REPORT

Tonkin+Taylor

MILLWATER SUBDIVISION - ARRANS POINT PRECINCT 7 STAGE 2

Geotechnical Completion Report

Prepared for
WFH Properties Ltd
Prepared by
Tonkin & Taylor Ltd
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Executive summary

Tonkin + Taylor Ltd (T+T) was engaged by WFH Properties Ltd to monitor and provide earthworks certification for the 27 No. Residential Lots contained within Stage 2 of Arran's Point Precinct 7 at the Millwater Subdivision in Silverdale. Stage 2 comprises residential Lots 120 to 136, 154 to 160 and 202 to 204 (high density residential Lots), Joint Owned Access Lane Lot 605 and Road Lots 901 (Arran Point Parade) and 902 (Mana Terrace) inclusive as shown on the Woods Final Contour As–Built Plan (Woods Ref 37001–02-100-AB) in Appendix A1.

This Geotechnical Completion Report contains information required for subdivisional earthworks completion reporting, as well as outlining geotechnical design issues that need to be considered for subsequent building design and construction on each residential Lot.

Previous geotechnical investigation work across the subdivision was undertaken by T+T and reported in:

a 2000 and 2001 Preliminary feasibility reporting (Ref. [1] and [2]).

b 2003 Major reconnaissance report covering land in the Silverdale North and Orewa West areas (Ref. [3]).

c November 2011 Geotechnical Investigation Report for the North Bridge, Southern Abutment (Ref. [4]).

d November 2013 Geotechnical Investigation Report for Arran's Point Precinct 7 (Ref. [5]).

Woods Ltd (Woods) undertook the engineering design for this stage and the overall subdivision.

Bulk earthworks associated with development of Stage 2 of Arrans Point (Precinct 7) commenced in March 2014 and were completed by February 2016. Earthworks comprised the following:

a Stripping of vegetation, organic materials and topsoil to stockpile.

b Installation of subsoil drains.

c Cut to fill earthworks across the entire Stage 2 area as shown on the Woods Cut & Fill As–Built Plan Lowest to Final Surface (Woods Ref 37001–02–110-AB) in Appendix A1.

d Construction of 1 No. Shear Key (SK1) as shown on T+T Drawing 21854.0037–APP7S2–101 in Appendix A2.

e Construction of 1 No. palisade wall (PW2) as shown on T+T Drawing 21854.0037–APP7S2–101 in Appendix A2.

f Construction of a 3m high Screen Block retaining wall (Wall 3) along the northern boundary of Lots 120 to 131 (immediately below RE 5) and the western boundary of Lot 160 as shown on T+T Drawing 21854.0037–APP7S2–101 in Appendix A2.

g Construction of a 7m high, 1 in 1 (V:H) engineered fill batter slope (RE 5) along the northern boundary of Lots 120 to 136 as shown on T+T Drawing 21854.0037–APP7S2–101 in Appendix A2.

Civil earthworks commenced on site in June 2016 and were completed by February 2017, and comprised the following:

a Minor cut to fill earthworks across parts of the site as part of final Lot development.

b Construction of 1 No. geogrid reinforced segmental block wall (i.e. part of Allan Block Wall 9), as shown on T+T Drawing 21854.0037–APP7S2–101 in Appendix A2.

c Installation of roading and services.

Overall subdivisional soil types are moderately expansive (Class M), based on laboratory testing undertaken in accordance with AS 2870:2011 (Ref. [7]). Due to this classification, soils lie outside the definition of good ground within NZS 3604:2011 (Ref. [8]). Building foundations will require either

specific foundation design for expansive soils or foundation design in accordance with AS 2870:2011 (Ref. [7]). Subject to design issues outlined in Section 3, and CSIRO recommendations outlined in the Appendices relating to expansive soils foundation design and home owner maintenance, each residential Lot is considered to have a building platform area generally suitable for domestic residential development subject to specific geotechnical assessment and foundation design due to the presence of expansive soils and where Lots contain, or are adjacent to, land with slopes steeper than 1 in 4 (V:H).

Foundation design for residential development should proceed in accordance with Sections 6.5 to 6.10 of this report.

1 Introduction

1.1 General

Tonkin + Taylor Ltd (T+T) was engaged by WFH Properties Ltd to monitor and provide earthworks certification for the 27 No. Residential Lots contained within Stage 2 of Arran's Point Precinct 7 at the Millwater Subdivision in Silverdale. Stage 2 comprises residential Lots 120 to 136, 154 to 160 and 202 to 204 (high density residential Lots), Joint Owned Access Lane Lot 605, and Road Lots 901 (Arran Point Parade) and 902 (Mana Terrace) inclusive as shown on the Woods Final Contour As–Built Plan (Woods Ref 37001–02–100-AB) in Appendix A1.

Previous geotechnical investigation work across the subdivision was undertaken by T+T and reported in:

a 2000 and 2001 Preliminary feasibility reporting (Ref. [1], [2]).

b 2003 Major reconnaissance report covering land in the Silverdale North and Orewa West areas (Ref. [3]).

c November 2011 Geotechnical Investigation Report for the North Bridge, Southern Abutment (Ref. [4]).

d November 2013 Geotechnical Investigation Report for Arran's Point Precinct 7 (Ref. [5]).

The preliminary (Ref. [1], [2]) and investigation (Ref. [3], [4], [5]) reports noted the presence of existing instability comprising landsliding, soil creep and shallow slope movement across much of Arran's Point Precinct 7. These features were proposed to be stabilised, and/or undercut and replaced with engineered fill, during development works. Stability analyses further indicated that shear keys and geotechnical remediation works were also required to achieve satisfactory factors of safety against instability for the finished development of Stage 2.

Earthworks compaction control, in terms of minimum shear strengths and maximum air voids, was recommended, and, along with other recommendations, has been incorporated into our control of the works and, where applicable, included in completion reporting.

The scope of work covered by this completion report includes:

a Review of geotechnical investigation reporting for the site;

b Monitoring and certification of earthworks operations in compliance with NZS 4431:1989 (Ref. [6]), including construction of 1 No. reinforced earth slope (RE 5);

c Monitoring and certification of construction of 1 No. palisade wall (PW2);

d Monitoring and certification of construction of 2 No. geogrid reinforced segmental block (Screen Block and Allan Block) walls (Wall 3 and part of Wall 9 respectively);

e Assessment of soils for expansive conditions in accordance with AS 2870:2011 (Ref. [7]);

f Certification of completed Lots for residential development in accordance with NZS 3604:2011 (Ref. [8]).

Woods Ltd (Woods) undertook subdivision engineering design and civil works construction observations. As-built plans showing final contours and cut and fill depths have been prepared by Woods and are attached in Appendix A1.

1.2 Description of Subdivision

The Millwater subdivision is situated to the north of the Silverdale Township, and west of the Metro Park East reserve area, and comprises approximately 260 hectares. The subdivision is bound to the south and west by Wainui Road, to the north by the Orewa Estuary and to the east by the Orewa

Estuary and Millwater Parkway. The original site comprised a mix of farm properties and associated dwellings and existing residential developments.

The Arran's Point Precinct 7, Stage 2 area of the Millwater subdivision is located within what is known as Precinct 7 in the Orewa West Structure Plan.

The Arran's Point Precinct 7 area is bound by Arran Drive to the west, and the Orewa estuary to the north, south and east. The overall Arran's Point Precinct 7 and Stage 2 areas are shown on T+T Drawing 21854.0037–APP7S2–100 in Appendix A2.

Pre-development gradients within the Stage 2 area were gentle to moderately steep (1 in 3 to 1 in 15 (V:H)) with an overall fall to the north.

Post-development gradients within the Stage 2 area remain gentle to moderately steep (1 in 3 to 1 in 15 (V:H)) and generally fall to the north as before. In order to form more level building platforms, a steep reinforced earth slope of up to 1 in 1 (V:H) and a geogrid reinforced segmental block (Screen Block) wall have been constructed along some Lot boundaries as shown on T+T Drawing 21854.0037–APP7S2–101. In addition, part of a geogrid reinforced segmental block (Allen Block) wall has been constructed in the eastern end of Precinct 7 Stage 2.

Stage 2 is presently accessed from the existing Arran Drive.

1.3 Geological Setting

Published geological mapping and information indicates the Arran's Point Precinct 7 area is underlain by East Coast Bays materials. In addition to the East Coast Bays materials, our investigations identified the presence of alluvial materials on site.

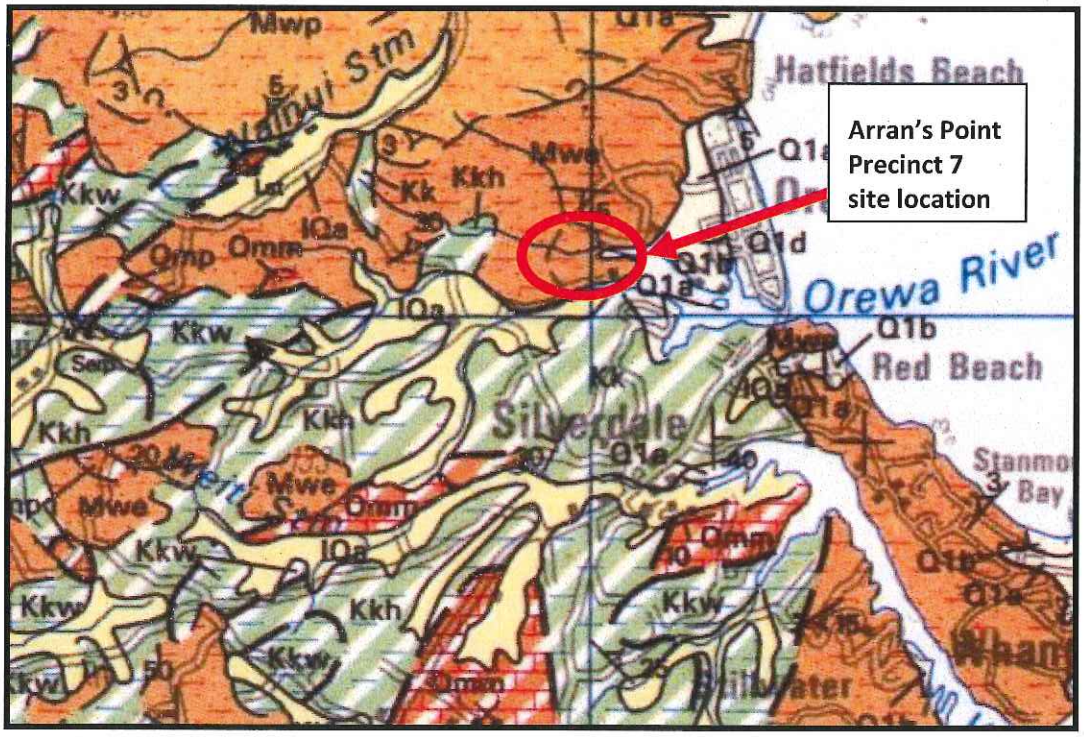


Figure 1 - Local Geology (from Edbrooke)

Summary descriptions of geological units in the Arrans Point area (after Kermode 1991) are as follows:

a East Coast Bays Formation

Alternating sandstone and mudstone with variable volcanic content (volcanic-poor lower in the sequence and mixed volcanic content higher) and interbedded volcaniclastic grit beds. These material typically show a well-developed weathering profile of clay, silt or sand depending on the parent lithology.

b Pleistocene Age Alluvium

Up to 20 m thick and from 3 to 10 m above present base level: forms higher coastal and valley terraces throughout the map area; in places locally discontinuous or absent. These alluvial deposits are typically very thinly to very thickly bedded, yellow-grey to orange-brown, angular to well rounded, mixed sizes (usually graded, coarse becoming fine upwards) of mud, sand and gravel, comprising rock fragments and weathered rock residue from the hinterland. They include some beds of black, humus-rich clay and white, pumice silt.

Geological cross-sections through the Arran's Point Precinct 7, Stage 2 area, based on site investigations and observations during construction, are enclosed as Drawing Number 21854.0037–APP7S2–103 in Appendix A2.

Fill material placed across the site to form the final design profile typically comprised site-won East Coast Bays Formation materials.

2 Earthworks Operations

2.1 Plant

Bulk earthworks and civil works were undertaken by Hick Bros Civil Construction Ltd (Hicks). Various areas of soft and/or wet materials were encountered during the works and were undercut and replaced with engineered fill. Much of this undercut material was considered suitable for re-use as engineered fill if conditioned appropriately. Accordingly, mixing of the cohesive fill materials with lime/cement to facilitate fill placement and compaction was undertaken by Hiway Stabilizers Ltd (Hiway) under Hicks' control. Construction of the palisade wall and retaining walls was undertaken by ICB Retaining and Construction Ltd (ICB), also under Hicks' control.

Various earthworks equipment was used to undertake the works, comprising motor scrapers, articulated dump trucks, tractors and discs, sheepsfoot compactors, padfoot rollers, and a number of 12 to 35 tonne excavators. This plant generally carried out all construction earthworks.

Specialist contractors and plant were brought on site for pavement construction. Certification of the pavement construction is beyond the scope of this report.

2.2 Construction Programme

Subdivisional earthworks commenced from March 2014 through to February 2016 under Hicks' control. Civil earthworks and construction for the residential Lots were also under Hicks' control and were undertaken progressively from June 2016 through to completion in February 2017.

Key Stage 2 earthworks components included:

a Stripping of vegetation, organic materials and topsoil to stockpile.

b Installation of subsoil drains.

c Cut to fill earthworks across the entire site as shown on the Woods Cut & Fill As–Built Plan Lowest to Final Surface (Woods Ref 37001–02–110-AB) in Appendix A1.

d Construction of 1 No. Shear Key (SK1) and 1 No. palisade wall (PW2), 1 No. geogrid reinforced segmental block wall (i.e. Screen Block Wall 3) and 1 No. reinforced earth slope (RE 5), as shown on T+T Drawing 21854.0037–APP7S2–101 in Appendix A2.

Key Stage 2 civil works components included:

a Minor cut to fill earthworks across parts of the site as part of final Lot development.

b Construction of 1 No. geogrid reinforced segmental block wall (i.e. part of Allan Block Wall 9), as shown on T+T Drawing 21854.0037–APP7S2–101 in Appendix A2.

c Installation of roading and services.

The earthworks, retaining walls, shear keys, undercuts and subsoil drainage as-built plans are included in Appendix A1 (Woods Drawings 37001–02-100, 110 to 111, 120 to 122 and 130 to 133-AB), and show the earthworks undertaken across the site.

2.3 Compaction Control

Compaction control criteria, consisting of maximum allowable air voids and minimum allowable shear strengths, were used for cohesive fill control. The Technical Specification included in our Geotechnical Investigation Report (Ref. [4],[5]) included the following requirement for the subdivisional earthworks:

Minimum Shear Strength and Maximum Air Voids Method

Minimum Undrained Shear Strength (Measured by insitu vane – IANZ calibrated)

General fills:	
Average value not less than	140 kPa
Minimum single value	110 kPa
High Strength Structural fills (Shear Keys & Reinforced Earth Fill Slopes):	
Average value not less than	150 kPa
Minimum single value	120 kPa

Maximum Air Voids Percentage (as defined in NZS 4402:1986)

General fills:	
Average value not more than	10%
Maximum single value	12%
High Strength Structural fills (Shear Keys & Reinforced Earth Fill Slopes):	
Average value not more than	8%
Maximum single value	10%

The average corrected shear strength value was determined over any ten consecutive tests.

Compaction control criteria consisting of minimum allowable Clegg Impact Values and minimum allowable in-situ dry density were used for cohesionless fill control. The Technical Specification included in our Geotechnical Investigation Report (Ref. [4],[5]) included the following requirement for the subdivisional earthworks (and in particular during construction of Walls 3 and 9):

Minimum Clegg Impact Value and Minimum In Situ Dry Density Method

Minimum Clegg Impact Value (Measured by Clegg Impact Hammer – IANZ calibrated)

General fills:

Average value not less than	20
Minimum single value	18

Minimum In-Situ Dry Density Percentage (as defined in NZS 4402:1986)

General fills:

Average value not less than	95%
Minimum single value	90%

The average Clegg Impact value was determined over any ten consecutive tests.

Regular in situ density, strength and water content tests were carried out on the filling at, or in excess of, the frequency recommended by NZS 4431:1989 (Ref. [6]). Test results are contained in Appendix E.

Quality Control (QC) testing showed that the results for the filling were consistently meeting the required undrained shear strength, density and air voids criteria, demonstrating that the water content of placed fill was consistently at, or close to, optimum. To the best of our knowledge, any problems encountered were rectified, where required, by close monitoring of the selection of borrow materials, discing and remixing of the available soil types and minor reworking.

3 Geotechnical Development Works

3.1 Subsoil Drainage

A network of subsoil drains has been installed across Arran's Point Precinct 7 during bulk earthworks as part of the shear key, reinforced earth slope and geogrid reinforced segmental block walls construction.

The subsoil drains installed within the shear key and reinforced earth slope were excavated into the underlying soil and rock to intercept groundwater and springs, and are as detailed in Section 3.2.

Subsoil drains installed as part of the geogrid reinforced segmental block walls construction comprised the following:

a 160mm diameter, Hiway grade, perforated Nexus pipes along the backface of the wall and base of the rear of the reinforced soil block.

b SAP50 scoria over the top of the Nexus pipe and up the back face of the reinforced soil block, to within 1m of the ground surface (at time of construction).

c Bidim A19 geotextile filter-cloth over the top of the scoria prior to placement of the reinforced soil.

The retaining wall drains were connected to the reticulated stormwater system or discharge into the Orewa Estuary below, as shown on the Woods Shear Key, Undercuts & Subsoil Drains As–Built Plans (Woods Ref 37001–02-120 to 122-AB) and the Retaining Wall As-Built Plans (Woods Ref 37001-02-130 to 132-AB) in Appendix A1, and on T+T Drawing 21854.0037–APP7S2–102 in Appendix A2.

3.2 Shear Keys

Based on stability analyses undertaken as part of the investigation reporting, shear keys were identified as being required across Arran's Point Precinct 7 to provide satisfactory factors of safety against instability for the finished development of Stage 2.

1 No. Shear Key (i.e. SK1) was excavated within Stage 2 during the bulk earthworks in the location shown on the T+T Drawing 21854.0037–APP7S2–101, included in Appendix A2. Excavations for the Shear Key were inspected and mapped by an Engineering Geologist to check that the key base had been extended sufficiently into the competent underlying ECBF rock materials, and that there were no apparent adverse structural features or lower strength materials exposed within the base and sides of the excavation. Any areas of suspect ground, including areas of identified land-slippage, were removed under the instruction of our site Engineering Geologist and replaced with well compacted engineered fill, placed in accordance with the bulk earthworks specification (Section 2.3 above).

The shear key long-section for SK1 was developed based on the mapping undertaken and is included in Appendix A2 (Drawings 21854.0037–APP7S2–113 and –114). This section shows the materials exposed within the side of the shear key excavation and relevant geological structural information mapped during our inspections.

Following completion of the shear key excavation, drainage blankets were placed along the rear face of the key, and comprised the following:

a 160mm diameter perforated Hiway grade Nexus drain pipe: This was run along the base of the rear of the excavation and discharges into the Orewa estuary in several locations (as per the Woods As-Built plans 37001–02–120 to 122-AB). Additional Novaflo pipes were also installed along mid-height benches where appropriate and connected into the key drainage outlet system.

b SAP50 scoria: A layer of minimum 300mm thickness of SAP 50 was placed across the entire rear face, and extended to within 2m of the top of the key. It should be noted that the top of the key at this stage generally coincided with the original ground surface.

c Bidim A19 geotextile filtercloth: This was placed over the surface of the SAP 50 scoria to prevent contamination of the drainage aggregate with overlying bulk earthworks materials.

The rear face drainage blanket was extended up to at least 1 metre above the soil / rock interface to intercept perched groundwater flows which typically flows along this interface. This in essence became the rear face drainage for the reinforced earth slope as well.

Ground conditions exposed during shear key construction were generally as anticipated from the design stage of the development. The slope stability analysis results from the original design phase are discussed in Section 4.

3.3 Palisade Wall

Due to the identified shear planes within SK1 dropping well below the adjacent estuary, and based on stability analyses undertaken as part of the investigation reporting, a palisade wall was identified as being required along a length of SK1 to provide satisfactory factors of safety against instability for the finished development of Stage 2.

1 No. palisade wall (i.e. PW2) was constructed within Stage 2 during the bulk earthworks in the location shown on the T+T Drawing 21854.0037–APP7S2–101, included in Appendix A2. Palisade Wall 2 comprises 4m to 8m long 310UC97 steel piles installed at 1.8m centres encased in 600mm diameter concreted holes. Drilling for the palisade wall pile bores was inspected and logged by an Engineering Geologist to check that the base of the piles had been extended sufficiently into the competent underlying ECBF rock materials.

Ground conditions exposed during palisade wall construction were generally as anticipated from the design stage of the development. The slope stability analysis results from the original design phase are discussed in Section 4.

3.4 Geogrid Reinforced Segmental Block Retaining Walls

Two geogrid reinforced segmental block walls (i.e. Screen Block Wall 3 and part of Allan Block Wall 9) were constructed within Stage 2.

Screen Block Wall 3 was constructed during the bulk earthworks and a section of the reinforced earth slope (RE5) discussed in Section 3.5 is constructed immediately above this wall. This wall comprises uniaxial High Density Polyethylene (HDPE) geogrids placed at a maximum of 1.0m (vertical) intervals within the well compacted engineered fill (i.e. 3m width of hardfill immediately behind the Screen Block units and cohesive fill for the remaining areas), placed in accordance with the bulk earthworks specification (Section 2.3 above). The grids extend up to the toe of the reinforced earth slope immediately above.

Construction of the Screen Block retaining wall comprised the following:

a placement and compaction of fill to the required levels;

b placement of the Screen Block units, including starter sections of geogrids cast into the blocks at the appropriate levels;

c placement of the geogrid and connection to the starter sections using a "Bodkin" joint, ensuring that the grid is held tightly in place;

d spreading of fill across the surface of the geogrid with lightweight plant;

e compaction and placement of further fill up to the level of the next grid layer.

This Screen Block retaining wall has been designed to accommodate a maximum 10kPa surcharge, or construction of the reinforced earth slope discussed in Section 3.5 where present immediately above, although development immediately behind/above the wall is likely to be precluded by Council planning rules.

Allan Block Wall 9 was constructed during the civil works period and comprises uniaxial High Density Polyethylene (HDPE) geogrids placed at a maximum of 0.4m (vertical) intervals within the well compacted engineered hardfill, placed in accordance with the bulk earthworks specification (Section 2.3 above). The grids extend up to within 0.3m of the ground surface. For the section of Allan Block Wall 9 retaining less than 1m, the reinforced block is backfilled with no fines concrete (i.e. no geogrid reinforcement).

Construction of the Allan Block retaining wall comprised the following:

a placement and compaction of fill to the required levels;

b placement of the Allan Block units;

c placement of the geogrid, ensuring that the grid is held tightly in place;

d spreading of fill across the surface of the geogrid with lightweight plant;

e compaction and placement of further fill up to the level of the next grid layer.

Allan Block Wall 9 has been designed to accommodate a maximum 10kPa surcharge, although development immediately behind/above the wall is likely to be precluded by Council planning rules.

Typical cross-sections of the retaining walls are shown on T+T Drawings 21854.0037–APP7S2–105, and –109 and –110 in Appendix A2.

As noted in Section 3.1, a drainage blanket was installed at the rear of the reinforced block of soil which comprises a minimum of 300mm thickness of SAP50 scoria, covered in Bidim A19 geotextile filtercloth. A 160mm diameter perforated Nexus pipe along the backface of the wall and base of the rear of the reinforced soil block provides a discharge outlet for any groundwater captured in the drainage blanket. The drainage pipes from behind the walls are connected into the stormwater system or discharge into the Orewa Estuary below, as shown on the Woods subsoil drainage as-built plan in Appendix A1.

Certification of these walls, in accordance with the relevant Engineering Approval, is to be supplied under separate cover.

3.5 Reinforced Earth Slope

A reinforced earth slope (RE 5) was constructed during the bulk earthworks within Stage 2.

The slope extends from above the western end of Screen Block Wall 03 to the east, with an approximately 210m long section of RE 5 constructed immediately above Wall 03 (see Section 3.4). RE 5 comprises horizontally laid biaxial geogrids placed at 0.5m (vertical) intervals within the engineered, compacted earth fill. The grids extend up to within 1.5 (vertical) metres of the slope crest. They have been placed at various lengths, starting at the face of the slope.

A typical cross-section of RE 5 is shown on T+T Drawing 21854.0037–APP7S2–107 in Appendix A2.

The placement of the geogrid allows steeper finished gradients than is possible with bulk fills, and will minimise risk of instability across the face of the slope, particularly where finished gradients across the slopes are up to 1 in 1 (V:H).

Construction of the slope comprised the following:

a placement and compaction of fill to the required levels;

b placement of the geogrid, ensuring that the grid is held tightly in place;

c spreading of fill across the surface of the geogrid with lightweight plant;

d compaction and placement of further fill up to the level of the next grid layer.

The fill was placed and compacted beyond the limit of the final slope face and then trimmed back to ensure full compaction of the slope face was achieved.

A drainage blanket was installed at the rear of the reinforced block of soil (essentially an extension of the underlying shear key drainage) and comprises a minimum of 300mm thickness of SAP50 scoria, covered in Bidim A19 geotextile filter-cloth. A 160mm diameter Novaflo pipe at the base of the drainage blanket provides regular discharge outlets for any groundwater captured in the drainage blanket. These outlets extend to discharge out to the adjacent stream system.

The slope has been designed to accommodate surcharge of up to 10kPa distributed load at the crest of the slope.

The slope faces will be subject to a planting covenant preventing construction within this area. Protection of the geogrids from damage also precludes construction across the slope faces and immediately adjacent to the slope crest. Accordingly, a building restriction zone has been applied across the slope (See Sections 5.3 and 6.6).

3.6 Undercuts

A 2m deep, minimum 5m wide, undercut was excavated below the toe of RE5 to ensure a consistent subgrade. The undercut was replaced with engineered, compacted fill, placed in accordance with the bulk earthworks specification (Section 2.3 above).

Earthworks operations across Lots 202 and 203, and through the road alignments in Stage 2 resulted in the exposure of some areas of unsuitable subgrade materials (i.e. soft and wet). The unsuitable material has been undercut to expose more competent soils (minimum shear strength of 75kPa) and replaced with engineered, compacted fill, placed in accordance with the bulk earthworks specification (Section 2.3 above).

The extent of the undercut areas is shown on the Woods Shear Key, Undercuts & Subsoil Drains As–Built Plans (Woods Ref 37001–02–120 to 122-AB) in Appendix A1.

4 Stability Analyses

As noted in Section 3, slope stability analyses undertaken during the investigation stage of the project identified the need for shear keys and a palisade wall to be constructed across Arran's Point Precinct 7, so as to provide acceptable factors of safety against slope instability for the finished development of Stage 2.

During excavation of Shear Key 1, the excavated faces were mapped to confirm the shear key had been extended sufficiently into the underlying competent ECBF rock materials and to check for any apparent adverse oriented geological structure or other features exposed within the sides and lower part of the key.

Inspections were also undertaken by a T+T Geologist during drilling of the PW2 pile bores to confirm the materials encountered and to ensure the piles extended into the competent underlying ECBF rock materials.

We are satisfied that the design stability analyses remain valid for the completed works on the following basis:

a the exposed ground conditions generally conform to those assumed for design;

b the as-built profiles match design levels;

c the earthworks monitoring shows compliance with specified criteria, upon which fill properties have been based.

5 Project Evaluation / Building Design Considerations

5.1 General

Ground conditions within the Arran's Point Precinct 7, Stage 2 area straddle a range of "design conditions" including cut ground, filled ground, expansive soils and constructed slopes up to 1 in 1 (V:H). The following sections set out relevant geotechnical design issues.

5.2 Bearing capacity for building foundations

All filled and natural ground within the influence of conventional residential shallow strip and pad foundation loads is assessed as generally having a geotechnical ultimate bearing capacity of 300kPa, as required by NZS 3604:2011 (Ref. [8]). This corresponds to a factored (Ultimate Limit State) bearing capacity of 150kPa and working (Serviceability Limit State) bearing capacity of 100kPa.

Due to the presence of expansive soils, foundation conditions fall outside the definition of "good ground" contained in NZS 3604:2011 (Ref. [8]). In terms of AS 2870:2011 (Ref. [7]), the soils present are considered to lie within Site Class M (moderately expansive) with characteristic surface movements anticipated to be in the range of 20mm to 40mm. Due allowance should be made for expansive soils, as discussed in Section 5.12.

Where a geotechnical ultimate bearing capacity greater than 300kPa is required to support any dwelling constructed outside the scope of NZS 3604:2011 (Ref. [8]), further specific site investigation and design of foundations will be required.

5.3 Building Limitation Zones – RE Slope

Identified steep slopes in the Stage 2 area have been constructed as reinforced earth fill structures with face gradients of between 1 in 1 and 1 in 1.8 (V:H). They are located in Lots 120 to 136 and Lots 154 to 160. Construction within the flatter parts of these Lots is intended, and a Building Restriction Zone ("No Build Zone") has been developed across the steeper sections of the Lots to ensure that the reinforcement of the slopes is not detrimentally affected by future development. The extent of the Building Restriction Zone associated with the RE slope is shown on T+T Drawing 21854.0037–APP7S2–116 (Building Limitation Plan) in Appendix A2. Excavation, fill placement and/or construction within this zone is not permitted.

Vegetation on slopes that are 1 in 4 (V:H) or steeper is recommended to reduce the potential for shallow slope instability and to minimise surface erosion. Where gradients are 1 in 4 (V:H) or steeper, there is potential for minor shallow creep of the topsoil layer. However, such creep is considered unlikely to detrimentally affect the global stability of the slope.

Where slopes exceed gradients of 1 in 2 (V:H), "Enkamat" or "Geocells" have been anchored to the face of the RE Slope to function as a protective reinforcing layer for the topsoil and plant root system.

5.4 Settlement

From our inspections during earthworks operations, and the results of compaction quality control testing, we consider that differential settlement induced by self-weight of engineered fill should now be largely complete. Further settlements should be within normally accepted design tolerances of 25mm, as outlined in NZS 3604:2011 (Ref. [8]), with respect to conventional building development.

Settlement points were installed in the areas of greatest fill thickness following completion of earthworks operations, to monitor the settlement of the subgrade. This monitoring shows that settlements of up to 70mm occurred during development of Stage 2. This settlement occurred between December 2015 and September 2016, with negligible movement since that time.

In order to minimise the risk of ground settlements exceeding 25 mm, NZS 3604:2011 (Ref. [8]) allows a maximum fill surcharge of 600 mm over the building platform during future development. Filling in excess of this thickness should be subject to specific foundation design and assessment.

5.5 Retaining walls

Due to the relatively shallow grades across most of the Stage 2 Lots, it is not anticipated that significant retaining walls will be required. However, if walls are required, then retaining wall design will be dependent on the site specific requirements.

For preliminary design we recommend the use of the following geotechnical design parameters:

$\gamma = 18\ kN/m^3$,

$c' = 0\ kPa$,

$\emptyset' = 30°$,

$K_a = 0.30$,

$K_p = 3.33$,

"Su" of 50kPa for the embedment soil (subject to confirmation during construction).

These values are based on level ground above and below the wall and will require appropriate amendment to allow for slope, traffic and other surcharges or toe slopes and the specific lot geometry and development requirements, as applicable.

All retaining walls should include a layer of free draining granular fill (with geotextile over the top) immediately behind the wall covered with a 0.3m thick (minimum) compacted clay fill cap, with intercepted groundwater seepage piped into the reticulated stormwater system.

Any walls greater than 1.5m retained height will require a geotechnical assessment, as a minimum, to check and confirm that the stability of the subject (or adjacent) Lot is not detrimentally affected.

The existing geogrid reinforced segmental block walls constructed within the Stage 2 area are shown on the Woods Retaining Walls As–Built Plans (Woods Ref 37001–02–130 to 133-AB). These walls have been designed to accommodate a maximum 10kPa surcharge or a reinforced earth slope where present immediately above, although development immediately behind/above the walls is likely to be precluded by Council planning rules. The presence of these walls should be taken into account for any proposed works downslope of the walls, specifically to ensure that any proposed cuts do not undermine the base of the walls. In general, earthworks should be limited to no closer than 1.5m from the toe of the walls.

For clarity, the Lots within Stage 2 that will need to consider the presence of the existing retaining walls during site development are:

a Screen Block Wall 3 – Lots 120, 160 and 202 to 204 inclusive

5.6 Subsoil Drainage

Following shear key construction during bulk earthworks, groundwater drainage was installed using Nexus drains covered in scoria and geotextile cloth to permanently handle ground water flows.

The extent of the subsoil drainage systems are shown on the Woods Shear Key, Undercuts & Subsoil Drains As–Built Plan (Woods Ref 37001–02–120 to 122-AB) in Appendix A1, and on T+T Drawing 21854.0037–APP7S2–102 in Appendix A2.

This drainage system is relatively deep and located so that it is unlikely to be encountered during future residential site development and is expected to be maintenance free. Any deep excavations should take account of the presence of these drains nonetheless. If a drain is encountered, damaged, or identified as defective, repairs should be observed by a Chartered Professional (Geotechnical) Engineer familiar with this report, and notified to Auckland Council.

5.7 Post Earthworks Investigations

Following the completion of earthworks operations, T+T have undertaken supplementary fieldwork to confirm the consistency of the natural subsoils and engineered fill. From the investigations, we confirm that the subsoils are considered to have a geotechnical ultimate bearing capacity of 300kPa, as required by NZS 3604:2011 (Ref. [8]). This corresponds to a factored (Ultimate Limit State) bearing capacity of 150kPa and working (Serviceability Limit State) bearing capacity of 100kPa. Associated borehole logs and site plan (T+T Drawing 21854.0037–APP7S2–117) are attached in Appendix E.

5.8 Stormwater

Public stormwater services have been installed within Arran's Point Precinct 7, Stage 2. Stormwater and runoff from roofs, decks and paved areas, together with discharges from future retaining wall drains and other subsoil drainage must be connected directly into the public stormwater drainage network.

5.9 Service lines

Trench backfill has been compacted to minimise potential for future settlements. However, where building envelopes lie adjacent to or across service lines, all foundations should extend and be founded below the 45 degree zone of influence line from pipe inverts. This requirement is to avoid excessive pipe surcharges, and to allow for future maintenance of the system without detrimentally affecting adjacent structures. Subject to approval from Auckland Council, foundations may extend and bridge over service lines provided specific foundation design is undertaken.

A copy of the stormwater as–built plans (Woods Ref 37001–02–300 to 303-AB) is included in Appendix A1.

5.10 Road subgrades

Based on the fill monitoring and site observations during development, filled and natural ground within the road and vehicle access Lots is considered generally suitable for the proposed residential pavements. Subgrade strength testing was carried out following excavation to formation levels along the road alignments. These subgrade test results were passed on to Woods for use in their pavement design. All road subgrades have been lime and cement stabilised to assist in pavement strengths, and to minimise the impact of expansive soils on road pavements.

For future road construction in other parts of the Arran's Point Precinct 7 Stage 2 development, within natural ground, a design CBR of 2% is considered appropriate while, within engineered fill areas, a design CBR of 7% is appropriate.

5.11 Topsoil

Following completion of topsoil spreading and grassing, topsoil depths were measured in each of the Lots and these are shown on T+T Drawing 21854.0037–APP7S2–118 attached in Appendix E. Due to variations in placement depths and earth worked surface levels, topsoil depths may vary from those recorded.

5.12 Expansive soils

Expansive soils (or "reactive soils" using Australian terminology) are clay soils that undergo appreciable volume change upon changes in moisture content. The reactivity and the typical range of movement that could be expected from soils underlying any given building site depend on the amount of clay present, clay mineral type, and proportion, depth and distribution of clay throughout the soil profile. Moisture changes tend to occur slowly in clays and produce swelling upon wetting and shrinkage upon drying.

Apart from seasonal moisture changes (wet winters / dry summers) other factors that can influence soil moisture content include:

a Influence of garden watering and site drainage;

b The presence of large trees (especially fast growing Australian species such as eucalyptus) close to building envelopes, and;

c Initial soil moisture conditions at construction time.

Visually, the surfaces of expansive soils are noted for developing extensive cracking during dry periods (especially late summer through autumn in Auckland) and can be locally identified by this feature when sites are excavated and left for a week or two to dry out. Further information on expansive soils is given in Appendices C and D of this report.

In order to assess for the presence of expansive soils within this stage of the development, representative soil samples were retrieved from near surface strata and tested by Geotechnics Ltd to determine soil shrinkage characteristics in accordance with AS 1289.7.1.1.

Based on the laboratory results (attached in Appendix E), the foundation soils on this stage of the subdivision lie outside the definition of 'good ground' as outlined in NZS 3604:2011 (Ref. [8]).

In terms of AS 2870:2011 (Ref. [7]), the soils present are considered to lie within Site Class M (moderately expansive) with characteristic surface movements anticipated to be in the range of 20mm to 40mm.

Accordingly, building foundations on this stage of the subdivision will need to be subject to specific foundation design by a Chartered Professional Engineer familiar with the contents of this report and responsible for design of structural elements (including foundations) of the building. Reference should be made to AS 2870:2011 (Ref. [7]) for assistance.

6 Statement of Professional Opinion as to the Suitability of Land for Building Development

I, Mr A.P. Stiles of Tonkin + Taylor Ltd, P O Box 5271, Wellesley St, Auckland, hereby confirm that:

6.1 I am a Chartered Professional Engineer experienced in the field of geotechnical engineering and an authorised representative of Tonkin + Taylor who was retained by WFH Properties Ltd as the Geotechnical Engineer on Arran's Point Precinct 7 Stage 2 (comprising residential Lots 120 to 136, 154 to 160 and 202 to 204, JOAL Lot 605 and Road Lots 901 and 902 inclusive) of the Millwater Residential Subdivision Development off Arran Drive in Silverdale. Inspection and observation of the works have been carried out during construction by either myself or staff acting under my direction.

6.2 The extents of investigations are described in Tonkin + Taylor Ltd Geotechnical Investigation Report for Arran's Point Precinct 7 Ref No. 21854.0037 dated November 2013. The conclusions and recommendations of those documents have been re-evaluated in the preparation of this report. Details of all earthworks control tests performed are enclosed (Appendix E).

6.3 The Contractor has confirmed that the work undertaken has been completed in accordance with the drawings, specifications and any variations issued and is consistent with the inspections and observations carried out by Tonkin + Taylor Ltd. Complete Construction Certificates have been provided by the Contractors and are presented in Appendix B. Tonkin + Taylor Ltd accepts no liability for any errors or omissions represented by those documents.

6.4 On the basis of our observations and inspections together with the information supplied by others, including the Contractor's Construction Certificates, it is my professional opinion, not to be construed as a guarantee that:

6.4.1 The earth fills shown on the attached Woods drawings, Project No 37001, Millwater, Arran's Point Precinct 7, Stage 2, Drawing Numbers 37001–02–100, –110 to –111 and –120 to 122-AB, have been generally placed in compliance with NZS 4431:1989 (Ref. ([6]).

6.4.2 The completed earthworks give due regard to land slope and foundation stability considerations.

6.5 **For Lots 120 to 136, 154 to 160 and 202 to 204 inclusive:**

6.5.1 Foundation design

The filled and natural ground within residential Lot boundaries is considered generally suitable for the erection thereon of light timber framed, flexibly clad residential buildings subject to clauses 6.5.2 to 6.5.6.

6.5.2 Bearing capacity

Foundation design for these Lots should limit geotechnical ultimate bearing capacity to 300 kPa (factored (ULS) 150 kPa, working (SLS) 100 kPa). This is as specified in NZS 3604:2011 (Ref. [8]).

6.5.3 Expansive soils

Due to the presence of expansive clay soils, foundation soils lie outside the definition of 'good ground' in NZS 3604:2011 (Ref. [8]). Soils are considered to lie in Site Class M (moderately expansive) as defined in AS 2870:2011 (Ref. [7]) with anticipated characteristic surface ground movements of 20mm to 40mm. Clause 6.5.3.1 of this

Geotechnical Completion Report may be used for expansive soil foundation design on this subdivision:

6.5.3.1 Specific foundation design for expansive soils

Specific foundation design should be undertaken by a Chartered Professional Engineer familiar with the contents of this report and responsible for design of structural elements (including foundations) of the building.

The minimum specific design requirements set for expansive soils within this clause are:

i) Minimum foundation embedment of 600 mm following topsoil removal and benching of building platform areas to finished ground levels

ii) Four bar steel reinforcing cages should be used

iii) For buildings having brittle exterior cladding, for example brick veneer, stucco plaster, solid plaster, block work, styrofoam type cladding or sprayed plaster over harditex systems etc, the potential effects of seasonal ground movements need to be considered by the building designer.

The above minimum requirements within this clause may be superceded if individual engineers are able to demonstrate their specific design solutions are applicable to site soil conditions to the satisfaction of Auckland Council. Specific design may be undertaken by first principles or by reference to AS 2870:2011 (Ref. [7]), Section 4 and related documents.

6.5.4 Floor Slab Construction

Slab on grade construction is expected to be relatively straightforward across the subdivision, but problems can occur with slab construction on shrink/swell sensitive soils. In soils which become desiccated in summer, subsequent capillary moisture rise may cause dry soils to wet up and swell, causing slab uplift and building distress. Alternatively, construction during winter may result in subgrade soils with high moisture contents drying out through summer, with subsequent soil shrinkage and possible building deformation.

The structural engineer should take likely construction timeframes into account and confirm that their design and construction methodologies will accommodate the soil shrinkage or swelling that may occur.

The Contractor should ensure that the ground beneath the floor slab areas is suitably conditioned to ensure that the subgrade is neither too dry nor too wet prior to hardfill placement and concrete pouring to avoid undue shrink or swell movements.

6.5.5 Building maintenance - Owners responsibility

The owner is responsible for maintenance of the building and site and should be familiar with the performance and maintenance requirements set out in CSIRO sheet BTF18 Foundation Maintenance and Footing Performance: A Home Owners Guide. A copy of this sheet is included in Appendix D.

6.5.6 Retaining walls / Earthworks

No retaining wall construction in excess of 1.5 metres height and no earthworks involving fills in excess of 600mm depth should take place on these Lots unless endorsed by a suitable design undertaken by a Chartered Professional (Geotechnical) Engineer familiar with the contents of this report and responsible for design of structural elements of the building.

6.6 **For Lots 120 to 136 and 154 to 160 inclusive:**

6.6.1 These Lots contain a "Building Line Limitation" relating to the reinforced earth slope which forms the 1 in 1 to 1 in 1.8 (V:H) slope along the Lot boundaries. The restriction zone is shown on T+T Drawing 21854.0037–APP7S2–116 in Appendix A2. Excavation, filling and/or construction within this zone is not to be undertaken, to ensure stability of the slope is not compromised.

6.6.2 The presence of geogrids within the reinforced earth slopes is brought to the attention of future building and services designers. The topmost grid is located between 1 to 2 metres below the surface at the top of the slope, and does not generally extend more than 2 metres back from the crest of the slope. It is not expected that the grids will be encountered during future development of this Lot, however, the presence of the grids should be recognized. Any exposure and/or damage and subsequent repair to the grids during any future development must be observed and certified by a Chartered Professional Engineer (Geotechnical) familiar with the contents of this report.

Design of the reinforced earth slope has assumed a maximum distributed load of 10kPa (dead plus live loads) up to the edge of the Building Limitation Line.

6.6.3 Any cut or fill walls greater than 1.5m retained height, or of any height within 2m of the building restriction lines shown on T+T Drawing 21854.0037–APP7S2–116 in Appendix A2, will require a geotechnical assessment, as a minimum, to ensure stability of the subject or adjacent Lot is not detrimentally affected.

6.6.4 Development outside of the Building Line Limitation zone may proceed in accordance with the recommendations outlined in Section 6.5.

6.7 Underfill (Subsoil) drainage

Underfill (Subsoil) drains have been installed during subdivisional development in the locations shown on the Woods Shear Key, Undercuts & Subsoil Drains As–Built Plans (Woods Ref 37001–02–120 to 122-AB) in Appendix A1, and on T+T Drawing 21854.0037–APP7S2–102 in Appendix A2. These drains are considered to be maintenance free. This drainage system is relatively deep and located so that it is unlikely to be encountered during future residential site development. Although future works are unlikely to encounter the drains, their location should be considered prior to designing deep foundations and, if damaged, repairs should be observed by a Chartered Professional (Geotechnical) Engineer familiar with this report, and notified to Auckland Council.

6.8 Stormwater and Sanitary Sewer Lines

Where building envelopes lie adjacent to or across service lines, all foundations should extend and be founded below the 45 degree zone of influence line extending from pipe inverts. This requirement is to avoid excessive pipe surcharges, and to allow for future maintenance of the system without detrimentally affecting adjacent structures. Subject to approval from Auckland Council, foundations may extend and bridge over service lines provided specific

foundation design is undertaken. A copy of the stormwater as-built plans are included in Appendix A1.

6.9 Road and Access Lots

Based on the fill monitoring and site observations undertaken during site development, the filled and natural ground within Arran's Point Precinct 7, Stage 2 is considered generally suitable for residential road and accessway construction. Scala penetrometer testing should be undertaken when road subgrades have been prepared to confirm subgrade strengths. Subject to such subgrade testing, for future road construction in other parts of the Arran's Point Precinct 7 Stage 2 development, within natural ground, a design CBR of 2% is considered appropriate, while within engineered fill areas, a design CBR of 7% is appropriate.

6.10 Unexpected ground conditions

Our assessment is based on interpolation between borehole positions, site observations and periodic earthworks control visits. Local variations in ground conditions may occur. Although unlikely, unfavourable ground conditions may be encountered during site benching and footing excavations. It is important that we be contacted in this eventuality, or in the event that any variation in subsoil conditions from those described in the report are found. Design assistance is available as required to accommodate any unforeseen ground conditions present.

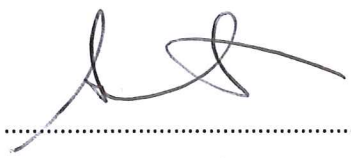
7 Applicability

This report has been prepared for the benefit of WFH Properties Ltd with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

It does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any dwelling, especially in cases where concrete blockwork and/or brick veneer or stucco plaster buildings are sited partly on fill or partly on natural ground, or where they are entirely sited on filling whose depth changes significantly across the building platform.

Tonkin & Taylor Ltd

Report prepared by:



.....

Andrew Linton

Senior Geotechnical Engineer

Authorised for Tonkin & Taylor Ltd by:

.....

Andrew Stiles

Project Director

JXXL
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8 References

[1] Tonkin & Taylor Ltd., October 2001. *Stoney Block,* T+T Ref. 18214.

[2] Tonkin & Taylor Ltd., May 2001. *Silverdale Blocks, Silverdale, Geotechnical Issues – Future Medium Density Development,* T+T Ref. 18213.

[3] Tonkin & Taylor Ltd., November 2003. *Silverdale North and Orewa West Blocks, Silverdale, Geotechnical Issues – Future Medium Density Development,* T+T Ref. 20914.

[4] Tonkin & Taylor Ltd., November 2011. *Millwater – North Bridge, Southern Abutment, Geotechnical Investigation Report,* T+T Ref. 21854.012.

[5] Tonkin & Taylor Ltd., November 2013. *Millwater Subdivision, Arrans Hill – Precinct 7 – Geotechnical Investigation Report,* T+T Ref. 21854.0037.

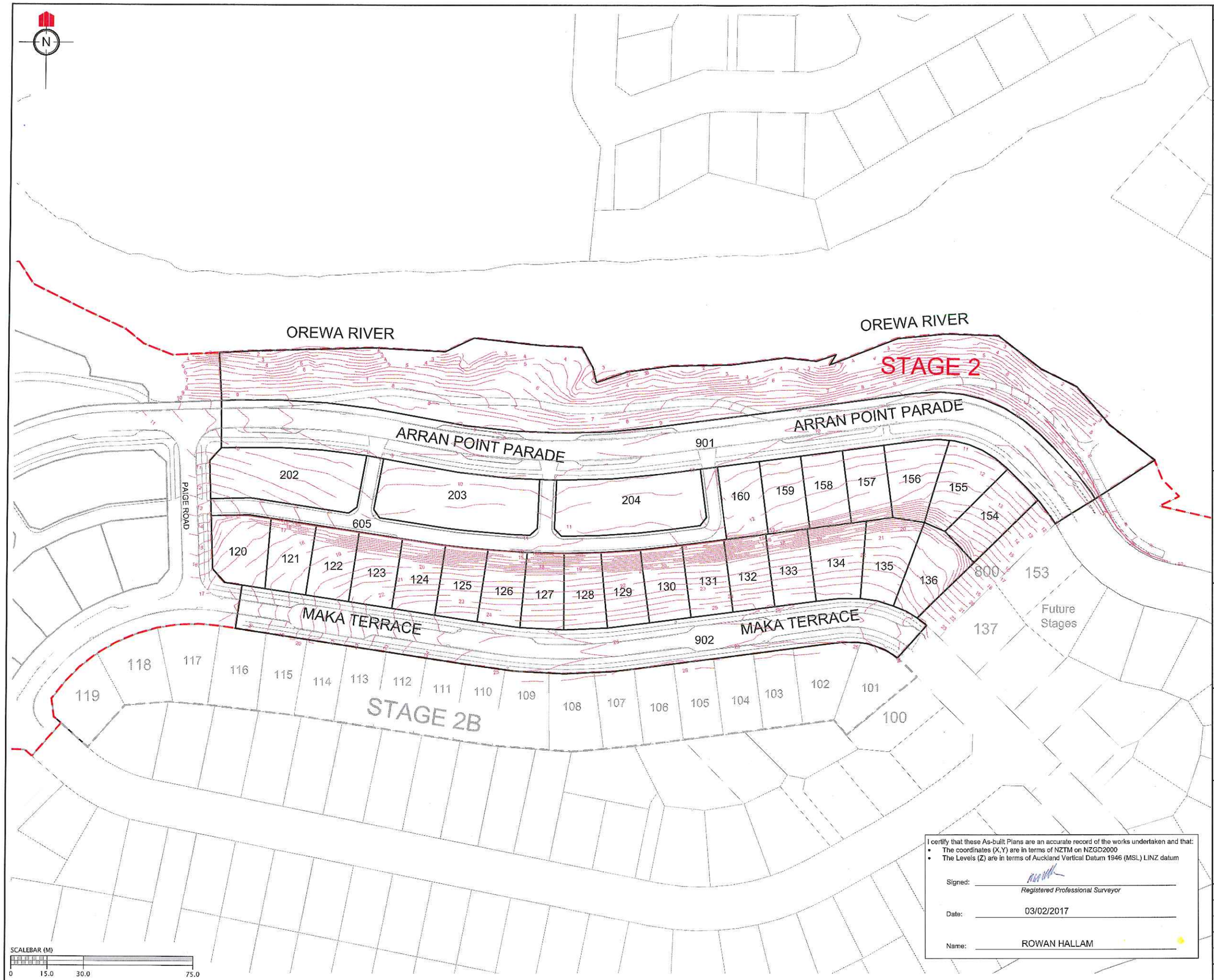
[6] New Zealand Standards, 1989. *NZS 4431:1989 Code of Practice for Earth Fill for Residential Development.*

[7] Standards Australia, 2011. *AS 2870:2011 Residential slabs and footings.*

[8] New Zealand Standards, 2011. *NZS 3604:2011 Timber Framed Buildings.*

Appendix A1: Woods Drawings

- 37001–02–100-AB Final Contour As–Built Plan
- 37001–02–110-AB Cut & Fill As–Built Plan - Lowest to Final Surface
- 37001–02–111-AB Cut & Fill As–Built Plan – Original to Final Surface
- 37001–02–120 to 122-AB Shear Key, Undercuts & Subsoil Drains As–Built Plans
- 37001–02–130 to 133-AB Retaining Wall As–Built Plans
- 37001–02–300 to 303-AB Stormwater Drainage As-Built Plans
- 37001–02–400 to 403-AB Sanitary Sewer As-Built Plans



REVISION DETAILS	NAME	DATE
1.		

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

- CONTOURS MAJOR
- CONTOURS MINOR
- STAGE BOUNDARIES
- LOT BOUNDARIES

CLIENT:

WFH PROPERTIES

WOODS
Engineers. Surveyors. Planners.
Urban Designers. Architects.

MILLWATER
ARRAN POINT
STAGE 2

FINAL CONTOUR
AS-BUILT PLAN
(SLC-62000)

AUCKLAND COUNCIL

I certify that these As-built Plans are an accurate record of the works undertaken and that:
- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____
Registered Professional Surveyor

Date: 03/02/2017

Name: ROWAN HALLAM

DESIGNED: MB	AS-BUILT
CHECKED: KR	DRAWN: DL
APPROVED: MRH	SURVEYED: AP
JOB NUMBER: 37001	SCALE: 1:1500 @ A3
ISSUED: JAN 2017	
DWG. NO. 37001-02-100-AB	REV.

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REVISION DETAILS	NAME	DATE
1.		

NOTES

1. CONTOURS ARE AT 1.0 METRE INTERVALS

LEGEND

- ZERO CONTOUR
- CUT CONTOUR
- FILL CONTOUR
- STAGE BOUNDARIES
- LOT BOUNDARIES

I certify that these As-built Plans are an accurate record of the works undertaken and that:

- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____
Registered Professional Surveyor

Date: 03/02/2017

Name: Rowan Hallam

CLIENT:

WFH PROPERTIES

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MILLWATER
ARRAN POINT
STAGE 2

CUT & FILL AS-BUILT
LOWEST TO FINAL SURFACE
SHEET 1 OF 2
(SLC-62000)

AUCKLAND COUNCIL

DESIGNED:	MB	AS-BUILT	
CHECKED:	KR	DRAWN:	DL
APPROVED:	MRH	SURVEYED:	AP
JOB NUMBER:	37001	SCALE:	1:1500 @ A3
ISSUED:	JAN 2017		
DWG. NO.	37001-02-110-AB	REV.	

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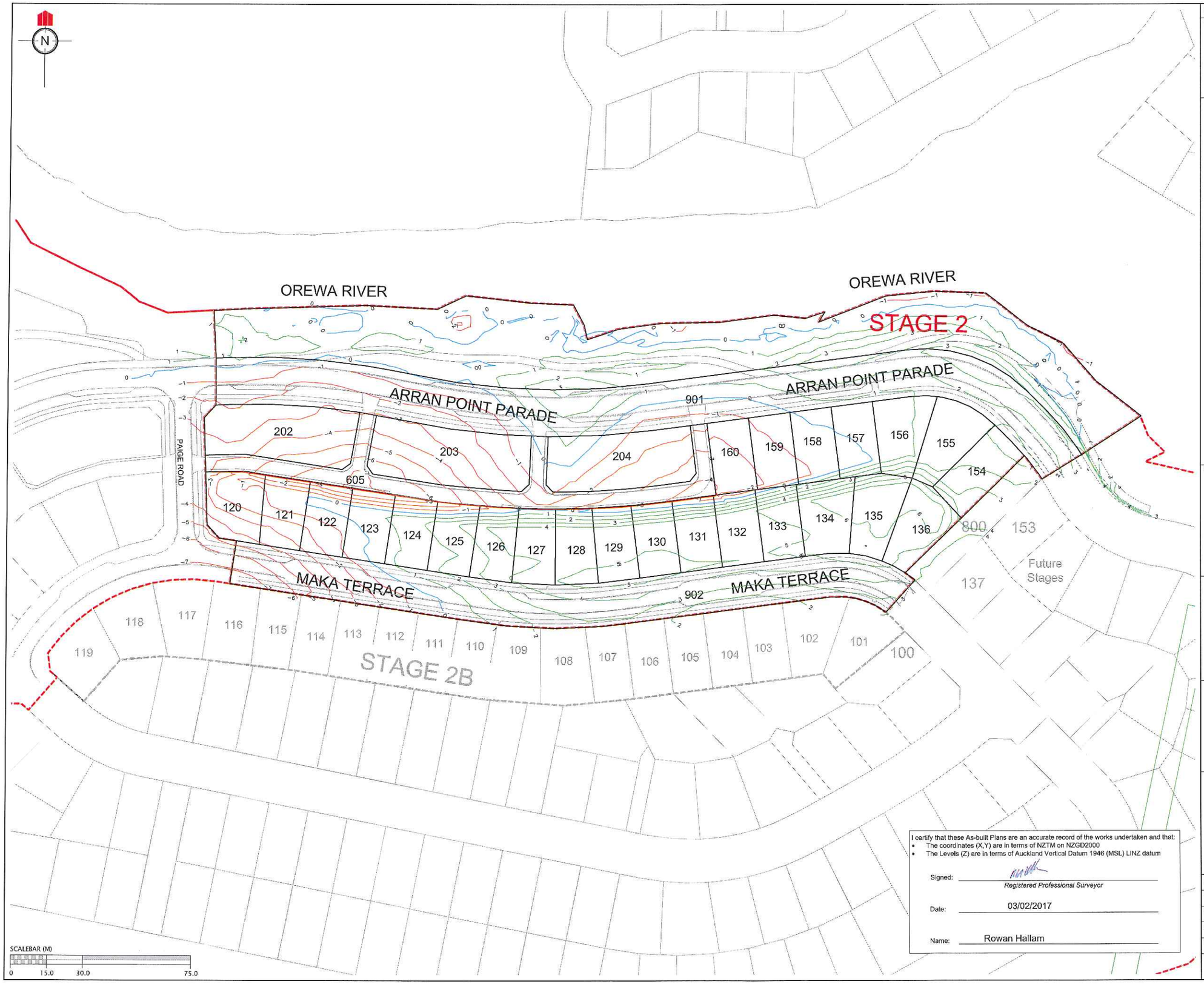

REVISION DETAILS	NAME	DATE
1.		

NOTES

1. CONTOURS ARE AT 1.0 METRE INTERVALS

LEGEND

- ZERO CONTOUR
- CUT CONTOUR
- FILL CONTOUR
- STAGE BOUNDARIES
- LOT BOUNDARIES

CLIENT:

WFH PROPERTIES

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Engineers. Surveyors. Planners.
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MILLWATER
ARRAN POINT
STAGE 2

CUT & FILL AS-BUILT
ORIGINAL TO FINAL SURFACE
SHEET 2 OF 2
(SLC-62000)

AUCKLAND COUNCIL

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- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____
Registered Professional Surveyor

Date: 03/02/2017

Name: Rowan Hallam

DESIGNED:	MB	AS-BUILT	
CHECKED:	KR	DRAWN:	DL
APPROVED:	MRH	SURVEYED:	AP
JOB NUMBER:	37001	SCALE:	1:1500 @ A3
ISSUED:	JAN 2017		
DWG. NO.	37001-02-111-AB	REV.	

