ENGEO

Expect Excellence

Geotechnical Investigation Report Rev 1

Corner of SH1 and Port Marsden Highway (SH15A)

Ruakaka

Submitted to:

SK Aotearoa Trust
45 Great North Road
Kamo
Whangarei 0112

ENGEO Limited
8 Greydene Place, Takapuna, Auckland 0622
PO Box 33-1527, Takapuna, Auckland 0740
Tel +64 9 972 2205 Fax +64 3 328 9013
www.engeo.co.nz

05.11.2020
16234.000.000_04

ACENZ

Contents

Tables

Figures

Appendices

ENGEO Document Control:

Report Title	Geotechnical Investigation - Corner of SH1 and Port Marsden Highway (SH15A), Ruakaka			
Project No.	16234.000.000	Doc ID	04	
Client	SK Aotearoa Trust	Client Contact	Simon Tan	
Distribution (PDF)	SK Aotearoa Trust, Blue Barn Consultants, Tattico			
Date	Revision Details/Status	WP	Author	Reviewer
01/08/2019	Issued to Client	DF	DCB	PF
05/11/2020	Rev 1 – Updated Plans	JT	LEG	PF

1 Introduction

ENGEO Ltd was requested by Simon Tan on behalf of the SK Aotearoa Trust to undertake a geotechnical investigation for a new service centre proposed at the corner of State Highway 1 (SH1) and the Port Marsden Highway (SH15A). This work has been carried out in accordance with our signed agreement dated 29 May 2019 (reference P2019.001.018) and the variation agreement dated 28 June 2019. This report has been revised to reference an updated development plan set, and supersedes our previous report issued on 2 August 2019.

The purpose of our services is to provide preliminary geotechnical information to inform site development works and structural design, while also supporting the Resource Consent application. Our scope of works comprised the following:

- Review of published geotechnical and geological information relevant to the site, including the New Zealand Geotechnical Database (NZGD).
- Site assessment by an experienced ground engineering professional to evaluate the current landform, and identify evidence of natural hazards that may affect the development.
- Drill eight hand auger boreholes with associated *in situ* strength testing (Scala penetrometer and / or shear vane) to practical refusal or 5 m depth, to establish an understanding of the near surface soil profile.
- Coordination and technical logging of one day of test pits to support recommendations that *in situ* materials be reused within earthworks.
- Completion of nine Scala penetrometer tests (Scalas) within the proposed paved access-ways and parking areas to provide an indicative CBR for the site.
- Assessment of the potential site geohazards relevant to the proposed development, as well as an assessment against Section 106 of the Resource Management Act 1991.
- Preparation of a geotechnical report based on the findings of our enquiries and ground investigation, including recommendations and geotechnical parameters for future building foundations, and development earthworks. This report will be suitable to accompany the Resource Consent application and inform current structural design.

Our scope of works does not include any detailed design, detailed liquefaction assessments, or laboratory testing.

2 Site Description

The site is located immediately north of the road intersection formed by SH1 and the Port Marsden Highway (Figure 1). The site is bound by SH1 to the southwest, Port Marsden highway to the east, and neighbouring grass pastures to the north. The site is located approximately 1.7 km from the Ruakaka River estuary and 3.0 km from the coastline.

The site is broadly level and is currently utilised predominantly as grassed land for pasture. Within the northern section of site, there is an unnamed river flowing west to east. There is also an irrigation channel within the southern section of site. An existing residential dwelling and implement shed is located in the near the centre of the site.

3 Proposed Development

We have been provided with the following documents and plans in preparation of this report:

- Buchan Architects – Resource Consent plan set dated 30 September 2020 (ref: 917004). Attached in Appendix 1.
- Maven Associates – Civil Resource Consent plan set dated October 2020 (ref: 117019). Attached in Appendix 2.

The proposed site layout is presented within the Buchan plans and depicts that the proposed development includes construction of a petrol station, café and retail spaces along with associated paved access ways and car parking for cars and long-haul trucks. Formation of a wetland and stormwater retention pond is proposed in the north, beyond the proposed buildings and car parking. The proposed petrol station is located in the southern area.

The development works are predominantly located in the south-eastern half of the site, and the extent of earthworks are largely located in the southern half of the site. Filling is proposed in the building and parking areas to raise the ground level above the expected 100 year flood level. Approximately 25,000 m^3 of filling is proposed, with a maximum fill thickness of 2.0 m, and approximately 4,500 m^3 of cutting is proposed with a maximum cut depth of 1.0 m.

In addition to the bulk earthworks, we anticipate cuts will be required in association with installation of the petrol tanks. The installation depth of the tanks is not yet determined. However, we understand through correspondence that the petrol tanks are likely to consist of 80,000 L capacity tanks, which have an approximate depth of 3.2 m. Therefore we anticipate an excavation depth on the order of 5 m is required for the tanks, allowing for approximately 0.5 m of slab preparation and on the order of 1 m of fill cover to create a trafficable area.

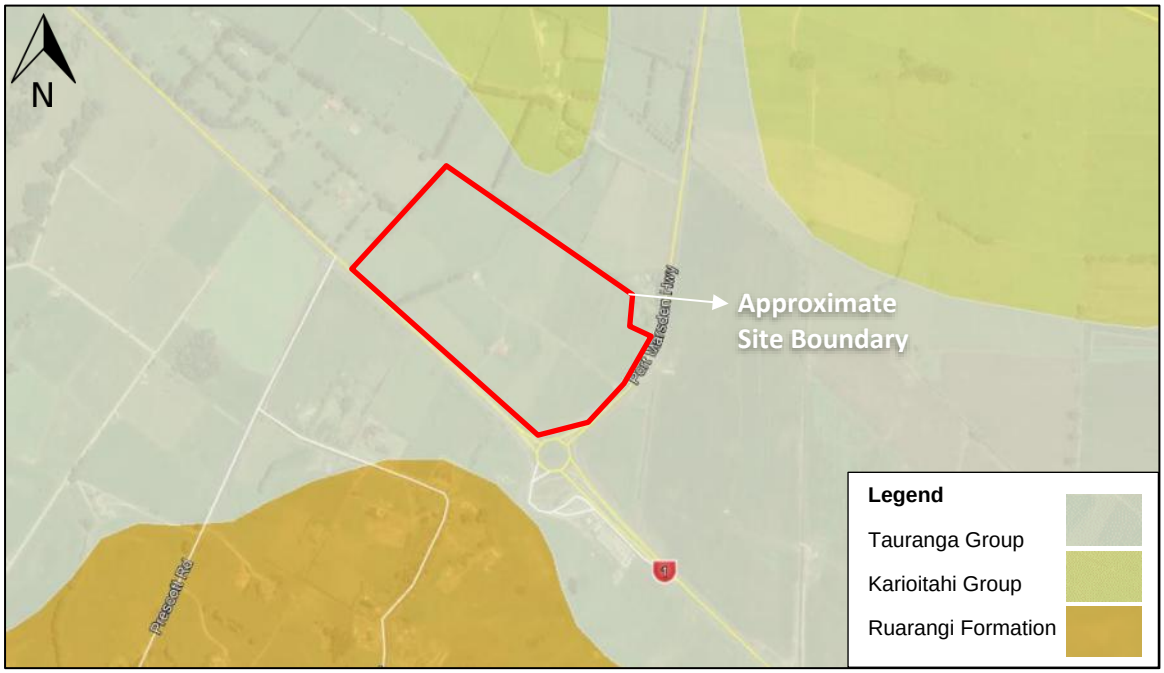
4 Area Wide Geotechnical Data

4.1 Regional Geology

The site is mapped by GNS (Edbrooke and Brook, 2009) as being underlain by Tauranga Group soils (Figure 1), which are described as unconsolidated to poorly consolidated mud, sand, gravel and peat deposits of alluvial, colluvial and lacustrine origins.

To the north and northeast of the site are areas underlain by Karioitahi Group, which comprises weakly cemented and fixed transverse dune ridges. To the south of the site is an area mapped as being underlain by Ruarangi Formation, which comprises laminated to thin-bedded, calcareous siltstone with rate, interbedded shelly sandstone.

Figure 1: Geological Map



Excerpt from Google Maps with GNZ Geological Unit QMap overlay. Not to scale.

4.2 New Zealand Geotechnical Database

We have reviewed the New Zealand Geotechnical Database, to identify subsurface investigations previously completed within the vicinity of the site. However, from our review, the nearest available subsurface investigation was completed over 6 km southeast of the site. As such, we do not consider this to be representative of the site conditions and have not considered this further in our assessment.

4.3 Seismicity

We have reviewed the New Zealand Active Faults Database, which indicates no **active** faults on-site. The nearest mapped active fault is the Wairoa North Fault located approximately 130 km south of the site. The fault dips at approximately 60° to 70° to the west, and has a vertical slip rate of 0.1 mm / year. GNS have not established a recurrence interval and date for the last rupture event.

4.4 Volcanic Activity

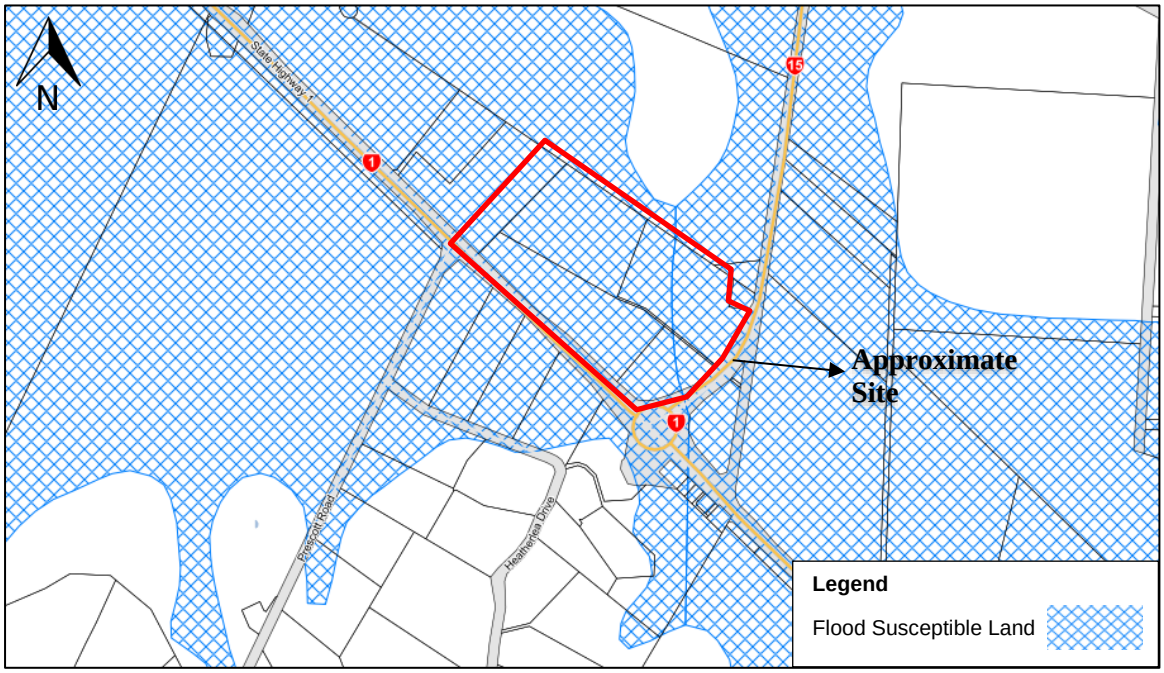
The Northland Volcanic Arc comprised two belts of volcanoes that erupted along both sides of Northland and Auckland between 23 and 15 million years ago (Hayward, Bruce, 2017). The western belt (Waitakere Group) consists primarily of the Hukatere and Waipoua Subgroups and include numerous offshore volcanoes. Hukatere Subgroup rocks outcrop between Waihue and the Kaipara Harbour and consist of remnants of several small satellite volcanoes. Waipoua Subgroup is located within the Hokianga-Kaihu area and primarily includes basalt flows, notably those capping the Tutamoe Range north of Dargaville, and volcanic derived sediments, such as the Omapere Conglomerate within the Hokianga-Kaihu area. Tutamoe is the onshore remnant of a large submarine shield volcano mapped offshore by geophysical methods (Edbrooke and Brook, 2009).

As such, further low-magnitude eruptions are unlikely, as it is generally considered that the volcanic fields within the Kaipara have a relatively low recurrence interval.

4.5 Flooding

The site is mapped by the Whangarei District Council as being within an area that is susceptible to flooding as indicated in Figure 2.

Figure 2: Mapped Flood Zones



Excerpt retrieved June 2019 from Whangarei District Council IntraMaps (http://gis.wdc.govt.nz/intramaps90/?project=Whangarei&configId=0df84abb-1e1f-4b1c-a202-d198446d9c4e).

4.6 Historical Aerial Photography

Aerial photographs dating from 1961 to 2018 sourced from Retrolens and Google Earth Pro have been reviewed as part of this investigation. The review showed that the current land use has been consistent through the recorded history with some movement of building and farm tracks.

5 Site Investigation

5.1 Site Observations

ENGEO visited the site on 7 June and 11 July 2019 and made the following observations (see photos presented in Figure 3):

- The site is undeveloped and is currently used for pasture (Figure 3 - Photos 1 and 2).
- The landform is broadly flat across the site. There is an irrigation channel within the central section of site (Figure 3 - Photos 3 and 4).
- There is a dwelling and associated shed near the centre of the site.
- Within the central area there is an assumed water bore for irrigation (Figure 3 - Photo 4).
- The site appears to be low lying.

Figure 3: Site Photographs

Photo 1: View south along the southern boundary of site.

Photo 2: View south within the northern section of site.

Photo 3: View north, within the northern section of site.

Photo 4: View north within the northern section of site, showing an assumed water bore with the overland slow path in the back.

5.2 Shallow Subsurface Investigations

5.2.1 Hand Auger Boreholes

During the 7 June 2019 site visit, ENGEO completed eight hand auger boreholes with associated Shear Vane and Scala penetrometer testing at the locations presented in Appendix 3. The investigations extended to variable depths of between 2.7 m and 4.3 m before reaching practical refusal on hard ground. Hand auger borehole HA04 met practical refusal due to poor recovery at 2.7 m depth.

Full borehole logs are presented within Appendix 4 to this report, and are written in accordance with the New Zealand Geotechnical Society field classification guidelines (NZGS, 2005).

5.2.2 Scala Penetrometer

In addition to the hand auger boreholes, ENGEO completed nine additional Scala penetrometer tests to a target depth of 1.0 m at the locations presented in Appendix 3.

Full Scala penetrometer logs are presented within Appendix 5 of this report.

5.2.3 Test Pits

ENGEO completed a supplementary test pit investigation on 11 July 2019. This work was undertaken following discussion of the initial hand auger results - to assist in assessing the suitability of local materials for reuse as structural fill. ENGEO completed nine test pits with associated Shear Vane and Scala penetrometer testing at the locations presented in Appendix 3. The test pits were advanced to termination depths ranging from 3.1 m to 4.5 m.

Full test pit logs are presented within Appendix 6 to this report, and are written in accordance with the New Zealand Geotechnical Society field classification guidelines (NZGS, 2005).

5.3 Summary of Subsurface Investigations

5.3.1 Development Area

The materials encountered in our subsurface investigations are broadly consistent with published mapping, and are summarised in Table 1.

Within the eastern development area, topsoil was encountered to depths ranging between 0 to 0.3 m within the majority of the hand auger borehole locations. HA08 did not record any topsoil and penetrated directly into filled ground.

Undocumented fill was encountered underlying the topsoil within HA01, HA02, HA05, HA07, and from the ground surface in HA08. The fill was encountered to a maximum depth of 0.5 m below existing ground level and generally consisted of firm to hard material, intermixed brown and orange clay / silt with trace sand. We consider that this fill is likely associated with historical agriculture.

Firm to hard clay soils were encountered underlying the fill, extending to a maximum depth of 3.4 m. A thin organic layer was encountered at a typical depth of 0.8 m to 1.0 m. These organic soils typically consisted of organic stained soils with trace rootlets and other fibrous organic inclusions.

Under laying the alluvial material, soils of the Ruarangi Formation (mapped at the surface, south of SH1) were encountered at between 1.9 m depth and 3.4 m depth. On the basis of investigations undertaken to date it appears that the upper surface of this material is dipping to the northwest. These soils (as recovered in the hand auger boreholes), generally consist of dark bluish grey, highly sheared and differentiated clayey silt with variable sand content.

Table 1: Summary of Subsurface Conditions – Development Footprint

Depth (m)	Soil Type	Material Strength
0 – 0.3	Topsoil[1]	NA[2]
0 – 0.5	FILL Typically comprising of varying amounts of sand with gravel, silt and clay	Firm to Hard
0.1 – 4.3	Alluvium – Clayey SILT / Silty CLAY Typically comprising alternating silt and clay with the presence of varying sand and trace to some organics	Firm to Hard
0.8 -1.0	Organic clays and silts with minor organic inclusions	N/A
0.9 – 1.50	Alluvium – Clayey SILT / Silty CLAY Typically comprising alternating silt and clay with the presence of varying sand and trace to some organics	Firm to Hard
1.5 – 3.8	Ruarangi Formation Completely weathered laminated to thin-bedded, calcareous siltstone with rate, interbedded shelly sandstone. Recovered as stiff to hard blue/ grey clays and silts	Hard

[1]Topsoil was encountered within all Hand Auger Boreholes with the exception of HA08

[2]NA = Not Assessed

5.3.2 North-Western Borrow Pit Area

Topsoil was encountered between 0 m to 0.25 m depth at all test pit locations.

Undocumented fill was not encountered within this section of site.

The soil profile within this portion of the site typically comprises stiff to hard alluvial clays and silts which extend to an average depth of between 1.3 and 2.9 m averaging 2.0 m. A thin (approximately 100 to 200 mm thick) organic silt horizon with minor to some fibrous organic inclusions was encountered within this layer at approximately 0.8 m depth.

Grey sands, silts and clay with some remnant rock fabric were encountered underlying the alluvial clays and are interpreted to comprise completely weathered Ruarangi Formation soils with some highly weathered rock inclusions.

Table 2: Summary of Subsurface Conditions – Borrow Pit Area

Depth (m)	Soil Type	Consistency / Density
0 – 0.25	Topsoil[1]	NA[2]
0.1 – 2.9	Alluvium – Clayey SILT / Silty CLAY Typically comprising alternating silt and clay with the presence of varying sand and trace to some organics	Stiff to Hard
0.8 – 1.10	Organic SILT Typically comprising organic stained silt with some fibrous organics and occasional wood	Very Stiff
1.3 – 4.5	Ruarangi Formation Completely weathered laminated to thin-bedded, calcareous siltstone with rate, interbedded shelly sandstone. Recovered as stiff to hard blue/ grey clays and silts	Loose to Medium Dense / Hard

[1]Topsoil was encountered at all Test Pit locations

[2]NA = Not Assessed

5.4 Groundwater

Groundwater was encountered within the hand auger boreholes undertaken across the proposed development footprint at variable depths of between 1.5 m and 2.3 m below ground level when dipped at the end of the day.

The test pit investigations recorded groundwater within the proposed borrow pit area at depths ranging from 2.5 m to 4.0 m below ground level. TP09 which was undertaken in the centre of the site did not encounter any groundwater.

Variation in recorded groundwater levels between test pits and hand auger boreholes may occur due to test pits only being open for a short period of time before being backfilled. The hand auger boreholes were open longer and were dipped at the end of the day.

Groundwater levels recorded during this investigation are presented in Table 3. At this preliminary stage, it is considered that ground water should be assumed at 1.5 m depth below current ground level across the site.

Table 3: Groundwater Depths

Investigation Reference	Depth (m)	Investigation Reference	Depth (m)
HA01	2.2	TP01	3.1
HA02	2.3	TP02	3.2
HA03	1.9	TP03	4.0
HA04	2.5	TP04	2.5
HA05	2.1	TP05	2.5
HA06	1.5	TP06	2.7
HA07	1.8	TP07	3.5
HA08	1.9	TP08	2.8
-	-	TP09	Not Encountered

6 Geohazards and Geotechnical Assessment

6.1 Expansive Soil

No expansive soil testing was undertaken as part of this preliminary assessment. Expansive soil testing will be required prior to detailed design to determine the expansive site classification in line with AS2870.

6.2 Soil Classification

This site is considered suitable for a seismic site class of C: Shallow Soils, in keeping with NZS1170.5.

6.3 Seismic Hazards

While there are no active faults located within the nearby site area and the Northland region is generally considered to be relatively stable from a tectonic perspective, the site may still be at risk from large earthquakes centered elsewhere in New Zealand.

Potential seismic hazards resulting from moderate to major earthquakes can generally be classified as primary and secondary. Primary hazards comprise ground rupture (also called surface faulting), while common secondary seismic hazards include ground shaking, ground lurching, regional subsidence or uplift, soil liquefaction, lateral spreading, landslides, tsunamis, flooding, or seiches.

Due to the proximity of the site to the nearest active fault line we consider the likelihood of ground rupture to be low. Additionally, based on the site location and topography, we consider the risk from landslides and seiches to be low.

The following sections present a discussion of the other seismic hazards as they apply to the site.

6.3.1 Ground Shaking

We understand that the proposed development includes the construction of a petrol station, café and retail spaces. We have assumed that these structures are Importance Level 2 (IL2) in accordance with NZS 1170.5:2004, and as such they should be designed to resist earthquake shaking with an annual probability of exceedance of 1/500 (i.e. a 500 year return period). This is the Ultimate Limit State (ULS) design seismic loading. Structures are expected to retain their structural integrity during the ULS earthquake, and not collapse or endanger life. Furthermore, Importance Level 2 buildings should sustain little or no structural damage under a Serviceability Limit State (SLS) design load case, which is based on earthquake shaking with a 25 year return period.

Peak horizontal ground accelerations (a_{max}) have been calculated in accordance with MBIE / NZGS Module 1 (2016) using the following formula:

a_{max} = $C_{0,1000}$ R f g / 1.3

$C_{0,1000}$ = 0.16 for Ruakaka (Table 6A.1 – Addendum 6A of the bridge manual , 2016)

R = 1.0 for a 500 year return period event (NZS1170.5) (ULS)

0.25 for a 25 year return period event (NZS1170.5) (SLS)

F = 1.00 for Class D

Thus a_{max} = 0.16 x 1.0 x 1.00 g / 1.3 = 0.12 g for ULS

= 0.16 x 0.25 x 1.00 g / 1.3 = 0.03 g for SLS

The effective earthquake magnitude can be taken as 5.6 for the ULS case.

6.3.2 Liquefaction and Lateral Spreading

Soil liquefaction results from loss of strength during cyclic loading, such as imposed by earthquakes. Soils most susceptible to liquefaction are clean, loose, saturated, uniformly graded, fine-grained, cohesionless materials. Empirical evidence indicates that loose to medium dense gravels, silty sands, low-plasticity silts, and some low-plasticity clays are also potentially liquefiable. These soils have been identified in our hand auger boreholes and confirmed with laboratory testing.

When seismic ground shaking occurs, the soil is subjected to cyclic shear stresses that can cause excess hydrostatic pressures to develop. If excess hydrostatic pressures exceed the effective confining stress of the soil, the soil is considered to have liquefied. If the soil consolidates or vents to the surface during and following liquefaction, ground settlement and surface deformation may occur.

Lateral spread is the lateral movement of ground as a result of liquefaction during an earthquake. Lateral spread occurs when a soil mass slides laterally on a liquefied layer and gravitational and seismic forces cause the layer, and overlying non-liquefied material, to move in a downslope direction or towards a free face. The magnitude of lateral spreading depends on a variety of factors including earthquake magnitude and peak ground acceleration, thickness of the liquefied layer, and ground slope or ratio of free-face height to distance between the free face.

Based on the regional geological setting, and data collected from our explorations i.e., the typically cohesive nature of the soils and depth to groundwater, we consider that the risk of liquefaction induced settlement and lateral spread to the eastern section of the site (the development area) to be low.

However, ground conditions within the western proportion of site encountered a layer of loose saturated sand which may be susceptible to liquefaction. Any future development within this portion of the site should be subject to further geotechnical investigation.

6.3.3 Tsunami and Earthquake Induced Flooding

The Northland Regional Council have mapped the site within a tsunami evacuation zone. It is located within the “Yellow Zone” which requires evacuation in the event of a tsunami with a wave height in excess of 1.5 m, as inundation is considered possible within this zone.

6.4 Assessment against RMA Section 106

We do not consider the proposed development to be presently subject to significant subsidence (including liquefaction), falling debris, or inundation by soil or rock in accordance with the provision of Section 106 of the Resource Management Act 1991. Given the typically gentle site contours and provided the recommendations presented in this report are followed, we consider it unlikely that future erosion or slippage that could pose a risk to structures and infrastructure will occur.

Further, we consider that future development and use of the land (when undertaken in accordance with geotechnical advice), is unlikely to accelerate, worsen or result in material damage to the land.

7 Preliminary Geotechnical Recommendations

We consider this site to be generally suitable for the proposed development, provided the recommendations of this report are followed.

7.1 Shallow Foundations

The site is underlain predominantly by stiff to hard alluvial soils overlying the Ruarangi Formation weathered rock which was encountered at a relatively shallow depth. However, a band of organic silts containing variable quantities of organic inclusions is present between 0.8 and 1.0 m depth.

Based on our understanding of site grading requirements, the majority of this site will be raised via the placement of an average of 0.6 m of fill (maximum proposed filling of 2.0 m), with localized backfilling to a maximum fill depth to 1.6 m within an existing drainage channel.

Provided that this fill is placed in accordance with NZS4431: the Code of Practice for Earthfill for Residential Development, shallow foundations founding upon either stiff native soils or engineered clay fill may be designed for a geotechnical ultimate bearing capacity of 300 kPa.

7.2 Proposed Borrow Pit Area

The soil profile within this portion of the site typically comprises stiff to hard alluvial clays and silts which extend to an average depth of between 1.3 m and 2.9 m averaging 2.0 m. A thin (approximately 100 mm to 200 mm thick) organic silt horizon with minor to some fibrous organic inclusions was encountered within this layer at approximately 0.8 m depth.

Grey sands, silts and clay with some remnant rock fabric were encountered underlying the alluvial clays and are interpreted to comprise completely weathered Ruarangi Formation soils with some highly weathered rock inclusions.

Accordingly, shallow excavations of less than 2 m in depth are likely to encounter clays and silts considered to be generally suitable as borrow materials for re-use as engineered fill on-site. These materials will require some moisture conditioning prior to placement and the organic layer noted to extend between 0.8 and 1.0 metres will need to be separated out and not included in the engineered fill. Deeper excavations are likely to encounter sandy and silty materials and may be affected by the local groundwater table.

7.3 Engineered Fill Placement

ENGEO has been provided with the earthworks cut / fill plans prepared by Maven for Resource Consent (ref: 117019, dated October 2020). The plans show cuts - predominantly around the northern perimeter of the development area, up to approximately 1.5 m depth, and fill thicknesses - predominately concentrated through the central-southern portions of the site, of up to 2.0 m.

The alluvial and Ruarangi Formation silt and clay soils present within the proposed fill area typically have shear strengths between 60 kPa and greater than 200 kPa, and with the exception of trace rootlets and minor fibrous organics, are relatively inorganic. On this basis, settlement of the underlying soils due to placement of the proposed 2.0 m of filling is not expected to induce significant settlement. If additional filling (>2.0 m) is to be placed, settlement monitoring during construction may be required.

ENGEO understands that a fill source has not yet been selected, however consideration is being given to utilising a borrow pit directly northeast of the development footprint - to reduce the requirement to import fill.

Future filling should be completed in accordance with NZS 4431 and under the observation of a certifying geotechnical engineer.

All engineered fill or structural hard-fills should be placed in <200 mm thick lifts, and be compacted to a minimum of 95% of the Maximum Dry Density, at no less than optimum moisture content.

We propose to certify the placement of the engineered fill using a Nuclear Densometer (NDM) to certify the material is placed suitably. Compaction curves should be taken for the fill material to gather a representative maximum dry density (MDD) and optimum moisture content which will be used as a basis of reference for the certification testing.

However, ground conditions may necessitate that the air void and shear vane testing method is utilised during construction.

We recommend that all vegetation including tree roots larger than 20 mm in diameter are removed as part of the site stripping operations undertaken prior to commencement of earthworks.

A number of existing drainage ditches are present on-site and extend through the proposed development area. Prior to backfilling, these ditches should be mucked out, then widened out to at least a width of five metres. It is recommended that this excavation is then stepped back up to the surrounding ground level over a distance of not less than 10 m. This stepped excavation is intended to reduce differential settlement of the completed development.

7.4 General Earthworks

- Cut earthworks may result in exposure of the thin organic layer noted at approximately 0.8 m depth. Where exposed at ground level, this organic horizon should be undercut and replaced with engineered fill.
- Where encountered during site development works, any pre-existing fill or atypical material should be observed by ENGEO to assess its suitability.
- Engineered fill materials should be assessed and approved by ENGEO (or a suitably qualified geotechnical professional) prior to placement.
- Exposed cohesive soils should be kept moist prior to pouring concrete. It is difficult to recharge moisture content in clayey soils. If these soils dry out, undercutting and replacement with hardfill may be required.
- All engineered or structural hardfill should be placed in ≤ 200 mm lifts and be compacted to a minimum of 95% of maximum dry density, at no less than optimum moisture content. Maximum dry density for granular fill materials may be obtained from the source quarry, a geotechnical laboratory or from plateau testing undertaken on-site. Compaction should be achieved using standard plant and methodology suitable for the imported material. A water source should be maintained on-site for moisture control.
- Our experience with the types of soils present on this site indicates that when they are exposed to the weather their strengths may be significantly reduced. We therefore recommend that trafficked areas and building platforms are only trimmed to final levels immediately prior to metaling and that at all times the site is shaped to avoid water ponding during rain, thereby limiting the need for additional undercutting and hard filling. On no account should areas of trimmed subgrade be left exposed to allow the ingress of water, nor should subgrade areas be trafficked prior to drying out after rain.
- Wherever filling or soft native ground is present at foundation level it should be undercut and replaced with approved compacted hardfill. Its suitability or otherwise as a bearing material beneath the floor slab should be determined on-site by the Engineer.
- All foundation cuts, pile holes and retaining wall excavations should be inspected by ENGEO (or a suitably qualified Geotechnical professional), prior to constructing foundation elements to verify founding conditions are as anticipated.
- All excavations should be in line with the WorkSafe Good Practice Guidelines for Excavation Safety (July 2016).
- Once a fill material has been selected an appropriate fill specification should be developed by ENGEO.

7.5 Tank Excavations

We anticipate that the bulk earthworks will be undertaken on-site prior to installation of the proposed in ground petrol tanks. Plans provided indicate that the proposed petrol tanks will be located within the southern corner of the site, in an area where between 1.5 m and 2.0 m of filling is proposed.

Excavations for the petrol tanks are anticipated to be of the order of 5.0 m depth. Based on the findings of hand auger boreholes (HA05 through to HA07) drilled in the general vicinity of the tank locations, stiff to very stiff silt and clay layers are likely to be present at the base of the tank excavation. At this preliminary stage it is anticipated that a geotechnical ultimate bearing capacity of 300 kPa may be adopted for shallow concrete slab or strip foundations supported on very stiff native alluvial / Ruarangi Formation material at the base of the excavation.

Groundwater data indicates that tank excavations on the order of 5.0 m below the finished (filled) ground level may extend below the groundwater level and require dewatering. Groundwater is likely to be present at around 3.0 m depth below the finished ground level.

Depending upon project sequencing it may be that sufficient space is present around the perimeter of the proposed tank locations such that the temporary tank excavation may be battered. In this instance a batter slope of 1 vertical : 2 horizontal (1V:2 can be adopted for the temporary excavation.

If the tanks are to be installed following construction of the proposed buildings and completion of the bulk earthworks, we anticipate the area will be laterally confined by the site developments and temporary support will be required (i.e. sheet piles). Dewatering of the excavation undertaken in this circumstance must consider settlement of the surrounding soils and structures.

7.6 Cuts and Batters

- Temporary unsupported cut slopes should not exceed a height of 1.5 m, for a batter of 1 horizontal: 1 vertical (45° from horizontal), and should not be left unsupported at this batter angle for longer than two weeks. Deeper excavations should be battered at 1V:2H and should be the subject of specific site inspections. This is especially pertinent where excavations are proposed to extend below the groundwater table.
- Cuts must not be exposed to adverse weather conditions and should be covered to minimise environmental effects (i.e. with polythene plastic).
- Suitable drainage channels must be put in place to divert surface water from unsupported cut faces. Subsurface drains should also be considered for the toe of long-term slopes.
- If any permanent cuts are to be higher than 1.5 m, they should be supported with a specifically designed retaining wall and will need to be approved by a Chartered Professional Engineer practising in Geotechnical Engineering.
- Where vertical and sub-vertical cut faces higher than 1.0 m are required for the construction of retaining walls, in addition to the above recommendations, we recommend that this is done in shortened sections (<5 m) and the faces are left unsupported for a minimal time period (i.e. one week) or temporarily shored, particularly in close proximity to site boundaries and structures.
- All temporary cuts and batters proximate to boundaries should take into account the potential surcharge and risk of undermining neighbouring property.
- All cuts and batters should be in line with the WorkSafe Good Practice Guidelines for Excavation Safety (July 2016).

7.7 Consolidation Settlement

Given the typically shallow depth and uniform thickness of fill proposed for this site, and taking into account the relatively stiff nature of the underlying soils, it is considered that settlement of the underlying native soils under fill loadings is unlikely to be a significant issue.

Differential settlement concerns due to fill depth variations across the site should be ameliorated by benching out the existing drainage channels on-site as noted previously.

7.8 Pavements

A number of Scala penetrometer tests were undertaken across the development footprint, within the native alluvial soils. Based on *in situ* test results, we recommend adopting a preliminary California Bearing Ratio (CBR) of 3% to support preliminary design within the natural ground. We would expect a CBR of 7% to 9% in the areas where engineered fill is placed.

Further testing should be undertaken on-site at finished levels to confirm these values.

7.9 Site Preparation

Topsoil should be stripped from all cut and fill areas with stripping operations being planned to extend well beyond cut and fill lines to avoid peripheral fill contamination. Stockpiles of topsoil and unsuitable materials should be sited well clear of the works on suitable areas of natural ground, such that these stockpiles will not adversely affect existing slopes and excavations.

Exposed cohesive soils should be kept moist. It is difficult to recharge clayey soils in excavations. If these soils dry out, undercutting and replacement may be required.

If temporary platforms are required to facilitate construction and mobilisation of heavy machinery, the Geotechnical Engineer and earthworks contractor should coordinate formation of stable platforms that are suitable for use.

7.10 Further Works

Expansive soil class testing should be undertaken within the borrow area on-site prior to foundation design, this will enable classification of the fill material.

To further understand the groundwater implications within the tank excavations, additional investigations should be undertaken once the design proposal for this site is finalised.

8 References

Tsunami
https://northlandcdem.maps.arcgis.com/apps/webappviewer/index.html?id=00bf741d369b4eb7802021004d123e3b

GNS, 2001. Institute of Geological and Nuclear Sciences Ltd. 2001. 1:250,000 Geological Map 3, Auckland.

ENGEO, 2019. Preliminary Environmental Site Investigation – Corner of SH1 and Port Marsden Highway (SH15A), Ruakaka. Prepared for SK Aotearoa Trust by ENGEO Ltd.

9 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, SK Aotearoa Trust, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ / ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (09) 972 2205 if you require any further information.

Report prepared by

David Brodie

Associate Geotechnical Engineer

Report reviewed by

Paul Fletcher, CMEngNZ (CPEng)

Associate Geotechnical Engineer

Olivia Ellis-Garland

Engineering Geologist

APPENDIX 1:

Proposed Development Plans

Ruakaka Service Centre

Architectural Design Report
for Resource Consent Submission

BUCHAN tattico

Architecture
Resource Consent

917004
30.09.2020

buchangroup.co.nz
www.tattico.co.nz

Contents

Conceptual Aerial Perspective from North West

Introduction

This report outlines the design of a proposed new Service Centre at the intersection of State Highway One (SH1) and Port Marsden Highway (SH15A) Ruakaka, Northland. It forms part of the Resource Application and AEE report prepared by other consultants.

The scope of this proposal is the new buildings and associated parking, activities, landscape groundworks within the footprint of lots identified on the drawing A-RC-170321-B

The proposed Service Centre comprise of a number of new buildings. A Quick Service Restaurant, Café, Convenience store, Retail store, Fuel stops for both commercial and general traffic, public toilet facilities with associated public parking and building user amenities.

The proposal is designed as an integrated building and landscape outcome and should be read in conjunction with appended design drawings.

Fig 1 Site: aerial view NTS

Fig 2 Site Driving South

Fig 3 Site Driving North

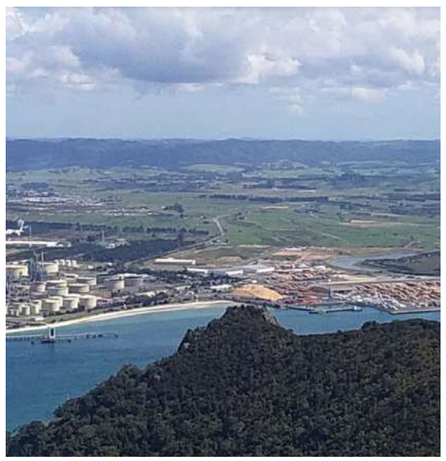


Fig 4 Marsden Point

Fig 5 North Port

Fig 6 Existing Commercial Activity

Context

The Existing Site

The rural site in Ruakaka is located north of a significant roundabout at the intersections of SH1 and SH15A. The proposal is located on a site made up of a series of individual Lots under the same ownership.

It is located 28km travel south of Whangarei and 11km north of Waipu.

The land is currently used for a mix of rural activities but primarily for periodic grazing. It exhibits a primarily flat contour positioned within a identified flood plain and approximately 1.5 mtrs below the two formed roads identified adjacent to it.

To the south west of the site there are exiting small scale commercial activities including a fuel stop, bakery, superette and tyre service centre. The surrounding properties are generally similar rural farm land with low density residential occupation.

Historic Context.

The traditional historical associations relating to the region reflect the migrations, conquests and occupations which have taken place over the centuries.

Ruakaka was a small seaside community. With the establishment of New Zealand's only oil refinery, Marsden Point A and B, it grow in scale to house in the first instance people constructing the refinery and then employed at the refinery.

More recently new timber-based businesses have been establish and coastal residential activities including waterway communities have been established with associated small scale facilities and general amenities.

Fig 7- Cafe Precedent Image

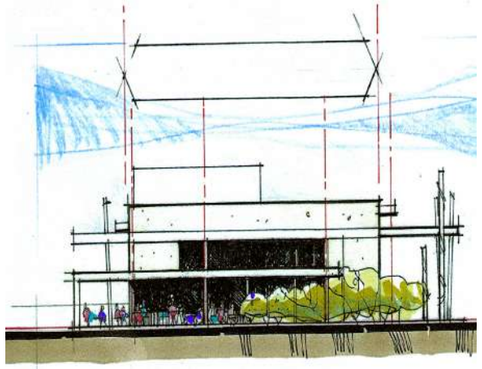


Fig 8 - Elevation Proposed Cafe

Fig 9 - Cafe Canopy Precedent

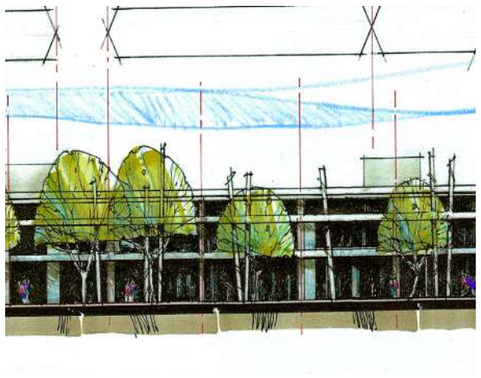


Fig 10 - Proposed Convenience Store

Fig 11 - Precedent Image - Convenience Store

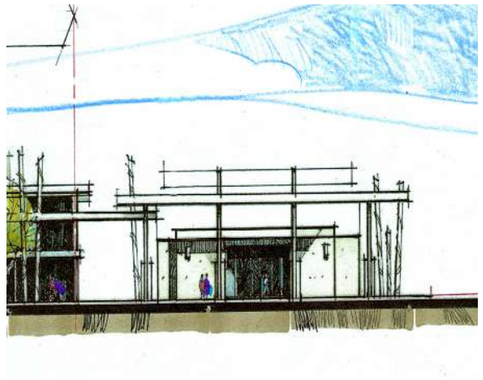


Fig 12 - Proposed Fuel Kiosk

Fig 13 Quick Service Restaurant

Fig 14 - Typical 'Brand' Fuel Stop

Fig 15 -Contemporary Fuel Stop

Proposed Activities

Proposed Activities Overall

The proposal is to develop a comprehensive Service Centre to provide facilities and amenity for local, regional and international visitors. While its everyday function is a fuel stop to service commercial and private commuters it will provide additional services and amenities for all users particularly the tourist market. These include landscaped picnic sites, public toilet and shower facilities, and overflow parking. This facility will provide employment opportunities and due to its location those places would most likely be filled from the local community.

Quick Service Restaurant (QSR)

A QSR is a typical offering for this kind of facility. While no specific operator has been secured the facility would operate in the typical manner of this kind activity offering both seating and drive through options but generally targeting costumers requiring a quick stop or short stay.

Picnic Play Area

This is specifically located with a northern orientation as a place of rest and respite centrally located within the general food and beverage area. This area will be a pivot point specifically designed by landscape Architects as part of a comprehensive landscape design.

Café

The 400 sqm Café is intended for patrons wanting a longer stay or different type of food and beverage experience. The Northern aspect looking over the picnic and play areas will have a flexible transparent façade. This will allow for indoor and outdoor dining to suit the variable seasons of the year offering both shelter and shade as required.

The Café, QSR in conjunction with picnic/park and the integration of the proposed landscaping will form a cohesive and flexible food and beverage experience.

Convenience Store

A 800 sqm Convenience Store is proposed as an alternative and closer option to that of Whangarei. It is envisaged it would be primarily for locals and workers who could utilise this store on their ways to and from their place of residence/work. In addition, it is well located to suit travellers and tourists as a one stop shop for fuel, supplies and respite from the road.

Retail

This is proposed as a flexible space of approximately 400 sqm. The activity is likely to be orientated toward the tourist and traveller market but could be utilized in any number of other ways to meet the servicing and needs of the community and wider region.

Fuel Kiosk

The proposed location of the Fuel Kiosk is to enable servicing both heavy commercial vehicles and the general public alike, at the same time keeping the location of the two conflicting activities quite separate. This will make for a safer pedestrian outcome particularly being located at the opposite end of the facility.

On-site Management

It is proposed that there be 24 hour presence at the Service Centre. The provision of 2 apartments of approximately 106 sqm & 134 sqm will be located centrally above the location of the public amenity area.


Fig 7- Precedent Image


Fig 8 - Precedent - facade treatment


Fig 9 - Canopy Precedent


Fig 10 - Pedestrian Concourse


Fig 11 - Precedent - pedestrian treatment

Fig 12 -Pedestrian Picnic/ParkZone


Fig 13 Pre-finished Articulated Panels


Fig 14 - Decorative Timber Panelling

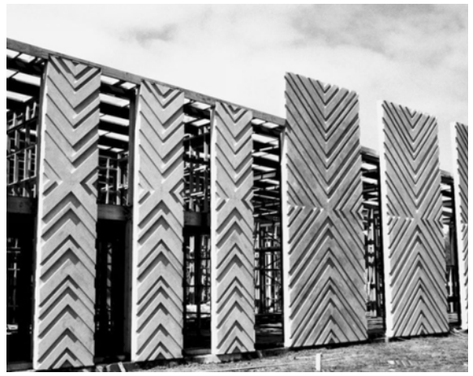


Fig 15 -Decorative Precast Panels

Form and Articulation

The design approach in this proposal is to develop a strong but simple framework which the various forms and articulation can respond to the variety of activities proposed. The types of articulation of the building can be expressed with references to existing and historical cues from the immediate and wider region. The building is robust but playful in character acknowledging the mixed role of a commercial hub and place of respite.

The main building will read as the central form approximately 8.4m in height and 75m long. The mass being broken down using expansive 'playful' canopies and glazing for a sense of lightness and transparency in the façade achieving a variety of spacial experiences for the users. Each of the activities will be visually defined by the changes in depth, openness and voids of the facades in response to the requirements of the respective activities.

The QSR and Fuel operators have not been defined but it is anticipated they will be typically a 'Corporate Brand' and thus follow the approach that has been developed by those parties. It can be noted that many of these businesses are developing more variety to the form and articulation of their facilities on a site by site basis. This would be encouraged for this development to establish a more cohesive outcome.

Architectural Articulation and Materials

The south western elevation will be primarily glazed with aluminium glazed curtain walling, with a combination of exposed steel and timber faced columns supporting the overhead canopies. The underside of the canopies along this public promenade will be in timber battens (Fig 9, 10). The concourse will be specifically designed as part of the landscape plan with a variety of finishes and furnishings to reflect the pedestrian nature of the space (Fig 11)

The north western elevation will continue the pedestrian theme and expand on this. It's a solely pedestrian zone with the café/open space transition. More variety in canopy heights and size are proposed to reflect the purely pedestrian use of this space. Flooring materials and set-outs will transition the interior and exterior spaces (Fig 7, 9)

The north eastern elevation is more of a functional area for arrivals, servicing and loading. It will be clad for durability with a combination of decorative precast panels and pre-finished insulating panels to soften the visual impact. In addition, a pedestrian canopy like the others will be installed with the timber linings (Fig 13, 15) extending through the walkway past the public amenities giving connectivity and guidance through to the more pedestrian zones.

The south eastern elevation will be in a combination of precast concrete and timber panels. It is viewed as an opportunity to celebrate the history of the area with decorative works (Fig 14,15) in consultation with the local communities.

Fig 16 - Landscape plan: refer Landscape Report-Boffa Miskall

Integration with the Site.

Landscape

The rural site is currently used for periodic grazing. There will be a comprehensive landscape plan prepared for the whole site fully integrated with the proposed buildings and proposed activities. A preliminary landscape plan has been prepared by Boffa Miskall as a part of this Resource Consent application.

Building Structure

The site has its own inherent natural challengers, a flood plan, peat and the corrosive environment for example. A full assessment of the existing environmental conditions will need to be undertaken and required to direct informed decisions. It is most likely to be a structure using a combination of lightweight steel and concrete. This will be undertaken by other suitably qualified consultants.

Building services and Environmental Services

As with the building structure services will need to respond to the existing environment and conditions. This will be undertaken by other suitably qualified consultants.

Servicing and Parking

Access to the site is proposed from both SH1 and Port Marsden Highway. A report has been prepared by Traffic Planning Consultants Ltd as part of this Resource Consent application.

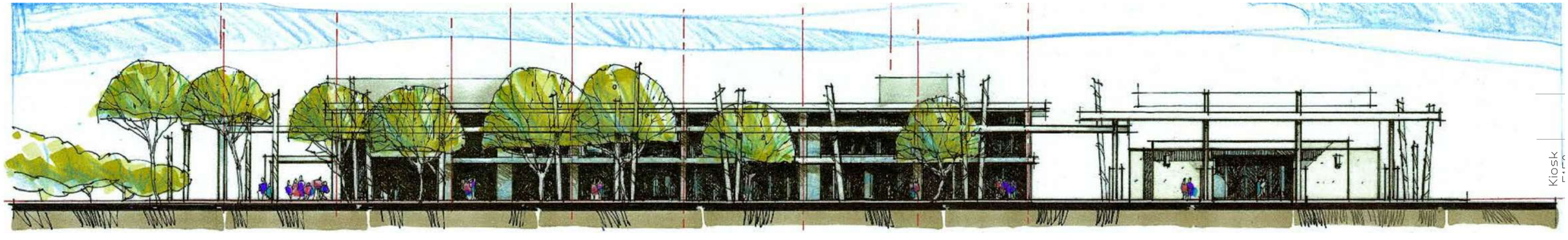
Within the site a number of parking areas have been designed for the variety of activity users. General parking is located adjacent to the facility including accessible parking located close to each of the proposed activities. Specific parking area is allocated here for campers and trailers. Dedicated pedestrian routes have been designed for pedestrian safety.

In addition, area has been allocated for overflow parking or potentially longer term parking.

Loading zones, short-term and longer-term parking has been allowed for in the truck stop area.

Appendix A

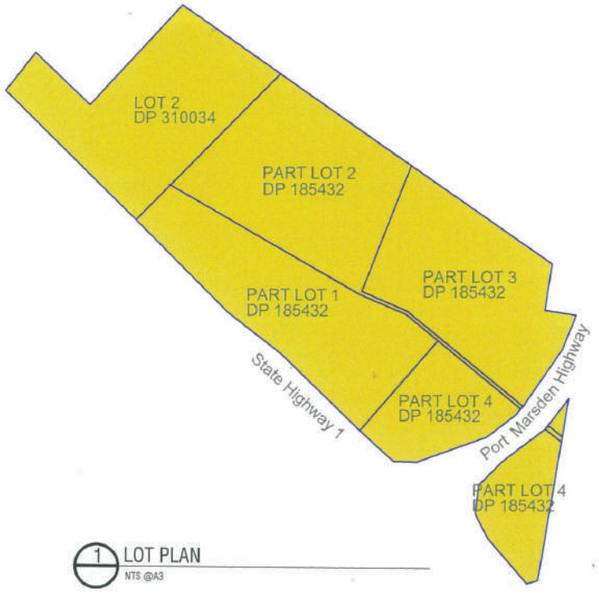
Sketch Design



BUCHAN | Auckland Studio Masterplanning |

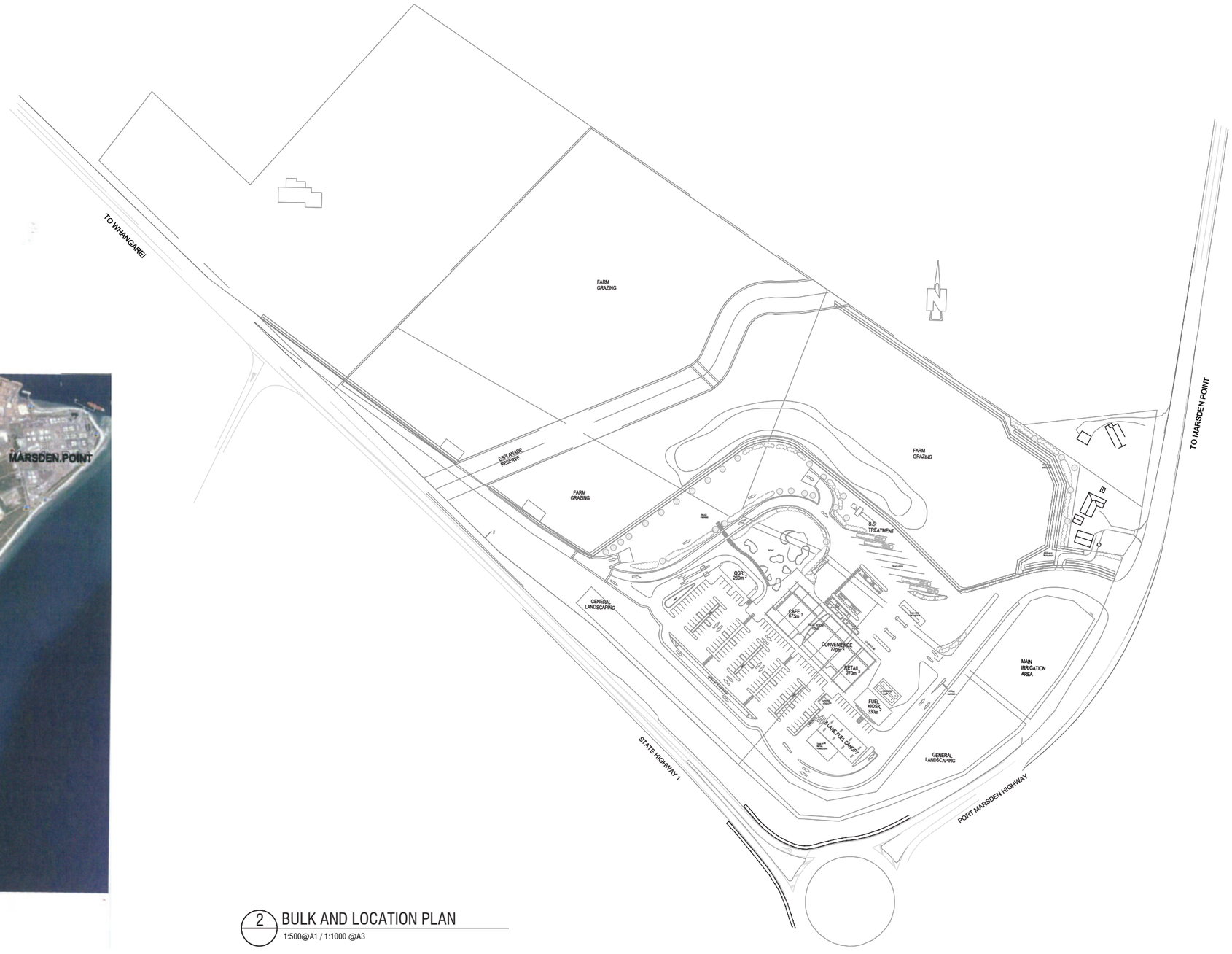
Drawing Title
COVER.SHEET
.
.
Drawing Number
A-RC-170321-00

Revision
B



1 LOT PLAN
NTS @A3

3 SITE LOCATION PLAN
NTS @A3



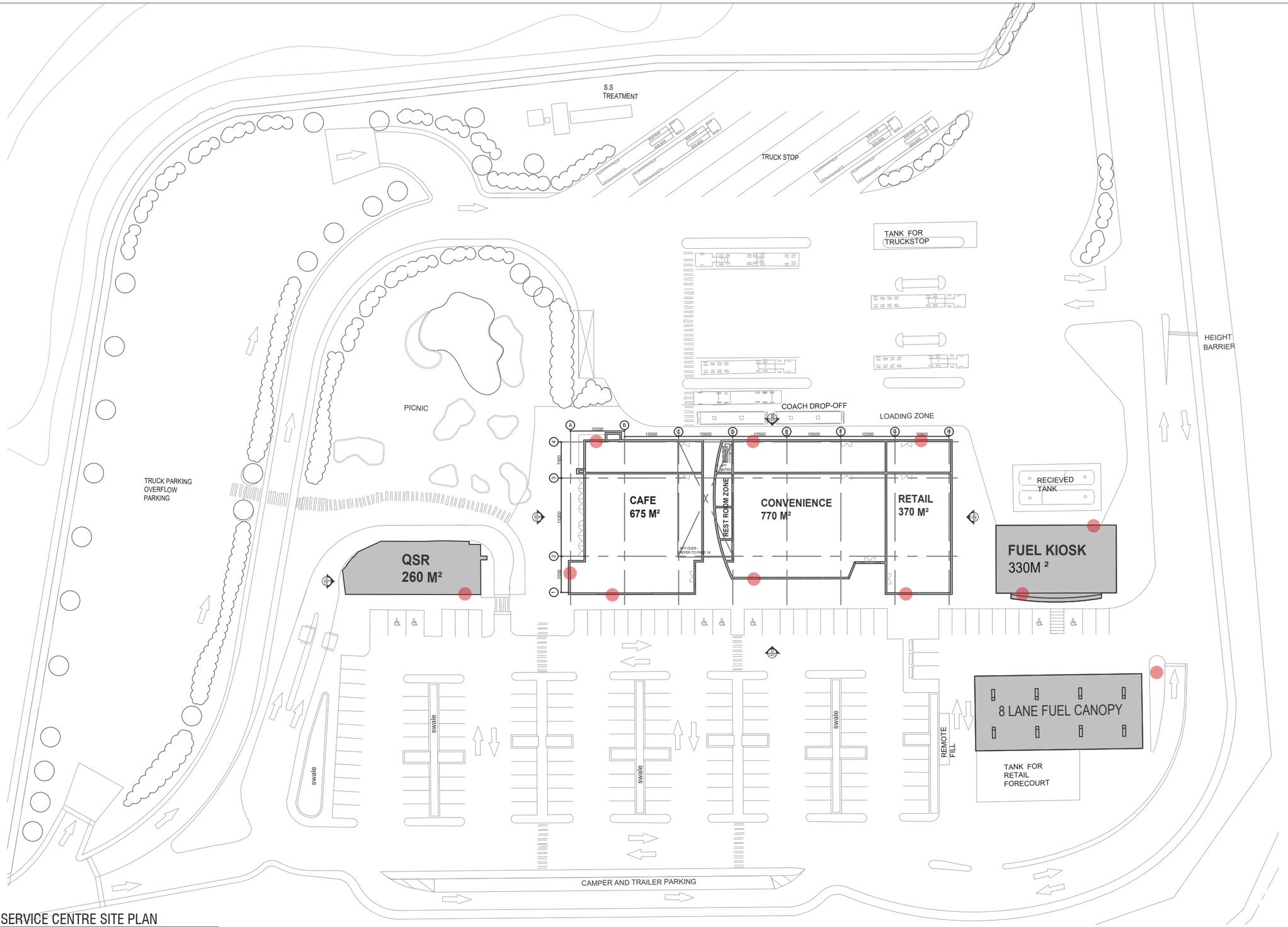
2 BULK AND LOCATION PLAN
1:500@A1 / 1:1000 @A3

BUCHAN | Auckland Studio Masterplanning |

Drawing Title
PROPOSED.SERVICE.CENTRE
SITE.LAYOUT
CONCEPT

Drawing Number
A-RC-170321-01

Revision
B



1 SERVICE CENTRE SITE PLAN
1:750 @A3

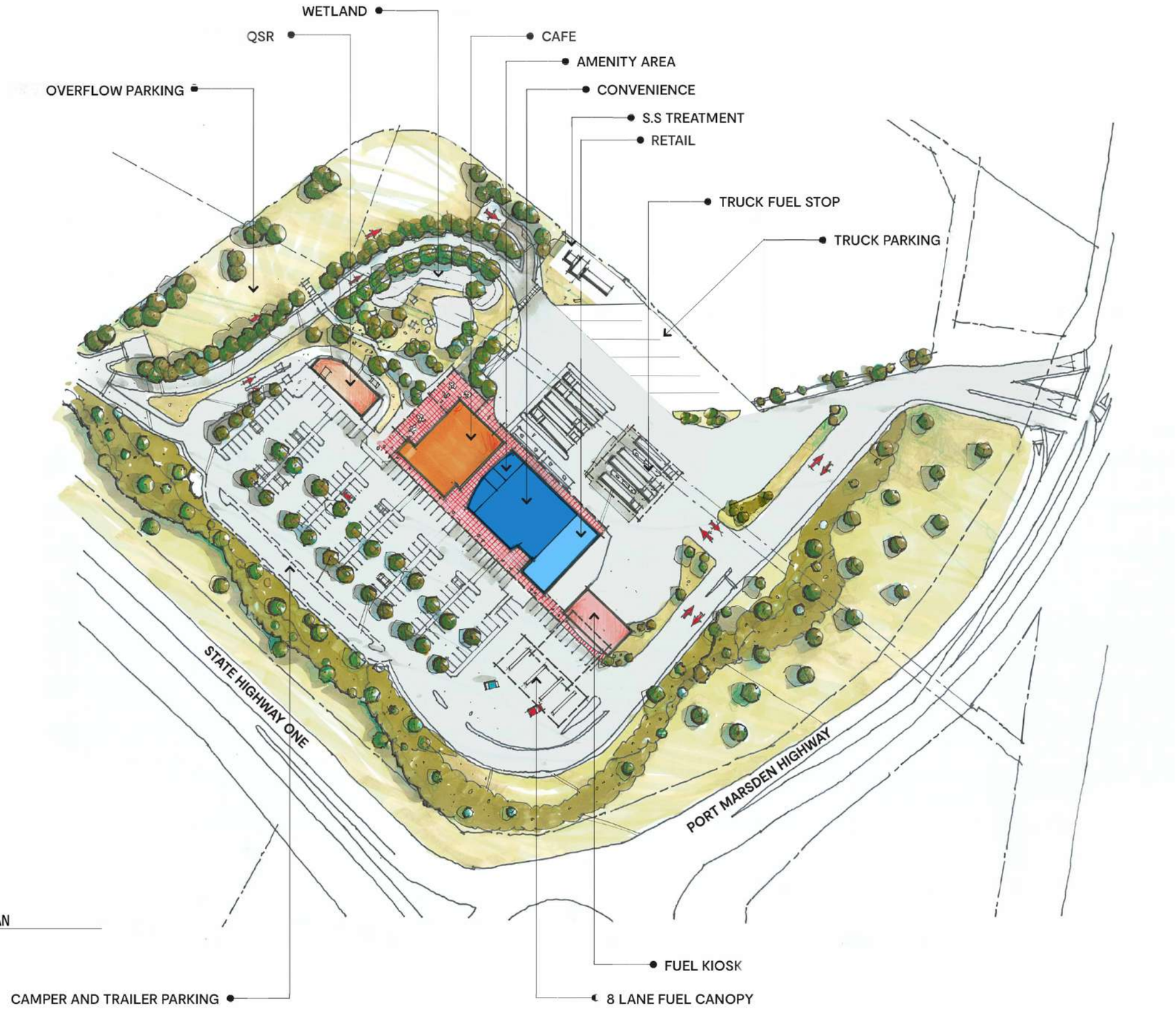
Signage location (refer pg 15 & 16)

