REPORT

Tonkin+Taylor

MILLWATER SUBDIVISION - ARRAN POINT PRECINCT 7 STAGE 4

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 38 No. Residential Lots contained within Stage 4 of Arran Point Precinct 7 at the Millwater Subdivision in Silverdale. Stage 4 comprises residential Lots 44 to 51, 54 to 68 and 84 to 98, Joint Owned Access Lane (JOAL) Lots 601 to 602, and Road 01 (Arran Point Parade) and Road 03 (Cassidy Drive) inclusive as shown on the Woods Final Contours Plan (Woods Ref 37004–04–100–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 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 4 of Arran Point (Precinct 7) were undertaken by Hick Bros Civil Contractors Ltd and commenced in March 2014 with completion by April 2018. Earthworks comprised the following, and are shown on T+T Drawing 21854.0037–APP7S4–101 in Appendix A2:

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

b Installation of subsoil drains.

c Cut to fill earthworks across the entire Stage 4 area as shown on the Woods Cut & Fill As–Built Lowest to Final Surface (Woods Ref 37004–04–110–AB) in Appendix A1.

d Construction of 1 No. Shear Key (SK1).

e Construction of 2 No. Palisade Walls (Palisade Wall 1D and part of Palisade Wall 1C).

f Construction of 3 No. 9m high, 1 in 1.5 (V:H) engineered fill batter slopes (parts of RE 2, RE 3 and RE 4).

g Construction of a 6m high, 1 in 2 (V:H) engineered fill batter slope (RE Slope 6) along the Esplanade Reserve Path between CH0 to CH130m.

We note that landslide ground movement occurred on 15 December 2016 during bulk earthworks across the Stage 4 area. The landslip has been remediated in accordance with the methodology agreed with all parties.

Civil earthworks commenced on site in May 2018 and were completed by October 2018, and comprised the following:

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

b Installation of roading and services.

Overall subdivisional soil types are moderately to highly expansive (Class M to H1), 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 6.11 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 38 No. Residential Lots contained within Stage 4 of Arran Point Precinct 7 at the Millwater Subdivision in Silverdale. Stage 4 comprises residential Lots 44 to 51, 54 to 68 and 84 to 98, Joint Owned Access Lane (JOAL) Lots 601 to 602, and Road 01 (Arran Point Parade) and Road 03 (Cassidy Drive) inclusive as shown on the Woods Final Contours Plan (Woods Ref 37004–04–100–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 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 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 4.

Bulk earthworks associated with development of Stage 4 of Arran Point (Precinct 7) were undertaken by Hick Bros Civil Contractors Ltd and commenced in March 2014 with completion by April 2018. The geotechnical works associated with the development are shown on T+T Drawing 21854.0037–APP7S4–101 in Appendix A2.

We note that landslide ground movement occurred on 15 December 2016 during bulk earthworks across the Stage 4 area. The landslip has been remediated in accordance with the methodology agreed with all parties.

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 4 No. reinforced earth slopes (parts of RE 2, RE 3, RE 4 and RE 6);

c Monitoring and certification of construction of 2 No. Palisade Walls (Palisade Wall 1D and part of Palisade Wall 1C);

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

e 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 Point Precinct 7, Stage 4 area of the Millwater subdivision is located within what is known as Precinct 7 in the Orewa West Structure Plan.

The Arran 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 Point Precinct 7 and Stage 4 areas are shown on T+T Drawing 21854.0037–APP7S4–100 in Appendix A2.

Pre-development gradients within the Stage 4 area were gentle to moderately steep (1 in 3 to 1 in 15 (V:H)) with an overall fall to the south.

Post-development gradients within the Stage 4 area remain gentle to moderately steep (1 in 3 to 1 in 15 (V:H)) and generally fall to the south as before. In order to form more level building platforms, steep reinforced earth slopes of up to 1 in 1.5 (V:H) have been constructed along some Lot boundaries as shown on T+T Drawing 21854.0037–APP7S4–101.

Stage 4 is presently accessed from the existing Arran Point Parade.

1.3 Geological Setting

Published geological mapping and information indicates the Arran Point Precinct 7 area is underlain by East Coast Bays Formation (ECBF) materials. In addition to the ECBF materials, our investigations identified the presence of alluvial materials in isolated locations on site.

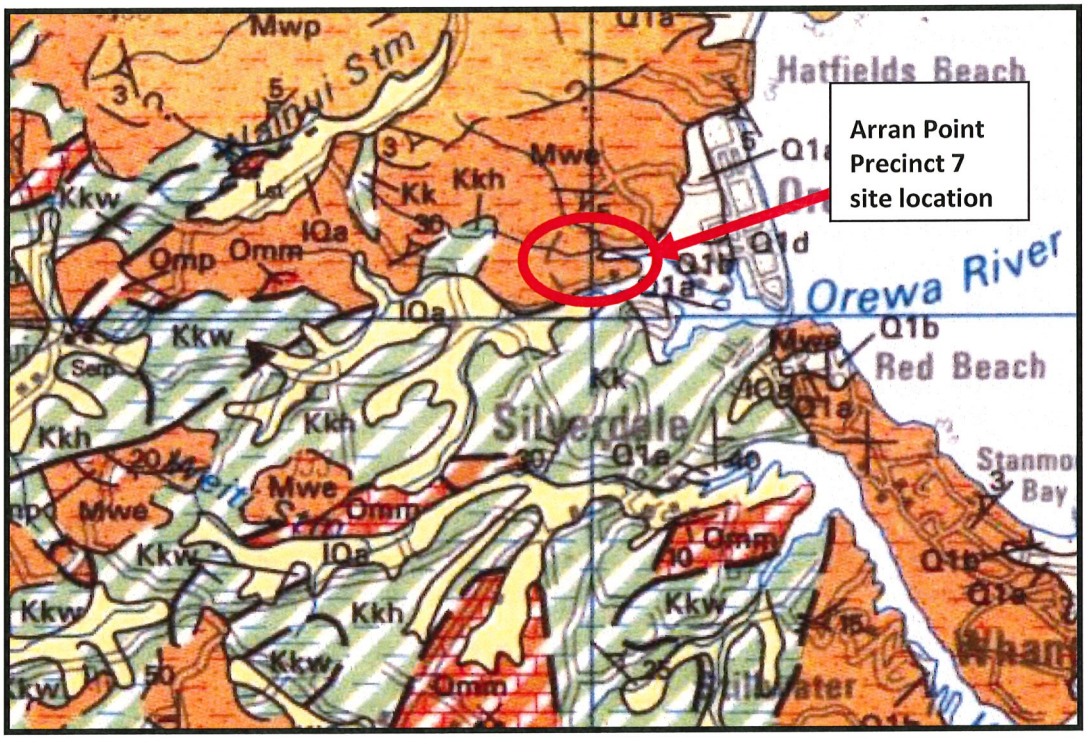


Figure 1 - Local Geology (from Edbrooke)

Summary descriptions of geological units in the Arran 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 Point Precinct 7, Stage 4 area, based on site investigations and observations during construction, are enclosed as Drawing Numbers 21854.0037–APP7S4–103 to –105 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 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 walls were undertaken by ICB Retaining and Construction Ltd (ICB), also under Hicks' control.

Civil works construction has been completed by JG Civil Ltd (JGCL).

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 April 2018 under Hicks' control. Civil earthworks and construction for the residential Lots were under JGCL's control and were undertaken progressively from May 2018 through to completion in October 2018.

Key Stage 4 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 Lowest to Final Surface (Woods Ref 37004–04–110–AB) in Appendix A1.

d Construction of 1 No. Shear Key (SK1) and 2 No. Palisade Walls (Palisade Wall 1D and part of Palisade Wall 1C), and 4 No. reinforced earth slopes (parts of RE 2, RE 3, RE 4 and RE 6), as shown on T+T Drawing 21854.0037–APP7S4–101 in Appendix A2.

e Remediation, as part of bulk earthworks, of a landslide that occurred within the Stage 4 area, as shown on T+T Drawing 21854.0037–APP7S4–101 in Appendix A2.

Key Stage 4 civil works components included:

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

b Installation of roading and services.

The earthworks, shear keys, undercuts and subsoil drainage as–built plans are included in Appendix A1 (Woods Drawings 37004–04–100–AB, –110–AB to –112–AB, –120–AB to –122–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 (Undercuts, 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 (Undercuts, 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.

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 Point Precinct 7 during bulk earthworks as part of the undercut, shear key and reinforced earth slopes construction.

The subsoil drains installed within the undercut, shear key and reinforced earth slopes were excavated into the underlying soil and rock to intercept groundwater and springs, and are as detailed in Sections 3.2 and 3.4.

Subsoil drains installed as part of reinforced earth slope construction comprised the following:

a 160mm diameter, Hiway grade, perforated Nexus pipes along the 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 2.0 metres 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 reinforced earth slope drains were connected to the reticulated stormwater system or discharge into the Orewa Estuary below, as shown on the Woods Shear Key, Undercut and Subsoil Drain AsBuilt Plans (Woods Ref 37004–04–120–AB to –122–AB) in Appendix A1, and on T+T Drawing 21854.0037–APP7S4–102 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 Point Precinct 7 to provide satisfactory factors of safety against instability for the finished development of Stage 4.

1 No. Shear Key (i.e. SK1) was excavated within Stage 4 during the bulk earthworks in the location shown on the T+T Drawing 21854.0037–APP7S4–101, 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).

Due to the depth of competent rock expected along part of the shear key alignment, 2 No. palisade pile walls were extended through the base of the shear key to be founded within the underlying competent rock. This is discussed further in Section 3.3 below.

The shear key long–section for SK1 was developed based on the mapping undertaken and is included in Appendix A2 (T+T Drawings 21854.0037–APP7S4–108 and –109). 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 37004–04–120–AB 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 also became the rear face drainage for the reinforced earth slope.

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 Walls

The ECBF bedding plane shears identified during excavations and mapping within SK1 were assessed as dipping down southwards below the adjacent estuary. In view of that assessment, and the results of stability analyses undertaken as part of the investigation reporting, 2 No. Palisade Walls (i.e. Palisade Wall 1D and part of Palisade Wall 1C) were identified as being required along SK1 to provide satisfactory factors of safety against instability for the finished Stage 4 development.

2 No. Palisade Walls (i.e. Palisade Wall 1D and part of Palisade Wall 1C) were constructed within Stage 4 during the bulk earthworks in the location shown on the T+T Drawing 21854.0037–APP7S4–101, included in Appendix A2. Palisade Wall 1C comprises 8m to 10m long 310UC97 steel piles installed at 1.4m centres encased in 600mm diameter concreted holes. Palisade Wall 1D comprises 11m long 300mm diameter timber SED piles installed at 1.8m centres encased in 550mm diameter concreted holes. Drilling for the palisade walls pile bores were 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 the palisade walls' 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 Reinforced Earth Slopes

4 No. reinforced earth slopes (i.e. parts of RE 2, RE 3, RE 4 and RE 6) were constructed during the bulk earthworks and comprise horizontally laid uniaxial High Density Polyethylene (HDPE) geogrids placed at maximum 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 the reinforced earth slopes is shown on T+T Drawings 21854.0037–APP7S4–106 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 1.5 (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 connect into the reticulated stormwater system or 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 6.7).

3.5 Undercuts

Undercuts (minimum 2m deep and 5m wide) were excavated below the toe of RE 2 and RE 4 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).

In addition, an undercut extending sufficiently into the competent underlying ECBF rock materials was excavated below the toe of RE 3. Excavations for this undercut were inspected and mapped by an Engineering Geologist to check that the undercut 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).

1m deep undercuts were excavated to expose more competent soils (minimum shear strength of 75kPa) across the Residential Lots and through the road alignments in Stage 4 due to exposure of some areas of unsuitable subgrade materials (i.e. soft and wet). The undercut was 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, Undercut and Subsoil Drain AsBuilt Plans (Woods Ref 37004–04–120–AB 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 palisade walls to be constructed across Arran Point Precinct 7, so as to provide acceptable factors of safety against slope instability for the finished development of Stage 4.

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 Engineering Geologist during drilling of the Palisade Walls 1C and 1D 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 Point Precinct 7, Stage 4 area straddle a range of "design conditions" including cut ground, filled ground, expansive soils and constructed slopes up to 1 in 1.5 (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 to H1 (moderately to highly expansive) with characteristic surface movements anticipated to be in the range of 20mm to 60mm. 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 4 area have been constructed as reinforced earth fill structures with face gradients of 1 in 1.5 (V:H). They are located in Lots 44 to 51, Lots 54 to 68, Lots 84 to 87, Lot 90 to 91 and Lots 95 to 98. 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–APP7S4–110 (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. This is shown on the Woods Deadman Location Plan (Woods Ref 37004–04–125–AB) in Appendix A1.

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 will 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.

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 4 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.

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, Undercut and Subsoil Drain AsBuilt Plans (Woods Ref 37004–04–120–AB to –122–AB) in Appendix A1, and on T+T Drawing 21854.0037–APP7S4–102 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–APP7S4–111) are attached in Appendix E.

5.8 Stormwater

Public stormwater services have been installed within Arran Point Precinct 7, Stage 4. 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 and Wastewater As–Built Plans (Woods Ref 37004–04–300–AB to –302–AB and –400–AB to –402–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 Point Precinct 7 Stage 4 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–APP7S4–112 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 to H1 (moderately to highly expansive) with characteristic surface movements anticipated to be in the range of 20mm to 60mm.

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 Point Precinct 7 Stage 4 (comprising residential Lots 44 to 51, 54 to 68 and 84 to 98, JOAL Lots 601 to 602, Road 01 (Arran Point Parade) and Road 03 (Cassidy Drive) 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 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 37004, Millwater, Arran Point Precinct 7, Stage 4, Drawing Numbers 37004–04–100–AB, –110–AB to –112–AB and –120–AB 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 44 to 49, 55 to 68 and 84 to 98 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 50 to 51 and 54 inclusive:**

6.6.1 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 6.6.2 to 6.6.6.

6.6.2 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]).

6.6.3 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 H1 (highly expansive) as defined in AS 2870:2011 (Ref. [7]) with anticipated characteristic surface ground movements of 40mm to 60mm. Clause 6.6.3.1 of this Geotechnical Completion Report may be used for expansive soil foundation design on this subdivision:

6.6.3.1 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 750 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.

6.6.4 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.

6.6.5 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.

6.6.6 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.

6.7 **For Lots 44 to 51, 54 to 68, 84 to 87, 90 to 91 and 95 to 98 inclusive:**

6.7.1 These Lots contain a "Building Line Limitation" relating to the reinforced earth slope which forms the 1 in 1.5 (V:H) slope along the Lot boundaries. The restriction zone is shown on T+T Drawing 21854.0037–APP7S4–110 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.

6.7.2 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.

6.7.3 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–APP7S4–110 in

Appendix A2, will require a geotechnical assessment, as a minimum, to ensure stability of the subject or adjacent Lot is not detrimentally affected.

6.7.4 Development outside of the Building Line Limitation zone may proceed in accordance with the recommendations outlined in Sections 6.5 and 6.6.

6.8 Underfill (Subsoil) drainage

Underfill (Subsoil) drains have been installed during subdivisional development in the locations shown on the Woods Shear Key, Undercut and Subsoil Drain AsBuilt Plans (Woods Ref 37004–04–120–AB to –122–AB) in Appendix A1, and on T+T Drawing 21854.0037–APP7S4–102 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.

6.9 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.

6.10 Road and Access Lots

Based on the fill monitoring and site observations undertaken during site development, the filled and natural ground within Arran Point Precinct 7, Stage 4 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 Point Precinct 7 Stage 4 development, within natural ground, a design CBR of 2% is considered appropriate, while within engineered fill areas, a design CBR of 7% is appropriate.

6.11 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:

.....

James Lee

Geotechnical Engineer

Authorised for Tonkin & Taylor Ltd by:

.....

Andrew Stiles

Project Director

JXXL
p:\21854\21854.0037 - arrans hill p7\gcr\stage 4\jxxl.180808.app7s4-gcr.docx

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.

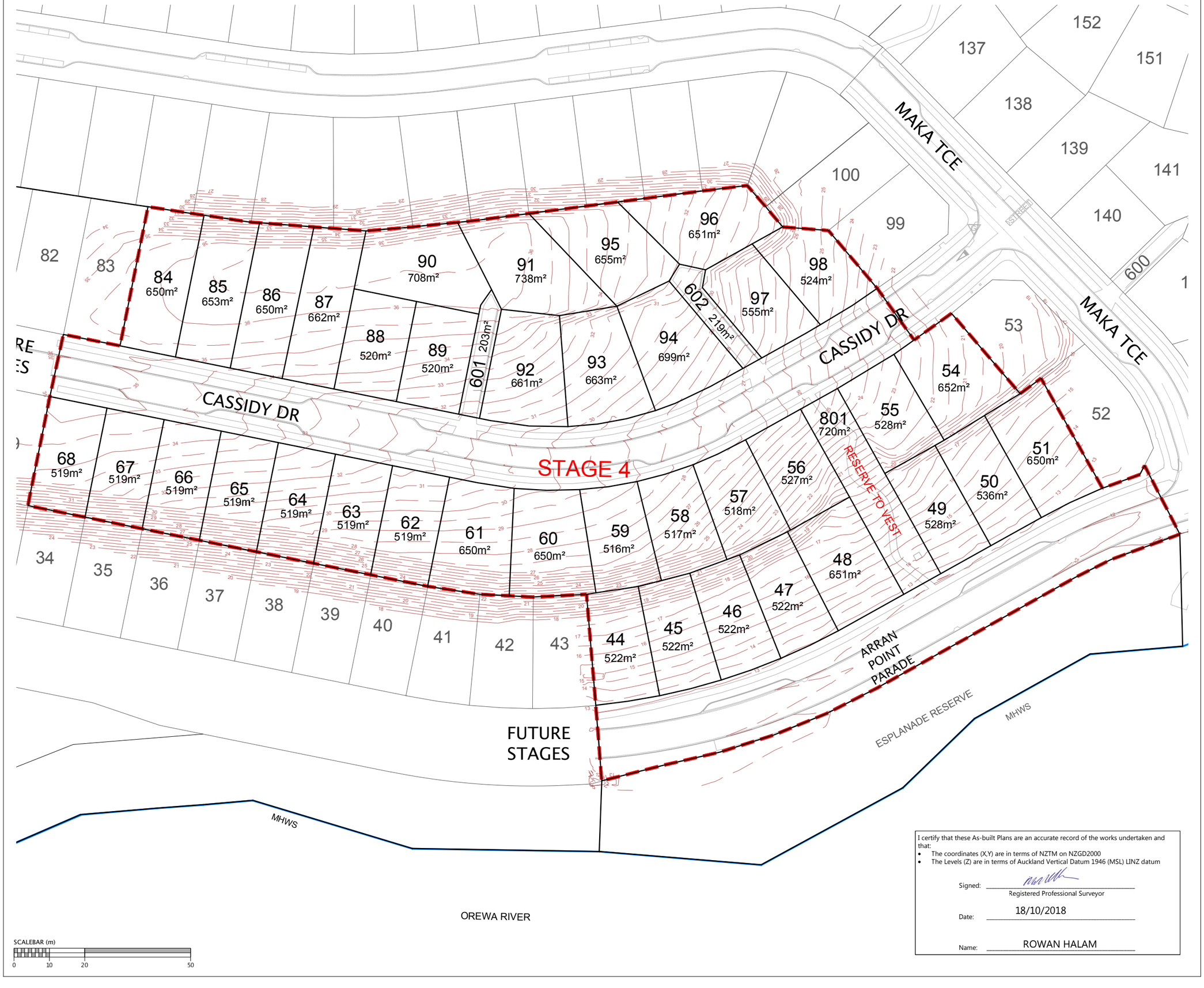
[6] New Zealand Standards, 1989. *NZS 4431:1989 Code of Practice for Earth Fill for Residential Development.*

[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

- **37004–04–100–AB** **Final Contours Plan**
- **37004–04–110–AB** **Cut & Fill As–Built – Lowest to Final Surface**
- **37004–04–111–AB** **Cut & Fill As–Built – Original to Lowest Surface**
- **37004–04–112–AB** **Cut & Fill As–Built – Original to Final Surface**
- **37004–04–120–AB to –122** **Shear Key, Undercut and Subsoil Drain As–Built Plans**
- **37004–04–125–AB** **Deadman Location Plan**
- **37004–04–300–AB to –303** **Stormwater As–Built Plans**
- **37004–04–400–AB to –403** **Wastewater As–Built Plans**



SCALEBAR (m)

0 10 20 50

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: 18/10/2018

Name: ROWAN HALAM

WOODS
EST.1970

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

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

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	18/10/18

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	MRB	
CHECKED	KR	
APPROVED	MRH	WOODS.CO.NZ

N

WFH PROPERTIES

MILLWATER
ARRAN POINT
STAGE 4

FINAL CONTOURS PLAN

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37004-04-100-AB	

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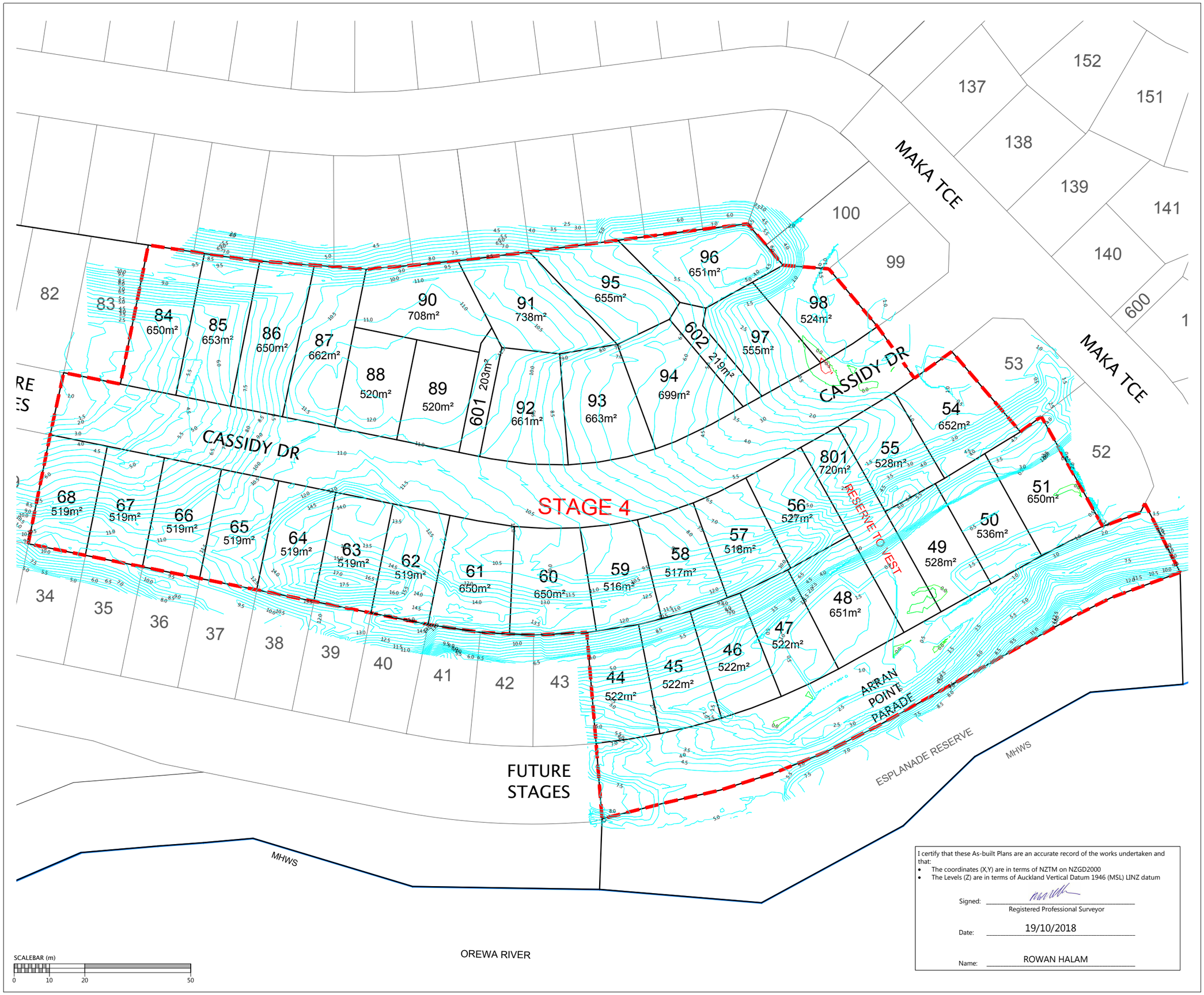

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

- FILL CONTOUR
- CUT CONTOUR
- ZERO 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: 19/10/2018

Name: ROWAN HALAM

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	18/10/18

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	MRB	
CHECKED	KR	
APPROVED	MRH	WOODS.CO.NZ

MILLWATER
ARRAN POINT
STAGE 4
CUT & FILL AS-BUILT
LOWEST TO FINAL SURFACE
SHEET 1 OF 3

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37004-04-110-AB	

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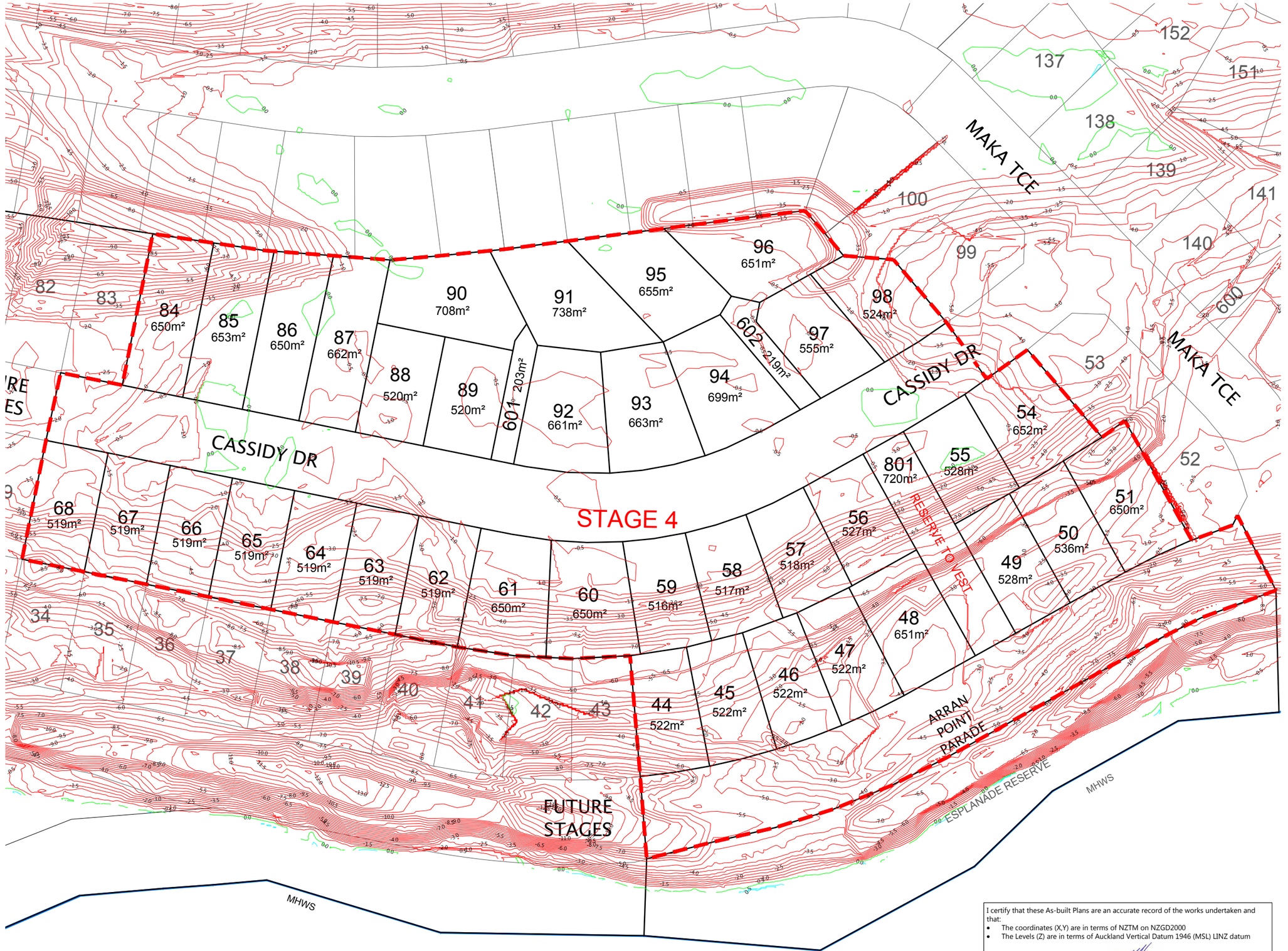

SCALEBAR (m)

0 10 20 50

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: 19/10/2018

Name: ROWAN HALAM

WOODS
EST.1970

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

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

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	18/10/18

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	MRB	
CHECKED	KR	
APPROVED	MRH	WOODS.CO.NZ

N

WFH PROPERTIES

MILLWATER
ARRAN POINT
STAGE 4
CUT & FILL AS-BUILT
ORIGINAL TO LOWEST SURFACE
SHEET 2 OF 3

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37004-04-111-AB	

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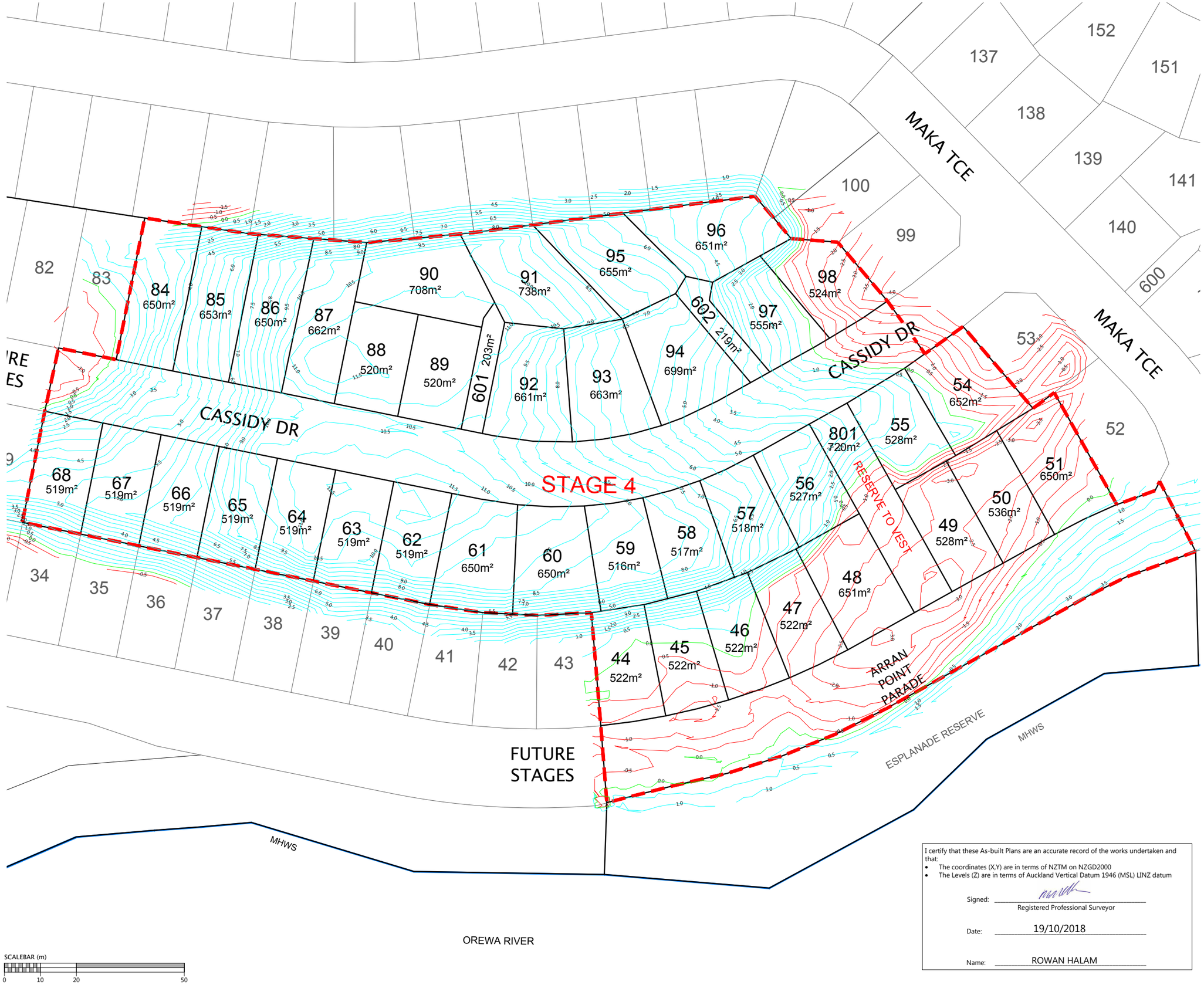

SCALEBAR (m)

0 10 20 50

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: 19/10/2018

Name: ROWAN HALAM

WOODS
EST.1970

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

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

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	18/10/18

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	MRB	
CHECKED	KR	
APPROVED	MRH	WOODS.CO.NZ

N

WFH PROPERTIES

MILLWATER
ARRAN POINT
STAGE 4
CUT & FILL AS-BUILT
ORIGINAL TO FINAL SURFACE
SHEET 3 OF 3

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37004-04-112-AB	

Document No. C:\USERS\ROWANH\APPDATA\LOCAL\TEMP\BRICSCAD\BP_0\37004-04-110-AB CUT FILL CONTOURS.DWG

WOODS
Est.1970

SEE SHEET 121

SEE SHEET 122

FUTURE STAGES

FUTURE STAGES

STAGE 4

UNDERCUT 2

UNDERCUT 2

UNDERCUT 3

UNDERCUT 4

UNDERCUT 5

UNDERCUT 5

MAKA TCE

MAKA TCE

CASSIDY DR

CASSIDY DR

ARRAN POINT PDE

ARRAN POINT PARADE

SHEARKEY 1

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SHEARKEY 1

MHWS

ESPLANADE RESERVE

ESPLANADE RESERVE

RESERVE TO VEST

RESERVE TO VEST

ESPLANADE RESERVE

601

602

801

600

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS
2. SUBSOIL DATA SUPPLIED BY CONTRACTOR

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
- SUBGRADE UNDERCUT AREAS

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	18/10/18
2	ADDITIONAL PALISADE WALLS	KR	16/11/18

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	MRB	
CHECKED	KR	
APPROVED	MRH	WOODS.CO.NZ

N

WFH PROPERTIES

MILLWATER
ARRAN POINT
STAGE 4
SHEAR KEY, UNDERCUT AND SUBSOIL DRAIN ASBUILT OVERALL LAYOUT
SHEET 1 OF 3

STATUS	AS-BUILT	REV
SCALE	1:1500 @ A3	2
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37004-04-120-AB	

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

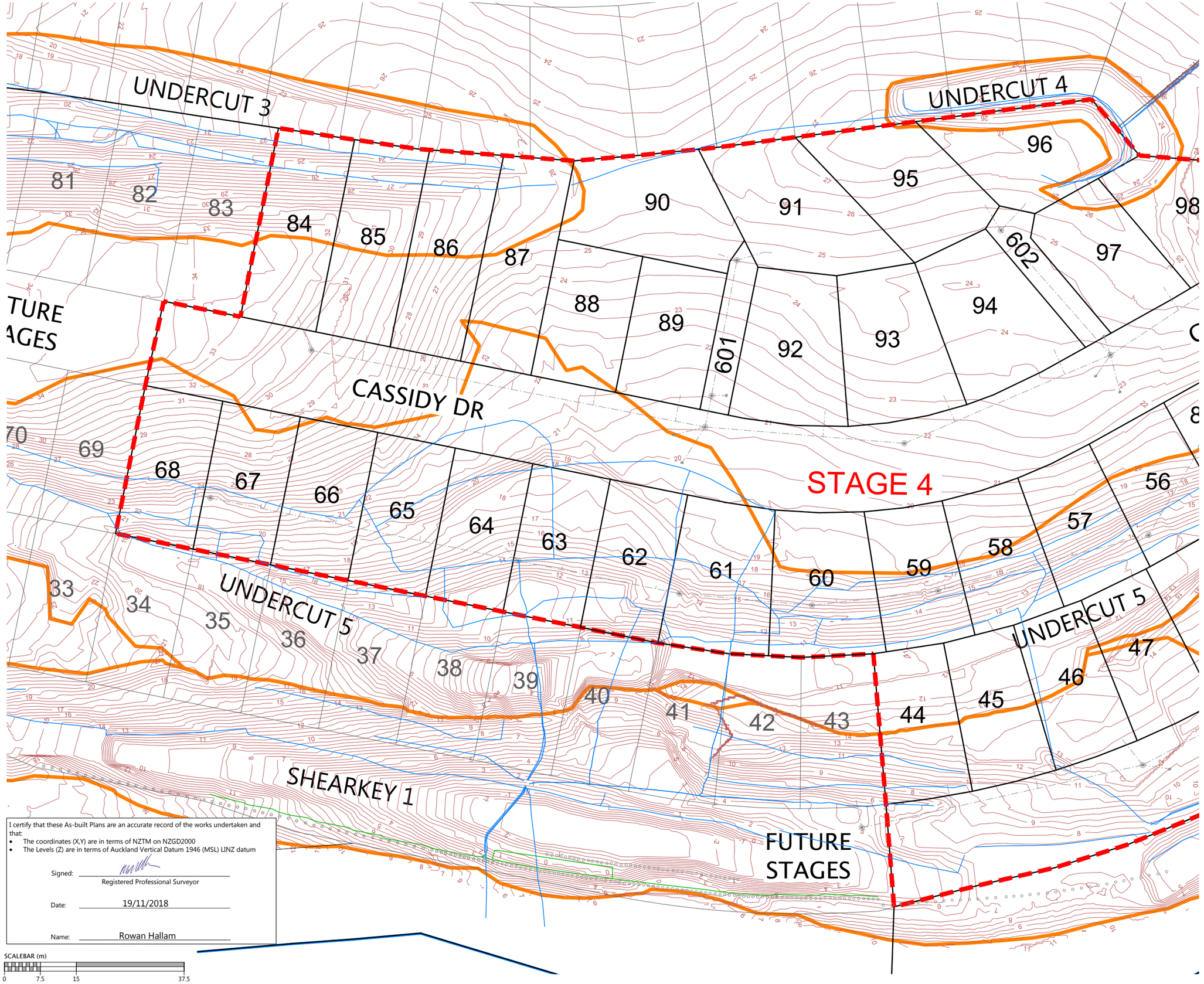
Date: 19/11/2018

Name: Rowan Hallam

SCALEBAR (m)

0 15 30 75

Document No. WP-PEN-FS03\WAPCO_DWGS_ALBANY\37004 - ARRAN HILL PRECINCT 7 STAGE 4\DRAWINGS\SURV\ASBUILT\37004-04-120-AB SK UC & SUBSOIL.DWG



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: 19/11/2018

Name: Rowan Hallam

SCALEBAR (m)

0 7.5 15 37.5

WOODS
Est.1970

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS
2. SUBSOIL DATA SUPPLIED BY CONTRACTOR

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
- SUBGRADE UNDERCUT AREAS

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	18/10/18
2	ADDITIONAL PALISADE WALLS	KR	16/11/18

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	MRB	
CHECKED	KR	
APPROVED	MRH	WOODS.CO.NZ