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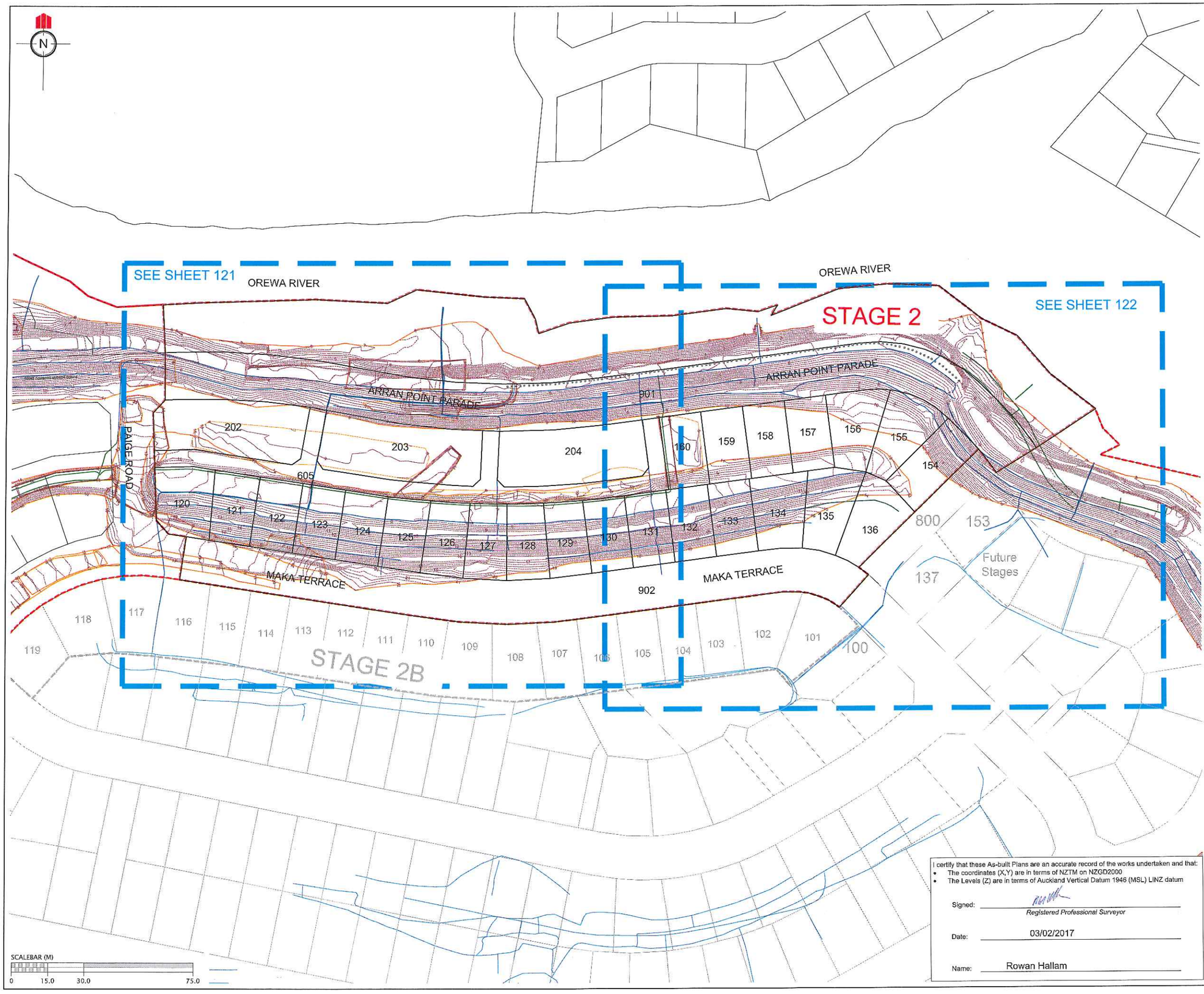

REVISION DETAILS	NAME	DATE
1. ISSUED FOR INFORMATION	KR	11/01/2017
2. PALISADE WALL PILES ADDED	AF	8/2/2017

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

- NOVACOIL SUBSOIL DRAINS
- REINFORCED EARTH & RETAINING WALL SUBSOIL DRAINS
- EXISTING STORMWATER DRAINAGE
- NEW STORMWATER DRAINAGE
- STAGE BOUNDARIES
- LOT BOUNDARIES
- CONTOURS
- SHEAR KEY & UNDERCUT AREAS
- PALISADE WALL PILE AT BOTTOM OF SHEARKEY

I certify that these As-built Plans are an accurate record of the works undertaken and that:

- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____ *Registered Professional Surveyor*

Date: 03/02/2017

Name: Rowan Hallam

CLIENT: WFH PROPERTIES

WOODS Engineers. Surveyors. Planners. Urban Designers. Architects.

MILLWATER ARRAN POINT STAGE 2

SHEAR KEY, UNDERCUTS, & SUBSOIL DRAINS AS-BUILT PLAN SHEET 1 of 3

AUCKLAND COUNCIL

DESIGNED:	MB	AS-BUILT	
CHECKED:	RDC	DRAWN:	KR
APPROVED:	MRH	SURVEYED:	WOODS
JOB NUMBER:	37001	SCALE:	1:1500 @ A3
ISSUED:	8-02-2017		
DWG. NO.	37001-02-120-AB	REV.	2

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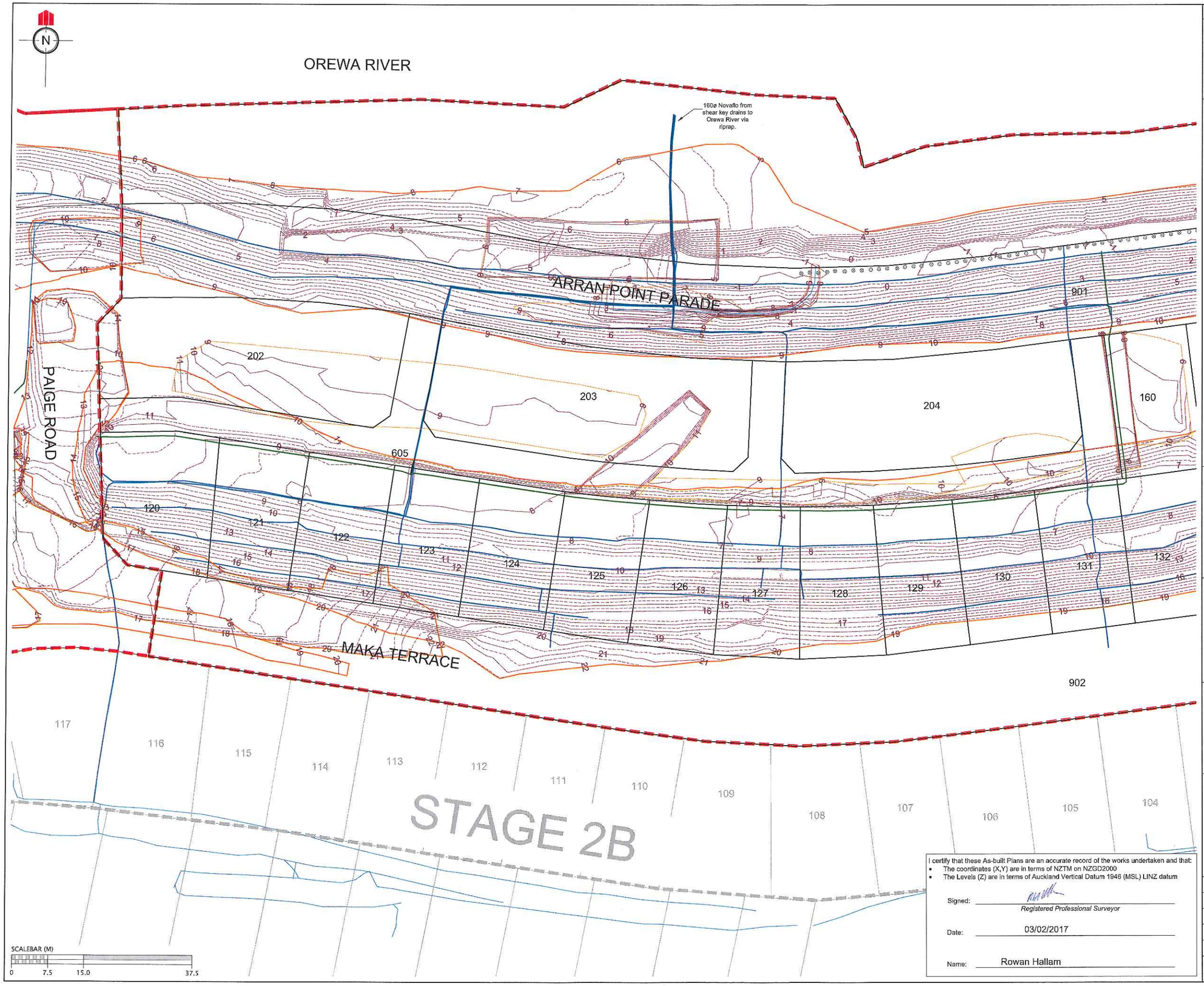

REVISION DETAILS	NAME	DATE
1. ISSUED FOR INFORMATION	KR	11/01/2017
2. PALISADE WALL PILES ADDED	AF	8/2/2017

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

- NOVACOIL SUBSOIL DRAINS
- REINFORCED EARTH & RETAINING WALL SUBSOIL DRAINS
- EXISTING STORMWATER DRAINAGE
- NEW STORMWATER DRAINAGE
- STAGE BOUNDARIES
- LOT BOUNDARIES
- CONTOURS
- SHEAR KEY & UNDERCUT AREAS
- PALISADE WALL PILE AT BOTTOM OF SHEARKEY

I certify that these As-built Plans are an accurate record of the works undertaken and that:

- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____
Registered Professional Surveyor

Date: 03/02/2017

Name: Rowan Hallam

CLIENT:

WFH PROPERTIES

WOODS
Engineers. Surveyors. Planners. Urban Designers. Architects.

MILLWATER ARRAN POINT STAGE 2

SHEAR KEY, UNDERCUTS, & SUBSOIL DRAINS AS-BUILT PLAN SHEET 2 of 3

AUCKLAND COUNCIL

DESIGNED:	MB	AS-BUILT	
CHECKED:	RDC	DRAWN:	KR
APPROVED:	MRH	SURVEYED:	WOODS
JOB NUMBER:	37001	SCALE:	1:750 @ A3
ISSUED:	8-02-2017		
DWG. NO.	37001-02-121-AB	REV.	2

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OREWA RIVER

STAGE 2

160ø Novaflo from shear key drains to Orewa River via riprap.

160ø Novaflo from retaining wall drains to Orewa River via riprap.

ARRAN POINT PARADE

MAKA TERRACE

901

902

800

Future Stages

204 160 159 158 157 156 155 154 153 137 136 135 134 133 132 131 130 129

107 106 105 104 103 102 101 100

SCALEBAR (M)

0 7.5 15.0 37.5

I certify that these As-built Plans are an accurate record of the works undertaken and that:

- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____
Registered Professional Surveyor

Date: 03/02/2017

Name: Rowan Hallam

REVISION DETAILS	NAME	DATE
1. ISSUED FOR INFORMATION	KR	11-01-2017
2. PALISADE WALL PILES ADDED	AF	8/02/2017

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

- NOVACOIL SUBSOIL DRAINS
- REINFORCED EARTH & RETAINING WALL SUBSOIL DRAINS
- EXISTING STORMWATER DRAINAGE
- NEW STORMWATER DRAINAGE
- STAGE BOUNDARIES
- LOT BOUNDARIES
- CONTOURS
- SHEAR KEY & UNDERCUT AREAS
- PALISADE WALL PILE AT BOTTOM OF SHEARKEY

CLIENT:

WFH PROPERTIES

WOODS
Engineers. Surveyors. Planners.
Urban Designers. Architects.

MILLWATER
ARRAN POINT
STAGE 2

SHEAR KEY, UNDERCUTS, & SUBSOIL DRAINS AS-BUILT PLAN
SHEET 3 of 3

AUCKLAND COUNCIL

DESIGNED: MB	AS-BUILT
CHECKED: RDC	DRAWN: KR
APPROVED: MRH	SURVEYED: WOODS
JOB NUMBER: 37001	SCALE: 1:750 @ A3
ISSUED: 8-02-2017	
DWG. NO. 37001-02-122-AB	REV. 2

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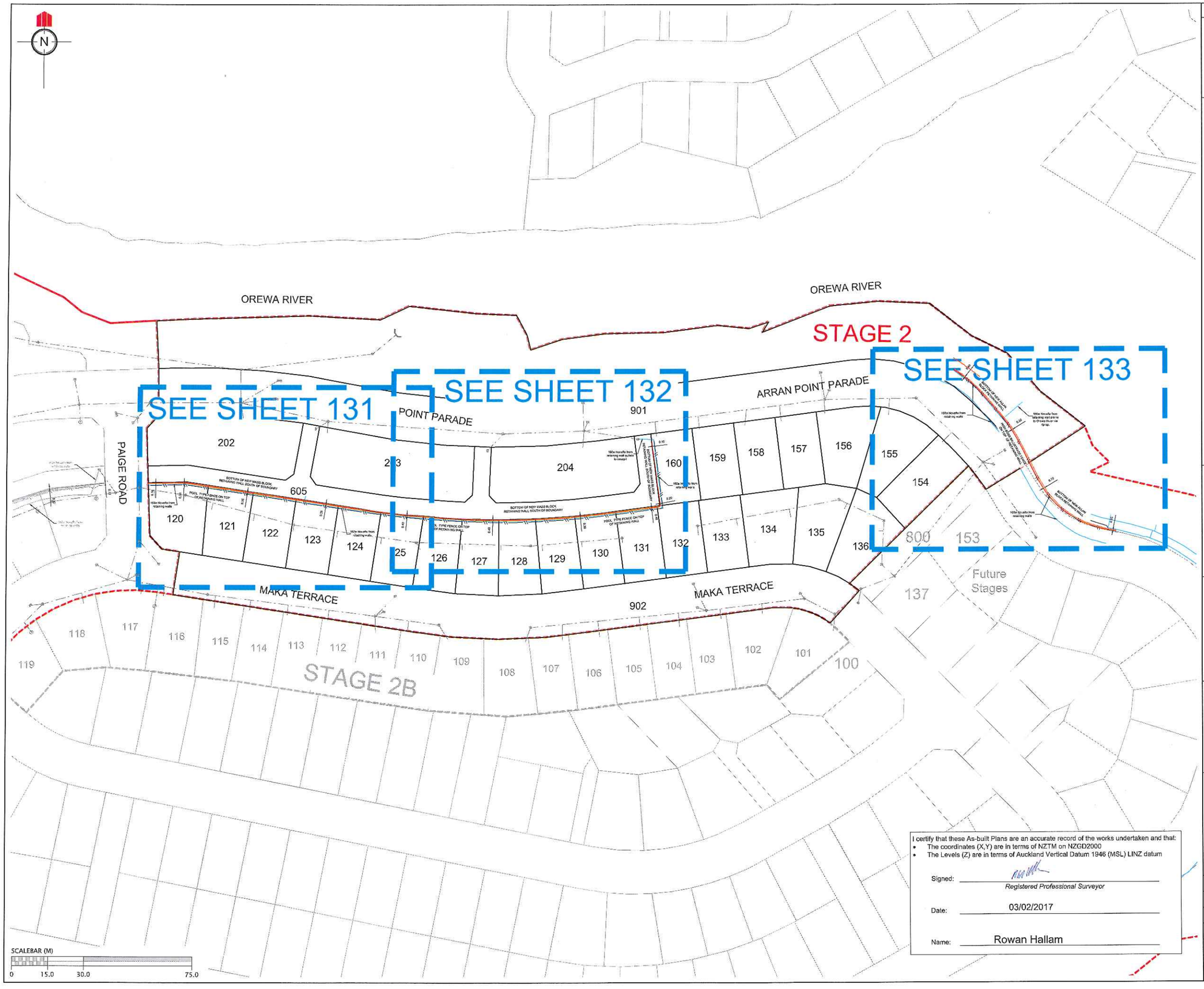

REVISION DETAILS	NAME	DATE

LEGEND:

- BOTTOM FACE OF WALL
- TOP FACE OF WALL
- CATCH PIT/BERM SUMP
- STORMWATER MANHOLE
- FENCE
- STORMWATER LINE
- BOUNDARY
- WALL DRAINAGE LINE

I certify that these As-built Plans are an accurate record of the works undertaken and that:

- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____
Registered Professional Surveyor

Date: 03/02/2017

Name: Rowan Hallam

CLIENT:

WFH PROPERTIES

WOODS
Engineers. Surveyors. Planners.
Urban Designers. Architects.

MILLWATER ARRAN POINT STAGE 2

RETAINING WALL AS-BUILT
SHEET 1 OF 4

AUCKLAND COUNCIL

DESIGNED:	MB	AS-BUILT	
CHECKED:	RDC	DRAWN:	KR
APPROVED:	MRH	SURVEYED:	KH
JOB NUMBER:	37001	SCALE:	1:1500 @ A3
ISSUED:	SEPT 2016		
DWG. NO.	37001-02-130-AB	REV.	

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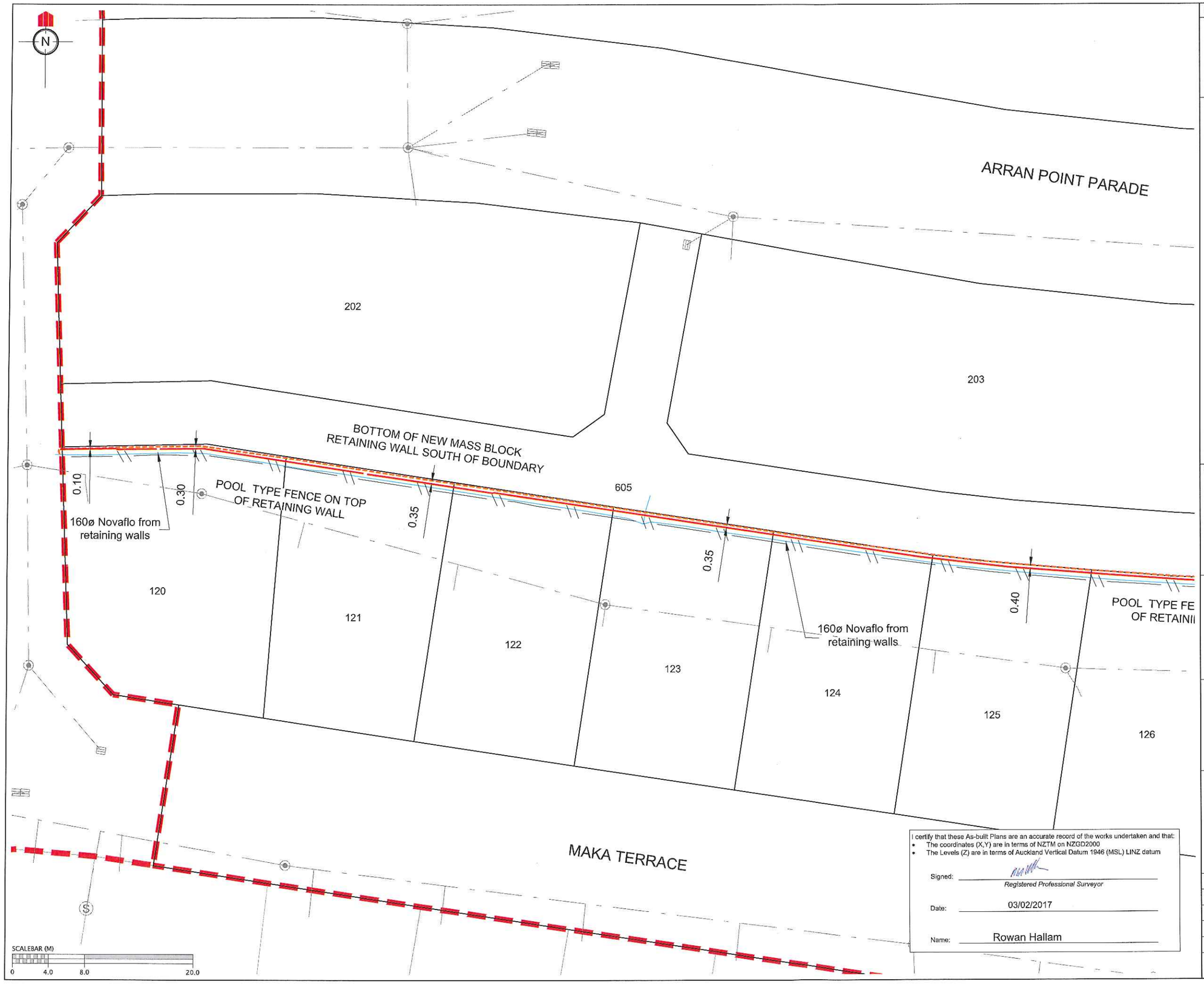

REVISION DETAILS	NAME	DATE

LEGEND:

- BOTTOM FACE OF WALL
- TOP FACE OF WALL
- CATCH PIT/BERM SUMP
- STORMWATER MANHOLE
- FENCE
- STORMWATER LINE
- BOUNDARY
- WALL DRAINAGE LINE

CLIENT:

WFH PROPERTIES

WOODS
Engineers. Surveyors. Planners.
Urban Designers. Architects.

MILLWATER
ARRAN POINT
STAGE 2

RETAINING WALL AS-BUILT
SHEET 2 OF 4

AUCKLAND COUNCIL

I certify that these As-built Plans are an accurate record of the works undertaken and that:
- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____
Registered Professional Surveyor

Date: 03/02/2017

Name: Rowan Hallam

DESIGNED:	M8	AS-BUILT	
CHECKED:	RDC	DRAWN:	KR
APPROVED:	MRH	SURVEYED:	KH
JOB NUMBER:	37001	SCALE:	1:400 @ A3
ISSUED:	JAN 2016		
DWG. NO.	37001-02-131-AB	REV.	

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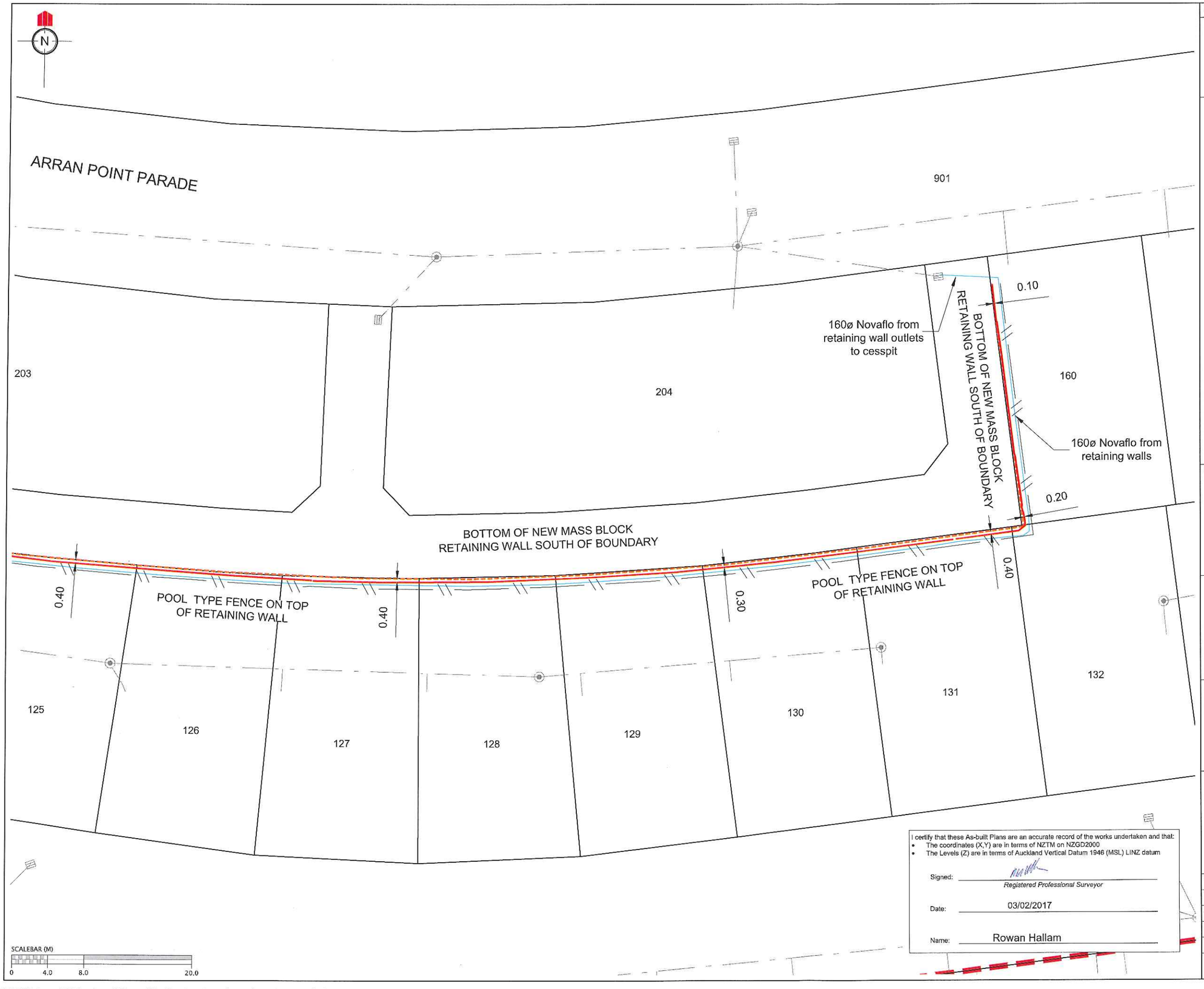

REVISION DETAILS	NAME	DATE

LEGEND:

- BOTTOM FACE OF WALL
- TOP FACE OF WALL
- CATCH PIT/BERM SUMP
- STORMWATER MANHOLE
- FENCE
- STORMWATER LINE
- BOUNDARY
- WALL DRAINAGE LINE

CLIENT:

WFH PROPERTIES

WOODS
Engineers. Surveyors. Planners. Urban Designers. Architects.

MILLWATER ARRAN POINT STAGE 2

RETAINING WALL AS-BUILT
SHEET 3 OF 4

AUCKLAND COUNCIL

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- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____
Registered Professional Surveyor

Date: 03/02/2017

Name: Rowan Hallam

DESIGNED:	MB	AS-BUILT	
CHECKED:	RDC	DRAWN:	KR
APPROVED:	MRH	SURVEYED:	KH
JOB NUMBER:	37001	SCALE:	1:400 @ A3
ISSUED:	JAN 2016		
DWG. NO.	37001-02-132-AB	REV.	

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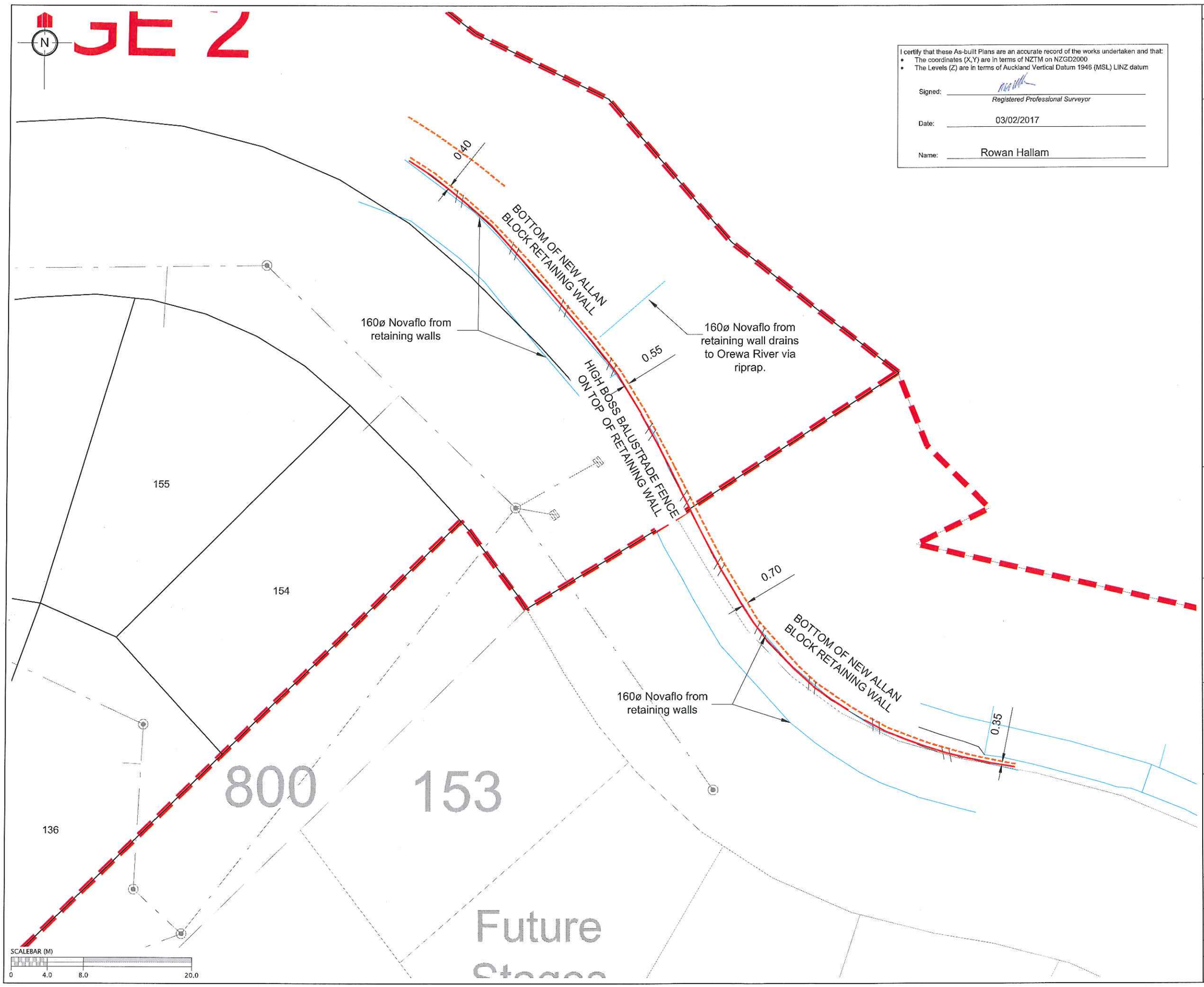

I certify that these As-built Plans are an accurate record of the works undertaken and that:

- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____
Registered Professional Surveyor

Date: 03/02/2017

Name: Rowan Hallam

REVISION DETAILS	NAME	DATE

LEGEND:

- BOTTOM FACE OF WALL
- TOP FACE OF WALL
- CATCH PIT/BERM SUMP
- STORMWATER MANHOLE
- FENCE
- STORMWATER LINE
- BOUNDARY
- WALL DRAINAGE LINE

CLIENT:

WFH PROPERTIES

WOODS
Engineers. Surveyors. Planners.
Urban Designers. Architects.

MILLWATER ARRAN POINT STAGE 2

RETAINING WALL AS-BUILT
SHEET 4 OF 4

AUCKLAND COUNCIL

DESIGNED:	MB	AS-BUILT	
CHECKED:	RDC	DRAWN:	KR
APPROVED:	MRH	SURVEYED:	KH
JOB NUMBER:	37001	SCALE:	1:400 @ A3
ISSUED:	JAN 2016		
DWG. NO.	37001-02-133-AB	REV.	

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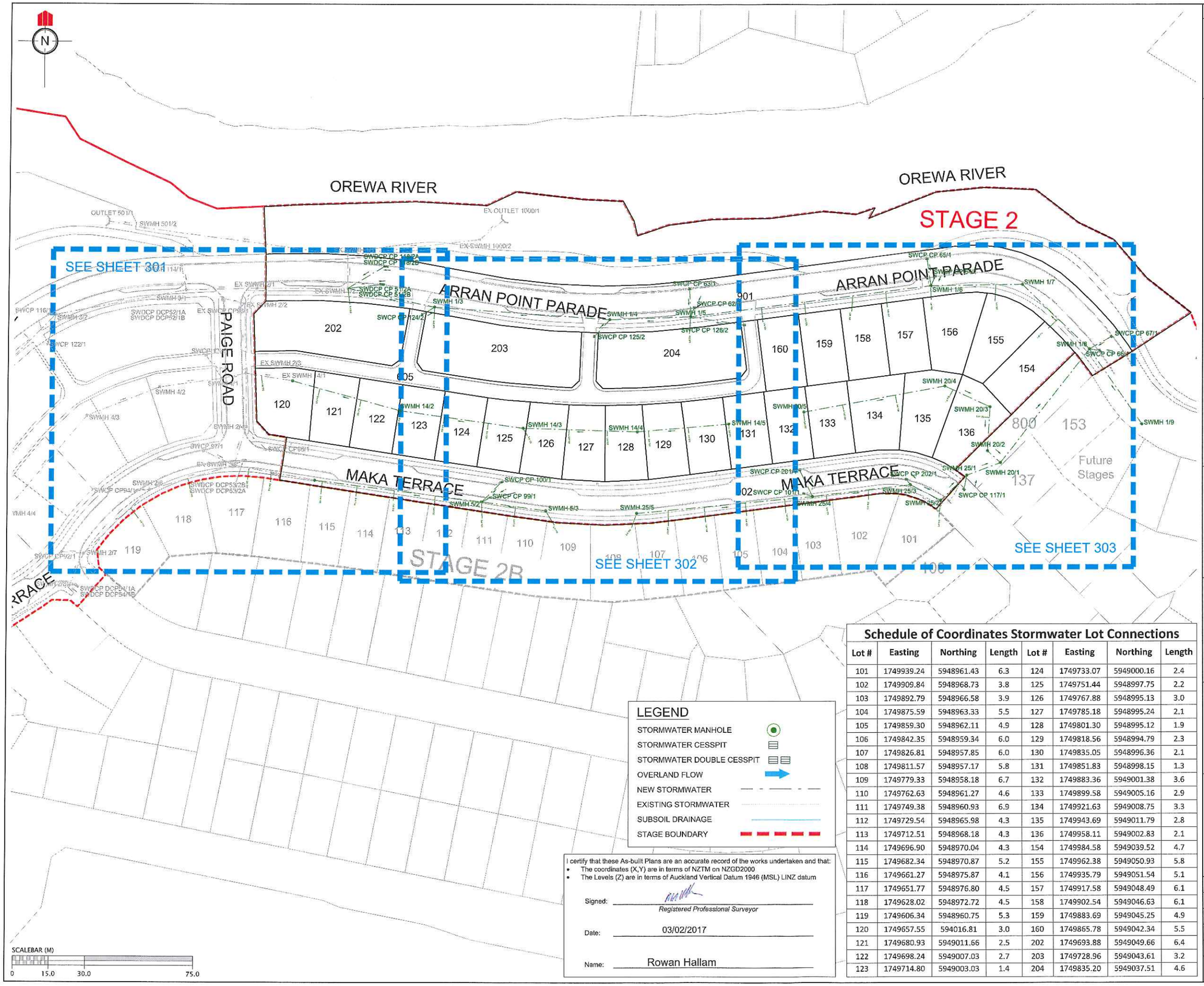

REVISION DETAILS	NAME	DATE
Issued for information.	KR	11/01/2017

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AC STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
2. ALL PIPE BEDDING COMPLIES WITH AC STANDARDS
3. ALL CESSPIT LEADS AND PIPES UNDER THE ROAD AND CARRIDGEWAYS ARE REINFORCED CONCRETE PIPES CLASS 4 (Z) RRJ. ALL OTHER PIPELINES ARE REINFORCED CONCRETE CLASS 2 (X) RRJ UNLESS OTHERWISE NOTED.
4. ALL PIPE CROSSINGS UNDER ROADS AND ACCESSWAYS HAVE BEEN HARDFILL BACKFILLED.
5. ALL SW 100mm DIA. RAMPED RISERS HAVE BEEN EXTENDED AND CAPPED OFF 1.0m BELOW THE FINISHED GROUND SURFACE.
6. ALL PRIVATE DRAINAGE CONNECTIONS ARE 100mmØ.
7. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
8. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.

LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
- OVERLAND FLOW
- NEW STORMWATER
- EXISTING STORMWATER
- SUBSOIL DRAINAGE
- STAGE BOUNDARY

I certify that these As-built Plans are an accurate record of the works undertaken and that:
- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____ *Registered Professional Surveyor*

Date: 03/02/2017

Name: Rowan Hallam

SCALEBAR (M)

0 15.0 30.0 75.0

Schedule of Coordinates Stormwater Lot Connections

Lot #	Easting	Northing	Length	Lot #	Easting	Northing	Length
101	1749939.24	5948961.43	6.3	124	1749733.07	5949000.16	2.4
102	1749909.84	5948968.73	3.8	125	1749751.44	5948997.75	2.2
103	1749892.79	5948966.58	3.9	126	1749767.88	5948995.13	3.0
104	1749875.59	5948963.33	5.5	127	1749785.18	5948995.24	2.1
105	1749859.30	5948962.11	4.9	128	1749801.30	5948995.12	1.9
106	1749842.35	5948959.34	6.0	129	1749818.56	5948994.79	2.3
107	1749826.81	5948957.85	6.0	130	1749835.05	5948996.36	2.1
108	1749811.57	5948957.17	5.8	131	1749851.83	5948998.15	1.3
109	1749779.33	5948958.18	6.7	132	1749883.36	5949001.38	3.6
110	1749762.63	5948961.27	4.6	133	1749899.58	5949005.16	2.9
111	1749749.38	5948960.93	6.9	134	1749921.63	5949008.75	3.3
112	1749729.54	5948965.98	4.3	135	1749943.69	5949011.79	2.8
113	1749712.51	5948968.18	4.3	136	1749958.11	5949002.83	2.1
114	1749696.90	5948970.04	4.3	154	1749984.58	5949039.52	4.7
115	1749682.34	5948970.87	5.2	155	1749962.38	5949050.93	5.8
116	1749661.27	5948975.87	4.1	156	1749935.79	5949051.54	5.1
117	1749651.77	5948976.80	4.5	157	1749917.58	5949048.49	6.1
118	1749628.02	5948972.72	4.5	158	1749902.54	5949046.63	6.1
119	1749606.34	5948960.75	5.3	159	1749883.69	5949045.25	4.9
120	1749657.55	594016.81	3.0	160	1749865.78	5949042.34	5.5
121	1749680.93	5949011.66	2.5	202	1749693.88	5949049.66	6.4
122	1749698.24	5949007.03	2.7	203	1749728.96	5949043.61	3.2
123	1749714.80	5949003.03	1.4	204	1749835.20	5949037.51	4.6

CLIENT: WFH PROPERTIES

WOODS Engineers. Surveyors. Planners. Urban Designers. Architects.

MILLWATER ARRAN POINT STAGE 2

STORMWATER ASBUILT OVERALL LAYOUT SHEET 1 OF 4 (SLC-62000)
AUCKLAND COUNCIL

DESIGNED:	MB	ASBUILT	
CHECKED:	KR	DRAWN:	KR
APPROVED:	MRH	SURVEYED:	AP
JOB NUMBER:	37001	SCALE:	1:1500 @ A3
ISSUED:	JAN 2017		
DWG. NO.	37001-02-300-AB	REV.	1.

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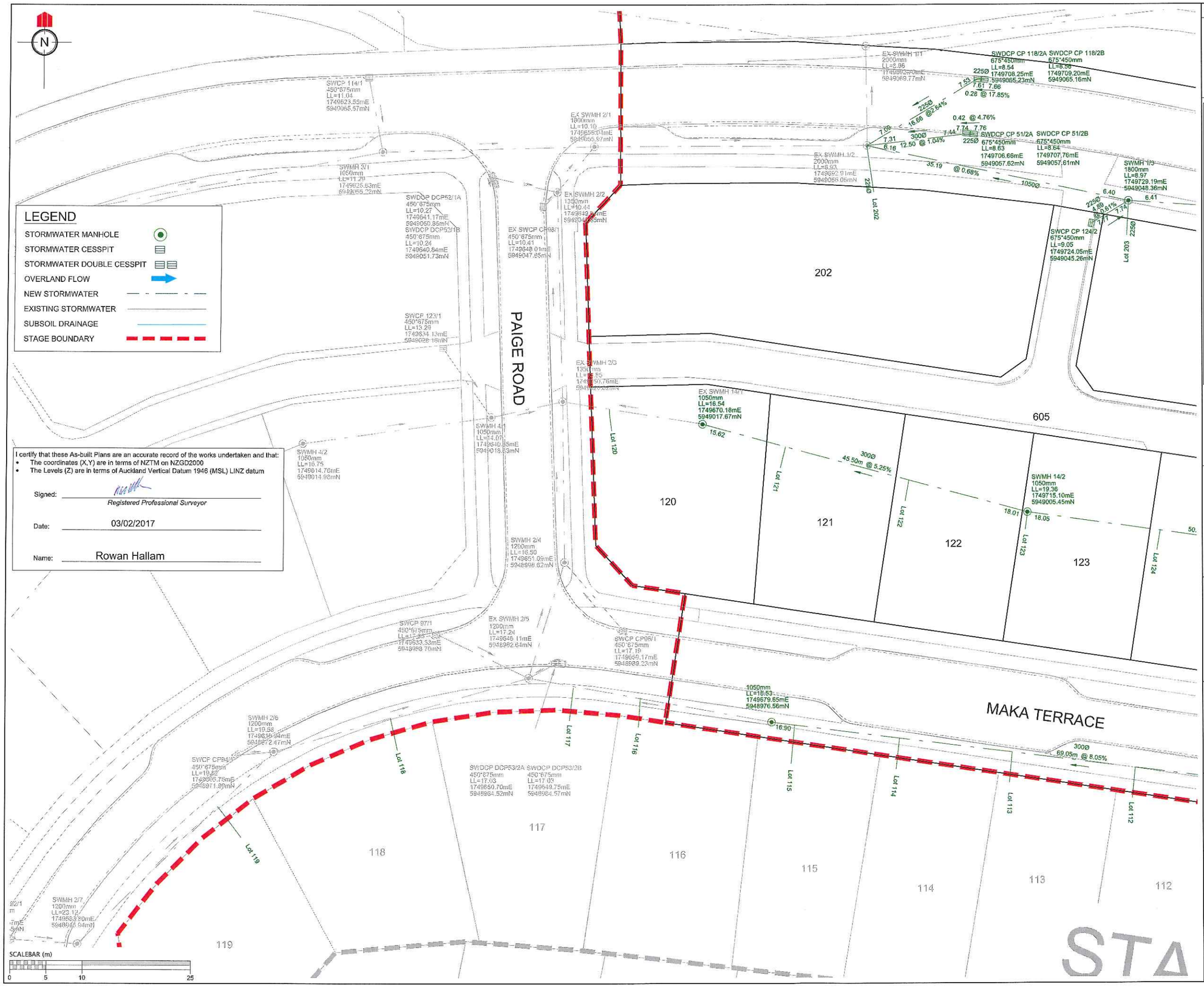

REVISION DETAILS	NAME	DATE
Issued for information.	KR	11/01/2017

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AC STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
2. ALL PIPE BEDDING COMPLIES WITH AC STANDARDS
3. ALL CESSPIT LEADS AND PIPES UNDER THE ROAD AND CARRIDGEWAYS ARE REINFORCED CONCRETE PIPES CLASS 4 (Z) RRJ. ALL OTHER PIPELINES ARE REINFORCED CONCRETE CLASS 2 (X) RRJ UNLESS OTHERWISE NOTED.
4. ALL PIPE CROSSINGS UNDER ROADS AND ACCESSWAYS HAVE BEEN HARDFILL BACKFILLED.
5. ALL SW 100mm DIA. RAMPED RISERS HAVE BEEN EXTENDED AND CAPPED OFF 1.0m BELOW THE FINISHED GROUND SURFACE.
6. ALL PRIVATE DRAINAGE CONNECTIONS ARE 100mmØ.
7. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
8. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.

CLIENT:

WFH PROPERTIES

WOODS
Engineers. Surveyors. Planners. Urban Designers. Architects.

MILLWATER ARRAN POINT STAGE 2

STORMWATER ASBUILT
SHEET 2 OF 4
(SLC-62000)

AUCKLAND COUNCIL

DESIGNED:	MB	ASBUILT	
CHECKED:	KR	DRAWN:	KR
APPROVED:	MRH	SURVEYED:	AP
JOB NUMBER:	37001	SCALE:	1:500 @ A3
ISSUED:	JAN 2017		
DWG. NO.	37001-02-301-AB	REV.	1.

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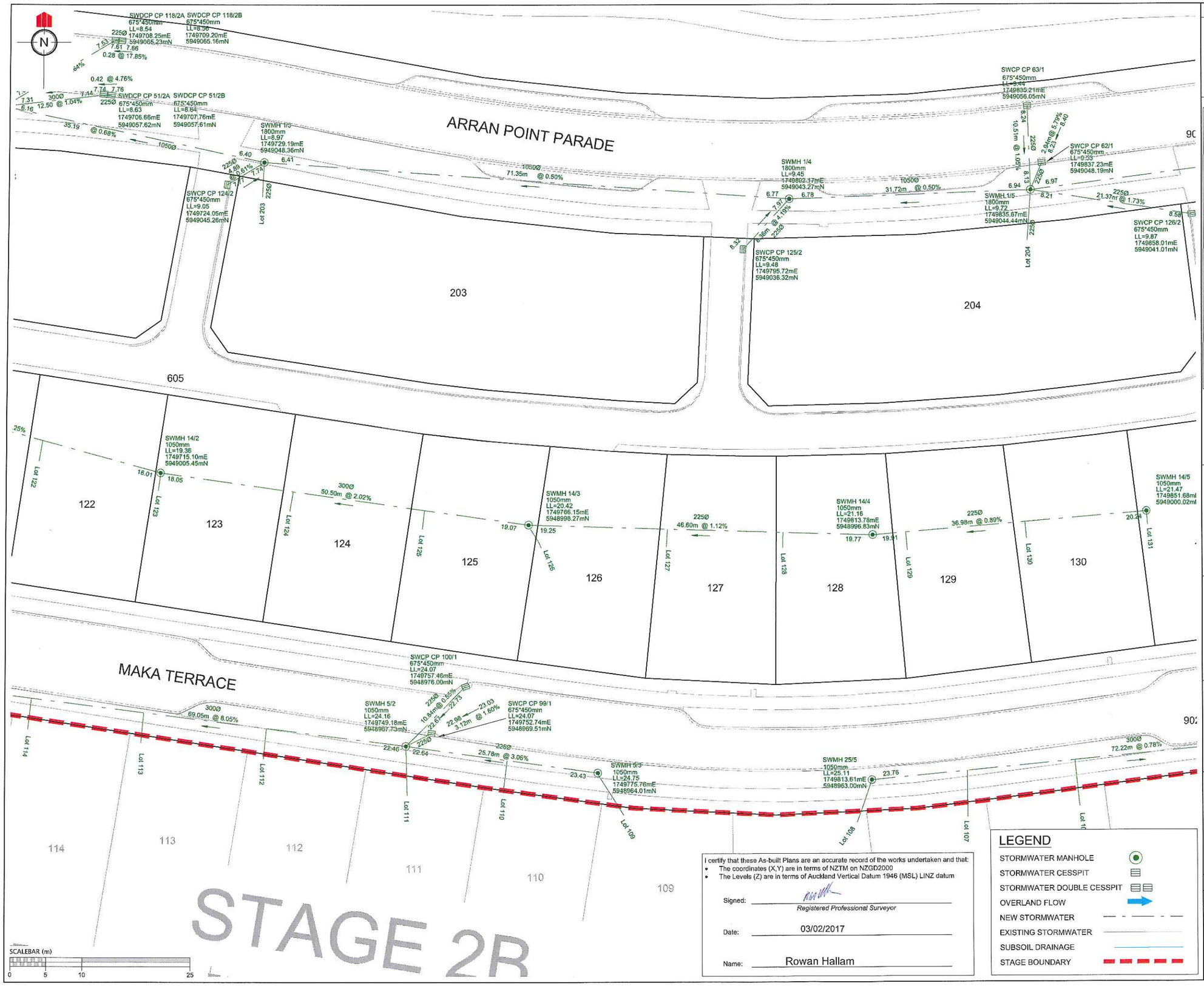

REVISION DETAILS	NAME	DATE
Issued for information.	KR	11/01/2017

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AC STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
2. ALL PIPE BEDDING COMPLIES WITH AC STANDARDS
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4. ALL PIPE CROSSINGS UNDER ROADS AND ACCESSWAYS HAVE BEEN HARDFILL BACKFILLED.
5. ALL SW 100mm DIA. RAMPED RISERS HAVE BEEN EXTENDED AND CAPPED OFF 1.0m BELOW THE FINISHED GROUND SURFACE.
6. ALL PRIVATE DRAINAGE CONNECTIONS ARE 100mmØ.
7. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
8. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.

I certify that these As-built Plans are an accurate record of the works undertaken and that:
- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____ *Registered Professional Surveyor*

Date: 03/02/2017

Name: Rowan Hallam

LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
- OVERLAND FLOW
- NEW STORMWATER
- EXISTING STORMWATER
- SUBSOIL DRAINAGE
- STAGE BOUNDARY

CLIENT:

WFH PROPERTIES

WOODS
Engineers. Surveyors. Planners. Urban Designers. Architects.

MILLWATER ARRAN POINT STAGE 2

STORMWATER ASBUILT
SHEET 3 OF 4
(SLC-62000)

AUCKLAND COUNCIL

DESIGNED:	MB	ASBUILT	
CHECKED:	KR	DRAWN:	KR
APPROVED:	MRH	SURVEYED:	AP
JOB NUMBER:	37001	SCALE:	1:500 @ A3
ISSUED:	JAN 2017		
DWG. NO.	37001-02-302-AB	REV.	

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REVISION DETAILS	NAME	DATE
Issued for information.	KR	11/01/2017

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AC STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
2. ALL PIPE BEDDING COMPLIES WITH AC STANDARDS
3. ALL CESSPIT LEADS AND PIPES UNDER THE ROAD AND CARRIDGEWAYS ARE REINFORCED CONCRETE PIPES CLASS 4 (Z) RRJ. ALL OTHER PIPELINES ARE REINFORCED CONCRETE CLASS 2 (X) RRJ UNLESS OTHERWISE NOTED.
4. ALL PIPE CROSSINGS UNDER ROADS AND ACCESSWAYS HAVE BEEN HARDFILL BACKFILLED.
5. ALL SW 100mm DIA. RAMPED RISERS HAVE BEEN EXTENDED AND CAPPED OFF 1.0m BELOW THE FINISHED GROUND SURFACE.
6. ALL PRIVATE DRAINAGE CONNECTIONS ARE 100mmØ.
7. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
8. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.

CLIENT:

WFH PROPERTIES

WOODS
Engineers. Surveyors. Planners. Urban Designers. Architects.

MILLWATER ARRAN POINT STAGE 2

STORMWATER ASBUILT
SHEET 4 OF 4
(SLC-62000)

AUCKLAND COUNCIL

DESIGNED: MB	ASBUILT
CHECKED: KR	DRAWN: KR
APPROVED: MRH	SURVEYED: AP
JOB NUMBER: 37001	SCALE: 1:500 @ A3
ISSUED: JAN 2017	
DWG. NO. 37001-02-303-AB	REV.

I certify that these As-built Plans are an accurate record of the works undertaken and that:
- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____ *Registered Professional Surveyor*

Date: 03/02/2017

Name: Rowan Hallam

LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
- OVERLAND FLOW
- NEW STORMWATER
- EXISTING STORMWATER
- SUBSOIL DRAINAGE
- STAGE BOUNDARY

SCALEBAR (m) 0 5 10 25

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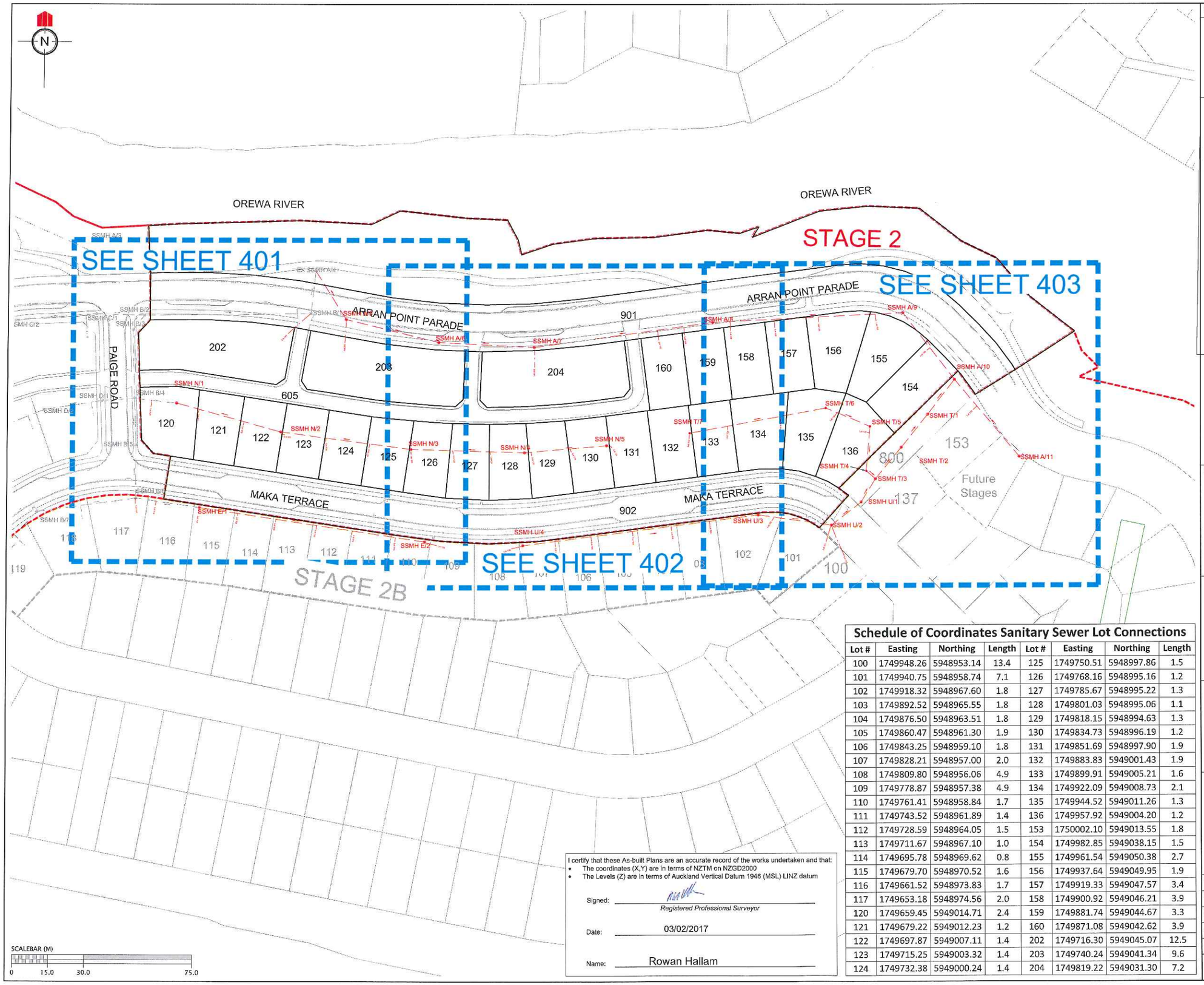

SCALEBAR (M)

0 15.0 30.0 75.0

I certify that these As-built Plans are an accurate record of the works undertaken and that:

- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____
Registered Professional Surveyor

Date: 03/02/2017

Name: Rowan Hallam

Schedule of Coordinates Sanitary Sewer Lot Connections

Lot #	Easting	Northing	Length	Lot #	Easting	Northing	Length
100	1749948.26	5948953.14	13.4	125	1749750.51	5948997.86	1.5
101	1749940.75	5948958.74	7.1	126	1749768.16	5948995.16	1.2
102	1749918.32	5948967.60	1.8	127	1749785.67	5948995.22	1.3
103	1749892.52	5948965.55	1.8	128	1749801.03	5948995.06	1.1
104	1749876.50	5948963.51	1.8	129	1749818.15	5948994.63	1.3
105	1749860.47	5948961.30	1.9	130	1749834.73	5948996.19	1.2
106	1749843.25	5948959.10	1.8	131	1749851.69	5948997.90	1.9
107	1749828.21	5948957.00	2.0	132	1749883.83	5949001.43	1.9
108	1749809.80	5948956.06	4.9	133	1749899.91	5949005.21	1.6
109	1749778.87	5948957.38	4.9	134	1749922.09	5949008.73	2.1
110	1749761.41	5948958.84	1.7	135	1749944.52	5949011.26	1.3
111	1749743.52	5948961.89	1.4	136	1749957.92	5949004.20	1.2
112	1749728.59	5948964.05	1.5	153	1750002.10	5949013.55	1.8
113	1749711.67	5948967.10	1.0	154	1749982.85	5949038.15	1.5
114	1749695.78	5948969.62	0.8	155	1749961.54	5949050.38	2.7
115	1749679.70	5948970.52	1.6	156	1749937.64	5949049.95	1.9
116	1749661.52	5948973.83	1.7	157	1749919.33	5949047.57	3.4
117	1749653.18	5948974.56	2.0	158	1749900.92	5949046.21	3.9
120	1749659.45	5949014.71	2.4	159	1749881.74	5949044.67	3.3
121	1749679.22	5949012.23	1.2	160	1749871.08	5949042.62	3.9
122	1749697.87	5949007.11	1.4	202	1749716.30	5949045.07	12.5
123	1749715.25	5949003.32	1.4	203	1749740.24	5949041.34	9.6
124	1749732.38	5949000.24	1.4	204	1749819.22	5949031.30	7.2

REVISION DETAILS	NAME	DATE

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AUCKLAND COUNCIL & WATERCARE SERVICES LTD STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
2. ALL SANITARY SEWER LINES ARE 150mmØ uPVC CLASS SN16 UNLESS STATED OTHERWISE.
3. ALL PIPE BEDDING COMPLIES WITH WATERCARE STANDARDS.
4. ALL PIPE CROSSINGS UNDER ROADS AND ACCESSWAYS HAVE BEEN HARDFILL BACKFILLED.
5. ALL PRIVATE LOT CONNECTIONS ARE 100mmØ UNLESS STATED OTHERWISE
6. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
7. ALL PIPE AND MH DIAMETERS ARE INTERNAL, AND SHOWN IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
8. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.