BUCHAN | Auckland Studio Masterplanning |

Drawing Title
PROPOSED.SERVICE.CENTRE
SITE.LAYOUT
CONCEPT

Drawing Number
A-RC-170321-02

Revision
B



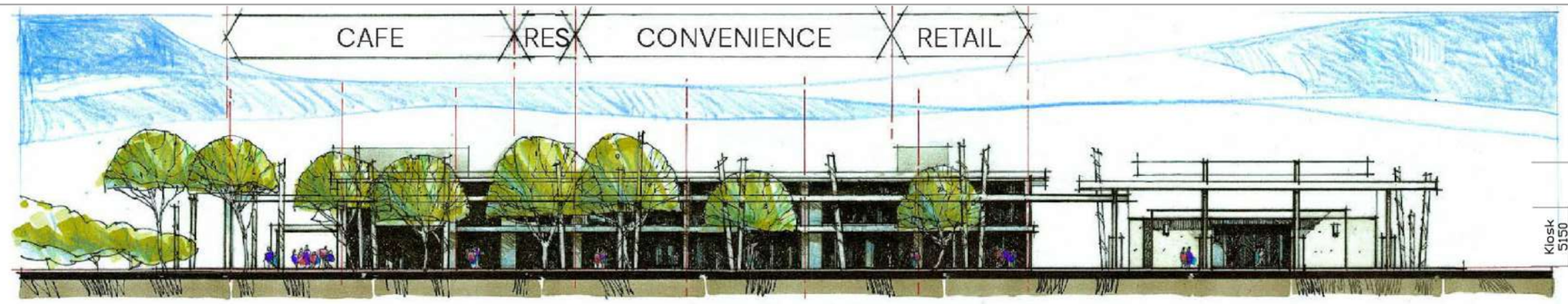
1 SERVICE CENTRE PLAN
NTS

BUCHAN | Auckland Studio Masterplanning |

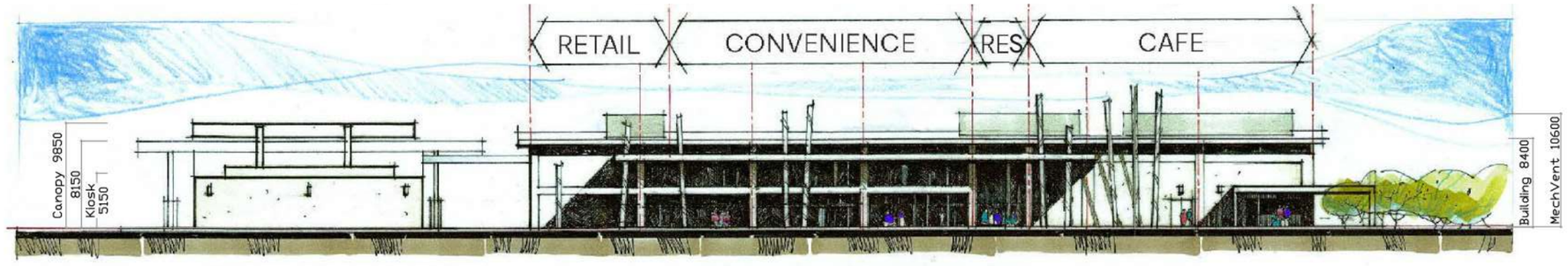
Drawing Title
PROPOSED.SERVICE.CENTRE PLAN CONCEPT

Drawing Number
A-RC-170321-03

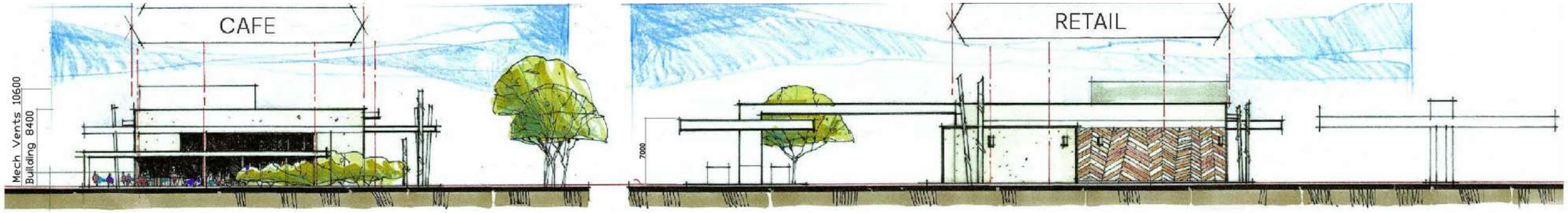
Revision
B



FRONT ELEVATION



REAR ELEVATION



END ELEVATION CAFE

END ELEVATION FUEL STOP

1 ELEVATIONS-SERVICE CENTRE
1:300@A1 / 1:600 @A3

1 PRECEDENT IMAGERY
NTS

BUCHAN | Auckland Studio Masterplanning |

Drawing Title
PROPOSED.SERVICE.CENTRE
ELEVATIONS
CONCEPT

Drawing Number
A-RC-170321-04

Revision
B

1 PERSPECTIVE-BULK AND LOCATION
SOUTH EAST VIEW NTS

BUCHAN | Auckland Studio Masterplanning |

Drawing Title
PROPOSED.SERVICE.CENTRE
PERSPECTIVE
CONCEPT

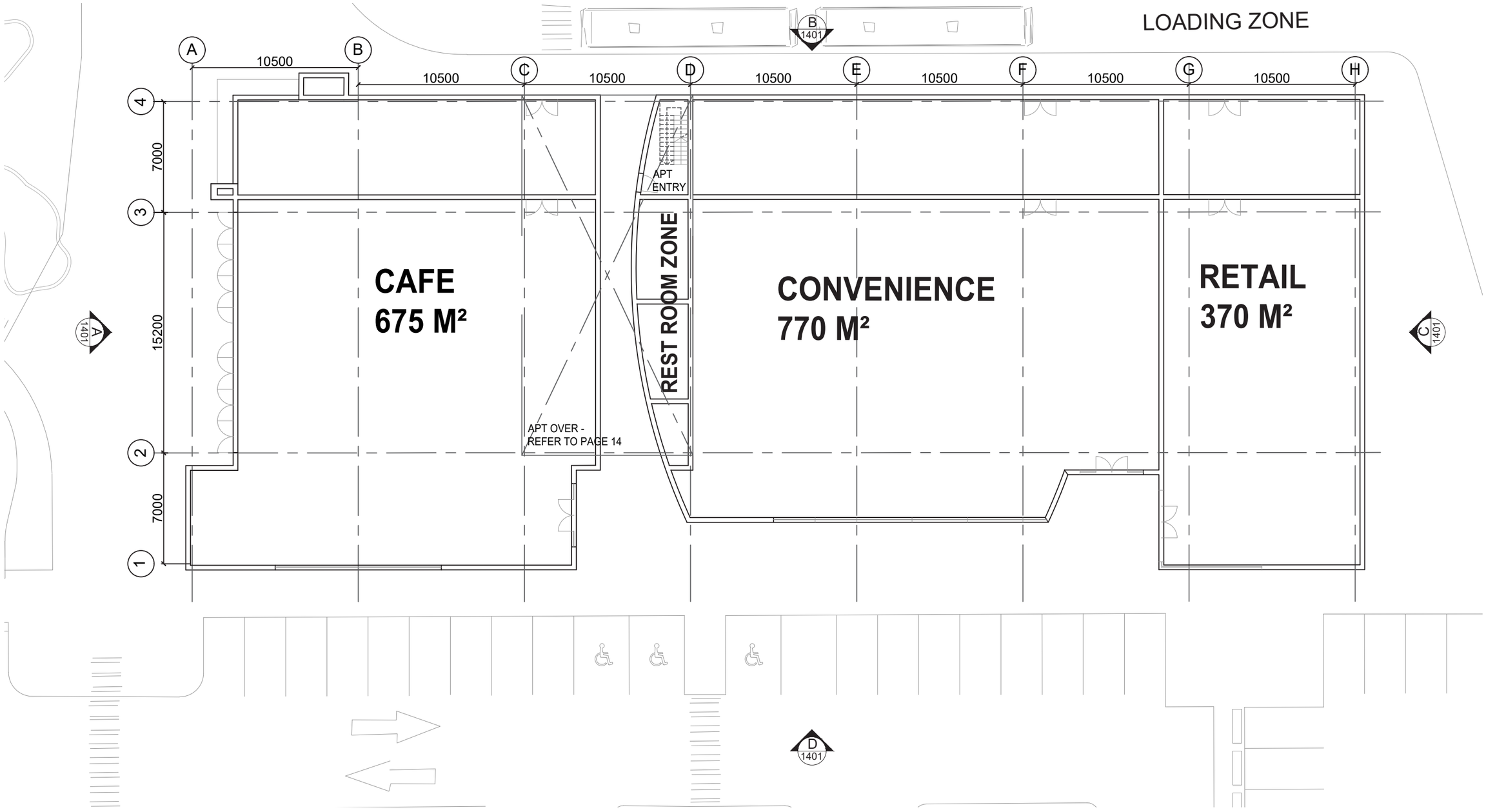
Drawing Number
A-RC-170321-05

Revision
B

Appendix B

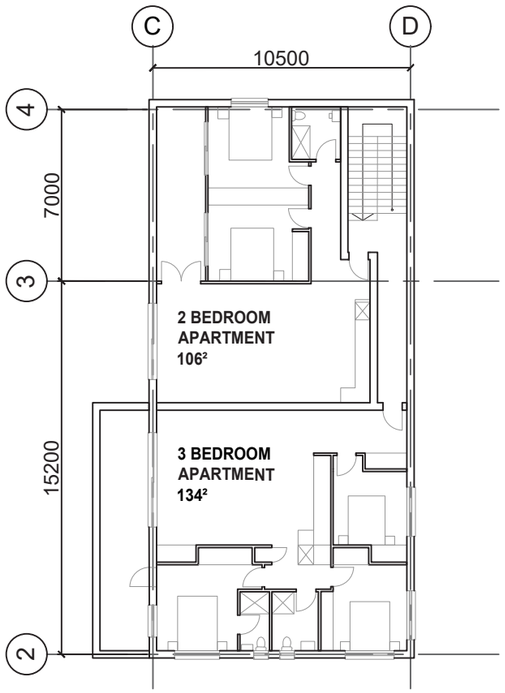
Concept Design

/ Floor Plan
/ Apartments and Landscape Plans
/ Elevations
/ Concept Views
/ Signage Concept

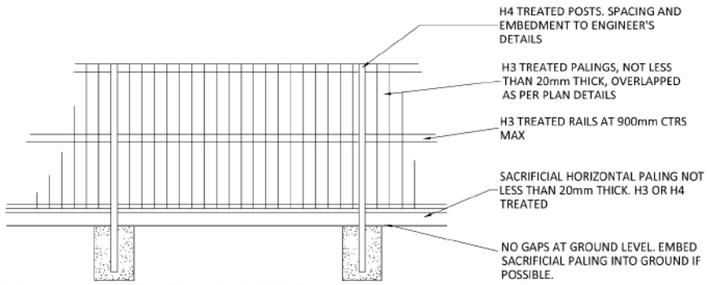


1 SERVICE CENTRE FLOOR PLAN
1:250 @A3

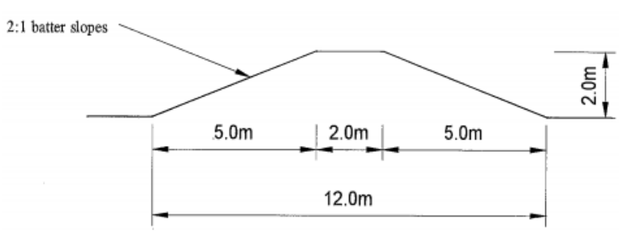
BUCHAN | Auckland Studio Masterplanning |



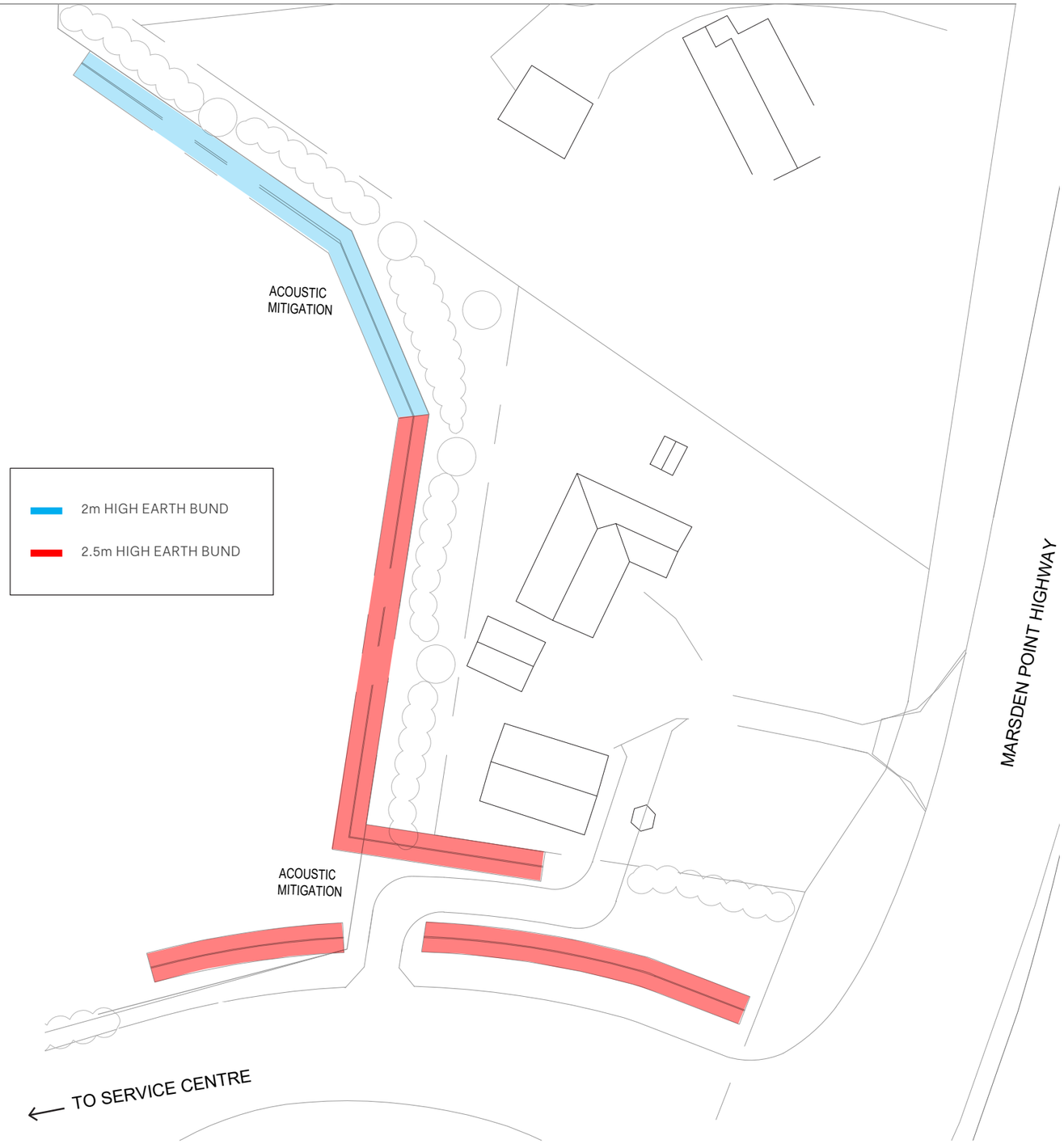
1 APARTMENTS FLOOR PLAN
1:250 @A3



TYPICAL ACOUSTIC FENCE - REFER TO MARSHALL DAY ACOUSTICS

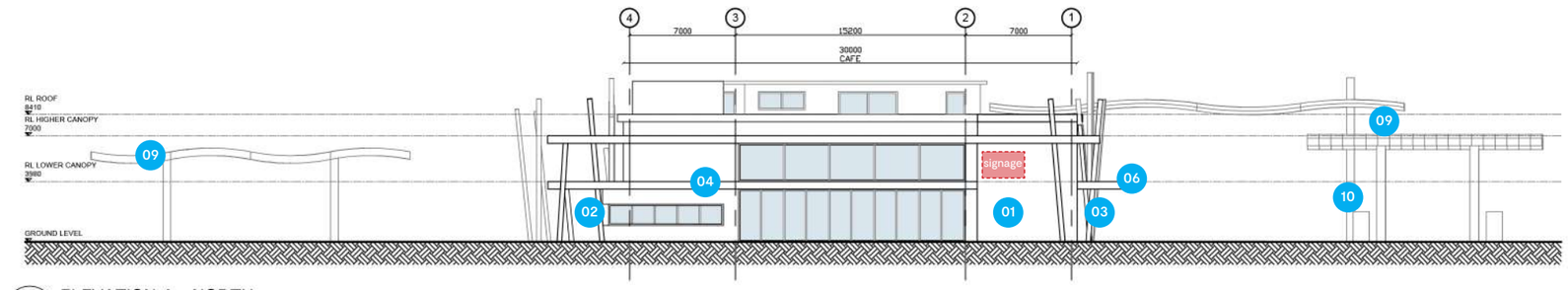


TYPICAL EARTH BUND - REFER TO MARSHALL DAY ACOUSTICS

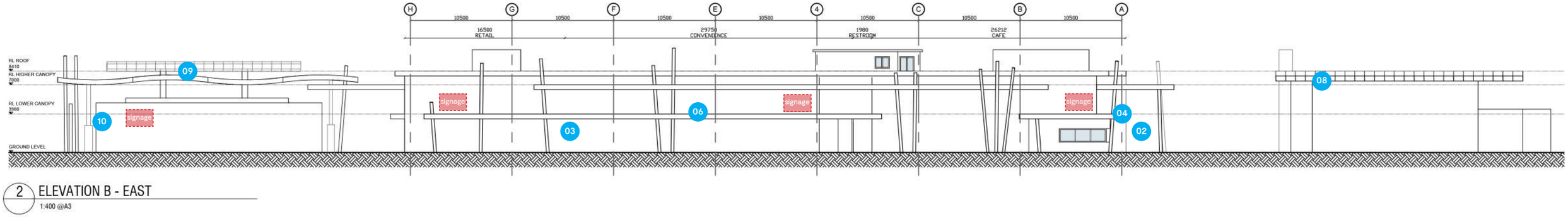


2 LANDSCAPE BUNDING PLAN
1:250 @A3

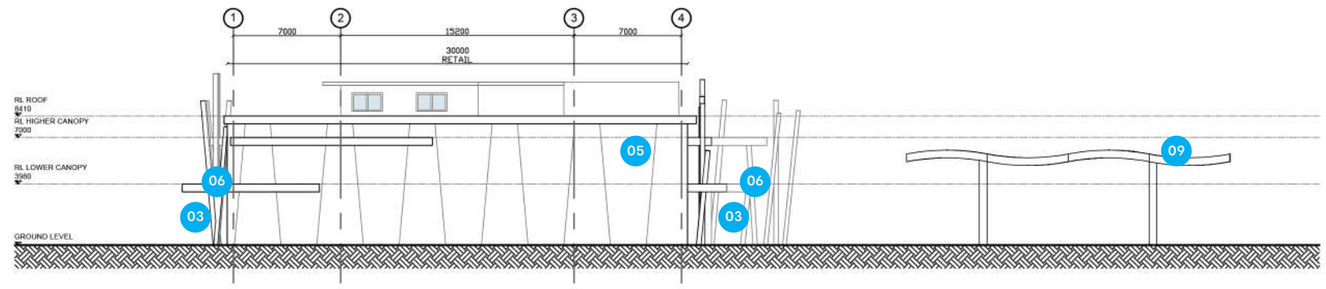
BUCHAN | Auckland Studio Masterplanning |



1 ELEVATION A - NORTH
1:400 @A3



2 ELEVATION B - EAST
1:400 @A3



3 ELEVATION C - SOUTH
1:400 @A3

Tenant Signage
5 sqm max area

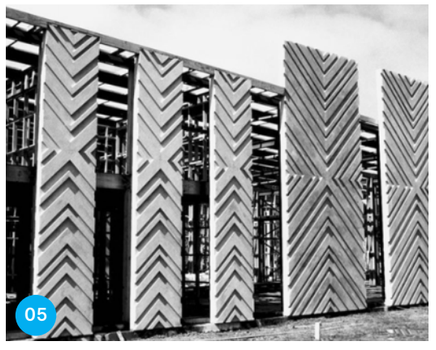
Precedent Image - Signage

01 / Elevation Precedent

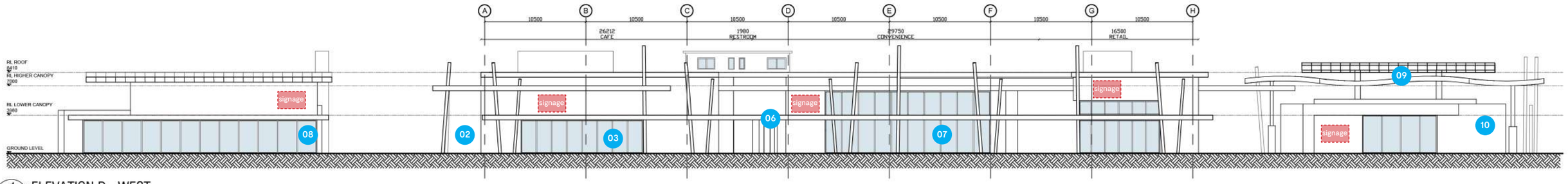
02 / Cafe Precedent Image

03 / Canopy Precedent - Pedestrian

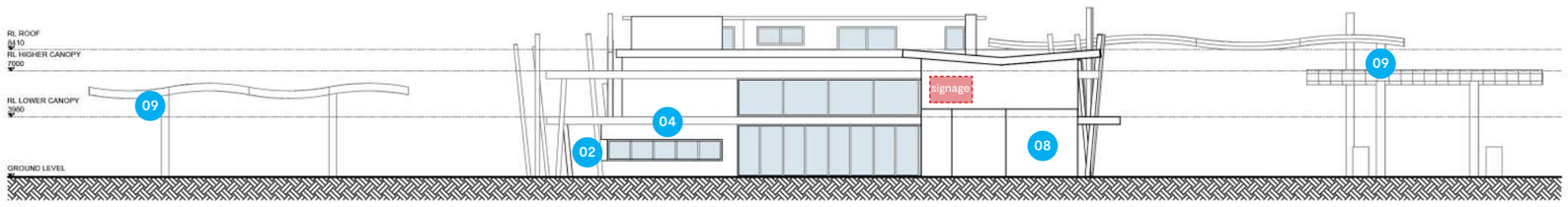
04 / Cafe Canopy Precedent



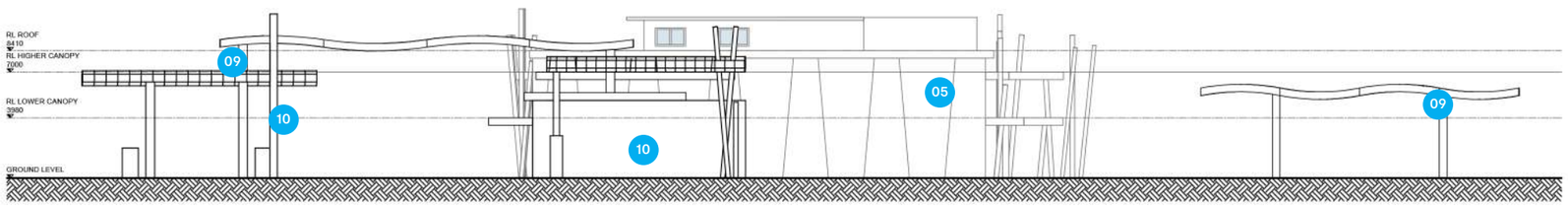
05 / Decorative Precast Panels



1 ELEVATION D - WEST
1:400 @A3



2 ELEVATION E - NORTH
1:400 @A3



3 ELEVATION F - SOUTH
1:400 @A3

Tenant Signage
5 sqm max area

Precedent Image - Signage

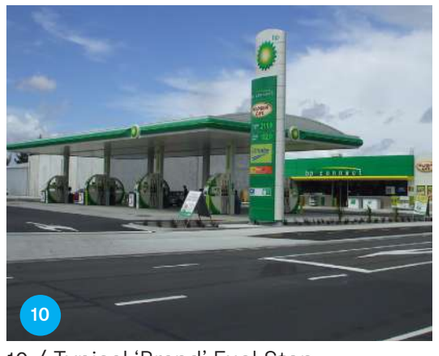
Precedent Image - Signage

06 / Pedestrian Concourse

07 / Precedent Image

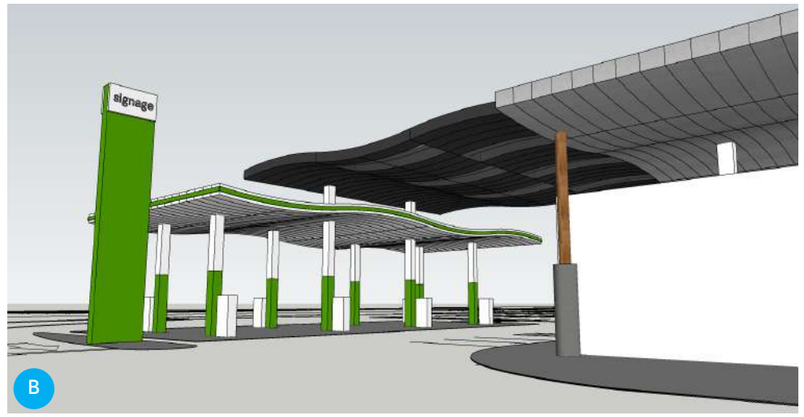
08 / Quick Service Restaurant

09 / Contemporary Fuel Stop



10 / Typical 'Brand' Fuel Stop

View through fuel forecourt along front facade



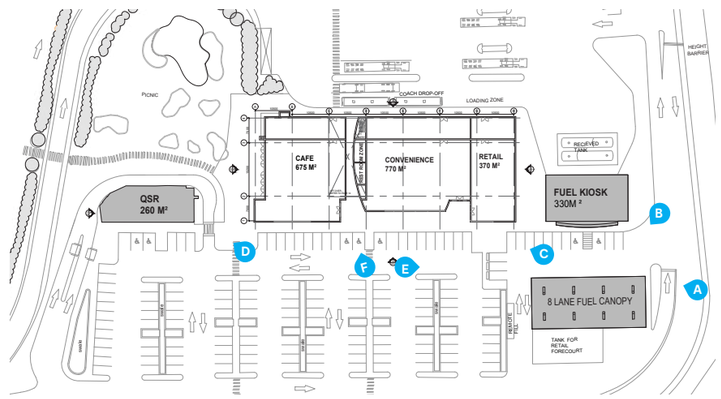
Fuel kiosk & Forecourt

View from retail down to QSR

Corner Cafe & QSR

View back towards fuel kiosk

Pedestrian connection to amenities & Rear court



View Key

BUCHAN | Auckland Studio
Masterplanning |

Long view at front facade

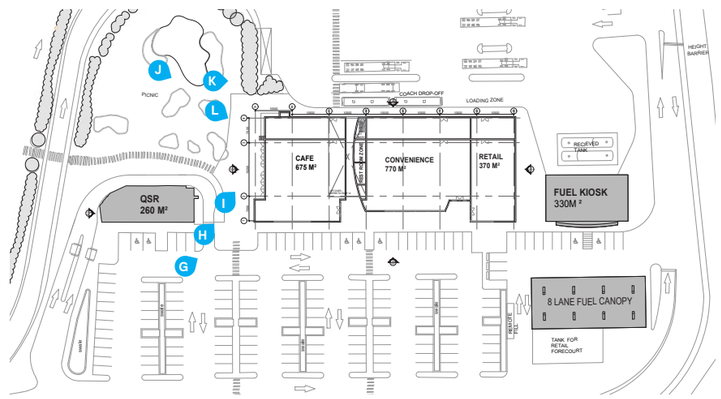
Covered Cafe outdoor space

Cafe

Cafe & Rear service court area

View along rear service court

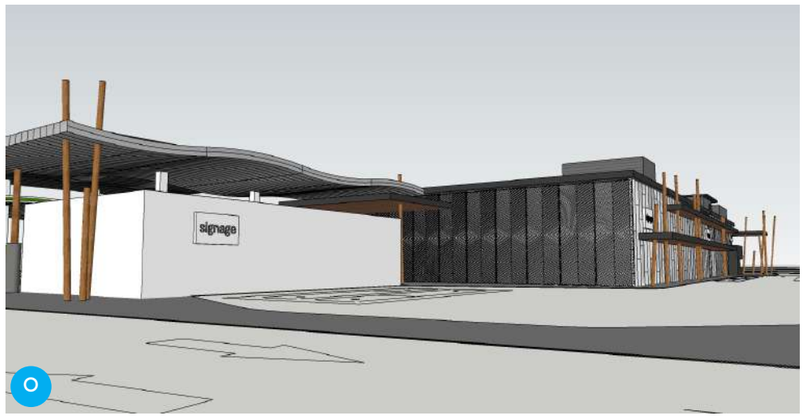
Fast service cafe



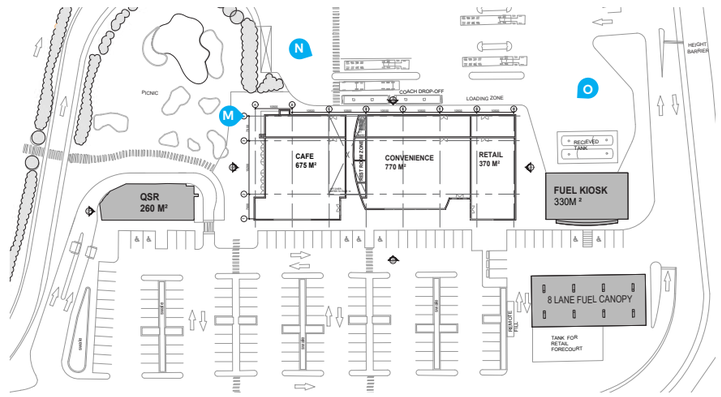
View Key

View along service court concourse

Service court & Truck fuel stop



Loading & Service area

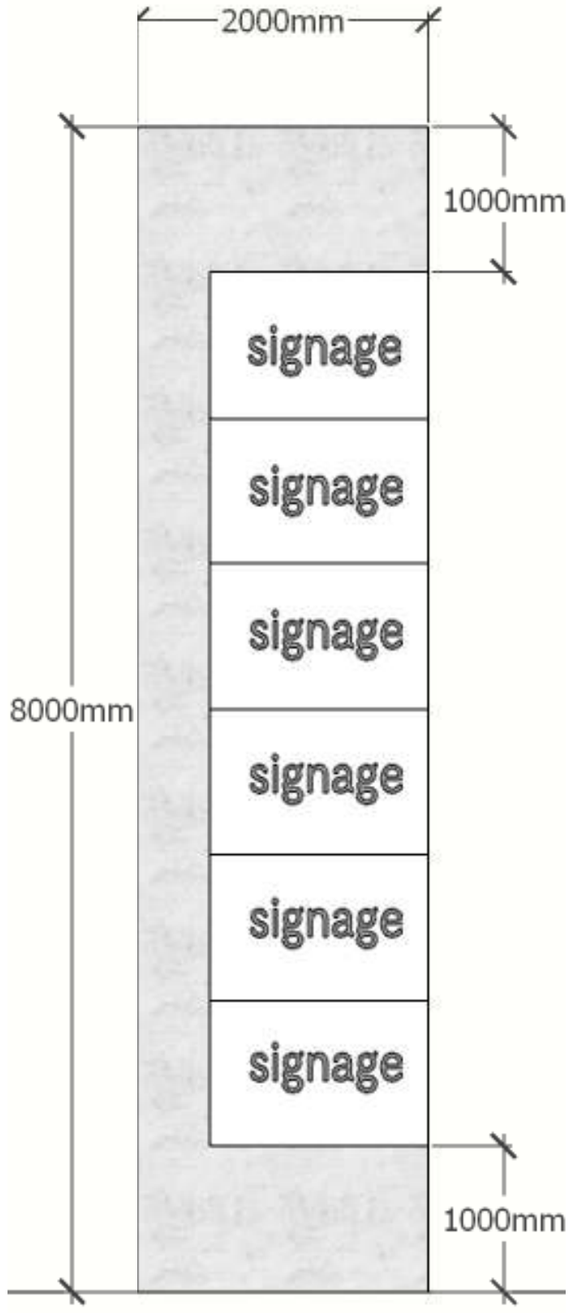


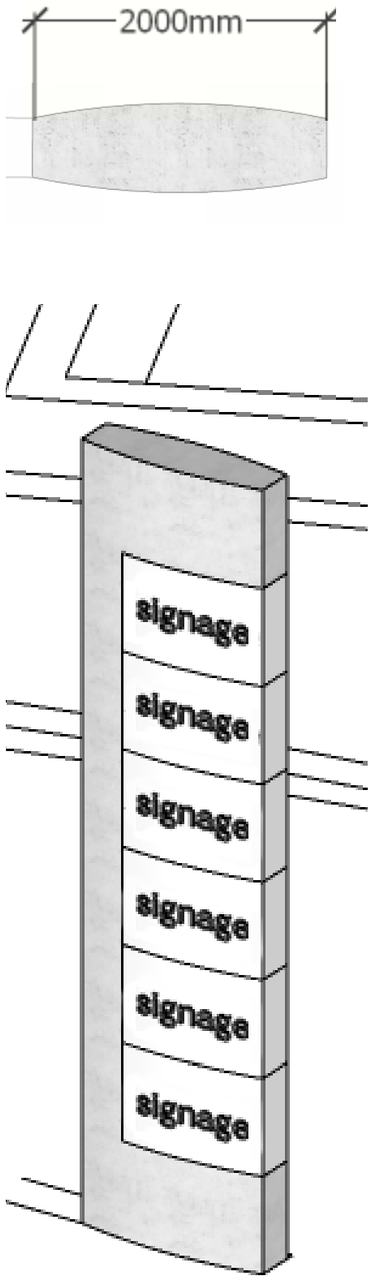
View Key

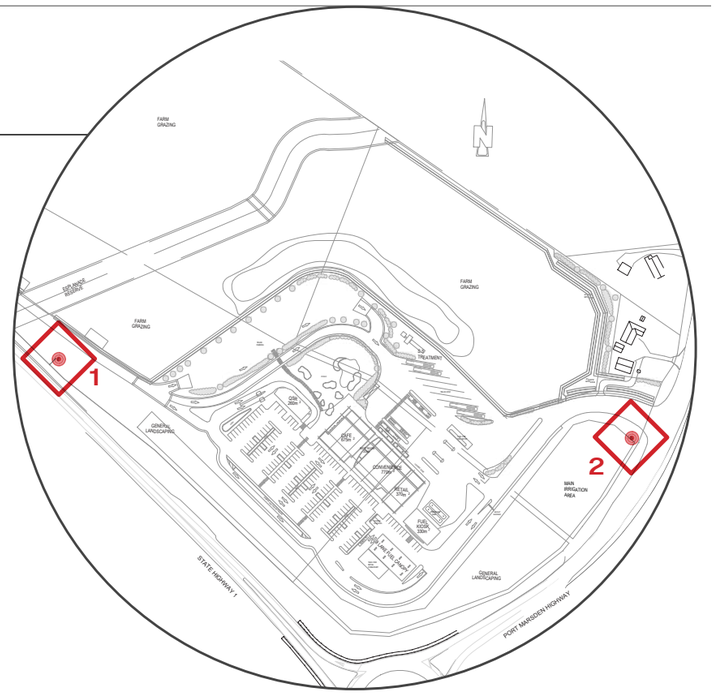
BUCHAN | Auckland Studio
Masterplanning |

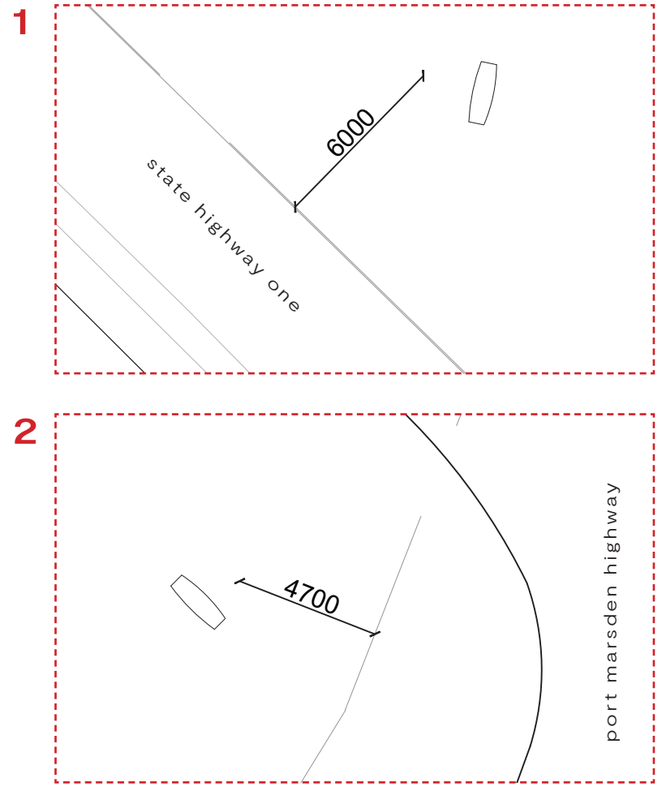
Pylon signs with tenant brands

Precedent Images









BUCHAN | Auckland Studio Masterplanning | NTS

ADELAIDE
AUCKLAND
BRISBANE
CHRISTCHURCH
DUBAI
GOLD COAST
LONDON
MELBOURNE
PERTH
SHANGHAI
SYDNEY

'Little High St', 55–57 High Street
Auckland 1010 New Zealand
+64 09 303 1451 / **buchangroup.co.nz**

BUCHAN tattico

Document Located: M:\917\917004 Ruakaka\ARCH\WORK\SK\20200928_ Ruakaka RC.indd

APPENDIX 2:

Earthworks Cut and Fill Plans

INFRASTRUCTURE REPORT

RUAKAKA SERVICE CENTER

RUAKAKA

WHANGAREI

Maven Associates	**Job Number** 117019		**Rev** A
Job Title Ruakaka Services Center **Title** Infrastructure Report	**Author** KH	**Date** 29/09/20	**Checked** GB

CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 PROJECT

The purpose of this report is to provide an assessment of the infrastructure required to support the proposal in support of a land use consent application for the Ruakaka Services Center development.

The information provided herein relates to the stormwater, wastewater, water supply and other service infrastructure and the potential capacity to service the proposed development.

The calculations and assessments included in this report are a 'desktop' analysis and are preliminary in nature based on information available at time of issue. Final design plans and calculations will be provided at Engineering approval and Building Consent stage as required.

1.2 LEGAL DESCRIPTION

The legal description of the Land parcels are as follows-

2533 State Highway 1	Lot 2 DP 310034	Area = 3.730ha
2581 State Highway 1	Pt Lot 1 DP 185432	Area = 3.757ha
0 Port Marsden Highway	Pt Lot 3 DP 185432	Area = 3.672hav
0 Port Marsden Highway	Pt Lot 2 DP 185432	Area = 4.018ha
0 State Highway 1	Pt Lot 4 DP 185432	Area = 2.683ha

1.3 SITE DESCRIPTION

The site comprises of five parcels of land located at the northern side of the intersection of State Highway one (SH1) and Port Marden Highway (SH 15A), as shown in Figure 1, below.

Figure 1: Site Location

2.0 PROPOSAL

The proposal consists of the creation of petrol station, retail space, fast food restaurants and associated parking for both travellers and long-haul truck services.

In order to provide suitable infrastructure to service the proposed development. The following works are proposed or required:

- Earthworks – filling on site to raise the proposed building and parking areas above the expected flood level.
- Stormwater – treatment, attenuate and discharge of stormwater taking into consideration the Whangarei district council requirement. Including a flooding assessment to address the initial feedback received from Whangarei land development department.
- Wastewater –on-site disposal system to treat the wastewater generated from the proposed land-use activities.
- Water Supply and Services – water supply is proposed to be extended from existing fire hydrant located north of Ruakaka bridge, power and fibre connections are otherwise available within the vicinity of the subject site.

3.0 EARTHWORKS

3.1 EARTHWORKS

For the creation of developable area and construction of associated infrastructure, the most significant item of earthworks will be filling the site to raise the building and parking areas above the expected 100yr flood level.

The Earthworks will involve cut to fill operations and importing of fill pavement and foundation construction. The site is to be lifted from the southern boundary and will generally slope toward the north to drain the stormwater run-off. As earthworks are completed areas are to be progressively stabilised

A geotechnical site investigation has been prepared for the site. All earthworks are to adhere to the recommendations within this report.

The proposed earthworks volumes within the subject area are listed below:

Total area of ground disturbance	= 57,629m^2
Total volume of fill	= 26,289m^3
Total volume of cut	= 4,589m^3
Maximum cut and fill depth	= 2.0m Fill, 1.5m Cut
Total volume of imported material	= 21,700m^3

There is not an earthworks balance for the subject site, due to tan expected short fall in fill. The majority of fill required on site would be use for the pavement construction for the roading and car parking area, resulting in approximately 13,500m^3 of imported aggregate. In addition to this, there is aggregate required to construct the proposed stormwater network. We expect this will range in an additional 2,000m^3 of imported material.

Imported material/aggregates will be imported from a nearby quarry resulting in an approximately 2,200 truck movement over the construction period - assuming one truck can load 10m^3 of material.

Stripped topsoil from the development area is to be reused in proposed landscape works. The remain topsoil and any unsuitable material will be used to construct the acoustic mitigation bund along the northern boundary. The volume required for these works will would account for approximately 3,000m3 of material.

3.2 SEDIMENT AND EROSION CONTROL

A sediment and erosion control plan has been developed to mitigate any adverse effects of the proposed earthworks on site. Sediment and erosion control has been designed in accordance with GD05 and Whangarei District Council (WDC) guidelines.

The sediment laden stormwater will be treated via sediment retention ponds, decanting earth bunds and controlled via earth diversion bunds, cut-off drains and silt fences. Clean water and dirty water diversions will direct any runoff generated to the appropriate treatment device.

Sediment controls, use of the existing site entrance, a stabilised gravel site entrance and wheel washes as required will be constructed prior to bulk earthworks commencing. All exposed natural ground will be stabilised as soon as practical throughout construction.

4.0 FLOODING

4.1 FLOODING

An assesment has been prepared and appended in accordance with the flood modeling prepared for the Northland Regional Concil for this catchment.

A portion of the site is subject to an existing 100 year flood plain. During the process of reviewing the previous draft submited, information to support the landuse consent applciation has been generated for this site.

The land development department of the Whangarei District Council had raised intial feedback related to the flood modeling on site. A specific flooding memo has been prepared to address these concern.

Overall, the flooding level post development on site has been determined to ensure all proposed buildings are above the minimum floor level in accordance with the WDC guidelines; 500mm above the the flood level in the post development scenerio.

5.0 STORMWATER

The Whangarei District Council Environmental Engineering Standards has sets out design and construction standards for stormwater.

5.1 STORMWATER RETICULATION

A private stormwater networks is proposed to be installed on site to service this development and ultimately discharges to existing watercourses on site.

Works required within the NZTA corridor include removal of drainage structures bridging the table drains either side of the existing crossings onsite and construction of appropriate diversions to enable to construction of the proposed offramp. Details of which will be subject to approval from NZTA and building consent.

5.2 STORMWATER CAPACITY

Although the proposed stormwater pipe network on site is private. It has been designed to have capacity for 5YR ARI events inclusive of predicted climate change as is required of all public drainage within the district. In locations where the stormwater run-off is captured by the grass swale. The grass swale has been designed to convey design flows from the 100 year event.

5.3 STORMWATER QUALITY

The stormwater quality treatment on site has been designed in accordance with TP10 with a treatment train approach to ensure that the water discharged from site will achieve a minimum of 75% TSS removal.

Stormwater run-off generated from the site will generally be pre-treated within a rain garden/ swale prior discharge to the dual-purpose stormwater attenuation pond/ rain garden downstream of the developed area. The bottom of the pond has been designed to be one single rain garden with a capacity to treat the run-off generated by the entire contaminant and trafficable area of the site.

Referring to the appended catchment plans within the engineering calculations:

- Catchments A, B, M & L do not discharge to the large dual-purpose rain garden location due to fall onsite and instead drain smaller treatment devices.
- Run-off generated from catchment L will be treated by a dedicated swale designed to TP10 standards.
- While the run-off generated from catchment M (approximately 210m^2) will be treated with a rain garden.

5.4 STORMWATER ATTENUATION

The WDC Environmental Engineering Standards has set a requirement to attenuate the post development 100 year stormwater run-off flow back to 80% of the pre-development run-off flow.

A stormwater peak run-off analysis in accordance with TR55 has been developed for this site to calculate the attenuation and flow restriction required to support the development on site.

An extensive swale system also been proposed on site to replicate the post development environment and to offset the storage volume provided by those existing farms drained which going to be filled.

The stormwater run-off generated from this site will be control by an outlet structure within the proposed rain garden. The outlet structure has been designed to attenuate not only for the 100 years event. It also been designed to attenuate for the 5 years event to the requirements of WDC. Please refer to the attached HEC Report for modelling details and outputs.

5.4 CONCLUSION

Stormwater drainage can be provided for the proposed development. The stormwater quality will be provided via the use of swale & raingarden in accordance with TP10. The stormwater attenuation has been provided via the attenuation pond at the downstream of the site.

6.0 WASTEWATER

The Whangarei District Council Environmental Engineering Standards has sets out design and construction standards for wastewater disposal.

6.1 WASTEWATER RETICULATION

There is no existing public wastewater connection located close to the subject site. Hence a wastewater disposal for onsite disposal has been designed to treat the wastewater generated from the land use activity.

The system has been designed by Reflection Wastewater Treatment Solution which consist of a primary treatment via specialised septic tanks and a secondary treatment via drip lines discharging the treated wastewater into the denoted 1.0ha disposal area. The disposal area has been selected as the frontage of the site where extensive planting has been proposed.

Away from the main flood plain. An additional 0.5ha of land has been reserved for this treatment system to provide additional treatment area if required.

Please refer to attached design provided by Reflection Wastewater Treatment solution for more information. Detail drawings has been prepared in the overall engineering drawings set.

6.2 CONCLUSION

Wastewater drainage can be provided for the proposed development There is a suitable disposal method with respect to wastewater which can meet WDC standards.

7.0 WATER SUPPLY

The Whangarei District Council Environmental Engineering Standards sets out the design principles for water supply and requires assessment against SNZPAS 4509:2008 NZ Fire Service Fire Fighting Water Supply Code of Practise

7.1 WATER RETICULATION

There is an Existing 150mmØ water main located just north of the Ruakaka Bridge 2km away from site. To services this development, this existing water supply pipe will be extended from this fire hydrant location to site with a 225mm PE pipe. The water supply pipe will be designed in accordance with WDC standards.

7.2 POTABLE WATER AND FIRE FIGHTING SUPPLY

To meet the minimum requirement of the fire water classification W3. All the building onsite shall be installed with the sprinkler in accordance with the requirement of Building Code. The new public water supply for this site shall meet the following requirement below:

- A primary water flow of 12.5 litres/sec within a radial distance of 135m
- An additional secondary flow of 12.5 litres/sec within a radial distance of 270m
- The required flow must be achieved from a maximum of one or two hydrants operating simultaneously
- A minimum running pressure of 100kPa

Flow rates and pressures are to be tested to confirm minimum requirements for the water supply classification stipulated in SNZPAS 4509:2008 can be achieved. Further design detail shall be provided at the Engineering approval stage.

7.3 CONCLUSION

There is public water supply infrastructure accessible by the site which is considered sufficient for potable water and firefighting supply.

8.0 OTHER SERVICES

Telecommunications in the area are managed by Chorus, Power supply in the area is managed by North power.

Adequate provision for connection to both of these networks is expected due to the proximity of existing utilities to the site, details will be confirmed and upgrades required delivered in coordination with the relevant utility suppliers..

9.0 CONCLUSIONS

The information gathered to-date confirms the site is suitable for the proposed subdivision and future residential development.

Stormwater drainage can be provided for the proposed development, stormwater attenuation and quality treatment will be provided in accordance with WDC's standards

There is adequate space for the wastewater drainage to be treated and disposed of onsite for waste generated as part of the proposed development, consistent with WDC's standards.

Water supply infrastructure can be provided via an extension of the existing public network which is considered sufficient for potable water and firefighting supply for the proposed development.

Power and Telecommunication networks are present in the surrounding area and service is considered available.

Overall it is concluded that the proposed development is able to be adequately serviced by existing and proposed infrastructure in accordance with the relevant local authority standards.

APPENDIX A – FLOODING MEMO

STORMWATER FLOODING ASSESSMENT MEMO

CLIENT: S K AOTEAROA TRUST

SITE: INTERSECTION OF SH1 AND SH15 PORT MARSDEN HIGHWAY, RUAKAKA
CONSENT REF NO: LUC2000057

1 INTRODUCTION

The purpose of the assessment is to address the flooding issues noted in the Whangarei District Council (WDC) initial response.

1.1 INITIAL RESPONSE QUERIES

The following queries will be addressed in this report.

> *2. The analysis relies on WDC and NRC mapping to define flood extents. We note that the NRC flood hazard maps are accompanied by a lengthy disclaimer, so such reliance may well be inappropriate. Further, WDC may become jointly liable for any future flooding issues if it does not at least challenge reliance on the NRC flood hazard maps.*
>
> The specific comment is in regards sea level rises.
>
> *From discussions with NRC, their flood mapping assumes 1m sea level rise as the tailwater condition. As WDC has not yet developed an adaptive planning pathway, the flood assessment should, as a transitional response, avoid hazard risk by using sea-level rise over more than 100 years and the H+ scenario, as per MFE "Preparing for Coastal Change" (Category A). This approach will assume sea level rise of at least 1.3m, so reliance on NRC flood mapping is immediately inappropriate.*
>
> *5. The on-site post-development flood extents appear greater than the pre-development. Whether flooding extends off-site requires clarification.*

1.2 PROPOSED STRATEGY

A HEC RAS v5.07 2D model will be built using LiDAR terrain data supplied from Northland Regional Council (NRC). HEC-HMS v4.6 will be used to create run-off hydrographs with previous study parameters. The analysis is for the 100-year storm including climate change rainfall.

In effect the model is to be "calibrated" with the NRC floodplain provided. This model will be then be used to address the queries. However, there is limitations to this model. The key issue is whether the sea level rise prediction has any impact on the flood levels provided by the NRC and effects on the immediate neighbours. It is not intended as a detailed model which requires inputting numerous structures, detailed surveying of cross-sections and model calibration.

1.2.1 SEA LEVEL RISE

The model will check the sensitivity of the NRC flood map on the site to the sea level rise. The NRC flood modelling was based on a sea level rise (SLR) of 1.0m. WDC state the SLR should be 1.3m and this may affect the site finished floor levels required.

1.2.2 EFFECTS ON NEIGHBOURS

The HEC RAS 2D model will be updated to include the proposed site levels to confirm effects of the development on immediate neighnours.

1.3 Reference Technical Documents

- Waikato stormwater run-off modelling guideline, TR2018/02, Waikato Regional Council,
- Infrastructure Report, Ruakaka Travel Centre, Blue Barn, December 2019
- Part C Policies – Natural Hazards – Section 19, Whangarei District Council
- Ruakaka Modelling and Calibration Report, for Northland Regional Council, URS, 2012
- Ruakaka River Modelling Memo Calibration Review and Willow removal analysis, Ewaters Ltd, 2016

1.4 Previous Study Parameters Summary

URS published a report on 29 October 2012 titled Ruakaka Modelling and Calibration Report for the NRC. In 2016 Ewater NZ Ltd undertook a review of the work with a number of recommendations.

The key methods and parameters used by URS were

- Hydrology done by non-linear reservoir
- No Areal Reduction Factor for the rainfall
- A 12-hour duration event.
- Simplified representation of culverts and structures
- 1D model combined with 2D floodplain areas
- Manning's n in the range of 0.059 to 0.08 for the main channel

NRC provided via their website the shape file for the 100-year floodplain.

2 Hydrology

2.1 Methodology

The analysis was done using the following steps:

- Delineate the catchment,
- Determine the appropriate curve number based on soil maps and land-use
- Develop a rainfall hyetograph
- Build an HEC-HMS model to calculate flow hydrographs

2.2 Rainfall depth and distribution

A central location within the catchments was used in HIRDSv4 to define the whole catchment's rainfall. HIRDS RCP6.0 2081 to 2100 gives a 12-hour rainfall depth of 221mm.

The nested storm was developed from the HIRDS data for each duration. Figure 2.1 shows the distribution used extracted from the HEC-HMS file.

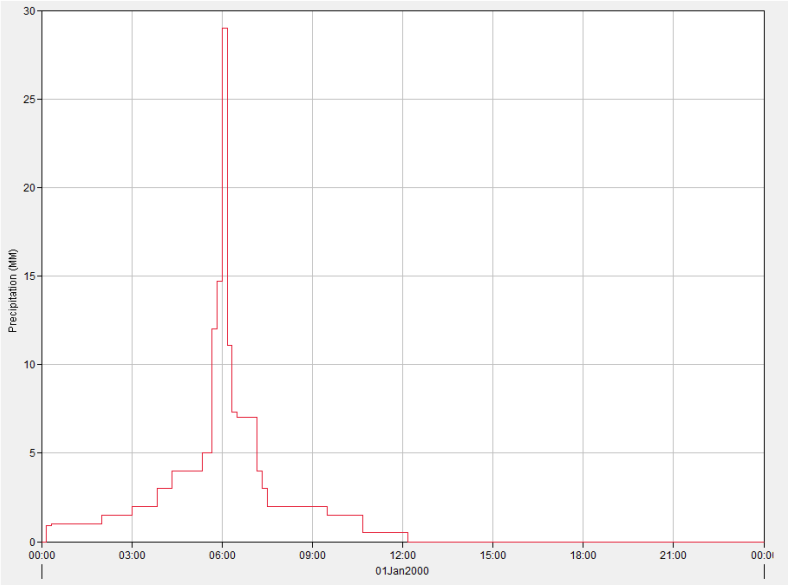


Figure 2.1 Rainfall distribution

Catchment size and time to peak

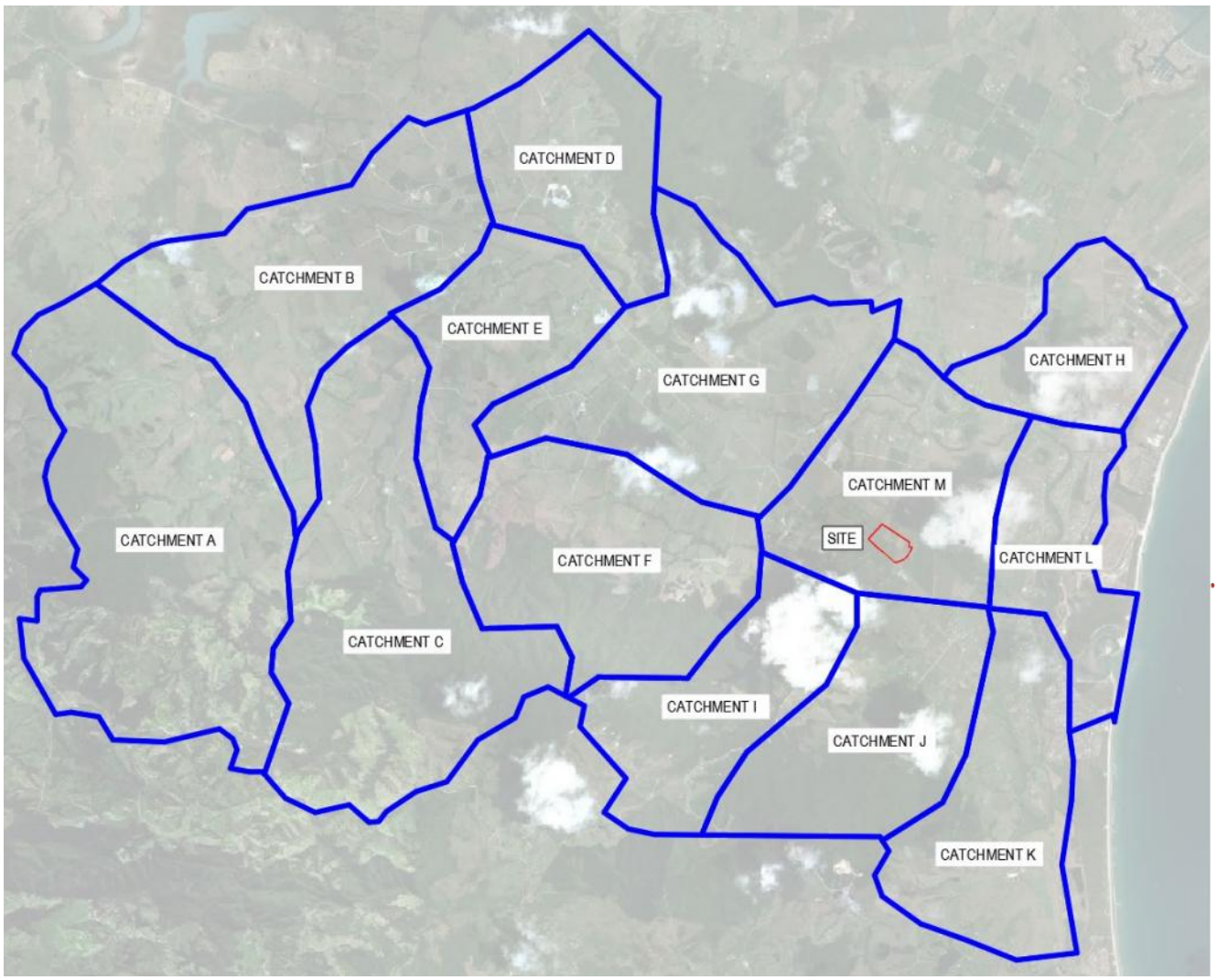


Figure 2.2 shows the approximate catchment and the sub-catchments

Table 2.1 gives the sub-catchment areas and the calculated time to peak based on the time of concentration given by.

$$t_c = 0.0195(L^3/H)^{0.385}$$ Equation 7-4

Where:
t_c = time of concentration (minutes)
L = Length of catchment (m) measured along the flow path
H = rise from bottom to top of catchment (m)

Source: Ministry of Business, Innovation and Employment Department of Building and Housing guidance on E1 Surface Water

Table 2.1 - Hydrology Parameters

Subcatchment	Area	L	H	Tc	Tp
	km^2	km	m	minutes	Minutes
A	13.581	5.5	212	52	35
B	8.874	5.8	81	80	53
C	11.48	6.3	167	66	45
D	4.948	3.5	102	41	27
E	4.76	4.6	84	60	40
F	7.715	3.9	128	42	28
G	9.013	4.5	105	54	36
H	3.629	2.3	8	67	45
I	5.325	4.2	221	37	25
J	6.238	4.1	203	38	25
K	6.114	4.7	55	73	49
L	3.914	3.1	7	99	67
M	6.364	2.5	60	34	23

2.3 LAND-USE AND TIME OF CONCENTRATION

Using the Managing Northland Soils factsheet viewer provided by the NRC it would appear the predominant soils in the catchment are types 1.2, 3.3.2 and 3.4.2. They have a reasonable clay content and are then regarded as Type C for hydrological purposes. There is some forestry in the catchment but it is predominantly rural pasture with small pockets of urbanisation. It was decided to use a curve number of 82 for the TR55 method. The corresponding initial abstraction is 2.8mm based on TR2010/02 Rainfall-Runoff guidelines used by Waikato Regional Council.

