REPORT

Tonkin+Taylor

MILLWATER SUBDIVISION ARRANS HILL PRECINCT 5 - STAGES 3B & 4

Geotechnical Completion Report

Prepared for
WFH Properties Ltd
Prepared by
Tonkin & Taylor Ltd
Date
February 2020
Job Number
21854.0031/AHP5S3B+4.v2

Exceptional thinking together
www.tonkintaylor.co.nz

Document Control

Title: MILLWATER SUBDIVISION ARRANS HILL PRECINCT 5 - STAGES 3B & 4, Geotechnical Completion Report					
Date	Version	Description	Prepared by:	Reviewed by:	Authorised by:
September 2019	1	Geotechnical Completion Report	JKK	APS	APS
February 2020	2	Geotechnical Completion Report	JKK	APS	APS

Distribution:

WFH Properties Ltd	2 copies
Woods Ltd	2 copies
Tonkin & Taylor Ltd (FILE)	1 copy

Table of contents

Executive summary

Tonkin + Taylor Ltd (T+T) was engaged by WFH Properties Ltd to monitor and provide earthworks certification for the 48 No. Residential Lots contained within Stages 3B and 4 of Arrans Hill Precinct 5 at the Millwater Subdivision in Silverdale. Stages 3B and 4 comprises Residential Lots 48 to 53, 164 to 173, 196 to 212 and 216 to 230, Reserve Lot 802, and Road Lot 903 (part of Road 2 within Stage 3B and parts of Roads 1, 5, 7 and 8 within Stage 4) inclusive as shown on the Woods Final Contour As–Built Plan (Woods Ref 37504–04–03B–100–AB) in Appendix A1.

This Geotechnical Completion Report contains information required for subdivisional earthworks completion reporting, as well as outlining geotechnical constraints that need to be considered for subsequent building design and construction on each residential Lot. This report supersedes the Geotechnical Completion Report dated September 2019, with minor changes being made to the post earthworks investigation plan and hand auger logs in Appendix E.

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 March 2013 Geotechnical Investigation Report for the North Bridge to Grand Drive (Ref. [4]).

d December 2015 Geotechnical Investigation Report for Arrans Hill Precinct 5 (Ref. [5]).

Woods Ltd (Woods) undertook the engineering design for these two stages and the overall subdivision.

Bulk earthworks associated with development of Stages 3B and 4 of Arrans Hill Precinct 5 were undertaken by Hick Bros Civil Contractors Ltd and commenced in February 2018 with completion by February 2019. Earthworks comprised the following:

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

b Installation of subsoil drains.

c Cut to fill earthworks across the entire Stages 3B and 4 areas as shown on the Woods Cut & Fill As–Built Plans (Woods Ref 37504–04–03B–110–AB to –112–AB) in Appendix A1.

d Construction of 1 No. Palisade Wall (part of PW5) as shown on T+T Drawing 21854.0031–AHP5S3B&4–101 in Appendix A2.

e Construction of a 4m high geogrid reinforced segmental block wall (Screen Block Wall 6) along the northern boundary of Lots 48 to 51 (immediately below RE 7) as shown on T+T Drawing 21854.0031–AHP5S3B&4–101 in Appendix A2.

f Construction of a 11m high, 1 in 1.5 (V:H) engineered fill batter slope (part of RE 7) along the northern boundary of Residential Lots 48 to 53 and Reserve Lot 802 as shown on T+T Drawing 21854.0031–AHP5S3B&4–101 in Appendix A2.

g Construction of a 8m high, 1 in 2 (V:H) engineered fill batter slope (RE 5) along the southern boundary of Residential Lots 164 to 173 as shown on T+T Drawing 21854.0031–AHP5S3B&4–101 in Appendix A2.

Civil earthworks were undertaken by JG Civil Ltd and commenced on site in February 2019 with completion by August 2019, 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 H2), 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 geotechnical constraints outlined in Section 3, and CSIRO recommendations outlined in the Appendices relating to expansive soils foundation design and home owner maintenance, all the residential Lots within Stages 3B and 4 are considered to have a building platform area that is 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 48 No. Residential Lots contained within Stages 3B and 4 of Arrans Hill Precinct 5 at the Millwater Subdivision in Silverdale. Stages 3B and 4 comprises Residential Lots 48 to 53, 164 to 173, 196 to 212 and 216 to 230 and Road Lot 903 (part of Road 2 within Stage 3B and parts of Roads 1, 5, 7 and 8 within Stage 4) inclusive as shown on the Woods Final Surface As–Built Plan (Woods Ref 37504–04–03B-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] and [2]).

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

c March 2013 Geotechnical Investigation Report for the North Bridge to Grand Drive (Ref. [4]).

d December 2015 Geotechnical Investigation Report for Arrans Hill Precinct 5 (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 Arrans Hill Precinct 5. These features were proposed to be stabilised, and/or undercut and replaced with engineered fill, during development works. While these stabilisation works are required across much of Precinct 5, such works were not generally required to achieve satisfactory factors of safety against instability for the finished development of Stages 3B and 4. However, undercutting was required to enable installation of the geogrid reinforcement required within Wall 6 and the reinforced earth slopes (RE 5 and part of RE 7), as well as to ensure Wall 6 and the RE slopes were founded in competent ground.

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 geotechnical 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 2 No. reinforced earth slopes (RE 5 and part of RE 7);

c Monitoring and certification of construction of 2 No. Palisade Walls (parts of PW5 and PW6);

d Monitoring and certification of construction of 1 No. geogrid reinforced segmental block wall (Screen Block Wall 6);

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

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

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

1.2 Description of Subdivision

The Millwater subdivision is situated to the north of the Silverdale Township, and west of the Metro Park East reserve area, and comprises approximately 260 hectares. The subdivision is bound to the

south and west by Wainui Road, to the north by the Orewa Estuary and to the east by the Orewa Estuary and Millwater Parkway. The original site comprised a mix of farm properties and associated dwellings and existing residential developments.

The Arrans Hill Precinct 5, Stages 3B and 4 areas of the Millwater subdivision is located within what is known as Precinct 5 in the Orewa West Structure Plan.

The Arrans Hill Precinct 5 area is bound by State Highway 1 to the west, Grand Drive to the north, Arran Drive to the east, and the Orewa estuary to the south. The overall Arrans Hill Precinct 5 and Stages 3B and 4 areas are shown on T+T Drawing 21854.0031–AHP5S3B&4–100 in Appendix A2.

Pre-development gradients within the Stages 3B and 4 areas were gentle to moderately steep (1 in 3, to 1 in 15 (V:H)) with an overall fall to the north.

Post-development gradients within the Stages 3B and 4 areas generally remain gentle to moderately steep (1 in 3, to 1 in 15 (V:H)) and fall to the north. In order to form more level building platforms, steep reinforced earth slopes of between 1 in 2 and 1 in 1.5 (V:H) have been constructed as shown on T+T Drawing 21854.0031–AHP5S3B&4–101 in Appendix A2.

Stages 3B and 4 are presently accessed from the existing Arran Drive.

1.3 Geological Setting

Published geological mapping and information indicates the Arrans Hill Precinct 5 area is underlain by East Coast Bays Formation (ECBF) materials. In addition to the ECBF materials, our investigations identified the presence of alluvial and colluvial materials on site along the stream margins.

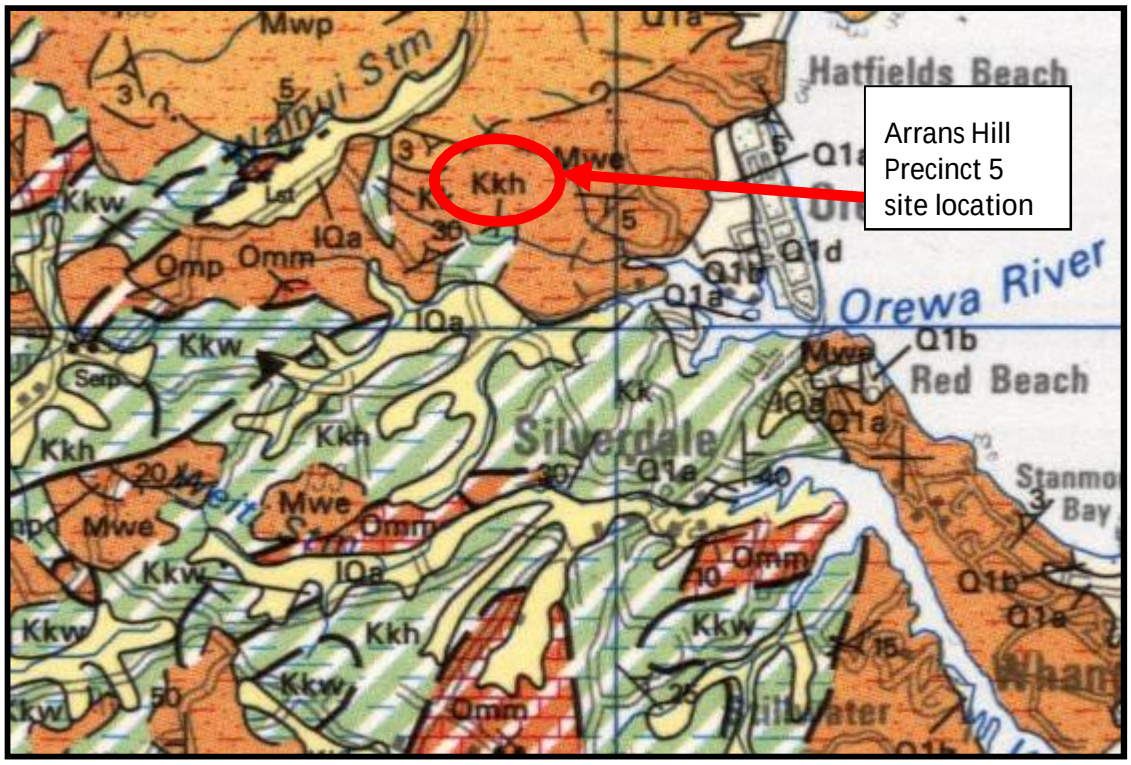


Figure 1 - Geological map of Arrans Hill Precinct 5 and Silverdale area (from Edbrooke, 2001)

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

a East Coast Bays Formation

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

b Pleistocene Age Alluvium and Colluvium

Alluvium and Colluvium are generally observed on the lower slopes, along the edges of the tidal tributaries of the Orewa River - along the southern and eastern boundary of the site. In places, it is locally discontinuous or absent.

The 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.

Colluvium closely resembles the undisturbed residual soil materials, comprising a mix of clayey silts and silts, but is often of lesser strength due to the deformation and disturbance that has occurred during transportation down-slope.

Geological cross-sections through the Arrans Hill Precinct 5 Stages 3B and 4 areas, based on site investigations and observations during construction, are enclosed as Drawing Number 21854.0031–AHP5S3B&4–103 and –104 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 Contractors and 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 two palisade walls (parts of PW5 and PW6) and Screen Block Wall 6 was undertaken by ICB Retaining and Construction Ltd (ICB), also under Hicks' control.

Civil works construction were 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 February 2018 through to February 2019 under Hicks' control. Civil earthworks and construction for the residential Lots were under JGCL's control and were undertaken progressively from February 2019 through to completion in August 2019.

Key Stages 3B and 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 Stages 3B and 4 areas as shown on the Woods Cut & Fill As–Built Plans (Woods Ref 37504–04–03B–110-AB to –112–AB) in Appendix A1.

d Construction of 2 No. Palisade Walls (parts of PW5 and PW6) as shown on T+T Drawing 21854.0031–AHP5S3B&4–101 in Appendix A2.

e Construction of a 4m high geogrid reinforced segmental block wall (Screen Block Wall 6) along the northern boundary of Lots 48 to 51 (immediately below RE 7) as shown on T+T Drawing 21854.0031–AHP5S3B&4–101 in Appendix A2.

f Construction of a 11m high, 1 in 1.5 (V:H) engineered fill batter slope (part of RE 7) along the northern boundary of Residential Lots 48 to 53 and Reserve Lot 802 as shown on T+T Drawing 21854.0031–AHP5S3B&4–101 in Appendix A2.

g Construction of a 8m high, 1 in 2 (V:H) engineered fill batter slope (RE 5) along the southern boundary of Residential Lots 164 to 173 as shown on T+T Drawing 21854.0031–AHP5S3B&4–101 in Appendix A2.

Key Stages 3B and 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, undercuts, palisade wall, retaining wall and subsoil drainage as–built plans are included in Appendix A1 (Woods Drawings 37504–04-03B–100–AB, 37504–04-03B–110–AB to –112–AB and 37504–04-03B–120–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 & 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 & Reinforced Earth Fill Slopes):

Average value not more than	8%
Maximum single value	10%

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

Compaction control criteria consisting of minimum allowable Clegg Impact Values and minimum allowable in–situ dry density were used for cohesionless fill control. The Technical Specification included in our Geotechnical Investigation Report (Ref. [4], [5]) included the following requirement for the subdivisional earthworks (and in particular during construction of Wall 6):

> Minimum Clegg Impact Value and Minimum In Situ Dry Density Method
>
> Minimum Clegg Impact Value (Measured by Clegg Impact Hammer – IANZ calibrated)
>
> General fills:
>
> | | |
> |---|---|
> | Average value not less than | 20 |
> | Minimum single value | 18 |
>
> Minimum In-Situ Dry Density Percentage (as defined in NZS 4402:1986)
>
> General fills:
>
> | | |
> |---|---|
> | Average value not less than | 95% |
> | Minimum single value | 90% |
>
> The average Clegg Impact value was determined over any ten consecutive tests.

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

Quality Control (QC) testing showed that the results for the filling were consistently meeting the required undrained shear strength, Clegg Impact value, 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 Arrans Hill Precinct 5 during bulk earthworks as part of the undercut, reinforced earth slopes and geogrid reinforced segmental block wall construction.

The subsoil drains installed within the undercut and reinforced earth slopes were excavated into the underlying in-situ soil to intercept groundwater and springs.

Following completion of the undercut excavation, SAP50 scoria drainage blankets were placed along the rear face of the undercut, and comprised the following:

a 160mm diameter perforated Hiway grade Nexus drain pipe installed along the base of the rear of the excavation.

b A minimum of 300mm cover of SAP50 scoria placed over the top of the Nexus pipe and across the entire rear face of the excavation, and connected into the drainage system of the overlying RE Slope and/or retaining wall.

c Bidim A19 geotextile filter-cloth placed over the surface of the SAP50 scoria prior to placement of the reinforced soil to prevent contamination of the drainage aggregate with overlying bulk earthworks materials.

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

a 160mm diameter perforated Hiway grade Nexus drain pipes installed along the base of the rear of the reinforced soil block.

b A minimum of 300mm cover of SAP50 scoria placed over the top of the Nexus pipe and across the entire rear 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 placed over the surface of the SAP50 scoria prior to placement of the reinforced soil to prevent contamination of the drainage aggregate with overlying bulk earthworks materials.

In addition, subsoil drains were installed as part of the geogrid reinforced segmental block retaining wall construction and comprised the following:

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

b A minimum of 300mm cover of SAP50 scoria placed over the top of the Nexus pipe and across the entire rear face of the reinforced soil block, to within 1m of the ground surface (at time of construction).

c Bidim A19 geotextile filter-cloth placed over the surface of the SAP50 scoria prior to placement of the reinforced soil to prevent contamination of the drainage aggregate with overlying bulk earthworks materials.

The subsoil drains were either connected to the reticulated stormwater system or discharged into the swale drain along Grand Drive, as shown on the Woods Undercut And Subsoil Drain As–Built Plan (Woods Ref 37504–04–03B–120–AB) in Appendix A1 and on T+T Drawing 21854.0031–AHP5S3B&4–102 in Appendix A2.

3.2 Undercuts

Undercuts (minimum 2m deep and 5m wide) were excavated below the toe of RE 5 and RE 7 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, 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 Stages 3B and 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).

Where required, the subsoil drains installed within the undercut are as detailed in Section 3.1.

The extent of the undercut areas is shown on the Woods Undercut And Subsoil Drain As–Built Plan (Woods Ref 37504–04–03B–120–AB) in Appendix A1.

3.3 Palisade Wall

Two Palisade Walls (PW5 and PW6) were identified as being required along a section of RE 7 (i.e. across Lots 52 and 53 for PW5; within Lot 48 for PW6) to provide satisfactory factors of safety against instability for the finished development of Stage 4.

Palisade Wall 5 was constructed within Stage 4 during the bulk earthworks in the location shown on the T+T Drawing 21854.0031–AHP5S3B&4–101, included in Appendix A2. Palisade Wall 5 comprises 6m long 250UC73 steel piles installed at 1.8m centres encased in 600mm diameter concreted holes. Drilling for the palisade wall pile bores was inspected and logged by an Engineering Geologist to check that the base of the piles had been extended sufficiently to the target depth.

Ground conditions exposed during construction of Palisade Walls 5 and 6 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

2 No. reinforced earth slopes (i.e. RE 5 and part of RE 7) were constructed during the bulk earthworks period within Stage 4.

The reinforced earth slopes comprise horizontally laid biaxial geogrids placed at 0.5m (vertical) intervals within the engineered, compacted earth fill. The grids extend up to within 1.5 (vertical) metres of the slope crest. They have been placed at various lengths, starting at the face of the slope.

Typical cross–sections of the reinforced earth slopes are shown on T+T Drawings 21854.0031–AHP5S3B&4–113 to –115 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, or excavation within natural ground, 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.

As noted in Section 3.1, a drainage blanket was installed at the rear of the reinforced block of soil and comprises a minimum of 300mm thickness of SAP50 scoria, covered in Bidim A19 geotextile filtercloth and a cap of engineered cohesive fill 2m in thickness. A 160mm diameter perforated Hiway grade Nexus drain pipe installed at the base of the drainage blanket provides regular discharge outlets for any groundwater captured in the drainage blanket. These drainage pipes are connected into the reticulated stormwater system (RE 5) or into the swale drain below Grand Drive (RE 7).

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

The slope faces will be subject to a planting covenant and Building Limitation Zone 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 Limitation Zone has been applied across the slopes (See Sections 5.4 and 6.7).

3.5 Geogrid Reinforced Segmental Block Retaining Wall

A geogrid reinforced segmental block wall (Screen Block Wall 06) was constructed during bulk earthworks within Stage 4. A section of RE 7 (discussed in Section 3.4) was constructed immediately above Screen Block Wall 6.

Screen Block Wall 06 comprises uniaxial High Density Polyethylene (HDPE) geogrids placed at a maximum of 1.0m (vertical) intervals within the well compacted engineered fill (i.e. hardfill and cohesive fill), placed in accordance with the bulk earthworks specification (Section 2.3 above). The grids for Screen Block Wall 6 extend up to the toe of RE 7 immediately above.

Construction of Screen Block Wall 6 comprised the following:

a placement and compaction of fill to the required levels;

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

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

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

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

Typical cross–sections of the geogrid reinforced segmental block walls are shown on T+T Drawings 21854.0031– AHP5S3B&4–111 and -112 in Appendix A2.

As noted in Section 3.1, a drainage blanket was installed at the rear of the reinforced block of soil which comprises a minimum of 300mm thickness of SAP50 scoria, covered in Bidim A19 geotextile filtercloth. A 160mm diameter perforated Hiway grade Nexus drain pipe installed along the backface of the wall and base of the rear of the reinforced soil block provides a discharge outlet for any groundwater captured in the drainage blanket. The drainage pipes from behind the wall discharges into the swale drain along Grand Drive, as shown on the Woods Undercut And Subsoil Drain As–Built Plan (Woods Ref 37504–04–03B–120–AB) in Appendix A1 and on T+T Drawing 21854.0031–AHP5S3B&4–102 in Appendix A2.

Screen Block Wall 6 has been designed to accommodate construction of the reinforced earth slope (discussed in Section 3.4) present immediately above, and development immediately behind/above the wall is likely to be precluded by Council planning rules.

Certification (Producer Statement PS4 – Construction Review) of this wall in accordance with the approved Building Consent (BCO–10270225) is to be supplied under a separate cover letter.

4 Stability Analyses

As noted in Section 1, slope stability analyses undertaken during the investigation stage of the project identified that shear keys were not required to achieve satisfactory factors of safety against slope instability for the finished development of Stages 3B and 4.

Observations and monitoring were undertaken during bulk earthworks construction to confirm that the ground conditions exposed were consistent with the assumptions made in the stability analyses.

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 Arrans Hill Precinct 5 Stages 3B and 4 areas 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 recommendations.

5.2 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 21854.0031–AHP5S3B&4–121) are attached in Appendix E.

5.3 Bearing capacity for building foundations

From the investigation described in Section 5.2, we consider that all filled and natural ground within the site 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 H2 (moderately to highly expansive) with characteristic surface movements anticipated to be in the range of 20mm to 75mm. 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.

5.4 Building Limitation Zones – RE Slopes

Identified steep slopes in the Stages 3B and 4 areas have been constructed as reinforced earth fill structures with face gradients of between 1 in 1.5 and 1 in 2 (V:H). They are located in Lots 48 to 53 and Lots 164 to 173. Construction within the flatter parts of these Lots is intended, and a Building Limitation Zone (i.e. "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 Limitation Zones associated with the RE Slopes are shown on T+T Drawing 21854.0031–AHP5S3B&4–120 (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 Slopes to function as a protective reinforcing layer for the topsoil and plant root system. This is shown on the Woods Reinforced Earth Batter & Slope Stabilisation Plan (Woods Ref 37504–04–03B–140–AB and 37504–04–03B–141–AB) in Appendix A1.

5.5 Settlement

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

Monitoring points were installed across the top of the RE 5 and RE 7 following completion of the construction works. The monitoring commenced in May 2019 and June 2018 for RE 5 and RE 7, respectively, and has continued through until August 2019. The monitoring shows that while settlements of up to 14mm have occurred, there has been negligible movement since June 2019 on either RE 5 or RE 7.

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

5.6 Earthworks and Retaining walls

All earthworks and retaining wall construction on the lots should comply with all requirements of the Resource Management Act (1991), the Building Act (2004) and the Auckland Unitary Plan.

All temporary and permanent cuts exceeding 1.5m in height, including cuts to be retained, should be specifically investigated by a suitably qualified geotechnical professional to confirm that the stability of the subject (or adjacent) Lot is not detrimentally affected. Retaining walls greater than 1.5m in height should be specifically investigated and designed by a Chartered Professional Engineer practising in geotechnical engineering.

Fill greater than 0.6m thick, and all fill proposed to be beneath structures (including hardstanding areas), should meet the requirements of NZS 4431:1989 – Code of Practice for Earthfill for Residential Development, and should include adequate stripping, benching, and underdrainage.

All fills greater than 0.6m thickness should be investigated and designed by a Chartered Professional Engineer practising in geotechnical engineering or by an experienced Engineering Geologist. The Engineer should consider the effect of the earthworks on global stability, i.e. the effect of the works on the stability of the lot and on the stability adjacent lots.

Due to the relatively shallow grades across most of the Stages 3B and 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 retaining wall design, we recommend the use of the following geotechnical design parameters for the retained soils:

- $\gamma = 18\ kN/m^3$,
- $c' = 0\ kPa$,
- $Ø' = 30°$,
- $K_a = 0.30$,
- $K_p = 3.33$,

We recommend an undrained shear strength, “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.

The existing geogrid reinforced segmental block wall constructed within the Stage 4 area is shown on the Woods Slope As-Built Plans (Woods Ref 37504–04–03B–140–AB) in Appendix A1. This wall has been designed to accommodate construction of the reinforced earth slope (discussed in Section 3.4) present immediately above, and development immediately behind/above the wall is likely to be precluded by Council planning rules.

5.7 Subsoil Drainage

Following undercutting during bulk earthworks, groundwater subsoil drainage was installed at select locations using Nexus subsoil 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 Undercut And Subsoil Drain As–Built Plan (Woods Ref 37504–04–03B–120–AB) in Appendix A1, and on T+T Drawing 21854.0031–AHP5S3B&4–102 in Appendix A2.

This subsoil 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 subsoil 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.

5.8 Stormwater

Public stormwater services have been installed within Arrans Hill Precinct 5, Stages 3B and 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 37504–04–03B–300–AB to –303–AB and –400–AB to –403–AB) are 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 Arrans Hill Precinct 5, Stages 3B and 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 a representative number of the Lots and these are shown on T+T Drawing 21854.0031–AHP5S3B&4–122 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 these stages 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 these stages 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 H2 (moderately to highly expansive) with characteristic surface movements anticipated to be in the range of 20mm to 75mm.

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 Arrans Hill Precinct 5 Stages 3B and 4 (comprising Residential Lots 48 to 53, 164 to 173, 196 to 212 and 216 to 230, Reserve Lot 802, and Road Lot 903 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 Arrans Hill Precinct 5 Ref. No. 21854.0031 dated December 2015. 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 37504, Millwater, Arrans Hill Precinct 5 Stages 3B and 4, Drawing Numbers 37504–04–03B–100–AB, –110–AB to –112–AB and –120–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 48 to 53, 167 to 173, 196 to 212, 216 to 218, 222 to 224 and 228 to 230 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 300kPa (factored (ULS) 150kPa, working (SLS) 100kPa). 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 600mm 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 earth cuts and/or retaining wall construction in excess of 1.5 metres height, and no earthworks involving fills in excess of 600mm depth, or fill below the influence zone of foundations, 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.

Development within Lots 48 to 53 and 167 to 173 should comply with the Building Limitation Zones set to protect RE Slopes 5 and 7.

6.6 For Lots 165 and 166, 219 to 221 and 225 to 227 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 300kPa (factored (ULS) 150kPa, working (SLS) 100kPa). 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 750mm 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 earth cuts and/or retaining wall construction in excess of 1.5 metres height, and no earthworks involving fills in excess of 600mm depth, or fill below the influence zone of foundations, 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.

Development within Lots 164 to 166 should comply with the Building Limitation Zones set to protect RE Slope 5.

6.7 For Lot 164:

6.7.1 Foundation design

The filled and natural ground within the residential Lot boundary is considered generally suitable for the erection thereon of light timber framed, flexibly clad residential buildings subject to clauses 6.7.2 to 6.7.6.

6.7.2 Bearing capacity

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

6.7.3 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

H2 (highly expansive) as defined in AS 2870:2011 (Ref. [7]) with anticipated characteristic surface ground movements of 60mm to 75mm. Clause 6.7.3.1 of this Geotechnical Completion Report may be used for expansive soil foundation design on this subdivision:

6.7.3.1 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:

iv) Minimum foundation embedment of 900mm following topsoil removal and benching of building platform areas to finished ground levels;

v) Four bar steel reinforcing cages should be used;

vi) 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.

6.7.4 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.

6.7.5 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.

6.7.6 Retaining walls / Earthworks

No earth cuts and/or retaining wall construction in excess of 1.5 metres height, and no earthworks involving fills in excess of 600mm depth, or fill below the influence zone of foundations, 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.

Development within this Lot should comply with the Building Limitation Zones set to protect RE Slope 5.

6.8 For Lots 48 to 53 and 164 to 173 inclusive:

6.8.1 These Lots contain a "Building Limitation Zone" relating to the reinforced earth slopes which forms the 1 in 1.5 to 1 in 2 (V:H) slopes along the Lot boundaries. The Building Limitation Zone is shown on T+T Drawing 21854.0031–AHP5S3B&4–120 in Appendix A2. Excavation, filling and/or construction within this zone is not to be undertaken, to ensure stability of the slopes is not compromised.

6.8.2 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 slopes have assumed a maximum distributed load of 10kPa (dead plus live loads) up to the edge of the Building Limitation Zone.

6.8.3 Any cut or fill walls greater than 1.5m retained height, or of any height within 2m of the Building Limitation Zone shown on T+T Drawing 21854.0031–AHP5S3B&4–120 in Appendix A2, will require a geotechnical assessment, as a minimum, to ensure stability of the subject or adjacent Lot is not detrimentally affected.

6.8.4 Development outside of the Building Limitation Zone may proceed in accordance with the recommendations outlined in Sections 6.5 and 6.6.

6.9 Underfill (Subsoil) drainage

Underfill (Subsoil) drains have been installed during subdivisional development in the locations shown on the Woods Undercut And Subsoil Drain As–Built Plan (Woods Ref 37504–04–03B–120–AB) in Appendix A1, and on T+T Drawing 21854.0031–AHP5S3B&4–102 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.

6.10 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 and sanitary sewer as–built plans are included in Appendix A1.

6.11 Road and Access Lots

Based on the fill monitoring and site observations undertaken during site development, the filled and natural ground within Arrans Hill Precinct 5 Stages 3B and 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 Stages 3B and 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.

6.12 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.

This suitability statement relates to the general suitability of the site; it does not remove the need for specific site investigation, design and inspection as required by the Building Code, NZS 3604:2011 and NZS 4431:1989.

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:

.....

Jason Kelly

Engineering Geologist

Authorised for Tonkin & Taylor Ltd by:

.....

Andrew Stiles

Project Director

JKK
t:\auckland\projects\21854\21854.0031 - arrans hill p5\gcr\stage 3b and stage 4\jkk.28022020.ahp5s3b+4-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., March 2013. *Millwater – North South Link, North Bridge to Grand Drive, Geotechnical Investigation Report,* T+T Ref. 21854.012.

[5] Tonkin & Taylor Ltd., December 2015. *Millwater Subdivision Arrans Hill – Precinct 5 – Geotechnical Investigation Report,* T+T Ref. 21854.0031.

[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

· 37504–04–03B–100–AB	Final Contour As–Built Plan
· 37504–04–03B–110–AB	Cut & Fill As–Built – Original to Lowest Surface
· 37504–04–03B–111–AB	Cut & Fill As–Built – Lowest to Final Surface
· 37504–04–03B–112–AB	Cut & Fill As–Built – Original to Final Surface
· 37504–04–03B–120–AB	Undercut And Subsoil Drain As–Built Plan
· 37504–04–03B–140–AB	Reinforced Earth Batter & Slope Stabilisation Plan
· 37503–04–03B–300–AB to –303–AB	Stormwater As–Built Plans
· 37503–04–03B–400–AB to –403–AB	Wastewater As–Built Plans
· 37504–04–03B–600–AB to –602–AB	Water Main As–Built Plans

CLIENT:

WFH PROPERTIES

COUNCIL:

Auckland Council
Te Kaunihera o Tamaki Makaurau

MILLWATER - ARRAN HILL
STAGE 4 & 3B
ASBUILTS DRAWINGS

August 2019

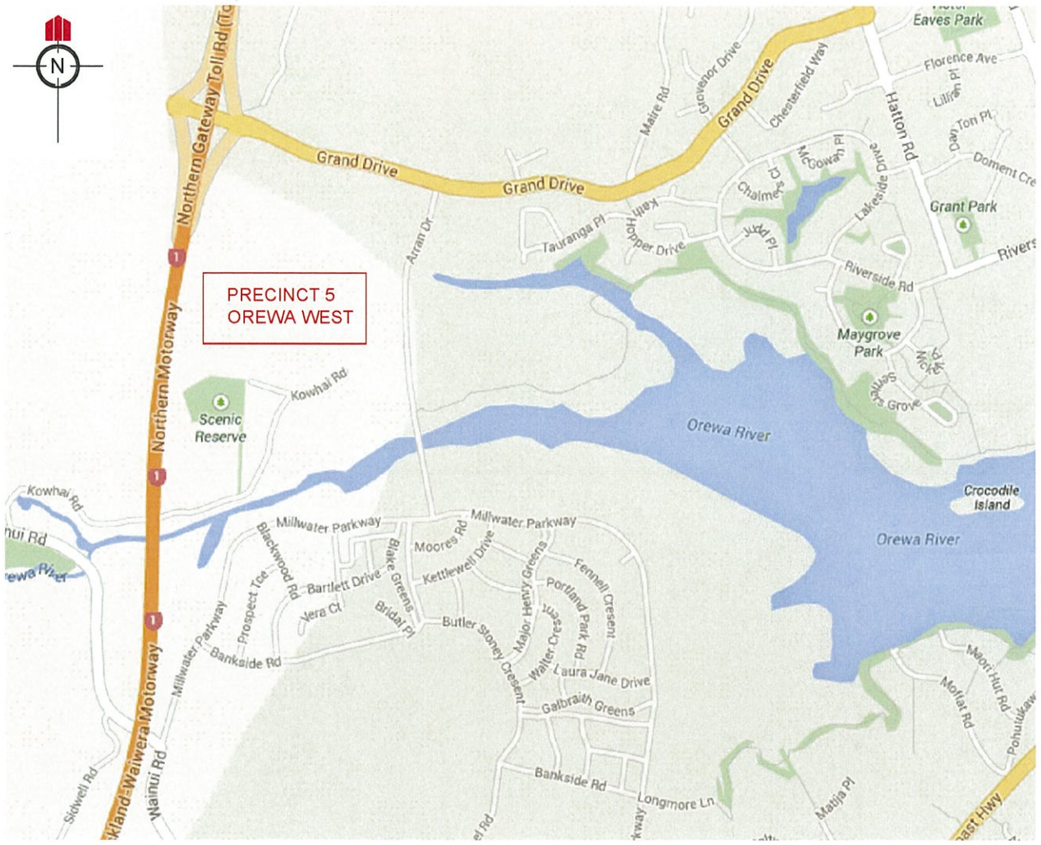
MILLWATER

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

MILLWATER - ARRAN HILL
STAGE 4 & 3B

CONTENT INDEX AND LOCALITY PLAN

SHEET NO.		SHEET TITLE
37504-04-03B-	000	Plans Index and Location Plan
37504-04-03B-	100	Final Contour Asbuilt Plan
37504-04-03B-	110-112	Cut & Fill Asbuilt Original to Final Surface
37504-04-03B-	120	Shear Key, Undercuts & Subsoil Drains Asbuilt Plan
37504-04-03B-	123-124	Deadman
37504-04-03B-	140-141	Slope Stabilisation Plan
37504-04-03B-	200-203	Roading Asbuilt Plans
37504-04-03B-	300-303	Stormwater Asbuilt Plans
37504-04-03B-	400-403	Sanitary Sewer Asbuilt Plans
37504-04-03B-	600-603	Watermain Asbuilt Plans



LOCATION PLAN
NOT TO SCALE

MILLWATER

WFH PROPERTIES

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

WOODS
Est.1970

NOTES

1. NEW CONTOURS ARE AT 0.25m INTERVALS

LEGEND

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

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	23/08/19

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

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5
STAGES 4 & 3B

FINAL CONTOUR
ASBUILT PLAN
SHEET 1 OF 1

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: 23/08/19

Name: Michael Bates

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-100-AB	

SCALEBAR (m)
0 10 20 50

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILTS\4 & 3B\37504_P5_04_03B_FINAL CONTOURS.DWG

WOODS
Est.1970

GRAND DRIVE
GODFREY DRIVE
GODFREY DRIVE
DAVEY CRESCENT
DAVEY CRESCENT
HIDA LANE
HIDA LANE
GROVER STREET

SCALEBAR (m)
0 10 20 50

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

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

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

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

Signed: M Bates
Registered Professional Surveyor

Date: 23/08/19

Name: Michael Bates

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	23/08/19

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

N

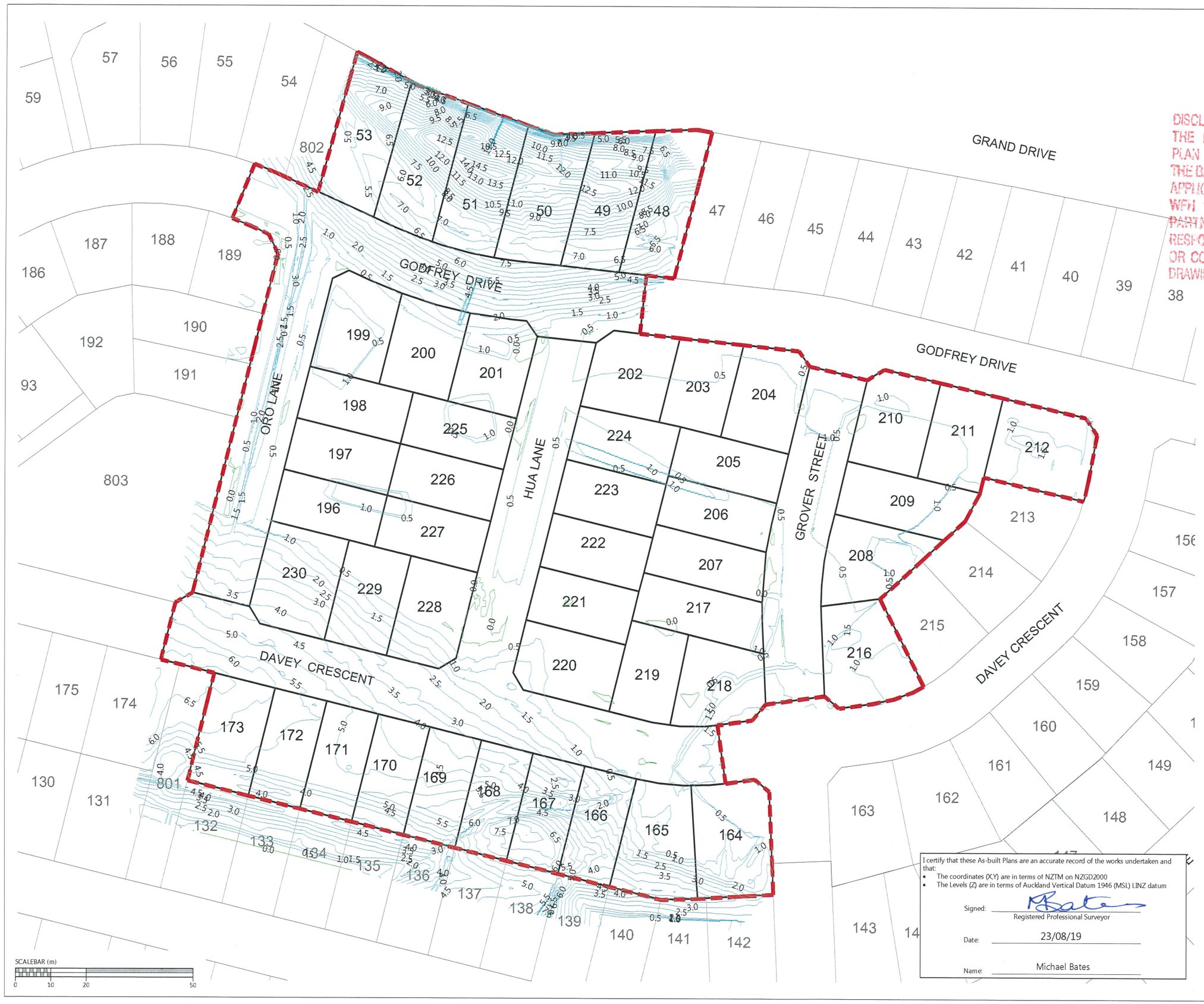
WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

CUT & FILL AS-BUILT
ORIGINAL TO LOWEST SURFACE

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-110-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILTS\4 & 3B\37504_P5_04_03B_CUT FILL CONTOURS.DWG



DISCLAIMER:
THE INFORMATION PORTRAYED ON THIS PLAN IS INTENDED TO BE SOLELY USED AS THE BASE DATA FOR THE PURPOSES OF 224c APPLICATION TO COUNCIL
WFH PROPERTIES LTD AND WOOD AND PARTNERS CONSULTANTS ACCEPT NO RESPONSIBILITY FOR ANY BUILDING DESIGN OR CONSTRUCTION WORK BASED ON THIS DRAWING FILE.

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

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

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	23/08/19

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

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: 23/08/19

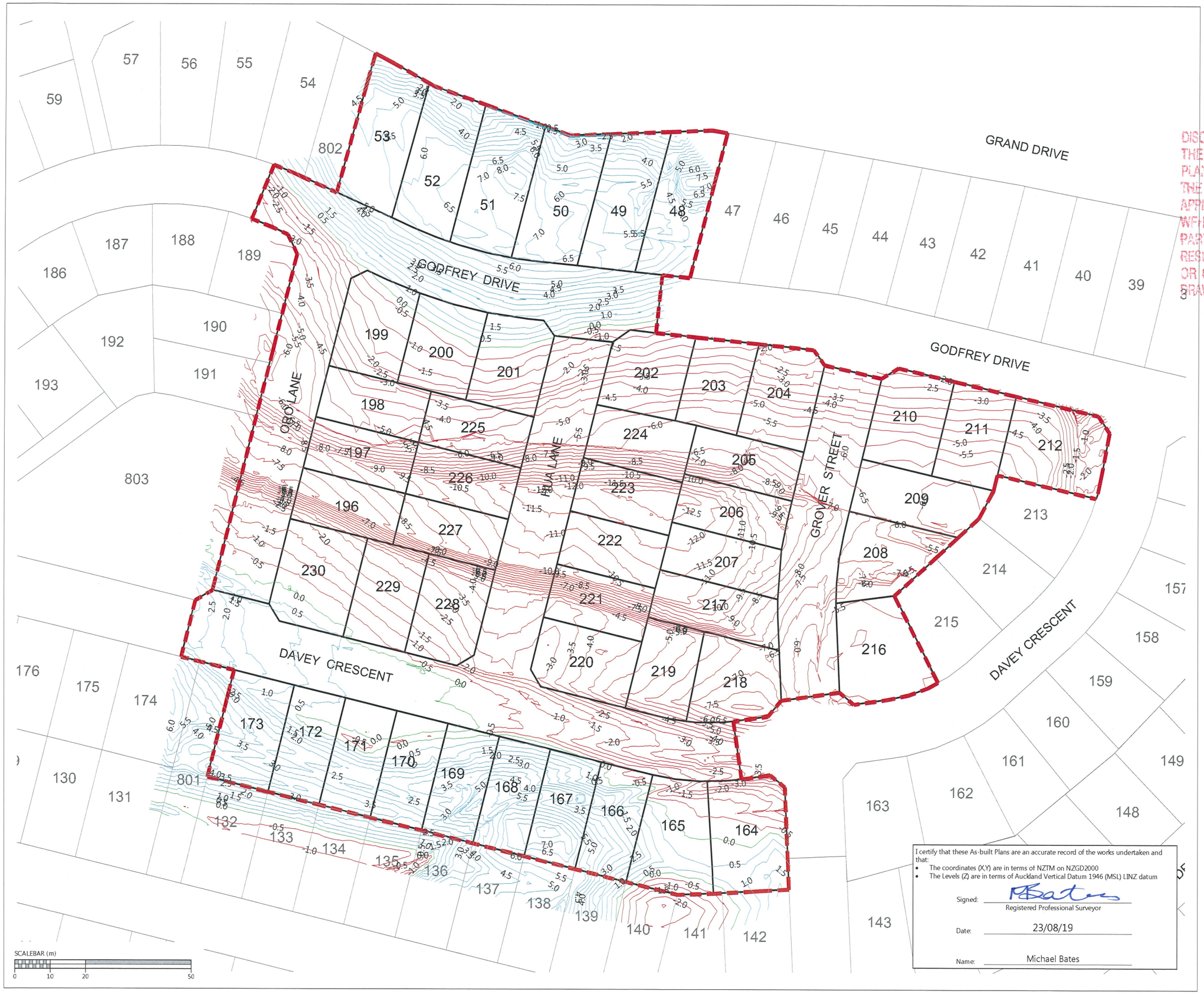
Name: Michael Bates

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

CUT & FILL AS-BUILT LOWEST TO FINAL SURFACE

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-111-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVEY\AS-BUILT\4 & 3B\37504_P5_04_03B_CUT FILL CONTOURS.DWG



DISCLAIMER:
THE INFORMATION PORTRAYED ON THIS PLAN IS INTENDED TO BE SOLELY USED AS THE BASE DATA FOR THE PURPOSES OF 224c APPLICATION TO COUNCIL
WFH PROPERTIES LTD AND WOOD AND PARTNERS CONSULTANTS ACCEPT NO RESPONSIBILITY FOR ANY BUILDING DESIGN OR CONSTRUCTION WORK BASED ON THIS DRAWING FILE.