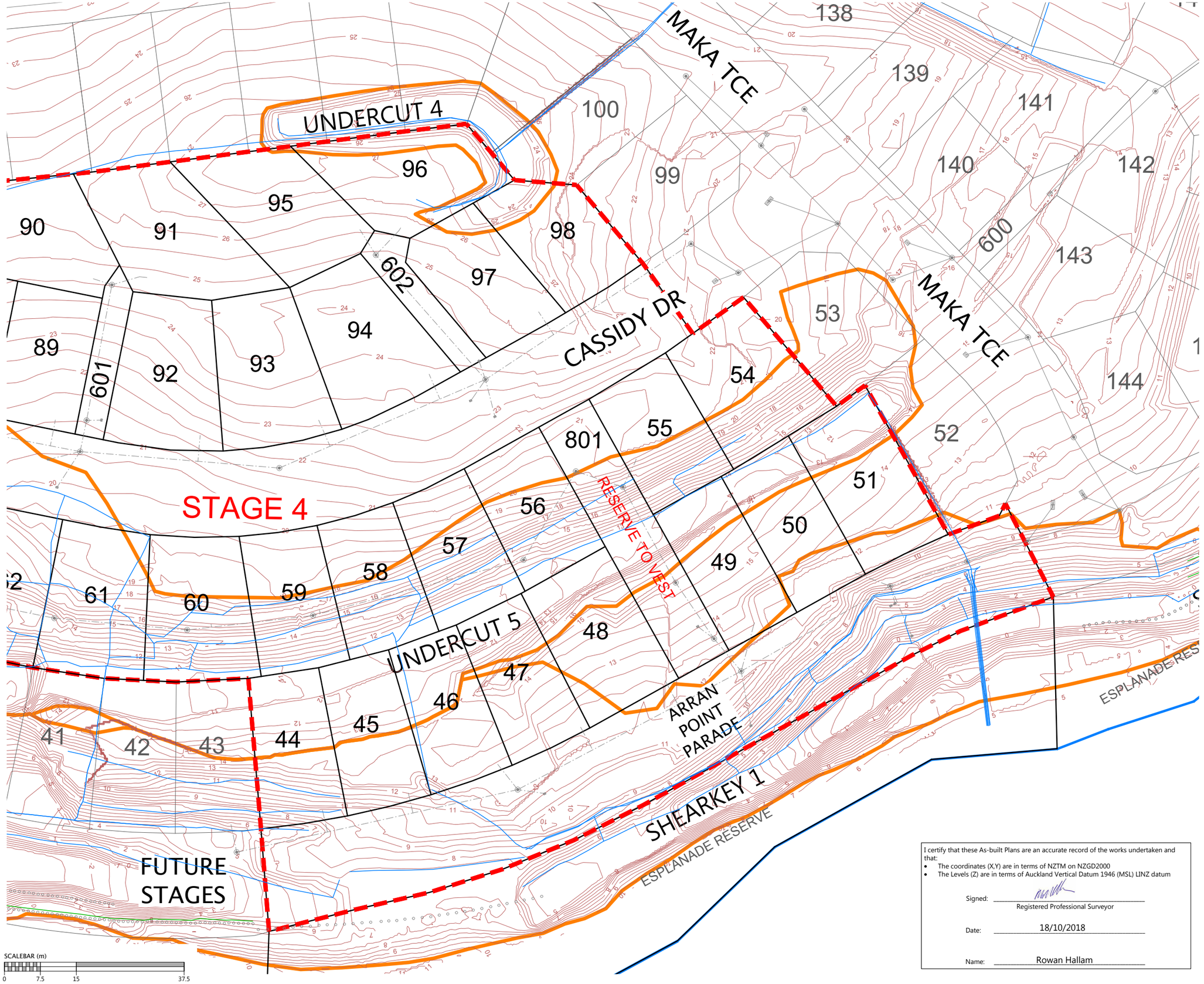
N

WFH PROPERTIES

MILLWATER
ARRAN POINT
STAGE 4
SHEAR KEY, UNDERCUT AND SUBSOIL DRAIN ASBUILT
SHEET 2 OF 3

STATUS	AS-BUILT	REV
SCALE	1:750 @ A3	2
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37004-04-121-AB	

Document No. WP-PEN-F503\WAPCO_DWGS_ALBANY\37004 - ARRAN HILL PRECINCT 7 STAGE 4\DRAWINGS\SURV\ASBUILT\37004-04-120-AB-SK UC & SUBSOIL.DWG



NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS
2. SUBSOIL DATA SUPPLIED BY CONTRACTOR

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
- SUBGRADE UNDERCUT AREAS

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	18/10/18
2	ADDITIONAL PALISADE WALLS	KR	16/11/18

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: 18/10/2018

Name: Rowan Hallam

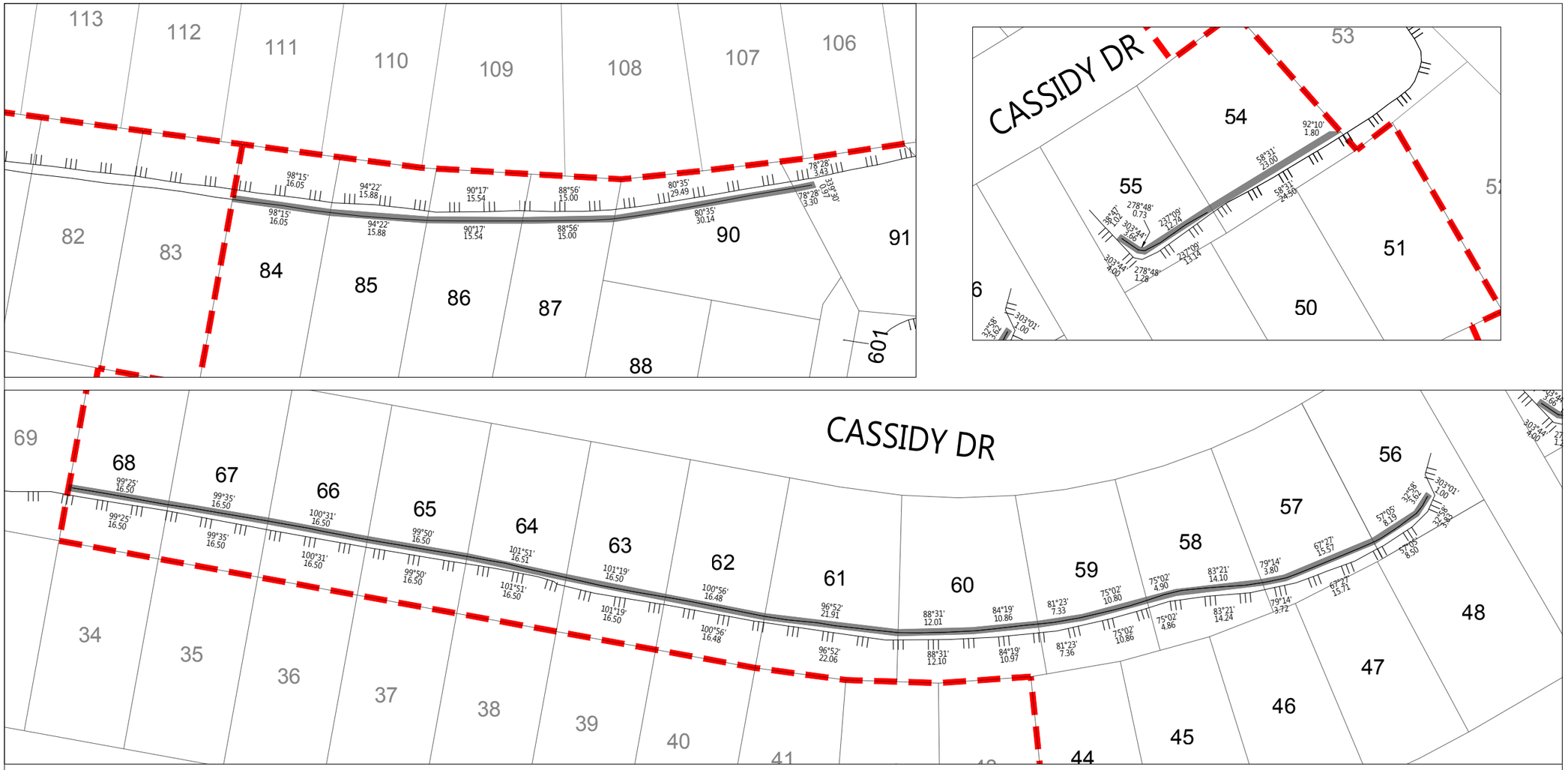
SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	MRB	
CHECKED	KR	
APPROVED	MRH	WOODS.CO.NZ

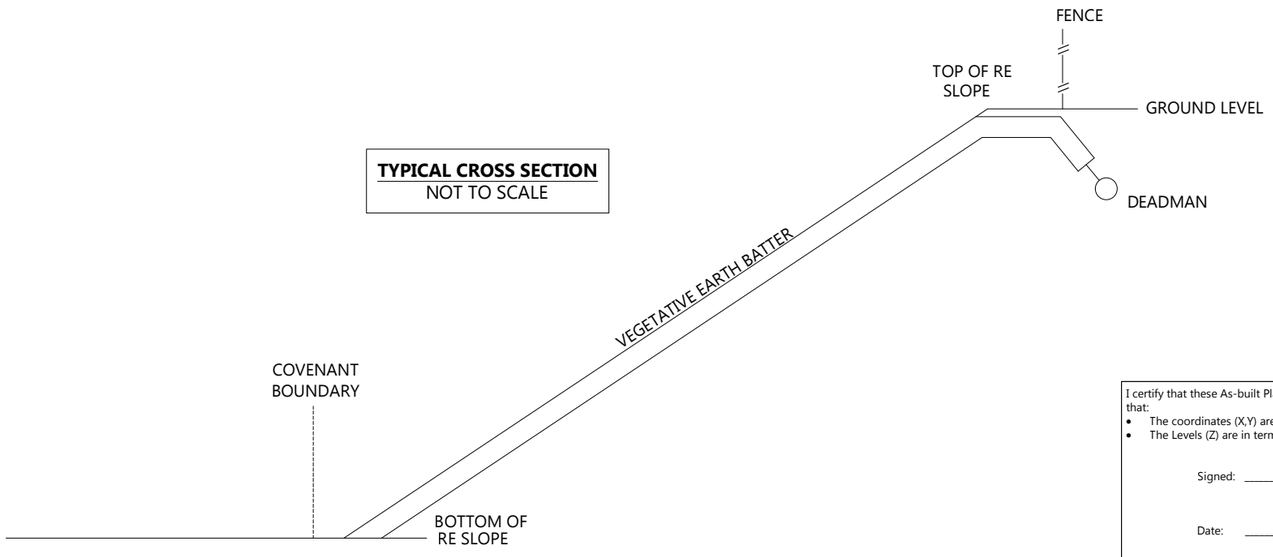
MILLWATER ARRAN POINT STAGE 4

SHEAR KEY, UNDERCUT AND SUBSOIL DRAIN ASBUILT SHEET 3 OF 3

STATUS	AS-BUILT	REV
SCALE	1:750 @ A3	2
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37004-04-122-AB	

Document No. WP-PEN-FS03\WAPCO_DWGS_ALBANY\37004 - ARRAN HILL PRECINCT 7 STAGE 4\DRAWINGS\SURV\ASBUILT\37004-04-120-AB SK UC & SUBSOIL.DWG





TYPICAL CROSS SECTION
NOT TO SCALE

SCALEBAR (m)
0 7.5 15 37.5

WOODS
EST.1970

LEGEND

- BOUNDARIES
- STAGE BOUNDARIES
- DEADMAN
- TOP OF BANK
- DEADMAN COVENANT AREA (67°27' 15.57 / 67°27' 15.57)

NOTES:

1. *DEADMAN LOCATION PROVIDED BY CONTRACTOR. LOT OWNER TO LOCATE AND PROTECT DEADMAN POSITION PRIOR TO ANY WORKS.*
2. *THE DIMENSIONS PROVIDED ARE A BEST FIT APPROXIMATION BASED ON LOCATIONS PROVIDED BY THE CONTRACTOR.*

DISCLAIMER:
THIS DRAWING IS INTENDED TO BE SOLELY USED AS THE BASE DATA FOR THE PURPOSES OF THE CLIENT. WOODS ACCEPT NO RESPONSIBILITY FOR ANY SUBSEQUENT WORKS CARRIED OUT IN THIS AREA.

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: 01/11/2018

Name: ROWAN HALLAM

REVISION DETAILS		BY	DATE
1	FOR INFORMATION	KR	01/11/18

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T & T	
DRAWN	MRB	
CHECKED	JL	
APPROVED	MRH	WOODS.CO.NZ

N

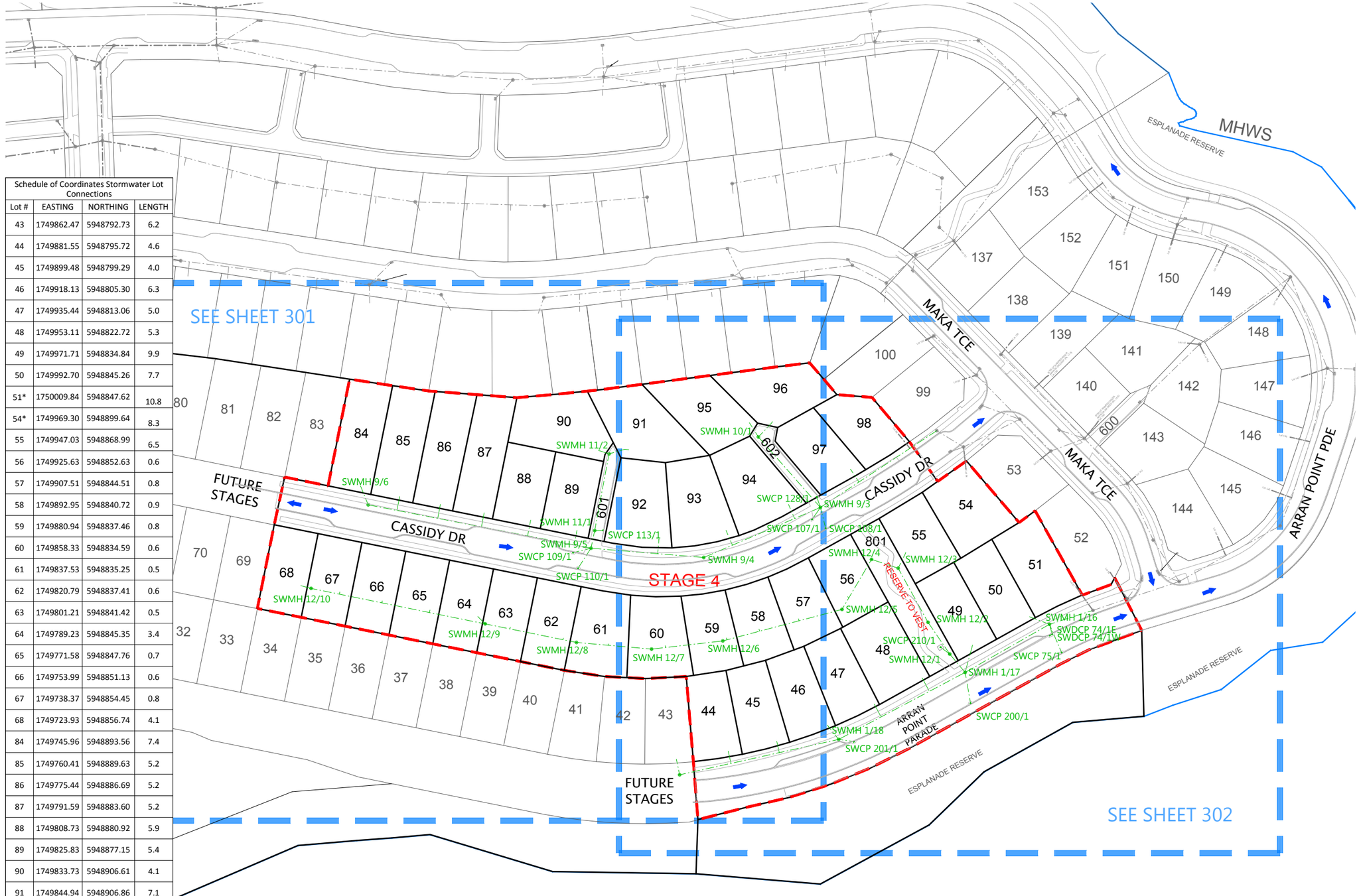
WFH PROPERTIES

MILLWATER
ARRAN POINT
STAGE 4

DEADMAN LOCATION PLAN

STATUS	ISSUED FOR INFORMATION	REV
SCALE	1:750 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37004-04-125-AB	

Document No. K:\37004 - ARRAN HILL PRECINCT 7 STAGE 4\DRAWINGS\SURV\ASBUILT\37004-04-125-AB-DEADMAN.DWG



Schedule of Coordinates Stormwater Lot Connections			
Lot #	EASTING	NORTHING	LENGTH
43	1749862.47	5948792.73	6.2
44	1749881.55	5948795.72	4.6
45	1749899.48	5948799.29	4.0
46	1749918.13	5948805.30	6.3
47	1749935.44	5948813.06	5.0
48	1749953.11	5948822.72	5.3
49	1749971.71	5948834.84	9.9
50	1749992.70	5948845.26	7.7
51*	1750009.84	5948847.62	10.8
54*	1749969.30	5948899.64	8.3
55	1749947.03	5948868.99	6.5
56	1749925.63	5948852.63	0.6
57	1749907.51	5948844.51	0.8
58	1749892.95	5948840.72	0.9
59	1749880.94	5948837.46	0.8
60	1749858.33	5948834.59	0.6
61	1749837.53	5948835.25	0.5
62	1749820.79	5948837.41	0.6
63	1749801.21	5948841.42	0.5
64	1749789.23	5948845.35	3.4
65	1749771.58	5948847.76	0.7
66	1749753.99	5948851.13	0.6
67	1749738.37	5948854.45	0.8
68	1749723.93	5948856.74	4.1
84	1749745.96	5948893.56	7.4
85	1749760.41	5948889.63	5.2
86	1749775.44	5948886.69	5.2
87	1749791.59	5948883.60	5.2
88	1749808.73	5948880.92	5.9
89	1749825.83	5948877.15	5.4
90	1749833.73	5948906.61	4.1
91	1749844.94	5948906.86	7.1
92	1749856.05	5948873.95	5.5
93	1749880.77	5948877.12	6.0
94	1749903.82	5948886.70	5.6
95	1749889.38	5948916.85	6.1
96	1749897.89	5948917.22	7.3
97	1749926.67	5948899.70	5.6
98*	1749944.34	5948912.62	6.8

* CONSTRUCTED IN A PREVIOUS STAGE

SCALEBAR (m)

0 15 30 75

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: 24/10/2018

Name: ROWAN HALLAM

WOODS
EST.1970

LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
- OVERLAND FLOW
- NEW STORMWATER
- EXISTING STORMWATER
- SUBSOIL DRAINAGE
- STAGE BOUNDARY
- REVISED INVERT LEVEL 19.17

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.

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	19/10/18

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	MRB	
CHECKED	AF	
APPROVED	MRH	WOODS.CO.NZ

N

WFH PROPERTIES

MILLWATER
ARRAN POINT
STAGE 4
STORMWATER AS-BUILT
OVERALL LAYOUT
SHEET 1 OF 3

STATUS	AS-BUILT	REV
SCALE	1:1500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37004-04-300-AB	

Document No. C:\USERS\ROWAN\APPDATA\LOCAL\TEMP\BRICSCAD\BP_0\37004-04-300-AB-STORMWATER.DWG

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: 24/10/2018

Name: ROWAN HALLAM

Schedule of Coordinates Stormwater Lot Connections			
Lot #	EASTING	NORTHING	LENGTH
43	1749862.47	5948792.73	6.2
44	1749881.55	5948795.72	4.6
45	1749899.48	5948799.29	4.0
46	1749918.13	5948805.30	6.3
47	1749935.44	5948813.06	5.0
48	1749953.11	5948822.72	5.3
49	1749971.71	5948834.84	9.9
50	1749992.70	5948845.26	7.7
51*	1750009.84	5948847.62	10.8
54*	1749969.30	5948899.64	8.3
55	1749947.03	5948868.99	6.5
56	1749925.63	5948852.63	0.6
57	1749907.51	5948844.51	0.8
58	1749892.95	5948840.72	0.9
59	1749880.94	5948837.46	0.8
60	1749858.33	5948834.59	0.6
61	1749837.53	5948835.25	0.5
62	1749820.79	5948837.41	0.6
63	1749801.21	5948841.42	0.5
64	1749789.23	5948845.35	3.4
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67	1749738.37	5948854.45	0.8
68	1749723.93	5948856.74	4.1
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96	1749897.89	5948917.22	7.3
97	1749926.67	5948899.70	5.6
98*	1749944.34	5948912.62	6.8

* CONSTRUCTED IN A PREVIOUS STAGE

SCALEBAR (m)
0 7.5 15 37.5

LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
- OVERLAND FLOW
- NEW STORMWATER
- EXISTING STORMWATER
- SUBSOIL DRAINAGE
- STAGE BOUNDARY
- REVISED INVERT LEVEL 19.17

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.

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	19/10/18

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	MRB	
CHECKED	AF	
APPROVED	MRH	WOODS.CO.NZ

MILLWATER
ARRAN POINT
STAGE 4
STORMWATER AS-BUILT
SHEET 2 OF 3
(SLC-62000)

STATUS	AS-BUILT	REV
SCALE	1:750 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37004-04-301-AB	

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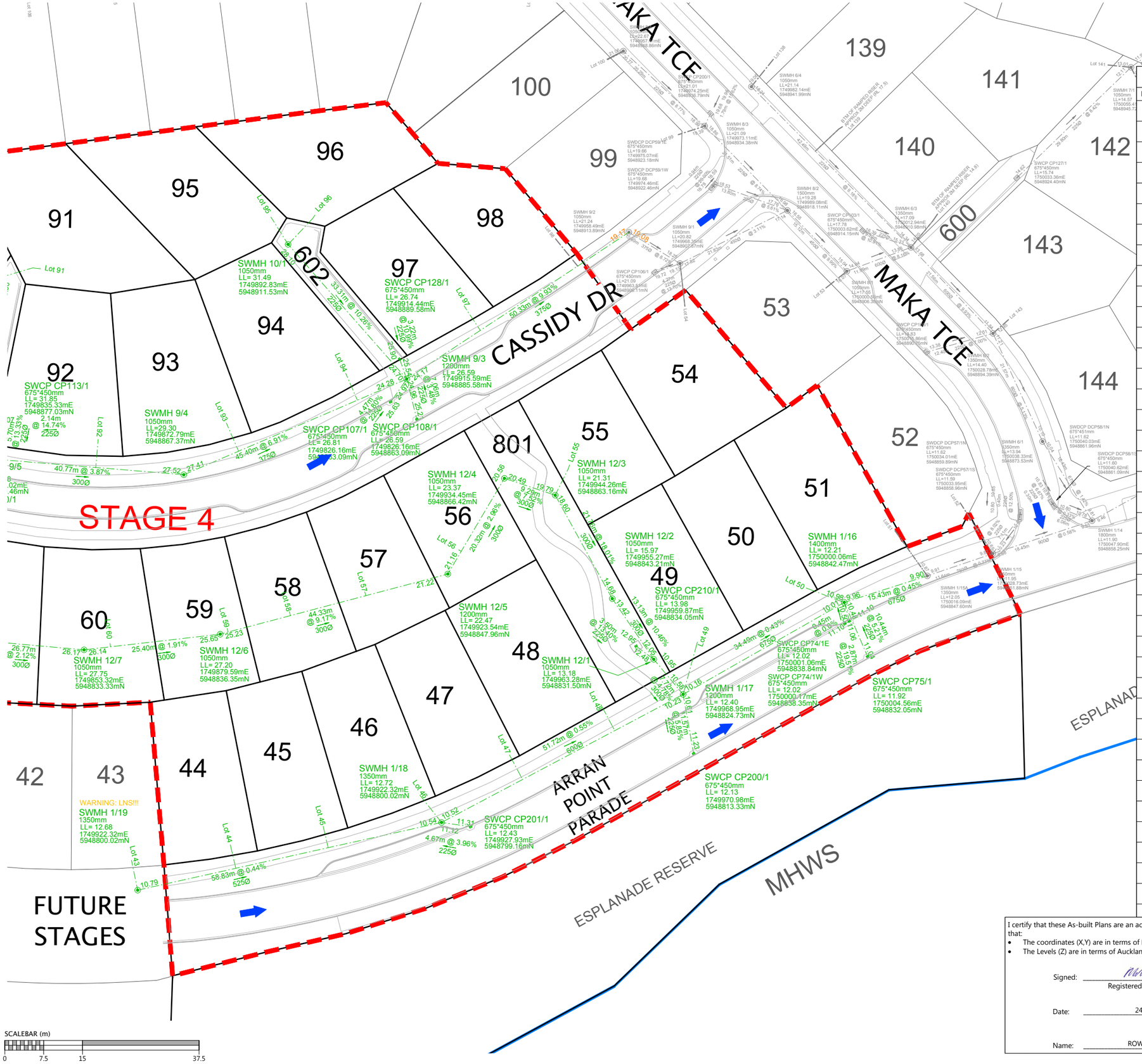

Schedule of Coordinates Stormwater Lot Connections			
Lot #	EASTING	NORTHING	LENGTH
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48	1749953.11	5948822.72	5.3
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50	1749992.70	5948845.26	7.7
51*	1750009.84	5948847.62	10.8
54*	1749969.30	5948899.64	8.3
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61	1749837.53	5948835.25	0.5
62	1749820.79	5948837.41	0.6
63	1749801.21	5948841.42	0.5
64	1749789.23	5948845.35	3.4
65	1749771.58	5948847.76	0.7
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84	1749745.96	5948893.56	7.4
85	1749760.41	5948889.63	5.2
86	1749775.44	5948886.69	5.2
87	1749791.59	5948883.60	5.2
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93	1749880.77	5948877.12	6.0
94	1749903.82	5948886.70	5.6
95	1749889.38	5948916.85	6.1
96	1749897.89	5948917.22	7.3
97	1749926.67	5948899.70	5.6
98*	1749944.34	5948912.62	6.8

* CONSTRUCTED IN A PREVIOUS STAGE

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: 24/10/2018

Name: ROWAN HALLAM

WOODS
EST.1970

LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
- OVERLAND FLOW
- NEW STORMWATER
- EXISTING STORMWATER
- SUBSOIL DRAINAGE
- STAGE BOUNDARY
- REVISED INVERT LEVEL 19.17

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.

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	19/10/18

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	MRB	
CHECKED	AF	
APPROVED	MRH	WOODS.CO.NZ

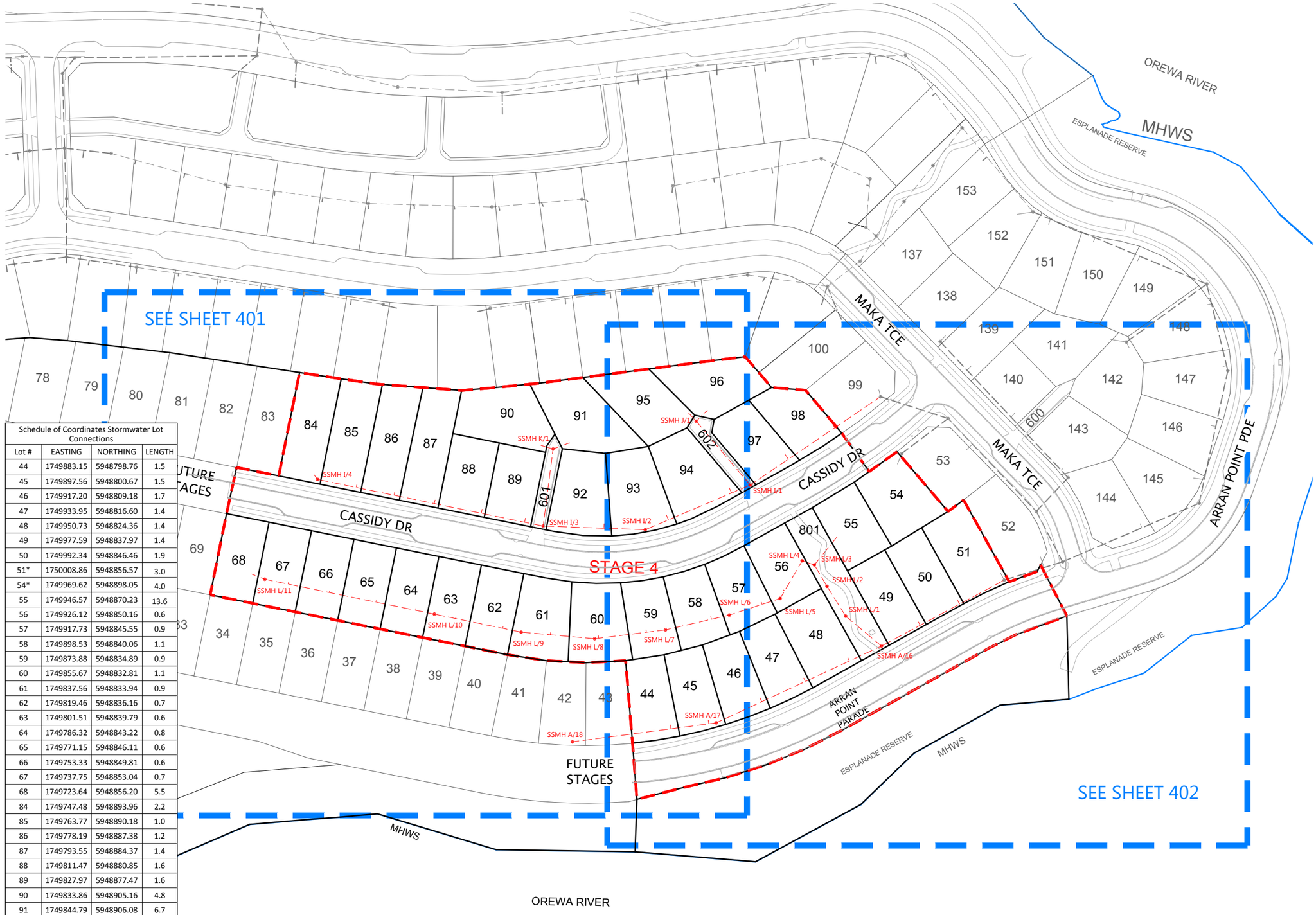
N

WFH PROPERTIES

MILLWATER
ARRAN POINT
STAGE 4
STORMWATER AS-BUILT
SHEET 3 OF 3
(SLC-62000)

STATUS	AS-BUILT	REV
SCALE	1:750 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37004-04-302-AB	

Document No. C:\USERS\ROWANH\APPDATA\LOCAL\TEMP\BRICSCAD\BP_0\37004-04-300-AB-STORMWATER.DWG



Schedule of Coordinates Stormwater Lot Connections			
Lot #	EASTING	NORTHING	LENGTH
44	1749883.15	5948798.76	1.5
45	1749897.56	5948800.67	1.5
46	1749917.20	5948809.18	1.7
47	1749933.95	5948816.60	1.4
48	1749950.73	5948824.36	1.4
49	1749977.59	5948837.97	1.4
50	1749992.34	5948846.46	1.9
51*	1750008.86	5948856.57	3.0
54*	1749969.62	5948898.05	4.0
55	1749946.57	5948870.23	13.6
56	1749926.12	5948850.16	0.6
57	1749917.73	5948845.55	0.9
58	1749898.53	5948840.06	1.1
59	1749873.88	5948834.89	0.9
60	1749855.67	5948832.81	1.1
61	1749837.56	5948833.94	0.9
62	1749819.46	5948836.16	0.7
63	1749801.51	5948839.79	0.6
64	1749786.32	5948843.22	0.8
65	1749771.15	5948846.11	0.6
66	1749753.33	5948849.81	0.6
67	1749737.75	5948853.04	0.7
68	1749723.64	5948856.20	5.5
84	1749747.48	5948893.96	2.2
85	1749763.77	5948890.18	1.0
86	1749778.19	5948887.38	1.2
87	1749793.55	5948884.37	1.4
88	1749811.47	5948880.85	1.6
89	1749827.97	5948877.47	1.6
90	1749833.86	5948905.16	4.8
91	1749844.79	5948906.08	6.7
92	1749857.88	5948875.33	1.7
93	1749881.60	5948878.68	2.0
94	1749905.58	5948889.01	2.2
95	1749890.04	5948917.52	4.3
96	1749897.38	5948918.35	6.0
97	1749926.93	5948901.60	2.1
98	1749945.04	5948912.84	1.2
* CONSTRUCTED IN A PREVIOUS STAGE			

SCALEBAR (m)

0 15 30 75

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: 19/10/2018

Name: Rowan Hallam

WOODS
Est.1970

LEGEND

NEW SANITARY SEWER MANHOLE	◉
NEW SANITARY SEWER	– – – –
EXISTING SANITARY SEWER	———
REVISED INVERT LEVEL	19.17

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
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.

REVISION DETAILS		BY	DATE
1	ISSEUD FOR INFORMATION	KR	19/10/18

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	MRB	
CHECKED	AF	
APPROVED	MRH	WOODS.CO.NZ

N

WFH PROPERTIES

MILLWATER
ARRAN POINT
STAGE 4

WASTEWATER AS-BUILT
OVERALL LAYOUT
SHEET 1 OF 3
(SLC-62000)

STATUS	AS BUILT	REV
SCALE	1:1500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37004-04-400-AB	

Document No. C:\USERS\ROWAN\APPDATA\LOCAL\TEMP\BRICSCAD\BP_0\37004-04-400-AB-SEWER.DWG

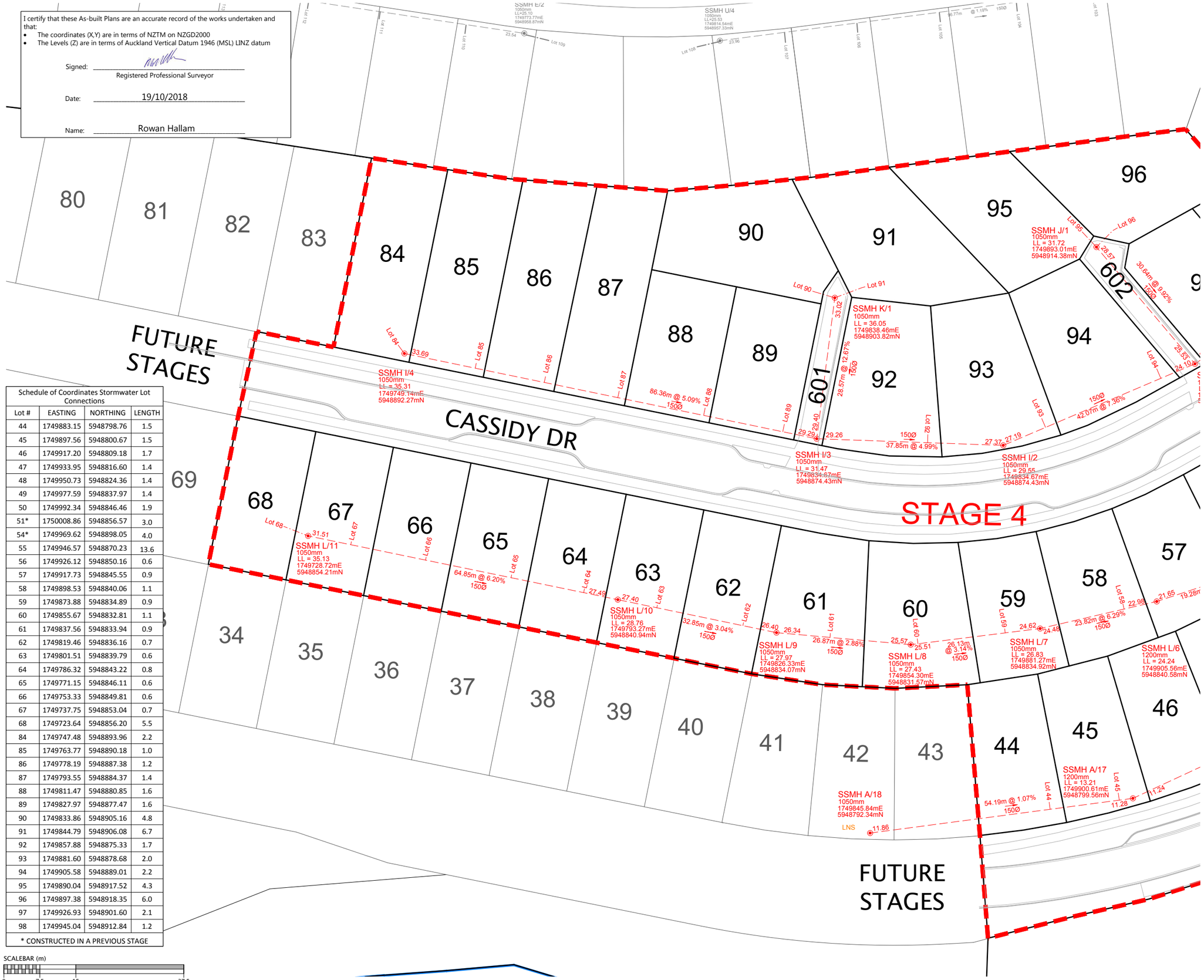
I certify that these As-built Plans are an accurate record of the works undertaken and that:

- 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: 19/10/2018

Name: Rowan Hallam



Schedule of Coordinates Stormwater Lot Connections			
Lot #	EASTING	NORTHING	LENGTH
44	1749883.15	5948798.76	1.5
45	1749897.56	5948800.67	1.5
46	1749917.20	5948809.18	1.7
47	1749933.95	5948816.60	1.4
48	1749950.73	5948824.36	1.4
49	1749977.59	5948837.97	1.4
50	1749992.34	5948846.46	1.9
51*	1750008.86	5948856.57	3.0
54*	1749969.62	5948898.05	4.0
55	1749946.57	5948870.23	13.6
56	1749926.12	5948850.16	0.6
57	1749917.73	5948845.55	0.9
58	1749898.53	5948840.06	1.1
59	1749873.88	5948834.89	0.9
60	1749855.67	5948832.81	1.1
61	1749837.56	5948833.94	0.9
62	1749819.46	5948836.16	0.7
63	1749801.51	5948839.79	0.6
64	1749786.32	5948843.22	0.8
65	1749771.15	5948846.11	0.6
66	1749753.33	5948849.81	0.6
67	1749737.75	5948853.04	0.7
68	1749723.64	5948856.20	5.5
84	1749747.48	5948893.96	2.2
85	1749763.77	5948890.18	1.0
86	1749778.19	5948887.38	1.2
87	1749793.55	5948884.37	1.4
88	1749811.47	5948880.85	1.6
89	1749827.97	5948877.47	1.6
90	1749833.86	5948905.16	4.8
91	1749844.79	5948906.08	6.7
92	1749857.88	5948875.33	1.7
93	1749881.60	5948878.68	2.0
94	1749905.58	5948889.01	2.2
95	1749890.04	5948917.52	4.3
96	1749897.38	5948918.35	6.0
97	1749926.93	5948901.60	2.1
98	1749945.04	5948912.84	1.2
* CONSTRUCTED IN A PREVIOUS STAGE			

WOODS
EST.1970

LEGEND

NEW SANITARY SEWER MANHOLE	◉
NEW SANITARY SEWER	— — —
EXISTING SANITARY SEWER	———
REVISED INVERT LEVEL	19.17

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
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.