This data was applied to the HEC-HMS model.

2.4 HEC-HMS MODEL

The data was then entered into a simple HEC-HMS model to create flow hydrographs. Figure 2.3 shows summary table generated. Figure 2.4 shows, as an example the hydrograph for sub-catchment A.

Global Summary Results for Run "100year-12hour"

Project: Ruakaka Travel Centre Simulation Run: 100year-12hour

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 30Sep2020, 11:24:33

Basin Model: Main
Meteorologic Model: 100-year
Control Specifications: 24-hour

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Alphabetic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
A	13.581	273.79643	01Jan2000, 06:41	2360.26231
B	8.874	202.23603	01Jan2000, 06:32	1542.22573
C	11.480	189.19772	01Jan2000, 07:02	1995.12637
D	4.948	116.77637	01Jan2000, 06:30	859.92032
E	4.760	81.47665	01Jan2000, 06:57	827.24752
F	7.715	145.79893	01Jan2000, 06:46	1340.80139
G	9.013	160.80556	01Jan2000, 06:52	1566.38275
H	3.629	88.88537	01Jan2000, 06:28	630.68934
I	5.325	125.67384	01Jan2000, 06:30	925.43972
J	6.238	124.06856	01Jan2000, 06:42	1084.11135
K	6.114	109.08301	01Jan2000, 06:52	1062.56121
L	3.914	57.74372	01Jan2000, 07:20	680.21991
M	6.364	142.62182	01Jan2000, 06:33	1106.00908
Sink-1	91.955	1682.54556	01Jan2000, 06:39	15980.99700

Figure 2.3 HEC-HMS summary table - 100-year, 12-hour with climate change

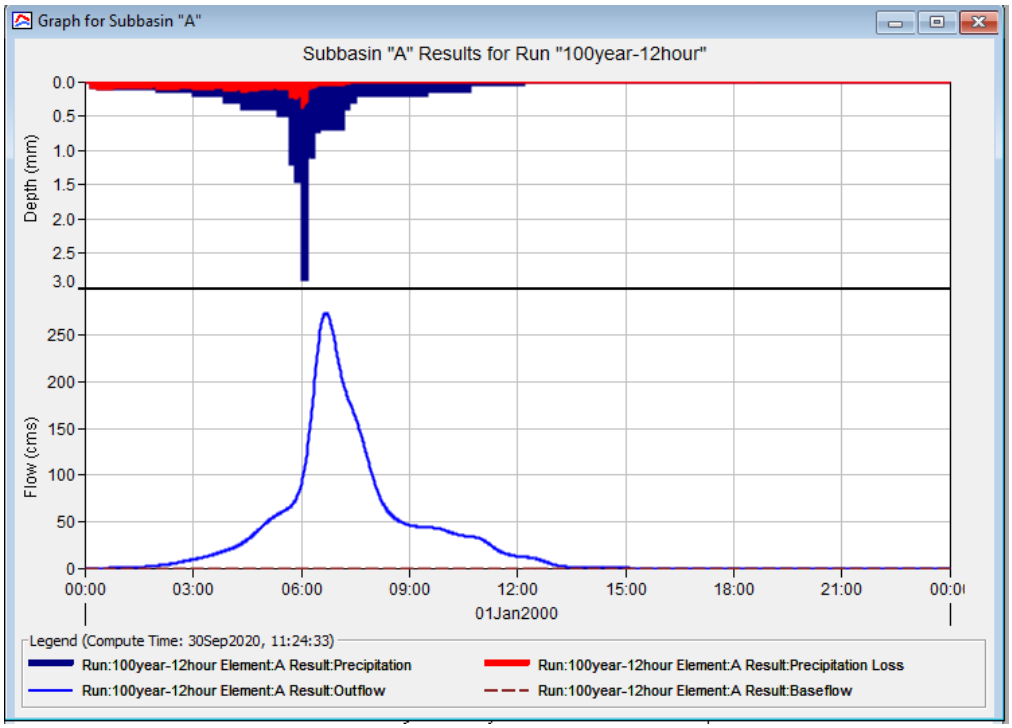


Figure 2.4 Sub-catchment A hydrograph - 100-year, 12-hour with climate change

3 HYDRAULIC ANALYSIS

3.1 MODEL LAYOUT

HEC-RAS was used to generate water levels in the main floodplain area. A 2D grid was developed from the LiDAR terrain data developed from NRC. All datums are NZVD 2016.

Figure 3.5 shows the general 10m x 10m grid. A 2m x 2m grid was tested and did not make a great deal of difference in such a large area. The time step used was 5 minutes but can be reduced to 5 seconds if the courant number is too high. The Manning's n was set to 0.08 in line with the previous work by URS.

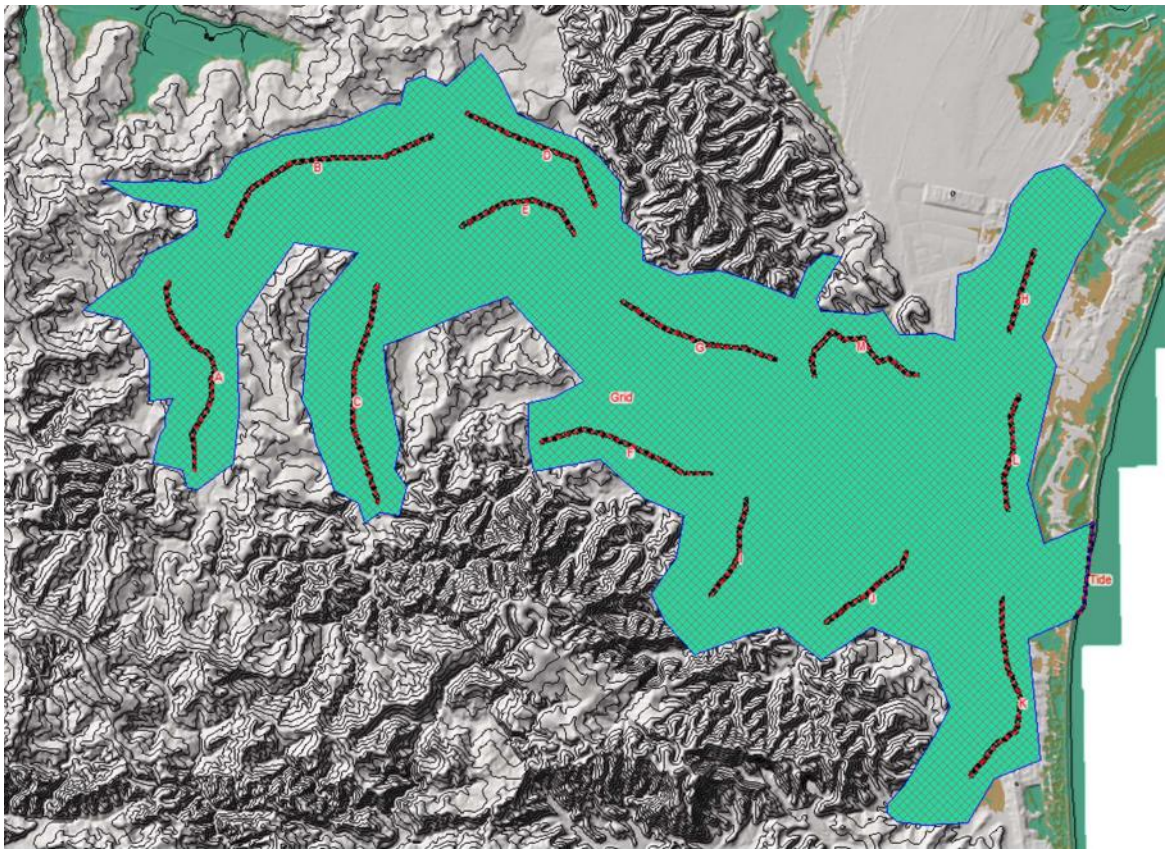


Figure 3.1 HEC-RAS model set up

The downstream boundary was based on the LINZ standard tide levels. The Marsden Point MSL is 1.60m. The SLR in the previous NRC flood maps used a value of 1.0m. The WDC initial response wanted the SLR to be 1.3m. This made the constant downstream boundary RL2.60m and RL2.9m in testing the sensitivity of the SLR at the site.

3.2 FLOOD MODEL RESULT

3.2.1 FLOOD-MAP FOR THE SITE AND COMPARISON TO NRC MODEL

Figure 3.2 shows a flood map near the site in the central part of the catchment. It includes climate change rainfall. The modelled flood extents are shown in blue and orange outline is the NRC floodplain extent for the 100-year event. The tide level is RL2.6m which is meant to replicate the NRC floodplain developed by URS in 2012.

The flood extents are reasonably similar. However, there are a few issues to discuss.

There are pockets of more flooding in this model. Although some of it shallow there are some channels with depths greater than 500mm. This is expected to be due to the way water enters the model from the hydrology method and/or URS model having more detail of stopbanking or culvert restrictions.

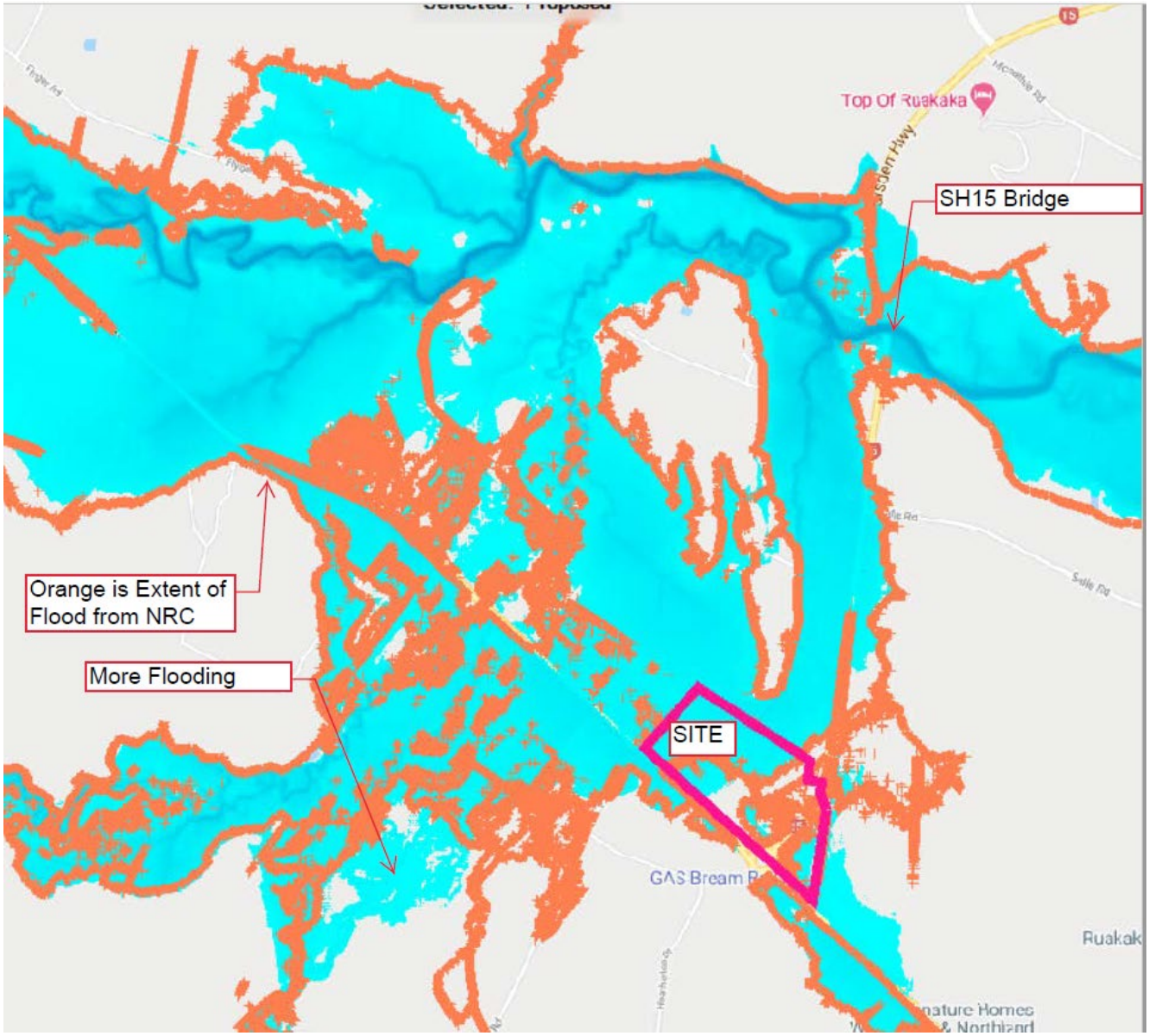


Figure 3.2 Flood Map at vicinity of the site with 100 year climate change

There is a bridge for SH15 to the north of the site. This bridge was not modelled explicitly. Figure 3.3 shows the cross-section.

Figure 3.3 SH15 bridge cross-section – 100yr-climate change

The water overtops the bridge in the URS model by 180m. If the bridge deck was modelled explicitly instead of just a flow restriction, it would make little difference to the site given the URS model is already showing overtopping and the water levels would be adjusted to match. It would make little difference in sensitivity testing required by the objective of this report.

There is also a similar issue for Marsden Point Road bridge. On this occasion the water level is below the bridge. If the deck is 1m deep flow may be obstructed. Given the distance from the site (4km) a lift of 0.5m we expect little difference in flood extents within the subject site.

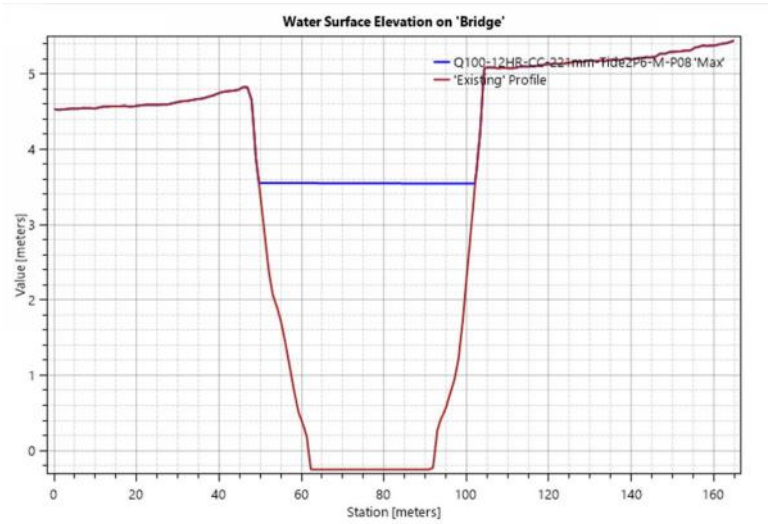


Figure 3.4 Flood-map for vicinity of the site – 100yr-climate change

3.2.2 HYDRAULIC GRADE LINES – SEA LEVEL ASSESSEMNT

Figure 3.5 shows the LONG hydraulic-grade-line from the site to the sea outlet. It is clear that the NRC terrain does not give river profiles below RL-0.2m. However, for the objective of the report it is not important. It would be important if non-climate change rainfall with high frequency floods were the issue. However, the SLR rise of 1.3m drowns the river channels during future MSL and makes the capacity of the river almost an irrelevance.

Figure 3.5 includes the SLR of 1.3m to compare with the SLR of 1m modelled by URS for NRC. The impact of the differential of SLR is felt at a distance of 2000m along the channel whereas the site is the top 500m and on a slope. In short, the SLR differential of 0.3m not considered in the NRC floodplain has no impact at the site.

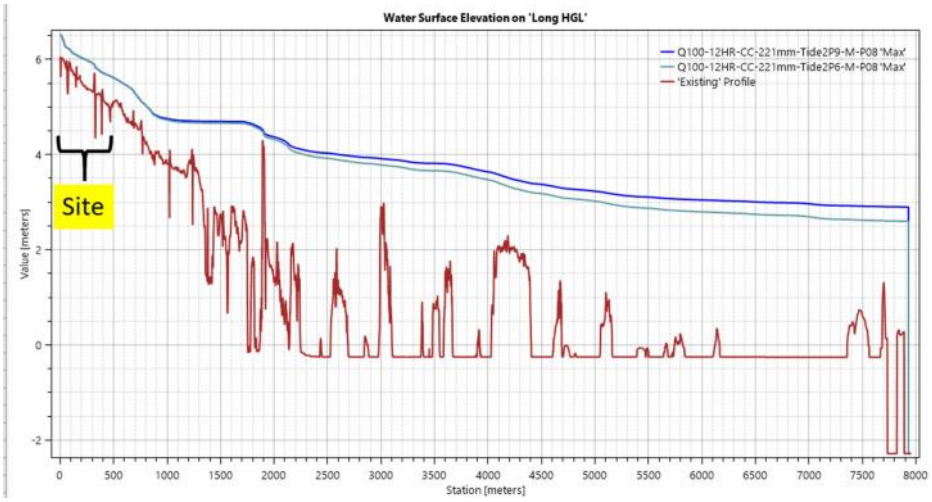


Figure 3. 5 HGL from Site (0m to 500m) to Sea, for SLR 1m and 1.3m – 100yr-climate Change

To emphasise this point Figure 3.6 shows the HGL through the site. The maximum water levels modelled cannot be differentiated.

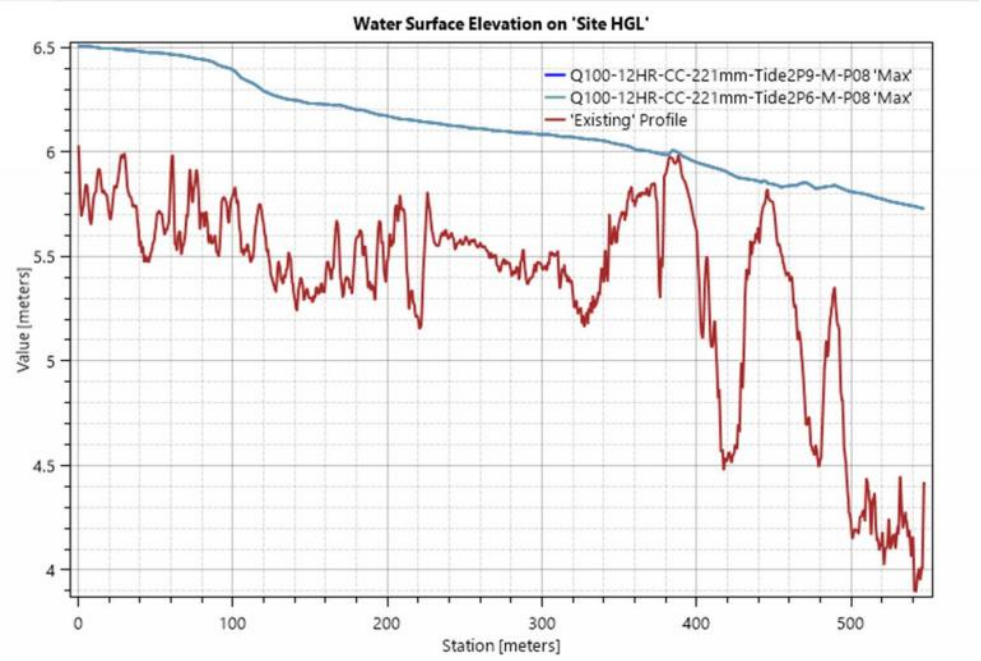


Figure 3.6 Site HGL comparing SLR of 1m and 1.3m – 100yr-climate change

3.3 EFFECTS ON NEIGHBOURS

For this assessment, the site area was further refined to 1m by 1m grids for pre-development and post development ground levels. However, the hydrology was maintained as the site is to discharge at 80% of predevelopment flow, the overall hydrology would be maintained/decreased.

Figure 3.9 shows no evidence of additional areas flooding due to proposed development

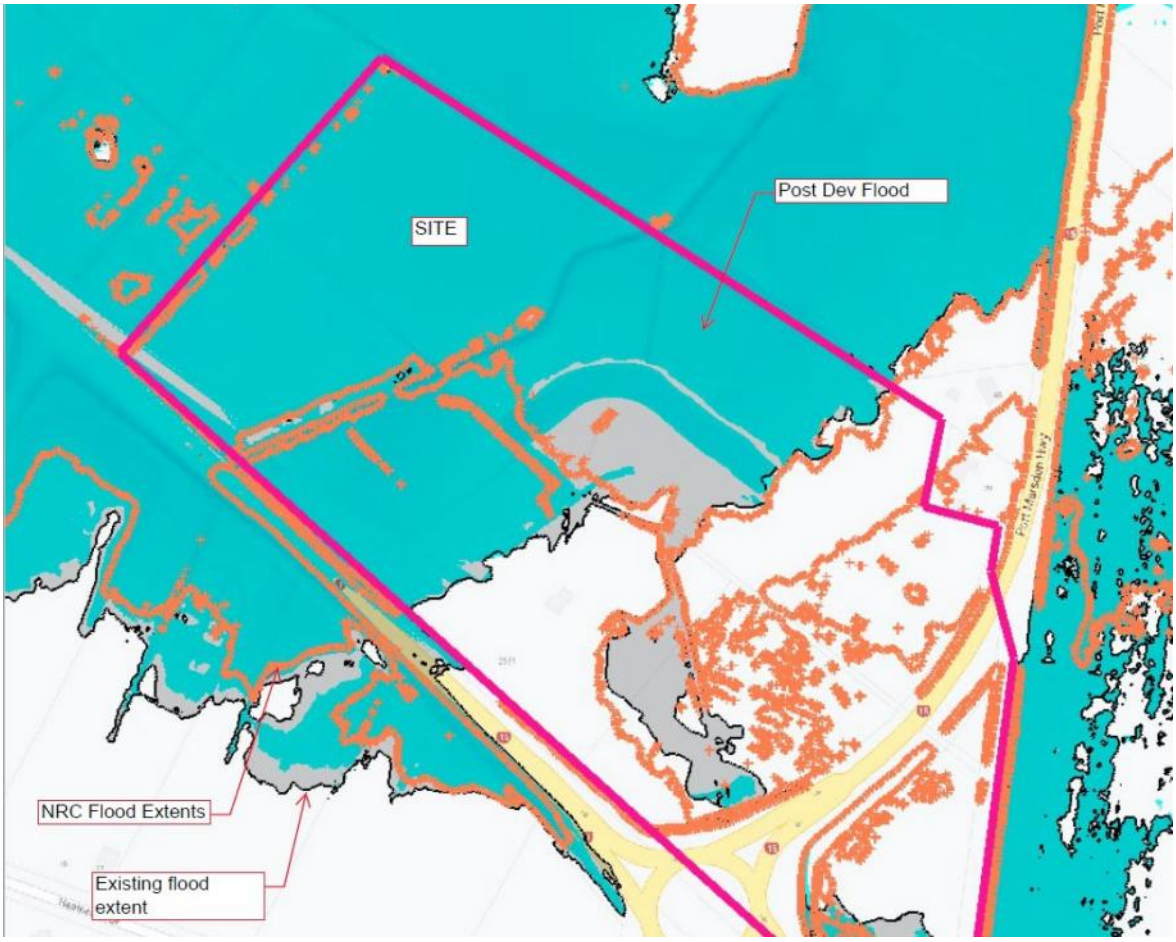


Figure 3.9 Pre and Post Development flooding overlayed

4 SUMMARY

A floodplain analysis has been undertaken to determine the 100-year flood levels through the site which includes climate change rainfall and sea level rise.

HEC-HMS generated flow hydrographs for 13 subcatchments.

Using HEC-RAS 2D, a 10m x 10m grid was built and the hydrographs applied.

Based on the information from the URS 2012 report we were able to generate a mock-up of their stormwater model and have managed to replicate the flood extent for a very large area using reasonable parameters. This model is only used to verify the potential effects of sea level rise and the proposed development on surrounding neighbours.

4.4 SEA LEVEL RISE

The objective was to determine whether an increase in expected sea level rise from 1m to 1.3m would affect the 100-year flood level determined by URS/NRC.

Based in this new sensitivity model the flooding on the site is not subject the sea level rise.

It would be reasonable therefore that the NRC flood levels are still applicable for setting floor levels.

4.5 EFFECTS ON NEIGHBOURS

There are no indications of additional flood areas generated on the immediate neighbours by the proposed development based of the RAS stormwater model.

APPENDIX B – STORMWATER REPORT

STORMWATER MODELLING REPORT

RUAKAKA SERVICE CENTER

RUAKAKA

Maven Associates	**Job Number** 117019		**Rev** A
Job Title Ruakaka Service Center **Title** Stormwater Modelling Report	**Author** LC	**Date** 30.09.20	**Checked** GB

1.0 INTRODUCTION

1.1 PURPOSE

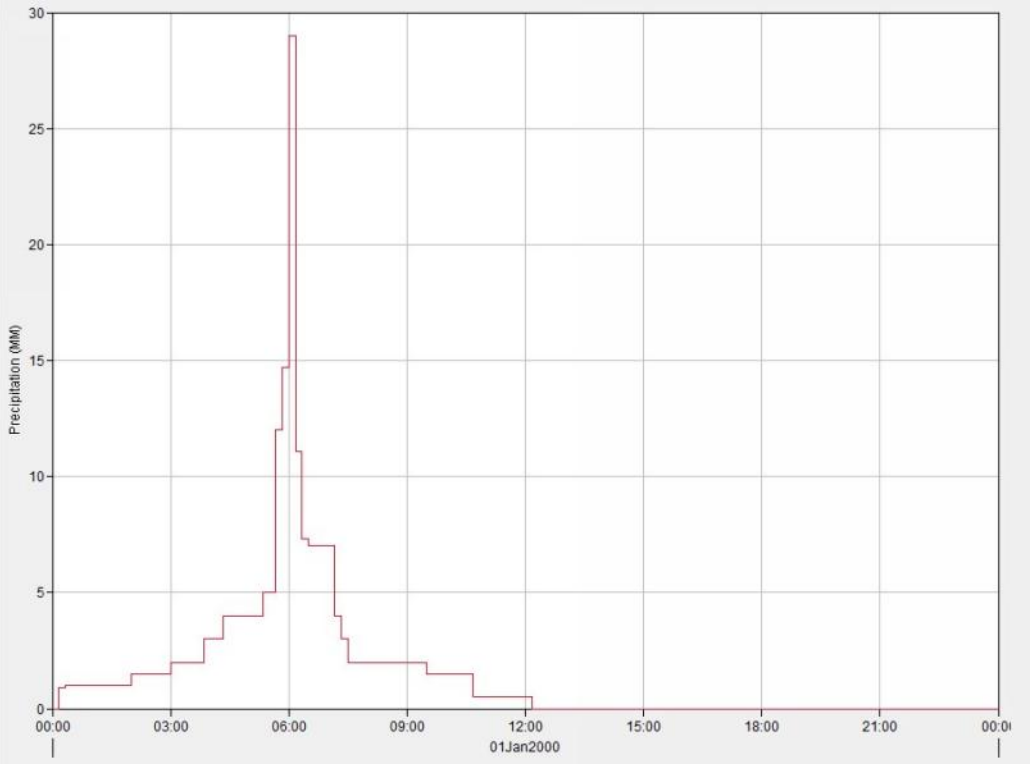
The purpose of this report is to provide an assessment of stormwater runoff volumes and design parameters for attenuation of runoff to control the following rainfall event:

- 20% AEP (5 Yr ARI) from developed areas
- 1% AEP (100 Yr ARI) from developed areas

1.2 STORMWATER MODELLING

Stormwater modelling has been completed with HEC-HMS stormwater modelling software, as per and in accordance with TP108 for the development to determine the runoff details required to design and comply with proposed stormwater guidelines.

HEC-HMS modelling allows for Climate change which comprises of both an increase in the rainfall depth for a given event and modification of the normalised 24hour Temporal rainfall intensity profile.



2.0 STORMWATER MODELLING

2.1 MODEL SUMMARY - EXISTING SITE (PRE-DEVELOPMENT)

Currently the site is used for rural/agricultural purposes, the catchment area assessed is reduced to the proposed developed area (as the developed area is to attenuated to a percentage of the pre-development flow as per WDC guidelines)

Drained via a Rain Garden / Flood Attenuation Device – 3.39 Ha

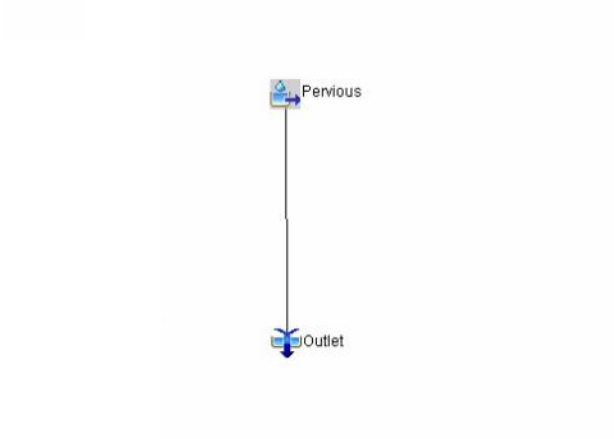
Runoff Factors – Type C Soils

Impervious	CN = 98	Area = 0.0m²
Pervious	CN = 74	Area = 33,933.00m²

Rainfall Depth: NIWA NIRDS – Historic

Storm Event	Rainfall Depth (mm)
5 Yr	130
100 Yr	234

HEC Model Overview:



2.1.2 5YR – PRE-DEVELOPMENT SITE DISCHARGE

Pre Development Peak Discharge:

Project: Ruakaka Service Station Simulation Run: PRE 5YR

Start of Run: 01Jan2000, 00:00 Basin Model: Existing
End of Run: 02Jan2000, 00:00 Meteorologic Model: 5YR
Compute Time: 30Sep2020, 14:38:25 Control Specifications: 24 hour

Show Elements: All Elements Volume Units: ○ MM ◉ 1000 M3 Sorting: Hydrologic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
Pervious	0.033933	0.1615	01Jan2000, 08:03	2.5478
Outlet	0.033933	0.1615	01Jan2000, 08:03	2.5478

Pre Development Flow: 0.1615 m^3/s

2.1.3 100YR – PRE-DEVELOPMENT SITE DISCHARGE

Pre Development Peak Discharge:

Project: Ruakaka Service Station Simulation Run: PRE 100YR

Start of Run: 01Jan2000, 00:00 Basin Model: Existing
End of Run: 02Jan2000, 00:00 Meteorologic Model: 100yr
Compute Time: 30Sep2020, 14:39:26 Control Specifications: 24 hour

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Hydrologic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
Pervious	0.033933	0.3519	01Jan2000, 08:02	5.1628
Outlet	0.033933	0.3519	01Jan2000, 08:02	5.1628

Pre Development Flow: 0.3519 m^3/s

2.2 POST DEVELOPMENT

Whangarei District EESPM require that post development flows are attenuated to 80% of pre-development flows, therefore the required peak flow rates in the design storms have been determined to be:

Storm Event (ARI)	Pre Development Flow (L/sec)	Post Development Target (80% of Pre-Dev)
5 Yr	161.5	129.2
100 Yr	351.9	281.5

Hydrology controls are to be provided by a basin attenuating flow prior to the discharges to the existing stormwater channel onsite.

2.3 MODEL SUMMARY – POST DEVELOPMENT

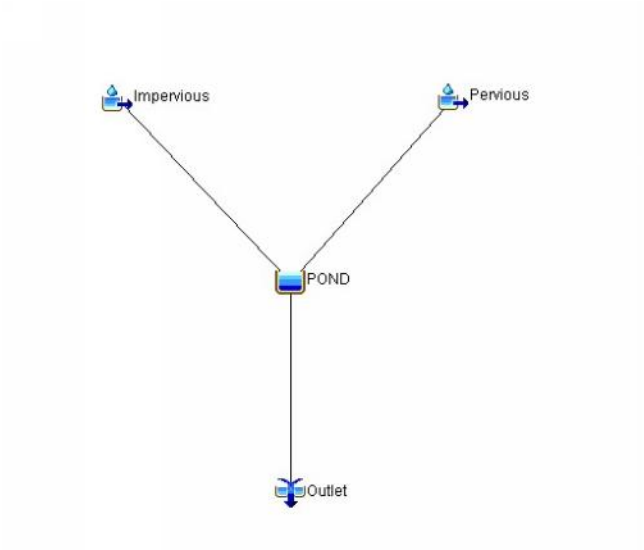
Runoff Factors – Type C Soil (Clay soils)

Impervious	CN = 98	Area = 30,313.00m²
Pervious	CN = 74	Area = 3620.00m²

Rainfall Depth: NIWA NIRDS – V6.0

Storm Event	Rainfall Depth (mm)
5 Yr	146
100 Yr	267

HEC Model Overview:



2.3.1 Basin Details:

Live Storage Volume = 2200.0m³

Between RL 5.00m to 5.20m allocated for Water Quality Treatment

Elevation Storage Table:

Elevation (m)	Volume (m3)
5.00	0.0
5.20	760.0
5.80	2960.0

5 YR Control:

Orifice Diameter = 375mm
Orifice Height (Centre) = 188mm

5 YR Model Output

Discharge Details:

Project: Ruakaka Service Station Simulation Run: POST 5YR

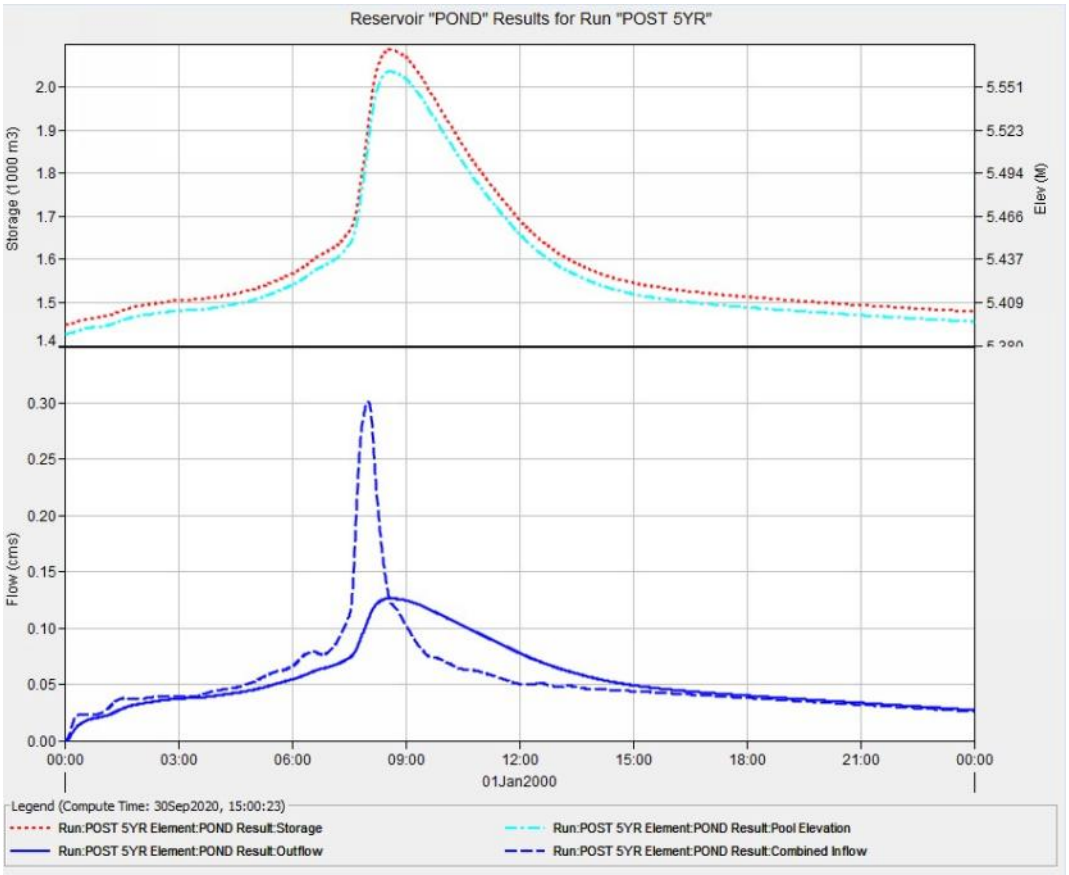
Start of Run: 01Jan2000, 00:00 Basin Model: Post Dev
End of Run: 02Jan2000, 00:00 Meteorologic Model: 5YR
Compute Time: 30Sep2020, 14:59:35 Control Specifications: 24 hour

Show Elements: All Elements Volume Units: (•) MM ( ) 1000 M3 Sorting: Hydrologic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Impervious	0.030313	0.2845	01Jan2000, 08:00	145.396
Pervious	0.003620	0.0172	01Jan2000, 08:03	75.082
POND	0.033933	0.1264	01Jan2000, 08:35	137.029
Outlet	0.033933	0.1264	01Jan2000, 08:35	137.029

Post Development Target 129.2 l/s
Post Development Peak Discharge: 126.4 l/s (OK)

5 YR Discharge Graph



Peak Water RL: 5.561m

100 YR Control:

Weir Length = 1.65m

Weir RL = 5.562m

100 YR Model Output

Discharge Details:

Project: Ruakaka Service Station Simulation Run: POST 100YR

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 30Sep2020, 15:03:40

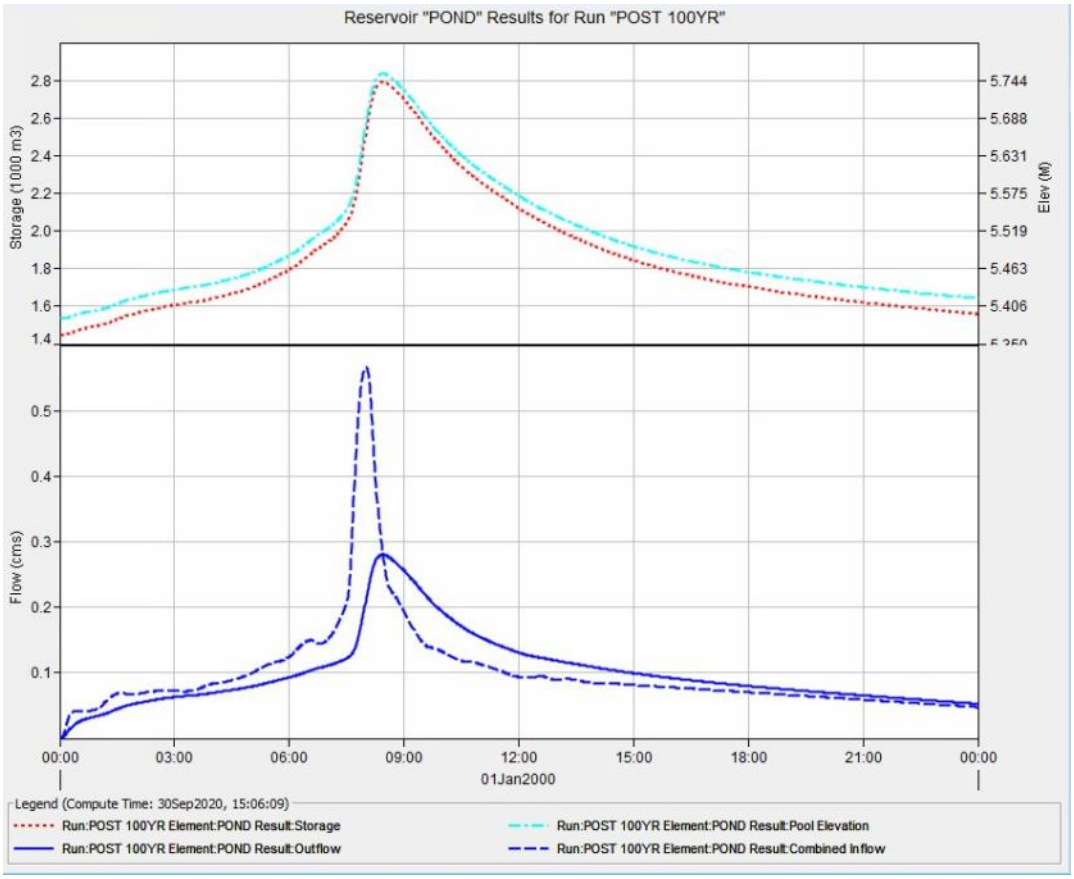
Basin Model: Post Dev
Meteorologic Model: 100+cc
Control Specifications: 24 hour

Show Elements: All Elements | Volume Units: MM / 1000 M3 | Sorting: Hydrologic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
Impervious	0.030313	0.5202	01Jan2000, 08:00	8.0601
Pervious	0.003620	0.0455	01Jan2000, 08:02	0.6605
POND	0.033933	0.2827	01Jan2000, 08:27	8.6099
Outlet	0.033933	0.2827	01Jan2000, 08:27	8.6099

Post Development Target 281.5 l/s
Post Development Peak Discharge: 280.8 l/s (OK)

100 YR Discharge Graph



2.4 CONCLUSION

Stormwater discharge can be attenuated to attenuate peak flows from both 5yr & 100yr storm events through outlet control from the proposed stormwater basin. Details within this report were, where necessary, assumed to confirm stormwater control potential and provide a baseline for future detailing at engineering or building consent stage. Details to be considered include:

- No ground disposal allowed for.
- Total Live Storage Volume = 2200 m^3
- Pre-development Flow (20% AEP) = 161 l/s
- Pre-development Flow (1% AEP) = 352 l/s
- Post development Target (20% AEP) = 129 l/s
- Post development Target (1% AEP) = 282 l/s

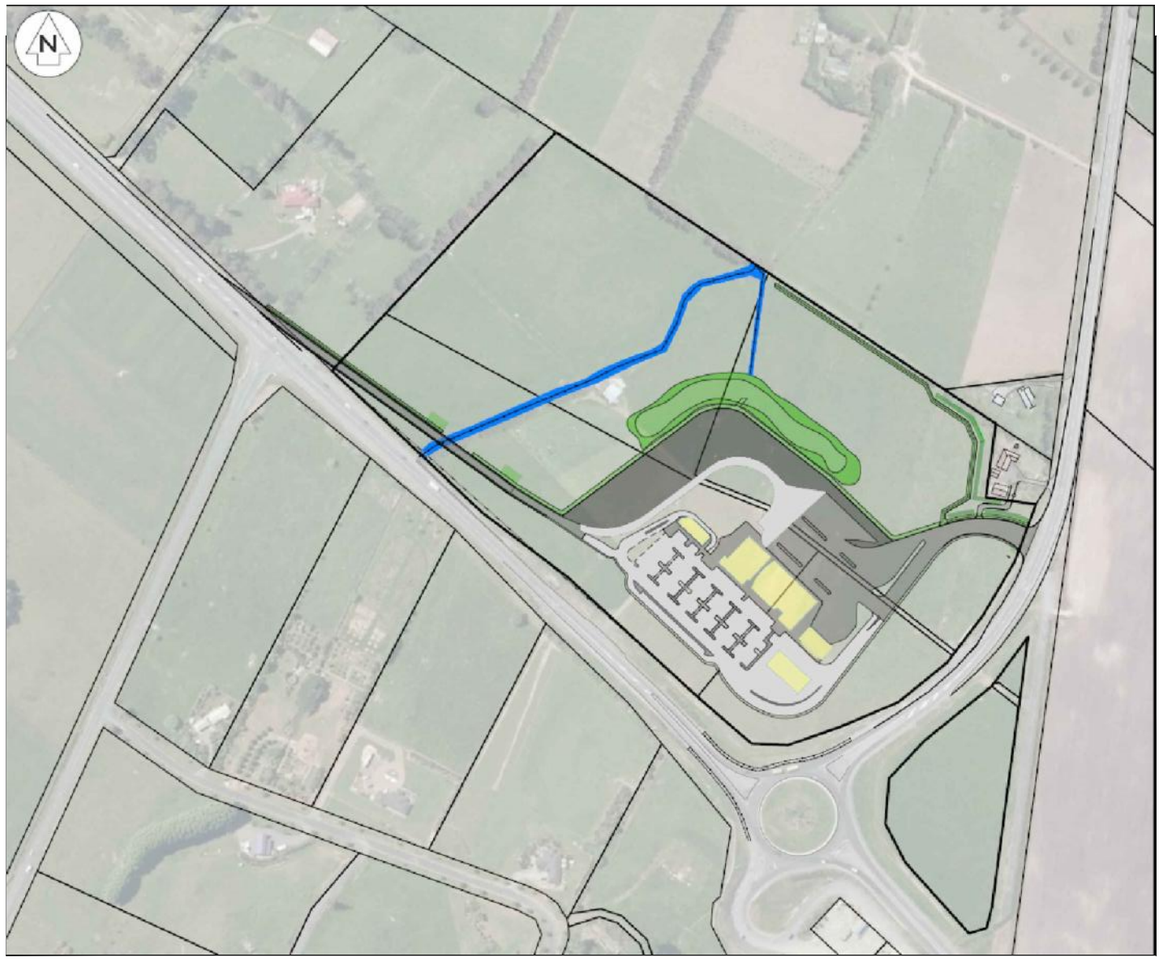
APPENDIX C – ENGINEERING DRAWINGS

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12 -14 Walls Road, Penrose

RUAKAKA
SERVICE CENTRE

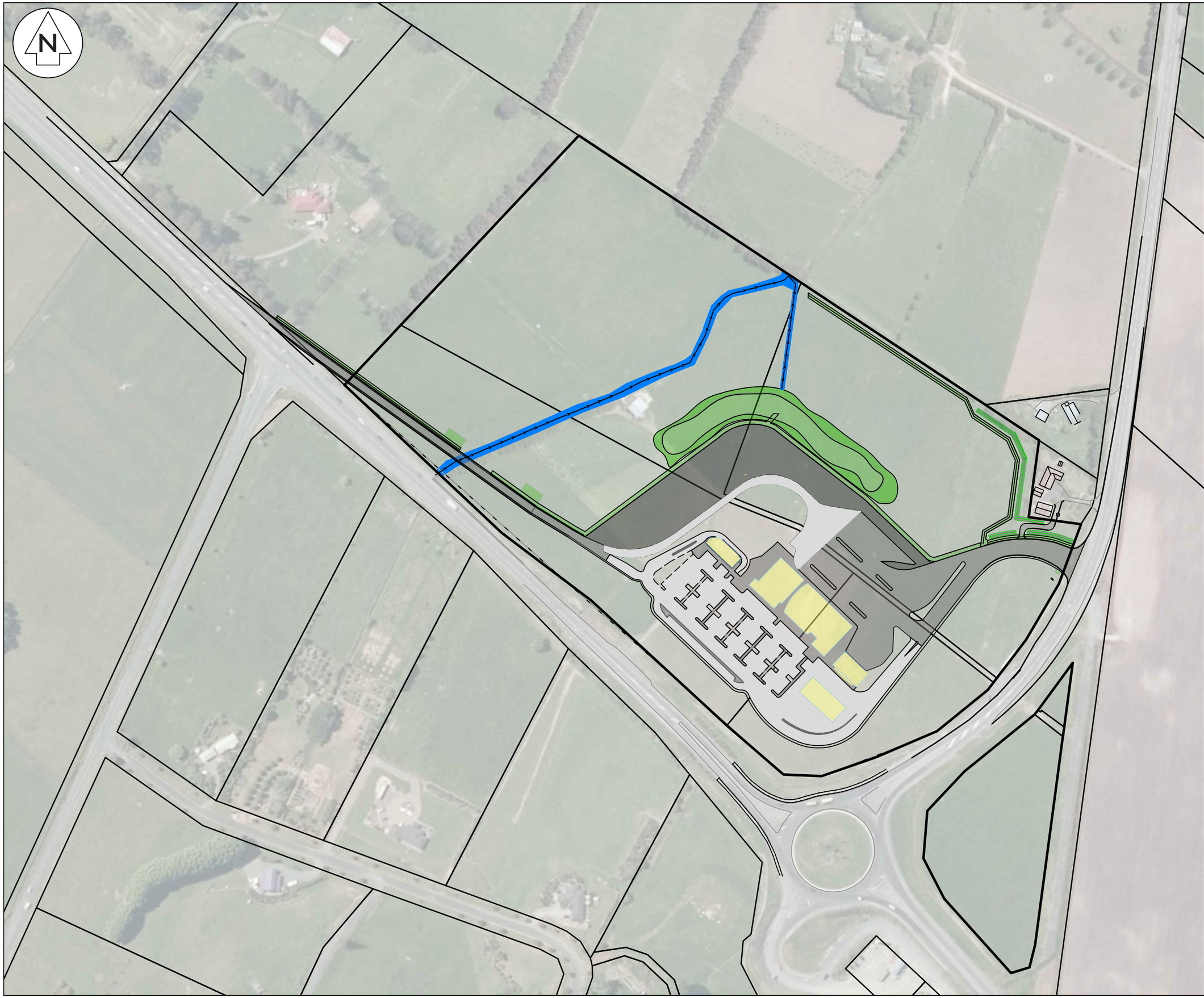
FOR

S K AOTEAROA TRUST



LOCALITY PLAN
SCALE 1:100 @ A3

DRAWINGS



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the Auckland Vertical Datum 1946.
3. It is the contractors responsibility to locate all services that may be affected by his operations.

Legend

EX BDY

PROP BDY

Rev	Description	By	Date
A	RC	JK	10/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design		
Drawn	JK	10/20
Checked	LC	10/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

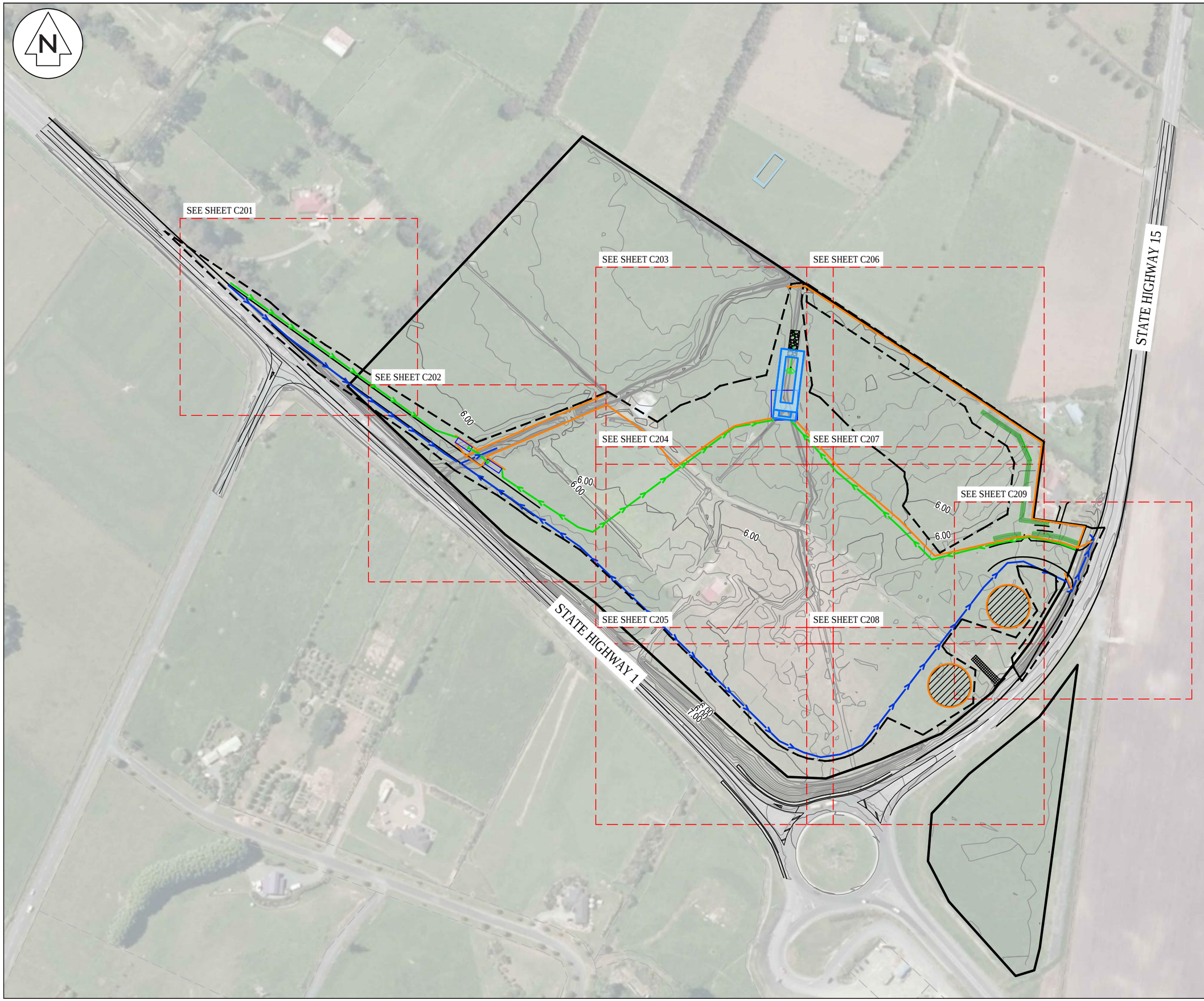
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED CONCEPT OVERVIEW PLAN

Project no.	117019		
Scale	1:2500 @ A3		
Cad file	C100 CONCEPT.DWG		
Drawing no.	C100	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000
3. Levels in terms of the Auckland Vertical Datum 1946.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. The contractor shall comply with all relevant Health and Safety requirements.
6. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
7. Sediment control shall be installed and operational before earthworks start onsite in accordance with council standards.
8. Contractor shall provide asbuilt of working sediment control devices and confirmation of pond/decent volumes to engineer.

Legend

- EX BDY
- PROP BDY
- EX MAJOR CONTOUR
- EX MINOR CONTOUR
- PR MAJOR CONTOUR
- PR MINOR CONTOUR
- PROP EXTENT WORK
- PROP CLEANWATER
- PROP DIRTYWATER
- PROP SILT FENCE
- PROP STOCKPILE
- PROP STABILISED ENTRANCE
- PROP DECANT BAR

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

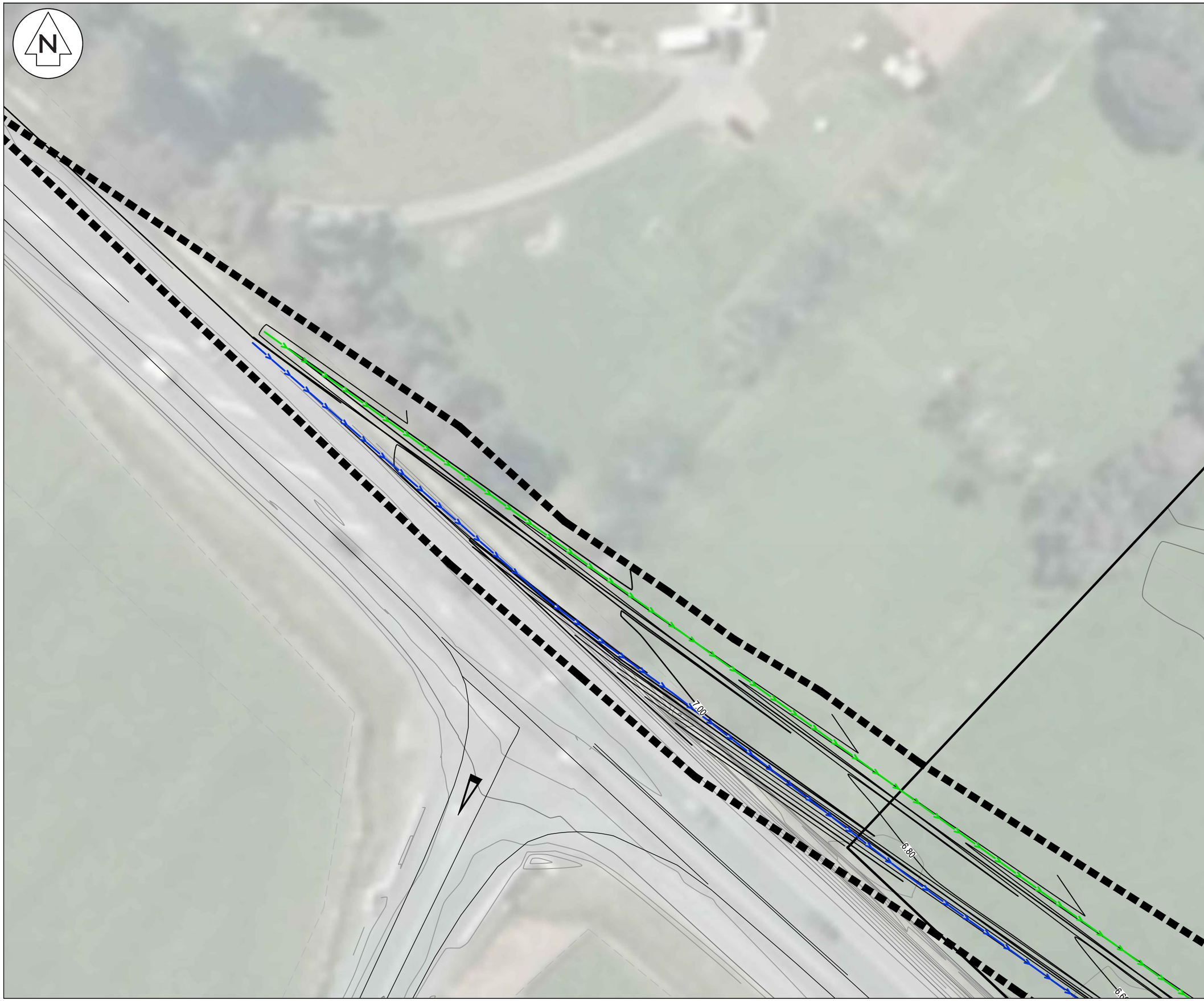
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED EARTHWORKS OVERVIEW PLAN

Project no.	117019		
Scale	1:2500 @ A3		
Cad file	C200 EW.DWG		
Drawing no.	C200	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000
3. Levels in terms of the Auckland Vertical Datum 1946.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. The contractor shall comply with all relevant Health and Safety requirements.
6. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
7. Sediment control shall be installed and operational before earthworks start onsite in accordance with council standards.
8. Contractor shall provide asbuilt of working sediment control devices and confirmation of pond/decent volumes to engineer.

