date logged 3/08/2021 Logged SK Checked GP		Driller McMillan Started 29/07/2021 Finished 3/08/2021 Drill Rig N119 Core Boxes 13		Page 4 of 11	
Hand Held Shear Vane DR2272: 19mm blade: Correction Factor = 1.572 vane shear strength per NZGS guideline			Remarks 50 mm standpipe piezometer installed upon completion of drilling. Piezometer developed by air lift.		Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016							

2021 EB DRILLHOLE LOG 2021-12-21 SBS MASTER.GPJ BASE.GDT 21/12/21



Box: 1 of 13 - Depth: 00.00m to 02.35m of 34.00m
 Date Drilled 29/07/2021 to 2/08/2021



Box: 2 of 13 - Depth: 02.35m to 05.75m of 34.00m
 Date Drilled 29/07/2021 to 2/08/2021



Box: 3 of 13 - Depth: 05.75m to 08.70m of 34.00m
 Date Drilled 29/07/2021 to 2/08/2021



Box: 4 of 13 - Depth: 08.70m to 11.15m of 34.00m
 Date Drilled 29/07/2021 to 2/08/2021



Box: 5 of 13 - Depth: 11.15m to 13.95m of 34.00m
 Date Drilled 29/07/2021 to 2/08/2021



Box: 6 of 13 - Depth: 13.95m to 16.65m of 34.00m
 Date Drilled 29/07/2021 to 2/08/2021



Box: 7 of 13 - Depth: 16.65m to 19.35m of 34.00m
 Date Drilled 29/07/2021 to 2/08/2021



Box: 8 of 13 - Depth: 19.35m to 21.75m of 34.00m
 Date Drilled 29/07/2021 to 2/08/2021



Box: 9 of 13 - Depth: 21.75m to 24.15m of 34.00m
 Date Drilled 29/07/2021 to 2/08/2021



Box: 10 of 13 - Depth: 24.15m to 27.00m of 34.00m
 Date Drilled 29/07/2021 to 2/08/2021



Box: 11 of 13 - Depth: 27.00m to 29.75m of 34.00m
 Date Drilled 29/07/2021 to 2/08/2021



Box: 12 of 13 - Depth: 29.75m to 32.70m of 34.00m
 Date Drilled 29/07/2021 to 2/08/2021



Box: 13 of 13 - Depth: 32.70m to 34.00m of 34.00m
Date Drilled 29/07/2021 to 2/08/2021

TERMINOLOGY AND SYMBOLS

Drilling / Investigation Methods

CFHSA	- Continuous Flight Hollow Stem Auger.
CFSSA	- Continuous Flight Solid Stem Auger.
DC	- Dynamic Coring (eg Terrier Rig).
DCP	- Dynamic Cone Penetrometer.
HA	- Hand Auger.
HQ3	- HQ Triple Tube.
HQWL	- HQ Wire Line.
HWOB	- Heavy Weight Open Barrel.
NQ3	- NQ Triple Tube.
NQWL	- NQ Wire Line.
OB	- 100mm diameter Open Barrel.
OB70	- 70mm diameter Open Barrel.
PERC	- Percussion.
PS	- Piston Sample.
PQ3	- PQ Triple Tube.
PQWL	- PQ Wire Line.
RC	- Reverse Circulation.
RCDHH	- Reverse Circulation Down Hole Hammer.
SPT	- Standard Penetration Test.
SPERC	- Sonic Percussion.
PT	- Push Tube Sample
VAC EX	- Vacuum Excavation.
WASH	- Wash Drilling.

Test Results

SPT "N" value; uncorrected blow count for 300 mm penetration
/ # / # / # / # / # blows per 75 mm penetration

ss - Standard Penetration Test - split spoon
sc - Standard Penetration Test - solid cone (no sample recovery)
SUOW - Sunk Under Own Weight

Vane Shear Strength Tests

/ # Vane shear strength test results given as peak / remoulded shear strengths (kPa). Test as per NZGS Guideline, 2001.

= Vane test performed on core recovered prior to extrusion from core barrel.
* = Vane test performed on excavated material of suitable size.

UTP - Unable to penetrate.

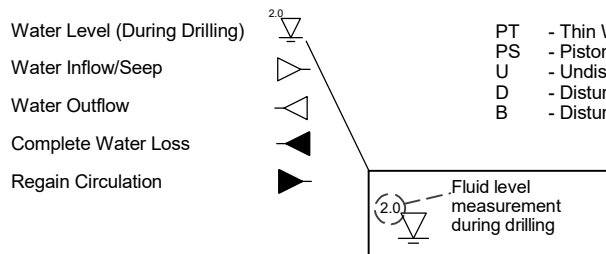
Unit/Geological Boundary Lines

———— Known
- - - - - Inferred/Unknown

Installation & Backfill

Standpipe		Grout	
Slotted Standpipe		Cement	
Collapse/Cuttings /Spoil		Gravel Pack Filter	
Bentonite		Sand Pack Filter	
Inclinometer		Gravel Backfill	

Groundwater Records



Samples

PT	- Thin Wall Push Sample
PS	- Piston Sample
U	- Undisturbed
D	- Disturbed (Core)
B	- Disturbed (Pit)

Rock Descriptions

Relative Strength

ES	- Extremely strong	> 250
VS	- Very Strong	100 - 250
S	- Strong	50 - 100
MS	- Moderately Strong	20 - 50
W	- Weak	5 - 20
VW	- Very Weak	1 - 5
EW	- Extremely Weak	< 1

Weathering

UW	- Unweathered
SW	- Slightly Weathered
MW	- Moderately Weathered
HW	- Highly Weathered
CW	- Completely Weathered

Soil Descriptions

Consistency Cohesive Soils

Very Soft	Su (kPa) < 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	200 - 500

Relative Density Non-cohesive soils

Very Loose	SPT "N" Value (uncorrected) < 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

Rock Defect Abbreviations

Defect Type

BP	= Bedding Plane Defect
CZ	= Crush Zone
DB	= Drilling Break
FZ	= Fracture Zone
HJ	= Healed Joint
J	= Joint
SZ	= Shear Zone
Ve	= Vein

Defect Aperture

T	= Tight (Nil)
VN	= Very Narrow (>0-2mm)
N	= Narrow (2-6mm)
MN	= Moderately Narrow (6-20mm)
MW	= Moderately Wide (20-60mm)
W	= Wide (60-200mm)
VW	= Very Wide (>200mm)

Defect Roughness

Pl	= Planar
St	= Stepped
Ud	= Undulating
Ro	= Rough
Sm	= Smooth
Slk	= Slickensided
	= Parallel
Po	= Polished

Infill Thickness

Sn	= Stained
Vn	= Veneer (<0.5mm)
Cg	= Coating
P	= Partially infilled
C	= Completely infilled

Infill Colour

bl	= Blue
bn	= Brown
bk	= Black
gn	= Green
gy	= Grey
or	= Orange
pk	= Pink
rd	= Red
wh	= White
ye	= Yellow

Infill Material

Calc	= Calcareous
Cb	= Carbonaceous
Cc	= Calcite
Cl	= Clay
Fe	= Iron Oxide
Mn	= Manganese
NF	= No Infill
Py	= Pyrite
Qtz	= Quartz
S	= Sand
Slt	= Silt

Graphic Log (typical symbols)

	Peat		Mudstone
	Clay		Siltstone
	Silt		Sandstone
	Sand		Basalt
	Gravel / Cobbles		No recovery
	Welded Tuff		

Core Measurements

TCR	= Total Core Recovery
RQD	= Rock Quality Designation

Soil and rock descriptions generally as in "Guidelines for the Field Description of Soil and Rock for Engineering Purposes" by the NZ Geotechnical Society Inc, December 2005.

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409778.54mE 796464.74mN
 Orientation -90° Elevation 17.01m
 Location 3 William Roberts Rd
 Feature Validate CPT514 & confirm settlement

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>MS MS W VW</small>	Rock Weathering <small>SW MW HW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES <small>Subordinate MAJOR minor; colour, structure. Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation	
	Shear Vane/ SPT	SPT N Values <small>0 - 50</small>									DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>		
			VAC EX				1		0		0.0m: Vacuum excavation not witnessed.		
1.5m: ALLUVIUM comprising clay, silt and sand, in places pumiceous or organic.	ss 0,1,1,1,1,2 N=5		SPT				2		100		1.5m: Silty CLAY with trace fine sand; Light brownish grey with mottled orange. Stiff, moist, high plasticity.		
			HQ3						100		2.6 to 3.2m: Some fine sand.		
	65/3 ss 0,1,1,1,1,2 N=5		SPT				3		100		3.0m: 114mm diameter, HWT casing to 3.0m depth.		
			HQ3						100		3.2m: CLAY with trace silt; brownish grey. Firm, moist, high plasticity . 3.45 to 3.7m: Some fine to medium sand.		
	24/0 ss 0,0,0,0,0,0 N=0 SUOW		SPT				4		100		3.9 to 5.55m: Trace organic flecks.		
			WASH				5		0		4.6 to 5.55m: Dark grey.		
			PT						100				
			HQ3						100			5.55m: Fine SAND with minor silt and trace medium sand; light grey. Dense, moist, uniformly graded.	
	4,9,10,10,10,10 ss N=40		SPT				6		100		6.15 to 6.4m: Trace fine to coarse gravel. Medium to coarse gravel is angular and volcanic, fine gravel is subrounded pumice.		
		HQ3						100		6.75 to 8.3m: Fine to medium sand.			
7,8,10,10,10,10 ss N=40		SPT				7		80					
		WASH				8		0		8.0 to 8.5m: No recovery in push tube.			
		PT						0					
		HQ3						100			8.3m: CLAY with trace silt; greyish brown. Firm, moist, high plasticity. Trace dark organic flecks.		
		SPT				9		100					
		WASH						0					
		PT						100					

For explanation of symbols and observations, see key sheet

FLUID DEPTHS AND DRILLING PROGRESS (m)			
Date Time	Drilled Depth	Casing Depth	Fluid Depth
26/07/2021 14:30	01.50	3.0	1.3
26/07/2021 17:00	04.50	3.0	1.2
27/07/2021 08:00	04.50	3.0	0.9
27/07/2021 17:00	21.00	3.0	3.8
28/07/2021 08:00	21.00	3.0	2.68
28/07/2021 17:00	35.00	3.0	3.5
29/07/2021 08:00	35.00	3.0	7.1

RELATIVE STRENGTH VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak	WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered	Date logged 29/07/2021 Logged SK Checked GP	Driller McMillan Started 27/07/2021 Finished 28/07/2021 Drill Rig N119 Core Boxes 13
Remarks Backfilled with bentonite cement grout upon completion.		Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016	

Hand Held Shear Vane
 DR2272: 19mm blade: Correction Factor = 1.572
 vane shear strength per NZGS guideline

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409778.54mE 796464.74mN
 Orientation -90° Elevation 17.01m
 Location 3 William Roberts Rd
 Feature Validate CPT514 & confirm settlement

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records <small>Shear Vane/ SPT N Values</small>	Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>MS MSW VW W</small>	Rock Weathering <small>SW MW HW EW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES <small>Subordinate MAJOR minor; colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation
										DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>	
TAURANGA GROUP	57/7 SS 0,0,0, 0,1,1 N=2	HQ3						100		9.8m: Organic silty CLAY with some fibres; black. Firm becoming soft, moist, high plasticity. (continued)	
		SPT				11		100		10.95m: Silty CLAY with minor fine to medium sand and trace organics; bluish grey with black flecks. Stiff, moist, high plasticity.	
		HQ3				12		100		11.9 to 12.3m: Grades to brown.	
	UTP SS 2,3,2, 3,4,5 N=14	SPT				13		100		12.3m: Silty fine to coarse SAND; brownish grey. Medium dense, moist, well graded. 12.5 to 13.0m: Sand if fine to medium, dense. 12.5 to 13.5m: Light grey.	
		HQ3				14		100		13.45 to 13.5m: Sand is fine to medium, dense, poorly graded.	
	SS 1,1,1, 2,2,3 N=8	SPT				15		100		13.5m: Silty CLAY with trace organics (wood); brown. Firm, moist, high plasticity. 13.8 to 14.0m: Minor fine to medium sand, grey, without organics.	
		HQ3				16		100		14.0m: Fine sandy SILT with some clay; bluish grey. Stiff, moist, low plasticity.	
		SPT				17		100		15.15m: Silty CLAY; dark brown. Firm, moist, high plasticity. (Graded contact above).	
	SS 2,2,2, 2,3,3 N=10	SPT				18		100		15.35m: CLAY with trace silt; bluish grey. Firm, moist, high plasticity.	
		HQ3				19		100			
	SS 1,1,1, 1,2,1 N=5	SPT						100			
	44/0 SS 0,0,0, 1,1,1 N=3	SPT						100			
	HQ3						100				
76/5 SS 1,1,1, 1,2,2 N=6	SPT						100		19.5 to 22.9m: Stiff.		
For explanation of symbols and observations, see key sheet						RELATIVE STRENGTH		WEATHERING		Date logged 29/07/2021	Driller McMillan Started 27/07/2021 Finished 28/07/2021 Drill Rig N119 Core Boxes 13
FLUID DEPTHS AND DRILLING PROGRESS (m) Date Time Drilled Depth Casing Depth Fluid Depth						VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak		UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered		Logged SK Checked GP	
Hand Held Shear Vane DR2272: 19mm blade: Correction Factor = 1.572 vane shear strength per NZGS guideline						Remarks Backfilled with bentonite cement grout upon completion.		Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016			