LEGEND

NEW SANITARY SEWER MANHOLE

NEW SANITARY SEWER

EXISTING SANITARY SEWER

CLIENT:

WFH PROPERTIES

WOODS
Engineers. Surveyors. Planners.
Urban Designers. Architects.

MILLWATER
ARRAN POINT
STAGE 2

SANITARY SEWER ASBUILT
OVERALL LAYOUT
SHEET 1 OF 4
(SLC-62000)

AUCKLAND COUNCIL

DESIGNED: AF	ASBUILT
CHECKED: KR	DRAWN: KR
APPROVED: MRH	SURVEYED: WOODS
JOB NUMBER: 37001	SCALE: 1:1500 @ A3
ISSUED: FEB 2017	
DWG. NO. 37001-02-400-AB	REV.

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I certify that these As-built Plans are an accurate record of the works undertaken and that:

- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____
Registered Professional Surveyor

Date: 03/02/2017

Name: Rowan Hallam

REVISION DETAILS	NAME	DATE

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AUCKLAND COUNCIL & WATERCARE SERVICES LTD STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
2. ALL SANITARY SEWER LINES ARE 150mmØ uPVC CLASS SN16 UNLESS STATED OTHERWISE.
3. ALL PIPE BEDDING COMPLIES WITH WATERCARE STANDARDS.
4. ALL PIPE CROSSINGS UNDER ROADS AND ACCESSWAYS HAVE BEEN HARDFILL BACKFILLED.
5. ALL PRIVATE LOT CONNECTIONS ARE 100mmØ UNLESS STATED OTHERWISE
6. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
7. ALL PIPE AND MH DIAMETERS ARE INTERNAL, AND SHOWN IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
8. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.

LEGEND

NEW SANITARY SEWER MANHOLE

NEW SANITARY SEWER

EXISTING SANITARY SEWER

CLIENT:

WFH PROPERTIES

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Engineers. Surveyors. Planners. Urban Designers. Architects.

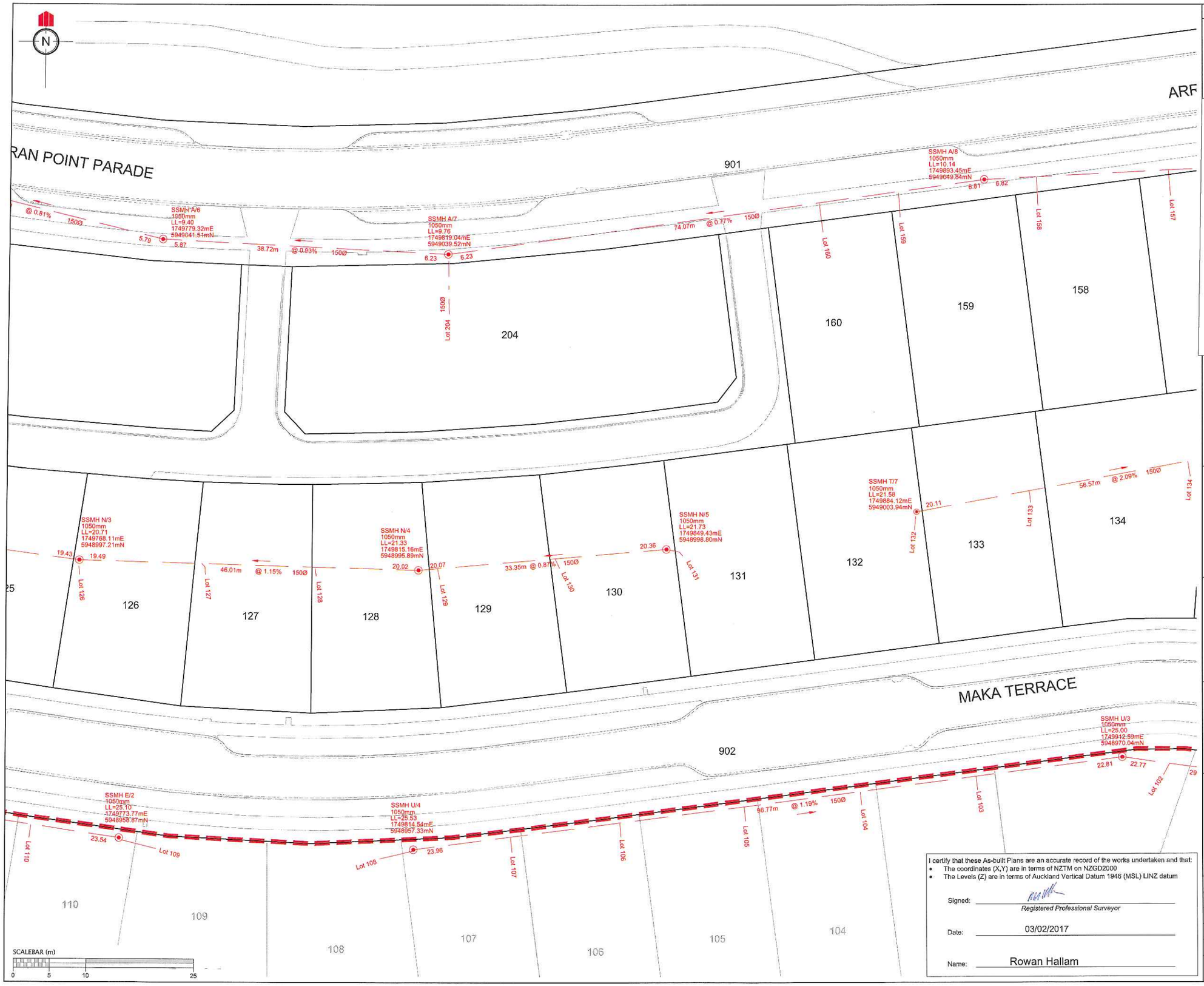
MILLWATER ARRAN POINT STAGE 2

SANITARY SEWER ASBUILT
SHEET 2 OF 4
(SLC-62000)

AUCKLAND COUNCIL

DESIGNED: AF	ASBUILT
CHECKED: KR	DRAWN: KR
APPROVED: MRH	SURVEYED: WOODS
JOB NUMBER: 37001	SCALE: 1:500 @ A3
ISSUED: FEB 2017	
DWG. NO. 37001-02-401-AB	REV.

K:\37001 Arran Hill Precinct 7 Stage 1\Project Data\Acad Drawings\Survey\Asbuilt\Stage 2 Asbuilts\37001-02-AB-400-SEWER.dwg, 7/02/2017 3:24:39 p.m.



REVISION DETAILS	NAME	DATE

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AUCKLAND COUNCIL & WATERCARE SERVICES LTD STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
2. ALL SANITARY SEWER LINES ARE 150mmØ uPVC CLASS SN16 UNLESS STATED OTHERWISE.
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4. ALL PIPE CROSSINGS UNDER ROADS AND ACCESSWAYS HAVE BEEN HARDFILL BACKFILLED.
5. ALL PRIVATE LOT CONNECTIONS ARE 100mmØ UNLESS STATED OTHERWISE
6. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
7. ALL PIPE AND MH DIAMETERS ARE INTERNAL, AND SHOWN IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
8. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.

LEGEND

NEW SANITARY SEWER MANHOLE

NEW SANITARY SEWER

EXISTING SANITARY SEWER

CLIENT:

WFH PROPERTIES

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MILLWATER ARRAN POINT STAGE 2

SANITARY SEWER ASBUILT
SHEET 3 OF 4
(SLC-62000)

AUCKLAND COUNCIL

I certify that these As-built Plans are an accurate record of the works undertaken and that:
- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

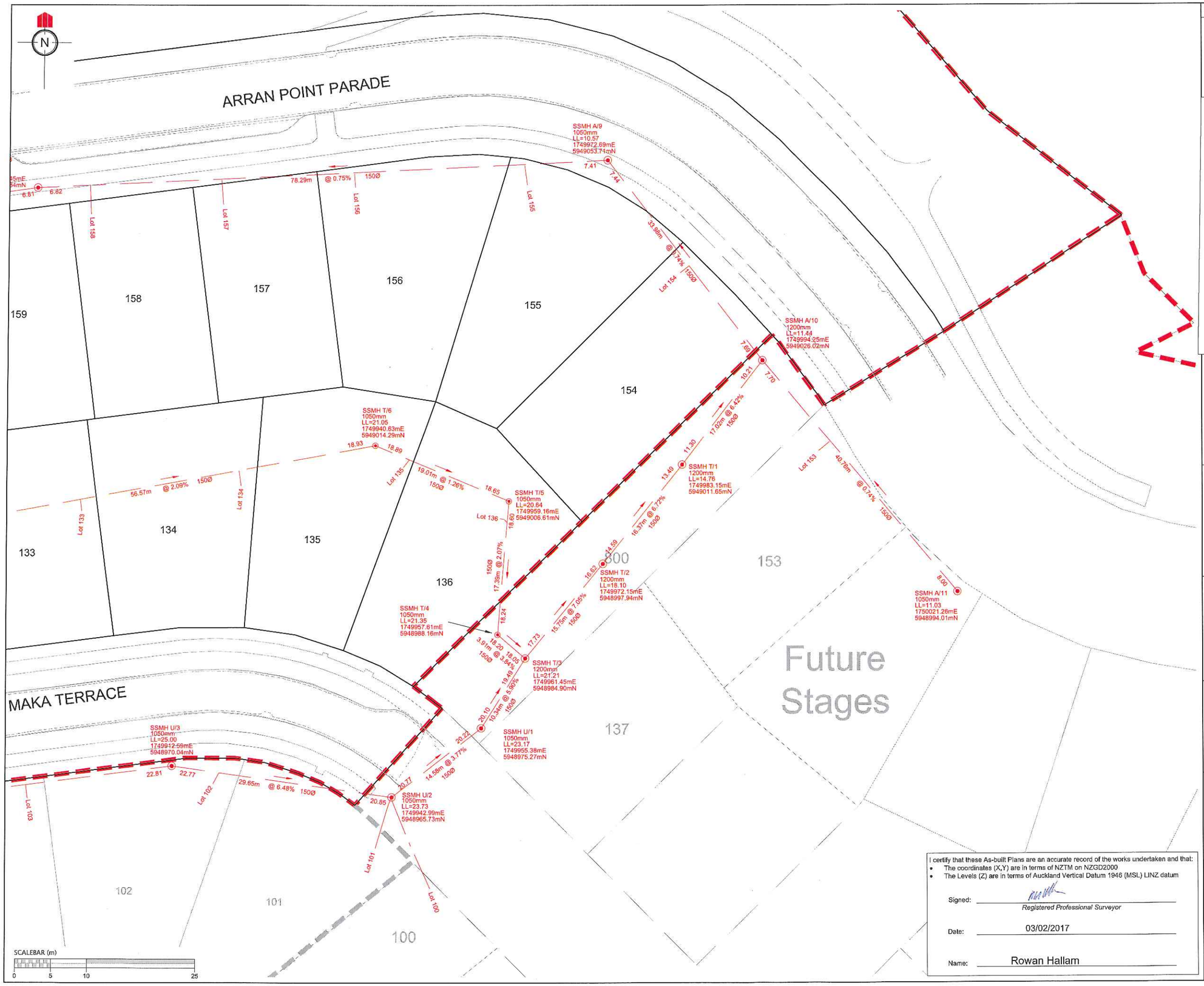
Signed: _____
Registered Professional Surveyor

Date: 03/02/2017

Name: Rowan Hallam

DESIGNED: AF	ASBUILT
CHECKED: KR	DRAWN: KR
APPROVED: MRH	SURVEYED: WOODS
JOB NUMBER: 37001	SCALE: 1:500 @ A3
ISSUED: FEB 2017	
DWG. NO. 37001-02-402-AB	REV.

K:\37001 Arran Hill Precinct 7 Stage 1\Project Data\Acad Drawings\Survey\Asbuilt\Stage 2 Asbuilts\37001-02-AB-400-SEWER.dwg, 7/02/2017 3:24:41 p.m.



REVISION DETAILS	NAME	DATE

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AUCKLAND COUNCIL & WATERCARE SERVICES LTD STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
2. ALL SANITARY SEWER LINES ARE 150mmØ uPVC CLASS SN16 UNLESS STATED OTHERWISE.
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5. ALL PRIVATE LOT CONNECTIONS ARE 100mmØ UNLESS STATED OTHERWISE
6. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
7. ALL PIPE AND MH DIAMETERS ARE INTERNAL, AND SHOWN IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
8. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.

LEGEND

- NEW SANITARY SEWER MANHOLE
- NEW SANITARY SEWER
- EXISTING SANITARY SEWER

CLIENT:

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MILLWATER ARRAN POINT STAGE 2

SANITARY SEWER ASBUILT
SHEET 4 OF 4
(SLC-62000)

AUCKLAND COUNCIL

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- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____
Registered Professional Surveyor

Date: 03/02/2017

Name: Rowan Hallam

DESIGNED: AF	ASBUILT
CHECKED: KR	DRAWN: KR
APPROVED: MRH	SURVEYED: WOODS
JOB NUMBER: 37001	SCALE: 1:500 @ A3
ISSUED: FEB 2017	
DWG. NO. 37001-02-403-AB	REV.

K:\37001 Arran Hill Precinct 7 Stage 1\Project Data\Acad Drawings\Survey\Asbuilt\Stage 2 Asbuilts\37001-02-AB-400-SEWER.dwg, 7/02/2017 3:24:42 p.m.

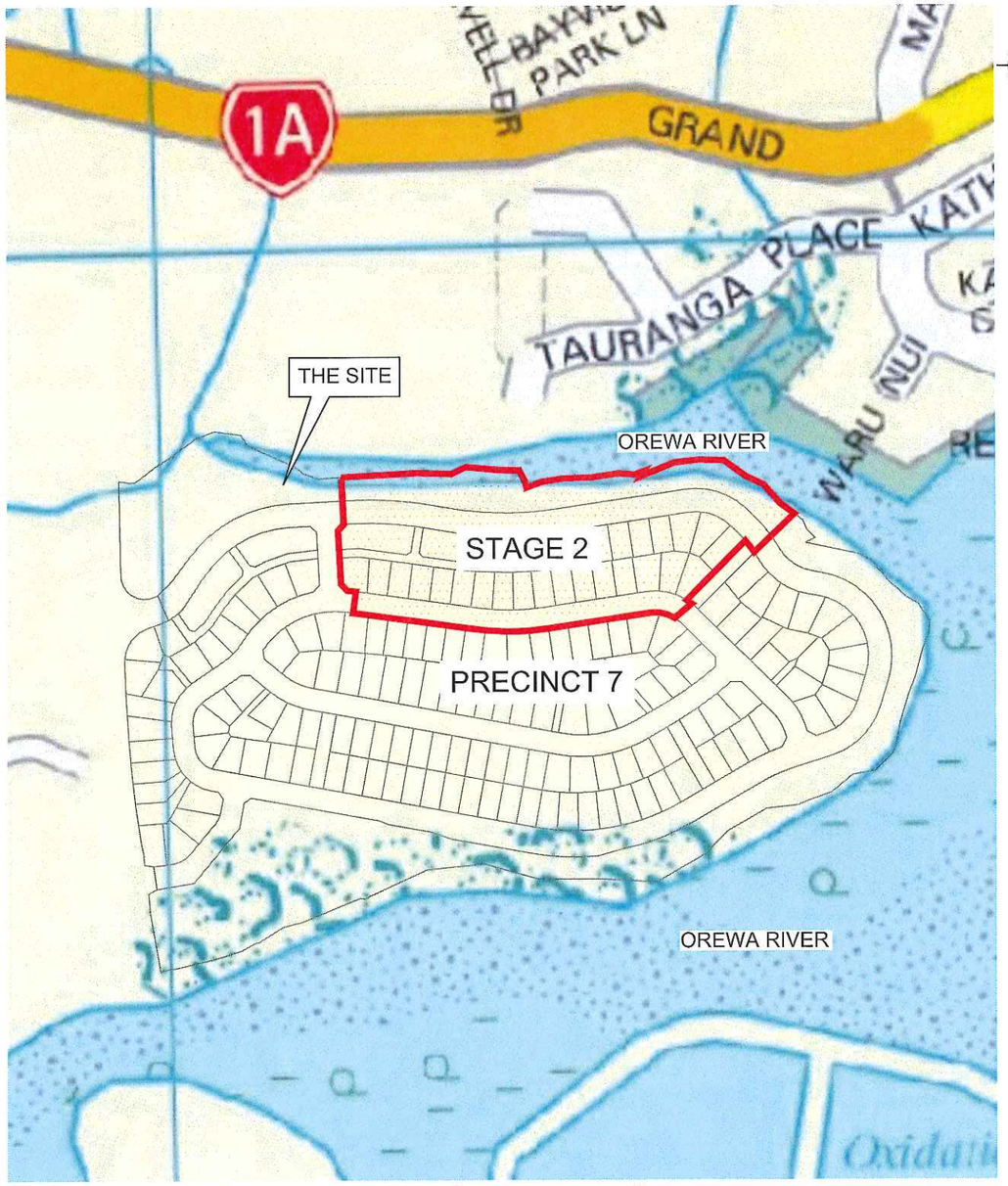
Appendix A2: T+T Drawings

- 21854.0037–APP7S2–100 Drawing List and Site Location Plan
- 21854.0037–APP7S2–101 Geotechnical Works Plan
- 21854.0037–APP7S2–102 Geotechnical Works Subsoil Drain Plan
- 21854.0037–APP7S2–103 Geological Cross Sections 6, 8 & 9
- 21854.0037–APP7S2–104 Retaining Wall 03 (Massbloc Retaining Wall) Plan and Elevation
- 21854.0037–APP7S2–105 Retaining Wall 03 Typical Cross Section Detail(s)
- 21854.0037–APP7S2–106 Retaining Wall 03 Massbloc Corner Detail
- 21854.0037–APP7S2–107 1(V):1(H) RE Slope Typical Details
- 21854.0037–APP7S2–108 Retaining Wall 9 – Plan and Elevation
- 21854.0037–APP7S2–109 Retaining Wall 9 – Typical Cross Section (Sheet 1 of 2)
- 21854.0037–APP7S2–110 Retaining Wall 9 – Typical Cross Section (Sheet 2 of 2)
- 21854.0037–APP7S2–111 Retaining Wall 9 – Typical Detail
- 21854.0037–APP7S2–112 Shear Key 1 Plan
- 21854.0037–APP7S2–113 Shear Key 1 Long Section (Sheet 1 of 2)
- 21854.0037–APP7S2–114 Shear Key 1 Long Section (Sheet 2 of 2)
- 21854.0037–APP7S2–115 Geology Legend and Definition of Terms
- 21854.0037–APP7S2–116 Building Limitation Plan

WFH PROPERTIES LTD
RESIDENTIAL SUBDIVISION
MILLWATER-ARRANS POINT PRECINCT 7 (STAGE 2)
Completion Report Issue

DRAWING	Rev	Title
GENERAL		
• 21854.0037-APP7S2-100	1	Drawing List and Location Plan
• 21854.0037-APP7S2-101	1	Geotechnical Works Plan
• 21854.0037-APP7S2-102	1	Geotechnical Works Subsoil Drain Plan
• 21854.0037-APP7S2-103	1	Geolgical Cross Sections 6, 8 &9
• 21854.0037-APP7S2-104	1	Retaining Wall 03 (Massbloc Retaining Wall) Plan and Elevation
• 21854.0037-APP7S2-105	1	Retaining Wall 03 Typical Cross Section Detail(s)
• 21854.0037-APP7S2-106	1	Retaining Wall 03 Massbloc Corner Detail
• 21854.0037-APP7S2-107	1	1(V):1(H) RE Slope Typical Details
• 21854.0037-APP7S2-108	1	Retaining Wall 9 - Plan and Elevation
• 21854.0037-APP7S2-109	1	Retaining Wall 9 - Typical Cross Section (Sheet 1 of 2)
• 21854.0037-APP7S2-110	1	Retaining Wall 9 - Typical Cross Section (Sheet 2 of 2)
• 21854.0037-APP7S2-111	1	Retaining Wall 9 - Typical Detail
• 21854.0037-APP7S2-112	1	Shear Key 1 Plan
• 21854.0037-APP7S2-113	1	Shear Key 1 Longsection (Sheet 1 of 2)
• 21854.0037-APP7S2-114	1	Shear Key 1 Longsection (Sheet 2 of 2)
• 21854.0037-APP7S2-115	1	Geology Legend and Definition of Terms
• 21854.0037-APP7S2-116	1	Building Limitation Plan
• 21854.0037-APP7S2-117	1	Post Earthworks Investigation Plan
• 21854.0037-APP7S2-118	1	Topsoil Depths Plan
• 21854.0037-APP7S2-119	1	Earthworks Testing Location Plan

• Denotes drawing this issue: 14/03/2017



Street map sourced from Land Information New Zealand data (Crown Copyright Reserved).

LOCATION PLAN
NOT TO SCALE

A3 SCALE 1:5000
0 50 100 150 200 250 (m)

ORIGINAL IN COLOUR

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	JXXL	Oct. 16
DRAWN :	JC	Oct. 16
DESIGN CHECKED :		
DRAFTING CHECKED :		
CADFILE : \\21854.0037-APP7S2-100.dwg		
APPROVED : NOT FOR CONSTRUCTION		

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NOTES :

REFERENCE :

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105 Carlton Gore Road, Newmarket, Auckland
Tel. (09) 355 6000 Fax. (09) 307 0265
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TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Drawing List and Location Plan

SCALES (AT A3 SIZE)	DWG. No.	REV.
1:5000	21854.0037-APP7S2-100	1

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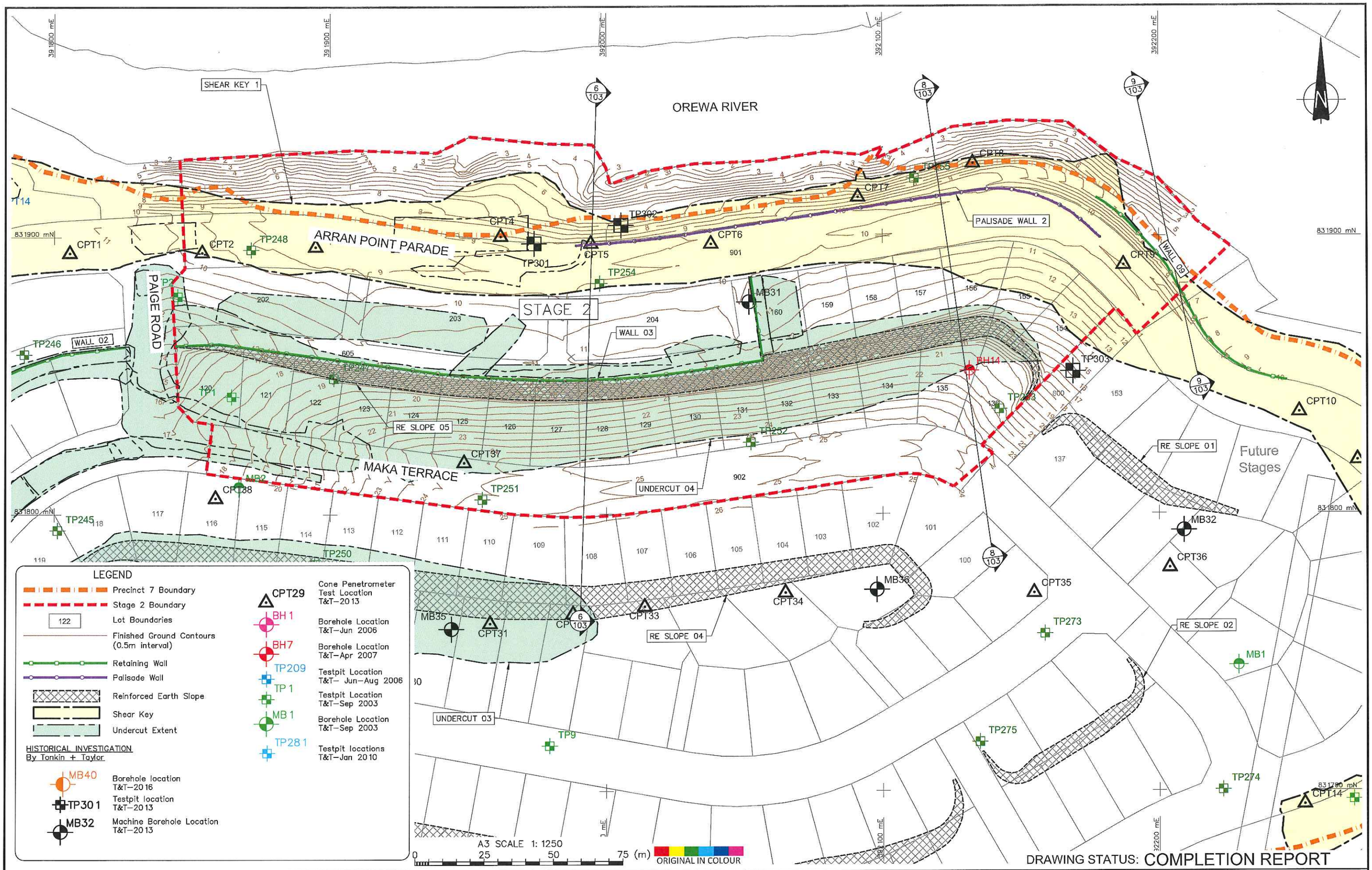

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	AJL	Mar. 17
DRAWN :	JC	Mar. 17
DESIGN CHECKED :		
DRAFTING CHECKED :		

CADFILE : \\21854.0037–APP7S1–00.dwg

APPROVED : NOT FOR CONSTRUCTION

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NOTES :
1. All dimensions are in millimetres unless noted otherwise.
2. Baseplan and final contour supplied by WOODS, reference data 37001–02–AB–100–FINAL CONTOURS.dwg" dated February 2017.
3. Undercut and shearkey supplied by WOODS, reference data "37001–02–AB–120 SK UC & SUBSOIL.dwg" dated Sep 2016
4. Coordinate Datum: NZGD2000, Mt Eden Circuit Circuit Coordinates. Origin: Lat 36 52 47S Long 174 45 51E 800,000mN 400,000mE

REFERENCE :

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TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Geotechnical Works Plan

SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 1250	21854.0037–APP7S2–101	1

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OREWA RIVER

Discharge to stream

Shear Key 1

ARRAN POINT PARADE

PAIGE ROAD

MAKA TERRACE

WALL 02

WALL 03

WALL 09

PALISADE WALL 2

RE SLOPE 01

RE SLOPE 02

RE SLOPE 03

RE SLOPE 04

RE SLOPE 05

UNDERCUT 03

UNDERCUT 04

Future Stages

831900 mN

831800 mN

831700 mN

392100 mE

392200 mE

A3 SCALE 1: 1250

0 25 50 75 (m)

ORIGINAL IN COLOUR

LEGEND

- Precinct 7 Boundary
- Stage 2 Boundary
- 122 Lot Boundaries
- Finished Ground Contours (0.5m interval)
- Retaining Wall
- Palisade Wall
- Reinforced Earth Slope
- Shear Key
- Undercut Extent
- Subsoil Drain

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	AJL	Mar. 17
DRAWN :	JC	Mar. 17
DESIGN CHECKED :		
DRAFTING CHECKED :		

CADFILE : \\21854.0037-APP7S1-00.dwg

APPROVED :

NOT FOR CONSTRUCTION

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NOTES :

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2. Baseplan and final contour supplied by WOODS, reference data 37001-02-AB-100-FINAL CONTOURS.dwg" dated February 2017.
3. Undercut and shearkey supplied by WOODS, reference data "37001-02-AB-120 SK UC & SUBSOIL.dwg" dated Sep 2016
4. Coordinate Datum: NZGD2000, Mt Eden Circuit Circuit Coordinates. Origin: Lat 36 52 47S Long 174 45 51E 800,000mN 400,000mE

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TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Geotechnical Works Subsoil Drain Plan

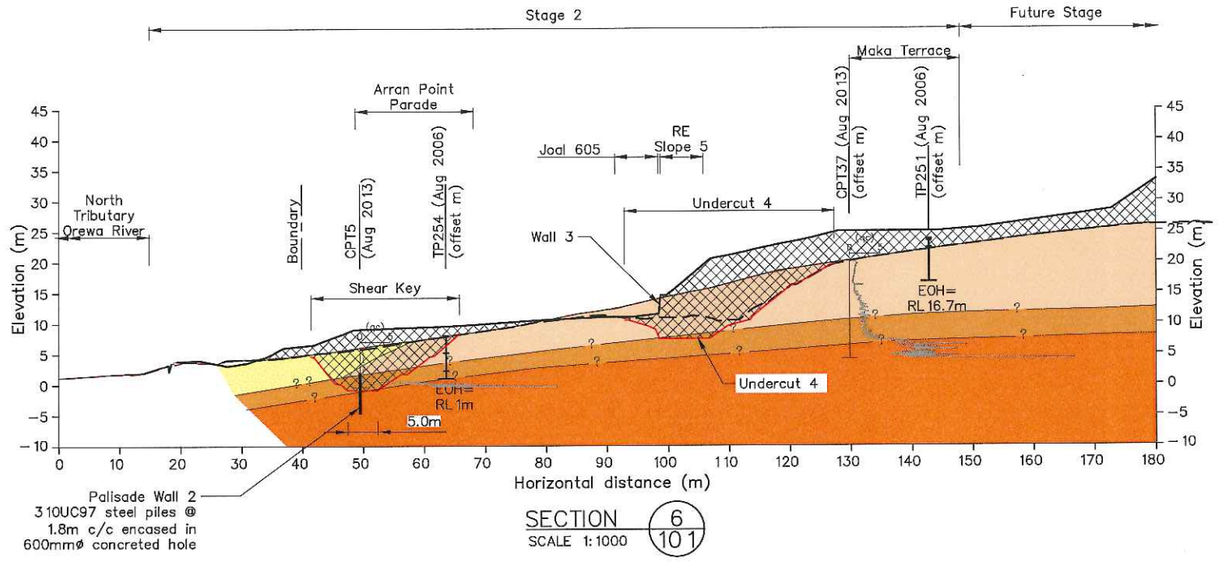
SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 1250	21854.0037-APP7S2-102	1

L:\21854\21854.0037 - Arrans Point Precinct 7\CAD\STAGE 2\GGR\21854.0037-APP7S2-102.dwg, 102, 14/03/2017 8:48:32 a.m., JC

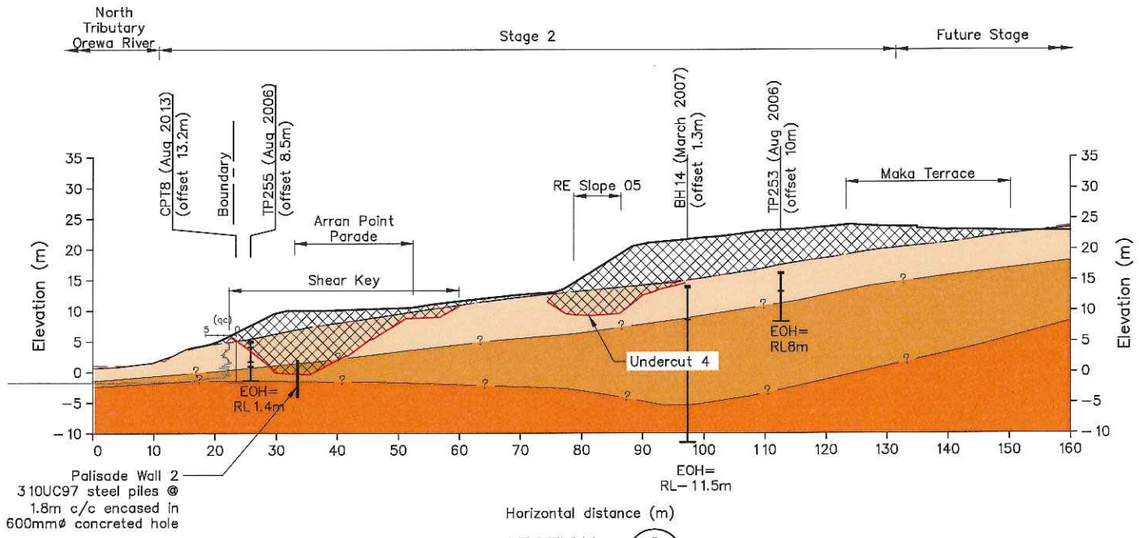
Geological sections are an interpretation of the investigation data which is available only at discrete locations. Additional Paleo–valleys and variability in soil layers and ECBF Rock interface may be present in areas between test locations.

LEGEND

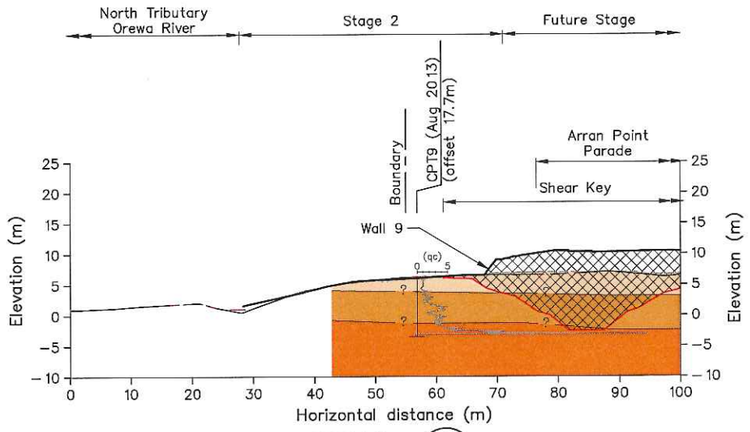
- Original 2009 Ground profile
- 2013 Ground profile
- Stage 2 Finished Ground level
- Inferred geological boundary
- Shearkey/Undercuts
- Engineered Fill
- Alluvium
- Residual Soils/ Completely Weathered ECBF
- Highly to Slightly Weathered ECBF
- Slightly Weathered to Unweathered ECBF



SECTION 6 (101)
SCALE 1:1000



SECTION 8 (101)
SCALE 1:1000



SECTION 9 (101)
SCALE 1:1000

A3 SCALE 1:1000
0 5 10 15 20 30 40 50 (m)
ORIGINAL IN COLOUR

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	AJL	Mar. 17
DRAWN :	JC	Mar. 17
DESIGN CHECKED :		
DRAFTING CHECKED :		
CADFILE : \\21854.0037–APP7S2–103.dwg		
APPROVED : NOT FOR CONSTRUCTION		

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NOTES :
1. All dimensions are in millimetres unless noted otherwise.

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TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Geolgical Cross Sections 6, 8 &9

SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 1000	21854.0037–APP7S2–103	1

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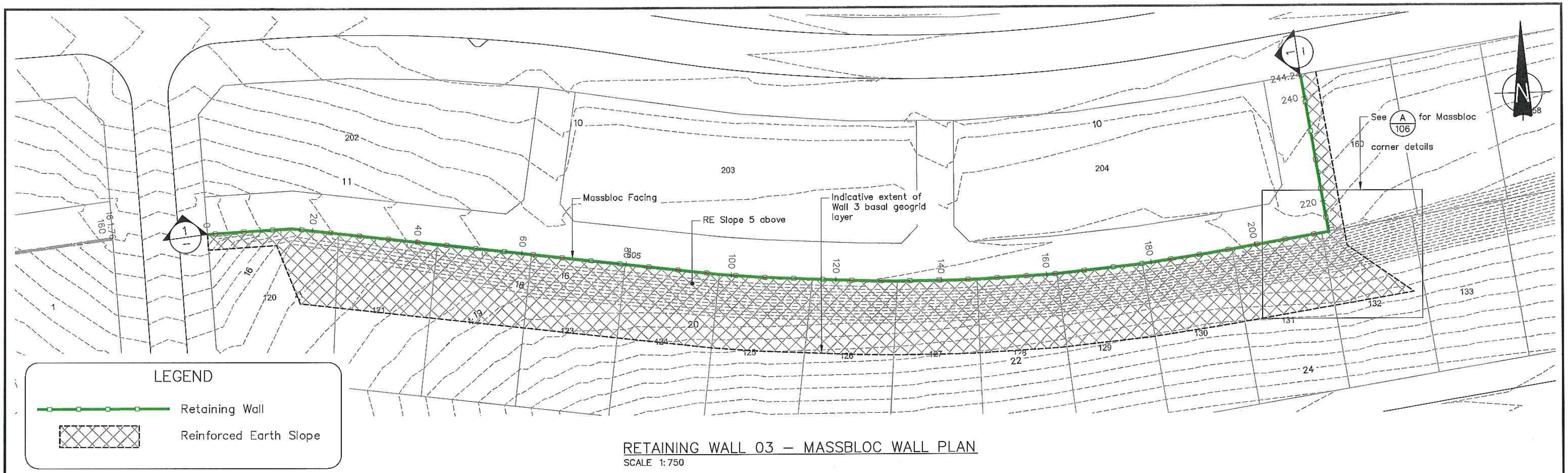
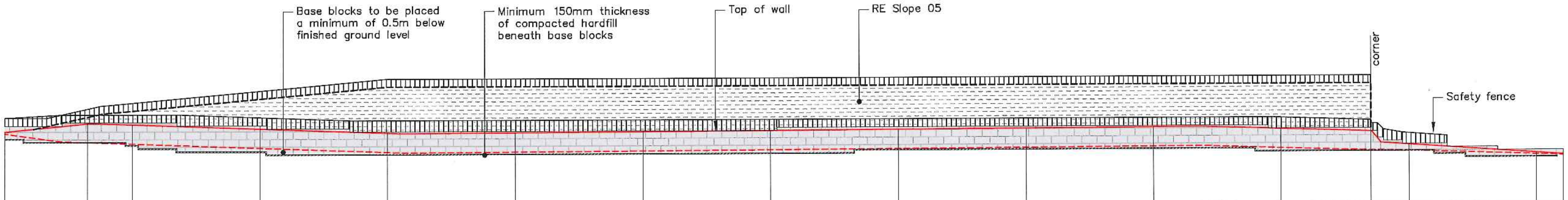


RETAINING WALL 03 – MASSBLOC WALL PLAN
SCALE 1:750



DATUM RL 2.00

RETAINED HEIGHT (m)	2.00	3.00	3.20	3.49	3.29	3.00	3.40	3.50	3.50	3.20	3.30	3.44	2.99	0.91	0.57	0.29
FINISHED GROUND LEVEL (mRL)	13.74	12.38	12.13	11.43	10.73	10.74	10.84	10.94	11.04	11.14	11.24	10.88	10.51	10.38	9.76	9.63
CHAINAGE (m)	0.0	13.0	20.0	40.0	60.0	80.0	100.0	120.0	140.0	160.0	180.0	200.0	214.0	220.0	240.0	244.24
WALL TYPE	A		B											A		

LONG SECTION (1/–) RETAINING WALL 03 – MASSBLOC WALL
SCALE 1:750

A3 SCALE 1:750
0 5 10 15 20 25 30 35 40 (m)

DRAWING STATUS: COMPLETION REPORT

1	Completion Report Issue	
REVISION DESCRIPTION	BY	DATE

DESIGNED :	AJL	Mar. 17
DRAWN :	JC	Mar. 17
DESIGN CHECKED :		
DRAFTING CHECKED :		
CADFILE : \\21854.0037-APP7S2-104.dwg		
APPROVED : NOT FOR CONSTRUCTION		

This drawing is not to be used for construction purposes unless signed as approved

NOTES :
1. Wall setout to be as provided by woods and confirmed on site by the Engineer.
2. Base layout plan supplied by WOODS. Reference drawing name, 37000-01-100-102-EARTHWORKS PLANS.dwg, received in August 2014.

REFERENCE :

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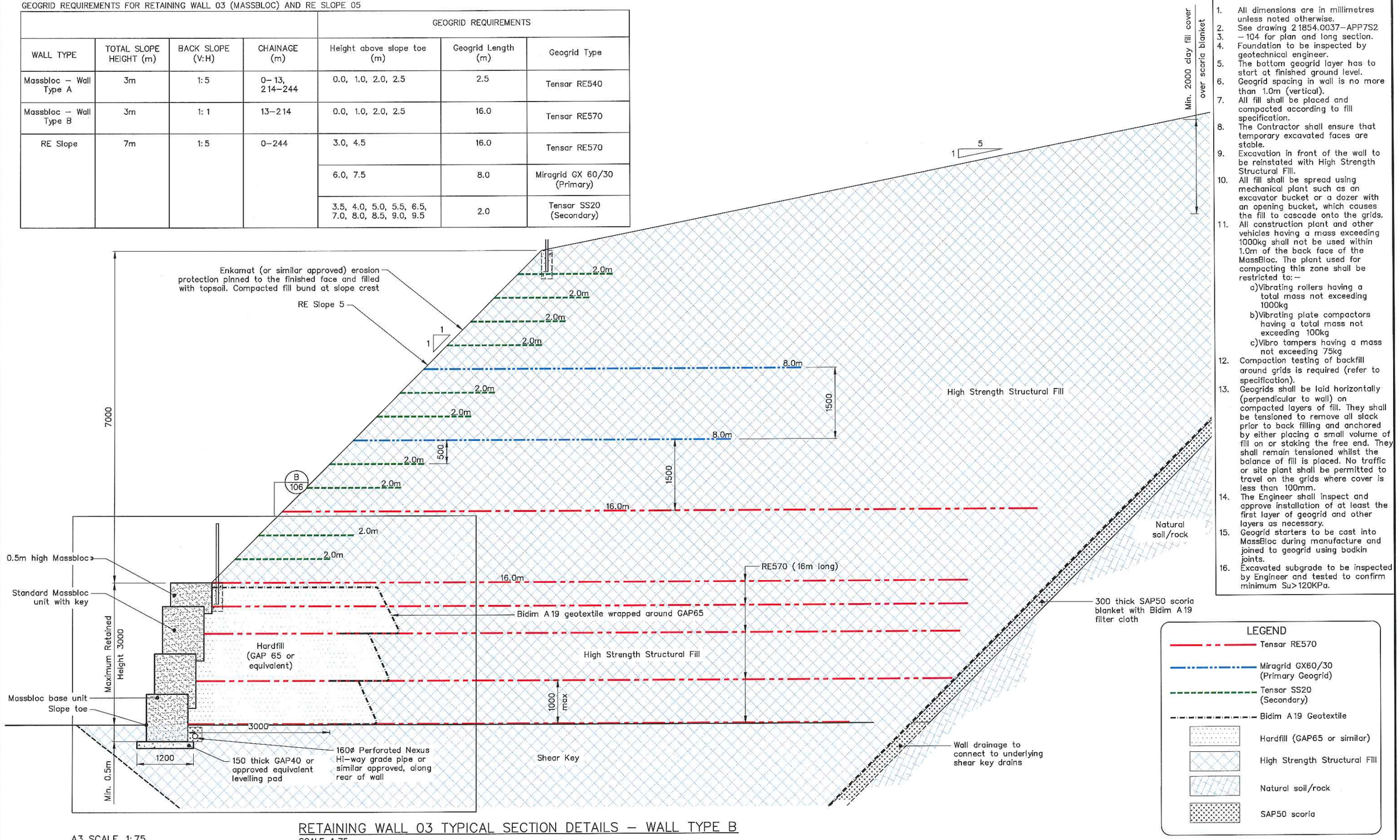
TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Retaining Wall 03 (Massbloc Retaining Wall) Plan and Elevation

SCALES (AT A3 SIZE): AS SHOWN
DWG. No.: 21854.0037-APP7S2-104
REV.: 1

L:\21854\21854.0037 - Arrans Point Precinct 7\CAD\STAGE 2\GCR\21854.0037-APP7S2-104.dwg, 104, 14/03/2017 8:48:47 a.m., JC

GEOGRID REQUIREMENTS FOR RETAINING WALL 03 (MASSBLOC) AND RE SLOPE 05

				GEOGRID REQUIREMENTS		
WALL TYPE	TOTAL SLOPE HEIGHT (m)	BACK SLOPE (V:H)	CHAINAGE (m)	Height above slope toe (m)	Geogrid Length (m)	Geogrid Type
Massbloc – Wall Type A	3m	1:5	0–13, 214–244	0.0, 1.0, 2.0, 2.5	2.5	Tensar RE540
Massbloc – Wall Type B	3m	1:1	13–214	0.0, 1.0, 2.0, 2.5	16.0	Tensar RE570
RE Slope	7m	1:5	0–244	3.0, 4.5	16.0	Tensar RE570
				6.0, 7.5	8.0	Miragrid GX 60/30 (Primary)
				3.5, 4.0, 5.0, 5.5, 6.5, 7.0, 8.0, 8.5, 9.0, 9.5	2.0	Tensar SS20 (Secondary)



RETAINING WALL 03 TYPICAL SECTION DETAILS – WALL TYPE B
SCALE 1:75

A3 SCALE 1:75
0 1 2 3 4 (m)

NOTES:

1. All dimensions are in millimetres unless noted otherwise.
2. See drawing 21854.0037–APP7S2 – 104 for plan and long section.
3. Foundation to be inspected by geotechnical engineer.
4. The bottom geogrid layer has to start at finished ground level.
5. Geogrid spacing in wall is no more than 1.0m (vertical).
6. All fill shall be placed and compacted according to fill specification.
7. The Contractor shall ensure that temporary excavated faces are stable.
8. Excavation in front of the wall to be reinstated with High Strength Structural Fill.
9. All fill shall be spread using mechanical plant such as an excavator bucket or a dozer with an opening bucket, which causes the fill to cascade onto the grids.
10. All construction plant and other vehicles having a mass exceeding 1000kg shall not be used within 1.0m of the back face of the MassBloc. The plant used for compacting this zone shall be restricted to:–
    a) Vibrating rollers having a total mass not exceeding 1000kg
    b) Vibrating plate compactors having a total mass not exceeding 100kg
    c) Vibro tampers having a mass not exceeding 75kg
11. Compaction testing of backfill around grids is required (refer to specification).
12. Geogrids shall be laid horizontally (perpendicular to wall) on compacted layers of fill. They shall be tensioned to remove all slack prior to back filling and anchored by either placing a small volume of fill on or staking the free end. They shall remain tensioned whilst the balance of fill is placed. No traffic or site plant shall be permitted to travel on the grids where cover is less than 100mm.
13. The Engineer shall inspect and approve installation of at least the first layer of geogrid and other layers as necessary.
14. Geogrid starters to be cast into MassBloc during manufacture and joined to geogrid using bodkin joints.
15. Excavated subgrade to be inspected by Engineer and tested to confirm minimum Su>120KPa.

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED : AJL Mar. 17
DRAWN : JC Mar. 17
DESIGN CHECKED :
DRAFTING CHECKED :
CADFILE : \\21854.0037–APP7S2–105_106.dwg
APPROVED :
NOT FOR CONSTRUCTION
This drawing is not to be used for construction purposes unless signed as approved

NOTES :

REFERENCE :

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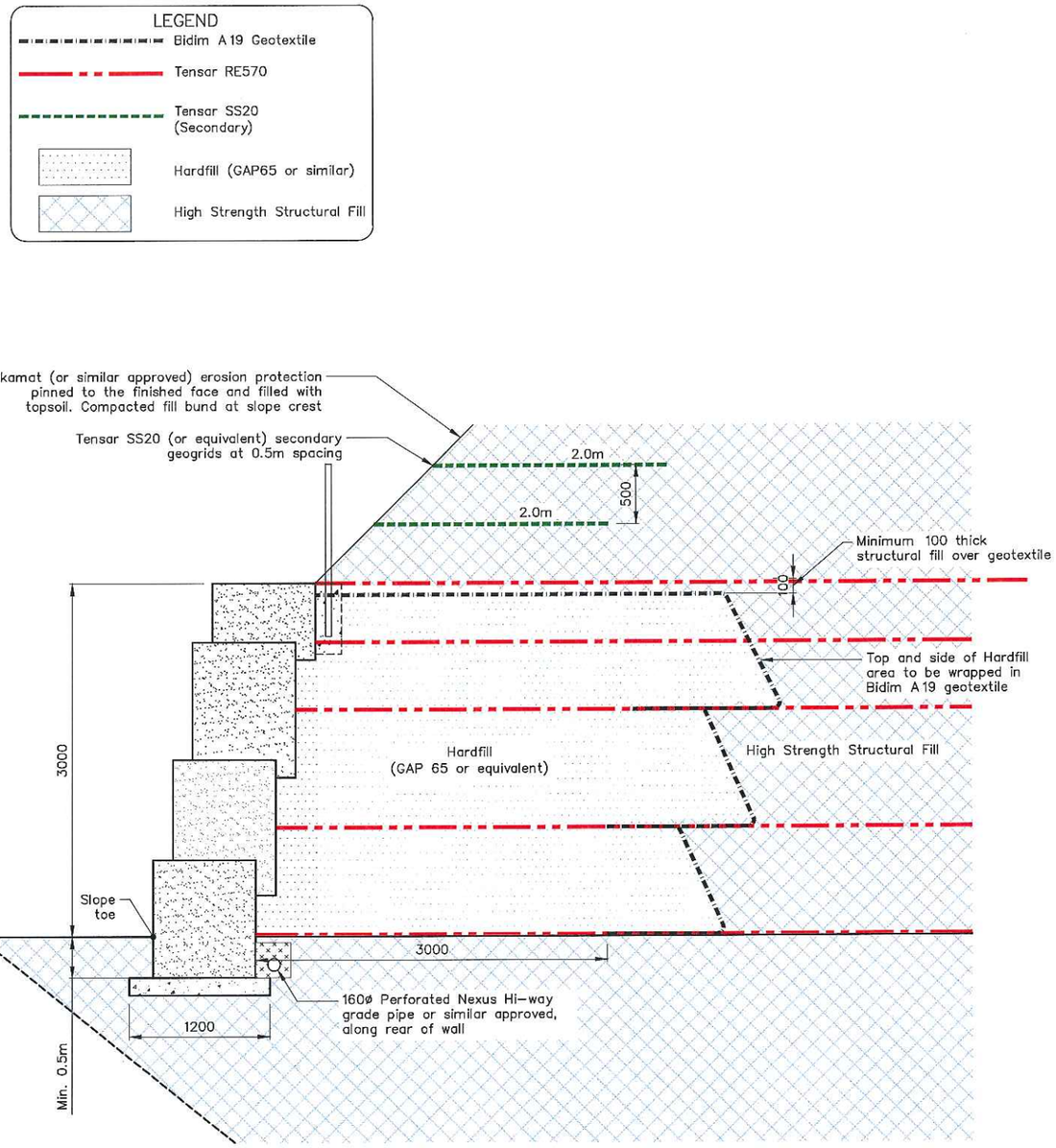
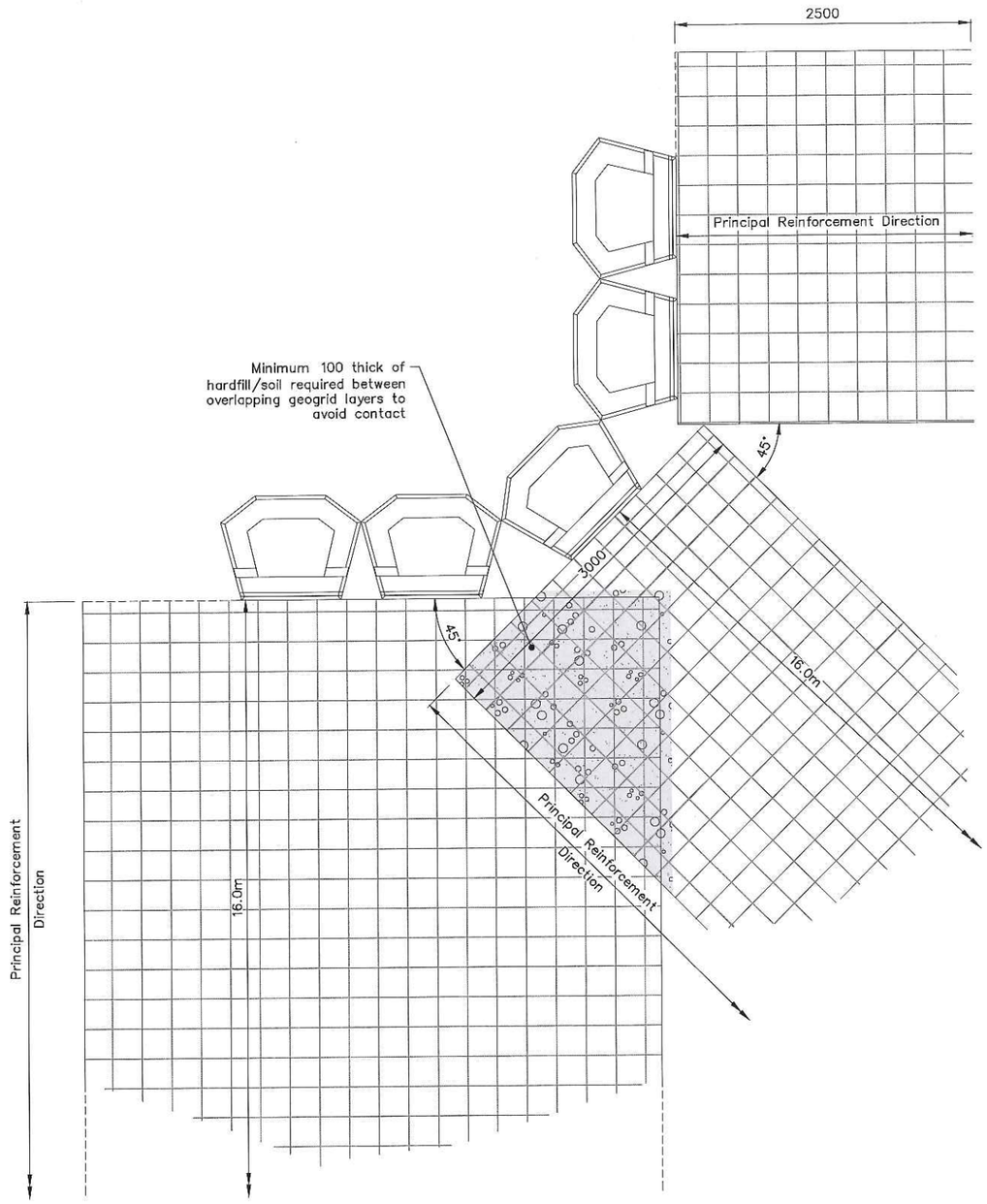
TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Retaining Wall 03 Typical Cross Section Detail(s)

SCALES (AT A3 SIZE) 1:75
DWG. No. 21854.0037–APP7S2–105
REV. 1

L:\21854\21854.0037 - Arrans Point Precinct 7\CAD\STAGE 2\GGR\21854.0037-APP7S2-105_106.dwg, 105, 14/03/2017 8:48:56 a.m., JC



DETAIL B 105 SCALE 1:50 RETAINING WALL 03 – MASSBLOC WALL DETAIL



DETAIL A 104 SCALE 1:50 RETAINING WALL 03 – MASSBLOC CORNER DETAILS

A3 SCALE 1:50

0 0.5 1.0 1.5 2.0 2.5 (m)

REVISION DESCRIPTION	BY	DATE
1 Completion Report Issue		

DESIGNED :	AJL	Mar. 17
DRAWN :	JC	Mar. 17
DESIGN CHECKED :		
DRAFTING CHECKED :		

CADFILE : \\21854.0037-APP7S2-105_106.dwg

APPROVED :

NOT FOR CONSTRUCTION

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NOTES :

1. All dimensions shown are in millimetres, unless noted otherwise.
2. For notes refer to Dwg 21854.0037-APPS2-105.

REFERENCE :

DRAWING STATUS: COMPLETION REPORT

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TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Retaining Wall 03 Massbloc Corner Detail

SCALES (AT A3 SIZE)	DWG. No.	REV.
1:50	21854.0037-APP7S2-106	1

GEOGRIDS REQUIREMENTS FOR A 1: 1 (V:H) REINFORCED EARTH SLOPE

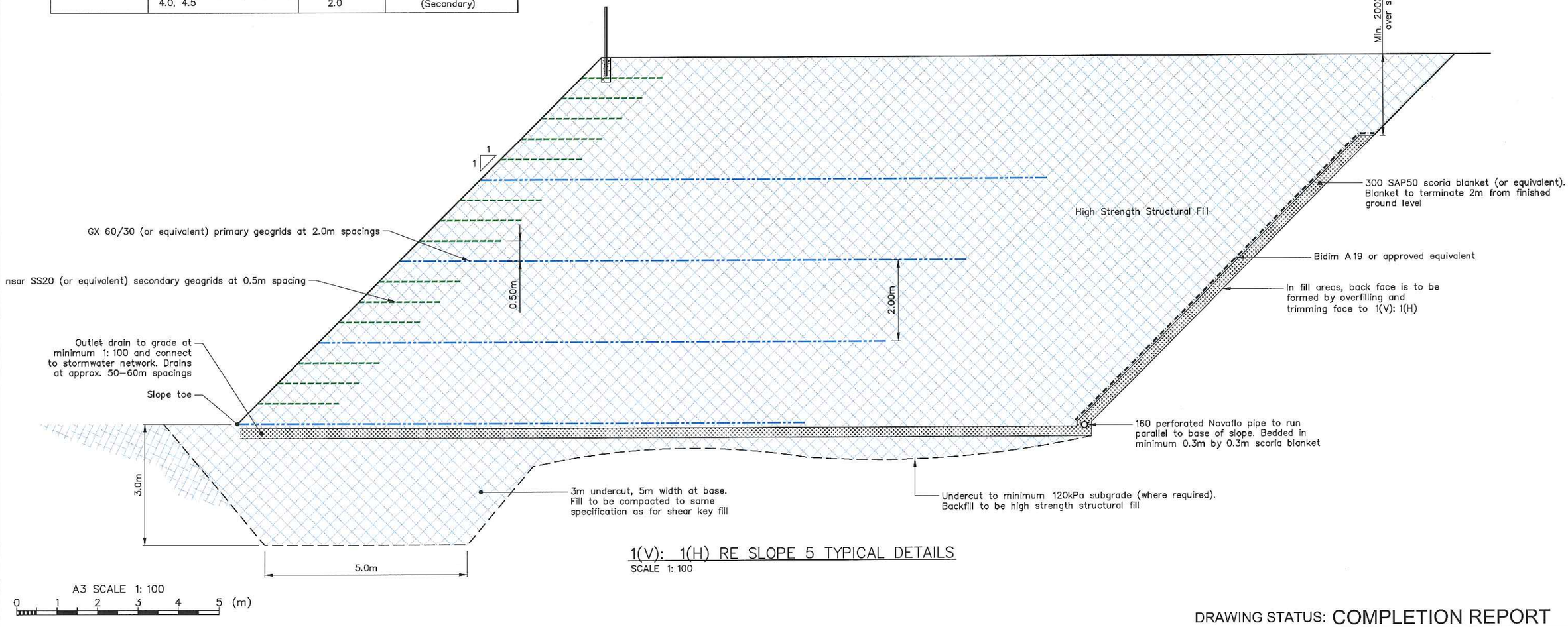
SLOPE HEIGHTS (m)	GEOGRID REQUIREMENTS		
	Height above slope toe (m)	Geogrid Length (m)	Geogrid Type
9.0	0.0, 2.0, 4.0, 6.0	14.0	Miragrid GX 60/30 (Primary)
	0.5, 1.0, 1.5, 2.5, 3.0, 3.5, 4.5, 5.0, 5.5, 6.5, 7.0, 7.5, 8.0, 8.5	2.0	Tensar SS20 (Secondary)
8.0	0.0, 2.0, 4.0, 6.0	12.0	Miragrid GX 60/30 (Primary)
	0.5, 1.0, 1.5, 2.5, 3.0, 3.5, 4.5, 5.0, 5.5, 6.5, 7.0, 7.5	2.0	Tensar SS20 (Secondary)
7.0	0.0, 2.0, 4.0	7.0	Miragrid GX 60/30 (Primary)
	0.5, 1.0, 1.5, 2.5, 3.0, 3.5, 4.5, 5.0, 5.5, 6.0, 6.5	2.0	Tensar SS20 (Secondary)
6.0	0.0, 2.0, 4.0	5.0	Miragrid GX 60/30 (Primary)
	0.5, 1.0, 1.5, 2.5, 3.0, 3.5, 4.5, 5.0, 5.5	2.0	Tensar SS20 (Secondary)
5.0	0.0, 2.0	5.0	Miragrid GX 60/30 (Primary)
	0.5, 1.0, 1.5, 2.5, 3.0, 3.5, 4.0, 4.5	2.0	Tensar SS20 (Secondary)

LEGEND

- Miragrid GX60/30 (Primary Geogrid)
- Tensar SS20 (Secondary)
- Bidim A19 Geotextile
- High Strength Structural Fill
- Natural soil/rock
- SAP50 Scoria

NOTES:

1. All dimensions are in millimetres unless noted otherwise.
2. See drawing 21854.0037–APP7S2–101 for plan.
3. Foundation to be inspected by geotechnical Engineer.
4. The bottom geogrid layer may be below the finished ground level but shall not be above the finished ground level.
5. Geogrid spacing in reinforce earth slope is no more than 0.5m (vertical).
6. All fill shall be placed and compacted according to the fill specification.
7. The Contractor shall ensure that temporary excavated faces are stable.
8. Excavation in front of the wall to be reinstated with High Strength Structural Fill.
9. All fill shall be spread using mechanical plant such as an excavator bucket or a dozer with an opening bucket, which causes the fill to cascade onto the grids.
10. Compaction testing of backfill around grids is required (refer to specification).
11. Geogrids shall be laid horizontally (perpendicular to slope) on compacted layers of fill. They shall be tensioned to remove all slack prior to back filling and anchored by either placing a small volume of fill on or staking the free end. They shall remain tensioned whilst the balance of fill is placed. No traffic or site plant shall be permitted to travel on the grids where cover is less than 100mm.
12. The Engineer shall inspect and approve installation of at least the first layer of geogrid and other layers as necessary.
13. Excavated subgrade to be inspected by Engineer and tested to confirm minimum Su>120KPa.