Legend

- EX BDY
- PROP BDY
- EX MAJOR CONTOUR
- EX MINOR CONTOUR
- PR MAJOR CONTOUR
- PR MINOR CONTOUR
- PROP EXTENT WORK
- PROP CLEANWATER
- PROP DIRTYWATER
- PROP SILT FENCE
- PROP STOCKPILE
- PROP STABILISED ENTRANCE
- PROP DECANT BAR

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

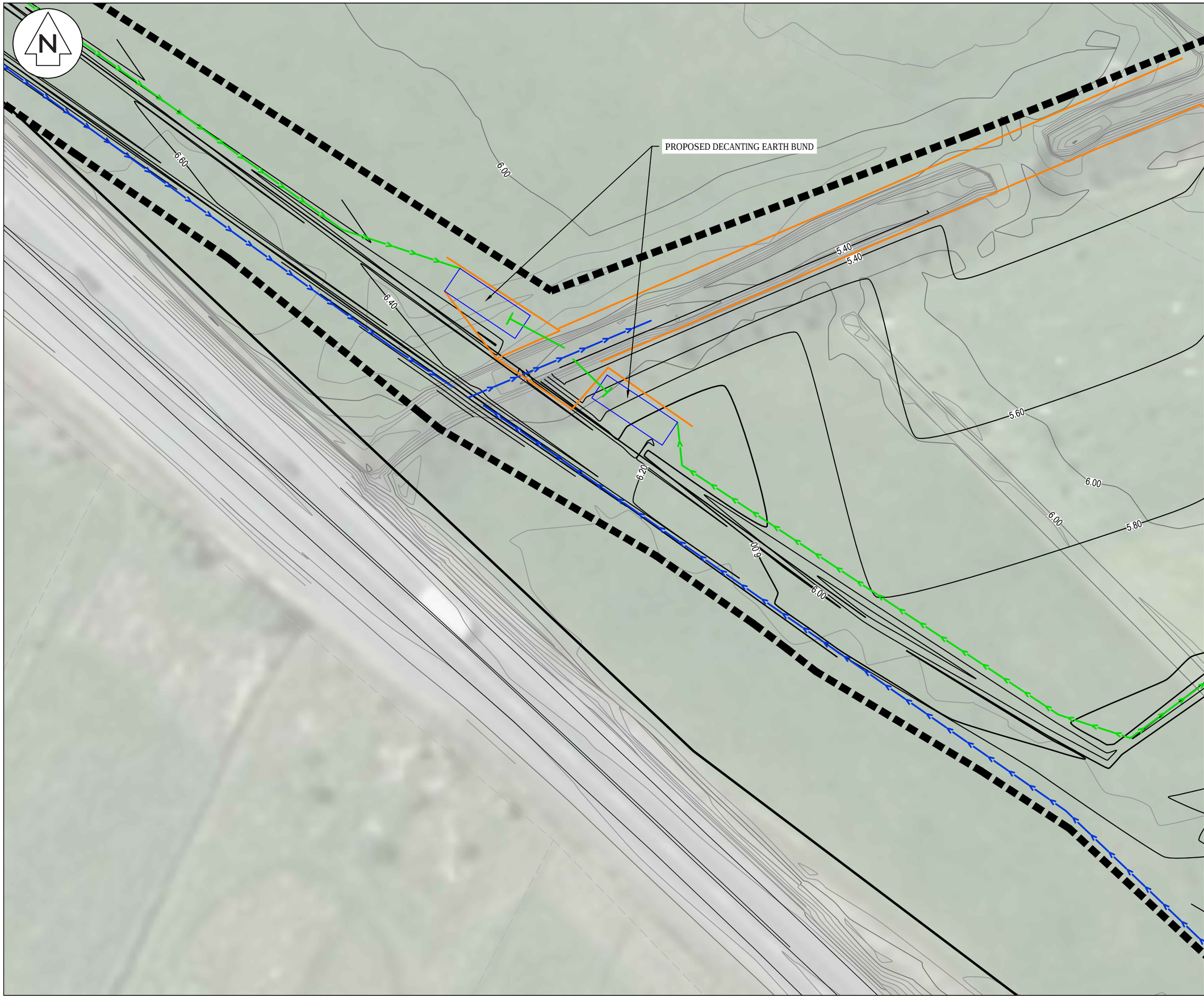
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED EARTHWORKS PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C200 EW.DWG		
Drawing no.	C201	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000
3. Levels in terms of the Auckland Vertical Datum 1946.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. The contractor shall comply with all relevant Health and Safety requirements.
6. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
7. Sediment control shall be installed and operational before earthworks start onsite in accordance with council standards.
8. Contractor shall provide asbuilt of working sediment control devices and confirmation of pond/decent volumes to engineer.

Legend

- EX BDY
- PROP BDY
- EX MAJOR CONTOUR
- EX MINOR CONTOUR
- PR MAJOR CONTOUR
- PR MINOR CONTOUR
- PROP EXTENT WORK
- PROP CLEANWATER
- PROP DIRTYWATER
- PROP SILT FENCE
- PROP STOCKPILE
- PROP STABILISED ENTRANCE
- PROP DECANT BAR

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

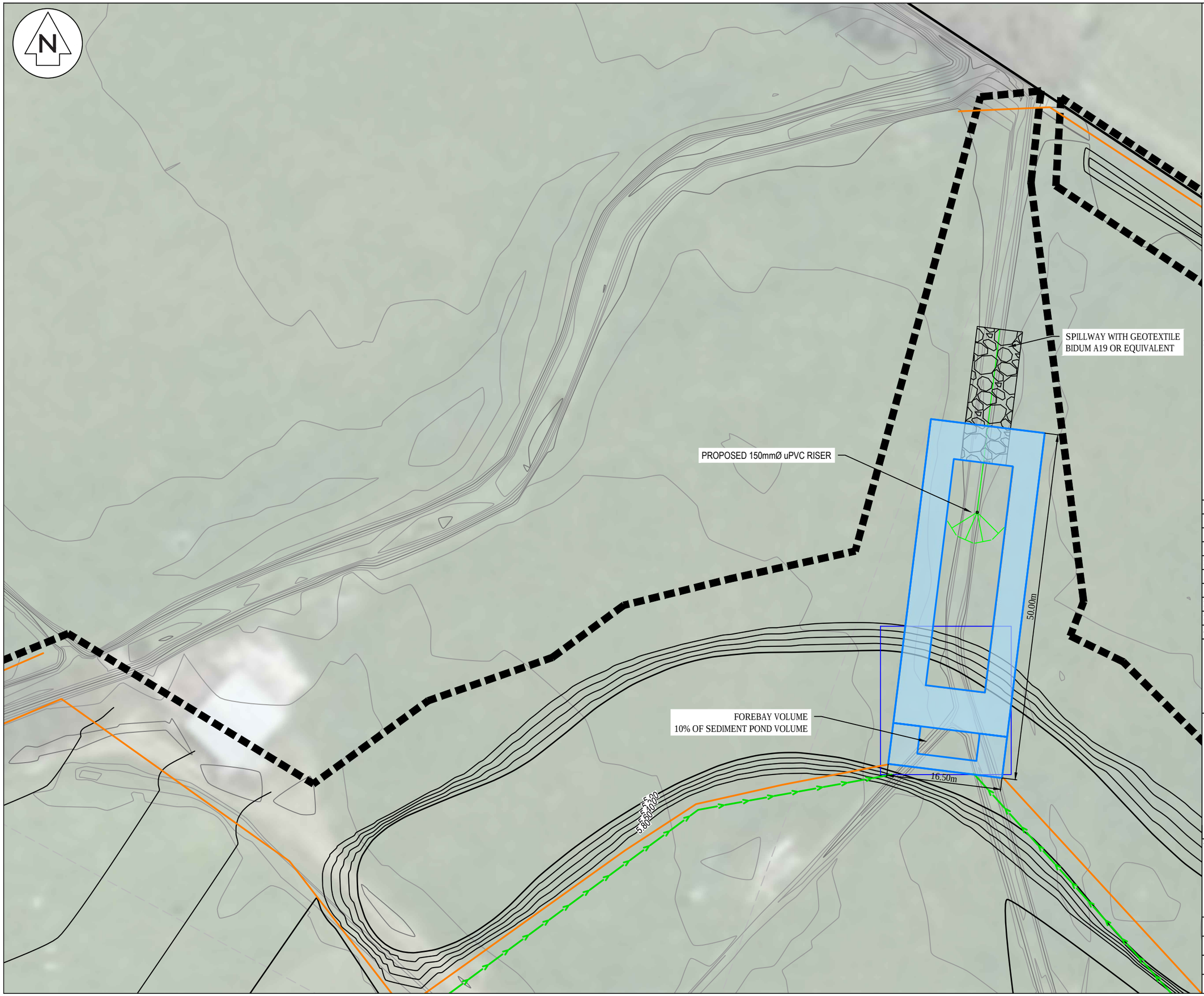
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED EARTHWORKS PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C200 EW.DWG		
Drawing no.	C202	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000
3. Levels in terms of the Auckland Vertical Datum 1946.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. The contractor shall comply with all relevant Health and Safety requirements.
6. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
7. Sediment control shall be installed and operational before earthworks start onsite in accordance with council standards.
8. Contractor shall provide asbuilt of working sediment control devices and confirmation of pond/decent volumes to engineer.

Legend

- EX BDY
- PROP BDY
- EX MAJOR CONTOUR
- EX MINOR CONTOUR
- PR MAJOR CONTOUR
- PR MINOR CONTOUR
- PROP EXTENT WORK
- PROP CLEANWATER
- PROP DIRTYWATER
- PROP SILT FENCE
- PROP STOCKPILE
- PROP STABILISED ENTRANCE
- PROP DECANT BAR

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED EARTHWORKS PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C200 EW.DWG		
Drawing no.	C203	Rev	A

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000
3. Levels in terms of the Auckland Vertical Datum 1946.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. The contractor shall comply with all relevant Health and Safety requirements.
6. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
7. Sediment control shall be installed and operational before earthworks start onsite in accordance with council standards.
8. Contractor shall provide asbuilt of working sediment control devices and confirmation of pond/decent volumes to engineer.

Legend

- EX BDY
- PROP BDY
- EX MAJOR CONTOUR
- EX MINOR CONTOUR
- PR MAJOR CONTOUR
- PR MINOR CONTOUR
- PROP EXTENT WORK
- PROP CLEANWATER
- PROP DIRTYWATER
- PROP SILT FENCE
- PROP STOCKPILE
- PROP STABILISED ENTRANCE
- PROP DECANT BAR

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

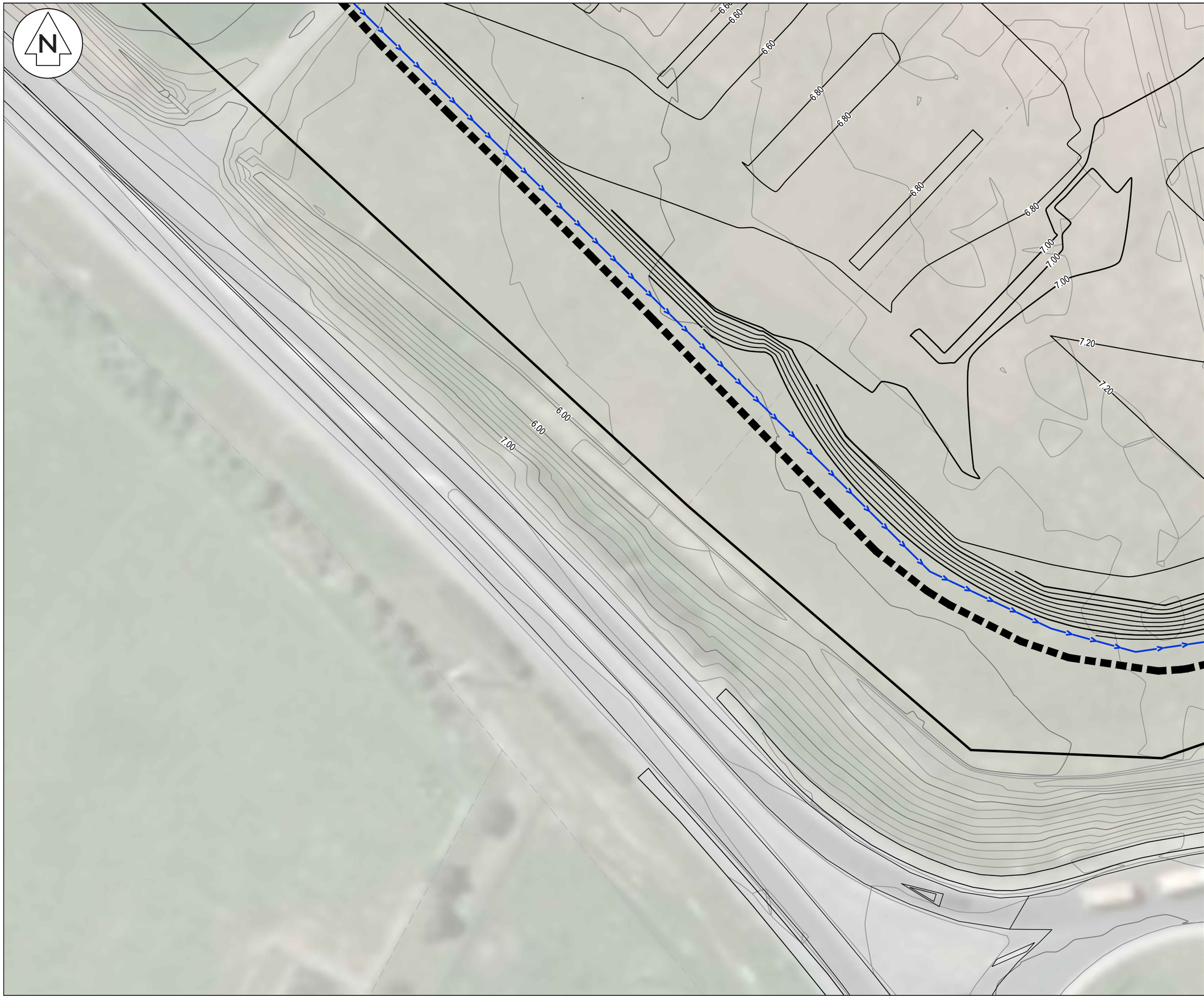
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED EARTHWORKS PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C200 EW.DWG		
Drawing no.	C204	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000
3. Levels in terms of the Auckland Vertical Datum 1946.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. The contractor shall comply with all relevant Health and Safety requirements.
6. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
7. Sediment control shall be installed and operational before earthworks start onsite in accordance with council standards.
8. Contractor shall provide asbuilt of working sediment control devices and confirmation of pond/decent volumes to engineer.

Legend

- EX BDY
- PROP BDY
- EX MAJOR CONTOUR
- EX MINOR CONTOUR
- PR MAJOR CONTOUR
- PR MINOR CONTOUR
- PROP EXTENT WORK
- PROP CLEANWATER
- PROP DIRTYWATER
- PROP SILT FENCE
- PROP STOCKPILE
- PROP STABILISED ENTRANCE
- PROP DECANT BAR

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED EARTHWORKS PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C200 EW.DWG		
Drawing no.	C205	Rev	A

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000
3. Levels in terms of the Auckland Vertical Datum 1946.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. The contractor shall comply with all relevant Health and Safety requirements.
6. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
7. Sediment control shall be installed and operational before earthworks start onsite in accordance with council standards.
8. Contractor shall provide asbuilt of working sediment control devices and confirmation of pond/decent volumes to engineer.

Legend

- EX BDY
- PROP BDY
- EX MAJOR CONTOUR
- EX MINOR CONTOUR
- PR MAJOR CONTOUR
- PR MINOR CONTOUR
- PROP EXTENT WORK
- PROP CLEANWATER
- PROP DIRTYWATER
- PROP SILT FENCE
- PROP STOCKPILE
- PROP STABILISED ENTRANCE
- PROP DECANT BAR

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

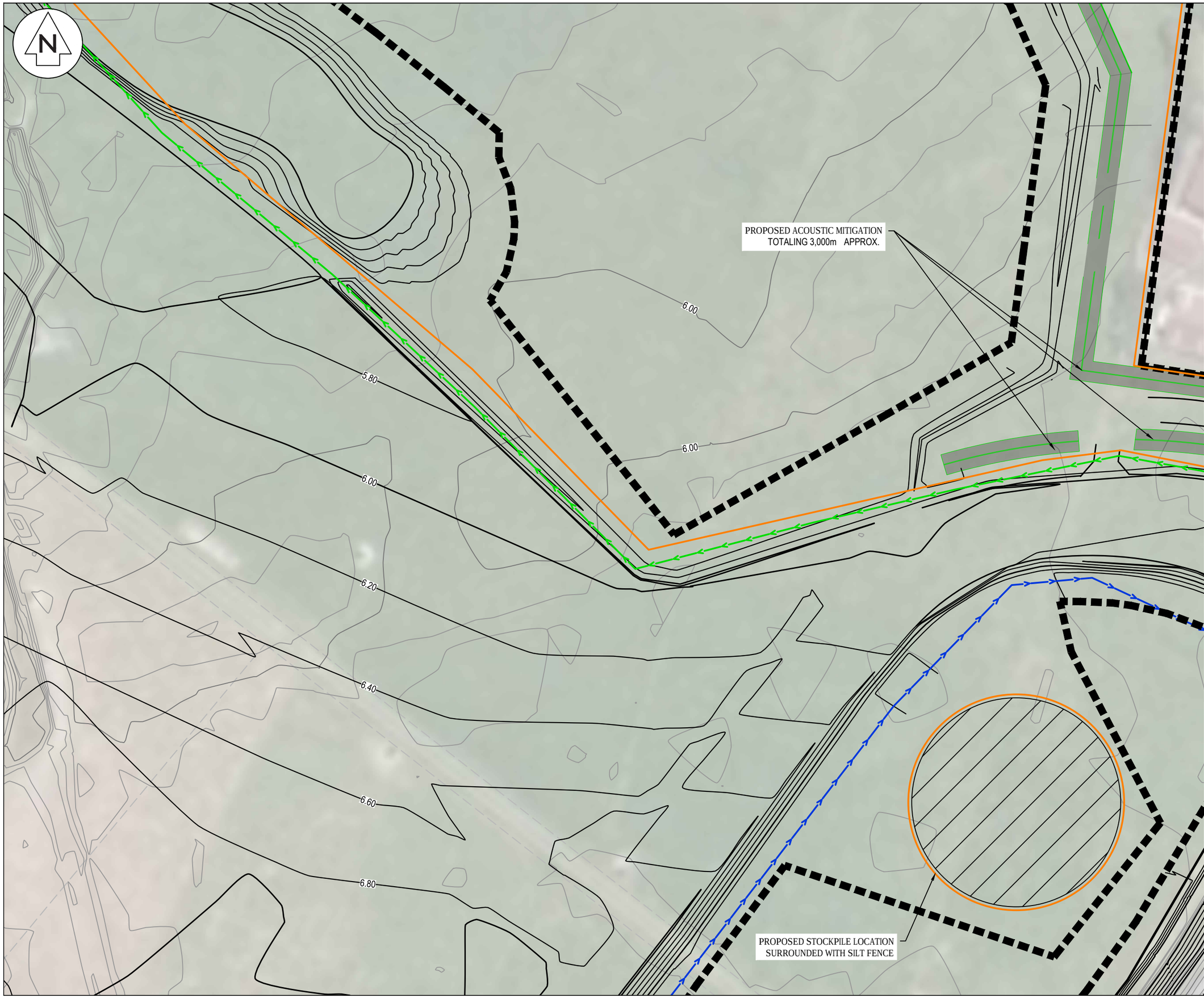
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED EARTHWORKS PLAN

Project no.	117019
Scale	1:500 @ A3
Cad file	C200 EW.DWG
Drawing no.	C206
Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000
3. Levels in terms of the Auckland Vertical Datum 1946.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. The contractor shall comply with all relevant Health and Safety requirements.
6. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
7. Sediment control shall be installed and operational before earthworks start onsite in accordance with council standards.
8. Contractor shall provide asbuilt of working sediment control devices and confirmation of pond/decent volumes to engineer.

Legend

- EX BDY
- PROP BDY
- EX MAJOR CONTOUR
- EX MINOR CONTOUR
- PR MAJOR CONTOUR
- PR MINOR CONTOUR
- PROP EXTENT WORK
- PROP CLEANWATER
- PROP DIRTYWATER
- PROP SILT FENCE
- PROP STOCKPILE
- PROP STABILISED ENTRANCE
- PROP DECANT BAR

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED EARTHWORKS PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C200 EW.DWG		
Drawing no.	C207	Rev	A

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000
3. Levels in terms of the Auckland Vertical Datum 1946.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. The contractor shall comply with all relevant Health and Safety requirements.
6. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
7. Sediment control shall be installed and operational before earthworks start onsite in accordance with council standards.
8. Contractor shall provide asbuilt of working sediment control devices and confirmation of pond/decent volumes to engineer.

Legend

- EX BDY
- PROP BDY
- EX MAJOR CONTOUR
- EX MINOR CONTOUR
- PR MAJOR CONTOUR
- PR MINOR CONTOUR
- PROP EXTENT WORK
- PROP CLEANWATER
- PROP DIRTYWATER
- PROP SILT FENCE
- PROP STOCKPILE
- PROP STABILISED ENTRANCE
- PROP DECANT BAR

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED EARTHWORKS PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C200 EW.DWG		
Drawing no.	C208	Rev	A

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000
3. Levels in terms of the Auckland Vertical Datum 1946.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. The contractor shall comply with all relevant Health and Safety requirements.
6. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
7. Sediment control shall be installed and operational before earthworks start onsite in accordance with council standards.
8. Contractor shall provide asbuilt of working sediment control devices and confirmation of pond/decent volumes to engineer.

Legend

- EX BDY
- PROP BDY
- EX MAJOR CONTOUR
- EX MINOR CONTOUR
- PR MAJOR CONTOUR
- PR MINOR CONTOUR
- PROP EXTENT WORK
- PROP CLEANWATER
- PROP DIRTYWATER
- PROP SILT FENCE
- PROP STOCKPILE
- PROP STABILISED ENTRANCE
- PROP DECANT BAR

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED EARTHWORKS PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C200 EW.DWG		
Drawing no.	C209	Rev	A

BULK SUBGRADE WORKS

CUT VOLUME		4589 m
FILL VOLUME		26289 m
NET FILL		21700m
TOPSOIL STRIPPED (200mm)	=	10,845 m
EARTHWORKS AREA	=	57629m

NOTE: NO ALLOWANCE FOR SERVICES TRENCHES, VOLUMES AREA UNFACTORED AND IN SITU

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000
3. Levels in terms of the Auckland Vertical Datum 1946.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. The contractor shall comply with all relevant Health and Safety requirements.
6. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
7. Sediment control shall be installed and operational before earthworks start onsite in accordance with council standards.
8. Contractor shall provide asbuilt of working sediment control devices and confirmation of pond/decent volumes to engineer.

Legend

EX BDY
PROP BDY
PROP EXTENT WORK

Cut/Fill Table

Number #	Minimum Elevation	Maximum Elevation	Color
1	-1.026	-0.500	
2	-0.500	0.000	
3	0.000	0.500	
4	0.500	1.000	
5	1.000	1.500	
6	1.500	2.022	

Rev	Description	By	Date
A	RC	KH	09/20

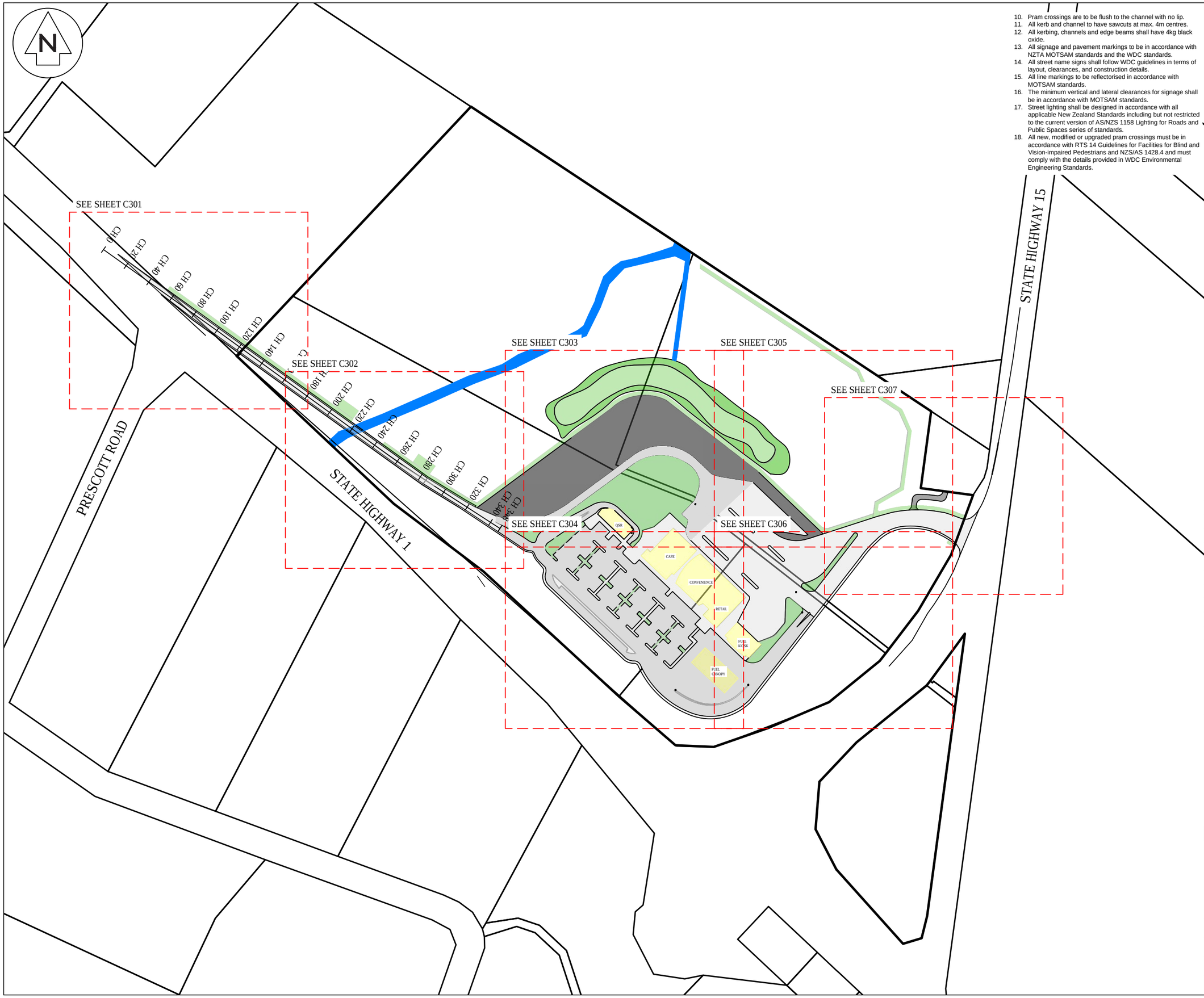
	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED CUT/FILL PLAN

Project no.	117019		
Scale	1:2000 @ A3		
Cad file	C200 EW.DWG		
Drawing no.	C210	Rev	A



10. Pram crossings are to be flush to the channel with no lip.
11. All kerb and channel to have sawcuts at max. 4m centres.
12. All kerbing, channels and edge beams shall have 4kg black oxide.
13. All signage and pavement markings to be in accordance with NZTA MOTSAM standards and the WDC standards.
14. All street name signs shall follow WDC guidelines in terms of layout, clearances, and construction details.
15. All line markings to be reflectorised in accordance with MOTSAM standards.
16. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
17. Street lighting shall be designed in accordance with all applicable New Zealand Standards including but not restricted to the current version of AS/NZS 1158 Lighting for Roads and Public Spaces series of standards.
18. All new, modified or upgraded pram crossings must be in accordance with RTS 14 Guidelines for Facilities for Blind and Vision-impaired Pedestrians and NZS/AS 1428.4 and must comply with the details provided in WDC Environmental Engineering Standards.

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Contractor is to avoid using GPS for set out of the kerb levels where gradients less than 1%.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. The contractor shall comply with all relevant Health and Safety requirements.
5. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
6. Final pavement design subject to CBR/Beam tests on subgrade material.
7. Setout schedule with co-ordinates of chainage points along road centreline to be supplied to the contractor prior to construction.
8. Refer to long section for finished centreline levels. Refer to typical cross sections to obtain levels for other locations
9. All ducts shall have locations marked on kerb lines in accordance with specification.

Line Marking

CENTER LINE 1-	WC100R (30m)
CENTER LINE 2-	WC100R
NO STOPPING LINE-	YI100R1x1
CONTINUITY LINE-	WI100R1x3
LIMIT LINE-	WC300R

Legend

	EX BDY
	PROP BDY
AC	AC PAVING
MT	METAL SURFACE
CEA	EXPOSED CONCRETE
SK	SLOTTED KERB
K&C	KERB AND CHANNEL
K&N	KERB AND NIB
	PROP SWCP SINGLE
	PROP ASPHALT
	PROP RAINGARDEN
	PROP CONCRETE
	PROP METAL

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	09/20
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED ROADING OVERVIEW PLAN

Project no.	117019
Scale	1:2500 @ A3
Cad file	C300 ROADING.DWG
Drawing no.	C300 Rev A

10. Pram crossings are to be flush to the channel with no lip.
11. All kerb and channel to have sawcuts at max. 4m centres.
12. All kerbing, channels and edge beams shall have 4kg black oxide.
13. All signage and pavement markings to be in accordance with NZTA MOTSAM standards and the WDC standards.
14. All street name signs shall follow WDC guidelines in terms of layout, clearances, and construction details.
15. All line markings to be reflectorised in accordance with MOTSAM standards.
16. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
17. Street lighting shall be designed in accordance with all applicable New Zealand Standards including but not restricted to the current version of AS/NZS 1158 Lighting for Roads and Public Spaces series of standards.
18. All new, modified or upgraded pram crossings must be in accordance with RTS 14 Guidelines for Facilities for Blind and Vision-impaired Pedestrians and NZS/AS 1428.4 and must comply with the details provided in WDC Environmental Engineering Standards.

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Contractor is to avoid using GPS for set out of the kerb levels where gradients less than 1%.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. The contractor shall comply with all relevant Health and Safety requirements.
5. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
6. Final pavement design subject to CBR/Beam tests on subgrade material.
7. Setout schedule with co-ordinates of chainage points along road centreline to be supplied to the contractor prior to construction.
8. Refer to long section for finished centreline levels. Refer to typical cross sections to obtain levels for other locations
9. All ducts shall have locations marked on kerb lines in accordance with specification.

Line Marking

CENTER LINE 1-	WC100R (30m)
CENTER LINE 2-	WC100R
NO STOPPING LINE-	YI100R1x1
CONTINUITY LINE-	WI100R1x3
LIMIT LINE-	WC300R

Legend

	EX BDY
	PROP BDY
AC	AC PAVING
MT	METAL SURFACE
CEA	EXPOSED CONCRETE
SK	SLOTTED KERB
K&C	KERB AND CHANNEL
K&N	KERB AND NIB
	PROP SWCP SINGLE
	PROP ASPHALT
	PROP RAINGARDEN
	PROP CONCRETE
	PROP METAL

Rev	Description	By	Date
A	RC	KH	09/20

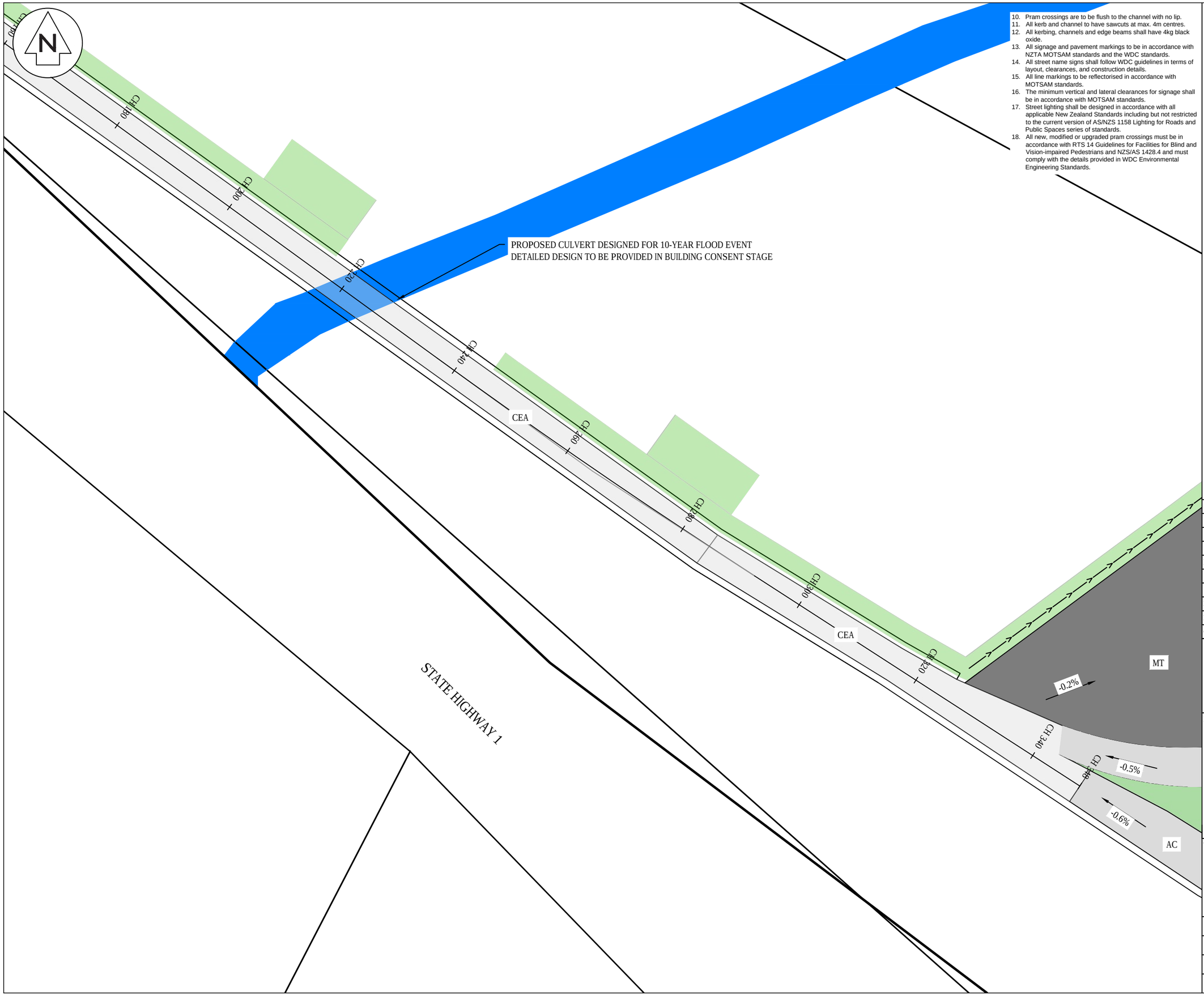
	By	Date
Survey	LANDS & SURVEY	09/20
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED ROADING PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C300 ROADING.DWG		
Drawing no.	C301	Rev	A



10. Pram crossings are to be flush to the channel with no lip.
11. All kerb and channel to have sawcuts at max. 4m centres.
12. All kerbing, channels and edge beams shall have 4kg black oxide.
13. All signage and pavement markings to be in accordance with NZTA MOTSAM standards and the WDC standards.
14. All street name signs shall follow WDC guidelines in terms of layout, clearances, and construction details.
15. All line markings to be reflectorised in accordance with MOTSAM standards.
16. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
17. Street lighting shall be designed in accordance with all applicable New Zealand Standards including but not restricted to the current version of AS/NZS 1158 Lighting for Roads and Public Spaces series of standards.
18. All new, modified or upgraded pram crossings must be in accordance with RTS 14 Guidelines for Facilities for Blind and Vision-impaired Pedestrians and NZS/AS 1428.4 and must comply with the details provided in WDC Environmental Engineering Standards.

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Contractor is to avoid using GPS for set out of the kerb levels where gradients less than 1%.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. The contractor shall comply with all relevant Health and Safety requirements.
5. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
6. Final pavement design subject to CBR/Beam tests on subgrade material.
7. Setout schedule with co-ordinates of chainage points along road centreline to be supplied to the contractor prior to construction.
8. Refer to long section for finished centreline levels. Refer to typical cross sections to obtain levels for other locations
9. All ducts shall have locations marked on kerb lines in accordance with specification.

Line Marking

CENTER LINE 1-	WC100R (30m)
CENTER LINE 2-	WC100R
NO STOPPING LINE-	YI100R1x1
CONTINUITY LINE-	WI100R1x3
LIMIT LINE-	WC300R

Legend

	EX BDY
	PROP BDY
AC	AC PAVING
MT	METAL SURFACE
CEA	EXPOSED CONCRETE
SK	SLOTTED KERB
K&C	KERB AND CHANNEL
K&N	KERB AND NIB
	PROP SWCP SINGLE
	PROP ASPHALT
	PROP RAINGARDEN
	PROP CONCRETE
	PROP METAL
	PROP WATERCOURSE

Rev	Description	By	Date
A	RC	KH	09/20

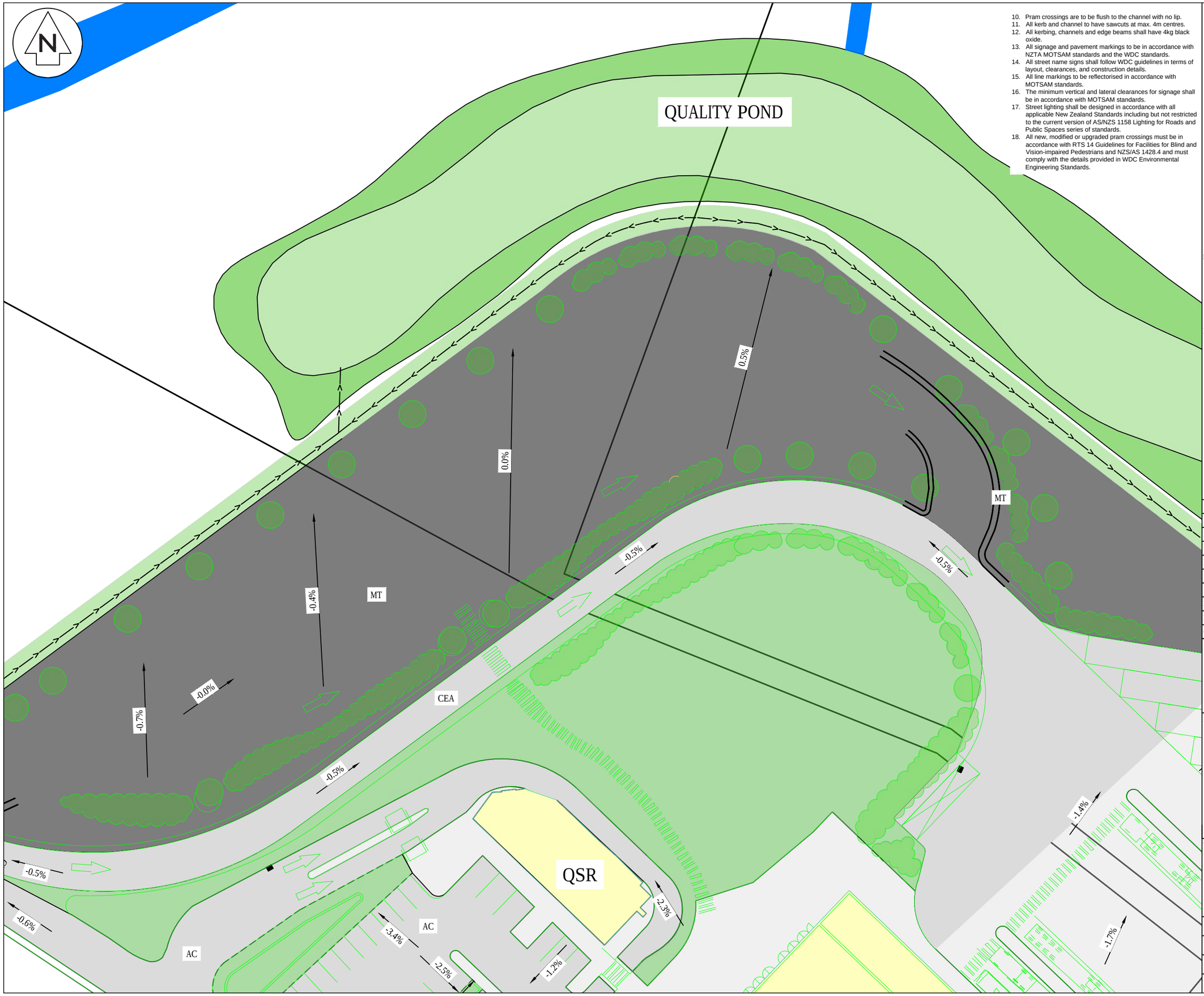
	By	Date
Survey	LANDS & SURVEY	09/20
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED ROADING PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C300 ROADING.DWG		
Drawing no.	C302	Rev	A



10. Pram crossings are to be flush to the channel with no lip.
11. All kerb and channel to have sawcuts at max. 4m centres.
12. All kerbing, channels and edge beams shall have 4kg black oxide.
13. All signage and pavement markings to be in accordance with NZTA MOTSAM standards and the WDC standards.
14. All street name signs shall follow WDC guidelines in terms of layout, clearances, and construction details.
15. All line markings to be reflectorised in accordance with MOTSAM standards.
16. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
17. Street lighting shall be designed in accordance with all applicable New Zealand Standards including but not restricted to the current version of AS/NZS 1158 Lighting for Roads and Public Spaces series of standards.
18. All new, modified or upgraded pram crossings must be in accordance with RTS 14 Guidelines for Facilities for Blind and Vision-impaired Pedestrians and NZS/AS 1428.4 and must comply with the details provided in WDC Environmental Engineering Standards.

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Contractor is to avoid using GPS for set out of the kerb levels where gradients less than 1%.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. The contractor shall comply with all relevant Health and Safety requirements.
5. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
6. Final pavement design subject to CBR/Beam tests on subgrade material.
7. Setout schedule with co-ordinates of chainage points along road centreline to be supplied to the contractor prior to construction.
8. Refer to long section for finished centreline levels. Refer to typical cross sections to obtain levels for other locations
9. All ducts shall have locations marked on kerb lines in accordance with specification.

Line Marking

CENTER LINE 1-	WC100R (30m)
CENTER LINE 2-	WC100R
NO STOPPING LINE-	YI100R1x1
CONTINUITY LINE-	WI100R1x3
LIMIT LINE-	WC300R

Legend

	EX BDY
	PROP BDY
AC	AC PAVING
MT	METAL SURFACE
CEA	EXPOSED CONCRETE
SK	SLOTTED KERB
K&C	KERB AND CHANNEL
K&N	KERB AND NIB
	PROP SWCP SINGLE
	PROP ASPHALT
	PROP RAINGARDEN
	PROP CONCRETE
	PROP METAL
	PROP WATERCOURSE

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	09/20
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED ROADING PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C300 ROADING.DWG		
Drawing no.	C303	Rev	A

10. Pram crossings are to be flush to the channel with no lip.
11. All kerb and channel to have sawcuts at max. 4m centres.
12. All kerbing, channels and edge beams shall have 4kg black oxide.
13. All signage and pavement markings to be in accordance with NZTA MOTSAM standards and the WDC standards.
14. All street name signs shall follow WDC guidelines in terms of layout, clearances, and construction details.
15. All line markings to be reflectorised in accordance with MOTSAM standards.
16. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
17. Street lighting shall be designed in accordance with all applicable New Zealand Standards including but not restricted to the current version of AS/NZS 1158 Lighting for Roads and Public Spaces series of standards.
18. All new, modified or upgraded pram crossings must be in accordance with RTS 14 Guidelines for Facilities for Blind and Vision-impaired Pedestrians and NZS/AS 1428.4 and must comply with the details provided in WDC Environmental Engineering Standards.

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Contractor is to avoid using GPS for set out of the kerb levels where gradients less than 1%.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. The contractor shall comply with all relevant Health and Safety requirements.
5. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
6. Final pavement design subject to CBR/Beam tests on subgrade material.
7. Setout schedule with co-ordinates of chainage points along road centreline to be supplied to the contractor prior to construction.
8. Refer to long section for finished centreline levels. Refer to typical cross sections to obtain levels for other locations
9. All ducts shall have locations marked on kerb lines in accordance with specification.

Line Marking

CENTER LINE 1-	WC100R (30m)
CENTER LINE 2-	WC100R
NO STOPPING LINE-	YI100R1x1
CONTINUITY LINE-	WI100R1x3
LIMIT LINE-	WC300R

Legend

	EX BDY
	PROP BDY
AC	AC PAVING
MT	METAL SURFACE
CEA	EXPOSED CONCRETE
SK	SLOTTED KERB
K&C	KERB AND CHANNEL
K&N	KERB AND NIB
	PROP SWCP SINGLE
	PROP ASPHALT
	PROP RAINGARDEN
	PROP CONCRETE
	PROP METAL

Rev	Description	By	Date
A	RC	KH	09/20

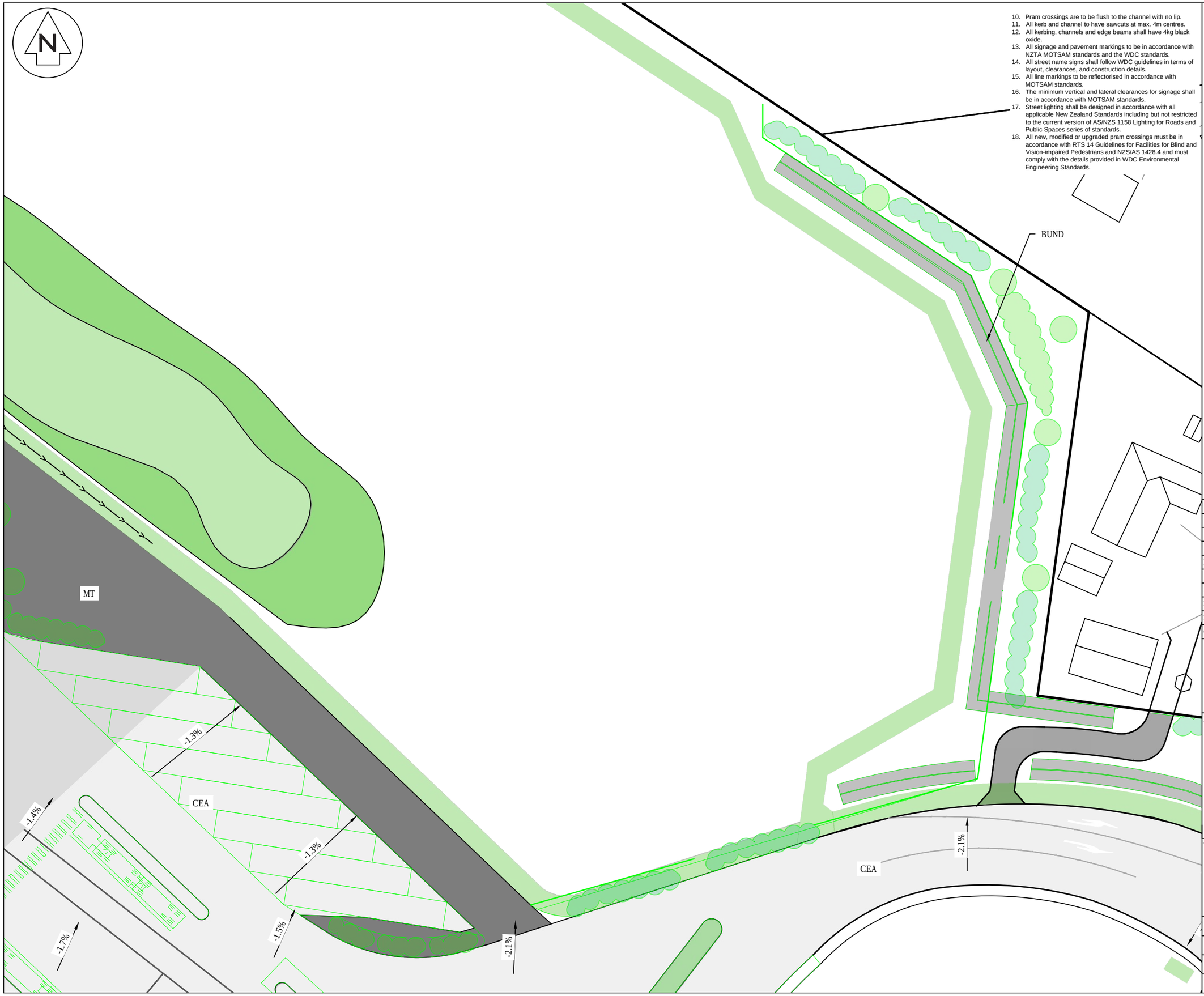
	By	Date
Survey	LANDS & SURVEY	09/20
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED ROADING PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C300 ROADING.DWG		
Drawing no.	C304	Rev	A



10. Pram crossings are to be flush to the channel with no lip.
11. All kerb and channel to have sawcuts at max. 4m centres.
12. All kerbing, channels and edge beams shall have 4kg black oxide.
13. All signage and pavement markings to be in accordance with NZTA MOTSAM standards and the WDC standards.
14. All street name signs shall follow WDC guidelines in terms of layout, clearances, and construction details.
15. All line markings to be reflectorised in accordance with MOTSAM standards.
16. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
17. Street lighting shall be designed in accordance with all applicable New Zealand Standards including but not restricted to the current version of AS/NZS 1158 Lighting for Roads and Public Spaces series of standards.
18. All new, modified or upgraded pram crossings must be in accordance with RTS 14 Guidelines for Facilities for Blind and Vision-impaired Pedestrians and NZS/AS 1428.4 and must comply with the details provided in WDC Environmental Engineering Standards.

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Contractor is to avoid using GPS for set out of the kerb levels where gradients less than 1%.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. The contractor shall comply with all relevant Health and Safety requirements.
5. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
6. Final pavement design subject to CBR/Beam tests on subgrade material.
7. Setout schedule with co-ordinates of chainage points along road centreline to be supplied to the contractor prior to construction.
8. Refer to long section for finished centreline levels. Refer to typical cross sections to obtain levels for other locations
9. All ducts shall have locations marked on kerb lines in accordance with specification.

Line Marking

CENTER LINE 1-	WC100R (30m)
CENTER LINE 2-	WC100R
NO STOPPING LINE-	YI100R1x1
CONTINUITY LINE-	WI100R1x3
LIMIT LINE-	WC300R

Legend

	EX BDY
	PROP BDY
AC	AC PAVING
MT	METAL SURFACE
CEA	EXPOSED CONCRETE
SK	SLOTTED KERB
K&C	KERB AND CHANNEL
K&N	KERB AND NIB
	PROP SWCP SINGLE
	PROP ASPHALT
	PROP RAINGARDEN
	PROP CONCRETE
	PROP METAL

Rev	Description	By	Date
A	RC	KH	09/20

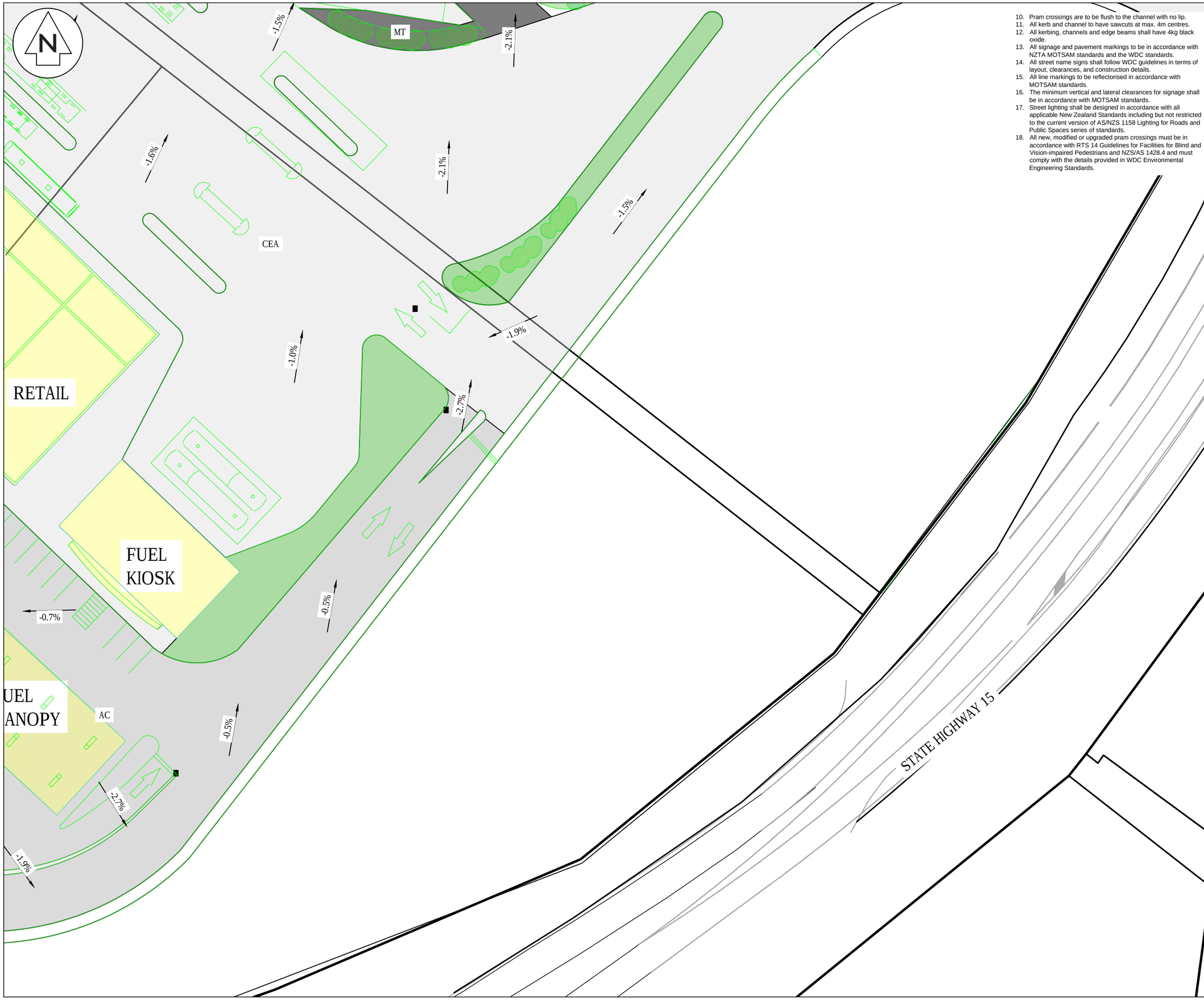
	By	Date
Survey	LANDS & SURVEY	09/20
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED ROADING PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C300 ROADING.DWG		
Drawing no.	C305	Rev	A



10. Pram crossings are to be flush to the channel with no lip.
11. All kerb and channel to have sawcuts at max. 4m centres.
12. All kerbing, channels and edge beams shall have 4kg black oxide.
13. All signage and pavement markings to be in accordance with NZTA MOTSAM standards and the WDC standards.
14. All street name signs shall follow WDC guidelines in terms of layout, clearances, and construction details.
15. All line markings to be reflectorised in accordance with MOTSAM standards.
16. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
17. Street lighting shall be designed in accordance with all applicable New Zealand Standards including but not restricted to the current version of AS/NZS 1158 Lighting for Roads and Public Spaces series of standards.
18. All new, modified or upgraded pram crossings must be in accordance with RTS 14 Guidelines for Facilities for Blind and Vision-impaired Pedestrians and NZS/AS 1428.4 and must comply with the details provided in WDC Environmental Engineering Standards.

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Contractor is to avoid using GPS for set out of the kerb levels where gradients less than 1%.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. The contractor shall comply with all relevant Health and Safety requirements.
5. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
6. Final pavement design subject to CBR/Beam tests on subgrade material.
7. Setout schedule with co-ordinates of chainage points along road centreline to be supplied to the contractor prior to construction.
8. Refer to long section for finished centreline levels. Refer to typical cross sections to obtain levels for other locations
9. All ducts shall have locations marked on kerb lines in accordance with specification.

Line Marking

CENTER LINE 1-	WC100R (30m)
CENTER LINE 2-	WC100R
NO STOPPING LINE-	YI100R1x1
CONTINUITY LINE-	WI100R1x3
LIMIT LINE-	WC300R

Legend

	EX BDY
	PROP BDY
AC	AC PAVING
MT	METAL SURFACE
CEA	EXPOSED CONCRETE
SK	SLOTTED KERB
K&C	KERB AND CHANNEL
K&N	KERB AND NIB
	PROP SWCP SINGLE
	PROP ASPHALT
	PROP RAINGARDEN
	PROP CONCRETE
	PROP METAL

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	09/20
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

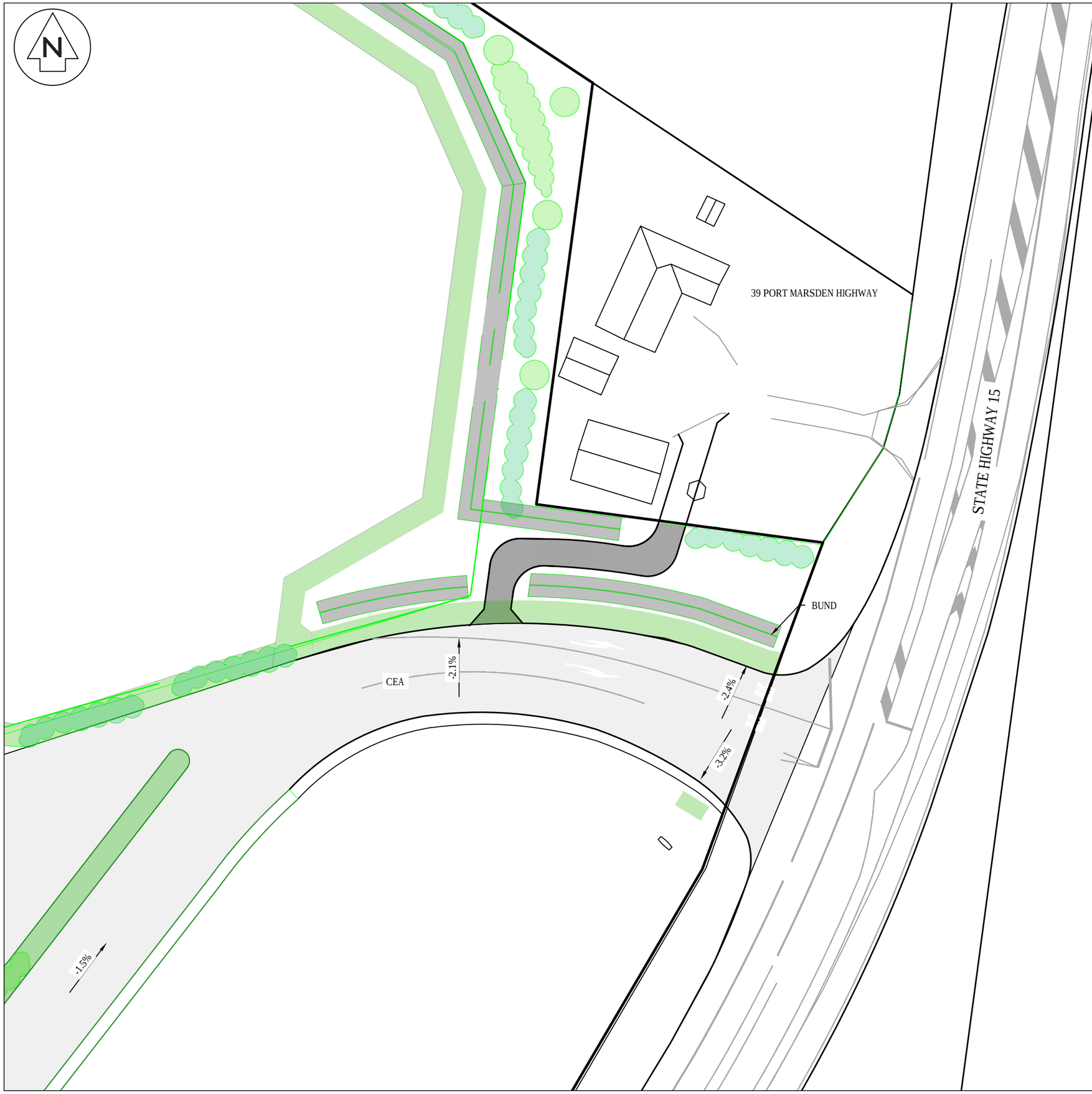
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED ROADING PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C300 ROADING.DWG		
Drawing no.	C306	Rev	A



10. Pram crossings are to be flush to the channel with no lip.
11. All kerb and channel to have sawcuts at max. 4m centres.
12. All kerbing, channels and edge beams shall have 4kg black oxide.
13. All signage and pavement markings to be in accordance with NZTA MOTSAM standards and the WDC standards.
14. All street name signs shall follow WDC guidelines in terms of layout, clearances, and construction details.
15. All line markings to be reflectorised in accordance with MOTSAM standards.
16. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
17. Street lighting shall be designed in accordance with all applicable New Zealand Standards including but not restricted to the current version of AS/NZS 1158 Lighting for Roads and Public Spaces series of standards.
18. All new, modified or upgraded pram crossings must be in accordance with RTS 14 Guidelines for Facilities for Blind and Vision-impaired Pedestrians and NZS/AS 1428.4 and must comply with the details provided in WDC Environmental Engineering Standards.