2021 EB DRILLHOLE LOG 2021-10-21 SBS MASTER.GPJ BASE.GDT 21/10/21

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409778.54mE 796464.74mN
 Orientation -90° Elevation 17.01m
 Location 3 William Roberts Rd
 Feature Validate CPT514 & confirm settlement

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records <small>Shear Vane/ SPT SPT N Values 0 - 50</small>	Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>MS MS W VW EW</small>	Rock Weathering <small>SW MW CW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES <small>Subordinate MAJOR minor; colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation	
										DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>		
TAURANGA GROUP	77/5 ss 0,0,1, 1,1,1 N=4	HQ3				21		100		15.35m: CLAY with trace silt; bluish grey. Firm, moist, high plasticity. (continued)		
		SPT						100				
		HQ3					22		100			
		SPT							100			
		HQ3						23		100		22.9m: Organic silty CLAY; dark brownish black. Soft to firm, moist, high plasticity.
		SPT							100			
EAST COAST BAYS FORMATION	81/8 ss 0,0,0, 2,2,2 N=6	HQ3				24		100		23.95m: Silty CLAY, grey. Very stiff.		
		SPT						100				
	HQ3					25		100 [38]	24.45 to 25.5m: Drilling breaks, 0°, at 25.27, 25.32, 25.35 & 25.45m.			
	SPT							100				
	HQ3					26		100 [100]	25.5 to 27.0m: Drilling breaks, 0°, at 26.1, 26.35, 26.37, 26.47 & 26.6m.			
	SPT							100	25.91m: J, 25°, Pl, Sm, VN, NF			
	HQ3					27		100 [100]	27.0 to 28.5m: Drilling breaks, 0°, at 27.15, 27.75, 27.79 & 27.93m.			
	SPT							100 [69]	27.79m: J, 25°, Pl, Sm, VN, NF 27.85m: J, 30°, Pl, Sm, VN, NF 27.88m: J, 75°, Ud, Ro, N, NF			
	HQ3					28		100 [69]	28.0m: Large siltstone inclusion, 11mm high and half width of core, fracture running through, drilling induced horizontal fractures throughout.			
	SPT							0	28.45m: 40mm rounded siltstone inclusion.			
23.95m: Highly weathered, grey, SILTSTONE. Extremely weak.	UTP ss 2,1,3, 3,3,3 N=12	HQ3				29		100 [100]	28.5 to 30.0m: Drilling breaks, 0°, at 28.65, 28.75, 28.95, 29.1, 29.6 & 29.8m.			
		SPT						100 [100]				
25.1 to 25.2m: MW, very weak.	ss 22,28 for 30mm N>50	HQ3				29		100 [100]	29.7 to 29.85m: Trace gravel.			
25.2m: Slightly weathered, grey, fine to medium SANDSTONE. Weak. Subrounded mudstone inclusions (5-10mm).		SPT						0				
25.6m: Unweathered, grey, massive, fine to medium SANDSTONE. Moderately strong. Subrounded mudstone inclusions (5-10mm).	sc 50 for 70mm N>50	HQ3				29		100 [100]				
28.63m: Unweathered, grey, thickly bedded, volcanoclastic fine to coarse SANDSTONE. Moderately strong. Contains subangular to angular gravel, red are fine, light grey and dark grey are fine to coarse.		SPT						0				

2021 EB DRILLHOLE LOG 2021-10-21 SBS MASTER.GPJ BASE.GDT 21/10/21

For explanation of symbols and observations, see key sheet

FLUID DEPTHS AND DRILLING PROGRESS (m)
 Date Time Drilled Depth Casing Depth Fluid Depth

Hand Held Shear Vane
 DR2272: 19mm blade: Correction Factor = 1.572
 vane shear strength per NZGS guideline

RELATIVE STRENGTH
 VS - Very strong
 S - Strong
 MS - Moderately strong
 W - Weak
 VW - Very weak
 EW - Extremely weak

WEATHERING
 UW - Unweathered
 SW - Slightly weathered
 MW - Moderately weathered
 HW - Highly weathered
 CW - Completely weathered

Remarks
 Backfilled with bentonite cement grout upon completion.

Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016

Date logged 29/07/2021
 Logged SK
 Checked GP

Driller McMillan
 Started 27/07/2021
 Finished 28/07/2021
 Drill Rig N119
 Core Boxes 13
 Page 3 of 11

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409778.54mE 796464.74mN
 Orientation -90° Elevation 17.01m
 Location 3 William Roberts Rd
 Feature Validate CPT514 & confirm settlement

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>MS VS W VW</small>	Rock Weathering <small>SW MW HW CW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm) <small>500 100 50 20 10</small>	SOIL PROPERTIES <small>Subordinate MAJOR minor; colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation
	Shear Vane/ SPT	SPT N Values <small>0 - 50</small>									DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>	
EAST COAST BAYS FORMATION 28.63m: Unweathered, grey, thickly bedded, volcanoclastic fine to coarse SANDSTONE. Moderately strong. Contains subangular to angular gravel, red are fine, light grey and dark grey are fine to coarse. (continued) 33.1m: Unweathered, grey, massive, fine SANDSTONE. Weak.			HQ3		MS	SW	31		100 [100]		30.0 to 31.2m: Largest granules are fine gravel. 30.0 to 31.5m: Drilling breaks, 0°, at 30.25, 30.5, 31.25, 31.3, 31.32, 31.4 & 31.47m.	
			HQ3		MS	SW	32		100 [100]	31.5 to 33.0m: Drilling breaks, 0°, at 31.6, 31.65, 31.75, 31.95, 32.5, 32.75 & 32.9m. 31.5 to 35.0m: 66% Flush Return.		
			HQ3		MS	SW	33		100 [100]	32.6m: J, 60°, Ud, Ro, VN, NF		
			HQ3		MS	SW	34		100 [100]	33.0 to 34.5m: Drilling breaks, 0°, at 33.4, 33.6, 33.9, 34.2 & 34.45m.		
							35		100 [100]		DH213 terminated at 35.0m Target Depth	
For explanation of symbols and observations, see key sheet					RELATIVE STRENGTH		WEATHERING		Date logged 29/07/2021		Driller McMillan Started 27/07/2021 Finished 28/07/2021 Drill Rig N119 Core Boxes 13	
FLUID DEPTHS AND DRILLING PROGRESS (m) Date Time Drilled Depth Casing Depth Fluid Depth					VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak		UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered		Logged SK Checked GP			
Hand Held Shear Vane DR2272: 19mm blade: Correction Factor = 1.572 vane shear strength per NZGS guideline					Remarks Backfilled with bentonite cement grout upon completion.		Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016		Page 4 of 11			

2021 EB DRILLHOLE LOG 2021-10-21 SBS MASTER.GPJ BASE.GDT 21/10/21



Box: 1 of 13 - Depth: 00.00m to 04.20m of 35.00m
 Date Drilled 27/07/2021 to 28/07/2021 - Date Photographed: 27/07/2021



Box: 2 of 13 - Depth: 04.20m to 07.15m of 35.00m
 Date Drilled 27/07/2021 to 28/07/2021 - Date Photographed: 27/07/2021



Box: 3 of 13 - Depth: 07.15m to 10.60m of 35.00m
 Date Drilled 27/07/2021 to 28/07/2021 - Date Photographed: 27/07/2021



Box: 4 of 13 - Depth: 10.60m to 13.20m of 35.00m
 Date Drilled 27/07/2021 to 28/07/2021 - Date Photographed: 27/07/2021



Box: 5 of 13 - Depth: 13.20m to 15.70m of 35.00m
 Date Drilled 27/07/2021 to 28/07/2021 - Date Photographed: 27/07/2021



Box: 6 of 13 - Depth: 15.70m to 18.30m of 35.00m
 Date Drilled 27/07/2021 to 28/07/2021 - Date Photographed: 27/07/2021



Box: 7 of 13 - Depth: 18.30m to 21.15m of 35.00m
 Date Drilled 27/07/2021 to 28/07/2021 - Date Photographed: 28/07/2021



Box: 8 of 13 - Depth: 21.15m to 23.40m of 35.00m
 Date Drilled 27/07/2021 to 28/07/2021 - Date Photographed: 28/07/2021



Box: 9 of 13 - Depth: 23.40m to 25.91m of 35.00m
 Date Drilled 27/07/2021 to 28/07/2021 - Date Photographed: 28/07/2021



Box: 10 of 13 - Depth: 25.91m to 28.75m of 35.00m
 Date Drilled 27/07/2021 to 28/07/2021 - Date Photographed: 28/07/2021



Box: 11 of 13 - Depth: 28.75m to 31.75m of 35.00m
 Date Drilled 27/07/2021 to 28/07/2021 - Date Photographed: 28/07/2021



Box: 12 of 13 - Depth: 31.75m to 34.50m of 35.00m
 Date Drilled 27/07/2021 to 28/07/2021 - Date Photographed: 28/07/2021



Box: 13 of 13 - Depth: 34.50m to 35.00m of 35.00m
Date Drilled 27/07/2021 to 28/07/2021 - Date Photographed: 28/07/2021

TERMINOLOGY AND SYMBOLS

Drilling / Investigation Methods

CFHSA	- Continuous Flight Hollow Stem Auger.
CFSSA	- Continuous Flight Solid Stem Auger.
DC	- Dynamic Coring (eg Terrier Rig).
DCP	- Dynamic Cone Penetrometer.
HA	- Hand Auger.
HQ3	- HQ Triple Tube.
HQWL	- HQ Wire Line.
HWOB	- Heavy Weight Open Barrel.
NQ3	- NQ Triple Tube.
NQWL	- NQ Wire Line.
OB	- 100mm diameter Open Barrel.
OB70	- 70mm diameter Open Barrel.
PERC	- Percussion.
PS	- Piston Sample.
PQ3	- PQ Triple Tube.
PQWL	- PQ Wire Line.
RC	- Reverse Circulation.
RCDHH	- Reverse Circulation Down Hole Hammer.
SPT	- Standard Penetration Test.
SPERC	- Sonic Percussion.
PT	- Push Tube Sample
VAC EX	- Vacuum Excavation.
WASH	- Wash Drilling.

Test Results

SPT "N" value; uncorrected blow count for 300 mm penetration
 # / # / # / # / # / # blows per 75 mm penetration

ss - Standard Penetration Test - split spoon
 sc - Standard Penetration Test - solid cone (no sample recovery)
 SUOW - Sunk Under Own Weight

Vane Shear Strength Tests

/ # Vane shear strength test results given as peak / remoulded shear strengths (kPa). Test as per NZGS Guideline, 2001.

= Vane test performed on core recovered prior to extrusion from core barrel.
 * = Vane test performed on excavated material of suitable size.

UTP - Unable to penetrate.