1(V): 1(H) RE SLOPE 5 TYPICAL DETAILS
SCALE 1: 100

A3 SCALE 1: 100
0 1 2 3 4 5 (m)

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	AJL	Mar. 17
DRAWN :	JC	Mar. 17
DESIGN CHECKED :	AJL	Feb. 15
DRAFTING CHECKED :	AMM	Feb. 15
CADFILE : \\21854.0037–APP7S2–107.dwg		
APPROVED : NOT FOR CONSTRUCTION		

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NOTES :

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TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
1(V): 1(H) RE Slope Typical Details

SCALES (AT A3 SIZE)	DWG. No.	REV.
AS SHOWN	21854.0037–APP7S2–107	1

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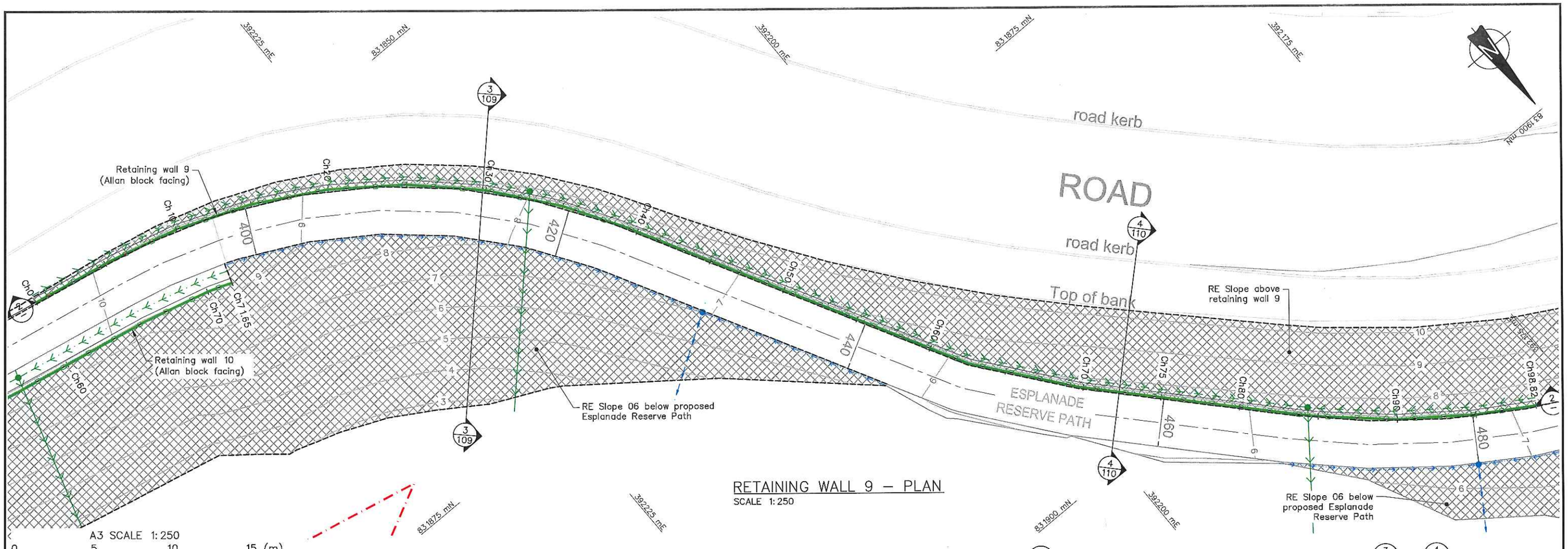
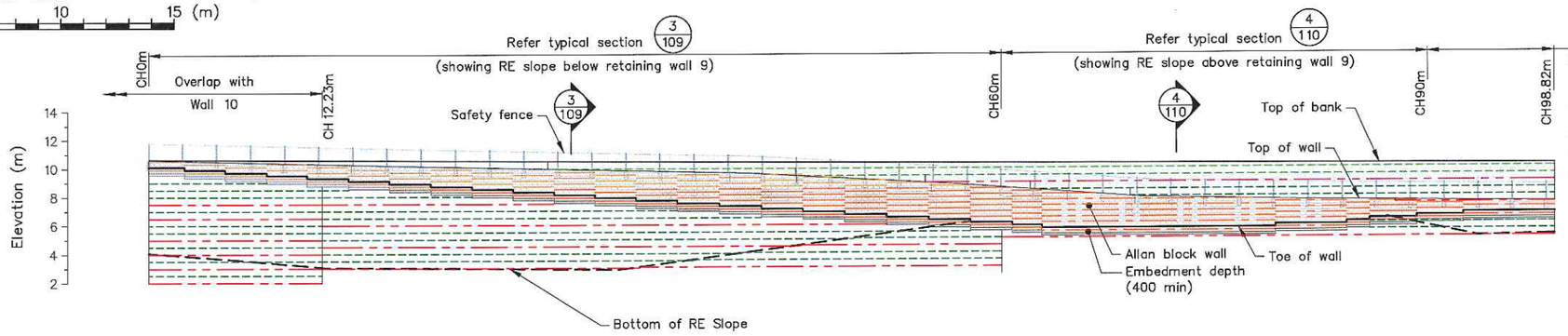


RETAINING WALL 9 – PLAN
SCALE 1: 250



Datum RL 0m

TOP OF WALL (m)	10.60	10.47	10.35	10.23	10.11	10.00	9.88	9.77	9.66	9.46	9.18	8.91	8.57	8.22	7.87	7.76	7.65	7.59	7.53	7.47	7.43
TOE OF WALL (m)	10.28	9.93	9.59	9.24	8.90	8.55	8.20	7.86	7.52	7.18	6.84	6.50	6.16	5.92	5.82	5.72	5.95	6.25	6.55	6.86	6.83
RETAINED HEIGHT OF WALL (m)	0.31	0.54	0.76	0.99	1.22	1.45	1.68	1.92	2.15	2.28	2.35	2.41	2.42	2.29	2.05	2.04	1.70	1.34	0.97	0.62	0.60
CHAINAGE (m)	0.00	5.00	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00	55.00	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.00	98.82

SECTION 2/– RETAINING WALL 9 – ELEVATION
SCALE 1:400

LEGEND
- Site Boundary
- Finished Ground Contour (1m Interval)
- Retaining Wall Chainage (m) / Retaining Wall Alignment
- Proposed Esplanade Reserved Path Chainage (m)
- Reinforced Earth Slope
- Retaining Wall Drain
- Proposed RE Slope Drain
- Allan block wall face
- Geogrid Stratagrid SG550 at the back of Allan block wall
- RE Slope Geogrid Tensar RE570 (Primary)
- RE Slope Geogrid Tensar SS20 (Secondary)

ORIGINAL IN COLOUR
A3 SCALE 1: 400
0 4 8 12 16 20 (m)

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	AJL	Mar. 17
DRAWN :	JC	Mar. 17
DESIGN CHECKED :		
DRAFTING CHECKED :		

CADFILE : \\21854.0037–APP7S2–108.dwg
APPROVED :
NOT FOR CONSTRUCTION
This drawing is not to be used for construction purposes unless signed as approved

NOTES:
1. All dimensions are in metres unless noted otherwise.
2. All setout to be completed by Contractor in accordance with WOODS drawings.
3. Existing ground surface (Sep.2009), base layout and design finished contour (Nov.2015) supplied by WOODS, reference "Arran Point–Esplanade Reserve.dwg"
4. Coordinate Datum: NZGD2000, Mt Eden Circuit Circuit Coordinates. Origin: Lat 36 52 47S Long 174 45 51E 800,000mN 400,000mE Level Datum: LINZ (MSL) Auckland Vertical Datum 1946
5. Refer to Design Report (Ref 21854.0037, Geotechnical Design Report – Retaining Walls 8–10 & RE Slope 6 along Esplanade Reserve Path, June 2016) for anticipated construction sequencing and staging of works.

REFERENCE :

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DRAWING STATUS: COMPLETION REPORT

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TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Retaining Wall 9 – Plan and Elevation

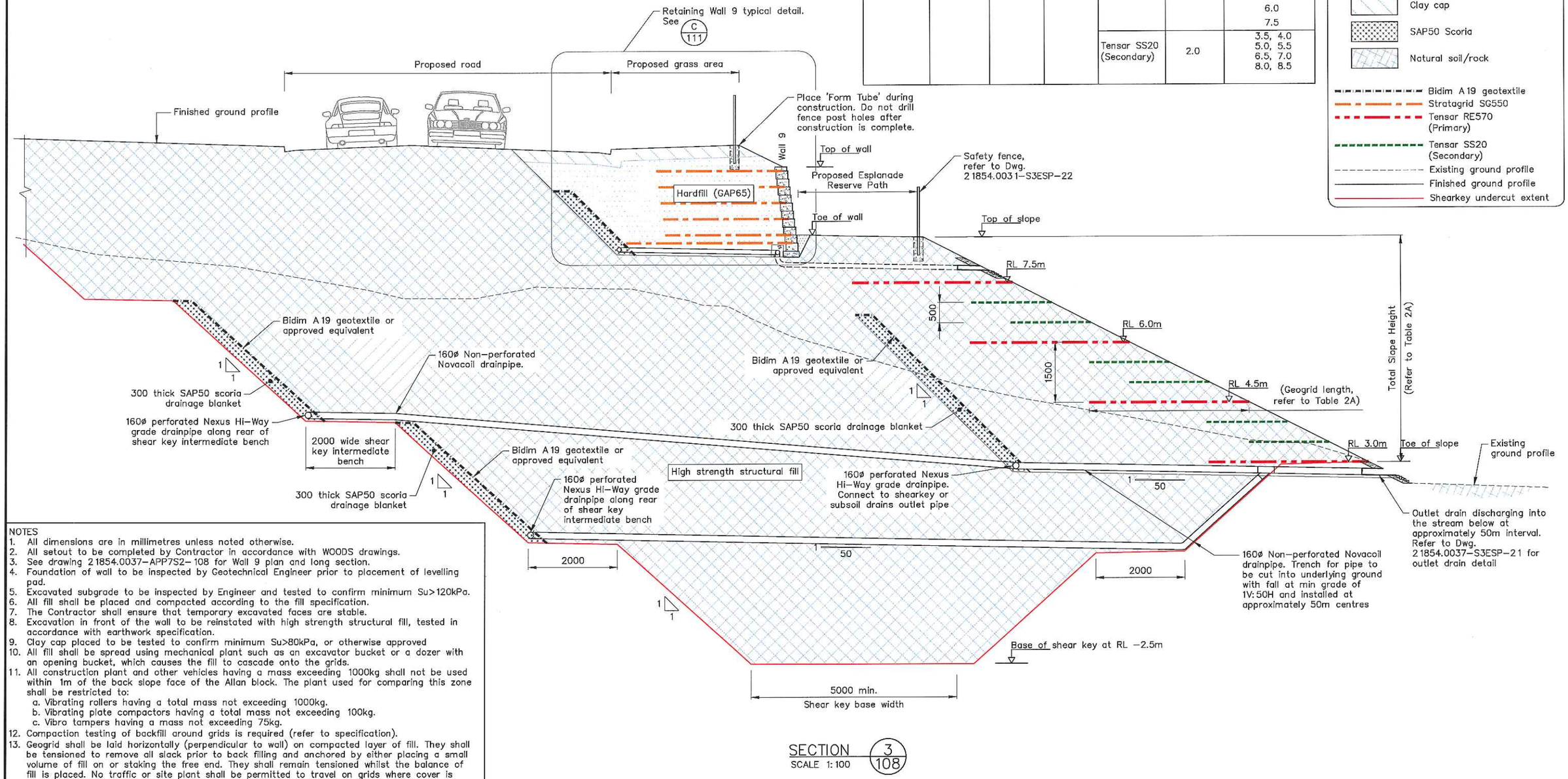
SCALES (AT A3 SIZE)	DWG. No.	REV.
AS SHOWN	21854.0037–APP7S2–108	1

TABLE 2A: RE Slope 6 (Below Retaining Wall 9) Reinforcement Details

Type of Wall	Total Slope Height (m)	Max. Forward Slope	Max. Back Slope	Geogrid Requirements		
				Geogrid Type	Min.Geogrid Length (m)	Geogrid RL (m)
RE Slope	≤ 7.0m	1V: 15H	1V: 30H	Tensar RE570 (Primary)	4.0	3.0 4.5 6.0 7.5
				Tensar SS20 (Secondary)	2.0	3.5, 4.0 5.0, 5.5 6.5, 7.0 8.0, 8.5

LEGEND

- High strength structural fill
- Hardfill (GAP65)
- Clay cap
- SAP50 Scoria
- Natural soil/rock
- Bidim A19 geotextile
- Stratagrid SG550
- Tensar RE570 (Primary)
- Tensar SS20 (Secondary)
- Existing ground profile
- Finished ground profile
- Shearkey undercut extent



SECTION 3/108
SCALE 1:100

NOTES

1. All dimensions are in millimetres unless noted otherwise.
2. All setout to be completed by Contractor in accordance with WOODS drawings.
3. See drawing 21854.0037-APP7S2-108 for Wall 9 plan and long section.
4. Foundation of wall to be inspected by Geotechnical Engineer prior to placement of levelling pad.
5. Excavated subgrade to be inspected by Engineer and tested to confirm minimum Su>120kPa.
6. All fill shall be placed and compacted according to the fill specification.
7. The Contractor shall ensure that temporary excavated faces are stable.
8. Excavation in front of the wall to be reinstated with high strength structural fill, tested in accordance with earthwork specification.
9. Clay cap placed to be tested to confirm minimum Su>80kPa, or otherwise approved
10. All fill shall be spread using mechanical plant such as an excavator bucket or a dozer with an opening bucket, which causes the fill to cascade onto the grids.
11. All construction plant and other vehicles having a mass exceeding 1000kg shall not be used within 1m of the back slope face of the Allan block. The plant used for comparing this zone shall be restricted to:
    a. Vibrating rollers having a total mass not exceeding 1000kg.
    b. Vibrating plate compactors having a total mass not exceeding 100kg.
    c. Vibro tampers having a mass not exceeding 75kg.
12. Compaction testing of backfill around grids is required (refer to specification).
13. Geogrid shall be laid horizontally (perpendicular to wall) on compacted layer of fill. They shall be tensioned to remove all slack prior to back filling and anchored by either placing a small volume of fill on or staking the free end. They shall remain tensioned whilst the balance of fill is placed. No traffic or site plant shall be permitted to travel on grids where cover is less than 100mm.
14. The Engineer shall inspect and approve installation of at least the first layer of geogrid and other layers as necessary.
15. All Stratagrid to be cut to length. No jointing shall be allowed for the Stratagrid.
16. Maximum 100mm overlap on adjoining grids.
17. Allan Block units used to construct the retaining wall to be produced and supplied in accordance with manufacture's specifications and recommendations.
18. Shear Key drainage to be installed in accordance with earthworks design.
19. Refer to Design Report (Ref 21854.0037, Geotechnical Design Report – Retaining Walls 8–10 & RE Slope 6 along Esplanade Reserve Path, June 2016) for anticipated construction sequencing and staging of works.

ORIGINAL IN COLOUR
A3 SCALE 1:100
0 1 2 3 4 5 (m)

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	AJL	Mar. 17
DRAWN :	JC	Mar. 17
DESIGN CHECKED :		
DRAFTING CHECKED :		
CADFILE : \\21854.0037-APP7S2-109_111.dwg		
APPROVED : NOT FOR CONSTRUCTION		

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NOTES :

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TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Retaining Wall 9 – Typical Cross Section (Sheet 1 of 2)

SCALES (AT A3 SIZE)	DWG. No.	REV.
1:100	21854.0037-APP7S2-109	1

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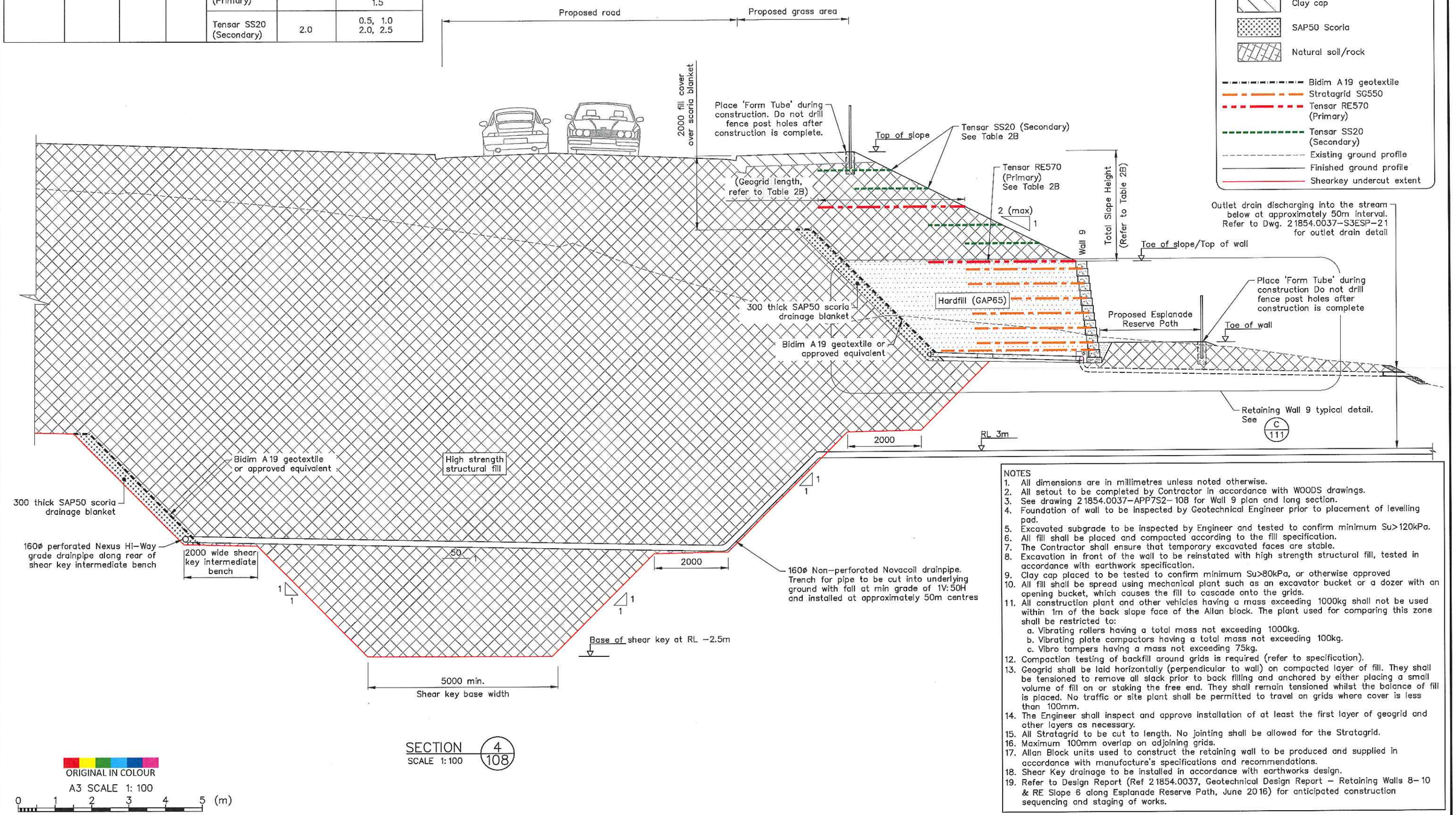
TABLE 2B: RE Slope (Above Retaining Wall 9) Reinforcement Details

Type of Wall	Total Slope Height (m)	Max. Forward Slope	Max. Back Slope	Geogrid Requirements		
				Geogrid Type	Min. Geogrid Length (m)	Vertical height above toe of slope (m)
RE Slope	≤ 3.0m	N/A	1V: 30H	Tensar RE570 (Primary)	4.0	0 1.5
				Tensar SS20 (Secondary)	2.0	0.5, 1.0 2.0, 2.5



SECTION 4/108
SCALE 1: 100

ORIGINAL IN COLOUR
A3 SCALE 1: 100
0 1 2 3 4 5 (m)

NOTES
1. All dimensions are in millimetres unless noted otherwise.
2. All setout to be completed by Contractor in accordance with WOODS drawings.
3. See drawing 21854.0037-APP7S2-108 for Wall 9 plan and long section.
4. Foundation of wall to be inspected by Geotechnical Engineer prior to placement of levelling pad.
5. Excavated subgrade to be inspected by Engineer and tested to confirm minimum Su>120kPa.
6. All fill shall be placed and compacted according to the fill specification.
7. The Contractor shall ensure that temporary excavated faces are stable.
8. Excavation in front of the wall to be reinstated with high strength structural fill, tested in accordance with earthwork specification.
9. Clay cap placed to be tested to confirm minimum Su>80kPa, or otherwise approved
10. All fill shall be spread using mechanical plant such as an excavator bucket or a dozer with an opening bucket, which causes the fill to cascade onto the grids.
11. All construction plant and other vehicles having a mass exceeding 1000kg shall not be used within 1m of the back slope face of the Allan block. The plant used for comparing this zone shall be restricted to:
    a. Vibrating rollers having a total mass not exceeding 1000kg.
    b. Vibrating plate compactors having a total mass not exceeding 100kg.
    c. Vibro tampers having a mass not exceeding 75kg.
12. Compaction testing of backfill around grids is required (refer to specification).
13. Geogrid shall be laid horizontally (perpendicular to wall) on compacted layer of fill. They shall be tensioned to remove all slack prior to back filling and anchored by either placing a small volume of fill on or staking the free end. They shall remain tensioned whilst the balance of fill is placed. No traffic or site plant shall be permitted to travel on grids where cover is less than 100mm.
14. The Engineer shall inspect and approve installation of at least the first layer of geogrid and other layers as necessary.
15. All Stratagrid to be cut to length. No jointing shall be allowed for the Stratagrid.
16. Maximum 100mm overlap on adjoining grids.
17. Allan Block units used to construct the retaining wall to be produced and supplied in accordance with manufacture's specifications and recommendations.
18. Shear Key drainage to be installed in accordance with earthworks design.
19. Refer to Design Report (Ref 21854.0037, Geotechnical Design Report – Retaining Walls 8–10 & RE Slope 6 along Esplanade Reserve Path, June 2016) for anticipated construction sequencing and staging of works.

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	AJL	Mar. 17
DRAWN :	JC	Mar. 17
DESIGN CHECKED :		
DRAFTING CHECKED :		

CADFILE : \\21854.0037-APP7S2-109_111.dwg
APPROVED : NOT FOR CONSTRUCTION
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NOTES :
REFERENCE :

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CLIENT, PROJECT: WFH PROPERTIES LTD
RESIDENTIAL SUBDIVISION
TITLE: MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Retaining Wall 9 – Typical Cross Section (Sheet 2 of 2)
SCALES (AT A3 SIZE): 1: 100
DWG. No.: 21854.0037-APP7S2-110
REV.: 1

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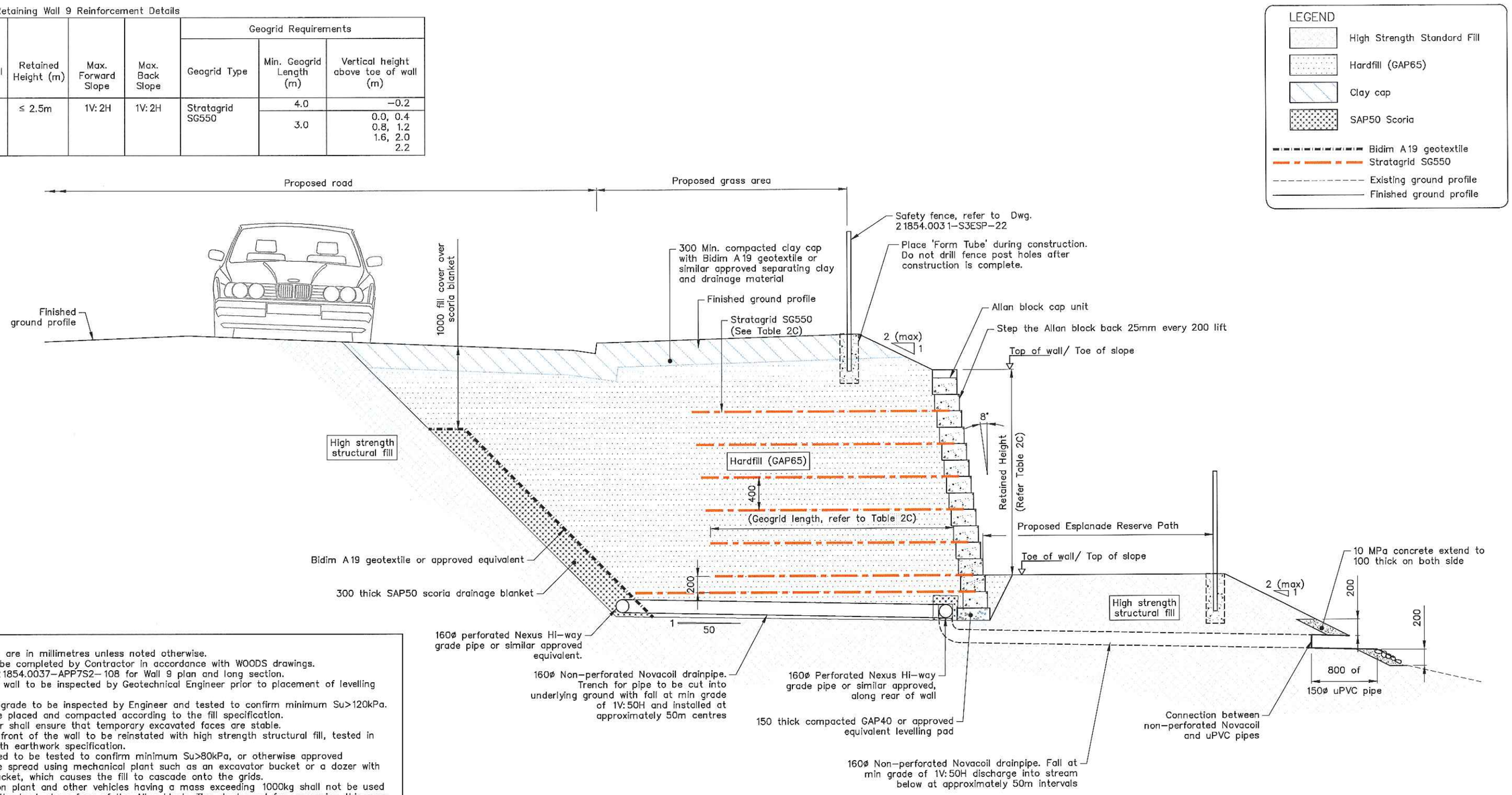
TABLE 2C: Retaining Wall 9 Reinforcement Details

Type of Wall	Retained Height (m)	Max. Forward Slope	Max. Back Slope	Geogrid Requirements		
				Geogrid Type	Min. Geogrid Length (m)	Vertical height above toe of wall (m)
MSE Wall	≤ 2.5m	1V: 2H	1V: 2H	Stratagrid SG550	4.0	−0.2
					3.0	0.0, 0.4 0.8, 1.2 1.6, 2.0 2.2



DETAIL C109 C110 TYPICAL RETAINING WALL 9 – DETAIL
SCALE 1:50

NOTES
1. All dimensions are in millimetres unless noted otherwise.
2. All setout to be completed by Contractor in accordance with WOODS drawings.
3. See drawing 21854.0037–APP7S2–108 for Wall 9 plan and long section.
4. Foundation of wall to be inspected by Geotechnical Engineer prior to placement of levelling pad.
5. Excavated subgrade to be inspected by Engineer and tested to confirm minimum Su>120kPa.
6. All fill shall be placed and compacted according to the fill specification.
7. The Contractor shall ensure that temporary excavated faces are stable.
8. Excavation in front of the wall to be reinstated with high strength structural fill, tested in accordance with earthwork specification.
9. Clay cap placed to be tested to confirm minimum Su>80kPa, or otherwise approved
10. All fill shall be spread using mechanical plant such as an excavator bucket or a dozer with an opening bucket, which causes the fill to cascade onto the grids.
11. All construction plant and other vehicles having a mass exceeding 1000kg shall not be used within 1m of the back slope face of the Allan block. The plant used for comparing this zone shall be restricted to:
    a. Vibrating rollers having a total mass not exceeding 1000kg.
    b. Vibrating plate compactors having a total mass not exceeding 100kg.
    c. Vibro tampers having a mass not exceeding 75kg.
12. Compaction testing of backfill around grids is required (refer to specification).
13. Geogrid shall be laid horizontally (perpendicular to wall) on compacted layer of fill. They shall be tensioned to remove all slack prior to back filling and anchored by either placing a small volume of fill on or staking the free end. They shall remain tensioned whilst the balance of fill is placed. No traffic or site plant shall be permitted to travel on grids where cover is less than 100mm.
14. The Engineer shall inspect and approve installation of at least the first layer of geogrid and other layers as necessary.
15. All Stratagrid to be cut to length. No jointing shall be allowed for the Stratagrid.
16. Maximum 100mm overlap on adjoining grids.
17. Allan Block units used to construct the retaining wall to be produced and supplied in accordance with manufacture's specifications and recommendations.
18. Shear Key drainage to be installed in accordance with earthworks design.
19. Refer to Design Report (Ref 21854.0037, Geotechnical Design Report – Retaining Walls 8–10 & RE Slope 6 along Esplanade Reserve Path, June 2016) for anticipated construction sequencing and staging of works.

ORIGINAL IN COLOUR
A3 SCALE 1:50
0 0.5 1.0 1.5 2.0 2.5 (m)

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	AJL	Mar. 17
DRAWN :	JC	Mar. 17
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CADFILE : \\21854.0037-APP7S2-109_111.dwg		
APPROVED : NOT FOR CONSTRUCTION		

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NOTES :

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TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Retaining Wall 9 – Typical Detail

SCALES (AT A3 SIZE)	DWG. No.	REV.
1:50	21854.0037-APP7S2-111	1

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SHEAR KEY 01 PLAN
SCALE 1:500

LEGEND
- Precinct 7 Boundary
- Stage 2 Boundary
- 201 Lot Boundaries
- Palisade Wall
- Shear Key
- 5 Shear key undercut contours (5m interval)
- Shear key undercut contours (1m interval)
- Ch 20 Base shear key and chainage

A3 SCALE 1:2000
0 20 40 60 80 100 (m)
ORIGINAL IN COLOUR

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	AJL	Mar. 17
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CADFILE : \\21854.0037-APP7S1-00.dwg		
APPROVED : NOT FOR CONSTRUCTION		

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NOTES :
1. All dimensions are in millimetres unless noted otherwise.
2. Baseplan and final contour supplied by WOODS, reference data 37001-02-AB-100-FINAL CONTOURS.dwg" dated February 2017.
3. Undercut and shearkey supplied by WOODS, reference data "37001-02-AB-120 SK UC & SUBSOIL.dwg" dated Sep 2016

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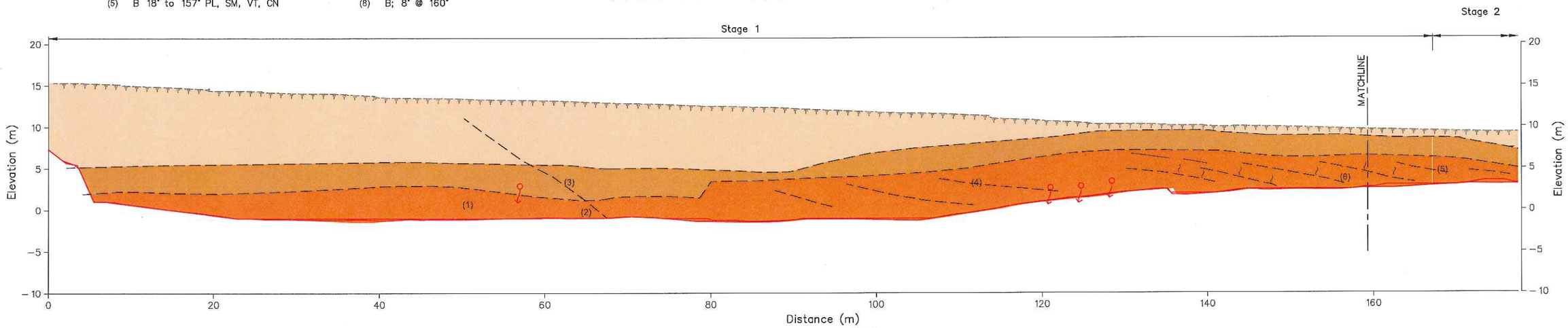
TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Shear Key 1 Plan

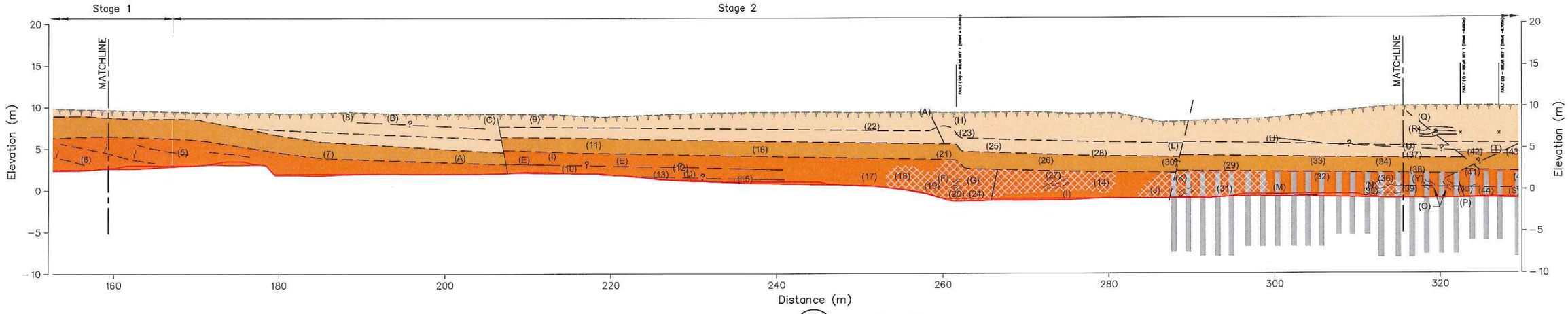
SCALES (AT A3 SIZE)	DWG. No.	REV.
1:500	21854.0037-APP7S2-112	1

(1) B 17° to 136° PL, SM, T, CN
(2) B 11° to 121° PL, SM, VT, CN
(3) F 40° to 82° SC, SM, T, FeSt within 500mm either side of fault
(4) B 19° to 157° PL, SM, VT, CN
(5) B 18° to 157° PL, SM, VT, CN
(6) J 65°–80° to 80° PL, SM, VT, CN spaced 200–500mm in both siltstone and sandstone beds, laterally discontinuous, no iron staining
(7) B; 6° @ 158°
(8) B; 8° @ 160°
(9) B; 4° @ 174°
(10) B; 4° @ 171°
(11) B; 10° @ 190°
(12) B; 7° @ 182°
(13) B; 4° @ 194°
(14) B; 7° @ 115°
(15) B; 6° @ 180°
(16) B; 8° @ 186°
(17) B; 8° @ 87°
(18) B; 10° @ 87°
(19) B; 10° @ 88°
(20) B; 4° @ 93°
(21) B; 81° @ 94°
(22) SHEAR PLANE: 3° @ 87°/PL/SM/CV/ Partially Polished
(23) B; 11° @ 92°
(24) B; 6° @ 124°
(25) B; 26° @ 122°
(26) B; 32° @ 117°
(27) B; 8° @ 132°
(28) B; 9° @ 115°
(29) B; 26° @ 104°
(30) B; 22° @ 136°/UM/SM/CC (Clay with minor silt: purplish grey)
(31) B; 11° @ 120°



SECTION 5 / 112
SCALE 1:500

(32) B; 8° @ 124°
(33) B; 18° @ 130°
(34) B; 8° @ 122°
(35) B; 18° @ 141°
(36) B; 9° @ 117°
(37) B; 10° @ 146°
(38) B; 7° @ 142°
(39) B; 5° @ 139°
(40) B; 8° @ 115°
(41) B; 12° @ 144°
(A) FAULT; 62° @ 95°/UN/SM/CV (clay)/ Polished
(B) SHEAR PLANE; 4° @ 173°/PL/SL/CN/ Polished. Saturated sand unit above & silt unit below
(C) SUSPECTED FAULT; Difficult to identify feature due to rubble on shear key face. 74° @ 78°. Can observe significant jump in all units levels (approx. 1.5m offset)
(D) Sheared Siltstone bed/UN/4–6° @ 180–194°.
(E) Sheared Siltstone bed/UN/4–7° @ 181–182°.
(F) J; 84° @ 85°/seepage
(G) J; 87° @ 95°/UN/SM/CV (silt)
(H) FAULT; 71–82° @ 945°/UN/SM/CC (CLAY; purplish grey, 20mm thick) / Polished. Approximate. 1m offset
(I) J; 68° @ 89°.
(J) J; 84° @ 85°/seepage
(K) 2 PARALLEL JOINTS; 87° @ 108°/PL/SM/with seepage
(L) FAULT; 80° @ 284°/PL/SM/CV. Associated with an offset of up to 300mm.
(M) Sheared Siltstone bed with seepage; 6° @ 138°



SECTION 5 / 112 CONTINUED
SCALE 1:500

(N) Sheared zone with seepage
(O) Zone of high seepage along the sheared siltstone.
(P) J; 60° @ 327°/UN/RO/N/CN/seepage
(Q) Fault with 600mm offset
(R) Soft sediment deformation observed across feature (Q)
(S) 2 PARALLEL JOINTS; 86° @ 165°
(T) SUSPECTED FAULT; Minor offset at the base of the MW ECBF

A3 SCALE 1:500
0 5 10 15 20 25 (m)
ORIGINAL IN COLOUR

Note: Refer Dwg. No. 21854.0037–APP7S2–115 for Geology Legend and Definition of Terms

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	AJL	Mar. 17
DRAWN :	JC	Mar. 17
DESIGN CHECKED :		
DRAFTING CHECKED :		
CADFILE : \\21854.0037–APP7S1–00.dwg		
APPROVED : NOT FOR CONSTRUCTION		

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NOTES :
1. All dimensions are in millimetres unless noted otherwise.
2. Refer to Dwg.21854.0037–APP7S2–115 for Geology Legend and Definition of Terms.
3. Nature and continuity of subsoil conditions away from these boreholes are inferred and it must be appreciated that actual conditions could vary from the assumed model.

REFERENCE :

Tonkin+Taylor
105 Carlton Gore Road, Newmarket, Auckland
Tel. (09) 355 6000 Fax. (09) 307 0265
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CLIENT, PROJECT
WFH PROPERTIES LTD
RESIDENTIAL SUBDIVISION

TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Shear Key 1 Longsection (Sheet 1 of 2)

SCALES (AT A3 SIZE)	DWG. No.	REV.
1:500	21854.0037–APP7S2–113	1

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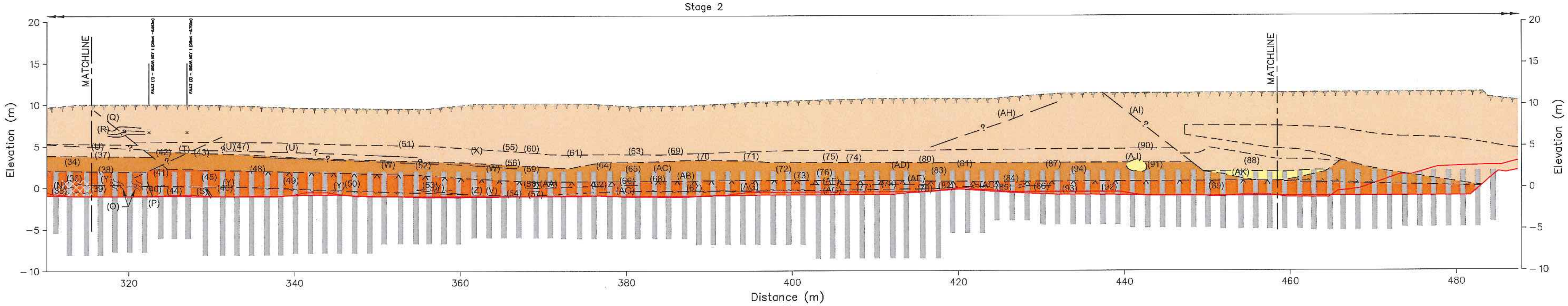
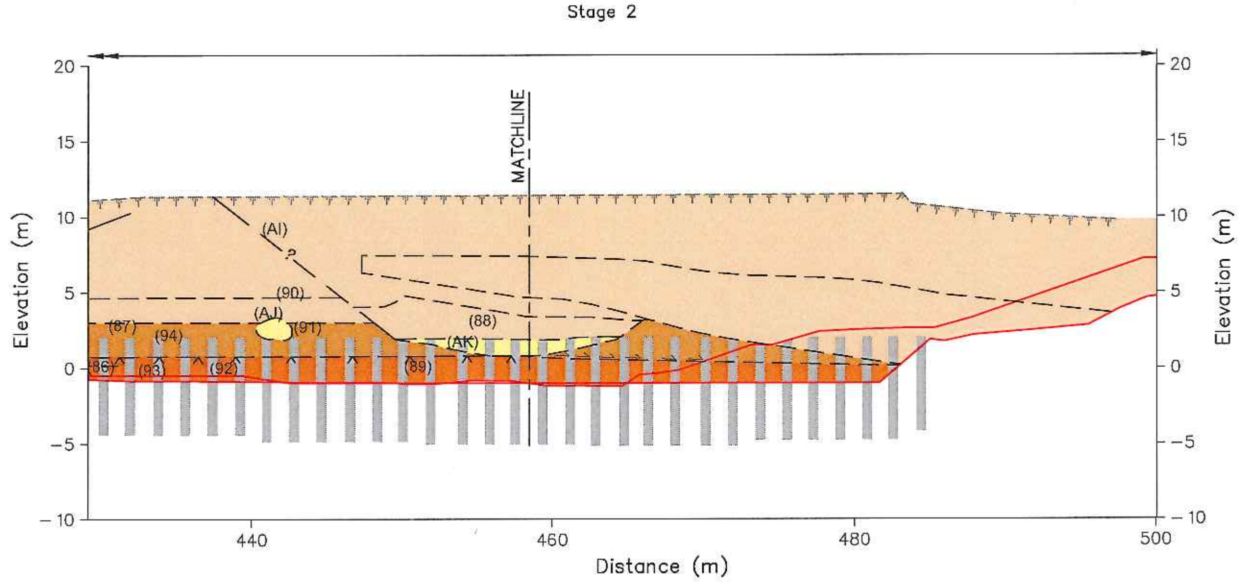
(42) J; 3° @ 124°
(43) J; 4° @ 120°
(44) J; 6° @ 121°
(45) J; 4° @ 129°
(46) J; 7° @ 103°
(47) J; 8° @ 126°
(48) J; 10° @ 139°
(49) J; 6° @ 126°
(50) J; 6° @ 142°
(51) J; 6° @ 122°
(52) J; 4° @ 139°
(53) J; 3° @ 145°
(54) J; 4° @ 148°
(55) J; 6° @ 129°
(56) J; 7° @ 137°
(57) J; 9° @ 129°
(58) J; 5° @ 141°
(59) J; 7° @ 139°
(60) J; 6° @ 1235°
(61) J; 10° @ 130°
(62) J; 7° @ 142°
(63) J; 7° @ 129°
(64) J; 4° @ 147°
(65) J; 10° @ 139°
(66) J; 4° @ 134°
(67) J; 8° @ 145°
(68) J; 4° @ 139°
(69) J; 5° @ 142°
(70) J; 4° @ 143°
(71) J; 7° @ 146°
(72) J; 6° @ 141°
(73) J; 7° @ 130°
(74) J; 3° @ 153°
(75) J; 9° @ 133°
(76) J; 7° @ 133°
(77) J; 5° @ 138°
(78) J; 9° @ 130°
(79) J; 7° @ 138°
(80) J; 5° @ 148°
(81) J; 65–88° @ 12°/UN/RO/VN/fEST
(82) J; 8° @ 161°
(83) J; 5° @ 172°
(84) J; 6° @ 167°
(85) J; 9° @ 182°
(86) J; 5° @ 152°
(87) J; 4° @ 168°
(88) J; 5° @ 156°
(89) J; 4° @ 153°
(90) J; 10° @ 162°
(91) J; 12° @ 169°
(92) J; 10° @ 162°
(93) J; 10° @ 162°
(94) J; 10° @ 169°



SECTION 5/112 CONTINUED
SCALE 1:500

(U) SHEAR PLANE; 6° @ 129°/PL/SM/VN/CN/Polished
(V) Sheared Siltstone bed.
(W) SHEAR PLANE; 9° @ 139°/Pl/20mm thick max. very soft, wet, purplish grey SILT seam. Suspect this possibly a shear surface
(X) J; 6–12° @ 234°/PL/SM/CV (silty clay)/Polished/ Striated to 248°
(Y) Sheared Siltstone beds with seepage along the base of the units.
(Z) 2 PARALLEL JOINTS; 69° @ 248°/UN/SM/CV (clayey SILT)
(AA) Sheared Siltstone beds; 7° @ 142°.
(AB) J; 27° @ 249°/PL/SM/CN/VN.
(AC) SHEAR PLANE; 7° @ 133°/UN/SM/VT/CV (clay; pink)
(AD) J; 54–82° @ 17°/UN/RO/V/FeST
(AE) 100mm thick, pink, SILT bed. Firm to stiff, with seepage on the units upper boudary. 6° @ 142°
(AF) Sheared Siltstone bed, 40mm thick; 9° @ 130°/PL/RO/T/CC (silty CLAY, up to 12mm thick). Sandstone above sounds hollow when struck.
(AG) Extremely weak Siltstone bed with seepage below. No clay seam, approx. 60mm thick typically &; 7° @ 138°
(AH) Suspected fault. Links with the feature (AD). No visual offset observed, seen as a linear feature in the face only.
(AI) SHEARED PLANE; 6–13° @ 120°/UN/SM/CC (up to 5mm thick & moist) Suspect all units to the east of this plane are colluvium. Observed within the Residual ECBF only.
(AJ) Alluvial Pocket betwwen CW & HW ECBF. Wood fragments visible within. Suspect all units to the east of feature (AH) are colluvial, however this pocket may have been transposed during the excavtion of the key.
(AJ) Alluvium at top of HW ECBF. Wood fragments visible within. Suspect all units above are Colluvium.



SECTION 5/112 CONTINUED
SCALE 1:500

Note: Refer Dwg. No. 21854.0037–APP7S2–115 for Geology Legend and Definition of Terms

A3 SCALE 1:500
0 5 10 15 20 25 (m)
ORIGINAL IN COLOUR

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	AJL	Mar.17
DRAWN :	JC	Mar.17
DESIGN CHECKED :		
DRAFTING CHECKED :		
CADFILE : \\21854.0037–APP7S1–00.dwg		
APPROVED :		

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CLIENT, PROJECT
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RESIDENTIAL SUBDIVISION

TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Shear Key 1 Longsection (Sheet 2 of 2)

SCALES (AT A3 SIZE) 1:500
DWG. No. 21854.0037–APP7S2–114
REV. 1

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LONGSECTION MATERIAL LEGEND

- Alluvium
  Silty Clay and Clayey Silt, firm to stiff, moist to wet, light grey to white, organic layers, generally thinly bedded (subhorizontal)
- East Coast Bays Formation Soils
  Stiff to very stiff Silty Clay, Clayey Silt and minor Silty Sand, moist to wet, light yellow to light grey
- MW East Coast Bays Formation
  Moderately Weathered ECBF, Silty Clay and Clayey Silt, minor Silty Sand, very stiff, wet, dark grey, thinly bedded
- SW–UW East Coast Bays Formation
  Slightly to unweathered ECBF. Interbedded Sandstone, Siltstone and Mudstone.
  Sandstone, Silty, very weak, dark grey.
  Siltstone and Mudstone, extremely weak to very weak, dark grey
- Engineered Fill
- Groundwater seepage
- Shear Surface
- Existing Ground Level
- Undercut Level
- Bedding Feature

DEFECT CODE LEGEND

SHAPE		ROUGHNESS		APERTURE		
TERM	CODE	DESCRIPTION OF JOINT SURFACE	CODE	TERM	SYMBOL	DESCRIPTION (Seperation)
Planar	PL	Slickensided	SL	Very Tight	VT	less than 0.1mm
Slightly Curved	SC	Smooth	SM	Tight	T	0.1 to 1.0mm
Curved	CV	Defined Ridges	DR	Open	O	1.0 to 10.0mm
Irregular	IR	Small Steps	ST	Very Open	VO	more than 10mm
Stepped	ST	Rough	R			
Wavy	WV	Very Rough	VR			

INFILLINGS AND COATINGS

Clay Gouge	CG	Joints have openings between opposing faces of intact rock substance in excess of 1mm filled with clay gouge. Clay is generally described in terms of soil properties.
Clay Veneers	CV	Joints contain clay coating whose maximum thickness does not exceed 1mm. Note: Describe clay in terms of soil properties.
Penetrative Limonite	PL	Joint traces are marked in terms of well defined zones of slightly to moderately weathered ferruginised rock–substance within the adjacent rock.
Limonite Stained	FeSt	Joint surfaces are stained or coated with limonite, although the rock substance immediately adjacent to the joints is fresh.
Coated	CT SC	Joints exhibit Coatings other than clay or limonite, eg. Carbonate (CT) or silica (SC)
Cemented	CL CS CC	Joints are cemented with limonite (CL), silica (CS), or carbonates (CC)
Clean	CN	Joint surfaces show no trace of clay, limonite, or other coatings

TYPE		
TERM	CODE	SYMBOL
Bedding	B	15° Dip angle / Strike
Joint	J	55° Dip angle / Strike
Shear zone	SZ	20° Dip angle / Strike
Fault trace	F	40° Dip angle / Strike

TYPICAL EXAMPLE:

(3) J60/152°, PL, SL, T, CV, stiff green CLAY

- (3) — No. in defect set
- J — Type
- 60 — Dip angle
- 152° — Dip direction
- PL — Shape
- SL — Roughness
- T — Aperture
- CV — Infilling/Coating Type
- stiff green CLAY — Infilling Description (as per Soil Description)

ORIGINAL IN COLOUR

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	JXXL	Mar. 17
DRAWN :	JC	Mar. 17
DESIGN CHECKED :		
DRAFTING CHECKED :		
CADFILE : \\21854.0037–APP7S2–115.dwg		
APPROVED : NOT FOR CONSTRUCTION		

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TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Geology Legend and Definition of Terms

SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 1000	21854.0037–APP7S2–115	1

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OREWA RIVER

ARRAN POINT PARADE

PAIGE ROAD

MAKA TERRACE

PALISADE WALL 2

WALL 02

WALL 03

WALL 09

RE SLOPE 01

RE SLOPE 02

RE SLOPE 03

RE SLOPE 04

RE SLOPE 05

Future Stages

831900 mN

831800 mN

831700 mN

391800 mE

391900 mE

392000 mE

392100 mE

392200 mE

A3 SCALE 1: 1250

0 25 50 75 (m)

ORIGINAL IN COLOUR

LEGEND

- Precinct 2 Boundary
- Stage 2A Boundary
- 122 Lot Boundaries
- Finished Ground Contours (0.5m interval)
- Retaining Wall
- Palisade Wall
- Reinforced Earth Extent
- Building Limitation Zone

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	JXXL	Oct. 16
DRAWN :	JC	Oct. 16
DESIGN CHECKED :		
DRAFTING CHECKED :		

CADFILE : \\21854.0037-APP7S1-00.dwg

APPROVED : NOT FOR CONSTRUCTION

This drawing is not to be used for construction purposes unless signed as approved

NOTES :

1. All dimensions are in millimetres unless noted otherwise.
2. Baseplan and final contour supplied by WOODS, reference data 37001-02-AB-100-FINAL CONTOURS.dwg" dated February 2017.
3. Undercut and shearkey supplied by WOODS, reference data "37001-02-AB-120 SK UC & SUBSOIL.dwg" dated Sep 2016
4. Coordinate Datum: NZGD2000, Mt Eden Circuit Circuit Coordinates. Origin: Lat 36 52 47S Long 174 45 51E 800,000mN 400,000mE

REFERENCE :

Tonkin+Taylor
105 Carlton Gore Road, Newmarket, Auckland
Tel. (09) 355 6000 Fax. (09) 307 0265
www.tonkintaylor.co.nz

CLIENT, PROJECT
WFH PROPERTIES LTD
RESIDENTIAL SUBDIVISION

TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Building Limitation Plan

SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 1250	21854.0037-APP7S2-116	1

Appendix B: Contractors Certificates

- Hick Bros - Producer Statement PS3 – Contract 37000-02 (Stage 1 Bulk Earthworks)
- Hick Bros - Producer Statement PS3 – Contract 37001-02 (All Stage 2 Civil works)
- ICB Retaining and Construction Ltd – Producer Statement 3 (Massbloc Wall 03 Construction)
- ICB Retaining and Construction Ltd – Producer Statement 3 (Palisade Wall 02 Construction)
- ICB Retaining and Construction Ltd – Producer Statement 3 (Allan Block Wall 09 Construction)
- Getgroup.co.nz Ltd – Producer Statement 3 (Walls 03 & 09, and RE Slope 5 Fences)

PS3 - FORM OF PRODUCER STATEMENT- CONSTRUCTION

ISSUED BY: HICK BROS CIVIL CONSTRUCTION LIMITED

TO: WFH PROPERTIES

IN RESPECT OF: PRECINT 7 OREWA WEST BULK EARTHWORKS AND GEOTECHNICAL REMEDIATION
AT: PRECINCT 7 CONTRACT 37000-02

HICK BROS CIVIL CONSTRUCTION LTD has contracted to WFH PROPERTIES to carry out and complete certain building works in accordance with a contract, titled PRECINT 7 OREWA WEST BULK EARTHWORKS AND GEOTECHNICAL REMEDIATION ("the contract")

I JAMES BILKEY a duly authorized representative of HICK BROS CIVIL CONSTRUCTION LIMITED believe on reasonable grounds that HICK BROS CIVIL CONSTRUCTION LIMITED has carried out and completed part only as specified in the attached particulars of the contract works in in accordance with the contract.