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	19/10/18

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	MRB	
CHECKED	AF	
APPROVED	MRH	WOODS.CO.NZ

N

WFH PROPERTIES

MILLWATER ARRAN POINT STAGE 4

WASTEWATER AS-BUILT SHEET 2 OF 3 (SLC-62000)

STATUS	AS BUILT	REV
SCALE	1:750 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37004-04-401-AB	

Document No. C:\USERS\ROWANH\APPDATA\LOCAL\TEMP\BRICSCAD\BP_0\37004-04-400-AB-SEWER.DWG

SCALEBAR (m)

0 7.5 15 37.5

Schedule of Coordinates Stormwater Lot Connections			
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60	1749855.67	5948832.81	1.1
61	1749837.56	5948833.94	0.9
62	1749819.46	5948836.16	0.7
63	1749801.51	5948839.79	0.6
64	1749786.32	5948843.22	0.8
65	1749771.15	5948846.11	0.6
66	1749753.33	5948849.81	0.6
67	1749737.75	5948853.04	0.7
68	1749723.64	5948856.20	5.5
84	1749747.48	5948893.96	2.2
85	1749763.77	5948890.18	1.0
86	1749778.19	5948887.38	1.2
87	1749793.55	5948884.37	1.4
88	1749811.47	5948880.85	1.6
89	1749827.97	5948877.47	1.6
90	1749833.86	5948905.16	4.8
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94	1749905.58	5948889.01	2.2
95	1749890.04	5948917.52	4.3
96	1749897.38	5948918.35	6.0
97	1749926.93	5948901.60	2.1
98	1749945.04	5948912.84	1.2

* CONSTRUCTED IN A PREVIOUS STAGE

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
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Signed: _____
Registered Professional Surveyor

Date: 19/10/2018

Name: Rowan Hallam

WOODS
EST.1970

LEGEND

- NEW SANITARY SEWER MANHOLE
- NEW SANITARY SEWER
- EXISTING SANITARY SEWER
- REVISED INVERT LEVEL 19.17

NOTES

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DESIGNED	MB	
DRAWN	MRB	
CHECKED	AF	
APPROVED	RH	WOODS.CO.NZ

N

WFH PROPERTIES

MILLWATER
ARRAN POINT
STAGE 4

WASTEWATER AS-BUILT
SHEET 3 OF 3
(SLC-62000)

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37003-03-402-AB	

Document No. C:\USERS\ROWAN\APPDATA\LOCAL\TEMP\BRICSCAD\BP_0\37004-04-400-AB-SEWER.DWG

Appendix A2: T+T Drawings

- **21854.0037–APP7S4–100 Drawing List and Location Plan**
- **21854.0037–APP7S4–101 Geotechnical Works Plan**
- **21854.0037–APP7S4–102 Geotechnical Works Subsoil Drain Plan**
- **21854.0037–APP7S4–103 Geological Cross Sections 1 & 6**
- **21854.0037–APP7S4–104 Geological Cross Sections 7 & 8**
- **21854.0037–APP7S4–105 Geological Cross Sections 10 & 11**
- **21854.0037–APP7S4–106 RE Slopes 2, 3 and 4 Typical Details**
- **21854.0037–APP7S4–107 Shear Key 1 Plan**
- **21854.0037–APP7S4–108 Shear Key 1 Longsection**
- **21854.0037–APP7S4–109 Geology Legend and Definition of Terms**
- **21854.0037–APP7S4–110 Building Limitation Plan**

Esplanade Retaining Walls (RE Slope 06 and Palisade Wall 1C) Drawings

- **21854.0037–S3ESP–00 Drawing List and Location Plan**
- **21854.0037–S3ESP–01 Geotechnical Works Plan – Retaining Walls 8, 9 and 10**
- **21854.0037–S3ESP–02 Geotechnical Works Plan – Subsoil Drainage**
- **21854.0037–S3ESP–03 Geotechnical Works Plan – Shear Key 1 and Piles**
- **21854.0037–S3ESP–16 RE Slope 6 – Plan and Elevation**
- **21854.0037–S3ESP–17 RE Slope 6 (CH 115.5 to 175m) – Typical Cross Section**
- **21854.0037–S3ESP–18 RE Slope 6 (CH 53.5 to 115.5m) – Typical Cross Section**

Retaining Wall 05 (Palisade Wall 1D) Drawings

- **21854.0037–MBW5–00 Drawing List and Location Plan**
- **21854.0037–MBW5–13 Geotechnical Works Plan – Shear Key 1 and Piles**
- **21854.0037–MBW5–14 Shear Key 1 Longsection**
- **21854.0037–MBW5–15 Retaining Wall 05 – Grid Layout Details**
- **21854.0037–MBW5–16 Shear Key 1F – Typical Cross Section**

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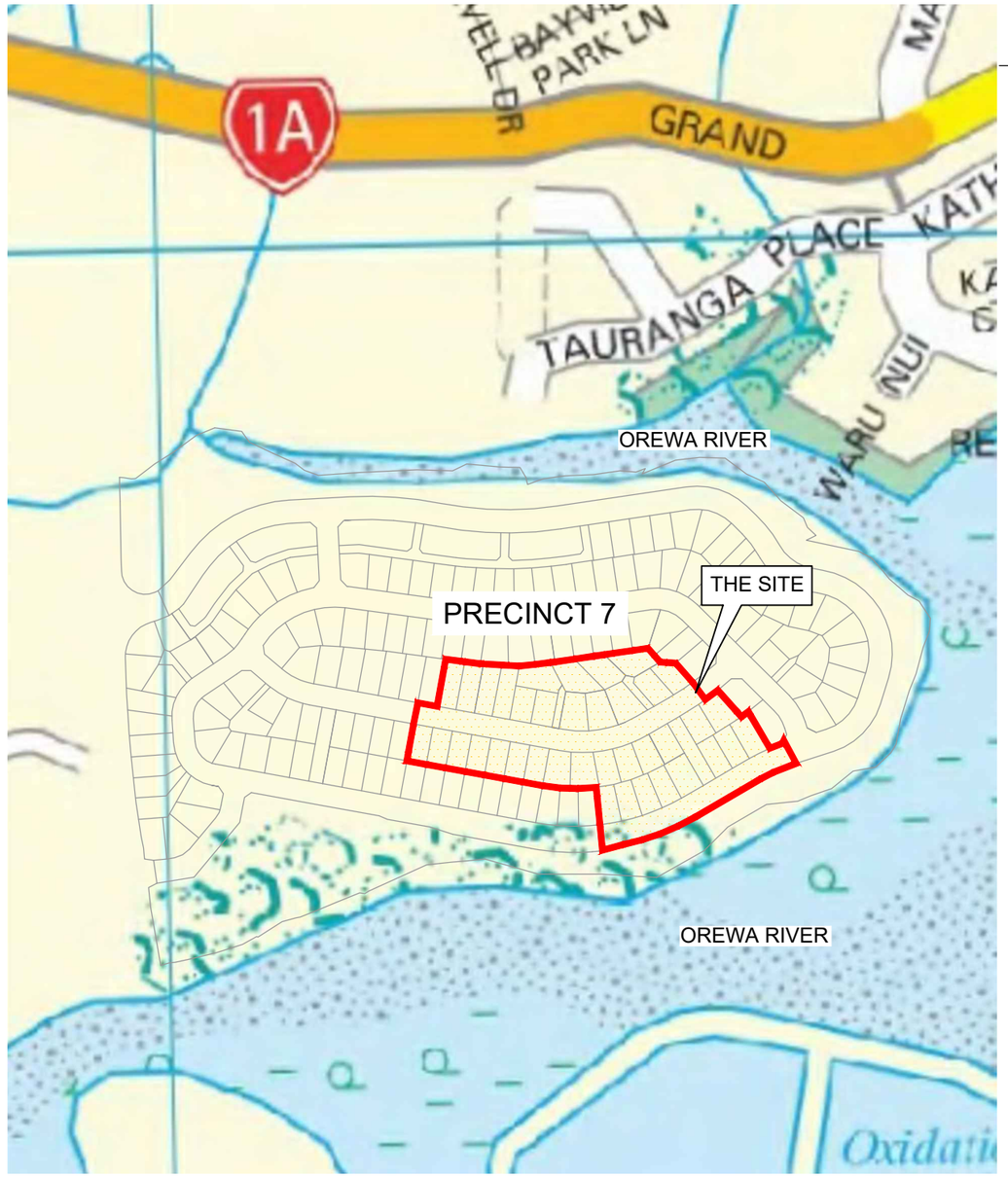
WFH PROPERTIES LTD
RESIDENTIAL SUBDIVISION
MILLWATER-ARRANS POINT PRECINCT 7 (STAGE 4)
COMPLETION REPORT ISSUE

DRAWING	Rev	Title
GENERAL		
● 21854.0037-APP7S4-100	1	DRAWING LIST AND LOCATION PLAN
● 21854.0037-APP7S4-101	1	GEOTECHNICAL WORKS PLAN
● 21854.0037-APP7S4-102	1	GEOTECHNICAL WORKS SUBSOIL DRAIN PLAN
● 21854.0037-APP7S4-103	1	GEOLGICAL CROSS SECTIONS 1 & 6
● 21854.0037-APP7S4-104	1	GEOLGICAL CROSS SECTIONS 7 & 8
● 21854.0037-APP7S4-105	1	GEOLGICAL CROSS SECTIONS 10 & 11
● 21854.0037-APP7S4-106	1	RE SLOPES 2, 3 AND 4 TYPICAL DETAILS
● 21854.0037-APP7S4-107	1	SHEAR KEY 1 PLAN
● 21854.0037-APP7S4-108	1	SHEAR KEY 1 LONGSECTION
● 21854.0037-APP7S4-109	1	GEOLOGY LEGEND AND DEFINITION OF TERMS
● 21854.0037-APP7S4-110	1	BUILDING LIMITATION PLAN
APPENDIX E		
● 21854.0037-APP7S4-111	1	POST EARTHWORKS INVESTIGATION PLAN
● 21854.0037-APP7S4-112	1	TOPSOIL DEPTHS PLAN
● 21854.0037-APP7S4-113	1	EARTHWORKS TESTING LOCATION PLAN

● Denotes drawing this issue: 22/11/2018



STREET MAP SOURCED FROM LAND INFORMATION NEW ZEALAND DATA (CROWN COPYRIGHT RESERVED).

LOCATION PLAN
SCALE 1:5000

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

ORIGINAL IN COLOUR

Tonkin+Taylor
Exceptional thinking together www.tonkintaylor.co.nz

REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE					

DESIGNED	JXXL	Nov.18	DRAWING STATUS
DRAWN	JC	Nov.18	COMPLETION REPORT
DESIGN CHECKED			
DRAWING CHECKED			

NOT FOR CONSTRUCTION

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AS APPROVED

CLIENT	**WFH PROPERTIES LTD**
PROJECT	**RESIDENTIAL SUBDIVISION**
TITLE	MILLWATER - ARRANS POINT PRECINCT 7 (STAGE 4) DRAWING LIST AND LOCATION PLAN
SCALE (A3)	1:5000
DWG No.	21854.0037-APP7S4-100
REV	1

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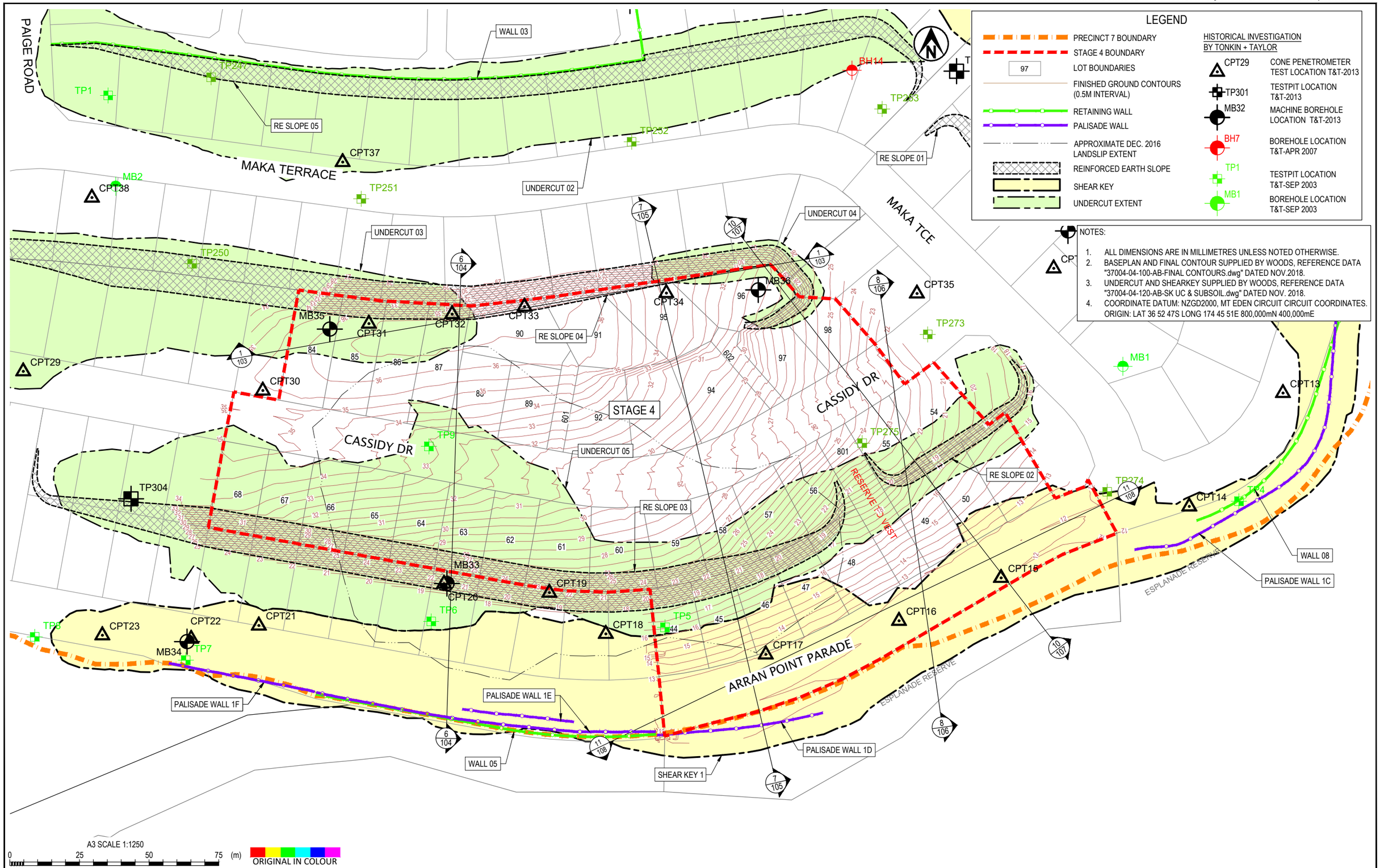

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REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE					

DESIGNED	JXXL	Nov.18	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Nov.18	PROJECT PHASE
DESIGN CHECKED			
DRAWING CHECKED			

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CLIENT **WFH PROPERTIES LTD**

PROJECT **RESIDENTIAL SUBDIVISION**

TITLE MILLWATER - ARRANS POINT PRECINCT 7 (STAGE 4) GEOTECHNICAL WORKS PLAN

SCALE (A3) 1:1250 DWG No. 21854.0037-APP7S4-101 REV 1

L:\21854\21854.0037 - Arrans Point Precinct 7\CAD\STAGE 4\21854.0037-APP7S4-102.dwg 2018-Nov-23 1:43:40 PM Plotted By: JONALD CASTRO

PAIGE ROAD

MAKA TERRACE

MAKA TCE

CASSIDY DR

ARRAN POINT PARADE

ESPLANADE RESERVE

RESERVE (13) WEST

STAGE 4

WALL 03

RE SLOPE 05

UNDERCUT 02

RE SLOPE 01

UNDERCUT 03

UNDERCUT 04

RE SLOPE 04

UNDERCUT 05

RE SLOPE 03

RE SLOPE 02

WALL 08

PALISADE WALL 1C

PALISADE WALL 1F

WALL 05

PALISADE WALL 1E

PALISADE WALL 1D

SHEAR KEY 1

LEGEND

- PRECINCT 7 BOUNDARY
- STAGE 4 BOUNDARY
- 97 — LOT BOUNDARIES
- FINISHED GROUND CONTOURS (0.5M INTERVAL)
- RETAINING WALL
- PALISADE WALL
- REINFORCED EARTH SLOPE
- SHEAR KEY
- UNDERCUT EXTENT
- SUBSOIL DRAIN

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. BASEPLAN AND FINAL CONTOUR SUPPLIED BY WOODS, REFERENCE DATA "37004-04-100-AB- FINAL CONTOURS.dwg" DATED NOV.2018.
3. UNDERCUT AND SHEARKEY SUPPLIED BY WOODS, REFERENCE DATA "37004-04-120-AB-SK UC & SUBSOIL.dwg" DATED NOV. 2018.
4. COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT CIRCUIT COORDINATES.
   ORIGIN: LAT 36 52 47S LONG 174 45 51E 800,000mN 400,000mE

A3 SCALE 1:1250

0 25 50 75 (m)

ORIGINAL IN COLOUR

Tonkin+Taylor

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REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE					

DESIGNED	JXXL	Nov.18	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Nov.18	PROJECT PHASE
DESIGN CHECKED			
DRAWING CHECKED			

NOT FOR CONSTRUCTION

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CLIENT **WFH PROPERTIES LTD**

PROJECT **RESIDENTIAL SUBDIVISION**

TITLE MILLWATER - ARRANS POINT PRECINCT 7 (STAGE 4)
GEOTECHNICAL WORKS SUBSOIL DRAIN PLAN

SCALE (A3) 1:1250 DWG No. 21854.0037-APP7S4-102 REV 1

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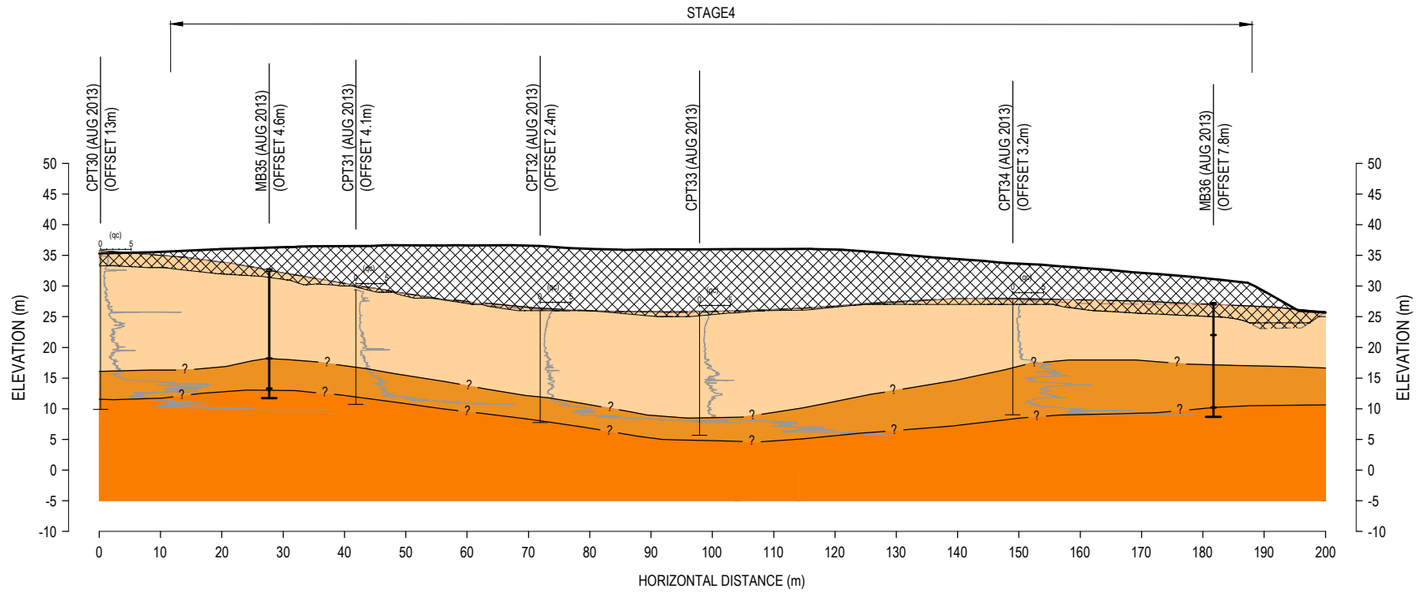
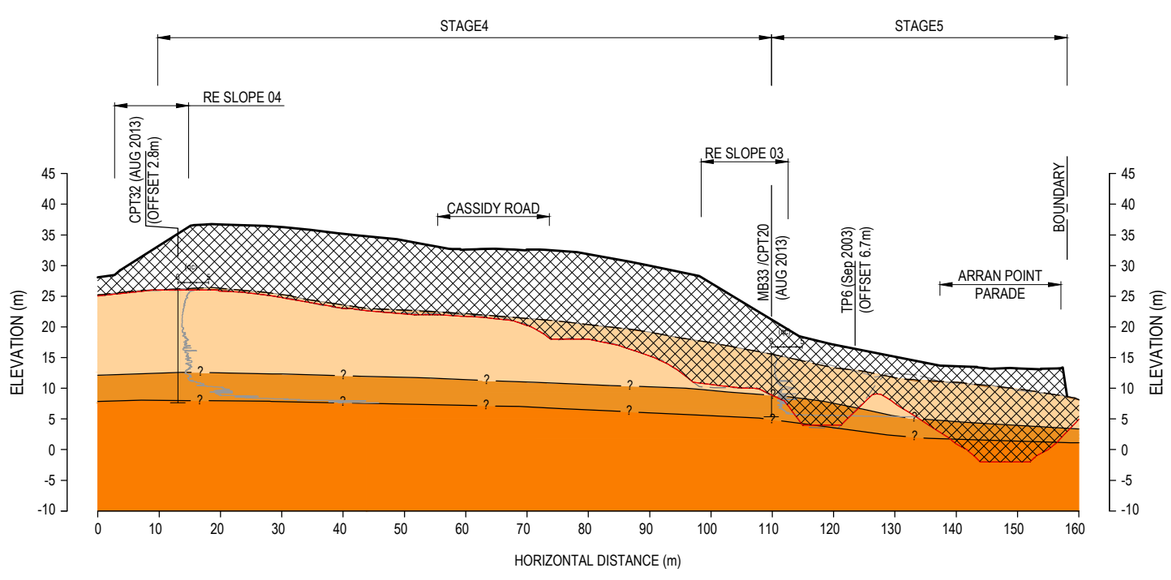


SECTION 1 / 101
SCALE 1: 1000



SECTION 6 / 101
SCALE 1: 1000

LEGEND

- ORIGINAL 2009 GROUND PROFILE
- 2015 GROUND PROFILE
- STAGE 4 FINISHED GROUND LEVEL
- INFERRED GEOLOGICAL BOUNDARY
- SHEARKEY/UNDERCUTS
- ENGINEERED FILL
- COLLUVIUM
- RESIDUAL SOILS/ COMPLETELY WEATHERED ECBF
- HIGHLY TO SLIGHTLY WEATHERED ECBF
- SLIGHTLY WEATHERED TO UNWEATHERED ECBF

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.

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

ORIGINAL IN COLOUR

Tonkin+Taylor
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REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE					

DESIGNED	JXXL	Nov.18	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Nov.18	
DESIGN CHECKED			
DRAWING CHECKED			

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CLIENT **WFH PROPERTIES LTD**
PROJECT **RESIDENTIAL SUBDIVISION**
TITLE MILLWATER - ARRANS POINT PRECINCT 7 (STAGE 4)
GEOLGICAL CROSS SECTIONS 1 & 6
SCALE (A3) 1:1000 DWG No. 21854.0037-APP7S4-103 REV 1

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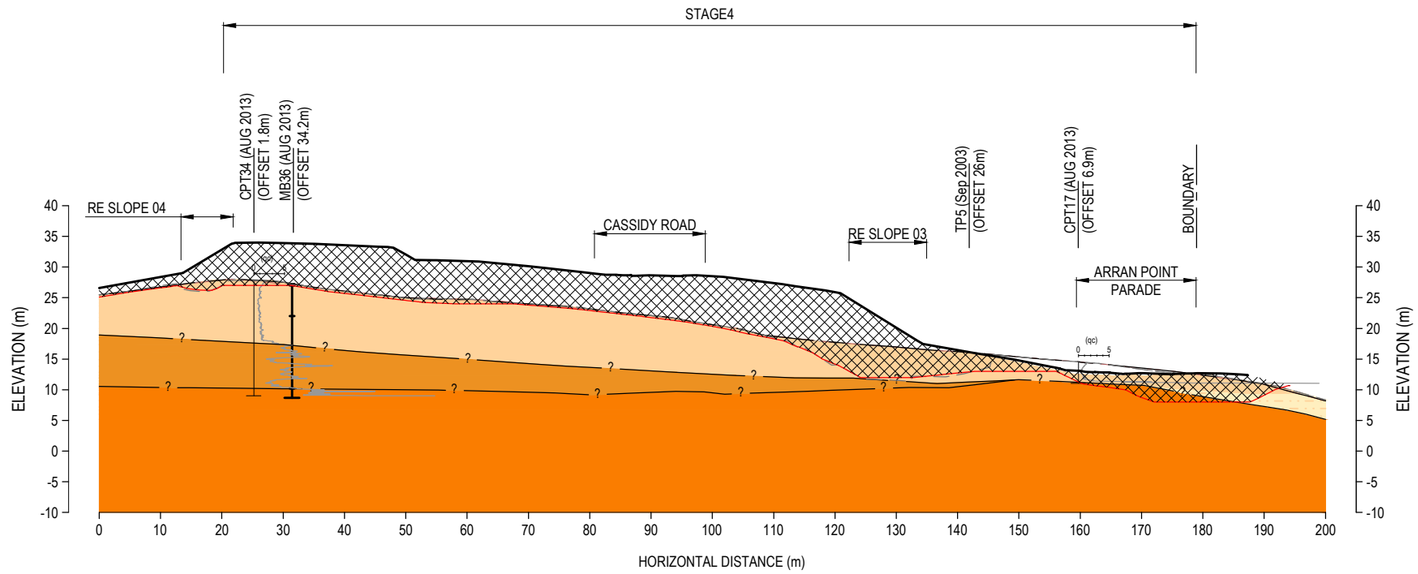
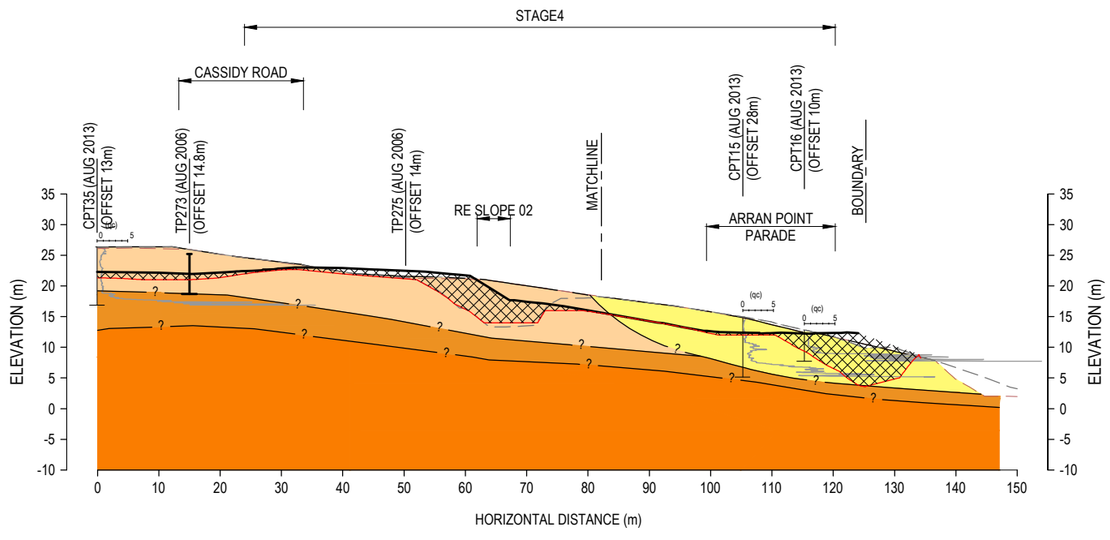


SECTION 7
SCALE 1: 1000



SECTION 8
SCALE 1: 1000

LEGEND

- ORIGINAL 2009 GROUND PROFILE
- 2015 GROUND PROFILE
- STAGE 4 FINISHED GROUND LEVEL
- INFERRED GEOLOGICAL BOUNDARY
- SHEARKEY/UNDERCUTS
- ENGINEERED FILL
- COLLUVIUM
- RESIDUAL SOILS/ COMPLETELY WEATHERED ECBF
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A3 SCALE 1:1000
0 5 10 15 20 30 40 50 (m)

ORIGINAL IN COLOUR

Tonkin+Taylor
Exceptional thinking together www.tonkintaylor.co.nz

REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE					

DESIGNED	JXXL	Nov.18	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Nov.18	
DESIGN CHECKED			
DRAWING CHECKED			

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CLIENT **WFH PROPERTIES LTD**
PROJECT **RESIDENTIAL SUBDIVISION**
TITLE MILLWATER - ARRANS POINT PRECINCT 7 (STAGE 4) GEOLGICAL CROSS SECTIONS 7 & 8
SCALE (A3) 1:1000 DWG No. 21854.0037-APP7S4-104 REV 1

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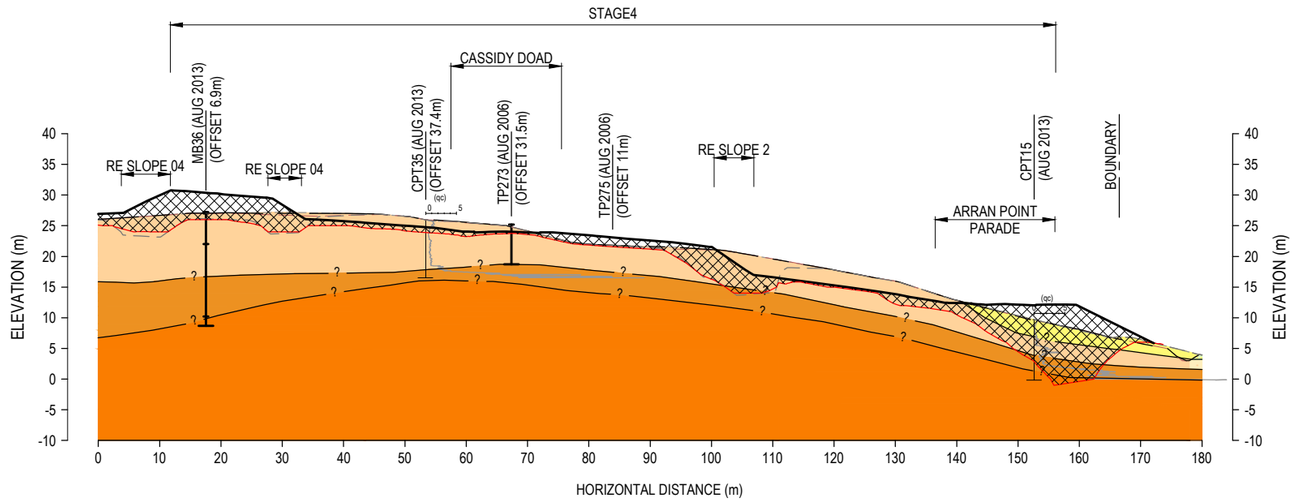
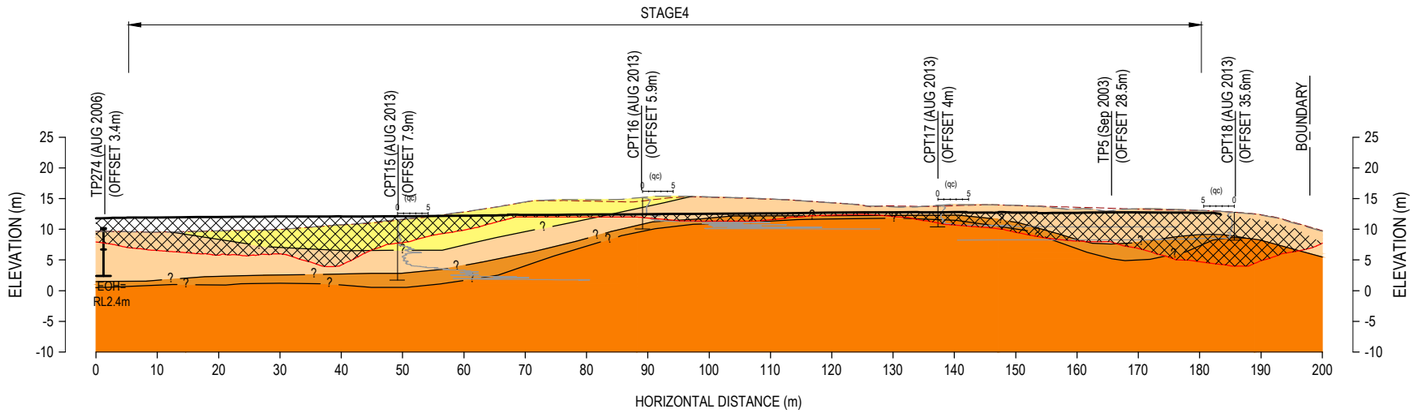


SECTION 10
SCALE 1: 1000 101



SECTION 11
SCALE 1: 1000 101

LEGEND

- ORIGINAL 2009 GROUND PROFILE
- 2015 GROUND PROFILE
- STAGE 4 FINISHED GROUND LEVEL
- INFERRED GEOLOGICAL BOUNDARY
- SHEARKEY/UNDERCUTS
- ENGINEERED FILL
- COLLUVIUM
- RESIDUAL SOILS/ COMPLETELY WEATHERED ECBF
- HIGHLY TO SLIGHTLY WEATHERED ECBF
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A3 SCALE 1:1000
0 5 10 15 20 30 40 50 (m)

ORIGINAL IN COLOUR

Tonkin+Taylor
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REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE					

DESIGNED	JXXL	Nov.18	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Nov.18	
DESIGN CHECKED			
DRAWING CHECKED			

NOT FOR CONSTRUCTION

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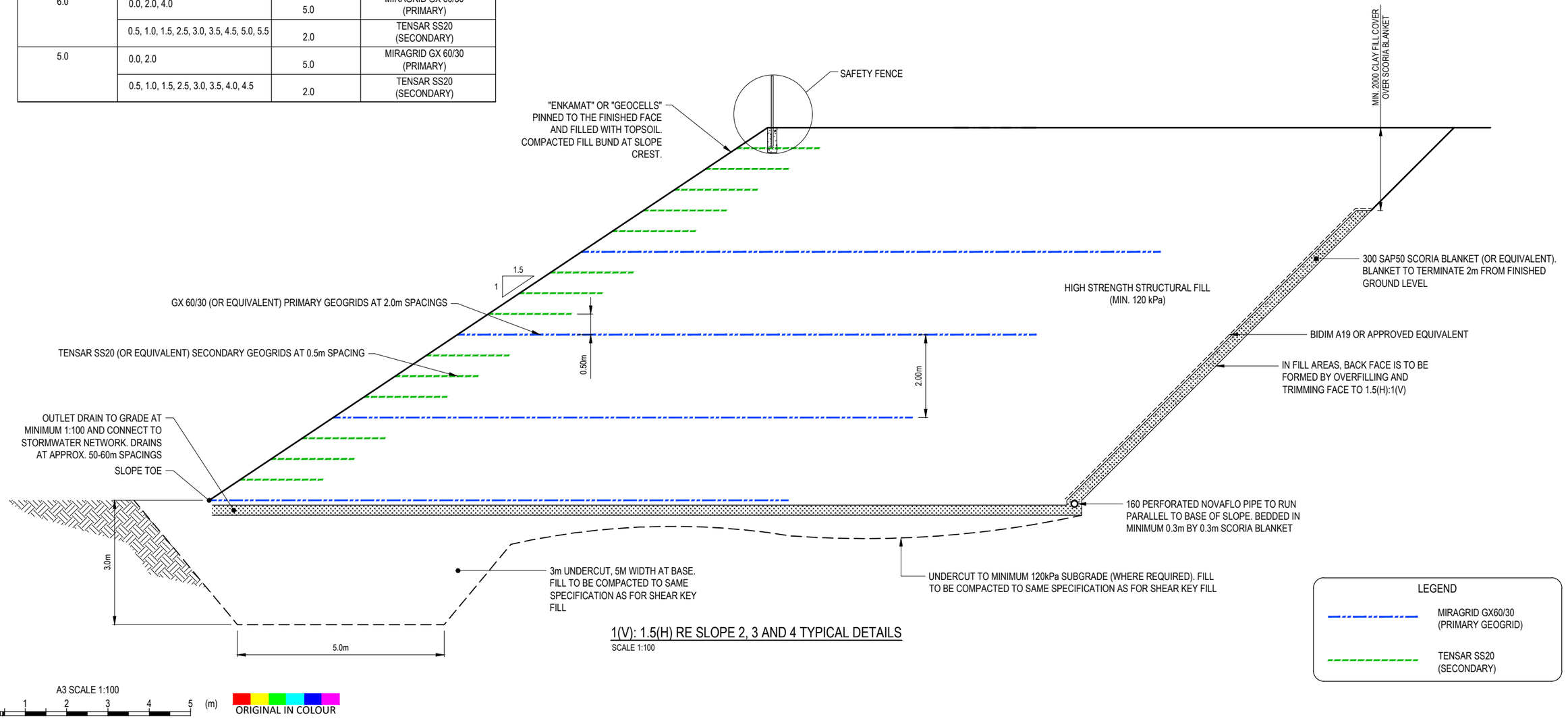
CLIENT **WFH PROPERTIES LTD**
PROJECT **RESIDENTIAL SUBDIVISION**
TITLE MILLWATER - ARRANS POINT PRECINCT 7 (STAGE 4)
GEOLGICAL CROSS SECTIONS 10 & 11
SCALE (A3) 1:1000 DWG No. 21854.0037-APP7S4-105 REV 1

L:\21854\21854.0037 - Arrans Point Precinct 7\CAD\STAGE 4\21854.0037-APP7S4-106.dwg 2018-Nov-23 1:43:59 PM Plotted By: JONALD CASTRO

GEOGRIDS REQUIREMENTS FOR A 1.5:1 (H:V) 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)



1(V): 1.5(H) RE SLOPE 2, 3 AND 4 TYPICAL DETAILS

SCALE 1:100

A3 SCALE 1:100

0 1 2 3 4 5 (m)

ORIGINAL IN COLOUR

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REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE					

DESIGNED	JXXL	Nov.18	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Nov.18	
DESIGN CHECKED			
DRAWING CHECKED			

NOT FOR CONSTRUCTION

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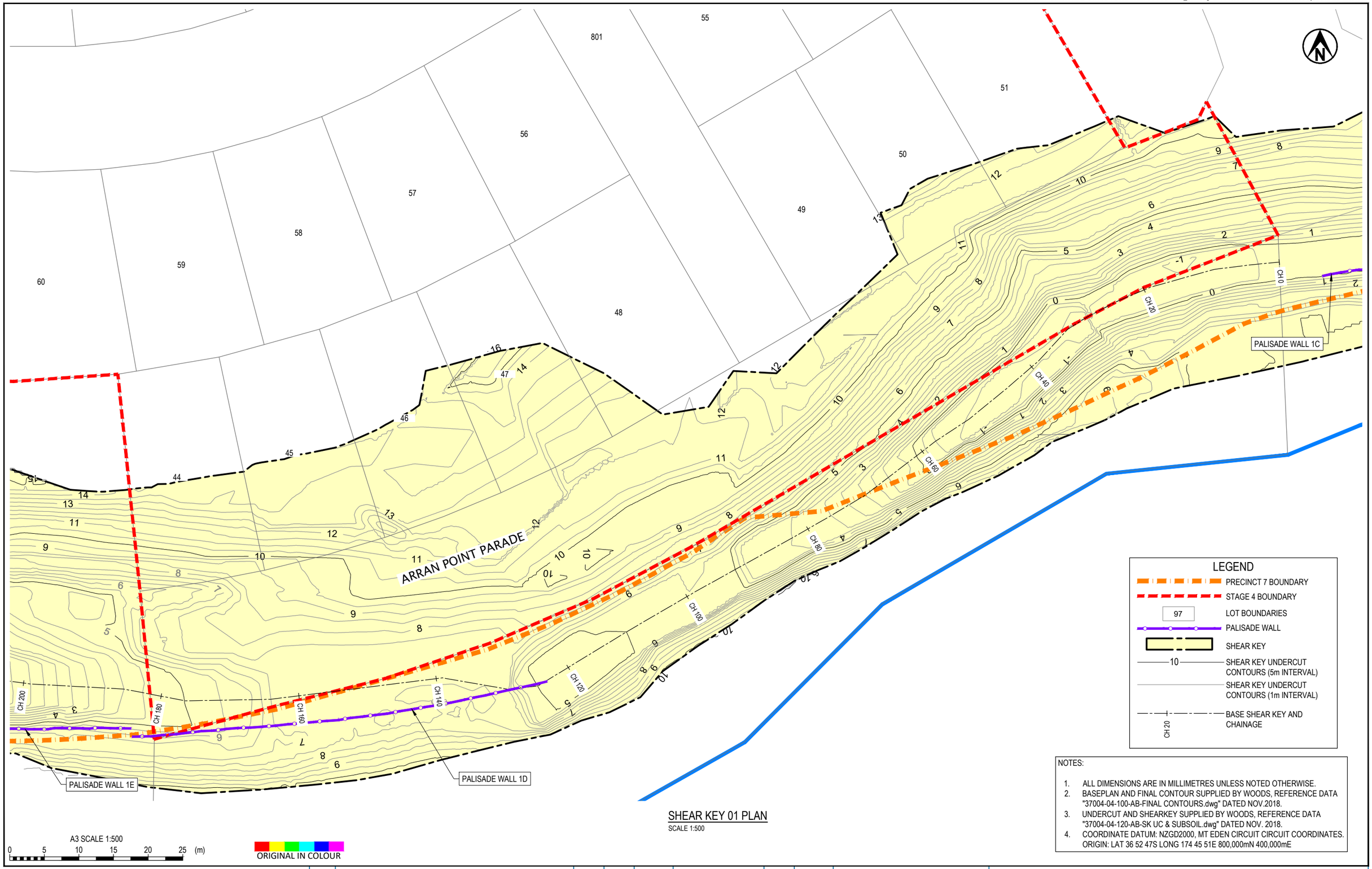
PROJECT **RESIDENTIAL SUBDIVISION**