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

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

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	23/08/19

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

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: 23/08/19

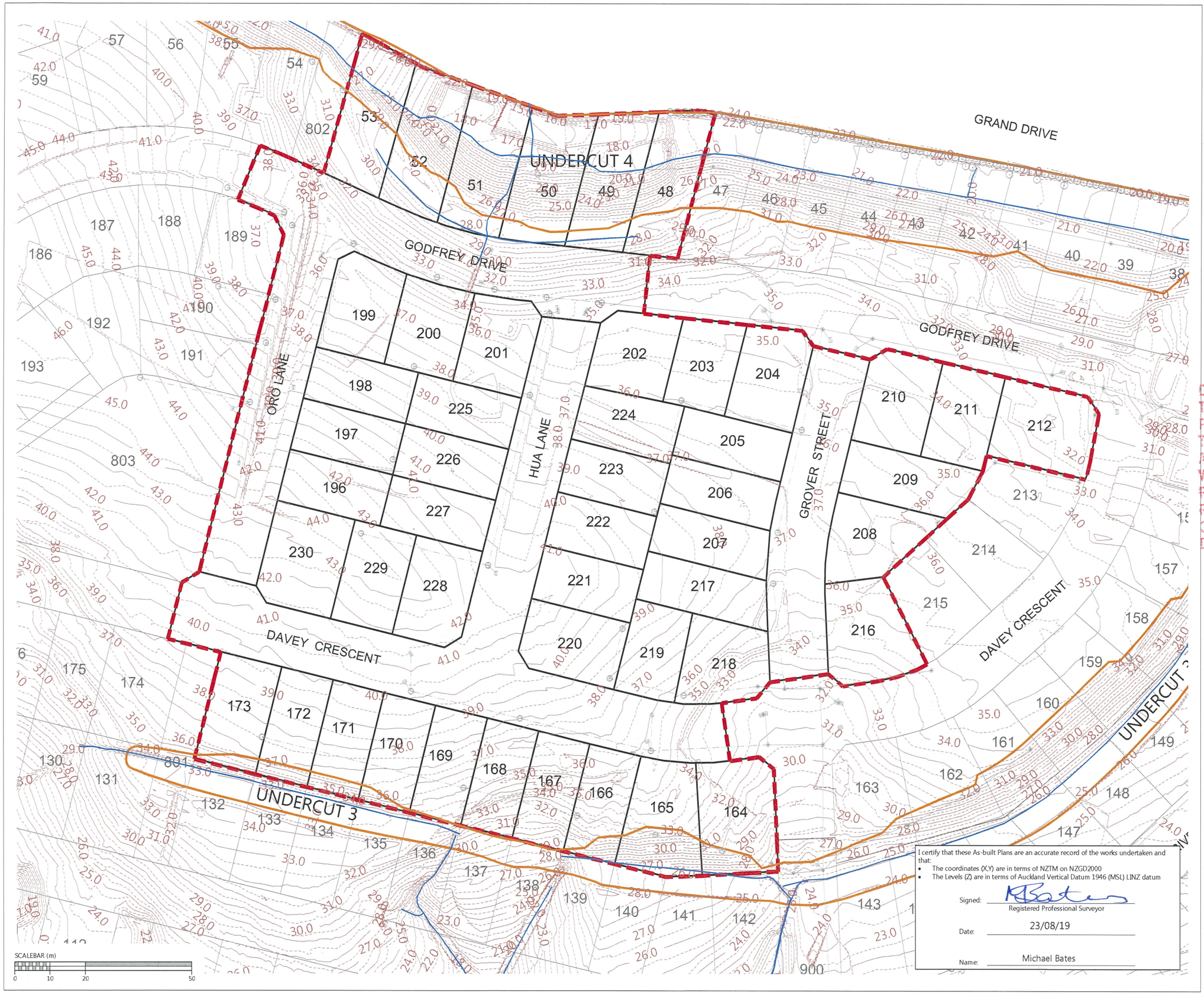
Name: Michael Bates

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

CUT & FILL AS-BUILT ORIGINAL TO FINAL SURFACE

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-112-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILT\4 & 3B\37504_P5_04_03B_CUT FILL CONTOURS.DWG



WOODS
EST.1970

NOTES

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

LEGEND

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

DISCLAIMER:
THE INFORMATION PORTRAYED ON THIS PLAN IS INTENDED TO BE SOLELY USED AS THE BASE DATA FOR THE PURPOSES OF 224c APPLICATION TO COUNCIL
WFH PROPERTIES LTD AND WOOD AND PARTNERS CONSULTANTS ACCEPT NO RESPONSIBILITY FOR ANY BUILDING DESIGN OR CONSTRUCTION WORK BASED ON THIS DRAWING FILE

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	23/08/19

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

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

SHEAR KEY, UNDERCUT AND SUBSOIL DRAIN ASBUILT SHEET 1 OF 1

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: K Bates
Registered Professional Surveyor

Date: 23/08/19

Name: Michael Bates

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-120-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5-STAGE 4\DRAWINGS\SURVAS-BUILT\V4 & 3B\37504_P5_04_03B_SK UC & SUBSOIL.DWG

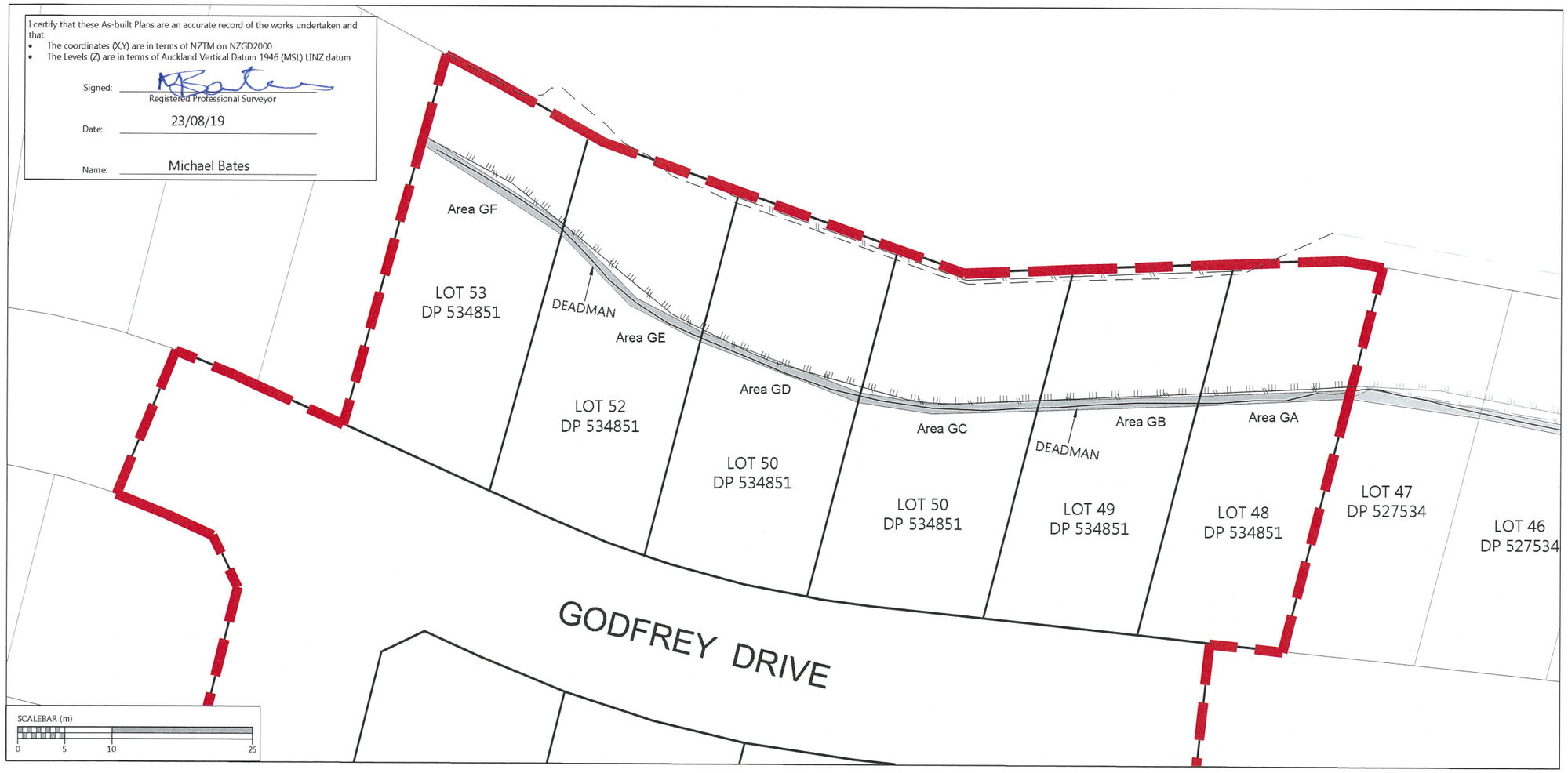
I certify that these As-built Plans are an accurate record of the works undertaken and that:

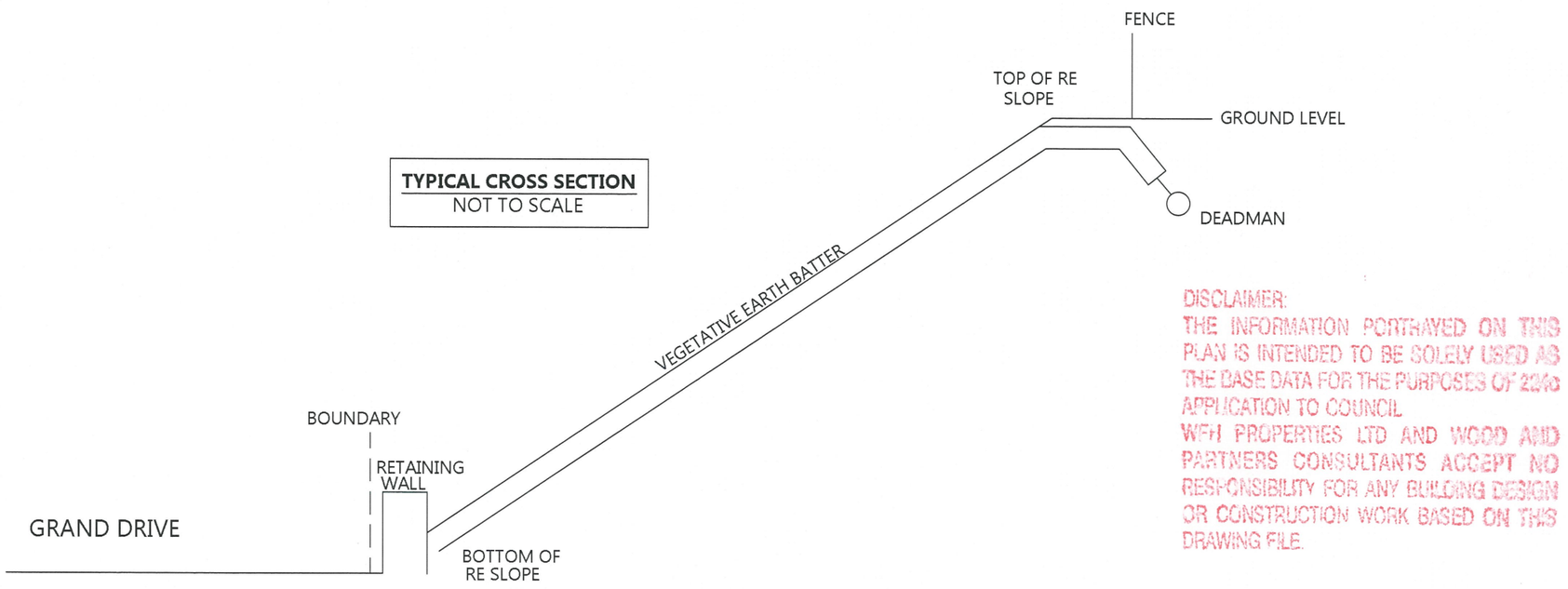
- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____ Registered Professional Surveyor

Date: 23/08/19

Name: Michael Bates





TYPICAL CROSS SECTION
NOT TO SCALE

WOODS
EST.1970

LEGEND:

- BOUNDARY
- DEADMAN COVENANT AREA
- TOP OF BANK
- FENCE
- STAGE EXTENTS

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.*
3. *TITLE DIMENSIONS ARE SOURCED FROM DP 534851 - SEE CRF FOR CONFIRMATION OF DIMENSIONS.*

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.

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	23/08/19

SURVEYED	CONTRACTOR	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	SK	
CHECKED	NC	
APPROVED	MB	WOODS.CO.NZ

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

DEADMAN COVENENT DIAGRAM
SHEET 1 OF 2

STATUS	INFORMATION	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-123-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVVAS-BUILT\V4 & 3B\37504_PS_04_03B_DEADMAN.DWG

DAVEY CRESCENT

LOT 173 DP 534851
Area GP
DEADMAN
LOT 172 DP 534851
Area GO
LOT 171 DP 534851
Area GN
LOT 170 DP 534851
Area GM
LOT 169 DP 534851
Area GL
LOT 168 DP 534851
Area GK
LOT 167 DP 534851
Area GJ
DEADMAN
LOT 166 DP 534851
Area GI
LOT 165 DP 534851
Area GH
LOT 164 DP 534851
Area GG
DEADMAN

SCALEBAR (m)
0 5 10 25

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: 23/08/19

Name: Michael Bates

WOODS
EST.1970

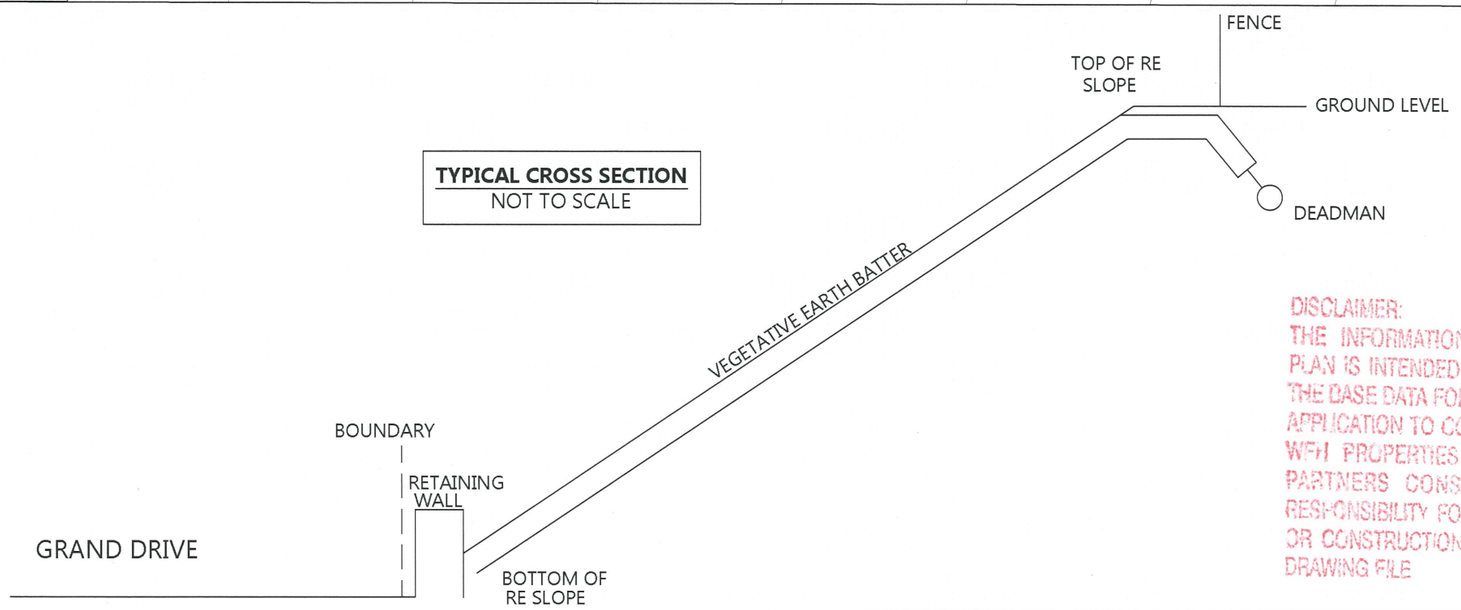
LEGEND:

- BOUNDARY
- DEADMAN COVENANT AREA
- TOP OF BANK
- FENCE
- STAGE EXTENTS

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.*
3. *TITLE DIMENSIONS ARE SOURCED FROM DP 534851 - SEE CRF FOR CONFIRMATION OF DIMENSIONS.*

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.

TYPICAL CROSS SECTION
NOT TO SCALE



DISCLAIMER:
THE INFORMATION PORTRAYED ON THIS PLAN IS INTENDED TO BE SOLELY USED AS THE BASE DATA FOR THE PURPOSES OF 224c APPLICATION TO COUNCIL.
WFH PROPERTIES LTD AND WOOD AND PARTNERS CONSULTANTS ACCEPT NO RESPONSIBILITY FOR ANY BUILDING DESIGN OR CONSTRUCTION WORK BASED ON THIS DRAWING FILE

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	23/08/19

SURVEYED	CONTRACTOR	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	SK	
CHECKED	NC	
APPROVED	MB	WOODS.CO.NZ

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

DEADMAN COVENENT DIAGRAM
SHEET 2 OF 2

STATUS	INFORMATION	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-124-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVVAS-BUILT\4 & 3B\37504_PS_04_03B_DEADMAN.DWG

SEE SHEET 141

NEW ALLAN BLOCK RETAINING WALL ALONG BOTTOM OF BANK

POOL STYLE FENCE ON TOP OF RETAINING WALL

VEGETATED REINFORCED EARTHBATTER

POOL STYLE FENCE ON TOP OF BANK

GRAND DRIVE

GODFREY DRIVE

ORO LANE

HUA LANE

GROVER STREET

DAVEY CRESCENT

SCALEBAR (m)
0 10 20 50

LEGEND:

- BOUNDARY
- DEADMAN
- SLOPE STABILISATION DEVICE
- TOP OF BANK
- BOTTOM OF BANK
- FENCE
- TOP OF WALL
- BOTTOM OF WALL

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.

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	23/08/19

SURVEYED	CONTRACTOR	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	SK	
CHECKED	NC	
APPROVED	MB	WOODS.CO.NZ

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: MBates
Registered Professional Surveyor

Date: 23/08/19

Name: Michael Bates

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

REINFORCED EARTH BATTER & SLOPE STABILISATION PLAN SHEET 1 OF 2

STATUS	INFORMATION	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-140-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILT\4 & 3B\37504_PS_04 03B_RE SLOPE.DWG

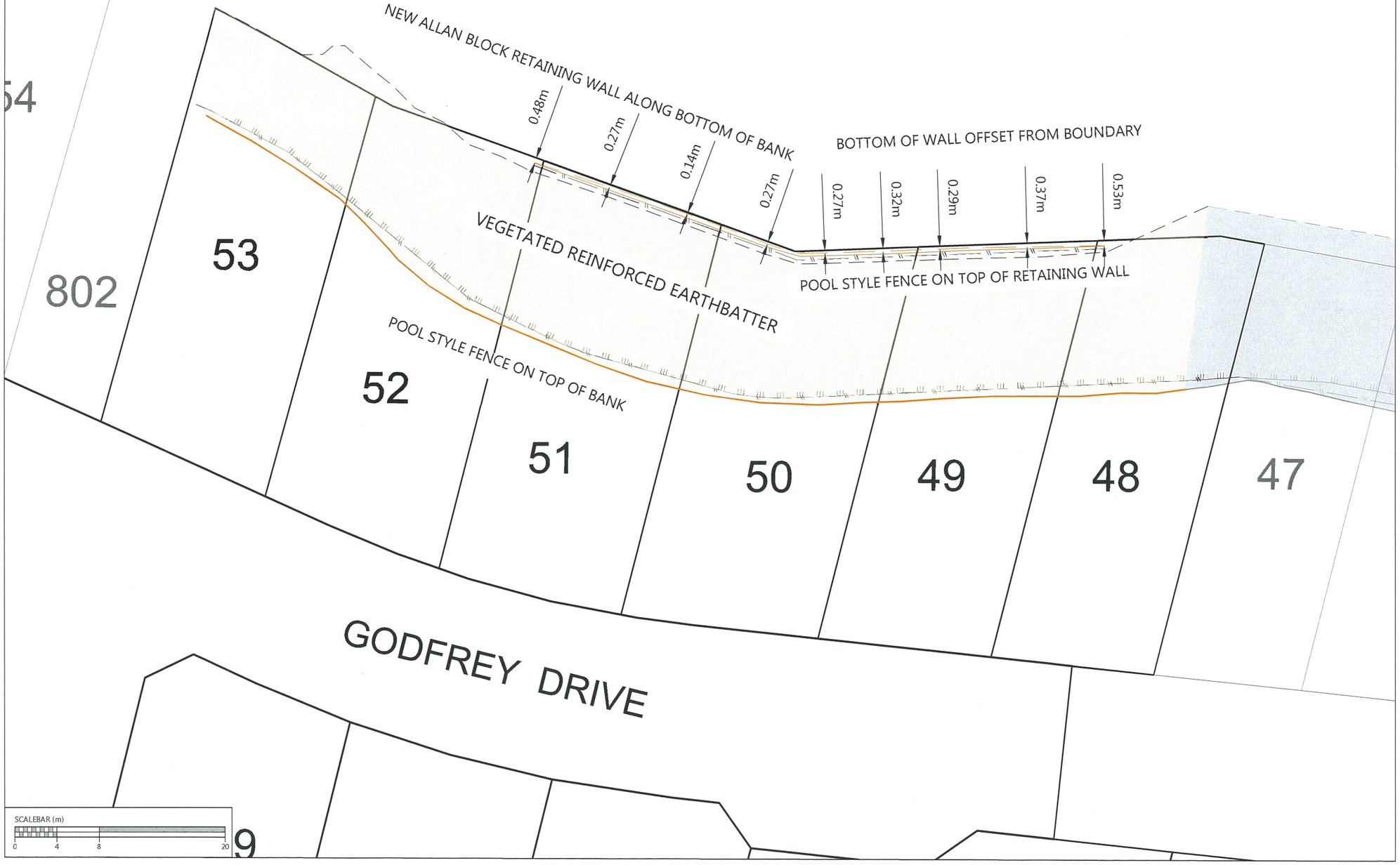
DISCLAIMER:
THE INFORMATION PORTRAYED ON THIS PLAN IS INTENDED TO BE SOLELY USED AS THE BASE DATA FOR THE PURPOSES OF 224C APPLICATION TO COUNCIL
WFH PROPERTIES LTD AND WOOD AND PARTNERS CONSULTANTS ACCEPT NO RESPONSIBILITY FOR ANY BUILDING DESIGN OR CONSTRUCTION WORK BASED ON THIS DRAWING FILE

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: 23/08/19

Name: Michael Bates



LEGEND:

- BOUNDARY
- DEADMAN
- SLOPE STABILISATION DEVICE
- TOP OF BANK
- BOTTOM OF BANK
- FENCE
- TOP OF WALL
- BOTTOM OF WALL

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.

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	23/08/19

SURVEYED	CONTRACTOR	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	SK	
CHECKED	NC	
APPROVED	MB	WOODS.CO.NZ

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

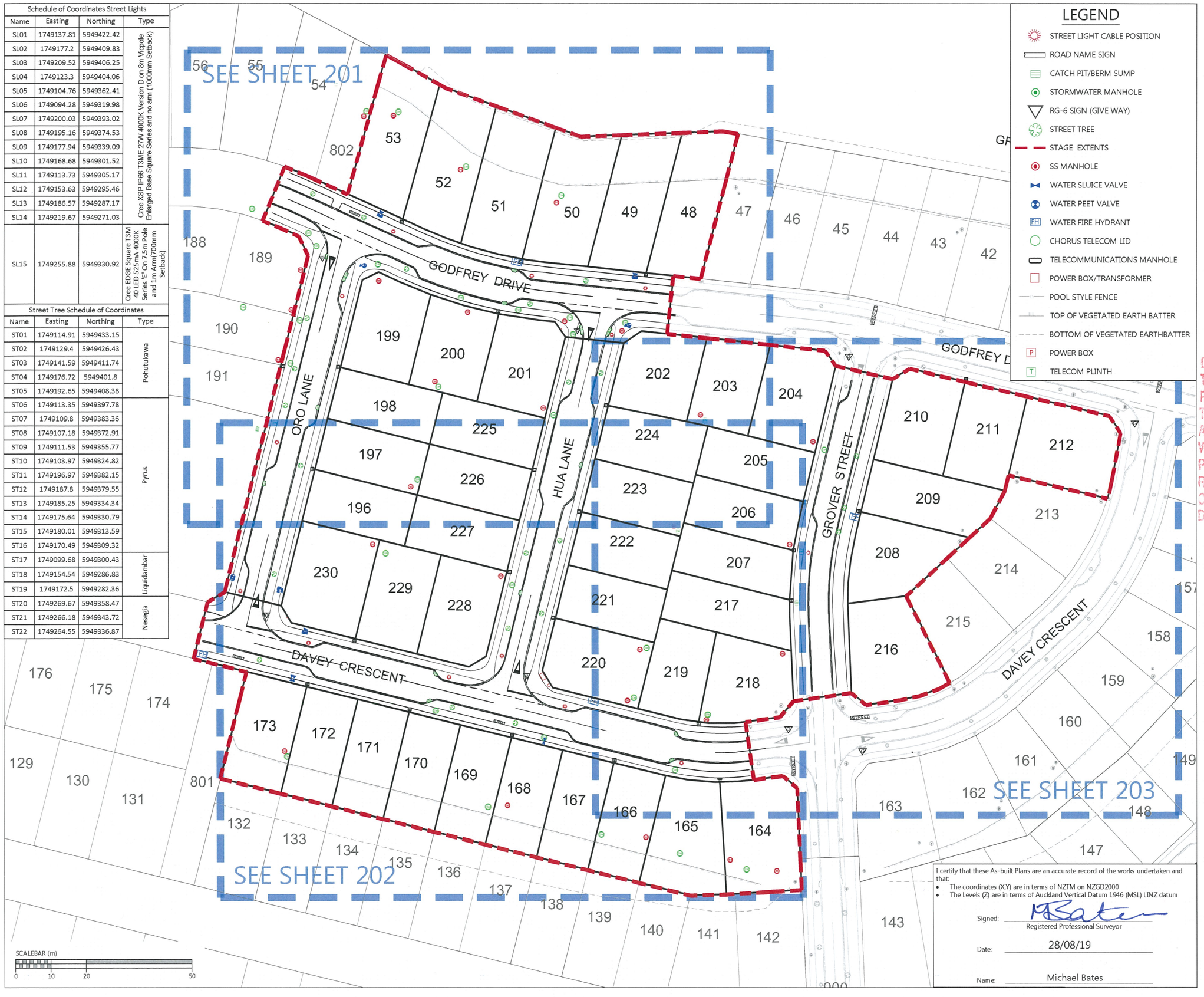
REINFORCED EARTH BATTER & SLOPE STABILISATION PLAN SHEET 2 OF 2

STATUS	INFORMATION	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-141-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILT\V4 & 3B\37504_P5_04_03B_RE SLOPE.DWG

Schedule of Coordinates Street Lights			
Name	Easting	Northing	Type
SL01	1749137.81	5949422.42	Cree XSP IP66 T3ME 27W 4000K Version D on 8m Vigpole Enlarged Base Square Series and no arm (1000mm Setback)
SL02	1749177.2	5949409.83	
SL03	1749209.52	5949406.25	
SL04	1749123.3	5949404.06	
SL05	1749104.76	5949362.41	
SL06	1749094.28	5949319.98	
SL07	1749200.03	5949393.02	
SL08	1749195.16	5949374.53	
SL09	1749177.94	5949339.09	
SL10	1749168.68	5949301.52	
SL11	1749113.73	5949305.17	
SL12	1749153.63	5949295.46	
SL13	1749186.57	5949287.17	
SL14	1749219.67	5949271.03	
SL15	1749255.88	5949330.92	Cree EDGE Square T3M 40 LED 525mA 4000K Series 'E' On 7.5m Pole and 1m Arm(700mm Setback)

Street Tree Schedule of Coordinates			
Name	Easting	Northing	Type
ST01	1749114.91	5949433.15	Pohutukawa
ST02	1749129.4	5949426.43	
ST03	1749141.59	5949411.74	
ST04	1749176.72	5949401.8	
ST05	1749192.65	5949408.38	
ST06	1749113.35	5949397.78	Pyrus
ST07	1749109.8	5949383.36	
ST08	1749107.18	5949372.91	
ST09	1749111.53	5949355.77	
ST10	1749103.97	5949324.82	
ST11	1749196.97	5949382.15	
ST12	1749187.8	5949379.55	
ST13	1749185.25	5949334.34	
ST14	1749175.64	5949330.79	
ST15	1749180.01	5949313.59	
ST16	1749170.49	5949309.32	
ST17	1749099.68	5949300.43	Liquidambar
ST18	1749154.54	5949286.83	
ST19	1749172.5	5949282.36	
ST20	1749269.67	5949358.47	Nesegia
ST21	1749266.18	5949343.72	
ST22	1749264.55	5949336.87	



LEGEND

- STREET LIGHT CABLE POSITION
- ROAD NAME SIGN
- CATCH PIT/BERM SUMP
- STORMWATER MANHOLE
- RG-6 SIGN (GIVE WAY)
- STREET TREE
- STAGE EXTENTS
- SS MANHOLE
- WATER SLUICE VALVE
- WATER PEET VALVE
- WATER FIRE HYDRANT
- CHORUS TELECOM LID
- TELECOMMUNICATIONS MANHOLE
- POWER BOX/TRANSFORMER
- POOL STYLE FENCE
- TOP OF VEGETATED EARTH BATTER
- BOTTOM OF VEGETATED EARTHBATTER
- POWER BOX
- TELECOM PLINTH

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AC STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION ISSUE NOV 2005.
2. ALL ROADS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH APPROVED ENGINEERING PLANS.
3. ALL FINISHED ROAD SURFACES ARE ASHPHALT CONCRETE 30mm THICK.
4. ALL FOOTPATHS ARE 100mm THICK BRUSHED CONCRETE OR EXPOSED AGGREGATE AS NOTED.
5. ALL PIPE CROSSINGS UNDER ROADS HAVE BEEN HARDFILL BACKFILLED.
6. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY DATA AND CONTRACTOR RECEIVED DATA.

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	28/08/19

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: 28/08/19

Name: Michael Bates

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

ARRAN HILL PRECINCT 5
STAGES 4 & 3B
ROADING AS-BUILT
OVERALL LAYOUT
SHEET 1 OF 4

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-200-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVVAS-BUILT\V4 & 3B\37504_P5_04_03B_ROADING PLANS.DWG

DISCLAIMER:
THE INFORMATION POTRAYED ON THIS PLAN IS INTENDED TO BE SOLELY USED AS THE BASE DATA FOR THE PURPOSES OF 224S APPLICATION TO COUNCIL
WFH PROPERTIES LTD AND WOOD AND PARTNERS CONSULTANTS ACCEPT NO RESPONSIBILITY FOR ANY BUILDING DESIGN OR CONSTRUCTION WORK BASED ON THIS DRAWING FILE

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

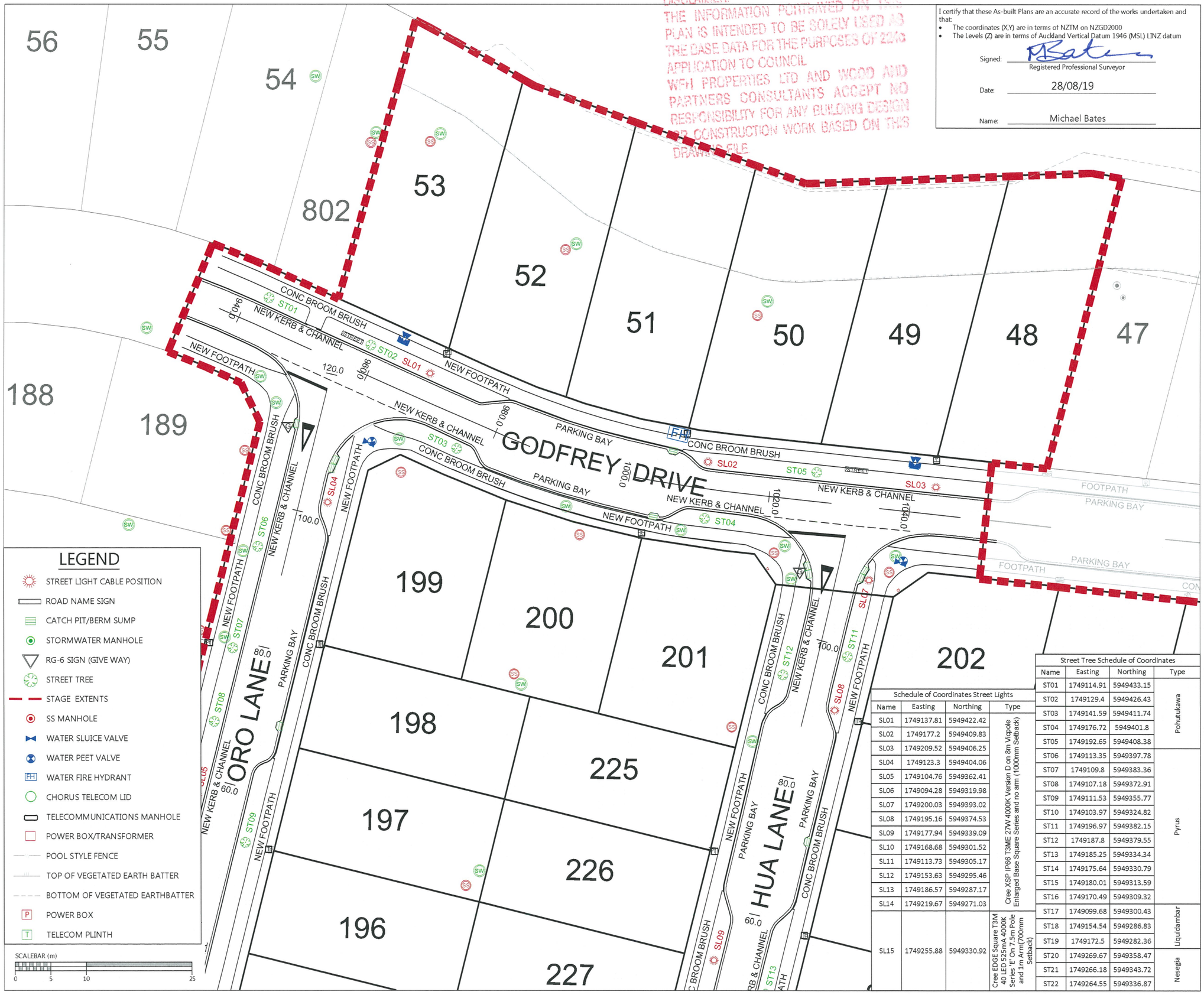
Date: 28/08/19

Name: Michael Bates

WOODS Est.1970

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AC STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION ISSUE NOV 2005.
2. ALL ROADS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH APPROVED ENGINEERING PLANS.
3. ALL FINISHED ROAD SURFACES ARE ASHPHALT CONCRETE 30mm THICK.
4. ALL FOOTPATHS ARE 100mm THICK BRUSHED CONCRETE OR EXPOSED AGGREGATE AS NOTED.
5. ALL PIPE CROSSINGS UNDER ROADS HAVE BEEN HARDFILL BACKFILLED.
6. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY DATA AND CONTRACTOR RECEIVED DATA.



LEGEND

- STREET LIGHT CABLE POSITION
- ROAD NAME SIGN
- CATCH PIT/BERM SUMP
- STORMWATER MANHOLE
- RG-6 SIGN (GIVE WAY)
- STREET TREE
- STAGE EXTENTS
- SS MANHOLE
- WATER SLUICE VALVE
- WATER PEET VALVE
- WATER FIRE HYDRANT
- CHORUS TELECOM LID
- TELECOMMUNICATIONS MANHOLE
- POWER BOX/TRANSFORMER
- POOL STYLE FENCE
- TOP OF VEGETATED EARTH BATTER
- BOTTOM OF VEGETATED EARTHBATTER
- POWER BOX
- TELECOM PLINTH

SCALEBAR (m)
0 5 10 25

Schedule of Coordinates Street Lights

Name	Easting	Northing	Type
SL01	1749137.81	5949422.42	Cree XSP IP66 T3ME 27W 4000K Version D on 8m Vicpole Enlarged Base Square Series and no arm (1000mm Setback)
SL02	1749177.2	5949409.83	
SL03	1749209.52	5949406.25	
SL04	1749123.3	5949404.06	
SL05	1749104.76	5949362.41	
SL06	1749094.28	5949319.98	
SL07	1749200.03	5949393.02	
SL08	1749195.16	5949374.53	
SL09	1749177.94	5949339.09	
SL10	1749168.68	5949301.52	
SL11	1749113.73	5949305.17	
SL12	1749153.63	5949295.46	
SL13	1749186.57	5949287.17	
SL14	1749219.67	5949271.03	
SL15	1749255.88	5949330.92	Cree EDGE Square T3M 40 LED 525mA 4000K Series 'E' On 7.5m Pole and 1m Arm(700mm Setback)

Street Tree Schedule of Coordinates

Name	Easting	Northing	Type
ST01	1749114.91	5949433.15	Pohutukawa
ST02	1749129.4	5949426.43	
ST03	1749141.59	5949411.74	
ST04	1749176.72	5949401.8	
ST05	1749192.65	5949408.38	
ST06	1749113.35	5949397.78	Pyrus
ST07	1749109.8	5949383.36	
ST08	1749107.18	5949372.91	
ST09	1749111.53	5949355.77	
ST10	1749103.97	5949324.82	
ST11	1749196.97	5949382.15	
ST12	1749187.8	5949379.55	
ST13	1749185.25	5949334.34	
ST14	1749175.64	5949330.79	
ST15	1749180.01	5949313.59	
ST16	1749170.49	5949309.32	
ST17	1749099.68	5949300.43	Liquidambar
ST18	1749154.54	5949286.83	
ST19	1749172.5	5949282.36	
ST20	1749269.67	5949358.47	Nesegia
ST21	1749266.18	5949343.72	
ST22	1749264.55	5949336.87	

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	28/08/19

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

N

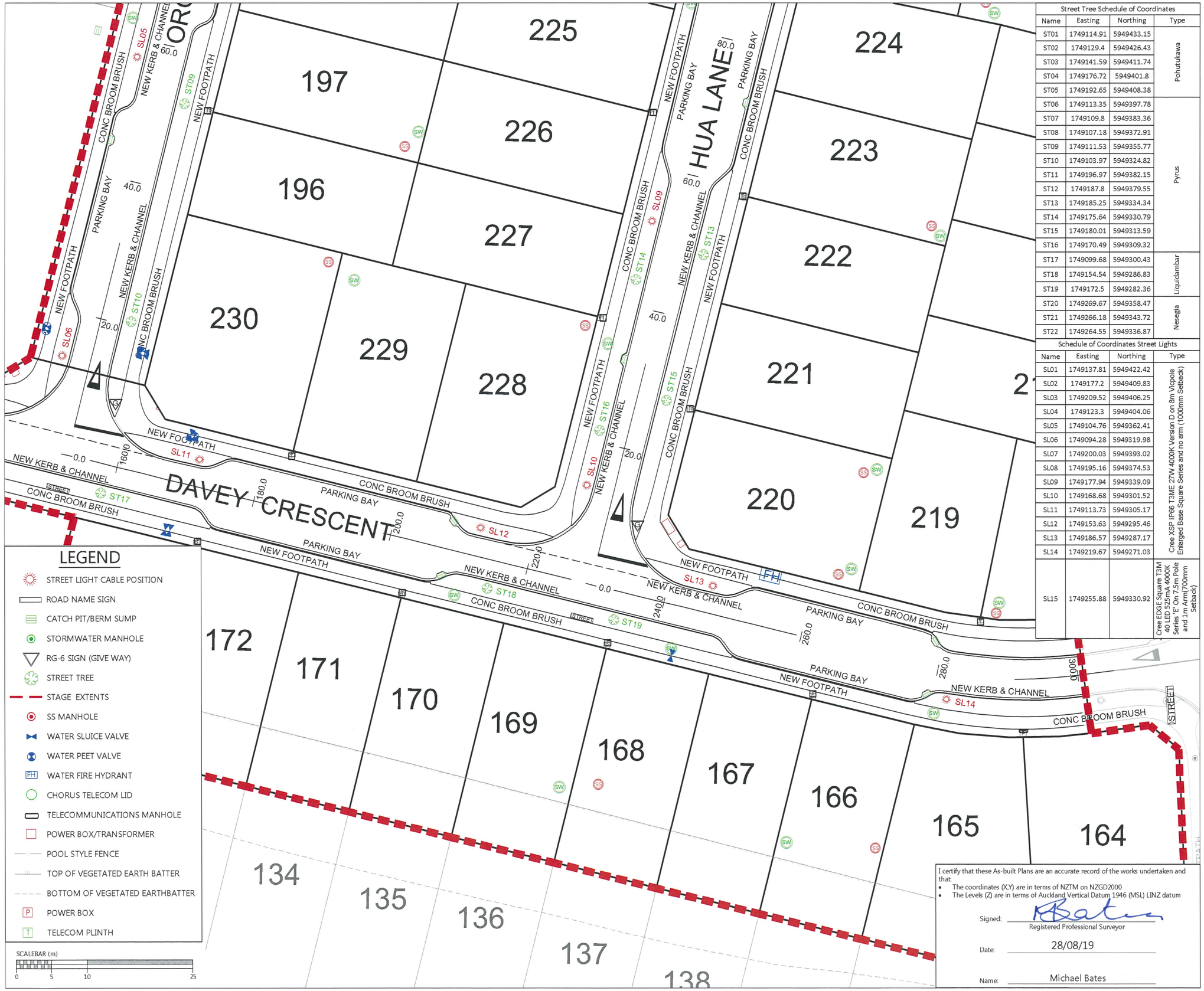
WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

ROADING AS-BUILT
SHEET 2 OF 4

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-201-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILT\4 & 3B\37504_P5_04_03B_ROADING PLANS.DWG



LEGEND

- STREET LIGHT CABLE POSITION
- ROAD NAME SIGN
- CATCH PIT/BERM SUMP
- STORMWATER MANHOLE
- RG-6 SIGN (GIVE WAY)
- STREET TREE
- STAGE EXTENTS
- SS MANHOLE
- WATER SLUICE VALVE
- WATER PEET VALVE
- WATER FIRE HYDRANT
- CHORUS TELECOM LID
- TELECOMMUNICATIONS MANHOLE
- POWER BOX/TRANSFORMER
- POOL STYLE FENCE
- TOP OF VEGETATED EARTH BATTER
- BOTTOM OF VEGETATED EARTHBATTER
- P POWER BOX
- T TELECOM PLINTH

SCALEBAR (m)
0 5 10 25

Street Tree Schedule of Coordinates			
Name	Easting	Northing	Type
ST01	1749114.91	5949433.15	Pohutukawa
ST02	1749129.4	5949426.43	
ST03	1749141.59	5949411.74	
ST04	1749176.72	5949401.8	
ST05	1749192.65	5949408.38	
ST06	1749113.35	5949397.78	Pyrus
ST07	1749109.8	5949383.36	
ST08	1749107.18	5949372.91	
ST09	1749111.53	5949355.77	
ST10	1749103.97	5949324.82	
ST11	1749196.97	5949382.15	
ST12	1749187.8	5949379.55	
ST13	1749185.25	5949334.34	
ST14	1749175.64	5949330.79	
ST15	1749180.01	5949313.59	
ST16	1749170.49	5949309.32	
ST17	1749099.68	5949300.43	Liquidambar
ST18	1749154.54	5949286.83	
ST19	1749172.5	5949282.36	
ST20	1749269.67	5949358.47	Nesegia
ST21	1749266.18	5949343.72	
ST22	1749264.55	5949336.87	

Schedule of Coordinates Street Lights			
Name	Easting	Northing	Type
SL01	1749137.81	5949422.42	Cree XSP IP66 T3ME 27W 4000K Version D on 8m Vicpole Enlarged Base Square Series and no arm (1000mm Setback)
SL02	1749177.2	5949409.83	
SL03	1749209.52	5949406.25	
SL04	1749123.3	5949404.06	
SL05	1749104.76	5949362.41	
SL06	1749094.28	5949319.98	
SL07	1749200.03	5949393.02	
SL08	1749195.16	5949374.53	
SL09	1749177.94	5949339.09	
SL10	1749168.68	5949301.52	
SL11	1749113.73	5949305.17	
SL12	1749153.63	5949295.46	
SL13	1749186.57	5949287.17	
SL14	1749219.67	5949271.03	Cree EDGE Square T3M 40 LED 525mA 4000K Series 'E' On 7.5m Pole and 1m Arm(700mm Setback)
SL15	1749255.88	5949330.92	

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: 28/08/19

Name: Michael Bates

WOODS Est.1970

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AC STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION ISSUE NOV 2005.
2. ALL ROADS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH APPROVED ENGINEERING PLANS.
3. ALL FINISHED ROAD SURFACES ARE ASHPHALT CONCRETE 30mm THICK.
4. ALL FOOTPATHS ARE 100mm THICK BRUSHED CONCRETE OR EXPOSED AGGREGATE AS NOTED.
5. ALL PIPE CROSSINGS UNDER ROADS HAVE BEEN HARDFILL BACKFILLED.
6. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY DATA AND CONTRACTOR RECEIVED DATA.

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	28/08/19

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

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

ROADING AS-BUILT
SHEET 3 OF 4

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-202-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILTS\4 & 3B\37504_PS_04_03B_ROADING PLANS.DWG

LEGEND

- STREET LIGHT CABLE POSITION
- ROAD NAME SIGN
- CATCH PIT/BERM SUMP
- STORMWATER MANHOLE
- RG-6 SIGN (GIVE WAY)
- STREET TREE
- STAGE EXTENTS
- SS MANHOLE
- WATER SLUICE VALVE
- WATER PEET VALVE
- WATER FIRE HYDRANT
- CHORUS TELECOM LID
- TELECOMMUNICATIONS MANHOLE
- POWER BOX/TRANSFORMER
- POOL STYLE FENCE
- TOP OF VEGETATED EARTH BATTER
- BOTTOM OF VEGETATED EARTHBATTER
- POWER BOX
- TELECOM PLINTH

GODFREY DRIVE

GROVER STREET

DAVEY CRESCENT

STREET

203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 159 160 161 162 163

CONC BROOM BRUSH
NEW KERB & CHANNEL
NEW FOOTPATH
PARKING BAY
EXPOSED AGGREGATE
KERB & CHANNEL
FOOTPATH
260.0
240.0
220.0
200.0
180.0
300.0
280.0
SL15
SL14
ST20
ST21
ST22

SCALEBAR (m)
0 5 10 25

Street Tree Schedule of Coordinates

Name	Easting	Northing	Type
ST01	1749114.91	5949433.15	Pohutukawa
ST02	1749129.4	5949426.43	
ST03	1749141.59	5949411.74	
ST04	1749176.72	5949401.8	
ST05	1749192.65	5949408.38	
ST06	1749113.35	5949397.78	Pyrus
ST07	1749109.8	5949383.36	
ST08	1749107.18	5949372.91	
ST09	1749111.53	5949355.77	
ST10	1749103.97	5949324.82	
ST11	1749196.97	5949382.15	
ST12	1749187.8	5949379.55	
ST13	1749185.25	5949334.34	
ST14	1749175.64	5949330.79	
ST15	1749180.01	5949313.59	
ST16	1749170.49	5949309.32	
ST17	1749099.68	5949300.43	Liquidambar
ST18	1749154.54	5949286.83	
ST19	1749172.5	5949282.36	
ST20	1749269.67	5949358.47	Nesegia
ST21	1749266.18	5949343.72	
ST22	1749264.55	5949336.87	

Schedule of Coordinates Street Lights

Name	Easting	Northing	Type
SL01	1749137.81	5949422.42	Cree XSP IP66 T3ME 27W 4000K Version D on 8m Vicpole Enlarged Base Square Series and no arm (1000mm Setback)
SL02	1749177.2	5949409.83	
SL03	1749209.52	5949406.25	
SL04	1749123.3	5949404.06	
SL05	1749104.76	5949362.41	
SL06	1749094.28	5949319.98	
SL07	1749200.03	5949393.02	
SL08	1749195.16	5949374.53	
SL09	1749177.94	5949339.09	
SL10	1749168.68	5949301.52	
SL11	1749113.73	5949305.17	
SL12	1749153.63	5949295.46	
SL13	1749186.57	5949287.17	
SL14	1749219.67	5949271.03	
SL15	1749255.88	5949330.92	Cree EDGE Square T3M 40 LED 525mA 4000K Series 'E' On 7.5m Pole and 1m Arm(700mm Setback)

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AC STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION ISSUE NOV 2005.
2. ALL ROADS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH APPROVED ENGINEERING PLANS.
3. ALL FINISHED ROAD SURFACES ARE ASHPHALT CONCRETE 30mm THICK.
4. ALL FOOTPATHS ARE 100mm THICK BRUSHED CONCRETE OR EXPOSED AGGREGATE AS NOTED.
5. ALL PIPE CROSSINGS UNDER ROADS HAVE BEEN HARDFILL BACKFILLED.
6. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY DATA AND CONTRACTOR RECEIVED DATA.