Date: 4th August 2016

(Signature of Authorized Agent on behalf of)

HICK BROS CIVIL CONSTRUCTION LIMITED
(Contractor)

42 FORGE ROAD, SILVERDALE
(Address)

Attachments:
1) List detailing works carried out

ATTACHMENT 1

PRECINT 7 OREWA WEST BULK EARTHWORKS AND GEOTECHNICAL REMEDIATION

LIST OF WORK CARRIED OUT:

1) All the earthworks within Stage 1
2) Construction of Wall 1
3) Construction of Wall 2
4) Construction of Palisade Wall 1

PS3 - FORM OF PRODUCER STATEMENT- CONSTRUCTION

ISSUED BY: HICK BROS CIVIL CONSTRUCTION LIMITED

TO: WFH PROPERTIES

IN RESPECT OF: PRECINT 7 OREWA WEST STAGE 1 & 2 CIVIL WORKS
AT: PRECINCT 7 CONTRACT 37001-02

HICK BROS CIVIL CONSTRUCTION LTD has contracted to WFH PROPERTIES to carry out and complete certain building works in accordance with a contract, titled PRECINT 7 OREWA WEST STAGE 1 & 2 CIVIL WORKS ("the contract")

I JAMES BILKEY a duly authorized representative of HICK BROS CIVIL CONSTRUCTION LIMITED believe on reasonable grounds that HICK BROS CIVIL CONSTRUCTION LIMITED has carried out and completed part only as specified in the attached particulars of the contract works in in accordance with the contract.

Date: 4th August 2016

(Signature of Authorized Agent on behalf of)

HICK BROS CIVIL CONSTRUCTION LIMITED
(Contractor)

42 FORGE ROAD, SILVERDALE
(Address)

Attachments:
1) List detailing works carried out

ATTACHMENT 1

PRECINT 7 OREWA WEST STAGE 1 & 2 CIVIL WORKS

LIST OF WORK CARRIED OUT:

1) All of the works in Stage 1
2) Fencing above Wall 1
3) Fencing above Wall 2
4) Fencing next to road 1
5) Fencing of inlet structure to wetland

SIXTH SCHEDULE

(NZS 3910:2003)

FORM OF PRODUCER STATEMENT CONSTRUCTION

ISSUED BY **ICB Retaining & Construction Limited**
(Contractor)

TO **Hick Brothers**
(Principal)

IN RESPECT OF **Retaining Wall No. 3 (Mass Blocks). Consent ABA-1019549**
(Description of Contract Works)

AT **Lot 1 DP 463561, Silverdale 0931, (Arran Point, Millwater Precent 7)**
(Address)

ICB Retaining & Construction Ltd
(Contractor)

has contracted to **Hick Brothers**
(Principal)

to carry out and complete certain building works in accordance with a contract, titled

Mass Block Wall No. 3 Arran Point, Millwater Precent 7 *(The Contract)*
(The Project)

I, ***Chris Burke*** a duly authorised
(Duly Authorised Agent)

representative of **ICB Retaining & Construction Limited**
(Contractor)

Believe on reasonable grounds that **ICB Retaining & Construction Limited**
(Contractor)

has carried out and completed:
☑ All ☐ Part only as specified in the attached particulars of the building works in accordance with the Building Consent No. and any Authorised Instruction / Variations that have been issued during the course of the work.

(Signature of Authorised Agent on Behalf of)

15 August 2016
(Date)

ICB Construction Limited
(Contractor)

PO Box 303 340, North Harbour, Auckland
(Address)

SIXTH SCHEDULE

(NZS 3910:2003)

FORM OF PRODUCER STATEMENT CONSTRUCTION

ISSUED BY **ICB Retaining & Construction Limited**
(Contractor)

TO **Hick Brothers**
(Principal)

IN RESPECT OF **Allen Block Wall No. 9**
(Description of Contract Works)

AT **Lot 1 DP 463561, Silverdale 0931, (Arran Point, Millwater Precent 7)**
(Address)

ICB Retaining & Construction Ltd
(Contractor)

has contracted to **Hick Brothers**
(Principal)

to carry out and complete certain building works in accordance with a contract, titled

Allen Block Wall No. 9, Arran Point, Millwater Precent 7 *(The Contract)*
(The Project)

I, ***Chris Burke*** a duly authorised
(Duly Authorised Agent)

representative of **ICB Retaining & Construction Limited**
(Contractor)

Believe on reasonable grounds that **ICB Retaining & Construction Limited**
(Contractor)

has carried out and completed:
☑ All ☐ Part only as specified in the attached particulars of the building works in accordance with the Building Consent No. and any Authorised Instruction / Variations that have been issued during the course of the work.

(Signature of Authorised Agent on Behalf of)

17 August 2016
(Date)

ICB Construction Limited
(Contractor)

PO Box 303 340, North Harbour, Auckland
(Address)

SIXTH SCHEDULE

(NZS 3910:2003)

FORM OF PRODUCER STATEMENT CONSTRUCTION

ISSUED BY **ICB Retaining & Construction Limited**
(Contractor)

TO **Hick Brothers**
(Principal)

IN RESPECT OF **Palisade Wall No. 2 (310UC97). Consent ABA-1019549**
(Description of Contract Works)

AT **Lot 1 DP 463561, Silverdale 0931, (Arran Point, Millwater Precent 7)**
(Address)

ICB Retaining & Construction Ltd
(Contractor)

has contracted to **Hick Brothers**
(Principal)

to carry out and complete certain building works in accordance with a contract, titled

Palisade Wall No. 2, Arran Point, Millwater Precent 7 *(The Contract)*
(The Project)

I, ***Chris Burke*** a duly authorised
(Duly Authorised Agent)

representative of **ICB Retaining & Construction Limited**
(Contractor)

Believe on reasonable grounds that **ICB Retaining & Construction Limited**
(Contractor)

has carried out and completed:
☑ All ☐ Part only as specified in the attached particulars of the building works in accordance with the Building Consent No. and any Authorised Instruction / Variations that have been issued during the course of the work.

(Signature of Authorised Agent on Behalf of)

15 August 2016
(Date)

ICB Construction Limited
(Contractor)

PO Box 303 340, North Harbour, Auckland
(Address)

Producer statement construction (PS3)
General construction work

Auckland Council
Te Kaunihera o Tāmaki Makaurau

All sections of this form must be completed

TO BE COMPLETED BY THE PERSON WHO HAS UNDERTAKEN THE BUILDING WORK

Author name:	Paul Jones.	Building consent No:	
Author company:	Get Group.co.nz Ltd	Author Registration No:	
Description of building work:	Fencing to top of WALL. 3.		
Performance standard for maintenance and inspection, if applicable	Subject to ongoing corrosion protection. ☐ N/A		
Legal description:			
Site address:	Aaron Point Parade		

NZBC clauses: (select as applicable)

(B1)	(B2)	C1	C2	C3	C4	C5	C6	D1	D2	E1	E2	E3
F1	F2	F3	F4	F5	F6	F7	F8	G1	G2	G3	G4	G5
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15	H1		

I have sighted the above building consent and read the attached conditions of consent and confirm that I have undertaken the building work described above in accordance with the consented plans and specifications.

I understand that Council will rely upon this producer statement, for the purposes of establishing compliance with the above building consent.

Signature: [signature] Date: 19/1/17.

Tradesperson's contact details:

Address:	17 Kahikatea Flat Rd. Dairy Flat	Postcode: 0794	
Business:	09 - 4275421	Fax:	
Mobile:	027 2525228	Email	paul@getgroup.co.nz

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Name: Date:

Producer statement accepted as establishing compliance with the consented plans: YES ☐ NO ☐

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Producer statement construction (PS3)
General construction work

Auckland Council
Te Kaunihera o Tāmaki Makaurau

All sections of this form must be completed

TO BE COMPLETED BY THE PERSON WHO HAS UNDERTAKEN THE BUILDING WORK

Author name: DAN WRIGHT

Building consent No:

Author company: GET GATES + FENCE IT LTD

Author Registration No:

Description of building work: RETAINING WALL FENCE

Performance standard for maintenance and inspection, if applicable: SUBJECT TO ONGOING CORROSION PROTECTION ☐ N/A

Legal description:

Site address: PRECINCT 7 OREWA WEST WALL 9

NZBC clauses: (select as applicable)

(B1)	(B2)	C1	C2	C3	C4	C5	C6	D1	D2	E1	E2	E3
F1	F2	F3	F4	F5	F6	F7	F8	G1	G2	G3	G4	G5
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15	H1		

I have sighted the above building consent and read the attached conditions of consent and confirm that I have undertaken the building work described above in accordance with the consented plans and specifications.

I understand that Council will rely upon this producer statement, for the purposes of establishing compliance with the above building consent.

Signature: Date: 9/1/2017.

Tradesperson's contact details:

Address: 17 KAITIKATEA FLAT ROAD, DAIRY FLAT Postcode: 0794

Business: 09 4275421 Fax:

Mobile: 027 25 25 227 Email dan@getgroup.co.nz

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Register checked: Council ☐ LBP ☐ N/A ☐

Name: Date:

Producer statement accepted as establishing compliance with the consented plans: YES ☐ NO ☐

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Producer statement construction (PS3)
General construction work

Auckland Council
Te Kaunihera o Tāmaki Makaurau

All sections of this form must be completed

TO BE COMPLETED BY THE PERSON WHO HAS UNDERTAKEN THE BUILDING WORK

Author name:	Paul Jones.	Building consent No:	
Author company:	Get Group.co.nz Ltd.	Author Registration No:	
Description of building work:	Fencing on top of wall 5.		
Performance standard for maintenance and inspection, if applicable	subject to ongoing corrosion protection ☐ N/A		
Legal description:			
Site address:	Aaron Point Parade		

NZBC clauses: (select as applicable)

(B1)	(B2)	C1	C2	C3	C4	C5	C6	D1	D2	E1	E2	E3
F1	F2	F3	F4	F5	F6	F7	F8	G1	G2	G3	G4	G5
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15	H1		

I have sighted the above building consent and read the attached conditions of consent and confirm that I have undertaken the building work described above in accordance with the consented plans and specifications.

I understand that Council will rely upon this producer statement, for the purposes of establishing compliance with the above building consent.

Signature: [signature] Date: 19/1/17.

Tradesperson's contact details:

Address:	17 Kahikatea Flat Rd	Postcode:	0794
Business:	09-4275421	Fax:	
Mobile:	027 2525228	Email	Paul@getgroup.co.nz.

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Register checked: Council ☐ LBP ☐ N/A ☐

Name: Date:

Producer statement accepted as establishing compliance with the consented plans: YES ☐ NO ☐

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http://www.aucklandcouncil.govt.nz/EN/ratesbuildingproperty/consents/Consent%20documents/ac2301producerstatementpolicy.pdf

Appendix C: NZS 3604:2011 Expansive Soils (Extract)

NZS 3604:2011 Expansive Soils (Extract)

Expansive soils tend to be moderately to highly plastic clays that undergo appreciable volume change upon changes in moisture content. Technically, they are defined in NZS 3604:2011 as those soils having a liquid limit of more than 50% and a linear shrinkage of more than 15%. Where soils are quite silty or sandy, shrink and swell is less of a problem, due to the lower clay contents.

Building damage resulting from expansive soil movement can range from relatively minor brick veneer cracking and internal cracking on wall corners and wall ceiling corners with attendant door and windows jamming, through to extensive cracking of foundation block framework, extensive internal visual cracking and significant warping of building frames. Damage is dependent on building construction and materials and is rarely of structural concern.

NZS 3604:2011 "Timber Framed Buildings" defines good ground as follows:

"Any soil or rock capable of permanently withstanding an ultimate bearing capacity of 300 kPa (i.e. an allowable bearing pressure of 100 kPa using a factor of safety of 3.0), but excludes:

a) Potentially compressible ground such as topsoil, soft soils such as clay which can be moulded easily in the fingers, and uncompacted loose gravel which contains obvious voids;

b) Expansive soils being those that have a liquid limit of more than 50% when tested in accordance with NZS 4402 Test 2.2, and a linear shrinkage of more than 15% when tested in accordance with NZS 4402 Test 2.6, and

c) Any ground which could forseeably experience movement of 25 mm or greater for any reason including one or a combination of: land instability, ground creep, subsidence, seasonal swelling and shrinking, frost heave, changing ground water level, erosion, dissolution of soil in water, and effects of tree roots."

Foundations on expansive soils are outside the scope of NZS 3604:2011 as an acceptable solution to the New Zealand Building Code (NZBC). Specific engineering design of foundation elements is involved where expansive soils are present with a recommendation that AS 2870:2011 is used for building design. While not mandatory, AS 2870 designs will allow for a non-specific design foundation to be used without resorting to further ongoing investigation or design.

This geotechnical completion report has classified the soils present on this subdivision to be in Site Class M as per the requirements of AS 2870:2011. Descriptions of the various site classes, together with characteristic surface ground movements are outlined below.

Allowing for some correlation with NZS 3604, the various site classes applicable to NZ conditions are considered to be:

Characteristic Surface Movements	Site Class	Description
a) 20 mm (Note NZS 3604:2011 assumes movement of 25 mm as part of underlying design.	Class A (sand) and/or Class S (Silts) Equivalent to NZS 3604:2011 "Good Ground" sites	Poor to slightly expansive
b) 20 mm – 40 mm	Class M	Moderately expansive
c) 40 mm – 60 mm	Class H1	Highly expansive
d) 60 mm – 75mm	Class H2	Highly expansive
e) > 75 mm	Class E	Extremely expansive

AS 2870 uses a range of factors to assess characteristic soil movement including:

i. Building distress due to ground movement visible on adjacent structures,

ii. Known soil properties and site specific testing to determine the shrink / swell index of a soil (Test 7.1.1 in AS 1289 – Methods of Testing Soils for Engineering Purposes).

AS 2870 is based on defining soil types into various hazard classes based on expected surface movement and depth of desiccation that could occur. It then applies various foundation designs and embedment depths based on the form of building construction (slab on ground, strip footing, stiffened raft, stiffened slab with deep edge beams, etc). AS2870 uses more reinforcing steel than NZ designs generally would to create stiffer foundations that are better able to tolerate ground movement.

The Australian approach also regards expansive soil to a considerable extent being a home owner maintenance issue and significant emphasis is put into ensuring that people understand the influence that trees and dry summers etc may have on foundation performance. See Appendix D.

Appendix D: CSIRO – BTF18 – Foundation Maintenance and Footing Performance: A Homeowners Guide

Foundation Maintenance and Footing Performance:
A Homeowner's Guide

CSIRO

BTF 18
replaces
Information
Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction
There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion
All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation
This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume – particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil
All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure
This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.
- In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes
H	Highly reactive clay sites, which can experience high ground movement from moisture changes
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P	Filled sites
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise

Tree root growth
Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation
Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpends).

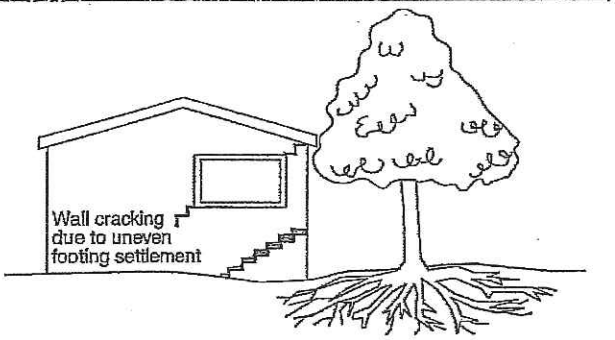
Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

Seasonal swelling/shrinkage in clay
Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish-effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

Trees can cause shrinkage and damage



As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots
In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself
Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures
Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures
Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation cause a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures
Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem.
Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.
- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870.

AS 2870 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

Plumbing
Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

Ground drainage
In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

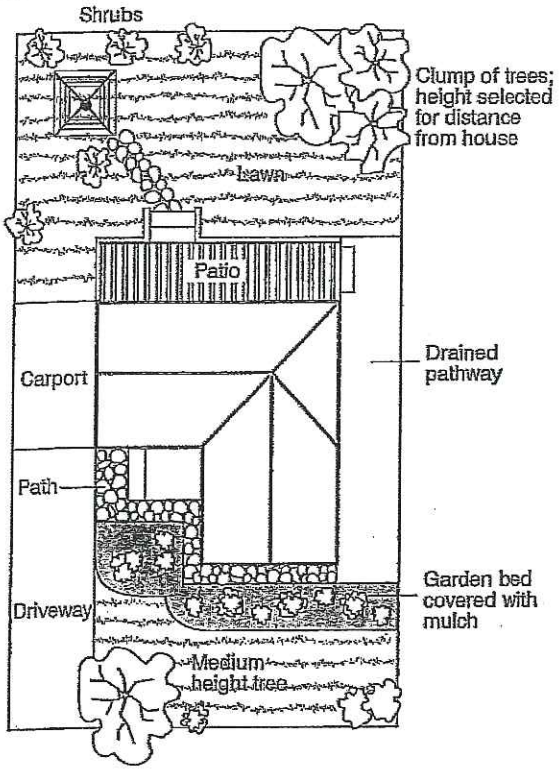
It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

Protection of the building perimeter
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired	5–15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted	15–25 mm but also depend on number of cracks	4



should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

Warning: Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

The garden

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

Existing trees

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

Excavation

Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

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Appendix E: Test Results

- 21854.0037–APPP7S2–117 Post Earthworks Investigation Plan
- 21854.0037–APPP7S2–118 Topsoil Depths Plan
- 21854.0037–APPP7S2–119 Earthworks Testing Location Plan
- Soil Expansion Test Results
- Post Earthworks Investigation Borehole Logs HA5 to HA10 – 28 January 2016
- Post Earthworks Investigation Borehole Logs HA1 to HA9 – December 2016
- Earthworks Test Results

OREWA RIVER

ARRAN POINT PARADE

PAIGE ROAD

MAKA TERRACE

PALISADE WALL 2

WALL 02

WALL 03

WALL 09

RE SLOPE 01

RE SLOPE 02

RE SLOPE 03

RE SLOPE 04

RE SLOPE 05

Future Stages

E1 HA1 HA5 HA6

E2 HA2 HA7 HA8

E3 HA3 HA9 HA10

E4 HA4

E6 HA5

E6 HA6

E7 HA7

E8 HA8

E9 HA9

831900 mN

831800 mN

831700 mN

391800 mE

391900 mE

392000 mE

392100 mE

392200 mE

0 mE

392000 mE

392100 mE

A3 SCALE 1: 1250

0 25 50 75 (m)

ORIGINAL IN COLOUR

LEGEND

- Precinct 7 Boundary
- Stage 2 Boundary
- 122 Lot Boundaries
- Finished Ground Contours (0.5m interval)
- Retaining Wall
- Palisade Wall
- Reinforced Earth Slope
- E6 Expansive soil test samples @ 0.5m and 1.0m depth
- HA1 Hand Auger to 3m depth carried out 20/10/2016
- HA2 Hand Auger to 3m depth, carried out 28/01/2016

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	JXXL	Mar. 17
DRAWN :	JC	Mar. 17
DESIGN CHECKED :		
DRAFTING CHECKED :		
CADFILE : \\21854.0037-APP7S1-00.dwg		
APPROVED : NOT FOR CONSTRUCTION		

This drawing is not to be used for construction purposes unless signed as approved

NOTES :

1. All dimensions are in millimetres unless noted otherwise.
2. Baseplan and final contour supplied by WOODS, reference data 37001-02-AB-100-FINAL CONTOURS.dwg" dated February 2017.
3. Undercut and shearkey supplied by WOODS, reference data "37001-02-AB-120 SK UC & SUBSOIL.dwg" dated Sep 2016
4. Coordinate Datum: NZGD2000, Mt Eden Circuit Circuit Coordinates. Origin: Lat 36 52 47S Long 174 45 51E 800,000mN 400,000mE

REFERENCE :

Tonkin+Taylor
105 Carlton Gore Road, Newmarket, Auckland
Tel. (09) 355 6000 Fax. (09) 307 0265
www.tonkintaylor.co.nz

CLIENT, PROJECT
WFH PROPERTIES LTD
RESIDENTIAL SUBDIVISION

TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Post Earthworks Investigation Plan

SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 1250	21854.0037-APP7S2-117	1

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OREWA RIVER

ARRAN POINT PARADE

PAIGE ROAD

MAKA TERRACE

PALISADE WALL 2

WALL 02

WALL 03

WALL 09

RE SLOPE 01

RE SLOPE 02

RE SLOPE 03

RE SLOPE 04

RE SLOPE 05

Future Stage

391600 mE | 391900 mE | 392000 mE | 392100 mE | 392200 mE

831900 mN | 831800 mN | 831700 mN

0 mE | 392000 mE | 392100 mE

A3 SCALE 1: 1250

0 25 50 75 (m)

ORIGINAL IN COLOUR

LEGEND

- Precinct 7 Boundary
- Stage 2 Boundary
- 122 Lot Boundaries
- Finished Ground Contours (0.5m interval)
- Retaining Wall
- Palisade Wall
- Reinforced Earth Slope
- 250 Topsoil depth (mm) taken at centre of each lot

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	JXXL	Mar. 17
DRAWN :	JC	Mar. 17
DESIGN CHECKED :		
DRAFTING CHECKED :		
CADFILE : \\21854.0037-APP7S1-00.dwg		
APPROVED : NOT FOR CONSTRUCTION		

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NOTES :

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2. Baseplan and final contour supplied by WOODS, reference data 37001-02-AB-100-FINAL CONTOURS.dwg" dated February 2017.
3. Undercut and shearkey supplied by WOODS, reference data "37001-02-AB-120 SK UC & SUBSOIL.dwg" dated Sep 2016
4. Coordinate Datum: NZGD2000, Mt Eden Circuit Circuit Coordinates. Origin: Lat 36 52 47S Long 174 45 51E 800,000mN 400,000mE

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TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Topsoil Depths Plan

SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 1250	21854.0037-APP7S2-118	1

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OREWA RIVER

ARRAN POINT PARADE

PAIGE ROAD

MAKA TERRACE

WALL 02

WALL 03

WALL 09

PALISADE WALL 2

RE SLOPE 01

RE SLOPE 02

RE SLOPE 03

RE SLOPE 04

RE SLOPE 05

Future Stage

831900 mN

831800 mN

831700 mN

392000 mE

392100 mE

392200 mE

A3 SCALE 1: 1250

0 25 50 75 (m)

ORIGINAL IN COLOUR

LEGEND

- Precinct 7 Boundary
- Stage 2 Boundary
- 122 Lot Boundaries
- Finished Ground Contours (0.5m interval)
- 2.0 Fill Contours
- 0.0 Zero Contours
- -2.0 Cut Contours
- Retaining Wall
- Palisade Wall
- Reinforced Earth Slopeze
- S14-187 Earthworks Testing Location (URN number)

DRAWING STATUS: COMPLETION REPORT

REVISION	DESCRIPTION	BY	DATE
1	Completion Report Issue		

DESIGNED :	JXXL	Mar. 17
DRAWN :	JC	Mar. 17
DESIGN CHECKED :		
DRAFTING CHECKED :		

CADFILE : \\21854.0037-APP7S1-00.dwg

APPROVED : NOT FOR CONSTRUCTION

This drawing is not to be used for construction purposes unless signed as approved

NOTES :

1. All dimensions are in millimetres unless noted otherwise.
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3. Undercut and shearkey supplied by WOODS, reference data "37001-02-AB-120 SK UC & SUBSOIL.dwg" dated Sep 2016
4. Coordinate Datum: NZGD2000, Mt Eden Circuit Circuit Coordinates. Origin: Lat 36 52 47S Long 174 45 51E 800,000mN 400,000mE

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CLIENT, PROJECT
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TITLE
MILLWATER – ARRANS POINT PRECINCT 7 (STAGE 2)
Earthworks Testing Location Plan

SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 1250	21854.0037-APP7S2-119	1

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GEOTECHNICS
23 Morgan Street, Newmarket
Auckland 1023, New Zealand
p. +64 9 356 3510
w. www.geotechnics.co.nz

Site: **Arran Point, Precinct 7, Stage 2, Millwater**

Your Job No: 21854.0037

Our Job No: 21854.0038.0.0

Test Method Used: **AS 1289.7.1.1 - 2003 Determination of the Shrink - Swell Index**

SUMMARY OF SHRINK - SWELL TEST RESULTS

Sample No.:			**S1A**	**S1B**	**S2A**	**S2B**
DEPTH		**(m)**	**0.4 - 0.6**	**0.9 - 1.1**	**0.4 - 0.6**	**0.9 - 1.1**
Applied Pressure		**(kPa)**	**55**	**55**	**55**	**55**
SWELL TEST	Initial Water Content	(%)	34.7	35.3	35.0	35.9
	Bulk Density	(t/m³)	1.82	1.67	1.76	1.80
	Dry Density	(t/m³)	1.35	1.23	1.30	1.32
	Final Water Content	(%)	35.5	36.8	36.9	37.6
	Swelling Strain	(%)	0.04	0.03	0.2	0.03
SHRINKAGE TEST	Initial Water Content	(%)	34.0	36.1	33.5	34.8
	Estimated Shrinkage Limit	(%)	12.0	12.9	9.0	9.2
	Shrinkage Strain	(%)	3.6	3.9	2.3	2.5
	Inert Material Estimate in the Soil Specimen	(%)	0	0	0	0
	Soil Crumbling During Shrinkage		Nil	Nil	Nil	Nil
	Cracking of the Shrinkage Specimen		Moderate	Moderate	Moderate	Moderate
SHRINK - SWELL INDEX		**(%)**	**2.0**	**2.2**	**1.3**	**1.4**

Entered by: ST Date: 22/11/2016 Checked by: JR Date: 22/11/2016

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23 Morgan Street, Newmarket
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Site: **Arran Point, Precinct 7, Stage 2, Millwater**

Your Job No: 21854.0037
Our Job No: 21854.0038

Test Method Used: **AS 1289.7.1.1 - 2003 Determination of the Shrink - Swell Index**

SUMMARY OF SHRINK - SWELL TEST RESULTS

Sample No.:			**S3A**	**S3B**	**S4A**	**S4B**	**S5A**	**S5B**	**S6A**	**S6B**
DEPTH		**(m)**	**0.4 - 0.6**	**0.9 - 1.1**	**0.4 - 0.6**	**0.9 - 1.1**	**0.4 - 0.6**	**0.9 - 1.1**	**0.4 - 0.6**	**0.9 - 1.1**
Applied Pressure		**(kPa)**	**55**	**55**	**55**	**55**	**55**	**55**	**55**	**55**
SWELL TEST	Initial Water Content	(%)	43.7	41.5	31.3	32.4	32.1	31.3	35.9	33.0
	Bulk Density	(t/m³)	1.74	1.71	1.85	1.82	1.83	1.80	1.77	1.82
	Dry Density	(t/m³)	1.21	1.21	1.41	1.37	1.39	1.37	1.30	1.37
	Final Water Content	(%)	45.2	42.9	32.5	34.0	33.8	33.0	37.3	34.7
	Swelling Strain	(%)	0.34	0.03	0.05	0.09	0.09	0.29	0.04	0.06
SHRINKAGE TEST	Initial Water Content	(%)	47.1	43.7	30.5	32.2	31.2	31.6	30.9	33.6
	Estimated Shrinkage Limit	(%)	21.2	12.8	10.0	10.6	9.1	10.9	10.1	15.5
	Shrinkage Strain	(%)	7.9	5.2	4.2	2.5	2.6	2.8	1.3	4.0
	Inert Material Estimate in the Soil Specimen	(%)	0	0	0	0	0	0	0	0
	Soil Crumbling During Shrinkage		Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Cracking of the Shrinkage Specimen		Moderate	Moderate	Moderate	Minor	Minor	Minor	Minor	Moderate
SHRINK - SWELL INDEX		**(%)**	**4.5**	**2.9**	**2.3**	**1.4**	**1.5**	**1.7**	**0.8**	**2.2**

Entered by: ST Date: 19/10/2016 Checked by: MP Date: 19/10/2016

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w. www.geotechnics.co.nz

Site: **Arran Point, Precinct 7, Stage 2, Millwater**

Your Job No: 21854.0037
Our Job No: 21854.0038

Test Method Used: **AS 1289.7.1.1 - 2003 Determination of the Shrink - Swell Index**

SUMMARY OF SHRINK - SWELL TEST RESULTS

Sample No.:			**S7A**	**S7B**	**S8A**	**S8B**	**S9A**	**S9B**
DEPTH		**(m)**	**0.4 - 0.6**	**0.9 - 1.1**	**0.4 - 0.6**	**0.9 - 1.1**	**0.4 - 0.6**	**0.9 - 1.1**
Applied Pressure		**(kPa)**	**55**	**55**	**55**	**55**	**55**	**55**
SWELL TEST	Initial Water Content	(%)	32.1	37.1	32.3	28.8	34.8	29.9
	Bulk Density	(t/m³)	1.85	1.80	1.84	1.86	1.84	1.84
	Dry Density	(t/m³)	1.40	1.31	1.39	1.44	1.36	1.42
	Final Water Content	(%)	34.3	39.1	34.3	30.7	36.7	31.5
	Swelling Strain	(%)	0.07	0.01	0.01	0.01	0.2	0.52
SHRINKAGE TEST	Initial Water Content	(%)	33.1	30.8	33.2	30.2	31.1	30.8
	Estimated Shrinkage Limit	(%)	10.9	11.3	9.0	9.6	11.8	12.4
	Shrinkage Strain	(%)	3.3	2.3	2.9	1.8	3.1	4.1
	Inert Material Estimate in the Soil Specimen	(%)	0	0	0	0	0	0
	Soil Crumbling During Shrinkage		Nil	Nil	Nil	Nil	Nil	Nil
	Cracking of the Shrinkage Specimen		Moderate	Minor	Minor	Minor	Moderate	Moderate
SHRINK - SWELL INDEX		**(%)**	**1.8**	**1.3**	**1.6**	**1.0**	**1.8**	**2.4**

Entered by: ST Date: 19/10/2016 Checked by: MP Date: 19/10/2016

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No:HA05
Hole Location: Refer to site plan

SHEET 1 OF 1

PROJECT: MillwaterAHP7-largelots	LOCATION: Arran Point	JOB No: 21854.0037
CO-ORDINATES:	DRILL TYPE: 50mm hand auger	HOLE STARTED: 28/1/16
	DRILL METHOD: HA	HOLE FINISHED: 28/1/16
R.L.:		DRILLED BY:
DATUM:	DRILL FLUID:	LOGGED BY: rbe CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
FILL						UTP			0.5				H				SILT, minor sand and gravel, some clay, friable, dry to moist, brown and yellowish brown
						119/70kPa							VSt				-yellowish brown and grey 0.5
						158/70kPa			1.0								clayey SILT, low plasticity, moist, light brownish white mottled yellowish brown
						120/44kPa											SILT, minor clay, non plastic, moist, yellowish brown and grey 1.0
RESIDUAL SOILS						100/25kPa			1.5		MS						sandy SILT, minor clay, low plasticity, moist, light yellowish brown 1.5
COMPLETELY WEATHERED ECBF						171/63kPa					ML						-moist to wet, orange brown to light grey
						87/19kPa			2.0		MS		St				SILT, non plastic, moist, grey 2.0
						70/16kPa			2.5				VSt				sandy SILT, non plastic, moist, grey
						138/44kPa					MC		St				-moist to wet 2.5
						89/22kPa			3.0		MS						clayey SILT, low plasticity, moist, grey
																	sandy SILT, non plastic, wet, grey 3.0
									4								**END OF BOREHOLE 3.1m (target depth)**

Hole dry on completion

T+T DATATEMPLATE.GDT rbe

Log Scale 1:17.5

BORELOG 616818.GPJ 28-Jan-2016

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No:HA06
Hole Location: Refer to site plan

SHEET 1 OF 1

PROJECT: MillwaterAHP7-largelots	LOCATION: Arran Point	JOB No: 21854.0037
CO-ORDINATES:	DRILL TYPE: 50mm hand auger	HOLE STARTED: 28/1/16
	DRILL METHOD: HA	HOLE FINISHED: 28/1/16
R.L.:		DRILLED BY:
DATUM:	DRILL FLUID:	LOGGED BY: rbe CHECKED:

GEOLOGICAL									ENGINEERING DESCRIPTION							
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 10 50 100 200	DEFECT SPACING (mm) 50 200 600 2000	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
FILL								0				H				SILT, some clay, low plasticity, moist, yellowish brown and brown
						● >221kPa										-yellowish brown and grey
								0.5								0.5
						● >221kPa										SILT, non plastic, moist, yellowish brown and grey
						● >221kPa		1.0								1.0
COMPLETELY WEATHERED ECBF										ML		VSt				SILT, non plastic, moist, grey
						● 155/32kPa				MS						sandy SILT, non plastic, moist, grey, minor layers of low plasticity clayey silt
						● 202/27kPa		1.5				Fb				1.5
						● >221kPa										
						● >221kPa		2.0								2.0
						● UTP										
								2.5								2.5
						● UTP										
						● UTP		3.0								3.0
																END OF BOREHOLE 3.1m (target depth)
								4								

Hole dry on completion

T+T DATATEMPLATE.GDT rbe

Log Scale 1:17.5

BORELOG 616818.GPJ 28-Jan-2016

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No:HA07
Hole Location: Refer to site plan

SHEET 1 OF 1

PROJECT: MillwaterAHP7-largelots	LOCATION: Arran Point	JOB No: 21854.0037
CO-ORDINATES:	DRILL TYPE: 50mm hand auger	HOLE STARTED: 28/1/16
	DRILL METHOD: HA	HOLE FINISHED: 28/1/16
R.L.:		DRILLED BY:
DATUM:	DRILL FLUID:	LOGGED BY: rbe CHECKED:

GEOLOGICAL									ENGINEERING DESCRIPTION								
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE / WEATHERING CONDITION	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (mm) 60 250 1000 2000	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
FILL						• UTP							H				SILT, friable, moist, yellowish brown and grey, minor gravel
						• >221kPa			0.5								SILT, some clay, low plasticity, moist, yellowish brown and grey 0.5
						• 149/51kPa			1.0				VSt				1.0
COMPLETELY WEATHERED ECBF						• 96/17kPa					MS		St				sandy SILT, non plastic, moist, grey
						• 128/44kPa			1.5				VSt				1.5
						• 93/22kPa					ML		St				SILT, some clay, low plasticity, moist, grey
						• 138/22kPa			2.0		MS		VSt				sandy SILT, non plastic, moist to wet, grey 2.0
						• >221kPa			2.5				H				2.5
		Hole dry on completion				• UTP											
						• UTP			3.0		MC						clayey SILT, low plasticity, moist, grey 3.0
									4								END OF BOREHOLE 3.1m (target depth)

T+T DATATEMPLATE.GDT rbe

Log Scale 1:17.5

BORELOG 616818.GPJ 28-Jan-2016

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No:HA08
Hole Location: Refer to site plan

SHEET 1 OF 1

PROJECT: MillwaterAHP7-largelots	LOCATION: Arran Point	JOB No: 21854.0037
CO-ORDINATES:	DRILL TYPE: 50mm hand auger	HOLE STARTED: 28/1/16
	DRILL METHOD: HA	HOLE FINISHED: 28/1/16
R.L.:		DRILLED BY:
DATUM:	DRILL FLUID:	LOGGED BY: rbe CHECKED:

GEOLOGICAL									ENGINEERING DESCRIPTION							
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 20 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 10 50 100 250	DEFECT SPACING (mm) 60 200 600 2000	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
FILL						138/70kPa			0.5				VSt				SILT, some clay, low plasticity, moist, yellowish brown mottled light brown
						>221kPa											clayey SILT, low plasticity, moist, yellowish brown and light brown
						>221kPa			1.0				H				SILT, non plastic, moist, yellowish brown and grey
						190/84kPa							VSt				
COMPLETELY WEATHERED ECBF						114/25kPa			1.5								SILT, non plastic, moist, grey mottled yellowishbrown
						150/35kPa			2.0								
						149/28kPa							H				-minor clay
						220/38kPa			2.5								SILT, non plastic, moist, grey
						209/40kPa											sandy SILT, non plastic, moist, grey
						>221kPa			3.0								
									4								END OF BOREHOLE 3.1m (target depth)

Hole dry on completion

T+T DATATEMPLATE.GDT rbe

Log Scale 1:17.5

BORELOG 616818.GPJ 28-Jan-2016

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No:HA09
Hole Location: Refer to site plan

SHEET 1 OF 1

PROJECT: MillwaterAHP7-largelots	LOCATION: Arran Point	JOB No: 21854.0037
CO-ORDINATES:	DRILL TYPE: 50mm hand auger	HOLE STARTED: 28/1/16
	DRILL METHOD: HA	HOLE FINISHED: 28/1/16
R.L.:		DRILLED BY:
DATUM:	DRILL FLUID:	LOGGED BY: rbe CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.

FLUID LOSS | WATER | CORE RECOVERY (%) | METHOD | CASING | TESTS | SAMPLES | R.L. (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MOISTURE CONDITION / WEATHERING | STRENGTH/DENSITY CLASSIFICATION | SHEAR STRENGTH (kPa) | COMPRESSIVE STRENGTH (MPa) | DEFECT SPACING (mm)

SOIL DESCRIPTION
Soil type, minor components, plasticity or particle size, colour.

ROCK DESCRIPTION
Substance: Rock type, particle size, colour, minor components.
Defects: Type, inclination, thickness, roughness, filling.

DEPTH (m)	TESTS	CLASSIFICATION SYMBOL	STRENGTH/DENSITY CLASSIFICATION	FLUID LOSS	WATER	DESCRIPTION
RESIDUAL SOILS						
0.0	112/59kPa	MC	VSt			clayey SILT, medium plasticity, moist, yellowish brown and light whitish grey
0.5	101/51kPa					
1.0	100/41kPa		F			
	43/13kPa		St			
1.5	84/35kPa					
	76/28kPa					
2.0	51/17kPa					
	51/16kPa		F			
2.5	44/16kPa			Hole dry on completion		
3.0	33/14kPa					
4						END OF BOREHOLE 3.2m (target depth)

T+T DATATEMPLATE.GDT rbe

Log Scale 1:17.5

BORELOG 616818.GPJ 28-Jan-2016

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No:HA10
Hole Location: Refer to site plan

SHEET 1 OF 1

PROJECT: MillwaterAHP7-largelots | LOCATION: Arran Point | JOB No: 21854.0037

CO-ORDINATES:

R.L.:

DATUM:

DRILL TYPE: 50mm hand auger

DRILL METHOD: HA

DRILL FLUID:

HOLE STARTED: 28/1/16

HOLE FINISHED: 28/1/16

DRILLED BY:

LOGGED BY: rbe CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.

FLUID LOSS | WATER | CORE RECOVERY (%) | METHOD | CASING | TESTS | SAMPLES | R.L. (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MOISTURE CONDITION / WEATHERING | STRENGTH/DENSITY CLASSIFICATION | SHEAR STRENGTH (kPa) | COMPRESSIVE STRENGTH (MPa) | DEFECT SPACING (mm)

SOIL DESCRIPTION
Soil type, minor components, plasticity or particle size, colour.

ROCK DESCRIPTION
Substance: Rock type, particle size, colour, minor components.
Defects: Type, inclination, thickness, roughness, filling.

FILL									0							SILT, friable, dry to moist, light brown and yellowish brown
					>221kPa											
									0.5							0.5
RESIDUAL SOILS					70/35kPa					MC						clayey SILT, low plasticity, moist, light brownish white mottled yellowish brown -light greyish white mottled yellowish brown
					82/38kPa				1.0	ML						SILT, some clay, low plasticity, moist, orange brown and light greyish white
																1.0
					60/25kPa					ML						SILT, trace sand, non plastic, moist, light greyish white
					60/25kPa				1.5	MC						1.5 clayey SILT, low plasticity, moist, light greyish white mottled orange brown
					59/27kPa											
									2.0							2.0
					62/17kPa					ML						SILT, some clay, minor sand, low to no plasticity, wet, orange brown
					84/38kPa				2.5	MC						clayey SILT, medium plasticity, moist, light greyish white mottled yellowish orange brown 2.5
					104/49kPa					MCS						clayey SILT, sandy, low plasticity, moist, light greyish white; light brownish white mottled yellowish brown from 3m
					101/36kPa				3.0							3.0
									4							END OF BOREHOLE 3.1m (target depth)

Hole dry on completion

T+T DATATEMPLATE.GDT rbe

Log Scale 1:17.5

BORELOG 616818.GPJ 28-Jan-2016

Tonkin+Taylor

HAND AUGER LOG

HOLE Id: **HA1**

SHEET: 1 OF 1

PROJECT: MILLWATERAHP7	LOCATION: Arran's Point - P7 S2	JOB No.: 0021854.0037_S2
CO-ORDINATES: (NZTM 2000)	DRILL TYPE: 50mm hand auger	HOLE STARTED: 10/11/2016
	DRILL METHOD: HA	HOLE FINISHED: 10/11/2016
R.L.:		DRILLED BY: TAJ
DATUM:	DRILL FLUID:	LOGGED BY: TAJ CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 2 4 6 8 10 12 14 16 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Obserbvations
Topsoil								0	TS				0.0m: Topsoil.
Fill					>214 kPa			0.5		M	H		0.2m: sandy SILT; yellowish brown mottled grey. Hard, moist, low to moderate plasticity.
					>214 kPa			1.0					
					>214 kPa								
Weathered East Coast Bays Formation					>214 kPa			1.5					1.2m: clayey SILT; yellowish brown mottled grey. Hard, moist, moderate plasticity.
					>214 kPa								1.8m: grey with yellow brown mottles.
					>214 kPa			2.0					
					>214 kPa			2.5					
					>214 kPa								
					>214 kPa			3.0					3m: END OF BOREHOLE
								3.5					
								4.0					
								4.5					

COMMENTS:

Hole Depth 3m

Scale 1:25

Tonkin+Taylor

HAND AUGER LOG

HOLE Id: **HA2**

SHEET: 1 OF 1

PROJECT: MILLWATERAHP7	LOCATION: Arran's Point - P7 S2	JOB No.: 0021854.0037_S2
CO-ORDINATES: (NZTM 2000)	DRILL TYPE: 50mm hand auger	HOLE STARTED: 10/11/2016
	DRILL METHOD: HA	HOLE FINISHED: 10/11/2016
R.L.:		DRILLED BY: TAJ
DATUM:	DRILL FLUID:	LOGGED BY: TAJ CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 2 4 6 8 10 12 14 16 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
Topsoil								0	TS				0.0m: Topsoil.
Fill					>214 kPa			0.5		M	H		0.2m: sandy SILT; yellow brown mottled grey. Hard, moist, low to moderate plasticity.
					>214 kPa			1.0					
					>214 kPa								
					>214 kPa			1.5					
					>214 kPa								1.5m: clayey SILT; yellowish brown mottled grey. Hard, moist, moderate plasticity.
Weathered East Coast Bays Formation					>214 kPa			2.0					1.7m: grey with yellow brown mottles.
					>214 kPa								
					>214 kPa			2.5					
					>214 kPa								
					>214 kPa			3.0					3m: END OF BOREHOLE
								3.5					
								4.0					
								4.5					

COMMENTS:

Hole Depth 3m

Scale 1:25

Tonkin+Taylor

HAND AUGER LOG

HOLE Id: **HA3**

SHEET: 1 OF 1

PROJECT: MILLWATERAHP7	LOCATION: Arran's Point - P7 S2	JOB No.: 0021854.0037_S2
CO-ORDINATES: (NZTM 2000)	DRILL TYPE: 50mm hand auger	HOLE STARTED: 20/10/2016
		HOLE FINISHED: 20/10/2016
R.L.:	DRILL METHOD: HA	DRILLED BY: TAJ/LG
DATUM:	DRILL FLUID:	LOGGED BY: TAJ/SREI CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 2 4 6 8 10 12 14 16 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Obserbvations
Topsoil								0.0	TS				0.0m: Topsoil.
Weathered East Coast Bays Formation					214/- kPa					D-M	VSt-H		0.2m: sandy SILT; yellowish brown with grey mottling. Very stiff to hard, dry to moist, low plasticity.
					183/113 kPa			0.5		M			0.5m: light yellowish brown. Moist.
					179/113 kPa								
					189/113 kPa			1.0			VSt-H		Clayey SILT; yellowish brown with grey mottling. Very stiff to hard, moist, low plasticity.
					165/101 kPa			1.5					
					137/107 kPa						St		Clayey SILT; yellowish brown and grey. Stiff, moist, moderate plasticity.
					137/92 kPa			2.0					
					137/98 kPa			2.5					
					144/95 kPa								
					134/89 kPa			3.0					3m: END OF BOREHOLE
								3.5					
								4.0					
								4.5					

COMMENTS:

Hole Depth 3m

Scale 1:25

Tonkin+Taylor

HAND AUGER LOG

HOLE Id: **HA4**

SHEET: 1 OF 1

PROJECT: MILLWATERAHP7	LOCATION: Arran's Point - P7 S2	JOB No.: 0021854.0037_S2
CO-ORDINATES: (NZTM 2000)	DRILL TYPE: 50mm hand auger	HOLE STARTED: 26/10/2016
	DRILL METHOD: HA	HOLE FINISHED: 26/10/2016
R.L.:		DRILLED BY: TAJ/LG
DATUM:	DRILL FLUID:	LOGGED BY: TAJ/LG CHECKED:

GEOLOGICAL									ENGINEERING DESCRIPTION				
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 2 4 6 8 10 12 14 16 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Obserbvations
Topsoil								0	TS				TOPSOIL.
Weathered East Coast Bays Formation					● >214 kPa ● >214 kPa ● >214 kPa ● >214 kPa ● 175/107 kPa ● 168/128 kPa ● 198/146 kPa ● 165/119 kPa ● 162/134 kPa ● 198/156 kPa			0.5 1.0 1.5 2.0 2.5 3.0		M	VSt		Sandy SILT; yellowish brown with grey mottles. Very stiff, moist, low plasticity. - increasing plasticity.
								3.5 4.0 4.5					3m: END OF BOREHOLE

COMMENTS:

Hole Depth 3m

Scale 1:25

Tonkin+Taylor

HAND AUGER LOG

HOLE Id: **HA5**

SHEET: 1 OF 1

PROJECT: MILLWATERAHP7	LOCATION: Arran's Point - P7 S2	JOB No.: 0021854.0037_S2
CO-ORDINATES: (NZTM 2000)	DRILL TYPE: 50mm hand auger	HOLE STARTED: 26/10/2016
	DRILL METHOD: HA	HOLE FINISHED: 26/10/2016
R.L.:		DRILLED BY: TAJ/LG
DATUM:	DRILL FLUID:	LOGGED BY: TAJ/LG CHECKED:

GEOLOGICAL									ENGINEERING DESCRIPTION				
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 2 4 6 8 10 12 14 16 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
Topsoil								0	TS				TOPSOIL.
Weathered East Coast Bays Formation					● 198/86 kPa ● UTP ● UTP ● UTP ● UTP ● UTP ● UTP ● 183/110 kPa ● UTP ● UTP			0.5 1.0 1.5 2.0 2.5		M	VSt		Sandy SILT; yellow brown, grey mottles. Very stiff, moist, low plasticity. 1.5m: becomes moderate plasticity. Clayey SILT; yellow brown, grey mottles. Very stiff, moist, low plasticity.
								3.0 3.5 4.0 4.5					3m: END OF BOREHOLE

COMMENTS:

Hole Depth 3m

Scale 1:25

Tonkin+Taylor

HAND AUGER LOG

HOLE Id: **HA6**

SHEET: 1 OF 1

PROJECT: MILLWATERAHP7	LOCATION: Arran's Point - P7 S2	JOB No.: 0021854.0037_S2
CO-ORDINATES: (NZTM 2000)	DRILL TYPE: 50mm hand auger	HOLE STARTED: 20/10/2016
	DRILL METHOD: HA	HOLE FINISHED: 20/10/2016
R.L.:		DRILLED BY: TA/SREI
DATUM:	DRILL FLUID:	LOGGED BY: TAJ/SREI CHECKED:

GEOLOGICAL											ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 2 4 6 8 10 12 14 16 18	TESTS	SAMPLES	RL (m) / DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Obserbvations
Fill					● >214 kPa ● >214 kPa ● >214 kPa ● >214 kPa ● >214 kPa ● >214 kPa ● >214 kPa ● >214 kPa		0.5 1.0 1.5 2.0 2.5		M	VSt		Sandy SILT; yellowish brown, grey mottles. Very stiff, moist, low plasticity. 0.6m: with pink mottles. As above, but more clayey SILT. 1.3m: becomes sandy SILT, with pink mottling. Dry to moist.
							3.0 3.5 4.0 4.5		D-M			2.7m: END OF BOREHOLE

COMMENTS:

Hole Depth 2.7m

Scale 1:25

Tonkin+Taylor

HAND AUGER LOG

HOLE Id: **HA7**

SHEET: 1 OF 1

PROJECT: MILLWATERAHP7	LOCATION: Arran's Point - P7 S2	JOB No.: 0021854.0037_S2
CO-ORDINATES: (NZTM 2000)	DRILL TYPE: 50mm hand auger	HOLE STARTED: 20/10/2016
		HOLE FINISHED: 20/10/2016
R.L.:	DRILL METHOD: HA	DRILLED BY: TA/SREI
DATUM:	DRILL FLUID:	LOGGED BY: TAJ/SREI CHECKED:

GEOLOGICAL									ENGINEERING DESCRIPTION				
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 2 4 6 8 10 12 14 16 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Obserbvations
Topsoil								0	TS				TOPSOIL.
Fill					>214 kPa			0.5		M	VSt		Clayey SILT, traces of sand; grey and yellow and pink mottling. Very stiff, moist, moderate plasticity.
					>214 kPa			1.0					Sandy SILT; grey, yellow brown mottles. Very stiff, moist, low plasticity.
					>214 kPa			1.5					Sandy SILT; yellow brown, with grey mottling. Very stiff, moist, low to moderate plasticity.
					>214 kPa			2.0					
					>214 kPa			2.5					Sandy SILT; yellowish brown with grey mottling. Very stiff, moist, low plasticity.
					>214 kPa			3.0					3m: END OF BOREHOLE
								3.5					
								4.0					
								4.5					

COMMENTS:

Hole Depth 3m

Scale 1:25

Tonkin+Taylor

HAND AUGER LOG

HOLE Id: **HA8**

SHEET: 1 OF 1

PROJECT: MILLWATERAHP7	LOCATION: Arran's Point - P7 S2	JOB No.: 0021854.0037_S2
CO-ORDINATES: (NZTM 2000)	DRILL TYPE: 50mm hand auger	HOLE STARTED: 20/10/2016
	DRILL METHOD: HA	HOLE FINISHED: 20/10/2016
R.L.:		DRILLED BY: TA/SREI
DATUM:	DRILL FLUID:	LOGGED BY: TAJ/SREI CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 2 4 6 8 10 12 14 16 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Obserbvations
Topsoil								0	TS				TOPSOIL.
Fill					>214 kPa			0.5		M	VSt		Clayey SILT, with sand; yellow brown, with grey mottles. Very stiff, moist, low plasticity.
					>214 kPa			1.0					0.7m: dry to moist.
					>214 kPa			1.5					1.1m: no grey mottles, moist.
					>214 kPa			2.0					Clayey SILT, with minor sand; grey and pink mottling. Very stiff.
					>214 kPa			2.5					
					>214 kPa			3.0		D-M / M			3m: END OF BOREHOLE
					>214 kPa			3.5					
					>214 kPa			4.0					
					>214 kPa			4.5					

COMMENTS:

Hole Depth 3m

Scale 1:25

Tonkin+Taylor

HAND AUGER LOG

HOLE Id: **HA9**

SHEET: 1 OF 1

PROJECT: MILLWATERAHP7	LOCATION: Arran's Point - P7 S2	JOB No.: 0021854.0037_S2
CO-ORDINATES: (NZTM 2000)	DRILL TYPE: 50mm hand auger	HOLE STARTED: 20/09/2016
	DRILL METHOD: HA	HOLE FINISHED: 20/09/2016
R.L.:		DRILLED BY: TRJM
DATUM:	DRILL FLUID:	LOGGED BY: TRJM CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 2 4 6 8 10 12 14 16 18	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Obserbvations
Topsoil								0	TS				0.0m: Topsoil.
Fill					● >214 kPa			0.5		D-M	H		0.3m: clayey SILT; light yellowish brown mottled light grey. Hard, dry to moist, low to non-plastic.
					● >214 kPa					D			0.7m: SILT with some clay; light yellowish brown mottled light grey. Hard, dry, non-plastic.
					● >214 kPa			1.0		D-M			0.8m: clayey SILT; light brown mottled yellowish brown and grey. Hard, dry to moist, low to non-plastic.
					● UTP								1.2m: dry, non-plastic.
					● >214 kPa			1.5					1.5m: dry to moist, low to non-plastic.
					● UTP					D			1.8m: SILT with minor clay; light brown mottled yellowish brown and grey. Hard, dry, non-plastic.
								2.0					1.9m: Refusal
								2.5					
								3.0					
								3.5					
								4.0					
								4.5					

COMMENTS:

Hole Depth 1.9m

Scale 1:25

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job # 614089.032/1**

T&T Job #: 21854.0037 **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-021/1	2659977.532	6510634.072	25.051	Bulk Earthworks	YA	30/09/2014	1.81	1.35	34.4	2.7	3.6	150	140	178	154	156		P	
							1.82	1.36	34.4	2.7	3.5								
S14-021/2	2659980.806	6510597.003	24.203	Bulk Earthworks	YA	30/09/2014	1.79	1.32	35.5	2.7	4.4	133	137	150	171	148		P	
							1.78	1.31	35.5	2.7	4.7								
S14-021/3	2659982.342	6510566.312	23.837	Bulk Earthworks	YA	30/09/2014	1.79	1.35	32.8	2.7	5.8	154	157	140	150	150		P	
							1.79	1.35	32.8	2.7	5.9								
S14-022	-	-	-	Bulk Earthworks	YA	1/10/2014	-	-	-	-	-	137	140	133	154	141		P	
							-	-	-	-	-								
	-	-	-	Bulk Earthworks	YA	1/10/2014	-	-	-	-	-	150	137	154	130	143		P	
							-	-	-	-	-								
	-	-	-	Bulk Earthworks	YA	1/10/2014	-	-	-	-	-	161	154	157	154	157		P	
							-	-	-	-	-								
S14-025/1	2659983.9	6510558.757	24.28	Bulk Earthworks	YA	2/10/2014	1.76	1.29	36.3	2.7	5.4	127	137	154	157	144		P	
							1.76	1.29	36.3	2.7	5.6								
S14-025/2	2659984.222	6510588.862	24.47	Bulk Earthworks	YA	2/10/2014	1.78	1.30	36.2	2.7	4.5	130	147	154	161	148		P	
							1.77	1.30	36.2	2.7	5.1								
S14-025/3	2659981.243	6510610.096	26.369	Bulk Earthworks	YA	2/10/2014	1.74	1.29	35.5	2.7	6.6	133	140	154	161	147		P	
							1.75	1.29	35.5	2.7	6.5								
S14-026	-	-	-	Bulk Earthworks	YA	3/10/2014	-	-	-	-	-	140	150	150	160	150		P	
							-	-	-	-	-								
S14-044/1	2659981.814	6510603.425	26.661	Bulk Earthworks	YA	10/10/2014	1.75	1.26	38.9	2.7	4.1	154	154	171	188	167		P	
							1.75	1.28	38.9	2.7	4.2								
S14-044/2	2659986.544	6510580.69	27.417	Bulk Earthworks	YA	10/10/2014	1.76	1.27	38.8	2.7	3.9	137	154	171	188	163		P	
							1.76	1.27	38.8	2.7	3.8								
S14-044/3	2659983.738	6510556.36	26.898	Bulk Earthworks	YA	10/10/2014	1.75	1.28	36.5	2.7	5.6	137	144	154	168	151		P	
							1.76	1.29	36.5	2.7	5.2								
S14-108/1	2660295.59	6510675.844	23.218	Bulk Earthworks	YA	24/11/2014	1.79	1.33	34.7	2.7	4.5	137	154	171	205	167		P	
							1.79	1.33	34.7	2.7	4.9								
S14-108/2	2660345.365	6510688.878	20.063	Bulk Earthworks	YA	24/11/2014	1.80	1.35	33.0	2.7	5.4	171	154	188	205	180		P	
							1.79	1.35	33.0	2.7	5.7								
S14-110/1	2660326.499	6510684.049	22.943	Bulk Earthworks	YA	25/11/2014	1.76	1.29	37.0	2.7	4.8	120	137	154	171	146		P	
							1.75	1.28	37.0	2.7	5.3								
S14-110/2	2660368.287	6510692.239	24.151	Bulk Earthworks	YA	25/11/2014	1.74	1.25	39.5	2.7	4.6	120	137	154	171	146		P	
							1.76	1.26	39.5	2.7	3.7								
S14-113/1	2660315.478	6510678.445	23.786	Bulk Earthworks	HA	26/11/2014	1.83	1.38	32.9	2.7	4.4	137	154	154	205	163		P	
							1.83	1.39	32.9	2.7	4.3								
S14-113/2	2660352.932	6510688.494	23.057	Bulk Earthworks	HA	26/11/2014	1.83	1.33	37.3	2.7	1.2	133	137	137	154	140		P	
							1.83	1.33	37.3	2.7	1.0								
S14-113/3	2660411.639	6510700.074	20.153	Bulk Earthworks	HA	26/11/2014	1.88	1.44	31.2	2.7	2.1	120	128	150	171	142		P	
							1.88	1.44	31.2	2.7	2.0								
S14-117/1	2660320.848	6510681.609	23.688	Bulk Earthworks	YA	27/11/2014	1.73	1.20	43.9	2.7	2.7	123	144	140	171	145		P	
							1.73	1.20	43.9	2.7	2.6								
S14-117/2	2660359.563	6510689.249	23.46	Bulk Earthworks	YA	27/11/2014	1.74	1.12	54.7	2.7	0.0	137	144	154	171	152		P	
							1.72	1.11	54.7	2.7	0.0								
S14-117/3	-	-	-	Bulk Earthworks	YA	27/11/2014	-	-	-	-	-	120	137	144	171	143		P	
							-	-	-	-	-								
S14-121/1	2660303.673	6510674.832	24.087	Bulk Earthworks	HA	1/12/2014	1.79	1.23	44.9	2.7	0.0	120	137	171	171	150		P	
							1.79	1.23	44.9	2.7	0.0								
S14-121/2	2660356.9	6510681.931	25.677	Bulk Earthworks	HA	1/12/2014	1.77	1.31	34.8	2.7	5.8	154	154	171	205	171		P	
							1.76	1.31	34.8	2.7	6.2								
S14-126/1	2660454.618	6510709.441	17.608	Bulk Earthworks	YA	2/12/2014	1.64	1.14	44.4	2.7	7.4	133	137	144	154	142		P	
							1.64	1.14	44.4	2.7	7.4								
S14-126/2	2660436.875	6510712.405	19.163	Bulk Earthworks	YA	2/12/2014	1.64	1.18	39.7	2.7	9.8	133	137	140	154	141		P	
							1.65	1.18	39.7	2.7	9.6								
S14-129	2660426.333	6510693.222	21.743	Bulk Earthworks	HA	2/12/2014	-	-	-	-	-	120	140	160	188	152		P	
							-	-	-	-	-								
S14-132/1	2660418.022	6510692.992	21.265	Bulk Earthworks	HA	3/12/2014	1.80	1.29	38.8	2.7	1.8	137	154	120	171	146		P	
							1.80	1.29	38.8	2.7	1.8								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job # 614089.032/1**