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Contractor is to avoid using GPS for set out of the kerb levels where gradients less than 1%.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. The contractor shall comply with all relevant Health and Safety requirements.
5. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
6. Final pavement design subject to CBR/Beam tests on subgrade material.
7. Setout schedule with co-ordinates of chainage points along road centreline to be supplied to the contractor prior to construction.
8. Refer to long section for finished centreline levels. Refer to typical cross sections to obtain levels for other locations
9. All ducts shall have locations marked on kerb lines in accordance with specification.

Line Marking

CENTER LINE 1-	WC100R (30m)
CENTER LINE 2-	WC100R
NO STOPPING LINE-	YI100R1x1
CONTINUITY LINE-	WI100R1x3
LIMIT LINE-	WC300R

Legend

	EX BDY
	PROP BDY
AC	AC PAVING
MT	METAL SURFACE
CEA	EXPOSED CONCRETE
SK	SLOTTED KERB
K&C	KERB AND CHANNEL
K&N	KERB AND NIB
	PROP SWCP SINGLE
	PROP ASPHALT
	PROP RAINGARDEN
	PROP CONCRETE
	PROP METAL

Rev	Description	By	Date
A	RC	KH	09/20

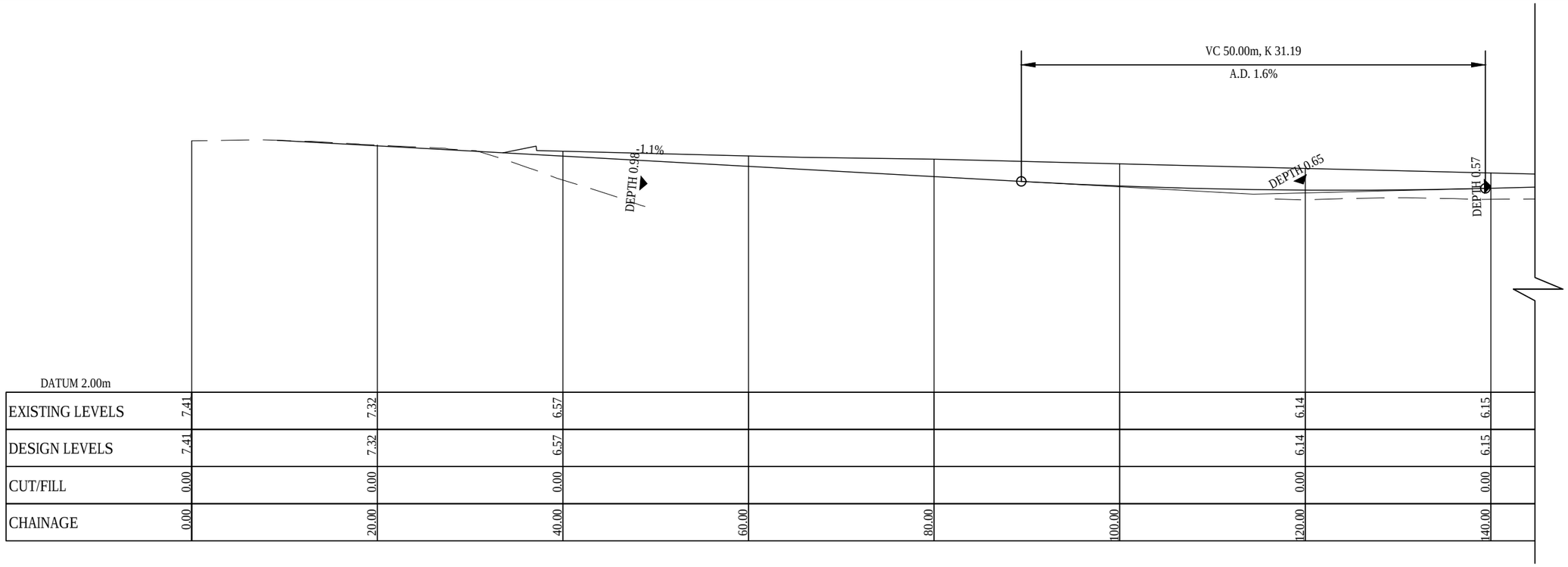
	By	Date
Survey	LANDS & SURVEY	09/20
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED ROADING PLAN

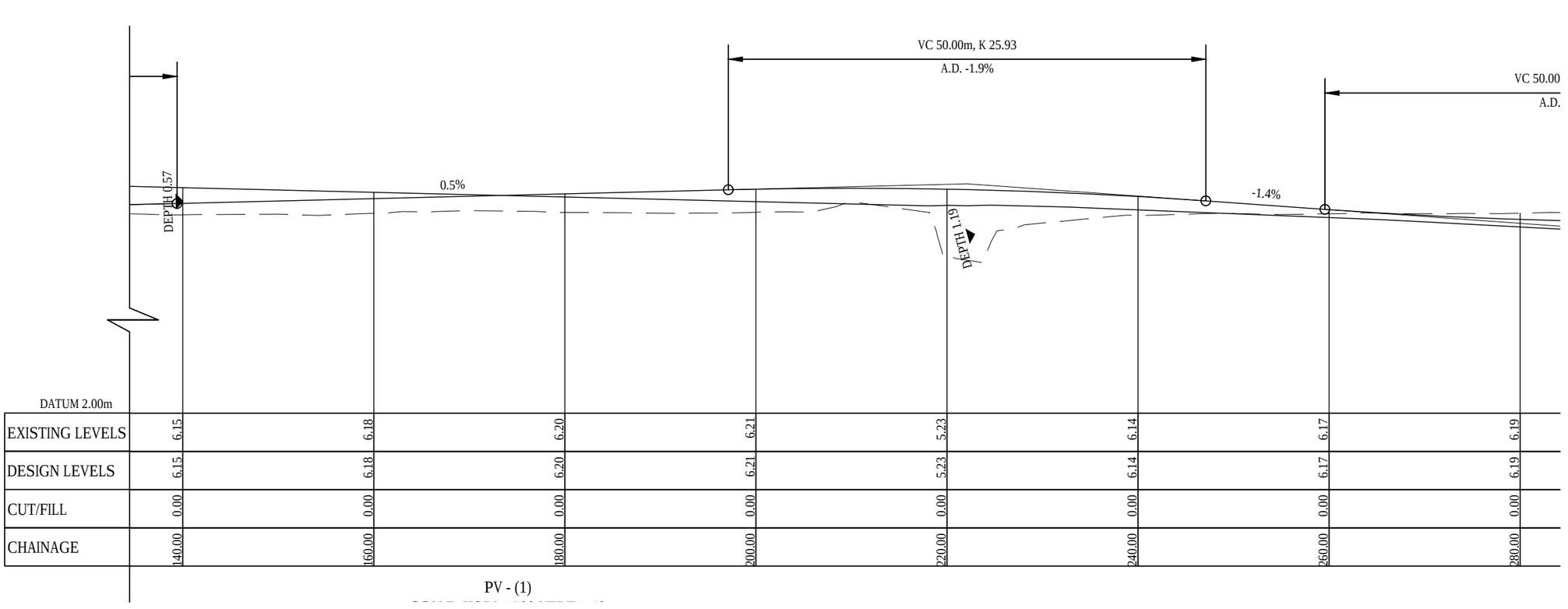
Project no.	117019		
Scale	1:500 @ A3		
Cad file	C300 ROADING.DWG		
Drawing no.	C307	Rev	A



DATUM 2.00m								
EXISTING LEVELS	7.41	7.32	6.57				6.14	6.15
DESIGN LEVELS	7.41	7.32	6.57				6.14	6.15
CUT/FILL	0.00	0.00	0.00				0.00	0.00
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00

ACCESS RAMP LONG SECTION (CONTINUE BELOW)

SCALE 1:500 HORZ 1:100 VERT @ A3



DATUM 2.00m								
EXISTING LEVELS	6.15	6.18	6.20	6.21	5.23	6.14	6.17	6.19
DESIGN LEVELS	6.15	6.18	6.20	6.21	5.23	6.14	6.17	6.19
CUT/FILL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHAINAGE	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00

PV - (1)

ACCESS RAMP LONG SECTION (CONTINUE FROM ABOVE & CONTINUE TO C311)

SCALE 1:500 HORZ 1:100 VERT @ A3

DRAFT FOR REVIEW

DATE: 10/2/20

Notes

1. Details will be provided at building consent stage.

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LAND & SURVEY	09/20
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

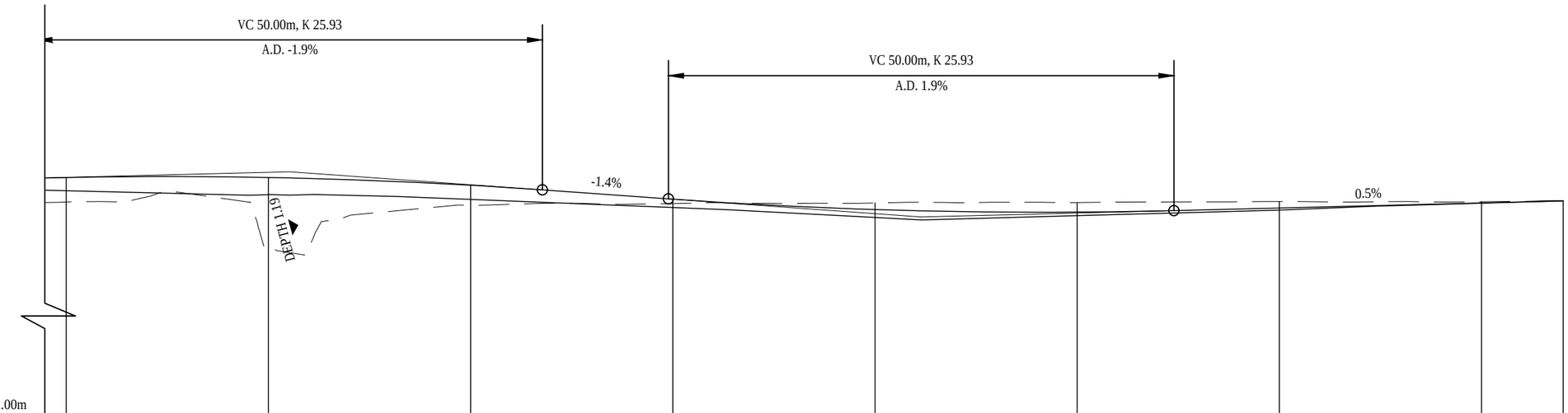
Project

RUAKAKA SERVICE CENTRE FOR S K AOTEAROA TRUST

Title

PROPOSED RAMP LONG SECTION

Project no.	117019		
Scale	-		
Cad file	C300 ROADING.DWG		
Drawing no.	C310	Rev	A



DATUM 2.00m								
EXISTING LEVELS	6.21	5.23	6.14	6.17	6.19	6.19	6.21	6.21	6.23
DESIGN LEVELS	6.21	5.23	6.14	6.17	6.19	6.19	6.21	6.21	6.23
CUT/FILL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHAINAGE	200.00	220.00	240.00	260.00	280.00	300.00	320.00	340.00	348.08

ACCESS RAMP LONG SECTION (CONTINUE FROM C310)

SCALE 1:500 HORZ 1:100 VERT @ A3

DRAFT FOR REVIEW

DATE: 10/2/20

Notes
1. Details will be provided at building consent stage.

Rev	Description	By	Date
A	RC	KH	09/20

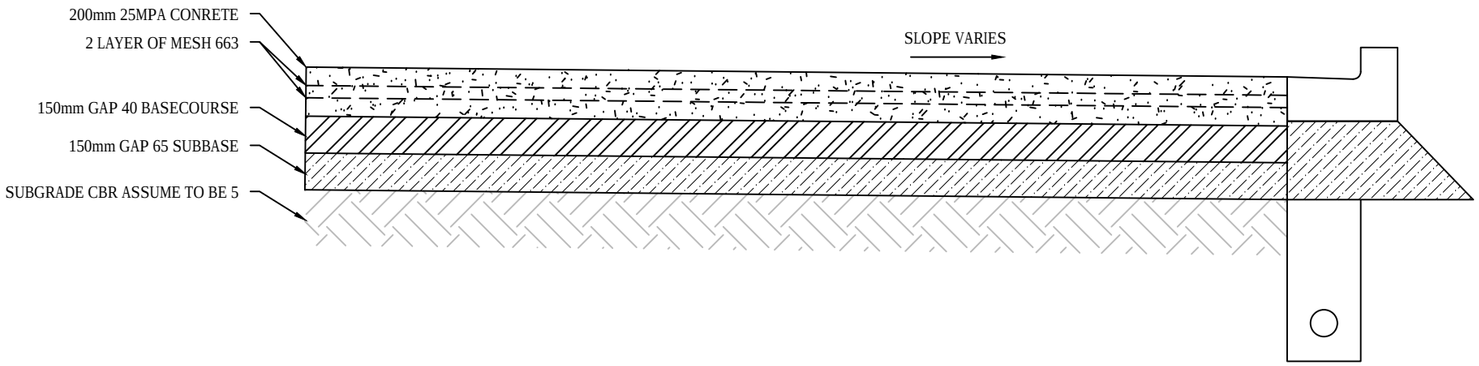
	By	Date
Survey	LAND & SURVEY	09/20
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

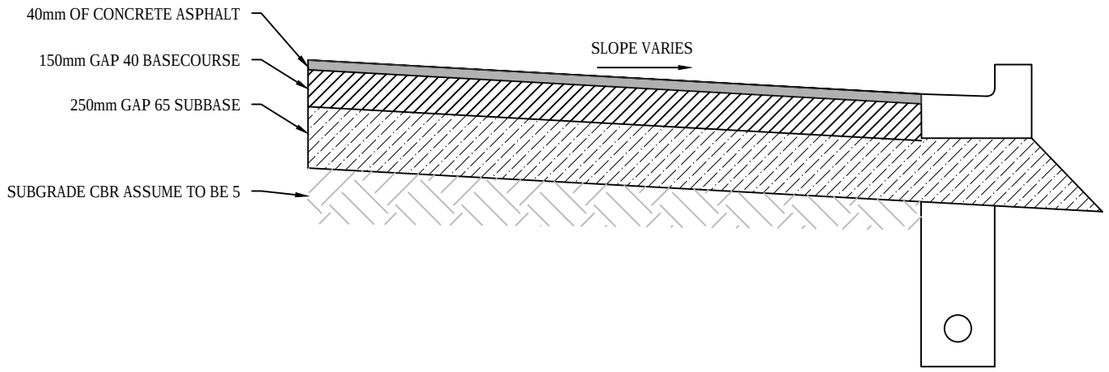
Project
RUAKAKA SERVICE CENTRE FOR S K AOTEAROA TRUST

Title
PROPOSED RAMP LONG SECTION

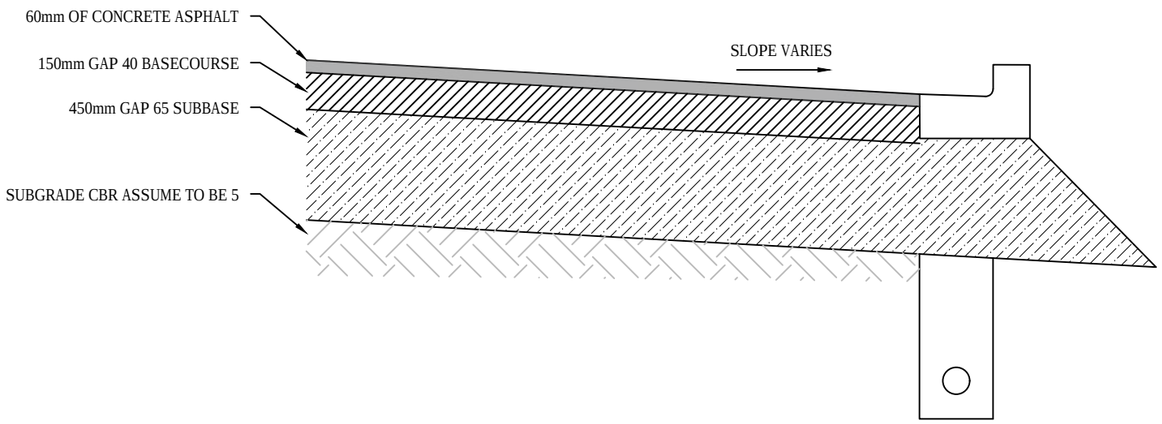
Project no.	117019
Scale	-
Cad file	C300 ROADING.DWG
Drawing no.	C311 Rev A



CONCRETE DRIVEWAY PAVEMENT DETAIL
SCALE 1:25 @ A3



FRONT CARPARK ASPHALTIC CONCRETE PAVEMENT DETAIL
SCALE 1:25 @ A3



MAIN DRIVEWAY ASPHALTIC CONCRETE PAVEMENT DETAIL
SCALE 1:25 @ A3

Notes
1. Detail design will be provided at building consent stage

A	RC	KH	09/20
Rev	Description	By	Date

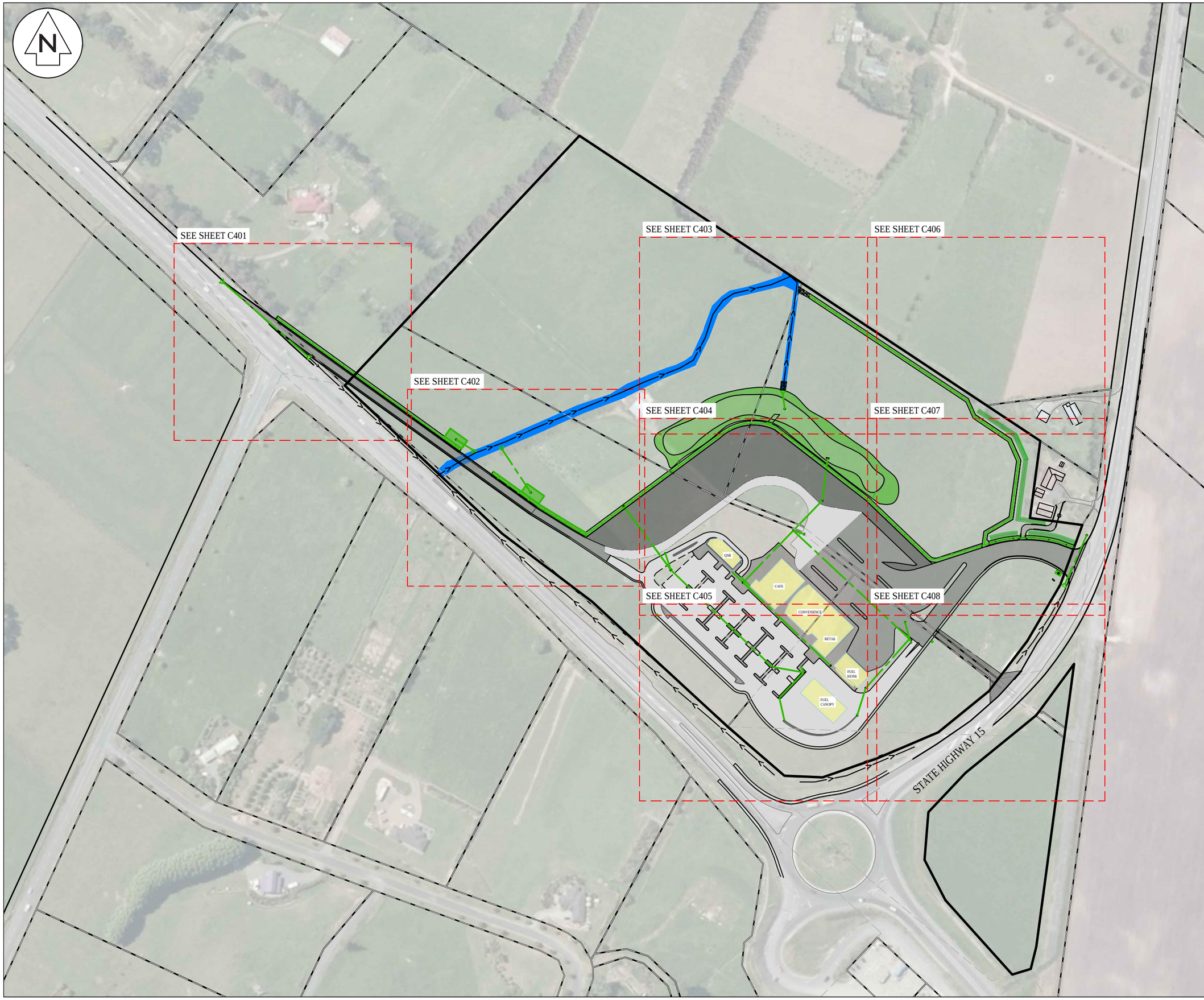
	By	Date
Survey	LANDS & SURVEY	09/20
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED ROADING PAVEMENT DETAIL

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C300 ROADING.DWG		
Drawing no.	C320	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. 2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the Auckland Vertical Datum 1946.
3. ll ends and connec ions o e no more an 45
4. All connections to existing drains shall be carried out by a licensed Drainlayer/Plumber.
5. Drainage shall comply in full with E1/AS1 building code for storm water.
6. All cesspits shall have half syphons installed.
7. All sanitary waste drains shall be uPVC to AS/NZS 1260.
8. Sewer shall comply in full with AS/NZS 3500.2 - 2003 and/or G13 Building Code
9. Refer to Hydraulic engineers drawings for building plumbing beyond that shown including down pipe sizes.
10. All pipes shall be SN16 grade unless otherwise stated.
11. Drainlayer shall locate and confirm connection invert before starting building works.
12. Plans to be read in conjunction with Hydraulic Engineers and differences shall clarified be before contractor starts.
13. All chamber lids shall have a minimum 200mm maximum 300 throat to provide sufficient cover for landscape and pavement over the top.

Legend

- EX BDY
- EX SW
- PROP SW
- EX/PROP SWMH
- PROP SWCP SINGLE
- PROP SWCP DOUBLE

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

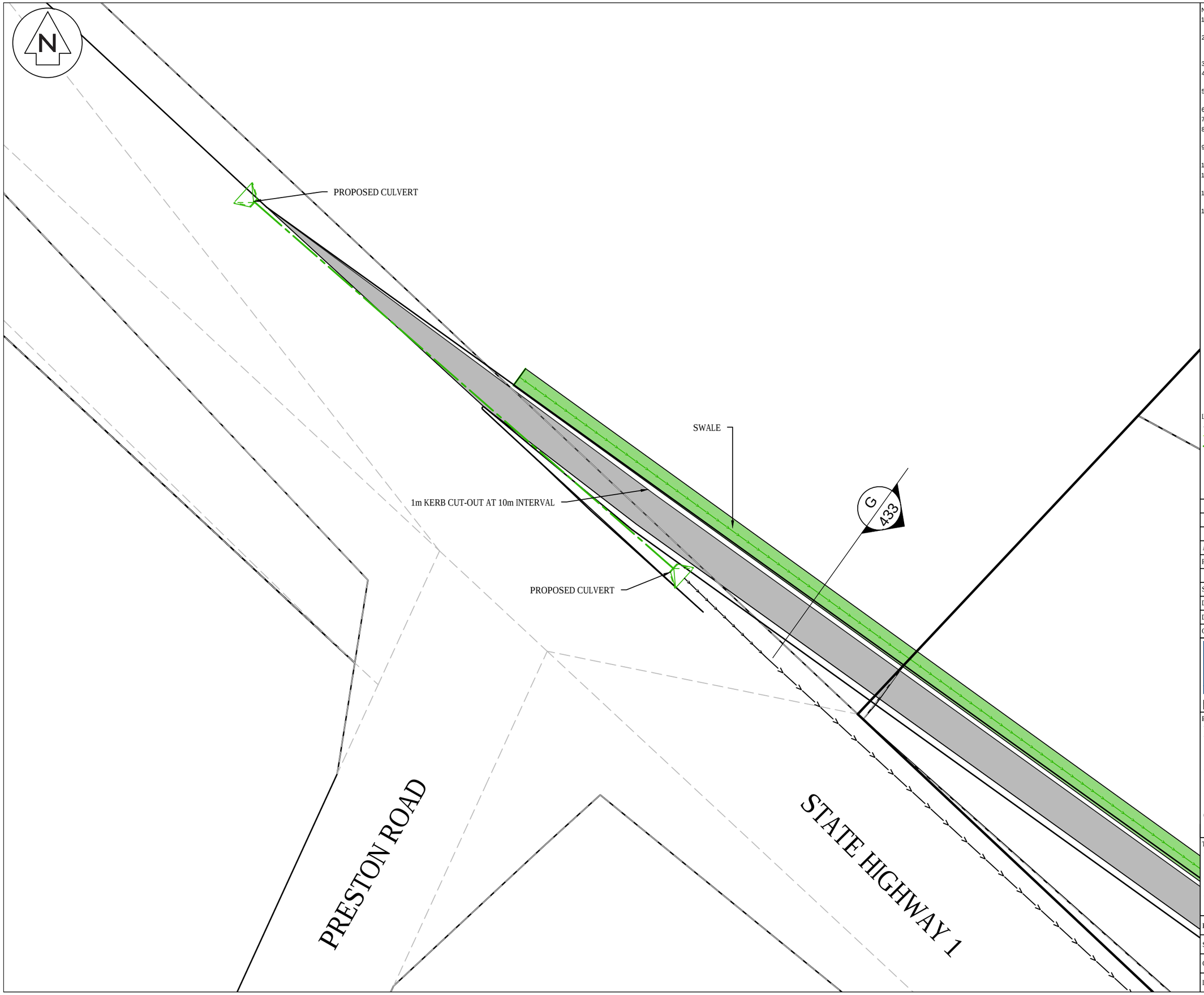
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED PRIVATE STORMWATER DRAINAGE OVERVIEW PLAN

Project no.	117019		
Scale	1:2500 @ A3		
Cad file	C400 SW.DWG		
Drawing no.	C400	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. 2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the Auckland Vertical Datum 1946.
3. ll ends and connec ions o e no more an 45
4. All connections to existing drains shall be carried out by a licensed Drainlayer/Plumber.
5. Drainage shall comply in full with E1/AS1 building code for storm water.
6. All cesspits shall have half syphons installed.
7. All sanitary waste drains shall be uPVC to AS/NZS 1260.
8. Sewer shall comply in full with AS/NZS 3500.2 - 2003 and/or G13 Building Code
9. Refer to Hydraulic engineers drawings for building plumbing beyond that shown including down pipe sizes.
10. All pipes shall be SN16 grade unless otherwise stated.
11. Drainlayer shall locate and confirm connection invert before starting building works.
12. Plans to be read in conjunction with Hydraulic Engineers and differences shall clarified be before contractor starts.
13. All chamber lids shall have a minimum 200mm maximum 300 throat to provide sufficient cover for landscape and pavement over the top.

Legend

- EX BDY
- EX SW
- PROP SW
- EX/PROP SWMH
- PROP SWCP SINGLE
- PROP SWCP DOUBLE

A	RC	KH	09/20
Rev	Description	By	Date

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

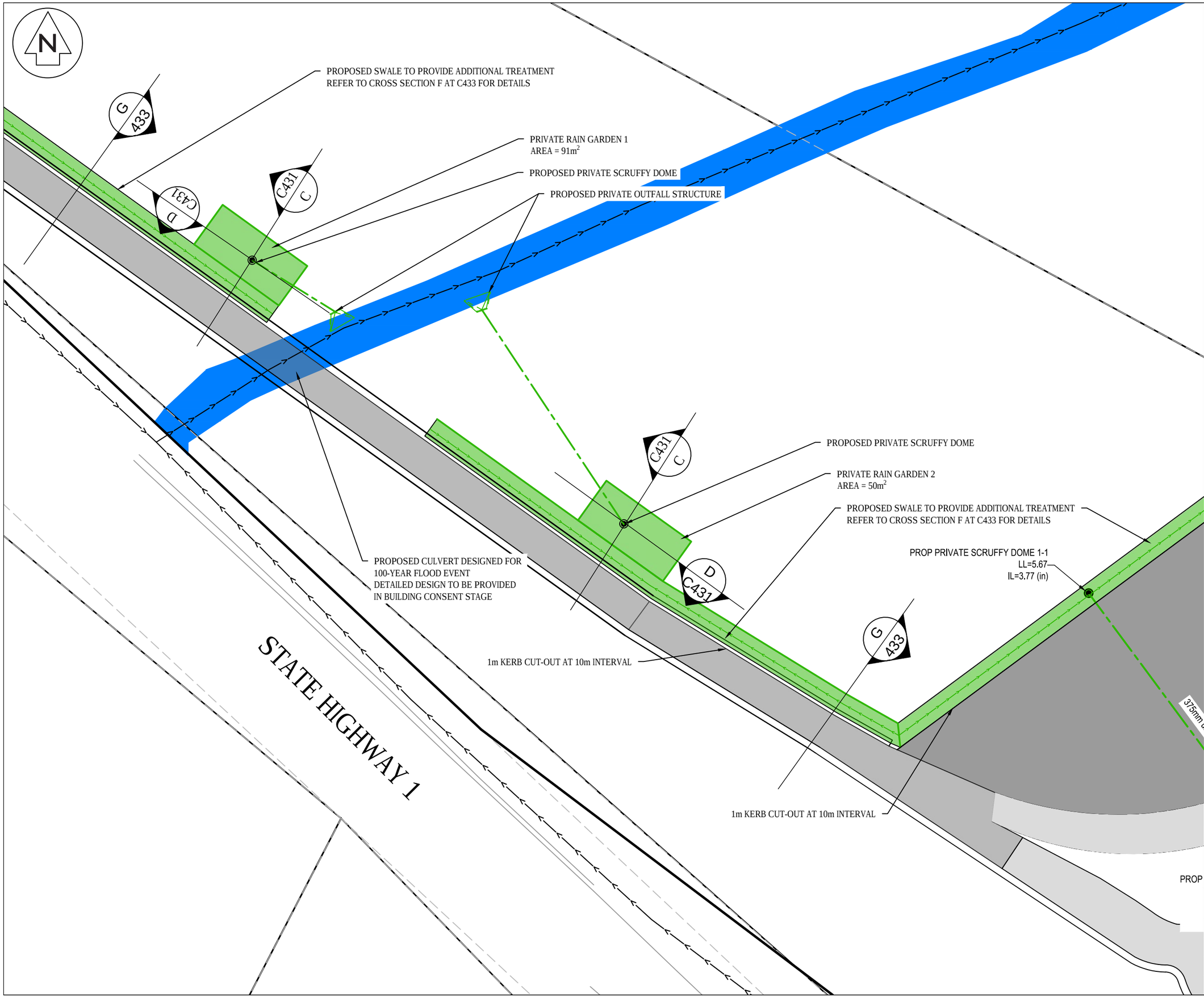
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED PRIVATE STORMWATER DRAINAGE PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C400 SW.DWG		
Drawing no.	C401	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. 2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the Auckland Vertical Datum 1946.
3. ll ends and connec ions o e no more an 45
4. All connections to existing drains shall be carried out by a licensed Drainlayer/Plumber.
5. Drainage shall comply in full with E1/AS1 building code for storm water.
6. All cesspits shall have half syphons installed.
7. All sanitary waste drains shall be uPVC to AS/NZS 1260.
8. Sewer shall comply in full with AS/NZS 3500.2 - 2003 and/or G13 Building Code
9. Refer to Hydraulic engineers drawings for building plumbing beyond that shown including down pipe sizes.
10. All pipes shall be SN16 grade unless otherwise stated.
11. Drainlayer shall locate and confirm connection invert before starting building works.
12. Plans to be read in conjunction with Hydraulic Engineers and differences shall clarified be before contractor starts.
13. All chamber lids shall have a minimum 200mm maximum 300 throat to provide sufficient cover for landscape and pavement over the top.

Legend

- EX BDY
- EX SW
- PROP SW
- EX/PROP SWMH
- PROP SWCP SINGLE
- PROP SWCP DOUBLE

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED PRIVATE STORMWATER DRAINAGE PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C400 SW.DWG		
Drawing no.	C402	Rev	A

N

ROCK RIP RAP

EXISTING FARM DRAIN BATTER
TO BE STABILISED

ROCK RIP RAP

OUTLET STRUCTURE WITH FLAP
FOR BACKFLOW PREVENTION

PROPSOED 100-YEAR ATTENUATION POND
WITH UP TO 2800m^3 STORAGE CAPACITY

OVERFLOW WEIR FOR 100-YEAR EVENT
THE DISCHARGE RATE WILL BE RESTRICTED
TO 80% OF PRE-DEVELOPMENT LEVEL
DETAILS TO BE PROVIDED IN BUILDING
CONSENT STAGE

E
C432

2700m^2 OF RAIN GARDEN TO PROVIDE FINAL
TREATMENT PRIOR TO DISCHARGING BACK
TO EXISTING FARM DRAIN

F
C432

PROPOSED PRIVATE SCRUFFY
DOME TO CONTROL SW
DISCHARGE RATE OF 5-YEAR
EVENT

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. 2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the Auckland Vertical Datum 1946.
3. ll ends and connec ions o e no more an 45
4. All connections to existing drains shall be carried out by a licensed Drainlayer/Plumber.
5. Drainage shall comply in full with E1/AS1 building code for storm water.
6. All cesspits shall have half syphons installed.
7. All sanitary waste drains shall be uPVC to AS/NZS 1260.
8. Sewer shall comply in full with AS/NZS 3500.2 - 2003 and/or G13 Building Code
9. Refer to Hydraulic engineers drawings for building plumbing beyond that shown including down pipe sizes.
10. All pipes shall be SN16 grade unless otherwise stated.
11. Drainlayer shall locate and confirm connection invert before starting building works.
12. Plans to be read in conjunction with Hydraulic Engineers and differences shall clarified be before contractor starts.
13. All chamber lids shall have a minimum 200mm maximum 300 throat to provide sufficient cover for landscape and pavement over the top.

Legend

- EX BDY
- EX SW
- PROP SW
- EX/PROP SWMH
- PROP SWCP SINGLE
- PROP SWCP DOUBLE

Rev	Description	By	Date
A	RC	KH	09/20

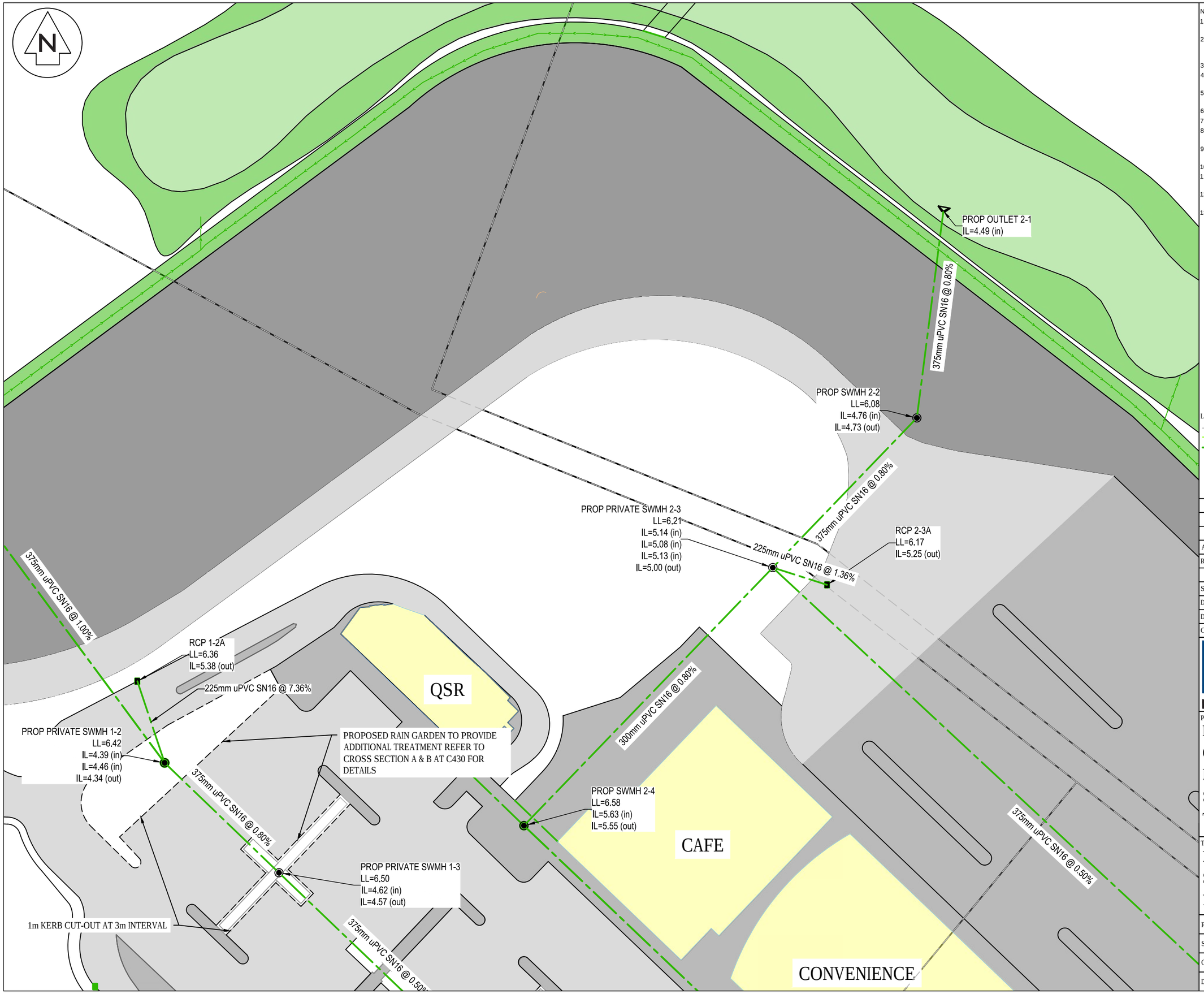
	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED PRIVATE STORMWATER DRAINAGE PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C400 SW.DWG		
Drawing no.	C403	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. 2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the Auckland Vertical Datum 1946.
3. ll ends and connec ions o e no more an 45
4. All connections to existing drains shall be carried out by a licensed Drainlayer/Plumber.
5. Drainage shall comply in full with E1/AS1 building code for storm water.
6. All cesspits shall have half syphons installed.
7. All sanitary waste drains shall be uPVC to AS/NZS 1260.
8. Sewer shall comply in full with AS/NZS 3500.2 - 2003 and/or G13 Building Code
9. Refer to Hydraulic engineers drawings for building plumbing beyond that shown including down pipe sizes.
10. All pipes shall be SN16 grade unless otherwise stated.
11. Drainlayer shall locate and confirm connection invert before starting building works.
12. Plans to be read in conjunction with Hydraulic Engineers and differences shall clarified be before contractor starts.
13. All chamber lids shall have a minimum 200mm maximum 300 throat to provide sufficient cover for landscape and pavement over the top.

Legend

- EX BDY
- EX SW
- PROP SW
- EX/PROP SWMH
- PROP SWCP SINGLE
- PROP SWCP DOUBLE

Rev	Description	By	Date
A	RC	KH	09/20

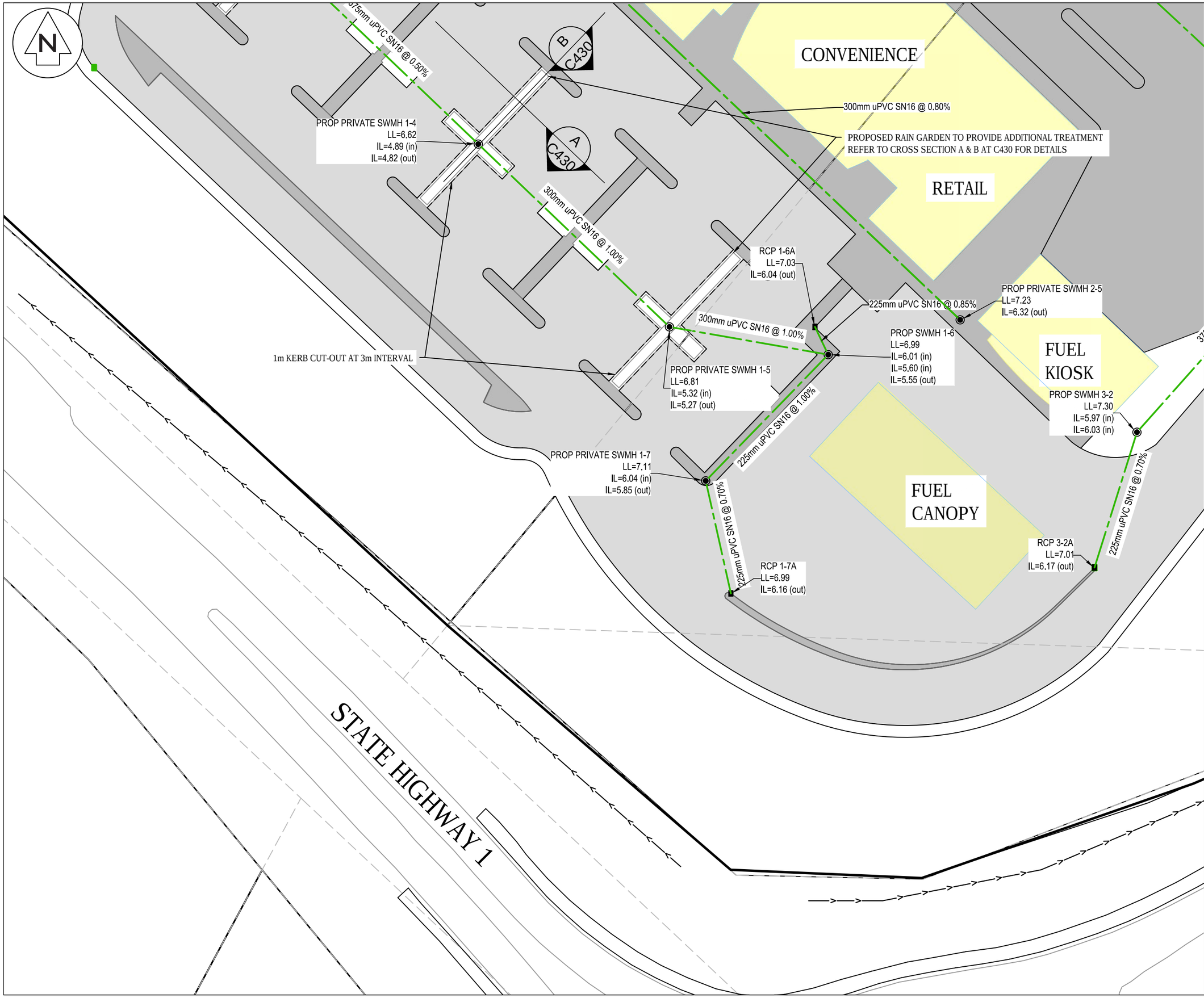
	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED PRIVATE STORMWATER DRAINAGE PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C400 SW.DWG		
Drawing no.	C404	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. 2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the Auckland Vertical Datum 1946.
3. ll ends and connec ions o e no more an 45
4. All connections to existing drains shall be carried out by a licensed Drainlayer/Plumber.
5. Drainage shall comply in full with E1/AS1 building code for storm water.
6. All cesspits shall have half syphons installed.
7. All sanitary waste drains shall be uPVC to AS/NZS 1260.
8. Sewer shall comply in full with AS/NZS 3500.2 - 2003 and/or G13 Building Code
9. Refer to Hydraulic engineers drawings for building plumbing beyond that shown including down pipe sizes.
10. All pipes shall be SN16 grade unless otherwise stated.
11. Drainlayer shall locate and confirm connection invert before starting building works.
12. Plans to be read in conjunction with Hydraulic Engineers and differences shall clarified be before contractor starts.
13. All chamber lids shall have a minimum 200mm maximum 300 throat to provide sufficient cover for landscape and pavement over the top.

Legend

- EX BDY
- EX SW
- PROP SW
- EX/PROP SWMH
- PROP SWCP SINGLE
- PROP SWCP DOUBLE

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

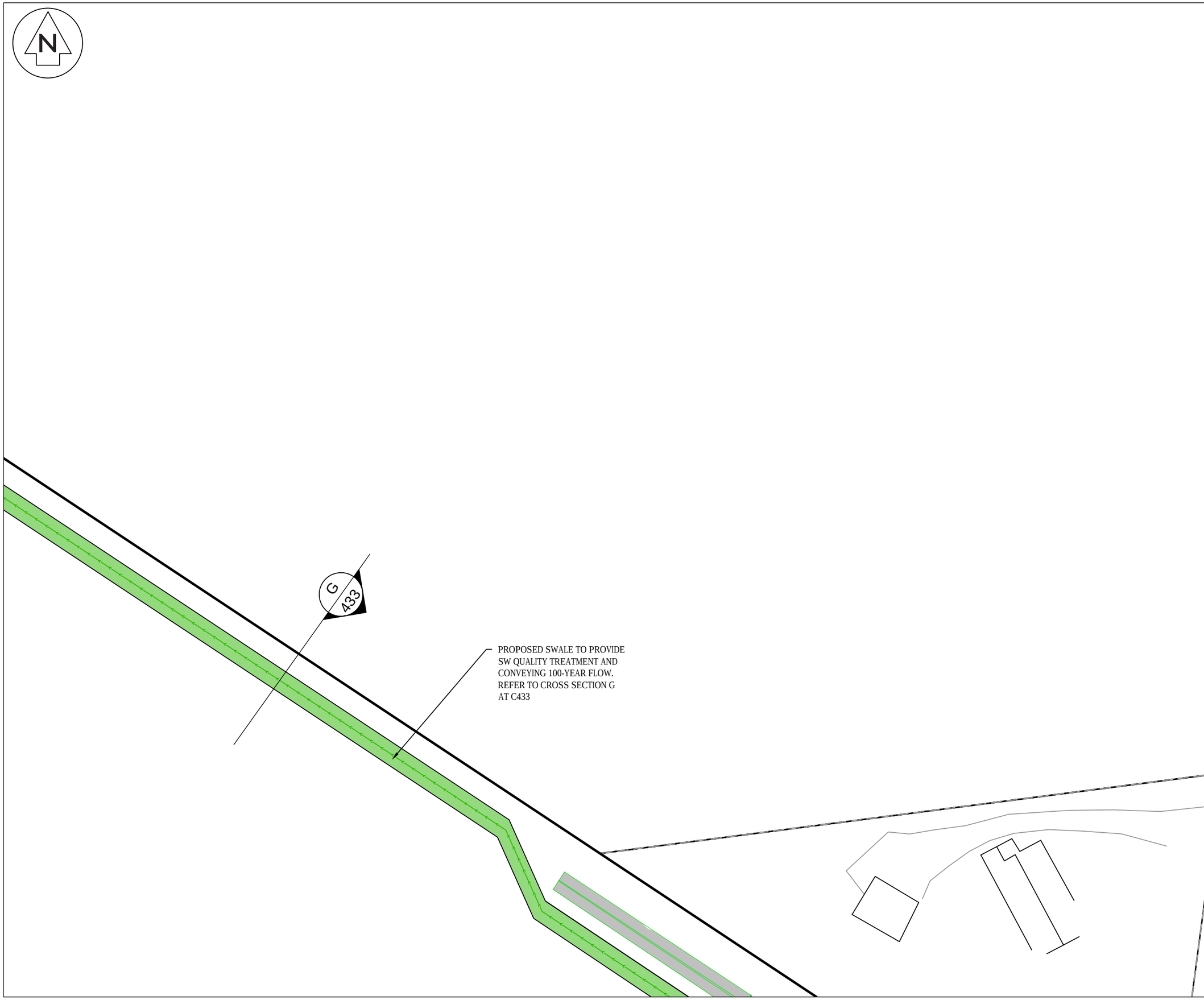
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED PRIVATE STORMWATER DRAINAGE PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C400 SW.DWG		
Drawing no.	C405	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. 2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the Auckland Vertical Datum 1946.
3. ll ends and connec ions o e no more an 45
4. All connections to existing drains shall be carried out by a licensed Drainlayer/Plumber.
5. Drainage shall comply in full with E1/AS1 building code for storm water.
6. All cesspits shall have half syphons installed.
7. All sanitary waste drains shall be uPVC to AS/NZS 1260.
8. Sewer shall comply in full with AS/NZS 3500.2 - 2003 and/or G13 Building Code
9. Refer to Hydraulic engineers drawings for building plumbing beyond that shown including down pipe sizes.
10. All pipes shall be SN16 grade unless otherwise stated.
11. Drainlayer shall locate and confirm connection invert before starting building works.
12. Plans to be read in conjunction with Hydraulic Engineers and differences shall clarified be before contractor starts.
13. All chamber lids shall have a minimum 200mm maximum 300 throat to provide sufficient cover for landscape and pavement over the top.

Legend

- EX BDY
- PROP BDY
- EX SW
- PROP SW
- EX/PROP SWMH
- PROP SWCP SINGLE
- PROP SWCP DOUBLE

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

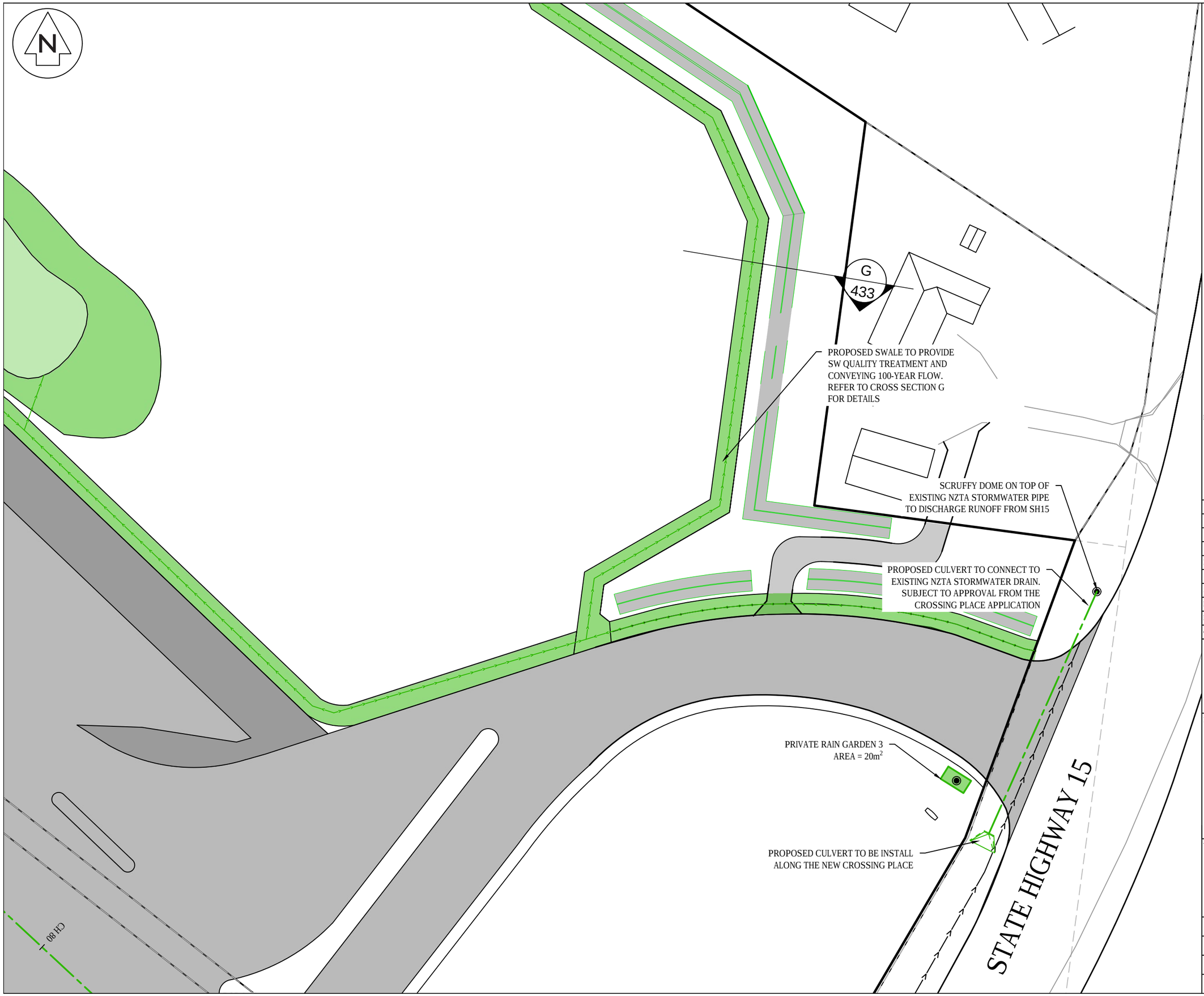
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED PRIVATE STORMWATER DRAINAGE PLAN

Project no.	117019		
Scale	1:250 @ A3		
Cad file	C400 SW.DWG		
Drawing no.	C406	Rev	A



Notes

1. All works to be in accordance with Whagarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the Auckland Vertical Datum 1946.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. Pipe bedding: 0 - 10% granular bedding,10 - 20% weak concrete bedding.greater than 20% weak concrete bedding (7mpa plus anti scour blocks at 6m crs).
5. Each connection shall be marked by a 50mmx50mm treated pine stake extending 600mm above ground level with the top painted. This marker post shall be placed alongside a timber marker installed at the time of pipelaying and extending from the connection to 150mm below finished ground level. Connections shall be accurately indicated on "as built" plans.
6. Approved hardfill is to be used in backfilling of all road crossings and vehicle crossings to council standards.
7. Heavy duty manhole lids and frames to be used in trafficked areas.
8. All cesspit leads shall have min cover 0.9m.
9. All lines are to be 150mmØ PVC Class SN16 unless shown otherwise.
10. All lines to be abandoned shall be sealed at each end. timing of all sealing to be coordinated with council staff.

Legend

- EX BDY
- EX SW
- PROP SW
- EX/PROP SWMH
- PROP SWCP SINGLE
- PROP SWCP DOUBLE

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

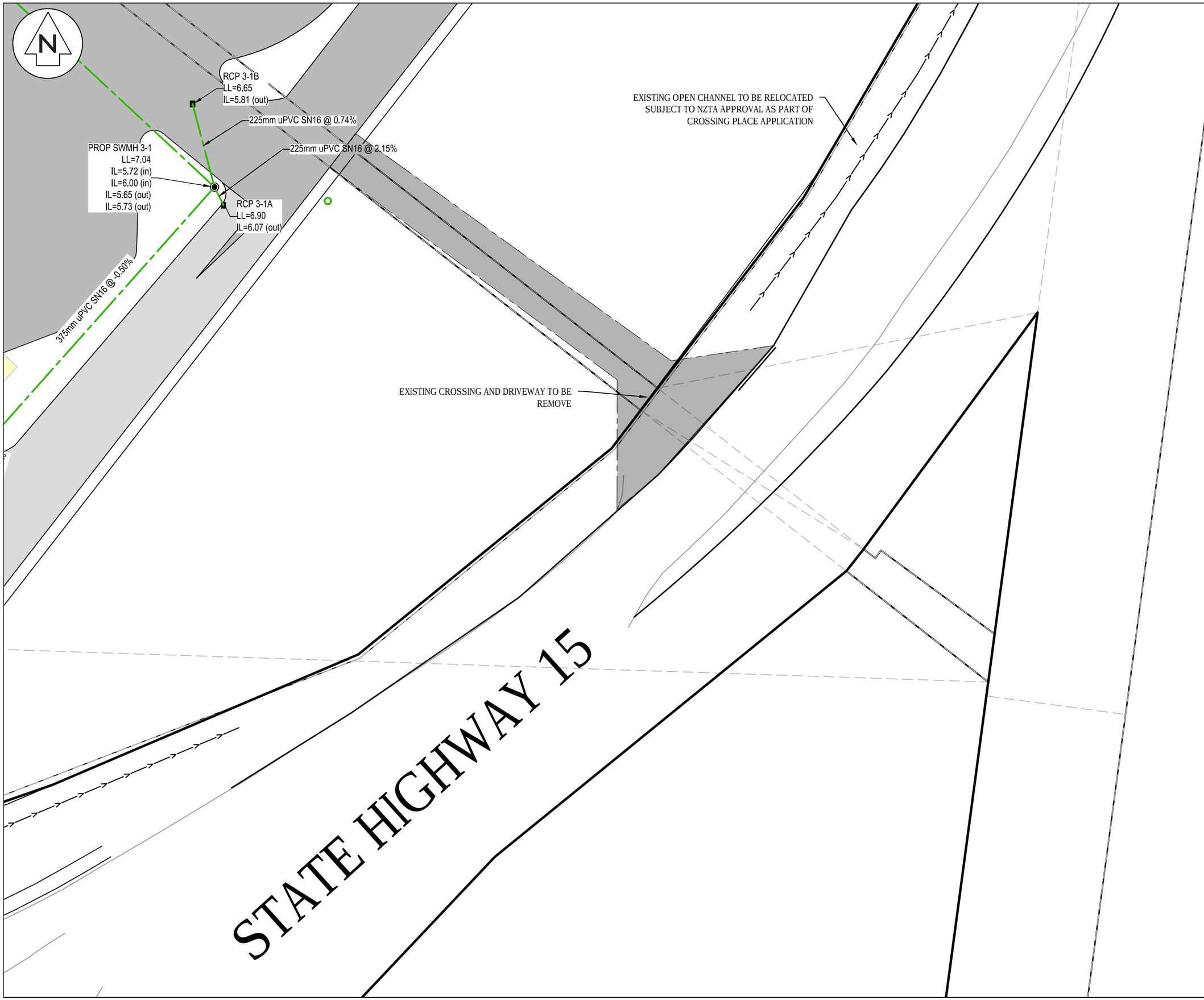
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED PRIVATE STORMWATER DRAINAGE PLAN

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C400 SW.DWG		
Drawing no.	C407	Rev	A



Notes

1. All works to be in accordance with Whagarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the Auckland Vertical Datum 1946.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. Pipe bedding: 0 - 10% granular bedding,10 - 20% weak concrete bedding.greater than 20% weak concrete bedding (7mpa plus anti scour blocks at 6m crs).
5. Each connection shall be marked by a 50mmx50mm treated pine stake extending 600mm above ground level with the top painted. This marker post shall be placed alongside a timber marker installed at the time of pipelaying and extending from the connection to 150mm below finished ground level. Connections shall be accurately indicated on "as built" plans.
6. Approved hardfill is to be used in backfilling of all road crossings and vehicle crossings to council standards.
7. Heavy duty manhole lids and frames to be used in trafficked areas.
8. All cesspit leads shall have min cover 0.9m.
9. All lines are to be 150mmØ PVC Class SN16 unless shown otherwise.
10. All lines to be abandoned shall be sealed at each end. timing of all sealing to be coordinated with council staff.