DISCLAIMER
THE INFORMATION PORTRAYED ON THIS PLAN IS INTENDED TO BE USED AS THE BASE DATA FOR THE PURPOSES OF 224C APPLICATION TO COUNCIL
WFH PROPERTIES LTD AND WOOD AND PARTNERS CONSULTANTS ACCEPT NO RESPONSIBILITY FOR ANY BUILDING DESIGN OR CONSTRUCTION WORK BASED ON THIS DRAWING FILE

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: 28/08/19
Name: Michael Bates

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	28/08/19

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

N

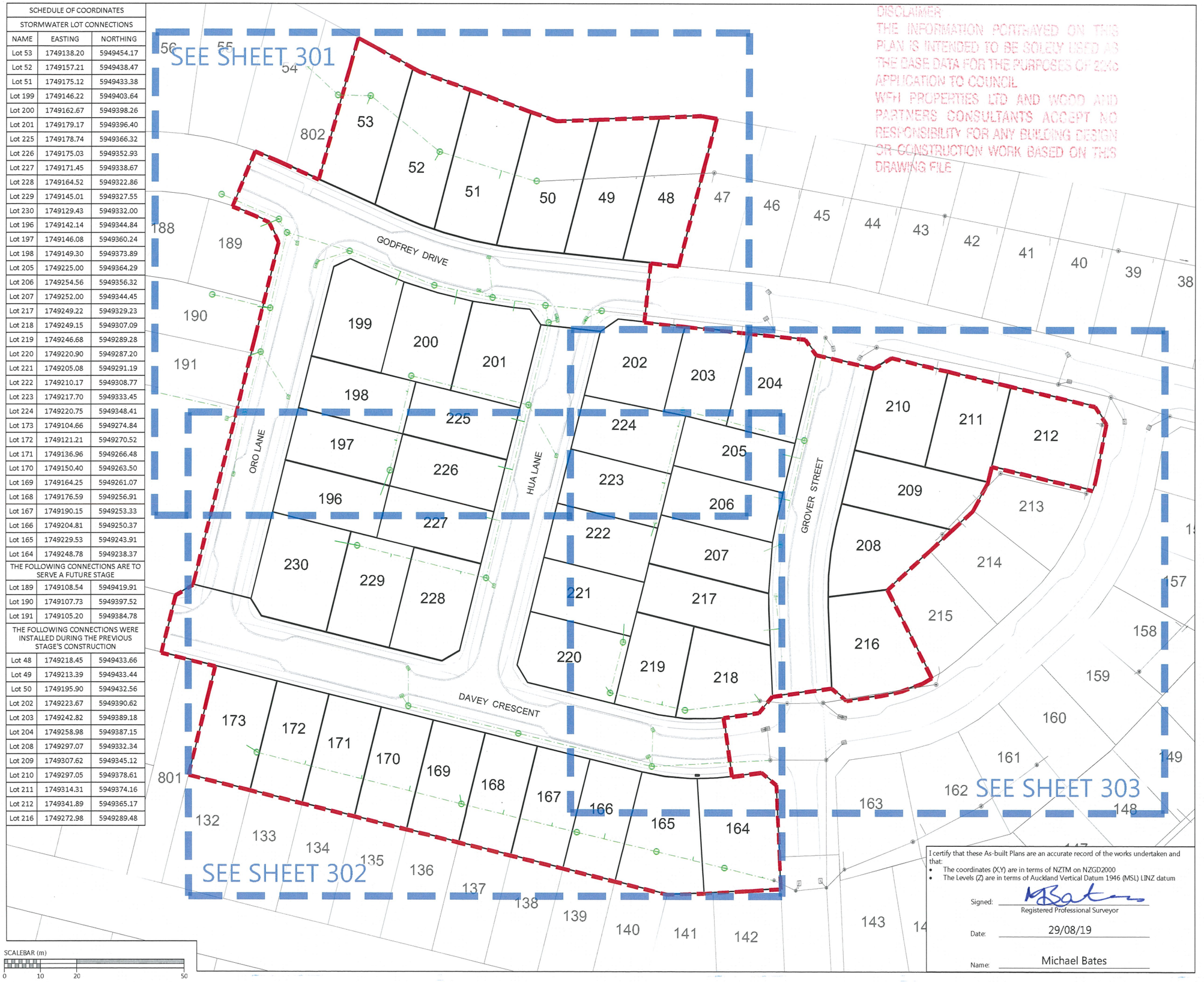
ARRAN HILL PRECINCT 5 STAGES 4 & 3B

ROADING AS-BUILT
SHEET 4 OF 4

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-203-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILT\4 & 3B\37504_PS_04 03B_ROADING PLANS.DWG

SCHEDULE OF COORDINATES		
STORMWATER LOT CONNECTIONS		
NAME	EASTING	NORTHING
Lot 53	1749138.20	5949454.17
Lot 52	1749157.21	5949438.47
Lot 51	1749175.12	5949433.38
Lot 199	1749146.22	5949403.64
Lot 200	1749162.67	5949398.26
Lot 201	1749179.17	5949396.40
Lot 225	1749178.74	5949366.32
Lot 226	1749175.03	5949352.93
Lot 227	1749171.45	5949338.67
Lot 228	1749164.52	5949322.86
Lot 229	1749145.01	5949327.55
Lot 230	1749129.43	5949332.00
Lot 196	1749142.14	5949344.84
Lot 197	1749146.08	5949360.24
Lot 198	1749149.30	5949373.89
Lot 205	1749225.00	5949364.29
Lot 206	1749254.56	5949356.32
Lot 207	1749252.00	5949344.45
Lot 217	1749249.22	5949329.23
Lot 218	1749249.15	5949307.09
Lot 219	1749246.68	5949289.28
Lot 220	1749220.90	5949287.20
Lot 221	1749205.08	5949291.19
Lot 222	1749210.17	5949308.77
Lot 223	1749217.70	5949333.45
Lot 224	1749220.75	5949348.41
Lot 173	1749104.66	5949274.84
Lot 172	1749121.21	5949270.52
Lot 171	1749136.96	5949266.48
Lot 170	1749150.40	5949263.50
Lot 169	1749164.25	5949261.07
Lot 168	1749176.59	5949256.91
Lot 167	1749190.15	5949253.33
Lot 166	1749204.81	5949250.37
Lot 165	1749229.53	5949243.91
Lot 164	1749248.78	5949238.37
THE FOLLOWING CONNECTIONS ARE TO SERVE A FUTURE STAGE		
Lot 189	1749108.54	5949419.91
Lot 190	1749107.73	5949397.52
Lot 191	1749105.20	5949384.78
THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE PREVIOUS STAGE'S CONSTRUCTION		
Lot 48	1749218.45	5949433.66
Lot 49	1749213.39	5949433.44
Lot 50	1749195.90	5949432.56
Lot 202	1749223.67	5949390.62
Lot 203	1749242.82	5949389.18
Lot 204	1749258.98	5949387.15
Lot 208	1749297.07	5949332.34
Lot 209	1749307.62	5949345.12
Lot 210	1749297.05	5949378.61
Lot 211	1749314.31	5949374.16
Lot 212	1749341.89	5949365.17
Lot 216	1749272.98	5949289.48



WOODS
Est.1970

LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
- NEW STORMWATER
- EXISTING STORMWATER
- STAGE BOUNDARY

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 100mmΦ.
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	29/08/19

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: 29/08/19

Name: Michael Bates

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

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

STORMWATER AS-BUILT OVERALL LAYOUT SHEET 1 OF 4

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37503-04-03B-300-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILTs\4 & 3B\37504_P5_04_038_STORMWATER.DWG

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

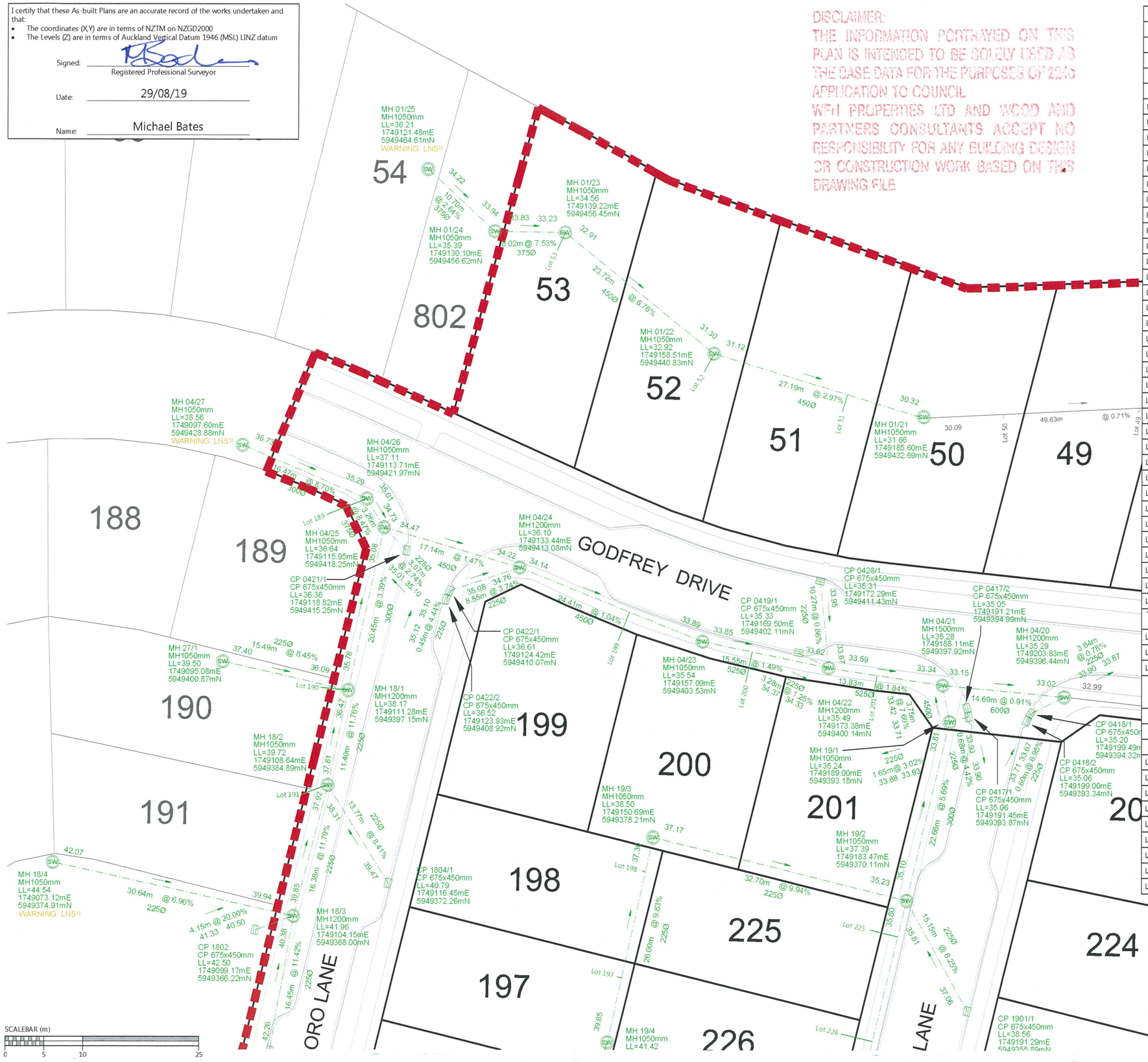
- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____
Registered Professional Surveyor

Date: 29/08/19

Name: Michael Bates

DISCLAIMER:
THE INFORMATION PORTRAYED ON THIS PLAN IS INTENDED TO BE SOLELY USED AS THE BASE DATA FOR THE PURPOSES OF 224c APPLICATION TO COUNCIL
WFH PROPERTIES LTD AND WOOD AND PARTNERS CONSULTANTS ACCEPT NO RESPONSIBILITY FOR ANY BUILDING DESIGN OR CONSTRUCTION WORK BASED ON THIS DRAWING FILE



SCHEDULE OF COORDINATES		
STORMWATER LOT CONNECTIONS		
NAME	EASTING	NORTHING
Lot 53	1749138.20	5949454.17
Lot 52	1749157.21	5949438.47
Lot 51	1749175.12	5949433.38
Lot 199	1749146.22	5949403.64
Lot 200	1749162.67	5949398.26
Lot 201	1749179.17	5949396.40
Lot 225	1749178.74	5949366.32
Lot 226	1749175.03	5949352.93
Lot 227	1749171.45	5949338.67
Lot 228	1749164.52	5949322.86
Lot 229	1749145.01	5949327.55
Lot 230	1749129.43	5949332.00
Lot 196	1749142.14	5949344.84
Lot 197	1749146.08	5949360.24
Lot 198	1749149.30	5949373.89
Lot 205	1749225.00	5949364.29
Lot 206	1749254.56	5949356.32
Lot 207	1749252.00	5949344.45
Lot 217	1749249.22	5949329.23
Lot 218	1749249.15	5949307.09
Lot 219	1749246.68	5949289.28
Lot 220	1749220.90	5949287.20
Lot 221	1749205.08	5949291.19
Lot 222	1749210.17	5949308.77
Lot 223	1749217.70	5949333.45
Lot 224	1749220.75	5949348.41
Lot 173	1749104.66	5949274.84
Lot 172	1749121.21	5949270.52
Lot 171	1749136.96	5949266.48
Lot 170	1749150.40	5949263.50
Lot 169	1749164.25	5949261.07
Lot 168	1749176.59	5949256.91
Lot 167	1749190.15	5949253.33
Lot 166	1749204.81	5949250.37
Lot 165	1749229.53	5949243.91
Lot 164	1749248.78	5949238.37
THE FOLLOWING CONNECTIONS ARE TO SERVE A FUTURE STAGE		
Lot 189	1749108.54	5949419.91
Lot 190	1749107.73	5949397.52
Lot 191	1749105.20	5949384.78
THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE PREVIOUS STAGE'S CONSTRUCTION		
Lot 48	1749218.45	5949433.66
Lot 49	1749213.39	5949433.44
Lot 50	1749195.90	5949432.56
Lot 202	1749223.67	5949390.62
Lot 203	1749242.82	5949389.18
Lot 204	1749258.98	5949387.15
Lot 208	1749297.07	5949332.34
Lot 209	1749307.62	5949345.12
Lot 210	1749297.05	5949378.61
Lot 211	1749314.31	5949374.16
Lot 212	1749341.89	5949365.17
Lot 216	1749272.98	5949289.48

WOODS
Est.1970

LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
- NEW STORMWATER
- EXISTING STORMWATER
- STAGE BOUNDARY

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	29/08/19

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

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

STORMWATER AS-BUILT SHEET 2 OF 4

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-301-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILT\4 & 3B\37504_P5_04_03B_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: 29/08/19

Name: Michael Bates

SCHEDULE OF COORDINATES		
STORMWATER LOT CONNECTIONS		
NAME	EASTING	NORTHING
Lot 53	1749138.20	5949454.17
Lot 52	1749157.21	5949438.47
Lot 51	1749175.12	5949433.38
Lot 199	1749146.22	5949403.64
Lot 200	1749162.67	5949398.26
Lot 201	1749179.17	5949396.40
Lot 225	1749178.74	5949366.32
Lot 226	1749175.03	5949352.93
Lot 227	1749171.45	5949338.67
Lot 228	1749164.52	5949322.86
Lot 229	1749145.01	5949327.55
Lot 230	1749129.43	5949332.00
Lot 196	1749142.14	5949344.84
Lot 197	1749146.08	5949360.24
Lot 198	1749149.30	5949373.89
Lot 205	1749225.00	5949364.29
Lot 206	1749254.56	5949356.32
Lot 207	1749252.00	5949344.45
Lot 217	1749249.22	5949329.23
Lot 218	1749249.15	5949307.09
Lot 219	1749246.68	5949289.28
Lot 220	1749220.90	5949287.20
Lot 221	1749205.08	5949291.19
Lot 222	1749210.17	5949308.77
Lot 223	1749217.70	5949333.45
Lot 224	1749220.75	5949348.41
Lot 173	1749104.66	5949274.84
Lot 172	1749121.21	5949270.52
Lot 171	1749136.96	5949266.48
Lot 170	1749150.40	5949263.50
Lot 169	1749164.25	5949261.07
Lot 168	1749176.59	5949256.91
Lot 167	1749190.15	5949253.33
Lot 166	1749204.81	5949250.37
Lot 165	1749229.53	5949243.91
Lot 164	1749248.78	5949238.37
THE FOLLOWING CONNECTIONS ARE TO SERVE A FUTURE STAGE		
Lot 189	1749108.54	5949419.91
Lot 190	1749107.73	5949397.52
Lot 191	1749105.20	5949384.78
THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE PREVIOUS STAGE'S CONSTRUCTION		
Lot 48	1749218.45	5949433.66
Lot 49	1749213.39	5949433.44
Lot 50	1749195.90	5949432.56
Lot 202	1749223.67	5949390.62
Lot 203	1749242.82	5949389.18
Lot 204	1749258.98	5949387.15
Lot 208	1749297.07	5949332.34
Lot 209	1749307.62	5949345.12
Lot 210	1749297.05	5949378.61
Lot 211	1749314.31	5949374.16
Lot 212	1749341.89	5949365.17
Lot 216	1749272.98	5949289.48

WOODS
EST.1970

LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
- NEW STORMWATER
- EXISTING STORMWATER
- STAGE BOUNDARY

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	29/08/19

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

N

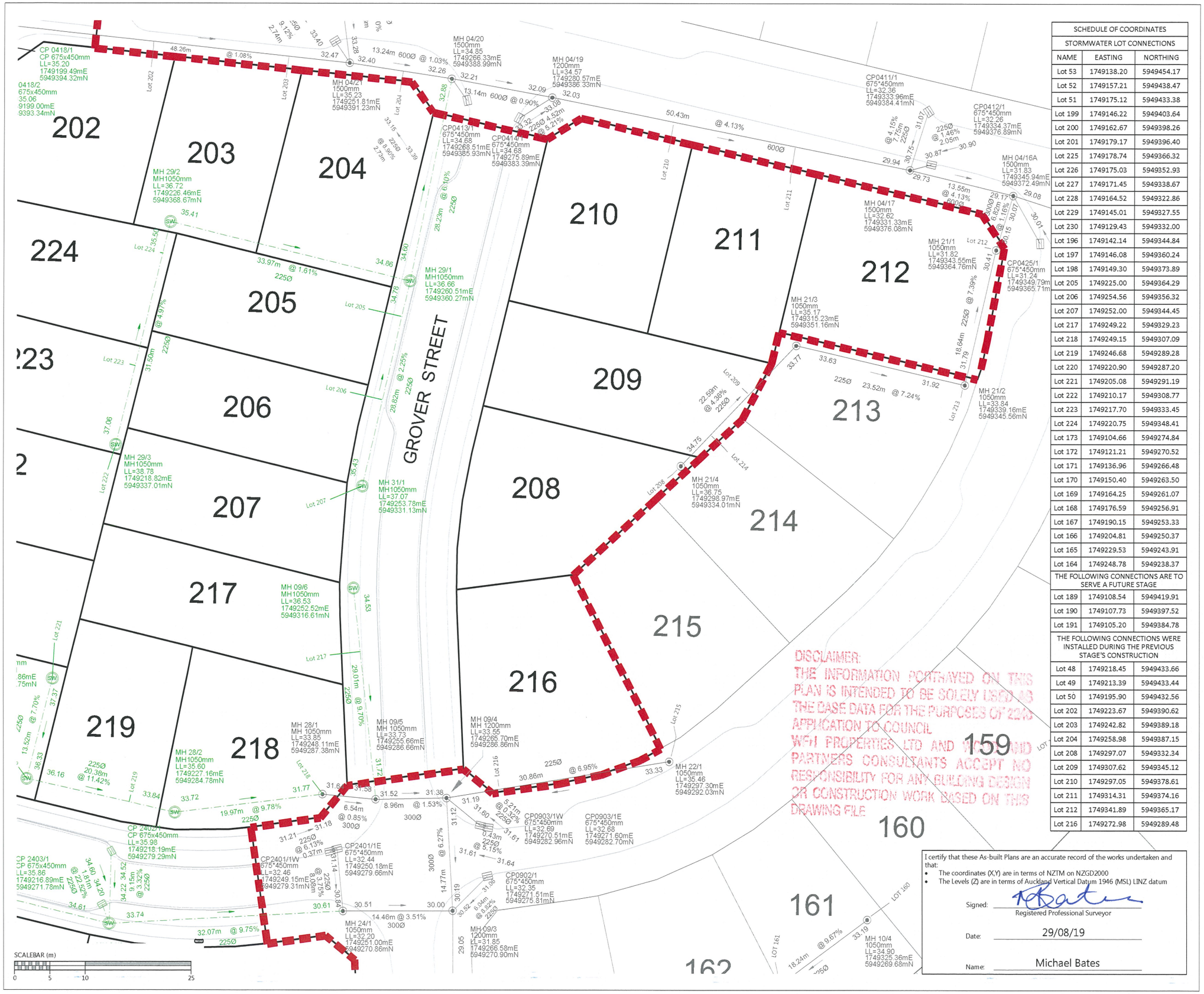
WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

STORMWATER AS-BUILT
SHEET 3 OF 4

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-302-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILT\4 & 3B\37504_P5_04_03B_STORMWATER.DWG



SCHEDULE OF COORDINATES		
STORMWATER LOT CONNECTIONS		
NAME	EASTING	NORTHING
Lot 53	1749138.20	5949454.17
Lot 52	1749157.21	5949438.47
Lot 51	1749175.12	5949433.38
Lot 199	1749146.22	5949403.64
Lot 200	1749162.67	5949398.26
Lot 201	1749179.17	5949396.40
Lot 225	1749178.74	5949366.32
Lot 226	1749175.03	5949352.93
Lot 227	1749171.45	5949338.67
Lot 228	1749164.52	5949322.86
Lot 229	1749145.01	5949327.55
Lot 230	1749129.43	5949332.00
Lot 196	1749142.14	5949344.84
Lot 197	1749146.08	5949360.24
Lot 198	1749149.30	5949373.89
Lot 205	1749225.00	5949364.29
Lot 206	1749254.56	5949356.32
Lot 207	1749252.00	5949344.45
Lot 217	1749249.22	5949329.23
Lot 218	1749249.15	5949307.09
Lot 219	1749246.68	5949289.28
Lot 220	1749220.90	5949287.20
Lot 221	1749205.08	5949291.19
Lot 222	1749210.17	5949308.77
Lot 223	1749217.70	5949333.45
Lot 224	1749220.75	5949348.41
Lot 173	1749104.66	5949274.84
Lot 172	1749121.21	5949270.52
Lot 171	1749136.96	5949266.48
Lot 170	1749150.40	5949263.50
Lot 169	1749164.25	5949261.07
Lot 168	1749176.59	5949256.91
Lot 167	1749190.15	5949253.33
Lot 166	1749204.81	5949250.37
Lot 165	1749229.53	5949243.91
Lot 164	1749248.78	5949238.37
THE FOLLOWING CONNECTIONS ARE TO SERVE A FUTURE STAGE		
Lot 189	1749108.54	5949419.91
Lot 190	1749107.73	5949397.52
Lot 191	1749105.20	5949384.78
THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE PREVIOUS STAGE'S CONSTRUCTION		
Lot 48	1749218.45	5949433.66
Lot 49	1749213.39	5949433.44
Lot 50	1749195.90	5949432.56
Lot 202	1749223.67	5949390.62
Lot 203	1749242.82	5949389.18
Lot 204	1749258.98	5949387.15
Lot 208	1749297.07	5949332.34
Lot 209	1749307.62	5949345.12
Lot 210	1749297.05	5949378.61
Lot 211	1749314.31	5949374.16
Lot 212	1749341.89	5949365.17
Lot 216	1749272.98	5949289.48

DISCLAIMER:
THE INFORMATION PORTRAYED ON THIS PLAN IS INTENDED TO BE SOLELY USED AS THE BASE DATA FOR THE PURPOSES OF 224 APPLICATION TO COUNCIL
WFH PROPERTIES LTD AND WOODS AND PARTNERS CONSULTANTS ACCEPT NO RESPONSIBILITY FOR ANY BUILDING DESIGN OR CONSTRUCTION WORK BASED ON THIS DRAWING FILE

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: 29/08/19

Name: Michael Bates

WOODS
Est.1970

LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
- NEW STORMWATER
- EXISTING STORMWATER
- STAGE BOUNDARY

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 100mmΦ.
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	29/08/19

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

N

WFH PROPERTIES

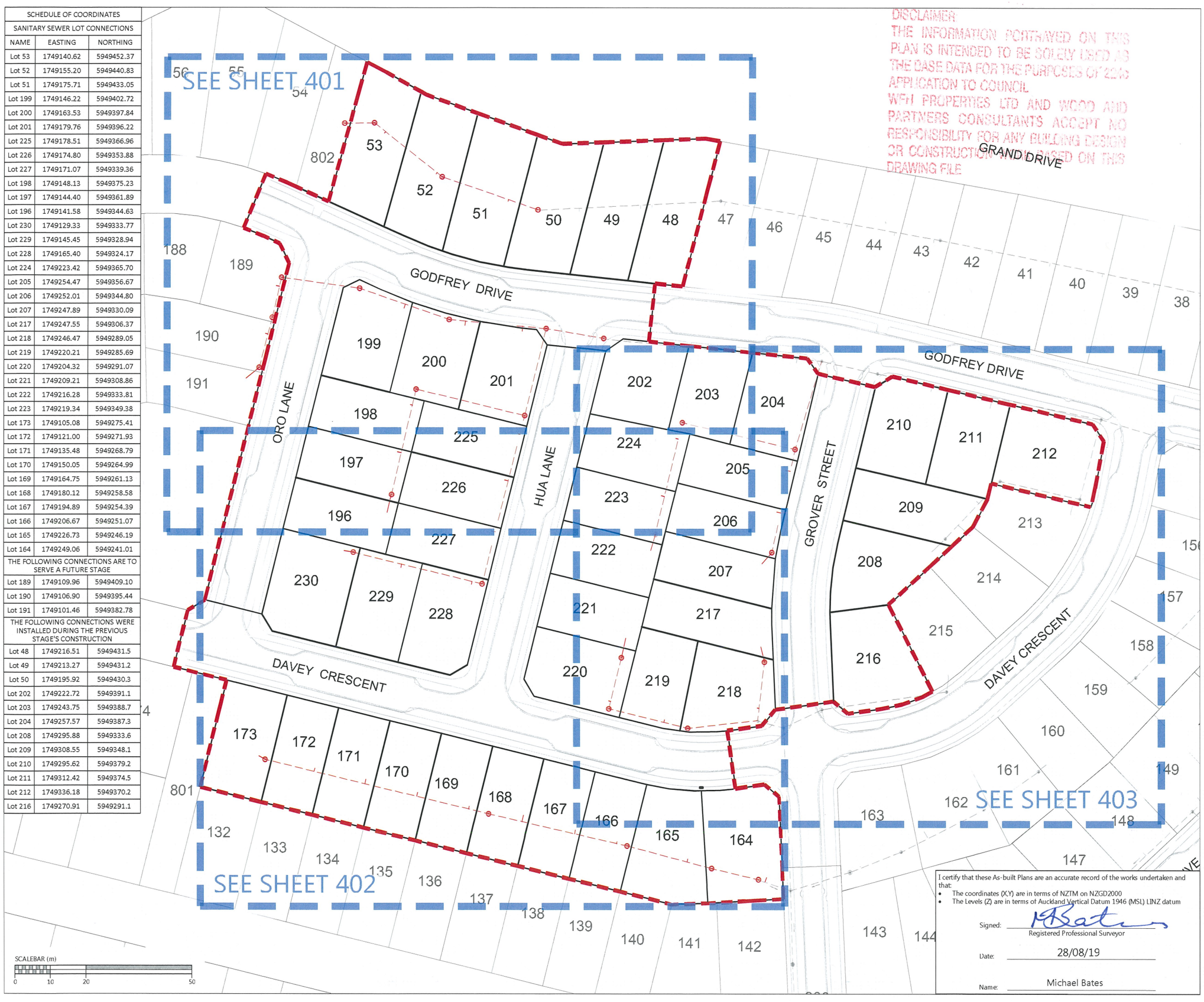
ARRAN HILL PRECINCT 5 STAGES 4 & 3B

STORMWATER AS-BUILT
SHEET 4 OF 4

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-303-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILT\4 & 3B\37504_P5_04_03B_STORMWATER.DWG

SCHEDULE OF COORDINATES		
SANITARY SEWER LOT CONNECTIONS		
NAME	EASTING	NORTHING
Lot 53	1749140.62	5949452.37
Lot 52	1749155.20	5949440.83
Lot 51	1749175.71	5949433.05
Lot 199	1749146.22	5949402.72
Lot 200	1749163.53	5949397.84
Lot 201	1749179.76	5949396.22
Lot 225	1749178.51	5949366.96
Lot 226	1749174.80	5949353.88
Lot 227	1749171.07	5949339.36
Lot 198	1749148.13	5949375.23
Lot 197	1749144.40	5949361.89
Lot 196	1749141.58	5949344.63
Lot 230	1749129.33	5949333.77
Lot 229	1749145.45	5949328.94
Lot 228	1749165.40	5949324.17
Lot 224	1749223.42	5949365.70
Lot 205	1749254.47	5949356.67
Lot 206	1749252.01	5949344.80
Lot 207	1749247.89	5949330.09
Lot 217	1749247.55	5949306.37
Lot 218	1749246.47	5949289.05
Lot 219	1749220.21	5949285.69
Lot 220	1749204.32	5949291.07
Lot 221	1749209.21	5949308.86
Lot 222	1749216.28	5949333.81
Lot 223	1749219.34	5949349.38
Lot 173	1749105.08	5949275.41
Lot 172	1749121.00	5949271.93
Lot 171	1749135.48	5949268.79
Lot 170	1749150.05	5949264.99
Lot 169	1749164.75	5949261.13
Lot 168	1749180.12	5949258.58
Lot 167	1749194.89	5949254.39
Lot 166	1749206.67	5949251.07
Lot 165	1749226.73	5949246.19
Lot 164	1749249.06	5949241.01
THE FOLLOWING CONNECTIONS ARE TO SERVE A FUTURE STAGE		
Lot 189	1749109.96	5949409.10
Lot 190	1749106.90	5949395.44
Lot 191	1749101.46	5949382.78
THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE PREVIOUS STAGE'S CONSTRUCTION		
Lot 48	1749216.51	5949431.5
Lot 49	1749213.27	5949431.2
Lot 50	1749195.92	5949430.3
Lot 202	1749222.72	5949391.1
Lot 203	1749243.75	5949388.7
Lot 204	1749257.57	5949387.3
Lot 208	1749295.88	5949333.6
Lot 209	1749308.55	5949348.1
Lot 210	1749295.62	5949379.2
Lot 211	1749312.42	5949374.5
Lot 212	1749336.18	5949370.2
Lot 216	1749270.91	5949291.1



WOODS
EST.1970

LEGEND

- NEW SANITARY SEWER MANHOLE
- NEW SANITARY SEWER
- EXISTING SANITARY SEWER
- STAGE BOUNDARY

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	28/08/19

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: 28/08/19

Name: Michael Bates

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

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

WASTEWATER AS-BUILT OVERALL LAYOUT SHEET 1 OF 4

STATUS	AS BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37503-04-03B-400-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVVAS-BUILT\V4 R: 3B\37504_PS_04_03B_SEWER.DWG

GODFREY DRIVE

ORO LANE

HUA LANE

55 54 802 53 52 51 50 49 48 189 190 191 199 200 201 202 203 198 225 224 205 197 226 223 206 196 227

MH J/21 MH1050mm LL=35.48 1749129.35mE 5949455.19mN
MH J/20 MH1050mm LL=34.74 1749137.77mE 5949455.33mN
MH J/19 MH1050mm LL=33.07 1749156.98mE 5949439.99mN
MH J/18 MH1050mm LL=31.97 1749184.20mE 5949430.65mN
MH I/17 MH1200mm LL=36.94 1749111.50mE 5949411.44mN
MH I/18 MH1200mm LL=38.04 1749108.85mE 5949400.05mN
MH BB/1 MH1050mm LL=40.03 1749105.14mE 5949385.84mN
MH I/16 MH1050mm LL=36.35 1749133.69mE 5949408.34mN
MH I/15 MH1050mm LL=35.72 1749159.02mE 5949399.46mN
MH I/14 MH1200mm LL=35.39 1749186.59mE 5949396.90mN
MH I/13 MH1050mm LL=35.18 1749202.90mE 5949394.14mN
MH Q/2 MH1050mm LL=38.38 1749149.69mE 5949379.68mN
MH Q/1 MH1200mm LL=37.26 1749180.52mE 5949372.15mN
MH Q/3 MH1050mm LL=41.81 1749142.82mE 5949349.69mN
MH S/2 MH1050mm LL=36.69 1749225.24mE 5949370.17mN
MH S/3 MH1050mm LL=38.73 1749217.60mE 5949338.39mN
MH T/1 MH1050mm LL=37.35 1749250.66mE 5949333.22mN

7.32m @ 6.98% 150Ø
23.51m @ 6.29% 150Ø
27.72m @ 4.10% 150Ø
51.91m @ 1.00% 150Ø
21.27m @ 1.20% 150Ø
10.48m @ 6.93% 150Ø
13.55m @ 5.09% 150Ø
26.59m @ 2.76% 150Ø
15.45m @ 1.20% 150Ø
62.18m @ 1.03% 150Ø
24.33m @ 5.50% 150Ø
30.59m @ 6.61% 150Ø
29.67m @ 7.07% 150Ø
35.04 @ 6.72% 150Ø

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: 28/08/19
Name: Michael Bates

SCALEBAR (m)
0 5 10 25

SCHEDULE OF COORDINATES		
SANITARY SEWER LOT CONNECTIONS		
NAME	EASTING	NORTHING
Lot 53	1749140.62	5949452.37
Lot 52	1749155.20	5949440.83
Lot 51	1749175.71	5949433.05
Lot 199	1749146.22	5949402.72
Lot 200	1749163.53	5949397.84
Lot 201	1749179.76	5949396.22
Lot 225	1749178.51	5949366.96
Lot 226	1749174.80	5949353.88
Lot 227	1749171.07	5949339.36
Lot 198	1749148.13	5949375.23
Lot 197	1749144.40	5949361.89
Lot 196	1749141.58	5949344.63
Lot 230	1749129.33	5949333.77
Lot 229	1749145.45	5949328.94
Lot 228	1749165.40	5949324.17
Lot 224	1749223.42	5949365.70
Lot 205	1749254.47	5949356.67
Lot 206	1749252.01	5949344.80
Lot 207	1749247.89	5949330.09
Lot 217	1749247.55	5949306.37
Lot 218	1749246.47	5949289.05
Lot 219	1749220.21	5949285.69
Lot 220	1749204.32	5949291.07
Lot 221	1749209.21	5949308.86
Lot 222	1749216.28	5949333.81
Lot 223	1749219.34	5949349.38
Lot 173	1749105.08	5949275.41
Lot 172	1749121.00	5949271.93
Lot 171	1749135.48	5949268.79
Lot 170	1749150.05	5949264.99
Lot 169	1749164.75	5949261.13
Lot 168	1749180.12	5949258.58
Lot 167	1749194.89	5949254.39
Lot 166	1749206.67	5949251.07
Lot 165	1749226.73	5949246.19
Lot 164	1749249.06	5949241.01
THE FOLLOWING CONNECTIONS ARE TO SERVE A FUTURE STAGE		
Lot 189	1749109.96	5949409.10
Lot 190	1749106.90	5949395.44
Lot 191	1749101.46	5949382.78
THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE PREVIOUS STAGE'S CONSTRUCTION		
Lot 48	1749216.51	5949431.5
Lot 49	1749213.27	5949431.2
Lot 50	1749195.92	5949430.3
Lot 202	1749222.72	5949391.1
Lot 203	1749243.75	5949388.7
Lot 204	1749257.57	5949387.3
Lot 208	1749295.88	5949333.6
Lot 209	1749308.55	5949348.1
Lot 210	1749295.62	5949379.2
Lot 211	1749312.42	5949374.5
Lot 212	1749336.18	5949370.2
Lot 216	1749270.91	5949291.1

WOODS Est.1970

LEGEND
- NEW SANITARY SEWER MANHOLE
- NEW SANITARY SEWER
- EXISTING SANITARY SEWER
- STAGE BOUNDARY

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	28/08/19

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

N

WFH PROPERTIES

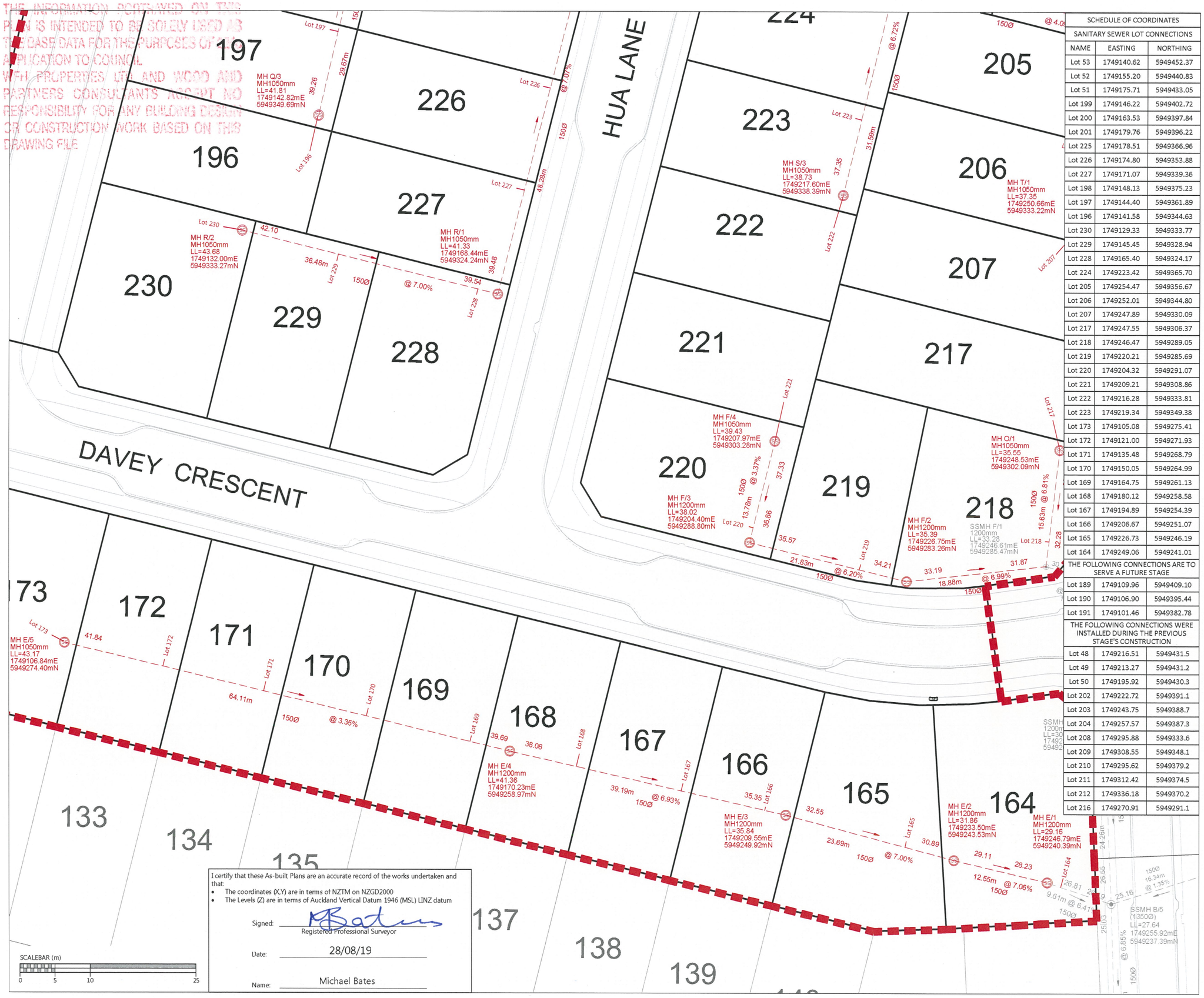
ARRAN HILL PRECINCT 5 STAGES 4 & 3B

WASTEWATER AS-BUILT SHEET 2 OF 4

STATUS	AS BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37503-04-03B-401-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILT\4 & 3B\37504_P5_04_03B_SEWER.DWG

DISCLAIMER:
THE INFORMATION CONTAINED ON THIS PLAN IS INTENDED TO BE SOLELY USED AS THE BASE DATA FOR THE PURPOSES OF AN APPLICATION TO COUNCIL.
WFH PROPERTIES LTD AND WOODS AND PARTNERS CONSULTANTS ACCEPT NO RESPONSIBILITY FOR ANY BUILDING DESIGN OR CONSTRUCTION WORK BASED ON THIS DRAWING FILE.



SCALEBAR (m)
0 5 10 25

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: 28/08/19
Name: Michael Bates

SCHEDULE OF COORDINATES		
SANITARY SEWER LOT CONNECTIONS		
NAME	EASTING	NORTHING
Lot 53	1749140.62	5949452.37
Lot 52	1749155.20	5949440.83
Lot 51	1749175.71	5949433.05
Lot 199	1749146.22	5949402.72
Lot 200	1749163.53	5949397.84
Lot 201	1749179.76	5949396.22
Lot 225	1749178.51	5949366.96
Lot 226	1749174.80	5949353.88
Lot 227	1749171.07	5949339.36
Lot 198	1749148.13	5949375.23
Lot 197	1749144.40	5949361.89
Lot 196	1749141.58	5949344.63
Lot 230	1749129.33	5949333.77
Lot 229	1749145.45	5949328.94
Lot 228	1749165.40	5949324.17
Lot 224	1749223.42	5949365.70
Lot 205	1749254.47	5949356.67
Lot 206	1749252.01	5949344.80
Lot 207	1749247.89	5949330.09
Lot 217	1749247.55	5949306.37
Lot 218	1749246.47	5949289.05
Lot 219	1749220.21	5949285.69
Lot 220	1749204.32	5949291.07
Lot 221	1749209.21	5949308.86
Lot 222	1749216.28	5949333.81
Lot 223	1749219.34	5949349.38
Lot 173	1749105.08	5949275.41
Lot 172	1749121.00	5949271.93
Lot 171	1749135.48	5949268.79
Lot 170	1749150.05	5949264.99
Lot 169	1749164.75	5949261.13
Lot 168	1749180.12	5949258.58
Lot 167	1749194.89	5949254.39
Lot 166	1749206.67	5949251.07
Lot 165	1749226.73	5949246.19
Lot 164	1749249.06	5949241.01
THE FOLLOWING CONNECTIONS ARE TO SERVE A FUTURE STAGE		
Lot 189	1749109.96	5949409.10
Lot 190	1749106.90	5949395.44
Lot 191	1749101.46	5949382.78
THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE PREVIOUS STAGE'S CONSTRUCTION		
Lot 48	1749216.51	5949431.5
Lot 49	1749213.27	5949431.2
Lot 50	1749195.92	5949430.3
Lot 202	1749222.72	5949391.1
Lot 203	1749243.75	5949388.7
Lot 204	1749257.57	5949387.3
Lot 208	1749295.88	5949333.6
Lot 209	1749308.55	5949348.1
Lot 210	1749295.62	5949379.2
Lot 211	1749312.42	5949374.5
Lot 212	1749336.18	5949370.2
Lot 216	1749270.91	5949291.1

WOODS
EST.1970

LEGEND
- NEW SANITARY SEWER MANHOLE
- NEW SANITARY SEWER
- EXISTING SANITARY SEWER
- STAGE BOUNDARY

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	28/08/19

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

N

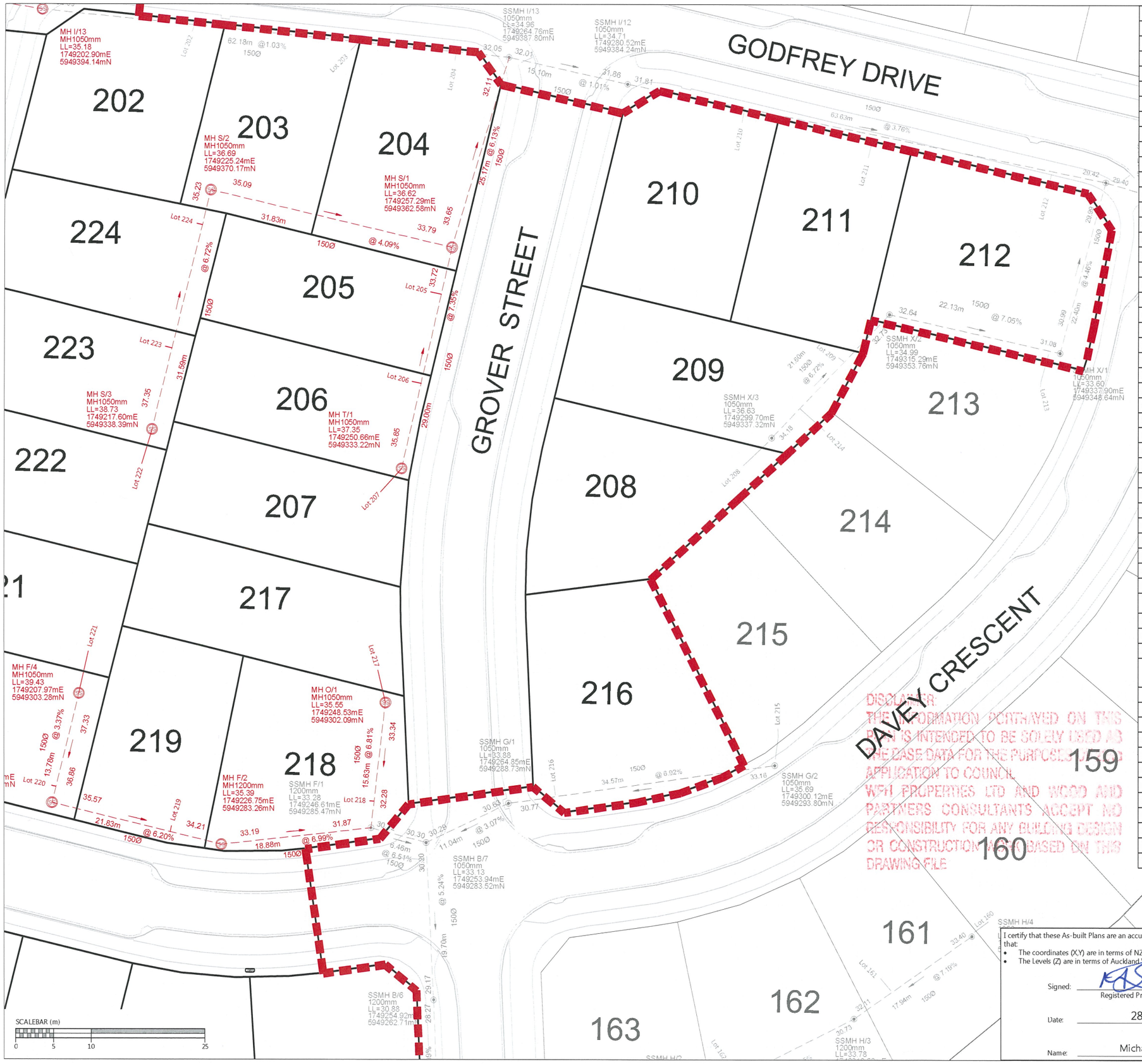
WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

WASTEWATER AS-BUILT SHEET 3 OF 4

STATUS	AS BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37503-04-03B-402-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILT\4 & 3B\37504_P5_04 03B_SEWER.DWG



SCHEDULE OF COORDINATES		
SANITARY SEWER LOT CONNECTIONS		
NAME	EASTING	NORTHING
Lot 53	1749140.62	5949452.37
Lot 52	1749155.20	5949440.83
Lot 51	1749175.71	5949433.05
Lot 199	1749146.22	5949402.72
Lot 200	1749163.53	5949397.84
Lot 201	1749179.76	5949396.22
Lot 225	1749178.51	5949366.96
Lot 226	1749174.80	5949353.88
Lot 227	1749171.07	5949339.36
Lot 198	1749148.13	5949375.23
Lot 197	1749144.40	5949361.89
Lot 196	1749141.58	5949344.63
Lot 230	1749129.33	5949333.77
Lot 229	1749145.45	5949328.94
Lot 228	1749165.40	5949324.17
Lot 224	1749223.42	5949365.70
Lot 205	1749254.47	5949356.67
Lot 206	1749252.01	5949344.80
Lot 207	1749247.89	5949330.09
Lot 217	1749247.55	5949306.37
Lot 218	1749246.47	5949289.05
Lot 219	1749220.21	5949285.69
Lot 220	1749204.32	5949291.07
Lot 221	1749209.21	5949308.86
Lot 222	1749216.28	5949333.81
Lot 223	1749219.34	5949349.38
Lot 173	1749105.08	5949275.41
Lot 172	1749121.00	5949271.93
Lot 171	1749135.48	5949268.79
Lot 170	1749150.05	5949264.99
Lot 169	1749164.75	5949261.13
Lot 168	1749180.12	5949258.58
Lot 167	1749194.89	5949254.39
Lot 166	1749206.67	5949251.07
Lot 165	1749226.73	5949246.19
Lot 164	1749249.06	5949241.01
THE FOLLOWING CONNECTIONS ARE TO SERVE A FUTURE STAGE		
Lot 189	1749109.96	5949409.10
Lot 190	1749106.90	5949395.44
Lot 191	1749101.46	5949382.78
THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE PREVIOUS STAGE'S CONSTRUCTION		
Lot 48	1749216.51	5949431.5
Lot 49	1749213.27	5949431.2
Lot 50	1749195.92	5949430.3
Lot 202	1749222.72	5949391.1
Lot 203	1749243.75	5949388.7
Lot 204	1749257.57	5949387.3
Lot 208	1749295.88	5949333.6
Lot 209	1749308.55	5949348.1
Lot 210	1749295.62	5949379.2
Lot 211	1749312.42	5949374.5
Lot 212	1749336.18	5949370.2
Lot 216	1749270.91	5949291.1

WOODS
Est.1970

LEGEND

- NEW SANITARY SEWER MANHOLE
- NEW SANITARY SEWER
- EXISTING SANITARY SEWER
- STAGE BOUNDARY

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	28/08/19

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: 28/08/19

Name: Michael Bates

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

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGES 4 & 3B

WASTEWATER AS-BUILT SHEET 4 OF 4

STATUS	AS BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37503-04-03B-403-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILT\4 & 3B\37504_P5_04_03B_SEWER.DWG