T&T Job #: 21854.0037 **Entered By: YA**

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode
NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-132/2	2660430.436	6510699.124	20.111	Bulk Earthworks	HA	3/12/2014	-	-	-	-	-	103	111	120	137	118		F	
							-	-	-	-	-								
S14-132/3	2659799.55	6508448.984	28.163	Bulk Earthworks	HA	3/12/2014	1.80	1.31	37.8	2.7	2.2	137	120	154	150	140		P	
							1.81	1.31	37.8	2.7	1.8								
S14-133/1	2660348.865	6510678.549	24.784	Bulk Earthworks	HA	3/12/2014	-	-	-	-	-	120	140	180	205	161		P	
							-	-	-	-	-								
S14-133/2	2660434.527	6510700.347	19.763	Bulk Earthworks	HA	3/12/2014	-	-	-	-	-	137	140	180	205	166	Y	P	Retest of URN S14-132/2
							-	-	-	-	-								
S14-135	-	-	-	Shear Key	YA	4/12/2014	-	-	-	-	-	100	110	120	140	118		F	
							-	-	-	-	-								
S14-136/1	2660431.613	6510707.05	22.207	Bulk Earthworks	YA	4/12/2014	1.82	1.34	35.6	2.7	2.6	137	154	171	188	163		P	
							1.82	1.34	35.6	2.7	2.6								
S14-136/2	2660452.276	6510697.438	18.352	Bulk Earthworks	YA	4/12/2014	1.87	1.43	30.9	2.7	2.8	137	154	171	188	163		P	
							1.89	1.45	30.9	2.7	1.8								
S14-138/1	2660336.172	6510536.081	12.726	Shear Key	HA	4/12/2014	1.79	1.30	37.7	2.7	2.6	171	180	205	154	178		P	
							1.82	1.32	37.7	2.7	1.2								
S14-138/2	2660325.847	6510539.432	10.922	Shear Key	HA	4/12/2014	-	-	-	-	-	111	120	103	140	119		F	
							-	-	-	-	-								
S14-139	2660406.673	6510691.259	22.405	Bulk Earthworks	HA	4/12/2014	-	-	-	-	-	137	160	180	205	171		P	
							-	-	-	-	-								
S14-141	-	-	-	Shear Key	YA	4/12/2014	-	-	-	-	-	120	135	155	171	145	Y	P	Material not meeting spec but as it is Lime stabilized A Linton agreed that these results can pass with the assumption that the strength will increase over time. Retest of URN S14-138/2
							-	-	-	-	-								
S14-142/1	2660335.864	6510536.489	8.101	Shear Key	HA	5/12/2014	1.80	1.30	38.2	2.7	2.1	154	137	162	197	163		P	
							1.80	1.30	38.2	2.7	2.0								
S14-142/2	2660325.788	6510542.289	7.951	Shear Key	HA	5/12/2014	1.81	1.33	36.5	2.7	2.3	162	171	137	162	158		P	
							1.80	1.32	36.5	2.7	2.9								
S14-143/1	2660442.067	6510706.87	24.007	Bulk Earthworks	HA	5/12/2014	1.89	1.42	33.0	2.7	0.3	137	154	205	205	175		P	
							1.90	1.42	33.0	2.7	0.2								
S14-143/2	2660363.194	6510688.504	26.771	Bulk Earthworks	HA	5/12/2014	1.85	1.34	37.8	2.7	0.0	137	154	188	205	171		P	
							1.86	1.35	37.8	2.7	0.0								
S14-145/1	2660325.91	6510543.131	11.6	Shear Key	HA	5/12/2014	1.79	1.30	37.3	2.7	3.4	137	137	205	188	167		P	
							1.80	1.31	37.3	2.7	2.8								
S14-145/2	2660335.918	6510540.439	12.306	Shear Key	HA	5/12/2014	1.71	1.25	37.0	2.7	7.7	145	205	188	171	177		P	
							1.71	1.25	37.0	2.7	7.7								
S14-146	2660335.52	6510679.66	24.917	Bulk Earthworks	HA	5/12/2014	-	-	-	-	-	145	160	170	188	166		P	
							-	-	-	-	-								
S14-148/1	2660322.412	6510544.995	16.033	Shear Key	YA	6/12/2014	1.73	1.26	37.5	2.7	6.2	137	144	154	171	152		P	
							1.79	1.30	37.5	2.7	2.9								
S14-148/2	2660332.127	6510539.332	15.389	Shear Key	YA	6/12/2014	1.78	1.30	36.5	2.7	4.4	140	137	154	137	142		P	
							1.78	1.30	36.5	2.7	4.1								
S14-149	-	-	-	Bulk Earthworks	YA	6/12/2014	-	-	-	-	-	140	160	180	200	170		P	
							-	-	-	-	-								
S14-152/1	2660316.673	6510543.682	16.068	Shear Key	HA	8/12/2014	1.84	1.32	38.5	2.7	0.0	188	205	171	188	188		P	
							1.84	1.33	38.5	2.7	0.0								
S14-152/2	2660333.843	6510537.812	16.27	Shear Key	HA	8/12/2014	1.81	1.31	37.7	2.7	1.8	137	188	145	205	169		P	
							1.80	1.31	37.7	2.7	2.1								
S14-153/1	2660394.239	6510659.087	25.417	Bulk Earthworks	HA	8/12/2014	1.85	1.40	32.0	2.7	3.1	145	154	145	188	158		P	
							1.85	1.40	32.0	2.7	3.0								
S14-153/2	2660401.191	6510688.662	24.309	Bulk Earthworks	HA	8/12/2014	1.86	1.42	30.8	2.7	3.6	137	154	188	188	167		P	
							1.86	1.42	30.8	2.7	3.6								
S14-153/3	2660436.036	6510692.06	21.158	Bulk Earthworks	HA	8/12/2014	1.82	1.32	37.2	2.7	1.7	188	154	154	188	171		P	
							1.81	1.32	37.2	2.7	2.1								

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T&T Job #: 21854.0037 **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-155/1	2660325.765	6510543.647	15.863	Shear Key	HA	8/12/2014	1.86	1.36	36.3	2.7	0.0	154	188	188	205	184		P	
							1.84	1.36	36.3	2.7	0.8								
S14-155/2	2660329.848	6510532.968	14.945	Shear Key	HA	8/12/2014	1.80	1.31	37.9	2.7	2.2	137	137	188	205	167		P	
							1.80	1.30	37.9	2.7	2.5								
S14-156	-	-	-	Bulk Earthworks	HA	8/12/2014	-	-	-	-	-	154	175	195	205	182		P	
							-	-	-	-	-								
S14-158	2660329.742	6510545.648	17.563	Shear Key	HA	9/12/2014	-	-	-	-	-	137	155	175	205	168		P	
							-	-	-	-	-								
S14-159	-	-	-	Bulk Earthworks	HA	9/12/2014	-	-	-	-	-	120	150	170	205	161		P	
							-	-	-	-	-								
S14-162/1	2660327.576	6510535.627	15.903	Shear Key	HA	9/12/2014	1.87	1.38	34.8	2.7	0.6	188	154	154	171	167		P	
							1.86	1.38	34.8	2.7	0.8								
S14-162/2	2660348.096	6510527.459	13.29	Shear Key	HA	9/12/2014	1.74	1.29	34.9	2.7	7.1	188	188	205	137	180		P	
							1.75	1.29	34.9	2.7	6.9								
S14-163/1	2660404.052	6510658.774	26.475	Bulk Earthworks	HA	9/12/2014	1.84	1.36	35.3	2.7	1.8	154	154	188	205	175		P	
							1.83	1.36	35.3	2.7	1.9								
S14-163/2	2660387.846	6510657.062	27.268	Bulk Earthworks	HA	9/12/2014	1.83	1.41	30.0	2.7	5.5	205	205	205	197	203		P	
							1.83	1.41	30.0	2.7	5.4								
S14-166/1	2660337.428	6510537.993	15.332	Shear Key	HA	10/12/2014	1.85	1.36	35.9	2.7	0.7	145	205	180	188	180		P	
							1.84	1.36	35.9	2.7	1.1								
S14-166/2	2660372.846	6510530.481	14.915	Shear Key	HA	10/12/2014	1.84	1.34	37.0	2.7	0.8	188	137	188	205	180		P	
							1.84	1.34	37.0	2.7	0.8								
S14-167/1	2660354	6510676.675	26.081	Bulk Earthworks	HA	10/12/2014	1.90	1.45	30.3	2.7	2.1	205	UTP	205	UTP	205		P	
							1.89	1.45	30.3	2.7	2.6								
S14-167/2	2660373.112	6510678.516	25.263	Bulk Earthworks	HA	10/12/2014	1.84	1.37	33.8	2.7	2.9	154	188	171	UTP	171		P	
							1.84	1.37	33.8	2.7	2.9								
S14-169/1	2660336.754	6510543.226	14.887	Shear Key	HA	10/12/2014	1.83	1.34	36.4	2.7	1.6	120	137	205	154	154		P	
							1.83	1.34	36.4	2.7	1.7								
S14-169/2	2660362.186	6510533.142	14.796	Shear Key	HA	10/12/2014	1.78	1.27	40.3	2.7	2.0	137	154	154	205	163		P	
							1.78	1.27	40.3	2.7	2.0								
S14-170	2660365.726	6510682.667	24.693	Bulk Earthworks	HA	10/12/2014	-	-	-	-	-	137	155	175	205	168		P	
							-	-	-	-	-								
S14-174/1	2660350.436	6510538.277	16.358	Shear Key	HA	11/12/2014	1.83	1.36	34.9	2.7	2.5	162	154	188	205	177		P	
							1.82	1.35	34.9	2.7	2.7								
S14-174/2	2660368.142	6510537.797	15.127	Shear Key	HA	11/12/2014	1.83	1.29	41.6	2.7	0.0	154	162	188	188	173		P	
							1.83	1.29	41.6	2.7	0.0								
S14-175/1	2660410.857	6510689.568	24.148	Bulk Earthworks	HA	11/12/2014	1.89	1.42	32.7	2.7	0.9	154	171	180	188	173		P	
							1.88	1.42	32.7	2.7	1.2								
S14-175/2	2660436.387	6510693.523	22.17	Bulk Earthworks	HA	11/12/2014	1.78	1.30	36.6	2.7	4.0	137	120	UTP	205	154		P	
							1.78	1.31	36.6	2.7	3.8								
S14-178/1	2660353.361	6510543.091	15.995	Shear Key	HA	11/12/2014	1.82	1.31	38.9	2.7	0.6	120	111	111	154	124		P	Material not meeting spec but as it is Lime stabilized A Linton agreed that these results can pass with the assumption that the strength will increase over time.
							1.82	1.31	38.9	2.7	0.3								
S14-178/2	2660336.648	6510546.599	17.002	Shear Key	HA	11/12/2014	1.80	1.30	38.6	2.7	1.9	103	145	116	120	121		P	
							1.79	1.29	38.6	2.7	2.3								
S14-179	-	-	-	Bulk Earthworks	HA	11/12/2014	-	-	-	-	-	137	155	175	188	164		P	
							-	-	-	-	-								
S14-183	2660356.867	6510547.889	17.873	Shear Key	HA	12/12/2014	-	-	-	-	-	120	160	180	205	166		P	
							-	-	-	-	-								
S14-184	2660404.508	6510693.242	23.708	Bulk Earthworks	HA	12/12/2014	-	-	-	-	-	137	160	180	205	171		P	
							-	-	-	-	-								
S14-185	2660356.866	6510547.744	17.727	Shear Key	HA	12/12/2014	-	-	-	-	-	103	140	180	205	157		P	
							-	-	-	-	-								
S14-186/1	2660380.15	6510541.396	17.22	Shear Key	YA	13/12/2014	1.79			2.7		109	127	137	154	132		P	
							1.79			2.7									
S14-186/2	2660394.133	6510540.959	16.655	Shear Key	YA	13/12/2014	1.79			2.7		109	127	137	154	132		P	
							1.78			2.7									
S14-187	2660320.933	6510664.276	27.333	Bulk Earthworks	YA	13/12/2014	-	-	-	-	-	150	170	190	205	179		P	
							-	-	-	-	-								

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T&T Job #: 21854.0037 **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-195	2660348.265	6510533.371	17.219	Bulk Earthworks	HA	16/12/2014	1.78	1.30	36.9	2.7	3.8	137	137	188	205	167		P	
							1.79	1.31	36.9	2.7	3.2								
S14-200/1	2660407.545	6510556.264	15.752	Shear Key	HA	20/12/2014	1.77	1.31	35.6	2.7	5.2	188	205	154	137	171		P	
							1.78	1.31	35.6	2.7	4.6								
S14-200/2	2660387.761	6510552.955	16.909	Shear Key	HA	20/12/2014	1.80	1.34	34.3	2.7	4.5	205	205	188	180	195		P	
							1.80	1.34	34.3	2.7	4.6								
S14-203/1	2660405.222	6510554.957	14.802	Shear Key	HA	22/12/2014	1.79	1.31	36.5	2.7	3.4	137	137	154	205	158		P	
							1.78	1.31	36.5	2.7	3.9								
S14-203/2	2660399.23	6510555.637	19.851	Shear Key	HA	22/12/2014	1.80	1.33	36.0	2.7	3.2	137	137	154	205	168		P	
							1.80	1.33	36.0	2.7	3.1								
S14-206/1	2660367.615	6510564.527	20.788	Shear Key	HA	23/12/2014	1.80	1.27	41.5	2.7	0.3	205	137	120	188	163		P	
							1.79	1.27	41.5	2.7	0.5								
S14-206/2	2660338.696	6510559.065	20.233	Shear Key	HA	23/12/2014	1.80	1.27	41.3	2.7	0.2	103	103	154	86	112		P	
							1.79	1.27	41.3	2.7	0.5								
S14-214/1	2660359.777	6510569.92	18.519	Bulk Earthworks	HA	5/01/2015	1.72	1.22	40.3	2.7	5.4	205	205	188	UTP	199		P	
							1.70	1.21	40.3	2.7	6.2								
S14-214/2	2660324.207	6510581.162	21.209	Bulk Earthworks	HA	5/01/2015	1.76	1.36	29.8	2.7	9.2	103	103	154	188	137		P	
							1.76	1.36	29.8	2.7	9.4								
S14-216/1	2660348.084	6510562.661	21.412	Shear Key	HA	5/01/2015	1.79	1.30	38.5	2.7	2.2	103	120	154	205	146		P	
							1.79	1.29	38.5	2.7	2.2								
S14-216/2	2660319.167	6510580.336	21.531	Shear Key	HA	5/01/2015	1.79	1.36	31.3	2.7	6.8	86	103	120	188	124		F	
							1.79	1.36	31.3	2.7	6.9								
S14-218/1	2660339.329	6510570.108	21.505	Shear Key	HA	6/01/2015	1.82	1.31	38.6	2.7	0.9	154	154	137	103	137		P	
							1.82	1.32	38.6	2.7	0.5								
S14-218/2	2660335.269	6510597.72	21.77	Shear Key	HA	6/01/2015	1.80	1.36	32.4	2.7	5.7	171	120	111	205	152		P	No oven Moisture content collected. Average field Moisture content used
							1.80	1.36	32.4	2.7	5.5								
S14-220/1	2660316.77	6510593.071	22.115	Shear Key	HA	6/01/2015	1.87	1.37	36.9	2.7	0.0	154	171	188	205	180		P	
							1.86	1.36	36.9	2.7	0.0								
S14-220/2	2660342.935	6510572.524	23.485	Shear Key	HA	6/01/2015	1.86	1.36	36.7	2.7	0.0	205	188	188	205	197		P	
							1.86	1.36	36.7	2.7	0.0								
S14-222/1	2660336.637	6510565.947	20.724	Shear Key	HA	7/01/2015	1.75	1.26	38.9	2.7	4.1	145	188	205	137	169		P	
							1.79	1.29	38.9	2.7	2.0								
S14-222/2	2660333.071	6510598.227	25.374	Shear Key	HA	7/01/2015	1.85	1.39	33.2	2.7	2.5	188	154	154	188	171		P	
							1.86	1.39	33.2	2.7	2.0								
S14-224/1	2660339.634	6510575.936	23.153	Shear Key	HA	7/01/2015	1.78	1.22	46.3	2.7	0.0	111	137	188	154	148		P	
							1.78	1.22	46.3	2.7	0.0								
S14-224/2	2660307.753	6510606.177	23.99	Shear Key	HA	7/01/2015	1.87	1.38	34.9	2.7	0.4	154	188	188	205	184		P	
							1.86	1.38	34.9	2.7	0.8								
S14-228/1	2660306.587	6510612.634	24.321	Shear Key	HA	8/01/2015	1.76	1.25	41.1	2.7	2.4	180	137	145	180	161		P	
							1.76	1.24	41.1	2.7	2.8								
S14-228/2	2660337.693	6510566.559	22.13	Shear Key	HA	8/01/2015	1.87	1.35	38.9	2.7	0.0	188	205	145	188	182		P	
							1.88	1.35	38.9	2.7	0.0								
S14-230/1	2660340.07	6510574.501	22.797	Shear Key	HA	8/01/2015	1.82	1.38	31.7	2.7	4.9	111	120	171	188	148		P	
							1.82	1.38	31.7	2.7	5.0								
S14-230/2	2660307.673	6510613.315	24.72	Shear Key	HA	8/01/2015	1.81	1.35	33.9	2.7	4.2	103	120	154	128	126		P	
							1.80	1.35	33.9	2.7	4.6								
S14-232/1	2660325.917	6510584.193	24.308	Shear Key	HA	9/01/2015	1.81	1.41	28.4	2.7	7.7	137	154	205	120	154		F	
							1.79	1.40	28.4	2.7	8.6								
S14-232/2	2660339.209	6510598.486	24.275	Shear Key	HA	9/01/2015	1.81	1.35	33.6	2.7	4.5	103	111	120	154	122		P	
							1.80	1.35	33.6	2.7	4.7								
S14-235/1	2660334.963	6510595.249	24.347	Bulk Earthworks	YA	9/01/2015	1.82	1.40	29.8	2.7	6.4	205	205	205	205	205		P	
							1.82	1.40	29.8	2.7	6.4								
S14-235/2	2660308.055	6510612.713	25.146	Bulk Earthworks	YA	9/01/2015	1.83	1.41	29.9	2.7	5.9	205	171	154	188	180		P	
							1.83	1.41	29.9	2.7	6.7								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job # 614089.032/1**

T&T Job #: 21854.0037 **Entered By: YA**

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m^3)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-237/1	2660484.063	6510590.613	14.653	Shear Key	YA	10/01/2015	1.87	1.37	36.1	2.7	0.0	137	150	161	188	159		P	
							1.87	1.37	36.1	2.7	0.0								
S14-237/2	2660411.327	6510558.576	17.394	Shear Key	YA	10/01/2015	1.86	1.42	31.7	2.7	2.7	137	150	161	188	159		P	
							1.87	1.42	31.7	2.7	2.7								
S14-239/1	2660445.852	6510573.208	16.086	Shear Key	HA	12/01/2015	1.89	1.43	31.8	2.7	1.4	162	188	171	205	182		P	
							1.89	1.43	31.8	2.7	1.3								
S14-239/2	2660349.428	6510580.66	23.834	Shear Key	HA	12/01/2015	1.89	1.45	30.5	2.7	2.1	145	171	188	188	173		P	
							1.89	1.44	30.5	2.7	2.4								
S14-239/3	2660318.808	6510602.659	24.897	Shear Key	HA	12/01/2015	1.86	1.36	36.6	2.7	0.0	137	145	171	205	165		P	
							1.86	1.36	36.6	2.7	0.0								
S14-245/1	2660360.831	6510590.029	22.747	Shear Key	HA	12/01/2015	1.82	1.28	41.9	2.7	0.0	120	137	145	188	148		P	
							1.80	1.27	41.9	2.7	0.0								
S14-245/2	2660329.537	6510617.728	25.147	Shear Key	HA	12/01/2015	1.82	1.34	35.9	2.7	2.6	103	137	145	188	143		P	
							1.82	1.34	35.9	2.7	2.3								
S14-248/1	2660476.051	6510587.691	13.734	Shear Key	HA	13/01/2015	1.88	1.44	30.8	2.7	2.4	205	205	188	154	188		P	
							1.87	1.43	30.8	2.7	3.2								
S14-248/2	2660437.178	6510571.478	14.03	Shear Key	HA	13/01/2015	1.86	1.28	44.8	2.7	0.0	137	137	154	188	154		P	
							1.86	1.28	44.8	2.7	0.0								
S14-248/3	2660309.535	6510631.185	26.948	Shear Key	HA	13/01/2015	1.86	1.40	32.7	2.7	2.4	162	188	205	205	190		P	
							1.86	1.40	32.7	2.7	2.6								
S14-248/4	2660332.091	6510612.046	24.006	Shear Key	HA	13/01/2015	1.83	1.32	38.2	2.7	0.6	154	137	120	188	150		P	
							1.83	1.32	38.2	2.7	0.6								
S14-253/1	2660454.412	6510579.275	14.484	Shear Key	HA	13/01/2015	1.82	1.39	31.0	2.7	5.3	111	128	137	188	141		P	
							1.81	1.38	31.0	2.7	5.8								
S14-253/2	2660436.041	6510561.921	16.029	Shear Key	HA	13/01/2015	1.86	1.40	32.4	2.7	2.6	180	188	205	188	190		P	
							1.85	1.40	32.4	2.7	2.8								
S14-253/3	2660330.187	6510622.028	25.015	Shear Key	HA	13/01/2015	1.87	1.37	36.2	2.7	0.0	188	137	154	205	171		P	
							1.86	1.37	36.2	2.7	0.0								
S14-253/4	2660355.881	6510604.027	25.801	Shear Key	HA	13/01/2015	1.82	1.34	35.6	2.7	2.7	171	154	188	205	180		P	
							1.81	1.33	35.6	2.7	3.0								
S14-256/1	2660426.773	6510567.626	16.501	Shear Key	HA	14/01/2015	1.79	1.28	39.9	2.7	1.5	137	145	154	205	160		P	
							1.76	1.26	39.9	2.7	3.0								
S14-256/2	2660472.248	6510587.706	16.087	Shear Key	HA	14/01/2015	1.78	1.30	37.4	2.7	3.6	137	145	137	188	152		P	
							1.78	1.29	37.4	2.7	3.8								
S14-256/3	2660354.894	6510588.965	23.911	Bulk Earthworks	HA	14/01/2015	-	-	-	-	-	77	86	103	103	92		F	
							-	-	-	-	-								
S14-256/4	2660354.485	6510585.316	23.729	Bulk Earthworks	HA	14/01/2015	1.78	1.27	39.4	2.7	2.7	103	120	120	120	116		P	
							1.77	1.27	39.4	2.7	3.2								
S14-256/5	2660300.897	6510618.802	25.647	Bulk Earthworks	HA	14/01/2015	-	-	-	-	-	68	77	103	137	96		F	
							-	-	-	-	-								
S14-259/1	2660373.763	6510576.892	22.512	Bulk Earthworks	HA	14/01/2015	1.79	1.32	35.3	2.7	4.4	137	154	137	205	158		P	
							1.79	1.32	35.3	2.7	4.6								
S14-259/2	2660342.298	6510598.537	25.004	Bulk Earthworks	HA	14/01/2015	-	-	-	-	-	77	86	120	68	88		F	
							-	-	-	-	-								
S14-259/3	2660327.485	6510611.582	23.489	Bulk Earthworks	HA	14/01/2015	1.77	1.21	46.9	2.7	0.0	120	154	120	103	124		F	
							1.79	1.22	45.9	2.7	0.0								
S14-259/4	-	-	-	Bulk Earthworks	HA	14/01/2015	-	-	-	-	-	120	120	86	103	107		P	
							-	-	-	-	-								
S14-262/1	2660362.014	6510586.358	23.48	Bulk Earthworks	HA	15/01/2015	1.77	1.28	38.0	2.7	3.8	137	137	205	205	171		P	
							1.76	1.27	38.0	2.7	4.5								
S14-262/2	2660342.661	6510616.672	25.802	Bulk Earthworks	HA	15/01/2015	1.76	1.27	38.4	2.7	4.0	154	205	188	137	171		P	
							1.77	1.28	38.4	2.7	3.7								
S14-265/1	2660332.742	6510627.974	26.839	Bulk Earthworks	HA	15/01/2015	1.77	1.25	41.3	2.7	2.1	205	137	137	154	158		P	
							1.76	1.24	41.3	2.7	2.5								
S14-265/2	2660335.53	6510586.155	26.07	Bulk Earthworks	HA	15/01/2015	1.84	1.32	39.6	2.7	0.0	205	205	205	205	205		P	
							1.83	1.31	39.6	2.7	0.0								
S14-266	-	-	-	Shear Key	HA	15/01/2015	-	-	-	-	-	111	137	188	103	135		F	
							-	-	-	-	-								

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T&T Job #: 21854.0037 **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-267	2660304.887	6510536.404	9.06	Shear Key	HA	15/01/2015	1.88	1.45	30.1	2.7	2.9	188	205	205	171	192		P	
							1.88	1.44	30.1	2.7	3.2								
S14-268	2660306.493	6510537.422	10.015	Shear Key	HA	16/01/2015	1.77	1.31	34.8	2.7	5.6	145	205	188	205	186		P	
							1.77	1.31	34.8	2.7	5.7								
S14-269/1	2660338.397	6510591.13	25.617	Bulk Earthworks	HA	16/01/2015	1.79	1.38	29.7	2.7	7.7	120	137	154	188	150		P	
							1.78	1.37	29.7	2.7	8.7								
S14-269/2	2660358.38	6510616.548	27.189	Bulk Earthworks	HA	16/01/2015	1.84	1.40	31.3	2.7	4.4	137	154	154	188	158		P	
							1.84	1.40	31.3	2.7	4.2								
S14-273/1	2660383.138	6510575.781	22.961	Bulk Earthworks	HA	16/01/2015	1.84	1.31	40.5	2.7	0.0	154	205	205	205	192		P	
							1.84	1.31	40.5	2.7	0.0								
S14-273/2	2660416.543	6510566.098	18.991	Bulk Earthworks	HA	16/01/2015	1.86	1.42	30.7	2.7	3.7	162	205	162	205	184		P	
							1.83	1.40	30.7	2.7	5.1								
S14-278/1	2660338.969	6510591.155	27.184	Bulk Earthworks	HA	17/01/2015	1.82	1.36	33.9	2.7	3.8	188	137	137	154	154		P	
							1.80	1.35	33.9	2.7	4.4								
S14-278/2	2660354.075	6510594.041	25.941	Bulk Earthworks	HA	17/01/2015	1.85	1.38	34.6	2.7	1.4	120	137	128	188	143		P	
							1.85	1.38	34.6	2.7	1.3								
S14-282/1	2660335.951	6510615.004	26.659	Bulk Earthworks	HA	19/01/2015	-	-	-	-	-	86	103	68	154	103		F	
							-	-	-	-	-								
S14-282/2	2660402.159	6510566.532	20.721	Bulk Earthworks	HA	19/01/2015	1.87	1.42	31.7	2.7	2.3	137	154	188	154	158		P	
							1.86	1.41	31.7	2.7	2.8								
S14-290				Bulk Earthworks	HA	19/01/2015	1.86	1.38	35.3	2.7	0.4	154	154	188	154	163		P	
							1.85	1.37	35.3	2.7	1.0								
S14-292/1				Bulk Earthworks	HA	20/01/2015	1.75	1.30	35.3	2.7	6.3	188	154	120	171	158	y	P	
							1.76	1.30	35.3	2.7	6.1								Retest of URN S14-282/1
S14-292/2				Bulk Earthworks	HA	20/01/2015	1.77	1.28	37.8	2.7	4.1	205	205	171	205	197		P	
							1.76	1.28	37.8	2.7	4.3								
S14-294/1				Bulk Earthworks	HA	20/01/2015	1.86	1.41	31.7	2.7	3.1	137	154	154	188	158		P	
							1.86	1.41	31.7	2.7	3.2								
S14-294/2				Bulk Earthworks	HA	20/01/2015	1.86	1.41	32.0	2.7	3.0	154	154	171	188	167		P	
							1.86	1.41	32.0	2.7	2.9								
S14-294/3				Bulk Earthworks	HA	20/01/2015	1.83	1.36	34.8	2.7	2.3	128	137	154	154	143		P	
							1.83	1.36	34.8	2.7	2.4								
S14-297/1	2660373.198	6510591.952	25.387	Bulk Earthworks	HA	21/01/2015	1.80	1.30	38.5	2.7	1.6	137	137	154	188	154		P	
							1.81	1.31	38.5	2.7	1.3								
S14-297/2	2660393.613	6510584.892	24.318	Bulk Earthworks	HA	21/01/2015	1.82	1.36	34.0	2.7	3.3	188	180	145	171	171		P	
							1.84	1.37	34.0	2.7	2.6								
S14-299/1	2660316.788	6510622.826	25.738	Bulk Earthworks	HA	21/01/2015	1.85	1.38	33.4	2.7	2.6	154	137	154	197	161		P	
							1.84	1.38	33.4	2.7	2.9								
S14-299/2	2660345.897	6510601.809	26.224	Bulk Earthworks	HA	21/01/2015	1.85	1.40	31.9	2.7	3.3	188	171	188	188	184		P	
							1.86	1.41	31.9	2.7	3.0								
S14-301/1	2660334.024	6510617.044	26.855	Bulk Earthworks	HA	22/01/2015	1.87	1.38	35.3	2.7	0.2	197	205	205	205	203		P	
							1.86	1.37	35.3	2.7	0.6								
S14-301/2	2660356.559	6510601.619	26.834	Bulk Earthworks	HA	22/01/2015	1.83	1.34	35.8	2.7	2.1	154	162	180	145	160		P	
							1.83	1.35	35.8	2.7	1.9								
S14-301/3	2660409.811	6510589.494	23.783	Bulk Earthworks	HA	22/01/2015	1.78	1.19	49.7	2.7	0.0	171	145	205	205	182		P	
							1.78	1.19	49.7	2.7	0.0								
S14-307/1	2660317.469	6510601.768	27.358	Bulk Earthworks	HA	22/01/2015	1.79	1.36	32.0	2.7	6.2	171	205	154	205	184		P	
							1.80	1.36	32.0	2.7	5.9								
S14-307/2	2660347.311	6510581.002	26.451	Bulk Earthworks	HA	22/01/2015	1.81	1.34	34.8	2.7	3.8	137	188	188	145	165		P	
							1.80	1.34	34.8	2.7	3.9								
S14-312/1	2660296.735	6510533.815	6.179	Shear Key	HA	23/01/2015	1.89	1.43	32.0	2.7	1.0	205	205	205	205	205		P	
							1.89	1.43	32.0	2.7	1.0								
S14-312/2	2660337.822	6510631.652	26.456	Bulk Earthworks	HA	23/01/2015	1.82	1.29	40.6	2.7	0.0	154	137	154	180	156		P	
							1.81	1.29	40.6	2.7	0.0								
S14-312/3	2660361.951	6510612.177	26.853	Bulk Earthworks	HA	23/01/2015	1.83	1.33	37.4	2.7	0.9	154	120	162	137	143		P	
							1.83	1.33	37.4	2.7	0.9								

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T&T Job #: 21854.0037 **Entered By: YA**

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode
NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-316/1	2660296.042	6510535.028	7.652	Shear Key	YA	23/01/2015	1.85	1.41	30.9	2.7	3.9	205	205	205	205	205		P	
							1.86	1.42	30.9	2.7	3.6								
S14-316/2	2660303.183	6510538.32	9.757	Shear Key	YA	23/01/2015	1.86	1.43	29.4	2.7	4.7	205	205	205	205	205		P	
							1.86	1.43	29.4	2.7	4.7								
S14-319/1	2660305.135	6510538.977	12.079	Shear Key	YA	24/01/2015	1.87	1.34	39.4	2.7	0.0	154	171	188	205	180		P	
							1.88	1.35	39.4	2.7	0.0								
S14-319/2	-	-	-	Bulk Earthworks	YA	24/01/2015	-	-	-	-	-	80	103	86	120	97		F	
							-	-	-	-	-								
S14-324/1	2660328.237	6510537.338	15.465	Shear Key	HA	27/01/2015	1.86	1.41	31.9	2.7	2.6	205	205	205	205	205		P	
							1.86	1.41	31.9	2.7	3.0								
S14-324/2	2660314.962	6510538.856	12.225	Shear Key	HA	27/01/2015	1.77	1.32	34.1	2.7	6.4	171	205	205	205	197		P	
							1.76	1.31	34.1	2.7	6.5								
S14-325/1	2660385.805	6510603.91	26.323	Bulk Earthworks	HA	27/01/2015	1.89	1.41	33.9	2.7	0.0	188	205	205	205	201		P	
							1.89	1.41	33.9	2.7	0.0								
S14-325/2	2660377.161	6510610.218	27.594	Bulk Earthworks	HA	27/01/2015	1.82	1.45	25.6	2.7	9.0	205	180	188	205	195		P	
							1.82	1.45	25.6	2.7	9.0								
S14-328/1	2660329.796	6510539.914	15.227	Shear Key	HA	27/01/2015	1.89	1.42	33.3	2.7	0.4	188	205	205	205	201		P	
							1.90	1.42	33.3	2.7	0.0								
S14-328/2	2660303.98	6510537.537	14.126	Shear Key	HA	27/01/2015	1.72	1.27	35.1	2.7	8.4	205	205	205	205	205		F	
							1.71	1.27	35.1	2.7	8.6								
S14-328/3	2660304.184	6510538.076	12.38	Shear Key	HA	27/01/2015	1.75	1.32	32.2	2.7	8.4	205	205	205	205	205		F	
							1.75	1.32	32.2	2.7	8.6								
S14-329/1	2660377.658	6510606.058	27.439	Bulk Earthworks	HA	27/01/2015	1.86	1.30	42.5	2.7	0.0	205	188	205	205	201		P	
							1.86	1.30	42.5	2.7	0.0								
S14-329/2	2660348.135	6510628.389	26.965	Bulk Earthworks	HA	27/01/2015	1.87	1.46	28.2	2.7	4.7	154	188	171	205	180		P	
							1.87	1.46	28.2	2.7	4.6								
S14-332/1				Shear Key	HA	28/01/2015	1.76	1.27	37.9	2.7	4.6	180	188	205	205	195		P	
							1.74	1.26	37.9	2.7	5.2								
S14-332/2				Shear Key	HA	28/01/2015	1.83	1.38	32.8	2.7	3.7	188	205	205	205	201		P	
							1.83	1.38	32.8	2.7	3.9								
S14-333/1				Bulk Earthworks	HA	28/01/2015	1.89	1.52	24.1	2.7	7.1	205	205	205	205	205		P	
							1.88	1.51	24.1	2.7	7.6								
S14-333/2				Bulk Earthworks	HA	28/01/2015	1.86	1.43	29.5	2.7	4.5	154	205	205	205	192		P	
							1.85	1.43	29.5	2.7	4.8								
S14-335/1				Bulk Earthworks	YA	28/01/2015	1.96	1.49	31.4	2.7	0.0	137	154	154	171	154		P	
							1.86	1.42	31.4	2.7	3.1								
S14-335/2				Bulk Earthworks	YA	28/01/2015	1.88	1.43	31.7	2.7	1.8	137	144	161	185	157		P	
							1.88	1.43	31.7	2.7	1.9								
S14-335/3				Bulk Earthworks	YA	28/01/2015	1.86	1.43	30.3	2.7	4.0	140	161	178	188	167		P	
							1.86	1.43	30.3	2.7	3.7								
S14-338/1				Shear Key	HA	29/01/2015	1.85	1.41	31.1	2.7	3.7	188	205	205	205	201		P	
							1.85	1.41	31.1	2.7	4.1								
S14-338/2				Shear Key	HA	29/01/2015	1.82	1.34	36.1	2.7	2.4	205	205	205	205	205		P	
							1.82	1.34	36.1	2.7	2.4								
S14-339/1				Bulk Earthworks	HA	29/01/2015	1.87	1.40	33.8	2.7	0.9	137	188	171	205	175		P	
							1.87	1.39	33.8	2.7	1.3								
S14-339/2				Bulk Earthworks	HA	29/01/2015	1.87	1.43	31.5	2.7	2.3	205	205	205	205	205		P	
							1.86	1.41	31.5	2.7	3.2								
S14-343/1				Bulk Earthworks	HA	29/01/2015	1.82	1.38	32.3	2.7	4.6	205	205	205	205	205		P	
							1.81	1.37	32.3	2.7	5.2								
S14-343/2				Bulk Earthworks	HA	29/01/2015	1.86	1.44	30.5	2.7	2.7	205	205	205	205	205		P	
							1.87	1.44	30.5	2.7	3.0								
S14-347/1				Bulk Earthworks	HA	30/01/2015	1.87	1.42	31.7	2.7	2.6	145	145	145	162	149		P	
							1.86	1.41	31.7	2.7	2.9								
S14-347/2				Bulk Earthworks	HA	30/01/2015	1.84	1.41	30.0	2.7	5.4	128	145	145	162	145		P	
							1.83	1.41	30.0	2.7	5.7								
S14-349/1				Bulk Earthworks	HA	30/01/2015	1.80	1.26	42.5	2.7	0.0	171	154	137	154	154		P	
							1.79	1.26	42.5	2.7	0.1								
S14-349/2				Bulk Earthworks	HA	30/01/2015	1.83	1.42	28.9	2.7	6.5	145	128	145	154	143		P	
							1.83	1.42	28.9	2.7	6.4								
S14-352/1				Bulk Earthworks	HA	30/01/2015	-	-	-	-	-	120	68	86	120	98		F	

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job #** 614089.032/1

T&T Job #: 21854.0037 **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode
NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m^3)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
[illegible]				[illegible]	[illegible]	[illegible]	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		F	
S14-352/2				Bulk Earthworks	HA	2/02/2015	1.85	1.42	30.6	2.7	4.1	120	137	150	154	140		P	
							1.85	1.42	30.6	2.7	4.2								
S14-355/1				Bulk Earthworks	HA	2/02/2015	1.84	1.32	39.5	2.7	0.0	120	133	137	171	140		P	
							1.83	1.31	39.5	2.7	0.0								
S14-355/2				Bulk Earthworks	HA	2/02/2015	1.77	1.38	28.8	2.7	9.3	120	137	154	188	150		P	
							1.78	1.38	28.8	2.7	9.1								
S14-355/3				Shear Key	HA	2/02/2015	1.89	1.29	46.6	2.7	0.0	205	205	205	205	205		P	
							1.90	1.29	46.6	2.7	0.0								
S14-359/1				Bulk Earthworks	HA	3/02/2015	1.93	1.47	30.7	2.7	0.1	171	154	205	205	184		P	
							1.92	1.47	30.7	2.7	0.7								
S14-359/2				Shear Key	HA	3/02/2015	1.85	1.41	31.0	2.7	4.2	205	154	171	205	184		P	
							1.85	1.41	31.0	2.7	4.0								
S14-362/1				Shear Key	HA	4/02/2015	1.81	1.31	38.2	2.7	1.7	205	188	154	188	184		P	
							1.80	1.30	38.2	2.7	2.2								
S14-363/1				Shear Key	HA	4/02/2015	-	-	-	-	-	120	150	180	205	164		P	
							-	-	-	-	-								
S14-364/1				Shear Key	HA	4/02/2015	1.84	1.43	28.4	2.7	6.2	180	180	205	205	193		P	
							1.84	1.43	28.4	2.7	6.2								
S14-364/2				Shear Key	HA	4/02/2015	1.83	1.36	34.6	2.7	2.7	137	154	171	205	167		P	
							1.82	1.35	34.6	2.7	3.3								
S14-371/1				Shear Key	HA	9/02/2015	1.85	1.43	29.3	2.7	5.2	145	205	180	205	184		P	
							1.84	1.42	29.3	2.7	5.8								
S14-371/2				Shear Key	HA	9/02/2015	1.80	1.32	36.7	2.7	2.8	205	180	205	154	186		P	
							1.83	1.34	36.7	2.7	1.5								
S14-372/1				Bulk Earthworks	HA	9/02/2015	-	-	-	-	-	103	111	120	94	107		F	Failed SV. Material too wet.
							-	-	-	-	-								
S14-372/2				Bulk Earthworks	HA	9/02/2015	1.90	1.40	36.1	2.7	0.0	128	154	137	180	150		P	
							1.90	1.40	36.1	2.7	0.0								
S14-375/1				Shear Key	HA	9/02/2015	1.88	1.39	35.0	2.7	0.0	205	205	180	188	195		P	
							1.88	1.39	35.0	2.7	0.0								
S14-375/2				Shear Key	HA	9/02/2015	1.86	1.42	31.4	2.7	3.1	188	154	205	205	188		P	
							1.86	1.42	31.4	2.7	3.0								
S14-376/1				Bulk Earthworks	HA	9/02/2015	1.86	1.38	34.3	2.7	1.3	137	154	171	188	163	Y	P	Retest of URN S14-372/1
							1.85	1.38	34.3	2.7	1.7								
S14-376/2				Bulk Earthworks	HA	9/02/2015	1.90	1.43	32.3	2.7	0.7	137	180	188	205	178		P	
							1.89	1.43	32.3	2.7	0.8								
S14-382/1				Shear Key	HA	10/02/2015	1.81	1.36	32.8	2.7	4.9	205	154	137	154	163		P	
							1.80	1.35	32.8	2.7	5.4								
S14-383/1				Bulk Earthworks	HA	10/02/2015	1.88	1.40	34.7	2.7	0.0	137	205	154	171	167		P	
							1.88	1.39	34.7	2.7	0.1								
S14-388/1				Shear Key	HA	10/02/2015	-	-	-	-	-	94	111	120	162	122		F	
							-	-	-	-	-								
S14-389/1				Bulk Earthworks	HA	10/02/2015	1.81	1.32	37.2	2.7	2.0	120	137	154	205	154		P	
							1.81	1.32	37.2	2.7	2.3								
S14-390/1				Bulk Earthworks	HA	11/02/2015	-	-	-	-	-	86	103	103	120	103		F	
							-	-	-	-	-								
S14-390/2				Bulk Earthworks	HA	11/02/2015	-	-	-	-	-	103	103	120	154	120		F	
							-	-	-	-	-								
S14-390/3				Bulk Earthworks	HA	11/02/2015	1.80	1.34	34.8	2.7	3.9	154	137	154	188	158		P	
							1.93	1.43	34.8	2.7	0.0								
S14-397/1				Shear Key	HA	11/02/2015	1.91	1.42	34.1	2.7	0.0	154	188	154	205	175	Y	P	Retest of URN S14-388/1
							1.91	1.42	34.1	2.7	0.0								
S14-397/2				Bulk Earthworks	HA	11/02/2015	1.88	1.42	32.5	2.7	1.4	188	137	154	205	171		P	
							1.87	1.41	32.5	2.7	2.1								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job #** 614089.032/1

T&T Job #: 21854.0037 **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-398/1				Shear Key	HA	12/02/2015	1.89	1.36	39.2	2.7	0.0	180	171	171	205	182		P	
							1.90	1.36	39.2	2.7	0.0								
S14-398/2				Shear Key	HA	12/02/2015	1.86	1.33	39.6	2.7	0.0	154	205	205	205	192		P	
							1.85	1.33	39.6	2.7	0.0								
S14-398/3				Bulk Earthworks	HA	12/02/2015	1.90	1.42	34.0	2.7	0.0	171	154	205	205	184		P	
							1.91	1.42	34.0	2.7	0.0								
S14-403/1				Shear Key	HA	12/02/2015	1.84	1.34	37.3	2.7	0.4	171	205	145	171	173		P	
							1.84	1.34	37.3	2.7	0.5								
S14-403/2				Shear Key	HA	12/02/2015	1.87	1.39	34.4	2.7	0.4	205	180	205	205	199		P	
							1.87	1.39	34.4	2.7	0.4								
S14-404				Bulk Earthworks	HA	12/02/2015	-	-	-	-	-	154	170	190	205	180		P	
							-	-	-	-	-								
S14-406/1				Shear Key	HA	13/02/2015	1.90	1.50	26.3	2.7	4.9	205	171	188	171	184		P	
							1.85	1.46	26.3	2.7	7.4								
S14-406/2				Shear Key	HA	13/02/2015	1.86	1.40	33.3	2.7	1.6	171	205	162	162	175		P	
							1.86	1.40	33.3	2.7	1.6								
S14-406/3				Bulk Earthworks	HA	13/02/2015	1.88	1.46	29.0	2.7	3.6	205	188	188	205	197		P	
							1.88	1.46	29.0	2.7	3.9								
S14-407				Bulk Earthworks	HA	13/02/2015	-	-	-	-	-	154	170	190	205	180	Y	P	Failed material from URN S14-390 removed and reworked. Underlying layer passing on SV.
							-	-	-	-	-								
S14-412/1				Shear Key	HA	13/02/2015	1.87	1.40	33.9	2.7	0.8	188	154	162	188	173		P	
							1.87	1.39	33.9	2.7	1.1								
S14-418/1				Shear Key	YA	14/02/2015	1.88	1.40	34.0	2.7	0.3	137	154	168	185	161		P	
							1.89	1.41	34.0	2.7	0.0								
S14-418/2				Shear Key	YA	14/02/2015	1.89	1.40	34.8	2.7	0.0	171	154	188	171	171		P	
							1.88	1.40	34.8	2.7	0.0								
S14-418/3				Bulk Earthworks	YA	14/02/2015	-	-	-	-	-	154	161	180	205	175		P	
							-	-	-	-	-								
S14-419/1				Shear Key	HA	16/02/2015	1.90	1.46	30.6	2.7	1.5	145	154	154	188	160		P	
							1.90	1.45	30.6	2.7	1.8								
S14-419/2				Shear Key	HA	16/02/2015	1.86	1.48	25.9	2.7	6.8	180	145	171	188	171		P	
							1.86	1.48	25.9	2.7	6.9								
S14-422/1				Shear Key	HA	16/02/2015	1.89	1.35	39.9	2.7	0.0	188	205	205	205	201		P	
							1.89	1.35	39.9	2.7	0.0								
S14-422/2				Shear Key	HA	16/02/2015	1.84	1.41	30.4	2.7	4.6	188	205	162	154	177		P	
							1.83	1.40	30.4	2.7	5.3								
S14-425/1				Shear Key	HA	17/02/2015	1.86	1.41	32.0	2.7	2.6	154	205	188	197	186		P	
							1.88	1.42	32.0	2.7	1.9								
S14-425/2				Shear Key	HA	17/02/2015	1.85	1.39	32.9	2.7	2.8	188	154	205	205	188		P	
							1.85	1.39	32.9	2.7	2.6								
S14-425/3				Bulk Earthworks	HA	17/02/2015	1.87	1.38	35.5	2.7	0.1	171	188	205	154	180		P	
							1.87	1.38	35.5	2.7	0.1								
S14-430/1					HA	17/02/2015	1.81	1.35	33.3	2.7	4.8	180	188	154	205	182		P	
							1.81	1.36	33.3	2.7	4.6								
S14-430/2				Shear Key	HA	17/02/2015	1.90	1.37	38.4	2.7	0.0	171	154	205	180	178		P	
							1.90	1.38	38.4	2.7	0.0								
S14-433/1				Shear Key	HA	18/02/2015	1.85	1.38	33.6	2.7	2.4	145	154	171	205	169		P	
							1.85	1.38	33.6	2.7	2.4								
S14-433/2				Shear Key	HA	18/02/2015	1.88	1.46	28.7	2.7	4.1	205	205	205	205	205		P	
							1.88	1.46	28.7	2.7	4.0								
S14-433/3				Bulk Earthworks	HA	18/02/2015	1.81	1.31	38.5	2.7	1.3	145	128	171	154	150		P	
							1.80	1.30	38.5	2.7	1.8								
S14-437/1				Shear Key	HA	18/02/2015	1.76	1.26	39.5	2.7	3.7	171	145	154	154	156		P	
							1.75	1.26	39.5	2.7	3.8								
S14-437/2				Shear Key	HA	18/02/2015	1.81	1.30	39.4	2.7	0.9	205	145	154	171	169		P	
							1.81	1.30	39.4	2.7	0.9								
S14-437/3				Bulk Earthworks	HA	18/02/2015	1.77	1.21	45.7	2.7	0.0	205	180	154	137	169		P	
							1.76	1.21	45.7	2.7	0.3								
S14-440/1				Shear Key	HA	19/02/2015	1.81	1.29	40.0	2.7	0.6	205	171	171	UTP	182		P	
							1.81	1.29	40.0	2.7	0.7								

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T&T Job #: 21854.0037 **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-440/2				Shear Key	HA	19/02/2015	1.82	1.32	37.8	2.7	1.2	188	162	162	205	179		P	
							1.81	1.31	37.8	2.7	1.9								
S14-440/3				Bulk Earthworks	HA	19/02/2015	1.75	1.34	30.8	2.7	9.1	205	188	171	205	192		P	
							1.75	1.34	30.8	2.7	9.3								
S14-445/1				Bulk Earthworks	HA	19/02/2015	1.82	1.32	37.4	2.7	1.6	205	205	188	205	201		P	
							1.82	1.33	37.4	2.7	1.3								
S14-445/2				Bulk Earthworks	HA	19/02/2015	1.83	1.30	40.3	2.7	0.0	205	171	162	188	182		P	
							1.83	1.31	40.3	2.7	0.0								
S14-449/1				Bulk Earthworks	HA	20/02/2015	1.84	1.39	32.9	2.7	3.0	180	162	171	171	171		P	
							1.84	1.39	32.9	2.7	3.1								
S14-449/2				Bulk Earthworks	HA	20/02/2015	1.83	1.41	29.9	2.7	5.8	205	205	205	197	203		P	
							1.81	1.40	29.9	2.7	6.6								
S14-453/1				Bulk Earthworks	HA	20/02/2015	1.77	1.29	37.6	2.7	3.8	171	145	145	154	154		P	
							1.81	1.31	37.6	2.7	1.9								
S14-453/2				Bulk Earthworks	HA	20/02/2015	1.86	1.36	36.9	2.7	0.0	205	205	180	205	199		P	
							1.86	1.36	36.9	2.7	0.0								
S14-456/1				Bulk Earthworks	HA	21/02/2015	1.80	1.35	33.4	2.7	5.1	205	205	205	205	205		P	
							1.80	1.35	33.4	2.7	4.7								
S14-456/2				Bulk Earthworks	HA	21/02/2015	1.76	1.24	41.9	2.7	1.9	171	188	205	154	180		P	
							1.77	1.25	41.9	2.7	1.7								
S14-459/1				Bulk Earthworks	HA	23/02/2015	1.84	1.40	31.6	2.7	4.1	137	154	171	137	150		P	
							1.84	1.40	31.6	2.7	4.0								
S14-459/2				Bulk Earthworks	HA	23/02/2015	1.81	1.36	33.9	2.7	4.4	145	154	154	188	160		P	
							1.80	1.35	33.9	2.7	4.4								
S14-463/1				Bulk Earthworks	HA	23/02/2015	1.77	1.30	36.7	2.7	4.5	205	171	145	154	169		P	
							1.77	1.29	36.7	2.7	4.6								
S14-463/2				Bulk Earthworks	HA	23/02/2015	1.81	1.34	35.6	2.7	2.8	145	205	171	188	177		P	
							1.82	1.34	35.6	2.7	2.7								
S14-476/1				Bulk Earthworks	YA	25/02/2015	1.82	1.37	32.6	2.7	4.6	137	154	171	188	163		P	
							1.81	1.37	32.6	2.7	4.9								
S14-476/2				Bulk Earthworks	YA	25/02/2015	1.82	1.32	37.3	2.7	1.6	137	154	171	188	163		P	
							1.81	1.32	37.3	2.7	2.2								
S14-480/1				Bulk Earthworks	YA	25/02/2015	-	-	-	-	-	100	115	125	140	120		P	Lime stabilized Material. Low SV result accepted as pass because material will harden as Lime cures
							-	-	-	-	-								
S14-481/1				Bulk Earthworks	HA	26/02/2015	1.83	1.37	34.2	2.7	2.6	205	128	171	205	177		P	
							1.83	1.36	34.2	2.7	3.0								
S14-481/2				Bulk Earthworks	HA	26/02/2015	1.85	1.34	37.9	2.7	0.0	128	154	171	205	165		P	
							1.83	1.32	37.9	2.7	0.7								
S14-486/1				Bulk Earthworks	HA	26/02/2015	1.84	1.35	36.5	2.7	0.7	154	180	162	145	160		P	
							1.84	1.34	36.5	2.7	1.1								
S14-486/2				Bulk Earthworks	HA	26/02/2015	1.82	1.36	33.9	2.7	3.8	154	128	154	205	160		P	
							1.84	1.37	33.9	2.7	2.5								
S14-491				Bulk Earthworks	HA	27/02/2015	-	-	-	-	-	128	150	170	205	163		P	
							-	-	-	-	-								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job # 614089.032/1**

T&T Job #: 21854.0037 **Entered By: YA**

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-496/1	2660287.557	6510585.859	26.309	Bulk Earthworks	HA	27/02/2015	1.88	1.36	38.6	2.7	0.0	137	137	128	154	139		P	Lime stabilized Material. Low SV result accepted as pass because material will harden as Lime cures
							1.83	1.32	38.6	2.7	0.2								
S14-496/2	2660281.756	6510577.907	25.877	Bulk Earthworks	HA	27/02/2015	1.87	1.38	35.7	2.7	0.0	154	137	111	154	139		P	
							1.87	1.37	35.7	2.7	0.0								
S14-494/1	2660273.212	6510609.692	28.066	Bulk Earthworks	YA	28/02/2015	1.79	1.22	47.0	2.7	0.0	137	154	171	188	163		P	
							1.78	1.21	47.0	2.7	0.0								
S14-494/2	2660294.879	6510585.916	26.196	Bulk Earthworks	YA	28/02/2015	1.78	1.24	42.8	2.7	0.7	137	154	171	188	163		P	
							1.79	1.25	42.8	2.7	0.0								
S14-494/3	2660298.588	6510572.194	25.519	Bulk Earthworks	YA	28/02/2015	1.79	1.24	44.5	2.7	0.0	137	154	171	188	163		P	
							1.79	1.24	44.5	2.7	0.0								
S14-504/1	2660302.957	6510594.457	27.232	Bulk Earthworks	HA	2/03/2015	1.82	1.28	41.9	2.7	0.0	120	137	171	111	135		P	Lime stabilized Material. Low SV result accepted as pass because material will harden as Lime cures
							1.81	1.28	41.9	2.7	0.0								
S14-504/2	2660277.463	6510581.651	25.629	Bulk Earthworks	HA	2/03/2015	1.83	1.33	37.8	2.7	0.8	171	171	205	205	188		P	
							1.83	1.33	37.8	2.7	0.8								
S14-508/1	2660312.166	6510574.916	25.893	Bulk Earthworks	HA	2/03/2015	1.76	1.27	39.1	2.7	3.5	205	254	154	188	200		P	
							1.78	1.28	39.1	2.7	2.8								
S14-508/2	2660276.22	6510570.627	27.683	Bulk Earthworks	HA	2/03/2015	1.77	1.26	40.1	2.7	2.4	154	154	154	188	163		P	
							1.78	1.27	40.1	2.7	2.3								
S14-511/1	2660282.468	6510601.742	27.92	Bulk Earthworks	HA	3/03/2015	1.80	1.32	36.3	2.7	3.2	137	171	171	197	169		P	
							1.80	1.32	36.3	2.7	3.1								
S14-511/2	2660302.298	6510586.741	27.11	Bulk Earthworks	HA	3/03/2015	1.79	1.35	33.0	2.7	5.5	197	171	205	205	195		P	
							1.80	1.36	33.0	2.7	5.1								
S14-515/1	2660086.472	6510788.957	-0.149	Shear Key	HA	3/03/2015	1.79	1.20	49.1	2.7	0.0	171	137	137	205	163		P	
							1.78	1.19	49.1	2.7	0.0								
S14-516/1	2660313.885	6510623.778	31.293	Bulk Earthworks	HA	4/03/2015	1.69	1.30	29.3	2.7	13.4	145	162	205	205	179		F	
							1.70	1.32	29.3	2.7	12.7								
S14-516/2	2660353.473	6510619.244	30.366	Bulk Earthworks	HA	4/03/2015	1.90	1.46	29.9	2.7	2.2	171	205	154	188	180		P	
							1.89	1.45	29.9	2.7	2.6								
S14-516/3	2660328.751	6510625.61	30.884	Bulk Earthworks	HA	4/03/2015	1.68	1.30	29.1	2.7	14.0	205	205	188	171	192		F	Large area of failed material.
							1.68	1.30	29.1	2.7	14.0								
S14-516/4	2660315.248	6510621.428	30.779	Bulk Earthworks	HA	4/03/2015	1.73	1.33	29.9	2.7	10.8	197	205	205	188	199		F	
							1.72	1.32	29.9	2.7	11.3								
S14-516/5	2660286.577	6510575.15	26.1	Bulk Earthworks	HA	4/03/2015	1.76	1.25	40.4	2.7	3.2	188	162	137	171	165		P	
							1.75	1.25	40.4	2.7	3.3								
S14-521/1	2660302.326	6510584.633	27.004	Bulk Earthworks	HA	4/03/2015	1.78	1.26	40.5	2.7	2.0	154	123	128	137	136		P	
							1.80	1.28	40.5	2.7	0.4								
S14-521/2	2660278.981	6510603.969	28.503	Bulk Earthworks	HA	4/03/2015	1.79	1.31	36.1	2.7	4.0	188	128	154	137	152		P	
							1.80	1.32	36.1	2.7	3.6								
S14-522/1	2660087.034	6510791.995	1.776	Shear Key	HA	4/03/2015	1.83	1.37	33.4	2.7	3.4	171	154	145	188	165		P	
							1.83	1.37	33.4	2.7	3.3								
S14-530/1	2660274.039	6510613.12	41.177	Bulk Earthworks	HA	5/03/2015	1.80	1.31	37.6	2.7	2.5	128	128	137	137	133		P	Lime stabilized Material. Low SV result accepted as pass because material will harden as Lime cures
							1.79	1.30	37.6	2.7	2.8								
S14-530/2	2660308.229	6510577.052	25.002	Bulk Earthworks	HA	5/03/2015	1.80	1.26	42.7	2.7	0.0	188	205	137	128	165		P	
							1.79	1.26	42.7	2.7	0.0								
S14-531/1	2660078.367	6510782.903	2.717	Shear Key	HA	5/03/2015	1.81	1.33	36.3	2.7	2.7	154	154	171	188	167		P	
							1.80	1.32	36.3	2.7	2.9								
S14-531/2	2660100.06	6510786.33	4.001	Shear Key	HA	5/03/2015	1.80	1.32	36.3	2.7	3.0	188	188	205	205	197		P	
							1.80	1.32	36.3	2.7	3.4								
S14-536/1	-	-	-	Bulk Earthworks	HA	5/03/2015	-	-	-	-	-	86	205	205	205	175		-	Hand Auger and SV investigation to 1.0 metre depth of fill.
							-	-	-	-	-								
	-	-	-	Bulk Earthworks	HA	5/03/2015	-	-	-	-	-	205	205	-	-	205		-	
							-	-	-	-	-								
S14-536/2	-	-	-	Bulk Earthworks	HA	5/03/2015	-	-	-	-	-	137	120	162	205	156		-	
							-	-	-	-	-								
	-	-	-	Bulk Earthworks	HA	5/03/2015	-	-	-	-	-	162	UTP	-	-	162		-	
							-	-	-	-	-								
S14-536/3	-	-	-	Bulk Earthworks	HA	5/03/2015	-	-	-	-	-	162	154	188	145	162		-	
							-	-	-	-	-								
	-	-	-	Bulk Earthworks	HA	5/03/2015	-	-	-	-	-	205	137	-	-	171		-	
							-	-	-	-	-								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job # 614089.032/1**