TITLE MILLWATER - ARRANS POINT PRECINCT 7 (STAGE 4) RE SLOPES 2, 3 AND 4 TYPICAL DETAILS

SCALE (A3) 1:1250 DWG No. 21854.0037-APP7S4-106 REV 1

L:\21854\21854.0037 - Arrans Point Precinct 7\CAD\STAGE 4\21854.0037-APP7S4-107_108.dwg 2018-Nov-23 2:00:00 PM Plotted By: JONALD CASTRO



SHEAR KEY 01 PLAN
SCALE 1:500

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

ORIGINAL IN COLOUR

LEGEND

- PRECINCT 7 BOUNDARY
- STAGE 4 BOUNDARY
- 97 — LOT BOUNDARIES
- PALISADE WALL
- SHEAR KEY
- 10 — SHEAR KEY UNDERCUT CONTOURS (5m INTERVAL)
- SHEAR KEY UNDERCUT CONTOURS (1m INTERVAL)
- CH 20 — BASE SHEAR KEY AND CHAINAGE

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. BASEPLAN AND FINAL CONTOUR SUPPLIED BY WOODS, REFERENCE DATA "37004-04-100-AB-FINAL CONTOURS.dwg" DATED NOV.2018.
3. UNDERCUT AND SHEARKEY SUPPLIED BY WOODS, REFERENCE DATA "37004-04-120-AB-SK UC & SUBSOIL.dwg" DATED NOV. 2018.
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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REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE					

DESIGNED	JXXL	Nov.18	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Nov.18	
DESIGN CHECKED			
DRAWING CHECKED			

NOT FOR CONSTRUCTION

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CLIENT **WFH PROPERTIES LTD**

PROJECT **RESIDENTIAL SUBDIVISION**

TITLE MILLWATER - ARRANS POINT PRECINCT 7 (STAGE 4) SHEAR KEY 1 PLAN

SCALE (A3) 1:500 DWG No. 21854.0037-APP7S4-107 REV 1

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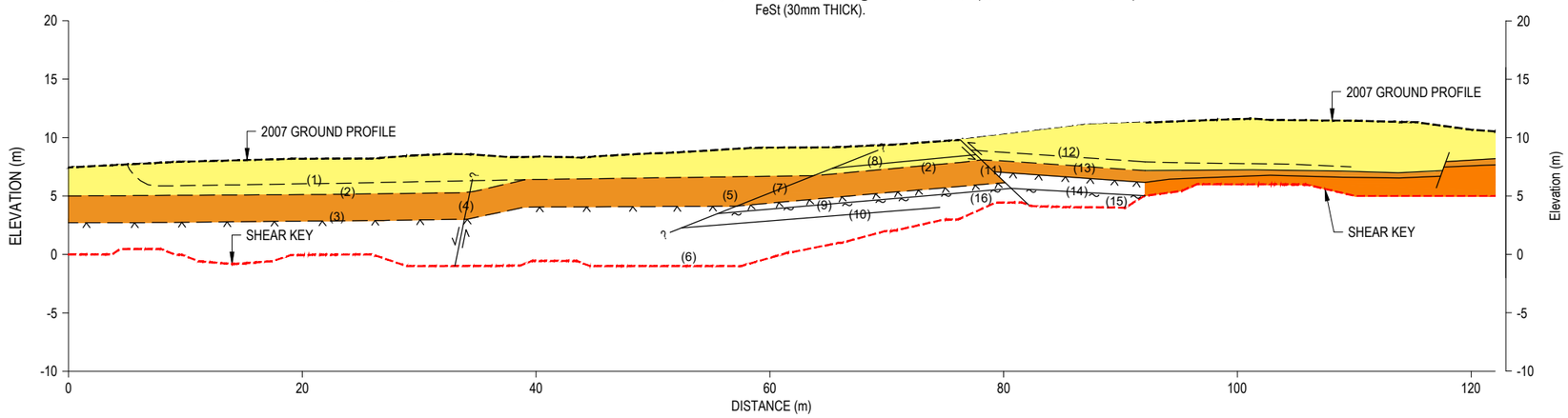
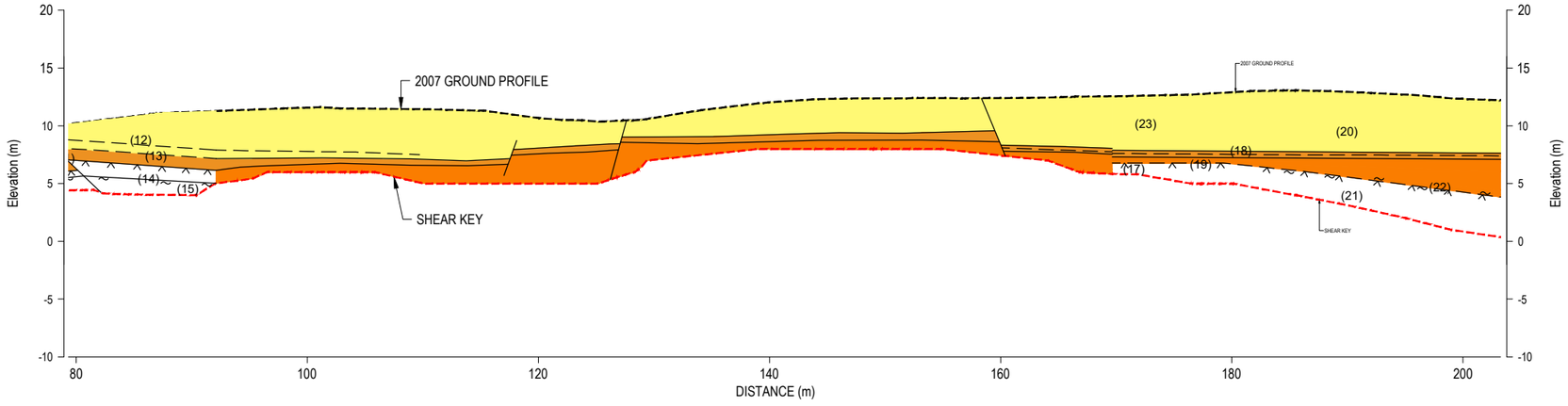
NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. REFER TO DWG.21854.0037-APP7S4-109 FOR GEOLOGY LEGEND AND DEFINITION OF TERMS.
3. NATURE AND CONTINUITY OF SUBSOIL CONDITIONS AWAY FROM THESE BOREHOLES ARE INFERRED AND IT MUST BE APPRECIATED THAT ACTUAL CONDITIONS COULD VARY FROM THE ASSUMED MODEL.

(1) SHEAR PLANE; 4˚ @ 287˚ / PL / SL (@ 199˚) / CG (CLAY, 8mm THICK).
(2) SHEAR PLANE; 4-6˚ @ 234˚ / UN / SM / CV (CLAY) / FeSt.
(3) SHEAR PLANE; 3-8˚ @ 248˚ / UN / SM / CV (CLAY) / BZ (60mm THICK).
(4) F; 79˚ @ 082˚ / UN / R / FeSt (3mm THICK) / INDETERMINATE OFFSET.
(5) MULTIPLE JOINTS. J; 86˚ @ 098˚ / UN / R / FeSt (6mm THICK) / UP TO 5mm OFFSET.
(6) B; 6˚ @ 217˚ / PL / R / CN.
(7) F; 38-52˚ @ 119˚ / UN / SL (@132˚) / FeSt / INDETERMINATE OFFSET.
(8) SHEAR PLANE; 3-11˚ @ 202˚ / UN / SM / CV (CLAY) / FeSt.
(9) SHEAR PLANE; 13˚ @ 193˚ / PL / SM / CG (SILTY CLAY, 110mm THICK) / VERY SLOW SEEPAGE.
(10) SHEAR PLANE; 5˚ @ 216˚ / PL / SM / CZ (35mm THICK, CLAYEY SILT) / FeSt (30mm THICK).



SECTION 2 / 107
SCALE 1: 500

(11) F; 38-79˚ @ 357˚ / UN / SL (@ 132˚) / BZ (500mm THICK) / FeSt (4mm THICK) / INDETERMINATE OFFSET.
(12) SHEAR PLANE; 2-6˚ @ 171˚ / UN / SM / FeSt (UP TO 12MM THICK).
(13) SHEAR PLANE; 5˚ @ 185˚ / UN / SM / FeSt (8mm THICK).
(14) SHEAR PLANE; 3-8˚ @ 176˚ / PL / R / FeSt / VERY SLOW SEEPAGE.
(15) B; 5˚ @ 198˚ / PL / R / CLAYEY SILT VENEER.
(16) B; 3˚ @ 177˚ / PL / R / SAND VENEER.
(17) B; 2˚ @ 189˚ / PL / R / FeSt.
(18) SHEAR PLANE; 2-5˚ @ 198-215˚ / UN / R / FeSt.
(19) SHEAR PLANE; 4-17˚ @ 211-217˚ / UN / SM / CV (CLAY) / FeSt.
(20) B; 2˚ @ 215˚ / UN / R / CN.
(21) B; 2˚ @ 211˚ / PL / R / FeSt.
(22) SHEAR PLANE; 11˚ @ 137˚ / PL / SM / CV (CLAY) / SLOW SEEPAGE.
(23) B; 9˚ @ 189˚ / PL / R / FeSt.



SECTION 2 / 107
SCALE 1: 500

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

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REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE					

DESIGNED	JXXL	Nov.18	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Nov.18	
DESIGN CHECKED			
DRAWING CHECKED			

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CLIENT **WFH PROPERTIES LTD**
PROJECT **RESIDENTIAL SUBDIVISION**
TITLE MILLWATER - ARRANS POINT PRECINCT 7 (STAGE 4)
SHEAR KEY 1 LONGSECTION
SCALE (A3) 1:500 DWG No. 21854.0037-APP7S4-108 REV 1

LONGSECTION MATERIAL LEGEND

- COLLUVIUM
  LANDSLIP DEBRIS TYPICALLY COMPOSED OF EAST COAST BAYS FORMATION SOILS
- 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	
TERM	CODE	DESCRIPTION OF JOINT SURFACE	CODE
PLANAR	PL	SLICKENSIDED	SL
SLIGHTLY CURVED	SC	SMOOTH	SM
CURVED	CV	DEFINED RIDGES	DR
IRREGULAR	IR	SMALL STEPS	ST
STEPPED	ST	ROUGH	R
WAVY	WV	VERY ROUGH	VR
UNDULATING	UN		

APERTURE		
TERM	SYMBOL	DESCRIPTION (SEPERATION)
VERY TIGHT	VT	LESS THAN 0.1mm
TIGHT	T	0.1 TO 1.0mm
OPEN	O	1.0 TO 10.0mm
VERY OPEN	VO	MORE THAN 10mm
VERY NARROW	VN	
MODERATELY NARROW	MN	
NARROW	N	

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

- NO. IN DEFECT SET
- TYPE
- DIP ANGLE
- DIP DIRECTION
- SHAPE
- ROUGHNESS
- APERTURE
- INFILLING/COATING TYPE
- INFILLING DESCRIPTION (AS PER SOIL DESCRIPTION)

ORIGINAL IN COLOUR

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REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE					

DESIGNED	JXXL	Nov.18	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Nov.18	
DESIGN CHECKED			
DRAWING CHECKED			

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CLIENT **WFH PROPERTIES LTD**

PROJECT **RESIDENTIAL SUBDIVISION**

TITLE MILLWATER - ARRANS POINT PRECINCT 7 (STAGE 4) GEOLOGY LEGEND AND DEFINITION OF TERMS

SCALE (A3) 1:1000 DWG No. 21854.0037-APP7S4-109 REV 1

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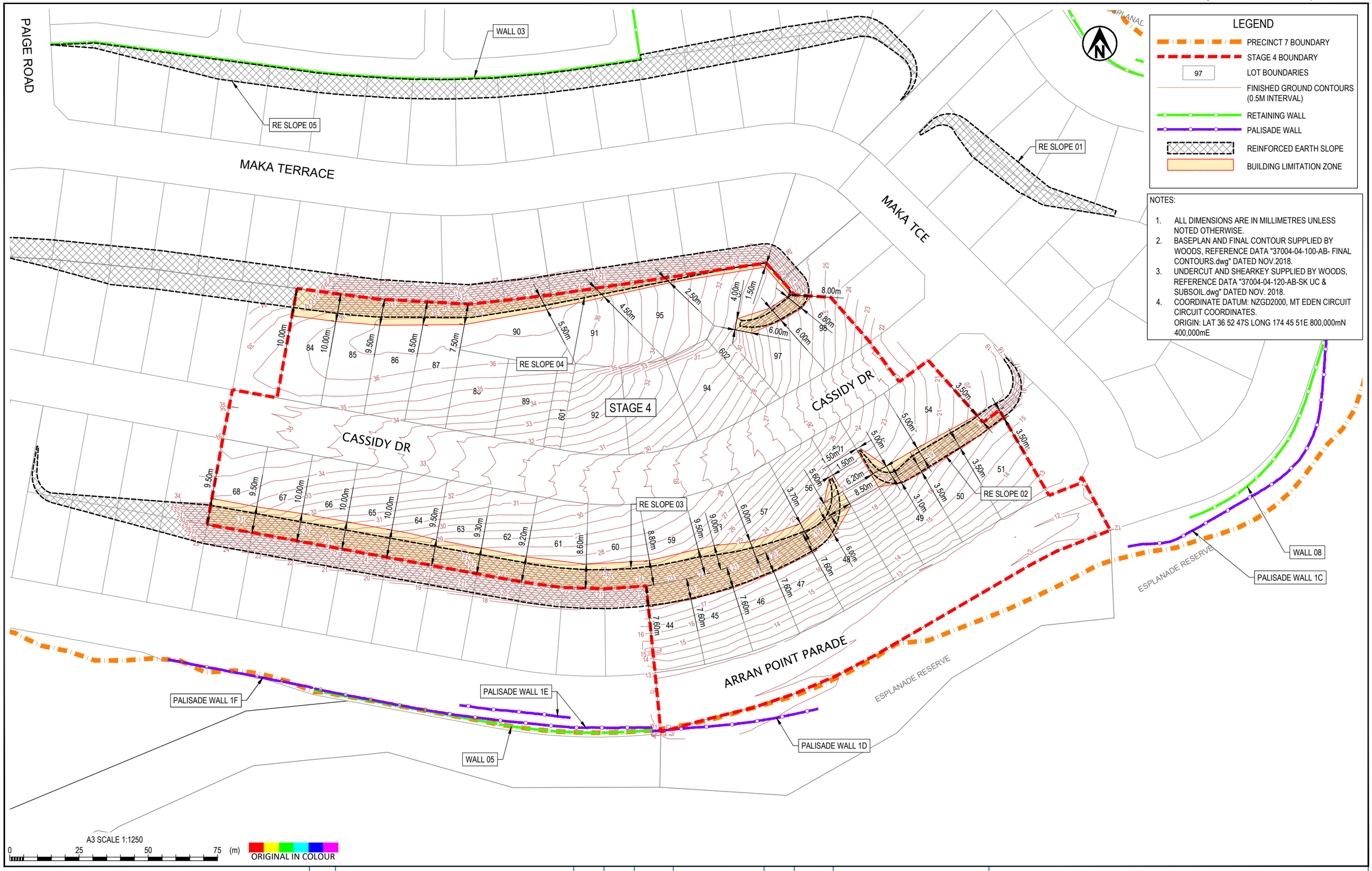

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REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE					

DESIGNED	JXXL	Nov.18	DRAWING STATUS
DRAWN	JC	Nov.18	COMPLETION REPORT
DESIGN CHECKED			PROJECT PHASE
DRAWING CHECKED			

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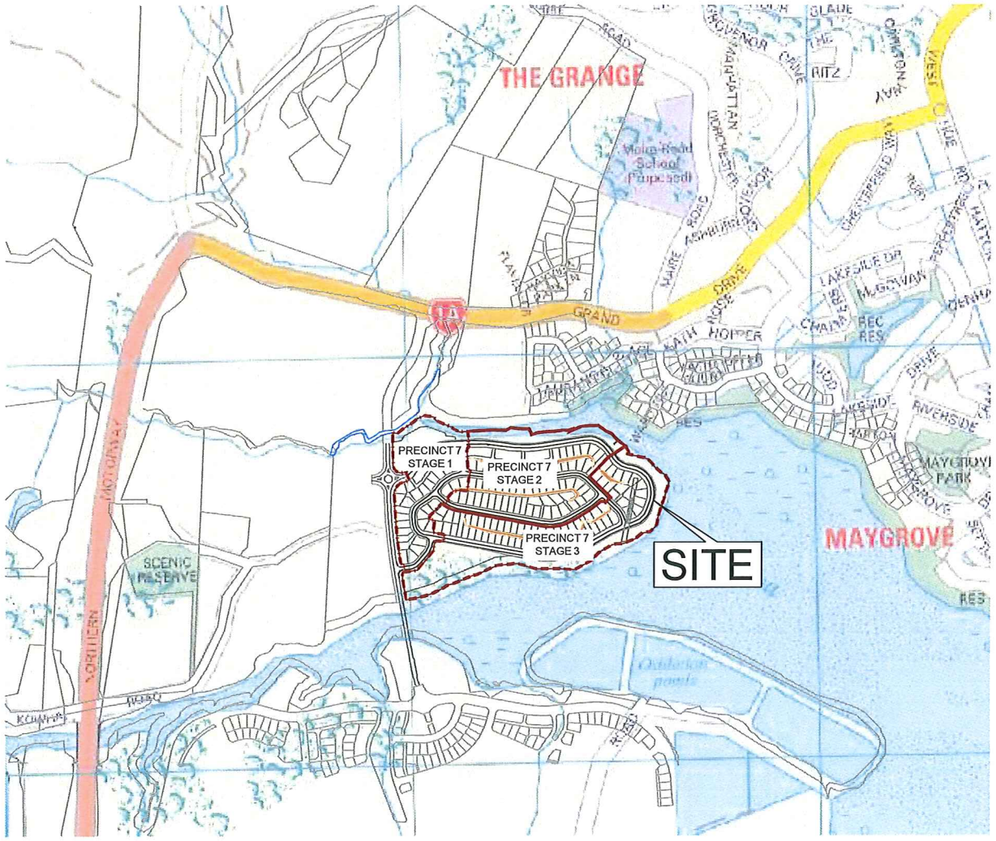
CLIENT	**WFH PROPERTIES LTD**
PROJECT	**RESIDENTIAL SUBDIVISION**
TITLE	MILLWATER - ARRANS POINT PRECINCT 7 (STAGE 4) BUILDING LIMITATION PLAN
SCALE (A3)	1:1250
DWG No.	21854.0037-APP7S4-110
REV	1

WFH PROPERTIES LTD
MILLWATER ARRANS HILL PRECINCT 7
STAGE 3 - ESPLANADE RETAINING WALLS

Construction Issue

DRAWING	Rev	Title
General		
• 21854.0037-S3ESP-00	A	Drawing List and Location Plan
• 21854.0037-S3ESP-01	A	Geotechnical Works Plan - Retaining Walls 8, 9 and 10
• 21854.0037-S3ESP-02	A	Geotechnical Works Plan - Subsoil Drainage
• 21854.0037-S3ESP-03	A	Geotechnical Works Plan - Shear Key 1 ans Piles
• 21854.0037-S3ESP-04	A	Retaining Wall 8 - Plan and Elevation
• 21854.0037-S3ESP-05	A	Retaining Wall 8 - Typical Cross Section (Sheet 1 of 2)
• 21854.0037-S3ESP-06	A	Retaining Wall 8 - Typical Cross Section (Sheet 2 of 2)
• 21854.0037-S3ESP-07	A	Retaining Wall 9 - Plan and Elevation
• 21854.0037-S3ESP-08	A	Retaining Wall 9 - Typical Detail (1 of 3)
• 21854.0037-S3ESP-09	A	Retaining Wall 9 - Typical Detail (2 of 3)
• 21854.0037-S3ESP-10	A	Retaining Wall 9 - Typical Detail (3 of 3)
• 21854.0037-S3ESP-11	A	Retaining Wall 10 - Plan and Elevation
• 21854.0037-S3ESP-12	A	Retaining Wall 10 - Typical Cross Section (Sheet 1 of 3)
• 21854.0037-S3ESP-13	A	Retaining Wall 10 - Typical Cross Section (Sheet 2 of 3)
• 21854.0037-S3ESP-14	A	Retaining Wall 10 - Typical Cross Section (Sheet 3 of 3)
• 21854.0037-S3ESP-15	A	RE Slope 6 - Typical Detail
• 21854.0037-S3ESP-16	A	RE Slope 6 - Plan and Elevation
• 21854.0037-S3ESP-17	A	RE Slope 6 (Ch 115.5 to 175m) - Typical Cross Section
• 21854.0037-S3ESP-18	A	RE Slope 6 (Ch 53.5 to 115.5m) - Typical Cross Section
• 21854.0037-S3ESP-20	A	Retaining Wall Typical Geogrid Overlap Details
• 21854.0037-S3ESP-21	A	Outlet Drain Detail
• 21854.0037-S3ESP-22	A	Safety Fence Detail



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

LOCATION PLAN
1: 15,000

A3 SCALE 1: 15000
0 0.2 0.4 0.6 0.8 1.0 (km)

• Denotes drawing this issue: 3/06/2016

DRAWING STATUS: CONSTRUCTION ISSUE

REV	REVISION DESCRIPTION	BY	DATE
A	Construction Issue	JXL	6/16
1	Additional Information	AJL	May. 16
0	Design Issue	AJL	Apr. 16

DESIGNED : JXXL Jun. 16
DRAWN : JC Jun. 16
DESIGN CHECKED : JXL 6/16
DRAFTING CHECKED : [illegible]
CADFILE : \\2 1854.0037-S3ESP-00.dwg
APPROVED : / /
This drawing is not to be used for construction purposes unless signed as approved

NOTES :

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
MILLWATER ARRANS HILL PRECINCT 7
TITLE: STAGE 3 – ESPLANADE RETAINING WALLS
Drawing List and Location Plan
SCALES (AT A3 SIZE): AS SHOWN
DWG. No.: 2 1854.0037-S3ESP-00
REV.: A

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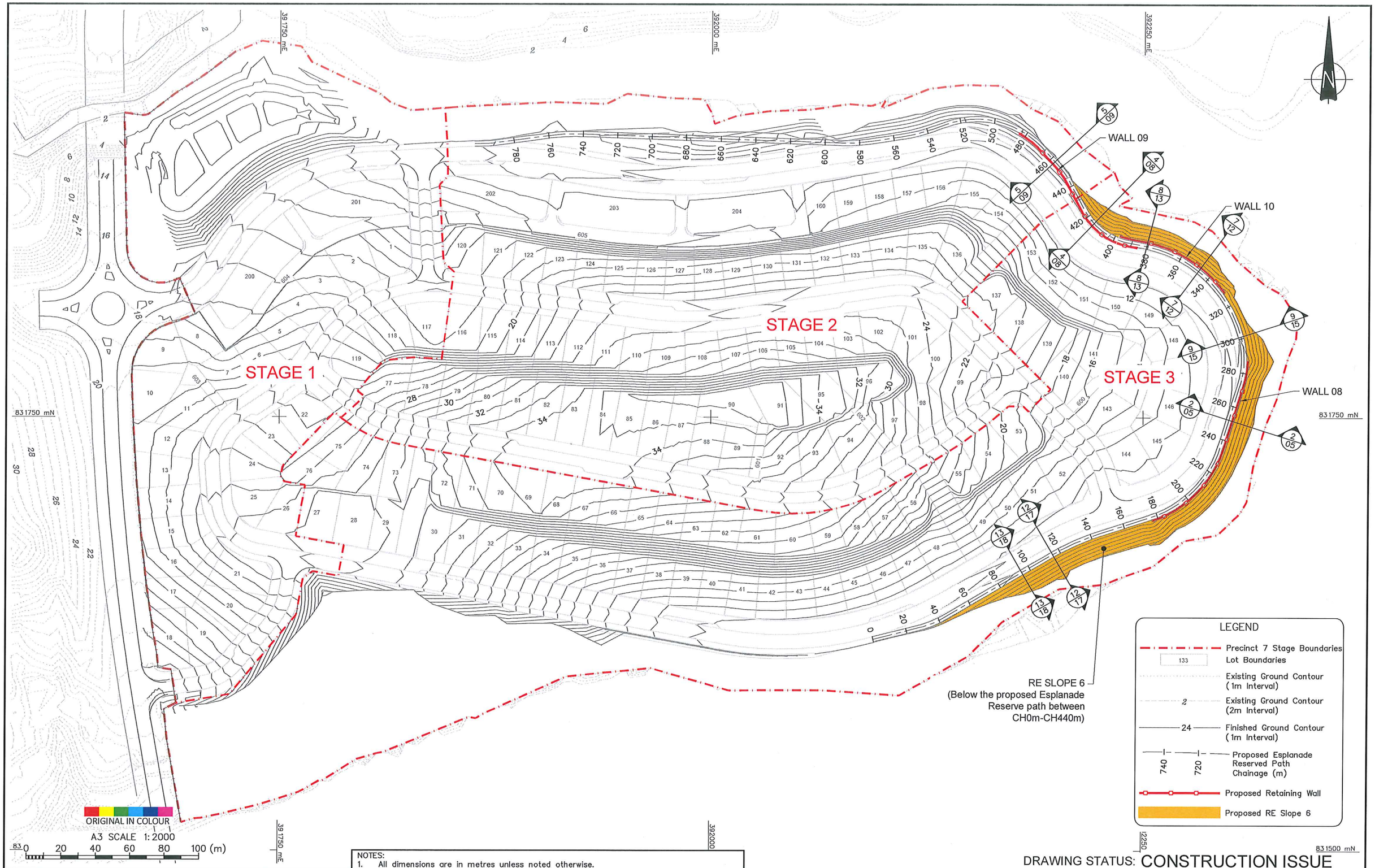

A	Construction Issue	JC	6/16
1	Additional Information	AJL	May. 16
0	Design Issue	AJL	Apr. 16
REVISION DESCRIPTION		BY	DATE

DESIGNED :	JXXL	Jun. 16
DRAWN :	JC	Jun. 16
DESIGN CHECKED :		6/16
DRAFTING CHECKED :		
CADFILE : \\21854.0037-S3ESP-01.dwg		
APPROVED :		7.6.16

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. Only Walls 8, 9, 10 and RE Slope 6 are shown on this drawing for clarity.
6. 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 :

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

DRAWING STATUS: CONSTRUCTION ISSUE

CLIENT, PROJECT
WFH PROPERTIES LTD
MILLWATER ARRANS HILL PRECINCT 7

TITLE
STAGE 3 – ESPLANADE RETAINING WALLS
Geotechnical Works Plan – Retaining Walls 8, 9 and 10

SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 2000	21854.0037–S3ESP–01	A

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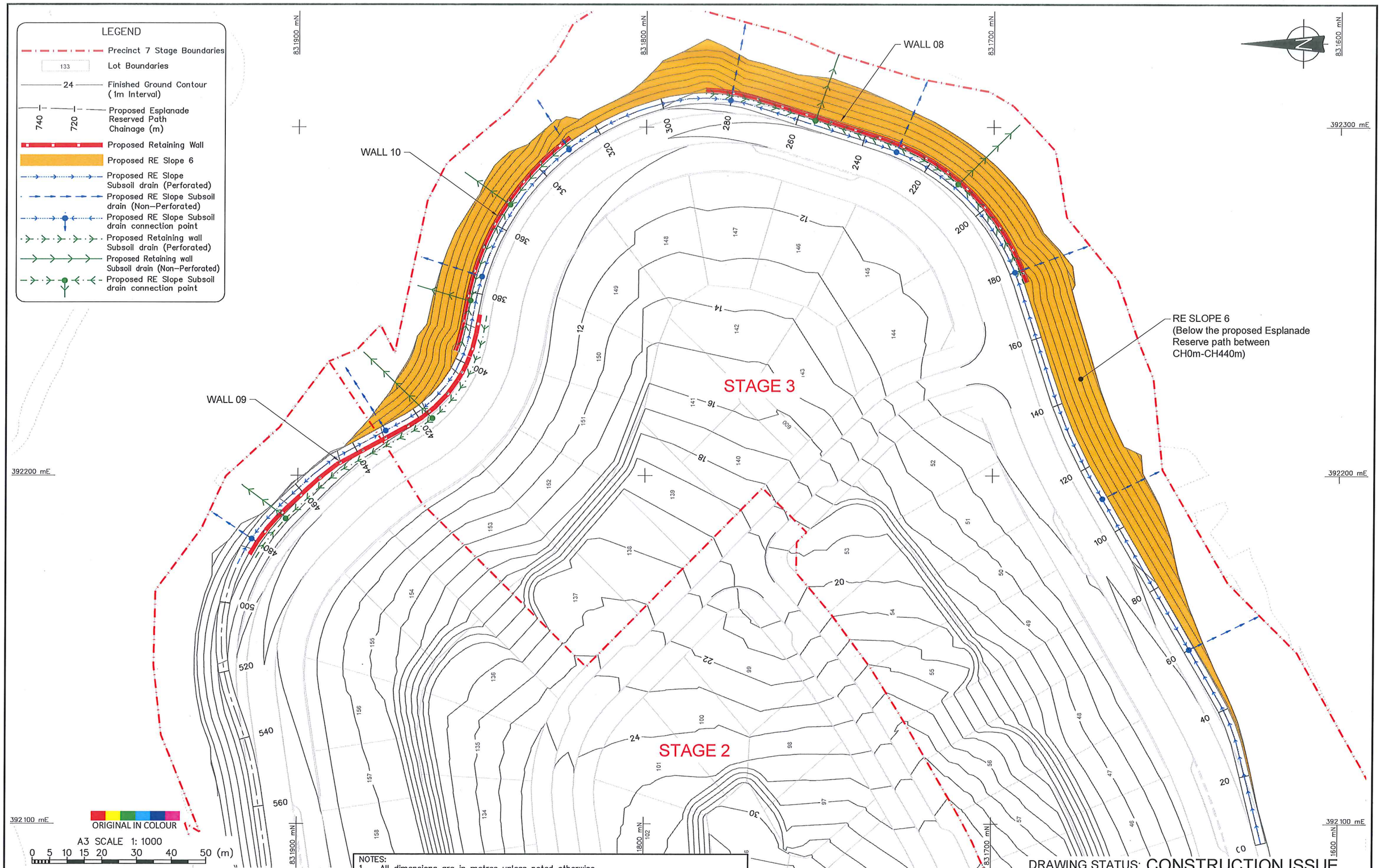

NOTES:
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6. Refer to Design Report (Ref 21854.0037, Geotechnical Design Report – Retaining Walls 8–10 & RE Slope 6 along Esplanade Reserve Path, June 2016) for anticipated construction sequencing and staging of works.

REVISION	DESCRIPTION	BY	DATE
A	Construction Issue		6/16
0	Design Issue	AJL	Apr. 16

DESIGNED :	JXXL	Jun. 16
DRAWN :	JC	Jun. 16
DESIGN CHECKED :		6/16
DRAFTING CHECKED :		17/06/16
CADFILE :	\21854.0037-S3ESP-02.dwg	
APPROVED		17/06/16

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REFERENCE :

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Tel. (09) 355 6000 Fax. (09) 307 0265
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DRAWING STATUS: CONSTRUCTION ISSUE

CLIENT, PROJECT
WFH PROPERTIES LTD
MILLWATER ARRANS HILL PRECINCT 7

TITLE
STAGE 3 – ESPLANADE RETAINING WALLS
Geotechnical Works Plan – Subsoil Drainage

SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 1000	21854.0037-S3ESP-02	A

I:\21854\21854.0037 - arrans point precinct 7\CAD\P7 S3ESP\21854.0037-S3ESP-02.dwg, 02, 2/06/2016 3:49:35 p.m., JC

392000 mE

392250 mE

831750 mN

831500 mN

WALL 09

WALL 10

WALL 08

375ø SED Timber piles @ 1m c/c

310UC97 Steel piles @ 1.4m c/c

RE SLOPE 6 (Below the proposed Esplanade Reserve path between CH0m–CH440m)

Shear key 1

STAGE 1

STAGE 2

STAGE 3

LEGEND

- Precinct 7 Stage Boundaries
- 133 Lot Boundaries
- Proposed RE Slope 6
- Proposed Retaining Wall
- Proposed Shear Key Extent
- Proposed Shear Key Benching
- 6 Shear Key Contour Level (2m Interval)
- Proposed 375SED Timber piles
- Proposed 310UC97 Steel piles

ORIGINAL IN COLOUR

A3 SCALE 1: 2000

0 20 40 60 80 100 (m)

NOTES:

1. All dimensions are in metres unless noted otherwise.
2. All setout to be completed by Contractor in accordance with WOODS drawings.
3. Base layout (Nov.2015) and Shear Key 1 Layout (Feb 2016) supplied by WOODS, reference "Arran Point–Esplanade Reserve.dwg" and "AP Shearkey 1.12da"
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. Only Proposed Shear key 1 contours and Piles (where required), and Walls 8, 9, 10 and RE Slope 6 are shown on this drawing for clarity.
6. 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 :

REVISION	DESCRIPTION	BY	DATE
A	Construction Issue	AJL	6/16
1	Additional Information	AJL	May. 16
0	Design Issue	AJL	Apr. 16

DESIGNED :	JXXL	Jun. 16
DRAWN :	JC	Jun. 16
DESIGN CHECKED :	AJL	6/16
DRAFTING CHECKED :	Graham Lowe	6/16
CADFILE : \\21854.0037–S3ESP–03.dwg		
APPROVED :		17/6/16

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DRAWING STATUS: CONSTRUCTION ISSUE

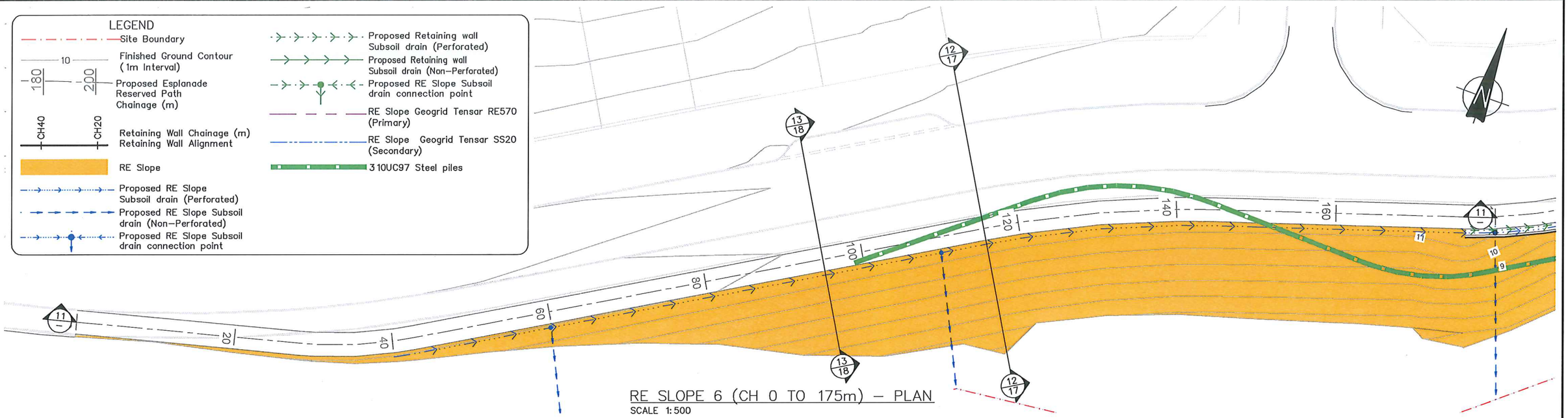
CLIENT, PROJECT
WFH PROPERTIES LTD
MILLWATER ARRANS HILL PRECINCT 7

TITLE
STAGE 3 – ESPLANADE RETAINING WALLS
Geotechnical Works Plan – Shear Key 1 and Piles

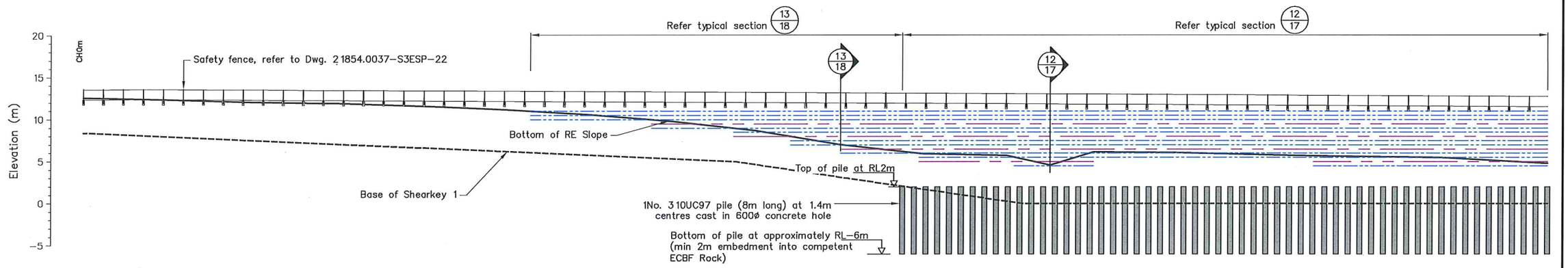
SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 2000	21854.0037–S3ESP–03	A

LEGEND

- Site Boundary
- 10 — Finished Ground Contour (1m Interval)
- 180 — 200 — Proposed Esplanade Reserved Path Chainage (m)
- CH40 — CH20 — Retaining Wall Chainage (m) / Retaining Wall Alignment
- RE Slope
- Proposed RE Slope Subsoil drain (Perforated)
- Proposed RE Slope Subsoil drain (Non-Perforated)
- Proposed RE Slope Subsoil drain connection point
- Proposed Retaining wall Subsoil drain (Perforated)
- Proposed Retaining wall Subsoil drain (Non-Perforated)
- Proposed RE Slope Subsoil drain connection point
- RE Slope Geogrid Tensar RE570 (Primary)
- RE Slope Geogrid Tensar SS20 (Secondary)
- 310UC97 Steel piles



RE SLOPE 6 (CH 0 TO 175m) – PLAN
SCALE 1:500



DATUM RL – 10.0m

TOP OF RE SLOPE (m)	12.37	12.39	12.34	12.27	12.23	12.18	12.13	12.08	12.03	11.98	11.93	11.88	11.83	11.77	11.72	11.67	11.62	11.57	11.54	
BOTTOM OF RE SLOPE (m)	12.57	12.39	12.07	11.93	11.64	11.20	10.63	9.84	8.75	7.09	6.00	5.74	5.92	6.06	5.86	5.63	5.49	5.06	4.80	
HEIGHT OF SLOPE (m)	-0.20	0.00	0.27	0.34	0.59	0.98	1.50	2.24	3.28	4.89	5.93	6.14	5.91	5.71	5.86	6.04	6.12	6.50	6.74	
CHAINAGE (m)		10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	175.00	

SECTION 11/– RE SLOPE 6 – ELEVATION (CH 0 – 175m)
SCALE 1:500

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

ORIGINAL IN COLOUR

REVISION	DESCRIPTION	BY	DATE
A	Construction Issue		16/6/16
0	Design Issue	AJL	Apr. 16

DESIGNED :	JXXL	Jun. 16
DRAWN :	JC	Jun. 16
DESIGN CHECKED :		16/6/16
DRAFTING CHECKED :		16/6/16
CADFILE : \\21854.0037-S3ESP-16.dwg		
APPROVED :		17/6/16

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. See Dwg.21854.0037-S3ESP-01 for Esplanade Reserve Path plan.
6. 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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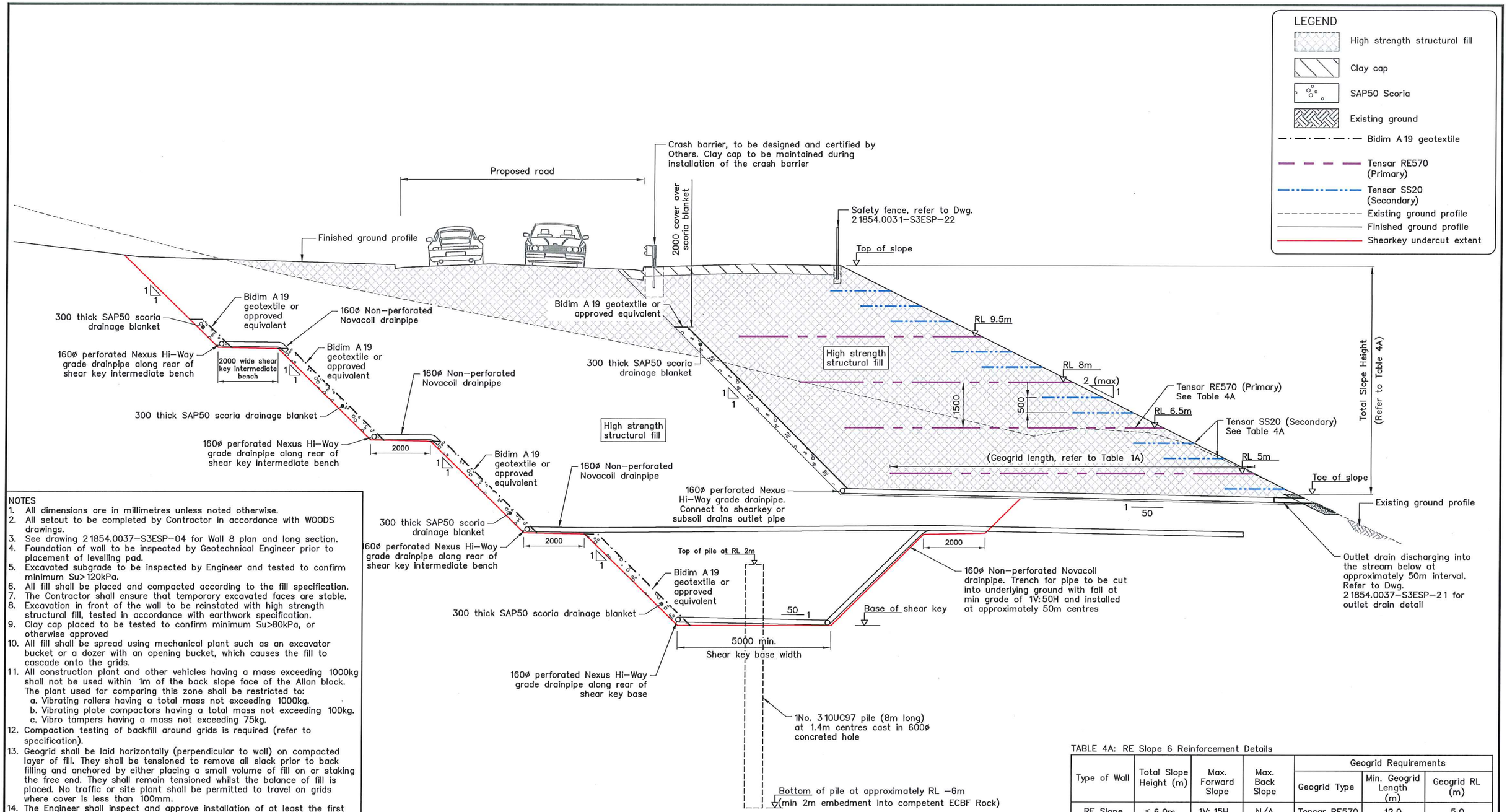
DRAWING STATUS: CONSTRUCTION ISSUE

CLIENT, PROJECT
WFH PROPERTIES LTD
MILLWATER ARRANS HILL PRECINCT 7

TITLE
STAGE 3 – ESPLANADE RETAINING WALLS
RE Slope 6 – Plan and Elevation

SCALES (AT A3 SIZE)	DWG. No.	REV.
1:400	21854.0037-S3ESP-16	A

I:\21854\21854.0037 - arrans point precinct 7\CAD\P7 S3ESP\21854.0037-S3ESP-16.dwg, 16, 2/06/2016 3:51:53 p.m., jc



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-S3ESP-04 for Wall 8 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. All piling work to be inspected and approved by a competent Geotechical Engineer or Engineering Geologist.
20. All steel members shall conform to AS/NZS 3618, AS/NZS 3679.1
21. 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.