SCHEDULE OF COORDINATES		
NAME	EASTING	NORTHING
WATERMAIN CONNECTIONS		
WM53	1749139.30	5949424.96
WM52	1749140.35	5949424.47
WM51	1749173.97	5949413.43
WM50	1749174.86	5949413.28
WM49	1749209.04	5949409.51
WM48	1749210.02	5949409.35
WM200	1749167.73	5949400.24
WM201	1749168.23	5949400.19
WM189	1749110.68	5949398.66
WM606	1749110.53	5949398.04
WM303	1749106.86	5949383.07
WM199	1749121.78	5949384.41
WM198	1749121.54	5949383.46
WM197	1749114.43	5949355.06
WM196	1749114.32	5949354.62
WM202	1749197.99	5949373.52
WM224	1749197.77	5949372.68
WM225	1749178.76	5949354.82
WM226	1749178.62	5949354.15
WM223	1749190.27	5949343.05
WM222	1749190.08	5949342.29
WM227	1749171.64	5949325.68
WM228	1749171.46	5949324.98
WM221	1749182.68	5949312.91
WM220	1749182.50	5949312.23
WM204	1749259.09	5949359.44
WM205	1749258.94	5949358.83
WM206	1749252.84	5949331.74
WM207	1749252.74	5949331.12
WM217	1749251.56	5949316.91
WM209	1749269.61	5949343.47
WM208	1749269.34	5949342.37
WM230	1749126.57	5949305.26
WM229	1749127.44	5949305.07
WM173	1749113.00	5949294.24
WM172	1749114.00	5949293.97
WM171	1749142.47	5949286.86
WM170	1749142.92	5949286.79
WM169	1749171.17	5949279.74
WM168	1749171.90	5949279.56
WM167	1749200.23	5949272.42
WM166	1749201.18	5949272.19
WM165	1749229.82	5949267.45
WM164	1749230.84	5949267.49
WM219	1749224.07	5949281.44
WM218	1749224.69	5949281.39
INSTALLED DURING PREVIOUS STAGE		
WM 202	1749226.29	5949393.54
WM 203	1749228.54	5949393.29
WM 204	1749246.66	5949391.24
WM 210	1749299.63	5949381.33
WM 211	1749302.04	5949380.80
WM 212	1749342.34	5949347.25
WM 216	1749295.49	5949292.09

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

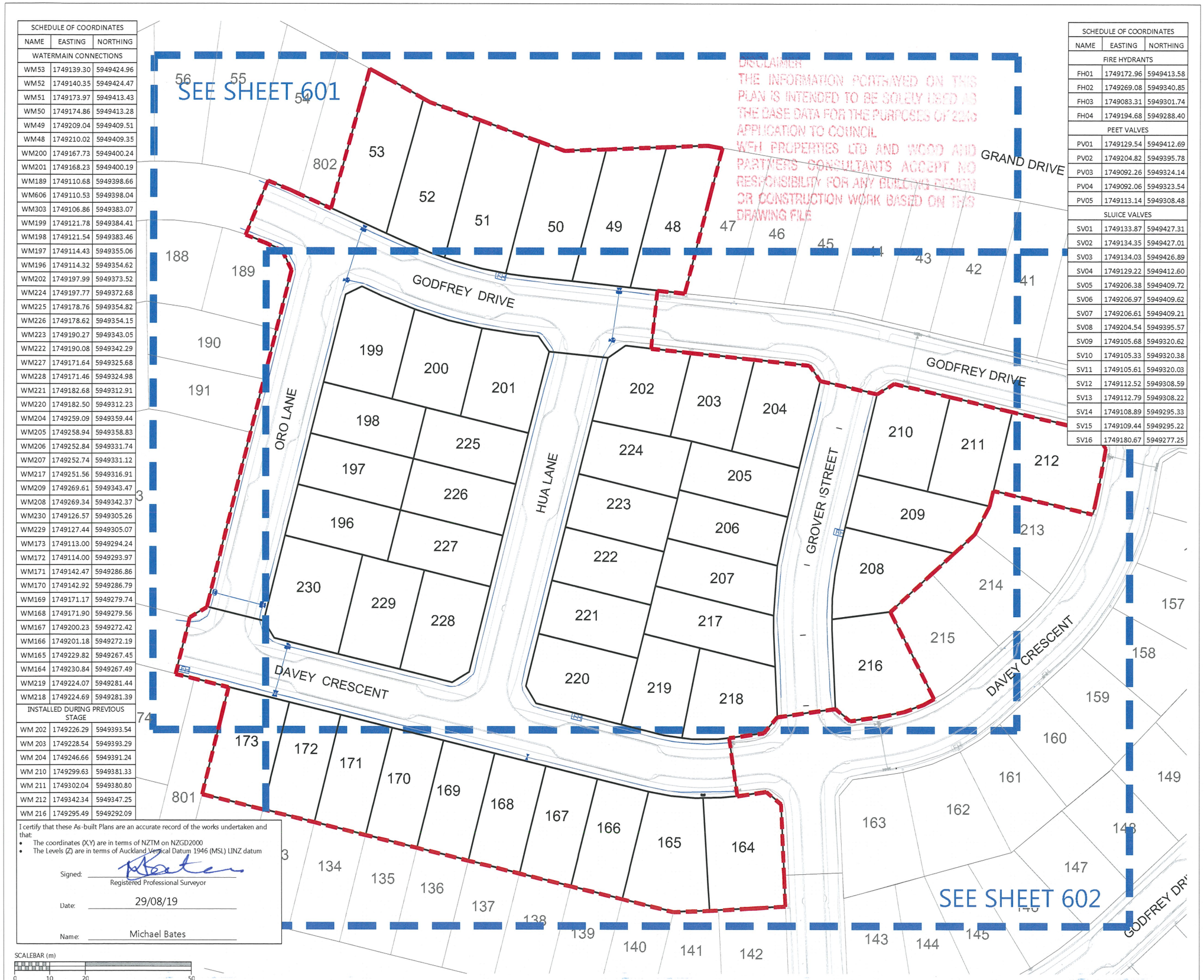
Signed: _____
Registered Professional Surveyor

Date: 29/08/19

Name: Michael Bates

SCALEBAR (m)

0 10 20 50



SCHEDULE OF COORDINATES		
NAME	EASTING	NORTHING
FIRE HYDRANTS		
FH01	1749172.96	5949413.58
FH02	1749269.08	5949340.85
FH03	1749083.31	5949301.74
FH04	1749194.68	5949288.40
PEET VALVES		
PV01	1749129.54	5949412.69
PV02	1749204.82	5949395.78
PV03	1749092.26	5949324.14
PV04	1749092.06	5949323.54
PV05	1749113.14	5949308.48
SLUICE VALVES		
SV01	1749133.87	5949427.31
SV02	1749134.35	5949427.01
SV03	1749134.03	5949426.89
SV04	1749129.22	5949412.60
SV05	1749206.38	5949409.72
SV06	1749206.97	5949409.62
SV07	1749206.61	5949409.21
SV08	1749204.54	5949395.57
SV09	1749105.68	5949320.62
SV10	1749105.33	5949320.38
SV11	1749105.61	5949320.03
SV12	1749112.52	5949308.59
SV13	1749112.79	5949308.22
SV14	1749108.89	5949295.33
SV15	1749109.44	5949295.22
SV16	1749180.67	5949277.25

WOODS
Est.1970

NOTES

1. ALL WORK AND MATERIALS COMPLIES WITH AC STANDARD FOR ENGINEERING DESIGN AND CONSTRUCTION.
2. PIPE BEDDING COMPLIES WITH AC STD DETAIL DRAWING 18000 SHEET 4.4 UNLESS OTHERWISE NOTED.
3. WATERMAINS ARE AN AVERAGE 0.6m BELOW GROUND IN BERMS AND 0.9m BELOW GROUND UNDER ROADS. HARDFILL BACKFILLED BENEATH ROAD CROSSINGS.
4. ALL PIPES ARE LAID 1.4m OFF THE ROAD RESERVE BOUNDARY IN THE COMMON SERVICE TRENCH.
5. PIPE SIZES SHOWN ARE EXTERNAL DIAMETER.
6. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
7. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.
8. EXISTING WATERMAIN SOURCED FROM AUCKLAND COUNCIL GIS

LEGEND

- EXISTING WATERMAIN
- HIGH PESSURE WATERMAIN
- LOW PRESSURE WATERMAIN
- SLUICE VALVE
- PEET VALVE
- FIRE HYDRANT
- TAPPING BAND
- BLANK CAP
- MANIFOLD BOX (MB)
- STAGE BOUNDARY

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	29/08/19

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

N

WFH PROPERTIES

MILLWATER PRECINCT 5
OREWA WEST
STAGES 4 & 3B

WATERMAIN AS-BUILT
SHEET 1 OF 3

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-600-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILT\4 & 3B\37504_PS_04-03B_WATERMAIN.DWG

DISCLAIMER
THE INFORMATION CONTAINED ON THIS PLAN IS INTENDED TO BE SOLELY USED AS THE BASE DATA FOR THE PURPOSES OF 224S APPLICATION TO COUNCIL
WFH PROPERTIES LTD AND WOOD AND PARTNERS CONSULTANTS ACCEPT NO RESPONSIBILITY FOR ANY BUILDING DESIGN OR CONSTRUCTION WORK BASED ON THIS DRAWING FILE

SCHEDULE OF COORDINATES			SCHEDULE OF COORDINATES		
NAME	EASTING	NORTHING	NAME	EASTING	NORTHING
WATERMAIN CONNECTIONS			FIRE HYDRANTS		
WM53	1749139.30	5949424.96	FH01	1749172.96	5949413.58
WM52	1749140.35	5949424.47	FH02	1749269.08	5949340.85
WM51	1749173.97	5949413.43	FH03	1749083.31	5949301.74
WM50	1749174.86	5949413.28	FH04	1749194.68	5949288.40
WM49	1749209.04	5949409.51	PEET VALVES		
WM48	1749210.02	5949409.35	PV01	1749129.54	5949412.69
WM200	1749167.73	5949400.24	PV02	1749204.82	5949395.78
WM201	1749168.23	5949400.19	PV03	1749092.26	5949324.14
WM189	1749110.68	5949398.66	PV04	1749092.06	5949323.54
WM606	1749110.53	5949398.04	PV05	1749113.14	5949308.48
WM303	1749106.86	5949383.07	SLUICE VALVES		
WM199	1749121.78	5949384.41	SV01	1749133.87	5949427.31
WM198	1749121.54	5949383.46	SV02	1749134.35	5949427.01
WM197	1749114.43	5949355.06	SV03	1749134.03	5949426.89
WM196	1749114.32	5949354.62	SV04	1749129.22	5949412.60
WM202	1749197.99	5949373.52	SV05	1749206.38	5949409.72
WM224	1749197.77	5949372.68	SV06	1749206.97	5949409.62
WM225	1749178.76	5949354.82	SV07	1749206.61	5949409.21
WM226	1749178.62	5949354.15	SV08	1749204.54	5949395.57
WM223	1749190.27	5949343.05	SV09	1749105.68	5949320.62
WM222	1749190.08	5949342.29	SV10	1749105.33	5949320.38
WM227	1749171.64	5949325.68	SV11	1749105.61	5949320.03
WM228	1749171.46	5949324.98	SV12	1749112.52	5949308.59
WM221	1749182.68	5949312.91	SV13	1749112.79	5949308.22
WM220	1749182.50	5949312.23	SV14	1749108.89	5949295.33
WM204	1749259.09	5949359.44	SV15	1749109.44	5949295.22
WM205	1749258.94	5949358.83	SV16	1749180.67	5949277.25
WM206	1749252.84	5949331.74			
WM207	1749252.74	5949331.12			
WM217	1749251.56	5949316.91			
WM209	1749269.61	5949343.47			
WM208	1749269.34	5949342.37			
WM230	1749126.57	5949305.26			
WM229	1749127.44	5949305.07			
WM173	1749113.00	5949294.24			
WM172	1749114.00	5949293.97			
WM171	1749142.47	5949286.86			
WM170	1749142.92	5949286.79			
WM169	1749171.17	5949279.74			
WM168	1749171.90	5949279.56			
WM167	1749200.23	5949272.42			
WM166	1749201.18	5949272.19			
WM165	1749229.82	5949267.45			
WM164	1749230.84	5949267.49			
WM219	1749224.07	5949281.44			
WM218	1749224.69	5949281.39			
INSTALLED DURING PREVIOUS STAGE					
WM 202	1749226.29	5949393.54			
WM 203	1749228.54	5949393.29			
WM 204	1749246.66	5949391.24			
WM 210	1749299.63	5949381.33			
WM 211	1749302.04	5949380.80			
WM 212	1749342.34	5949347.25			
WM 216	1749295.49	5949292.09			

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: 29/08/19

Name: Michael Bates

WOODS Est.1970

NOTES

1. ALL WORK AND MATERIALS COMPLIES WITH AC STANDARD FOR ENGINEERING DESIGN AND CONSTRUCTION.
2. PIPE BEDDING COMPLIES WITH AC STD DETAIL DRAWING 18000 SHEET 4.4 UNLESS OTHERWISE NOTED.
3. WATERMAINS ARE AN AVERAGE 0.6m BELOW GROUND IN BERMS AND 0.9m BELOW GROUND UNDER ROADS. HARDFILL BACKFILLED BENEATH ROAD CROSSINGS.
4. ALL PIPES ARE LAID 1.4m OFF THE ROAD RESERVE BOUNDARY IN THE COMMON SERVICE TRENCH.
5. PIPE SIZES SHOWN ARE EXTERNAL DIAMETER.
6. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
7. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.
8. EXISTING WATERMAIN SOURCED FROM AUCKLAND COUNCIL GIS

LEGEND

- EXISTING WATERMAIN
- HIGH PESSURE WATERMAIN
- LOW PRESSURE WATERMAIN
- SLUICE VALVE
- PEET VALVE
- FIRE HYDRANT
- TAPPING BAND
- BLANK CAP
- MANIFOLD BOX (MB)
- STAGE BOUNDARY

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	29/08/19

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

N

WFH PROPERTIES

MILLWATER PRECINCT 5
OREWA WEST
STAGES 4 & 3B

WATERMAIN AS-BUILT
SHEET 2 OF 3

STATUS	AS-BUILT	REV
SCALE	1:750 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-601-AB	

SCALEBAR (m)
0 7.5 15 37.5

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVAS-BUILT\4 & 3B\37504_PS_04_03B_WATERMAIN.DWG

SCHEDULE OF COORDINATES		
NAME	EASTING	NORTHING
WATERMAIN CONNECTIONS		
WM53	1749139.30	5949424.96
WM52	1749140.35	5949424.47
WM51	1749173.97	5949413.43
WM50	1749174.86	5949413.28
WM49	1749209.04	5949409.51
WM48	1749210.02	5949409.35
WM200	1749167.73	5949400.24
WM201	1749168.23	5949400.19
WM189	1749110.68	5949398.66
WM606	1749110.53	5949398.04
WM303	1749106.86	5949383.07
WM199	1749121.78	5949384.41
WM198	1749121.54	5949383.46
WM197	1749114.43	5949355.06
WM196	1749114.32	5949354.62
WM202	1749197.99	5949373.52
WM224	1749197.77	5949372.68
WM225	1749178.76	5949354.82
WM226	1749178.62	5949354.15
WM223	1749190.27	5949343.05
WM222	1749190.08	5949342.29
WM227	1749171.64	5949325.68
WM228	1749171.46	5949324.98
WM221	1749182.68	5949312.91
WM220	1749182.50	5949312.23
WM204	1749259.09	5949359.44
WM205	1749258.94	5949358.83
WM206	1749252.84	5949331.74
WM207	1749252.74	5949331.12
WM217	1749251.56	5949316.91
WM209	1749269.61	5949343.47
WM208	1749269.34	5949342.37
WM230	1749126.57	5949305.26
WM229	1749127.44	5949305.07
WM173	1749113.00	5949294.24
WM172	1749114.00	5949293.97
WM171	1749142.47	5949286.86
WM170	1749142.92	5949286.79
WM169	1749171.17	5949279.74
WM168	1749171.90	5949279.56
WM167	1749200.23	5949272.42
WM166	1749201.18	5949272.19
WM165	1749229.82	5949267.45
WM164	1749230.84	5949267.49
WM219	1749224.07	5949281.44
WM218	1749224.69	5949281.39
INSTALLED DURING PREVIOUS STAGE		
WM 202	1749226.29	5949393.54
WM 203	1749228.54	5949393.29
WM 204	1749246.66	5949391.24
WM 210	1749299.63	5949381.33
WM 211	1749302.04	5949380.80
WM 212	1749342.34	5949347.25
WM 216	1749295.49	5949292.09

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: 29/08/19

Name: Michael Bates

NOTES

1. ALL WORK AND MATERIALS COMPLIES WITH AC STANDARD FOR ENGINEERING DESIGN AND CONSTRUCTION.
2. PIPE BEDDING COMPLIES WITH AC STD DETAIL DRAWING 18000 SHEET 4.4 UNLESS OTHERWISE NOTED.
3. WATERMAINS ARE AN AVERAGE 0.6m BELOW GROUND IN BERMS AND 0.9m BELOW GROUND UNDER ROADS. HARDFILL BACKFILLED BENEATH ROAD CROSSINGS.
4. ALL PIPES ARE LAID 1.4m OFF THE ROAD RESERVE BOUNDARY IN THE COMMON SERVICE TRENCH.
5. PIPE SIZES SHOWN ARE EXTERNAL DIAMETER.
6. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
7. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.
8. EXISTING WATERMAIN SOURCED FROM AUCKLAND COUNCIL GIS

LEGEND

- EXISTING WATERMAIN
- HIGH PESSURE WATERMAIN
- LOW PRESSURE WATERMAIN
- SLUICE VALVE
- PEET VALVE
- FIRE HYDRANT
- TAPPING BAND
- BLANK CAP
- MANIFOLD BOX (MB)
- STAGE BOUNDARY

SCHEDULE OF COORDINATES		
NAME	EASTING	NORTHING
FIRE HYDRANTS		
FH01	1749172.96	5949413.58
FH02	1749269.08	5949340.85
FH03	1749083.31	5949301.74
FH04	1749194.68	5949288.40
PEET VALVES		
PV01	1749129.54	5949412.69
PV02	1749204.82	5949395.78
PV03	1749092.26	5949324.14
PV04	1749092.06	5949323.54
PV05	1749113.14	5949308.48
SLUICE VALVES		
SV01	1749133.87	5949427.31
SV02	1749134.35	5949427.01
SV03	1749134.03	5949426.89
SV04	1749129.22	5949412.60
SV05	1749206.38	5949409.72
SV06	1749206.97	5949409.62
SV07	1749206.61	5949409.21
SV08	1749204.54	5949395.57
SV09	1749105.68	5949320.62
SV10	1749105.33	5949320.38
SV11	1749105.61	5949320.03
SV12	1749112.52	5949308.59
SV13	1749112.79	5949308.22
SV14	1749108.89	5949295.33
SV15	1749109.44	5949295.22
SV16	1749180.67	5949277.25

DISCLAIMER:
THE INFORMATION CONTAINED ON THIS PLAN IS INTENDED TO BE SOLELY USED AS THE BASE DATA FOR THE PURPOSES OF 224c APPLICATION TO COUNCIL.
WFH PROPERTIES LTD AND WOOD AND PARTNERS CONSULTANTS ACCEPT NO RESPONSIBILITY FOR ANY BUILDING DESIGN OR CONSTRUCTION WORK BASED ON THIS DRAWING FILE.

SCALEBAR (m)
0 7.5 15 37.5

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	29/08/19

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

MILLWATER PRECINCT 5
OREWA WEST
STAGES 4 & 3B

WATERMAIN AS-BUILT
SHEET 3 OF 3

STATUS	AS-BUILT	REV
SCALE	1:750 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37504-04-03B-602-AB	

Document No. K:\37504-ARRAN HILL PRECINCT 5 STAGE 4\DRAWINGS\SURVVAS-BUILT\M & 3B\37504_P5_04_03B_WATERMAIN.DWG

Appendix A2: T+T Drawings

·	21854.0031–AHP5S3B&4–100	Drawing List and Location Plan
·	21854.0031–AHP5S3B&4–101	Geotechnical Works Plan
·	21854.0031–AHP5S3B&4–102	Geotechnical Works Subsoil Drain Plan
·	21854.0031–AHP5S3B&4–103	Geological Cross Sections 1 & 2
	21854.0031–AHP5S3B&4–104	Geological Cross Sections 3 & 4
·	21854.0031–AHP5S3B&4–110	Retaining Wall 06 – Plan and Elevation
·	21854.0031–AHP5S3B&4–111	Retaining Wall 06 – Typical Section (H<3m)
·	21854.0031–AHP5S3B&4–112 (3m<H≤4.7m)	Retaining Wall 06 – Typical Section
·	21854.0031–AHP5S3B&4–113	RE Slope 5 – Typical Section
·	21854.0031–AHP5S3B&4–114	RE Slope 7 – Typical Section (Sheet 1)
·	21854.0031–AHP5S3B&4–115	RE Slope 7 – Typical Section (Sheet 2)
·	21854.0031–AHP5S3B&4–120	Building Limitation Plan

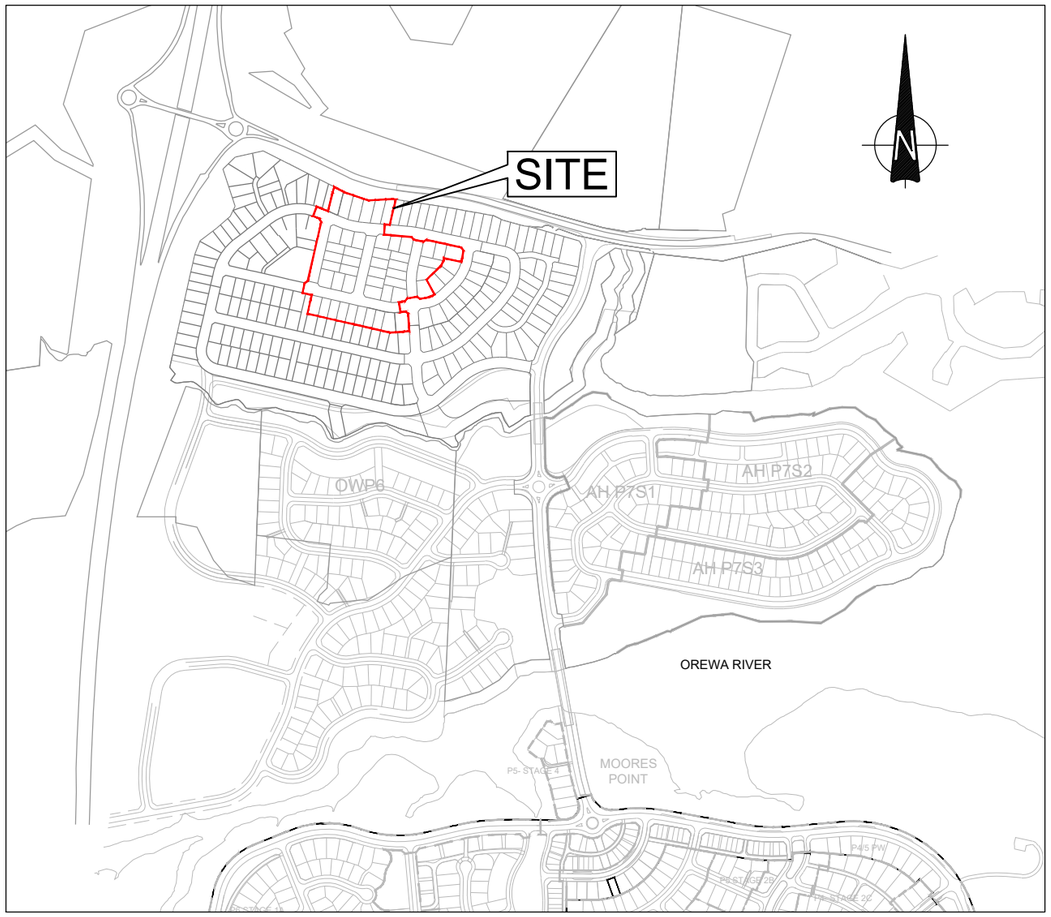
Retaining Wall 6 Construction Drawings (BCO–10270225)

·	21854.0031–P5–101	Geotechnical Works Plan – Retaining Walls and RE Slopes
·	21854.0031–P5–102	Geotechnical Works Plan – Subsoil Drainage
·	21854.0031–P5–103	Geotechnical Works Plan – Shear Keys, Undercuts & Piles
·	21854.0031–P5–124	Retaining Wall 06 – Plan and Elevation
·	21854.0031–P5–125	Retaining Walls 05 and 06 – Typical Section (H<=3m)
·	21854.0031–P5–126	Retaining Walls 05 and 06 – Typical Section (3m<H<=4.2m)
·	21854.0031–P5–143	Outlet Drain Detail
·	21854.0031–P5–144	Safety Fence Detail

L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 3B & 4\21854.0031-AHP5S3B&4-100.dwg 2019-Sep-02 1:12:01 PM Plotted By: JONALD CASTRO

WFH PROPERTIES LTD
MILLWATER - ARRANS HILL
PRECINCT 5 STAGE 3B & 4
COMPLETION REPORT ISSUE

DRAWING	Rev	Title
GENERAL		
● 21854.0031-AHP5S3B&4-100	1	DRAWING LIST AND LOCATION PLAN
● 21854.0031-AHP5S3B&4-101	1	GEOTECHNICAL WORKS PLAN
● 21854.0031-AHP5S3B&4-102	1	GEOTECHNICAL WORKS SUBSOIL DRAIN PLAN
● 21854.0031-AHP5S3B&4-103	1	GEOLOGICAL CROSS SECTIONS 1 & 2
● 21854.0031-AHP5S3B&4-104	1	GEOLOGICAL CROSS SECTIONS 3 & 4
● 21854.0031-AHP5S3B&4-110	1	RETAINING WALL 06 - PLAN AND ELEVATION
● 21854.0031-AHP5S3B&4-111	1	RETAINING WALLS 06 - TYPICAL SECTION (H≤3m)
● 21854.0031-AHP5S3B&4-112	1	RETAINING WALL 06 - TYPICAL SECTION (3m<H≤ 4.7m)
● 21854.0031-AHP5S3B&4-113	1	RE SLOPE 5 - TYPICAL SECTION
● 21854.0031-AHP5S3B&4-114	1	RE SLOPE 7 - TYPICAL SECTION (SHEET 1)
● 21854.0031-AHP5S3B&4-115	1	RE SLOPE 7 - TYPICAL SECTION (SHEET 2)
● 21854.0031-AHP5S3B&4-120	1	BUILDING LIMITATION PLAN
● 21854.0031-AHP5S3B&4-121	1	POST EARTHWORKS INVESTIGATION PLAN
● 21854.0031-AHP5S3B&4-122	1	TOPSOIL DEPTHS PLAN
● 21854.0031-AHP5S3B&4-123	1	EARTHWORKS TESTING LOCATION PLAN



LOCATION PLAN
SCALE 1:10,000

● Denotes drawing this issue: 02/09/2019

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

REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE	JC				

DESIGNED	JXXL	Aug.19	DRAWING STATUS	COMPLETION REPORT
DRAWN	JC	Aug.19		
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	**MILLWATER - ARRANS HILL**
TITLE	PRECINCT 5 STAGE 3B & 4 DRAWING LIST AND LOCATION PLAN
SCALE (A3)	1:10,000
DWG No.	21854.0031-AHP5S3B&4-100
REV	1

L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 3B & 4\21854.0031-AHP5S3B&4-101.dwg 2019-Sep-02 1:12:06 PM Plotted By: JONALD CASTRO

LEGEND

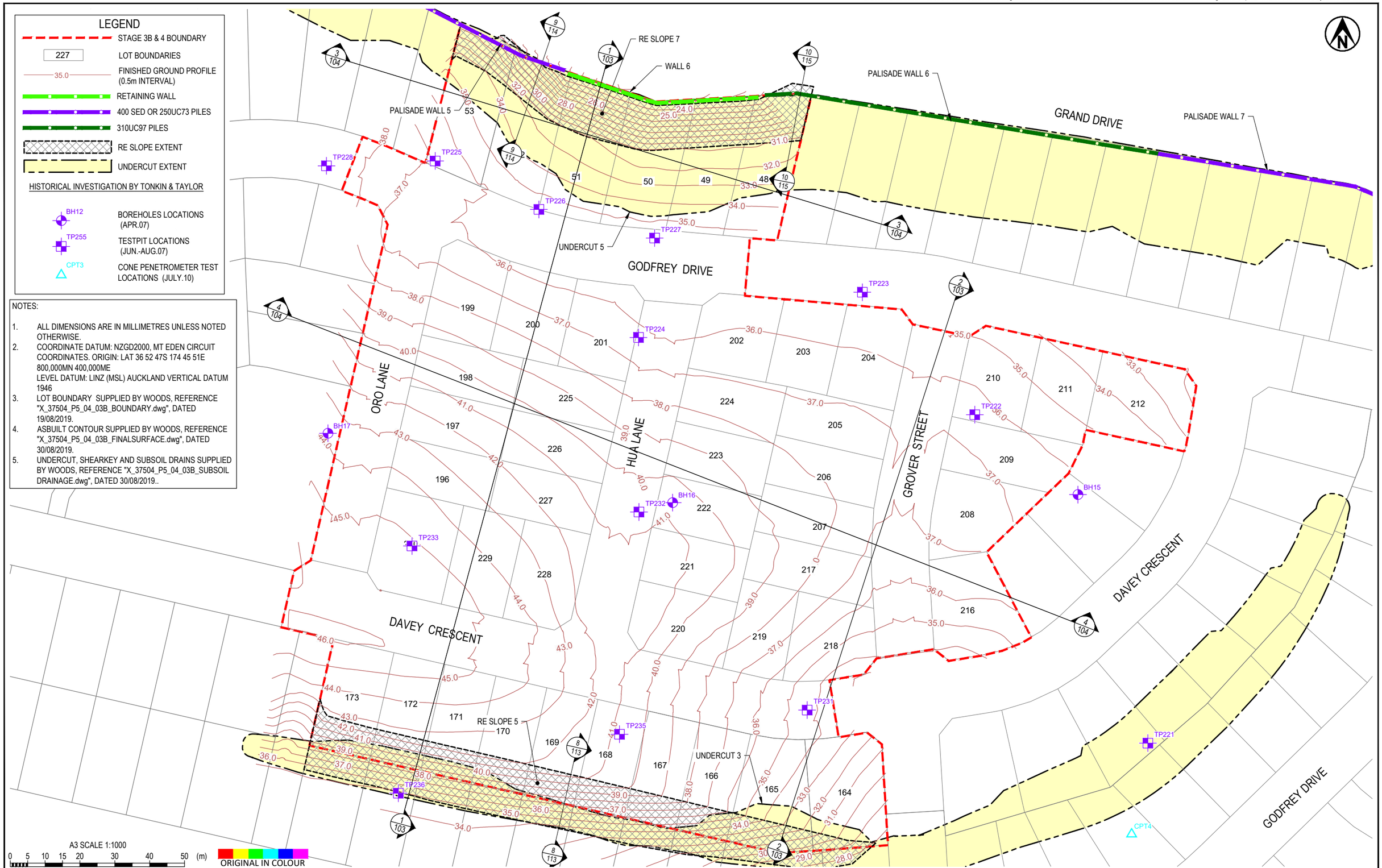
- STAGE 3B & 4 BOUNDARY
- 227 — LOT BOUNDARIES
- 35.0 — FINISHED GROUND PROFILE (0.5m INTERVAL)
- RETAINING WALL
- 400 SED OR 250UC73 PILES
- 310UC97 PILES
- RE SLOPE EXTENT
- UNDERCUT EXTENT

HISTORICAL INVESTIGATION BY TONKIN & TAYLOR

- BH12 — BOREHOLES LOCATIONS (APR.07)
- TP255 — TESTPIT LOCATIONS (JUN.-AUG.07)
- CPT3 — CONE PENETROMETER TEST LOCATIONS (JULY.10)

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT COORDINATES. ORIGIN: LAT 36 52 47S 174 45 51E 800,000MN 400,000ME
   LEVEL DATUM: LINZ (MSL) AUCKLAND VERTICAL DATUM 1946
3. LOT BOUNDARY SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_BOUNDARY.dwg", DATED 19/08/2019.
4. ASBUILT CONTOUR SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_FINALSURFACE.dwg", DATED 30/08/2019.
5. UNDERCUT, SHEARKEY AND SUBSOIL DRAINS SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_SUBSOIL DRAINAGE.dwg", DATED 30/08/2019..



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
1	COMPLETION REPORT ISSUE	JC		

DESIGNED	JXXL	Aug.19	DRAWING STATUS	COMPLETION REPORT
DRAWN	JC	Aug.19		
DESIGN CHECKED				
DRAWING CHECKED				

NOT FOR CONSTRUCTION

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

APPROVED DATE

CLIENT **WFH PROPERTIES LTD**

PROJECT **MILLWATER - ARRANS HILL**

TITLE PRECINCT 5 STAGE 3B & 4
GEOTECHNICAL WORKS PLAN

SCALE (A3) 1:1000 DWG No. 21854.0031-AHP5S3B&4-101 REV 1

L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 3B & 4\21854.0031-AHP5S3B&4-102.dwg 2019-Sep-02 1:12:11 PM Plotted By: JONALD CASTRO

LEGEND

- STAGE 3B & 4 BOUNDARY
- 227 — LOT BOUNDARIES
- 35.0 — FINISHED GROUND PROFILE (0.5m INTERVAL)
- RETAINING WALL
- 400 SED OR 250UC73 PILES
- 310UC97 PILES
- RE SLOPE EXTENT
- UNDERCUT EXTENT
- SUBSOIL DRAIN
- REINFORCED EARTH SLOPE SUBSOIL DRAIN
- GULLY SUBSOIL DRAIN

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT COORDINATES. ORIGIN: LAT 36 52 47S 174 45 51E 800,000MN 400,000ME
   LEVEL DATUM: LINZ (MSL) AUCKLAND VERTICAL DATUM 1946
3. LOT BOUNDARY SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_BOUNDARY.dwg", DATED 19/08/2019.
4. ASBUILT CONTOUR SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_FINALSURFACE.dwg", DATED 30/08/2019.
5. UNDERCUT, SHEARKEY AND SUBSOIL DRAINS SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_SUBSOIL DRAINAGE.dwg", DATED 30/08/2019..

RE SLOPE 7
OUTLET TO EXISTING CULVERT
WALL 6
PALISADE WALL 6
PALISADE WALL 5
PALISADE WALL 7
GRAND DRIVE
UNDERCUT 5
GODFREY DRIVE
ORO LANE
HUA LANE
GROVER STREET
DAVEY CRESCENT
RE SLOPE 5
UNDERCUT 3
CONNECTS TO GULLY DRAIN
RE SLOPE 6

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	JC				

DESIGNED	JXXL	Aug.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Aug.19	
DESIGN CHECKED			
DRAWING CHECKED			

NOT FOR CONSTRUCTION

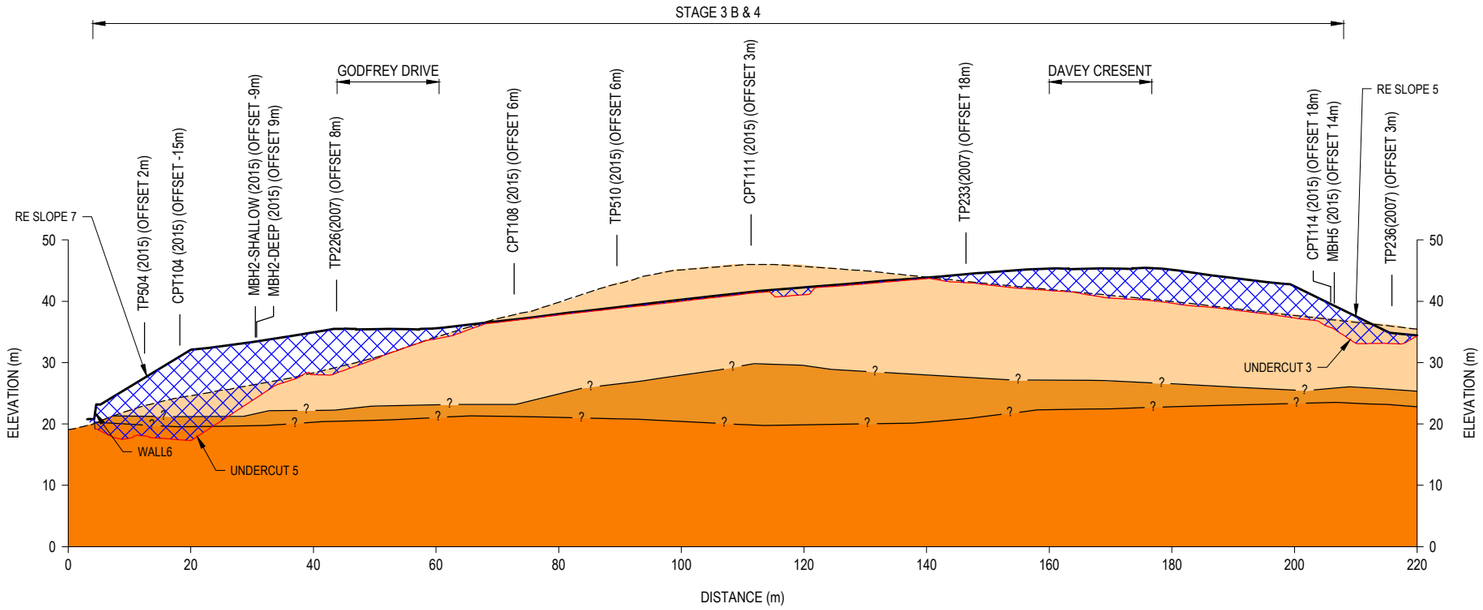
THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AS APPROVED

CLIENT **WFH PROPERTIES LTD**
PROJECT **MILLWATER - ARRANS HILL**
TITLE PRECINCT 5 STAGE 3B & 4
GEOTECHNICAL WORKS SUBSOIL DRAIN PLAN
SCALE (A3) 1:1000 DWG No. 21854.0031-AHP5S3B&4-102 REV 1

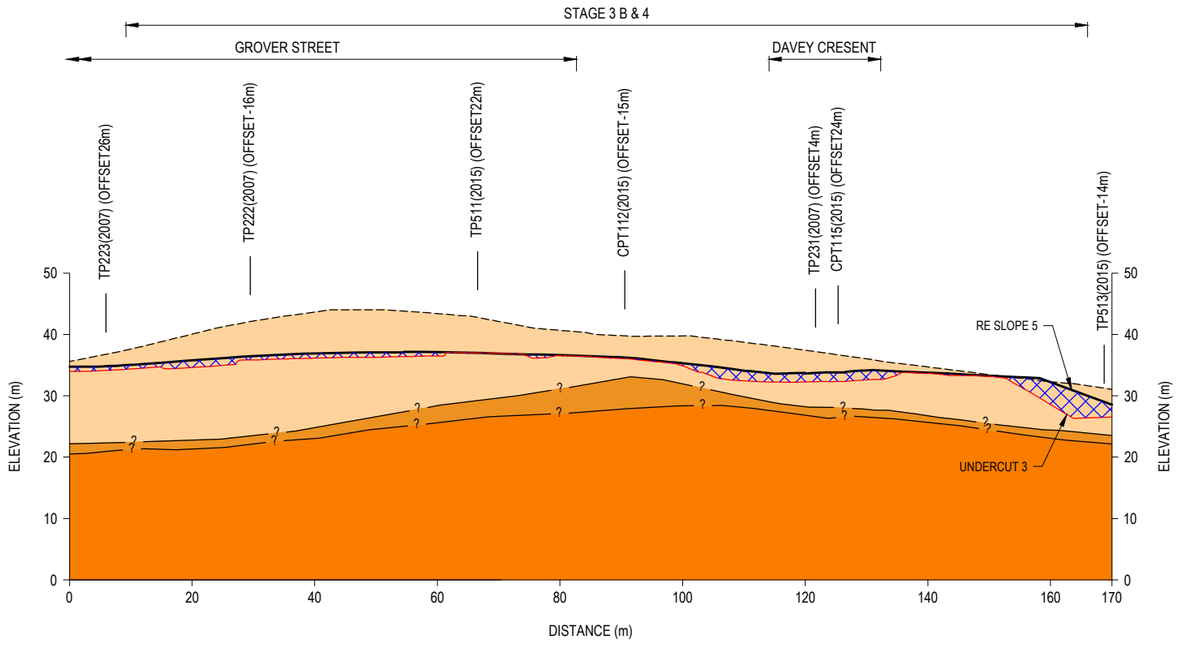
L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 3B & 4\21854.0031-AHP5S3B&4-103_104.dwg 2019-Sep-02 1:12:15 PM Plotted By: JONALD CASTRO

LEGEND

- ORIGINAL GROUND PROFILE
- GROUND PROFILE PRIOR TO PRECINCT 5 COMMENCEMENT
- FINAL GROUND PROFILE
- UNDERCUT/LOWEST SURFACE
- ? GEOLOGICAL CONTACT
- ENGINEERED FILL
- RESIDUAL-WEATHERED ECBF
- HIGHLY WEATHERED ECBF
- SLIGHTLY WEATHERED ECBF



SECTION 1 / 101
SCALE 1: 500



SECTION 2 / 101
SCALE 1: 500

NOTE:

1. ALL GEOLOGICAL BOUNDARIES ARE APPROXIMATE AND INFERRED FROM POINT LOCATION DATA.
2. AS-BUILT PROFILE BASED ON 3D SURFACE SUPPLIED BY WOODS, "X_37504 3D triangles.dwg" DATED 30/08/2019.
3. UNDERCUT / LOWEST LEVEL SUPPLIED BY WOODS, REF "P5_Lowest surface triangles-1.0-.dwg" DATED 08/08/2019.

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	JC				

DESIGNED	JXXL	Aug.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Aug.19	
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 **MILLWATER - ARRANS HILL**

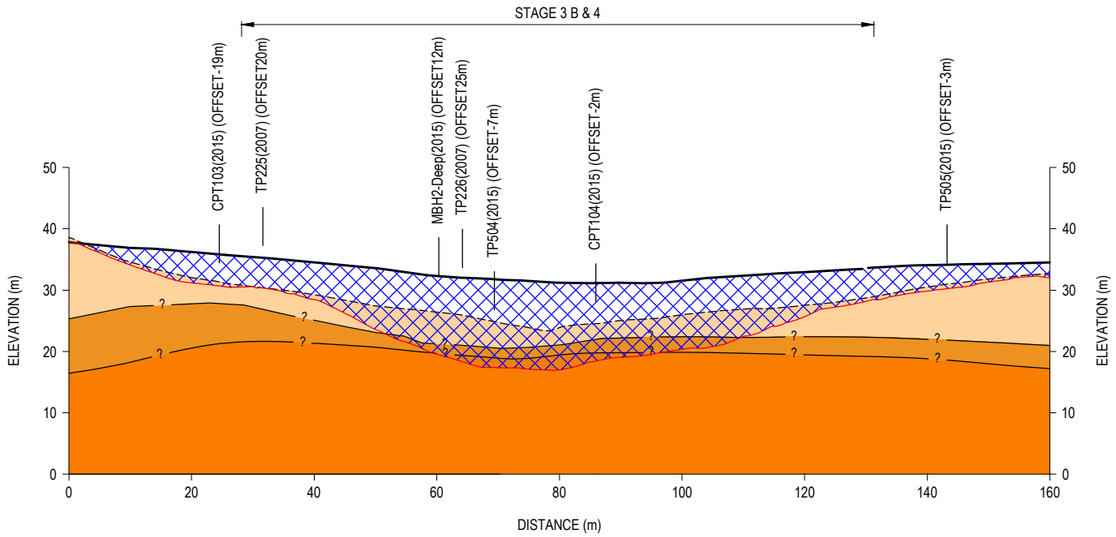
TITLE PRECINCT 5 STAGE 3B & 4
GEOLOGICAL CROSS SECTIONS 1 & 2

SCALE (A3) 1:1000 DWG No. 21854.0031-AHP5S3B&4-103 REV 1

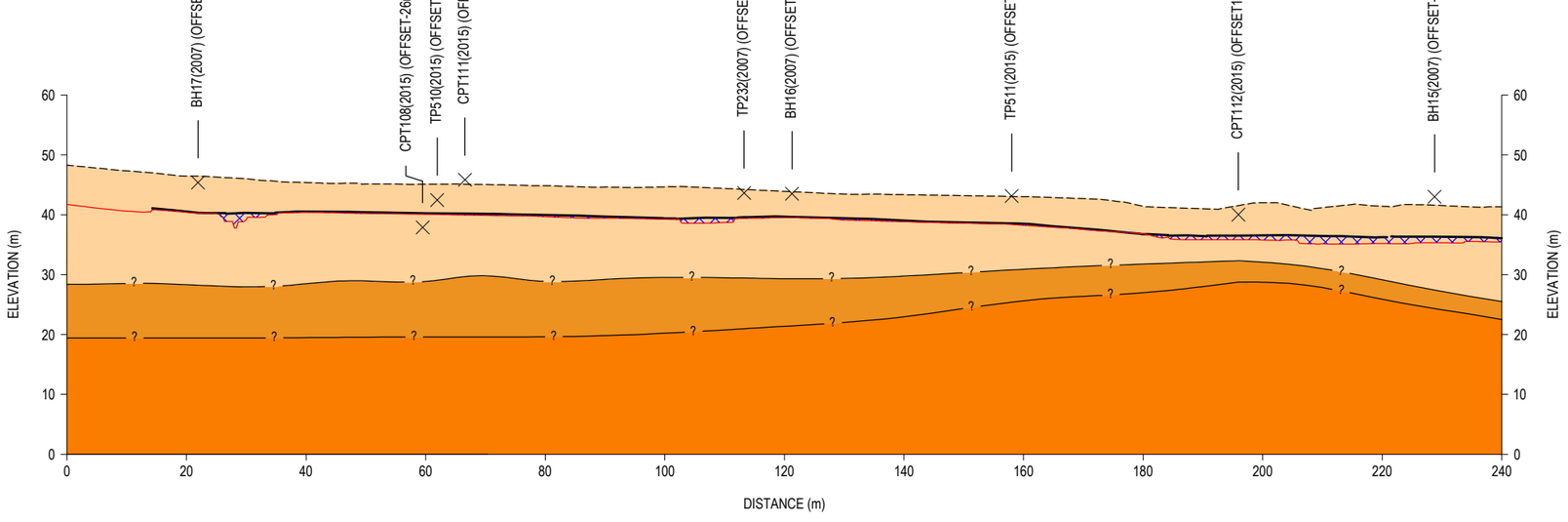
L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 3B & 4\21854.0031-AHP5S3B&4-103_104.dwg 2019-Sep-02 1:12:16 PM Plotted By: JONALD CASTRO

LEGEND

- ORIGINAL GROUND PROFILE
- GROUND PROFILE PRIOR TO PRECINCT 5 COMMENCEMENT
- FINAL GROUND PROFILE
- UNDERCUT/LOWEST SURFACE
- ? GEOLOGICAL CONTACT
- ENGINEERED FILL
- RESIDUAL-WEATHERED ECBF
- HIGHLY WEATHERED ECBF
- SLIGHTLY WEATHERED ECBF



SECTION 2 / 101
SCALE 1: 500



SECTION 2 / 101
SCALE 1: 500

NOTE:

1. ALL GEOLOGICAL BOUNDARIES ARE APPROXIMATE AND INFERRED FROM POINT LOCATION DATA.
2. AS-BUILT PROFILE BASED ON 3D SURFACE SUPPLIED BY WOODS, "X_37504 3D triangles.dwg" DATED 30/08/2019.
3. UNDERCUT / LOWEST LEVEL SUPPLIED BY WOODS, REF "P5_Lowest surface triangles-1.0-.dwg" DATED 08/08/2019.