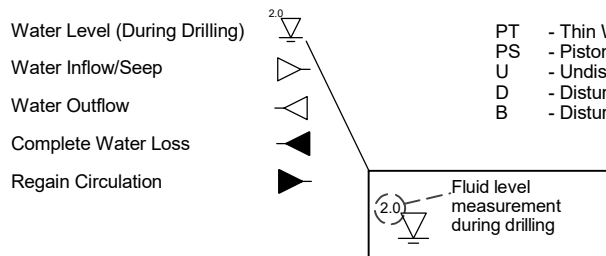
Unit/Geological Boundary Lines

———— Known
 - - - - - Inferred/Unknown

Installation & Backfill

Standpipe		Grout	
Slotted Standpipe		Cement	
Collapse/Cuttings /Spoil		Gravel Pack Filter	
Bentonite		Sand Pack Filter	
Inclinometer		Gravel Backfill	

Groundwater Records



Samples

PT	- Thin Wall Push Sample
PS	- Piston Sample
U	- Undisturbed
D	- Disturbed (Core)
B	- Disturbed (Pit)

Rock Descriptions

Relative Strength

ES	- Extremely strong	> 250
VS	- Very Strong	100 - 250
S	- Strong	50 - 100
MS	- Moderately Strong	20 - 50
W	- Weak	5 - 20
VW	- Very Weak	1 - 5
EW	- Extremely Weak	< 1

Weathering

UW	- Unweathered
SW	- Slightly Weathered
MW	- Moderately Weathered
HW	- Highly Weathered
CW	- Completely Weathered

Soil Descriptions

Consistency Cohesive Soils

Very Soft	Su (kPa) < 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	200 - 500

Relative Density Non-cohesive soils

	SPT "N" Value (uncorrected)
Very Loose	< 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

Rock Defect Abbreviations

Defect Type

BP	= Bedding Plane Defect
CZ	= Crush Zone
DB	= Drilling Break
FZ	= Fracture Zone
HJ	= Healed Joint
J	= Joint
SZ	= Shear Zone
Ve	= Vein

Defect Aperture

T	= Tight (Nil)
VN	= Very Narrow (>0-2mm)
N	= Narrow (2-6mm)
MN	= Moderately Narrow (6-20mm)
MW	= Moderately Wide (20-60mm)
W	= Wide (60-200mm)
VW	= Very Wide (>200mm)

Defect Roughness

Pl	= Planar
St	= Stepped
Ud	= Undulating
Ro	= Rough
Sm	= Smooth
Slk	= Slickensided
	= Parallel
Po	= Polished

Infill Thickness

Sn	= Stained
Vn	= Veneer (<0.5mm)
Cg	= Coating
P	= Partially infilled
C	= Completely infilled

Infill Colour

bl	= Blue
bn	= Brown
bk	= Black
gn	= Green
gy	= Grey
or	= Orange
pk	= Pink
rd	= Red
wh	= White
ye	= Yellow

Infill Material

Calc	= Calcareous
Cb	= Carbonaceous
Cc	= Calcite
Cl	= Clay
Fe	= Iron Oxide
Mn	= Manganese
NF	= No Infill
Py	= Pyrite
Qtz	= Quartz
S	= Sand
Slt	= Silt

Graphic Log (typical symbols)

	Peat		Mudstone
	Clay		Siltstone
	Silt		Sandstone
	Sand		Basalt
	Gravel / Cobbles		No recovery
	Welded Tuff		

Core Measurements

TCR	= Total Core Recovery
RQD	= Rock Quality Designation

Soil and rock descriptions generally as in "Guidelines for the Field Description of Soil and Rock for Engineering Purposes" by the NZ Geotechnical Society Inc, December 2005.

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409364.66mE 796020.26mN
 Orientation -90° Elevation 6.56m
 Location Opposite 10 Seven Oaks Drive
 Feature Fill slope/MSE wall

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0-100%</small>	Relative Strength <small>MS MS W VW EW</small>	Rock Weathering <small>SW MW HW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects <small>(mm) 0-100 100-200 200-300 300-400 400-500</small>	SOIL PROPERTIES <small>Subordinate MAJOR minor: colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation
	Shear Vane/ SPT	SPT N Values									DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>	
0.0m: Wash boring for iVane & piston samples. Refer to adjacent drillhole log (DH203) for soil properties/geological description.		0-50	VAC EX				1		0		0.0 to 1.8m: Vacuum excavation not witnessed.	
			WASH				2		0		1.8 to 1.9m: iVane test.	2.45
			WASH				3		0		3.0m: 140mm diameter PWT casing installed to 3m depth.	2.65
			WASH				4		0			3.45
			WASH				5		0			
			WASH				6		0		6.0 to 6.1m: iVane test.	
			PT				7		100		7.0m: Push Tube (100% recovery): Top & Base: Silty CLAY; bluish grey. Firm, moist, high plasticity.	
			WASH				8		0		7.5 to 7.6m: iVane test.	
			PT				9		100		8.5m: Push Tube (100% recovery): Top & Base: Silty CLAY; bluish grey. Firm, moist, high plasticity.	
			WASH						0			

For explanation of symbols and observations, see key sheet

FLUID DEPTHS AND DRILLING PROGRESS (m)			
Date Time	Drilled Depth	Casing Depth	Fluid Depth
07/12/2021 08:30	09.50	3.0	2.65
08/12/2021 08:15	16.50	3.0	2.45
09/12/2021 08:30	17.80	3.0	3.45

RELATIVE STRENGTH

VS - Very strong
 S - Strong
 MS - Moderately strong
 W - Weak
 VW - Very weak
 EW - Extremely weak

WEATHERING

UW - Unweathered
 SW - Slightly weathered
 MW - Moderately weathered
 HW - Highly weathered
 CW - Completely weathered

Date logged 9/12/2021

Logged SK
 Checked GP

Driller

McMillan
 Started 6/12/2021
 Finished 9/12/2021

Drill Rig N118

Core Boxes 0

Remarks

Wash bore for iVane and Push Tube sampling. 50 mm standpipe piezometer installed upon completion of drilling. Piezometer developed by air lift.

Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409364.66mE 796020.26mN
 Orientation -90° Elevation 6.56m
 Location Opposite 10 Seven Oaks Drive
 Feature Fill slope/MSE wall

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength <small>MS MSW VW W</small>	Rock Weathering <small>SW MW HW</small>	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects <small>0-100 100-200 200-300 300-400 400-500</small>	SOIL PROPERTIES <small>Subordinate MAJOR minor: colour, structure, Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation		
	Shear Vane/ SPT	SPT N Values <small>0 - 50</small>									DEFECT DESCRIPTION <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>			
			WASH				11		0					
			WASH				12		0					
			WASH				13		0					
			WASH				14		0		13.65 to 13.75m: iVane test.			
			WASH				15		0					
			PT				16		100		16.0m: Push Tube (100% recovery): Top & Base: Silty CLAY; bluish grey. Firm, moist, high plasticity.			
			WASH				17		0		16.5m: iVane test.			
							18				17.8 to 17.9m: iVane test.			
							19				WB203_P terminated at 17.8m Target Depth			
<p><i>For explanation of symbols and observations, see key sheet</i></p> <p>FLUID DEPTHS AND DRILLING PROGRESS (m) Date Time Drilled Depth Casing Depth Fluid Depth</p>			<p>RELATIVE STRENGTH</p> <p>VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak</p>		<p>WEATHERING</p> <p>UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered</p>		<p>Date logged 9/12/2021</p> <p>Logged SK</p> <p>Checked GP</p>		<p>Driller McMillan Started 6/12/2021 Finished 9/12/2021 Drill Rig N118 Core Boxes 0</p>		<p>Remarks</p> <p>Wash bore for iVane and Push Tube sampling. 50 mm standpipe piezometer installed upon completion of drilling. Piezometer developed by air lift.</p> <p>Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016</p>		<p>Page 2 of 2</p>	
<p>Hand Held Shear Vane</p> <p><i>vane shear strength per NZGS guideline</i></p>														

2021 EB DRILLHOLE LOG 2022-01-24 SBS MASTER.GPJ BASE.GDT 24/01/22

TERMINOLOGY AND SYMBOLS

Drilling / Investigation Methods

CFHSA	- Continuous Flight Hollow Stem Auger.
CFSSA	- Continuous Flight Solid Stem Auger.
DC	- Dynamic Coring (eg Terrier Rig).
DCP	- Dynamic Cone Penetrometer.
HA	- Hand Auger.
HQ3	- HQ Triple Tube.
HQWL	- HQ Wire Line.
HWOB	- Heavy Weight Open Barrel.
NQ3	- NQ Triple Tube.
NQWL	- NQ Wire Line.
OB	- 100mm diameter Open Barrel.
OB70	- 70mm diameter Open Barrel.
PERC	- Percussion.
PS	- Piston Sample.
PQ3	- PQ Triple Tube.
PQWL	- PQ Wire Line.
RC	- Reverse Circulation.
RCDHH	- Reverse Circulation Down Hole Hammer.
SPT	- Standard Penetration Test.
SPERC	- Sonic Percussion.
PT	- Push Tube Sample
VAC EX	- Vacuum Excavation.
WASH	- Wash Drilling.

Test Results

SPT "N" value; uncorrected blow count for 300 mm penetration
 # / # / # / # / # / # blows per 75 mm penetration

ss - Standard Penetration Test - split spoon
 sc - Standard Penetration Test - solid cone (no sample recovery)
 SUOW - Sunk Under Own Weight

Vane Shear Strength Tests

/ # Vane shear strength test results given as peak / remoulded shear strengths (kPa). Test as per NZGS Guideline, 2001.

= Vane test performed on core recovered prior to extrusion from core barrel.
 * = Vane test performed on excavated material of suitable size.

UTP - Unable to penetrate.

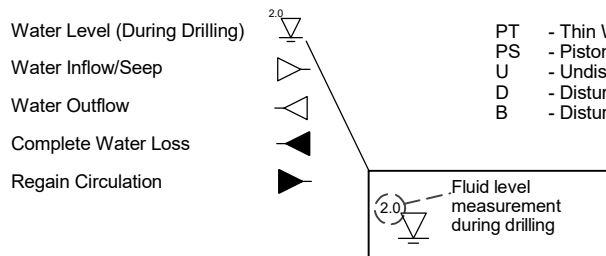
Unit/Geological Boundary Lines

———— Known
 - - - - - Inferred/Unknown

Installation & Backfill

Standpipe		Grout	
Slotted Standpipe		Cement	
Collapse/Cuttings /Spoil		Gravel Pack Filter	
Bentonite		Sand Pack Filter	
Inclinometer		Gravel Backfill	

Groundwater Records



Samples

PT	- Thin Wall Push Sample
PS	- Piston Sample
U	- Undisturbed
D	- Disturbed (Core)
B	- Disturbed (Pit)

Rock Descriptions

Relative Strength

ES	- Extremely strong	> 250
VS	- Very Strong	100 - 250
S	- Strong	50 - 100
MS	- Moderately Strong	20 - 50
W	- Weak	5 - 20
VW	- Very Weak	1 - 5
EW	- Extremely Weak	< 1

Weathering

UW	- Unweathered
SW	- Slightly Weathered
MW	- Moderately Weathered
HW	- Highly Weathered
CW	- Completely Weathered

Soil Descriptions

Consistency Cohesive Soils

Very Soft	Su (kPa) < 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	200 - 500

Relative Density Non-cohesive soils

Very Loose	SPT "N" Value (uncorrected) < 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

Rock Defect Abbreviations

Defect Type

BP	= Bedding Plane Defect
CZ	= Crush Zone
DB	= Drilling Break
FZ	= Fracture Zone
HJ	= Healed Joint
J	= Joint
SZ	= Shear Zone
Ve	= Vein

Defect Aperture

T	= Tight (Nil)
VN	= Very Narrow (>0-2mm)
N	= Narrow (2-6mm)
MN	= Moderately Narrow (6-20mm)
MW	= Moderately Wide (20-60mm)
W	= Wide (60-200mm)
VW	= Very Wide (>200mm)

Defect Roughness

Pl	= Planar
St	= Stepped
Ud	= Undulating
Ro	= Rough
Sm	= Smooth
Slk	= Slickensided
	= Parallel
Po	= Polished

Infill Thickness

Sn	= Stained
Vn	= Veneer (<0.5mm)
Cg	= Coating
P	= Partially infilled
C	= Completely infilled

Infill Colour

bl	= Blue
bn	= Brown
bk	= Black
gn	= Green
gy	= Grey
or	= Orange
pk	= Pink
rd	= Red
wh	= White
ye	= Yellow

Infill Material

Calc	= Calcareous
Cb	= Carbonaceous
Cc	= Calcite
Cl	= Clay
Fe	= Iron Oxide
Mn	= Manganese
NF	= No Infill
Py	= Pyrite
Qtz	= Quartz
S	= Sand
Slt	= Silt

Graphic Log (typical symbols)

	Peat		Mudstone
	Clay		Siltstone
	Silt		Sandstone
	Sand		Basalt
	Gravel / Cobbles		No recovery
	Welded Tuff		

Core Measurements

TCR	= Total Core Recovery
RQD	= Rock Quality Designation

Soil and rock descriptions generally as in "Guidelines for the Field Description of Soil and Rock for Engineering Purposes" by the NZ Geotechnical Society Inc, December 2005.