SECTION 12 01 | 12 03 | 12 16
SCALE 1: 1.25

ORIGINAL IN COLOUR

A3 SCALE 1: 125

0 1 2 3 4 5 6 7 (m)

TABLE 4A: RE Slope 6 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	≤ 6.0m	1V: 15H	N/A	Tensar RE570 (Primary)	12.0 10.5 9.0 8.0	5.0 6.5 8.0 9.5
				Tensar SS20 (Secondary)	2.0	4.5, 5.5 6.0, 7.0 7.5, 8.5 9.0, 10.0 10.5, 11.0

DRAWING STATUS: CONSTRUCTION ISSUE

REVISION	DESCRIPTION	BY	DATE
A	Construction Issue	JXXL	6/16
0	Design Issue	AJL	Apr. 16

DESIGNED : JXXL Jun. 16
DRAWN : JC Jun. 16
DESIGN CHECKED : JXXL 6/16
DRAFTING CHECKED : [illegible] 6/16
CADFILE : \\21854\0037-S3ESP-17_18.dwg
APPROVED : [signature] 6/16

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NOTES :

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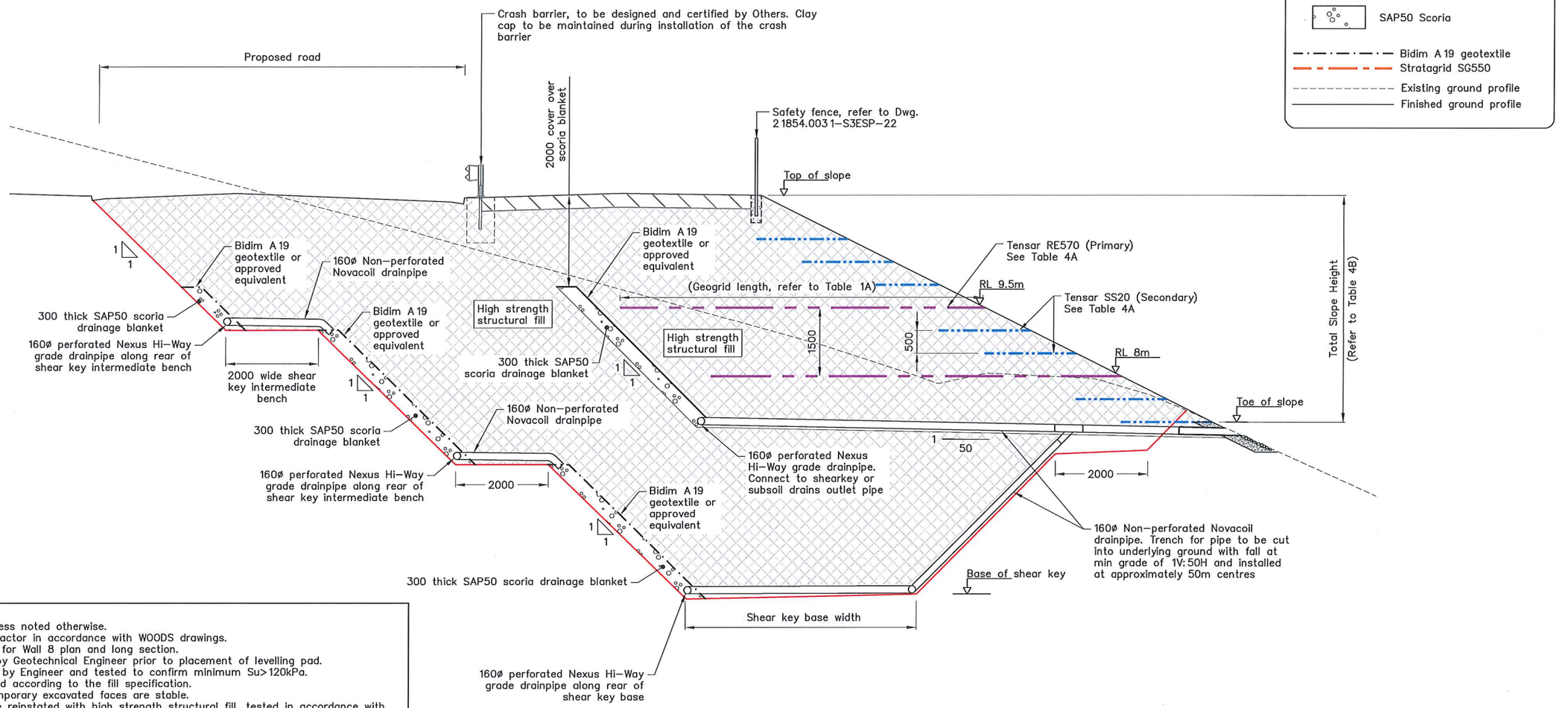
TITLE
STAGE 3 – ESPLANADE RETAINING WALLS
RE Slope 6 (Ch 115.5 to 175m) – Typical Cross Section

SCALES (AT A3 SIZE) 1: 125
DWG. No. 21854.0037-S3ESP-17
REV. A



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-S3ESP-07 for Wall 8 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.

SECTION 13 01 13 03 13 16
SCALE 1: 100

TABLE 4B: RE Slope 6 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	≤ 6.0m	1V: 15H	N/A	Tensar RE570 (Primary)	12.0 10.5 9.0 8.0	5.0 6.5 8.0 9.5
				Tensar SS20 (Secondary)	2.0	4.5, 5.5 6.0, 7.0 7.5, 8.5 9.0, 10.0 10.5, 11.0

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

DRAWING STATUS: CONSTRUCTION ISSUE

REVISION	DESCRIPTION	BY	DATE
A	Construction Issue		6/16
0	Design Issue	AJL	Apr. 16

DESIGNED :	JXXL	Jun. 16
DRAWN :	JC	Jun. 16
DESIGN CHECKED :		6/16
DRAFTING CHECKED :		6/16
CADFILE : \\21854\0037-S3ESP-17_18.dwg		
APPROVED :		6/16

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NOTES :

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WFH PROPERTIES LTD
MILLWATER ARRANS HILL PRECINCT 7

TITLE
STAGE 3 – ESPLANADE RETAINING WALLS
RE Slope 6 (Ch 53.5 to 115.5m) – Typical Cross Section

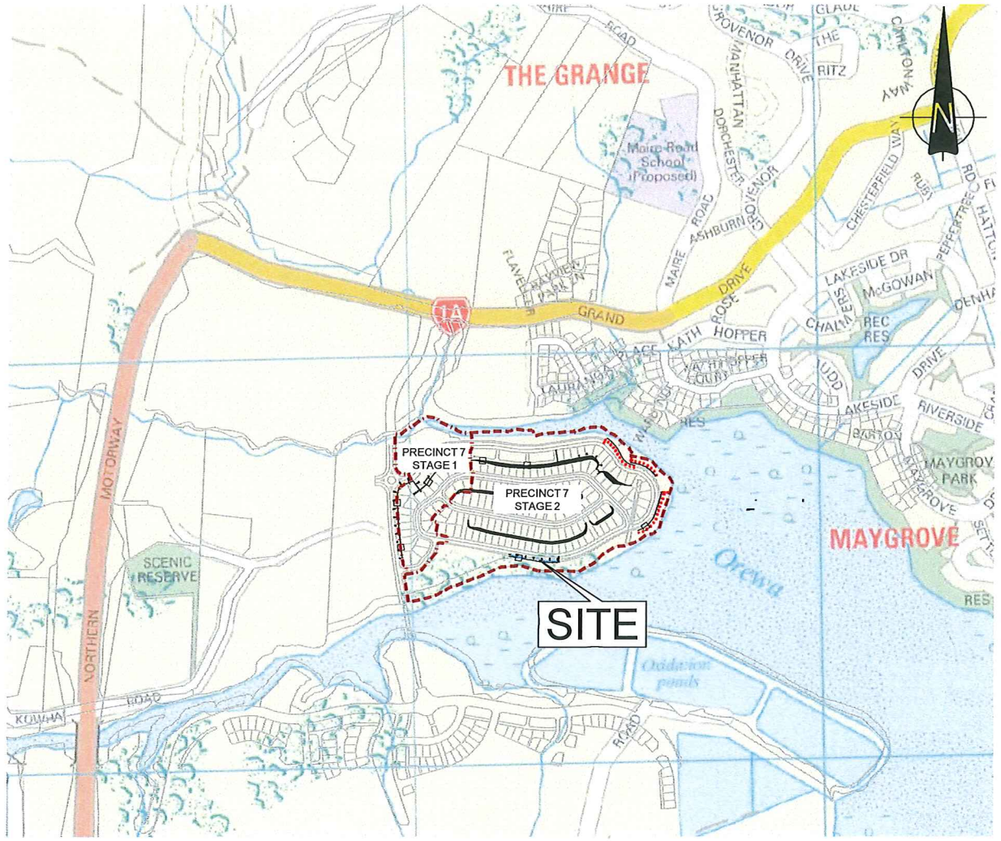
SCALES (AT A3 SIZE) 1.: 100
DWG. No. 21854.0037-S3ESP-18
REV. A

WFH PROPERTIES LTD
MILLWATER ARRANS HILL PRECINCT 7
STAGE 2 - RETAINING WALL 05

Construction Issue

DRAWING	Rev	Title
General		
• 21854.0037-MBW5-00	C	Drawing List and Location Plan
• 21854.0037-MBW5-01	B	Geotechnical Works Plan - Retaining Walls
• 21854.0037-MBW5-02	B	Geotechnical Works Plan - Subsoil Drainage
• 21854.0037-MBW5-03	C	Retaining Wall 05 - Plan & Elevation
• 21854.0037-MBW5-04	C	Retaining Wall 05 - Typical Cross Section (Sheet 1 of 3)
• 21854.0037-MBW5-05	C	Retaining Wall 05 - Typical Cross Section (Sheet 2 of 3)
• 21854.0037-MBW5-06	C	Retaining Wall 05 - Typical Cross Section (Sheet 3 of 3)
• 21854.0037-MBW5-07	C	Retaining Wall 05 - Typical Cross Section (6m<H≤7.3m)
• 21854.0037-MBW5-08	C	Retaining Wall 05 - Typical Cross Section (5m<H≤6m)
• 21854.0037-MBW5-09	C	Retaining Wall 05 - Typical Cross Section (3m<H≤5m)
• 21854.0037-MBW5-10	C	Retaining Wall 05 - Typical Cross Section (H≤3m)
• 21854.0037-MBW5-11	C	Retaining Wall Fence Details
• 21854.0037-MBW5-12	C	Retaining Wall Drains Typical Details
• 21854.0037-MBW5-13	A	Geotechnical Works Plan - Shear Key 1 and Piles
• 21854.0037-MBW5-14	A	Shear Key 1 Longsection
• 21854.0037-MBW5-15	A	Retaining Wall 05 - Grid Layout Details
• 21854.0037-MBW5-16	A	Shear Key 1F - Typical Cross Section
• 21854.0037-MBW5-17	A	Outlet Drain Detail

• Denotes drawing this issue: 2/08/2016



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

LOCATION PLAN
NOT TO SCALE

DRAWING STATUS: CONSTRUCTION ISSUE

REVISION	DESCRIPTION	BY	DATE
C	Revise Pile Requirements		
B	Revised Wall 5 Pile	AJL	Mar. 16
A	Construction Issue	AJL	Dec. 15

DESIGNED : JXXL Aug. 16
DRAWN : JC Aug. 16
DESIGN CHECKED : 10/8/16
DRAFTING CHECKED : 8/8/16
CADFILE : \\21854.0037-MBW5-00.dwg
APPROVED : 19/8/16
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NOTES :

REFERENCE :

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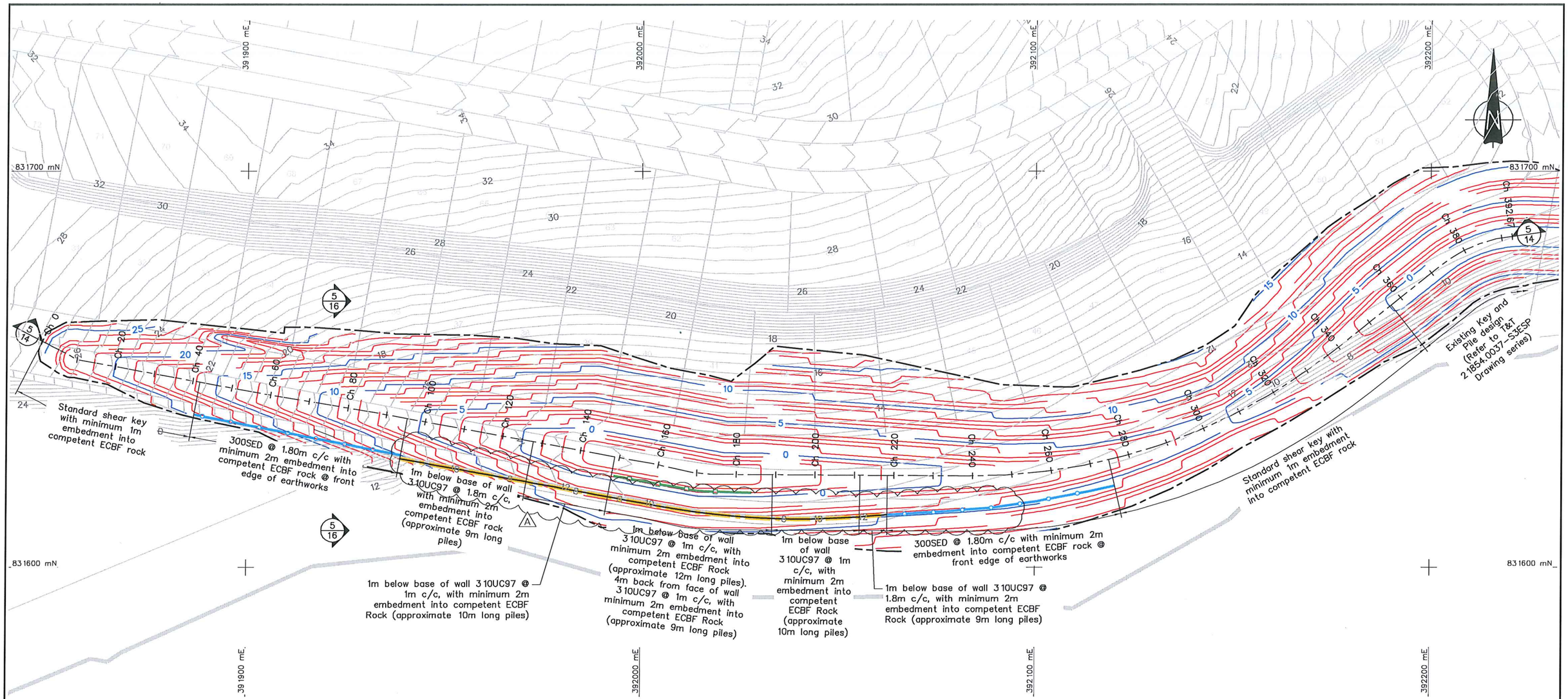
CLIENT, PROJECT: WFH PROPERTIES LTD
MILLWATER ARRANS HILL PRECINCT 7
TITLE: STAGE 2 – RETAINING WALL 05
Drawing List and Location Plan
SCALES (AT A3 SIZE): NTS
DWG. No.: 21854.0037-MBW5-00
REV.: C



LEGEND

- Wall 5
- 300SED Timber pile
- 310UC97 Pile
- Palisade wall
- Shear Key Extent
- Finished Ground Contours (1m interval)
- 10 — Shear key Contours (5m interval)
- Shear key Contours (1m interval)

SHEAR KEY PLAN

SCALE 1: 1000

A3 SCALE 1: 1000

0 5 10 15 20 30 40 50 (m)

DRAWING STATUS: CONSTRUCTION ISSUE

REVISION	DESCRIPTION	BY	DATE
A	Construction Issue		

DESIGNED :	JXXL	Aug. 16
DRAWN :	JC	Aug. 16
DESIGN CHECKED :		8/16
DRAFTING CHECKED :		8/16
CADFILE :	\\21854.0037-MBW5-13_14.dwg	
APPROVED :		12/8/16

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

NOTES :

1. 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
2. Base layout plan supplied by WOODS. Reference drawing name, 37000-01-100-102-EARTHWORKS PLANS.dwg, received in August 2014.
3. Existing ground contours supplied by WOODS. Reference drawing name, "Arran Point_Undercut 5.dwg", received in June 2015.
4. Design contours supplied by WOODS. Reference drawing name, "Arran Point-Esplanade Reserve.dwg", received in Dec2015.

REFERENCE :

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TITLE
STAGE 2 – RETAINING WALL 05
Geotechnical Works Plan – Shear Key 1 and Piles

SCALES (AT A3 SIZE)	DWG. No.	REV.
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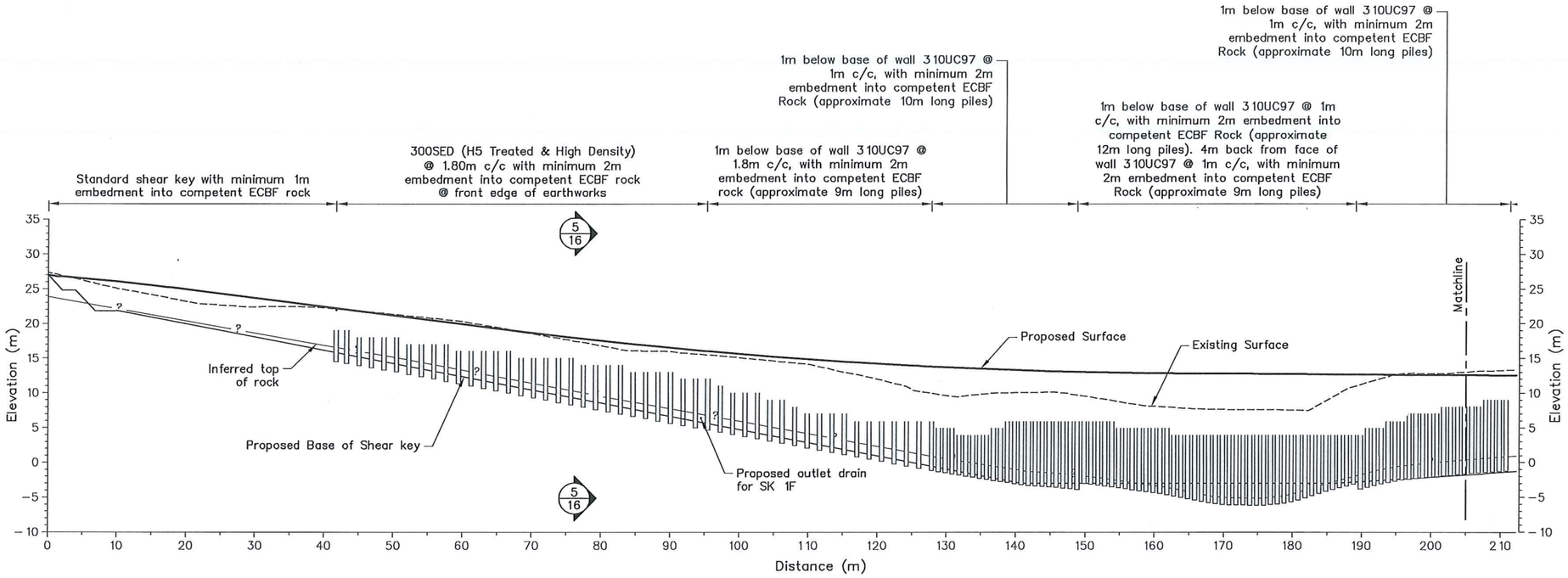

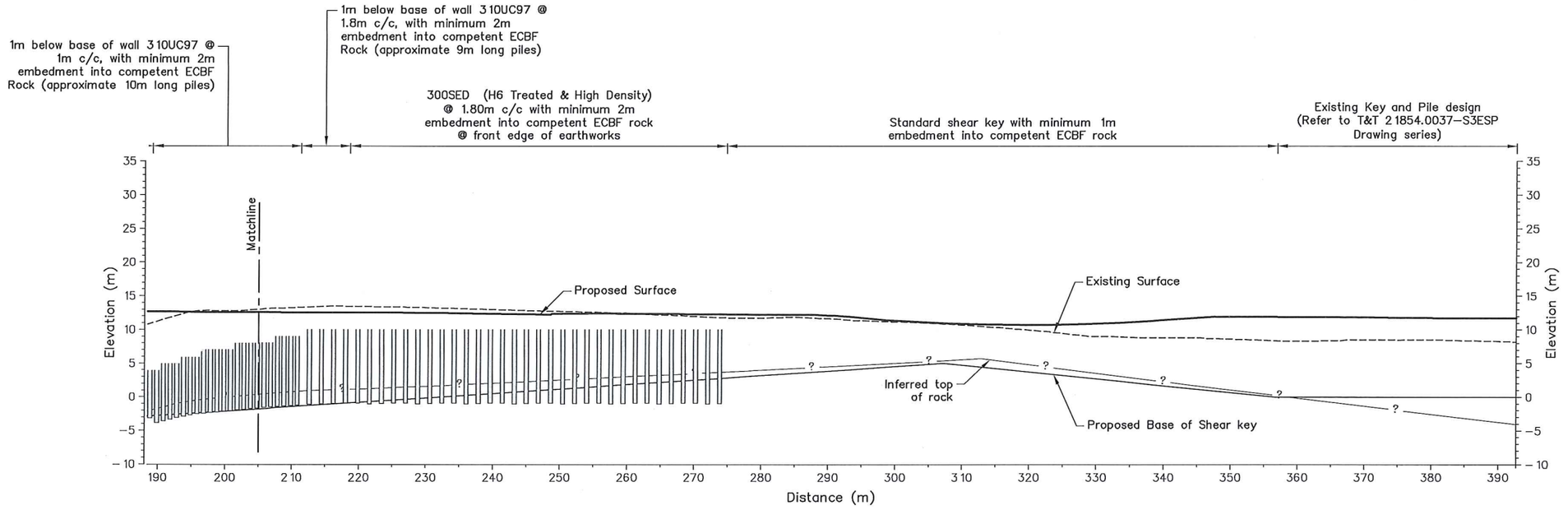

SECTION 5/13
SCALE 1:750

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

DRAWING STATUS: CONSTRUCTION ISSUE

REVISION	DESCRIPTION	BY	DATE
A	Construction Issue		

DESIGNED :	JXXL	Aug. 16
DRAWN :	JC	Aug. 16
DESIGN CHECKED :		8/16
DRAFTING CHECKED :		8/16
CADFILE : \\21854\0037-MBW5-13_14.dwg		
APPROVED :		17/8/16

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

NOTES :
1. 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
2. Base layout plan supplied by WOODS. Reference drawing name, 37000-01-100-102-EARTHWORKS PLANS.dwg, received in August 2014.
3. Existing ground contours supplied by WOODS. Reference drawing name, "Arran Point_Undercut 5.dwg", received in June 2015.
4. Design contours supplied by WOODS. Reference drawing name, "Arran Point-Esplanade Reserve.dwg", received in Dec2015.

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TITLE
STAGE 2 – RETAINING WALL 05
Shear Key 1 Longsection

SCALES (AT A3 SIZE)	DWG. No.	REV.
1:750	21854.0037-MBW5-14	A

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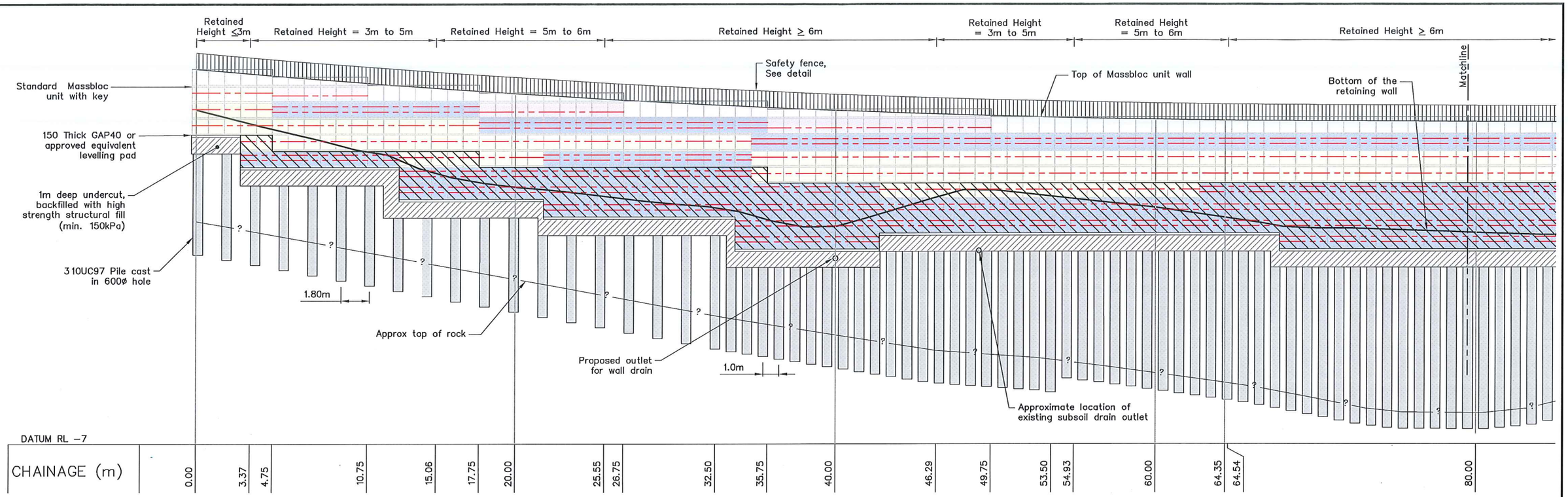

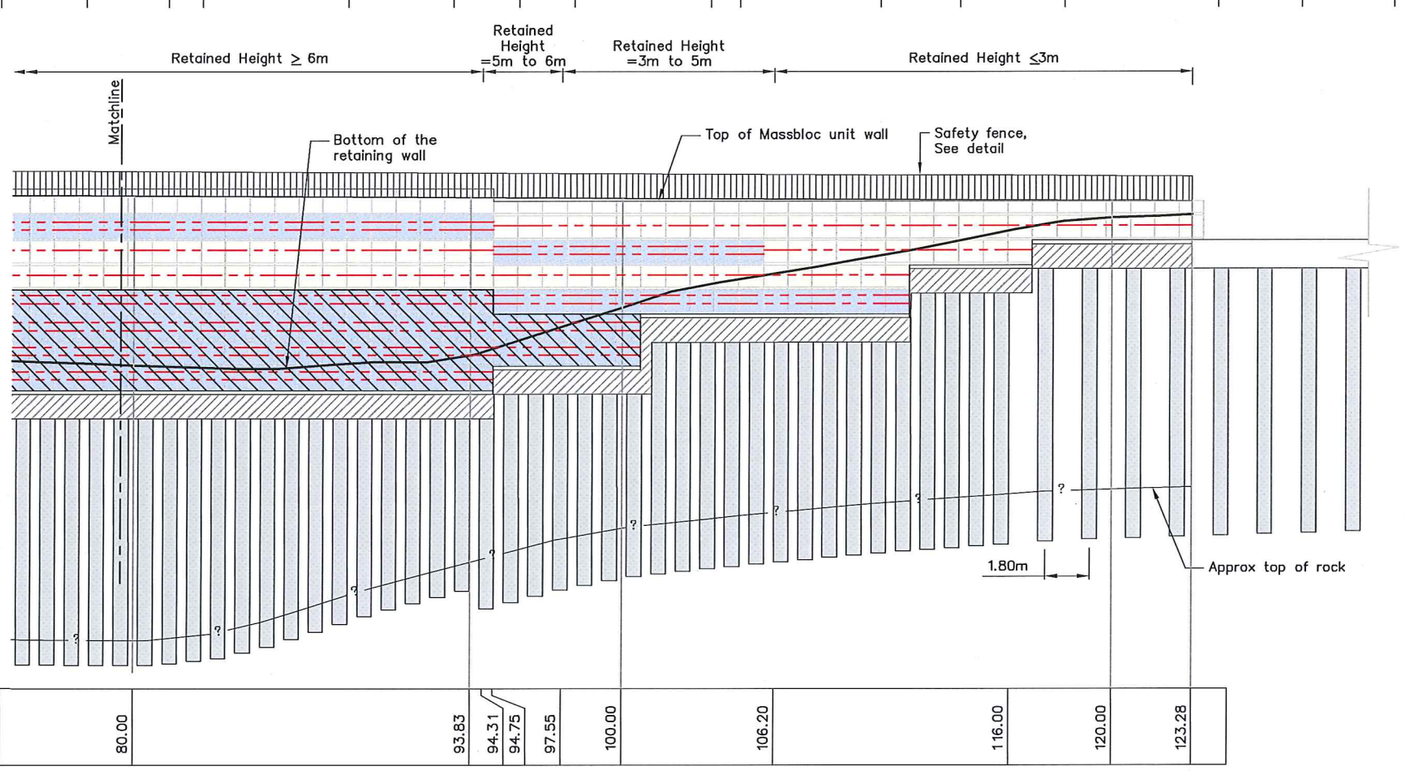

LEGEND

- Double grid at top & lower third of block
- Single grid at midpoint of block
- Single grid at lower third of block
- 30MPa block

ORIGINAL IN COLOUR

A3 SCALE 1: 250

0 5 10 15 (m)

DRAWING STATUS: CONSTRUCTION ISSUE

REVISION	DESCRIPTION	BY	DATE
A	Construction Issue		

DESIGNED :	JXXL	Aug. 16
DRAWN :	JC	Aug. 16
DESIGN CHECKED :		8/16
DRAFTING CHECKED :		8/16
CADFILE :	\\21854.0037-MBW5-15.dwg	
APPROVED :		24/8/16

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

NOTES :

1. All dimensions are in metres unless noted otherwise.

REFERENCE :

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MILLWATER ARRANS HILL PRECINCT 7

TITLE
STAGE 2 – RETAINING WALL 05
Retaining Wall 05 – Grid Layout Details

SCALES (AT A3 SIZE)	DWG. No.	REV.
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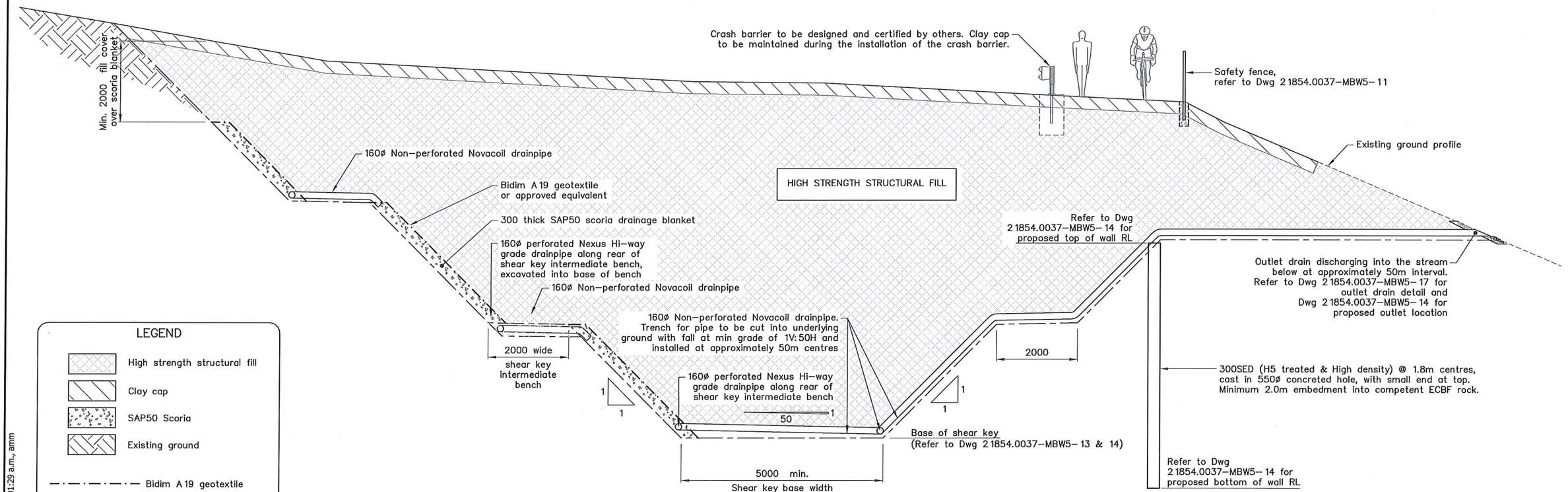


LEGEND

- High strength structural fill
- Clay cap
- SAP50 Scoria
- Existing ground
- Bidim A 19 geotextile
- Existing ground profile
- Finished ground profile
- Shearkey undercut extent

SECTION 5/13 SCALE 1: 100 — SHEAR KEY 1F – TYPICAL CROSS SECTION

NOTES
1. All dimensions are in millimetres unless noted otherwise.
2. All setout to be completed by Contractor in accordance with WOODS drawings.
3. Excavated subgrade to be inspected by Engineer and tested to confirm minimum Su>120kPa.
4. All fill shall be placed and compacted according to the fill specification.
5. The Contractor shall ensure that temporary excavated faces are stable.
6. Excavation in front of the wall to be reinstated with high strength structural fill, tested in accordance with earthwork specification.
7. Clay cap placed to be tested to confirm minimum Su>80kPa, or otherwise approved.
8. Shear Key drainage to be installed in accordance with earthworks design.
9. All piling work to be inspected and approved by a competent Geotechnical Engineer or Engineering geologist.

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

DRAWING STATUS: CONSTRUCTION ISSUE

REVISION	DESCRIPTION	BY	DATE
A	Construction Issue		

DESIGNED :	JXXL	Aug. 16
DRAWN :	JC	Aug. 16
DESIGN CHECKED :		8/16
DRAFTING CHECKED :		8/16
CADFILE : \\21854.0037–MBW5– 16.dwg		
APPROVED :		12/8/16

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

NOTES :
1. 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
2. Base layout plan supplied by WOODS. Reference drawing name, 37000–01– 100– 102–EARTHWORKS PLANS.dwg, received in August 2014.
3. Existing ground contours supplied by WOODS. Reference drawing name, "Arran Point_Undercut 5.dwg", received in June 2015.
4. Design contours supplied by WOODS. Reference drawing name, "Arran Point–Esplanade Reserve.dwg", received in Dec2015.