A3 SCALE 1:500

0 5 10 15 20 25 (m)

ORIGINAL IN COLOUR

Tonkin+Taylor

Exceptional thinking together www.tonkintaylor.co.nz

REV	DESCRIPTION	CAD	CHK	DATE
1	COMPLETION REPORT ISSUE	JC		

DESIGNED	JXXL	Aug.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Aug.19	
DESIGN CHECKED			
DRAWING CHECKED			

NOT FOR CONSTRUCTION

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

APPROVED DATE

CLIENT **WFH PROPERTIES LTD**

PROJECT **MILLWATER - ARRANS HILL**

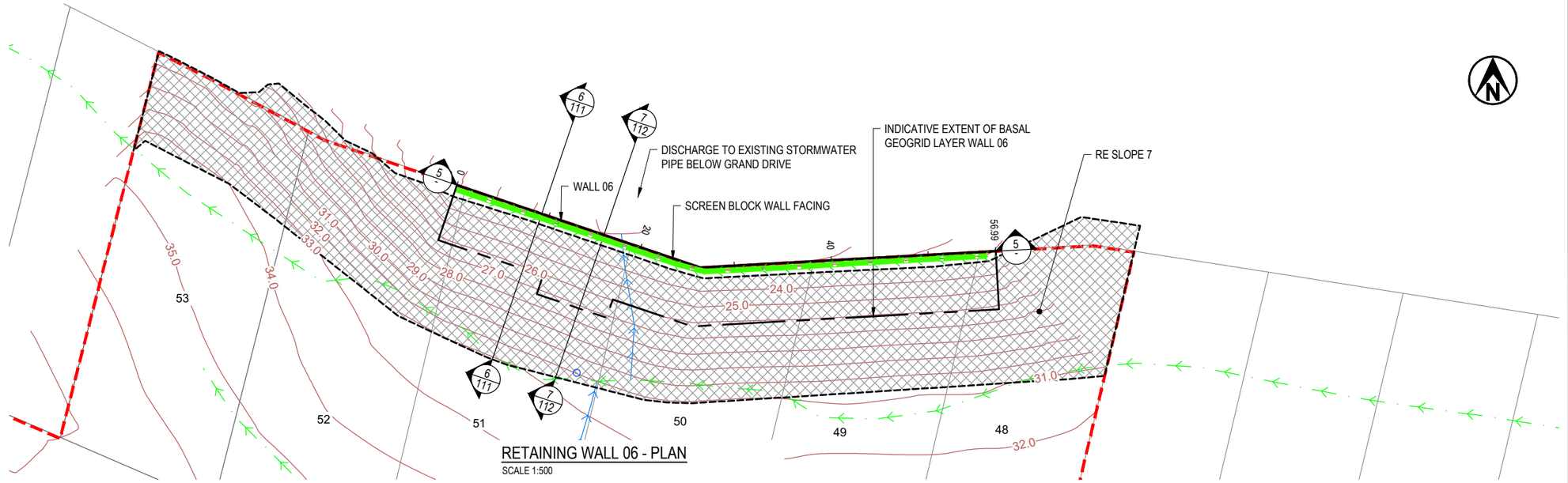
TITLE PRECINCT 5 STAGE 3B & 4
GEOLOGICAL CROSS SECTIONS 3 & 4

SCALE (A3) 1:500 DWG No. 21854.0031-AHP5S3B&4-104 REV 1

L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 3B & 4\21854.0031-AHP5S3B&4-110.dwg 2019-Sep-02 1:12:21 PM Plotted By: JONALD CASTRO

LEGEND

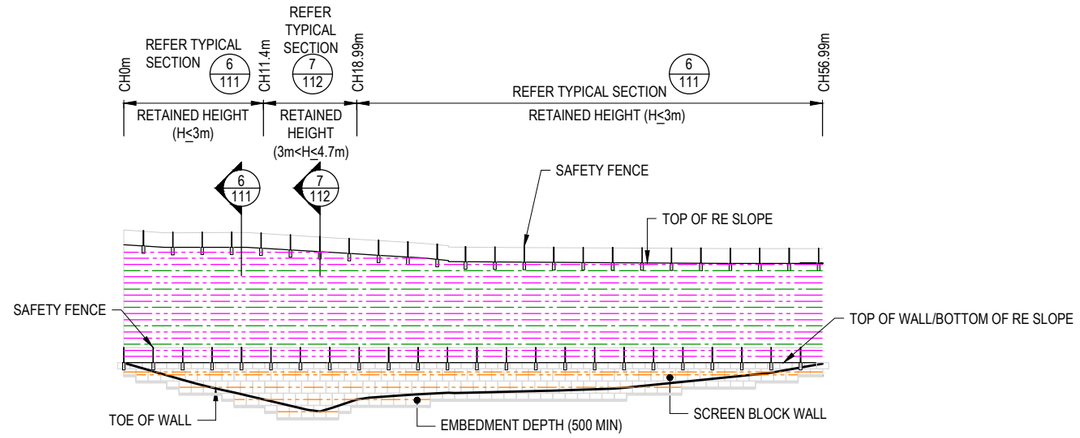
- STAGE 3B & 4 BOUNDARY
- 227 — LOT BOUNDARIES
- 35.0 — FINISHED GROUND PROFILE (0.5m INTERVAL)
- 40 / 20 — RETAINING WALL CHAINAGE (m)
- RETAINING WALL ALIGNMENT
- RE SLOPE EXTENT
- GEOGRID TENSAR RE580 AT THE BACK OF SCREEN BLOCK WALL
- RE SLOPE GEOGRID TENSAR RE540 (PRIMARY)
- RE SLOPE GEOGRID TENSAR SS20 (SECONDARY)
- SUBSOIL DRAIN
- REINFORCED EARTH SLOPE SUBSOIL DRAIN



RETAINING WALL 06 - PLAN
SCALE 1:500

NOTE:

1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. LOT BOUNDARY SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_BOUNDARY.dwg", DATED 19/08/2019.
3. ASBUILT CONTOUR SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_FINALSURFACE.dwg", DATED 19/08/2019.
4. COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT COORDINATES.
   LEVEL DATUM: LINZ (MSL) AUCKLAND VERTICAL DATUM 1946
5. ALL SETOUT TO BE COMPLETED BY CONTRACTOR IN ACCORDANCE WITH WOODS DRAWINGS.



DATUM RL 16.00

CHAINAGE (m)	0.00	5.00	10.00	11.40	15.00	18.99	20.00	25.00	30.00	35.00	40.00	45.00	50.00	55.00	56.99
TOP OF WALL (m)	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70
TOE OF WALL (m)	22.67	21.24	20.03	19.70	18.86	19.70	19.84	20.17	20.30	20.43	20.59	21.07	21.58	22.27	22.61
HEIGHT OF WALL (m)	0.03	1.46	2.67	3.00	3.84	3.00	2.86	2.53	2.40	2.27	2.11	1.63	1.12	0.43	0.09

SECTION 5/- RETAINING WALL 06 - ELEVATION
SCALE 1:500

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

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

REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE	JC				

DESIGNED	JXXL	Aug.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Aug.19	
DESIGN CHECKED			
DRAWING CHECKED			

NOT FOR CONSTRUCTION

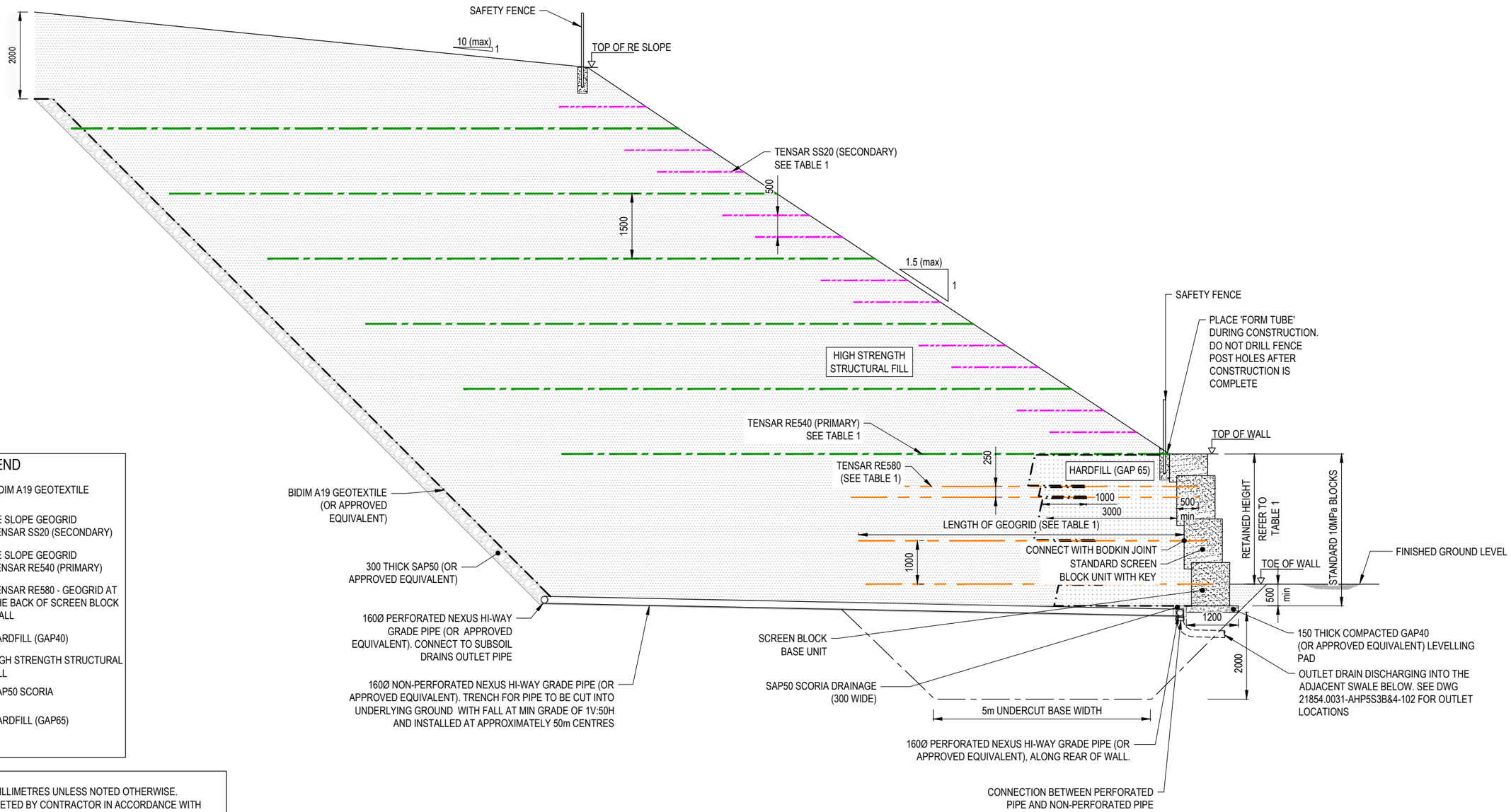
THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AS APPROVED

CLIENT **WFH PROPERTIES LTD**
PROJECT **MILLWATER - ARRANS HILL**
TITLE PRECINCT 5 STAGE 3B & 4
RETAINING WALL 06 - PLAN AND ELEVATION
SCALE (A3) 1:500 DWG No. 21854.0031-AHP5S3B&4-110 REV 1

L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 3B & 4\21854.0031-AHP5S3B&4-111.dwg 2019-Sep-02 1:12:25 PM Plotted By: JONALD CASTRO

TABLE 1: RETAINING WALL 06 (H≤3m) DETAIL TABLE

GEOGRID REQUIREMENTS						
WALL TYPE	TOTAL SLOPE/ RETAINED HEIGHT (m)	MAX BACKSLOPE	MAX FORWARD SLOPE	GEOGRID TYPE	GEOGRID LENGTH (m)	VERTICAL LOCATION ABOVE TOE OF WALL (m)
SCREEN BLOCK	H ≤ 3	1V:1.5H	0°	TENSAR RE580	8.0	0.0, 1.0, 2.0, 2.25
RE SLOPE						MAX VERTICAL SPACING (m)
	8 < H ≤ 9	1V:10H	N/A	TENSAR RE540 (PRIMARY)	14.0	1.5
				TENSAR SS20 (SECONDARY)	2.0	0.5



LEGEND

- BIDIM A19 GEOTEXTILE
- RE SLOPE GEOGRID TENSAR SS20 (SECONDARY)
- RE SLOPE GEOGRID TENSAR RE540 (PRIMARY)
- TENSAR RE580 - GEOGRID AT THE BACK OF SCREEN BLOCK WALL
- HARDFILL (GAP40)
- HIGH STRENGTH STRUCTURAL FILL
- SAP50 SCORIA
- HARDFILL (GAP65)

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 DWG.21854.0031-AHP5S3B&4-110 FOR WALL 06 PLAN AND LONGSECTION.

A3 SCALE 1:100

0 1 2 3 4 5 (m)

SECTION 6/110 SCREEN BLOCK WALL TYPICAL SECTION (H≤3m) RETAINING WALL 06
SCALE 1: 100

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

REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE	JC				

DESIGNED	JXXL	Aug.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Aug.19	
DESIGN CHECKED			
DRAWING CHECKED			

NOT FOR CONSTRUCTION

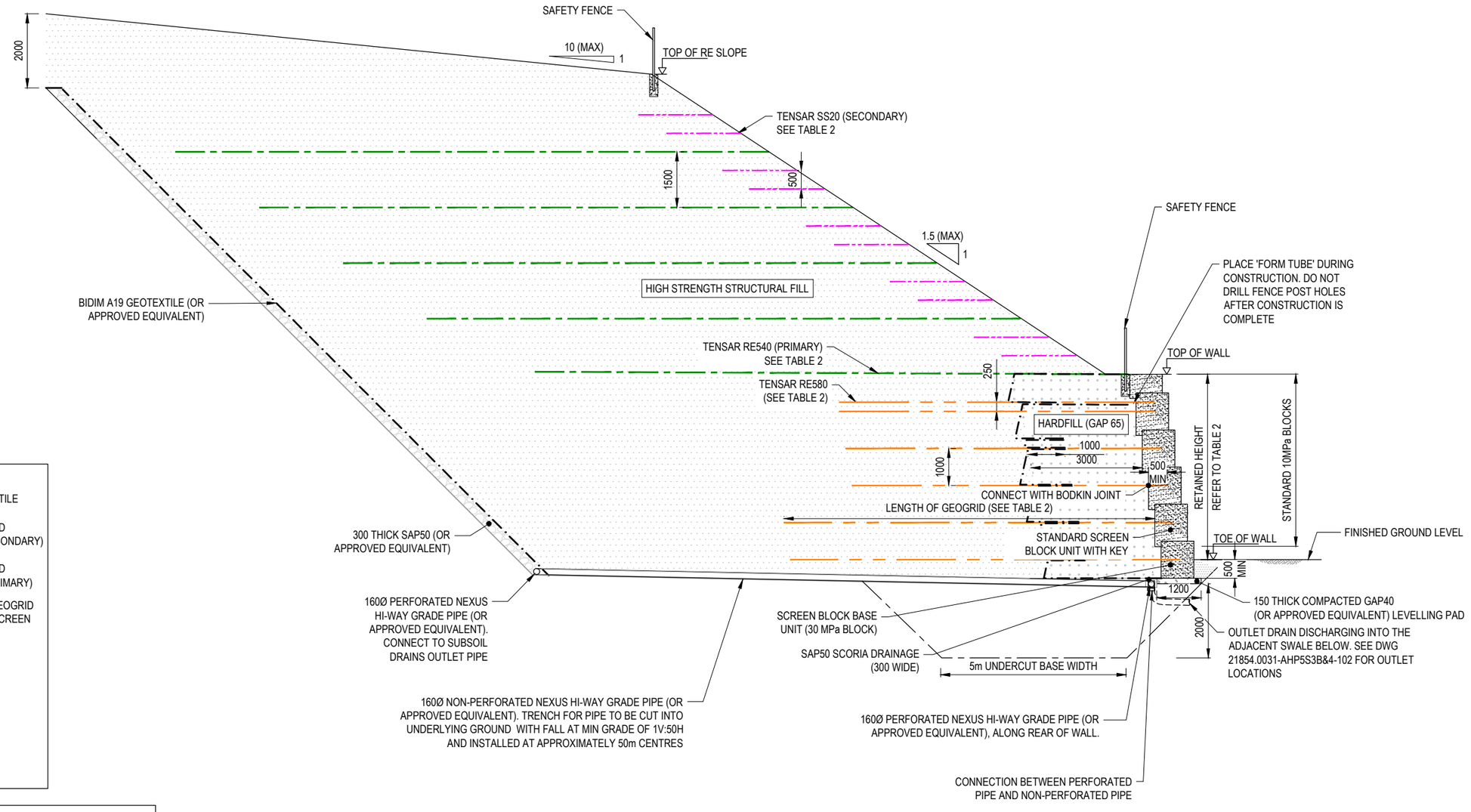
THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AS APPROVED

CLIENT **WFH PROPERTIES LTD**
PROJECT **MILLWATER - ARRANS HILL**
TITLE PRECINCT 5 STAGE 3B & 4
RETAINING WALLS 06 - TYPICAL SECTION (H≤3m)
SCALE (A3) 1:500 DWG No. 21854.0031-AHP5S3B&4-111 REV 1

L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 3B & 4\21854.0031-AHP5S3B&4-112.dwg 2019-Sep-02 1:12:29 PM Plotted By: JONALD CASTRO

TABLE 2: RETAINING WALL 06 (3m<H≤4.7m) DETAIL TABLE

GEOGRID REQUIREMENTS						
WALL TYPE	TOTAL SLOPE/ RETAINED HEIGHT (m)	MAX BACKSLOPE	MAX FORWARD SLOPE	GEOGRID TYPE	GEOGRID LENGTH (m)	VERTICAL LOCATION ABOVE TOE OF WALI (m)
SCREEN BLOCK	H ≤ 4.7	1V:1.5H	0°	TENSAR RE580	10.0	-0.5, 0.5, 1.5, 2.5
					8.0	3.25, 3.75, 4.5
RE SLOPE						MAX VERTICAL SPACING (m)
	8 < H ≤ 9	1V:10H	N/A	TENSAR RE540 (PRIMARY)	16.0	1.5
				TENSAR SS20 (SECONDARY)	2.0	0.5



LEGEND

- BIDIM A19 GEOTEXTILE
- RE SLOPE GEOGRID TENSAR SS20 (SECONDARY)
- RE SLOPE GEOGRID TENSAR RE540 (PRIMARY)
- TENSAR RE580 - GEOGRID AT THE BACK OF SCREEN BLOCK WALL
- HARDFILL (GAP40)
- HIGH STRENGTH STRUCTURAL FILL
- SAP50 SCORIA
- HARDFILL (GAP65)

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 DWG.21854.0031-AHP5S3B&4-110 FOR WALL 06 PLAN AND LONGSECTION.

A3 SCALE 1:125

0 1 2 3 4 5 6 7 (m)

SECTION 7/110 SCREEN BLOCK WALL TYPICAL SECTION (3m<H≤4.7m)
SCALE 1: 125 RETAINING WALL 06

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

REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE	JC				

DESIGNED	JXXL	Aug.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Aug.19	
DESIGN CHECKED			
DRAWING CHECKED			

NOT FOR CONSTRUCTION

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

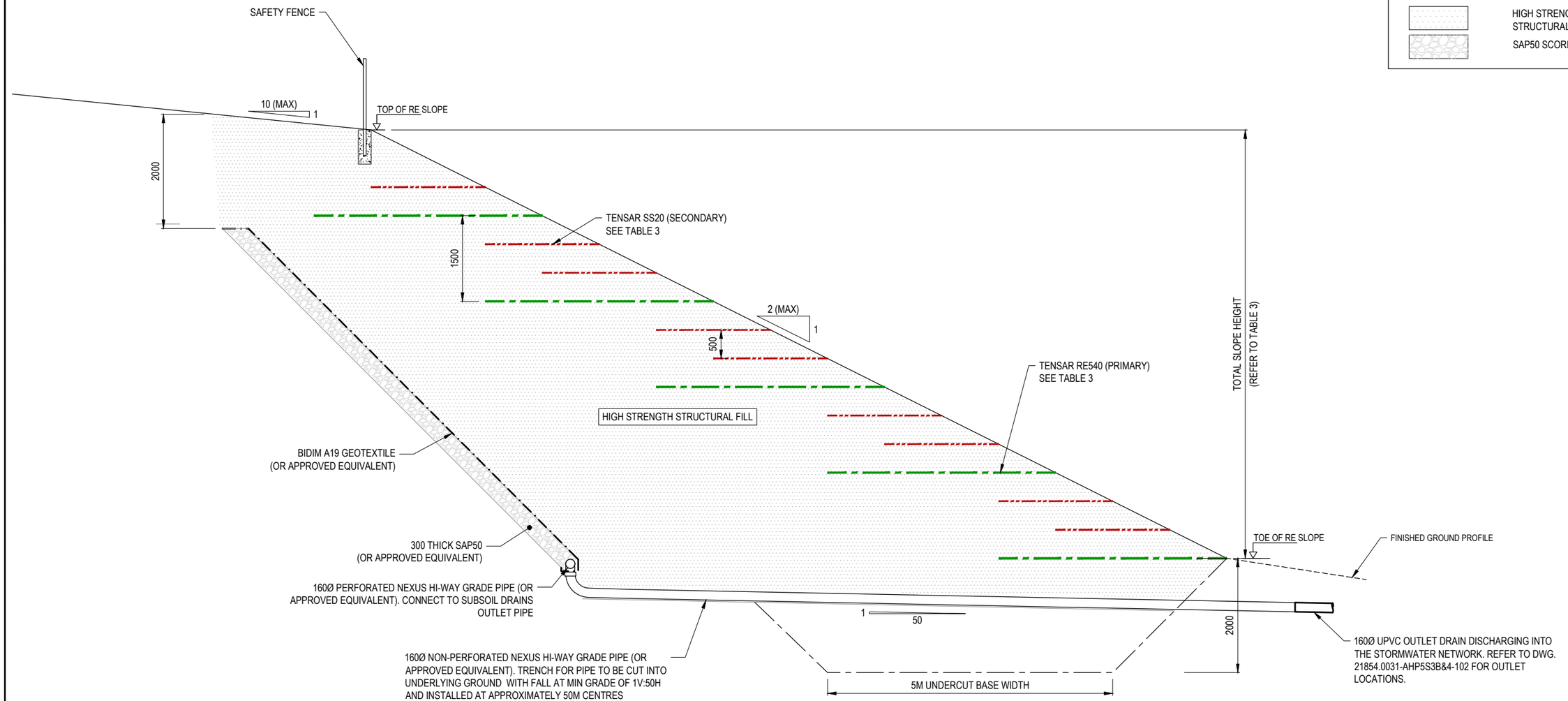
CLIENT **WFH PROPERTIES LTD**
PROJECT **MILLWATER - ARRANS HILL**
TITLE PRECINCT 5 STAGE 3B & 4
RETAINING WALL 06 - TYPICAL SECTION (3m<H≤ 4.7m)
SCALE (A3) 1:500 DWG No. 21854.0031-AHP5S3B&4-112 REV 1

L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 3B & 4\21854.0031-AHP5S3B&4-113_115.dwg 2019-Sep-02 1:12:34 PM Plotted By: JONALD CASTRO

NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. WALL SETOUT AS PROVIDED BY WOODS AND CONFIRMED ON SITE BY THE ENGINEER.
3. SEE DWG.21854.0031-AHP5S3B&4-101 FOR RE SLOPE 7 PLAN.

TABLE 8: REINFORCEMENT DETAIL FOR RE SLOPE 5

WALL TYPE	MAXIMUM TOTAL SLOPE HEIGHT (m)	MAX SLOPE	MAX FORWARD SLOPE	MAX BACK SLOPE	GEOGRID REQUIREMENTS		
					GEOGRID TYPE	GEOGRID LENGTH (m)	MAX VERTICAL SPACING (m)
RE SLOPE 5	H ≤ 8	1V:2H	1V:10H	1V:10H	TENSAR RE540	4.0	1.5
					TENSAR SS20	2.0	0.5



SECTION 8/101 RE SLOPE 5
SCALE 1: 75

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

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

REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE	JC				

DESIGNED	JXXL	Aug.19	DRAWING STATUS
DRAWN	JC	Aug.19	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 **MILLWATER - ARRANS HILL**
TITLE PRECINCT 5 STAGE 3B & 4
RE SLOPE 5 - TYPICAL SECTION
SCALE (A3) 1:75 DWG No. 21854.0031-AHP5S3B&4-113 REV 1

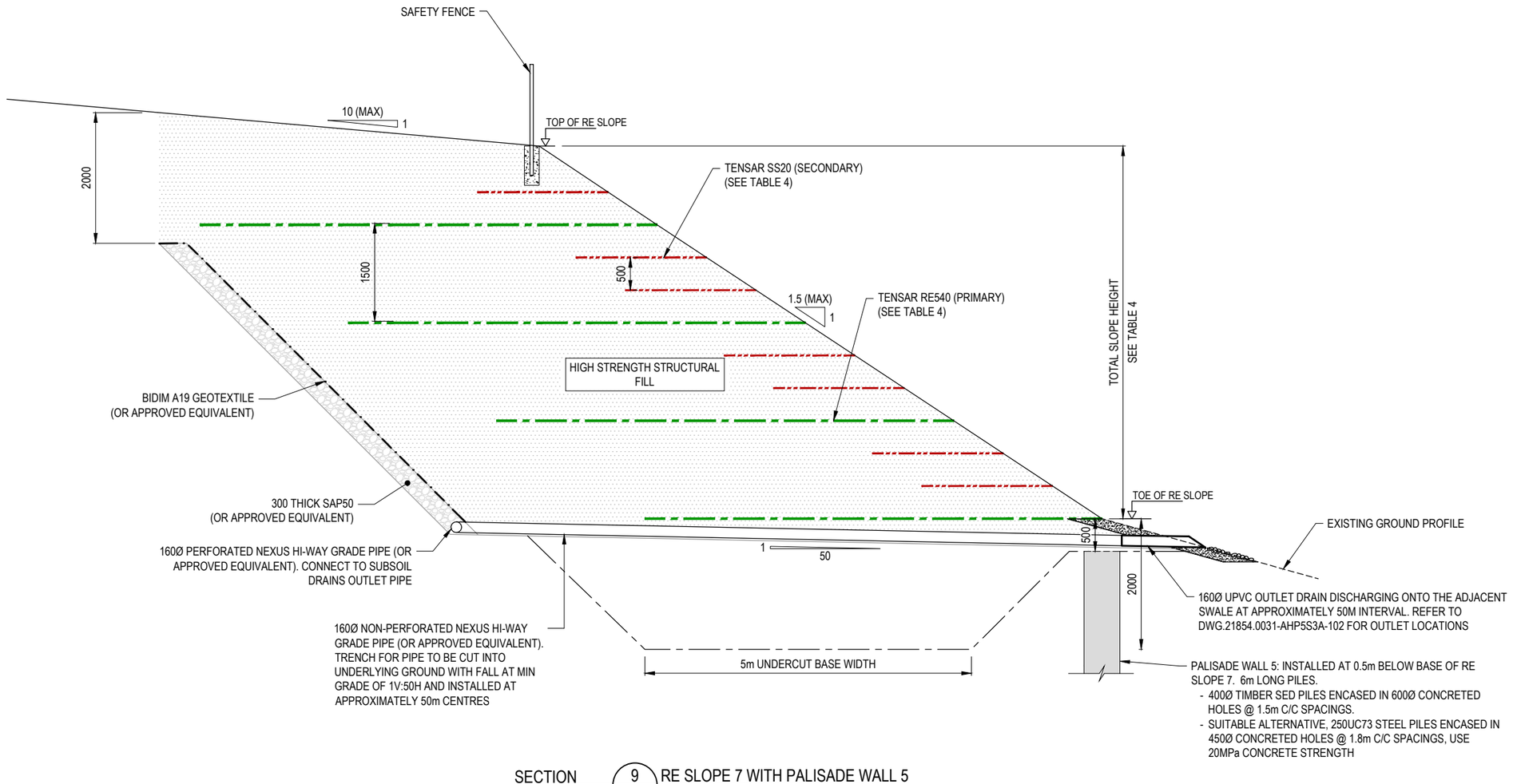
L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 3B & 4\21854.0031-AHP5S3B&4-113_115.dwg 2019-Sep-02 1:12:35 PM Plotted By: JONALD CASTRO

NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. WALL SETOUT AS PROVIDED BY WOODS AND CONFIRMED ON SITE BY THE ENGINEER.
3. SEE DWG.21854.0031-AHP5S3B&4-101 FOR RE SLOPE 7 PLAN.

TABLE 4: REINFORCEMENT DETAIL FOR RE SLOPE 7

WALL TYPE	MAXIMUM TOTAL SLOPE HEIGHT (m)	MAX SLOPE	MAX BACK SLOPE	GEOGRID REQUIREMENTS		
				GEOGRID TYPE	GEOGRID LENGTH (m)	MAX VERTICAL SPACING (m)
RE SLOPE 7	H ≤ 5	1V:1.5H	1V:10H	TENSAR RE540	4.0	1.5
				TENSAR SS20	2.0	0.5
	5 < H ≤ 7	1V:1.5H	1V:10H	TENSAR RE540	7.0	1.5
				TENSAR SS20	2.0	0.5
	7 < H ≤ 9	1V:1.5H	1V:10H	TENSAR RE540	11.0	1.5
				TENSAR SS20	2.0	0.5
	9 < H ≤ 11	1V:1.5H	1V:10H	TENSAR RE540	14.0	1.5
				TENSAR SS20	2.0	0.5

LEGEND
- BIDIM A19 GEOTEXTILE
- TENSAR SS20 (SECONDARY)
- TENSAR RE540 (PRIMARY)
- HIGH STRENGTH STRUCTURAL FILL
- SAP50 SCORIA



SECTION 9/101 RE SLOPE 7 WITH PALISADE WALL 5
SCALE 1:75

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

ORIGINAL IN COLOUR

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

REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE	JC				

DESIGNED	JXXL	Aug.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Aug.19	
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 MILLWATER - ARRANS HILL
TITLE PRECINCT 5 STAGE 3B & 4
RE SLOPE 7 - TYPICAL SECTION (SHEET 1)
SCALE (A3) 1:75 DWG No. 21854.0031-AHP5S3B&4-114 REV 1

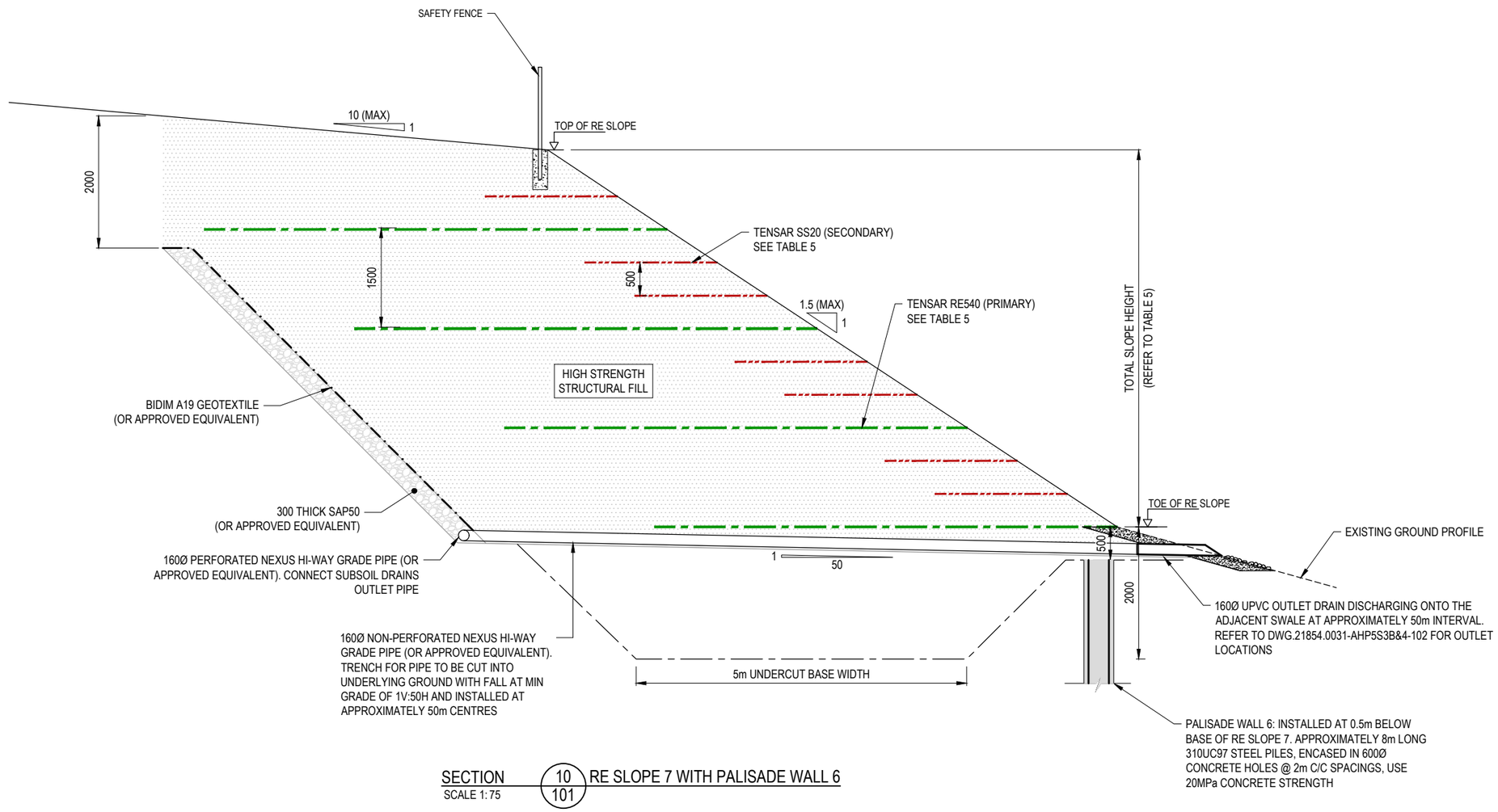
L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 3B & 4\21854.0031-AHP5S3B&4-113_115.dwg 2019-Sep-02 1:12:36 PM Plotted By: JONALD CASTRO

NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. WALL SETOUT AS PROVIDED BY WOODS AND CONFIRMED ON SITE BY THE ENGINEER.
3. SEE DWG.21854.0031-AHP5S3B&4-101 FOR RE SLOPE 7 PLAN.

TABLE 5: REINFORCEMENT DETAIL FOR RE SLOPE 7

WALL TYPE	MAXIMUM TOTAL SLOPE HEIGHT (m)	MAX SLOPE	MAX BACK SLOPE	GEOGRID REQUIREMENTS		
				GEOGRID TYPE	GEOGRID LENGTH (m)	MAX VERTICAL SPACING (m)
RE SLOPES 7	H ≤ 5	1V:1.5H	1V:10H	TENSAR RE540	4.0	1.5
				TENSAR SS20	2.0	0.5
	5 < H ≤ 7	1V:1.5H	1V:10H	TENSAR RE540	7.0	1.5
				TENSAR SS20	2.0	0.5
	7 < H ≤ 9	1V:1.5H	1V:10H	TENSAR RE540	11.0	1.5
				TENSAR SS20	2.0	0.5
	9 < H ≤ 11	1V:1.5H	1V:10H	TENSAR RE540	14.0	1.5
				TENSAR SS20	2.0	0.5

LEGEND
- BIDIM A19 GEOTEXTILE
- TENSAR SS20 (SECONDARY)
- TENSAR RE540 (PRIMARY)
- HIGH STRENGTH STRUCTURAL FILL
- SAP50 SCORIA



SECTION 10 101 RE SLOPE 7 WITH PALISADE WALL 6
SCALE 1:75

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

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

REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE	JC				

DESIGNED	JXXL	Aug.19	DRAWING STATUS
DRAWN	JC	Aug.19	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 **MILLWATER - ARRANS HILL**
TITLE PRECINCT 5 STAGE 3B & 4
RE SLOPE 7 - TYPICAL SECTION (SHEET2)
SCALE (A3) 1:75 DWG No. 21854.0031-AHP5S3B&4-115 REV 1

L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 3B & 4\21854.0031-AHP5S3B&4-120.dwg 2019-Sep-02 1:12:40 PM Plotted By: JONALD CASTRO

LEGEND

- STAGE 3B & 4 BOUNDARY
- 227 — LOT BOUNDARIES
- 35.0 — FINISHED GROUND PROFILE (1m INTERVAL)
- RETAINING WALL
- PROPOSED 400 SED OR 250UC73 PILES
- 310UC97 PILES
- BUILDING LIMITATION ZONE

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT COORDINATES. ORIGIN: LAT 36 52 47S 174 45 51E 800,000MN 400,000ME
   LEVEL DATUM: LINZ (MSL) AUCKLAND VERTICAL DATUM 1946
3. LOT BOUNDARY SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_BOUNDARY.dwg", DATED 30/08/2019.
4. ASBUILT CONTOUR SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_FINALSURFACE.dwg", DATED 30/08/2019.

PALISADE WALL 5
RE SLOPE 7
WALL 6
PALISADE WALL 6
PALISADE WALL 7
GRAND DRIVE
GODFREY DRIVE
ORO LANE
HUA LANE
GROVER STREET
DAVEY CRESCENT
RE SLOPE 5

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	JC				

DESIGNED	JXXL	Aug.19	DRAWING STATUS	COMPLETION REPORT
DRAWN	JC	Aug.19		
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 **MILLWATER - ARRANS HILL**
TITLE PRECINCT 5 STAGE 3B & 4
BUILDING LIMITATION PLAN
SCALE (A3) 1:1000 DWG No. 21854.0031-AHP5S3B&4-120 REV 1

WFH PROPERTIES LTD
MILLWATER - ARRANS HILL
PRECINCT 5 - DETAILED DESIGN
Construction Issue

AUCKLAND COUNCIL
25 JUL 2018
APPROVED
BUILDING CONSENT PLANS

DRAWING	Rev	Title
GENERAL		
• 21854.0031-P5-100	A	Drawing List and Location Plan
• 21854.0031-P5-101	A	Geotechnical Works Plan - Retaining Walls and RE Slopes
• 21854.0031-P5-102	A	Geotechnical Works Plan - Subsoil Drainage
• 21854.0031-P5-103	A	Geotechnical Works Plan - Shear Keys, Undercuts & Piles
• 21854.0031-P5-110	A	Retaining Wall 03 - Plan, Elevation and Typical Section
• 21854.0031-P5-111	A	Retaining Wall 04A & 04B - Plan
• 21854.0031-P5-112	A	Retaining Wall 04A - Elevation (Sheet 1 of 2)
• 21854.0031-P5-113	A	Retaining Wall 04A - Elevation (Sheet 2 of 2)
• 21854.0031-P5-114	A	Retaining Wall 04B - Elevation
• 21854.0031-P5-115	A	Retaining Walls 04A and 04B - Typical Section (Hμ 3m)
• 21854.0031-P5-116	A	Retaining Walls 04A and 04B - Typical Section (3m<Hμ 5m)
• 21854.0031-P5-117	A	Retaining Wall 04A - Typical Section with Palisade Wall 1 (3m<Hμ 5m)
• 21854.0031-P5-118	A	Retaining Wall 04B - Typical Section with Palisade Wall 3 (3m<Hμ 5m)
• 21854.0031-P5-119	A	Retaining Wall 04A - Typical Section with Palisade wall 2 (3m<Hμ 5m)
• 21854.0031-P5-120	A	Retaining Wall 04B - Typical Section (5m<H<7m)
• 21854.0031-P5-121	A	Retaining Wall 04A - Typical Section with Palisade Wall 1 (5m<Hμ 7m)
• 21854.0031-P5-122	A	Retaining Wall 04B - Typical Section with Palisade Wall 3 (5m<Hμ 7m)
• 21854.0031-P5-123	A	Retaining Wall 05 - Plan and Elevation
• 21854.0031-P5-124	A	Retaining Wall 06 - Plan and Elevation
• 21854.0031-P5-125	A	Retaining Walls 05 and 06 - Typical Section (Hμ 3m)
• 21854.0031-P5-126	A	Retaining Walls 05 and 06 - Typical Section (3m<Hμ 4.2m)
• 21854.0031-P5-127	A	Retaining Wall 07 - Plan and Elevation
• 21854.0031-P5-128	A	Retaining Wall 07 - Typical Section
• 21854.0031-P5-131	A	RE Slopes 2 and 3 - Typical Section
• 21854.0031-P5-132	A	RE Slopes 4, 5 and 6 - Typical Section
• 21854.0031-P5-133	A	RE Slopes 7 and 8 - Typical Section (Sheet 1 of 4)
• 21854.0031-P5-134	A	RE Slopes 7 and 8 - Typical Section (Sheet 2 of 4)
• 21854.0031-P5-135	A	RE Slopes 7 and 8 - Typical Section (Sheet 3 of 4)
• 21854.0031-P5-136	A	RE Slopes 7 and 8 - Typical Section (Sheet 4 of 4)
• 21854.0031-P5-137	A	RE Slope 9 - Typical Section
• 21854.0031-P5-138	A	RE Slopes Return - Plan
• 21854.0031-P5-139	A	RE Slopes 2 - 8 Return Typical Details
• 21854.0031-P5-140	A	Palisade Wall 4 Plan and Typical Details
• 21854.0031-P5-142	A	Retaining Wall Typical Geogrid Overlap Details
• 21854.0031-P5-143	A	Outlet Drain Detail
• 21854.0031-P5-144	A	Safety Fence Detail

LOCATION PLAN
SCALE 1: 10,000

SCALE 1: 10,000
0 100 200 300 400 500 (m)
ORIGINAL IN COLOUR

Auckland Council
10270225

• Denotes drawing this issue: 4/05/2018

DRAWING STATUS: CONSTRUCTION ISSUE

REVISION	DESCRIPTION	BY	DATE
A	Construction Issue		

DESIGNED :	JXXL	May. 18
DRAWN :	JC	May. 18
DESIGN CHECKED :		5/18
DRAFTING CHECKED :		5/18
CADFILE : \\2 1854.0031–P5– 100.dwg		
APPROVED :		8/5/18

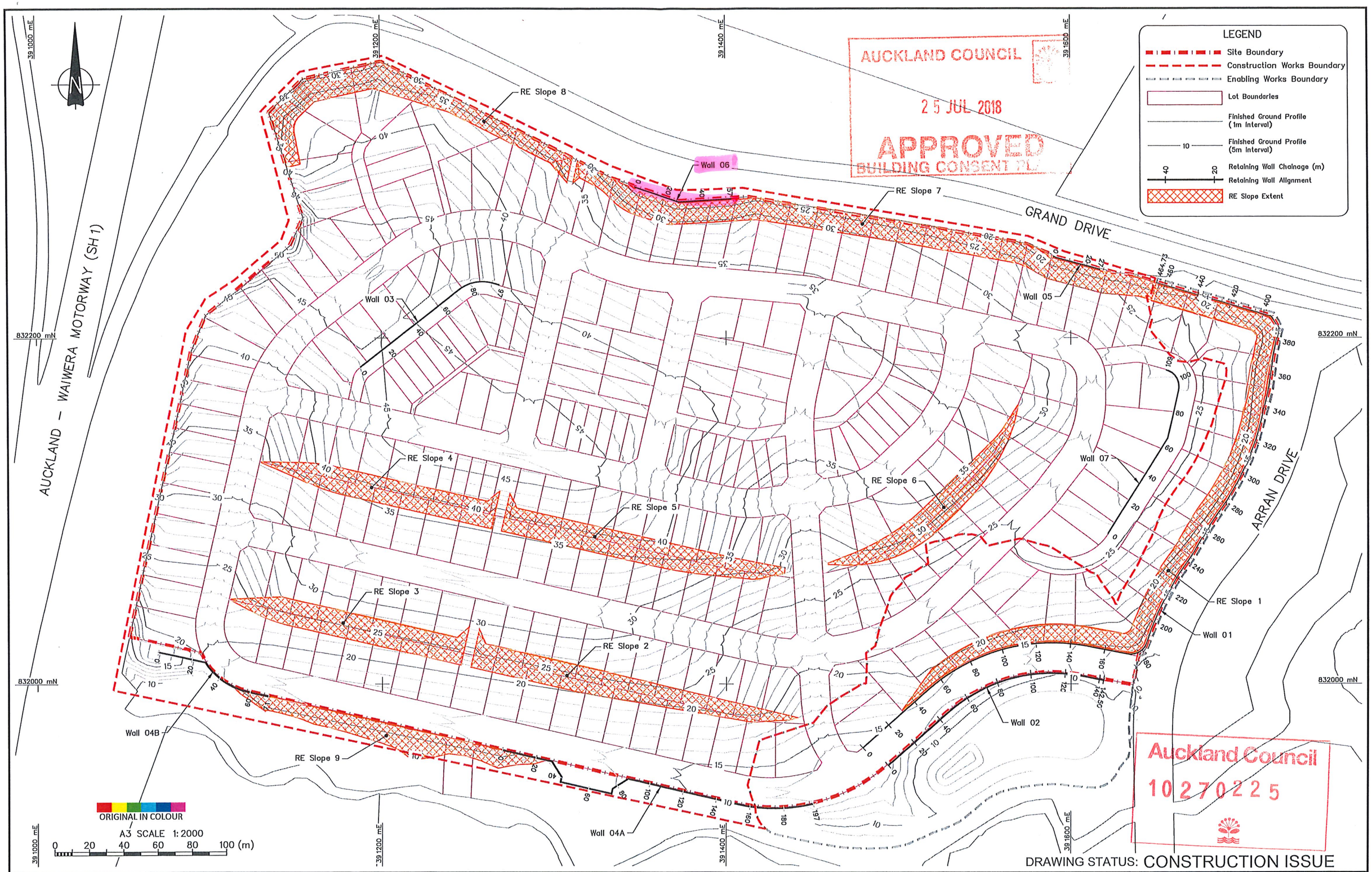
This drawing is not to be used for construction purposes unless signed as approved

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
TITLE: PRECINCT 5 – DETAILED DESIGN
Drawing List and Location Plan
SCALES (AT A3 SIZE): 1: 10,000
DWG. No.: 2 1854.0031–P5– 100
REV.: A



				DESIGNED :	JXXL	May. 18
				DRAWN :	JC	May. 18
				DESIGN CHECKED :		5/18
				DRAFTING CHECKED :		5/18
				CADFILE : \\ 21854.0031–P5–101.dwg		
				APPROVED		8/5/18
A	Construction Issue			This drawing is not to be used for construction purposes unless signed as approved		
REVISION	DESCRIPTION	BY	DATE	COPYRIGHT ON THIS DRAWING IS RESERVED		

NOTES :
1. All dimensions are in millimetres unless noted otherwise.
2. Lot boundary supplied by WOODS, reference "Precinct 5–Latest surface_17.02.16.dwg", dated Feb 2016.
3. Design contour supplied by WOODS, reference "Precinct 5 – Revised tin.dwg", dated 11/5/2017.
4. Coordinate Datum: NZGD2000, Mt Eden Circuit Coordinates.
   Origin: Lat 36 52 47S 174 45 51E 800,000mN 400,000mE
   Level Datum: LINZ (MSL) Auckland Vertical Datum 1946
5. All setout to be completed by Contractor in accordance with WOODS drawings.

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

TITLE
PRECINCT 5 – DETAILED DESIGN
Geotechnical Works Plan – Retaining Walls and RE Slopes

SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 2000	21854.0031–P5–101	A

I:\21854\21854.0031 - oreva west precinct 5\workingmaterial\CAD\DWG\detail design\21854.0031-P5-101.dwg, 101, 4/05/2018 1:47:24 PM, jc

LEGEND

- Site Boundary
- Construction Works Boundary
- Enabling Works Boundary
- Lot Boundaries
- Finished Ground Profile (1m Interval)
- 10 — Finished Ground Profile (5m Interval)
- 40 — 20 — Retaining Wall Chainage (m)
- Retaining Wall Alignment
- RE Slope Extent
- RE Slope Subsoil drain (Perforated)
- RE Slope Subsoil drain (Non-Perforated)
- RE Slope Subsoil drain connection point
- Retaining wall Subsoil drain (Perforated)
- Retaining wall Subsoil drain (Non-Perforated)
- Retaining wall Subsoil drain connection point
- Underfill Subsoil drain

AUCKLAND COUNCIL
25 JUL 2018
APPROVED
BUILDING CONSENT PLANS

AUCKLAND – WAIWERA MOTORWAY (SH 1)

GRAND DRIVE

ARRAN DRIVE

RE Slope 1
RE Slope 2
RE Slope 3
RE Slope 4
RE Slope 5
RE Slope 6
RE Slope 7
RE Slope 8
RE Slope 9

Wall 01
Wall 02
Wall 03
Wall 04A
Wall 04B
Wall 05
Wall 06
Wall 07

39 1200 mE
39 1400 mE
39 1600 mE
832000 mN
832200 mN

ORIGINAL IN COLOUR

A3 SCALE 1:2000

0 20 40 60 80 100 (m)

Auckland Council
10270225

DRAWING STATUS: CONSTRUCTION ISSUE

REVISION	DESCRIPTION	BY	DATE
A	Construction Issue		

DESIGNED :	JXXL	May. 18
DRAWN :	JC	May. 18
DESIGN CHECKED :		5/18
DRAFTING CHECKED :		5/18
CADFILE : \\21854.0031-P5-102.dwg		
APPROVED :		8/5/18

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

NOTES :
1. All dimensions are in millimetres unless noted otherwise.
2. Lot boundary supplied by WOODS, reference "Precinct 5-Latest surface_17.02.16.dwg", dated Feb 2016.
3. Design contour supplied by WOODS, reference "Precinct 5 – Revised tin.dwg", dated 11/5/2017.
4. Coordinate Datum: NZGD2000, Mt Eden Circuit Coordinates.
   Origin: Lat 36 52 47S 174 45 51E 800,000mN 400,000mE
   Level Datum: LINZ (MSL) Auckland Vertical Datum 1946
5. All setout to be completed by Contractor in accordance with WOODS drawings.
6. Retaining Walls and RE Slopes drainage are to be connected into the shear key drainage system or the stormwater system or discharged into the adjacent swale or stream.