Legend

- EX BDY
- EX SW
- PROP SW
- EX/PROP SWMH
- PROP SWCP SINGLE
- PROP SWCP DOUBLE

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

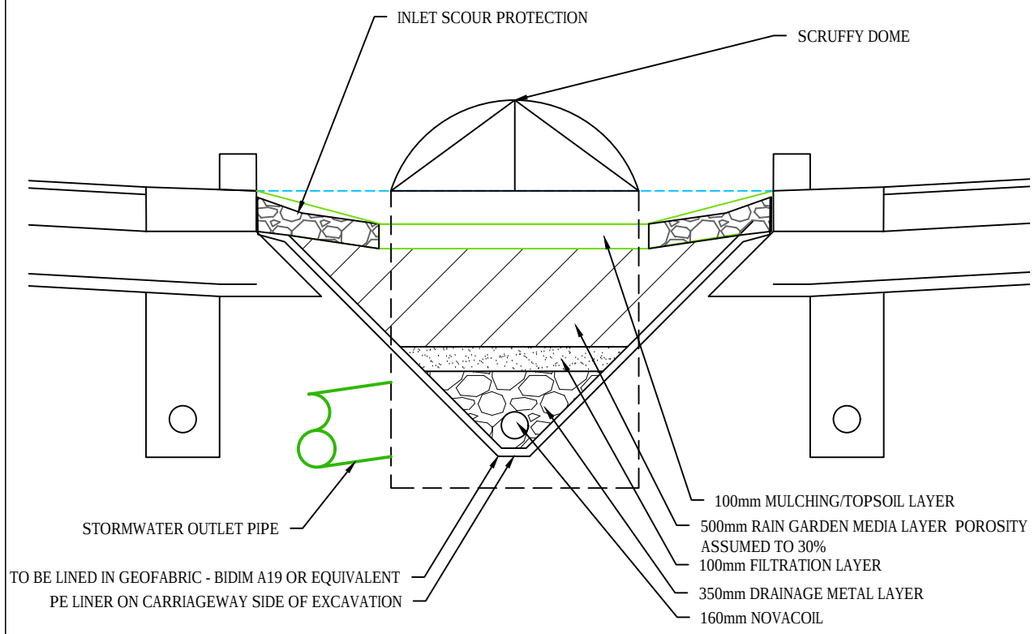
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

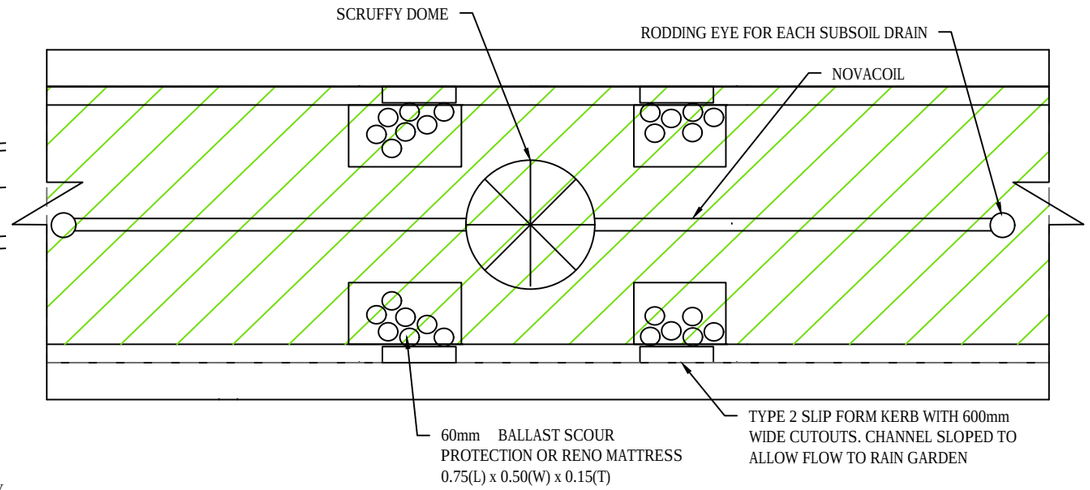
Title

PROPOSED PRIVATE STORMWATER DRAINAGE PLAN

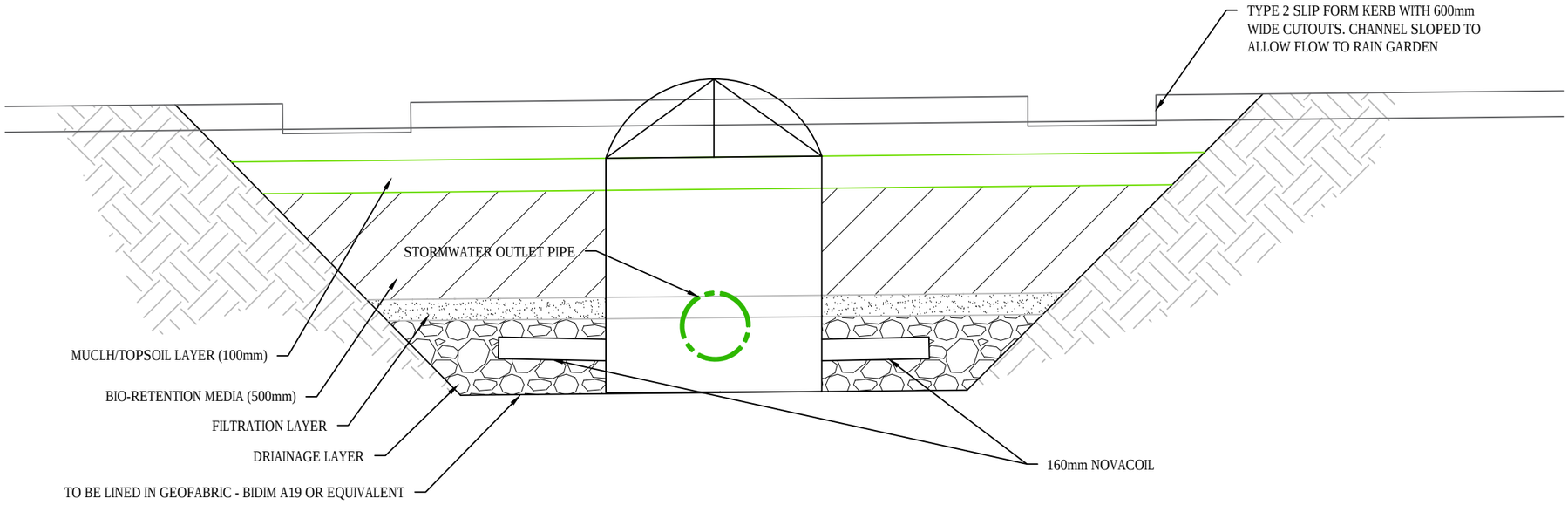
Project no.	117019		
Scale	1:500 @ A3		
Cad file	C400 SW.DWG		
Drawing no.	C408	Rev	A



A / C430 RAIN GARDEN AT CAR PARK SECTION DETAIL
SCALE 1:25 @ A3



C430 RAIN GARDEN AT CAR PARK PLAN DETAIL
SCALE 1:50 @ A3



B / C430 RAIN GARDEN AT CAR PARK SECTION DETAIL
SCALE 1:25 @ A3

Notes

1. ll ends and connec ions o e no more an 45
2. All connections to existing drains shall be carried out by a licensed Drainlayer/Plumber.
3. Drainage shall comply in full with E1/AS1 building code for storm water.
4. All cesspits shall have half syphons installed.
5. All sanitary waste drains shall be uPVC to AS/NZS 1260.
6. Sewer shall comply in full with AS/NZS 3500.2 - 2003 and/or G13 Building Code
7. Refer to Hydraulic engineers drawings for building plumbing beyond that shown including down pipe sizes.
8. All pipes shall be SN16 grade unless otherwise stated.
9. Drainlayer shall locate and confirm connection invert before starting building works.
10. Plans to be read in conjunction with Hydraulic Engineers and differences shall clarified be before contractor starts.
11. All chamber lids shall have a minimum 200mm maximum 300 throat to provide sufficient cover for landscape and pavement over the top.

Rev	Description	By	Date
A	RC	KH	09/20

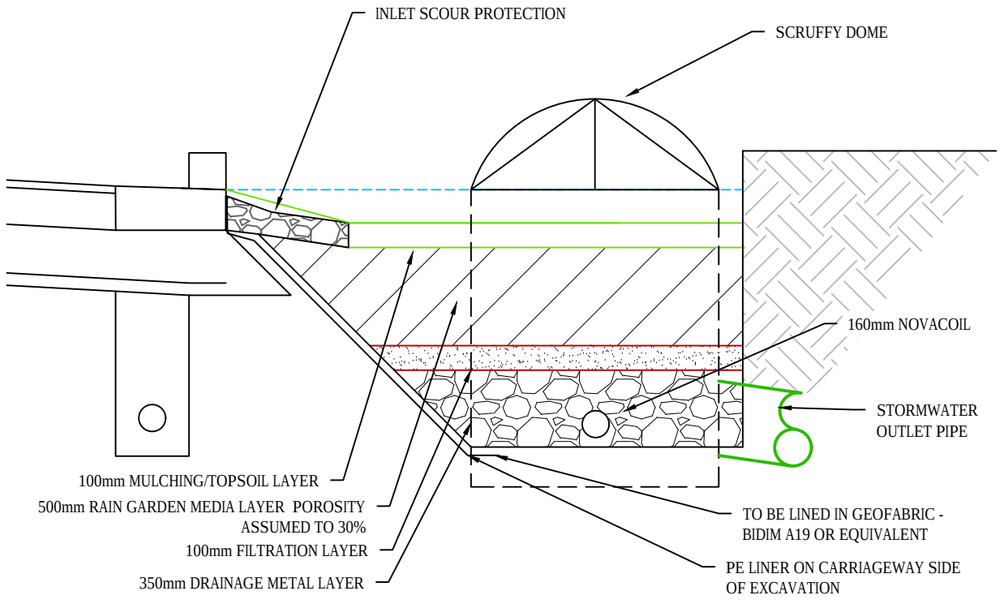
	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

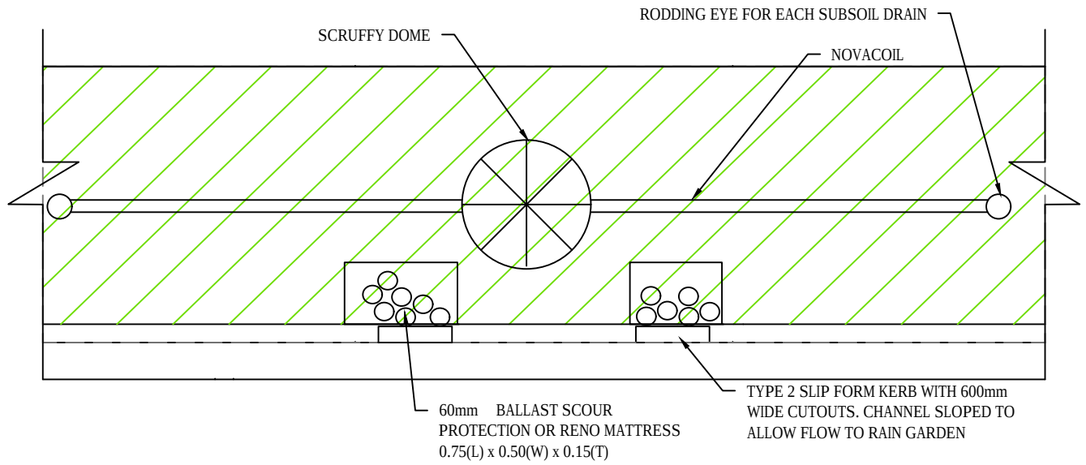
Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED TYPICAL CAR PARK RAINGARDEN DETAILS

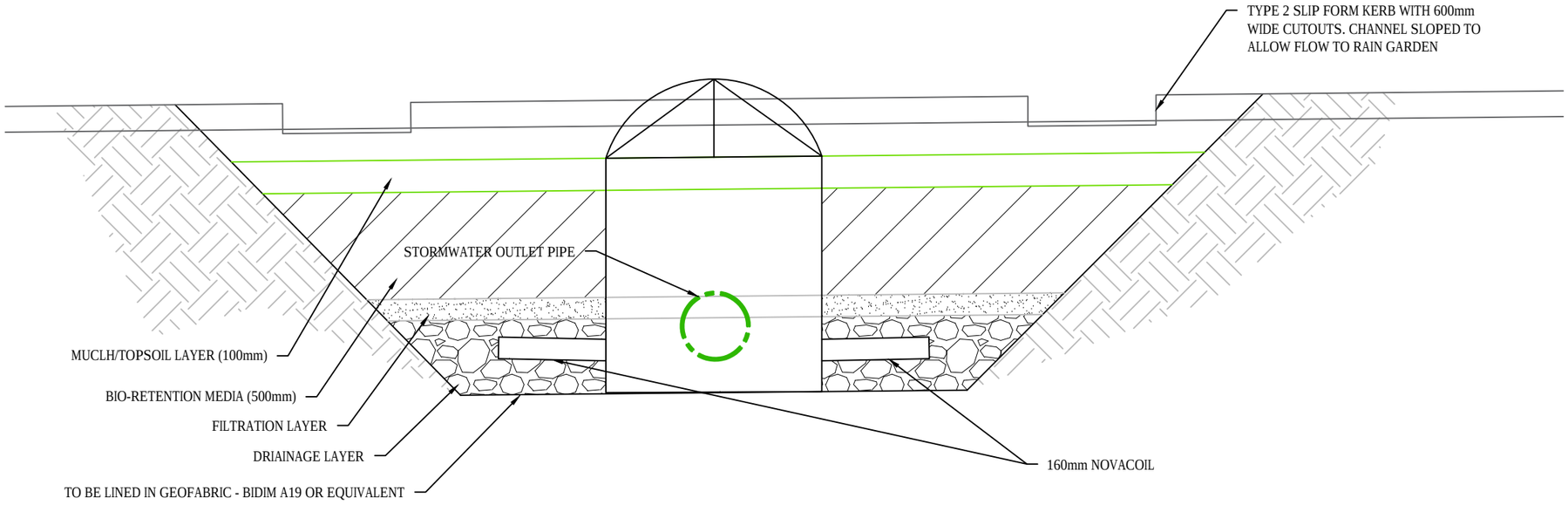
Project no.	117019		
Scale	AS SHOWN		
Cad file	C400 SW.DWG		
Drawing no.	C430	Rev	A



C / C431 TYPICAL RAIN GARDEN SECTION DETAIL
SCALE 1:25 @ A3



C431 RAIN GARDEN AT CAR PARK PLAN DETAIL
SCALE 1:50 @ A3



D / C431 RAIN GARDEN AT CAR PARK SECTION DETAIL
SCALE 1:25 @ A3

Notes

1. All bends and connections on pipe no more than 45
2. All connections to existing drains shall be carried out by a licensed Drainlayer/Plumber.
3. Drainage shall comply in full with E1/AS1 building code for storm water.
4. All cesspits shall have half syphons installed.
5. All sanitary waste drains shall be uPVC to AS/NZS 1260.
6. Sewer shall comply in full with AS/NZS 3500.2 - 2003 and/or G13 Building Code
7. Refer to Hydraulic engineers drawings for building plumbing beyond that shown including down pipe sizes.
8. All pipes shall be SN16 grade unless otherwise stated.
9. Drainlayer shall locate and confirm connection invert before starting building works.
10. Plans to be read in conjunction with Hydraulic Engineers and differences shall clarified be before contractor starts.
11. All chamber lids shall have a minimum 200mm maximum 300 throat to provide sufficient cover for landscape and pavement over the top.

Rev	Description	By	Date
A	RC	KH	09/20

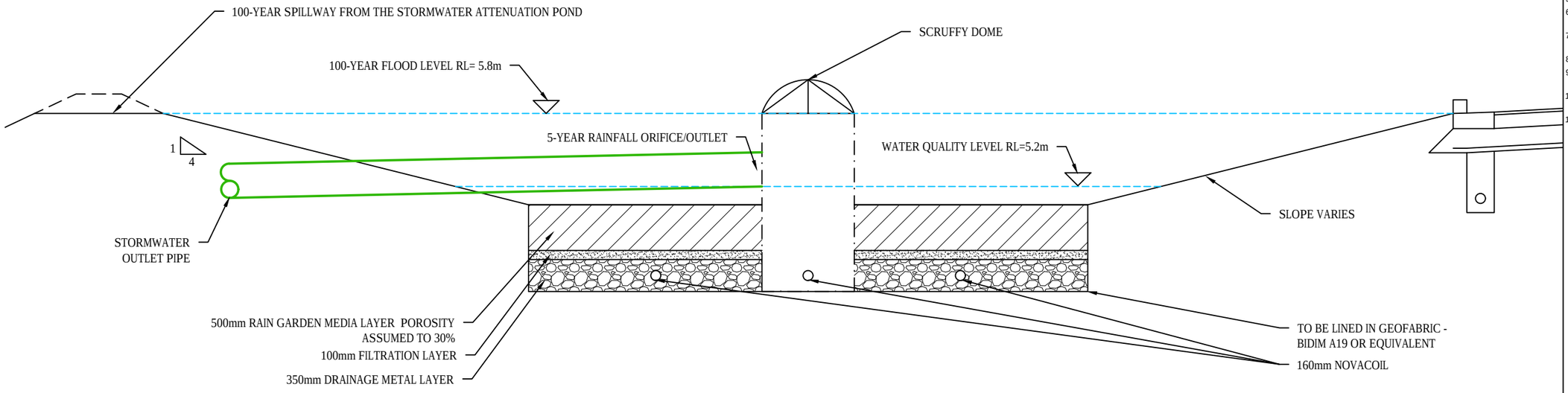
	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

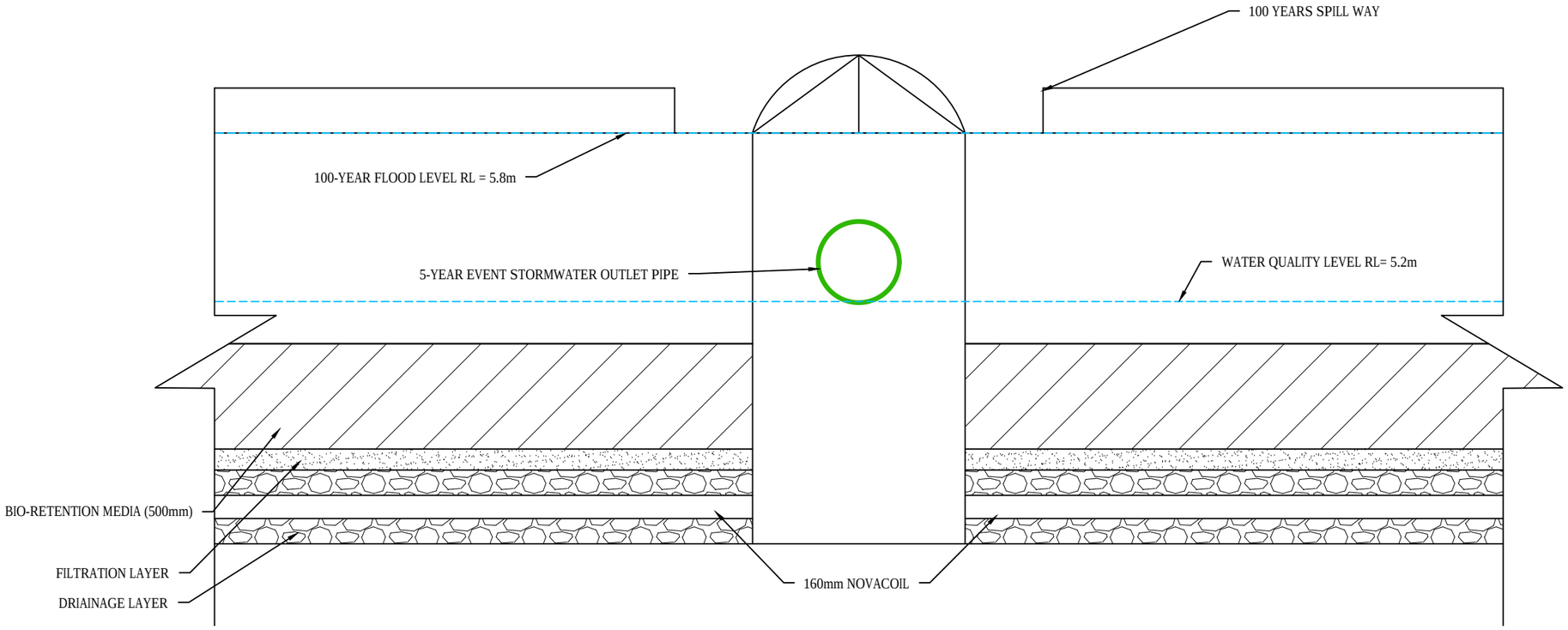
Title
PROPOSED TYPICAL CARPARK RAINGARDEN DETAILS

Project no.	117019		
Scale	AS SHOWN		
Cad file	C400 SW.DWG		
Drawing no.	C431	Rev	A



E / C432 TYPICAL ATTENUATION POND/RAIN GARDEN SECTION DETAIL

SCALE: NTS



F / C432 TYPICAL ATTENUATION POND/RAIN GARDEN SECTION DETAIL

SCALE: NTS

Notes

1. All bends and connections on pipe runs no more than 45
2. All connections to existing drains shall be carried out by a licensed Drainlayer/Plumber.
3. Drainage shall comply in full with E1/AS1 building code for storm water.
4. All cesspits shall have half syphons installed.
5. All sanitary waste drains shall be uPVC to AS/NZS 1260.
6. Sewer shall comply in full with AS/NZS 3500.2 - 2003 and/or G13 Building Code
7. Refer to Hydraulic engineers drawings for building plumbing beyond that shown including down pipe sizes.
8. All pipes shall be SN16 grade unless otherwise stated.
9. Drainlayer shall locate and confirm connection invert before starting building works.
10. Plans to be read in conjunction with Hydraulic Engineers and differences shall clarified be before contractor starts.
11. All chamber lids shall have a minimum 200mm maximum 300 throat to provide sufficient cover for landscape and pavement over the top.

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

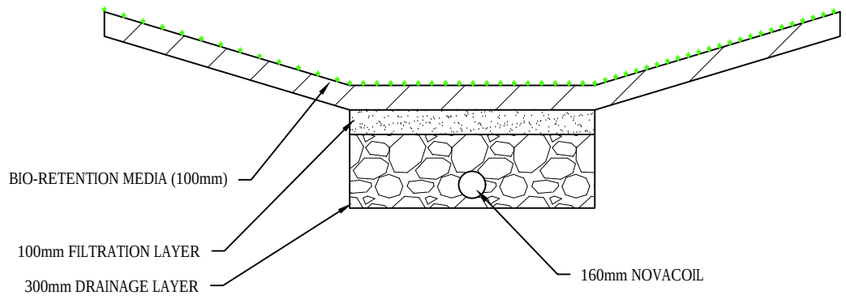
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED TYPICAL RAIN GARDEN & DETENTION BASIN

Project no.	117019		
Scale	N.T.S.		
Cad file	C400 SW.DWG		
Drawing no.	C432	Rev	A



SLOPE	WQV
0.5% GRADE	64.7m^3

G / C433 TYPICAL GRASS SWALE SECTION

SCALE: 1:25 @ A3

Notes

1. All bends and connections on one no more than 45
2. All connections to existing drains shall be carried out by a licensed Drainlayer/Plumber.
3. Drainage shall comply in full with E1/AS1 building code for storm water.
4. All cesspits shall have half syphons installed.
5. All sanitary waste drains shall be uPVC to AS/NZS 1260.
6. Sewer shall comply in full with AS/NZS 3500.2 - 2003 and/or G13 Building Code
7. Refer to Hydraulic engineers drawings for building plumbing beyond that shown including down pipe sizes.
8. All pipes shall be SN16 grade unless otherwise stated.
9. Drainlayer shall locate and confirm connection invert before starting building works.
10. Plans to be read in conjunction with Hydraulic Engineers and differences shall clarified be before contractor starts.
11. All chamber lids shall have a minimum 200mm maximum 300 throat to provide sufficient cover for landscape and pavement over the top.

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

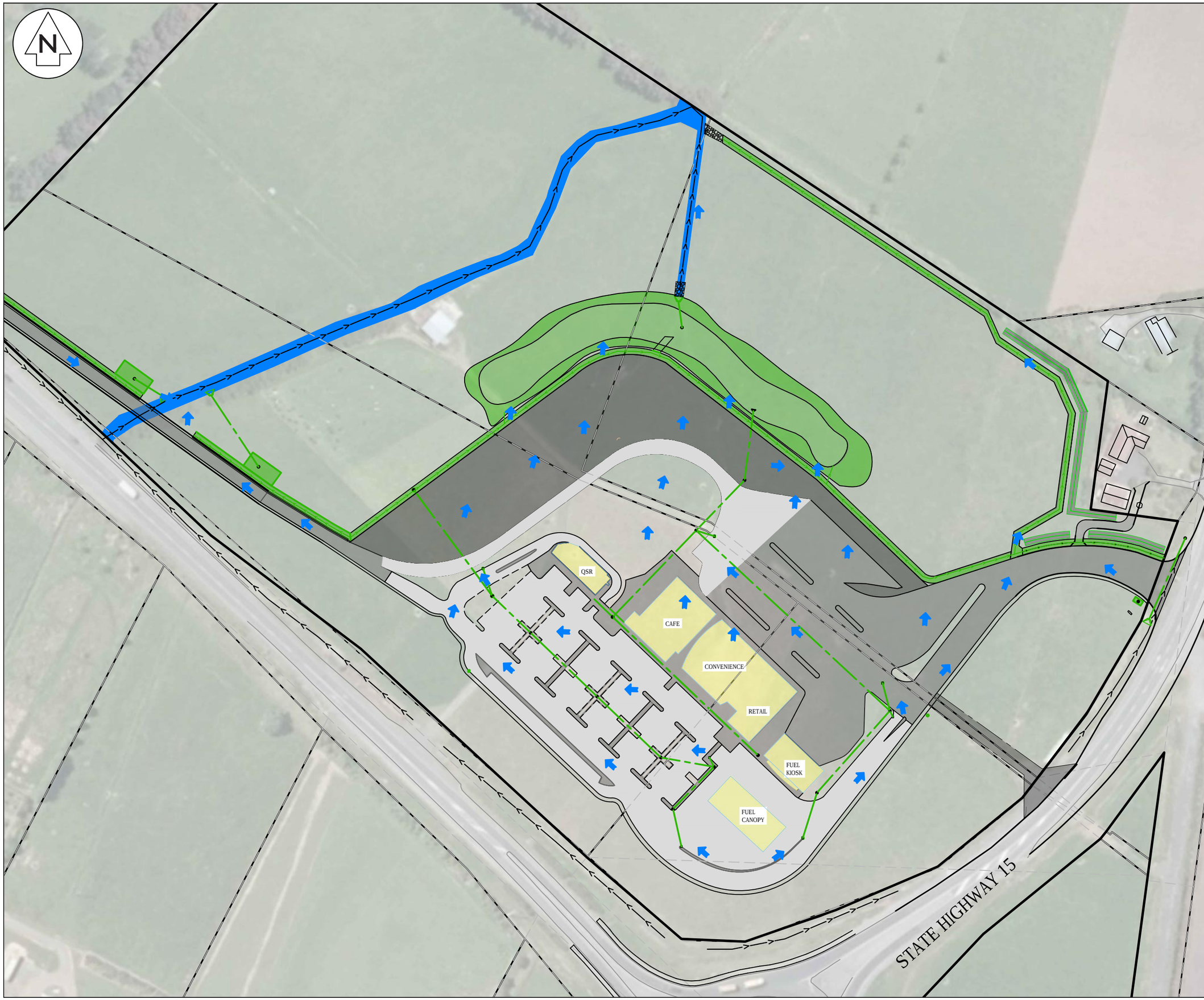
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED TYPICAL SWALE DETAILS

Project no.	117019		
Scale	N.T.S.		
Cad file	C400 SW.DWG		
Drawing no.	C433	Rev	A



Notes

1. All works to be in accordance with Whagarei council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the Auckland Vertical Datum 1946.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. Pipe bedding: 0 - 10% granular bedding,10 - 20% weak concrete bedding.greater than 20% weak concrete bedding (7mpa plus anti scour blocks at 6m crs).
5. Each connection shall be marked by a 50mmx50mm treated pine stake extending 600mm above ground level with the top painted. This marker post shall be placed alongside a timber marker installed at the time of pipelaying and extending from the connection to 150mm below finished ground level. Connections shall be accurately indicated on "as built" plans.
6. Approved hardfill is to be used in backfilling of all road crossings and vehicle crossings to council standards.
7. Heavy duty manhole lids and frames to be used in trafficked areas.
8. All cesspit leads shall have min cover 0.9m.
9. All lines are to be 150mmØ PVC Class SN16 unless shown otherwise.
10. All lines to be abandoned shall be sealed at each end. timing of all sealing to be coordinated with council staff.

Legend

- EX BDY
- EX SW
- PROP SW
- EX/PROP SWMH
- PROP SWCP SINGLE
- PROP SWCP DOUBLE
- SHEET FLOW

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	LC	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

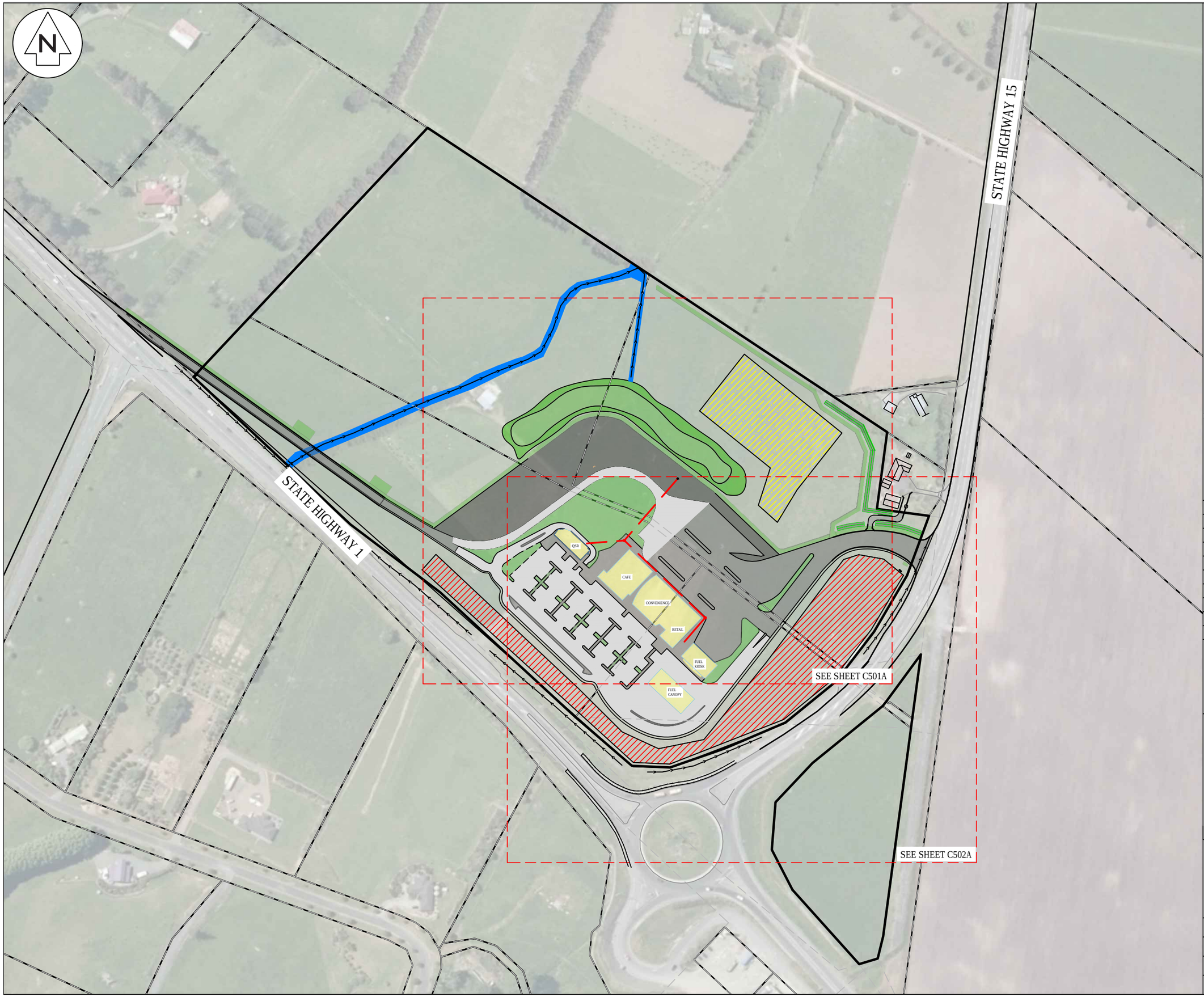
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED OVERLAND FLOW PATH PLAN

Project no.	117019		
Scale	1:1500 @ A3		
Cad file	C400 SW.DWG		
Drawing no.	C455	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the Auckland Vertical Datum 1946.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. Pipe bedding: 0 - 10% granular bedding,10 - 20% weak concrete bedding.greater than 20% weak concrete bedding (7mpa plus anti scour blocks at 6m crs).
5. Approved hardfill is to be used in backfilling of all road crossings and vehicle crossings to council standards.
6. Heavy duty manhole lids and frames to be used in trafficked areas, all manholes shall have stainless grates installed.
7. All lines are to be 150mmØ PVC Class SN16 unless shown otherwise.
8. 150mmØ pipes that do not terminate in a manhole must be terminated with a 100mmØ on a 150mmØ london junction and blank cap.
9. All lines to be abandoned shall be sealed at each end. timing of all sealing to be coordinated with council staff.

Legend

- EX BDY
- PROP BDY
- PROP PRIVATE WW
- EX/PROP WWMH
- MAIN DISPOSAL FIELD
- RESERVE DISPOSAL FIELD

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	GB	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

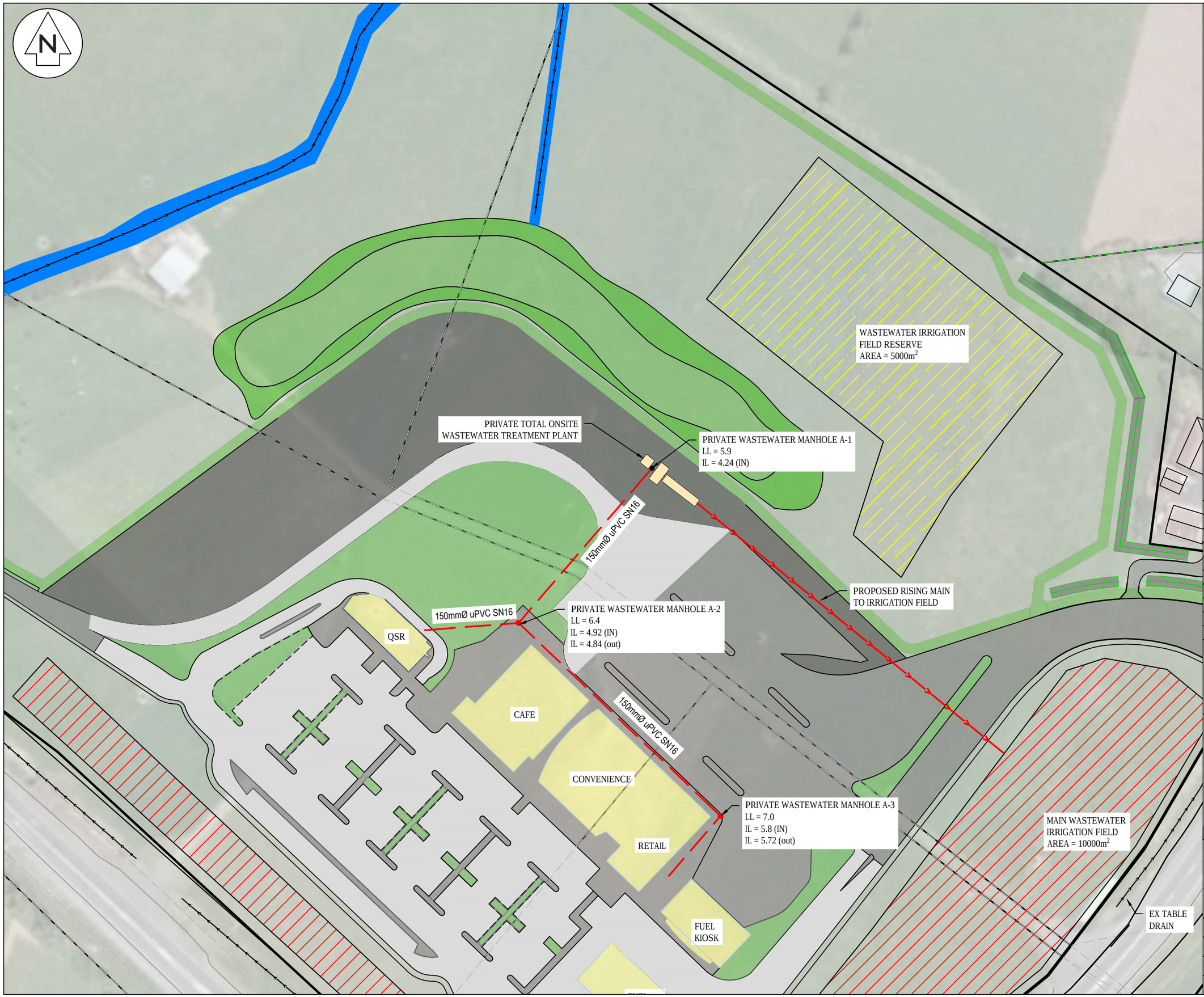
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED PRIVATE WASTEWATER DRAINAGE OVERVIEW PLAN

Project no.	117019
Scale	1:2500 @ A3
Cad file	C500 WW.DWG
Drawing no.	C500A
Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the Auckland Vertical Datum 1946.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. Pipe bedding: 0 - 10% granular bedding,10 - 20% weak concrete bedding.greater than 20% weak concrete bedding (7mpa plus anti scour blocks at 6m crs).
5. Approved hardfill is to be used in backfilling of all road crossings and vehicle crossings to council standards.
6. Heavy duty manhole lids and frames to be used in trafficked areas, all manholes shall have stainless grates installed.
7. All lines are to be 150mmØ PVC Class SN16 unless shown otherwise.
8. 150mmØ pipes that do not terminate in a manhole must be terminated with a 100mmØ on a 150mmØ london junction and blank cap.
9. All lines to be abandoned shall be sealed at each end. timing of all sealing to be coordinated with council staff.

Legend

- EX BDY
- PROP BDY
- EX TABLE DRAIN
- PROP PRIVATE WW
- PROP RISING MAIN
- EX/PROP WWMH
- MAIN DISPOSAL FIELD
- RESERVE DISPOSAL FIELD

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	GB	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

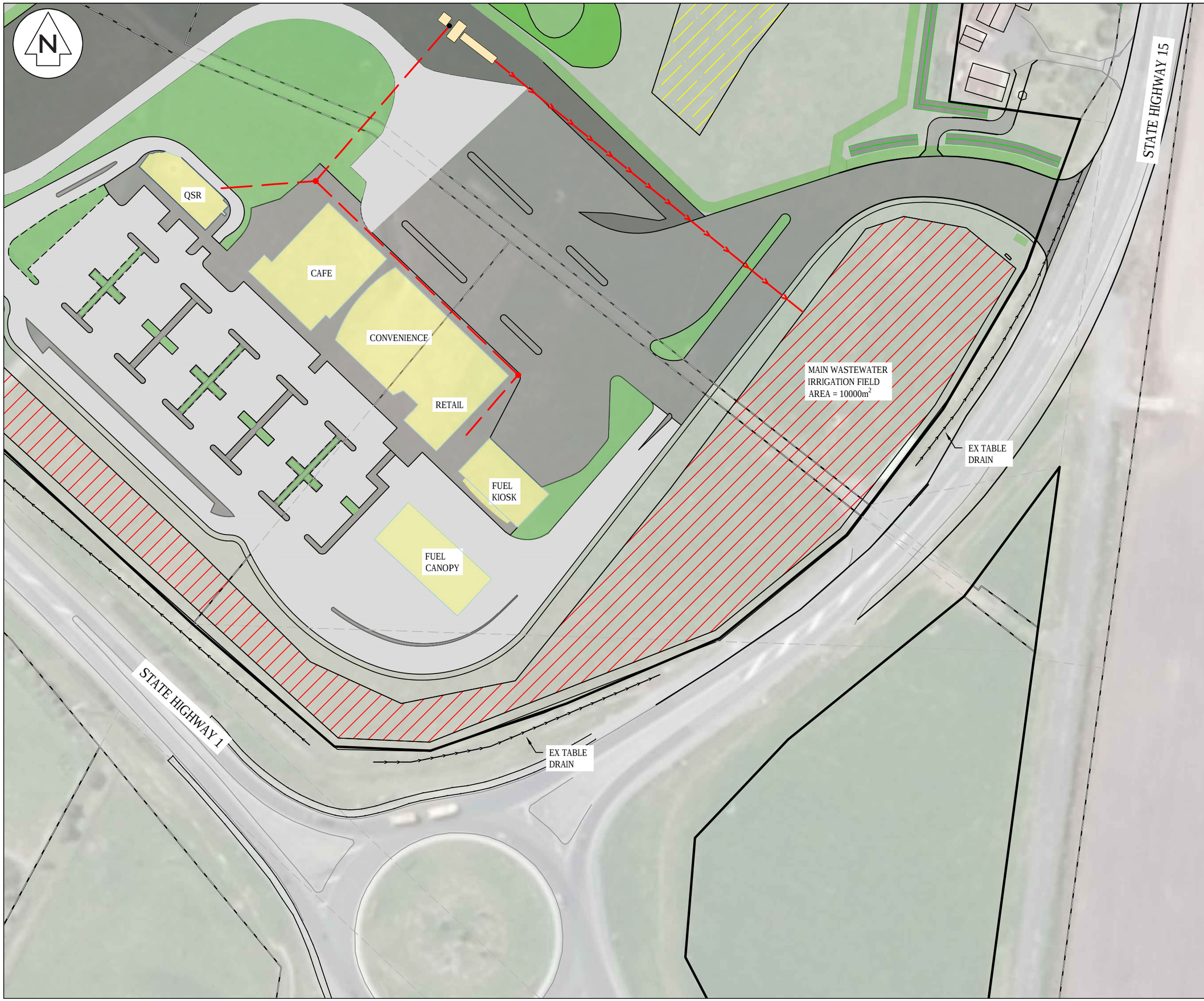
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED PRIVATE WASTEWATER DRAINAGE PLAN

Project no.	117019		
Scale	1:1000 @ A3		
Cad file	C500 WW.DWG		
Drawing no.	C501A	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the Auckland Vertical Datum 1946.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. Pipe bedding: 0 - 10% granular bedding,10 - 20% weak concrete bedding.greater than 20% weak concrete bedding (7mpa plus anti scour blocks at 6m crs).
5. Approved hardfill is to be used in backfilling of all road crossings and vehicle crossings to council standards.
6. Heavy duty manhole lids and frames to be used in trafficked areas, all manholes shall have stainless grates installed.
7. All lines are to be 150mmØ PVC Class SN16 unless shown otherwise.
8. 150mmØ pipes that do not terminate in a manhole must be terminated with a 100mmØ on a 150mmØ london junction and blank cap.
9. All lines to be abandoned shall be sealed at each end. timing of all sealing to be coordinated with council staff.

Legend

- EX BDY
- PROP BDY
- EX TABLE DRAIN
- PROP PRIVATE WW
- PROP RISING MAIN
- EX/PROP WWMH
- MAIN DISPOSAL FIELD
- RESERVE DISPOSAL FIELD

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	GB	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED PRIVATE WASTEWATER DRAINAGE PLAN

Project no.	117019		
Scale	1:1000 @ A3		
Cad file	C500 WW.DWG		
Drawing no.	C502A	Rev	A

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. It is the contractors responsibility to locate any underground services prior to the commencement of works.
3. Minimum cover shall be:
   - Roads, footpaths,crossings: 1000mm
   - Berms 600mm
   - Service connections: 550-650mm
4. Watermains laid across roads shall be backfilled with hardfill compacted in 200mm layers above the embedment material.
5. All uPVC pipe shall be PN12 minimum pressure rated with spignot and socket rubber ring joints.
6. All PE pipe shall be PN12.5 minimum pressure rated with butt-welded. Weld beads shall be removed to provide a smooth bore.
7. All non-metalic pipes are to have tracer wire fitted to council standards.
8. Pipes shall be bedded and surrounded to 150mm above the pipe soffit with sand or ap20.
9. Metal detector tape printed with 'water pipe below' shall be laid 150mm above all watermains.
10. A yellow isosceles triangle with cats eye pointing to FH shall be painted in the centre of all sealed roads.
11. All valves to be marked with sawcut kerb and blue paint.
12. All flange joints to be protected with denso tape or similar approved by the engineer.

Legend

- EX BDY
- PROP BDY
- EX WATERMAIN
- PROP WATERMAIN
- EX/PROP HYDRANT
- EX/PROP METER
- EX SLUICE VALVE
- EX PEAT VALVE
- PROP SLUICE VALVE
- PROP PEAT VALVE

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	GB	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

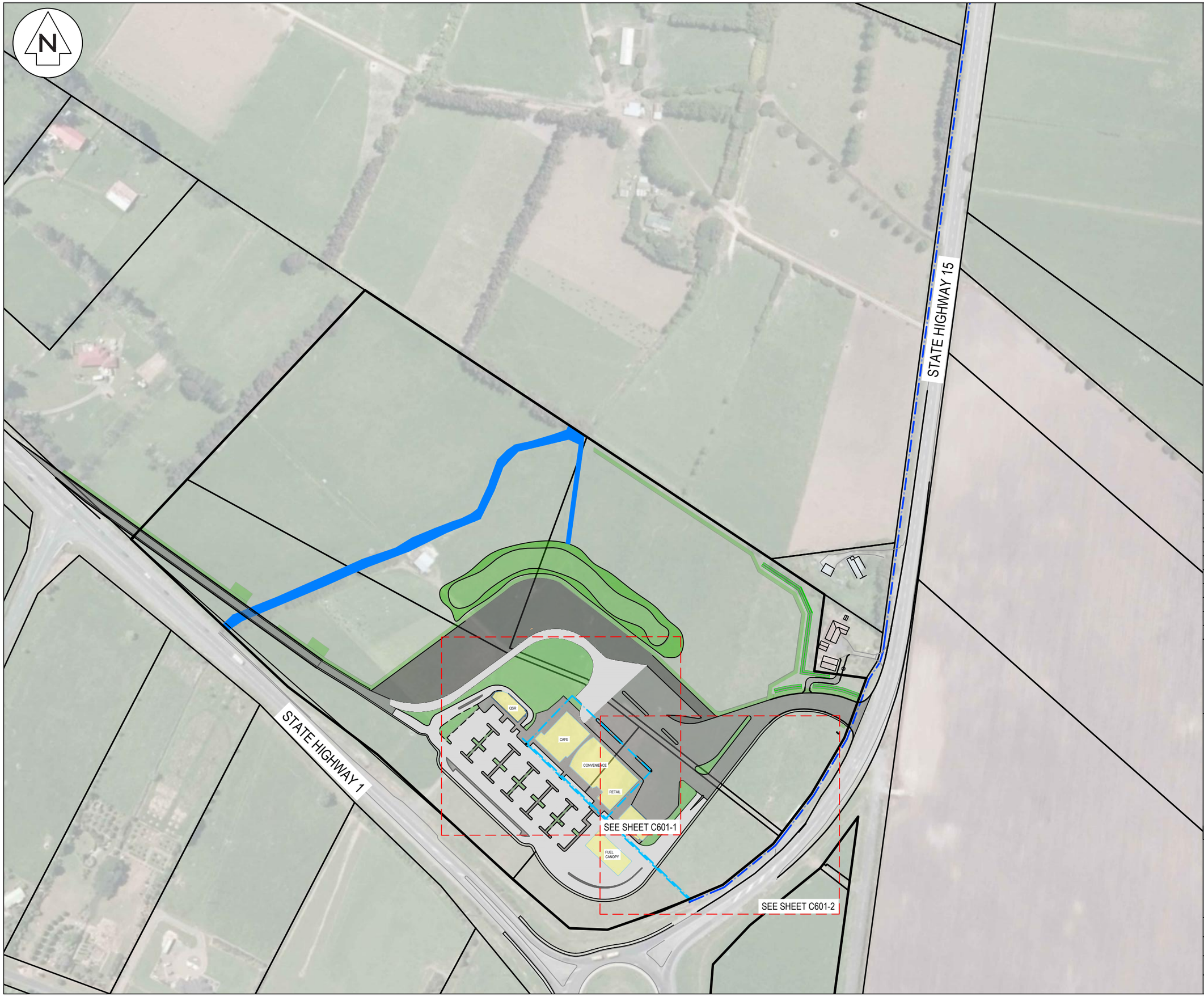
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED WATER SUPPLY OVERVIEW PLAN

Project no.	117019		
Scale	1:10000 @ A3		
Cad file	C600 WS.DWG		
Drawing no.	C600	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. It is the contractors responsibility to locate any underground services prior to the commencement of works.
3. Minimum cover shall be:
   - Roads, footpaths,crossings: 1000mm
   - Berms 600mm
   - Service connections: 550-650mm
4. Watermains laid across roads shall be backfilled with hardfill compacted in 200mm layers above the embedment material.
5. All uPVC pipe shall be PN12 minimum pressure rated with spignot and socket rubber ring joints.
6. All PE pipe shall be PN12.5 minimum pressure rated with butt-welded. Weld beads shall be removed to provide a smooth bore.
7. All non-metalic pipes are to have tracer wire fitted to council standards.
8. Pipes shall be bedded and surrounded to 150mm above the pipe soffit with sand or ap20.
9. Metal detector tape printed with 'water pipe below' shall be laid 150mm above all watermains.
10. A yellow isosceles triangle with cats eye pointing to FH shall be painted in the centre of all sealed roads.
11. All valves to be marked with sawcut kerb and blue paint.
12. All flange joints to be protected with denso tape or similar approved by the engineer.

Legend

- EX BDY
- PROP BDY
- EX WATERMAIN
- PROP WATERMAIN
- EX/PROP HYDRANT
- EX/PROP METER
- EX SLUICE VALVE
- EX PEAT VALVE
- PROP SLUICE VALVE
- PROP PEAT VALVE

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	GB	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

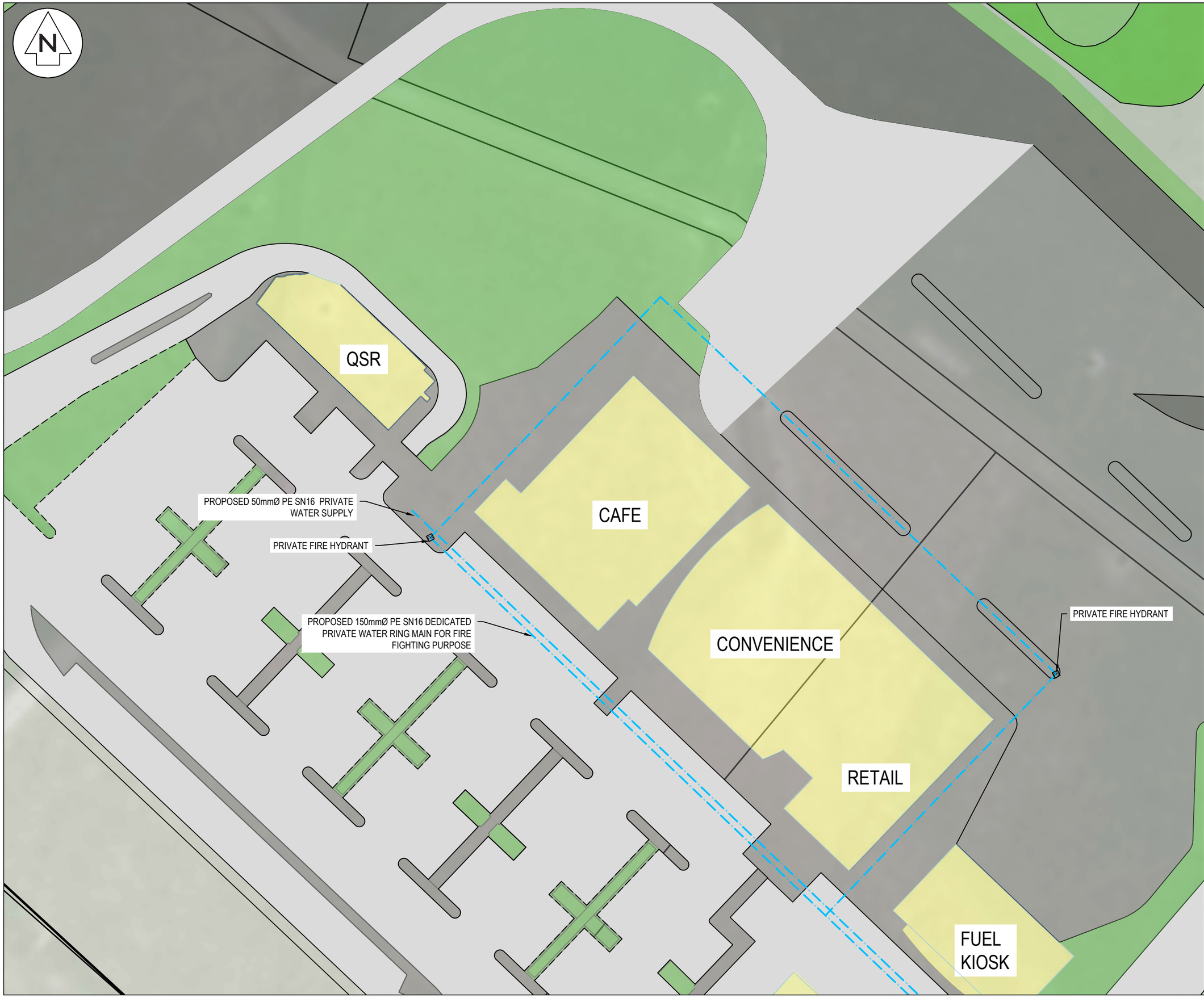
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED WATER SUPPLY PLAN

Project no.	117019		
Scale	1:2500 @ A3		
Cad file	C600 WS.DWG		
Drawing no.	C601	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. It is the contractors responsibility to locate any underground services prior to the commencement of works.
3. Minimum cover shall be:
   - Roads, footpaths,crossings: 1000mm
   - Berms 600mm
   - Service connections: 550-650mm
4. Watermains laid across roads shall be backfilled with hardfill compacted in 200mm layers above the embedment material.
5. All uPVC pipe shall be PN12 minimum pressure rated with spignot and socket rubber ring joints.
6. All PE pipe shall be PN12.5 minimum pressure rated with butt-welded. Weld beads shall be removed to provide a smooth bore.
7. All non-metalic pipes are to have tracer wire fitted to council standards.
8. Pipes shall be bedded and surrounded to 150mm above the pipe soffit with sand or ap20.
9. Metal detector tape printed with 'water pipe below' shall be laid 150mm above all watermains.
10. A yellow isosceles triangle with cats eye pointing to FH shall be painted in the centre of all sealed roads.
11. All valves to be marked with sawcut kerb and blue paint.
12. All flange joints to be protected with denso tape or similar approved by the engineer.

Legend

- EX BDY
- PROP BDY
- EX WATERMAIN
- PROP WATERMAIN
- EX/PROP HYDRANT
- EX/PROP METER
- EX SLUICE VALVE
- EX PEAT VALVE
- PROP SLUICE VALVE
- PROP PEAT VALVE

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	GB	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED WATER SUPPLY PLAN

Project no.	117019		
Scale	1:250 @ A3		
Cad file	C600 WS.DWG		
Drawing no.	C601-1	Rev	A

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. It is the contractors responsibility to locate any underground services prior to the commencement of works.
3. Minimum cover shall be:
   - Roads, footpaths,crossings: 1000mm
   - Berms 600mm
   - Service connections: 550-650mm
4. Watermains laid across roads shall be backfilled with hardfill compacted in 200mm layers above the embedment material.
5. All uPVC pipe shall be PN12 minimum pressure rated with spignot and socket rubber ring joints.
6. All PE pipe shall be PN12.5 minimum pressure rated with butt-welded. Weld beads shall be removed to provide a smooth bore.
7. All non-metalic pipes are to have tracer wire fitted to council standards.
8. Pipes shall be bedded and surrounded to 150mm above the pipe soffit with sand or ap20.
9. Metal detector tape printed with 'water pipe below' shall be laid 150mm above all watermains.
10. A yellow isosceles triangle with cats eye pointing to FH shall be painted in the centre of all sealed roads.
11. All valves to be marked with sawcut kerb and blue paint.
12. All flange joints to be protected with denso tape or similar approved by the engineer.

Legend

- EX BDY
- PROP BDY
- EX WATERMAIN
- PROP WATERMAIN
- EX/PROP HYDRANT
- EX/PROP METER
- EX SLUICE VALVE
- EX PEAT VALVE
- PROP SLUICE VALVE
- PROP PEAT VALVE

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	GB	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED WATER SUPPLY PLAN

Project no.	117019		
Scale	1:250 @ A3		
Cad file	C600 WS.DWG		
Drawing no.	C601-2	Rev	A

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. It is the contractors responsibility to locate any underground services prior to the commencement of works.
3. Minimum cover shall be:
   - Roads, footpaths,crossings: 1000mm
   - Berms 600mm
   - Service connections: 550-650mm
4. Watermains laid across roads shall be backfilled with hardfill compacted in 200mm layers above the embedment material.
5. All uPVC pipe shall be PN12 minimum pressure rated with spignot and socket rubber ring joints.
6. All PE pipe shall be PN12.5 minimum pressure rated with butt-welded. Weld beads shall be removed to provide a smooth bore.
7. All non-metalic pipes are to have tracer wire fitted to council standards.
8. Pipes shall be bedded and surrounded to 150mm above the pipe soffit with sand or ap20.
9. Metal detector tape printed with 'water pipe below' shall be laid 150mm above all watermains.
10. A yellow isosceles triangle with cats eye pointing to FH shall be painted in the centre of all sealed roads.
11. All valves to be marked with sawcut kerb and blue paint.
12. All flange joints to be protected with denso tape or similar approved by the engineer.

Legend

- EX BDY
- PROP BDY
- EX WATERMAIN
- PROP WATERMAIN
- EX/PROP HYDRANT
- EX/PROP METER
- EX SLUICE VALVE
- EX PEAT VALVE
- PROP SLUICE VALVE
- PROP PEAT VALVE

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	GB	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED WATER SUPPLY PLAN

Project no.	117019
Scale	1:2500 @ A3
Cad file	C600 WS.DWG
Drawing no.	C602
Rev	A

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. It is the contractors responsibility to locate any underground services prior to the commencement of works.
3. Minimum cover shall be:
   - Roads, footpaths,crossings: 1000mm
   - Berms 600mm
   - Service connections: 550-650mm
4. Watermains laid across roads shall be backfilled with hardfill compacted in 200mm layers above the embedment material.
5. All uPVC pipe shall be PN12 minimum pressure rated with spignot and socket rubber ring joints.
6. All PE pipe shall be PN12.5 minimum pressure rated with butt-welded. Weld beads shall be removed to provide a smooth bore.
7. All non-metalic pipes are to have tracer wire fitted to council standards.
8. Pipes shall be bedded and surrounded to 150mm above the pipe soffit with sand or ap20.
9. Metal detector tape printed with 'water pipe below' shall be laid 150mm above all watermains.
10. A yellow isosceles triangle with cats eye pointing to FH shall be painted in the centre of all sealed roads.
11. All valves to be marked with sawcut kerb and blue paint.
12. All flange joints to be protected with denso tape or similar approved by the engineer.

Legend

- EX BDY
- PROP BDY
- EX WATERMAIN
- PROP WATERMAIN
- EX/PROP HYDRANT
- EX/PROP METER
- EX SLUICE VALVE
- EX PEAT VALVE
- PROP SLUICE VALVE
- PROP PEAT VALVE

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	GB	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED WATER SUPPLY PLAN

Project no.	117019		
Scale	1:2500 @ A3		
Cad file	C600 WS.DWG		
Drawing no.	C603	Rev	A

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. It is the contractors responsibility to locate any underground services prior to the commencement of works.
3. Minimum cover shall be:
   - Roads, footpaths,crossings: 1000mm
   - Berms 600mm
   - Service connections: 550-650mm
4. Watermains laid across roads shall be backfilled with hardfill compacted in 200mm layers above the embedment material.
5. All uPVC pipe shall be PN12 minimum pressure rated with spignot and socket rubber ring joints.
6. All PE pipe shall be PN12.5 minimum pressure rated with butt-welded. Weld beads shall be removed to provide a smooth bore.
7. All non-metalic pipes are to have tracer wire fitted to council standards.
8. Pipes shall be bedded and surrounded to 150mm above the pipe soffit with sand or ap20.
9. Metal detector tape printed with 'water pipe below' shall be laid 150mm above all watermains.
10. A yellow isosceles triangle with cats eye pointing to FH shall be painted in the centre of all sealed roads.
11. All valves to be marked with sawcut kerb and blue paint.
12. All flange joints to be protected with denso tape or similar approved by the engineer.

Legend

- EX BDY
- PROP BDY
- EX WATERMAIN
- PROP WATERMAIN
- EX/PROP HYDRANT
- EX/PROP METER
- EX SLUICE VALVE
- EX PEAT VALVE
- PROP SLUICE VALVE
- PROP PEAT VALVE

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	GB	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED WATER SUPPLY PLAN

Project no.	117019		
Scale	1:250 @ A3		
Cad file	C600 WS.DWG		
Drawing no.	C603-1	Rev	A

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Existing services, where no survey data available are obtained from service providers via BeforeUDig. It is the contractors responsibility to locate any underground services prior to the commencement of works.
3. Minimum cover shall be:
   - Roads, footpaths,crossings: 1000mm
   - Berms 600mm
4. Utility services shall be installed in accordance with providers specification.
5. Service trenches under roads, accessways and paths shall be hardfilled backfilled and compacted in 200mm layers.
6. Work areas shall be reinstated to an equal standard before work started.
7. Utility Services shall maintain minimum clearances to stormwater and wastewater assets.