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
MILLWATER ARRANS HILL PRECINCT 7

TITLE
STAGE 2 – RETAINING WALL 05
Shear Key 1F – Typical Cross Section

SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 100	2 1854.0037–MBW5– 16	A

Appendix B: Contractors Certificates

- **Hick Bros Civil Construction Ltd – Sixth Schedule – Contract 37000-02 (Stages 4 & 5 Bulk Earthworks)**
- **JG Civil Ltd – Sixth Schedule – Stage 4 Civil Earthworks**
- **ICB Retaining & Construction - Producer Statement PS3 – Construction of Palisade Wall 1C**
- **ICB Retaining & Construction - Producer Statement PS3 – Construction of Palisade Wall 1D**
- **North Harbour Fencing Ltd – Producer Statement PS3 (Fencing for RE Slopes 2, 3 and 4)**

Schedule 6 – Form of Producer Statement – Construction

ISSUED BY HICK BROS CIVIL CONSTRUCTION Ltd *(Contractor)*

TO WFH PROPERTIES Ltd *(Principal)*

IN RESPECT OF PRECINCT 7 OREWA WEST 37000-02 BULK EARTHWORKS AND GEOTECHNICAL REMEDIATION *(Description of Contract Works)*

AT ARRAN POINT *(Address)*

HICK BROS CIVIL CONSTRUCTION Ltd (Contractor) has contracted to *WFH PROPERTIES Ltd Principal)* to carry out and complete certain building works in accordance with a Contract titled *PRECINCT 7 OREWA WEST CONTRACT 37000-02* ('the Contract')

I JAMES BILKEY *(Duly Authorised Agent)* a duly authorised representative of *HICK BROS CIVIL CONSTRUCTION Ltd (Contractor)* believe on reasonable grounds that *HICK BROS CIVIL CONSTRUCTION Ltd (Contractor)* has carried out and completed:

☐ All

☑ Part only as specified in the attached particulars of the contract works in accordance with the Contract

(Signature of Authorised Agent on behalf of)

Date 27/04/2018

HICK BROS CIVIL CONSTRUCTION Ltd
(Contractor)

42 FORGE RD, SILVERDALE
(Address)

- ALL EARTHWORKS WITHIN STAGES 4+5
- PART ONLY WORKS OF RE WALLS 2+3 (EARTHWORKS ONLY) NO FENCING / PLANTING / TOPSOIL

NZS 3910:2013 Conditions of contract for building and civil Engineering construction

Schedule 6 – Form of Producer Statement – Construction

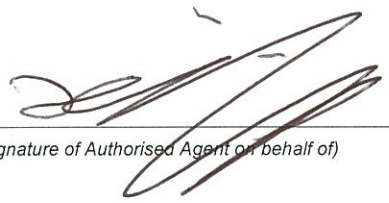
ISSUED BY	JG Civil Ltd	*(Contractor)*
TO	WFH PROPERTIES Ltd	*(Principal)*
IN RESPECT OF	Millwater Precinct 7, Orewa West Stage 4	*(Description of Contract Works)*
AT	Arran Point, Millwater	*(Address)*

JG Civil Ltd *(Contractor)* has contracted to *WFH PROPERTIES Ltd* *(Principal)* to carry out and complete certain building works in accordance with a Contract titled *PRECINCT 7 STAGE 4* ('the Contract')

I *Joel Giddy* *(Duly Authorised Agent)* a duly authorised representative of *JG Civil Ltd* *(Contractor)* believe on reasonable grounds that *JG Civil Ltd* *(Contractor)* has carried out and completed:

☑ All

☐ Part only as specified in the attached particulars of the contract works in accordance with the Contract



(Signature of Authorised Agent on behalf of)

Date *31-10-2018*

JG Civil Ltd

(Contractor)

180 Foundry Road, Silverdale

(Address)

SIXTH SCHEDULE

(NZS 3910:2003)

FORM OF PRODUCER STATEMENT CONSTRUCTION

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

TO **Hick Brothers Construction.**
(Principal)

IN RESPECT OF **Palisade Wall 1C, Precent 7, Orewa West, Auckland.**
(Description of Contract Works)

AT **Grand Drive, Orewa, Auckland**
(Address)

ICB Retaining & Construction Ltd
(Contractor)

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

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

Supply and Installation of Palisade Wall 1C, Precent 7, Orewa West (Arran Point) – for WFH Properties Ltd
(The Project) *(The Contract)*

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. Engineering Approval and any Authorised Instruction / Variations that have been issued during the course of the work.

(Signature of Authorised Agent on Behalf of)

20 October 2017
(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 Bros Civil**
(Principal)

IN RESPECT OF **Shear Key Wall 1D, Stage 4 at Precinct 7, Millwater, Arran Point, Auckland**
(Description of Contract Works)

AT **Precinct 7, Millwater, Arran Point**
(Address)

ICB Retaining & Construction Ltd
(Contractor)

has contracted to **Hick Bros Civil**
(Principal)

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

Supply and Installation of Palisade walls at Precinct 7, Millwater, Arran Point, Auckland – for WFH Properties Ltd
(The Project) *(The Contract)*

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 and any Authorised Instruction / Variations that have been issued during the course of the work.

(Signature of Authorised Agent on Behalf of)

29 October 2018
(Date)

ICB Construction Limited
(Contractor)

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

FORM OF PRODUCER STATEMENT PS3 – CONSTRUCTION
At project completion, this form shall be completed by the building contractor and supplied to the Engineer.

ISSUED BY: NORTH HARBOUR FENCING LTD
(Building Contractor)

TO: J. G. CIVIL LTD
(Owner/Principal)

IN RESPECT OF: PANEL FENCING ON BATTER
(Description of Contract Works)

AT: CASIDY RD., MILLWATER.
(Address)

T/A: ..... **BUILDING CONSENT No:** .....
(Territorial Authority / Building Consent Authority)

The above Building Contractor has contracted to the above Owner/Principal to carry out and complete certain building works in accordance with the contract, titled

..... ("the contract")
(Title of building contract)

I ROY HERBERT a duly authorised representative of the
(Builder's Authorised Agent)

above building contractor, believe on reasonable grounds that the above building contractor has carried out and completed

☐All ☑Part only as specified in the attached particulars

of the building works in accordance with the contract.

.....
(Signature of Authorised Agent on behalf of the Building Contractor)

01/11/18
(Date)

20A MANGA RD
SILVERDALE
(Address)

This producer statement is confirmation by the builder(s) that they have carried out the building work in accordance with the drawings, specifications (and site amendments) that are part of the contract / building consent documents.

Work covered by this statement should have been supervised and checked by suitably qualified trades-persons.

The Engineer requires this producer statement and a copy of the T/A's building consent conditions, to confirm that items of the contract that he has not personally examined, have in fact been built according to the documents, so that the Engineer may issue appropriate documents to the T/A for it to release the Code Compliance Certificate.

20393-1

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 to H1 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).

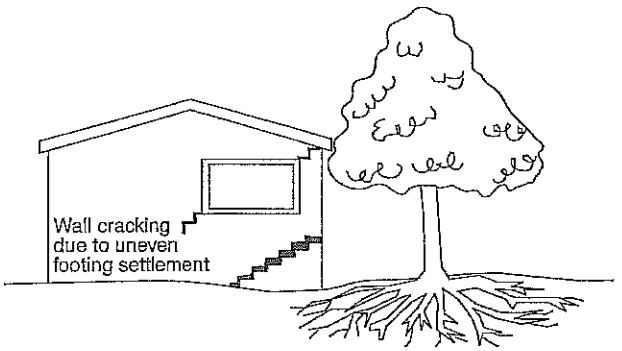
Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

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.

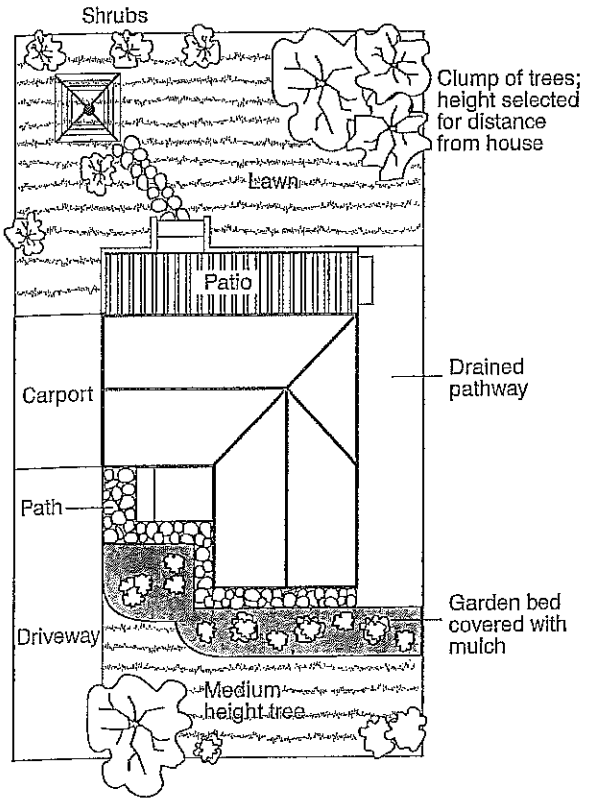
It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

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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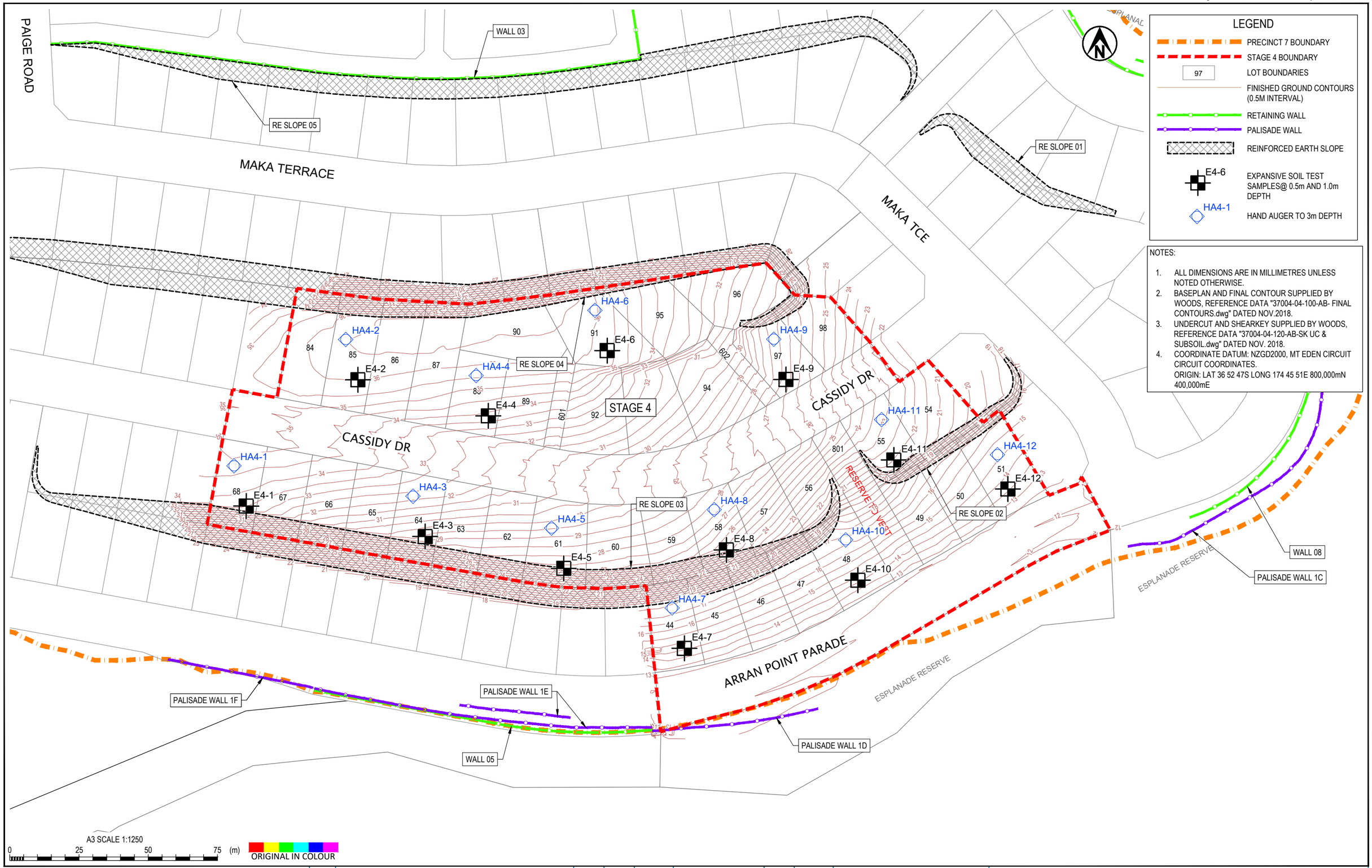
Appendix E: Test Results

- **21854.0037–APP7S4–111 Post Earthworks Investigation Plan**
- **21854.0037–APP7S4–112 Topsoil Depths Plan**
- **21854.0037–APP7S4–113 Earthworks Testing Location Plan**
- **Soil Expansion Test Results**
- **Post Earthworks Investigation Borehole Logs (HA4–01 to HA4–12)**
- **Earthworks Test Results**

L:\21854\21854.0037 - Arrans Point Precinct 7\CAD\STAGE 4\21854.0037-APP7S4-111.dwg 2018-Nov-23 2:00:17 PM Plotted By: JONALD CASTRO



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REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE					

DESIGNED	JXXL	Nov.18	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Nov.18	
DESIGN CHECKED			
DRAWING CHECKED			

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PROJECT **RESIDENTIAL SUBDIVISION**

TITLE MILLWATER - ARRANS POINT PRECINCT 7 (STAGE 4) POST EARTHWORKS INVESTIGATION PLAN

SCALE (A3) 1:1250 DWG No. 21854.0037-APP7S4-111 REV 1

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PAIGE ROAD

MAKA TERRACE

MAKA TCE

CASSIDY DR

ARRAN POINT PARADE

ESPLANADE RESERVE

RESERVE TO VEST

STAGE 4

WALL 03

RE SLOPE 05

RE SLOPE 01

RE SLOPE 04

RE SLOPE 03

RE SLOPE 02

WALL 08

PALISADE WALL 1C

PALISADE WALL 1F

PALISADE WALL 1E

PALISADE WALL 1D

WALL 05

LEGEND

- PRECINCT 7 BOUNDARY
- STAGE 4 BOUNDARY
- 97 — LOT BOUNDARIES
- FINISHED GROUND CONTOURS (0.5M INTERVAL)
- RETAINING WALL
- PALISADE WALL
- REINFORCED EARTH SLOPE
- 100 — TOPSOIL DEPTH (mm) TAKEN AT CENTRE OF EACH LOT

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. BASEPLAN AND FINAL CONTOUR SUPPLIED BY WOODS, REFERENCE DATA "37004-04-100-AB- FINAL CONTOURS.dwg" DATED NOV.2018.
3. UNDERCUT AND SHEARKEY SUPPLIED BY WOODS, REFERENCE DATA "37004-04-120-AB-SK UC & SUBSOIL.dwg" DATED NOV. 2018.
4. COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT CIRCUIT COORDINATES.
   ORIGIN: LAT 36 52 47S LONG 174 45 51E 800,000mN 400,000mE

A3 SCALE 1:1250

0 25 50 75 (m)

ORIGINAL IN COLOUR

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REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
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TITLE MILLWATER - ARRANS POINT PRECINCT 7 (STAGE 4) TOPSOIL DEPTHS PLAN

SCALE (A3) 1:1250 DWG No. 21854.0037-APP7S4-112 REV 1

L:\21854\21854.0037 - Arrans Point Precinct 7\CAD\STAGE 4\21854.0037-APP7S4-113.dwg 2018-Nov-23 2:00:33 PM Plotted By: JONALD CASTRO

PAIGE ROAD

MAKA TERRACE

MAKA TCE

CASSIDY DR

ARRAN POINT PARADE

ESPLANADE RESERVE

STAGE 4

WALL 03

RE SLOPE 05

RE SLOPE 01

RE SLOPE 04

RE SLOPE 02

RE SLOPE 03

WALL 08

PALISADE WALL 1C

PALISADE WALL 1F

PALISADE WALL 1E

PALISADE WALL 1D

WALL 05

LEGEND

- PRECINCT 7 BOUNDARY
- STAGE 4 BOUNDARY
- 97 — LOT BOUNDARIES
- FINISHED GROUND CONTOURS (0.5M INTERVAL)
- RETAINING WALL
- PALISADE WALL
- 2.0 — FILL CONTOURS
- 0.0 — ZERO CONTOURS
- -2.0 — CUT CONTOURS
- REINFORCED EARTH SLOPE
- S14-5612 — EARTHWORKS TESTING LOCATION (URN NUMBER)

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. BASEPLAN AND FINAL CONTOUR SUPPLIED BY WOODS, REFERENCE DATA "37004-04-100-AB- FINAL CONTOURS.dwg" DATED NOV.2018.
3. UNDERCUT AND SHEARKEY SUPPLIED BY WOODS, REFERENCE DATA "37004-04-120-AB-SK UC & SUBSOIL.dwg" DATED NOV. 2018.
4. COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT CIRCUIT COORDINATES.
   ORIGIN: LAT 36 52 47S LONG 174 45 51E 800,000mN 400,000mE

A3 SCALE 1:1250

0 25 50 75 (m)

ORIGINAL IN COLOUR

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1	COMPLETION REPORT ISSUE					

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DESIGN CHECKED			
DRAWING CHECKED			

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PROJECT **RESIDENTIAL SUBDIVISION**

TITLE MILLWATER - ARRANS POINT PRECINCT 7 (STAGE 4) EARTHWORKS TESTING LOCATION PLAN

SCALE (A3) 1:1250 DWG No. 21854.0037-APP7S4-113 REV 1

GEOTECHNICS

Our Ref: 1008204.0.0.0/Rep 1
Customer Ref: 21854.0037
11 September 2018

Tonkin & Taylor
PO Box 5271, Wellesley Street,
Auckland 1141

Attention: Mr James Lee

Dear James

Millwater - Arran Point, Precinct 7, Stage 4

Laboratory Test Report

Samples from the above mentioned site have been tested as received according to your instructions. Test results are included in this report.

Samples were destroyed during testing.

Please reproduce this report in full when transmitting to others or including in internal reports.

If we can be of any further assistance, feel free to get in touch. Contact details are provided at the bottom of this page.

GEOTECHNICS LTD

Report prepared by:

Sim Tirunahari
I am the author of this document
2018.09.11 08:18:04 +12'00'

.....
Sim Tirunahari
Soils Laboratory Manager
Approved Signatory

Authorised for Geotechnics by:

.....
Steven Anderson
Project Director

Report checked by:

.....
Steven Anderson
Operations & Technical Manager

This document consists of 4 pages.
11-Sep-18
t:\geotechnicsgroup\projects\1008204\issueddocuments\20180911.arran point_p7_stage 4.st.final.rep1.docx

GEOTECHNICS
Ground Floor, 19 Morgan Street, Newmarket, Auckland 1023
PO Box 9360, Newmarket, Auckland 1149
p 64 9 356 3510
www.geotechnics.co.nz

Site: **Millwater - Arran Point, Precinct 7, Stage 4**

Your Job No: 21854.0037

Our Job No: 1008204.0000.0.0

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

SUMMARY OF SHRINK - SWELL TEST RESULTS

HA No.:			**1**	**1**	**2**	**2**	**3**	**3**	**4**	**4**
DEPTH		**(m)**	**0.5**	**1.0**	**0.5**	**1.0**	**0.5**	**1.0**	**0.5**	**1.0**
Applied Pressure		**(kPa)**	**55**	**55**	**55**	**55**	**55**	**55**	**55**	**55**
SWELL TEST	Initial Water Content	(%)	31.3	31.6	33.3	31.1	27.6	32.1	30.9	31.9
	Bulk Density	(t/m³)	1.86	1.89	1.80	1.83	1.88	1.77	1.81	1.78
	Dry Density	(t/m³)	1.42	1.44	1.35	1.4	1.47	1.34	1.38	1.35
	Final Water Content	(%)	33.2	32.2	35.3	32.5	29.1	34.0	32.8	33.4
	Swelling Strain	(%)	0.09	-0.36	0.06	0.08	0.02	0.063	0.12	0.05
SHRINKAGE TEST	Final Water Content	(%)	21.1	18.0	20.7	22.4	18.4	16.6	22.7	23.7
	Shrinkage Strain	(%)	4.3	2.1	2.42	4.3	0.5	1.34	4.3	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	Moderate	Major	Moderate	Moderate	Moderate
SHRINK - SWELL INDEX		**(%)**	**2.4**	**1.0**	**1.4**	**2.4**	**0.3**	**0.76**	**2.4**	**2.2**

Remarks: The test results are IANZ accredited.

Entered by: JK Date: 11/09/2018 Checked by: ST Date: 11/09/2018

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Site: Millwater - Arran Point, Precinct 7, Stage 4

Your Job No: 21854.0037

Our Job No: 1008204.0000.0.0

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

SUMMARY OF SHRINK - SWELL TEST RESULTS

HA No.:			**5**	**5**	**6**	**6**	**7**	**7**	**8**	**8**
DEPTH		**(m)**	**0.5**	**1.0**	**0.5**	**1.0**	**0.5**	**1.0**	**0.5**	**1.0**
Applied Pressure		**(kPa)**	**55**	**55**	**55**	**55**	**55**	**55**	**55**	**55**
SWELL TEST	Initial Water Content	(%)	33.2	37.1	32.2	35.7	40.7	31.5	31.1	36.0
	Bulk Density	(t/m³)	1.81	1.78	1.78	1.73	1.75	1.85	1.85	1.81
	Dry Density	(t/m³)	1.36	1.30	1.35	1.27	1.24	1.41	1.41	1.33
	Final Water Content	(%)	35.1	38.8	34.1	38.0	42.1	33.4	32.9	37.2
	Swelling Strain	(%)	0.15	0.11	0.04	0.05	-0.06	0.03	0.12	-0.07
SHRINKAGE TEST	Final Water Content	(%)	22.3	23.8	15.2	18.9	24.5	17.0	14.9	16.4
	Shrinkage Strain	(%)	3.8	2.6	1.8	3.8	2.0	5.2	5.8	5.6
	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	Moderate	Moderate	Moderate	Moderate	Moderate
SHRINK - SWELL INDEX		**(%)**	**2.2**	**1.5**	**1.0**	**2.1**	**1.1**	**2.9**	**3.3**	**3.1**

Remarks: The test results are IANZ accredited.

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Site: Millwater - Arran Point, Precinct 7, Stage 4

Your Job No: 21854.0037

Our Job No: 1008204.0000.0.0

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

SUMMARY OF SHRINK - SWELL TEST RESULTS

HA No.:			**9**	**9**	**10**	**10**	**11**	**11**	**12**	**12**
DEPTH		**(m)**	**0.5**	**1.0**	**0.5**	**1.0**	**0.5**	**1.0**	**0.5**	**1.0**
Applied Pressure		**(kPa)**	**55**	**55**	**55**	**55**	**55**	**55**	**55**	**55**
SWELL TEST	Initial Water Content	(%)	30.8	34.0	36.9	28.3	26.7	21.4	52.5	59.2
	Bulk Density	(t/m³)	1.81	1.85	1.72	1.85	1.90	1.95	1.69	1.60
	Dry Density	(t/m³)	1.38	1.38	1.26	1.44	1.50	1.61	1.11	1.01
	Final Water Content	(%)	32.6	35.8	38.5	30.2	28.7	23.3	53.8	60.7
	Swelling Strain	(%)	0.23	0.71	0.07	0.19	0.15	0.42	0.05	0.05
SHRINKAGE TEST	Finall Water Content	(%)	14.2	14.7	26.8	19.3	20.0	17.7	42.4	32.1
	Shrinkage Strain	(%)	1.6	4.2	3.0	1.4	3.1	3.0	10.8	3.2
	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	Moderate	Major	Moderate	Major	Major
SHRINK - SWELL INDEX		**(%)**	**1.0**	**2.5**	**1.7**	**0.8**	**1.8**	**1.8**	**6.0**	**1.8**

Remarks: The test results are IANZ accredited.

Entered by: JK Date: 11/09/2018 Checked by: ST Date: 11/09/2018

BOREHOLE LOG

BOREHOLE No.: **HA4-01**

SHEET: 1 OF 1

PROJECT: Arran Point Precinct 7 - Stage 4	LOCATION: Arran Point, Millwater	JOB No.: 21854.0037/s3
CO-ORDINATES: 5948857.66 mN (NZTM2000) 1749721.89 mE	DRILL TYPE: 50MM HAND AUGER	HOLE STARTED: 08/08/2018
	DRILL METHOD: HA	HOLE FINISHED: 08/08/2018
R.L.: 34.50m		DRILLED BY: GEOTECHNICS
DATUM: NZVD2016	DRILL FLUID:	LOGGED BY: RBE CHECKED: AGRA

GEOLOGICAL																ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%) 25 50 75	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 60 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (cm) 20 60 200 600 2000	Description and Additional Observations
Fill						● 173/67 kPa ● 160/30 kPa ● UTP ● 65/33 kPa ● 199/51 kPa ● UTP ● 160/51 kPa ● UTP ● 110/54 kPa ● UTP		34 33 32	0.5 1.0 1.5 2.0 2.5	TS	M-W M D-M M	VSt-H				clayey SILT, low plasticity, moist to wet, dark brown and yellowish brown clayey SILT, low plasticity, moist, yellowish brown, and SILT, non plastic, moist, grey, with inclusions of grey sandstone gravel SILT non plastic to friable, hard, dry to moist, grey gravelly SILT,sandy, non plastic, moist, grey, with minor yellowish brown inclusions SANDSTONE (sandy SILT) hard, grey, penetrated with difficulty sandy SILT, non plastic, moist, grey, minor orange inclusions SILT, gravelly, non plastic, moist, grey (crushed siltstone) *2.70m:* sandstone gravel. Extremely hard to auger; refusal
								31	3.0 3.5							2.8m: Effective refusal

COMMENTS:

Hole Depth 2.8m

Scale 1:20

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **HA4-02**

SHEET: 1 OF 1

PROJECT: Arran Point Precinct 7 - Stage 4	LOCATION: Arran Point, Millwater	JOB No.: 21854.0037/s3
CO-ORDINATES: (NZTM2000) 5948911.00 mN 1749761.75 mE	DRILL TYPE: 50MM HAND AUGER	HOLE STARTED: 08/08/2018
	DRILL METHOD: HA	HOLE FINISHED: 08/08/2018
R.L.: 35.70m		DRILLED BY: GEOTECHNICS
DATUM: NZVD2016	DRILL FLUID:	LOGGED BY: AGRA CHECKED: AGRA

GEOLOGICAL											ENGINEERING DESCRIPTION						
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%) 25 50 75	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (cm) 20 60 200 600 2000	Description and Additional Observations
										TS	M	VSt-H				SILT non plastic, moist, dark brown
											D-M					SILT, and sandy SILT, trace gravel, non plastic, moist to dry, yellowish brown and grey
						● UTP			0.5							
						● >224 kPa		35								
						● >224 kPa			1.0							
						● >224 kPa										
Fill						● >224 kPa			1.5							
						● UTP		34								
						● >224 kPa			2.0							
						● 128/58 kPa			2.5							
						● 128/70 kPa		33								
						● UTP			3.0		M	VSt				clayey SILT, medium plasticity, moist, yellowish brown
											D-M	H				SILT, and Sandy SILT, non plalstic, moist to dry, yellowish brown and grey
																3.1m: Target depth
									3.5							
								32								

COMMENTS:

Hole Depth 3.1m

Scale 1:20

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **HA4-03**

SHEET: 1 OF 1

PROJECT: Arran Point Precinct 7 - Stage 4	LOCATION: Arran Point, Millwater	JOB No.: 21854.0037/s3
CO-ORDINATES: 5948855.42 mN (NZTM2000) 1749783.71 mE	DRILL TYPE: 50MM HAND AUGER	HOLE STARTED: 08/08/2018
		HOLE FINISHED: 08/08/2018
R.L.: 31.80m	DRILL METHOD: HA	DRILLED BY: GEOTECHNICS
DATUM: NZVD2016	DRILL FLUID:	LOGGED BY: RBE CHECKED: AGRA

GEOLOGICAL																ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%) 25 50 75	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (cm) 20 60 200 600 2000	Description and Additional Observations
Fill						● >224 kPa		31	0.5	TS	M	VSt-H				clayey SILT, low plasticity, moist, dark brown, with yellowish brown inclusions
						● 96/38 kPa										SILT non plastic, moist, yellowish brown and grey, with inclusions of grey sandstone
						● >224 kPa			1.0							*0.60m:* grey, with minor yellowish brown inclusions
						● 202/77 kPa										*1.10m:* grey and yellowish brown
						● UTP		30	1.5							sandy SILT, non plastic to friable, dry to moist, grey
						● 131/75 kPa										*1.60m:* moist
						● UTP			2.0							*1.90m:* low plasticity, yellowish brown and grey
						● UTP			2.5							*2.10m:* grey, crushed sandstone with abundant sandstone gravel
						● UTP		29				H				SILT, non plastic, dry to moist, grey and yellowish brown, with abundant sandstone gravel
						● >224 kPa			3.0							3m: Target depth
								28	3.5							

COMMENTS:

Hole Depth 3m

Scale 1:20

Rev.: A

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **HA4-04**

SHEET: 1 OF 1

PROJECT: Arran Point Precinct 7 - Stage 4		LOCATION: Arran Point, Millwater	JOB No.: 21854.0037/s3
CO-ORDINATES: (NZTM2000)	5948902.01 mN 1749804.48 mE	DRILL TYPE: 50MM HAND AUGER	HOLE STARTED: 08/08/2018 HOLE FINISHED: 08/08/2018
R.L.:	34.70m	DRILL METHOD: HA	DRILLED BY: GEOTECHNICS
DATUM:	NZVD2016	DRILL FLUID:	LOGGED BY: AGRA CHECKED: AGRA

GEOLOGICAL															ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%) 25 50 75	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 60 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (cm) 20 60 200 600 2000	Description and Additional Observations
Fill						● >224 kPa ● 221/87 kPa ● 186/77 kPa ● 183/103 kPa ● >224 kPa ● >224 kPa ● 189/90 kPa ● >224 kPa ● 144/70 kPa		34 33 32 31	0.5 1.0 1.5 2.0 2.5 3.0 3.5	TS	M D-M	VSt-H H				SILT, non plastic, moist, dark brown clayey SILT, and SILT, non plastic, dry to moist, yellowish brown, grey and orange sandy SILT,and SILT, non plastic, dry to moist, yellowish brown; minor grey sandstone gravel sandy GRAVEL, extremely hard to auger, refusal 2.8m: Refusal

COMMENTS:

Hole Depth 2.8m

Scale 1:20

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **HA4-05**

SHEET: 1 OF 1

PROJECT: Arran Point Precinct 7 - Stage 4	LOCATION: Arran Point, Millwater	JOB No.: 21854.0037/s3
CO-ORDINATES: 5948846.68 mN (NZTM2000) 1749832.16 mE	DRILL TYPE: 50MM HAND AUGER	HOLE STARTED: 08/08/2018 HOLE FINISHED: 08/08/2018
R.L.: 29.60m	DRILL METHOD: HA	DRILLED BY: GEOTECHNICS
DATUM: NZVD2016	DRILL FLUID:	LOGGED BY: RBE CHECKED: AGRA

GEOLOGICAL															ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%) 25 50 75	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 60 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (cm) 20 60 200 600 2000	Description and Additional Observations
Topsoil										TS	M	VSt-H				clayey SILT, low plasticity, moist, dark brown and yellowish brown
Fill						● UTP ● >224 kPa ● 129/43 kPa ● 116/71 kPa ● 173/77 kPa ● 102/42 kPa ● 122/64 kPa ● 176/77 kPa ● 211/42 kPa ● 112/65 kPa		29 28 27 26	0.5 1.0 1.5 2.0 2.5 3.0 3.5			H VSt VSt-H				SILT non plastic to friable, moist, yellowish brown and grey, with grey sandstone gravel clayey SILT low plasticity, moist, yellowish brown, with SILT non plastic, moist, grey, and inclusions of grey sandstone gravel sandy SILT, non plastic, moist, yellowish brown and grey clayey SILT, low plasticity, moist, yellowish brown with grey inclusions sandy SILT non plastic, moist, grey and yellowish brown, abundant crushed sandstone 3.1m: Target depth

COMMENTS:

Hole Depth 3.1m

Scale 1:20

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **HA4-06**

SHEET: 1 OF 1

PROJECT: Arran Point Precinct 7 - Stage 4	LOCATION: Arran Point, Millwater	JOB No.: 21854.0037/s3
CO-ORDINATES: 5948920.57 mN (NZTM2000) 1749842.72 mE	DRILL TYPE: 50MM HAND AUGER	HOLE STARTED: 08/08/2018
	DRILL METHOD: HA	HOLE FINISHED: 08/08/2018
R.L.: 36.20m		DRILLED BY: GEOTECHNICS
DATUM: NZVD2016	DRILL FLUID:	LOGGED BY: AGRA CHECKED: AGRA

GEOLOGICAL										ENGINEERING DESCRIPTION						
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
						141/64 kPa		36	0.5	TS	M	VSt				SILT, non plastic, moist, dark brown mottled orange
						122/74 kPa										SILT, some sand, non plastic, moist, to dry, yellowish brown and grey, with inclusions of sandstone gravel
						>224 kPa			1.0			H				sandy SILT, non plastic, moist to dry, white mottled orange, and SILT, minor clay, with trace grey gravel inclusions
Fill						>224 kPa		35								
						>224 kPa			1.5							*1.60m:* some grey siltstone gravel
						UTP										
						UTP		34	2.0							
						UTP			2.5							
						>224 kPa			3.0							
								33								3.1m: Target depth
									3.5							

COMMENTS:

Hole Depth 3.1m

Scale 1:20

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **HA4-07**

SHEET: 1 OF 1

PROJECT: Arran Point Precinct 7 - Stage 4	LOCATION: Arran Point, Millwater	JOB No.: 21854.0037/s3
CO-ORDINATES: 5948804.46 mN (NZTM2000) 1749872.22 mE	DRILL TYPE: 50MM HAND AUGER	HOLE STARTED: 08/08/2018
	DRILL METHOD: HA	HOLE FINISHED: 08/08/2018
R.L.: 15.70m		DRILLED BY: GEOTECHNICS
DATUM: NZVD2016	DRILL FLUID:	LOGGED BY: RBE CHECKED: AGRA

GEOLOGICAL																ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%) 25 50 75	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 60 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (cm) 20 60 200 600 2000	Description and Additional Observations
Topsoil										TS	W	VSt-H				clayey SILT, low plasticity, wet, dark brown
Fill						● >224 kPa					M	H				clayey SILT, medium plasticity, moist, yellowish brown, with minor grey inc lusions
						● >224 kPa		15	0.5							sandy SILT, non plastic, moist, yellowish brown with grey inclusions
						● >224 kPa					D-M					clayey SILT, low plasticity, dry to moist, yellowish brown with grey inclusions
						● UTP			1.0							SILT, non plastic, dry to moist, yellowish brown with grey inclusions
						● 205/128 kPa			1.5							*1.70m:* solid refusal, grey sandstone
						● UTP		14								1.7m: Refusal
									2.0							
									2.5							
								13								
									3.0							
									3.5							
								12								

COMMENTS:

Hole Depth 1.7m

Scale 1:20

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **HA4-08**

SHEET: 1 OF 1

PROJECT: Arran Point Precinct 7 - Stage 4	LOCATION: Arran Point, Millwater	JOB No.: 21854.0037/s3
CO-ORDINATES: (NZTM2000) 5948849.23 mN 1749894.44 mE	DRILL TYPE: 50MM HAND AUGER	HOLE STARTED: 08/08/2018
	DRILL METHOD: HA	HOLE FINISHED: 08/08/2018
R.L.: 27.00m		DRILLED BY: GEOTECHNICS
DATUM: NZVD2016	DRILL FLUID:	LOGGED BY: RBE CHECKED: AGRA

GEOLOGICAL																ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%) 25 50 75	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (cm) 20 60 200 600 2000	Description and Additional Observations
Fill						● 176/113 kPa			0.5	TS	M	VSt				clayey SILT, low plasticity, moist, brown
						● 128/70 kPa						St-VSt				clayey SILT, low plasticity, moist, yellowish brown, and SILT non plastic, moist, grey; fragments of grey sandstone gravel
						● 167/58 kPa		26	1.0							
						● 173/80 kPa										
						● 90/54 kPa			1.5							
						● 189/112 kPa										
						● 131/65 kPa		25	2.0			VSt				SILT non plastic, moist to dry, yellowish brown and grey with inclusions of grey siltstone
						● 158/93 kPa			2.5							
						● UTP					D-M	H				sandy SILT, non plastic, moist to dry, grey (broken and crushed sandstone) , with minor clayey SILT, low plasticity, moist, yellowish brown
						● UTP		24	3.0							3m: Target depth
									3.5							

COMMENTS:

Hole Depth 3m

Scale 1:20

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **HA4-09**

SHEET: 1 OF 1

PROJECT: Arran Point Precinct 7 - Stage 4	LOCATION: Arran Point, Millwater	JOB No.: 21854.0037/s3
CO-ORDINATES: 5948902.37 mN (NZTM2000) 1749914.11 mE	DRILL TYPE: 50MM HAND AUGER	HOLE STARTED: 08/08/2018
		HOLE FINISHED: 08/08/2018
R.L.: 26.20m	DRILL METHOD: HA	DRILLED BY: GEOTECHNICS
DATUM: NZVD2016	DRILL FLUID:	LOGGED BY: AGRA CHECKED: AGRA

GEOLOGICAL																ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
Fill						● 176/87 kPa ● >224 kPa ● >224 kPa ● 221/80 kPa ● UTP ● 202/135 kPa ● 167/96 kPa ● 154/70 kPa ● 109/38 kPa ● 112/48 kPa		26 25 24 23	0.5 1.0 1.5 2.0 2.5 3.0 3.5	TS	M D-M M	VSt VSt-H VSt				SILT non plastic, moist, dark brown clayey SILT, and SILT, non plastic, moist to dry, yellowish brown, white, orange and grey; minor gravel clayey SILT, low to no plasticity, moist, white and orange SILT, some clay, trace sand, non plastic, moist, white mottled orange 3.1m: Target depth

COMMENTS:

Hole Depth 3.1m

Scale 1:20

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **HA4-10**

SHEET: 1 OF 1

PROJECT: Arran Point Precinct 7 - Stage 4	LOCATION: Arran Point, Millwater	JOB No.: 21854.0037/s3
CO-ORDINATES: 5948837.58 mN (NZTM2000) 1749933.41 mE	DRILL TYPE: 50MM HAND AUGER	HOLE STARTED: 08/08/2018
	DRILL METHOD: HA	HOLE FINISHED: 08/08/2018
R.L.: 16.00m		DRILLED BY: GEOTECHNICS
DATUM: NZVD2016	DRILL FLUID:	LOGGED BY: AGRA CHECKED: AGRA

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	TESTS	RL (m)	DEPTH (m)	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	Description and Additional Observations
				M	VSt-H	SILT, non plastic, moist, dark brown
	>224 kPa		0.5	D-M	H	sandy SILT, and SILT, non plastic, dry to moist, yellowish brown
	>224 kPa				VSt-H	gravelly SAND, non plastic, dry to moist, grey
Fill	173/125 kPa	15	1.0	M	St-VSt	SILT, some clay, non plastic, moist, brown mottled yellowish brown, trace grey gravel inclusions
	167/35 kPa					
	80/19 kPa		1.5			
	74/16 kPa					
Residual Soil	154/35 kPa	14	2.0		VSt	SILT, some sand, non plastic, moist, grey
			2.5			2.3m: Refusal
		13	3.0			
			3.5			

COMMENTS:

Hole Depth 2.3m

Scale 1:20

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **HA4-11**

SHEET: 1 OF 1

PROJECT: Arran Point Precinct 7 - Stage 4	LOCATION: Arran Point, Millwater	JOB No.: 21854.0037/s3
CO-ORDINATES: (NZTM2000) 5948875.07 mN 1749946.16 mE	DRILL TYPE: 50MM HAND AUGER	HOLE STARTED: 08/08/2018
	DRILL METHOD: HA	HOLE FINISHED: 08/08/2018
R.L.: 22.20m		DRILLED BY: GEOTECHNICS
DATUM: NZVD2016	DRILL FLUID:	LOGGED BY: RBE CHECKED: AGRA