T&T Job #: 21854.0037 **Entered By: YA**

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-537/1	2660081.304	6510791.434	4.802	Shear Key	HA	5/03/2015	1.80	1.31	37.1	2.7	2.8	205	145	154	205	177		P	
							1.80	1.31	37.1	2.7	2.8								
S14-537/2	2660086.77	6510791.055	3.536	Shear Key	HA	5/03/2015	1.78	1.30	36.9	2.7	4.1	171	154	205	180	178		P	
							1.78	1.30	36.9	2.7	3.9								
S14-538/1	2660477.769	6510588.701	15.928	RE Wall	HA	6/03/2015	1.80	1.40	28.9	2.7	7.8	UTP	205	UTP	UTP	205		P	
							1.86	1.45	28.9	2.7	4.7								
S14-539/1	-	-	-	Bulk Earthworks	HA	6/03/2015	-	-	-	-	-	154	120	111	205	148		-	Hand Auger and SV investigation to 1.0 metre depth of fill.
							-	-	-	-	-								
	-	-	-	Bulk Earthworks	HA	6/03/2015	-	-	-	-	-	188	205	-	-	197		-	
							-	-	-	-	-								
S14-539/2	-	-	-	Bulk Earthworks	HA	6/03/2015	-	-	-	-	-	120	188	128	197	158		-	
							-	-	-	-	-								
	-	-	-	Bulk Earthworks	HA	6/03/2015	-	-	-	-	-	205	205	-	-	205		-	
							-	-	-	-	-								
S14-539/3	-	-	-	Bulk Earthworks	HA	6/03/2015	-	-	-	-	-	188	205	205	UTP	199		-	
							-	-	-	-	-								
	-	-	-	Bulk Earthworks	HA	6/03/2015	-	-	-	-	-	UTP	UTP	-	-	UTP		-	
							-	-	-	-	-								
S14-539/4	-	-	-	Bulk Earthworks	HA	6/03/2015	-	-	-	-	-	188	123	205	205	180		-	
							-	-	-	-	-								
	-	-	-	Bulk Earthworks	HA	6/03/2015	-	-	-	-	-	205	205	-	-	205		-	
							-	-	-	-	-								
S14-540/1	2660078.681	6510790.285	5.698	Shear Key	HA	6/03/2015	1.86	1.42	30.9	2.7	3.6	162	188	145	188	171		P	
							1.85	1.41	30.9	2.7	4.0								
S14-540/2	2660113.608	6510785.88	2.875	Shear Key	HA	6/03/2015	1.84	1.37	34.5	2.7	2.3	205	162	188	205	190		P	
							1.84	1.37	34.5	2.7	2.3								
S14-546/1	2660130.192	6510791.143	3.604	Shear Key	HA	6/03/2015	1.88	1.43	31.5	2.7	1.8	UTP	UTP	154	154	154		P	
							1.88	1.43	31.5	2.7	2.0								
S14-546/2	2660070.978	6510785.348	4.91	Shear Key	HA	6/03/2015	1.84	1.26	46.2	2.7	0.0	205	205	205	UTP	205		P	
							1.84	1.26	46.2	2.7	0.0								
S14-547/1	2660308.613	6510584.639	27.55	Bulk Earthworks	HA	7/03/2015	1.82	1.31	38.7	2.7	0.5	128	137	188	137	148		P	
							1.82	1.31	38.7	2.7	0.5								
S14-547/2	2660265.087	6510607.788	29.42	Bulk Earthworks	HA	7/03/2015	1.88	1.39	35.0	2.7	0.0	188	188	162	205	186		P	
							1.88	1.39	35.0	2.7	0.0								
S14-548/1	2660075.101	6510791.121	3.807	Shear Key	HA	7/03/2015	1.85	1.44	28.0	2.7	6.1	154	188	UTP	205	182		P	
							1.86	1.45	28.0	2.7	5.7								
S14-554/1	2660359.715	6510527.933	16.138	Silt Pond	HA	9/03/2015	1.85	1.45	27.5	2.7	6.3	205	205	205	205	205		P	
							1.84	1.44	27.5	2.7	6.8								
S14-555/1	2660088.879	6510775.73	-2.839	Shear Key	HA	9/03/2015	1.89	1.47	28.4	2.7	3.9	154	188	188	205	184		P	
							1.89	1.47	28.4	2.7	3.8								
S14-555/2	2660106.438	6510795.679	5.743	Shear Key	HA	9/03/2015	1.84	1.43	29.0	2.7	5.9	154	205	188	205	188		P	
							1.84	1.42	29.0	2.7	6.0								
S14-560/1	2660062.561	6510792.461	6.39	Shear Key	HA	9/03/2015	1.85	1.39	33.2	2.7	2.5	145	154	188	205	173		P	
							1.86	1.40	33.2	2.7	1.9								
S14-560/2	2660116.445	6510794.467	5.048	Shear Key	HA	9/03/2015	1.82	1.28	41.6	2.7	0.0	205	205	162	171	186		P	
							1.81	1.28	41.6	2.7	0.0								
S14-561/1	2660483.636	6510599.356	17.828	RE Wall 2	HA	10/03/2015	1.82	1.36	34.4	2.7	3.2	115	154	197	205	168		P	
							1.83	1.36	34.4	2.7	3.0								
S14-561/2	2660472.982	6510594.044	17.346	RE Wall 2	HA	10/03/2015	1.85	1.41	31.6	2.7	3.4	205	171	188	205	192		P	
							1.85	1.40	31.6	2.7	3.7								
S14-562/1	2660075.635	6510786.366	5.356	Shear Key	HA	10/03/2015	1.82	1.36	34.0	2.7	3.7	154	188	205	162	177		P	
							1.81	1.35	34.0	2.7	3.8								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job # 614089.032/1**

T&T Job #: 21854.0037 **Entered By: YA**

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode
NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-569/1	2660469.586	6510593.245	18.098	RE Wall 2	HA	10/03/2015	1.79	1.32	35.7	2.7	4.0	162	188	154	171	169		P	
							1.78	1.31	35.7	2.7	4.6								
S14-569/2	2660485.025	6510600.089	6.167	RE Wall 2	HA	10/03/2015	1.79	1.36	31.4	2.7	6.7	205	188	171	205	192		P	
							1.79	1.36	31.4	2.7	7.0								
S14-570/1	2660087.849	6510800.087	6.442	Shear Key	HA	10/03/2015	1.84	1.40	31.8	2.7	3.7	154	154	188	205	175		P	
							1.84	1.40	31.8	2.7	3.7								
S14-570/2	2660119.619	6510789.752	6.544	Shear Key	HA	10/03/2015	1.80	1.30	38.3	2.7	1.8	154	154	145	188	160		P	
							1.79	1.30	38.3	2.7	2.4								
S14-581/1	2660273.005	6510588.757	47.663	Bulk Fill	HA	11/03/2015	1.81	1.36	32.4	2.7	5.2	205	UTP	205	205	205		P	
							1.81	1.37	32.4	2.7	5.1								
S14-581/2	2660294.021	6510605.235	27.602	Bulk Fill	HA	11/03/2015	1.90	1.38	38.0	2.7	0.0	188	205	197	205	199		P	
							1.85	1.34	38.0	2.7	0.0								
S14-581/3	2660304.515	6510641.156	29.866	Bulk Fill	HA	11/03/2015	1.80	1.35	33.3	2.7	4.9	205	205	205	205	205	Y	P	Retest of URN.SI4-516
							1.81	1.36	33.3	2.7	4.4								
S14-581/4	2660321.715	6510643.529	29.76	Bulk Fill	HA	11/03/2015	1.86	1.42	30.5	2.7	3.8	154	154	154	188	163		P	
							1.84	1.41	30.5	2.7	4.7								
S14-582/1	2660105.38	6510791.446	7.207	Shear Key	HA	11/03/2015	1.78	1.37	30.1	2.7	8.4	154	162	162	162	160		P	
							1.81	1.39	30.1	2.7	6.8								
S14-582/2	2660151.04	6510790.713	5.406	Shear Key	HA	11/03/2015	1.89	1.48	27.7	2.7	4.4	154	154	145	171	156		P	
							1.89	1.48	27.7	2.7	4.3								
S14-586/1	2660483.065	6510604.837	18.921	RE Wall 2	HA	11/03/2015	1.87	1.35	38.4	2.7	0.0	205	205	205	205	205		P	
							1.86	1.35	38.4	2.7	0.0								
S14-586/2	2660490.422	6510612.76	20.048	RE Wall 2	HA	11/03/2015	1.84	1.44	27.8	2.7	6.8	205	188	171	205	192		P	
							1.84	1.44	27.8	2.7	6.7								
S14-588/1	2660166.261	6510782.889	5.252	Shear Key	HA	11/03/2015	-	-	-	-	-	145	145	103	86	120		F	
							-	-	-	-	-								
S14-588/2	2660107.277	6510787.507	9.726	Shear Key	HA	11/03/2015	1.85	1.40	32.6	2.7	2.8	154	154	188	205	175		P	
							1.80	1.35	32.6	2.7	5.7								
S14-596/1	2660106.334	6510783.097	9.047	Shear Key	HA	12/03/2015	1.86	1.37	35.8	2.7	0.1	145	145	188	145	156		P	
							1.86	1.37	35.8	2.7	0.2								
S14-596/2	2660172.278	6510779.895	4.199	Shear Key	HA	12/03/2015	1.91	1.46	31.5	2.7	0.6	188	188	145	205	182		P	
							1.92	1.46	31.5	2.7	0.1								
S14-602/1	2660454.72	6510585.991	20.558	RE Wall 2	HA	12/03/2015	1.83	1.32	37.8	2.7	0.9	180	180	205	205	193		P	
							1.79	1.30	37.8	2.7	3.0								
S14-602/2	2660470.266	6510596.745	19.974	RE Wall 2	HA	12/03/2015	1.80	1.29	39.5	2.7	1.1	188	188	205	162	186		P	
							1.80	1.29	39.5	2.7	1.2								
S14-603/1	2660091.187	6510786.701	7.355	Shear Key	HA	12/03/2015	1.90	1.43	33.4	2.7	0.0	188	154	205	205	188		P	
							1.89	1.42	33.4	2.7	0.1								
S14-603/2	2660140.148	6510788.997	6.749	Shear Key	HA	12/03/2015	1.90	1.42	33.6	2.7	0.0	188	145	188	205	182		P	
							1.89	1.41	33.6	2.7	0.2								
S14-610/1	2660450.046	6510585.067	21.446	RE Wall	HA	13/03/2015	1.71	1.21	41.0	2.7	5.6	171	171	171	171	171		P	
							1.73	1.22	41.0	2.7	4.4								
S14-611/1	2660161.799	6510779.432	6.177	Shear Key	HA	13/03/2015	1.81	1.30	39.4	2.7	0.5	162	171	145	171	162		P	
							1.80	1.29	39.4	2.7	1.1								
S14-614/1	2660170.785	6510780.656	7.682	Shear Key	HA	13/03/2015	1.84	1.37	34.5	2.7	2.2	171	162	188	162	171		P	
							1.84	1.37	34.5	2.7	2.0								
S14-614/2	2660115.051	6510781.723	8.186	Shear Key	HA	13/03/2015	1.84	1.41	30.3	2.7	4.8	205	205	205	205	205		P	
							1.83	1.41	30.3	2.7	5.4								
S14-615/1	2660163.322	6510777.59	11.338	Shear Key	HA	14/03/2015	1.91	1.44	32.7	2.7	0.0	145	188	180	180	173		P	
							1.91	1.44	32.7	2.7	0.0								
S14-615/2	2660137.197	6510782.307	8.315	Shear Key	HA	14/03/2015	1.90	1.44	31.6	2.7	1.2	162	205	205	180	188		P	
							1.87	1.42	31.6	2.7	2.4								
S14-628/1				Bulk Fill	HA	19/03/2015	1.93	1.45	33.2	2.7	0.0	205	154	145	154	165		P	
							1.91	1.43	33.2	2.7	0.0								
S14-628/2				Bulk Fill	HA	19/03/2015	1.87	1.37	36.7	2.7	0.0	154	154	188	137	158		P	
							1.81	1.33	36.7	2.7	2.2								
S14-636/1				Bulk Fill	HA	20/03/2015	1.76	1.33	32.0	2.7	8.0	145	154	128	120	137		P	Lime Dried
							1.76	1.34	32.0	2.7	7.8								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job #** 614089.032/1

T&T Job #: 21854.0037 **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-639/1				Bulk Fill	HA	20/03/2015	1.61	1.15	40.2	2.7	11.5	205	171	137	171	171		P	Lime Dried
							1.61	1.15	40.2	2.7	11.4								
S14-639/2				Bulk Fill	HA	20/03/2015	1.79	1.32	35.5	2.7	4.2	188	154	205	UTP	182		P	
							1.79	1.32	35.5	2.7	4.1								
S14-642/1				Bulkfill	YA	21/03/2015	1.83	1.43	27.5	2.7	7.5	120	137	154	171	146		P	
							1.83	1.43	27.5	2.7	7.4								
S14-642/2				Bulkfill	YA	21/03/2015	1.83	1.43	27.3	2.7	7.8	120	137	154	171	146		P	
							1.83	1.44	27.3	2.7	7.6								
S14-643/1				Silt pond fill	YA	21/03/2015	1.90	1.40	35.8	2.7	0.0	154	171	188	205	180		P	
							1.89	1.39	35.8	2.7	0.0								
S14-643/2				Silt pond fill	YA	21/03/2015	1.91	1.39	36.7	2.7	0.0	154	171	188	205	180		P	
							1.90	1.39	36.7	2.7	0.0								
S14-648				R.E Wall 3	HA	23/03/2015	-	-	-	-	-	145	188	162	162	164		P	
							-	-	-	-	-								
S14-649/1				Bulk Fill	HA	23/03/2015	1.97	1.54	27.9	2.7	0.1	120	137	154	205	154		P	Lime stabilized. Poor SV result expected to increase as Lime stabilizes.
							1.91	1.49	27.9	2.7	2.9								
S14-649/2				Bulk Fill	HA	23/03/2015	1.88	1.35	39.6	2.7	0.0	103	103	103	103	103		P	
							1.85	1.33	39.6	2.7	0.0								
S14-654/1				R.E Wall 3	HA	23/03/2015	1.81	1.37	32.2	2.7	5.3	188	188	205	205	197		P	
							1.81	1.37	32.2	2.7	5.1								
S14-654/2				R.E Wall 3	HA	23/03/2015	1.88	1.48	26.6	2.7	5.7	205	205	205	205	205		P	
							2.04	1.61	26.6	2.7	0.0								
S14-655/1				Silt Pond Fill	HA	23/03/2015	2.08	1.53	36.4	2.7	-12.0	205	154	171	188	180		P	
							2.01	1.47	36.4	2.7	-7.9								
S14-655/2				Silt Pond Fill	HA	23/03/2015	1.76	1.28	37.0	2.7	5.0	171	205	188	205	192		P	
							1.76	1.28	37.0	2.7	5.0								
S14-663				Silt Pond Fill	HA	26/03/2015	-	-	-	-	-	120	120	188	188	154		P	
							-	-	-	-	-								
S14-664/1				R.E Wall 3	HA	26/03/2015	1.84	1.29	42.9	2.7	0.0	145	154	188	188	169		P	
							1.82	1.28	42.9	2.7	0.0								
S14-664/2				R.E Wall 3	HA	26/03/2015	-	-	-	2.7	-	103	103	128	154	122	Y	F	
							-	-	-	2.7	-								
S14-664/3				R.E Wall 3	HA	26/03/2015	1.91	1.43	33.3	2.7	0.0	188	154	188	205	184		P	
							1.83	1.37	33.3	2.7	3.6								
S14-672/1				Undercut	HA	31/03/2015	1.83	1.41	30.0	2.7	5.5	188	205	188	205	197		P	
							1.84	1.42	30.0	2.7	5.1								
S14-678/1				R.E Wall 3	HA	31/03/2015	-	-	-	-	-	94	103	94	86	94		F	
							-	-	-	-	-								
S14-678/2				R.E Wall 3	HA	31/03/2015	-	-	-	-	-	103	120	154	120	124		F	
							-	-	-	-	-								
S14-679/1				Undercut	HA	31/03/2015	2.16	1.54	40.4	2.7	0.0	128	205	128	171	158		P	
							2.10	1.50	40.4	2.7	0.0								
S14-683/1				R.E Wall 3	HA	1/04/2015	1.74	1.20	45.2	2.7	1.5	162	180	145	154	160		P	
							1.69	1.16	45.2	2.7	4.2								
S14-683/2				R.E Wall 3	HA	1/04/2015	1.69	1.22	39.4	2.7	7.1	145	154	188	145	158		P	
							1.70	1.22	39.4	2.7	6.6								
S14-684				Siltpond wall	HA	1/04/2015	-	-	-	-	-	145	145	205	205	175		P	
							-	-	-	-	-								
S14-685				Drainage Line	HA	1/04/2015	-	-	-	-	-	171	171	205	205	188		P	
							-	-	-	-	-								
S14-691/1				R.E Wall 3	HA	2/04/2015	2.04	1.42	43.0	2.7	0.0	205	154	188	188	184		P	
							1.90	1.33	43.0	2.7	0.0								
S14-691/2				R.E Wall 3	HA	2/04/2015	1.87	1.55	21.0	2.7	10.2	205	205	205	205	205		F	
							1.91	1.58	21.0	2.7	8.6								
S14-692/1				Bulkfill	HA	2/04/2015	-	-	-	-	-	154	188	128	137	152		P	
							-	-	-	-	-								
S14-692/2				Bulkfill	HA	2/04/2015	-	-	-	-	-	137	137	154	188	154		P	
							-	-	-	-	-								

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T&T Job #: **21854.0037** **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-693/1				BulkFill - Lime Dried Area	HA	2/04/2015	-	-	-	-	-	86	103	120	154	116	Y	F	Lime Dried Area
							-	-	-	-	-								
S14-693/2				BulkFill - Lime Dried Area	HA	2/04/2015	-	-	-	-	-	86	120	154	103	116	Y	F	
							-	-	-	-	-								
S14-693/3				BulkFill - Lime Dried Area	HA	2/04/2015	-	-	-	-	-	86	137	120	103	112	Y	F	
							-	-	-	-	-								
S14-693/4				BulkFill - Lime Dried Area	HA	2/04/2015	-	-	-	-	-	94	103	120	137	114	Y	F	
							-	-	-	-	-								
S14-700/1				Bulkfill	HA	7/04/2015	2.12	1.55	37.2	2.7	0.0	128	137	154	145	141		P	
							2.04	1.49	37.2	2.7	0.0								
S14-700/2				Bulkfill	HA	7/04/2015	1.88	1.43	30.8	2.7	2.8	205	205	171	145	182		P	
							1.85	1.41	30.8	2.7	4.1								
S14-701/1				BulkFill - Lime Dried Area	HA	7/04/2015	-	-	-	-	-	120	120	137	154	133		P	Lime Dried Area
							-	-	-	-	-								
S14-701/2				BulkFill - Lime Dried Area	HA	7/04/2015	-	-	-	-	-	130	120	137	154	135		P	
							-	-	-	-	-								
S14-701/3				BulkFill - Lime Dried Area	HA	7/04/2015	-	-	-	-	-	137	154	103	205	150		P	
							-	-	-	-	-								
S14-701/4				BulkFill - Lime Dried Area	HA	7/04/2015	-	-	-	-	-	120	137	154	110	130		P	
							-	-	-	-	-								
S14-707				Bulkfill	HA	7/04/2015	-	-	-	-	-	128	128	205	205	167		P	
							-	-	-	-	-								
S14-712/1				Bulkfill	HA	8/04/2015	1.85	1.38	33.9	2.7	2.2	171	171	154	137	158		P	
							1.85	1.38	33.9	2.7	1.8								
S14-712/2				Bulkfill	HA	8/04/2015	1.82	1.26	44.8	2.7	0.0	205	120	137	154	154		P	
							1.82	1.26	44.8	2.7	0.0								
S14-715/1				Bulkfill	HA	9/04/2015	1.79	1.25	43.0	2.7	0.0	120	154	137	120	133		P	
							1.79	1.25	43.0	2.7	0.0								
S14-715/2				Bulkfill	HA	9/04/2015	1.78	1.24	43.9	2.7	0.0	120	154	188	128	148		P	
							1.78	1.24	43.9	2.7	0.0								
S14-718/1				Shear Key	HA	9/04/2015	-	-	-	-	-	120	120	145	188	143	Y	F	
							-	-	-	-	-								
S14-718/2				Shear Key	HA	9/04/2015	-	-	-	-	-	120	137	154	154	141	Y	F	
							-	-	-	-	-								
S14-719/1				R.E Wall 3	HA	9/04/2015	1.84	1.39	32.2	2.7	3.7	145	145	171	188	162		P	
							1.84	1.39	32.2	2.7	3.4								
S14-719/2				R.E Wall 3	HA	9/04/2015	1.77	1.32	33.9	2.7	6.5	162	171	188	145	167		P	
							1.77	1.32	33.9	2.7	6.4								
S14-722/1				R.E Wall 3	HA	10/04/2015	-	-	-	-	-	103	171	103	171	137		F	
							-	-	-	-	-								
S14-722/2				R.E Wall 3	HA	10/04/2015	-	-	-	-	-	103	171	103	171	137		F	
							-	-	-	-	-								
S14-723/1				Shear Key	HA	10/04/2015	1.86	1.46	26.9	2.7	6.6	205	188	180	205	195		P	
							1.85	1.46	26.9	2.7	6.6								
S14-723/2				Shear Key	HA	10/04/2015	1.79	1.23	45.3	2.7	0.0	154	205	154	205	180		P	
							1.79	1.23	45.3	2.7	0.0								
S14-726				R.E Wall 3	HA	10/04/2015	-	-	-	-	-	120	120	188	188	154		F	
							-	-	-	-	-								
S14-727				Shear Key	HA	10/04/2015	-	-	-	-	-	145	205	145	205	175		P	
							-	-	-	-	-								
S14-731/1				Undercut 2	HA	17/04/2015	1.83	1.38	32.2	2.7	4.2	188	154	205	171	180		P	
							1.83	1.39	32.2	2.7	3.9								
S14-731/2				Undercut 2	HA	17/04/2015	1.82	1.36	34.5	2.7	3.0	154	145	188	171	165		P	
							1.82	1.35	34.5	2.7	3.2								
S14-731/3				Undercut 2	HA	17/04/2015	1.79	1.33	34.7	2.7	4.9	162	162	137	171	158		P	
							1.79	1.33	34.7	2.7	4.9								
S14-732/1				Undercut 2	HA	17/04/2015	1.82	1.33	36.6	2.7	1.9	145	162	188	171	167		P	
							1.82	1.34	36.6	2.7	1.7								

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S14-732/2				Undercut 2	HA	17/04/2015	1.81	1.35	34.0	2.7	3.9	162	145	145	154	152		P	
							1.82	1.36	34.0	2.7	3.7								
S14-736/1	2660348.2	6510722.192	8.33	Undercut 2	HA	18/04/2015	1.82	1.34	36.0	2.7	2.2	171	154	205	154	171		P	
							1.82	1.34	36.0	2.7	2.1								
S14-736/2	2660377.223	6510730.161	9.161	Undercut 2	HA	18/04/2015	1.82	1.34	36.0	2.7	2.2	154	154	205	145	165		P	
							1.82	1.34	36.0	2.7	2.0								
S14-738/1	2660424.32	6510736.853	10.823	Undercut 2	HA	20/04/2015	1.81	1.35	34.2	2.7	4.0	145	154	162	145	152		P	
							1.81	1.35	34.2	2.7	3.8								
S14-738/2	2660390.268	6510730.037	10.071	Undercut 2	HA	20/04/2015	1.81	1.37	31.8	2.7	5.5	137	145	162	188	158		P	
							1.81	1.37	31.8	2.7	5.7								
S14-738/3	2660360.42	6510724.226	8.844	Undercut 2	HA	20/04/2015	1.77	1.30	36.0	2.7	4.9	154	137	162	145	150		P	
							1.77	1.30	36.0	2.7	5.0								
S14-741/1	2660405.709	6510733.615	11.555	Undercut 2	HA	20/04/2015	1.80	1.36	32.6	2.7	5.3	145	154	205	154	165		P	
							1.81	1.36	32.6	2.7	5.2								
S14-741/2	2660369.764	6510728.451	7.127	Undercut 2	HA	20/04/2015	1.78	1.29	38.1	2.7	3.0	205	188	188	180	190		P	
							1.78	1.29	38.1	2.7	3.3								
S14-747/1	2660042.761	6510781.431	5.306	R.e Wall Plus Silt Pond Wall	HA	21/04/2015	1.83	1.38	32.7	2.7	3.7	205	171	180	154	178		P	
							1.83	1.38	32.7	2.7	3.8								
S14-747/2	2660063.295	6510792.329	4.715	R.e Wall Plus Silt Pond Wall	HA	21/04/2015	1.76	1.27	38.7	2.7	4.0	205	162	180	171	180		P	
							1.76	1.27	38.7	2.7	3.7								
S14-747/3	2660069.857	6510805.607	5.484	R.e Wall Plus Silt Pond Wall	HA	21/04/2015	1.79	1.28	40.0	2.7	1.7	162	171	128	180	160		P	
							1.79	1.28	40.0	2.7	1.7								
S14-750/1	Missing GPS	Missing GPS	Missing GPS	R.e Wall Plus Silt Pond Wall	HA	21/04/2015	1.80	1.33	35.4	2.7	3.5	162	154	162	188	167		P	
							1.80	1.33	35.4	2.7	3.8								
S14-750/2	2660037.149	6510777.598	2.982	R.e Wall Plus Silt Pond Wall	HA	21/04/2015	1.79	1.30	36.8	2.7	3.7	145	145	171	205	167		P	
							1.79	1.31	36.8	2.7	3.3								
S14-750/3	Missing GPS	Missing GPS	Missing GPS	R.e Wall Plus Silt Pond Wall	HA	21/04/2015	1.86	1.40	32.5	2.7	2.6	171	145	145	171	158		P	
							1.86	1.41	32.5	2.7	2.3								
S14-754/1	2660042.625	6510777.039	5.844	R.E Wall	HA	22/04/2015	1.83	1.36	34.2	2.7	3.1	145	145	180	171	160		P	
							1.82	1.36	34.2	2.7	3.3								
S14-754/2	2660060.068	6510786.985	5.658	R.E Wall	HA	22/04/2015	1.82	1.36	33.5	2.7	3.9	205	188	171	205	192		P	
							1.82	1.36	33.5	2.7	3.9								
S14-761/1	2660069.796	6510785.599	6.082	R.E Wall	HA	22/04/2015	1.81	1.32	37.4	2.7	1.8	145	188	145	154	158		P	
							1.81	1.32	37.4	2.7	1.9								
S14-761/2	2660039.278	6510771.563	6.028	R.E Wall	HA	22/04/2015	1.80	1.36	32.4	2.7	5.5	145	171	205	205	182		P	
							1.80	1.36	32.4	2.7	5.8								
S14-767/1	Missing GPS	Missing GPS	Missing GPS	R.E Wall + Shear Key	HA	23/04/2015	1.79	1.28	39.4	2.7	1.8	188	145	205	162	175		P	
							1.79	1.28	39.4	2.7	2.1								
S14-767/2	2660030.715	6510765.139	8.73	R.E Wall + Shear Key	HA	23/04/2015	1.81	1.33	35.8	2.7	3.0	154	154	145	162	164		P	
							1.81	1.33	35.8	2.7	3.0								
S14-776/1	2660080.173	6510788.175	8.231	R.E Wall + SiltPond	HA	1/05/2015	1.80	1.31	37.6	2.7	2.4	154	154	188	205	175		P	
							1.80	1.31	37.6	2.7	2.2								
S14-776/2	2660068.466	6510816.748	6.493	R.E Wall + SiltPond	HA	1/05/2015	1.83	1.38	32.3	2.7	4.0	205	188	171	205	192		P	
							1.83	1.38	32.3	2.7	4.2								
S14-780/1	2660070.061	6510774.899	13.233	R.E Wall + Shear Key	HA	2/05/2015	-	-	-	-	-	145	154	154	188	160		P	
							-	-	-	-	-								
S14-780/2				R.E Wall + Shear Key	HA	2/05/2015	-	-	-	-	-	171	188	145	154	165		P	
							-	-	-	-	-								
S14-784/1	2660061.881	6510779.407	9.163	R.E Wall + Shear Key	HA	4/05/2015	1.83	1.35	35.1	2.7	2.5	205	188	205	205	201		P	
							1.83	1.36	35.1	2.7	2.1								
S14-784/2	2660028.066	6510753.77	10.894	R.E Wall + Shear Key	HA	4/05/2015	1.81	1.34	34.6	2.7	3.9	154	154	171	205	171		P	
							1.80	1.34	34.6	2.7	4.2								
S14-787/1	2660049.723	6510797.061	5.506	R.E Wall + SiltPond	HA	4/05/2015	-	-	-	-	-	205	154	171	188	180		P	
							-	-	-	-	-								
S14-787/2				R.E Wall + SiltPond	HA	4/05/2015	-	-	-	-	-	154	171	154	205	171		P	
							-	-	-	-	-								
S14-791/1	2660057.164	6510776.661	9.984	R.E Wall + Shear Key	HA	5/05/2015	1.81	1.29	40.4	2.7	0.3	154	162	145	145	152		P	
							1.81	1.29	40.4	2.7	0.3								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job # 614089.032/1**
T&T Job #: 21854.0037 **Entered By: YA**
Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode
NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-791/2	2660100.273	6510786.392	10.175	R.E Wall + Shear Key	HA	5/05/2015	1.75	1.25	39.5	2.7	4.1	120	128	162	171	145		P	
							1.76	1.26	39.5	2.7	3.7								
S14-795/1	2660089.519	6510778.937	6.776	R.E Wall + Shear Key	HA	5/05/2015	1.83	1.33	38.1	2.7	0.3	154	145	154	145	150		P	
							1.84	1.33	38.1	2.7	0.2								
S14-798/1	2660037.491	6510760.911	11.208	R.E Wall + Shear Key	YA	6/05/2015	1.74	1.29	34.9	2.7	7.4	137	127	154	171	147		P	
							1.74	1.29	34.9	2.7	7.0								
S14-798/2	2660067.464	6510777.519	11.167	R.E Wall + Shear Key	YA	6/05/2015	1.74	1.30	33.6	2.7	8.1	154	137	171	154	154		P	
							1.75	1.31	33.6	2.7	7.3								
S14-802/1	2660080.239	6510774.676	11.192	R.E Wall + Shear Key	YA	6/05/2015	1.79	1.32	36.0	2.7	3.8	120	137	154	185	149		P	
							1.78	1.31	36.0	2.7	4.4								
S14-802/2	2660047.035	6510757.299	11.332	R.E Wall + Shear Key	YA	6/05/2015	1.78	1.30	37.5	2.7	3.3	120	137	154	185	149		P	
							1.80	1.31	37.5	2.7	2.4								
S14-808/1	2660106.858	6510785.29	12.896	R.E Wall + Shear Key	HA	7/05/2015	-	-	-	-	-	205	205	154	145	177		P	
							-	-	-	-	-								
S14-808/2				R.E Wall + Shear Key	HA	7/05/2015	-	-	-	-	-	154	UTP	205	188	182		P	
							-	-	-	-	-								
S14-811/1	2660057.348	6510771.761	11.733	R.E Wall + Shear Key	HA	7/05/2015	1.81	1.34	36.1	2.7	3.6	137	162	128	154	145		P	
							1.80	1.34	36.1	2.7	3.7								
S14-811/2	2660105.834	6510783.649	11.653	R.E Wall + Shear Key	HA	7/05/2015	1.83	1.30	40.5	2.7	-1.0	205	188	154	145	173		P	
							1.83	1.31	40.5	2.7	-1.2								
S14-957/1	2660139.31	6510744.166	14.178	Undercut	RHN	13/07/2015	1.89	1.46	29.3	2.7	3.1	205	205	205	205	205		P	
							1.88	1.45	29.3	2.7	3.6								
S14-957/2	2660137.914	6510728.909	15.857	Undercut	RHN	14/07/2015	1.83	1.39	32.1	2.7	4.1	205	188	154	171	180		P	
							1.83	1.38	32.1	2.7	4.3								
S14-970A/1				Mass block wall	RHN	17/07/2015	-	-	-	-	-	154	123	154	171	150		P	
							-	-	-	-	-								
S14-970A/2				Mass block wall	RHN	17/07/2015	-	-	-	-	-	120	137	137	120	128		P	
							-	-	-	-	-								
S14-970A/3				Mass block wall	RHN	17/07/2015	-	-	-	-	-	154	154	137	140	146		P	
							-	-	-	-	-								
S14-970A/4				Mass block wall	RHN	17/07/2015	-	-	-	-	-	205	137	154	140	159		P	
							-	-	-	-	-								
S14/979/1	2660082.672	6510796.289	7.238	Bulkfill	RHN	22/07/2015	1.83	1.40	30.4	2.7	5.3	171	188	154	150	166		P	
							1.85	1.42	30.4	2.7	4.4								
S14/979/2	2660152.174	6510734.04	8.586	Undercut	RHN	22/07/2015	1.81	1.38	30.6	2.7	6.5	150	188	205	188	183		P	
							1.79	1.37	30.6	2.7	7.1								
S14-1002/1				Mass block wall	RHN	10/08/2015	-	-	-	-	-	140	144	171	171	156		P	
							-	-	-	-	-								
S14-1002/2				Mass block wall	RHN	10/08/2015	-	-	-	-	-	188	171	154	188	175		P	
							-	-	-	-	-								
S14-1002/3				Mass block wall	RHN	10/08/2015	-	-	-	-	-	171	168	188	171	174		P	
							-	-	-	-	-								
S14-1002/4				Mass block wall	RHN	10/08/2015	-	-	-	-	-	171	147	161	171	162		P	
							-	-	-	-	-								
S14-1007/1				Mass block wall	RHN	11/08/2015	-	-	-	-	-	89	99	111	103	100		F	
							-	-	-	-	-								
S14-1007/2				Mass block wall	RHN	11/08/2015	-	-	-	-	-	123	79	82	109	98		F	
							-	-	-	-	-								
S14-1007/3				Mass block wall	RHN	11/08/2015	-	-	-	-	-	205	171	154	188	180		P	
							-	-	-	-	-								
S14-1007/4				Mass block wall	RHN	11/08/2015	-	-	-	-	-	188	171	188	168	179		P	
							-	-	-	-	-								
S14-1008/1				Mass block wall	RHN	12/08/2015	-	-	-	-	-	120	137	123	127	127	Y	P	
							-	-	-	-	-								
S14-1008/2				Mass block wall	RHN	12/08/2015	-	-	-	-	-	140	171	120	106	134	Y	P	
							-	-	-	-	-								
S14-1008/3				Mass block wall	RHN	12/08/2015	-	-	-	-	-	120	109	137	127	123	Y	P	
							-	-	-	-	-								
S14-1008/4				Mass block wall	RHN	12/08/2015	-	-	-	-	-	130	127	147	123	132	Y	P	
							-	-	-	-	-								
S14-1012				Bench 5 backfill	RHN	13/08/2015	1.82	1.33	37.0	2.7	1.8	130	127	147	123	132		P	Engineered backfill
							1.82	1.33	37.0	2.7	1.4								
S14-1023/1	2660119.617	6510731.83	15.828	Bulkfill	RHN	21/08/2015	1.80	1.34	34.6	2.7	4.2	137	161	171	161	157		P	
							1.79	1.33	34.6	2.7	4.8								
S14-1023/2	2660125.322	6510731.265	15.044	Bulkfill	RHN	21/08/2015	1.83	1.38	33.3	2.7	3.3	188	188	171	188	184		P	
							1.82	1.37	33.3	2.7	3.9								

Subgrade
Subgrade
Subgrade
Bench 5 under cut 500, retest of URN S14-1007/1 & 2 subgrade shear strength

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job # 614089.032/1**

T&T Job #: 21854.0037 **Entered By: YA**

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode
NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S14-1023/3	2660131.929	6510720.501	16.171	Bulkfill	RHN	21/08/2015	1.83	1.36	33.8	2.7	3.4	UTP	UTP	UTP	UTP	UTP		P	
							1.82	1.36	33.8	2.7	3.5								
S14-1027/1	2660115.481	6510731.303	14.771	Bulkfill	RHN	24/08/2015	1.80	1.31	37.3	2.7	2.8	188	188	205	188	192		P	
							1.79	1.31	37.3	2.7	2.9								
S14-1027/2	2660099.115	6510728.796	14.75	Bulkfill	RHN	24/08/2015	1.76	1.21	45.7	2.7	-0.1	205.2	205	188	188.1	197		P	
							1.77	1.21	45.7	2.7	-0.5								
S14-1037/1	2660064.645	6510705.911	16.366	Bulkfill	RHN	28/08/2015	1.74	1.26	39.0	2.7	4.7	136.8	171	154	136.8	150		P	
							1.73	1.24	39.0	2.7	5.5								
S14-1037/2	2660080.435	6510719.231	16.148	Bulkfill	RHN	28/08/2015	1.74	1.24	41.0	2.7	3.5	153.9	171	171	153.9	162		P	
							1.74	1.24	41.0	2.7	3.5								
S14-1037/3	2660096.622	6510728.529	16.219	Bulkfill	RHN	28/08/2015	1.71	1.22	40.1	2.7	5.7	153.9	154	171	153.9	158		P	
							1.72	1.23	40.1	2.7	5.3								
S14-1037/4	2660110.443	6510729.903	16.17	Bulkfill	RHN	28/08/2015	1.75	1.26	40.1	2.7	3.8	136.8	188	171	153.9	162		P	
							1.72	1.23	40.1	2.7	5.4								
S14-1052/1	2660115.673	6510731.296	15.552	Behind Mass block wall	JED	9/09/2015	1.66	1.11	50.5	2.7	3.2	165	180	195	165	176		P	
							1.66	1.10	50.5	2.7	3.4								
S14-1052/2	2660087.217	6510722.724	16.595	Behind Mass block wall	JED	9/09/2015	1.71	1.21	40.8	2.7	5.6	195	195	195	195	195		P	
							1.71	1.21	40.8	2.7	5.6								
S14-1052/3	2660070.791	6510709.855	14.329	Behind Mass block wall	JED	9/09/2015	1.66	1.18	41.2	2.7	7.9	195	165	195	180	184		P	
							1.66	1.17	41.2	2.7	8.1								
S15-001/1	2660172.691	6510737.941	11.573	Undercut 2	JED	15/09/2015	1.82	1.31	38.2	2.7	1.1	195	195	195	195	195		P	
							1.82	1.32	38.2	2.7	1.0								
S15-001/2	2660187.603	6510730.836	10.295	Undercut 2	JED	15/09/2015	1.78	1.24	43.7	2.7	0.1	165	150	158	165	160		P	
							1.78	1.24	43.7	2.7	0.1								
S15-008/1	2660202.631	6510726.465	9.741	Undercut 2	JED	16/09/2015	-	-	-	2.7	-	105	120	112	120	114		F	
							-	-	-	2.7	-								
S15-008/2	2660187.799	6510738.034	10.779	Undercut 2	JED	16/09/2015	-	-	-	2.7	-	135	120	142	105	126		F	
							-	-	-	2.7	-								
S15-008/3	2660178.453	6510734.588	11.026	Undercut 2	JED	16/09/2015	-	-	-	2.7	-	105	120	112	127	116		F	
							-	-	-	2.7	-								
S15-014/2	2660176.842	6510736.375	11.579	Undercut 2	JED	17/09/2015	1.78	1.29	38.6	2.7	2.7	195	195	195	195	195	Y	P	Retest of URN S15-008/1-3
							1.78	1.29	38.6	2.7	2.7								
S15-014/2	2660204.256	6510727.705	10.357	Undercut 2	JED	17/09/2015	1.81	1.35	33.9	2.7	4.3	195	180	165	150	173	Y	P	
							1.81	1.35	33.9	2.7	4.3								
S15-044/1	2660213.918	6510725.422	8.719	Undercut 2	JED	28/09/2015	1.75	1.24	41.1	2.7	3.3	150	195	135	143	156		P	
							1.75	1.24	41.1	2.7	3.0								
S15-044/2	2660226.792	6510725.794	9.131	Undercut 2	JED	28/09/2015	-	-	-	2.7	-	150	143	135	180	152		P	
							-	-	-	2.7	-								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job # 614089.032/1**

T&T Job #: 21854.0037 **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S15-051/1				Undercut 2	JED	1/10/2015	1.88	1.40	34.6	2.7	0.0	150	165	135	157	152		P	
							1.89	1.40	34.6	2.7	0.0								
S15-051/2				Undercut 2	JED	1/10/2015	1.83	1.36	35.1	2.7	2.2	150	164	180	142	159		P	
							1.84	1.36	35.1	2.7	1.7								
S15-056/1				Undercut 2	JED	6/10/2015	1.81	1.34	35.2	2.7	3.4	196	196	196	196	196		P	
							1.78	1.31	35.2	2.7	5.2								
S15-056/2				Undercut 2	JED	6/10/2015	1.79	1.32	35.8	2.7	3.9	196	196	196	196	196		P	
							1.82	1.34	35.8	2.7	2.4								
S15-056/3				Undercut 2	JED	6/10/2015	1.79	1.32	35.0	2.7	4.8	196	196	196	196	196		P	
							1.82	1.35	35.0	2.7	3.1								
S15-059/1				Undercut 2	TAJ	8/10/2015	1.76	1.27	38.7	2.7	3.9	147	154	161	168	158		P	
							1.78	1.28	38.7	2.7	2.8								
S15-060/3	2660258.982	6510715.934	10.491	Undercut 2	TAJ	9/10/2015	1.83	1.35	34.7	2.7	2.8	161	196	196	196	187		P	
							1.81	1.34	34.7	2.7	3.8								
S15-060/8	2660317.485	6510721.611	10.663	Undercut 2	TAJ	9/10/2015	1.82	1.30	39.4	2.7	0.4	196	196	196	196	196		P	
							1.82	1.31	39.4	2.7	0.1								
S15-060/4	2660258.654	6510731.286	10.561	SuperLot Below wall 303	TAJ	9/10/2015	1.83	1.38	33.0	2.7	3.7	196	196	196	196	196		P	
							1.93	1.45	33.0	2.7	0.0								
S15-060/5	2660235.767	6510746.005	10.221	SuperLot Below wall 303	TAJ	9/10/2015	1.80	1.31	36.9	2.7	3.1	143	185	196	196	180		P	
							1.81	1.32	36.9	2.7	2.5								
S15-060/6	2660219.4	6510739.766	10.444	SuperLot Below wall 303	TAJ	9/10/2015	1.91	1.43	33.7	2.7	0.0	196	196	196	196	196		P	
							1.92	1.43	33.7	2.7	0.0								
S15-060/7	2660197.225	6510750.469	10.249	SuperLot Below wall 303	TAJ	9/10/2015	1.83	1.34	36.1	2.7	1.7	196	196	196	196	196		P	
							1.82	1.34	36.1	2.7	2.3								
S15-060/9	2660321.66	6510730.839	11.045	SuperLot Below wall 303	TAJ	9/10/2015	1.78	1.32	34.7	2.7	5.4	196	196	196	196	196		P	
							1.77	1.32	34.7	2.7	5.6								
S15-067/5	2660204.698	6510778.824	4.764	Shear Key	TAJ	15/10/2015	1.76	1.34	31.7	2.7	8.1	196	196	196	196	196		P	
							1.82	1.38	31.7	2.7	5.1								
S15-067/6	2660189.11	6510779.541	5.714	Shear Key	TAJ	15/10/2015	1.76	1.31	34.7	2.7	6.3	196	196	196	196	196		P	
							1.76	1.31	34.7	2.7	6.3								
S15-069/1	2660199.391	6510779.455	6.66	Shear Key	TAJ	17/10/2015	1.80	1.34	33.8	2.7	4.9	196	196	196	196	196		P	
							1.78	1.33	33.8	2.7	5.8								
S15-069/2	2660186.175	6510777.622	7.758	Shear Key	TAJ	17/10/2015	1.76	1.27	38.8	2.7	3.6	196	196	196	196	196		P	
							1.77	1.27	38.8	2.7	3.6								
S15-070/3	2660193.387	6510773.584	8.134	Shear Key	TAJ	19/10/2015	1.84	1.36	35.0	2.7	1.9	196	196	196	196	196		P	
							1.84	1.36	35.0	2.7	1.9								
S15-072/4	2660213.663	6510774.904	7.313	Shear Key	TAJ	21/10/2015	1.78	1.33	33.5	2.7	5.8	196	196	196	196	196		P	
							1.77	1.33	33.5	2.7	6.3								
S15-074/5	2660224.738	6510774.713	5.796	Shear Key	TAJ	21/10/2015	1.77	1.32	34.6	2.7	5.6	196	196	196	196	196		P	
							1.78	1.32	34.6	2.7	5.3								
S15-072/5	2660363.414	6510734.223	8.692	Behind Wall 3	TAJ	21/10/2015	1.73	1.28	35.6	2.7	7.2	196	196	196	196	196		P	
							1.73	1.28	35.6	2.7	7.2								
S15-074/6	2660364.509	6510748.905	9.619	Behind Wall 3	TAJ	21/10/2015	1.77	1.34	32.3	2.7	7.0	196	196	196	196	196		P	
							1.78	1.34	32.3	2.7	6.9								
S15-073/9	2660221.134	6510767.725	7.916	Shear key	TAJ	22/10/2015	1.81	1.36	33.0	2.7	4.8	196	196	196	196	196		P	
							1.81	1.36	33.0	2.7	4.9								
s15-073/10	2660210.636	6510770.013	8.422	Shear key	TAJ	22/10/2015	1.82	1.36	34.1	2.7	3.5	196	196	196	196	196		P	
							1.83	1.36	34.1	2.7	3.0								
S15-077/7	2660230.008	6510769.491	7.348	Shear key	TAJ	23/10/2015	1.79	1.36	32.2	2.7	6.0	196	196	196	196	196		P	
							1.79	1.36	32.2	2.7	6.0								
S15-077/8	2660248.51	6510774.988	5.054	Shear key	TAJ	23/10/2015	1.83	1.37	34.0	2.7	2.8	196	196	196	196	196		P	
							1.83	1.36	34.0	2.7	3.3								
S15-078/1	2660222.665	6510771.068	7.2	Shear key	TAJ	27/10/2015	1.83	1.38	32.6	2.7	3.7	196	196	196	196	196		P	
							1.84	1.39	32.6	2.7	3.3								
S15-078/2	2660240.306	6510769.555	6.872	Shear key	TAJ	27/10/2015	1.81	1.35	34.0	2.7	4.2	196	196	196	196	196		P	
							1.82	1.36	34.0	2.7	3.4								
S15-079/4	2660258.921	6510775.017	4.397	Shear key	TAJ	28/10/2015	1.79	1.35	32.8	2.7	6.0	196	196	196	196	196		P	
							1.78	1.32	35.0	2.7	4.9								
S15-080/1	2660245.526	6510768.945	7.425	Shear key	TAJ	29/10/2015	1.84	1.41	30.4	2.7	4.8	168	179	182	196	181		P	
							1.82	1.40	30.4	2.7	5.9								
S15-080/2	2660265.722	6510771.414	4.246	Shear key	TAJ	29/10/2015	1.77	1.26	39.9	2.7	2.8	196	179	176	173	181		P	
							1.76	1.26	39.9	2.7	3.2								
S15-082/3	2660255.28	6510775.023	6.271	Shear key	TAJ	2/11/2015	1.76	1.29	36.4	2.7	5.4	196	196	196	196	196		P	
							1.78	1.31	36.4	2.7	4.1								
S15-082/4	2660243.892	6510767.955	7.625	Shear key	TAJ	2/11/2015	1.83	1.39	31.3	2.7	5.0	196	196	196	196	196		P	
							1.82	1.39	31.3	2.7	5.1								
S15-083/8	2660252.846	6510774.261	6.979	Shear key	TAJ	3/11/2015	1.83	1.39	31.4	2.7	4.5	196	196	196	196	196		P	
							1.84	1.40	31.4	2.7	4.3								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job # 614089.032/1**

T&T Job #: 21854.0037 Entered By: YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m^3)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments
												Test 1	Test 2	Test 3	Test 4				
S15-083/9	2660242.316	6510763.551	8.093	Shear key	TAJ	3/11/2015	1.77	1.30	35.8	2.7	5.1	196	196	196	196	196		P	These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
							1.78	1.31	35.8	2.7	4.6								
S15-084/3	2660280.961	6510773.088	3.768	Shear key	TAJ	5/11/2015	1.79	1.31	36.5	2.7	3.8	196	196	196	196	196		P	
							1.78	1.30	36.5	2.7	4.3								
S15-084/4	2660293.571	6510772.189	3.832	Shear key	TAJ	5/11/2015	1.78	1.28	39.1	2.7	2.6	196	196	196	196	196		P	
							1.79	1.28	39.1	2.7	2.2								
S15-085/9	2660250.366	6510767.261	8.369	Shear key	TAJ	6/11/2015	1.82	1.38	31.7	2.7	5.2	196	196	196	196	196		P	
							1.83	1.39	31.7	2.7	4.5								
S15-088/1	2660273.305	6510769.108	7.36	Shear key	TAJ	9/11/2015	1.70	1.17	45.3	2.7	3.9	196	196	196	196	196		P	
							1.69	1.16	45.3	2.7	4.4								
S15-088/2	2660261.713	6510770.099	8.01	Shear key	TAJ	9/11/2015	1.83	1.38	32.4	2.7	4.0	196	196	196	196	196		P	
							1.84	1.39	32.4	2.7	3.7								
S15-095/1	2660310.217	6510545.523	20.307	Re Wall	TAJ	19/11/2015	1.77	1.31	35.7	2.7	5.0	196	196	196	196	196		P	
				Re Wall			1.77	1.30	35.7	2.7	5.2								
S15-095/2	2660334.012	6510540.809	20.866	Re Wall	TAJ	19/11/2015	1.86	1.42	31.4	2.7	3.1	196	196	196	196	196		P	
				Re Wall			1.87	1.42	31.4	2.7	2.7								
S15-095/3	2660382.812	6510547.53	20.57	Re Wall	TAJ	19/11/2015	1.83	1.41	29.8	2.7	5.8	196	196	196	196	196		P	
				Re Wall			1.82	1.40	29.8	2.7	6.3								
S15-095/4	2660404.276	6510552.344	20.559	Re Wall	TAJ	19/11/2015	1.87	1.43	30.8	2.7	2.9	196	196	196	196	196		P	
				Re Wall			1.89	1.44	30.8	2.7	2.1								
S15-095/5	2660396.646	6510729.782	11.211	Behind Wall 3	TAJ	19/11/2015	1.83	1.38	32.5	2.7	3.9	175	178	185	162	175		P	
				Behind Wall 3			1.84	1.39	32.5	2.7	3.3								
S15-095/6	2660336.475	6510716.886	11.419	Behind Wall 3	TAJ	19/11/2015	1.80	1.36	31.6	2.7	6.4	143	171	157	196	167		P	
				Behind Wall 3			1.78	1.35	31.6	2.7	7.2								
S15-095/7	2660272.218	6510713.645	11.498	Behind Wall 3	TAJ	19/11/2015	1.81	1.38	31.2	2.7	6.1	196	182	196	196	193		P	
				Behind Wall 3			1.78	1.36	31.2	2.7	7.4								
S15-095/8	2660203.386	6510725.973	11.293	Behind Wall 3	TAJ	19/11/2015	1.84	1.37	34.0	2.7	2.5	196	196	185	178	189		P	
				Behind Wall 3			1.84	1.37	34.0	2.7	2.6								
S15-098/7	2660180.659	6510727.543	12.093	Behind Wall 3	TAJ	24/11/2015	1.87	1.45	28.7	2.7	4.7	196	196	196	196	196		P	
				Behind Wall 3			1.88	1.46	28.7	2.7	4.2								
S15-098/8	2660228.065	6510713.622	12.262	Behind Wall 3	TAJ	24/11/2015	1.86	1.41	31.5	2.7	3.2	196	196	196	196	196		P	
				Behind Wall 3			1.85	1.41	31.5	2.7	3.4								
S15-098/9	2660277.94	6510714.043	11.972	Behind Wall 3	TAJ	24/11/2015	1.75	1.33	32.3	2.7	8.1	196	196	196	196	196		P	
				Behind Wall 3			1.79	1.35	32.3	2.7	6.2								
S15-100/7	2660463.064	6510767.367	7.2	Shear Key	TAJ	26/11/2015	1.71	1.17	46.2	2.7	3.4	140	171	182	173	167		P	
							1.70	1.17	46.2	2.7	3.5								
S15-104/5	2660220.292	6510723.398	12.479	Behind Wall3	TAJ	2/12/2015	1.83	1.40	30.8	2.7	5.2	196	196	196	196	196		P	
							1.82	1.39	30.8	2.7	5.8								
S15-104/7	2660294.778	6510710.098	12.834	Behind Wall 3	TAJ	2/12/2015	1.85	1.41	30.6	2.7	4.3	176	196	196	196	191		P	
							1.84	1.41	30.6	2.7	4.6								
S15-104/8	2660390.525	6510734.077	12.655	Behind Wall3	TAJ	2/12/2015	1.86	1.41	31.9	2.7	2.6	196	196	196	196	196		P	
							1.87	1.42	31.9	2.7	2.3								
S15-104/9	2660433.827	6510741.446	13.01	Behind Wall3	TAJ	2/12/2015	1.81	1.37	31.8	2.7	5.4	196	196	196	196	196		P	
							1.82	1.38	31.8	2.7	4.9								
S15-105/8	2660263.589	6510556.273	21.209	Re Wall	TAJ	3/12/2015	1.84	1.38	33.2	2.7	2.9	196	196	196	196	196		P	
							1.84	1.38	33.2	2.7	3.1								
S15-105/9	2660287.151	6510549.486	21.322	Re Wall	TAJ	3/12/2015	1.82	1.36	33.5	2.7	4.1	196	196	196	196	196		P	
							1.82	1.36	33.5	2.7	3.9								
S15-105/10	2660321.148	6510551.684	21.479	Re Wall	TAJ	3/12/2015	1.85	1.42	30.1	2.7	4.6	196	196	196	196	196		P	
							1.85	1.42	30.1	2.7	4.5								
S15-105/11	2660348.383	6510542.394	21.479	Re Wall	TAJ	3/12/2015	1.82	1.39	30.8	2.7	5.6	196	196	196	196	196		P	
							1.83	1.40	30.8	2.7	5.3								
S15-105/12	2660371.886	6510548.944	21.293	Re Wall	TAJ	3/12/2015	1.82	1.36	33.4	2.7	4.1	196	196	196	196	196		P	
							1.81	1.36	33.4	2.7	4.3								
S15-115/9	2660159.266	6510730.533	12.862	Behind Wall3	TAJ	16/12/2015	1.89	1.48	27.7	2.7	4.2	196	196	196	196	196		P	
							1.90	1.49	27.7	2.7	3.8								
S15-115/10	2660210.194	6510722.838	13.984	Behind Wall3	TAJ	16/12/2015	1.89	1.46	29.2	2.7	3.3	196	196	196	196	196		P	
							1.89	1.46	29.2	2.7	3.3								
S15-115/11	2660284.473	6510714.337	13.748	Behind Wall3	TAJ	16/12/2015	1.83	1.40	30.7	2.7	5.0	196	196	196	196	196		P	
							1.86	1.42	30.7	2.7	3.8								
S15-115/12	2660395.892	6510726.701	13.178	Behind Wall3	TAJ	16/12/2015	1.81	1.44	25.7	2.7	9.6	196	196	196	196	196		P	
							1.81	1.44	25.7	2.7	9.6								
S15-117/5	2660335.128	6510770.554	4.429	Shear Key	TAJ	18/12/2015	1.81	1.34	34.7	2.7	3.6	145	154	154	157	153		P	
							1.81	1.34	34.7	2.7	3.6								
S15-117/6	2660298.772	6510775.423	5.946	Shear Key	TAJ	18/12/2015	1.81	1.38	31.4	2.7	5.9	196	196	196	157	186		P	
							1.80	1.37	31.4	2.7	6.1								
S15-117/7	2660317.581	6510772.398	5.203	Shear Key	TAJ	18/12/2015	1.86	1.37	35.7	2.7	0.4	196	196	196	196	196		P	
							1.86	1.37	35.7	2.7	0.5								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job # 614089.032/1**