REFERENCE :

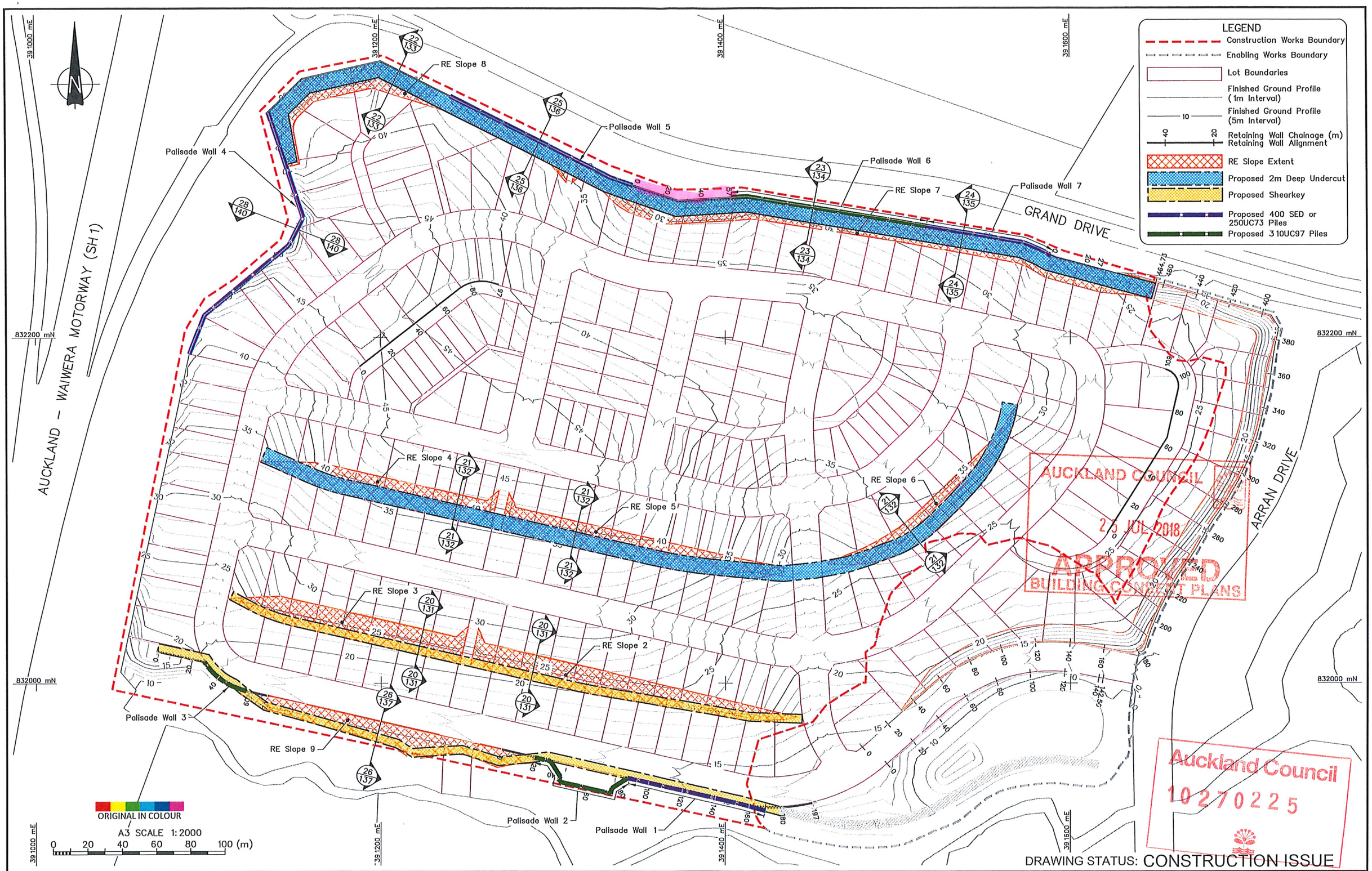
Tonkin+Taylor
105 Carlton Gore Road, Newmarket, Auckland
Tel. (09) 355 6000 Fax. (09) 307 0265
www.tonkintaylor.co.nz

CLIENT, PROJECT
WFH PROPERTIES LTD
MILLWATER – ARRANS HILL

TITLE
PRECINCT 5 – DETAILED DESIGN
Geotechnical Works Plan – Subsoil Drainage

SCALES (AT A3 SIZE)	DWG. No.	REV.
1:2000	21854.0031-P5-102	A

I:\21854\21854.0031 - orewa west precinct 5\workingmaterial\CAD\DWG\detail design\21854.0031-P5-102.dwg, 102, 4/05/2018 1:47:34 PM, jc



DRAWING STATUS: CONSTRUCTION ISSUE

REVISION	DESCRIPTION	BY	DATE
A	Construction Issue		

DESIGNED :	JXXL	May. 18
DRAWN :	JC	May. 18
DESIGN CHECKED :		4/7/18
DRAFTING CHECKED :		5/18
CADFILE :	21854.0031–P5–103.dwg	
APPROVED :		8.5.18

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

NOTES :

1. All dimensions are in millimetres unless noted otherwise.
2. Lot boundary supplied by WOODS, reference "Precinct 5–Latest surface_17.02.16.dwg", dated Feb 2016.
3. Design contour supplied by WOODS, reference "Precinct 5 – Revised tin.dwg", dated 11/5/2017.
4. Coordinate Datum: NZGD2000, Mt Eden Circuit Coordinates.
   Origin: Lat 36 52 47S 174 45 51E 800,000mN 400,000mE
   Level Datum: LINZ (MSL) Auckland Vertical Datum 1946
5. All setout to be completed by Contractor in accordance with WOODS drawings.

REFERENCE :

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

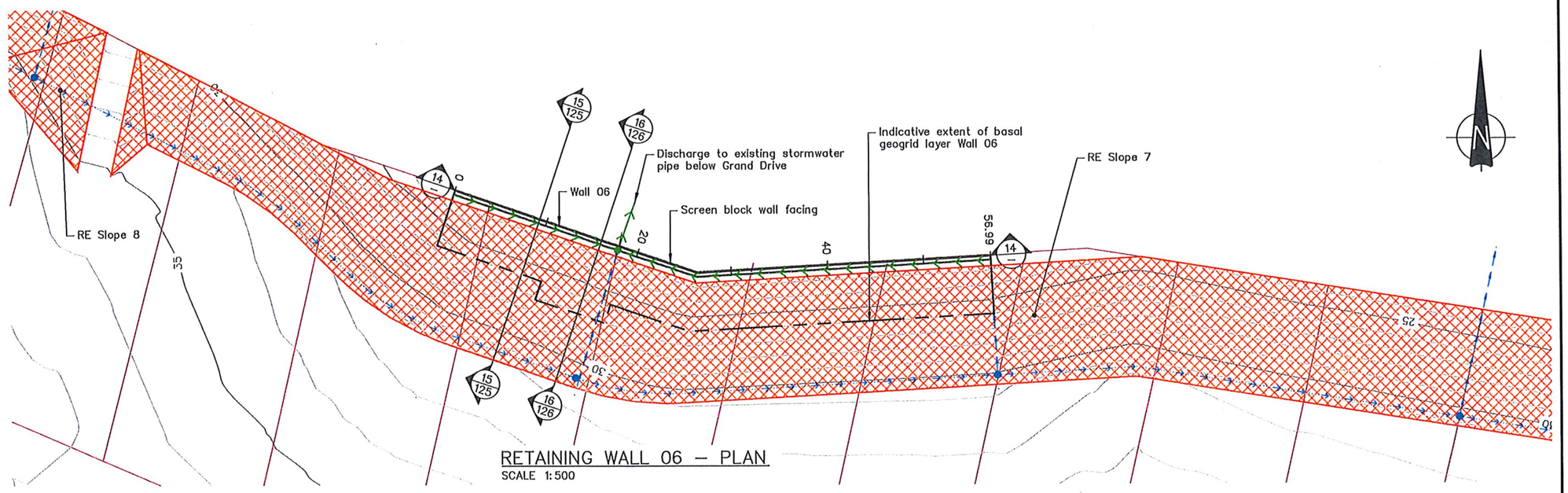
CLIENT, PROJECT
WFH PROPERTIES LTD
MILLWATER – ARRANS HILL

TITLE
PRECINCT 5 – DETAILED DESIGN
Geotechnical Works Plan – Shear Keys, Undercuts & Piles

SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 2000	21854.0031–P5–103	A

LEGEND

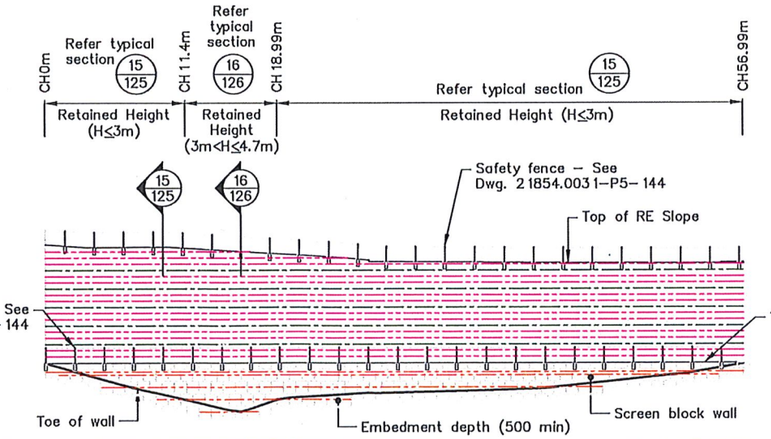
- Lot Layout
- Finished Ground Profile (1m Interval)
- Finished Ground Profile (5m Interval)
- Retaining Wall Chainage (m)
- Retaining Wall Alignment
- RE Slope Extent
- Geogrid Tensar RE580 at the back of Screen Block Wall
- RE Slope Geogrid Tensar RE540 (Primary)
- RE Slope Geogrid Tensar SS20 (Secondary)
- RE Slope Subsoil drain (Perforated)
- RE Slope Subsoil drain (Non-Perforated)
- RE Slope Subsoil drain connection point
- Proposed Subsoil drain (Perforated)
- Retaining wall Subsoil drain (Non-Perforated)
- Retaining Wall Subsoil drain connection point



RETAINING WALL 06 – PLAN
SCALE 1:500

NOTE:

1. All dimensions are in metres unless noted otherwise.
2. Lot boundary supplied by WOODS, reference "Precinct 5–Latest surface_17.02.16.dwg", dated Feb 2016.
3. Design contour supplied by WOODS, reference "Precinct 5 – Revised tin.dwg", dated 11/5/2017.
4. Coordinate Datum: NZGD2000, Mt Eden Circuit Coordinates.
   Level Datum: LINZ (MSL) Auckland Vertical Datum 1946
5. All setout to be completed by Contractor in accordance with WOODS drawings.
6. Wall 06 drainage to be discharging into the adjacent swale.
7. Refer to Design Report (Ref. 21854.0031/v1, Geotechnical Design Report – Retaining Walls 3–7 and RE slope 2–9, September 2017) for anticipated construction sequencing and staging of works.



DATUM RL 16.00

TOP OF WALL (m)	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70
TOE OF WALL (m)	22.67	21.24	20.03	19.70	18.86	19.70	19.84	20.17	20.30	20.43	20.59	21.07	21.58	22.27	22.61
HEIGHT OF WALL (m)	0.03	1.46	2.67	3.00	3.84	3.00	2.86	2.53	2.40	2.27	2.11	1.63	1.12	0.43	0.09
CHAINAGE (m)	0.00	5.00	10.00	11.40	15.00	18.99	20.00	25.00	30.00	35.00	40.00	45.00	50.00	55.00	56.99

SECTION 14/– RETAINING WALL 06 – ELEVATION
SCALE 1:500

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

AUCKLAND COUNCIL
25 JUL 2018
APPROVED
BUILDING CONSENT PLANS

Auckland Council
10270225

DRAWING STATUS: CONSTRUCTION ISSUE

REV	REVISION DESCRIPTION	BY	DATE
A	Construction Issue		

DESIGNED :	JXXL	May. 18
DRAWN :	JC	May. 18
DESIGN CHECKED :		5/18
DRAFTING CHECKED :		5/18
CADFILE : \\21854.0031–P5–124.dwg		
APPROVED :		8/5/18

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

TITLE
PRECINCT 5 – DETAILED DESIGN
Retaining Wall 06 – Plan and Elevation

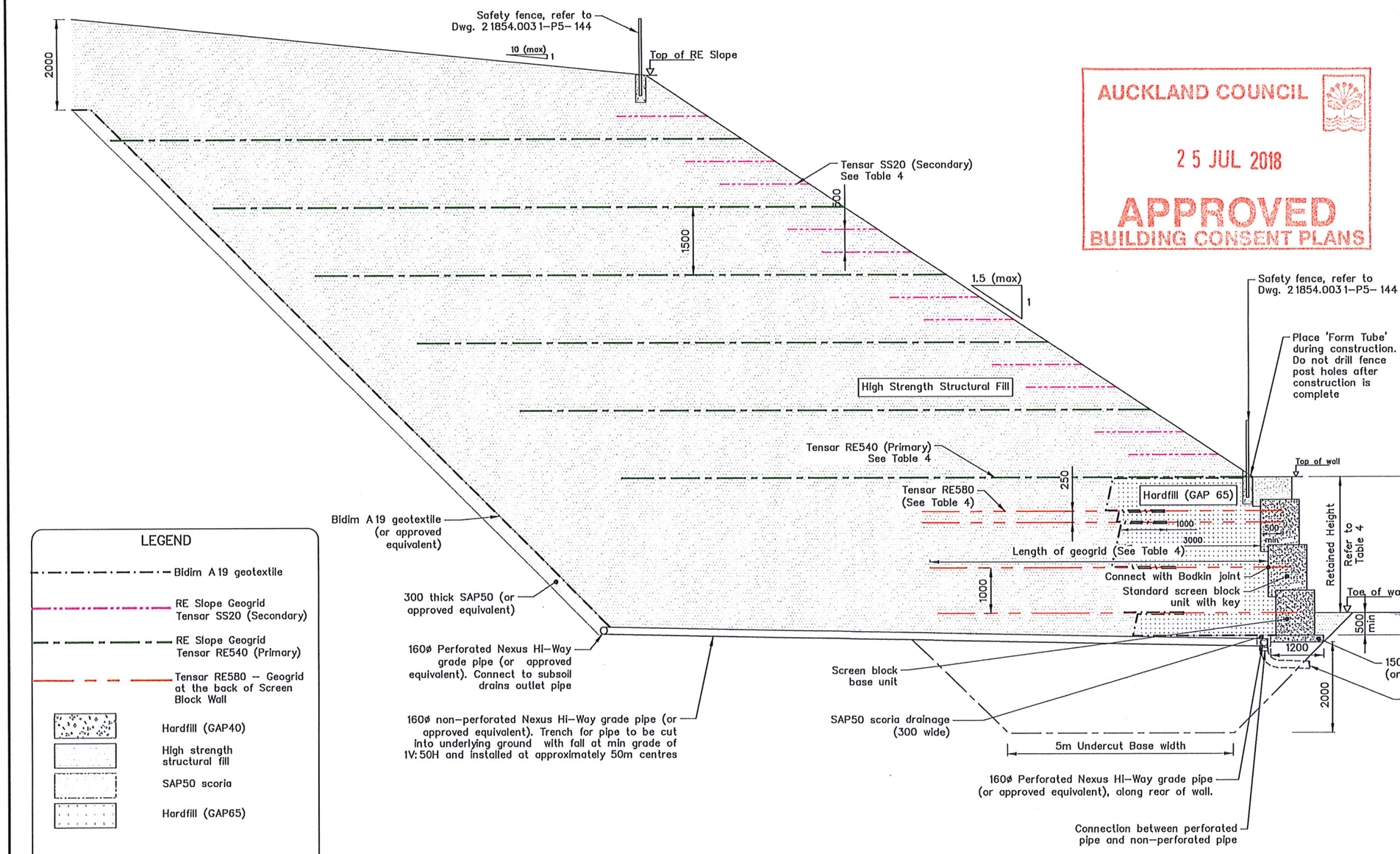
SCALES (AT A3 SIZE) 1:500
DWG. No. 21854.0031–P5–124
REV. A

I:\21854\21854.0031 - orewa west precinct 5\workingmaterial\CAD\DWG\detail design\21854.0031-P5-124.dwg, 124, 4/05/2018 1:48:29 PM, JC

TABLE 4: RETAINING WALLS 05 AND 06 (H≤3m) DETAIL TABLE

Geogrid Requirements						
Wall Type	Total Slope/ Retained Height (m)	Max Backslope	Max Forward Slope	Geogrid Type	Geogrid Length (m)	Vertical Location above toe of wall (m)
Screen Block	H ≤ 3	1V: 1.5H	0°	Tensar RE580	8.0	0.0, 1.0, 2.0, 2.25
RE Slope						Max Vertical Spacing (m)
	8 < H ≤ 9	1V: 10H	N/A	Tensar RE540 (Primary)	14.0	1.5
				Tensar SS20 (Secondary)	2.0	0.5

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 Dwg.2 1854.003 1–P5– 123 for Wall 05 plan and longsection. See Dwg.2 1854.003 1–P5– 124 for Wall 06 plan and longsection.
4. Foundation to be inspected by Geotechnical engineer prior to placement of levelling pad.
5. Excavated subgrade to be inspected by Geotechnical engineer and tested to confirm minimum Su> 120KPa, or otherwise approved.
6. All fill shall be placed and compacted according to fill specification.
7. The Contractor shall ensure that temporary excavated faces are stable.
8. Excavation in front of the wall to be reinstated with High Strength Structural Fill, tested in accordance with the earthworks 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 1.0m of the back face of the Screen Block. The plant used for compacting this zone shall be restricted to:
    a) Vibrating rollers having a total mass not exceeding 1000kg
    b) Vibrating plate compactors having a total mass not exceeding 100kg
    c) Vibro tampers having a mass not exceeding 75kg
12. Compaction testing of backfill around grids is required (refer to specification).
13. Geogrids shall be laid horizontally (perpendicular to wall) on compacted layers of fill. They shall be tensioned to remove all slack prior to back filling and anchored by either placing a small volume of fill on or staking the free end. They shall remain tensioned whilst the balance of fill is placed. No traffic or site plant shall be permitted to travel on the grids where cover is less than 100mm.
14. The Engineer shall inspect and approve installation of at least the first layer of geogrid and other layers as necessary.
15. Geogrid starters to be cast into Screen Block during manufacture and joined to geogrid using bodkin joints.
16. Screen Block units used to construct RW05 & RW06 are to be produced and supplied in accordance with manufacturer's specifications and recommendations.
17. Maximum 100mm overlap on adjoining grids.
18. Refer to Design Report (Ref. 2 1854.003 1/v1, Geotechnical Design Report – Retaining Walls 3–7 and RE slope 2–9, September 2017) for anticipated construction sequencing and staging of works.



LEGEND
- Bidim A19 geotextile
- RE Slope Geogrid Tensar SS20 (Secondary)
- RE Slope Geogrid Tensar RE540 (Primary)
- Tensar RE580 – Geogrid at the back of Screen Block Wall
- Hardfill (GAP40)
- High strength structural fill
- SAP50 scoria
- Hardfill (GAP65)

AUCKLAND COUNCIL
25 JUL 2018
APPROVED
BUILDING CONSENT PLANS

Auckland Council
10270225

SECTION 15 15 123 124 SCREEN BLOCK WALL TYPICAL SECTION (H<3m)
SCALE 1: 100 RETAINING WALLS 05 AND 06

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

DRAWING STATUS: CONSTRUCTION ISSUE

REVISION	DESCRIPTION	BY	DATE
A	Construction Issue		

DESIGNED :	JXXL	May. 18
DRAWN :	JG	May. 18
DESIGN CHECKED :	[illegible]	5/18
DRAFTING CHECKED :	[illegible]	5/18
CADFILE : \\2 1854.003 1–P5– 125.dwg		
APPROVED :	[illegible]	8/5/18

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

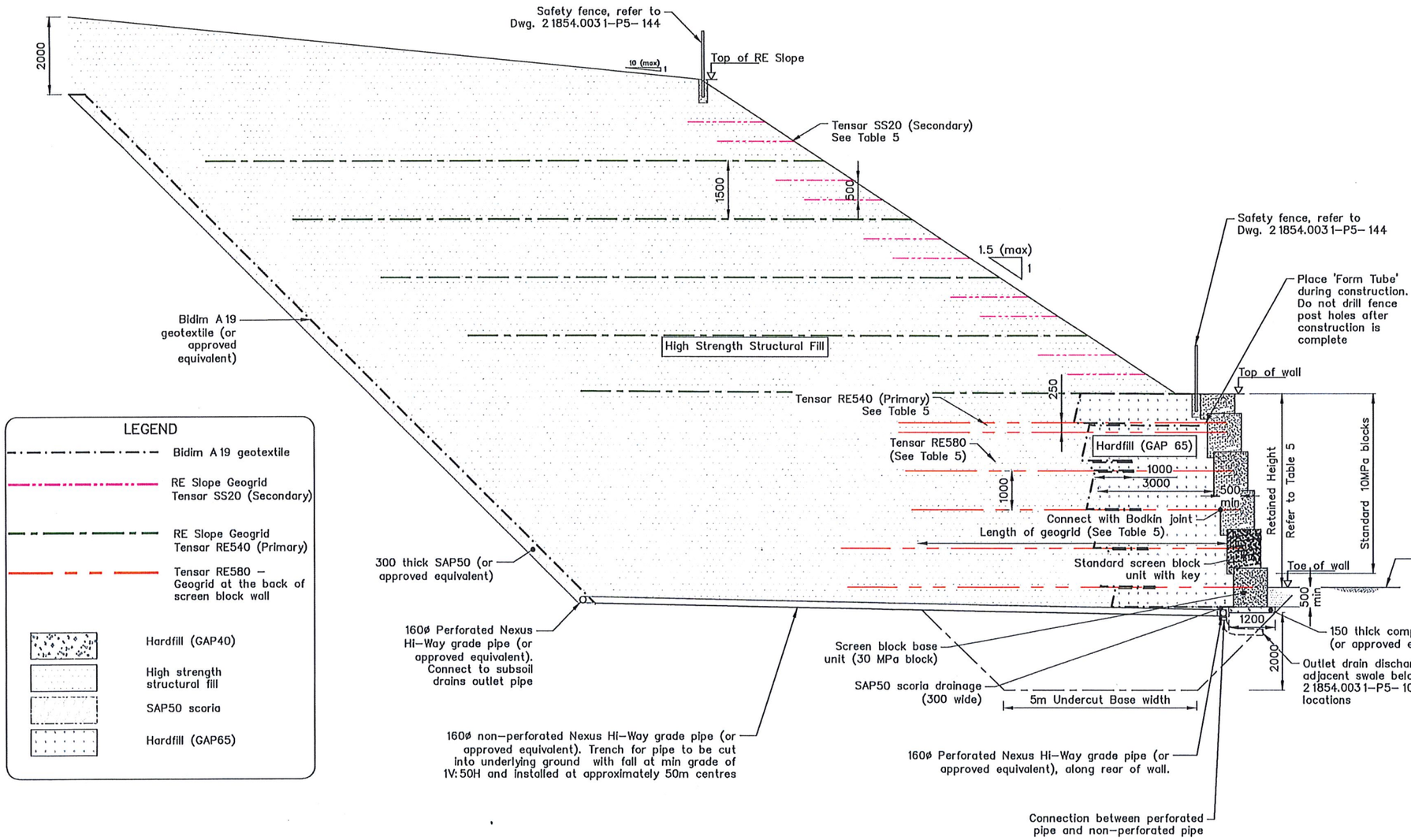
CLIENT, PROJECT
WFH PROPERTIES LTD
MILLWATER – ARRANS HILL

TITLE
PRECINCT 5 – DETAILED DESIGN
Retaining Walls 05 and 06 – Typical Section (H<3m)

SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 100	2 1854.003 1–P5– 125	A

TABLE 5: RETAINING WALLS 05 AND 06 (3m<H≤4.7m) DETAIL TABLE

Geogrid Requirements						
Wall Type	Total Slope/ Retained Height (m)	Max Backslope	Max Forward Slope	Geogrid Type	Geogrid Length (m)	Vertical Location above toe of wall (m)
Screen Block	H ≤ 4.7	1V: 1.5H	0°	Tensar RE580	10.0	−0.5, 0.5, 1.5, 2.5
					8.0	3.25, 3.75, 4.5
RE Slope						Max Vertical Spacing (m)
	8 < H ≤ 9	1V: 10H	N/A	Tensar RE540 (Primary)	16.0	1.5
				Tensar SS20 (Secondary)	2.0	0.5



LEGEND

- Bidim A 19 geotextile
- RE Slope Geogrid Tensar SS20 (Secondary)
- RE Slope Geogrid Tensar RE540 (Primary)
- Tensar RE580 – Geogrid at the back of screen block wall
- Hardfill (GAP40)
- High strength structural fill
- SAP50 scoria
- Hardfill (GAP65)

SECTION 16/123 16/124 SCREEN BLOCK WALL TYPICAL SECTION (3m<H≤4.7m)
SCALE 1: 125 RETAINING WALLS 05 AND 06

A3 SCALE 1: 125
0 1 2 3 4 5 6 7 (m)

NOTES
1. All dimensions are in millimetres unless noted otherwise.
2. All setout to be completed by Contractor in accordance with WOODS drawings.
3. See Dwg.2 1854.003 1–P5– 123 for Wall 05 plan and longsection. See Dwg.2 1854.003 1–P5– 124 for Wall 06 plan and longsection.
4. Foundation to be inspected 'by Geotechnical engineer prior to placement of levelling pad.
5. Excavated subgrade to be inspected by Geotechnical engineer and tested to confirm minimum Su> 120KPa, or otherwise approved.
6. All fill shall be placed and compacted according to fill specification.
7. The Contractor shall ensure that temporary excavated faces are stable.
8. Excavation in front of the wall to be reinstated with High Strength Structural Fill, tested in accordance with the earthworks 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 1.0m of the back face of the Screen Block. The plant used for compacting this zone shall be restricted to:
    a) Vibrating rollers having a total mass not exceeding 1000kg
    b) Vibrating plate compactors having a total mass not exceeding 100kg
    c) Vibro tampers having a mass not exceeding 75kg
12. Compaction testing of backfill around grids is required (refer to specification).
13. Geogrids shall be laid horizontally (perpendicular to wall) on compacted layers of fill. They shall be tensioned to remove all slack prior to back filling and anchored by either placing a small volume of fill on or staking the free end. They shall remain tensioned whilst the balance of fill is placed. No traffic or site plant shall be permitted to travel on the grids where cover is less than 100mm.
14. The Engineer shall inspect and approve installation of at least the first layer of geogrid and other layers as necessary.
15. Geogrid starters to be cast into Screen Block during manufacture and joined to geogrid using bodkin joints.
16. Screen Block units used to construct RW05 & RW06 are to be produced and supplied in accordance with manufacturer's specifications and recommendations.
17. Maximum 100mm overlap on adjoining grids.
18. Refer to Design Report (Ref. 2 1854.003 1/v1, Geotechnical Design Report – Retaining Walls 3–7 and RE slope 2–9, September 2017) for anticipated construction sequencing and staging of works.

AUCKLAND COUNCIL
25 JUL 2018
APPROVED
BUILDING CONSENT PLANS

Auckland Council
10270225

DRAWING STATUS: CONSTRUCTION ISSUE

REVISION	DESCRIPTION	BY	DATE
A	Construction Issue		

DESIGNED :	JXXL	May. 18
DRAWN :	JC	May. 18
DESIGN CHECKED :		5/18
DRAFTING CHECKED :		5/18
CADFILE : \\2 1854.003 1–P5– 126.dwg		
APPROVED :		5/5/18

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

NOTES :

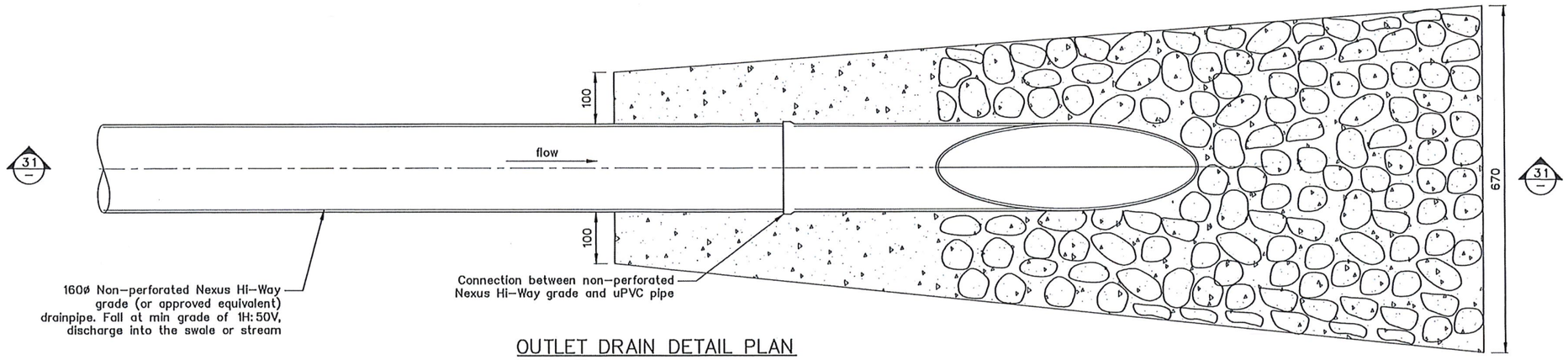
REFERENCE :

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

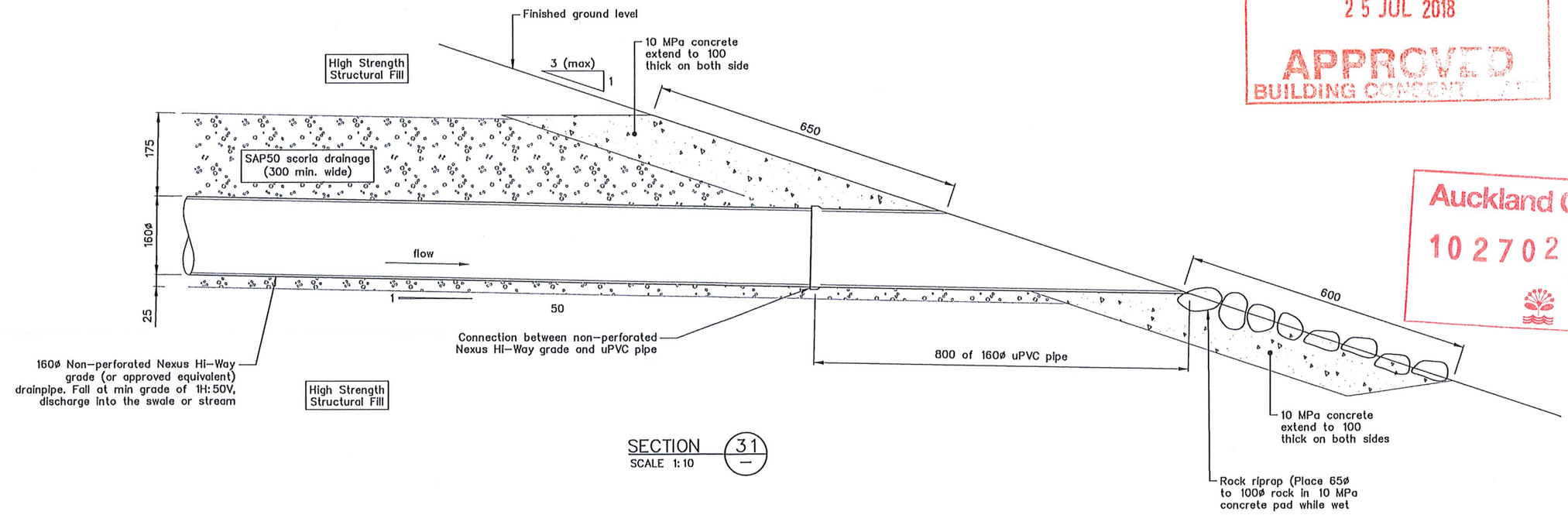
CLIENT, PROJECT
WFH PROPERTIES LTD
MILLWATER – ARRANS HILL

TITLE
PRECINCT 5 – DETAILED DESIGN
Retaining Walls 05 and 06 – Typical Section (3m<H<4.2m)

SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 125	2 1854.003 1–P5– 126	A



OUTLET DRAIN DETAIL PLAN
SCALE 1: 10



SECTION 31 —
SCALE 1: 10

A3 SCALE 1: 10
0 0.1 0.2 0.3 0.4 0.5 (m)

DRAWING STATUS: CONSTRUCTION ISSUE

REVISION DESCRIPTION	BY	DATE
A Construction Issue		

DESIGNED :	JXXL	May. 18
DRAWN :	JC	May. 18
DESIGN CHECKED :		5/18
DRAFTING CHECKED :		5/18
CADFILE : \\2 1854.0031–P5– 143.dwg		
APPROVED :		8/5/18

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

NOTES :
1. All dimensions are in millimetres unless noted otherwise.
2. Contractor to setout drains and retaining walls to ensure walls do not strike drains.
3. All setout to be completed by Contractor in accordance with Woods drawings.
4. Position of proposed drains approximate only. Actual position to be confirmed by Design Engineer onsite.

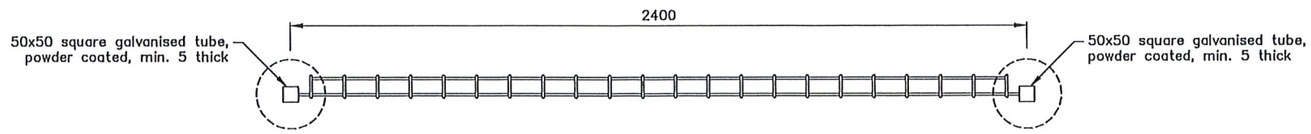
REFERENCE :

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

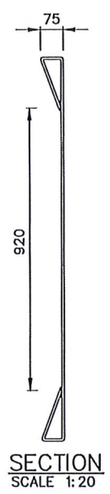
CLIENT, PROJECT
WFH PROPERTIES LTD
MILLWATER – ARRANS HILL

TITLE
PRECINCT 5 – DETAILED DESIGN
Outlet Drain Detail

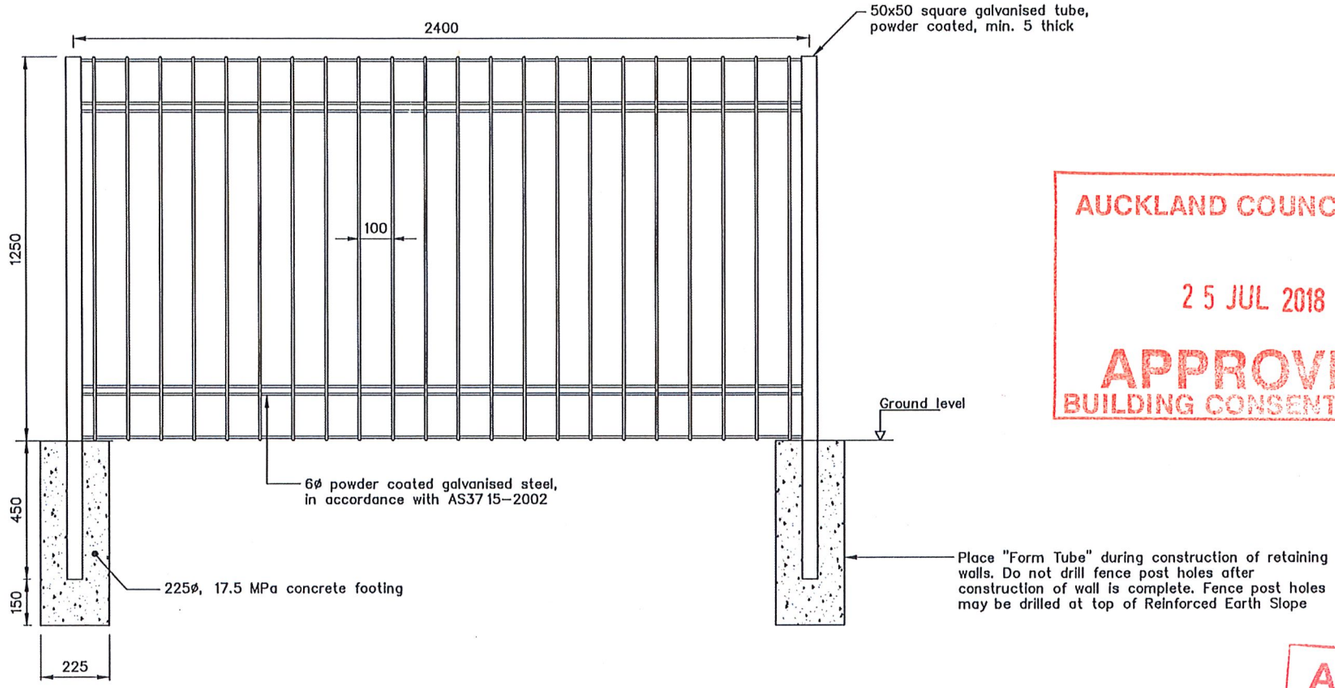
SCALES (AT A3 SIZE)	DWG. No.	REV.
1: 10	2 1854.003 1–P5– 143	A



FENCE DETAIL PLAN
SCALE 1:20



SECTION
SCALE 1:20



ELEVATION
SCALE 1:20

AUCKLAND COUNCIL
25 JUL 2018
APPROVED
BUILDING CONSENT PLANS

Auckland Council
10270225

A3 SCALE 1:20
0 0.2 0.4 0.6 0.8 1.0 (m)

DRAWING STATUS: CONSTRUCTION ISSUE

REVISION	DESCRIPTION	BY	DATE
A	Construction Issue		

DESIGNED :	JXXL	May. 18
DRAWN :	JC	May. 18
DESIGN CHECKED :		5/18
DRAFTING CHECKED :		5/18
CADFILE : \\21854.0031–P5–110.dwg		
APPROVED :		5/5/18

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

NOTES :
1. All dimensions are in millimetres unless noted otherwise.
2. Fence panels to be hot dip galvanised and black powder coated.
3. Fence panels must not have more than 100mm gap from ground level to base of installed panels.
4. Post to be 50mmø hot dip galvanised pipe and black poweder coated.
5. Posts to be installed vertically and packed out appropriately.
6. Fence panels and post to be installed in accordance with manufacturers recommendation and specification.

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

TITLE
PRECINCT 5 – DETAILED DESIGN
Safety Fence Detail

SCALES (AT A3 SIZE)	DWG. No.	REV.
1:75	21854.0031–P5–144	A

Appendix B: Contractors Certificates

- Hick Bros Civil Construction Ltd – Producer Statement 3 – Precinct 5 Stage 3B Bulk Earthworks Contract
- Hick Bros Civil Construction Ltd – Producer Statement 3 – Precinct 5 Stage 4 Bulk Earthworks Contract
- JG Civil Ltd – Sixth Schedule – Precinct 5 Stages 3B and 4 Civils Contract
- ICB Retaining and Construction Ltd – Producer Statement 3 (Palisade Wall 5 Construction)
- ICB Retaining and Construction Ltd – Producer Statement 3 (Screen Block Retaining Wall 6 Construction)
- North Harbour Fencing Ltd – Producer Statement 3 (RE Slope 7 and Retaining Wall 6 Fence)

PS3 - FORM OF PRODUCER STATEMENT- CONSTRUCTION

ISSUED BY: HICK BROS CIVIL CONSTRUCTION LIMITED

TO: WFH Development Ltd

IN RESPECT OF: Precinct 5 Stage 3B Earthworks
AT: 157 Grand Drive, Orewa

HICK BROS CIVIL CONSTRUCTION LTD has contracted to WFH Development Ltd to carry out and complete certain building works in accordance with a contract, titled Precinct 5 Stage 3B Earthworks ("the contract")

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

Date: 29th August 2019

(Signature of Authorized Agent on behalf of)

HICK BROS CIVIL CONSTRUCTION LIMITED
(Contractor)

42 FORGE ROAD, SILVERDALE
(Address)

PS3 - FORM OF PRODUCER STATEMENT- CONSTRUCTION

ISSUED BY: HICK BROS CIVIL CONSTRUCTION LIMITED

TO: WFH Development Ltd

IN RESPECT OF: Precinct 5 Stage 4 Earthworks
AT: 157 Grand Drive, Orewa

HICK BROS CIVIL CONSTRUCTION LTD has contracted to WFH Development Ltd to carry out and complete certain building works in accordance with a contract, titled Precinct 5 Stage 4 Earthworks ("the contract")

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

Date: 29th August 2019

(Signature of Authorized Agent on behalf of)

HICK BROS CIVIL CONSTRUCTION LIMITED
(Contractor)

42 FORGE ROAD, SILVERDALE
(Address)

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 5 - Stage 3b & 4 *(Description of Contract Works)*

AT Arran Hill - 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 5 - STAGE 3b & 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 29 August 2019

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 **Hicks Bros Civil Contractors Ltd**
(Principal)

IN RESPECT OF **Palisade Wall no.5**
(Description of Contract Works)

AT **Millwater Subdivision, Arran Hill, Precinct 5, Orewa West**
(Address)

ICB Retaining & Construction Ltd
(Contractor)

has contracted to **Hicks Bros Civil Contractors Ltd**
(Principal)

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

Palisade Wall no.5 *(The Contract)*
(The Project)

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

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

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

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

(Signature of Authorised Agent on Behalf of)

16 September 2019
(Date)

ICB Retaining & Construction Limited
(Contractor)

13 Volkner Place, Rosedale, Auckland 0632
(Address)

SIXTH SCHEDULE

(NZS 3910:2003)

FORM OF PRODUCER STATEMENT CONSTRUCTION

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

TO **Hicks Bros Civil Contractors Ltd**
(Principal)

IN RESPECT OF **Palisade Wall no.6**
(Description of Contract Works)

AT **Millwater Subdivision, Arran Hill, Precinct 5, Orewa West**
(Address)

ICB Retaining & Construction Ltd
(Contractor)

has contracted to **Hicks Bros Civil Contractors Ltd**
(Principal)

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

Palisade Wall no.6 *(The Contract)*
(The Project)

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

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

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

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

(Signature of Authorised Agent on Behalf of)

16 October 2018
(Date)

ICB Retaining & Construction Limited
(Contractor)

13 Volkner Place, Rosedale, Auckland 0632
(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 **Mass Block wall No. 6, Precent 5, Orewa West, Auckland, Lot 805 DP463561**
(Description of Contract Works)

AT **157 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 Mass Block wall to Precent 5, Orewa West (Arran Hill) – for WFH Properties Ltd
(The Contract)

(The Project)

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

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

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

has carried out and completed:
☑ All ☐ Part only as specified in the attached particulars of the building works in accordance with the Building Consent No. REG66652, REG66703 and any Authorised Instruction / Variations that have been issued during the course of the work.

(Signature of Authorised Agent on Behalf of)

9 April 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
(Building Contractor)

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

IN RESPECT OF: POOL FENCING AS INSTRUCTED
(Description of Contract Works)

AT: WALL 6, PRECENT 5 MILLWATER CONTRACT 37504 - 1
(Address)

T/A: AUCKLAND COUNCIL **BUILDING CONSENT No:** 10270225
(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

PRECENT 5, MILLWATER. ("the contract")
(Title of building contract)

I Ray 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)

19/7/19
(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.

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 300kPa (i.e. an allowable bearing pressure of 100kPa 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 25mm 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 H2 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).

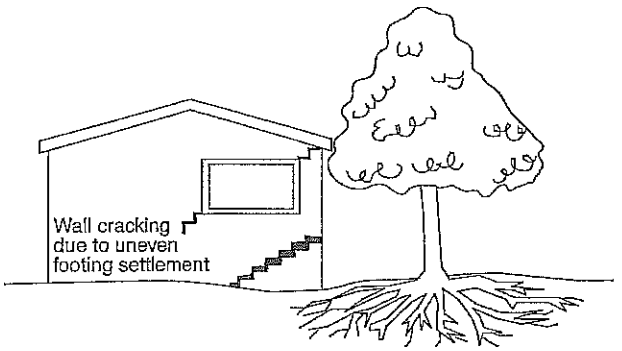
Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

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.

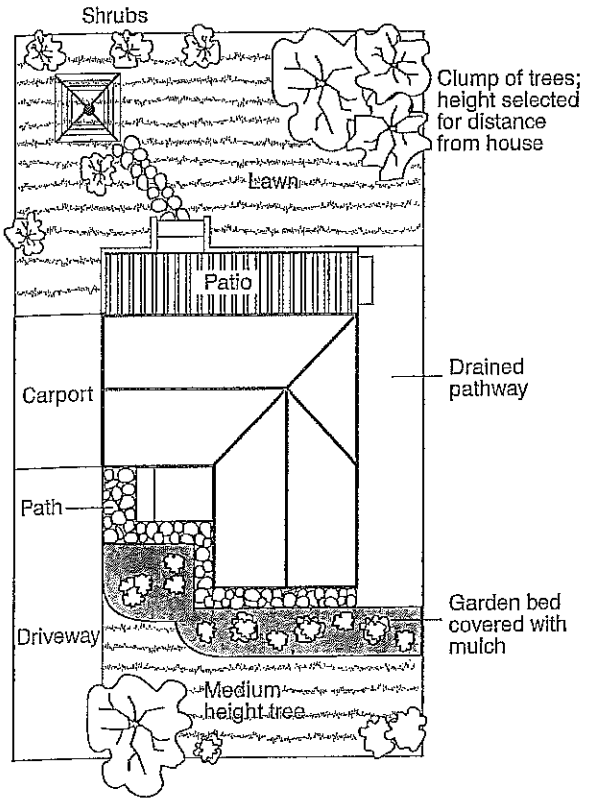
It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

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.