Legend

- EX BDY
- PROP BDY
- EX TELECOM
- EX POWER
- EX OVERHEAD 11kV
- EX OVERHEAD 400V
- EX FIBRE
- PROP TELECOM
- PROP POWER
- PROP FIBRE
- PROP OVERHEAD 11kV
- PROP OVERHEAD 400V
- OVERHEAD (REMOVED)
- EX/PROP PWR POLE
- EX TELECOM PILLAR
- EX PWR PILLAR
- EX FIBRE TUB

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	GB	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

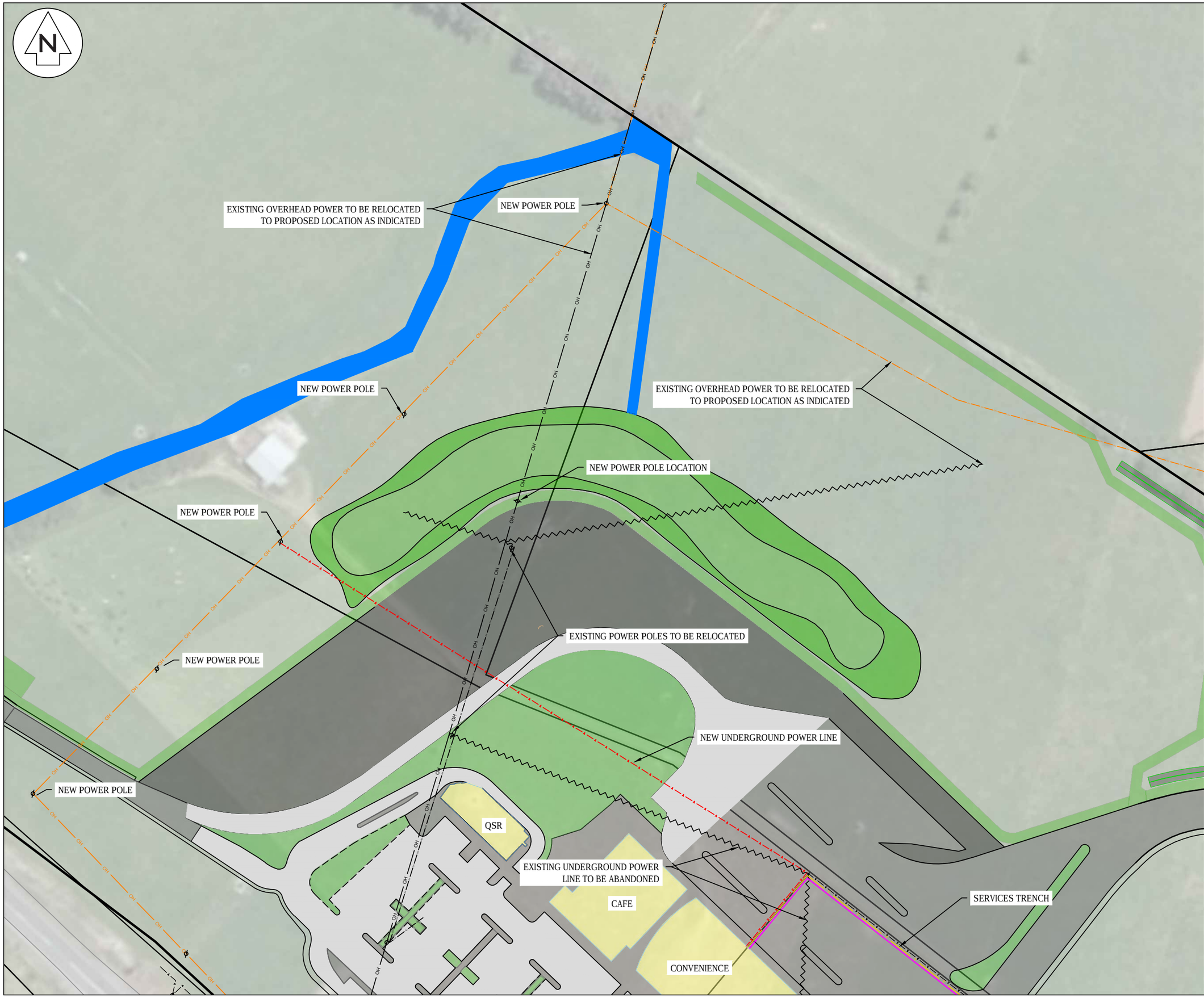
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED SERVICES OVERVIEW PLAN

Project no.	117019		
Scale	1:2500 @ A3		
Cad file	C700 SERVICES.DWG		
Drawing no.	C700	Rev	A



Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Existing services, where no survey data available are obtained from service providers via BeforeUDig. It is the contractors responsibility to locate any underground services prior to the commencement of works.
3. Minimum cover shall be:
   - Roads, footpaths,crossings: 1000mm
   - Berms 600mm
4. Utility services shall be installed in accordance with providers specification.
5. Service trenches under roads, accessways and paths shall be hardfilled backfilled and compacted in 200mm layers.
6. Work areas shall be reinstated to an equal standard before work started.
7. Utility Services shall maintain minimum clearances to stormwater and wastewater assets.

Legend

- EX BDY
- PROP BDY
- EX TELECOM
- EX POWER
- EX OVERHEAD 11kV
- EX OVERHEAD 400V
- EX FIBRE
- PROP TELECOM
- PROP POWER
- PROP FIBRE
- PROP OVERHEAD 11kV
- PROP OVERHEAD 400V
- OVERHEAD (REMOVED)
- EX/PROP PWR POLE
- EX TELECOM PILLAR
- EX PWR PILLAR
- EX FIBRE TUB

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	GB	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED SERVICES PLAN

Project no.	117019		
Scale	1:1000 @ A3		
Cad file	C700 SERVICES.DWG		
Drawing no.	C701	Rev	A

Notes

1. All works to be in accordance with Whangarei District Council standards.
2. Existing services, where no survey data available are obtained from service providers via BeforeUDig. It is the contractors responsibility to locate any underground services prior to the commencement of works.
3. Minimum cover shall be:
   - Roads, footpaths,crossings: 1000mm
   - Berms 600mm
4. Utility services shall be installed in accordance with providers specification.
5. Service trenches under roads, accessways and paths shall be hardfilled backfilled and compacted in 200mm layers.
6. Work areas shall be reinstated to an equal standard before work started.
7. Utility Services shall maintain minimum clearances to stormwater and wastewater assets.

Legend

- EX BDY
- PROP BDY
- EX TELECOM
- EX POWER
- EX OVERHEAD 11kV
- EX OVERHEAD 400V
- EX FIBRE
- PROP TELECOM
- PROP POWER
- PROP FIBRE
- PROP OVERHEAD 11kV
- PROP OVERHEAD 400V
- OVERHEAD (REMOVED)
- EX/PROP PWR POLE
- EX TELECOM PILLAR
- EX PWR PILLAR
- EX FIBRE TUB

Rev	Description	By	Date
A	RC	KH	09/20

	By	Date
Survey	LANDS & SURVEY	06/19
Design	KH	09/20
Drawn	KH	09/20
Checked	GB	09/20

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12-14 Walls Road, Penrose

Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title

PROPOSED SERVICES PLAN

Project no.	117019		
Scale	1:1000 @ A3		
Cad file	C700 SERVICES.DWG		
Drawing no.	C702	Rev	A

APPENDIX D – ENGINEERING CALCULATION

Maven Associates	Job Number 117019	Sheets 1	Rev A
Job Title: Ruakaka Service Center Calc Title: SRP Sizing	Author: YC	Date: 2-Oct	Checked: LC

Catchment Area	**47500**	m^2
Pond Volume 2% of Area	950	m^3
Dead Storage 30% of volume	285	m^3
Live Storage 70% of volume	665	m^3
Decant Dewatering (3l/s/ha)	14.25	l/s

Size Decant

Standard decent	4.5 l/s	=	200	holes
Therefore	14.25 l/s	=	633	holes

Use 4 decants

Pond Dimensions

v = 950 m^3

d = 1 m

x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	3	x^2+	8.5	x+	-940
x	=	16.34	width of pond base			
or	=	-19.17				

Check = 950 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	5	x^2+	12.5	x+	-940
x	=	12.52	width of pond base			
or	=	-15.02				

Check = 950 m^3

Width = 16.34 m

Length = 49.02 m

Dead Storage Depth

Pond Dimensions

x = 16.34 m

v = 285.0 m^3

d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 10d^3+8.5xd^2+3x^2d$ cubic equation to find "d"

			a		b		c
0	=	d^3+	13.88998289	d^2+	80.11002	+d	-28.5

e = 5.27

f = 100.45

g = 5.86

h = -0.90

d = 0.336 depth of dead storage

Check v = 285.00 m^3

Maven Associates	Job Number 117019	Sheets 1	Rev A
Job Title: Ruakaka Service Center Calc Title: DEP 1 Sizing	Author: YC	Date: 2-Oct	Checked: LC

Catchment Area	1500	m^2
Pond Volume 2% of Area	30	m^3
Dead Storage 30% of volume	9	m^3
Live Storage 70% of volume	21	m^3
Decant Dewatering (3l/s/ha)	0.45	l/s

Size Decant

Standard decent	4.5	l/s	=	200	holes
Therefore	0.45	l/s	=	20	holes

Use 1 decants

Pond Dimensions

v = 30 m^3

d = 1 m

x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	3	x^2+	8.5	x+	-20
x	=	1.53	width of pond base			
or	=	-4.36				

Check = 30 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	5	x^2+	12.5	x+	-20
x	=	1.11	width of pond base			
or	=	-3.61				

Check = 30 m^3

Width = 1.53 m

Length = 4.59 m

Dead Storage Depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Pond Dimensions

x = 1.53 m

v = 9.0 m^3

d = Dead storage depth

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 10d^3+8.5xd^2+3x^2d$ cubic equation to find "d"

			a		b		c
0	=	d^3+	1.299167915	d^2+	0.700832	+d	-0.9

e = 0.05

f = 0.52

g = 1.01

h = -0.05

d = 0.535 depth of dead storage

Check v = 9.00 m^3

Maven Associates	Job Number 117019	Sheets 1	Rev A
Job Title: Ruakaka Service Center Calc Title: DEB 2 Sizing	Author: YC	Date: 2-Oct	Checked: LC

Catchment Area	**1600**	m^2
Pond Volume 2% of Area	32	m^3
Dead Storage 30% of volume	9.6	m^3
Live Storage 70% of volume	22.4	m^3
Decant Dewatering (3l/s/ha)	0.48	l/s

Size Decant

Standard decent	4.5	l/s	=	200 holes
Therefore	0.48	l/s	=	21 holes

Use 1 decants

Pond Dimensions

v = **32** m^3

d = **1** m

x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	3	x^2+	8.5	x+	-22
x	=	1.64	width of pond base			
or	=	-4.47				

Check = 32 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	5	x^2+	12.5	x+	-22
x	=	1.19	width of pond base			
or	=	-3.69				

Check = 32 m^3

Width = 1.64 m

Length = 4.92 m

Dead Storage Depth

Pond Dimensions

x = 1.64 m

v = 9.6 m^3

d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 10d^3+8.5xd^2+3x^2d$ cubic equation to find "d"

			a		b		c
0	=	d^3+	1.393592116	d^2+	0.806408	+d	-0.96

e = 0.05

f = 0.57

g = 1.04

h = -0.05

d = 0.528 depth of dead storage

Check v = 9.60 m^3

Maven Associates	Job Number 117019	Sheets 1	Rev A
Job Title: Ruakaka Service Center Calc Title: DEB 3 Sizing	Author: YC	Date: 2-Oct	Checked: LC

Catchment Area	**3600**	m^2
Pond Volume 2% of Area	72	m^3
Dead Storage 30% of volume	21.6	m^3
Live Storage 70% of volume	50.4	m^3
Decant Dewatering (3l/s/ha)	1.08	l/s

Size Decant

Standard decent	4.5 l/s	=	200	holes
Therefore	1.08 l/s	=	48	holes

Use 1 decants

Pond Dimensions

v = 72 m^3

d = 1 m

x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	3	x^2+	8.5	x+	-62
x	=	3.35	width of pond base			
or	=	-6.18				

Check = 72 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	5	x^2+	12.5	x+	-62
x	=	2.49	width of pond base			
or	=	-4.99				

Check = 72 m^3

Width = 3.35 m

Length = 10.04 m

Dead Storage Depth

Pond Dimensions

x = 3.35 m

v = 21.6 m^3

d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 10d^3+8.5xd^2+3x^2d$ cubic equation to find "d"

			a		b		c
0	=	d^3+	2.843262644	d^2+	3.356737	+d	-2.16

e = 0.22

f = 1.82

g = 1.54

h = -0.14

d = 0.447 depth of dead storage

Check v = 21.60 m^3

MAVEN ASSOCIATES		Job Number	Sheet	Rev
		117019	1	A
Job Title	Ruakaka Service Station	Author	Date	Checked
Calc Title	Wastewater Geneartion cals	KH	29-Sep	LC

As per WDC standards: 0.4 l/Ha/ for light comercial water usage

PDWF 2.5

PWWF 5

GFA PER ARCHITECT DRAWINGS	0.2405
WASTE GENERATED	8311.68
PDWF	20779.2
PWWF	41558.4

THE TOTAL ONSITE HAS ADEQUATE CAPACITY TO TREAT THE PROPSOED DEVELOPMENT

MAVEN ASSOCIATES	Job Number	Sheet	Rev
	117019	1	A

Job Title	Ruakaka service center	Author	Date	Checked
Calc Title	Site Water Demand	KH	30-Sep	LC

As per WDC standards:

Demand Rates

Average Demand =	8311	litres/day
peak flow factor=	2	
water demand=	16622	litres/day
average hourly demand	692.58	litres/hour
peak flow factor=	5.00	
peak hourly demand=	3462.9	litres/hour

MAVEN ASSOCIATES	Job Number 117019	Sheet 1	Rev A
Job Title 2581 SH1 RUAKAKA Calc Title SW QUALITY CALS CATCHMENT B	Author KH	Date 22/09/2020	Checked LC

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Paved (concrete, gravel, metal, etc)	98		0.00
C	Grass (landscape and gardens)	74	0.2014	14.90
				0.00
				0.00
				0.00
* from Appendix B		Totals =	0.2014	14.90

WQV

CN (weighted) = total product / total area = 14.90 / 0.201 = 74.0

Ia (weighted) = 5 x pervious area / total area = 5 x 0.2 / 0.201 = 5.0 mm

2. Time of Concentration

Channelisation factor C = 1 (From Table 4.2)

Catchment length L = 0.3 km (along drainage path)

Catchment Slope Sc= 0.005 m/m (by equal area method)

Runoff factor, CN / (200 - CN) = 74.0 / (200- 74.0) = 0.59

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0 1 0.45 1.34 4.90 = 0.415 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.278 hrs

OK
use
0.4153971 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES	Job Number 117019	Sheet 2	Rev A
Job: 2581 SH1 RUAKAKA Calc: SW QUALITY CALS CATCHMENT B	Author KH	Date 22/09/2020	Checked LC

1. Data

Catchment Area	A=	0.002014	km2(100ha =1km2)
Runoff curve number	CN=	74.0	(from worksheet 1)
Initial abstraction	Ia=	5.0	mm (from worksheet 1)
Time of concentration	tc=	0.4153971	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 89 mm

3. Average recurrence interval, ARI	WQV	1/3 OF 2	(yr)
4. 24 hour rainfall depth, P24		32.9	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S		0.114	
6. Specific peak flow rate q*		0.036	
7. Peak flow rate, $q_p=q^*A^*P_{24}$		**0.002**	(m3/s)
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$		6.6	
9. Runoff volume, $V_{24} = 1000xQ_{24}A$		13.38	(m3)

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES	Job Number 117019	Sheet 3	Rev A
Job Title 2581 SH1 RUAKAKA Calc Title Post-development SW Demand	Author KH	Date 22/09/2020	Checked LC

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Paved (concrete, gravel, metal, etc)	98	0.2014	19.74
C	Grass (landscape and gardens)	74	0	0.00
				0.00
				0.00
				0.00
* from Appendix B		Totals =	0.2014	19.74

WQV

CN (weighted) = total product / total area = 19.74 / 0.201 = 98.0

Ia (weighted) = 5 x pervious area / total area = 5 x 0.0 / 0.201 = 0.0 mm

2. Time of Concentration

Channelisation factor C = 0.6 (From Table 4.2)

Catchment length L = 0.3 km (along drainage path)

Catchment Slope Sc= 0.005 m/m (by equal area method)

Runoff factor, CN / (200 - CN) = 98.0 / (200- 98.0) = 0.96

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0.1 0.6 0.45 1.02 4.90 = 0.190 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.127 hrs

OK
use
0.1901271 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES	Job Number 117019	Sheet 4	Rev A
Job Title 2581 SH1 RUAKAKA Calc Title Post-development SW Demand	Author KH	Date 22/09/2020	Checked LC

1. Data

Catchment Area	A=	0.002014	km2(100ha =1km2)
Runoff curve number	CN=	98.0	(from worksheet 1)
Initial abstraction	Ia=	0.0	mm (from worksheet 1)
Time of concentration	tc=	0.190127118	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 5 mm

3.	Average recurrence interval, ARI	WQV	1/3 OF 2	(yr)
4.	24 hour rainfall depth, P24		36.7	(mm)
5.	Compute c* = P24 - 2Ia/P24 - 2Ia+2S		0.780	
6.	Specific peak flow rate q*		0.158	
7.	Peak flow rate, q_p=q*A*P_{24}		**0.012**	
8.	Runoff depth, Q_{24} = $(P_{24}$-Ia$)^2/(P_{24}$-Ia)+S		32.1	
9.	Runoff volume, V_{24} = 1000xQ_{24}A		64.70	(m3)

HEC-HMS Check

	Pre-Dev

Pre development run off volume	**13.38**	(m3)
Post development run off volume	**64.70**	(m3)
Pre development flow rate	**0.00**	(m3/s)
Post development flow rate	**0.01**	(m3/s)
Detention Volume Required	**51.32**	(m3)

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES		Job Number 117019	Sheet 5	Rev A
Job Title	2581 SH1 RUAKAKA	Author	Date	Checked
Calc Title	Post-development SW Demand	KH	22/09/2020	LC

SWALE DESIGN		
GRASS HEIGHT	150	mm
DEPTH OF FLOW (d)	0.3	m
LONGITUDINAL SLOPE (s)	0.005	m/m
manning (n)	0.063	
trapezoid swale		
top width (W)	3	m
bottom width (b)	1	m
depth of swale (d)	0.3	m
z=e/d	3.3	
cross section area (A)	0.6	m2
hydraulic radius (R)	0.27	
Design flow Q	0.28	m3
Design velocity flow V	0.46	m/s
swale length	250.0	m

MAVEN ASSOCIATES	Job Number 117019	Sheet 1	Rev A
Job Title 2581 SH1 RUAKAKA Calc Title SW QUALITY CALS	Author KH	Date 22/09/2020	Checked LC

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Paved (concrete, gravel, metal, etc)	98		0.00
C	Grass (landscape and gardens)	74	2.8	207.20
				0.00
				0.00
				0.00
* from Appendix B		Totals =	2.8000	207.20

WQV

CN (weighted) = total product / total area = 207.20 / 2.800 = 74.0

Ia (weighted) = 5 x pervious area / total area = 5 x 2.8 / 2.800 = 5.0 mm

2. Time of Concentration

Channelisation factor C = 1 (From Table 4.2)

Catchment length L = 0.5 km (along drainage path)

Catchment Slope Sc= 0.005 m/m (by equal area method)

Runoff factor, CN / (200 - CN) = 74.0 / (200- 74.0) = 0.59

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0 1 0.63 1.34 4.90 = 0.582 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.390 hrs

OK
use
0.5819472 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES		Job Number 117019	Sheet 2	Rev A
Job Title	2581 SH1 RUAKAKA	Author	Date	Checked
Calc Title	SW QUALITY CALS	KH	22/09/2020	LC

1. Data

Catchment Area	A=	0.028	km2(100ha =1km2)
Runoff curve number	CN=	74.0	(from worksheet 1)
Initial abstraction	Ia=	5.0	mm (from worksheet 1)
Time of concentration	tc=	0.5819472	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 89 mm

3. Average recurrence interval, ARI	WQV	1/3 OF 2	(yr)
4. 24 hour rainfall depth, P24		32.9	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S		0.114	
6. Specific peak flow rate q*		0.036	
7. Peak flow rate, $q_p=q^*A^*P_{24}$		**0.033**	(m3/s)
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$		6.6	
9. Runoff volume, $V_{24} = 1000xQ_{24}A$		186.06	(m3)

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES	Job Number 117019	Sheet 3	Rev A
Job Title 2581 SH1 RUAKAKA Calc Title Post-development SW Demand	Author KH	Date 22/09/2020	Checked LC

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Paved (concrete, gravel, metal, etc)	98	2.8	274.40
C	Grass (landscape and gardens)	74	0	0.00
				0.00
				0.00
				0.00
* from Appendix B		Totals =	2.8000	274.40

WQV

CN (weighted) = total product / total area = 274.40 / 2.800 = 98.0

Ia (weighted) = 5 x pervious area / total area = 5 x 0.0 / 2.800 = 0.0 mm

2. Time of Concentration

Channelisation factor C = 0.6 (From Table 4.2)

Catchment length L = 0.5 km (along drainage path)

Catchment Slope Sc= 0.005 m/m (by equal area method)

Runoff factor, CN / (200 - CN) = 98.0 / (200- 98.0) = 0.96

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0.1 0.6 0.63 1.02 4.90 = 0.266 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.178 hrs

OK
use
0.2663571 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES	Job Number 117019	Sheet 4	Rev A
Job Title / Calc Title: 2581 SH1 RUAKAKA / Post-development SW Demand	Author KH	Date 22/09/2020	Checked LC

1. Data

Catchment Area	A=	0.028	km2(100ha =1km2)
Runoff curve number	CN=	98.0	(from worksheet 1)
Initial abstraction	Ia=	0.0	mm (from worksheet 1)
Time of concentration	tc=	0.266357077	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 5 mm

3.	Average recurrence interval, ARI	WQV	1/3 OF 2	(yr)
4.	24 hour rainfall depth, P24		36.7	(mm)
5.	Compute c* = P24 - 2Ia/P24 - 2Ia+2S		0.780	
6.	Specific peak flow rate q*		0.158	
7.	Peak flow rate, $q_p=q^*A^*P_{24}$		**0.162**	
8.	Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$		32.1	
9.	Runoff volume, $V_{24} = 1000xQ_{24}A$		899.50	(m3)

HEC-HMS Check

	Pre-Dev

Pre development run off volume	**186.06**	(m3)
Post development run off volume	**899.50**	(m3)
Pre development flow rate	**0.03**	(m3/s)
Post development flow rate	**0.16**	(m3/s)
Detention Volume Required	**713.44**	(m3)

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES	Job Number 117019	Sheet 1	Rev A
Job Title 2581 SH1 RUAKAKA Calc Title SW QUALITY CALS CATCHMENT A	Author KH	Date 22/09/2020	Checked LC

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Paved (concrete, gravel, metal, etc)	98	0	0.00
C	Grass (landscape and gardens)	74	0.0944	6.99
				0.00
				0.00
				0.00
* from Appendix B		Totals =	0.0944	6.99

WQV

CN (weighted) = total product / total area = 6.99 / 0.094 = 74.0

Ia (weighted) = 5 x pervious area / total area = 5 x 0.1 / 0.094 = 5.0 mm

2. Time of Concentration

Channelisation factor C = 1 (From Table 4.2)

Catchment length L = 0.1 km (along drainage path)

Catchment Slope Sc= 0.005 m/m (by equal area method)

Runoff factor, CN / (200 - CN) = 74.0 / (200- 74.0) = 0.59

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0 1 0.22 1.34 4.90 = 0.201 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.135 hrs

NO GOOD
use
0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES	Job Number 117019	Sheet 2	Rev A
Job 2581 SH1 RUAKAKA Calc SW QUALITY CALS CATCHMENT A	Author KH	Date 22/09/2020	Checked LC

1. Data

Catchment Area	A=	0.000944	km2(100ha =1km2)
Runoff curve number	CN=	74.0	(from worksheet 1)
Initial abstraction	Ia=	5.0	mm (from worksheet 1)
Time of concentration	tc=	0.17	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 89 mm

3. Average recurrence interval, ARI	WQV	1/3 OF 2	(yr)
4. 24 hour rainfall depth, P24		32.9	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S		0.114	
6. Specific peak flow rate q*		0.036	
7. Peak flow rate, $q_p=q^*A^*P_{24}$		**0.001**	(m3/s)
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$		6.6	
9. Runoff volume, $V_{24} = 1000xQ_{24}A$		6.27	(m3)

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES	Job Number 117019	Sheet 3	Rev A
Job Title 2581 SH1 RUAKAKA Calc Title Post-development SW Demand	Author KH	Date 22/09/2020	Checked LC

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Paved (concrete, gravel, metal, etc)	98	0.0944	9.25
C	Grass (landscape and gardens)	74	0	0.00
				0.00
				0.00
				0.00
* from Appendix B		Totals =	0.0944	9.25

WQV

CN (weighted) = total product / total area = 9.25 / 0.094 = 98.0

Ia (weighted) = 5 x pervious area / total area = 5 x 0.0 / 0.094 = 0.0 mm

2. Time of Concentration

Channelisation factor C = 0.6 (From Table 4.2)

Catchment length L = 0.1 km (along drainage path)

Catchment Slope Sc= 0.005 m/m (by equal area method)

Runoff factor, CN / (200 - CN) = 98.0 / (200- 98.0) = 0.96

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0.1 0.6 0.22 1.02 4.90 = 0.092 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.062 hrs

NO GOOD
use
0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES	Job Number 117019	Sheet 4	Rev A
Job Title / Calc Title: 2581 SH1 RUAKAKA / Post-development SW Demand	Author KH	Date 22/09/2020	Checked LC

1. Data

Catchment Area	A=	0.000944	km2(100ha =1km2)
Runoff curve number	CN=	98.0	(from worksheet 1)
Initial abstraction	Ia=	0.0	mm (from worksheet 1)
Time of concentration	tc=	0.17	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 5 mm

3.	Average recurrence interval, ARI	WQV	1/3 OF 2	(yr)
4.	24 hour rainfall depth, P24		36.7	(mm)
5.	Compute c* = P24 - 2Ia/P24 - 2Ia+2S		0.780	
6.	Specific peak flow rate q*		0.158	
7.	Peak flow rate, $q_p=q^*A^*P_{24}$		**0.005**	
8.	Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$		32.1	
9.	Runoff volume, $V_{24} = 1000xQ_{24}A$		30.33	(m3)

HEC-HMS Check

	Pre-Dev

Pre development run off volume	**6.27**	(m3)
Post development run off volume	**30.33**	(m3)
Pre development flow rate	**0.00**	(m3/s)
Post development flow rate	**0.01**	(m3/s)
Detention Volume Required	**24.05**	(m3)

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES	Job Number 117019	Sheet 1	Rev A
Job Title 2581 SH1 RUAKAKA Calc Title SW QUALITY CALS CATCHMENT B	Author KH	Date 22/09/2020	Checked LC

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Paved (concrete, gravel, metal, etc)	98		0.00
C	Grass (landscape and gardens)	74	0.0517	3.83
				0.00
				0.00
				0.00
* from Appendix B		Totals =	0.0517	3.83

WQV

CN (weighted) = total product / total area = 3.83 / 0.052 = 74.0

Ia (weighted) = 5 x pervious area / total area = 5 x 0.1 / 0.052 = 5.0 mm

2. Time of Concentration

Channelisation factor C = 1 (From Table 4.2)

Catchment length L = 0.1 km (along drainage path)

Catchment Slope Sc= 0.005 m/m (by equal area method)

Runoff factor, CN / (200 - CN) = 74.0 / (200- 74.0) = 0.59

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0 1 0.22 1.34 4.90 = 0.201 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.135 hrs

NO GOOD
use
0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES	Job Number 117019	Sheet 2	Rev A
Job 2581 SH1 RUAKAKA Calc SW QUALITY CALS CATCHMENT B	Author KH	Date 22/09/2020	Checked LC

1. Data

Catchment Area	A=	0.000517	km2(100ha =1km2)
Runoff curve number	CN=	74.0	(from worksheet 1)
Initial abstraction	Ia=	5.0	mm (from worksheet 1)
Time of concentration	tc=	0.17	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 89 mm

3. Average recurrence interval, ARI	WQV	1/3 OF 2	(yr)
4. 24 hour rainfall depth, P24		32.9	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S		0.114	
6. Specific peak flow rate q*		0.036	
7. Peak flow rate, $q_p=q^*A^*P_{24}$		**0.001**	(m3/s)
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$		6.6	
9. Runoff volume, $V_{24} = 1000xQ_{24}A$		3.44	(m3)

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES	Job Number 117019	Sheet 3	Rev A
Job Title 2581 SH1 RUAKAKA Calc Title Post-development SW Demand	Author KH	Date 22/09/2020	Checked LC

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Paved (concrete, gravel, metal, etc)	98	0.0517	5.07
C	Grass (landscape and gardens)	74	0	0.00
				0.00
				0.00
				0.00
* from Appendix B		Totals =	0.0517	5.07

WQV

CN (weighted) = total product / total area = 5.07 / 0.052 = 98.0

Ia (weighted) = 5 x pervious area / total area = 5 x 0.0 / 0.052 = 0.0 mm

2. Time of Concentration

Channelisation factor C = 0.6 (From Table 4.2)

Catchment length L = 0.1 km (along drainage path)

Catchment Slope Sc= 0.005 m/m (by equal area method)

Runoff factor, CN / (200 - CN) = 98.0 / (200- 98.0) = 0.96

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0.1 0.6 0.22 1.02 4.90 = 0.092 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.062 hrs

NO GOOD
use
0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES	Job Number 117019	Sheet 4	Rev A
Job Title 2581 SH1 RUAKAKA Calc Title Post-development SW Demand	Author KH	Date 22/09/2020	Checked LC

1. Data

Catchment Area	A=	0.000517	km2(100ha =1km2)
Runoff curve number	CN=	98.0	(from worksheet 1)
Initial abstraction	Ia=	0.0	mm (from worksheet 1)
Time of concentration	tc=	0.17	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 5 mm

3.	Average recurrence interval, ARI	WQV	1/3 OF 2	(yr)
4.	24 hour rainfall depth, P24		36.7	(mm)
5.	Compute c* = P24 - 2Ia/P24 - 2Ia+2S		0.780	
6.	Specific peak flow rate q*		0.158	
7.	Peak flow rate, q_p=q*A*P_{24}		**0.003**	
8.	Runoff depth, Q_{24} = $(P_{24}$-Ia$)^2/(P_{24}$-Ia)+S		32.1	
9.	Runoff volume, V_{24} = 1000xQ_{24}A		16.61	(m3)

HEC-HMS Check

	Pre-Dev

Pre development run off volume	**3.44**	(m3)
Post development run off volume	**16.61**	(m3)
Pre development flow rate	**0.00**	(m3/s)
Post development flow rate	**0.00**	(m3/s)
Detention Volume Required	**13.17**	(m3)

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES	Job Number 117019	Sheet 1	Rev A
Job Title 2581 SH1 RUAKAKA Calc Title SW QUALITY CALS CATCHMENT B	Author KH	Date 22/09/2020	Checked LC

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Paved (concrete, gravel, metal, etc)	98		0.00
C	Grass (landscape and gardens)	74	0.021	1.55
				0.00
				0.00
				0.00
* from Appendix B		Totals =	0.0210	1.55

WQV

CN (weighted) = total product / total area = 1.55 / 0.021 = 74.0

Ia (weighted) = 5 x pervious area / total area = 5 x 0.0 / 0.021 = 5.0 mm

2. Time of Concentration

Channelisation factor C = 1 (From Table 4.2)

Catchment length L = 0.03 km (along drainage path)

Catchment Slope Sc= 0.005 m/m (by equal area method)

Runoff factor, CN / (200 - CN) = 74.0 / (200- 74.0) = 0.59

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0 1 0.10 1.34 4.90 = 0.091 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.061 hrs

NO GOOD
use
0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES	Job Number 117019	Sheet 2	Rev A
Job 2581 SH1 RUAKAKA Calc SW QUALITY CALS CATCHMENT B	Author KH	Date 22/09/2020	Checked LC

1. Data

Catchment Area	A=	0.00021	km2(100ha =1km2)
Runoff curve number	CN=	74.0	(from worksheet 1)
Initial abstraction	Ia=	5.0	mm (from worksheet 1)
Time of concentration	tc=	0.17	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 89 mm

3. Average recurrence interval, ARI	WQV	1/3 OF 2	(yr)
4. 24 hour rainfall depth, P24		32.9	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S		0.114	
6. Specific peak flow rate q*		0.036	
7. Peak flow rate, $q_p=q^*A^*P_{24}$		**0.000**	(m3/s)
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$		6.6	
9. Runoff volume, $V_{24} = 1000xQ_{24}A$		1.40	(m3)

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES	Job Number 117019	Sheet 3	Rev A
Job Title 2581 SH1 RUAKAKA Calc Title Post-development SW Demand	Author KH	Date 22/09/2020	Checked LC

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Paved (concrete, gravel, metal, etc)	98	0.021	2.06
C	Grass (landscape and gardens)	74	0	0.00
				0.00
				0.00
				0.00
* from Appendix B		Totals =	0.0210	2.06

WQV

CN (weighted) = total product / total area = 2.06 / 0.021 = 98.0

Ia (weighted) = 5 x pervious area / total area = 5 x 0.0 / 0.021 = 0.0 mm

2. Time of Concentration

Channelisation factor C = 0.6 (From Table 4.2)

Catchment length L = 0.03 km (along drainage path)

Catchment Slope Sc= 0.005 m/m (by equal area method)

Runoff factor, CN / (200 - CN) = 98.0 / (200- 98.0) = 0.96

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0.1 0.6 0.10 1.02 4.90 = 0.042 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.028 hrs

NO GOOD
use
0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES	Job Number 117019	Sheet 4	Rev A
Job Title 2581 SH1 RUAKAKA Calc Title Post-development SW Demand	Author KH	Date 22/09/2020	Checked LC

1. Data

Catchment Area	A=	0.00021	km2(100ha =1km2)
Runoff curve number	CN=	98.0	(from worksheet 1)
Initial abstraction	Ia=	0.0	mm (from worksheet 1)
Time of concentration	tc=	0.17	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 5 mm

3.	Average recurrence interval, ARI	WQV	1/3 OF 2	(yr)
4.	24 hour rainfall depth, P24		36.7	(mm)
5.	Compute c* = P24 - 2Ia/P24 - 2Ia+2S		0.780	
6.	Specific peak flow rate q*		0.158	
7.	Peak flow rate, q_p=q*A*P_{24}		**0.001**	
8.	Runoff depth, Q_{24} = $(P_{24}$-Ia$)^2/(P_{24}$-Ia)+S		32.1	
9.	Runoff volume, V_{24} = 1000xQ_{24}A		6.75	(m3)

HEC-HMS Check

	Pre-Dev

Pre development run off volume	**1.40**	(m3)
Post development run off volume	**6.75**	(m3)
Pre development flow rate	**0.00**	(m3/s)
Post development flow rate	**0.00**	(m3/s)
Detention Volume Required	**5.35**	(m3)

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES		Job Number 117019	Sheet 5	Rev A
Job Title Calc Title	2581 SH1 RUAKAKA Post-development SW Demand	Author KH	Date 22/09/2020	Checked LC

Rain Garden design

	WQV VOLUME (m3)	df (m)	k	h (m)	tf (day)	RG area (m2)
CATCHMENT A	30.33	1	0.3	0.11	1	91.1
CATCHMENT B	16.61	1	0.3	0.11	1	49.9
CATCHMENT M	6.75	1	0.3	0.11	1	20.3
whole catchment	900.00	1	0.3	0.11	1	2702.7

APPENDIX E – TOTAL WASTEWATER REPORT

REFLECTION

WASTEWATER TREATMENT SOLUTIONS

WASTEWATER SYSTEM SPECIFICATION

FOR S K AOTEAROA TRUST

Client	S K AOTEAROA TRUST	*Email*	NIGEL@RWTS.CO..NZ	*Website*	RWTS.CO.NZ
Doc	WASTEWATER SYSTEM SPECIFICATION	*Contact*	NIGEL PAULL	*Phone*	021 909 026

THE LATEST GENERATION OF ONSITE
WASTEWATER TREATMENT SOLUTIONS

RWTS.CO.NZ

3rd November 2019

Blue Barn Consulting Engineers
PO Box 21525
Henderson 0650
Auckland

RE: - WASTEWATER SYSTEM SPECIFICATIONS – THE RUAKAKA SERVICE CENTRE

Dear Adam

Thank you for the opportunity to provide a system specification on the wastewater requirements, for your client S K Aotearoa Trust.

Waimauku-based Reflection Treatment Systems has an outstanding reputation for quality delivery in the wastewater treatment sector. Since its inception in 1995, the company has specialised in the design, manufacture, implementation and ongoing monitoring and maintenance of wastewater treatment plants and disposal systems, and is today recognised as one of the most experienced, capable companies of its kind in New Zealand.

Providing turnkey solutions for wastewater treatment plants and disposal systems for the public sector and for commercial and residential purposes, we stand apart in our industry for the quality service and technically-advanced products that are an integral part of the 3,000 systems we have installed. In addition, we provide an excellent service for the 300 systems we inspect, monitor, maintain and service every month.

The Reflection Treatment Systems team is outstanding, which is a result of the skills and experience of our key team members, their longevity with Reflection (ten years average), and the exceptional length of time they have worked together on projects identical or very similar in nature to this one.

As a team, they are unified in their commitment to 'getting it right first time' and doing whatever it takes for projects to be delivered at the highest possible level; as individuals, they are hugely knowledgeable and experienced. The depth and integration of their skills is in no small way the key to our success.

Our Contract Manager for this contract – Nigel Paull – has a strong vested interest in ensuring that our reputation for excellence is retained and, wherever possible, boosted even further on every project we undertake. It's about reaching beyond expectations and yesterday's achievements, and extending this commitment for excellence and continued improvement to each member of the Reflections' team.

- **Extensive experience in identical/similar projects:** We have designed manufactured and installed more than 3000 wastewater treatment and disposal systems (100 of them for public works and commercial facilities) – and we service 300 systems every month. This provides your client with certainty that we can deliver the requirements of the contract

- **Employees, not subcontractors:** With the exception of an electrician, our crew will be our own employees – not subcontractors. This key point of difference eliminates miscommunications and conflicts between contractor and subcontractors, and ensures that the entire team works under our own rigorous management systems. The result is a quicker, smoother, safer project delivery, and clear accountability by Reflection

- **Speed:** Many of our clients are surprised at our quick delivery of projects. This is the result of our efficient methodologies and a unified team who know their work thoroughly and 'just get on with the job' every day. A top priority will be to ensure this project is carried out in the shortest possible time with no compromise to quality

- **Capability:** We own all of the plant and equipment required for this contract (other than the HIAB crane for transporting) which will avoid the risk of delays due to equipment hireage.

- **Cost efficiencies:** Our knowledgeable team and streamlined processes keep costs as low as possible so that we can pass cost efficiencies on wherever possible to the council

- **Outstanding quality management:** We meet our clients' and our own exacting standards project after project and are committed to doing the same on this contract. We have never received a formal complaint and have never been required to carry out a rework (other than for minor remedial): we intend to continue with this on this project.

Working with other stakeholders: Reflections has worked on many large commercial projects, often having to communicate between multiple stake holders and concessionaires. We understand the importance of communication between all parties involved or impacted by our work and work hard to mitigate any issues.

At Reflection Treatment Systems, our specialist capabilities, resources and capacity, backed by our relevant experience and track record, will combine to undertake every aspect of this contract.

Kind regards

Nigel Paull
Managing Director

PROPOSED SYSTEM SPECIFICATIONS – 30,500L/Day

The system design is based on the information provided by Blue Barn Consulting Engineers and has been specified to meet a design flow of 30,000L/day. The system has been designed to treat commercial strength wastewater with an influent strength having an 'Average' BOD of 600mg/L, TSS of 220mg/L.

SYSTEM COMPONENTS

Septic Tank

Three 25,000 litre, solid pour concrete tanks will be installed to act as the systems 75,000 litre Primary WW Storage Tank. The Septic

Three Zoeller Commercial Filter 5000-007, capable of filtering flows of up to 30,000 litres a day will be fitted to the discharge, to retain solids larger than 1.5mm.

The tank does not contain any electrical components and does not therefore require any alarms or controls
The tanks will be fitted with locking lids to prevent unauthorised access and for safety.

Recirculation Tank and 24 Emergency Store Tank

Three 25,000 litre solid pour concrete tanks are to be installed creating the systems 75,000 litre re-circulation tank.

This tank will also act as the systems 30,000 litre 24 hour emergency storage tank.

This tank will receive filtered wastewater from septic tank and is used to hold diluted effluent which is then pumped to our textile filter for treatment.

Dosing to the textile filters, the next stage of the process, will be controlled via pre-set on/off timers. Float switches will over-ride the timed switches and turn the pump off if low levels are reached.

The pumping of the untreated wastewater will be done by a Lowara pump, designed to pump wastewater with suspended solids up to 5mm in diameter.

Timer settings will be adjusted as flows increase.

The tank will also include a high water level alarm to operate in event of pump failure.

Textile Media Filters

A textile media bed measuring 70m2 is proposed. The textile bed has been sized to cope with the specified levels of BOD and TSS.

The recirculating textile filter is also known as a recirculating textile pack bed reactor (rtPBR). Pack bed reactors are biological and physical treatment systems, which provide additional treatment for screened, and primary treated wastewater, producing a clear odourless, 'advanced secondary quality' wastewater suitable for irrigation onto/into the ground.

The Reflection Treatment Systems Textile Filter has been developed in New Zealand for New Zealand conditions. Recognised, by Councils and large public sector companies, as a market leader in wastewater treatment, the Reflection Treatment Systems Textile Filter has been subjected to in-depth regulatory testing.

Primary treated and screened effluent is diluted in the in the recirculation tank by treated effluent and timer dose loaded, by pumping, onto the textile filter as a series of controlled and frequent pulses over the day. This ensures non-saturated flow through the contactor media that, in turn, enhances the primary mechanisms involved in the effluent treatment.

As the effluent flows through the media it is treated to a high quality, with a large reduction in BOD, Total Suspended Solids and faecal organisms. Naturally occurring micro-organisms adhering to the textile particles utilise the organic component of the applied effluent as a source of food.

The Textile Filters do not hold any electrical components or pump and therefore do not need any controls

Recirculation Assembly

Treated water flowing out of the Textile Filters, enters a distribution box where 20% of the flow is directed to the Treated Effluent Holding Tank and the other 80% returned to the Recirculation Tank to be treated again.

Continuous operation of the filter at times of low flows without draining the RT, is effected by a float valve directing all treated effluent back to the RT when tank levels fall to 20%.

Treated Effluent Quality

Treated wastewater is expected to be Advanced Secondary level having the following discharge quality.

BOD5 (5 day Biochemical Oxygen Demand)	less than 10mg/l
Suspended Solids	less than 10mg/l

Irrigation tank

Two 25,000 litre solid pour concrete tanks will act as the systems Irrigation Tank, which receives gravity feed treated wastewater from the Textile Media Filters. The Irrigation Tank will have two Lowara pumps installed and set up in a duty/standby configuration. The tank will also be fitted with a high level alarm, which will activate should either of the pumps fail.

Water Meter

A water meter is to be installed, in line, following the Irrigation Tank with an accuracy of +/- 5%, to monitor discharge to the land disposal system. The water meter readings will be recorded and stored by the system control panel.

Land Disposal Area

Disposal of the treated wastewater is via 10,000m of Netafim UniRaam AS, which will be installed surface laid.

Drippers will operate at 2.3l/hour and will be spaced every 600mm along the irrigation line.

The disposal system will include.

Air Release Valve (ARV) – An ARV will be installed at the most elevated point of the main supply line from the pump chamber, prior to the supply submain.

Dripper line Non Leakage Valve (DNL) – DNL valves are to be installed at the start of each lateral line.

Manual Flush Taps – Manual flush taps are to be installed at the end of each lateral line.

Remote Monitoring and Management Control Panel

A Unitronics PLC Controller is to be installed to provide remote monitoring and management of the wastewater treatment plant. The system requires a dedicated mobile phone line, with good signal strength, for the main treatment plant and allows instant notification to Reflection Treatment Systems, or its service provider, in the event of an alarm.

An Outpost Telemetry Unit will be installed to give 24 hour remote alarm monitoring and recording of flow data.

The web based application can be accessed from any internet connected device, providing instant data on the systems performance or alarm state.

We have proposed a PLC Controller capable of controlling the proposed carbon and alkaline dosing systems should they be required.

RELEVANT EXPERIENCE

Central and Local Government Facilities

(Toilet Blocks, Lodges, Community Treatment Plants)

Customer	Location	Flow (m3/day)
Auckland City Council	Oneroa Township & Matiatia	70
Auckland City Council	Little Oneroa Toilets	6
Auckland Regional Council	Muriwai Toilets	65
Auckland Regional Council	Muriwai Campground	40
Auckland Regional Council	Arataki Visitor Centre	10
Auckland Regional Council	Huia Toilets	5.2
Auckland Regional Council	Whatipu Lodge	5.5
Department of Conservation	Goat Island Toilets	13
Department of Conservation	Motuihe Island	5
Manukau City Council	Puhinui Toilets	4
Manukau City Council	Clevedon Showgrounds & Clevedon Toilets	10
Manukau City Council	Umupuia Toilets	8.2
Manukau City Council	Clevedon Toilets and Hall	6
Manukau City Council	Clevedon Scenic Reserve	6
Manukau City Council	Council Homes	2
Manukau City Council	Orere Point Toilets	2.5
Rodney District Council	Riverhead Toilets	2
Rodney District Council	Huapai Domain Toilets	2
Rodney District Council	Waimauku Hall	2
Rodney District Council	Pakiri Hall	1
Waitakere City Council	Taupaki Park Toilets	1
Waitakere City Council	Piha South Toilets	4
Waitakere City Council	Huia Toilets	2
Waitakere City Council	Bethells Beach Public Toilets	7
Waitakere City Council	Waitakere Train Station	1
Waikato District Council	Maramarua Township	15
Waikato District Council	Matangi Township	50

INSTITUTIONS		
Customer	Location	Flow (m3/day)
Taupaki Gables Rest Home	Taupaki	12
Hare Krishna Temple/School/Accommodation	Riverhead	24
Te Kotahitanga Marae	Pt Waikato	18
Hunua Presbyterian Camp	Hunua	12
Huapai Golf Club	Riverhead	7
Goodwood Park Trust	Riverhead	10
IHC NZ	Warkworth	2
IHC NZ	Waitakere	2
IHC NZ	Waitakere	3
IHC NZ	Waitakere	2
IHC NZ	Dairy Flat	2
Piha Surf Club	Piha	3
New Zealand Scouts	Camp Maynard	6
Pinehaven Lodge	Hatfields Beach	3
Housing New Zealand	Opotiki	9
Housing New Zealand	Ardmore	5
Puatahi Marae	Kaipara	3
Rewiti Marae	Waimauku	2
NZ Kennel Club	Papakura	4
Ohui Enterprises Campground	Whangamata	6
Town & Country Motel	Hamilton	3
Vineyard Cottages	Waimauku	6
Nikau Caves	Waikaretu	2
Waimauku Shopping Centre	Waimauku	4
Vipassana Meditation Centre	Makarau	16
Maharishi Vedic Academy	Silverdale	10
Waitakere Soccer Club	Massey	6
University of Auckland (Goldies Wines)	Waiheke	7

RESTAURANTS		
Customer	Location	Flow (m3/day)
Allely House	Kumeu	4
Bees on Line	Waimauku	10
Blossoms	Riverhead/Kumeu	2
Hunting Lodge	Waimauku	8
Soljan's	Kumeu	5
Sookie Lee	Kumeu	2
Tasting Shed	Huapai	3

SUBDIVISIONS		
Subdivision	Reticulation	No. of Lots
The Sands – Mangawhai	STEG	130
Sea Breeze – Mangawhai	STEP	63
Oneroa Township	STEG/STEP	60
Park View – Universal Homes	Gravity Sewer	30
Longview	STEP	30
Solan Estate	Gravity Sewer	30
Nautical Heights	STEP	29
Mangawhai Grove	STEG	26
Taranga Estate Stage 1	STEP	26
Sunlea Estate	STEG	25
Riverside Estate (Matakana)	STEP/STEG	17
IMF Kumeu	Gravity Sewer	15
Flavell – Mangawhai x 2	STEP	14
J McDonald Trust	Gravity Sewer	10
Lotus – Mangawhai	STEP	8
Raven – Mangawhai	STEP	8
De Boer – Mangawhai	STEP	4

SCHOOLS

Customer	Flow (m3/day)
St Stevens	48
Dilworth Rural Campus	40
Waiheke Primary	16
Waimauku School	12
Clevedon	10
Taupaki	8
Henderson Valley	5
Kings College – Ahuroa	5
Te Hihi	5
Woodhill	4
Tomarata	3.5
Brookby	3
Ararimu	1
Ardmore	Upgrade

INDUSTRIAL / PROCESSING

Customer	Location	Flow (m3/day)
St Stevens School Oxidation Pond Dewatering	Bombay	80
Metrowater	Owhanake Phosphate Removal Slag	80
Soljan Winery	Kumeu	10
Kumeu Industrial	Kumeu	10
Brinks Poultry	Karaka	10
Matua Valley Wines	Waimauku	5
Westbrook Winery	Waimauku	4
Gourmet Paprika	Woodhill	3
Dricon	Tuakau	2
Formula Cruisers	Kumeu	1
Kajes Petroleum x 3	Waiheke	1
Caltex	Dairy Flat	1

OSET RESULTS

ROTORUA LAKES COUNCIL | water NEW ZEALAND | Bay of Plenty REGIONAL COUNCIL

On-site Effluent Treatment National Testing Programme (OSET NTP)

PERFORMANCE CERTIFICATE
Reflections Textile 5000
OSET NTP Trial 13, 2017/2018

System Tested

The Reflection Textile 5000 treatment plant, comprising a recirculating textile filter packed bed reactor (RTF), participated in Trial 13 of the On-site Effluent Treatment National Testing Programme (OSET NTP). This commenced on 23 October 2017 and ran over ten months (44 weeks) during which the treated effluent discharge was monitored generally every six days. The Reflection Textile 5000 treatment plant tested had a normal operational capacity of 2,000L/day and maximum capacity of 2,400L/day. The plant comprised two 5,100L concrete tanks, Tank 1 being a primary chamber with a Zoeller 170-0078 effluent filter and Tank 2 having 3 chambers, recirculation chamber (1950L) with a reflection 250DP 200L/h recirculation pump operating 60min/day, textile filter chamber (2250L) with 2.6m^2 needle punched non woven polyester media and effluent pump chamber (900L) with a Reflection 400IR Vortex 400W pump.

The emergency storage which includes the effluent pump station and media submergence is 2,000L.

The service requirement is annual

Test Flow Rate

The Reflection Textile 5000 treatment plant was tested at 1,000L/day (equivalent to servicing a 3-bedroom 5 to 6 person household) over an 10 month (40 week) period November 2017 to August 2018 including a 1 month (4 week) high load effects test involving 5 days at 2,000L/day then 1,000L/day over the following 3 weeks. Note that the manufacturer's advised design capacity for this plant is 2,000L/day.

Testing and Evaluation Procedures

A two-month (8 week) media development and settling-in period was initially proposed, but this was extended to 12 weeks due to an unscheduled geothermal waste influent flow on 23 November, followed by extreme weather events in Rotorua, resulting in widespread flooding and high infiltration into the sewerage system, along with an electrical storm impacting on the testing facility control system in early December. Ten samples were taken during this period (Weeks 4 to 12). Neither the geothermal influent nor the weather events had any significant impact upon the Reflection plant performance, which showed only a minor and short-duration increase in both BOD_5 and TSS.

The performance evaluation testing programme followed involving a three-month pre-benchmarking period (20 samples over Weeks 13 to 28), and a three-month benchmarking period (19 samples over Weeks 29 to 40). Within each block, a five-day consecutive sample period occurred (Weeks 25 and 34). A one-month high load assessment period followed in Weeks 42 to 44 (three samples).

The 39 samples taken through the pre-benchmarking and benchmarking periods were used to assess treatment performance against the **Secondary Effluent Quality** requirements for biochemical oxygen demand (BOD_5) and total suspended solids (TSS) defined by AS/NZS 1547:2012 as set out in AS/NZS 1546.3:2008

A total of 19 treated effluent samples of organic matter (BOD_5), total suspended solids (TSS), total nitrogen (TN), ammonia nitrogen (NH_4-N), total phosphorus (TP) and faecal coliforms (FC) at generally six day intervals during weeks 28 through 40 were tested and the results benchmarked and rated on their median values.

General Performance

The Reflection Textile 5000 treatment plant performed well throughout the study, with no equipment failures or attendance required throughout the trial period.

In terms of effluent quality, the plant performed well overall, with low and stable BOD_5 and TSS results, each having median results of 2.0mg/L throughout the analysis period. The plant achieved a high level of

On-site Effluent Treatment National Testing Programme (OSET NTP)

nitrification throughout, but with poor denitrification, resulting in low levels of NH_4-N, and high levels of TOXN and TN. The median Total Nitrogen level was 40mg/L. The high flow test was handled well with no change in BOD_5, TSS, or TN levels, although it should be noted the high flow of 2,000L/day was the same as the plant's nominated operational capacity. Bacteria removal was only moderate.

The plant's power usage at 0.61kWh/day, was low for a package secondary treatment plant.

AS/NZS 1547:2012 Secondary Effluent Quality Requirements

These requirements are that 90% of all test samples must achieve a BOD_5 of $\leq$ 20 g/m^3 and TSS of $\leq$ 30 g/m^3 with no one result for BOD_5 being >30 g/m^3 and no one result for TSS being >45 g/m^3.

The plant had low BOD and TSS results throughout except for one high TSS result of 53mg/L on 5 June which SWANS-MAG considered could be deleted from the AS/NZS 1547 evaluation analysis as an unexplained outlier.

The Reflection Textile 5000 plant therefore had **100% of BOD_5** results and **100% of TSS** results within the **Secondary Effluent Quality** requirements for both the 90 percentile and maximum limits above. **The Reflection Textile 5000 plant thus achieved AS/NZS 1547 secondary effluent quality performance requirements** when operated at 1,000L/day, which is 50% of the manufacturer's advised normal flow design capacity.

Benchmark Ratings

The Reflection Textile 5000 system achieved the following effluent quality ratings:

Indicator Parameters	Median	Std Dev	Rating	Rating System				
				A+	A	B	C	D
BOD_5 (mg/L)	2	0.4	A+	<5	<10	<20	<30	≥30
TSS (mg/L)	1	11.7	A+	<5	<10	<20	<30	≥30
Total Nitrogen (mg/L)	39	3.1	D	<5	<15	<25	<30	≥30
NH_4- Nitrogen (mg/L)	3.0	1.3	A	<1	<5	<10	<20	≥20
Total Phosphorus (mg/L)	4.0	0.5	B	<1	<2	<5	<7	≥7
Faecal Coliforms (cfu/100mL)	47,500	30,500	C	<10	<200	<10,000	<100,000	≥100,000
Energy (kWh/d) (mean)	0.61	0.12	A	0	<1	<2	<5	≥5

This Certificate of Performance only applies to the Reflection Textile 5000 treatment plant as described in the 'System Tested' above when operated at 1,000 L/day, which is 50% of manufacturer's advised normal flow design capacity. The certificate is valid for 5 years from the date below. For the full OSET NTP report on the performance of the Reflection Textile 5000 treatment plant contact Nigel Paull, Phone: 09 411 7337 , Mobile: 021 909 026 or Email: nigel@rwts.co.nz

Authorised By:

Ray Hedgland, Technical Manager, OSET NTP
27 November 2018

On-site Effluent Treatment National Testing Programme,
c/- Technical Manager 10 Tide Close, Mount Wellington, AUCKLAND 2013
Mob: 021 626 772 E-mail: ray@hedgland.co.nz

Thank you

REFLECTION TREATMENT SYSTEMS LIMITED

PO Box 168, Waimauku, Auckland 0842,
New Zealand

Ph: Head Office 09 411 7337

South Auckland 09 296 7400

Fax 09 411 8592

Email: info@septic.co.nz

www.rwts.co.nz

8 November 2019

Mr Simon Tan
SK Aotearoa Trust
45 Great North Road
Kamo
Whangarei 0112

Dear Simon

RE: Wastewater Disposal Field Geotechnical Assessment - Corner SH1 and Port Marsden Highway, Ruakaka,

(Our Reference: 16234.000.000_03)

1 Introduction

ENGEO Ltd was requested by SK Aotearoa Trust to undertake an assessment of the ground conditions underlying the proposed wastewater disposal field to service the proposed new service centre at the corner of State Highway 1 and Port Marsden Highway in Ruakaka. This work has been carried out in accordance with our signed agreement dated 18 October 2019 (ref. P2019.001.018_03).

The purpose of the assessment was to confirm the nature of the near surface soils to support design of the wastewater disposal system by a third party. Our scope of work is limited to assessing the GD06 Soil Category (Table 16, Auckland Council Guideline document 2018/006) and measurement of groundwater levels at investigation borehole locations. Our scope of work does not include soil permeability testing.

2 Background Information

ENGEO has completed a Preliminary Geotechnical Investigation Report (ref. 16234.000.000_02, dated 2 August 2019) for the proposed service centre, however the proposed wastewater disposal field area was not included in that investigation footprint.

The site is located on the northern corner of the intersection between State Highway 1 and the Port Marsden Highway. As detailed in the Preliminary Geotechnical Investigation Report, it is underlain by alluvium comprising mud, sand, gravel and peat of the Tauranga Group sedimentary lithology, with weathered clayey and sandy silt soils of the Ruarangi Formation at depth.

3 Wastewater Disposal Field Investigation

3.1 Hand Auger Boreholes

ENGEO visited the site on 29 October 2019 to drill four new hand auger boreholes within the footprint of the proposed wastewater disposal field. The locations of the boreholes are shown on the appended Investigation Location Plan.

All boreholes were progressed to a target depth of 3 m below the existing ground surface, with associated *in situ* shear vane testing. Full borehole records are appended.

3.2 Soil Profile

Topsoil was encountered at all borehole locations and was up to 0.3 m thick.

Tauranga Group alluvium comprising silty clay, clayey silt and organic silt layers with variable sand content was encountered underlying the topsoil at all borehole locations. Measured shear strengths ranged from 26 kPa to 101 kPa, indicating a variable strength soil described as firm to very stiff. Standing groundwater was measured within the Tauranga Group alluvium at all locations.

Ruarangi Formation soils comprising fine to coarse grained sandy silt were encountered underlying the alluvium at depths ranging from 1.9 m to 2.3 m below the ground surface. Measured shear strengths of 66 kPa and 157 kPa were recorded in borehole HA04 indicating a stiff to very stiff soil, however, at all other test locations the Ruarangi Formation soils were unable to be penetrated by the shear vane indicating a hard consistency.

3.3 Groundwater

The depth to groundwater at each borehole location was measured upon completion of the drilling. Recorded groundwater levels are summarised in Table 1 below, and are measured from the ground surface.

Table 1: Measured Groundwater

Borehole ID	Groundwater Depth (m)
HA09	0.7
HA10	0.6
HA11	0.7
HA12	0.8

4 Summary of Findings

The near surface soils (<1 m depth) typically comprise topsoil overlying silty clays and clayey silts with variable sand content, with an organic silt layer containing plant remains recorded at all boreholes at approximately 1 m depth. We consider the inorganic soils to be broadly consistent with GD06 Soil Category 5 – “Sandy clay, light clay, silty clay”. The soil structure is inferred to be weakly structured or massive due to its shallow depositional environment and geologically young age. However, the wastewater system designer should make their own assessment based on a review of the factual data provided.