T&T Job #: 21854.0037 **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S15 118/8	2660350.929	6510774.820	4.731	Shear Key	TAJ	21/12/2015	1.87	1.43	30.9	2.7	2.8	154	159	196	196	176		P	
							1.87	1.43	30.9	2.7	2.8								
S15 118/9	2660308.966	6510777.226	6.143	Shear Key	TAJ	21/12/2015	1.88	1.46	28.5	2.7	4.3	196	196	196	196	196		P	
							1.89	1.47	28.6	2.7	3.8								
S15 120/8	2660334.139	6510775.957	6.557	Shear Key	TAJ	22/12/2015	1.86	1.40	33.1	2.7	2.1	137	154	157	185	158		P	
							1.87	1.41	33.1	2.7	1.3								
S15 120/9	2660355.038	6510771.205	5.472	Shear Key	TAJ	22/12/2015	1.80	1.29	39.8	2.7	1.1	168	154	150	147	155		P	
							1.80	1.29	39.8	2.7	1.0								
S15 120/10	2660372.455	6510783.328	5.126	Shear Key	TAJ	22/12/2015	1.86	1.47	26.8	2.7	6.2	140	173	196	196	176		P	
							1.86	1.46	26.8	2.7	6.5								
S16 002/15				Fill Area	NTW	6/01/2016	1.95	1.48	31.2	2.7	-1.2	196	196	190	98	170		P	
							1.96	1.50	30.1	2.7	-0.9								
S16 002/16				Fill Area	NTW	6/01/2016	1.94	1.56	24.4	2.7	4.4	196	154	168	112	158		P	
							1.94	1.56	24.2	2.7	4.5								
S16 002/17				Undercut	NTW	6/01/2016	1.80	1.37	32.1	2.7	5.6	147	196	196	194	183		P	
							1.80	1.36	32.1	2.7	5.6								
S16 002/18				Undercut	NTW	6/01/2016	1.80	1.35	33.4	2.7	5.1	176	130	87	190	146		P	
							1.84	1.40	31.8	2.7	3.9								
S16 008/09				Shear key	NTW	14/01/2016	1.87	1.46	27.8	2.7	5.3	176	196	196	196	191		P	
							1.87	1.47	27.8	2.7	4.9								
S16 008/10				Shear key	NTW	14/01/2016	1.86	1.44	29.1	2.7	4.7	193	140	162	196	173		P	
							1.85	1.43	29.6	2.7	4.9								
S16 008/11				Shear key	NTW	14/01/2016	1.81	1.34	35.3	2.7	3.3	168	176	196	129	167		P	
							1.80	1.32	36.3	2.7	3.0								
S16 008/12				Shear key	NTW	14/01/2016	1.79	1.32	35.6	2.7	4.4	196	196	196	196	196		P	Behind mass block wall
							1.79	1.32	35.6	2.7	4.1								
S16 008/13				Shear key	NTW	14/01/2016	1.82	1.40	30.4	2.7	5.8	196	196	196	196	196		P	
							1.82	1.40	30.1	2.7	6.1								
S16 008/14				Shear key	NTW	14/01/2016	1.76	1.32	34.0	2.7	6.5	196	163	161	116	159		P	
							1.75	1.30	34.8	2.7	6.7								
S16 009/10	2660400.963	6510727.822	13.75	Behind Wall 3	BZZB	15/01/2016	1.84	1.34	36.6	2.7	1.0	144	161	205	205	179		P	
							1.84	1.35	36.6	2.7	0.8								
S16 009/11	2660418.546	6510733.893	14.177	Behind Wall 3	BZZB	15/01/2016	1.87	1.41	32.9	2.7	1.6	137	157	205	205	176		P	
							1.86	1.40	32.9	2.7	2.4								
S16 013/5	2660173.393	6510728.728	15.13	Behind Wall 3	TAJ	21/01/2016	1.83	1.37	33.8	2.7	3.1	196	196	196	196	196		P	
							1.83	1.36	33.8	2.7	3.4								
S16 013/6	2660218.98	6510719.676	14.724	Behind Wall 3	TAJ	21/01/2016	1.82	1.34	35.7	2.7	2.3	196	196	196	196	196		P	
							1.82	1.34	35.7	2.7	2.3								
S16 013/7	2660288.921	6510716.79	14.711	Behind Wall 3	TAJ	21/01/2016	1.81	1.33	36.2	2.7	2.4	196	196	196	196	196		P	
							1.81	1.33	36.2	2.7	2.6								
S16 013/8	2660342.83	6510714.196	15.005	Behind Wall 3	TAJ	21/01/2016	1.81	1.32	36.7	2.7	2.4	196	196	196	196	196		P	
							1.82	1.33	36.7	2.7	2.1								
S16 013/9	2660401.5	6510730.038	14.655	Behind Wall 3	TAJ	21/01/2016	1.83	1.33	37.8	2.7	0.7	196	196	196	196	196		P	
							1.83	1.33	37.8	2.7	0.7								
S16 015/2				Shear Key	TAJ	23/01/2016	1.79	1.27	40.1	2.7	1.7	154	157	196	169	169		P	
							1.80	1.29	40.1	2.7	0.8								
S16 015/3				Shear Key	TAJ	23/01/2016	1.77	1.29	36.3	2.7	5.0	162	157	145	154	155		P	
							1.77	1.30	36.3	2.7	4.8								
S16 015/4				Shear Key	TAJ	23/01/2016	1.85	1.34	37.6	2.7	0.0	190	154	196	196	184		P	
							1.83	1.33	37.6	2.7	1.0								
S16 015/5				Shear Key	TAJ	23/01/2016	1.81	1.36	32.6	2.7	5.2	196	196	196	196	196		P	
							1.79	1.35	32.6	2.7	5.8								
S16 016/1	2660443.040	6510793.515	5.778	Shear Key	TAJ	25/01/2016	1.87	1.41	32.9	2.7	2.3	180	196	196	196	192		P	
							1.86	1.41	32.9	2.7	2.9								
S16 016/2	2660403.776	6510784.918	7.339	Shear Key	TAJ	25/01/2016	1.84	1.45	27.3	2.7	6.9	196	196	196	196	196		P	
							1.84	1.45	27.3	2.7	6.9								
S16 017/6	2660437.407	6510793.414	6.592	Shear Key	TAJ	26/01/2016	1.88	1.44	30.1	2.7	3.1	205	205	205	205	205		P	
							1.88	1.44	30.1	2.7	3.2								
S16 017/7	2660442.860	6510781.083	6.188	Shear Key	TAJ	26/01/2016	1.83	1.39	32.0	2.7	4.2	205	205	205	205	205		P	
							1.83	1.39	32.0	2.7	4.3								
S16 017/8	2660466.187	6510776.959	4.247	Shear Key	TAJ	26/01/2016	1.85	1.41	31.0	2.7	3.9	205	205	205	205	205		P	
							1.85	1.41	31.0	2.7	3.9								
S16 021/5	2660440.174	6510776.774	7.089	Shear Key	TAJ	29/01/2016	1.87	1.41	32.1	2.7	2.4	205	205	205	205	205		P	
							1.85	1.40	32.1	2.7	3.4								
S16 021/6	2660448.552	6510792.542	8.138	Shear Key	TAJ	29/01/2016	1.81	1.39	30.3	2.7	6.5	205	205	205	205	205		P	
							1.82	1.39	30.3	2.7	6.2								
s16 022/3	2660433.022	6510778.881	8.578	Shear Key	TAJ	30/01/2016	1.87	1.41	32.7	2.7	1.8	196	196	196	196	196		P	
							1.86	1.40	32.7	2.7	2.0								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job # 614089.032/1**

T&T Job #: 21854.0037 **Entered By: YA**

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments
s16 022/4	2660459.173	6510782.994	7.298	Shear Key	TAJ	30/01/2016	1.78	1.31	35.9	2.7	4.6	196	196	196	196	196		P	These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
							1.77	1.30	35.9	2.7	4.9								
S16 024/4	2660448.780	6510790.047	9.109	Shear Key	TAJ	2/02/2016	1.84	1.38	33.4	2.7	2.9	205	205	205	205	205		P	
							1.84	1.38	33.4	2.7	2.7								
S16 024/5	2660448.491	6510777.572	9.025	Shear Key	TAJ	2/02/2016	1.89	1.44	31.3	2.7	1.7	205	205	205	205	205		P	
							1.87	1.43	31.3	2.7	2.5								
s16 025/1	2660447.656	6510783.130	9.614	Shear Key	TAJ	3/02/2016	1.82	1.44	26.6	2.7	8.4	205	205	205	205	205		P	
							1.81	1.43	26.6	2.7	8.8								
s16 025/2	2660470.263	6510782.780	8.621	Shear Key	TAJ	3/02/2016	1.84	1.43	28.7	2.7	6.0	205	205	205	205	205		P	
							1.85	1.44	28.7	2.7	5.6								
s16 026/3	2660474.295	6510707.473	16.612	Shear Key	TAJ	4/02/2016	1.83	1.41	30.0	2.7	5.4	205	205	205	205	205		P	
							1.84	1.41	30.0	2.7	5.3								
s16 026/4	2660471.757	6510728.257	14.911	Shear Key	TAJ	4/02/2016	1.79	1.36	31.3	2.7	7.0	205	205	205	205	205		P	
							1.81	1.38	31.3	2.7	6.0								
s16 028/6	2660237.256	6510714.734	15.706	Behind Wall 3	TAJ	9/02/2016	1.87	1.44	29.9	2.7	3.6	205	205	169	202	195		P	
							1.86	1.43	29.9	2.7	4.0								
s16 028/7	2660285.905	6510709.769	15.771	Behind Wall 3	TAJ	9/02/2016	1.82	1.32	38.1	2.7	0.8	205	195	197	161	190		P	
							1.83	1.32	38.1	2.7	0.7								
s16 028/8	2660327.406	6510710.054	15.859	Behind Wall 3	TAJ	9/02/2016	1.88	1.45	29.8	2.7	3.2	205	205	205	205	205		P	
							1.86	1.43	29.8	2.7	4.4								
S16 030/8	2660200.202	6510728.204	16.661	Behind Wall 3	TAJ	12/02/2016	1.81	1.38	31.1	2.7	5.8	205	205	205	205	205		P	
							1.80	1.37	31.1	2.7	6.4								
S16 030/9	2660273.771	6510719.072	16.539	Behind Wall 3	TAJ	12/02/2016	1.84	1.46	26.1	2.7	8.0	205	205	205	205	205		P	
							1.83	1.45	26.1	2.7	8.5								
S16 030/10	2660314.765	6510712.869	16.870	Behind Wall 3	TAJ	12/02/2016	1.82	1.39	31.1	2.7	5.6	205	205	205	205	205		P	
							1.81	1.38	31.1	2.7	5.9								
S16 030/11	2660358.694	6510723.728	17.767	Behind Wall 3	TAJ	12/02/2016	1.83	1.42	29.1	2.7	6.0	205	205	205	205	205		P	
							1.83	1.41	29.1	2.7	6.5								
S16 031/2	2660140.178	6510662.460	19.568	Shear Key	TAJ	13/02/2016	1.85	1.43	29.7	2.7	4.6	205	205	205	205	205		P	
							1.87	1.44	29.7	2.7	3.9								
S16 031/3	2660189.142	6510662.988	19.801	Shear Key	TAJ	13/02/2016	1.84	1.40	31.4	2.7	4.0	205	205	205	205	205		P	
							1.83	1.39	31.4	2.7	4.7								
S16 031/4	2660237.337	6510652.670	22.626	Shear Key	TAJ	13/02/2016	1.81	1.36	33.3	2.7	4.6	205	205	205	205	205		P	
							1.82	1.36	33.3	2.7	4.2								
S16 033/3				Re Wall	TAJ	16/02/2016	1.76	1.29	36.2	2.7	5.3	205	205	205	205	205		P	
							1.77	1.30	36.2	2.7	4.6								
S16 033/4				Re Wall	TAJ	16/02/2016	1.80	1.36	32.0	2.7	6.1	205	205	205	205	205		P	
							1.81	1.37	32.0	2.7	5.5								
S16 041/1	2660249.623	6510709.807	19.885	Behind wall 3	TAJ	26/02/2016	1.85	1.40	31.9	2.7	3.2	205	205	205	205	205		P	
							1.87	1.42	31.9	2.7	2.1								
S16 041/2	2660299.554	6510705.031	19.751	Behind Wall 3	TAJ	26/02/2016	1.88	1.48	26.6	2.7	5.6	205	205	205	205	205		P	
							1.88	1.48	26.6	2.7	5.7								
S16 041/3	2660360.490	6510712.813	19.626	Behind wall 3	TAJ	26/02/2016	1.84	1.35	36.7	2.7	1.6	205	205	205	205	205		P	
							1.84	1.36	36.7	2.7	1.4								
S16 041/4	2660405.726	6510722.122	19.530	Behind wall 3	TAJ	26/02/2016	1.85	1.42	30.1	2.7	4.4	205	205	205	205	205		P	
							1.86	1.43	30.1	2.7	4.2								
S16 035/6	2660289.119	6510708.092	18.728	Behind wall 3	TAJ	22/02/2016	1.83	1.35	35.7	2.7	2.1	205	171	180	205	190		P	
							1.83	1.35	35.7	2.7	1.9								
S16 035/7	2660332.772	6510712.238	18.375	Behind wall 3	TAJ	22/02/2016	1.87	1.39	34.3	2.7	0.7	205	205	205	205	205		P	
							1.88	1.40	34.3	2.7	0.2								
S16 035/8	2660386.662	6510722.151	18.275	Behind wall 3	TAJ	22/02/2016	1.84	1.37	33.9	2.7	2.6	171	205	205	205	197		P	
							1.83	1.37	33.9	2.7	2.8								
S16 035/9	2660417.893	6510733.998	18.014	Behind wall 3	TAJ	22/02/2016	1.86	1.45	28.2	2.7	5.4	205	205	205	205	205		P	
							1.86	1.46	28.2	2.7	5.6								
S16 039/9	2660205.273	6510718.372	19.308	Behind Wall 3	TAJ	24/02/2016	1.84	1.45	27.1	2.7	7.0	205	205	205	205	205		P	
							1.85	1.46	27.1	2.7	6.6								
S16 039/10	2660257.788	6510714.202	19.371	Behind Wall 3	TAJ	24/02/2016	1.82	1.41	29.3	2.7	6.8	205	205	205	205	205		P	
							1.82	1.41	29.3	2.7	6.5								
S16 039/11	2660321.816	6510714.634	18.839	Behind Wall 3	TAJ	24/02/2016	1.79	1.32	36.3	2.7	3.5	188	161	171	157	169		P	
							1.79	1.31	36.3	2.7	3.8								
s16 042/2	2660260.044	6510707.868	20.340	Behind wall3	TAJ	27/02/2016	1.73	1.32	31.3	2.7	9.8	205	205	205	205	205	Y	F	
							1.72	1.31	31.3	2.7	10.3								
s16 042/3	2660347.750	6510703.262	20.307	Behind wall3	TAJ	27/02/2016	1.84	1.35	36.5	2.7	0.9	205	205	205	205	205		P	
							1.84	1.35	36.5	2.7	0.8								
s16 042/4	2660397.386	6510724.869	20.111	Behind wall3	TAJ	27/02/2016	1.90	1.42	33.7	2.7	0.0	205	205	205	205	205		P	
							1.83	1.37	33.7	2.7	3.3								
S16 044/10		No GPS		Behind wall3	TAJ	4/03/2016	1.96	1.41	39.5	2.7	0.0	205	205	205	205	205		P	
							1.86	1.33	39.5	2.7	0.0								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job #** 614089.032/1

T&T Job #: 21854.0037 **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m^3)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments
												Test 1	Test 2	Test 3	Test 4				
S16 044/11		No GPS		Behind wall3	TAJ	4/03/2016	1.86	1.37	35.1	2.7	1.0	205	205	205	205	205		P	These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
							1.85	1.37	35.1	2.7	1.0								
S16 044/12		No GPS		Behind wall3	TAJ	4/03/2016	1.97	1.46	35.0	2.7	0.0	205	205	205	205	205		P	
							1.97	1.46	35.0	2.7	0.0								
S16 044/13		No GPS		Behind wall3	TAJ	4/03/2016	1.99	1.53	30.6	2.7	0.0	205	205	205	205	205		P	
							1.78	1.36	30.6	2.7	7.9								
S16 045/1		No GPS		Behind wall1	TAJ	7/03/2016	1.89	1.45	30.6	2.7	2.0	205	205	205	205	205		P	
							1.92	1.47	30.6	2.7	0.5								
S16 045/3		No GPS		Behind wall3	TAJ	7/03/2016	1.88	1.43	31.6	2.7	2.0	205	205	205	205	205		P	
							1.88	1.43	31.6	2.7	1.8								
S16 045/4		No GPS		Behind wall3	TAJ	7/03/2016	1.86	1.45	28.6	2.7	5.1	205	205	205	205	205		P	
							1.86	1.45	28.6	2.7	5.1								
S16 045/5		No GPS		Behind wall3	TAJ	7/03/2016	1.82	1.35	34.5	2.7	3.1	205	205	205	205	205		P	
							1.84	1.37	34.5	2.7	2.1								
S16 046/8		No GPS		southern shear key	TAJ	9/03/2016	1.71	1.22	40.1	2.7	6.1	150	154	146	150	150		P	
							1.71	1.22	40.1	2.7	6.0								
S16 046/10		No GPS		Behind wall 3	TAJ	9/03/2016	1.85	1.39	33.3	2.7	2.3	154	148	143	157	151		P	
							1.86	1.40	33.3	2.7	1.6								
S16 046/11		No GPS		Behind wall 3	TAJ	9/03/2016	1.78	1.35	32.2	2.7	6.7	196	196	196	196	196		P	
							1.76	1.33	32.2	2.7	7.7								
S16 046/12		No GPS		Behind wall 3	TAJ	9/03/2016	1.87	1.40	33.5	2.7	1.0	196	196	196	196	196		P	
							1.85	1.39	33.5	2.7	2.3								
S16 047/8				Shear key	TAJ	11/03/2016	1.86	1.42	30.8	2.7	0.0	171	150	157	171	162		P	
							1.85	1.41	30.8	2.7	0.0								
S16 047/9				Shear key	TAJ	11/03/2016	1.79	1.52	17.5	2.7	17.1	171	157	205	150	171	Y	F	
							1.79	1.53	17.5	2.7	16.7								
S16 049/13	2660493.125	6510753.369	0.465	Shear Key	TAJ	14/03/2016	1.88	1.44	30.8	2.7	2.4	196	196	196	196	196		P	
							1.87	1.43	30.8	2.7	2.9								
S16 049/14	2660509.753	6510737.803	0.176	Shear Key	TAJ	14/03/2016	1.85	1.38	33.5	2.7	2.6	196	196	196	196	196		P	
							1.86	1.39	33.5	2.7	1.9								
S16 050/8	2660412.114	6510700.454	24.348	Behind Wall 3	TAJ	15/03/2016	1.84	1.44	28.0	2.7	6.6	196	196	196	196	196		P	
							1.84	1.44	28.0	2.7	6.6								
S16 050/9	2660392.369	6510701.857	24.749	Behind Wall 3	TAJ	15/03/2016	1.85	1.41	31.2	2.7	3.9	196	196	196	196	196		P	
							1.86	1.41	31.2	2.7	3.5								
S16 050/10	2660366.57	6510695.751	24.833	Behind Wall 3	TAJ	15/03/2016	1.82	1.34	35.4	2.7	2.6	196	196	196	196	196		P	
							1.82	1.34	35.4	2.7	2.7								
S16 050/11	2660335.835	6510699.976	24.512	Behind Wall 3	TAJ	15/03/2016	1.79	1.34	33.8	2.7	5.1	168	154	158	157	159		P	
							1.79	1.34	33.8	2.7	5.0								
S16 051/6	2660567.114	6510559.604	2.374	P7 shear key	TAJ	16/03/2016	1.85	1.38	34.6	2.7	1.6	196	196	196	196	196		P	
							1.85	1.38	34.5	2.7	1.6								
S16 051/7	2660594.281	6510578.699	1.95	P7 shear key	TAJ	16/03/2016	1.84	1.36	34.9	2.7	1.9	154	168	162	157	160		P	
							1.84	1.36	34.9	2.7	2.1								
S16 053/6	2660602.904	6510601.62	1.371	P7 shear key	TAJ	18/03/2016	1.82	1.39	31.4	2.7	5.1	168	150	146	158	156		P	
							1.82	1.39	31.4	2.7	5.2								
S16 053/7	2660601.329	6510596.854	0.745	P7 shear key	TAJ	18/03/2016	1.85	1.40	32.5	2.7	2.8	168	154	146	151	155		P	
							1.85	1.39	32.5	2.7	3.0								
S16 053/8	2660593.291	6510577.686	1.511	P7 shear key	TAJ	18/03/2016	1.82	1.37	32.5	2.7	4.7	182	154	196	196	182		P	
							1.82	1.37	32.5	2.7	4.7								
S16 053/9	2660520.011	6510734.001	1.915	P7 shear key	TAJ	18/03/2016	1.78	1.35	31.7	2.7	7.1	196	196	196	196	196		P	
							1.78	1.35	31.7	2.7	6.9								
S16 053/10	2660490.423	6510747.139	2.97	P7 shear key	TAJ	18/03/2016	1.82	1.35	34.9	2.7	2.8	196	196	196	196	196		P	
							1.82	1.35	34.9	2.7	2.9								
S16 053/11	2660376.733	6510734.135	13.597	Batter	TAJ	18/03/2016	1.83	1.46	25.2	2.7	9.1	196	196	196	196	196		P	
							1.83	1.46	25.2	2.7	9.3								
S16 053/12	2660364.305	6510729.819	13.181	Batter	TAJ	18/03/2016	1.85	1.45	27.8	2.7	6.3	196	196	196	196	196		P	
							1.86	1.45	27.8	2.7	5.8								
S16 054/3	2659904.253	6510837.268	7.391	Shear key	TAJ	19/03/2016	1.88	1.43	31.6	2.7	2.1	196	196	196	196	196		P	
							1.87	1.42	31.6	2.7	2.4								
S16 054/4	2659915.645	6510834.623	5.75	Shear key	TAJ	19/03/2016	1.84	1.39	32.2	2.7	3.5	196	196	196	196	196		P	
							1.86	1.40	32.2	2.7	2.7								
S16 055/5				Batter	TAJ	21/03/2016	1.71	1.36	26.1	2.7	14.3	196	196	196	196	196	Y	F	
							1.71	1.36	26.1	2.7	14.4								
S16 055/6	2660432.438	6510765.551	12.672	Wall4	TAJ	21/03/2016	1.84	1.37	34.3	2.7	2.3	196	196	196	196	196		P	
							1.84	1.37	34.3	2.7	2.1								
S16 055/7				Wall4	TAJ	21/03/2016	1.82	1.37	33.0	2.7	4.0	196	196	196	196	196		P	
							1.82	1.37	33.0	2.7	3.9								
S16 055/8	2660189.951	6510657.852	21.623	Wall4	TAJ	21/03/2016	1.89	1.44	31.8	2.7	1.2	196	196	196	196	196		P	
							1.89	1.44	31.8	2.7	1.2								

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T&T Job #: 21854.0037 **Entered By: YA**

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments
												Test 1	Test 2	Test 3	Test 4				
S16 055/9	2660605.553	6510601.438	1.819	shear key	TAJ	21/03/2016	1.79	1.34	34.0	2.7	5.2	196	196	196	196	196		P	These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
							1.80	1.35	34.0	2.7	4.4								
S16 055/10	2660372.07	6510730.045	14.415	Batter	TAJ	21/03/2016	1.83	1.44	26.7	2.7	8.2	196	196	196	196	196		P	
							1.83	1.44	26.7	2.7	8.0								
S16 055/11	2660355.619	6510726.237	14.542	Batter	TAJ	21/03/2016	1.85	1.40	31.7	2.7	3.7	196	196	196	196	196		P	
							1.83	1.39	31.7	2.7	4.6								
S16 056/9	2660376.505	6510732.41	14.512	Batter	TAJ	22/03/2016	1.80	1.36	32.5	2.7	5.4	196	196	196	196	196		P	
							1.83	1.38	32.5	2.7	3.9								
S16 056/10	2660362.554	6510727.969	14.931	Batter	TAJ	22/03/2016	1.86	1.42	30.7	2.7	3.7	168	154	182	168	168		P	
							1.86	1.42	30.7	2.7	3.9								
S16 056/11	2660363.539	6510727.021	15.137	Batter	TAJ	22/03/2016	1.85	1.38	34.2	2.7	1.9	196	196	196	196	196		P	
							1.84	1.37	34.2	2.7	2.1								
S16 056/12	2660349.866	6510726.477	15.273	Batter	TAJ	22/03/2016	1.90	1.43	33.0	2.7	0.1	196	196	196	196	196		P	
							1.89	1.42	33.0	2.7	0.3								
S16 056/13	2660330.067	6510725.241	14.841	Batter	TAJ	22/03/2016	1.75	1.23	41.4	2.7	3.2	168	168	196	196	182		P	
							1.73	1.22	41.4	2.7	4.0								
S16 057/10	2660330.794	6510722.835	16.835	P7 Batter	TAJ	29/03/2016	1.77	1.29	37.1	2.7	4.4	196	196	196	196	196		P	
							1.76	1.29	37.1	2.7	4.7								
S16 057/11	2660354.487	6510724.772	16.295	P7 Batter	TAJ	29/03/2016	1.82	1.33	37.1	2.7	1.4	196	196	196	196	196		P	
							1.82	1.33	37.1	2.7	1.6								
S16 057/12	2660374.216	6510728.391	15.957	P7 Batter	TAJ	29/03/2016	1.76	1.33	32.5	2.7	7.5	196	196	196	196	196		P	
							1.75	1.32	32.5	2.7	8.2								
S16 057/13	2660199.537	6510656.857	22.418	P7 Shear key	TAJ	29/03/2016	1.84	1.36	34.9	2.7	2.1	160	196	140	154	163		P	
							1.84	1.36	34.9	2.7	2.0								
S16 057/14				P7 Shear key	TAJ	29/03/2016	1.85	1.37	35.3	2.7	1.0	143	196	168	196	176		P	
							1.84	1.36	35.3	2.7	1.7								
S16 057/15	2660146.52	6510661.182	22.511	P7 Shear key	TAJ	29/03/2016	1.85	1.39	33.3	2.7	2.3	150	167	154	175	162		P	
							1.85	1.39	33.3	2.7	2.3								
S16 058/7				P7 RE Wall	TA	30/03/2016	1.84	1.36	34.8	2.7	2.2	196	196	196	196	196		P	
							1.84	1.37	34.8	2.7	1.8								
S16 058/8				P7 RE Wall	TA	30/03/2016	1.81	1.32	37.4	2.7	1.7	196	196	196	196	196		P	
							1.81	1.32	37.4	2.7	2.1								
S16 059/14	2660365.827	6510722.706	19.247	P7 RE Wall 3	TA	31/03/2016	1.88	1.46	29.1	2.7	3.7	196	196	196	196	196		P	
							1.83	1.42	29.1	2.7	6.1								
S16 059/15	2660365.888	6510722.917	18.976	P7 RE Wall 3	TA	31/03/2016	1.86	1.41	32.1	2.7	2.8	196	196	196	196	196		P	
							1.84	1.39	32.1	2.7	3.6								
S16 059/16	2660342.26	6510719.938	19.826	P7 RE Wall 3	TA	31/03/2016	1.90	1.41	34.5	2.7	0.0	168	154	196	196	179		P	
							1.90	1.41	34.5	2.7	0.0								
S16 059/17	2660342.098	6510720.38	19.479	P7 RE Wall 3	TA	31/03/2016	1.85	1.41	31.6	2.7	3.4	196	196	196	196	196		P	
							1.84	1.40	31.6	2.7	3.8								
S16 059/18	2660534.477	6510730.349	2.053	P7 Shear key	TA	31/03/2016	1.85	1.37	34.6	2.7	1.8	196	196	196	196	196		P	
							1.85	1.37	34.6	2.7	1.6								
S16 059/19				P7 Shear key	TA	31/03/2016	1.85	1.39	33.4	2.7	2.4	196	196	196	196	196		P	
							1.86	1.39	33.4	2.7	1.8								
S16 059/20				P7 RE Wall	TA	31/03/2016	1.85	1.40	31.5	2.7	3.7	196	196	196	196	196		P	
							1.85	1.40	31.5	2.7	3.8								
S16 059/21	2660168.003	6510656.595	23.122	P7 RE Wall	TA	31/03/2016	1.85	1.42	29.6	2.7	5.1	196	196	196	196	196		P	
							1.86	1.43	29.6	2.7	4.4								
S16 060/5	2660572.69	6510716.907	2.217	P7 Shear key	TA	1/04/2016	1.84	1.41	30.4	2.7	4.7	196	196	196	196	196		P	
							1.86	1.43	30.4	2.7	3.9								
S16 060/6	2660551.579	6510721.436	2.281	P7 Shear key	TA	1/04/2016	1.83	1.36	35.1	2.7	2.1	196	196	196	196	196		P	
							1.85	1.37	35.1	2.7	1.4								
S16 060/7	2660530.673	6510727.199	2.992	P7 Shear key	TA	1/04/2016	1.83	1.36	34.6	2.7	2.6	196	196	196	196	196		P	
							1.83	1.36	34.6	2.7	2.4								
S16 060/11	2660132.936	6510659.66	24.18	P7 RE Wall	TA	1/04/2016	1.85	1.35	37.4	2.7	0.0	196	196	196	196	196		P	
							1.85	1.34	37.4	2.7	0.0								
S16 060/12	2660164.024	6510652.566	24.187	P7 RE Wall	TA	1/04/2016	1.85	1.37	34.8	2.7	1.5	196	196	196	196	196		P	
							1.85	1.37	34.8	2.7	1.3								
S16 060/13	2660181.243	6510658.102	24.216	P7 RE Wall	TA	1/04/2016	1.82	1.34	35.9	2.7	2.2	196	196	196	196	196		P	
							1.82	1.34	35.9	2.7	2.2								
S16 061/9	2660152.064	6510657.176	24.715	P7 RE Wall	TA	4/04/2016	1.78	1.29	37.6	2.7	3.7	196	196	196	196	196		P	
							1.77	1.28	37.6	2.7	4.3								
S16 061/10	2660177.519	6510656.646	25.05	P7 RE Wall	TA	4/04/2016	1.76	1.27	38.1	2.7	4.5	196	196	196	196	196		P	
							1.77	1.28	38.1	2.7	4.0								
S16 061/11	2660190.183	6510647.301	24.282	P7 RE Wall	TA	4/04/2016	1.76	1.29	36.7	2.7	5.0	196	196	196	196	196		P	
							1.76	1.29	36.7	2.7	5.1								
S16 061/12	2660158.459	6510649.251	24.784	P7 RE Wall	TA	4/04/2016	1.74	1.27	36.8	2.7	6.1	196	196	196	196	196		P	
							1.75	1.28	36.8	2.7	5.5								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job #** 614089.032/1

T&T Job #: 21854.0037 **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments
S16 062/19	2660499.506	6510747.117	4.409	P7 Shear key 1	TA	5/04/2016	1.77	1.33	32.5	2.7	7.2	154	154	154	150	153		P	These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
							1.78	1.34	32.6	2.7	6.8								
S16 062/20	2660482.625	6510758.201	5.499	P7 Shear key 1	TA	5/04/2016	1.83	1.36	34.4	2.7	2.7	196	154	154	158	166		P	
							1.82	1.35	34.4	2.7	3.2								
S16 062/21	2660227.169	6510648.609	24.968	P7 RE Wall	TA	5/04/2016	1.81	1.33	36.1	2.7	2.5	168	168	154	196	172		P	
							1.80	1.32	36.1	2.7	3.1								
S16 062/22	2660200.129	6510648.122	24.978	P7 RE Wall	TA	5/04/2016	1.85	1.35	37.3	2.7	0.0	168	154	196	196	179		P	
							1.85	1.35	37.3	2.7	0.0								
S16 063/8	2660159.786	6510653.497	24.605	P7 Re Wall	TA	6/04/2016	1.83	1.36	34.7	2.7	2.8	150	154	196	168	167		P	
							1.82	1.35	34.7	2.7	3.1								
S16 063/9	2660183.681	6510648.556	25.059	P7 Re Wall	TA	6/04/2016	1.87	1.39	34.0	2.7	1.1	154	182	168	196	175		P	
							1.84	1.37	34.0	2.7	2.4								
S16 063/10	2660203.408	6510650.193	24.907	P7 Re Wall	TA	6/04/2016	1.87	1.43	31.2	2.7	2.7	150	150	151	182	158		P	
							1.86	1.42	31.2	2.7	3.1								
S16 063/11	2660498.139	6510759.595	6.409	P7 Shear Key	TA	6/04/2016	1.76	1.26	39.3	2.7	3.4	182	195	179	154	178		P	
							1.76	1.26	39.3	2.7	3.6								
S16 063/12	2660505.454	6510737.614	6.448	P7 Shear Key	TA	6/04/2016	1.82	1.34	36.2	2.7	2.1	171	167	168	196	176		P	
							1.83	1.34	36.2	2.7	1.6								
S16 064/12	2660488.001	6510756.387	6.625	P7 Shear Key	TA	7/04/2016	1.85	1.38	34.2	2.7	1.9	196	196	196	196	196		P	
							1.84	1.37	34.2	2.7	2.3								
S16 064/13	2660488.326	6510767.35	7.221	P7 Shear Key	TA	7/04/2016	1.83	1.36	34.9	2.7	2.4	154	168	196	196	179		P	
							1.83	1.36	34.9	2.7	2.4								
S16 064/14	2660491.918	6510741.495	6.087	P7 Shear Key	TA	7/04/2016	1.82	1.35	35.3	2.7	2.5	150	150	196	196	173		P	
							1.82	1.34	35.3	2.7	2.9								
S16 064/15	2660543.455	6510730.268	3.331	P7 Shear Key	TA	7/04/2016	1.79	1.32	35.8	2.7	4.0	196	154	196	196	186		P	
							1.81	1.34	35.8	2.7	2.7								
S16 064/16	2660564.833	6510722.077	2.608	P7 Shear Key	TA	7/04/2016	1.81	1.37	32.1	2.7	5.4	168	155	196	196	179		P	
							1.80	1.36	32.1	2.7	6.1								
S16 064/17	2660202.663	6510646.758	25.14	P7 RE Wall	TA	7/04/2016	1.79	1.29	38.2	2.7	2.7	168	155	196	196	179		P	
							1.78	1.29	38.2	2.7	3.0								
S16 064/18	2660182.097	6510646.26	25.434	P7 RE Wall	TA	7/04/2016	1.80	1.31	37.8	2.7	2.2	168	155	196	196	179		P	
							1.81	1.31	37.8	2.7	1.8								
S16 064/19	2660146.189	6510656.134	26.01	P7 RE Wall	TA	7/04/2016	1.75	1.31	33.8	2.7	7.1	168	155	196	196	179		P	
							1.77	1.33	33.8	2.7	6.1								
S16 064/20	2660607.145	6510664.827	1.822	P7 S Shear Key	TA	7/04/2016	1.82	1.32	37.7	2.7	1.0	140	140	150	154	146		F	
							1.82	1.32	37.7	2.7	1.0								
S16 064/21	2660611.23	6510645.651	1.511	P7 S Shear Key	TA	7/04/2016	1.81	1.38	30.4	2.7	6.7	154	126	168	146	149		F	Failed material dried and reworked
							1.83	1.40	30.4	2.7	5.5								
S16 064/22	2660610.491	6510625.181	1.953	P7 S Shear Key	TA	7/04/2016	1.90	1.46	30.5	2.7	1.7	140	150	154	133	144		F	
							1.90	1.46	30.5	2.7	1.6								
S16 065/19	2660580.257	6510703.564	1.507	P7 Shear Key	TA	8/04/2016	1.83	1.40	30.8	2.7	4.9	196	196	182	150	181		P	
							1.85	1.41	30.8	2.7	4.1								
S16 065/20	2660589.544	6510689.069	1.043	P7 Shear Key	TA	8/04/2016	1.86	1.39	33.1	2.7	2.2	196	196	168	150	178		P	
							1.87	1.41	33.1	2.7	1.4								
S16 065/21	2660505.621	6510738.857	5.897	P7 Shear Key	TA	8/04/2016	1.82	1.33	37.1	2.7	1.5	154	154	150	146	151		P	
							1.82	1.33	37.1	2.7	1.5								
S16 065/22	2660499.219	6510747.979	6.364	P7 Shear Key	TA	8/04/2016	1.83	1.32	38.6	2.7	0.1	196	196	196	196	196		P	
							1.85	1.33	38.6	2.7	0.0								
S16 068/6	2660563.063	6510722.909	3.776	P7 Shear Key	TA	12/04/2016	1.77	1.29	37.2	2.7	4.2	196	196	196	196	196		P	
							1.80	1.31	37.2	2.7	2.9								
S16 068/7	2660511.698	6510735.388	5.881	P7 Shear Key	TA	12/04/2016	1.80	1.33	35.4	2.7	3.9	196	196	196	196	196		P	
							1.81	1.34	35.4	2.7	3.2								
S16 069/4				P7 Shear Key	TA	13/04/2016	1.79	1.33	34.6	2.7	4.7	151	151	164	192	165		P	
							1.81	1.34	34.6	2.7	3.9								
S16 069/5				P7 Shear Key	TA	13/04/2016	1.85	1.37	34.8	2.7	1.5	192	178	147	147	166		P	
							1.84	1.36	34.8	2.7	2.0								
S16 070/6	2660194.789	6510652.437	27.401	P7 RE Wall	TA	14/04/2016	1.76	1.32	33.3	2.7	7.0	192	192	164	151	175		P	
							1.77	1.33	33.3	2.7	6.8								
S16 070/7	2660229.713	6510650.938	27.288	P7 RE Wall	TA	14/04/2016	1.89	1.44	31.5	2.7	1.3	151	151	164	192	165		P	
							1.91	1.46	31.5	2.7	0.3								
S16 070/8	2660257.449	6510650.993	27.17	P7 RE Wall	TA	14/04/2016	1.85	1.37	35.5	2.7	0.9	158	164	192	192	177		P	
							1.87	1.38	35.5	2.7	0.0								
S16 070/9	2660149.131	6510649.984	26.455	P7 RE Wall	TA	14/04/2016	1.82	1.37	32.7	2.7	4.1	164	151	192	181	172		P	
							1.82	1.37	32.7	2.7	4.4								
S16 071/4	2660567.333	6510717.727	4.491	P7 Shear Key	TA	15/04/2016	1.84	1.32	39.8	2.7	0.0	147	147	147	192	158		P	
							1.84	1.31	39.8	2.7	0.0								
S16 071/5	2660539.279	6510731.109	4.42	P7 Shear Key	TA	15/04/2016	1.84	1.37	34.3	2.7	2.3	192	164	147	147	163		P	
							1.84	1.37	34.3	2.7	2.4								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job #** 614089.032/1

T&T Job #: 21854.0037 **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments
S16 074/7	2660020.624	6511051.711	15.597	P7 Shear Key	TA	20/04/2016	1.88	1.42	32.4	2.7	1.5	137	137	164	123	140		F	These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
							1.88	1.42	32.4	2.7	1.7								
S16 074/8	2660024.262	6511062.287	15.759	P7 Shear Key	TA	20/04/2016	1.77	1.23	43.8	2.7	0.6	137	137	164	123	140		F	
							1.78	1.24	43.8	2.7	0.1								
S16 074/1	2660545.794	6510725.621	4.351	P7 Shear Key	TA	21/04/2016	1.85	1.38	34.1	2.7	2.1	192	192	192	192	192		P	
							1.85	1.38	34.1	2.7	2.1								
S16 074/2	2660562.971	6510720.756	4.699	P7 Shear Key	TA	21/04/2016	1.89	1.43	32.2	2.7	0.9	192	192	192	192	192		P	
							1.89	1.43	32.2	2.7	1.2								
S16 074/3	2660585.48	6510714.215	1.982	P7 Shear Key	TA	21/04/2016	1.81	1.33	35.7	2.7	3.2	192	192	192	192	192		P	
							1.81	1.33	35.7	2.7	3.1								
S16 074/4	2660595.813	6510689.408	3.855	P7 Shear Key	TA	21/04/2016	1.81	1.32	37.5	2.7	1.8	192	192	192	192	192		P	
							1.81	1.32	37.5	2.7	1.9								
S16 074/5	2660601.216	6510664.917	4.39	P7 Shear Key	TA	21/04/2016	1.80	1.33	34.8	2.7	4.2	192	192	192	192	192		P	
							1.80	1.33	34.8	2.7	4.2								
S16 074/6	2660590.319	6510683.798	3.757	P7 Shear Key	TA	21/04/2016	1.85	1.36	36.2	2.7	0.4	192	192	192	192	192		P	
							1.85	1.36	36.2	2.7	0.5								
S16 074/28	2660169.603	6510646.433	29.297	P7 RE Wall	TA	21/04/2016	1.80	1.33	35.5	2.7	3.6	151	151	164	178	161		P	
							1.80	1.33	35.5	2.7	3.9								
S16 074/29	2660208.445	6510644.156	28.757	P7 RE Wall	TA	21/04/2016	1.78	1.30	36.4	2.7	4.3	151	151	164	178	161		P	
							1.80	1.32	36.4	2.7	3.3								
S16 074/30	2660265.266	6510640.869	28.609	P7 RE Wall	TA	21/04/2016	1.82	1.35	34.7	2.7	3.1	151	151	164	178	161		P	
							1.82	1.35	34.7	2.7	3.1								
S16 075/6	2660492.376	6510752.651	8.478	P7 Shear key	TA	22/04/2016	1.83	1.34	36.7	2.7	1.5	192	192	192	192	192		P	
							1.84	1.34	36.7	2.7	1.0								
S16 075/7	2660533.998	6510729.691	5.541	P7 Shear key	TA	22/04/2016	1.84	1.35	36.1	2.7	1.3	192	192	192	192	192		P	
							1.84	1.35	36.1	2.7	1.3								
S16 075/8	2660585.942	6510701.114	3.972	P7 Shear key	TA	22/04/2016	1.85	1.35	37.2	2.7	0.0	192	192	192	192	192		P	
							1.85	1.35	37.2	2.7	0.0								
S16 075/9	2660232.203	6510649.377	28.949	P7 Re Wall	TA	22/04/2016	1.83	1.38	32.7	2.7	3.7	192	192	192	192	192		P	
							1.85	1.39	32.7	2.7	3.0								
S16 076/4				P7 Shear Key	TA	26/04/2016	1.83	1.33	37.1	2.7	1.2	151	151	192	192	172		P	
							1.83	1.33	37.1	2.7	1.1								
S16 076/5				P7 Shear Key	TA	26/04/2016	1.78	1.27	40.4	2.7	1.8	178	178	192	192	185		P	
							1.79	1.28	40.4	2.7	1.1								
S16 076/6				P7 Re Wall	TA	26/04/2016	1.86	1.43	30.2	2.7	3.9	192	192	192	192	192		P	
							1.88	1.44	30.2	2.7	3.0								
S16 077/12				P7 Above RE Wall	TA	27/04/2016	1.82	1.33	37.0	2.7	1.6	123	151	137	164	144		F	
							1.82	1.33	37.0	2.7	1.5								
S16 078/6				P7 Above RE Wall	TA	28/04/2016	1.83	1.35	35.8	2.7	2.0	151	164	192	192	175		P	
							1.83	1.35	35.8	2.7	1.9								
S16 078/7				P7 Above RE Wall	TA	28/04/2016	1.83	1.37	33.8	2.7	3.2	151	164	192	192	175		P	
							1.82	1.36	33.8	2.7	3.5								
S16 078/8				P7 Above RE Wall	TA	28/04/2016	1.86	1.40	33.2	2.7	1.8	151	164	192	192	175		P	
							1.86	1.39	33.2	2.7	2.0								
S16 078/9				P7 Above RE Wall	TA	28/04/2016	1.84	1.38	33.2	2.7	2.8	151	164	192	192	175		P	
							1.84	1.38	33.2	2.7	3.0								
S16 078/10				P7 Above RE Wall	TA	28/04/2016	1.80	1.33	35.2	2.7	3.7	151	164	192	192	175		P	
							1.82	1.34	35.2	2.7	2.9								
S16 079/17				P7 Shear Key	TA	29/04/2016	1.85	1.34	37.7	2.7	0.0	137	151	192	151	158		P	
							1.86	1.35	37.7	2.7	0.0								
S16 079/18				P7 Shear Key	TA	29/04/2016	1.80	1.31	37.0	2.7	2.9	123	175	192	192	171		P	
							1.80	1.31	37.0	2.7	2.9								
S16 079/19				P7 Shear Key	TA	29/04/2016	1.82	1.31	38.5	2.7	0.8	192	192	164	158	177		P	
							1.83	1.32	38.5	2.7	0.4								
S16 079/12				P7 Above RE Wall	TA	29/04/2016	1.82	1.33	36.4	2.7	2.0	151	164	178	192	171		P	
							1.81	1.33	36.4	2.7	2.5								
S16 079/13				P7 Above RE Wall	TA	29/04/2016	1.76	1.23	42.8	2.7	1.8	164	178	151	151	161		P	
							1.76	1.23	42.8	2.7	1.6								
S16 079/14				P7 Above RE Wall	TA	29/04/2016	1.78	1.26	40.9	2.7	1.5	151	133	178	180	161		P	
							1.77	1.26	40.9	2.7	1.8								
S16 079/15				P7 Shear Key	TA	29/04/2016	1.83	1.35	35.5	2.7	1.8	151	164	164	171	163		P	
							1.83	1.35	35.5	2.7	1.8								
S16 079/16				P7 Shear Key	TA	29/04/2016	1.86	1.41	32.3	2.7	2.3	178	192	192	192	189		P	
							1.87	1.41	32.3	2.7	2.0								
S16 080/4	2660392.366	6510641.907	29.891	P7 Above Re Wall	TA	2/05/2016	1.83	1.37	32.9	2.7	3.8	192	192	192	192	192		P	
							1.81	1.36	32.9	2.7	4.7								
S16 080/5	2660366.737	6510639.713	30.816	P7 Above Re Wall	TA	2/05/2016	1.83	1.37	33.7	2.7	3.1	192	192	192	192	192		P	
							1.82	1.36	33.7	2.7	3.7								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job #** 614089.032/1

T&T Job #: 21854.0037 **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments
												Test 1	Test 2	Test 3	Test 4				
S16 080/6	2660328.811	6510633.377	32.262	P7 Above Re Wall	TA	2/05/2016	1.79	1.30	38.2	2.7	2.5	192	192	192	192	192		P	These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
							1.81	1.31	38.2	2.7	1.7								
S16 080/20	2660608.384	6510673.274	4.958	P7 Shear Key	TA	2/05/2016	1.88	1.41	33.3	2.7	0.7	192	192	192	192	192		P	
							1.87	1.40	33.3	2.7	1.2								
S16 080/21	2660594.174	6510680.435	5.321	P7 Shear Key	TA	2/05/2016	1.90	1.47	28.6	2.7	3.2	192	192	192	192	192		P	
							1.88	1.46	28.6	2.7	4.1								
S16 081/7	2660266.172	6508828.788	26.326	P7 Above RE Wall	TA	3/05/2016	1.84	1.38	33.7	2.7	2.6	151	192	166	171	170		P	
							1.83	1.37	33.7	2.7	3.0								
S16 081/8	2660357.958	6510633.118	31.370	P7 Above RE Wall	TA	3/05/2016	1.85	1.41	30.7	2.7	4.2	192	192	192	192	192		P	
							1.85	1.42	30.7	2.7	4.1								
S16 081/9	2660267.938	6510625.085	33.986	P7 Above RE Wall	TA	3/05/2016	1.86	1.38	34.3	2.7	1.3	151	192	192	192	182		P	
							1.86	1.38	34.3	2.7	1.2								
S16 081/10	2660604.301	6510661.708	6.197	P7 Shear Key	TA	3/05/2016	1.86	1.41	32.2	2.7	2.6	192	192	192	192	192		P	
							1.83	1.39	32.2	2.7	4.0								
S16 081/11				P7 Shear Key	TA	3/05/2016	1.86	1.45	27.8	2.7	5.7	192	192	192	192	192		P	
							1.88	1.47	27.8	2.7	4.7								
S16 082/10				P7 Above RE Wall	TA	4/05/2016	1.89	1.42	32.9	2.7	0.4	192	192	192	192	192		P	
							1.89	1.42	32.9	2.7	0.6								
S16 082/11				P7 Above RE Wall	TA	4/05/2016	1.82	1.36	33.5	2.7	3.9	192	192	192	192	192		P	
							1.82	1.36	33.5	2.7	3.9								
S16 082/12				P7 Above RE Wall	TA	4/05/2016	1.84	1.42	29.9	2.7	5.1	192	192	192	192	192		P	
							1.83	1.42	29.1	2.7	6.1								
S16 083/3				P7 Shear Key	TA	5/05/2016	1.84	1.37	34.2	2.7	2.5	192	192	192	192	192		P	
							1.84	1.37	34.2	2.7	2.6								
S16 083/4				P7 Shear Key	TA	5/05/2016	1.85	1.36	35.9	2.7	0.9	192	192	192	192	192		P	
							1.85	1.36	35.9	2.7	0.9								
S16 084/9				P7 Above re Wall	TA	6/05/2016	1.88	1.41	33.1	2.7	1.2	192	192	192	192	192		P	
							1.88	1.41	33.1	2.7	1.2								
S16 084/10				P7 Above re Wall	TA	6/05/2016	1.84	1.36	36.1	2.7	1.3	192	192	192	192	192		P	
							1.83	1.34	36.1	2.7	1.9								
S16 084/11				P7 Above re Wall	TA	6/05/2016	1.86	1.38	34.7	2.7	1.2	192	192	192	192	192		P	
							1.86	1.38	34.7	2.7	1.1								
S16 084/12				P7 Above re Wall	TA	6/05/2016	1.90	1.46	31.2	2.7	1.3	192	192	192	192	192		P	
							1.91	1.46	31.2	2.7	0.9								
S16 084/13				P7 Shear Key	TA	6/05/2016	1.80	1.39	30.0	2.7	7.1	192	192	192	192	192		P	
							1.82	1.40	30.0	2.7	6.3								
S16 084/14				P7 Shear Key	TA	6/05/2016	1.81	1.40	29.2	2.7	7.4	192	192	192	192	192		P	
							1.83	1.41	29.2	2.7	6.3								
S16 084/15				P7 Shear Key	TA	6/05/2016	1.86	1.40	32.4	2.7	2.5	192	192	192	192	192		P	
							1.85	1.40	32.4	2.7	3.0								
S16 085/4	2660531.212	6510718.741	9.213	P7 Shear Key	TA	9/05/2016	1.83	1.36	34.5	2.7	2.9	151	151	151	151	151		P	
							1.81	1.34	34.5	2.7	3.9								
S16 085/5	2660514.352	6510727.315	10.005	P7 Shear Key	TA	9/05/2016	1.85	1.38	34.5	2.7	1.6	151	151	151	151	151		P	
							1.85	1.37	34.5	2.7	1.8								
S16 085/6	2660409.538	6510652.796	27.479	P7 Re Wall	TA	9/05/2016	1.80	1.33	34.7	2.7	4.3	151	151	151	151	151		P	
							1.79	1.33	34.7	2.7	4.6								
S16 085/7	2660402.064	6510658.776	27.443	P7 Re Wall	TA	9/05/2016	1.83	1.36	34.5	2.7	2.6	151	151	151	151	151		P	
							1.83	1.36	34.5	2.7	2.6								
S16 089/7				P7 Re Wall	TA	13/05/2016	1.87	1.44	30.6	2.7	2.9	212	197	166	181	189		P	
							1.87	1.43	30.6	2.7	3.3								
S16 089/8				P7 Re Wall	TA	13/05/2016	1.84	1.39	32.4	2.7	3.5	166	212	151	142	168		P	
							1.82	1.38	32.4	2.7	4.6								
S16 090/4				P7 Shear Key	TA	16/05/2016	1.92	1.48	29.3	2.7	1.6	212	197	197	166	193		P	
							1.90	1.47	29.3	2.7	2.8								
S16 090/5				P7 Shear Key	TA	16/05/2016	1.85	1.47	26.2	2.7	7.1	212	197	197	166	193		P	
							1.84	1.46	26.2	2.7	7.6								
S16 090/6				P7 Shear Key	TA	16/05/2016	1.86	1.45	28.4	2.7	5.0	212	212	212	212	212		P	
							1.88	1.46	28.4	2.7	4.4								
S16 091/5				P5 Behind Wall 1	TA	17/05/2016	1.88	1.45	29.9	2.7	2.9	150	150	167	200	167		P	
							1.89	1.45	29.9	2.7	2.9								
S16 093/3				P7 Above RE Wall	TA	19/05/2016	1.87	1.41	33.2	2.7	1.2	141	153	156	214	166		P	
							1.89	1.42	33.2	2.7	0.2								
S16 093/4				P7 Above RE Wall	TA	19/05/2016	1.79	1.34	33.9	2.7	5.2	153	153	141	141	147		P	
							1.79	1.33	33.9	2.7	5.4								
S16 093/5				P7 Above RE Wall	TA	19/05/2016	1.81	1.33	35.6	2.7	3.3	214	214	214	214	214		P	
							1.80	1.33	35.6	2.7	3.4								
S16 094/6				Southern Pond	TA	20/05/2016	1.86	1.35	37.9	2.7	0.0	156	141	144	174	154		P	
							1.85	1.34	37.9	2.7	0.0								

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Job: Silverdale Arran's Point **Client: Tonkin & Taylor** **Job #** 614089.032/1

T&T Job #: 21854.0037 **Entered By:** YA

Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode
NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m³)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments
S16 097/1				Silt Pond	TA	7/06/2016	1.90	1.46	30.0	2.7	2.1	214	214	214	214	214		P	These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
							1.91	1.47	30.0	2.7	1.8								
S16 097/2				Silt Pond	TA	7/06/2016	1.82	1.35	34.5	2.7	3.2	214	214	160	183	193		P	
							1.82	1.35	34.5	2.7	3.5								
S16 102/7				Shear Key	TAJ	17/08/2016	1.79	1.32	35.8	2.7	3.8	145	153	153	214	166		P	
							1.80	1.32	35.8	2.7	3.6								
S16 102/8				Shear Key	TAJ	17/08/2016	1.82	1.36	34.0	2.7	3.5	137	153	153	199	161		P	
							1.81	1.35	34.0	2.7	3.8								
S16 105/2				Shear key east	TAJ	6/07/2016	1.88	1.40	34.0	2.7	0.3	214	214	214	214	214		P	
							1.88	1.40	34.0	2.7	0.5								
S16 105/3				Shear key east	TAJ	6/07/2016	1.86	1.38	34.8	2.7	0.9	214	214	214	214	214		P	
							1.87	1.39	34.8	2.7	0.5								
S16 105/4				Shear key east	TAJ	6/07/2016	1.85	1.38	34.3	2.7	1.5	214	214	214	214	214		P	
							1.84	1.37	34.3	2.7	2.2								
S16 103/3				shear key	TAJ	20/06/2016	1.80	1.31	37.1	2.7	2.7	122	137	160	183	151		P	
							1.79	1.30	37.1	2.7	3.4								
S16 103/4				shear key	TAJ	20/06/2016	1.84	1.37	34.6	2.7	2.1	137	153	168	183	160		P	
							1.86	1.38	34.6	2.7	0.9								
S16 103/5				shear key	TAJ	20/06/2016	1.85	1.38	33.6	2.7	2.4	214	199	168	145	182		P	
							1.85	1.38	33.6	2.7	2.3								
S16 104/1				shear key	TAJ	5/07/2016	1.83	1.32	38.1	2.7	0.6	145	153	168	160	157		P	
							1.80	1.30	38.1	2.7	2.1								
S16 104/2				shear key	TAJ	5/07/2016	1.80	1.31	37.2	2.7	2.6	145	137	183	171	159		P	
							1.81	1.32	37.2	2.7	2.2								
S16 104/3				shear key	TAJ	5/07/2016	1.79	1.31	36.8	2.7	3.5	153	153	145	167	155		P	
							1.78	1.30	36.8	2.7	3.9								
S16 104/4				East shear key	TAJ	5/07/2016	1.87	1.38	35.7	2.7	-0.4	145	153	168	183	162		P	
							1.87	1.37	35.7	2.7	0.0								
S16 104/5				East shear key	TAJ	5/07/2016	1.85	1.36	36.4	2.7	0.2	145	153	214	156	167		P	
							1.85	1.36	36.4	2.7	0.5								
S16 104/6				East shear key	TAJ	5/07/2016	1.83	1.32	38.3	2.7	0.6	145	153	214	156	167		P	
							1.82	1.32	38.3	2.7	0.9								
S16 106/1				East shear key	TAJ	7/07/2016	1.86	1.35	37.0	2.7	0.0	199	202	214	214	207		P	
							1.85	1.35	37.0	2.7	0.0								
S16 106/2				East shear key	TAJ	7/07/2016	1.80	1.31	36.9	2.7	3.1	214	214	214	214	214		P	
							1.81	1.32	36.9	2.7	2.2								
S16 106/4				East shear key	TAJ	12/07/2016	1.87	1.37	36.0	2.7	0.0	214	168	177	189	187		P	
							1.87	1.37	36.0	2.7	0.0								
S16 106/5				East shear key	TAJ	12/07/2016	1.84	1.29	41.8	2.7	0.0	214	214	214	214	214		P	
							1.84	1.30	41.8	2.7	0.0								
						21/07/2016				2.7	#VALUE!								
										2.7	#VALUE!								
						22/07/2016				2.7	#VALUE!								
										2.7	#VALUE!								
						23/07/2016				2.7	#VALUE!								
										2.7	#VALUE!								
						24/07/2016				2.7	#VALUE!								
										2.7	#VALUE!								
						25/07/2016				2.7	#VALUE!								
										2.7	#VALUE!								
						26/07/2016				2.7	#VALUE!								