Client Auckland Transport
 Project Eastern Busway
 Project number 60644113

Co-ordinates 409779.80mE 796470.43mN
 Orientation -90° Elevation 17.12m
 Location 3 William Roberts Road
 Feature Validate CPT514 & confirm settlement

GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift	Relative Strength	Rock Weathering	Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects (mm)	SOIL PROPERTIES	Instrumentation
	Shear Vane/ SPT	SPT N Values									Subordinate MAJOR minor: colour, structure. Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc	
		0 - 50									0.0m: Wash boring for iVane & piston samples. Refer to adjacent drillhole log (DH213) for soil properties/geological description. 3.0m: 140mm diameter PWT casing installed to 3m depth. 3.8 to 3.9m: iVane test. 4.3m: Push Tube (84% recovery): Top & Base: Silty CLAY with some fine to medium sand; brownish grey. 4.8 to 4.9m: iVane test. 8.5m: Push Tube (100% recovery): Top: Pumiceous sand with trace organic clay. Base: Silty CLAY with some organics; bluish grey. 9.0 to 9.1m: iVane test.	
For explanation of symbols and observations, see key sheet FLUID DEPTHS AND DRILLING PROGRESS (m) Date Time Drilled Depth Casing Depth Fluid Depth 13/12/2021 17:15 09.00 3.0 2.4 15/12/2021 08:00 09.00 3.0 2.4 15/12/2021 12:30 18.50 3.0 2.8			RELATIVE STRENGTH VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak		WEATHERING UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered		Date logged 15/12/2021 Logged SK Checked GP		Driller McMillan Started 13/12/2021 Finished 15/12/2021 Drill Rig N118 Core Boxes 0			
Hand Held Shear Vane			Remarks Wash bore for iVane and Push Tube sampling. 50 mm standpipe piezometer installed upon completion of drilling. Piezometer developed by air lift.		Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016		Page 1 of 2		vane shear strength per NZGS guideline			

2021 EB DRILLHOLE LOG 2022-01-28 SBS MASTER.GPJ BASE.GDT 28/01/22

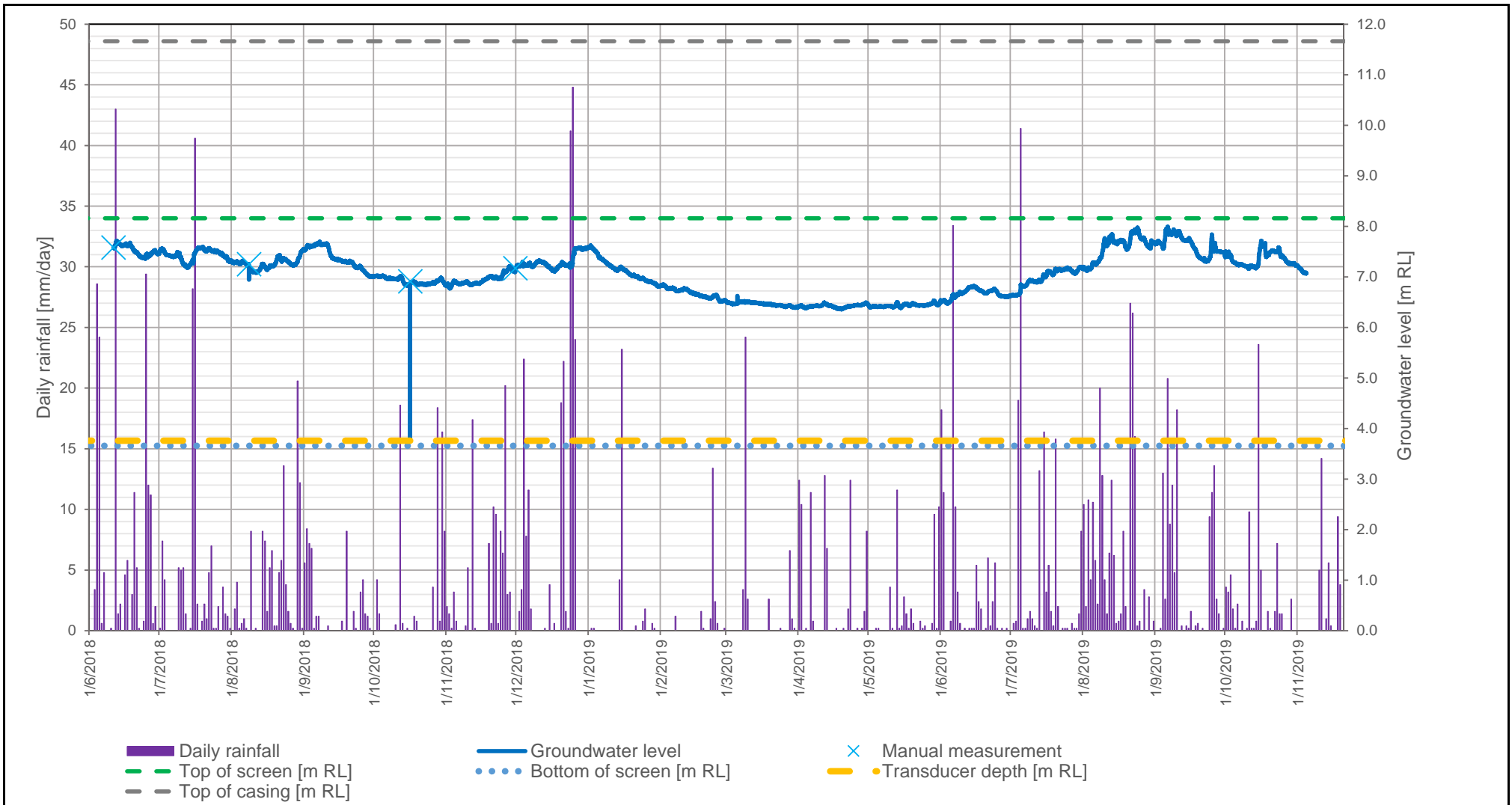
Client Auckland Transport
 Project Eastern Busway
 Project number 60644113


Co-ordinates 409779.80mE 796470.43mN
 Orientation -90° Elevation 17.12m
 Location 3 William Roberts Road
 Feature Validate CPT514 & confirm settlement

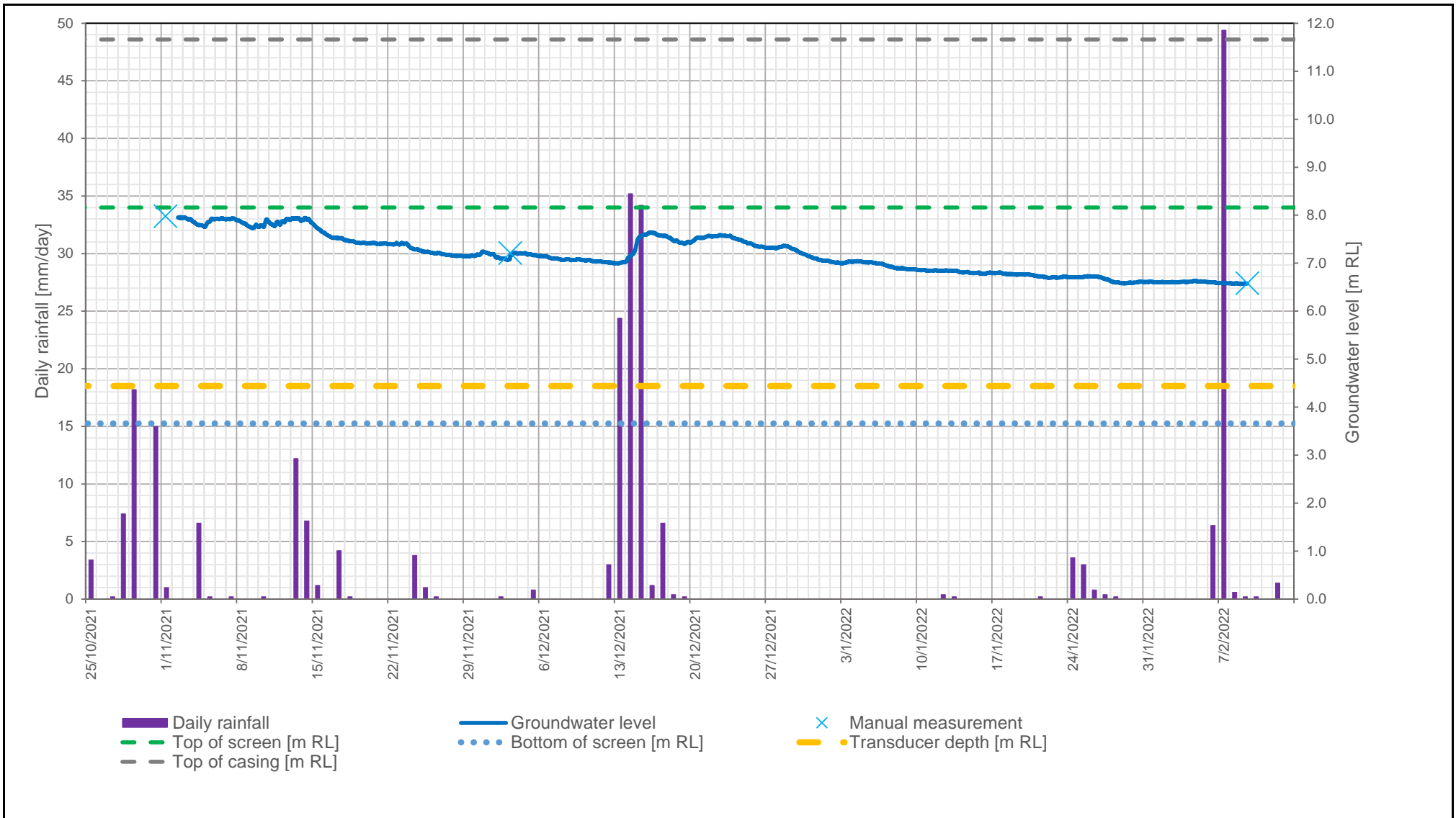
GEOLOGICAL DESCRIPTION <small>Weathering, Colour, Fabric, ROCK NAME. Strength, Discontinuities, Lithological Features (bedding, foliation, mineralogy, cement, etc).</small>	Test Records		Drilling Method <small>Casing remarks</small>	Core Loss/Lift <small>0 - 100%</small>	Relative Strength			Depth	Graphic Log	TCR [RQD] (%)	Spacing of Natural Defects <small>(mm)</small>	SOIL PROPERTIES <small>Subordinate MAJOR minor: colour, structure. Strength, moisture condition, grading, bedding, plasticity, sensitivity, major fraction description, subordinate fraction description, minor fraction description, additional structures, additional information, etc</small>	Instrumentation	
	Shear Vane/ SPT	SPT N Values <small>0 - 50</small>			MS	W	SW					SOIL PROPERTIES <small>(Joints, Bedding Seams, Shatter, Shear and Crush Zones, Foliation, Schistosity, Attitude, Spacing, continuity, roughness, infilling, etc.)</small>		
			PT							100		10.0m: Lab Description: Organic silty CLAY, dark brown and black; soft to stiff, moist, high plasticity.		
			WASH							0		10.28m: SILT with minor clay, trace sand, light bluish grey mixed with dark brown-black, stiff, moist, medium to high plasticity, few rootlets. 10.5 to 10.6m: iVane test.		
			WASH							0				
			WASH							0				
			WASH							0				
			WASH							0				
			WASH							0				
			PT							100		18.0m: Push Tube (100% recovery): Top: Silty CLAY; bluish grey. Base: Fine micaceous SAND; bluish grey.		
												WB213_P terminated at 18.5m Target Depth		
<p><i>For explanation of symbols and observations, see key sheet</i></p> <p>FLUID DEPTHS AND DRILLING PROGRESS (m) Date Time Drilled Depth Casing Depth Fluid Depth</p>					<p>RELATIVE STRENGTH</p> <p>VS - Very strong S - Strong MS - Moderately strong W - Weak VW - Very weak EW - Extremely weak</p>			<p>WEATHERING</p> <p>UW - Unweathered SW - Slightly weathered MW - Moderately weathered HW - Highly weathered CW - Completely weathered</p>			<p>Date logged 15/12/2021 Logged SK Checked GP</p>		<p>Driller McMillan Started 13/12/2021 Finished 15/12/2021 Drill Rig N118 Core Boxes 0</p>	
<p>Hand Held Shear Vane</p> <p><i>vane shear strength per NZGS guideline</i></p>					<p>Remarks</p> <p>Wash bore for iVane and Push Tube sampling. 50 mm standpipe piezometer installed upon completion of drilling. Piezometer developed by air lift.</p> <p>Horizontal / Vertical Survey Datums: NZGD2000 / Mount Eden 2000 / New Zealand Vertical Datum 2016</p>			<p>Page 2 of 2</p>						