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	TESTS	RL (m)	DEPTH (m)	Description and Additional Observations
Topsoil				clayey SILT, medium plasticity, moist, yellowish brown and brown
Fill	● 176/96 kPa ● >224 kPa ● >224 kPa	22	0.5 1.0	clayey SILT, low plasticity, moist, yellowish brown *0.80m:* grey inclusions
Residual Soil	● 150/77 kPa ● 122/61 kPa ● 99/49 kPa ● 99/49 kPa ● 74/38 kPa ● 77/32 kPa ● 90/33 kPa	21 20 19	1.5 2.0 2.5 3.0 3.5	clayey SILT, medium plasticity, moist, yellowish brown mottled light greyish white SILT, some clay, low plasticity, moist, light greyish white mottled yellowish brown 3.1m: Target depth

WATER | CORE RECOVERY (%) | METHOD | CASING | SAMPLES | GRAPHIC LOG | MOISTURE CONDITION / WEATHERING | STRENGTH/DENSITY CLASSIFICATION | SHEAR STRENGTH (kPa) | COMPRESSIVE STRENGTH (MPa) | DEFECT SPACING (cm)

MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION
M	VSt
	VSt-H
	St-VSt

COMMENTS:

Hole Depth 3.1m

Scale 1:20

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **HA4-12**

SHEET: 1 OF 1

PROJECT: Arran Point Precinct 7 - Stage 4	LOCATION: Arran Point, Millwater	JOB No.: 21854.0037/s3
CO-ORDINATES: 5948865.61 mN (NZTM2000) 1749994.24 mE	DRILL TYPE: 50MM HAND AUGER	HOLE STARTED: 08/08/2018
	DRILL METHOD: HA	HOLE FINISHED: 08/08/2018
R.L.: 14.00m		DRILLED BY: GEOTECHNICS
DATUM: NZVD2016	DRILL FLUID:	LOGGED BY: RBE CHECKED: AGRA

GEOLOGICAL																ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%) 25 50 75	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 60 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (cm) 20 60 200 600 2000	Description and Additional Observations
Fill						81/45 kPa			0.5	TS	W	St				clayey SILT, medium plasticity, wet, dark brown
											M					clayey SILT, low plasticity, moist, yellowish brown, minor grey inclusions
Residual Soil						86/39 kPa										clayey SILT, medium to low plasticity, moist, yellowish brown mottled light grey and orange brown
						147/42 kPa						VSt				SILT, some clay, low plasticity, moist, orange brown and light greyish white
								13	1.0			VSt-H				SILT, non plastic, moist, reddish brown mottled light greyish white
						224/67 kPa										
						221/45 kPa			1.5							
						160/51 kPa										*1.80m:* light greyish white mottled rusty brown
								12	2.0							
						>224 kPa										*2.10m:* light greyish white mottled yellowish brown
																2.35m: band of rusty oxides
						96/29 kPa						St-VSt				SILT some clay, low plasticity, moist, orange brown, pink and light brownish white
									2.5							
						144/38 kPa										
						198/48 kPa		11	3.0			VSt				SILT, non plastic, moist, orange brown
																3.2m: Target depth
									3.5							

COMMENTS:

Hole Depth 3.2m

Scale 1:20

Rev.: A

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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.
S14-022	-	-	-	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**	
							-	-	-	-	-								
S14-026	-	-	-	Bulk Earthworks	YA	3/10/2014	-	-	-	-	-	140	150	150	160	**150**		**P**	
							-	-	-	-	-								
S14-117/3	-	-	-	Bulk Earthworks	YA	27/11/2014	-	-	-	-	-	120	137	144	171	**143**		**P**	
							-	-	-	-	-								
S14-138/2	2660325.847	6510539.432	10.922	Shear Key	HA	4/12/2014	-	-	-	-	-	111	120	103	140	**119**	**Y**	**F**	See URN S14-141 for retest
							-	-	-	-	-								
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
							-	-	-	-	-								
S14-142/2	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**								
S14-145/1	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**								
S14-148/1	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**								
S14-156	-	-	-	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**	
							-	-	-	-	-								
S14-163/1	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**								
S14-169/1	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**								
S14-174/1	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**								
S14-178/1	2660353.361	6510543.091	15.995	Shear Key	HA	11/12/2014	1.82	**1.31**	**38.9**	2.7	**0.5**	120	111	111	154	**124**		**P**	Material not meeting spec but as it is Lime

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

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

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

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.
~~S14-176/1~~	~~2660333.301~~	~~6510543.091~~	~~19.993~~	~~Shear Key~~	~~HA~~	~~11/12/2014~~	1.82	**1.31**	**38.9**	2.7	**0.3**	~~126~~	~~111~~	~~111~~	~~134~~	~~124~~		~~F~~	~~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.~~
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**	
							-	-	**-**	-	-								
S14-185	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									
S14-200/1	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	**158**		**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**								
S14-214/2	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**	**Y**	**F**	See URN S14-218/1 for retest
							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**	**Y**	**P**	Retest of URN S14-216/2
							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**								
S14-228/2	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**								
S14-232/1	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**		**P**	
							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**								

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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 These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
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	**2.5**								
S14-248/4	2660332.091	6510612.046	24.006	Shear Key	HA	13/01/2015	1.83	**1.32**	**38.2**	2.7	**0.5**	154	137	120	188	**150**		**P**	
							1.83	**1.32**	**38.2**	2.7	**0.5**								
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	**2.5**	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**	**Y**	**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**	**Y**	**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**	See URN S14-262 for retest
							1.79	**1.32**	**35.3**	2.7	**4.5**								
S14-259/2	2660342.298	6510598.537	25.004	Bulk Earthworks	HA	14/01/2015	-	-	**-**	-	-	77	86	120	68	**88**	**Y**	**F**	
							-	-	**-**	-	-								
S14-259/3	2660327.485	6510611.582	23.489	Bulk Earthworks	HA	14/01/2015	1.77	**1.21**	**45.9**	2.7	**0.0**	120	154	120	103	**124**	**Y**	**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**	**Y**	**P**	Retest of URN S14-256 and URN S14-259
							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**	**Y**	**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**								
S14-269/1	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**	

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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.
~~S14-269/1~~	~~2660358.397~~	~~6510591.13~~	~~23.017~~	~~Bulk Earthworks~~	~~HA~~	~~16/01/2015~~	1.78	**1.37**	**29.7**	2.7	**8.7**	~~126~~	~~137~~	~~154~~	~~188~~	~~156~~		P	
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**	**Y**	**F**	See URN S14-292 for retest
							-	-	**-**	-	-								
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**	Retest of URN S14-282/1
							1.76	**1.30**	**35.3**	2.7	**6.1**								
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	**2.5**	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**								
S14-312/2	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**								
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**								
S14-328/1	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**								
S14-329/1	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**	

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

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

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

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

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~~S14-332/2~~				~~Shear Key~~	~~HA~~	~~28/01/2015~~	1.83	**1.38**	**32.8**	2.7	**3.9**	~~188~~	~~205~~	~~205~~	~~205~~	**~~201~~**		~~P~~	
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	1.88	**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**								
S14-355/1				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**	**Y**	**F**	Failed SV. Material too wet. See URN S14-376 for retest.
							-	-	**-**	-	-								
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~~	

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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/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.
~~S14-375/2~~				~~Shear Key~~	~~HA~~	~~9/02/2015~~	1.86	**1.42**	**31.4**	2.7	**3.0**	~~188~~	~~154~~	~~205~~	~~205~~	~~188~~		~~P~~	
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**	Y	F	To rework and retest area. See URN S14-397/1 for retest
							-	-	**-**	-	-								
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**	Y	F	To rework and retest area. See URN S14-407 for retest
							-	-	**-**	-	-								
S14-390/2				Bulk Earthworks	HA	11/02/2015	-	-	**-**	-	-	103	103	120	154	**120**	Y	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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NZS 4407:1991 Field water content and field dry density using a nuclear densometer **Checked By:**

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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**								
S14-402				Trench fill behind Wall 1	HA	12/02/2015	-	-	**-**	-	-	154	170	190	205	**180**		**P**	
							-	-	**-**	-	-								
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**	

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

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

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

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.
~~S14-437/3~~				~~Bulk Earthworks~~	~~HA~~	~~18/02/2015~~	1.76	**1.21**	**45.7**	2.7	**0.3**	~~205~~	~~186~~	~~154~~	~~137~~	~~183~~		~~P~~	
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**								
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	**1.35**	**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**	
							-	-	**-**	-	-								
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**								

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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.
S14-511/2	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**								
S14-516/1	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**	**Y**	**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**	**Y**	**F**	Large area of failed material. To rework and retest area. See URN S14-581 for retest.
							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**	**Y**	**F**	
							1.72	**1.32**	**29.9**	2.7	**11.3**								
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**								
S14-530/2	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**								
S14-531/2	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**								
S14-538/1	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**								
S14-547/1	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**								
S14-554/1	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**								

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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.
S14-569/1	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**								
S14-581/2	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 S14-516
							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**								
S14-602/1	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**								
S14-610/1	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**								
S14-628/1				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**								
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**	
							1.91	**1.49**	**27.9**	2.7	**2.9**								Lime stabilized. Poor SV result expected to increase as Lime stabilizes.
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**	
							-	-	-	-	-								
S14-672/1				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**								
S14-679/1				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**	

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

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

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

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.
~~S14-684~~				~~Slipped 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**	
S14-692/1				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**	
S14-700/1				Bulkfill	HA	7/04/2015	2.12 2.04	**1.55** **1.49**	**37.2** **37.2**	2.7 2.7	**0.0** **0.0**	128	137	154	145	**141**		**P**	
S14-700/2				Bulkfill	HA	7/04/2015	1.88 1.85	**1.43** **1.41**	**30.8** **30.8**	2.7 2.7	**2.8** **4.1**	205	205	171	145	**182**		**P**	
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 1.85	**1.38** **1.38**	**33.9** **33.9**	2.7 2.7	**2.2** **1.8**	171	171	154	137	**158**		**P**	
S14-712/2				Bulkfill	HA	8/04/2015	1.82 1.82	**1.26** **1.26**	**44.8** **44.8**	2.7 2.7	**0.0** **0.0**	205	120	137	154	**154**		**P**	
S14-715/1				Bulkfill	HA	9/04/2015	1.79 1.79	**1.25** **1.25**	**43.0** **43.0**	2.7 2.7	**0.0** **0.0**	120	154	137	120	**133**		**P**	
S14-715/2				Bulkfill	HA	9/04/2015	1.78 1.78	**1.24** **1.24**	**43.9** **43.9**	2.7 2.7	**0.0** **0.0**	120	154	188	128	**148**		**P**	
S14-719/1				R.E Wall 3	HA	9/04/2015	1.84 1.84	**1.39** **1.39**	**32.2** **32.2**	2.7 2.7	**3.7** **3.4**	145	145	171	188	**162**		**P**	
S14-719/2				R.E Wall 3	HA	9/04/2015	1.77 1.77	**1.32** **1.32**	**33.9** **33.9**	2.7 2.7	**6.5** **6.4**	162	171	188	145	**167**		**P**	
S14-723/1				Shear Key	HA	10/04/2015	1.86 1.85	**1.46** **1.46**	**26.9** **26.9**	2.7 2.7	**6.5** **6.6**	205	188	180	205	**195**		**P**	
S14-723/2				Shear Key	HA	10/04/2015	1.79 1.79	**1.23** **1.23**	**45.3** **45.3**	2.7 2.7	**0.0** **0.0**	154	205	154	205	**180**		**P**	
S14-727				Shear Key	HA	10/04/2015	- -	- -	- -	- -	- -	145	205	145	205	**175**		**P**	
S15-095/1	2660310.217	6510545.523	20.307	Re Wall Re Wall	TAJ	19/11/2015	1.77 1.77	**1.31** **1.30**	**35.7** **35.7**	2.7 2.7	**5.0** **5.2**	196	196	196	196	**196**		**P**	
S15-095/2	2660334.012	6510540.809	20.866	Re Wall Re Wall	TAJ	19/11/2015	1.86 1.87	**1.42** **1.42**	**31.4** **31.4**	2.7 2.7	**3.1** **2.7**	196	196	196	196	**196**		**P**	
S15-095/3	2660382.812	6510547.53	20.57	Re Wall Re Wall	TAJ	19/11/2015	1.83 1.82	**1.41** **1.40**	**29.8** **29.8**	2.7 2.7	**5.8** **6.3**	196	196	196	196	**196**		**P**	
S15-095/4	2660404.276	6510552.344	20.559	Re Wall Re Wall	TAJ	19/11/2015	1.87 1.89	**1.43** **1.44**	**30.8** **30.8**	2.7 2.7	**2.9** **2.1**	196	196	196	196	**196**		**P**	
S15-105/8	2660263.589	6510556.273	21.209	Re Wall	TAJ	3/12/2015	1.84 1.84	**1.38** **1.38**	**33.2** **33.2**	2.7 2.7	**2.9** **3.1**	196	196	196	196	**196**		**P**	
S15-105/9	2660287.151	6510549.486	21.322	Re Wall	TAJ	3/12/2015	1.82 1.82	**1.36** **1.36**	**33.5** **33.5**	2.7 2.7	**4.1** **3.9**	196	196	196	196	**196**		**P**	
S15-105/10	2660321.148	6510551.684	21.479	Re Wall	TAJ	3/12/2015	1.85 1.85	**1.42** **1.42**	**30.1** **30.1**	2.7 2.7	**4.6** **4.5**	196	196	196	196	**196**		**P**	
S15-105/11	2660348.383	6510542.394	21.479	Re Wall	TAJ	3/12/2015	1.82 1.83	**1.39** **1.40**	**30.8** **30.8**	2.7 2.7	**5.6** **5.3**	196	196	196	196	**196**		**P**	
S15-105/12	2660371.886	6510548.944	21.293	Re Wall	TAJ	3/12/2015	1.82 1.81	**1.36** **1.36**	**33.4** **33.4**	2.7 2.7	**4.1** **4.3**	196	196	196	196	**196**		**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/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 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**	These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
							1.82	**1.35**	**34.7**	2.7	**3.1**								
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 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**								
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**	
							1.81	**1.31**	**38.2**	2.7	**1.7**								
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	6510625.065	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 081/11				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	**1.35**	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**	

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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 084/11~~				~~P7 Above re Wall~~	~~TA~~	~~6/05/2016~~	1.86	**1.38**	34.7	2.7	**1.1**	~~192~~	~~192~~	~~192~~	~~192~~	~~192~~		P	
S16 084/12				P7 Above re Wall	TA	6/05/2016	1.90	**1.45**	31.2	2.7	**1.3**	192	192	192	192	**192**		P	
							1.91	**1.45**	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 085/6	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	**4.5**								
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 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**								
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	
							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	17/06/2016	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	17/06/2016	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**								

Comments
These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.

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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 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**	These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
							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**								

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Job: Silverdale Arran's Point
Client: Tonkin & Taylor
T&T Job #: 21854.0370
Job # 21854.037
Entered By: TA/CBEN/CMO
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 These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S16 174-5	2660522.155	6510552.82	3.36	Shear Key 1D	TA	28/11/2016	1.83	1.35	35.9	2.7	**1.6**	214	214	214	171	**203**		P	
							1.81	1.33	35.9	2.7	**2.7**								
S16 183-1				Shear Key 1D	TA	10/12/2016	1.83	1.38	32.7	2.7	**3.6**	183	148	168	214	**178**		P	
							1.84	1.39	32.7	2.7	**3.3**								
S16 183-2				Shear Key 1D	TA	10/12/2016	1.86	1.42	30.8	2.7	**3.7**	141	141	214	176	**168**		P	
							1.88	1.43	30.8	2.7	**2.7**								
S16 187-7				Shear Key 1D	TA	15/12/2016	1.84	1.41	31.1	2.7	**4.2**	153	160	168	168	**162**		P	
							1.84	1.40	31.1	2.7	**4.6**								
S16 187-8				Shear Key 1D	TA	15/12/2016	1.82	1.34	36.0	2.7	**2.3**	168	214	160	214	**189**		P	
							1.81	1.33	36.0	2.7	**2.6**								
S16 187-9				Shear Key 1D	TA	15/12/2016	1.86	1.37	35.5	2.7	**0.5**	168	199	199	199	**191**		P	
							1.88	1.39	35.5	2.7	**0.0**								
S16 187-10				Pond Undercut	TA	15/12/2016	1.85	1.35	37.2	2.7	**0.1**	168	199	214	214	**199**		P	
							1.85	1.35	37.2	2.7	**0.0**								
S16 187-11				Pond Undercut	TA	15/12/2016	1.90	1.46	29.7	2.7	**2.5**	214	214	214	214	**214**		P	
							1.89	1.45	29.7	2.7	**3.0**								
S16 187-12				Pond Undercut	TA	15/12/2016	1.83	1.38	32.8	2.7	**3.7**	214	214	214	214	**214**		P	
							1.83	1.38	32.8	2.7	**3.8**								
S16 188-4	2660502.331	6510546.12	3.475	Shear Key 1D	TA	16/12/2016	1.89	1.40	34.6	2.7	**0.0**	105	120	120	140	**121**		P	
							1.88	1.40	34.6	2.7	**0.0**								
S16 188-5	2660492.072	6510537.654	3.258	Shear Key 1D	TA	16/12/2016	1.85	1.36	35.5	2.7	**1.2**	110	130	140	135	**129**		P	
							1.84	1.36	35.5	2.7	**1.3**								
S16 190-1				Shear Key 1D	TA	18/12/2016	1.82	1.35	34.8	2.7	**3.1**	153	199	199	214	**191**		P	
							1.81	1.34	34.8	2.7	**3.6**								
S16 190-2				Shear Key 1D	TA	18/12/2016	1.83	1.36	34.4	2.7	**2.6**	214	214	214	214	**214**		P	
							1.84	1.37	34.4	2.7	**1.9**								
S16 192-4				Shear Key 1D	TA	20/12/2016	1.87	1.43	30.5	2.7	**3.2**	214	183	199	191	**197**		P	
							1.86	1.43	30.5	2.7	**3.6**								
S16 192-7	2660481.592	6510531.157	6.042	Shear Key 1D	TA	20/12/2016	1.80	1.31	37.6	2.7	**2.5**	153	176	176	183	**172**		P	
							1.80	1.31	37.6	2.7	**2.4**								
S16 192-11	2660393.09	6510508.495	12.537	Shear Key 1D	TA	20/12/2016	1.88	1.44	30.8	2.7	**2.5**	168	168	183	214	**183**		P	
							1.85	1.41	30.8	2.7	**4.3**								
S16 193-1	2660506.909	6510551.201	6.143	Shear Key 1D	TA	21/12/2016	1.82	1.37	32.9	2.7	**4.2**	183	199	153	214	**187**		P	
							1.83	1.37	32.9	2.7	**3.9**								
S16 193-3	2660390.338	6510497.652	14.562	Shear Key 1D	TA	21/12/2016	1.84	1.34	36.90	2.70	**0.7**	214	183	183	199	**195**		P	
							1.83	1.34	36.90	2.70	**1.1**								
S16 193-4	2660404.771	6510509.631	13.325	Shear Key 1D	TA	21/12/2016	1.85	1.35	37.30	2.70	**0.0**	214	214	183	199	**203**		P	
							1.85	1.35	37.30	2.70	**0.0**								
S16 193-8	2660514.479	6510549.981	7.282	Shear Key 1D	TA	21/12/2016	1.86	1.41	32.10	2.70	**2.7**	137	153	176	214	**170**		P	
							1.85	1.40	32.10	2.70	**3.0**								
S16 193-9	2660488.361	6510534.165	7.737	Shear Key 1D	TA	21/12/2016	1.78	1.34	32.7	2.7	**6.6**	214	214	214	214	**214**		P	
							1.77	1.34	32.7	2.7	**6.9**								
S16 194-9	2660484.218	6510538.214	7.248	Shear Key 1D	TA	22/12/2016	1.85	1.40	32.2	2.7	**3.1**	168	183	214	214	**195**		P	
							1.85	1.40	32.2	2.7	**3.3**								
S16 195-1				Shear Key 1D	TA	28/12/2016	1.91	1.49	27.8	2.7	**3.2**	199	183	214	168	**191**		P	
							1.93	1.51	27.8	2.7	**2.0**								
S16 195-2				Shear Key 1D	TA	28/12/2016	1.92	1.52	26.6	2.7	**3.6**	153	160	183	183	**170**		P	
							1.92	1.51	26.6	2.7	**3.6**								
S16 196-1				Shear Key 1D	TA	29/12/2016	1.84	1.39	32.8	2.7	**3.2**	141	168	153	153	**154**		P	
							1.83	1.38	32.8	2.7	**3.8**								
S16 196-2				Shear Key 1D	TA	29/12/2016	1.85	1.39	32.7	2.7	**2.8**	153	153	141	141	**147**		P	
							1.85	1.39	32.7	2.7	**2.8**								

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Job: Silverdale Arran's Point Client: Tonkin & Taylor Job # 21854.037

T&T Job #: 21854.0370 Entered By: TA/CBEN/CMO

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 These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S16 196-3				Shear Key 1D	TA	29/12/2016	1.81	1.34	35.6	2.7	**2.9**	153	168	168	168	**164**		P	
							1.80	1.33	35.6	2.7	**3.3**								
S16 196-4				Shear Key 1D	TA	29/12/2016	1.82	1.34	35.5	2.7	**2.7**	141	153	160	160	**154**		P	
							1.81	1.34	35.5	2.7	**2.8**								
S16 197-1				Shear Key 1D	TA	30/12/2016	1.84	1.37	34.5	2.7	**2.3**	153	199	153	160	**166**		P	
							1.85	1.38	34.5	2.7	**1.6**								
S16 197-2				Shear Key 1D	TA	30/12/2016	1.83	1.35	35.8	2.7	**1.6**	168	183	171	153	**169**		P	
							1.84	1.35	35.8	2.7	**1.4**								
S16 197-3				Shear Key 1D	TA	30/12/2016	1.81	1.34	34.70	2.7	**3.8**	153	130	199	168	**163**		P	
							1.84	1.37	34.70	2.7	**1.8**								
S16 197-4				Shear Key 1D	TA	30/12/2016	1.84	1.37	34.1	2.7	**2.5**	168	168	176	153	**166**		P	
							1.82	1.36	34.1	2.7	**3.5**								
S17 001-6				Shear Key 1D	TA	4/01/2017	1.83	1.36	34.7	2.7	**2.4**	153	199	214	199	**191**		P	
							1.83	1.36	34.7	2.7	**2.7**								
S17 001-7				Shear Key 1D	TA	4/01/2017	1.87	1.39	34.4	2.7	**0.4**	214	214	214	214	**214**		P	
							1.88	1.40	34.4	2.7	**0.1**								
S17 001-8				Shear Key 1D	TA	4/01/2017	1.83	1.42	28.9	2.7	**6.2**	214	214	214	214	**214**		P	
							1.84	1.43	28.9	2.7	**6.0**								
S17 001-11				Shear Key 1D	TA	4/01/2017	1.79	1.19	50.8	2.7	**0.0**	199	199	214	214	**207**		P	
							1.80	1.20	50.8	2.7	**0.0**								
S17 001-12				Shear Key 1D	TA	4/01/2017	1.79	1.34	33.9	2.7	**4.9**	214	214	214	199	**210**		P	
							1.80	1.34	33.9	2.7	**4.8**								
S17 001-13				Shear Key 1D	TA	4/01/2017	1.81	1.36	32.8	2.7	**4.9**	214	214	214	214	**214**		P	
							1.81	1.36	32.8	2.7	**4.8**								
S17 002-5				Shear Key 1D	TA	5/01/2017	1.86	1.40	32.9	2.7	**2.3**					**#DIV/0!**		P	
							1.85	1.39	32.9	2.7	**2.6**								
S17 002-6				Shear Key 1D	TA	5/01/2017	1.75	1.27	37.8	2.7	**5.2**					**#DIV/0!**		P	
							1.75	1.27	37.8	2.7	**5.1**								
S17 002-7				Shear Key 1D	TA	5/01/2017	1.80	1.35	33.8	2.7	**4.5**					**#DIV/0!**		P	
							1.82	1.36	33.8	2.7	**3.7**								
S17 002-8				Shear Key 1D	TA	5/01/2017	1.80	1.40	28.2	2.7	**8.4**					**#DIV/0!**		F	
							1.80	1.41	28.2	2.7	**8.3**								
S17 002-12				Shear Key 1D	TA	5/01/2017	1.79	1.33	34.1	2.7	**5.1**					**#DIV/0!**	Y	P	
							1.79	1.33	34.1	2.7	**5.1**								
S17 002-13				Shear Key 1D	TA	5/01/2017	1.82	1.35	34.60	2.7	**3.1**					**#DIV/0!**		P	
							1.82	1.35	34.60	2.7	**3.2**								

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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 These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S17 003-4				Shear Key 1D	TA	6/01/2017	1.85	1.40	32.3	2.7	**3.1**	141	214	186	186	**182**		P	
							1.86	1.40	32.3	2.7	**2.7**								
S17 003-5				Pond Fill	TA	6/01/2017	1.87	1.42	32.0	2.7	**2.1**	153	153	168	214	**172**		P	
							1.87	1.42	32.0	2.7	**2.3**								
S17 003-6				Pond Fill	TA	6/01/2017	1.79	1.34	33.7	2.7	**5.4**	137	153	168	199	**164**		P	
							1.79	1.34	33.7	2.7	**5.6**								
S17 003-11				Shear Key 1D	TA	6/01/2017	1.85	1.37	35.0	2.7	**1.1**	153	168	168	214	**176**		P	
							1.85	1.37	35.0	2.7	**1.1**								
S17 003-12				Shear Key 1D	TA	6/01/2017	1.77	1.32	34.1	2.7	**6.3**	186	214	214	214	**207**		P	
							1.77	1.32	34.1	2.7	**6.2**								
S17 004-1				Shear Key 1D	TA	9/01/2017	1.76	1.33	32.4	2.7	**7.9**	214	214	214	214	**214**		P	
							1.76	1.33	32.4	2.7	**7.7**								
S17 004-2				Shear Key 1D	TA	9/01/2017	1.79	1.35	32.6	2.7	**6.1**	214	214	214	214	**214**		P	
							1.79	1.35	32.6	2.7	**5.8**								
S17 004-3				Pond Fill Opposite Paige Rd	TA	9/01/2017	1.77	1.35	30.9	2.7	**8.1**	214	214	168	168	**191**		P	
							1.78	1.36	30.9	2.7	**7.6**								
S17 004-4				Pond Fill Opposite Paige Rd	TA	9/01/2017	1.80	1.38	30.4	2.7	**7.0**	186	186	153	141	**167**		P	
							1.79	1.37	30.4	2.7	**7.6**								
S17 004-5				Pond Fill Opposite Paige Rd	TA	9/01/2017	1.87	1.42	31.5	2.7	**2.6**	214	214	214	199	**210**		P	
							1.87	1.42	31.5	2.7	**2.8**								
S17 004-6				Pond Fill Opposite Paige Rd	TA	9/01/2017	1.88	1.44	30.5	2.7	**2.7**	214	214	214	199	**210**		P	
							1.86	1.42	30.5	2.7	**3.8**								
S17 004-11				Shear Key 1D	TA	9/01/2017	1.88	1.43	31.1	2.7	**2.3**	214	214	214	214	**214**		P	
							1.88	1.43	31.1	2.7	**2.3**								
S17 004-12				Shear Key 1D	TA	9/01/2017	1.83	1.39	31.4	2.7	**4.7**	214	214	214	214	**214**		P	
							1.83	1.39	31.4	2.7	**4.7**								
S17 005-9				Shear Key 1D	PO	10/01/2017	1.81	1.33	35.4	2.7	**3.4**	214	214	206	206	**210**		P	
							1.82	1.34	35.4	2.7	**2.7**								
S17 005-10				Shear Key 1D	PO	10/01/2017	1.81	1.33	36.0	2.7	**2.6**	141	153	214	214	**181**		P	
							1.80	1.32	36.0	2.7	**3.5**								
S17 005-11				Shear Key 1D	PO	10/01/2017	1.73	1.21	43.0	2.7	**3.2**	186	214	214	214	**207**		P	
							1.73	1.21	43.0	2.7	**3.0**								
S17 006-1				Shear Key 1D	PO	11/01/2017	1.82	1.37	33.0	2.7	**3.9**	199	214	214	186	**203**		P	
							1.82	1.37	33.0	2.7	**4.1**								
S17 007-1	2660431.359	6510508.901	10.388	Shear Key 1D	PO	12/01/2017	1.94	1.51	28.5	2.7	**1.0**	214	214	214	214	**214**		P	
							1.94	1.51	28.5	2.7	**1.0**								
S17 007-10				Shear Key 1E	PO	12/01/2017	1.90	1.45	31.2	2.7	**1.3**	153	186	214	199	**188**		S	
							1.90	1.45	31.2	2.7	**1.4**								
S17 008-1				Shear Key 1E	PO	13/01/2017	1.84	1.44	27.8	2.7	**6.7**	168	168	186	214	**184**		P	
							1.84	1.44	27.8	2.7	**6.5**								
S17 008-2				Shear Key 1E	PO	13/01/2017	1.87	1.44	29.6	2.7	**3.7**	168	214	214	214	**203**		P	
							1.88	1.45	29.6	2.7	**3.6**								
S17 008-11				Shear Key 1E	PO	13/01/2017	1.83	1.39	32.4	2.7	**3.8**	199	214	214	214	**210**		P	
							1.84	1.39	32.4	2.7	**3.6**								
S17 008-12				Shear Key 1E	PO	13/01/2017	1.86	1.37	35.8	2.7	**0.2**	186	199	214	214	**203**		P	
							1.86	1.37	35.8	2.7	**0.5**								
S17 009-8	2660363.434	6510498.325	9.658	Shear Key 1E	PO	16/01/2017	1.82	1.39	30.9	2.7	**5.7**	168	199	214	214	**199**		P	
							1.82	1.39	30.9	2.7	**5.6**								
S17 009-10	2660381.33	6510497.172	11.153	Shear Key 1E	PO	16/01/2017	1.90	1.49	27.4	2.7	**3.8**	214	214	214	214	**214**		P	
							1.89	1.48	27.4	2.7	**4.6**								
S17 010-2	2660382.178	6510494.446	11.439	Shear Key 1E	PO	17/01/2017	1.88	1.41	33.1	2.7	**0.8**	186	186	214	214	**200**		P	
							1.88	1.41	33.1	2.7	**1.0**								

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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 These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S17 010-3	2660361.248	6510488.887	10.994	Shear Key 1E	PO	17/01/2017	1.91	1.46	30.9	2.7	**0.9**	199	214	214	214	**210**		P	
							1.90	1.45	30.9	2.7	**1.5**								
S17 010-9	2660487.847	6510594.982	16.014	RE 2	PO	17/01/2017	1.76	1.22	44.1	2.7	**1.1**	130	141	214	214	**175**		P	
							1.77	1.23	44.1	2.7	**0.2**								
S17 010-10	2660481.245	6510587.65	16.152	RE 2	PO	17/01/2017	1.91	1.51	26.8	2.7	**3.9**	214	214	214	214	**214**		P	
							1.90	1.50	26.8	2.7	**4.5**								
S17 011-1	2660362.228	6510508.09	10.69	Shear Key 1E	TA	18/01/2017	1.87	1.45	28.5	2.7	**4.7**	186	199	214	214	**203**		P	
							1.87	1.45	28.5	2.7	**4.7**								
S17 029-1	2660385.519	6510543.652	16.97	NE of Shear Key 1E	CBEN	15/02/2017	1.90	1.38	37.3	2.7	**0.0**	176	183	168	191	**180**		P	
							1.87	1.36	37.3	2.7	**0.0**								
S17 029-2	2660399.288	6510554.951	17.09	NE of Shear Key 1E	CBEN	15/02/2017	1.86	1.37	36.2	2.7	**0.0**	160	168	214	214	**189**		P	
							1.88	1.38	36.2	2.7	**0.0**								
S17 030-6				NE of Shear Key 1E	CBEN	21/02/2017	1.86	1.39	33.7	2.7	**1.6**	214	214	183	168	**195**		P	
							1.85	1.38	33.7	2.7	**2.3**								
S17 030-7				NE of Shear Key 1E	CBEN	21/02/2017	1.85	1.39	33.2	2.7	**2.2**	214	214	214	214	**214**		P	
							1.86	1.40	33.2	2.7	**1.8**								
S17 031-1	2660393.205	6510559.404	21.25	NE of Shear Key 1E	CBEN	22/02/2017	1.85	1.38	33.6	2.7	**2.2**	191	183	214	214	**201**		P	
							1.86	1.39	33.6	2.7	**1.7**								
S17 031-2	2660382.561	6510558.314	21.198	NE of Shear Key 1E	CBEN	22/02/2017	1.85	1.39	32.9	2.7	**2.5**	168	171	191	214	**186**		P	
							1.86	1.40	32.9	2.7	**2.2**								
S17 034-1				Shear Key 1E	CBEN	25/02/2017	1.79	1.35	32.4	2.7	**5.9**	189	214	171	214	**197**		P	
							1.82	1.37	32.4	2.7	**4.7**								
S17 034-2				Shear Key 1E	CBEN	25/02/2017	1.81	1.30	39.5	2.7	**0.6**	202	214	214	214	**211**		P	
							1.80	1.29	39.5	2.7	**1.0**								
S17 034-3				Shear Key 1E	CBEN	25/02/2017	1.83	1.35	35.3	2.7	**2.3**	214	214	214	214	**214**		P	
							1.82	1.34	35.3	2.7	**2.8**								
S17 036-1				Fill E of Hole Above Shear Key 1E	CBEN	28/02/2017	1.92	1.51	27.5	2.7	**2.7**	214	214	214	214	**214**		P	
							1.94	1.52	27.5	2.7	**2.0**								
S17 036-2	2660347.806	6510538.04	14.433	Fill E of Hole Above Shear Key 1E	CBEN	28/02/2017	1.81	1.34	34.5	2.7	**3.8**	214	214	214	214	**214**		P	
							1.81	1.34	34.5	2.7	**4.0**								
S17 037-8	2660372.118	6510540.868	17.822	Fill E of Hole Above Shear Key 1E	CBEN	1/03/2017	1.84	1.38	33.8	2.7	**2.4**	168	214	191	153	**182**		P	
							1.84	1.38	33.8	2.7	**2.4**								
S17 037-9	2660363.619	6510540.24	17.725	Fill E of Hole Above Shear Key 1E	CBEN	1/03/2017	1.83	1.35	35.6	2.7	**1.9**	214	214	183	183	**199**		P	
							1.83	1.35	35.6	2.7	**1.9**								
S17 037-12	2660358.132	6510547.194	18.515	Fill E of Hole Above Shear Key 1E	CBEN	1/03/2017	1.95	1.59	22.5	2.7	**5.2**	214	214	214	214	**214**		P	
							1.96	1.60	22.5	2.7	**4.8**								

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												Test 1	Test 2	Test 3	Test 4				
S17 037-13	2660356.331	6510538.998	17.442	Fill E of Hole Above Shear Key 1E	CBEN	1/03/2017	1.87	1.45	29.0	2.7	**4.3**	214	214	214	214	**214**		P	
							1.87	1.45	29.0	2.7	**4.4**								
S17 039-6				Shear Key 1E	CBEN	3/03/2017	1.86	1.39	34.0	2.7	**1.5**	153	214	214	199	**195**		P	
							1.85	1.38	34.0	2.7	**1.7**								
S17 042-1	2660381.21	6510497.98	12.687	Shear Key 1E	CBEN	7/03/2017	1.85	1.40	32.1	2.7	**3.0**	214	214	214	214	**214**		P	
							1.86	1.41	32.1	2.7	**2.7**								
S17 046-6				Shear Key 1E	CBEN	15/03/2017						98	149	109	118	**119**	Y	F	Test 6 is a retest for test 4, further failure lead to removal of material.
S17 059 -1				Shear Key 1E	CMO	31/03/2017	1.84	1.40	31.5	2.7	**4.1**	183	168	176	199	**182**		P	
							1.85	1.41	31.1	2.7	**3.8**								
S17 067-4				Shear Key 1E - Trench Backfill	TA	20/04/2017	1.79	1.36	31.8	2.7	**6.6**	183	214	191	183	**193**		P	
							1.79	1.36	31.8	2.7	**6.7**								
S17 067-5				Shear Key 1E - Trench Backfill	TA	20/04/2017	1.84	1.38	33.2	2.7	**3.0**	183	199	176	153	**178**		P	
							1.85	1.39	33.2	2.7	**2.7**								
S17 069-1				Shear Key 1E - Trench Backfill	TA	22/04/2017	1.87	1.39	34.0	2.7	**1.0**	168	214	168	183	**183**		P	
							1.86	1.38	34.0	2.7	**1.6**								
S17 072-1	2660360.803	6510508.896	10.61	Shear Key 1E	TA	27/04/2017	1.82	1.36	34.3	2.7	**3.3**	214	153	170	168	**176**		P	
							1.84	1.37	34.3	2.7	**2.5**								
S17 075-3	2660371.978	6510511.387	12.496	Shear Key 1E	CMO	3/05/2017	1.85	1.43	29.8	2.7	**4.7**	207	196	183	214	**200**		P	
							1.84	1.42	29.3	2.7	**5.6**								
S17 076-1				Shear Key 1E	CMO	5/05/2017	1.84	1.40	31.7	2.7	**3.8**	153	214	214	168	**187**		P	
							1.85	1.44	28.5	2.7	**5.6**								
S17 076-2				Shear Key 1E	CMO	5/05/2017	1.82	1.37	32.6	2.7	**4.6**	214	214	214	214	**214**		P	
							1.80	1.36	32.6	2.7	**5.3**								
S17 078-7	2660360.56	6510522.238	15.347	Shear Key 1E	CMO	6/05/2017	1.88	1.43	31.1	2.7	**2.6**	168	183	186	199	**184**		P	
							1.87	1.45	28.8	2.7	**4.5**								
S17 077-5	2660375.32	6510516.934	14.238	Shear Key 1E	CMO	8/05/2017	1.84	1.40	31.40	2.7	**4.2**	153	183	214	168	**180**		P	
							1.83	1.37	33.00	2.7	**4.0**								
S17 077-6	2660375.033	6510506.106	13.278	Shear Key 1E	CMO	8/05/2017	1.95	1.53	27.0	2.7	**2.0**	214	214	214	214	**214**		P	
							1.94	1.52	27.1	2.7	**2.5**								
S17 077-7	2660362.301	6510507.268	13.535	Shear Key 1E	CMO	8/05/2017	1.86	1.43	30.0	2.7	**4.1**	214	199	191	214	**205**		P	
							1.87	1.44	29.7	4.0	**21.6**								
S17 080-3	2660329.675	6510536.278	15.514	Shear Key 1E	CMO	15/05/2017	1.82	1.37	33.1	2.7	**3.9**	141	168	183	183	**169**		P	
							1.82	1.37	32.8	2.7	**4.3**								
S17 113-2	2660400.166	6510523.433	14.585	Behind Wall 5	TA	23/08/2017	1.86	1.40	33.2	2.7	2.0	183	199	199	214	**199**		P	
							1.85	1.39	33.2	2.7	2.6								
S17 122-3	2660375.290	6510597.426	28.233	Area 3	CBEN	4/10/2017	1.80	1.29	39.9	2.7	1.0	160	146	204	175	**171**		P	
							1.80	1.29	39.9	2.7	1.0								
S17 124	2660239.721	6510518.267	15.981	Behind Wall 5 W End	CBEN	6/10/2017	1.85	1.39	32.7	2.7	3.0	153	128	120	131	**133**		P	
							1.86	1.40	32.7	2.7	2.4								
S17 124	2660371.068	6510522.322	15.951	Behind Wall 5 W End	CBEN	6/10/2017	1.81	1.31	38.5	2.7	1.3	134	137	175	204	**163**		P	
							1.81	1.31	38.5	2.7	1.1								
S17 128-3	2660362.207	6510614.137	31.304	Area 3	CBEN	13/10/2017	1.88	1.44	30.6	2.7	2.8	175	204	204	146	**182**		P	
							1.88	1.44	30.6	2.7	2.5								
S17 131-2	2660384.081	6510608.780	30.164	Area 3	CBEN	18/10/2017	1.82	1.37	33.4	2.7	3.8	146	146	175	160	**157**		P	
							1.82	1.37	33.4	2.7	3.7								
S17 136-2	2660381.359	6510566.730	23.787	Area 3	CBEN	27/10/2017	1.83	1.41	29.8	2.7	5.7	140	146	190	190	**167**		P	
							1.85	1.42	29.8	2.7	4.9								
S17 144-1	2660336.054	6510533.507	12.077	Slip Remediation	CBEN	7/11/2017	1.78	1.34	33.4	2.7	5.9	146	160	204	204	**179**		P	
							1.79	1.34	33.4	2.7	5.6								
S17 144-2	2660339.677	6510538.046	12.758	Slip Remediation	CBEN	7/11/2017	1.78	1.36	30.9	2.7	7.8	204	146	182	160	**173**		P	
							1.79	1.37	30.9	2.7	7.2								
S17 144-5	2660341.266	6510529.198	14.364	Slip Remediation	CBEN	7/11/2017	1.90	1.45	30.7	2.7	1.6	175	175	175	175	**175**		P	
							1.89	1.45	30.7	2.7	1.9								