Distributed by

CSIRO PUBLISHING PO Box 1139, Collingwood 3066, Australia

Freecall 1800 645 051 Tel (03) 9662 7666 Fax (03) 9662 7555 www.publish.csiro.au

Email: publishing.sales@csiro.au

Appendix E: Test Results

- 21854.0031–AHP5S3B&4–121 Post Earthworks Investigation Plan
- 21854.0031–AHP5S3B&4–122 Topsoil Depths Plan
- 21854.0031–AHP5S3B&4–123 Earthworks Testing Location Plan
- Soil Expansion Test Results
- Post Earthworks Investigation Borehole Logs (HA3B–1 to HA3B–21)
- Earthworks Test Results

L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 3B & 4\21854.0031-AHP5S3B&4-121.dwg 2020-Feb-28 1:28:17 PM Plotted By: JONALD CASTRO

LEGEND

- STAGE 3B & 4 BOUNDARY
- 227 — LOT BOUNDARIES
- 35.0 — FINISHED GROUND PROFILE (1m INTERVAL)
- RETAINING WALL
- PROPOSED 400 SED OR 250UC73 PILES
- 310UC97 PILES
- RE SLOPE EXTENT
- 2.0 — FILL CONTOURS
- 0.0 — ZERO CONTOURS
- -2.0 — CUT CONTOURS
- C3 — EXPANSIVE SOIL TEST SAMPLES @ 0.5m AND 1.0m DEPTH
- HA3B-1 — HAND AUGER TO 3m DEPTH (FULLY LOGGED)

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT COORDINATES. ORIGIN: LAT 36 52 47S 174 45 51E 800,000MN 400,000ME
   LEVEL DATUM: LINZ (MSL) AUCKLAND VERTICAL DATUM 1946
3. LOT BOUNDARY SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_BOUNDARY.dwg", DATED 30/08/2019.
4. ASBUILT CONTOUR SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_FINALSURFACE.dwg", DATED 30/08/2019.
5. CUTFILL CONTOUR SUPPLIED BY WOODS, REFERANCE "X_37504_P5_04_03B_ORIGINAL FINAL.dwg" DATED 30/08/2019.

PALISADE WALL 5
RE SLOPE 7
WALL 6
PALISADE WALL 6
PALISADE WALL 7
GRAND DRIVE
GODFREY DRIVE
ORO LANE
HUA LANE
GROVER STREET
DAVEY CRESCENT
RE SLOPE 5

HA3B-1 HA3B-2 HA3B-3 HA3B-4 HA3B-5 HA3B-6 HA3B-7 HA3B-8 HA3B-9 HA3B-10 HA3B-11 HA3B-12 HA3B-13 HA3B-14 HA3B-15 HA3B-16 HA3B-17 HA3B-18 HA3B-19 HA3B-20 HA3B-21

C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21

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	JC				

DESIGNED	JXXL	Feb.20	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Feb.20	
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 **MILLWATER - ARRANS HILL**
TITLE PRECINCT 5 STAGE 3B & 4
POST EARTHWORKS INVESTIGATION PLAN
SCALE (A3) 1:1000 DWG No. 21854.0031-AHP5S3B&4-121 REV 1

L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 3B & 4\21854.0031-AHP5S3B&4-122.dwg 2019-Sep-02 1:12:50 PM Plotted By: JONALD CASTRO

LEGEND

- STAGE 3B & 4 BOUNDARY
- 227 — LOT BOUNDARIES
- 35.0 — FINISHED GROUND PROFILE (1m INTERVAL)
- PROPOSED 400 SED OR 250UC73 PILES
- 310UC97 PILES
- RE SLOPE EXTENT
- UNDERCUT EXTENT
- 200 — TOPSOIL DEPTH (mm) TAKEN AT CENTRE OF EACH LOT

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT COORDINATES. ORIGIN: LAT 36 52 47S 174 45 51E 800,000MN 400,000ME
   LEVEL DATUM: LINZ (MSL) AUCKLAND VERTICAL DATUM 1946
3. LOT BOUNDARY SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_BOUNDARY.dwg", DATED 30/08/2019.
4. ASBUILT CONTOUR SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_FINALSURFACE.dwg", DATED 30/08/2019.

PALISADE WALL 5
RE SLOPE 7
WALL 6
PALISADE WALL 6
PALISADE WALL 7
GRAND DRIVE
GODFREY DRIVE
ORO LANE
HUA LANE
GROVER STREET
DAVEY CRESCENT
RE SLOPE 5

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	JC				

DESIGNED	JXXL	Aug.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Aug.19	
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 **MILLWATER - ARRANS HILL**
TITLE PRECINCT 5 STAGE 3B & 4
TOPSOIL DEPTHS PLAN
SCALE (A3) 1:1000 DWG No. 21854.0031-AHP5S3B&4-122 REV 1

L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 3B & 4\21854.0031-AHP5S3B&4-123.dwg 2019-Sep-02 1:12:55 PM Plotted By: JONALD CASTRO

LEGEND

- STAGE 3B & 4 BOUNDARY
- 227 — LOT BOUNDARIES
- 35.0 — FINISHED GROUND PROFILE (1m INTERVAL)
- RETAINING WALL
- PROPOSED 400 SED OR 250UC73 PILES
- 310UC97 PILES
- RE SLOPE EXTENT
- 2.0 — FILL CONTOURS
- 0.0 — ZERO CONTOURS
- -2.0 — CUT CONTOURS
- S16 08816 — EARTHWORKS TESTING LOCATION (URN NUMBER)

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT COORDINATES. ORIGIN: LAT 36 52 47S 174 45 51E 800,000MN 400,000ME
   LEVEL DATUM: LINZ (MSL) AUCKLAND VERTICAL DATUM 1946
3. LOT BOUNDARY SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_BOUNDARY.dwg", DATED 30/08/2019.
4. ASBUILT CONTOUR SUPPLIED BY WOODS, REFERENCE "X_37504_P5_04_03B_FINALSURFACE.dwg", DATED 30/08/2019.
5. CUTFILL CONTOUR SUPPLIED BY WOODS, REFERANCE "X_37504_P5_04_03B_ORIGINAL FINAL.dwg" DATED 30/08/2019.

PALISADE WALL 5
RE SLOPE 7
WALL 6
PALISADE WALL 6
PALISADE WALL 7
GRAND DRIVE
GODFREY DRIVE
ORO LANE
HUA LANE
GROVER STREET
DAVEY CRESCENT
RE SLOPE 5

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	JC				

DESIGNED	JXXL	Aug.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Aug.19	
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 **MILLWATER - ARRANS HILL**
TITLE PRECINCT 5 STAGE 3B & 4
EARTHWORKS TESTING LOCATION PLAN
SCALE (A3) 1:1000 DWG No. 21854.0031-AHP5S3B&4-123 REV 1

GEOTECHNICS

Our Ref: 1009870.0.0.0/Rep 1
Customer Ref: 21854.0031
16 May 2019

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

Attention: Mr James Lee

Dear James

Millwater, Precinct 5, Orewa West - Stage 3, Stage 4A, Stage 4B, Stage 4C and Stage 4D

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.

Descriptions are enclosed for your information, but are not covered under the IANZ endorsement of this report.

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
2019.05.16 12:37:54 +12'00'

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

Report checked by:

.....
James Kimiangatau
Laboratory Technician

Authorised for Geotechnics by:

.....
Steven Anderson
Project Director

IANZ ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

This document consists of 7 pages.

16-May-19
t:\geotechnicsgroup\projects\1009870\issueddocuments\20190516.millwater p5_stage3,4a,4b,4c,4d.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, Precinct 5, Orewa West - Stage 3

Your Job No: 21854.0031

Our Job No: 1009870.0.0.0

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

SUMMARY OF SHRINK - SWELL TEST RESULTS

HA No.:			**6**	**6**	**7**	**7**	**8**	**8**	**11**	**11**	**17**	**17**
DEPTH		**(m)**	**0.5**	**1.0**	**0.5**	**1.0**	**0.5**	**1.0**	**0.5**	**1.0**	**0.5**	**1.0**
Applied Pressure		**(kPa)**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**
SWELL TEST	Initial Water Content	(%)	31.4	37.1	35.5	38.1	36.5	36.2	35.0	30.1	36.9	38.5
	Bulk Density	(t/m³)	1.85	1.72	1.76	1.78	1.57	1.79	1.62	1.86	1.77	1.73
	Dry Density	(t/m³)	1.41	1.25	1.30	1.29	1.15	1.31	1.20	1.43	1.29	1.25
	Final Water Content	(%)	32.4	38.0	36.0	38.4	37.4	37.7	36.8	31.1	38.1	40.2
	Swelling Strain	(%)	0.12	0.03	0.05	-0.03	-0.02	0.34	0.02	0.02	0.04	0.04
SHRINKAGE TEST	Initial Water Content	(%)	29.9	34.6	37.2	37.0	34.7	33.8	32.6	30.6	37.5	39.9
	Shrinkage Strain	(%)	1.2	1.5	3.6	2.9	1.8	2.0	1.6	1.5	2.5	3.2
	Inert Material Estimate in the Soil Specimen	(%)	0	0	0	0	0	0	0	0	0	0
	Soil Crumbling During Shrinkage		None	None	None	None	None	None	None	None	None	None
	Cracking of the Shrinkage Specimen		Minor	Moderate	Moderate	Moderate	Moderate	Minor	Minor	Minor	Moderate	Moderate
SHRINK - SWELL INDEX		**(%)**	**0.7**	**0.9**	**2.0**	**1.6**	**1.0**	**1.2**	**0.9**	**0.8**	**1.4**	**1.8**

Remarks: The test results are IANZ accredited.

Entered by: JK Date: 16/05/2019 Checked by: ST Date: 16/05/2019

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, Precinct 5, Orewa West - Stage 4A

Your Job No: 21854.0031

Our Job No: 1009870.0.0.0

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

SUMMARY OF SHRINK - SWELL TEST RESULTS

HA No.:			**4**	**4**	**5**	**5**	**10**	**10**	**12**	**12**
DEPTH		**(m)**	**0.5**	**1.0**	**0.5**	**1.0**	**0.5**	**1.0**	**0.5**	**1.0**
Applied Pressure		**(kPa)**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**
SWELL TEST	Initial Water Content	(%)	31.8	39.5	31.3	41.7	31.7	39.5	41.8	46.6
	Bulk Density	(t/m³)	1.80	1.78	1.78	1.73	1.79	1.73	1.70	1.70
	Dry Density	(t/m³)	1.37	1.28	1.36	1.22	1.36	1.24	1.20	1.16
	Final Water Content	(%)	33.4	39.8	34.2	43.9	35.4	41.3	44.7	48.7
	Swelling Strain	(%)	-0.01	0.04	0.10	0.05	0.21	0.03	0.08	0.11
SHRINKAGE TEST	Initial Water Content	(%)	32.5	46.0	30.6	32.1	35.5	46.5	35.5	40.6
	Shrinkage Strain	(%)	2.6	6.2	2.0	1.0	4.5	7.4	2.6	5.2
	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	Major	Moderate	Minor	Major	Major	Moderate	Moderate
SHRINK - SWELL INDEX		**(%)**	**1.4**	**3.4**	**1.1**	**0.6**	**2.5**	**4.1**	**1.5**	**2.9**

Remarks: The test results are IANZ accredited.

Entered by: JK Date: 16/05/2019 Checked by: ST Date: 16/05/2019

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, Precinct 5, Orewa West - Stage 4A

Your Job No: 21854.0031

Our Job No: 1009870.0.0.0

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

SUMMARY OF SHRINK - SWELL TEST RESULTS

HA No.:			**15**	**15**	**16**	**16**
DEPTH		**(m)**	**0.5**	**1.0**	**0.5**	**1.0**
Applied Pressure		**(kPa)**	**40**	**40**	**40**	**40**
SWELL TEST	Initial Water Content	(%)	42.0	39.9	48.1	61.5
	Bulk Density	(t/m³)	1.75	1.75	1.73	1.61
	Dry Density	(t/m³)	1.23	1.25	1.17	1.00
	Final Water Content	(%)	45.3	43.7	50.5	64.1
	Swelling Strain	(%)	0.66	0.44	0.25	0.06
SHRINKAGE TEST	Initial Water Content	(%)	40.7	40.9	36.3	40.1
	Shrinkage Strain	(%)	7.8	6.4	3.9	3.5
	Inert Material Estimate in the Soil Specimen	(%)	0	0	0	0
	Soil Crumbling During Shrinkage		Nil	Nil	Nil	Nil
	Cracking of the Shrinkage Specimen		Minor	Major	Moderate	Moderate
SHRINK - SWELL INDEX		**(%)**	**4.5**	**3.7**	**2.2**	**2.0**

Remarks: The test results are IANZ accredited.

Entered by: JK Date: 16/05/2019 Checked by: ST Date: 16/05/2019

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, Precinct 5, Orewa West - Stage 4B

Your Job No: 21854.0031

Our Job No: 1009870.0.0.0

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**
DEPTH		**(m)**	**0.5**	**1.0**	**0.5**	**1.0**	**0.5**	**1.0**
Applied Pressure		**(kPa)**	**40**	**40**	**40**	**40**	**40**	**40**
SWELL TEST	Initial Water Content	(%)	27.2	32.1	26.9	32.7	27.3	24.1
	Bulk Density	(t/m³)	1.76	1.83	1.85	1.79	1.79	1.86
	Dry Density	(t/m³)	1.38	1.39	1.46	1.35	1.41	1.50
	Final Water Content	(%)	33.1	34.3	30.8	35.6	31.8	27.4
	Swelling Strain	(%)	0.21	0.13	0.49	0.22	0.30	0.14
SHRINKAGE TEST	Initial Water Content	(%)	27.2	30.1	28.8	28.1	30.0	28.2
	Shrinkage Strain	(%)	1.9	1.3	2.7	2.5	2.3	1.9
	Inert Material Estimate in the Soil Specimen	(%)	0	0	0	0	0	0
	Soil Crumbling During Shrinkage		Nil	Nil	Nil	Nil	Nil	Nil
	Cracking of the Shrinkage Specimen		Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
SHRINK - SWELL INDEX		**(%)**	**1.1**	**0.7**	**1.6**	**1.5**	**1.4**	**1.1**

Remarks: The test results are IANZ accredited.

Entered by: JK Date: 16/05/2019 Checked by: ST Date: 16/05/2019

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, Precinct 5, Orewa West - Stage 4C

Your Job No: 21854.0031

Our Job No: 1009870.0.0.0

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**	**13**	**13**	**14**	**14**	**18**	**18**
DEPTH		**(m)**	**0.5**	**1.0**	**0.5**	**1.0**	**0.5**	**1.0**	**1.0**	**1.0**
Applied Pressure		**(kPa)**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**
SWELL TEST	Initial Water Content	(%)	58.6	45.1	27.5	28.6	26.6	30.4	27.4	28.4
	Bulk Density	(t/m³)	1.60	1.64	1.91	1.89	1.90	1.84	1.90	1.83
	Dry Density	(t/m³)	1.01	1.13	1.50	1.47	1.50	1.41	1.49	1.43
	Final Water Content	(%)	60.1	47.3	30.4	30.8	28.4	33.1	28.7	31.0
	Swelling Strain	(%)	0.02	-0.10	0.22	0.32	0.04	0.31	0.03	0.23
SHRINKAGE TEST	Initial Water Content	(%)	49.7	54.1	28.7	37.1	33.4	26.4	27.9	27.9
	Shrinkage Strain	(%)	5.7	5.8	4.0	4.9	4.0	3.0	1.3	1.0
	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		Major	Major	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
SHRINK - SWELL INDEX		**(%)**	**3.2**	**3.2**	**2.3**	**2.8**	**2.2**	**1.7**	**0.7**	**0.6**

Remarks: The test results are IANZ accredited.

Entered by: JK Date: 16/05/2019 Checked by: ST Date: 16/05/2019

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, Precinct 5, Orewa West - Stage 4D

Your Job No: 21854.0031

Our Job No: 1009870.0.0.0

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

SUMMARY OF SHRINK - SWELL TEST RESULTS

HA No.:			**19**	**19**	**20**	**20**	**21**	**21**
DEPTH		**(m)**	**0.5**	**1.0**	**0.5**	**1.0**	**0.5**	**1.0**
Applied Pressure		**(kPa)**	**40**	**40**	**40**	**40**	**40**	**40**
SWELL TEST	Initial Water Content	(%)	34.3	24.9	35.6	38.2	39.4	37.5
	Bulk Density	(t/m³)	1.71	1.84	1.78	1.74	1.78	1.69
	Dry Density	(t/m³)	1.27	1.47	1.31	1.26	1.28	1.23
	Final Water Content	(%)	37.5	29.1	36.6	39.3	39.5	41.2
	Swelling Strain	(%)	0.04	0.80	-0.02	0.02	0.09	0.16
SHRINKAGE TEST	Initial Water Content	(%)	35.4	28.6	36.2	36.7	29.8	51.4
	Shrinkage Strain	(%)	2.6	3.0	2.0	1.8	4.3	10.1
	Inert Material Estimate in the Soil Specimen	(%)	0	0	0	0	0	0
	Soil Crumbling During Shrinkage		Nil	Nil	Nil	Nil	Nil	Nil
	Cracking of the Shrinkage Specimen		Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
SHRINK - SWELL INDEX		**(%)**	**1.5**	**1.9**	**1.1**	**1.0**	**2.4**	**5.6**

Remarks: The test results are IANZ accredited.

Entered by: JK Date: 16/05/2019 Checked by: ST Date: 16/05/2019

Our Ref: 1100151.0.0.0/ Rep 1
Customer Ref: 21854.0031
09 August 2019

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

Attention: Mr James Lee

Dear James

Millwater, Orewa West - Precinst 5 - Stage 4

Test Results

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

Samples were destroyed during testing.

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
2019.08.09 12:39:12 +12'00'

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

Authorised for Geotechnics by:

.....
Steven Anderson
Project Director

Report checked by:

.....
James Kimiangatau
Laboratory Technician

This document consists of 5 pages

9-Aug-19
t:\geotechnicsgroup\projects\1100151\issueddocuments\20190809.millwater_orewa west_p5_stage 4.st.final.rep1.docx

GEOTECHNICS

19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand
p: + 64 9 356 3510

Geotechnics Project Number	**1100151.0000**
QESTLab Work Order ID	**W19AK-0048**
Customer Project ID	**21854.0031**

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Millwater, Orewa West - Precinct 5 - Stage 4		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000151	**BH No**	---
	Reference	LOT 165_HA1_1	**Top Depth**	0.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	---
	Description	---		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	40
SWELL TEST	Initial Water Content	(%)	32.6
	Bulk Density	(t/m³)	1.75
	Dry Density	(t/m³)	1.32
	Final Water Content	(%)	35.6
	Swelling Strain	(%)	0.07
SHRINKAGE TEST	Initial Water Content	(%)	35.0
	Shrinkage Strain	(%)	3.9
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Minor
SHRINK - SWELL INDEX		(%)	2.2

TEST REMARKS

• Results apply only to sample tested. • This report may be reproduced only in full. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory Sim Tirunahari
Date 9/08/2019

IANZ ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.

GEOTECHNICS

19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand
p: + 64 9 356 3510

Geotechnics Project Number	**1100151.0000**
QESTLab Work Order ID	**W19AK-0048**
Customer Project ID	**21854.0031**

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Millwater, Orewa West - Precinct 5 - Stage 4		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000152	**BH No**	---
	Reference	LOT 165_HA1_2	**Top Depth**	1.0m
	Sampled By	Others, Tested As Received	**Bottom Depth**	---
	Description	---		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	40
SWELL TEST	Initial Water Content	(%)	41.3
	Bulk Density	(t/m³)	1.75
	Dry Density	(t/m³)	1.24
	Final Water Content	(%)	42.7
	Swelling Strain	(%)	0.10
SHRINKAGE TEST	Initial Water Content	(%)	34.7
	Shrinkage Strain	(%)	3.8
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Moderate
SHRINK - SWELL INDEX		(%)	2.2

TEST REMARKS

• Results apply only to sample tested. • This report may be reproduced only in full. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory Sim Tirunahari
Date 9/08/2019

IANZ ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.

GEOTECHNICS

19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand
p: + 64 9 356 3510

Geotechnics Project Number	**1100151.0000**
QESTLab Work Order ID	**W19AK-0048**
Customer Project ID	**21854.0031**

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Millwater, Orewa West - Precinct 5 - Stage 4		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000153	**BH No**	---
	Reference	LOT 166_HA1_1	**Top Depth**	0.5m
	Sampled By	Others, Tested As Received	**Bottom Depth**	---
	Description	---		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	40
SWELL TEST	Initial Water Content	(%)	30.6
	Bulk Density	(t/m³)	1.85
	Dry Density	(t/m³)	1.42
	Final Water Content	(%)	32.8
	Swelling Strain	(%)	0.18
SHRINKAGE TEST	Initial Water Content	(%)	25.4
	Shrinkage Strain	(%)	3.2
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Moderate
SHRINK - SWELL INDEX		(%)	1.8

TEST REMARKS

• Results apply only to sample tested. • This report may be reproduced only in full. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory Sim Tirunahari
Date 9/08/2019

IANZ ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.

GEOTECHNICS

19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand
p: + 64 9 356 3510

Geotechnics Project Number	**1100151.0000**
QESTLab Work Order ID	**W19AK-0048**
Customer Project ID	**21854.0031**

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Millwater, Orewa West - Precinct 5 - Stage 4		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000154	**BH No**	---
	Reference	LOT 166_HA1_2	**Top Depth**	1.0m
	Sampled By	Others, Tested As Received	**Bottom Depth**	---
	Description	---		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	40
SWELL TEST	Initial Water Content	(%)	29.6
	Bulk Density	(t/m³)	1.64
	Dry Density	(t/m³)	1.27
	Final Water Content	(%)	36.7
	Swelling Strain	(%)	0.13
SHRINKAGE TEST	Initial Water Content	(%)	29.1
	Shrinkage Strain	(%)	4.4
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Moderate
SHRINK - SWELL INDEX		(%)	2.5

TEST REMARKS

• Results apply only to sample tested. • This report may be reproduced only in full. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory Sim Tirunahari
Date 9/08/2019

IANZ ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.

HAND AUGER LOG

HOLE Id: **HA3B- 1**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5	LOCATION: Arran Drive, Millwater	JOB No.: 21854.0031 - 2018
CO-ORDINATES: 174.66713 WGS84 -36.58884	DRILL TYPE: 50mm hand auger	HOLE STARTED: 19/02/2019
		HOLE FINISHED: 19/02/2019
R.L.:	DRILL METHOD: HA	DRILLED BY: T+T
DATUM:		LOGGED BY: JASM CHECKED: OP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
					UTP			0.5	TS	D-M	H		Topsoil.
					SS sample @ 0.4m HA - S 14 - 0.5m								SILT, with some clay, with minor sand; orangish yellow. Hard; non-plastic; dry to moist; sand, fine.
					UTP								
					UTP			1.0					
					SS Sample @ 0.9m		29						
					UTP			1.5					1.6 - 1.7m: Sandy SILT; grey
		100	HA		>214 kPa								SILT, with some clay, with minor sand; orangish yellow. Hard; non-plastic; dry to moist; sand, fine.
					UTP					M	VSt		Clayey SILT, with minor sand, with trace gravel; light yellow. Stiff to hard; low plasticity; moist; sand, fine; gravel, medium.
					150/21 kPa		28	2.0					
					205/92 kPa			2.5			St		Clayey SILT, with minor sand, with trace gravel; light yellow. Stiff; low plasticity; moist; sand, fine; gravel, medium, Mudstone.
					75/40 kPa						H		Clayey SILT, with minor sand, with trace gravel; light yellow. Hard; low plasticity; moist; sand, fine; gravel, medium, Mudstone.
	DRY 19/02/2019				>214 kPa		27	3.0					3m: Target depth
								3.5					

COMMENTS: Shear Vane #132 - 19mm blade

Hole Depth 3m

Scale 1:20

Rev.: A

HandAugerLog - 26/02/2020 2:36:56 pm - Produced with Core-GS by GeRoc

HAND AUGER LOG

HOLE Id: **HA3B- 2**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5	LOCATION: Arran Drive, Millwater	JOB No.: 21854.0031 - 2018
CO-ORDINATES: 174.66749 WGS84 -36.58898	DRILL TYPE: 50mm hand auger	HOLE STARTED: 19/02/2019
		HOLE FINISHED: 19/02/2019
R.L.:	DRILL METHOD: HA	DRILLED BY: T+T
DATUM:		LOGGED BY: MTAN CHECKED: OP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
								0.0	TS				Topsoil.
					● UTP					D	H		Clayey SILT, with minor sand, with trace gravel; orangish brown. Hard; non-plastic; dry.
					SS sample @ 0.4m			0.5					
					● UTP								
					● >228 kPa					D-M	VSt		Clayey SILT, with minor sand, with trace gravel; reddish orange. Very stiff; low plasticity; dry to moist.
					SS sample @ 0.9m		25	1.0					
					● 146/67 kPa								
		103	HA		● 156/86 kPa			1.5					
					● 114/63 kPa								
							24	2.0		M	VSt-H		Silty CLAY, with trace sand; orangish grey. Very stiff to hard; low plasticity; moist.
					● 169/72 kPa								
					● >228 kPa			2.5					Silty CLAY, with trace gravel; orangish blue. Very stiff to hard; low plasticity; moist.
					● 195/101 kPa								Cobble of moderately weathered, MUDSTONE, very weak
	DRY 19/02/2019						23	3.0					Clayey SILT, with minor sand; orange brown. Very stiff to hard; low plasticity.
					● 182/75 kPa								3m.
								3.5					

COMMENTS: Shear Vane #660 - 19 mm blade. EOH @ Target Depth of 3m

Hole Depth 3m

Scale 1:20

Rev.: A

HAND AUGER LOG

HOLE Id: **HA3B- 3**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5 | LOCATION: Arran Drive, Millwater | JOB No.: 21854.0031 - 2018

CO-ORDINATES: 174.66827 -36.58894 WGS84

R.L.:

DATUM:

DRILL TYPE: 50mm hand auger

DRILL METHOD: HA

HOLE STARTED: 19/02/2019

HOLE FINISHED: 19/02/2019

DRILLED BY: T+T

LOGGED BY: BEJO CHECKED: OP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
									TS				Topsoil.
					>214 kPa					D	VSt-H		SILT, with some clay, with trace sand; yellowish orange. Very stiff to hard; non-plastic; dry; sand, fine.
					SS sample @ 0.4m			0.5					
					149/29 kPa								
					UTP								
					SS sample @ 0.9m		29	1.0					
					UTP								
		100	HA		150/57 kPa			1.5		M			Clayey SILT; light orangish yellow. Very stiff to hard; low plasticity; moist.
					>214 kPa								
							28	2.0					
					162/55 kPa								
					>214 kPa			2.5			H		SILT, with some clay and sand, with trace gravel; greenish grey. Hard; low plasticity; moist; gravel, fine.
					208/104 kPa								Clayey SILT, with trace gravel; brownish orange. Hard; low plasticity; moist; gravel, fine.
	DRY 19/02/2019				UTP		27	3.0					3m: Target depth
								3.5					

COMMENTS: Shear Vane #132 - 19mm blade

Hole Depth 3m

Scale 1:20

Rev.: A

Tonkin+Taylor

HAND AUGER LOG

HOLE Id: **HA3B- 4**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5 | LOCATION: Arran Drive, Millwater | JOB No.: 21854.0031 - 2018

CO-ORDINATES: 174.66735 -36.58934 WGS84

R.L.:

DATUM:

DRILL TYPE: 50mm hand auger

DRILL METHOD: HA

HOLE STARTED: 21/02/2019

HOLE FINISHED: 21/02/2019

DRILLED BY: T+T

LOGGED BY: BEJO CHECKED: JASM

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm)	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	Description and Additional Observations
									TS				Topsoil.
										D	VSt		Sandy SILT, with some clay; orangey brown. Very stiff; low plasticity; dry.
					111/57 kPa					M	St-VSt		SILT, with some clay; greyish orange. Stiff to very stiff; low plasticity; moist.
					SS sample @ 0.4m			0.5					
					98/47 kPa								
					81/41 kPa								SILT, with some clay; yellowish brown. Stiff to very stiff; low plasticity; moist.
					SS sample @ 0.9m		34	1.0					
					89/33 kPa								
					107/37 kPa			1.5					
					101/36 kPa								Clayey SILT; pinkish brown. Stiff to very stiff; high plasticity; moist.
					85/31 kPa		33	2.0					
					42/29 kPa						F		Clayey SILT; pinkish brown. Firm; high plasticity; moist.
								2.5			VSt		Clayey SILT; pinkish brown. Very stiff; high plasticity; moist.
					106/34 kPa								
	DRY 21/02/2019	100	HA				32	3.0					3m: Target depth
								3.5					

COMMENTS: Shear Vane # 660 - 19mm blade

Hole Depth 3m

Scale 1:20

Rev.: A

HAND AUGER LOG

HOLE Id: **HA3B- 5**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5	LOCATION: Arran Drive, Millwater	JOB No.: 21854.0031 - 2018
CO-ORDINATES: 174.667030870914 WGS84 -36.5895615509436	DRILL TYPE: 50mm hand auger	HOLE STARTED: 19/02/2019
		HOLE FINISHED: 20/02/2019
R.L.:	DRILL METHOD: HA	DRILLED BY: T+T
DATUM:		LOGGED BY: MTAN CHECKED: OP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
									TS				Topsoil.
					UTP					D	H		SILT, with minor gravel; orangish brown. Hard; non-plastic; dry.
					SS sample @ 0.4m			0.5					
					>214 kPa								
					>214 kPa								
					SS sample @ 0.9m		37	1.0			St		Gravelly SILT; yellowish orange. Stiff; non-plastic; dry.
		100	HA		74/31 kPa					M	St-VSt		Silty CLAY; yellowish orange. Stiff to very stiff; high plasticity; moist.
	DRY 20/02/2019				74/31 kPa			1.5					
					107/57 kPa								
							36	2.0			S-F		CLAY, with minor silt; yellowish orange. Soft to stiff; high plasticity; moist.
					6/5 kPa								
					34/32 kPa						VSt		CLAY, with minor silt; yellowish orange. Very stiff; high plasticity; moist.
								2.5					
					119/43 kPa								2.7m: Effective refusal
							35	3.0					
								3.5					

COMMENTS: Shear Vane #132 - 19mm blade. Effective refusal at 2.7m, hole started collapsing/squeezing

Hole Depth 2.7m

Scale 1:20

Rev.: A

HAND AUGER LOG

HOLE Id: **HA3B- 6**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5	LOCATION: Arran Drive, Millwater	JOB No.: 21854.0031 - 2018
CO-ORDINATES: 174.667468070984 -36.5896024696289 WGS84	DRILL TYPE: 50mm hand auger	HOLE STARTED: 20/02/2019
		HOLE FINISHED: 20/02/2019
R.L.:	DRILL METHOD: HA	DRILLED BY: T+T
DATUM:		LOGGED BY: JASM CHECKED: OP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm)	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	Description and Additional Observations
								0.0	TS				Topsoil.
					>214 kPa SS Sample @ 0.4m >214 kPa			0.5		M	H		SILT, with some clay, with minor sand; orangish yellow. Hard; low plasticity; dry to moist; sand, fine.
					211/34 kPa SS Sample @ 0.9m		37	1.0					
		100	HA		86/34 kPa						St		Silty CLAY; pinkish grey. Stiff; high plasticity; moist.
					80/37 kPa			1.5					
					67/28 kPa								
					86/37 kPa		36	2.0					
	DRY 20/02/2019				113/61 kPa						VSt		Silty CLAY; pinkish grey. Very stiff; high plasticity; moist; ER - hole collapsing and squeezing from ~1.9m.
					135/67 kPa			2.5					2.7m: Effective refusal
							35	3.0					
								3.5					

COMMENTS: Shear Vane #132 - 19mm blade

Hole Depth 2.7m

Scale 1:20

Rev.: A

HAND AUGER LOG

HOLE Id: **HA3B- 7**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5	LOCATION: Arran Drive, Millwater	JOB No.: 21854.0031 - 2018
CO-ORDINATES: 174.667409062386 WGS84 -36.5899944264621	DRILL TYPE: 50mm hand auger	HOLE STARTED: 20/02/2019
		HOLE FINISHED: 20/02/2019
R.L.:	DRILL METHOD: HA	DRILLED BY: T+T
DATUM:		LOGGED BY: JASM CHECKED: OP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
								0.0	TS				Topsoil.
					122/37 kPa					D-M	VSt		SILT, with some clay and sand, with trace gravel; reddish orange. Very stiff; low plasticity; dry to moist; gravel, fine to medium.
					SS sample @ 0.4m			0.5					
					144/34 kPa								
					92/31 kPa		40	1.0		M	St		Sandy SILT, with some clay; light red. Stiff; low plasticity; moist.
					SS sample @ 0.9m								
					113/43 kPa						St-VSt		Clayey SILT; light orange. Stiff to very stiff; high plasticity; moist.
		100	HA		113/37 kPa			1.5					
					95/34 kPa		39	2.0					Clayey SILT; light grey. Stiff to very stiff; high plasticity; moist; 2-2.2m trace fine sands.
					144/55 kPa								
					168/70 kPa			2.5					
	DRY 20/02/2019				95/37 kPa								
					132/40 kPa		38	3.0					3m: Target depth
								3.5					

COMMENTS: Shear Vane #132 - 19mm blade

Hole Depth 3m

Scale 1:20

Rev.: A

HandAugerLog - 26/02/2020 2:37:05 pm - Produced with Core-GS by GeRoc

Tonkin+Taylor

HAND AUGER LOG

HOLE Id: **HA3B- 8**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5 | LOCATION: Arran Drive, Millwater | JOB No.: 21854.0031 - 2018

CO-ORDINATES: 174.666963815689
WGS84 -36.589916896697

R.L.:

DATUM:

DRILL TYPE: 50mm hand auger

DRILL METHOD: HA

HOLE STARTED: 20/02/2019
HOLE FINISHED: 20/02/2019
DRILLED BY: T+T
LOGGED BY: MTAN CHECKED: OP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm)	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	Description and Additional Observations
									TS				Gravelly COBBLES. Topsoil.
					190/25 kPa					D	VSt		Gravelly SILT; gray. Very stiff; non-plastic; dry.
					SS sample @ 0.4m			0.5					
					138/90 kPa					D-M			Clayey SILT; yellowish brown. Very stiff; low plasticity; dry to moist.
					>214 kPa					D	H		SILT, with some clay; yellowish brown. Hard; non-plastic.
					SS sample @ 0.9m		37	1.0					
					118/46 kPa					M	VSt		Silty CLAY; yellowish brown. Very stiff; low plasticity; moist.
		100	HA		113/40 kPa			1.5					
					135/46 kPa								Clayey SILT; reddish grey. Very stiff; low plasticity; moist.
					161/54 kPa		36	2.0					
					141/52 kPa			2.5					
	DRY 20/02/2019				153/58 kPa								Silty CLAY; yellowish brown. Very stiff; low plasticity; moist.
					158/61 kPa		35	3.0					3m: Target depth
								3.5					

COMMENTS: Shear Vane #132 - 19mm blade

Hole Depth 3m

Scale 1:20

Rev.: A

HandAugerLog - 26/02/2020 2:37:06 pm - Produced with Core-GS by GeRoc

HAND AUGER LOG

HOLE Id: **HA3B- 9**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5	LOCATION: Arran Drive, Millwater	JOB No.: 21854.0031 - 2018
CO-ORDINATES: 174.666746556759 WGS84 -36.5903476166287	DRILL TYPE: 50mm hand augers	HOLE STARTED: 21/02/2019
		HOLE FINISHED: 21/02/2019
R.L.:	DRILL METHOD: HA	DRILLED BY: T+T
DATUM:		LOGGED BY: MTAN CHECKED: OP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
								0.0	TS				Topsoil.
					>214 kPa					M	H		SILT, with some clay, with minor sand; yellowish brown. Hard; low plasticity; moist.
					SS sample @ 0.4m			0.5					
					165/21 kPa						VSt-H		Silty CLAY; yellowish grey. Very stiff to hard; low plasticity; moist.
					UTP					D	H		SILT, with minor sand; yellowish orange. Hard; non-plastic; dry.
					SS sample @ 0.9m		45	1.0					
					184/35 kPa					M	VSt		Silty CLAY; greyish. Very stiff; low plasticity; moist.
		100	HA		141/32 kPa			1.5					
					UTP					D	H		SILT, with some clay; greyish brown. Hard; non-plastic; dry.
					UTP		44	2.0		M			CLAY, with some silt; gray. Hard; high plasticity; moist.
					>214 kPa			2.5					
	DRY 21/02/2019				UTP		43	3.0		D			SILT, with some sand; reddish brown. Hard; non-plastic; dry.
													3m: Target depth
								3.5					

COMMENTS: Shear Vane #132 - 19mm blade

Hole Depth 3m

Scale 1:20

Rev.: A

HAND AUGER LOG

HOLE Id: **HA3B-10**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5	LOCATION: Arran Drive, Millwater	JOB No.: 21854.0031 - 2018
CO-ORDINATES: 174.667269587517 WGS84 -36.590446681873	DRILL TYPE: 50mm hand auger	HOLE STARTED: 21/02/2019
		HOLE FINISHED: 21/02/2019
R.L.:	DRILL METHOD: HA	DRILLED BY: T+T
DATUM:		LOGGED BY: MTAN CHECKED: OP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
								0.0	TS				Topsoil.
					153/61 kPa					M	VSt		SILT, with minor clay, with trace sand; brownish orange. Very stiff; low plasticity; moist; sand, fine.
					SS sample @ 0.4m			0.5					
					147/58 kPa						VSt-H		Clayey SILT; blueish gray. Very stiff to hard; high plasticity; moist.
					113/40 kPa		44						
					SS sample @ 0.9m			1.0					
					199/55 kPa								
		100	HA		>214 kPa			1.5			St		SILT, with some clay; light grey. Stiff; high plasticity; moist.
					92/11 kPa						H		Clayey SILT; yellowish grey. Hard; high plasticity; moist; Limonite staining from 1.8-2.1m.
					UTP		43	2.0					SILT, with some clay; dark grey. Hard; low plasticity; moist.
					202/52 kPa								SILT, with some clay; light grey. Hard; high plasticity; moist.
					132/43 kPa			2.5			VSt-H		Clayey SILT; orange brown. Very stiff to hard; high plasticity; moist.
	DRY 21/02/2019				UTP		42	3.0					3m: Target depth
								3.5					

COMMENTS: Shear Vane #132 - 19mm blade

Hole Depth 3m

Scale 1:20

Rev.: A

HAND AUGER LOG

HOLE Id: **HA3B-11**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5	LOCATION: Arran Drive, Millwater	JOB No.: 21854.0031 - 2018
CO-ORDINATES: 174.667741656303 -36.5905522077542 WGS84	DRILL TYPE: 50mm hand auger	HOLE STARTED: 20/02/2019
	DRILL METHOD: HA	HOLE FINISHED: 20/02/2019
R.L.:		DRILLED BY: T+T
DATUM:		LOGGED BY: MTAN CHECKED: OP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
								0.0	TS				TOPSOIL.
										D	H		Sandy SILT; reddish black. Hard; non-plastic; dry.
					UTP						VSt		SILT, with some sand; yellowish brown. Very stiff; non-plastic; dry.
					SS sample @ 0.4m			0.5					
					107/28 kPa								Sandy SILT, with minor gravel; reddish brown. Very stiff; non-plastic; dry.
					132/31 kPa		43						Sandy SILT; yellowish brown. Very stiff; low plasticity; dry.
					SS sample @ 0.9m			1.0					
										M	St		Sandy SILT, with some clay; yellowish grey. Stiff; low plasticity; moist.
		100	HA		92/34 kPa			1.5			St-VSt		Silty CLAY, with minor sand; yellowish brown. Stiff to very stiff; low plasticity; moist.
	DRY 20/02/2019				119/34 kPa						VSt		Clayey SILT; reddish brown. Very stiff; low plasticity; moist.
					126/43 kPa		42	2.0			VSt-H		Silty CLAY, with minor gravel; greyish. Very stiff to hard; non-plastic; moist.
					103/32 kPa			2.5					
					>214 kPa						VSt		SILT, with some clay; brown . Very stiff; low plasticity; moist.
					113/31 kPa		41	3.0					3m: Target depth
								3.5					

COMMENTS: Shear Vane #132 - 19mm blade

Hole Depth 3m

Scale 1:20

Rev.: A

HAND AUGER LOG

HOLE Id: **HA3B-12**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5 | LOCATION: Arran Drive, Millwater | JOB No.: 21854.0031 - 2018

CO-ORDINATES: 174.667956233025 -36.5905931259143 WGS84

R.L.:

DATUM:

DRILL TYPE: 50mm hand auger

DRILL METHOD: HA

HOLE STARTED: 25/02/2019

HOLE FINISHED: 25/02/2019

DRILLED BY: T+T

LOGGED BY: JASM CHECKED: OP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm)	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	Description and Additional Observations
								0.0	TS				Topsoil.
					195/81 kPa					M	VSt-H		SILT, with some clay, with minor sand; reddish orange. Very stiff to hard; high plasticity; moist; sand, fine.
					SS sample @ 0.4m			0.5					
					146/57 kPa								
					182/65 kPa						VSt		SILT, with some clay, with trace gravel; reddish orange. Very stiff; low plasticity; moist; gravel, coarse.
					SS sample @ 0.9m		43	1.0					
					106/46 kPa						St-VSt		Clayey SILT; light orange. Stiff to very stiff; high plasticity; moist.
		100	HA					1.5					
					73/36 kPa								
							42	2.0			VSt		SILT, with some clay, with minor sand; light grey. Very stiff; low plasticity; moist; sand, fine.
					98/33 kPa								
											St-VSt		SILT, with some clay, with minor sand; greyish green. Stiff to very stiff; high plasticity; moist; sand, fine.
					72/36 kPa			2.5					
	DRY 25/02/2019												
					133/36 kPa		41	3.0					3m: Target depth
								3.5					

COMMENTS: Shear Vane #660 - 19mm blade

Hole Depth 3m

Scale 1:20

Rev.: A

Tonkin+Taylor

HAND AUGER LOG

HOLE Id: **HA3B-13**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5 | LOCATION: Arran Drive, Millwater | JOB No.: 21854.0031 - 2018

CO-ORDINATES: 174.668154716492
WGS84 -36.5906243529165

R.L.:

DATUM:

DRILL TYPE: 50mm hand auger

DRILL METHOD: HA

HOLE STARTED: 25/02/2019
HOLE FINISHED: 25/02/2019
DRILLED BY: T+T
LOGGED BY: SIKA CHECKED: OP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
								0.0	TS				Topsoil.
					>228 kPa					M	H		Clayey SILT, with minor sand; reddish orange. Hard; low plasticity; moist; sand, fine.
					SS sample @ 0.4m			0.5					
					>228 kPa								
					195/88 kPa		40	1.0					
					SS sample @ 0.9m								
					>228 kPa								
		100	HA		UTP			1.5					
					UTP								
					>228 kPa		39	2.0					
					UTP			2.5					
	DRY 25/02/2019				159/91 kPa						VSt		Clayey SILT; light orange. Very stiff; low plasticity; moist.
					146/75 kPa		38	3.0					3m: Target depth
								3.5					

COMMENTS:

Hole Depth 3m

Scale 1:20

Rev.: A

Tonkin+Taylor

HAND AUGER LOG

HOLE Id: **HA3B-14**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5 | LOCATION: Arran Drive, Millwater | JOB No.: 21854.0031 - 2018

CO-ORDINATES: 174.668365269899 -36.5906232761235 WGS84

R.L.:

DATUM:

DRILL TYPE: 50mm hand auger

DRILL METHOD: HA

HOLE STARTED: 25/02/2019

HOLE FINISHED: 25/02/2019

DRILLED BY: T+T

LOGGED BY: RLXB CHECKED: JASM

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
									TS	D	H		Organic SILT; dark greyish brown. Hard; non-plastic; dry; silt, [TOPSOIL].
					>201 kPa					M			CLAY, with some silt; light yellowish brown. Hard; low plasticity; moist; silt, [RESIDUAL ECBF SOIL].
					SS sample @ 0.4m			0.5					
					>201 kPa								
					126/75 kPa						VSt		0.9m: Grades; very stiff.
					SS sample @ 0.9m		43	1.0					
					161/80 kPa								Silty CLAY; light reddish brown. Very stiff; high plasticity; moist.
		100	HA		164/69 kPa			1.5					
					149/72 kPa								Silty CLAY, with trace sand; dark reddish brown. Very stiff; high plasticity; moist; sand, fine.
							42	2.0					
					158/83 kPa								
					118/57 kPa			2.5					Silty CLAY; light reddish brown. Very stiff; high plasticity; moist.
					181/57 kPa								Clayey SILT, with trace sand; dark reddish brown. Very stiff; low plasticity; moist; sand, fine.
	DRY 25/02/2019										St		Silty CLAY; dark yellowish brown. Stiff; high plasticity; moist.
					92/43 kPa		41	3.0					3m: Target depth
								3.5					

COMMENTS: Shear Vane #1739 - 19mm blade

Hole Depth 3m

Scale 1:20

Rev.: A

HAND AUGER LOG

HOLE Id: **HA3B-15**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5	LOCATION: Arran Drive, Millwater	JOB No.: 21854.0031 - 2018
CO-ORDINATES: 174.668744802475 -36.5901021065622 WGS84	DRILL TYPE: 50mm hand auger	HOLE STARTED: 25/02/2019
		HOLE FINISHED: 25/02/2019
R.L.:	DRILL METHOD: HA	DRILLED BY: T+T
DATUM:		LOGGED BY: MTAN CHECKED: OP

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
								0.0	TS				Topsoil.
					75/9 kPa					D	St-VSt		Sandy SILT, with some gravel; gray. Stiff to very stiff; non-plastic; dry.
					SS sample @ 0.4m			0.5					
					139/66 kPa					M	VSt		SILT, with minor clay; yellowish brown. Very stiff; low plasticity; moist.
					153/64 kPa								
					SS sample @ 0.9m		40	1.0					
					165/67 kPa			1.5					
					UTP					D			SILT, with trace sand; greyish yellow. Very stiff; non-plastic; dry.
					98/70 kPa		39	2.0		M	St-VSt		SILT, with some clay; yellowish brown, bands of grey and red. Stiff to very stiff; low plasticity; moist.
					122/74 kPa			2.5					
					122/83 kPa								
	DRY 25/02/2019	100	HA		92/61 kPa		38	3.0					3m: Target depth
								3.5					

COMMENTS: Shear Vane # 132 - 19mm blade

Hole Depth 3m

Scale 1:20

Rev.: A

Tonkin+Taylor

HAND AUGER LOG

HOLE Id: **HA3B-16**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5 | LOCATION: Arran Drive, Millwater | JOB No.: 21854.0031 - 2018

CO-ORDINATES: 174.66826 -36.59013 WGS84

R.L.:

DATUM:

DRILL TYPE: 50mm hand auger

DRILL METHOD: HA

HOLE STARTED: 25/02/2019

HOLE FINISHED: 25/02/2019

DRILLED BY: T+T

LOGGED BY: RLXB CHECKED: JASM

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
									TS	D	H		Organic SILT; dark greyish brown. Hard; non-plastic; dry; silt, [TOPSOIL].
										M	VSt		Clayey SILT; dark yellowish brown. Very stiff; low plasticity; moist; silt, [ENGINEERED FILL].
					144/46 kPa								Clayey SILT, with trace sand; light brown (mottled light pink). Very stiff; low plasticity; moist; sand, fine, [RESIDUAL ECBF SOIL].
					SS sample @ 0.4m			0.5					
					66/14 kPa						St		Clayey SILT; dark yellowish brown. Stiff; low plasticity; moist.
					89/14 kPa		40	1.0					Clayey SILT; light brown (streaked dark yellowish brown). Stiff; low plasticity; moist.
					SS sample @ 0.9m								
					101/29 kPa						VSt		1.3m: Grades; very stiff.
					106/26 kPa			1.5					
					101/20 kPa								Sandy SILT, with minor clay; dark brownish grey (mottled light brown). Very stiff; low plasticity; moist; sand, fine and medium.
					103/14 kPa		39	2.0					
	DRY 25/02/2019	100	HA							M / HW			Completely weathered; dark reddish brown; SANDSTONE; extremely weak; (tightly packed). [CW ECBF].
								2.5					
							38	3.0					2.6m: Refusal
								3.5					

COMMENTS: Shear Vane # 1739 - 19mm blade

Hole Depth 2.6m

Scale 1:20

Rev.: A

HAND AUGER LOG

HOLE Id: **HA3B-17**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5	LOCATION: Arran Drive, Millwater	JOB No.: 21854.0031 - 2018
CO-ORDINATES: 174.667870402336 -36.5901139513641 WGS84	DRILL TYPE: 50mm hand auger	HOLE STARTED: 20/02/2019
	DRILL METHOD: HA	HOLE FINISHED: 20/02/2019
R.L.:		DRILLED BY: T+T
DATUM:		LOGGED BY: BEJO CHECKED: OP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
									TS				Topsoil.
					>228 kPa SS sample @ 0.4m >228 kPa			0.5		D-M	H		Sandy SILT, with some clay, with trace gravel; light pinkish brown. Hard; low plasticity; dry to moist; sand, fine.
					>228 kPa SS sample @ 0.9m		40	1.0					
					UTP					M	VSt-H		Sandy SILT; yellowish orange. Very stiff to hard; low plasticity; moist; sand, fine.
		100	HA		208/50 kPa			1.5					
					179/41 kPa		39	2.0					
					202/88 kPa						H		SILT, with some clay and sand; brownish yellow. Hard; low plasticity; moist.
	DRY 20/02/2019				202/39 kPa			2.5					
					UTP								Sandy SILT, with some clay; reddish brown. Hard; low plasticity; moist.
					>228 kPa		38	3.0					3m: Target depth
								3.5					

COMMENTS: Shear vane #660 - 19mm blade

Hole Depth 3m

Scale 1:20

Rev.: A

HAND AUGER LOG

HOLE Id: **HA3B-18**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5	LOCATION: Arran Drive, Millwater	JOB No.: 21854.0031 - 2018
CO-ORDINATES: 174.667902588844 WGS84 -36.5897446080512	DRILL TYPE: 50mm hand auger	HOLE STARTED: 27/02/2019
		HOLE FINISHED: 27/02/2019
R.L.:	DRILL METHOD: HA	DRILLED BY: T+T
DATUM:		LOGGED BY: RLXB CHECKED: JASM

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
					>214 kPa					M			Clayey SILT, with minor sand, with trace gravel; dark yellowish brown. Hard; low plasticity; moist; sand, fine.
					SS sample @ 0.4m			0.5					
					UTP								
					UTP		38	1.0					
					SS sample @ 0.9m								
					184/70 kPa			1.5					
		100	HA		119/31 kPa								
					159/89 kPa						VSt		Silty CLAY; dark brownish yellow. Very stiff; high plasticity; moist.
					UTP		37	2.0					
					122/61 kPa			2.5					Clayey SILT, with minor sand; dark reddish brown. Very stiff; low plasticity; moist; sand, fine.
	DRY 27/02/2019				141/58 kPa								
					>214 kPa		36	3.0					3m: Target depth
								3.5					

COMMENTS: Shear Vane # 132 - 19mm blade. Topsoil not placed yet.