2021 EB DRILLHOLE LOG 2022-01-28 SBS MASTER.GPJ BASE.GDT 28/01/22

Appendix B – Groundwater Graphs

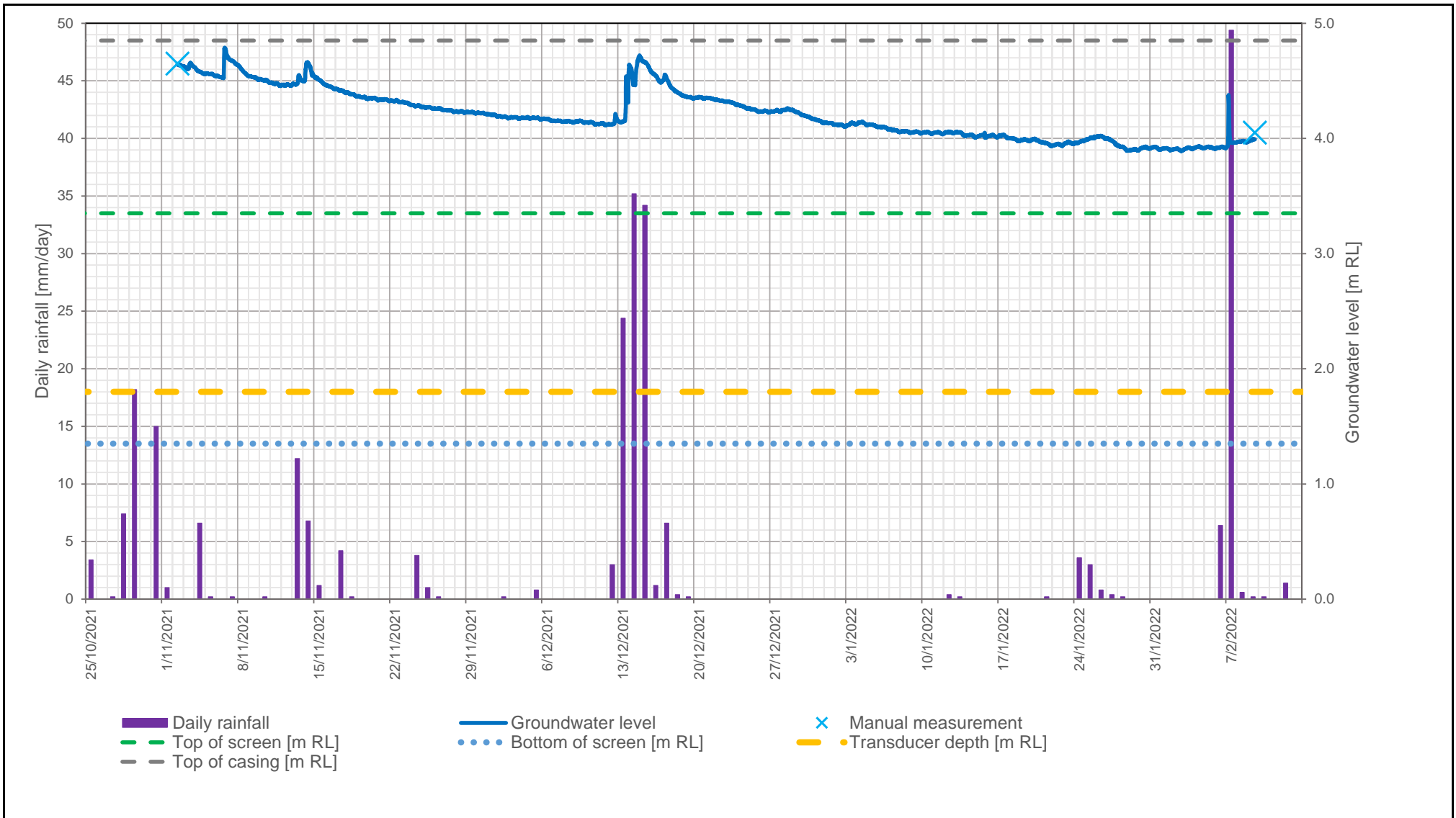



 Eastern Busway	Prepared by:	G. Sturgess	Eastern Busway
	Checked by:	E. Eddington	Groundwater Level Monitoring
	Date:	2/25/2022	DH18_103 Piezometer Results
	Figure No.:	1	

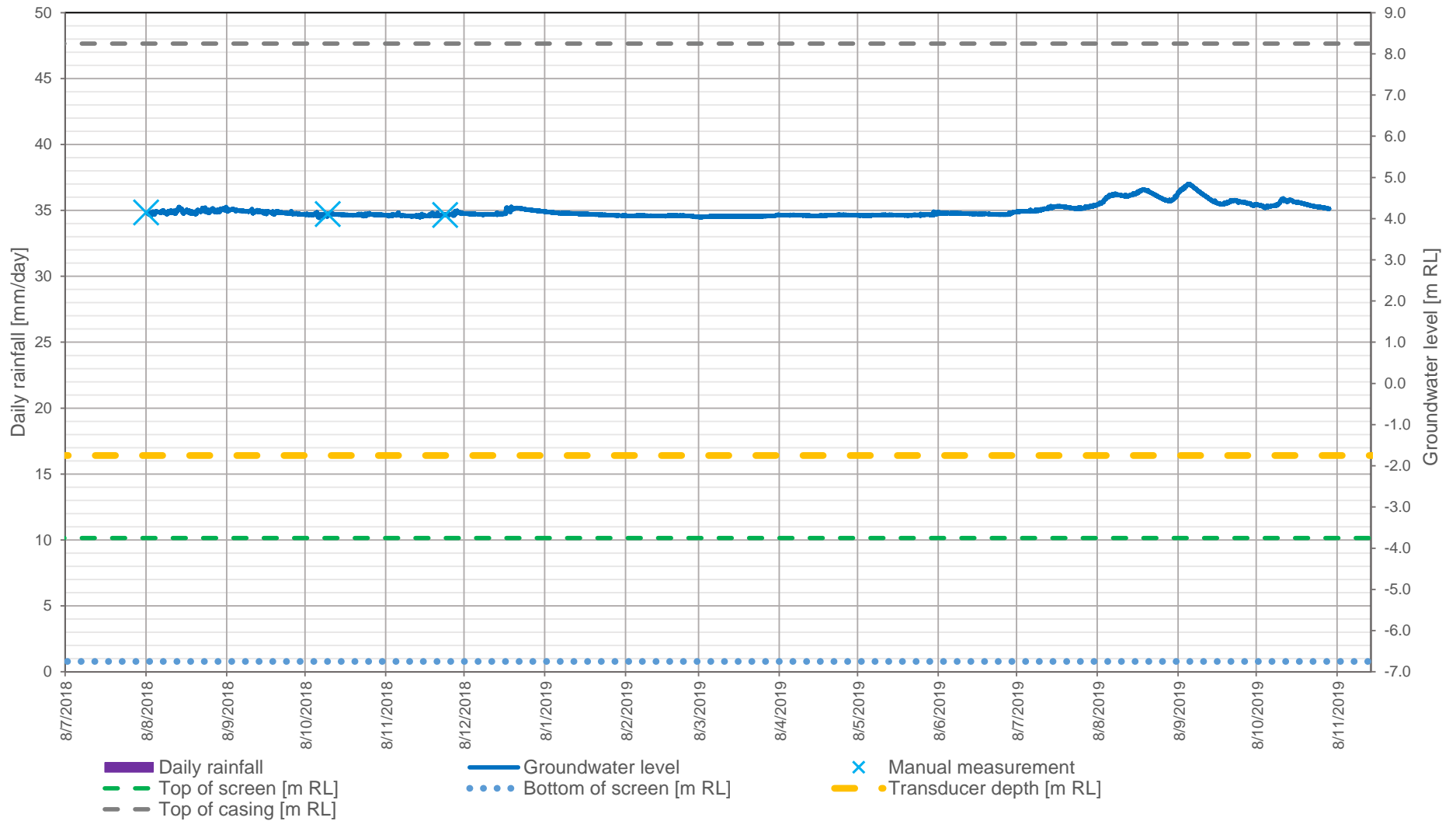


Prepared by:	G. Sturgess
Checked by:	E. Eddington
Date:	2/25/2022
Figure No.:	1

Eastern Busway
Groundwater Level Monitoring
DH18_103 Piezometer Results



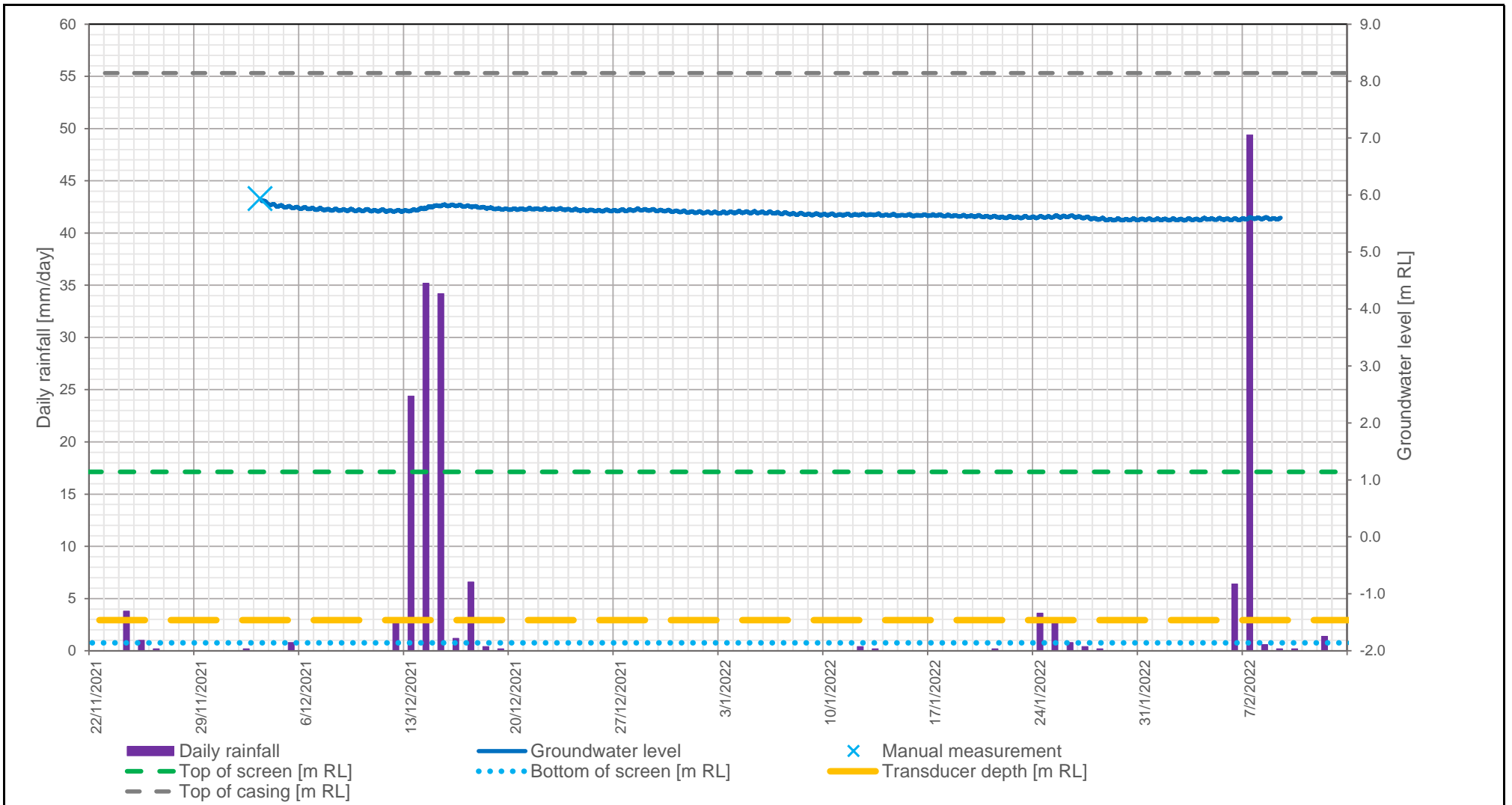
 Eastern Busway	Prepared by:	G. Sturgess	Eastern Busway Groundwater Level Monitoring DH18_104 Piezometer Results
	Checked by:	E. Eddington	
	Date:	2/25/2022	
	Figure No.:	1	