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T&T Job #: 21854.0370 Entered By: TA/CBEN/CMO

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

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 These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S17 144-7				Slip Remediation	CBEN	7/11/2017	1.86	1.37	35.5	2.7	0.5	146	160	204	197	**177**		P	
							1.85	1.36	35.5	2.7	1.1								
S17 145-1	2660342.099	6510538.419	16.242	Slip Remediation	CBEN	9/11/2017	1.91	1.48	29.3	2.7	2.1	142	149	156	170	**154**		P	
							1.91	1.47	29.3	2.7	2.2								
S17 145-12	2660307.987	6510540.487	7.565	Slip Remediation RL7	CBEN	9/11/2017	1.79	1.33	34.0	2.7	5.2	156	184	199	199	**185**		P	
							1.77	1.32	34.0	2.7	6.1								
S17 150-9	2660318.720	6510540.405	9.246	Slip Remediation	CBEN	16/11/2017	1.83	1.36	34.4	2.7	2.9	168	160	204	204	**184**		P	
							1.83	1.36	34.4	2.7	2.7								
S17 151-3	2660319.642	6510542.521	11.226	Slip Remediation	CBEN	17/11/2017	1.76	1.31	34.0	2.7	6.6	160	204	160	190	**179**		P	
							1.77	1.32	34.0	2.7	6.3								
S17 151-5				Slip Remediation	CBEN	17/11/2017	1.84	1.40	31.3	2.7	4.2	146	160	160	190	**164**		P	
							1.84	1.40	31.3	2.7	4.0								
S17 152-7	2660325.368	6510551.994	16.075	Slip Remediation	CBEN	20/11/2017	1.80	1.35	34.0	2.7	4.4	146	175	204	175	**175**		P	
							1.80	1.34	34.0	2.7	4.6								
S17 153-1	2660329.472	6510548.656	16.675	Slip Remediation	CBEN	21/11/2017	1.82	1.37	33.6	2.7	3.5	160	168	204	175	**177**		P	
							1.83	1.37	33.6	2.7	3.2								
S17 153-2	2660328.216	6510535.531	15.350	Slip Remediation	CBEN	21/11/2017	1.89	1.41	33.5	2.7	0.3	160	146	204	204	**179**		P	
							1.88	1.41	33.5	2.7	0.4								
S17 153-6	2660329.211	6510559.879	19.173	Slip Remediation	CBEN	21/11/2017	1.84	1.37	34.2	2.7	2.3	182	146	175	146	**162**		P	
							1.83	1.36	34.2	2.7	2.8								
S17 153-7	2660339.840	6510553.353	19.159	Slip Remediation	CBEN	21/11/2017	1.83	1.41	29.9	2.7	5.5	168	168	204	204	**186**		P	
							1.83	1.41	29.9	2.7	5.7								
S17 154-4	2660336.800	6510552.977	19.276	Slip Remediation	CBEN	22/11/2017	1.86	1.39	33.7	2.7	1.4	168	153	153	160	**159**		P	
							1.88	1.41	33.7	2.7	0.4								
S17 154-8	2660333.876	6510538.316	32.018	Slip Remediation	CBEN	22/11/2017	1.85	1.39	32.6	2.7	2.9	160	175	204	160	**175**		P	
							1.86	1.40	32.6	2.7	2.2								

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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 These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S17 155-4				Slip Remediation	CBEN	23/11/2017	1.84	1.40	32.0	2.7	3.7	204	204	204	204	**204**		P	
							1.86	1.41	32.0	2.7	3.0								
S17 157-2				Slip Remediation	CBEN	27/11/2017	1.91	1.51	25.90	2.7	4.8	160	190	204	204	**190**		P	
							1.91	1.52	25.90	2.7	4.3								
S17 158-2				Slip Remediation	CBEN	28/11/2017	1.86	1.54	21.0	2.7	10.6	146	204	204	204	**190**		P	
							1.91	1.58	21.0	2.7	8.6								
S17 158-5				Slip Remediation	CBEN	28/11/2017	1.82	1.35	34.5	2.7	3.5	139	153	160	204	**164**		P	
							1.81	1.35	34.5	2.7	3.7								
S17 158-6				Slip Remediation	CBEN	28/11/2017	1.88	1.42	32.7	2.7	1.2	139	153	160	204	**164**		P	
							1.87	1.41	32.7	2.7	1.5								
S17 159-9				Slip Remediation	CBEN	29/11/2017	1.86	1.40	33.0	2.7	2.0	175	175	160	204	**179**		P	
							1.87	1.41	33.0	2.7	1.4								
S17 159-10				Slip Remediation	CBEN	29/11/2017	1.87	1.41	32.7	2.7	1.6	175	160	175	204	**179**		P	
							1.86	1.40	32.7	2.7	2.0								
S17 160-1	2660302.768	6510543.686	14.525	Slip Remediation	CBEN	30/11/2017	1.88	1.43	31.0	2.7	2.6	175	146	204	204	**182**		P	
							1.87	1.43	31.0	2.7	3.0								
S17 160-3	2660304.152	6510554.362	15.402	Slip Remediation	CBEN	30/11/2017	1.85	1.39	33.0	2.7	2.4	146	175	204	204	**182**		P	
							1.87	1.40	33.0	2.7	1.6								
S17 160-4				Slip Remediation	CBEN	30/11/2017	1.84	1.36	35.8	2.7	1.1	146	140	160	160	**152**		P	
							1.85	1.36	35.8	2.7	1.0								
S17 160-10				Slip Remediation	CBEN	30/11/2017	1.83	1.36	34.3	2.7	3.0	140	146	160	204	**163**		P	
							1.83	1.36	34.3	2.7	2.9								
S17 162-3	2660314.522	6510558.103	22.431	Slip Remediation	CBEN	4/12/2017	1.90	1.40	35.4	2.7	0.0	160	175	204	204	**186**		P	
							1.89	1.39	35.4	2.7	0.0								
S17 162-9	2660256.898	6510556.619	19.287	Slip Remediation	CBEN	4/12/2017	1.87	1.43	31.4	2.7	2.5	160	160	175	190	**171**		P	
							1.88	1.43	31.4	2.7	1.9								
S17 163-2	2660289.121	6510563.407	19.378	Slip Remediation	CBEN	5/12/2017	1.88	1.34	40.7	2.7	0.0	204	190	190	160	**186**		P	
							1.88	1.34	40.7	2.7	0.0								
S17 163-3	2660319.678	6510562.944	20.813	Slip Remediation	CBEN	5/12/2017	1.88	1.34	40.7	2.7	0.0	204	204	204	204	**204**		P	
							1.88	1.34	40.7	2.7	0.0								
S17 163-7	2660309.383	6510566.793	16.792	Slip Remediation	CBEN	5/12/2017	1.84	1.39	32.0	2.7	3.8	175	204	175	160	**179**		P	
							1.85	1.40	32.0	2.7	3.5								
S17 164-1	2660304.939	6510578.24	20.863	Slip Remediation	CBEN	6/12/2017	1.89	1.45	30.1	2.7	2.7	160	190	204	204	**190**		P	
							1.89	1.45	30.1	2.7	2.7								
S17 164-3	2660328.331	6510571.038	20.642	Slip Remediation	CBEN	6/12/2017	1.84	1.44	27.7	2.7	6.5	204	204	190	204	**201**		P	
							1.85	1.45	27.7	2.7	6.5								
S17 164-7	2660332.752	6510571.214	23.326	Slip Remediation	CBEN	6/12/2017	1.88	1.44	30.3	2.7	3.0	204	204	204	204	**204**		P	
							1.88	1.44	30.3	2.7	2.9								
S17 164-8	2660294.034	6510565.677	20.596	Slip Remediation	CBEN	6/12/2017	1.90	1.50	26.9	2.7	4.2	204	204	204	204	**204**		P	
							1.90	1.50	26.9	2.7	4.1								
S17 164-9	2660272.014	6510551.314	20.625	Slip Remediation	CBEN	6/12/2017	1.89	1.49	27.2	2.7	4.5	204	204	204	204	**204**		P	
							1.91	1.50	27.2	2.7	3.5								
S17 165-1	2660309.875	6510561.685	22.076	Slip Remediation	CBEN	7/12/2017	1.91	1.46	30.8	2.7	0.7	175	204	204	204	**197**		P	
							1.92	1.47	30.8	2.7	0.3								
S17 165-2	2660327.557	6510576.203	22.007	Slip Remediation	CBEN	7/12/2017	1.85	1.41	30.8	2.7	4.3	204	140	182	175	**175**		P	
							1.87	1.43	30.8	2.7	3.3								
S17 165-7	2660292.596	6510570.426	22.225	Slip Remediation	CBEN	7/12/2017	1.84	1.34	37.8	2.7	0.1	146	146	160	160	**153**		P	
							1.82	1.32	37.8	2.7	0.9								
S17 165-8	2660332.303	6510560.296	20.757	Slip Remediation	CBEN	7/12/2017	1.84	1.33	38.2	2.7	0.0	204	204	204	204	**204**		P	
							1.84	1.33	38.2	2.7	0.0								
S17 165-9	2660322.321	6510583.313	23.672	Slip Remediation	CBEN	7/12/2017	1.82	1.36	33.6	2.7	3.7	204	204	204	204	**204**		P	
							1.82	1.36	33.6	2.7	3.6								

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Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

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												Test 1	Test 2	Test 3	Test 4				
S17 165-13	2660259.656	6510567.481	21.063	Slip Remediation	CBEN	7/12/2017	1.92	1.48	29.2	2.7	1.8	175	175	190	204	**186**		P	
							1.90	1.47	29.2	2.7	2.4								
S17 165-14	2660308.555	6510576.192	18.327	Slip Remediation	CBEN	7/12/2017	1.91	1.53	24.4	2.7	5.8	140	146	190	204	**170**		P	
							1.90	1.53	24.4	2.7	6.0								
S17 166-1	2660305.028	6510575.455	23.681	Slip Remediation	CBEN	8/12/2017	1.83	1.37	33.3	2.7	3.6	160	160	204	140	**166**		P	
							1.82	1.37	33.3	2.7	3.7								
S17 166-5	2660316.577	6510584.893	23.523	Slip Remediation	CBEN	8/12/2017	1.84	1.36	35.4	2.7	1.7	160	204	204	204	**193**		P	
							1.84	1.36	35.4	2.7	1.8								
S17 166-6	2660310.926	6510570.644	24.482	Slip Remediation	CBEN	8/12/2017	1.86	1.38	34.6	2.7	1.2	175	204	204	175	**190**		P	
							1.86	1.38	34.6	2.7	1.1								
S17 166-8	2660321.095	6510591.766	26.628	Slip Remediation	CBEN	8/12/2017	1.79	1.30	38.1	2.7	2.6	146	160	160	204	**168**		P	
							1.79	1.29	38.1	2.7	2.8								
S17 166-9	2660282.158	6510582.941	25.404	Slip Remediation	CBEN	8/12/2017	1.88	1.40	33.6	2.7	0.8	140	146	160	160	**152**		P	
							1.87	1.40	33.6	2.7	1.1								
S17 167-1	2660399.044	6510551.833	19.94	RE Wall 3 RL 17	CBEN	9/12/2017	1.79	1.36	31.5	2.7	6.7	204	204	204	204	**204**		P	
							1.78	1.36	31.5	2.7	7.0								
S17 167-2	2660392.424	6510548.904	17.817	RE Wall 3 RL 17.5	CBEN	9/12/2017	1.79	1.34	32.9	2.7	6.0	204	204	204	204	**204**		P	
							1.79	1.35	32.9	2.7	5.9								
S17 167-3	2660387.565	6510543.654	17.846	RE Wall 3 RL 17.5	CBEN	9/12/2017	1.88	1.44	30.9	2.7	2.5	204	204	204	204	**204**		P	
							1.88	1.44	30.9	2.7	2.4								
S17 167-4				Behind RE Wall 3	CBEN	9/12/2017	1.85	1.38	34.0	2.7	2.1	160	146	175	204	**171**		P	
							1.85	1.38	34.0	2.7	1.8								
S17 167-5				Behind RE Wall 3	CBEN	9/12/2017	1.85	1.38	34.1	2.7	1.8	160	160	160	204	**171**		P	
							1.84	1.37	34.1	2.7	2.4								
S17 168-1	2660355.238	6510536.396	18.454	RE Wall 3 RL 18	CBEN	11/12/2017	1.90	1.41	34.6	2.7	0.0	204	204	204	204	**204**		P	
							1.91	1.42	34.6	2.7	0.0								
S17 168-2	2660380.739	6510543.422	18.548	RE Wall 3 RL 18.5	CBEN	11/12/2017	1.89	1.47	28.4	2.7	3.7	204	204	204	204	**204**		P	
							1.91	1.49	28.4	2.7	2.8								
S17 168-3	2660398.727	6510550.5	18.558	RE Wall 3 RL 18.5	CBEN	11/12/2017	1.90	1.49	27.1	2.7	4.2	204	204	204	204	**204**		P	
							1.91	1.50	27.1	2.7	3.8								
S17 168-4	2660302.448	6510585.209	24.334	Behind RE Wall 3	CBEN	11/12/2017	1.83	1.37	33.4	2.7	3.4	204	175	182	204	**191**		P	
							1.82	1.36	33.5	2.7	4.0								
S17 168-5	2660339.045	6510573.135	23.534	Behind RE Wall 3	CBEN	11/12/2017	1.84	1.42	29.4	2.7	5.4	175	182	204	190	**188**		P	
							1.83	1.41	29.4	2.7	6.2								
S17 168-10	2660332.105	6510585.285	25.498	Behind RE Wall 3	CBEN	11/12/2017	1.80	1.36	32.7	2.7	5.4	204	204	175	175	**190**		P	
							1.79	1.35	32.7	2.7	5.8								

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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 These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S17 168-11	2660309.969	6510583.834	25.147	Behind RE Wall 3	CBEN	11/12/2017	1.87	1.41	32.4	2.7	2.0	204	175	175	204	**190**		P	
							1.87	1.42	32.4	2.7	1.7								
S17 168-13	2660332.886	6510539.666	19.183	RE Wall 3 RL 19	CBEN	11/12/2017	1.81	1.36	33.0	2.7	4.6	204	204	204	204	**204**		P	
							1.82	1.37	33.0	2.7	4.2								
S17 168-14	2660377.787	6510545.808	18.861	RE Wall 3 RL 19	CBEN	11/12/2017	1.90	1.45	31.0	2.7	1.1	204	204	204	204	**204**		P	
							1.91	1.46	31.0	2.7	0.8								
S17 168-15	2660305.285	6510570.456	24.711	RE Wall 3 RL 19	CBEN	11/12/2017	1.88	1.42	32.1	2.7	1.7	204	204	204	204	**204**		P	
							1.89	1.43	32.1	2.7	1.3								
S17 169-2	2660297.469	6510578.59	27.465	Behind RE Wall 3	CBEN	12/12/2017	1.87	1.47	27.7	2.7	5.2	204	204	204	204	**204**		P	
							1.86	1.45	27.7	2.7	5.9								
S17 169-3	2660341.048	6510575.89	25.514	Behind RE Wall 3	CBEN	12/12/2017	1.84	1.45	27.3	2.7	6.8	175	175	204	190	**186**		P	
							1.85	1.45	27.3	2.7	6.7								
S17 169-4	2660299.663	6510591.408	23.676	Behind RE Wall 3	CBEN	12/12/2017	1.83	1.40	30.7	2.7	5.0	175	190	204	175	**186**		P	
							1.86	1.42	30.7	2.7	3.5								
S17 170-5	2660399.159	6510551.043	19.508	RE Wall 3 Rl 19.5	CBEN	13/12/2017	1.92	1.52	26.4	2.7	3.9	204	204	204	204	**204**		P	
							1.92	1.52	26.4	2.7	3.7								
S17 170-6	2660297.126	6510570.496	25.156	Behind RE Wall 3	CBEN	13/12/2017	1.91	1.44	32.1	2.7	0.3	204	204	204	204	**204**		P	
							1.90	1.44	32.1	2.7	0.7								
S17 170-7	2660340.41	6510588.536	26.473	Behind RE Wall 3	CBEN	13/12/2017	1.89	1.42	33.4	2.7	0.3	204	204	204	204	**204**		P	
							1.88	1.41	33.4	2.7	0.9								
S17 170-10	2660329.413	6510542.512	19.771	RE Wall 3 Rl 19.5	CBEN	13/12/2017	1.94	1.48	31.0	2.7	0.0	204	204	204	204	**204**		P	
							1.95	1.49	31.0	2.7	0.0								
S17 170-11	2660314.41	6510586.214	26.397	Behind RE Wall 3	CBEN	13/12/2017	1.90	1.50	27.3	2.7	3.7	204	204	204	204	**204**		P	
							1.92	1.51	27.3	2.7	3.2								
S17 171-1	2660342.195	6510545.71	20.31	RE Wall 3 RL 20	CBEN	14/12/2017	1.80	1.36	32.9	2.7	5.1	160	175	204	204	**186**		P	
							1.81	1.36	32.9	2.7	4.9								
S17 171-2	2660310.664	6510542.643	20.357	RE Wall 3 RL 20	CBEN	14/12/2017	1.89	1.50	26.2	2.7	5.1	160	190	175	204	**182**		P	
							1.90	1.50	26.2	2.7	4.8								
S17 171-6	2660315.626	6510579.01	25.991	RE Wall 3 RL 20	CBEN	14/12/2017	1.82	1.30	40.6	2.7	0.0	204	204	204	204	**204**		P	
							1.83	1.30	40.6	2.7	0.0								
S17 172-1	2660270.684	6510551.266	19.165	RE Wall 3 RL 20.5	CBEN	15/12/2017	1.85	1.45	27.1	2.7	6.8	204	204	204	204	**204**		P	
							1.86	1.46	27.1	2.7	6.2								
S17 172-2	2660357.51	6510538.94	20.737	RE Wall 3 RL 20.5	CBEN	15/12/2017	1.88	1.47	28.1	2.7	4.5	204	204	204	204	**204**		P	
							1.86	1.45	28.1	2.7	5.4								
S17 172-3	2660330.661	6510586.959	26.898	Behind RE Wall 3	CBEN	15/12/2017	1.84	1.31	40.3	2.7	0.0	175	204	160	204	**186**		P	
							1.85	1.32	40.3	2.7	0.0								
S17 172-4	2660309.877	6510588.643	26.948	Behind RE Wall 3	CBEN	15/12/2017	1.84	1.33	38.3	2.7	0.0	204	160	175	204	**186**		P	
							1.84	1.33	38.3	2.7	0.0								
S17 173-1	2660313.729	6510547.958	17.12	RE Wall 3 RL 21	CBEN	18/12/2017	1.83	1.39	31.5	2.7	4.6	204	175	146	190	**179**		P	
							1.85	1.41	31.5	2.7	3.6								
S17 173-2	2660377.473	6510547.847	20.897	RE Wall 3 RL 21	CBEN	18/12/2017	1.90	1.43	32.9	2.7	0.2	204	204	204	204	**204**		P	
							1.89	1.42	32.9	2.7	0.5								
S17 173-3	2660345.962	6510581.266	25.629	Behind RE Wall 3	CBEN	18/12/2017	1.84	1.41	30.0	2.7	5.3	204	160	168	160	**173**		P	
							1.82	1.40	30.0	2.7	6.0								
S17 174-5	2660271.7	6510550.1	21.36	RE Wall 3 RL 21.5	CBEN	19/12/2017	1.87	1.39	34.5	2.7	0.7	204	175	140	160	**170**		P	
							1.86	1.38	34.5	2.7	1.1								
S17 174-6	2660368.448	6510550.171	26.331	RE Wall 3 RL 21.5	CBEN	19/12/2017	1.87	1.41	32.2	2.7	2.3	160	146	175	204	**171**		P	
							1.86	1.40	32.2	2.7	2.8								
S17 175-1	2660397.916	6510556.405	21.846	RE Wall 3 RL 22	CBEN	20/12/2017	1.86	1.40	32.7	2.7	2.2	204	204	204	204	**204**		P	
							1.87	1.41	32.7	2.7	1.6								
S17 176-2				Behind RE Wall 3	CBEN	21/12/2017	1.81	1.35	33.7	2.7	4.3	204	160	175	204	**186**		P	
							1.83	1.37	33.7	2.7	2.9								

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Job: Silverdale Arran's Point Client: Tonkin & Taylor Job # 21854.037

T&T Job #: 21854.0370 Entered By: TA/CBEN/CMO

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

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 These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S17 176-5	2660300.708	6510549.178	22.78	RE Wall 3 RL 22.5	CBEN	21/12/2017	1.77	1.32	33.6	2.7	6.6	204	204	204	204	**204**		P	
							1.76	1.32	33.60	2.7	6.7								
S17 176-6	2660366.507	6510552.359	22.878	RE Wall 3 RL 22.5	CBEN	21/12/2017	1.86	1.43	30.1	2.7	3.8	204	204	204	204	**204**		P	
							1.85	1.42	30.1	2.7	4.7								
S17 177-1	2660380.194	6510553.873	23.188	RE Wall 3 RL 23	CBEN	22/12/2017	1.86	1.35	37.8	2.7	0.0	204	204	204	204	**204**		P	
							1.86	1.35	37.8	2.7	0.0								
S17 180-1	2660293.233	6510560.129	23.455	RE Wall 3 RL 23.5	CBEN	27/12/2018	1.73	1.23	41.1	2.7	4.1	160	160	146	204	**168**		P	
							1.74	1.23	41.1	2.7	3.9								
S17 180-2	2660338.184	6510546.364	22.317	RE Wall 3 RL 23.5	CBEN	27/12/2018	1.74	1.26	38.2	2.7	5.3	160	175	175	204	**179**		P	
							1.75	1.27	38.2	2.7	4.6								
S17 180-4	2660326.721	6510583.376	26.672	Behind RE Wall 3	CBEN	27/12/2018	1.89	1.42	33.0	2.7	0.4	160	204	204	204	**193**		P	
							1.89	1.42	33.0	2.7	0.3								
S17 181-1	2660377.289	6510550.724	20.623	RE Wall 3 RL 23.5	CBEN	28/12/2018	1.84	1.45	27.3	2.7	7.0	160	204	204	160	**182**		P	
							1.83	1.44	27.3	2.7	7.6								
S17 181-2	2660338.256	6510557.489	16.908	RE Wall 3 RL 24	CBEN	28/12/2018	1.83	1.43	27.4	2.7	7.5	175	204	160	204	**186**		P	
							1.83	1.44	27.4	2.7	7.3								
S17 181-3	2660297.101	6510556.113	27.776	RE Wall 3 RL 24	CBEN	28/12/2018	1.89	1.50	25.7	2.7	5.8	204	204	175	204	**197**		P	
							1.88	1.50	25.7	2.7	6.2								
S17 181-4	2660339.944	6510586.459	26.465	Behind RE Wall 3	CBEN	28/12/2018	1.83	1.44	26.8	2.7	7.8	204	204	204	204	**204**		P	
							1.83	1.44	26.8	2.7	7.8								
S17 181-6	2660370.758	6510558.433	22.85	RE Wall 3 RL 24.5	CBEN	28/12/2018	1.83	1.42	28.6	2.7	6.5	204	204	204	204	**204**		P	
							1.85	1.44	28.6	2.7	5.6								
S17 182-1	2660340.227	6510550.567	23.074	RE Wall 3 RL 24.5	CBEN	29/12/2018	1.82	1.43	27.8	2.7	7.6	204	204	204	204	**204**		P	
							1.82	1.43	27.8	2.7	7.5								
S17 182-2	2660287.25	6510558.71	21.483	RE Wall 3 RL 25	CBEN	29/12/2018	1.86	1.44	29.2	2.7	4.5	175	204	190	175	**186**		P	
							1.87	1.45	29.2	2.7	4.3								
S17 182-3	2660359.844	6510583.101	27.297	Behind RE Wall 3	CBEN	29/12/2018	1.87	1.45	28.8	2.7	4.6	204	204	175	175	**190**		P	
							1.87	1.46	28.8	2.7	4.2								
S17 182-4	2660321.461	6510589.047	26.729	Behind RE Wall 3	CBEN	29/12/2018	1.83	1.44	27.1	2.7	7.4	204	204	204	204	**204**		P	
							1.85	1.46	27.1	2.7	6.6								
S17 182-5	2660374.245	6510555.728	24.146	RE Wall 3 RL 25	CBEN	29/12/2018	1.84	1.43	28.4	2.7	6.4	204	204	204	204	**204**		P	
							1.84	1.43	28.4	2.7	6.4								
S17 183-1	GPS Error			RE Wall 3 RL 25	CBEN	3/01/2018	1.88	1.45	29.7	2.7	3.5	204	204	204	204	**204**		P	
							1.86	1.43	29.7	2.7	4.3								
S17 183-2				RE Wall 3 RL 25	CBEN	3/01/2018	1.82	1.35	34.9	2.7	2.9	204	204	185	204	**199**		P	
							1.82	1.35	34.9	2.7	3.0								
S17 183-3				RE Wall 3 RL 25	CBEN	3/01/2018	1.85	1.42	30.2	2.7	4.5	159	183	200	144	**172**		P	
							1.87	1.44	30.2	2.7	3.4								
S18 001-1	2660378.442	6510554.364	25.101	RE Wall 3 RL 25.5	CBEN	8/01/2018	1.90	1.45	31.1	2.7	1.1	175	175	160	175	**171**		P	
							1.90	1.45	31.1	2.7	1.4								
S18 001-2	2660307.039	6510555.255	25.445	RE Wall 3 RL 25.5	CBEN	8/01/2018	1.89	1.43	32.2	2.7	1.0	204	175	204	204	**197**		P	
							1.88	1.43	32.2	2.7	0.0								
S18 001-4	2660321.381	6510587.472	30.083	Behind RE Wall 3	CBEN	8/01/2018	1.95	1.45	34.3	2.7	0.0	204	204	204	204	**204**		P	
							1.95	1.45	34.3	2.7	0.0								
S18 002-1	2660333.033	6510599.018	30.448	Behind RE Wall 3	CBEN	9/01/2018	1.85	1.33	38.7	2.7	0.0	146	146	190	204	**172**		P	
							1.85	1.34	38.7	2.7	0.0								
S18 002-2	2660311.677	6510588.805	30.271	Behind RE Wall 3	CBEN	9/01/2018	1.85	1.31	41.2	2.7	0.0	190	204	146	146	**172**		P	
							1.89	1.34	41.2	2.7	0.0								

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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 These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S18 002-6	2660315.863	6510549.333	25.755	RE Wall 3 RL 26	CBEN	9/01/2018	1.81	1.25	45.6	2.7	0.0	146	160	190	160	**164**		P	
							1.82	1.25	45.6	2.7	0.0								
S18 002-8	2660314.589	6510595.392	30.525	Behind RE Wall 3	CBEN	9/01/2018	1.80	1.34	34.5	2.7	4.1	204	204	204	204	**204**		P	
							1.79	1.33	34.5	2.7	4.5								
S18 003-1	2660346.816	6510551.159	26.103	RE Wall 3 RL 26.5	CBEN	10/01/2018	1.82	1.33	36.6	2.7	1.9	204	204	204	204	**204**		P	
							1.82	1.34	36.6	2.7	1.7								
S18 003-2	2660308.048	6510594.529	30.81	Behind RE Wall 3	CBEN	10/01/2018	1.85	1.37	34.7	2.7	1.5	204	204	204	204	**204**		P	
							1.85	1.37	34.7	2.7	1.7								
S18 004-3	2660348.609	6510553.82	26.715	RE Wall 3 RL 27	CBEN	11/01/2018	1.87	1.42	31.9	2.7	2.2	204	204	204	204	**204**		P	
							1.87	1.42	31.9	2.7	2.2								
S18 004-4	2660308.845	6510557.855	28.316	RE Wall 3 RL 27	CBEN	11/01/2018	1.86	1.41	32.4	2.7	2.2	204	204	204	204	**204**		P	
							1.87	1.41	32.4	2.7	2.1								
S18 005-1	GPS Error			RE Wall 3 RL 27.5	CBEN	12/01/2018	1.92	1.45	32.5	2.7	0.0	190	204	204	204	**201**		P	
							1.93	1.46	32.5	2.7	0.0								
S18 005-2	2660289.784	6510560.306	27.274	RE Wall 3 RL 27.5	CBEN	12/01/2018	1.93	1.46	31.9	2.7	0.0	204	190	204	204	**201**		P	
							1.94	1.47	31.9	2.7	0.0								
S18 005-5	2660301.569	6510555.707	25.756	RE Wall 3 RL 28	CBEN	12/01/2018	1.89	1.42	32.9	2.7	0.7	146	160	140	175	**155**		P	
							1.89	1.42	32.9	2.7	0.6								
S18 006-1	2660348.087	6510559.185	28.207	RE Wall 3 RL 29	CBEN	15/01/2018	1.85	1.43	30.0	2.7	4.4	182	178	204	173	**184**		P	
							1.85	1.42	30.0	2.7	4.7								
S18 006-2	2660301.43	6510561.408	28.783	RE Wall 3 RL 29.5	CBEN	15/01/2018	1.84	1.38	32.7	2.7	3.4	204	204	204	204	**204**		P	
							1.85	1.39	32.7	2.7	3.0								
S18 006-7	2660308.306	6510574.713	30.126	RE Wall 3 RL 30	CBEN	15/01/2018	1.90	1.41	34.5	2.7	0.0	134	146	204	204	**172**		P	
							1.89	1.40	34.5	2.7	0.0								
S18 007-1	2660362.867	6510581.777	29.511	RE Wall 3	CBEN	16/01/2018	1.93	1.53	26.2	2.7	3.4	134	134	204	204	**169**		P	
							1.93	1.53	26.2	2.7	3.4								
S18 007-2	2660310.738	6510576.896	31.096	RE Wall 3	CBEN	16/01/2018	1.92	1.50	28.1	2.7	2.4	204	134	134	204	**169**		P	
							1.93	1.50	28.1	2.7	2.0								
S18 013-3	GPS Error			Above RE Wall 3	CBEN	24/01/2018	1.74	1.28	35.6	2.7	6.8	204	204	204	204	**204**		P	
							1.78	1.31	35.6	2.7	4.8								
S18 015-2	2660325.344	6510599.703	31.607	Above RE Wall 3	CBEN	26/01/2018	1.87	1.44	30.1	2.7	3.6	140	140	146	204	**158**		P	
							1.86	1.43	30.1	2.7	3.8								
S18 015-3	2660339.623	6510603.287	31.767	Above RE Wall 3	CBEN	26/01/2018	1.86	1.44	28.6	2.7	5.2	175	175	190	204	**186**		P	
							1.87	1.46	28.6	2.7	4.4								
S18 020-1	2660211.584	6510561.992	17.832	Shear Key 2018	CBEN	7/02/2018	1.91	1.46	31.1	2.7	0.7	204	204	204	204	**204**		P	
							1.91	1.46	31.1	2.7	0.7								
S18 021-1	2660205.889	6510562.837	21.852	Shear Key 2018	CBEN	8/02/2018	1.89	1.45	30.5	2.7	2.4	160	146	140	140	**147**		P	
							1.88	1.44	30.5	2.7	2.8								
S18 026-3	2660230.757	6510565.686	24.258	RE Wall RL 24.5	CBEN	16/02/2018	1.86	1.39	33.2	2.7	2.2	140	146	160	146	**148**		P	
							1.85	1.39	33.2	2.7	2.7								
S18 026-4	2660222.053	6510564.668	24.391	RE Wall RL 24.5	CBEN	16/02/2018	1.84	1.38	33.2	2.7	2.8	146	140	160	146	**148**		P	
							1.86	1.40	33.2	2.7	1.9								
S18 027-1	2660208.239	6510567.152	25.553	RE Wall RL 25	CBEN	19/02/2018	1.92	1.49	29.2	2.7	1.6	160	175	204	204	**186**		P	
							1.92	1.48	29.2	2.7	1.8								
S18 027-2	2660177.696	6510564.491	26.292	RE Wall RL 25.5	CBEN	19/02/2018	1.90	1.48	28.2	2.7	3.3	160	204	204	204	**193**		P	
							1.90	1.49	28.2	2.7	3.1								
S18 027-4	2660203.974	6510569.238	26.055	RE Wall RL 26	CBEN	19/02/2018	1.88	1.40	34.6	2.7	0.0	140	140	204	204	**172**		P	
							1.88	1.40	34.6	2.7	0.0								
S18 027-5	2660249.783	6510558.029	25.795	RE Wall RL 26.5	CBEN	19/02/2018	1.82	1.34	35.7	2.7	2.6	140	160	160	140	**150**		P	
							1.81	1.34	35.7	2.7	2.9								
S18 028-6	2660253.691	6510567.724	27.451	RE Wall RL 27.5	CBEN	20/02/2018	1.84	1.41	30.7	2.7	4.7	204	204	204	204	**204**		P	
							1.82	1.39	30.7	2.7	5.6								
S18 028-7	2660209.401	6510571.298	27.382	RE Wall RL 27.5	CBEN	20/02/2018	1.90	1.45	30.6	2.7	1.6	204	204	204	204	**204**		P	

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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.
~~S18 029-7~~	~~2660209.401~~	~~6510571.298~~	~~27.382~~	~~RE Wall RL 27.5~~	~~CBEN~~	~~23/02/2018~~	1.91	1.46	30.6	2.7	1.2	~~204~~	~~204~~	~~204~~	~~204~~	~~204~~		P	
S18 029-1	2660256.929	6510564.205	27.759	RE Wall RL 28	CBEN	21/02/2018	1.92	1.49	28.2	2.7	2.5	204	204	204	204	**204**		P	
							1.92	1.50	28.2	2.7	2.4								
S18 029-2	2660222.173	6510576.171	29.223	RE Wall RL 28	CBEN	21/02/2018	1.91	1.50	27.2	2.7	3.8	204	204	204	204	**204**		P	
							1.87	1.47	27.2	2.7	5.6								
S18 029-5	2660221.646	6510574.126	28.207	RE Wall RL 28.5	CBEN	21/02/2018	1.92	1.52	26.3	2.7	3.9	204	204	204	204	**204**		P	
							1.91	1.51	26.3	2.7	4.1								
S18 029-9	2660237.304	6510574.148	28.641	RE Wall RL 28.5	CBEN	21/02/2018	1.91	1.53	24.9	2.7	5.2	204	204	204	204	**204**		P	
							1.90	1.52	24.9	2.7	5.8								
S18 030-1	2660234.33	6510567.17	28.813	RE Wall RL 29	CBEN	22/02/2018	1.93	1.48	29.7	2.7	0.9	204	204	204	204	**204**		P	
							1.94	1.49	29.7	2.7	0.3								
S18 031-2	2660238.244	6510570.61	28.019	RE Wall RL 30	CBEN	23/02/2018	1.86	1.45	28.7	2.7	4.8	204	204	204	204	**204**		P	
							1.87	1.45	28.7	2.7	4.4								
S18 032-1	2660239.703	6510574.858	30.091	RE Wall RL 30.5	CBEN	26/02/2018	1.86	1.39	34.3	2.7	1.0	204	204	204	204	**204**		P	
							1.86	1.39	34.3	2.7	1.0								
S18 032-2	2660215.778	6510575.562	30.733	RE Wall RL 31	CBEN	26/02/2018	1.93	1.53	25.6	2.7	3.9	204	204	204	204	**204**		P	
							1.91	1.52	25.6	2.7	4.6								
S18 032-6	2660226.969	6510581.008	30.835	RE Wall RL 31.5	CBEN	26/02/2018	1.87	1.47	27.1	2.7	5.5	204	204	204	204	**204**		P	
							1.91	1.50	27.1	2.7	3.8								
S18 033-1	2660233.437	6510577.271	31.206	RE Wall RL 32	CBEN	27/02/2018	1.83	1.41	29.7	2.7	5.7	204	204	204	204	**204**		P	
							1.83	1.41	29.7	2.7	5.7								
S18 033-8	2660236.888	6510574.117	30.481	RE Wall RL 32.5	CBEN	27/02/2018	1.90	1.50	26.7	2.7	4.3	204	204	204	204	**204**		P	
							1.88	1.48	26.7	2.7	5.4								
S18 034-2	2660234.323	6510580.773	32.55	RE Wall RL	CBEN	28/02/2018	1.92	1.52	26.5	2.7	3.4	204	204	204	204	**204**		P	
							1.93	1.53	26.5	2.7	3.0								
S18 034-6	2660222.603	6510588.022	33.435	RE Wall RL	CBEN	28/02/2018	1.89	1.47	28.6	2.7	3.5	204	204	204	204	**204**		P	
							1.91	1.48	28.6	2.7	2.7								
S18 034-7	2660209.615	6510591.623	32.694	RE Wall RL	CBEN	28/02/2018	1.89	1.47	28.4	2.7	3.5	204	204	204	204	**204**		P	
							1.90	1.48	28.4	2.7	3.4								
S18 035-1	2660203.901	6510581.345	34.597	RE Wall RL	CBEN	1/03/2018	1.95	1.52	28.3	2.7	0.8	204	204	204	204	**204**		P	
							1.94	1.51	28.3	2.7	1.1								
S18 035-2	2660236.108	6510580.432	32.78	RE Wall RL	CBEN	1/03/2018	1.94	1.52	27.1	2.7	2.3	204	204	204	204	**204**		P	
							1.95	1.54	27.1	2.7	1.5								
S18 035-4	2660231.999	6510584.655	34.089	RE Wall RL	CBEN	1/03/2018	1.87	1.42	31.2	2.7	2.9	204	204	204	204	**204**		P	
							1.87	1.43	31.2	2.7	2.5								
S18 049-1	2660429.98	6510532.518	13.205	Undercut S of Pond 7/10	CBEN	21/03/2018	1.89	1.46	29.4	2.7	3.0	204	204	204	204	**204**		P	
							1.88	1.45	29.4	2.7	3.4								
S18 049-2	2660419.733	6510534.838	14.104	Undercut S of Pond 7/10	CBEN	21/03/2018	1.89	1.46	29.4	2.7	2.9	204	204	204	204	**204**		P	
							1.88	1.45	29.4	2.7	3.6								
S18 061-1	2660429.67	6510509.247	12.457	Pond 7/11	CBEN	13/04/2018	1.76	1.29	36.0	2.7	5.5	146	160	140	146	**148**		P	
							1.77	1.29	36.7	2.7	4.7								
S18 061-2	2660422.519	6510504.05	10.616	Pond 7/11	CBEN	13/04/2018	1.78	1.30	36.6	2.7	4.1	204	204	204	204	**204**		P	
							1.78	1.30	36.6	2.7	4.2								
S18 061-3	2660434.265	6510507.509	10.152	Pond 7/11	CBEN	13/04/2018	1.79	1.33	35.4	2.7	4.0	204	204	204	204	**204**		P	
							1.80	1.33	35.4	2.7	3.7								

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