Hole Depth 3m

Scale 1:20

Rev.: A

HAND AUGER LOG

HOLE Id: **HA3B-19**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5 | LOCATION: Arran Drive, Millwater | JOB No.: 21854.0031 - 2018

CO-ORDINATES: 174.668259322643 -36.589681076516 WGS84

R.L.:

DATUM:

DRILL TYPE: 50 mm hand auger

DRILL METHOD: HA

HOLE STARTED: 27/02/2019

HOLE FINISHED: 27/02/2019

DRILLED BY: T+T

LOGGED BY: RLXB CHECKED: JASM

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
					● UTP					D	H		Clayey SILT; light brown. Hard; non-plastic; dry to moist; Lime stabilised.
					SS sample @ 0.4m			0.5					0.3m: Grades to moist
					● >214 kPa					M			Silty CLAY, with trace sand and gravel; dark brown yellow. Hard; low plasticity; moist; sand, fine, gravel, fine, Sandstone.
					● UTP								
					SS sample @ 0.9m		37	1.0					
					● 119/25 kPa						VSt		With trace sand and gravel; dark brown yellow. Very stiff; moist; sand, fine, gravel, fine, Sandstone.
					● 132/31 kPa			1.5					
					● 165/74 kPa		36	2.0					
					● >214 kPa						H		Clayey SILT, with trace sand and gravel; dark yellow brown. Hard; low plasticity; moist; sand, fine, gravel, fine, Sandstone.
					● >214 kPa			2.5					
	DRY 27/02/2019	100	HA		● >214 kPa		35	3.0					3m: Target depth
					● UTP								
								3.5					

COMMENTS: Shear Vane #132 - 19mm blade. Topsoil not placed yet.

Hole Depth 3m

Scale 1:20

Rev.: A

HAND AUGER LOG

HOLE Id: **HA3B-20**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5	LOCATION: Arran Drive, Millwater	JOB No.: 21854.0031 - 2018
CO-ORDINATES: 174.668939262629 -36.589713380693 WGS84	DRILL TYPE: 50 mm hand auger	HOLE STARTED: 07/03/2019
	DRILL METHOD: HA	HOLE FINISHED: 07/03/2019
R.L.:		DRILLED BY: T+T
DATUM:		LOGGED BY: MTAN CHECKED: OP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
								0.0	TS				Topsoil.
					>214 kPa					D	H		Sandy SILT; brownish yellow. Hard; non-plastic; dry.
					SS sample @ 0.4m			0.5					
					UTP								SILT, with some sand, with minor gravel; greyish brown. Hard; non-plastic; dry; gravel, fine.
					UTP								
					SS sample @ 0.9m		35	1.0					
					UTP								Sandy SILT, with trace gravel; gray. Hard; non-plastic; dry; sand, fine; gravel, fine.
		100	HA		>214 kPa			1.5					
					>214 kPa						VSt		Clayey SILT, with trace sand; brownish yellow. Very stiff; non-plastic; dry; sand, fine.
							34	2.0					Sandy SILT, with minor gravel; brownish yellow. Very stiff; non-plastic; dry; gravel, fine.
					153/74 kPa					D-M			
					136/63 kPa								Clayey SILT, with trace gravel; brownish yellow. Very stiff; low plasticity; dry to moist; gravel, fine to medium.
								2.5					
					UTP						H		Clayey SILT, with some sand, with trace gravel. Hard; low plasticity; dry to moist; sand, fine to medium; gravel, fine to medium.
	DRY 07/03/2019						33	3.0					
					UTP								3m: Target depth
								3.5					

COMMENTS: Shear Vane 132 - 19mm blade

Hole Depth 3m

Scale 1:20

Rev.: A

HAND AUGER LOG

HOLE Id: **HA3B-21**

SHEET: 1 OF 1

PROJECT: Millwater - Arrans Hill Precinct 5	LOCATION: Arran Drive, Millwater	JOB No.: 21854.0031 - 2018
CO-ORDINATES: 174.67021599412 -36.5896563099712 WGS84	DRILL TYPE: 50mm hand auger	HOLE STARTED: 07/03/2019
	DRILL METHOD: HA	HOLE FINISHED: 07/03/2019
R.L.:		DRILLED BY: T+T
DATUM:		LOGGED BY: JASM CHECKED: OP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/100mm) 0 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
									TS				Topsoil.
					169/65 kPa SS sample @ 0.4m			0.5		M	VSt		SILT, with some clay, with trace sand and gravel; greyish orange. Very stiff; low plasticity; moist; gravel, fine to medium.
					153/46 kPa								
					104/36 kPa SS sample @ 0.9m		35	1.0					Clayey SILT, with trace sand; light orangish grey. Very stiff; low plasticity; moist; sand, fine.
		100	HA		114/33 kPa			1.5					
					117/49 kPa		34	2.0					
					130/46 kPa								SILT, with some clay, with minor sand; light orange. Very stiff; low plasticity; moist; sand, fine.
					143/49 kPa			2.5					
	DRY 07/03/2019				163/88 kPa								
					150/91 kPa		33	3.0					3m: Target depth
								3.5					

COMMENTS: Shear Vane 660 - 19mm blade

Hole Depth 3m

Scale 1:20

Rev.: A

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

Earth Works **T&T Job #: 21854.0031**

Entered By:
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)
												Test 1	Test 2	Test 3	Test 4			
S16 177-1	2659626.089	6510994.821	39.89	Above undercut 3	TA	1/12/2016	1.82	**1.35**	**34.9**	2.7	**2.8**	214	214	214	214	**214**		**P**
							1.82	**1.35**	**34.9**	2.7	**2.9**							
S16 177-2	2659613.278	6510997.996	39.948	Above undercut 3	TA	1/12/2016	1.84	**1.40**	**31.4**	2.7	**4.2**	214	214	214	214	**214**		**P**
							1.83	**1.39**	**31.4**	2.7	**4.6**							
S16 177-3	2659593.744	6511003.862	39.288	Above undercut 3	TA	1/12/2016	1.84	**1.39**	**32.0**	2.7	**3.8**	214	214	214	214	**214**		**P**
							1.83	**1.38**	**32.0**	2.7	**4.5**							
S16 177-6	2659594.418	6511015.942	39.748	Above undercut 3	TA	1/12/2016	1.84	**1.36**	**34.9**	2.7	**2.1**	214	214	214	214	**214**		**P**
							1.84	**1.36**	**34.9**	2.7	**1.9**							
S16 177-7	2659627.513	6511012.738	41.342	Above undercut 3	TA	1/12/2016	1.84	**1.41**	**30.4**	2.7	**4.7**	214	214	214	214	**214**		**P**
							1.84	**1.41**	**30.4**	2.7	**5.0**							
S16 178-1	2659625.535	6510968.17	34.345	Undercut 3	TA	2/12/2016	1.83	**1.39**	**31.7**	2.7	**4.3**	214	214	214	214	**214**		**P**
							1.83	**1.39**	**31.7**	2.7	**4.4**							
S16 178-2	2659606.822	6510972.121	34.269	Undercut 3	TA	2/12/2016	1.82	**1.36**	**33.7**	2.7	**3.9**	214	214	214	214	**214**		**P**
							1.79	**1.34**	**33.7**	2.7	**5.4**							
S16 178-3	2659630.385	6510966.774	34.846	Undercut 3	TA	2/12/2016	1.86	**1.42**	**30.7**	2.7	**3.8**	162	214	183	199	**190**		**P**
							1.86	**1.42**	**30.7**	2.7	**3.5**							
S16 178-4	2659598.298	6510974.821	35.377	Undercut 3	TA	2/12/2016	1.89	**1.44**	**30.9**	2.7	**1.9**	177	183	183	199	**186**		**P**
							1.89	**1.44**	**30.9**	2.7	**2.2**							
S16 179-1	2659632.483	6510983.92	39.607	Above undercut 3	TA	5/12/2016	1.82	**1.32**	**37.4**	2.7	**1.6**	214	214	214	214	**214**		**P**
							1.82	**1.32**	**37.4**	2.7	**1.5**							
S16 179-2	2659630.416	6511008.305	41.9	Above undercut 3	TA	5/12/2016	1.82	**1.31**	**38.3**	2.7	**1.0**	214	214	214	214	**214**		**P**
							1.81	**1.31**	**38.3**	2.7	**1.2**							
S16 179-7	2659609.777	6511013.615	42.595	Above undercut 3	TA	5/12/2016	1.87	**1.40**	**32.8**	2.7	**1.9**	174	214	214	199	**200**		**P**
							1.82	**1.37**	**32.8**	2.7	**4.1**							
S16 179-8	2659626.779	6510987.35	40.348	Above undercut 3	TA	5/12/2016	1.84	**1.40**	**31.9**	2.7	**3.7**	214	214	199	199	**207**		**P**
							1.85	**1.40**	**31.9**	2.7	**3.3**							
S16 180-3	2659630.874	6511000.02	42.061	Above undercut 3	TA	6/12/2016	1.81	**1.34**	**34.8**	2.7	**3.4**	214	214	214	214	**214**		**P**
							1.83	**1.36**	**34.8**	2.7	**2.5**							
S16 180-4	2659601.818	6511024.579	42.605	Above undercut 3	TA	6/12/2016	1.79	**1.34**	**34.1**	2.7	**4.9**	214	214	214	214	**214**		**P**
							1.80	**1.34**	**34.1**	2.7	**4.5**							
S16 181-1	2659639.146	6510990.275	40.808	Above undercut 3	TA	7/12/2016	1.81	**1.35**	**33.8**	2.7	**4.3**	156	214	214	199	**196**		**P**
							1.79	**1.34**	**33.8**	2.7	**5.1**							
S16 181-2	2659615.421	6511020.264	43.567	Above undercut 3	TA	7/12/2016	1.80	**1.36**	**32.5**	2.7	**5.7**	196	208	214	214	**208**		**P**
							1.80	**1.36**	**32.5**	2.7	**5.7**							
S16 181-9	2659599.704	6511009.075	42.362	Above undercut 3	TA	7/12/2016	1.81	**1.36**	**33.6**	2.7	**4.3**	214	214	214	214	**214**		**P**
							1.82	**1.37**	**33.6**	2.7	**3.6**							
S16 181-10	2659637.367	6510991.975	41.219	Above undercut 3	TA	7/12/2016	1.81	**1.37**	**32.3**	2.7	**4.9**	214	214	214	214	**214**		**P**
							1.82	**1.38**	**32.3**	2.7	**4.5**							
S16 181-11	2659525.649	6510951.412	19.258	South Gully	TA	7/12/2016	1.81	**1.39**	**29.7**	2.7	**6.9**	214	214	214	214	**214**		**P**
							1.82	**1.40**	**29.7**	2.7	**6.4**							

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

Earth Works **T&T Job #: 21854.0031** **Entered By:**

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)
												Test 1	Test 2	Test 3	Test 4			
S16 182-1	2659868.397	6511101.295	26.311	North Gully	TA	9/12/2016	1.91	**1.55**	**23.5**	2.7	**6.2**	214	214	214	214	**214**		**P**
							1.91	**1.55**	**23.5**	2.7	**6.2**							
S16 184-1	2659689.156	6510987.357	37.53	Above undercut 3	TA	12/12/2016	1.87	**1.43**	**30.6**	2.7	**3.2**	214	214	214	214	**214**		**P**
							1.87	**1.43**	**30.6**	2.7	**3.0**							
S16 184-6	2659702.296	6510990.594	37.716	Above S Gully	TA	12/12/2016	1.86	**1.42**	**30.5**	2.7	**3.9**	214	214	214	214	**214**		**P**
							1.85	**1.42**	**30.5**	2.7	**4.2**							
S16 192-1	2659636.765	6511030.202	42.692	Above undercut 3	TA	20/12/2016	1.88	**1.42**	**32.2**	2.7	**1.4**	168	141	176	206	**173**		**P**
							1.87	**1.42**	**32.2**	2.7	**1.9**							
S16 192-2	2659611.809	6511027.552	43.309	Above undercut 3	TA	20/12/2016	1.81	**1.38**	**31.7**	2.7	**5.4**	214	214	214	214	**214**		**P**
							1.81	**1.38**	**31.7**	2.7	**5.3**							
S16 192-3	2659669.966	6511011.402	41.174	Above undercut 3	TA	20/12/2016	1.89	**1.43**	**31.8**	2.7	**1.4**	214	214	214	214	**214**		**P**
							1.87	**1.42**	**31.8**	2.7	**2.4**							
S16 192-8	2659692.318	6511005.368	41.154	Above undercut 3	TA	20/12/2016	1.84	**1.41**	**29.9**	2.7	**5.4**	214	214	214	214	**214**		**P**
							1.84	**1.41**	**29.9**	2.7	**5.4**							
S16 192-9	2659656.469	6511017.865	44.588	Above undercut 3	TA	20/12/2016	1.75	**1.34**	**30.3**	2.7	**9.6**	214	214	214	214	**214**		**P**
							1.77	**1.36**	**30.3**	2.7	**8.6**							
S16 192-10	2659625.103	6511033.75	44.69	Above undercut 3	TA	20/12/2016	1.84	**1.40**	**31.4**	2.7	**4.2**	214	214	214	214	**214**		**P**
							1.84	**1.40**	**31.4**	2.7	**4.1**							
S16 193-5	2659699.547	6511012.899	41.028	Above undercut 3	TA	21/12/2016	1.85	**1.38**	**33.9**	2.7	**2.2**	214	191	214	214	**208**		**P**
							1.86	**1.39**	**33.9**	2.7	**1.7**							
S16 193-6	2659652.437	6511024.884	43.778	Above undercut 3	TA	21/12/2016	1.78	**1.34**	**32.5**	2.7	**6.6**	214	214	214	214	**214**		**P**
							1.79	**1.35**	**32.5**	2.7	**6.0**							
S16 193-7	2659628.417	6511040.4	44.839	Above undercut 3	TA	21/12/2016	1.86	**1.38**	**34.1**	2.7	**1.5**	214	214	214	214	**214**		**P**
							1.87	**1.39**	**34.1**	2.7	**1.0**							
S16 194-1	2659670.539	6511024.77	44.428	Above undercut 3	TA	22/12/2016	1.83	**1.33**	**37.5**	2.7	**1.0**	214	214	214	214	**214**		**P**
							1.83	**1.33**	**37.5**	2.7	**0.8**							
S16 194-2	2659623.309	6511040.993	44.161	Above undercut 3	TA	22/12/2016	1.88	**1.45**	**29.6**	2.7	**3.3**	214	214	214	214	**214**		**P**
							1.88	**1.45**	**29.6**	2.7	**3.3**							
S16 194-3	2659630.979	6511020.987	42.98	Above undercut 3	TA	22/12/2016	1.88	**1.49**	**26.1**	2.7	**6.0**	214	214	214	214	**214**		**P**
							1.90	**1.51**	**26.1**	2.7	**4.9**							
S17 012-8	2659638.559	6511032.3	44.728	Fill above S Gully	PO	20/01/2017	1.90	**1.41**	**34.6**	2.7	**0.0**	214	214	214	214	**214**		**P**
							1.89	**1.40**	**34.6**	2.7	**0.0**							
S17 012-9	2659680.92	6511021.099	43.425	Fill above S Gully	PO	20/01/2017	1.91	**1.44**	**32.6**	2.7	**0.0**	214	214	214	214	**214**		**P**
							1.92	**1.45**	**32.6**	2.7	**0.0**							
S17 012-10	2659629.51	6511002.239	43.726	Fill above S Gully	PO	20/01/2017	1.95	**1.54**	**26.1**	2.7	**2.6**	214	214	214	214	**214**		**P**
							1.95	**1.54**	**26.1**	2.7	**2.5**							
S17 021-7	2659604.344	6511045.758	45.195	Fill above S Gully	CB	2/02/2017	1.89	**1.47**	**27.9**	2.7	**4.2**	199	214	214	214	**210**		**P**
							1.89	**1.48**	**27.9**	2.7	**4.2**							
S17 021-8	2659641.917	6511040.385	45.33	Fill above S Gully	CB	2/02/2017	1.86	**1.41**	**32.2**	2.7	**2.6**	214	214	214	214	**214**		**P**
							1.86	**1.40**	**32.2**	2.7	**2.8**							
S17 021-9	2659609.499	6511015.616	44.879	Fill above S Gully	CB	2/02/2017	1.80	**1.32**	**36.1**	2.7	**3.1**	183	214	214	214	**206**		**P**
							1.81	**1.33**	**36.1**	2.7	**2.8**							

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

Earth Works **T&T Job #: 21854.0031**

Entered By:
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)
												Test 1	Test 2	Test 3	Test 4			
S17 021-10	2659593.001	6511022.119	44.239	Fill above S Gully	CB	2/02/2017	1.89	**1.51**	**25.1**	2.7	**6.0**	214	214	214	214	**214**		**P**
							1.89	**1.51**	**25.1**	2.7	**6.2**							
S17 039-7	2659614.62	6511020.841	45.384	Undercut 3	CMO	3/03/2017	1.90	**1.49**	**27.7**	2.7	**3.7**	137	168	176	183	**166**		**P**
							1.92	**1.50**	**27.7**	2.7	**2.7**							
S17 039-8	2659626.547	6511006.959	45.157	Undercut 3	CMO	3/03/2017	1.93	**1.55**	**24.7**	2.7	**4.4**	122	84	98	95	**100**		**P**
							1.94	**1.56**	**24.7**	2.7	**4.0**							
S17 039-9	2659602.986	6511054.743	46.179	Undercut 3	CMO	3/03/2017	1.86	**1.50**	**24.4**	2.7	**8.1**	214	214	214	214	**214**		**P**
							1.86	**1.50**	**24.4**	2.7	**8.1**							
S17 039-10	2659594.42	6511046.68	45.547	Undercut 3	CMO	3/03/2017	1.91	**1.45**	**31.9**	2.7	**0.2**	214	214	153	153	**184**		**P**
							1.90	**1.44**	**31.9**	2.7	**0.7**							
S17 165-4	2659708.416	6511158.484	18.574	Undercut 5	CBEN	7/12/2017	1.96	**1.56**	**26.0**	2.7	**2.0**	204	204	204	204	**204**		**P**
							1.95	**1.54**	**26.0**	2.7	**2.7**							
S17 165-5	2659707.392	6511152.006	20.257	Undercut 5	CBEN	7/12/2017	1.95	**1.56**	**25.5**	2.7	**2.8**	204	204	204	204	**204**		**P**
							1.96	**1.56**	**25.5**	2.7	**2.3**							
S17 165-11	2659707.618	6511153.077	21.865	Undercut 5	CBEN	7/12/2017	1.87	**1.50**	**24.9**	2.7	**7.2**	204	204	204	204	**204**		**P**
							1.86	**1.49**	**24.9**	2.7	**7.6**							
S17 165-12	2659709.678	6511152.569	23.229	Undercut 5	CBEN	7/12/2017	1.85	**1.46**	**26.8**	2.7	**6.7**	204	204	204	204	**204**		**P**
							1.86	**1.47**	**26.8**	2.7	**6.4**							
S17 168-6	2659679.662	6511160.068	20.09	Undercut 5	CBEN	11/12/2017	1.78	**1.36**	**31.5**	2.7	**7.1**	204	204	204	204	**204**		**P**
							1.78	**1.36**	**31.5**	2.7	**7.0**							
S17 168-7	2659675.894	6511155.882	21.082	Undercut 5	CBEN	11/12/2017	1.78	**1.36**	**31.3**	2.7	**7.2**	204	204	204	204	**204**		**P**
							1.79	**1.36**	**31.3**	2.7	**6.8**							
S17 168-8	2659687.999	6511149.03	22.276	Undercut 5	CBEN	11/12/2017	1.78	**1.37**	**30.4**	2.7	**7.7**	204	204	204	204	**204**		**P**
							1.79	**1.37**	**30.4**	2.7	**7.7**							
S17 174-3	2659657.034	6511168.597	19.62	Gully 7	CBEN	19/12/2017	1.85	**1.42**	**30.3**	2.7	**4.3**	204	204	204	204	**204**		**P**
							1.86	**1.43**	**30.3**	2.7	**3.8**							
S17 174-4	2659667.788	6511161.869	19.556	Gully 7	CBEN	19/12/2017	1.83	**1.42**	**28.4**	2.7	**6.8**	204	204	204	204	**204**		**P**
							1.85	**1.44**	**28.4**	2.7	**5.7**							
S17 175-2	2659655.298	6511169.612	21.475	Gully 7	CBEN	20/12/2017	1.82	**1.39**	**31.2**	2.7	**5.2**	204	204	204	204	**204**		**P**
							1.82	**1.39**	**31.2**	2.7	**5.2**							
S17 175-3	2659648.443	6511168.076	22.712	Gully 7	CBEN	20/12/2017	1.83	**1.40**	**30.6**	2.7	**5.5**	204	204	204	204	**204**		**P**
							1.81	**1.39**	**30.6**	2.7	**6.1**							
S17 175-5	2659647.434	6511172.562	23.878	Gully 7	CBEN	20/12/2017	1.87	**1.43**	**31.1**	2.7	**2.8**	204	204	204	204	**204**		**P**
							1.88	**1.43**	**31.1**	2.7	**2.5**							
S17 175-6	2659660.706	6511158.92	21.768	Gully 7	CBEN	20/12/2017	1.87	**1.40**	**33.1**	2.7	**1.6**	204	204	204	204	**204**		**P**
							1.88	**1.41**	**33.1**	2.7	**0.8**							
S17 176-3	2659645.523	6511175.38	24.787	Gully 7	CBEN	21/12/2017	1.86	**1.44**	**29.3**	2.7	**4.6**	204	204	204	204	**204**		**P**
							1.86	**1.44**	**29.3**	2.7	**4.3**							
S17 176-4	2659665.767	6511168.875	20.033	Gully 7	CBEN	21/12/2017	1.87	**1.45**	**28.6**	2.7	**4.6**	204	204	204	204	**204**		**P**
							1.86	**1.44**	**28.6**	2.7	**5.2**							
S17 176-7	2659665.207	6511157.372	24.433	Gully 7	CBEN	21/12/2017	1.88	**1.46**	**29.3**	2.7	**3.5**	204	204	204	204	**204**		**P**
							1.88	**1.45**	**29.3**	2.7	**3.6**							
S17 176-8	2659642.637	6511176.03	25.726	Gully 7	CBEN	21/12/2017	1.87	**1.46**	**27.8**	2.7	**5.2**	204	204	204	204	**204**		**P**
							1.87	**1.46**	**27.8**	2.7	**5.2**							

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

Earth Works **T&T Job #: 21854.0031**

Entered By:
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)
												Test 1	Test 2	Test 3	Test 4			
S17 177-3	2659655.802	6511157.437	24.801	Gully 7	CBEN	22/12/2017	1.88	**1.47**	**28.2**	2.7	**4.1**	204	204	204	204	**204**		**P**
							1.88	**1.47**	**28.2**	2.7	**4.2**							
S17 177-4	2659646.617	6511169.003	25.894	Gully 7	CBEN	22/12/2017	1.88	**1.45**	**29.0**	2.7	**4.0**	204	204	204	204	**204**		**P**
							1.89	**1.46**	**29.0**	2.7	**3.3**							
S18 002-5	2659690.191	6511145.884	23.486	Above Road 4	ELHO	9/01/2018	1.92	**1.53**	**26.0**	2.7	**3.8**	204	204	204	204	**204**		**P**
							1.92	**1.52**	**26.0**	2.7	**4.2**							
S18 002-9	2659670.738	6511167.455	18.327	Gully 7	ELHO	9/01/2018	1.78	**1.35**	**32.0**	2.7	**6.9**	204	204	204	204	**204**		**P**
							1.77	**1.34**	**32.0**	2.7	**7.5**							
S18 003-5	2659683.879	6511160.759	17.468	Gully 2	ELHO	10/01/2018	1.86	**1.47**	**26.4**	2.7	**6.7**	204	204	204	204	**204**		**P**
							1.86	**1.47**	**26.4**	2.7	**6.6**							
S18 004-6	2659687.451	6511160.922	16.49	Gully 7	ELHO	11/01/2018	1.89	**1.48**	**28.2**	2.7	**3.6**	204	204	204	204	**204**		**P**
							1.88	**1.47**	**28.2**	2.7	**4.2**							
S18 004-7	2659707.347	6511161.059	17.779	Gully 7	ELHO	11/01/2018	1.88	**1.46**	**28.7**	2.7	**3.7**	204	204	204	204	**204**		**P**
							1.90	**1.47**	**28.7**	2.7	**3.1**							
S18 005-3	2659692.759	6511158.508	18.432	Gully 7	ELHO	12/01/2018	1.82	**1.39**	**31.6**	2.7	**4.9**	204	204	204	204	**204**		**P**
							1.81	**1.38**	**31.6**	2.7	**5.4**							
S18 005-4	2659707.07	6511164.874	20.65	Gully 7	ELHO	12/01/2018	1.84	**1.39**	**32.0**	2.7	**4.0**	204	204	204	204	**204**		**P**
							1.82	**1.38**	**32.0**	2.7	**4.7**							
S18 005-6	2659707.773	6511159.125	20.199	Gully 7	ELHO	12/01/2018	1.90	**1.46**	**30.4**	2.7	**1.8**	204	204	204	204	**204**		**P**
							1.90	**1.46**	**30.4**	2.7	**1.6**							
S18 005-7	2659693.853	6511164.304	19.342	Gully 7	ELHO	12/01/2018	1.90	**1.46**	**30.0**	2.7	**1.8**	204	204	204	204	**204**		**P**
							1.89	**1.45**	**30.0**	2.7	**2.7**							
S18 006-3	2659710.866	6511159.163	21.352	Gully 7	ELHO	15/01/2018	1.78	**1.33**	**33.6**	2.7	**5.8**	204	204	204	204	**204**		**P**
							1.79	**1.34**	**33.6**	2.7	**5.2**							
S18 018-2	2659678.989	6511160.73	21.423	Fill Behind Wall 6	ELHO	31/01/2018	1.88	**1.48**	**27.2**	2.7	**5.0**	204	204	204	204	**204**		**P**
							1.87	**1.47**	**27.2**	2.7	**5.3**							
S18 018-3	2659791.036	6510927.748	22.135	Lots 143-148	ELHO	31/01/2018	1.88	**1.48**	**27.4**	2.7	**4.7**	204	204	204	204	**204**		**P**
							1.88	**1.48**	**27.4**	2.7	**4.7**							
S18 019-1	2659676.397	6511159.463	20.624	Fill Behind Wall 6	ELHO	1/02/2018	1.90	**1.53**	**23.9**	2.7	**6.7**	204	204	204	204	**204**		**P**
							1.91	**1.54**	**23.9**	2.7	**6.2**							
S18 019-2	2659697.03	6511158.077	21.038	Fill Behind Wall 6	ELHO	1/02/2018	1.92	**1.53**	**25.7**	2.7	**4.3**	204	204	204	204	**204**		**P**
							1.91	**1.52**	**25.7**	2.7	**4.9**							
S18 047-4	2659709.607	6510952.24	30.647	Undercut 3	ELHO	19/03/2018	1.81	**1.34**	**35.5**	2.7	**3.0**	204	204	204	204	**204**		**P**
							1.82	**1.34**	**35.5**	2.7	**2.8**							
S18 048-2	2659671.341	6511156.637	23.274	RE Wall 7	ELHO	20/03/2018	1.82	**1.35**	**34.6**	2.7	**3.4**	204	204	204	204	**204**		**P**
							1.80	**1.34**	**34.6**	2.7	**4.0**							
S18 048-3	2659697.605	6511156.471	23.69	RE Wall 7	ELHO	20/03/2018	1.79	**1.33**	**34.5**	2.7	**4.8**	204	204	204	204	**204**		**P**
							1.80	**1.34**	**34.5**	2.7	**4.3**							
S18 049-5	2659677.59	6511155.835	23.763	RE Wall 7	ELHO	21/03/2018	1.81	**1.34**	**34.7**	2.7	**3.6**	204	204	204	204	**204**		**P**
							1.82	**1.35**	**34.7**	2.7	**3.2**							
S18 049-6	2659705.978	6511156.507	23.88	RE Wall 7	ELHO	21/03/2018	1.78	**1.33**	**33.6**	2.7	**5.9**	204	204	204	204	**204**		**P**
							1.80	**1.34**	**33.6**	2.7	**5.0**							
S18 049-9	2659688.419	6511159.84	27.076	RE Wall 7	ELHO	21/03/2018	1.78	**1.32**	**35.0**	2.7	**5.0**	204	204	204	204	**204**		**P**
							1.78	**1.32**	**35.0**	2.7	**5.2**							
S18 050-3	2659573.941	6510903.975	17.659	Shear Key 2	ELHO	22/03/2018	1.84	**1.42**	**29.0**	2.7	**6.1**	204	204	204	204	**204**		**P**
							1.84	**1.42**	**29.0**	2.7	**6.0**							

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

Earth Works **T&T Job #: 21854.0031** **Entered By:**

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)
												Test 1	Test 2	Test 3	Test 4			
S18 050-4	2659697.9	6511158.69	24.674	RE Wall 7	ELHO	22/03/2018	1.80	**1.35**	**33.5**	2.7	**5.0**	204	204	204	204	**204**		**P**
							1.78	**1.34**	**33.5**	2.7	**5.8**							
S18 050-7	2659691.862	6511152.905	25.082	Shear Key 2	ELHO	22/03/2018	1.84	**1.37**	**34.6**	2.7	**1.9**	204	204	204	204	**204**		**P**
							1.84	**1.36**	**34.6**	2.7	**2.3**							
S18 051-1	2659713.303	6511158.983	26.087	RE Wall 7	ELHO	23/03/2018	1.83	**1.38**	**32.7**	2.7	**3.9**	204	204	204	204	**204**		**P**
							1.82	**1.37**	**32.7**	2.7	**4.2**							
S18 051-2	2659676.413	6511158.806	25.64	RE Wall 7	ELHO	23/03/2018	1.81	**1.36**	**33.3**	2.7	**4.3**	204	204	204	204	**204**		**P**
							1.83	**1.38**	**33.3**	2.7	**3.2**							
S18 052-3	2659682.413	6511154.274	26.297	RE Wall 7	CBEN	27/03/2018	1.81	**1.35**	**34.4**	2.7	**3.6**	204	204	204	204	**204**		**P**
							1.82	**1.35**	**34.7**	2.7	**3.3**							
S18 052-4	2659661.994	6511162.216	26.797	RE Wall 7	CBEN	27/03/2018	1.87	**1.42**	**31.5**	2.7	**2.6**	204	204	204	204	**204**		**P**
							1.87	**1.42**	**31.5**	2.7	**2.7**							
S18 053-1	2659679.401	6511150.889	27.302	RE Wall 7	CBEN	28/03/2018	1.83	**1.39**	**32.2**	2.7	**4.1**	175	204	204	160	**186**		**P**
							1.82	**1.38**	**32.2**	2.7	**4.5**							
S18 053-2	2659695.333	6511145.302	27.129	RE Wall 7	CBEN	28/03/2018	1.84	**1.39**	**32.3**	2.7	**3.8**	160	175	160	204	**175**		**P**
							1.82	**1.37**	**32.3**	2.7	**4.7**							
S18 053-3	2659718.295	6511152.884	28.024	RE Wall 7	CBEN	28/03/2018	1.81	**1.37**	**32.2**	2.7	**5.2**	204	204	204	204	**204**		**P**
							1.82	**1.38**	**32.2**	2.7	**4.5**							
S18 053-4	2659692.189	6511151.408	27.892	RE Wall 7	CBEN	28/03/2018	1.82	**1.38**	**32.3**	2.7	**4.5**	204	204	204	204	**204**		**P**
							1.81	**1.36**	**32.3**	2.7	**5.4**							
S18 054-1	2659693.708	6511148.469	27.905	RE Wall 7	CBEN	29/03/2018	1.87	**1.44**	**29.5**	2.7	**4.1**	204	204	204	204	**204**		**P**
							1.89	**1.46**	**29.5**	2.7	**3.0**							
S18 054-2	2659667.162	6511158.6	22.652	RE Wall 7	CBEN	29/03/2018	1.86	**1.44**	**29.7**	2.7	**4.1**	204	204	204	204	**204**		**P**
							1.88	**1.45**	**29.7**	2.7	**3.4**							
S18 054-3	2659683.548	6511154.841	28.472	RE Wall 7	CBEN	29/03/2018	1.84	**1.41**	**31.0**	2.7	**4.3**	204	204	204	204	**204**		**P**
							1.83	**1.40**	**31.0**	2.7	**4.8**							
S18 057-3	2659691.425	6511145.452	28.638	RE Wall 7	CBEN	5/04/2018	1.83	**1.41**	**29.7**	2.7	**5.6**	204	204	204	204	**204**		**P**
							1.83	**1.41**	**29.7**	2.7	**5.6**							
S18 057-4	2659668.397	6511149.404	28.193	RE Wall 7	CBEN	5/04/2018	1.84	**1.42**	**29.7**	2.7	**5.4**	204	204	204	204	**204**		**P**
							1.84	**1.42**	**29.7**	2.7	**5.3**							
S18 057-5	2659654.321	6511164.692	28.743	RE Wall 7	CBEN	5/04/2018	1.84	**1.43**	**29.1**	2.7	**5.6**	204	204	204	204	**204**		**P**
							1.83	**1.42**	**29.1**	2.7	**6.1**							
S18 058-1	2659717.136	6511146.735	28.933	RE Wall 7	CBEN	6/04/2018	1.81	**1.38**	**30.8**	2.7	**6.1**	204	204	204	204	**204**		**P**
							1.83	**1.40**	**30.8**	2.7	**5.2**							
S18 058-2	2659693.605	6511147.968	29.126	RE Wall 7	CBEN	6/04/2018	1.82	**1.40**	**30.3**	2.7	**5.8**	204	204	204	204	**204**		**P**
							1.81	**1.39**	**30.3**	2.7	**6.3**							
S18 058-5	2659710.19	6511136.835	28.945	RE Wall 7	CBEN	6/04/2018	1.85	**1.44**	**28.1**	2.7	**6.1**	204	204	204	204	**204**		**P**
							1.85	**1.44**	**28.1**	2.7	**6.0**							
S18 059-1	2659684.963	6511134.835	29.795	RE Wall 7	CBEN	9/04/2018	1.89	**1.49**	**26.9**	2.7	**4.9**	204	204	204	204	**204**		**P**
							1.88	**1.48**	**26.9**	2.7	**5.4**							
S18 059-4	2659747.704	6510969.321	29.982	Undercut above Rd 2	CBEN	9/04/2018	1.88	**1.41**	**33.8**	2.7	**0.4**	204	204	204	204	**204**		**P**
							1.89	**1.41**	**33.8**	2.7	**0.1**							
S18 059-5	2659617.834	6511191.659	30.448	RE Wall 7	CBEN	9/04/2018	1.90	**1.49**	**27.9**	2.7	**3.4**	204	204	204	204	**204**		**P**
							1.90	**1.49**	**27.9**	2.7	**3.6**							
S18 061-4	2659707.327	6511142.48	30.966	RE Wall 7	CBEN	13/04/2018	1.88	**1.50**	**25.4**	2.7	**6.2**	160	204	204	204	**193**		**P**
							1.89	**1.51**	**25.4**	2.7	**5.7**							

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

Earth Works **T&T Job #: 21854.0031** **Entered By:**

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)
												Test 1	Test 2	Test 3	Test 4			
S18 061-5	2659687.417	6511142.766	30.774	RE Wall 7	CBEN	13/04/2018	1.90	**1.50**	**26.2**	2.7	**4.9**	160	160	204	204	**182**		**P**
							1.90	**1.51**	**26.2**	2.7	**4.6**							
S18 064-1	2659710.37	6511134.711	31.173	RE Wall 7	ELHO	19/04/2018	1.81	**1.36**	**33.2**	2.7	**4.5**	175	204	182	175	**184**		**P**
							1.82	**1.37**	**33.2**	2.7	**4.1**							
S18 064-2	2659676.742	6511146.286	31.087	RE Wall 7	ELHO	19/04/2018	1.83	**1.40**	**30.6**	2.7	**5.0**	204	204	175	175	**190**		**P**
							1.83	**1.40**	**30.6**	2.7	**5.3**							
S18 065-1	2659708.962	6511132.918	31.192	RE Wall 7	ELHO	20/04/2018	1.86	**1.42**	**31.2**	2.7	**3.4**	204	204	204	204	**204**		**P**
							1.86	**1.42**	**31.2**	2.7	**3.1**							
S18 065-2	2659692.393	6511139.74	31	RE Wall 7	ELHO	20/04/2018	1.87	**1.43**	**30.5**	2.7	**3.2**	204	204	204	204	**204**		**P**
							1.87	**1.43**	**30.5**	2.7	**3.3**							
S18 065-3	2659642.114	6511164.877	31.738	RE Wall 7	ELHO	20/04/2018	1.80	**1.37**	**32.0**	2.7	**5.6**	160	190	204	204	**190**		**P**
							1.81	**1.37**	**32.0**	2.7	**5.6**							
S18 066-1	2659711.14	6511138.126	31.557	RE Wall 7	SABY	23/04/2018	1.87	**1.44**	**29.4**	2.7	**4.1**	204	204	204	204	**204**		**P**
							1.86	**1.43**	**30.2**	2.7	**4.0**							
S18 066-2	2659690.153	6511140.535	31.458	RE Wall 7	SABY	23/04/2018	1.85	**1.38**	**34.1**	2.7	**2.1**	204	204	204	204	**204**		**P**
							1.84	**1.41**	**30.2**	2.7	**5.1**							
S18 066-7	2659673.061	6511145.706	32.213	RE Wall 7	SABY	23/04/2018	1.88	**1.49**	**26.1**	2.7	**5.8**	204	204	204	204	**204**		**P**
							1.89	**1.51**	**24.8**	2.7	**6.5**							
S18 066-8	2659700.257	6511141.657	32.223	RE Wall 7	SABY	23/04/2018	1.88	**1.53**	**23.2**	2.7	**7.9**	204	148	204	204	**190**		**P**
							1.89	**1.52**	**23.9**	2.7	**7.1**							
S18 067-1	2659650.352	6511161.335	32.437	RE Wall 7	SABY	24/04/2018	1.89	**1.43**	**31.6**	2.7	**1.6**	204	204	204	204	**204**		**P**
							1.89	**1.44**	**31.1**	2.7	**1.7**							
S18 067-2	2659649.496	6511134.994	31.662	RE Wall 7	SABY	24/04/2018	1.79	**1.31**	**36.2**	2.7	**3.9**	204	204	204	204	**204**		**P**
							1.80	**1.33**	**35.4**	2.7	**3.9**							
S18 067-3	2659643.29	6511149.434	31.788	RE Wall 7	SABY	24/04/2018	1.81	**1.37**	**31.7**	2.7	**5.5**	146	160	175	204	**171**		**P**
							1.80	**1.38**	**30.3**	2.7	**6.8**							
S18 067-4	2659662.314	6511137.96	31.659	RE Wall 7	SABY	24/04/2018	1.85	**1.45**	**27.5**	2.7	**6.5**	140	175	190	204	**177**		**P**
							1.83	**1.41**	**29.4**	2.7	**6.1**							
S18 069-2	2659688.876	6511129.421	33.611	RE Wall 7	SABY	27/04/2018	1.86	**1.41**	**31.8**	2.7	**3.0**	204	204	204	204	**204**		**P**
							1.85	**1.40**	**31.7**	2.7	**3.6**							
S18 069-3	2659591.604	6511206.018	32.471	RE Wall 7	SABY	27/04/2018	1.90	**1.47**	**29.0**	2.7	**3.0**	175	190	190	204	**190**		**P**
							1.87	**1.43**	**30.4**	2.7	**3.5**							
S18 071-1	2659675.237	6511124.681	33.276	RE Wall 7	ELHO	3/05/2018	1.81	**1.34**	**35.2**	2.7	**3.1**	204	204	204	204	**204**		**P**
							1.82	**1.35**	**35.2**	2.7	**2.5**							
S18 071-2	2659649.046	6511134.628	32.183	RE Wall 7	ELHO	3/05/2018	1.77	**1.28**	**38.7**	2.7	**3.1**	204	204	204	204	**204**		**P**
							1.77	**1.27**	**38.7**	2.7	**3.5**							
S18 072-1	2659657.944	6511129.185	32.243	RE Wall 7	ELHO	4/05/2018	1.71	**1.20**	**42.0**	2.7	**5.0**	140	140	190	140	**153**		**P**
							1.79	**1.26**	**42.0**	2.7	**0.5**							
S18 072-2	2659629.845	6511159.141	32.076	RE Wall 7	ELHO	4/05/2018	1.78	**1.32**	**35.3**	2.7	**4.6**	146	160	175	204	**171**		**P**
							1.79	**1.32**	**35.3**	2.7	**4.5**							
S18 073-1	2659659.043	6511131.928	34.582	RE Wall 7	ELHO	7/05/2018	1.81	**1.32**	**37.1**	2.7	**2.3**	204	204	204	204	**204**		**P**
							1.81	**1.32**	**37.1**	2.7	**2.1**							
S18 073-2	2659640.159	6511145.099	32.178	RE Wall 7	ELHO	7/05/2018	1.79	**1.31**	**36.3**	2.7	**3.6**	140	175	190	190	**174**		**P**
							1.79	**1.31**	**36.3**	2.7	**4.0**							
S18 073-5	2659651.146	6511151.027	32.108	RE Wall 7	ELHO	7/05/2018	1.81	**1.29**	**40.1**	2.7	**0.4**	140	140	146	146	**143**		**P**
							1.80	**1.29**	**40.1**	2.7	**0.8**							

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

Earth Works **T&T Job #:** **21854.0031** **Entered By:**

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)
												Test 1	Test 2	Test 3	Test 4			
S18 074-4	2659704.085	6511117.21	34.934	RE Wall 7	ELHO	8/05/2018	1.82	**1.36**	**33.4**	2.7	**4.0**	204	204	204	190	**201**		**P**
							1.84	**1.38**	**33.4**	2.7	**3.0**							
S18 075-1	2659670.106	6511125.133	34.812	RE Wall 7	ELHO	9/05/2018	1.72	**1.28**	**34.5**	2.7	**8.4**	204	204	204	204	**204**		**P**
							1.75	**1.30**	**34.5**	2.7	**7.0**							
S18 075-2	2659639.98	6511138.976	33.62	RE Wall 7	ELHO	9/05/2018	1.78	**1.34**	**32.8**	2.7	**6.6**	204	204	204	204	**204**		**P**
							1.79	**1.35**	**32.8**	2.7	**6.0**							

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

Earth Works **T&T Job #:** **21854.0031** **Entered By:**

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)
												Test 1	Test 2	Test 3	Test 4			
S18 076-2	2659623.402	6511155.914	35.341	RE Wall 7	ELHO	10/05/2018	1.81	**1.35**	**33.8**	2.7	**4.2**	204	204	204	204	**204**		**P**
							1.81	**1.35**	**33.8**	2.7	**4.4**							
S18 076-3	2659774.636	6511009.644	34.587	Undercut above wall 6	ELHO	10/05/2018	1.85	**1.46**	**27.2**	2.7	**6.4**	204	204	204	204	**204**		**P**
							1.87	**1.47**	**27.2**	2.7	**5.4**							
S18 076-5	2659782.893	6511013.892	35.757	Undercut above wall 6	ELHO	10/05/2018	1.89	**1.39**	**35.7**	2.7	**0.0**	140	160	204	204	**177**		**P**
							1.90	**1.40**	**35.7**	2.7	**0.0**							
S18 077-1	2659644.19	6511134.051	35.665	RE Wall 7	ELHO	11/05/2018	1.84	**1.36**	**35.4**	2.7	**1.6**	204	204	204	204	**204**		**P**
							1.83	**1.35**	**35.4**	2.7	**1.9**							
S18 078-2	2659738.498	6511004.974	34.007	Undercut above wall 6	ELHO	15/05/2018	1.84	**1.41**	**30.0**	2.7	**5.2**	204	204	204	204	**204**		**P**
							1.84	**1.41**	**30.0**	2.7	**5.4**							
S18 079-1	2659628.004	6511139.184	35.493	RE Wall 7	ELHO	16/05/2018	1.76	**1.29**	**35.9**	2.7	**5.6**	146	160	160	204	**168**		**P**
							1.76	**1.29**	**35.9**	2.7	**5.7**							
S18 079-3	2659638.497	6511127.086	35.283	RE Wall 7	ELHO	16/05/2018	1.80	**1.34**	**34.6**	2.7	**4.3**	175	175	204	204	**190**		**P**
							1.79	**1.33**	**34.6**	2.7	**4.7**							
S18 081-1	2659822.013	6511089.67	32.13	undercut end of rd 4	ELHO	21/05/2018	1.79	**1.29**	**39.0**	2.7	**1.9**	140	140	175	204	**165**		**P**
							1.78	**1.28**	**39.0**	2.7	**2.6**							
S18 084-4	2659814.984	6511090.657	33.044	undercut end of rd 4	ELHO	29/05/2018	1.79	**1.31**	**36.3**	2.7	**3.8**	204	146	146	160	**164**		**P**
							1.79	**1.32**	**36.3**	2.7	**3.6**							
S18 085-1	2659804.043	6511090.924	32.799	undercut end of rd 4	ELHO	30/05/2018	1.80	**1.38**	**30.6**	2.7	**6.8**	148	162	162	207	**170**		**P**
							1.80	**1.38**	**30.6**	2.7	**6.8**							
S18 106-1	2659794.319	6511045.538	36.375	Super Lot	CBEN	4/07/2018	1.76	**1.25**	**40.5**	2.7	**3.1**	162	148	148	162	**155**		**P**
							1.74	**1.24**	**40.5**	2.7	**4.2**							
S18 107-2	2659803.887	6511060.041	35.583	Super Lot	CBEN	5/07/2018	1.76	**1.31**	**34.9**	2.7	**6.1**	148	148	177	162	**159**		**P**
							1.76	**1.30**	**34.9**	2.7	**6.2**							

www.tonkintaylor.co.nz