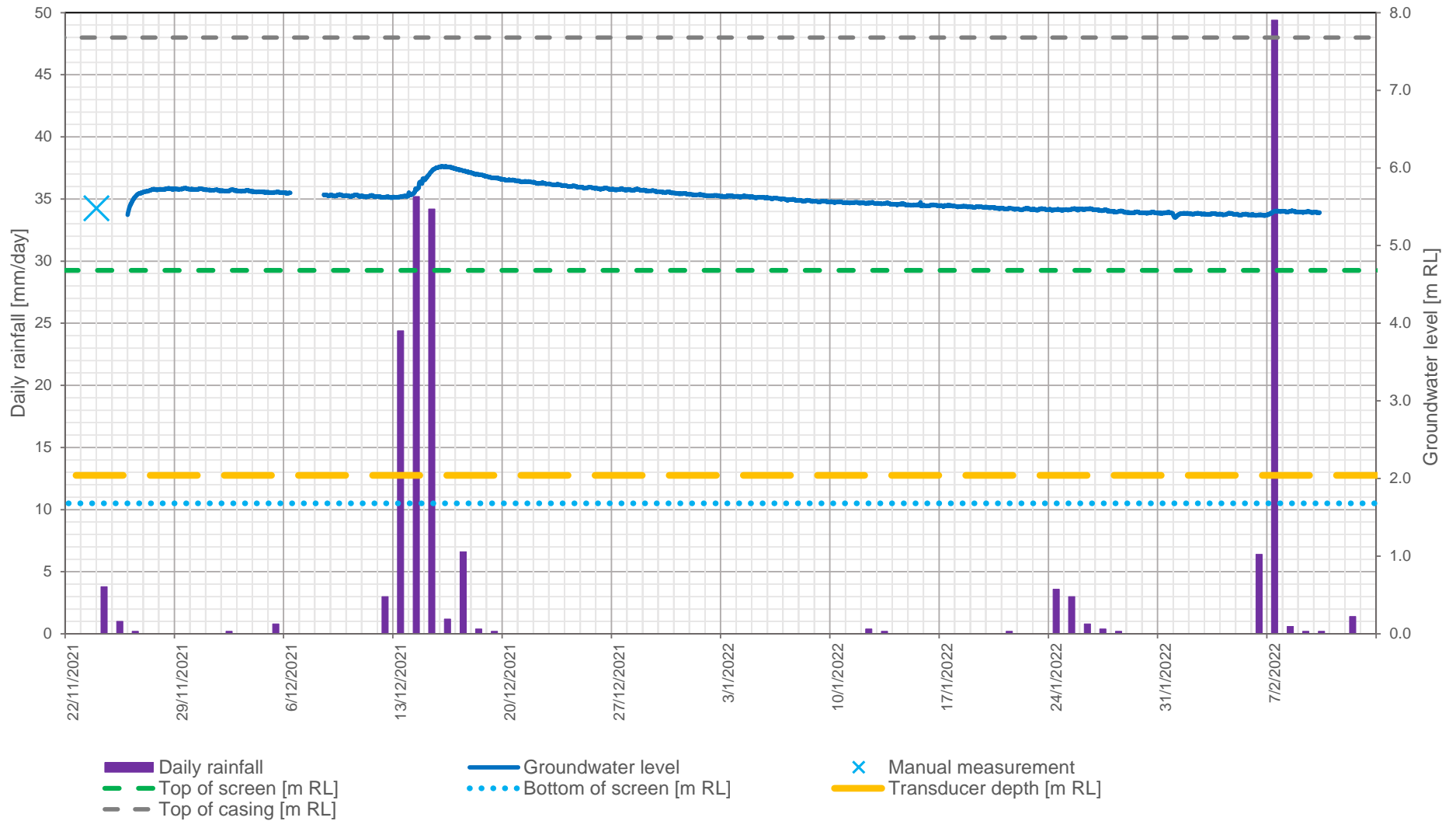
Prepared by:	G. Sturgess
Checked by:	E. Eddington
Date:	2/25/2022
Figure No.:	1

Eastern Busway
Groundwater Level Monitoring

DH18_108 Piezometer Results

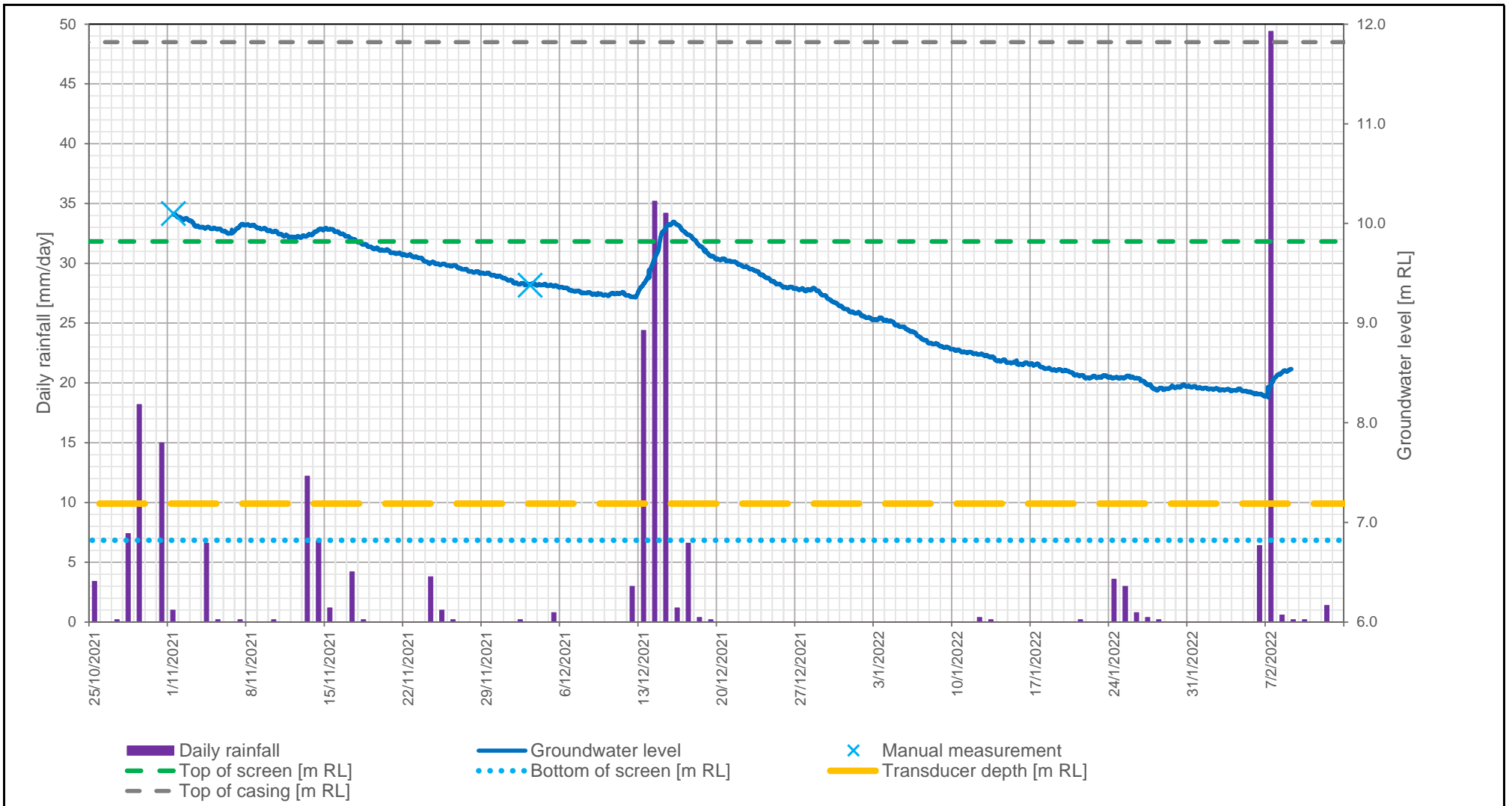



 Eastern Busway	Prepared by:	S. Kirkman	Eastern Busway
	Checked by:	E. Eddington	Groundwater Level Monitoring
	Date:	2/25/2022	EB21_DH204 Piezometer Results
	Figure No.:	1	

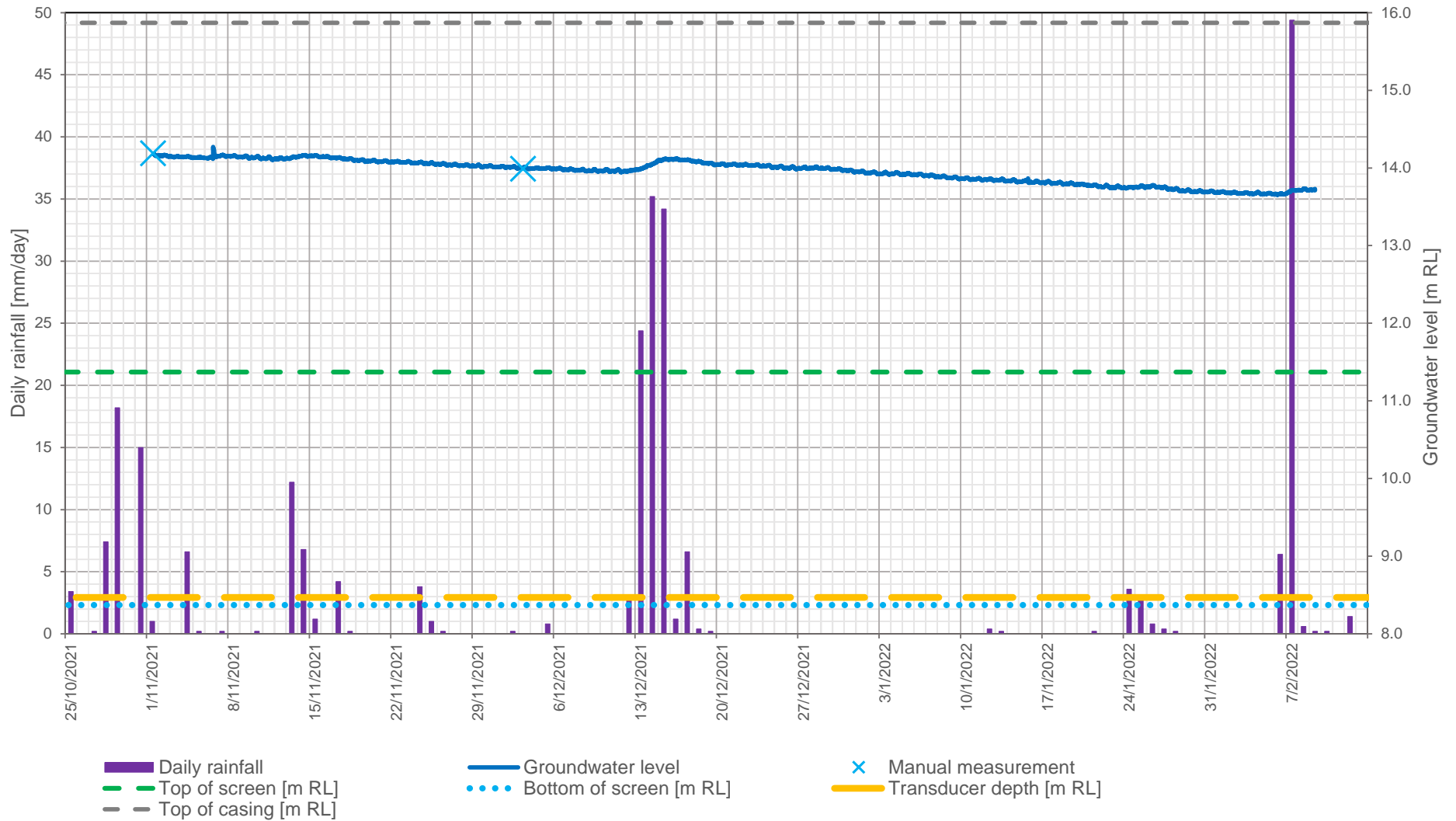


Prepared by:	S. Kirkman
Checked by:	E. Eddington
Date:	2/25/2022
Figure No.:	1

Eastern Busway
Groundwater Level Monitoring
EB21_205_P Piezometer Results

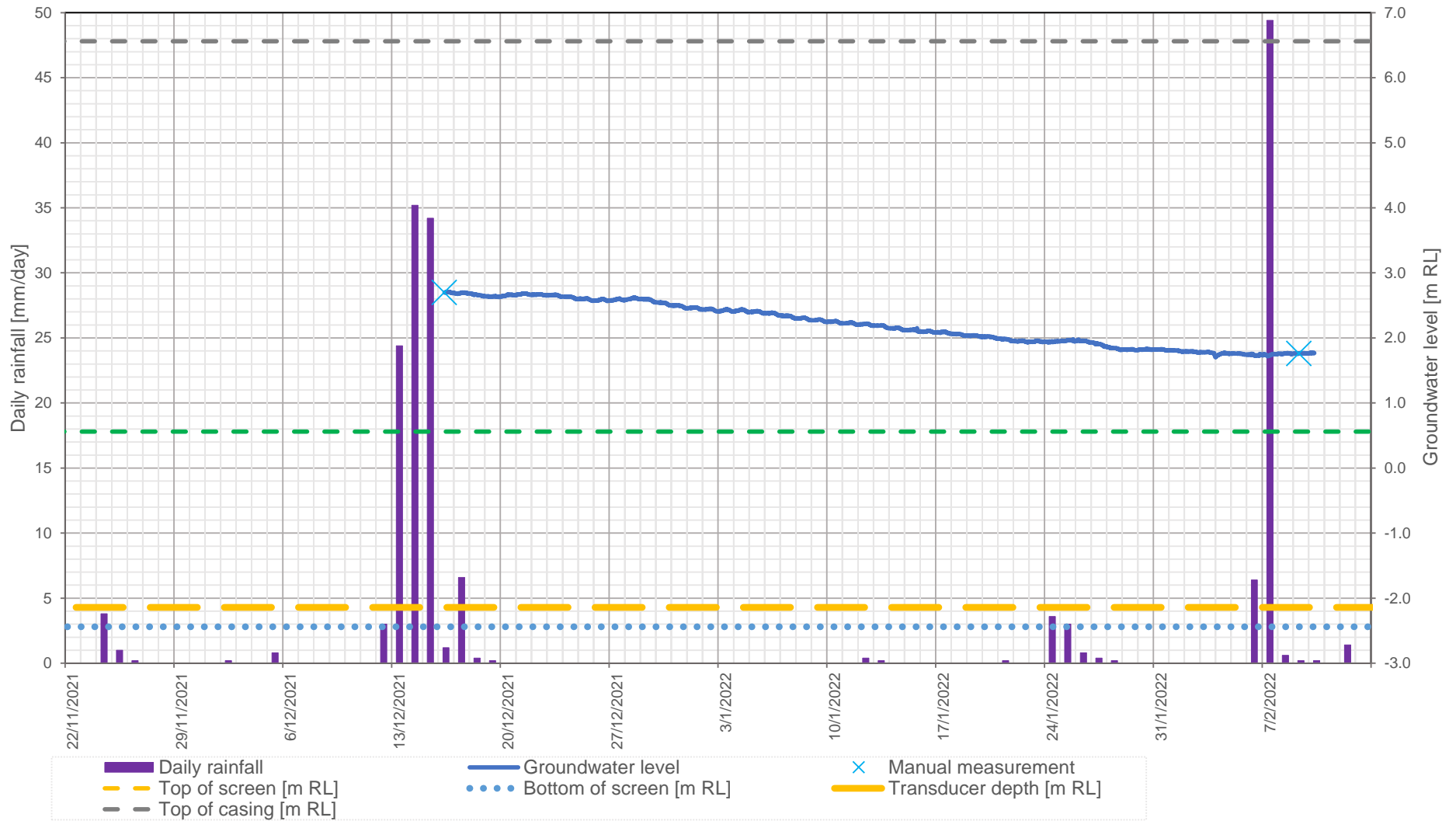


 Eastern Busway	Prepared by:	S. Kirkman	Eastern Busway
	Checked by:	E. Eddington	Groundwater Level Monitoring
	Date:	2/25/2022	EB21_210 Piezometer Results
	Figure No.:	1	



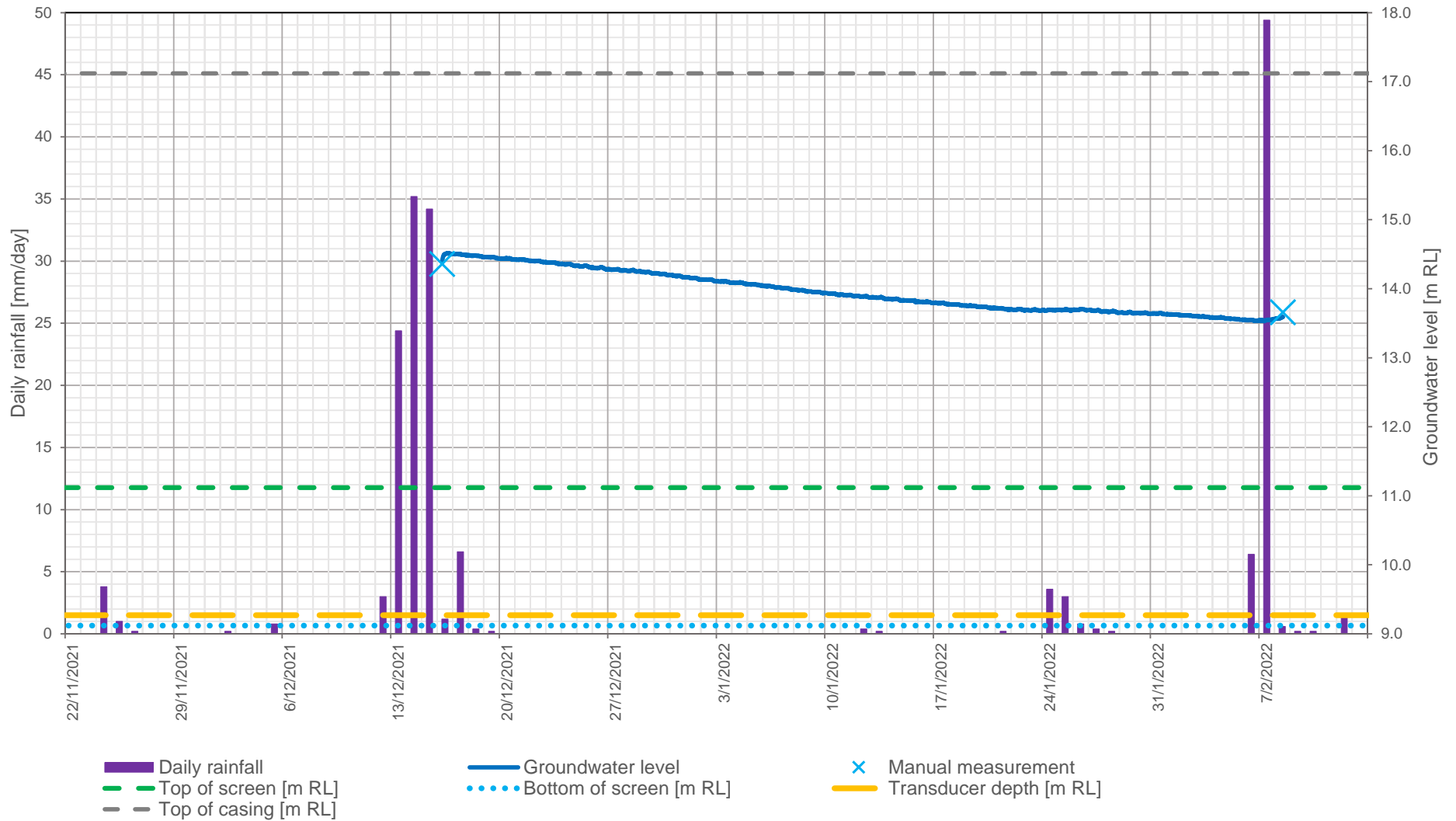
Prepared by:	S. Kirkman
Checked by:	E. Eddington
Date:	2/25/2022
Figure No.:	1

Eastern Busway
Groundwater Level Monitoring
EB21_DH212 Piezometer Results



Prepared by:	G. Sturgess
Checked by:	E. Eddington
Date:	2/25/2022
Figure No.:	1

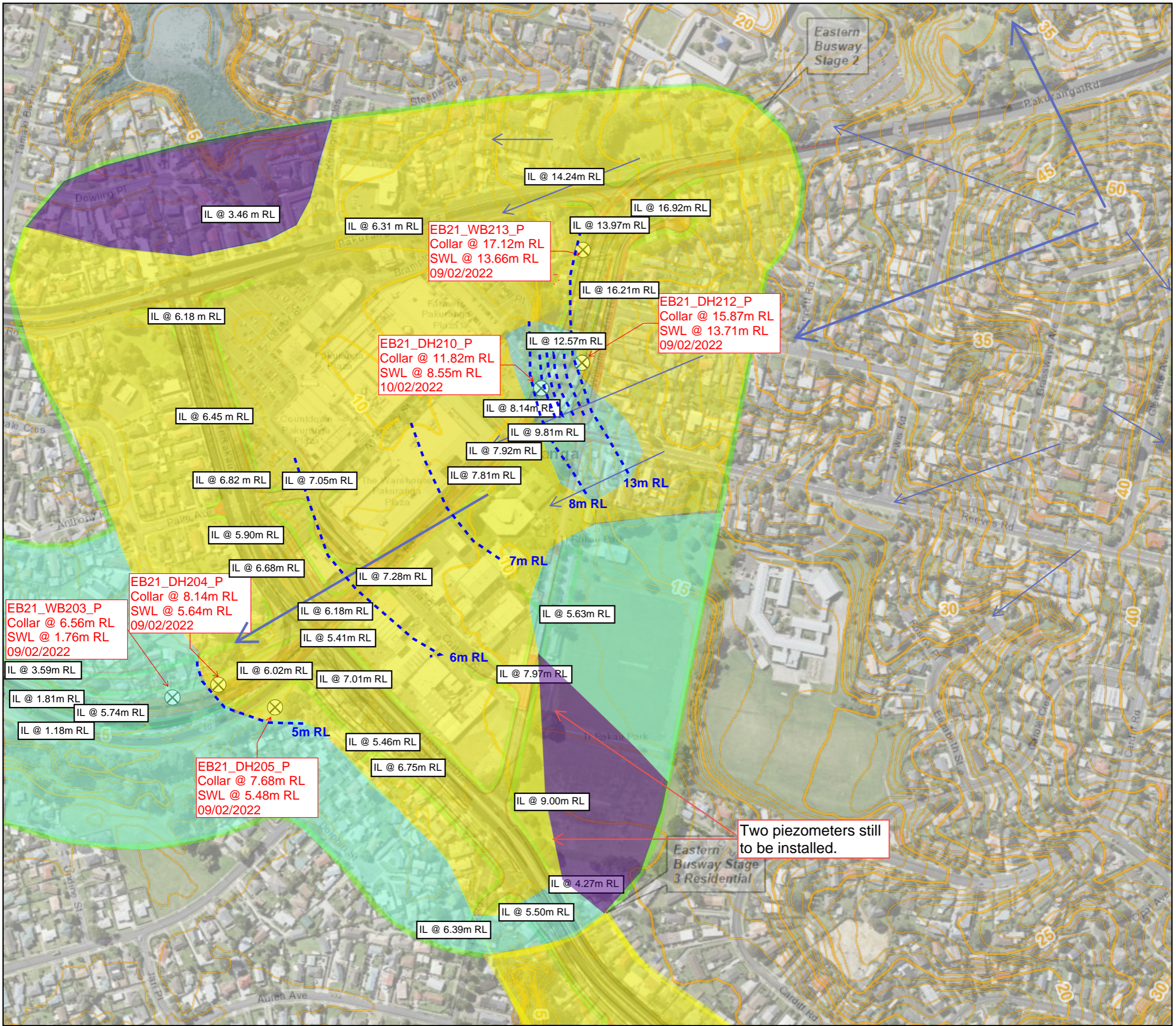
Eastern Busway
Groundwater Level Monitoring
EB21_WB203 Piezometer Results



Prepared by:	S. Kirkman
Checked by:	E. Eddington
Date:	2/25/2022
Figure No.:	1

Eastern Busway
Groundwater Level Monitoring
EB21_WB213 Piezometer Results

Appendix C – Flow Maps



EB2 Flow Map

- Eastern Busway Stage 2
- Eastern Busway Stage 3 Residential
- 2m Contours
- 5m Contours
- Inferred flow direction
- Inferred excavations may be below <1.0m of SWL
- Inferred excavations may be below <0.6m of SWL
- Inferred excavations to be above SWL

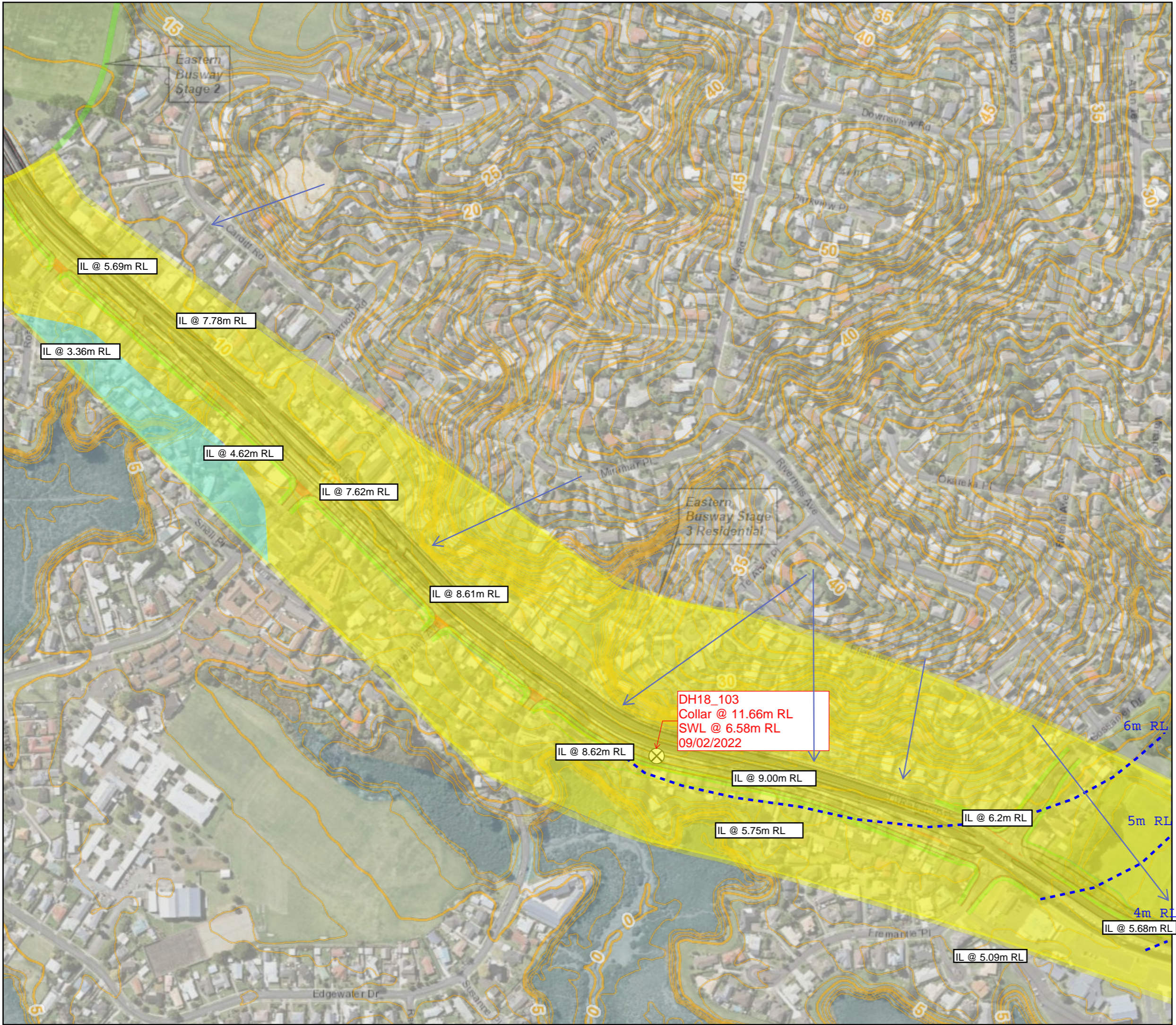
Abbreviations

- IL: Invert level
- SWL: Standing water level
- IL @ Xm RL: Deepest Stormwater trench invert level in area



Map Creation Date: 2/23/2022 Scale: 1:4,514

This map is shown for reference purposes only. Acciona provides this information "as is" with the understanding that it is not guaranteed to be accurate, correct or complete and conclusions drawn from such information are the responsibility of the user. While every effort is made to ensure the information displayed is as accurate and current as possible, Acciona will not be held responsible for any loss, damage or inconvenience caused as a result of reliance on such information or data.



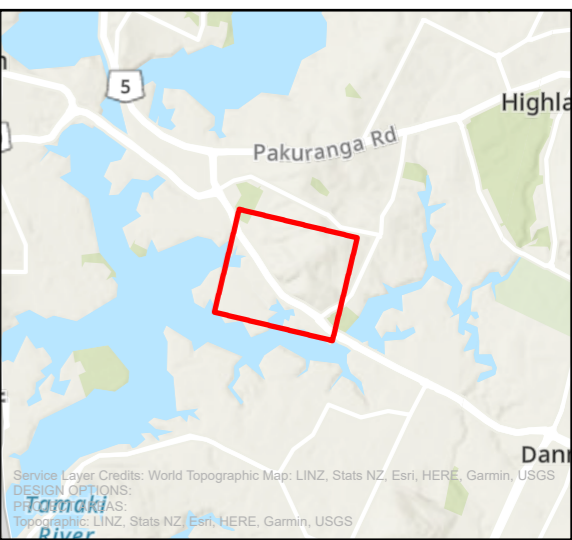
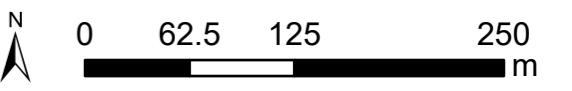
EB3R Flow Map (North)

- Eastern Busway Stage 2
- Eastern Busway Stage 3 Residential
- 2m Contours
- 5m Contours
- Inferred flow direction
- Inferred equipotential hydraulic head
- Inferred excavations may be below <1.5m of SWL
- Inferred excavations to be above SWL

Abbreviations

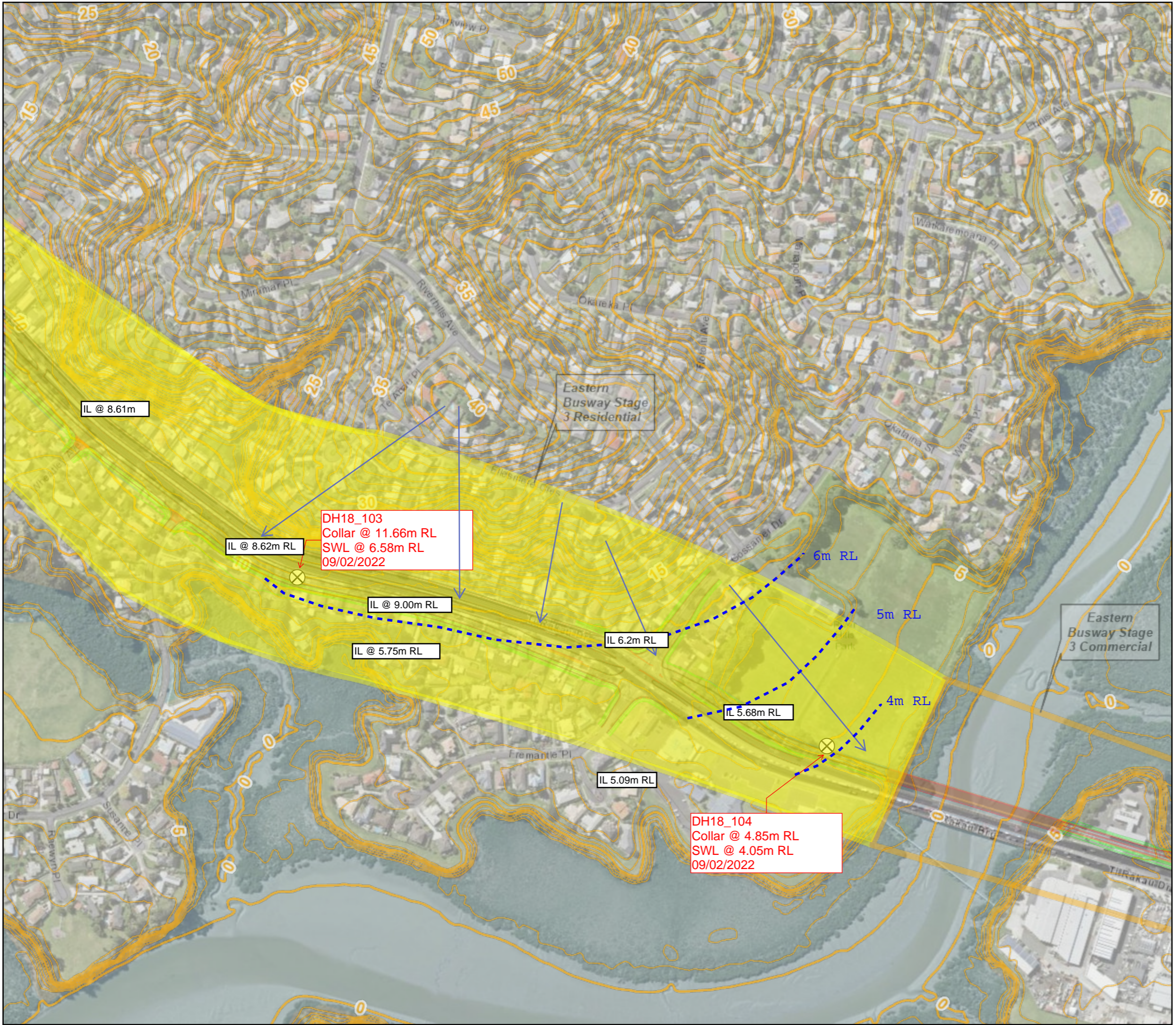
IL: Invert level
 SWL: Standing water level

IL @ X m RL Deepest Stormwater trench invert level in area



Map Creation Date: 2/24/2022 Scale: 1:4,514

This map is shown for reference purposes only. Acciona provides this information "as is" with the understanding that it is not guaranteed to be accurate, correct or complete and conclusions drawn from such information are the responsibility of the user. While every effort is made to ensure the information displayed is as accurate and current as possible, Acciona will not be held responsible for any loss, damage or inconvenience caused as a result of reliance on such information or data.



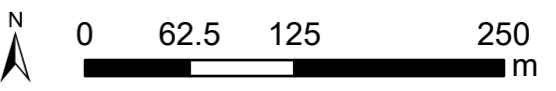
EB3R Flow Map (South)

- █ Eastern Busway Stage 2
- █ Eastern Busway Stage 3 Residential
- 2m Contours
- 5m Contours
- Inferred flow direction
- - - Inferred equipotential hydraulic head
- █ Inferred excavations may be below <1.5m of SWL
- █ Inferred excavations to be above SWL

Abbreviations

- IL: Invert level
- SWL: Standing water level

IL @ Xm RL Deepest Stomwater trench invert level in area



Map Creation Date: 2/23/2022 Scale: 1:4,514

This map is shown for reference purposes only. Acciona provides this information "as is" with the understanding that it is not guaranteed to be accurate, correct or complete and conclusions drawn from such information are the responsibility of the user. While every effort is made to ensure the information displayed is as accurate and current as possible, Acciona will not be held responsible for any loss, damage or inconvenience caused as a result of reliance on such information or data.

Appendix D – Existing Bores





Legend

- Buffered
- ClosedLandfill
- ContaminatedSubTypes
- PossibleContamRecords
- PropertyNotesFromSAP
- LegacyApplicationsAll
- LegacyBores
- LegacyConsentsAll
- LegacyPermittedActivities
- OAS_CONS_D_CONTAMINATED_SITE
- SIIEPollution