Groundwater was encountered at all of the borehole locations at depths between 0.6 m and 0.8 m below the ground surface.

5 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, SK Aotearoa Trust, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the Client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ / ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (09) 972 2205 if you require any further information.

Report prepared by

Heather Lyons, CMEngNZ (PEngGeol)

Associate Engineering Geologist

Report reviewed by

Dustin Tookey, CMEngNZ (CPEng)

Senior Geotechnical Engineer

Attachments:

Investigation Location Plans

Hand Auger Borehole Records HA09 – HA12

ENGEO
Expect Excellence

Date	Nov-19	**Client**	SK Aotearoa Trust		
Drawn by	BF	**Project**	Corner SH1 and Port Marsden Highway, Whangarei		
Approved by	HL	**Description**	Investigation Location Plan		
Scale	NTS	**Appendix:**	1	**Project Number**	16234.000.000

LOG OF HAND AUGER HA09

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.0000
Date : 29/10/2019
Hole Depth : 3 m
Hole Diameter : 50 mm

Shear Vane No : 2524
Logged By : BF
Reviewed By : RB
Latitude : -35.888336
Longitude : 174.433276

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Notes/Remarks
	TS	OL	Topsoil.					N/A		
0.5	ALLUVIUM	ML	Clayey SILT with minor fine to coarse sand and trace organics; light grey with orange streaks. Low plasticity.			▼	M	St	58/26 91/29 78/31	
1.0		OL	Organic SILT with minor fine to coarse sand; black and brown. Low plasticity. Organics, amorphous, rootlets and bark.					St		
1.5		CH	Silty CLAY; light grey with orange streaks. High plasticity.					St	55/26 65/26	
2.0		OL	Organic SILT with minor fine to coarse sand; black and brown. Low plasticity. Organics, amorphous, rootlets and bark.				W	St	60/17	
		ML	Clayey SILT with minor fine to coarse sand; dark brown. Low plasticity.					St	75/34	
2.5	RF	ML	Fine to coarse sandy SILT; brown with grey streaks. Low plasticity.				S	H	UTP UTP UTP	
3.0			End of Hole Depth: 3 m Termination Condition: Target depth							

Hand auger met target depth at 3 m.
Dip test showed standing water at 0.7 m depth.
TS = Topsoil
UTP = Unable to Penetrate

N/A = Not Assessed
RF = Ruarangi Formation

LOG OF HAND AUGER HA10

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.0000
Date : 29/10/2019
Hole Depth : 3 m
Hole Diameter : 50 mm

Shear Vane No : 2524
Logged By : BF
Reviewed By : RB
Latitude : -35.889067
Longitude : 174.433208

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Notes/Remarks
	TS	ML	Topsoil.					N/A		
0.5	ALLUVIUM	CH	Silty CLAY with trace organics; light grey with brown streaks. High plasticity.			▼	M	St	75/31 80/13	
1.0	ALLUVIUM	OL	Organic SILT with trace sand; black and brown. Low plasticity. Organics, amorphous, rootlets and bark.				W	St	83/26 53/36	
1.5	ALLUVIUM	CH	Silty CLAY; light grey. High plasticity.				W	F - St	26/21	
2.0	ALLUVIUM	ML	Fine to medium sandy SILT with trace organics; brown with grey streaks. Low plasticity.				W	St	60/26 66/29	
2.5	RUARANGI FORMATION	ML	Fine to coarse sandy SILT; brown with grey streaks. Low plasticity.				S	H	UTP UTP UTP	
3.0			End of Hole Depth: 3 m Termination Condition: Target depth							

Hand auger met target depth at 3 m.
Dip test showed standing water at 0.6 m depth.
TS = Topsoil
UTP = Unable to Penetrate

N/A = Not Assessed

GEOTECH HAND AUGER - NO SCALA HA.GPJ NZ DATA TEMPLATE 2.GDT 7/11/19

LOG OF HAND AUGER HA11

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.0000
Date : 29/10/2019
Hole Depth : 3 m
Hole Diameter : 50 mm

Shear Vane No : 2524
Logged By : BF
Reviewed By : RB
Latitude : -35.888988
Longitude : 174.434081

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Notes/Remarks
	TS	ML	Topsoil.					N/A		
	ALLUVIUM	ML	Clayey SILT with minor fine to coarse sand; light grey. Low plasticity.					VSt	101/31	
0.5		ML	Silty CLAY with minor fibrous organics; brown with black streaks. Low plasticity.			▼	M	St	93/39	
1.0		OL	Organic SILT; black with brown streaks. Low plasticity. Organics, fibrous.					St	99/39	
		CH	Silty CLAY; light brown with orange streaks. High plasticity.				W	St	83/31	
1.5			Encountered 100 mm of organic material at 1.7 m depth.						77/26	
2.0	RUARANGI FORMATION	ML	Fine to medium sandy SILT; brown. Low plasticity.				S	St - VSt	66/29	
2.5									109/27	
								H	UTP	
3.0			End of Hole Depth: 3 m Termination Condition: Target depth						UTP	

Hand auger met target depth at 3 m.
Dip test showed standing water at 0.7 m depth.
TS = Topsoil
UTP = Unable to Penetrate

N/A = Not Assessed

GEOTECH HAND AUGER - NO SCALA HA.GPJ NZ DATA TEMPLATE 2.GDT 7/11/19

LOG OF HAND AUGER HA12

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.0000
Date : 29/10/2019
Hole Depth : 3 m
Hole Diameter : 50 mm

Shear Vane No : 2524
Logged By : BF
Reviewed By : RB
Latitude : -35.889838
Longitude : 174.433978

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Notes/Remarks
0	TS	ML	Topsoil.					N/A		
	ALLUVIUM	ML	Clayey SILT with minor fine to coarse sand; light grey. Low plasticity.				M	St	83/13	
0.5		ML	Clayey SILT with some fibrous organics; brown with black streaks. Low plasticity.			▼		St	77/34	
1.0		OL	Organic SILT; black with brown streaks. Low plasticity.					St	79/34	
		CH	Silty CLAY; light brown with orange streaks. High plasticity.				W	St	53/36	
1.5			Encountered 100 mm of organic material at 1.7 m depth.						62/21	
	RUARANGI FORMATION	ML	Fine to medium sandy SILT; brown. Low plasticity.				S	St	79/23	
2.0									66/29	
2.5								H	157/27	
3.0			End of Hole Depth: 3 m Termination Condition: Target depth						UTP UTP	

Hand auger met target depth at 3 m.
Dip test showed standing water at 0.8 m depth.
TS = Topsoil
UTP = Unable to Penetrate

N/A = Not Assessed

GEOTECH HAND AUGER - NO SCALA HA.GPJ NZ DATA TEMPLATE 2.GDT 7/11/19

APPENDIX 3:

Investigation Location Plans

DATE PLOTTED: 4 November 2020 4:03 p.m. BY: DOUG FINLAY

Note:
1. Underlying pdf plan sourced from Maven Associates: Drawing 117019-C100 Rev.A dated 10/20.

Legend
- Test Pit
- Scala Penetrometer
- Hand Auger Borehole
- Approximate site boundary

ENGEO
Auckland Office
8 Greydene Place, Takapuna 0622, Auckland
Tel: 09 972 2205, www.engeo.co.nz

Rev	Date	Description	Drwn	Chkd
A	4.11.20	Issue	DF	LEG

Title:

INVESTIGATION LOCATION PLAN

Client: SK Aotearoa Trust		Appendix: 3
Project: Cnr SH 1 and Port Marsden Highway Ruakaka	Designed: LEG Drawn: DF Checked: - Date: 4.11.20	Size: A3
Project No: 16234.000.000	Scale: 1:2000	Rev: A

CAD File: Z:\Drafting\16001 to 17000\16234 - Cnr SH1 and Port Marsden Highway, Ruakaka\16234-ILP-Ruakaka-1120.dwg
XREF's:

ORIGINAL SHEET PRINTED IN COLOUR

APPENDIX 4:

Hand Augers Borehole Logs

LOG OF AUGER HA01

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Hole Depth : 4.3 m
Hole Diameter : 50 mm

Shear Vane No : 2557
Logged By : BF
Reviewed By : RB
Latitude : -35.88952
Longitude : 174.431888

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
	T		Topsoil.					N/A		
	FILL	ML	Clayey SILT with trace sand and plastic; brown with orange streaks. Low plasticity [FILL].					VSt	153/43	
0.5		ML	Clayey SILT with trace organics; light grey intermixed with orange and black. Low plasticity [FILL].						200+	
	ALLUVIUM	CH	Silty CLAY; light grey with orange mottles. High plasticity.				W	H	200+	
1.0									200+	
		CH	Silty CLAY with some fibrous organics; light grey with black streaks. High plasticity.						200+	
1.5			Becomes light grey from 1.7 m depth.						200+	
									200+	
2.0						▼			200+	
		ML	Fine to coarse sandy SILT; light grey with orange streaks. Low plasticity.				S	VSt	143/49	
2.5									133/43	
	RUARANGI FORMATION	ML	Clayey SILT with minor fine to coarse sand; dark bluish grey. Low plasticity.					H	200+	
3.0									200+	
		ML	Clayey SILT with trace shell fragments; grey. Low plasticity.				W		200+	
3.5			No shell fragments encountered from 3.5 m depth.						UTP	
4.0									UTP	
			End of Hole Depth: 4.3 m Termination Condition: Practical refusal							>>
4.5										
5.0										

Hand auger met practical refusal at 4.3 m depth .
Dip test showed standing water at 2.2 m depth.
T = Topsoil
UTP = Unable To Penetrate

N/A = Not Assessed

GEOTECH HAND AUGER RUAKAKA SERVICE CENTRE - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 2/8/19

LOG OF AUGER HA02

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Hole Depth : 3.6 m
Hole Diameter : 50 mm

Shear Vane No : 2557
Logged By : BF
Reviewed By : RB
Latitude : -35.890065
Longitude : 174.431685

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		Topsoil.					N/A		
	F	ML	Clayey SILT with trace rootlets and sand; dark brown intermixed with orange and grey. Low plasticity [FILL].					VSt	167/49	
0.5	ALLUVIUM	CH	Silty CLAY; light grey with orange streaks. High plasticity.				M		200+	
									200+	
1.0		OL	Organic SILT with some clay; dark brown. Low plasticity.							
		CH	Silty CLAY; grey with orange mottles. High plasticity.				W	H	200+	
1.5									200+	
		CH	Silty CLAY with trace sand; light bluish grey with orange streaks. High plasticity.						147/74	
2.0	RUARANGI FORMATION	ML	Clayey SILT with trace sand; light grey. Low plasticity.			▼	M	VSt	182/53	
									200+	
2.5								H	UTP	
3.0									UTP	
									UTP	
3.5			End of Hole Depth: 3.6 m Termination Condition: Practical refusal							>>
4.0										
4.5										
5.0										

Hand auger met practical refusal at 3.6 m depth on hard material.
Dip test showed standing water at 2.3 m depth.
TS = Topsoil
F = Fill

UTP = Unable To Penetrate
N/A = Not Assessed

GEOTECH HAND AUGER RUAKAKA SERVICE CENTRE - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 2/8/19

LOG OF AUGER HA03

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Hole Depth : 3.3 m
Hole Diameter : 50 mm

Shear Vane No : 2182
Logged By : VP
Reviewed By : RB
Latitude : -35.889763
Longitude : 174.432314

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer (Blows per 100mm)
0.0	TS	ML	Topsoil.					N/A		
0.5	ALLUVIUM	ML	Clayey SILT with minor fine to medium sand; grey with orange mottles. Low plasticity.				M	H	200+	
1.0		ML	No sand observed from 0.8 m depth. Becomes grey from 1.3 m depth.					VSt	200+ 163 144	
1.5		ML	Clayey SILT with trace sand and organics; grey with dark brown mottles. Low plasticity.							
		SM	Silty fine to medium SAND; grey with white mottles. Poorly graded. Wood encountered from 1.5 to 1.6 m depth.					MD-D		
2.0		CH	Silty CLAY with trace sand; grey. High plasticity.			▼	W	VSt	110 171	
2.5		SM	Silty fine to medium SAND; grey. Poorly graded. Some fine to medium sandy SILT lobes encountered from 2.9 m depth.				M	MD-D		
3.0	RF	ML	Clayey SILT with trace sand; bluish grey. Low plasticity. Crushable clasts (<1 mm) observed from 3.1 m depth.					VSt		
3.5			End of Hole Depth: 3.3 m Termination Condition: Practical refusal							
4.0										
4.5										
5.0										

Scala Penetrometer: Blows per 100mm — 2, 4, 6, 8, 10, 12; >>

Hand auger met practical refusal at 3.3 m depth on hard material.
Dip test showed standing water at 1.9 m depth.
TS = Topsoil, DS = Dune sands
RF = Ruarangi Formation

UTP = Unable To Penetrate
Remolded shear vane tests were not undertaken during test

GEOTECH HAND AUGER RUAKAKA SERVICE CENTRE - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 2/8/19

LOG OF AUGER HA04

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Hole Depth : 2.7 m
Hole Diameter : 50 mm

Shear Vane No : 2182
Logged By : VP
Reviewed By : RB
Latitude : -35.890294
Longitude : 174.432272

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
0.0	TS	ML	Topsoil.					N/A		
	ALLUVIUM	CH	Silty CLAY; grey with orange mottles. High plasticity.				M	VSt	111/33 100/34 111/38	
1.0		CH	Silty CLAY with trace rootlets; grey. High plasticity. No rootlets observed from 1.3 m depth.				W	VSt	143/63 128/78 191/116	
2.0		ML	Clayey SILT; grey. Low plasticity.				M	VSt - H	172/66 200+	
2.5	RF	CH	Silty CLAY with trace sand; grey. High plasticity.					H	200+	>>
			End of Hole Depth: 2.7 m Termination Condition: Practical refusal							
3.0										
3.5										
4.0										
4.5										
5.0										

Hand auger met practical refusal at 2.7 m depth due to poor recovery.
Dip test showed standing water at 2.5 m depth.
TS = Topsoil
RF = Ruarangi Formation

N/A = Not Assessed
UTP = Unable To Penetrate

LOG OF AUGER HA05

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Hole Depth : 3.3 m
Hole Diameter : 50 mm

Shear Vane No : 2557
Logged By : BF
Reviewed By : RB
Latitude : -35.890249
Longitude : 174.432691

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	T	ML	Topsoil.					N/A		
	F	ML	Clayey SILT; brown with orange mottles. Low plasticity [FILL].					St	53/49	
0.5	ALLUVIUM	OL	Organic SILT with trace rootlets; dark brown. Low plasticity. Organics, fibrous.					F	33/16	
1.0		CH	Silty CLAY with minor fibrous organics; greyish brown. High plasticity.				W	St - VSt	69/20 178/49	
1.5		ML	Fine to medium sandy SILT with trace organics; brown with grey streaks. Low plasticity. Poor recovery from 1.7 m depth.			▼		St	86/57 80/41	
2.0									49/20	
2.5							S	F	57/33	
3.0	RF	ML	Clayey SILT; bluish grey. Low plasticity.					St - VSt	114/16	
								VSt - H	UTP	
								H	UTP	>>
3.3			End of Hole Depth: 3.3 m Termination Condition: Practical refusal							
3.5										
4.0										
4.5										
5.0										

Hand auger met practical refusal at 3.3 m depth .
Dip test showed standing water at 2.1 m depth.
T = Topsoil
F = Fill

UTP = Unable To Penetrate
RF = Ruarangi Formation

GEOTECH HAND AUGER RUAKAKA SERVICE CENTRE - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 2/8/19

LOG OF AUGER HA06

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Hole Depth : 4 m
Hole Diameter : 50 mm

Shear Vane No : 2182
Logged By : VP
Reviewed By : RB
Latitude : -35.890408
Longitude : 174.433056

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
0.0	T		Topsoil.					N/A		
	ALLUVIUM	ML	Clayey SILT with minor organics and trace sand; dark brown. Low plasticity. Organics, fibrous.				W	F	31/9	
0.5									41/19	
									49/16	
1.0		CH	Silty CLAY; grey. High plasticity.						41/19	
1.5		ML	Clayey SILT with trace sand; grey with orange mottles. Low plasticity.			▼	S		44/19	
									100/19	
2.0		ML	Fine to medium sandy SILT; grey. Low plasticity.					VSt	157/44	
2.5			Becomes wet and poor recovery from 2.5 m depth.				W	St	53/22	
									86/58	
3.0									50/34	
									64/22	
3.5	RF	CH	Silty CLAY with trace sand; bluish grey. High plasticity.					H	200+	
4.0			End of Hole Depth: 4 m Termination Condition: Practical refusal						200+	>>
4.5										
5.0										

Hand auger met practical refusal at 4 m depth on hard material.
Dip test showed standing water at 1.5 m depth.
T = Topsoil
RF = Ruarangi Formation

UTP = Unable To Penetrate
N/A = Not Assessed

LOG OF AUGER HA07

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Hole Depth : 3.5 m
Hole Diameter : 50 mm

Shear Vane No : 2557
Logged By : BF
Reviewed By : RB
Latitude : -35.890702
Longitude : 174.432652

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer (Blows per 100mm)
0.0	T	ML	Topsoil.					N/A		
	FILL	ML	Clayey SILT with minor fiberous organics; dark brown with orange streaks. Low plasticity [FILL].					VSt	163/12	
0.5	ALLUVIUM	CH	Silty CLAY; light brown with dark brown streaks. High plasticity.					H	200+	
1.0							W	F	25/12	
								VSt	155/59	
1.5		SW	Fine to coarse SAND with trace organics; greyish brown. Well graded.			▼		L - MD	184/74	
2.0							S			
2.5	RUARANGI FORMATION	ML	Clayey SILT with trace sand; grey. Low plasticity. Crushable clasts (<1 mm) observed from 2.4 m depth.				W	VSt - H	UTP	
3.0									UTP	
3.5			End of Hole Depth: 3.5 m Termination Condition: Practical refusal							>>
4.0										
4.5										
5.0										

Hand auger met practical refusal at 3.5 m depth .
Dip test showed standing water at 1.8 m depth.
T = Topsoil
UTP = Unable To Penetrate

N/A = Not Assessed

GEOTECH HAND AUGER RUAKAKA SERVICE CENTRE - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 2/8/19

LOG OF AUGER HA08

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Hole Depth : 3.8 m
Hole Diameter : 50 mm

Shear Vane No : 2557
Logged By : BF
Reviewed By : RB
Latitude : -35.88973
Longitude : 174.432855

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.0	FILL	ML	Clayey SILT with trace organics; intermixed brown and orange. Low plasticity [FILL].					F	45/12
0.5	ALLUVIUM	ML	Clayey SILT with trace rootlets; light grey. Low plasticity.					VSt	125/53
1.0		OL	Organic SILT with trace rootlets; dark brown. Low plasticity.				W		184/41
1.5		CH	Silty CLAY; light grey. High plasticity.					F	49/16
2.0		ML	Fine to coarse sandy SILT; grey with orange streaks. Low plasticity.			▼		St	61/43
2.5		SW	Fine to coarse SAND; bluish grey. Well graded.				S	St - VSt	94/43
3.0	RF	ML	Clayey SILT with trace sand; bluish grey. Low plasticity.					VSt - H	155/61
3.5								L	200+
4.0			End of Hole Depth: 3.8 m Termination Condition: Practical refusal					H	200+
4.5									UTP
5.0									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 3.8 m depth .
Dip test showed standing water at 1.9 m depth.
RF = Ruarangi Formation
UTP = Unable To Penetrate

N/A = Not Assessed

GEOTECH HAND AUGER RUAKAKA SERVICE CENTRE - HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 2/8/19

APPENDIX 5:

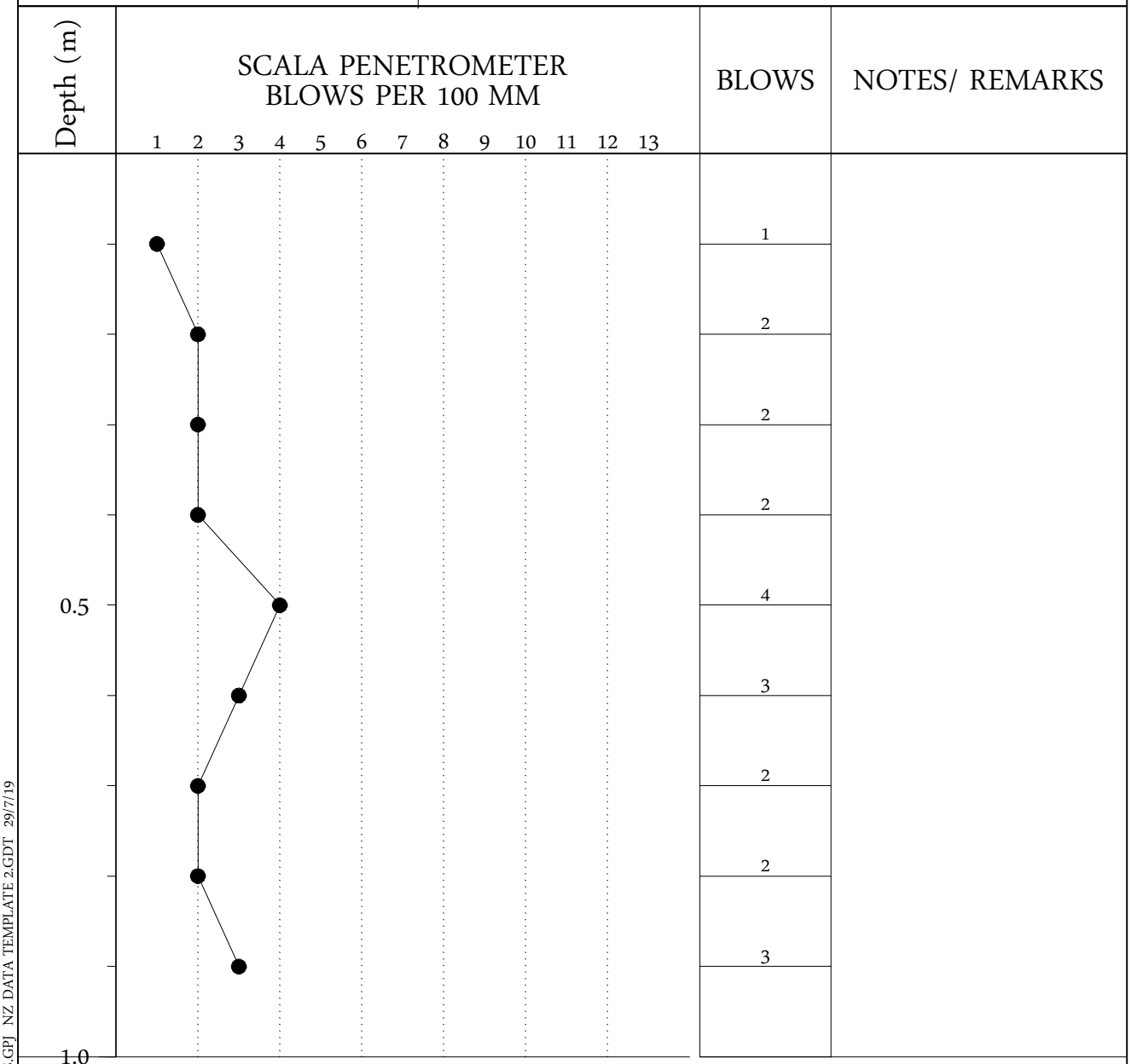
Scala Penetrometer Results

LOG OF SCALA SP01

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Scala Depth : 1 m

Logged By : BF/VP
Reviewed By : RB
Latitude : 174.432196
Longitude :-35.890197



BLOWS	NOTES/ REMARKS
1	
2	
2	
2	
4	
3	
2	
2	
3	

Scala Penetrometer met target depth

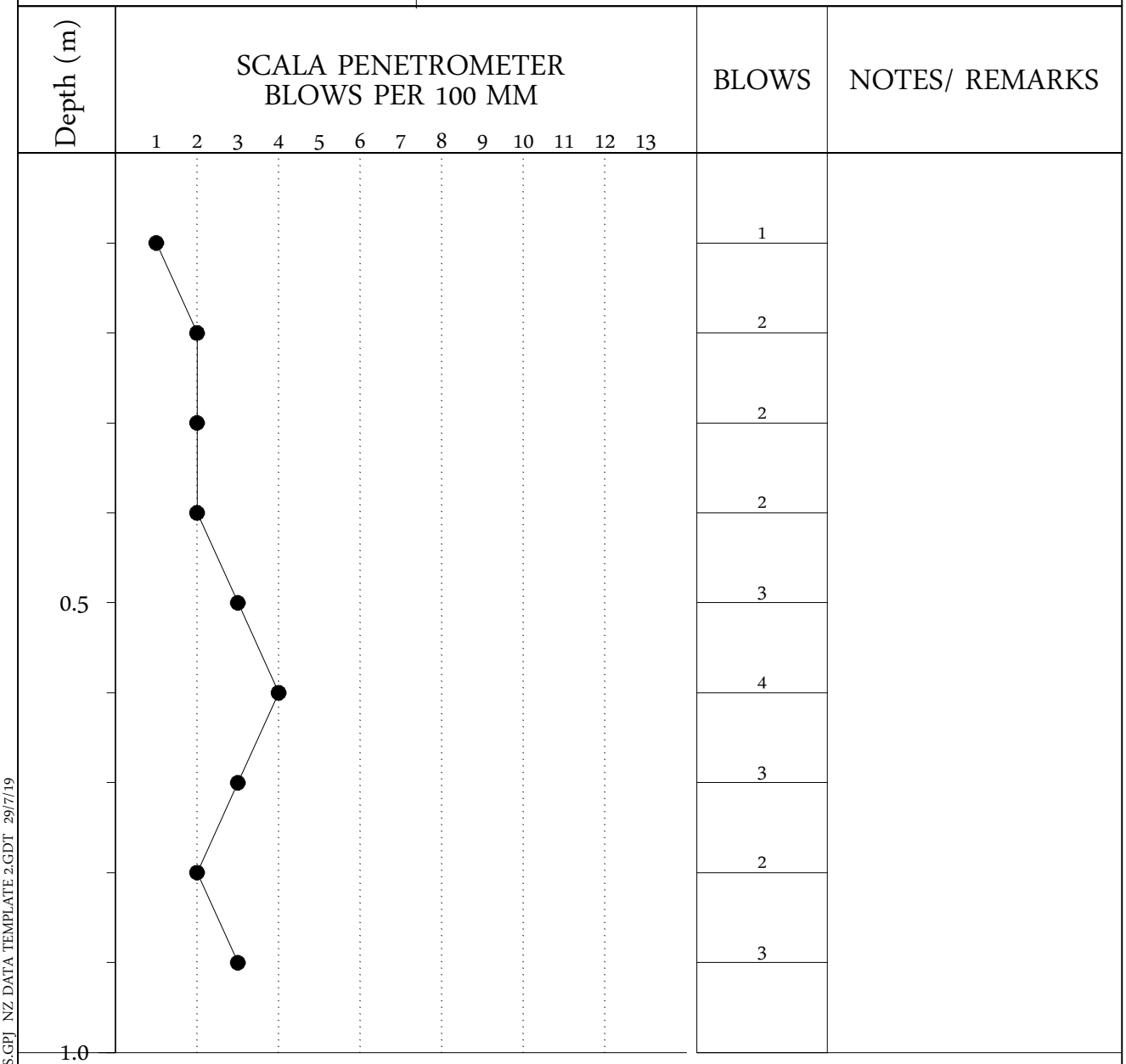
GEOTECH SCALA RUAKAKA SERVICE CENTRE - SCALAS.GPJ NZ DATA TEMPLATE 2.GDT 29/7/19

LOG OF SCALA SP02

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Scala Depth : 1 m

Logged By : BF/VP
Reviewed By : RB
Latitude : 174.431808
Longitude :-35.889872



BLOWS	NOTES/ REMARKS
1	
2	
2	
2	
3	
4	
3	
2	
3	

Scala Penetrometer met target depth

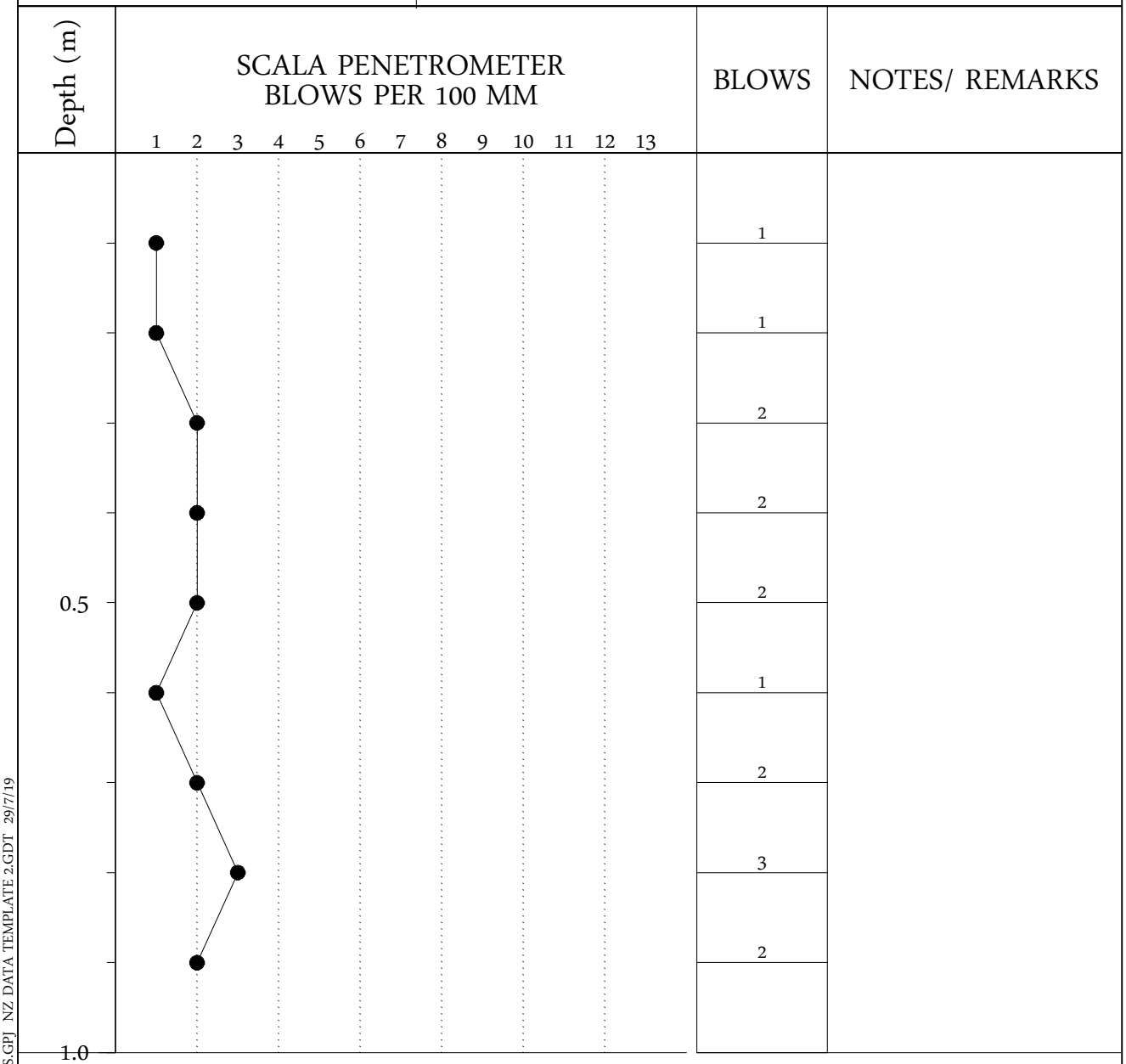
GEOTECH SCALA RUAKAKA SERVICE CENTRE - SCALAS.GPJ NZ DATA TEMPLATE 2.GDT 29/7/19

LOG OF SCALA SP03

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Scala Depth : 1 m

Logged By : BF/VP
Reviewed By : RB
Latitude : 174.431207
Longitude :-35.889037



BLOWS	NOTES/ REMARKS
1	
1	
2	
2	
2	
1	
2	
3	
2	

Scala Penetrometer met target depth

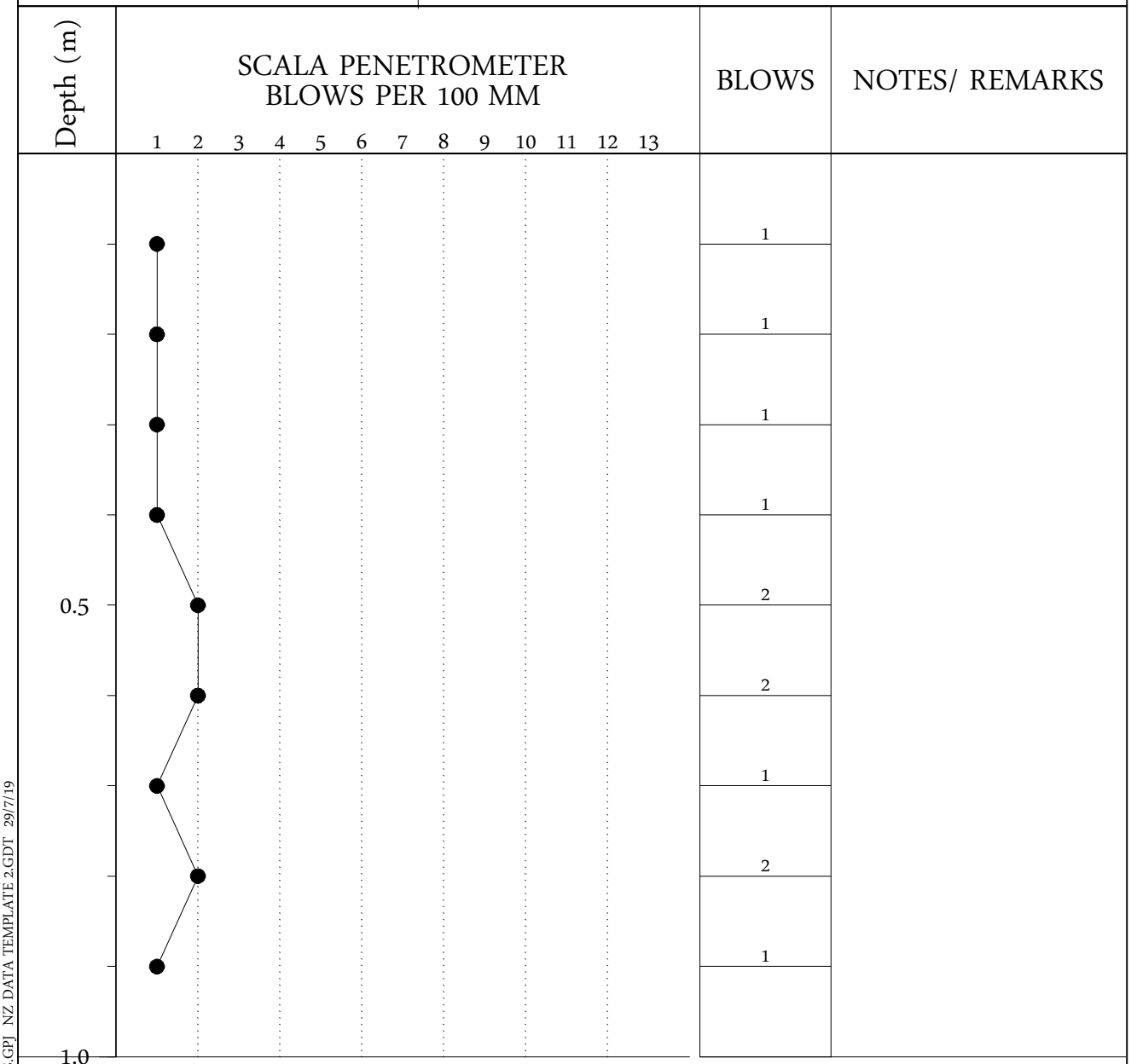
GEOTECH SCALA RUAKAKA SERVICE CENTRE - SCALAS.GPJ NZ DATA TEMPLATE 2.GDT 29/7/19

LOG OF SCALA SP04

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Scala Depth : 1 m

Logged By : BF/VP
Reviewed By : RB
Latitude : 174.43012
Longitude :-35.889064



BLOWS	NOTES/ REMARKS
1	
1	
1	
1	
2	
2	
1	
2	
1	

Scala Penetrometer met target depth

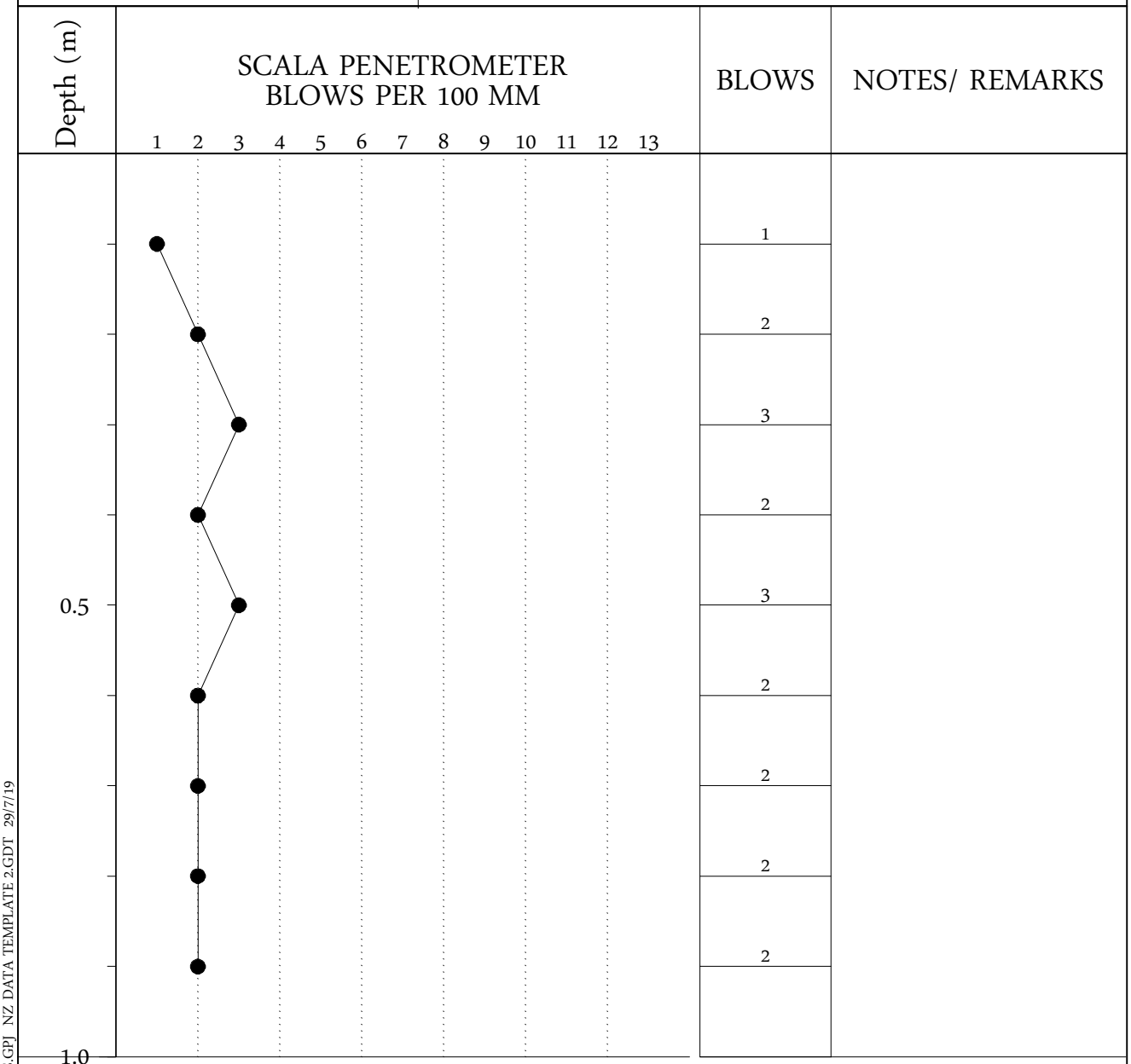
GEOTECH SCALA RUAKAKA SERVICE CENTRE - SCALAS.GPJ NZ DATA TEMPLATE 2.GDT 29/7/19

LOG OF SCALA SP05

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Scala Depth : 1 m

Logged By : BF/VP
Reviewed By : RB
Latitude : 174.430924
Longitude :-35.888649



BLOWS	NOTES/ REMARKS
1	
2	
3	
2	
3	
2	
2	
2	
2	

Scala Penetrometer met target depth

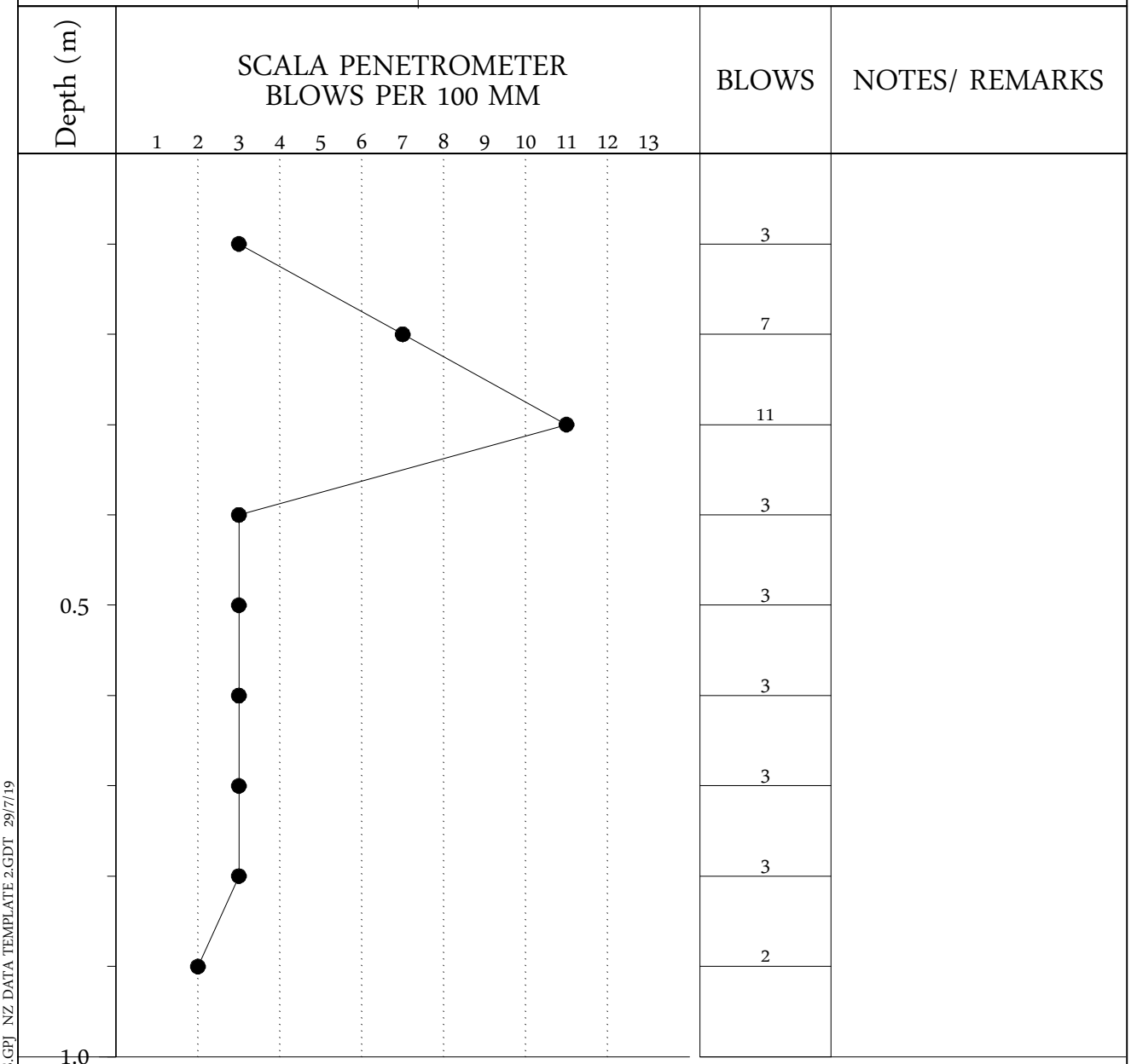
GEOTECH SCALA RUAKAKA SERVICE CENTRE - SCALAS.GPJ NZ DATA TEMPLATE 2.GDT 29/7/19

LOG OF SCALA SP06

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Scala Depth : 1 m

Logged By : BF/VP
Reviewed By : RB
Latitude : 174.431503
Longitude :-35.888597



BLOWS	NOTES/ REMARKS
3	
7	
11	
3	
3	
3	
3	
3	
2	

Scala Penetrometer met target depth

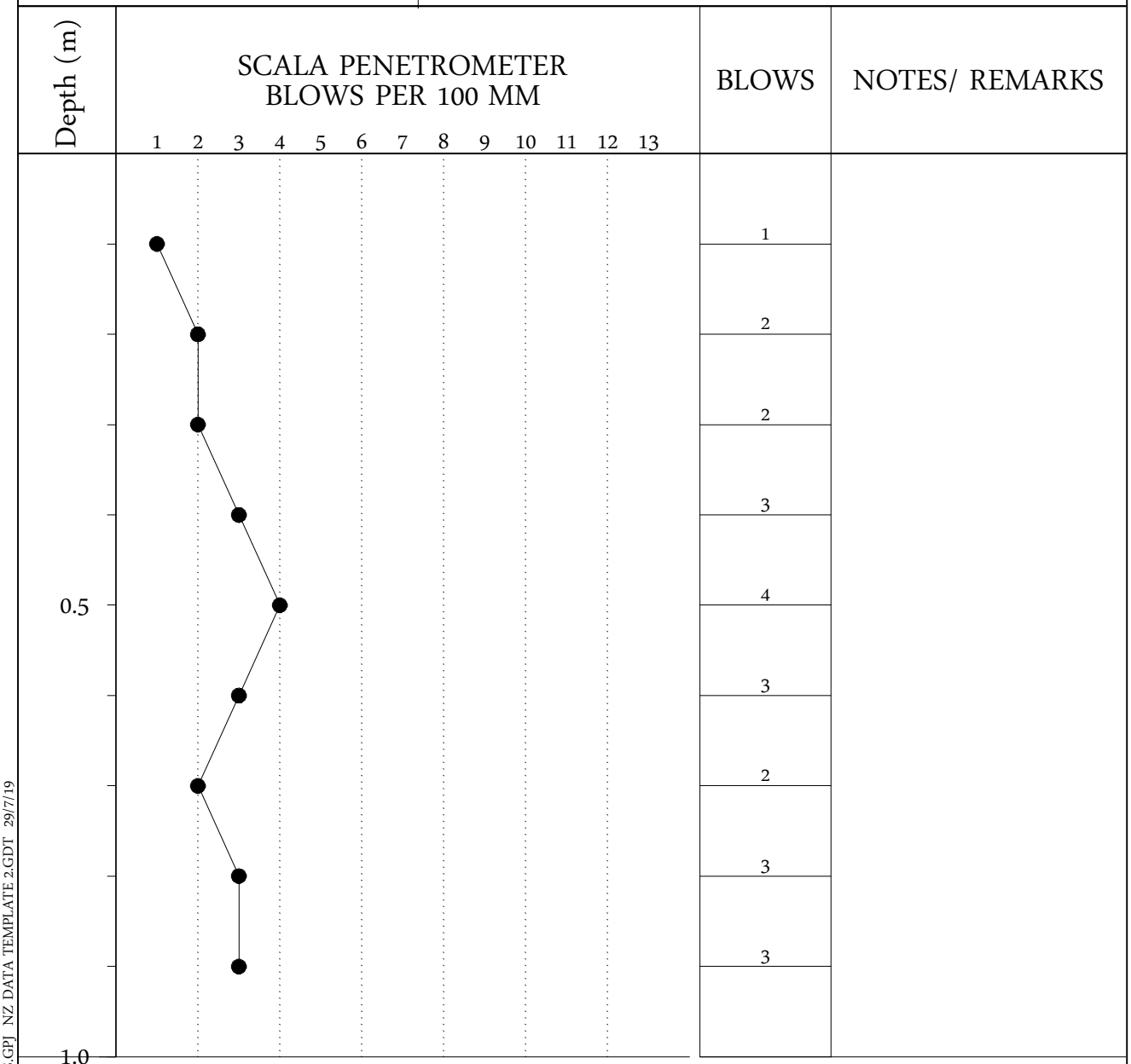
GEOTECH SCALA RUAKAKA SERVICE CENTRE - SCALAS.GPJ NZ DATA TEMPLATE 2.GDT 29/7/19

LOG OF SCALA SP07

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Scala Depth : 1 m

Logged By : BF/VP
Reviewed By : RB
Latitude : 174.432386
Longitude :-35.888996



BLOWS	NOTES/ REMARKS
1	
2	
2	
3	
4	
3	
2	
3	
3	

Scala Penetrometer met target depth

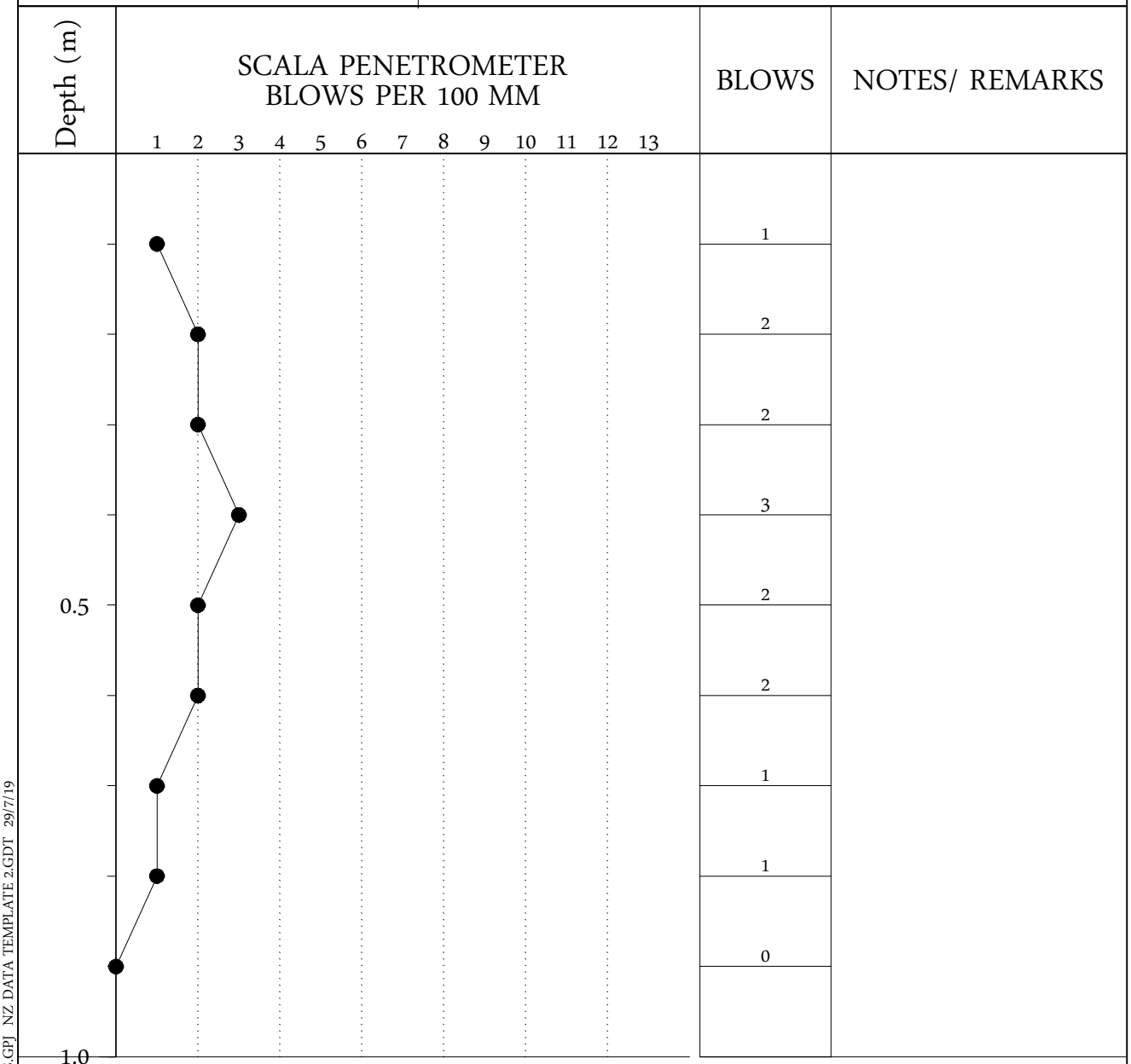
GEOTECH SCALA RUAKAKA SERVICE CENTRE - SCALAS.GPJ NZ DATA TEMPLATE 2.GDT 29/7/19

LOG OF SCALA SP08

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Scala Depth : 1 m

Logged By : BF/VP
Reviewed By : RB
Latitude : 174.433559
Longitude :-35.889533



BLOWS	NOTES/ REMARKS
1	
2	
2	
3	
2	
2	
1	
1	
0	

Scala Penetrometer met target depth

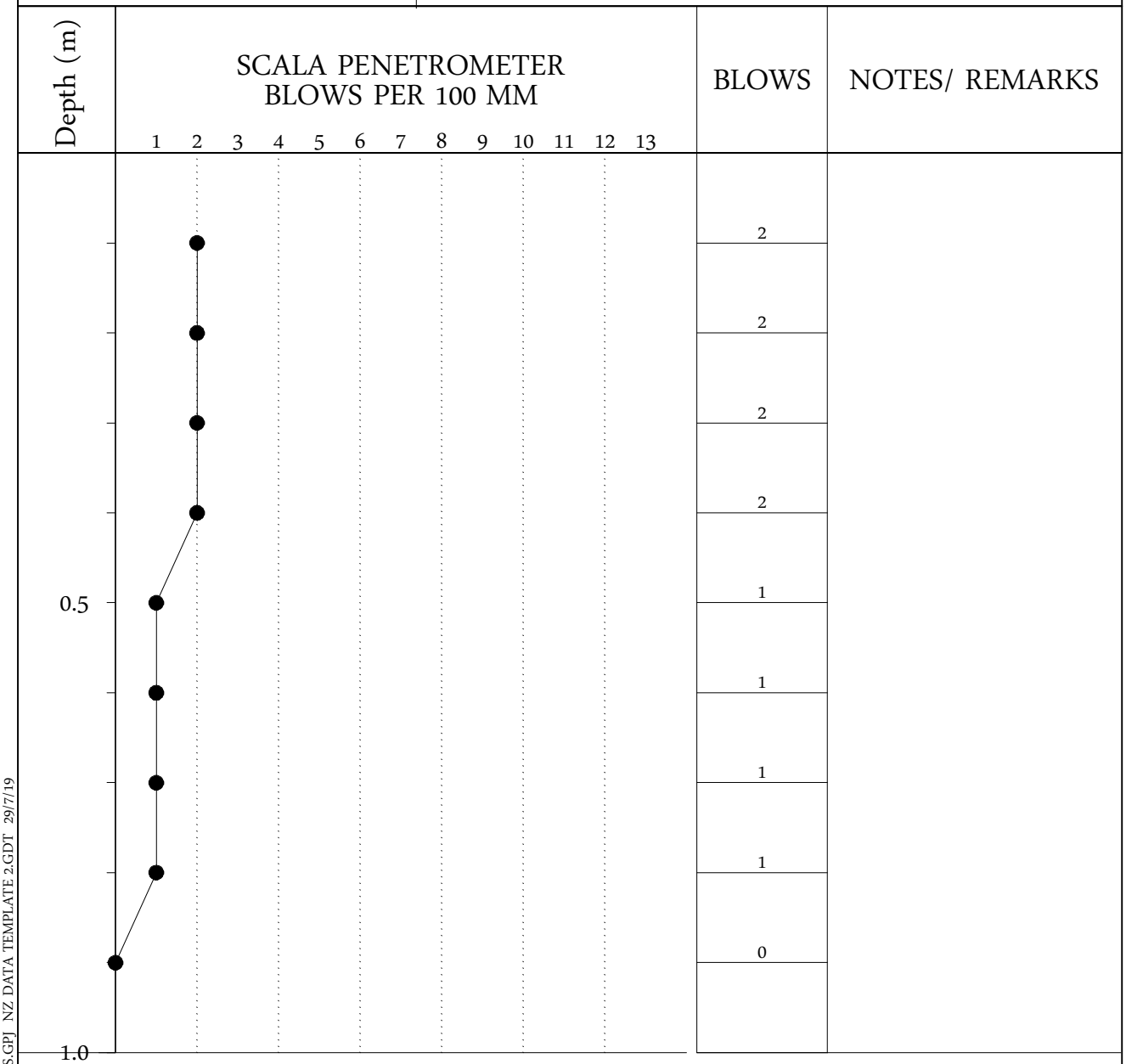
GEOTECH SCALA RUAKAKA SERVICE CENTRE - SCALAS.GPJ NZ DATA TEMPLATE 2.GDT 29/7/19

LOG OF SCALA SP09

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei

Client : SK Aotearoa Trust
Client Ref. : 16234.000.000
Date : 07/06/2019
Scala Depth : 1 m

Logged By : BF/VP
Reviewed By : RB
Latitude : 174.434122
Longitude :-35.889299



Scala Penetrometer met target depth

GEOTECH SCALA RUAKAKA SERVICE CENTRE - SCALAS.GPJ NZ DATA TEMPLATE 2.GDT 29/7/19

APPENDIX 6:

Test Pits Results

LOG OF TEST PIT TP01

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei
16234.000.000

Client : SK Aotearoa Trust
Date : 11/07/2019
Max Test Pit Depth : 3.5 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : N/A

Shear Vane No : 2557
Logged By : BF
Reviewed By : NB
Latitude : -35.887775
Longitude : 174.431587

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	T		ML	Topsoil.					N/A		
0.5	ALLUVIUM		CH	Silty CLAY with trace organics; light orange brown with brown mottles. High plasticity.					VSt	176/59	
1.0			CH	Silty CLAY with some organics; light brown with orange and black streaks. High plasticity. Organics, bark, fibers and woody debris.				W	VSt	159/78	
1.5			CH	Silty CLAY with trace organics; light grey. High plasticity.					VSt		
2.0			SW	Fine to coarse SAND with minor silt; light brown. Well graded.					L	45/12	
2.5			SW	Fine to coarse SAND; dark grey. Well graded.				S	L	61/20	
3.0				Groundwater seepage at 3.1 m depth.			▼			37/8	
3.5				Depth of Excavation: 3.5 m Termination Condition: Target depth							
4.0											
4.5											
5.0											

Excavator met target depth
Standing water infilled hole at 3.1
T = Topsoil

N/A = Not Assessed

GEOTECH TEST PIT LOG TEST PITS.GPJ NZ MASTER DATA TEMPLATE.GDT 2/8/19

LOG OF TEST PIT TP02

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei
16234.000.000

Client : SK Aotearoa Trust
Date : 11/07/2019
Max Test Pit Depth : 3.5 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : N/A

Shear Vane No : 2557
Logged By : BF
Reviewed By : NB
Latitude : -35.888109
Longitude : 174.431164

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	T	ML	Topsoil.				N/A		
0.5	ALLUVIUM	CH	Silty CLAY with trace rootlets; light grey with orange mottles. High plasticity.				VSt	167/57	
1.0		ML	Clayey SILT with minor organics; dark brown. Low plasticity. Organics, woody debris and rootlets.				VSt	114/41	
1.5		CH	Silty CLAY with trace rootlets; light grey. Low plasticity.			W	VSt		
2.0		ML	Clayey SILT with minor organics and trace sand; dark brown with black streaks. Low plasticity. Organics, woody debris.				VSt	100/37	
2.5		SW	Fine to coarse SAND; dark grey. Well graded.			W	L	106/37	
3.0			Becomes saturated at 3.2 m depth.		▼			78/12	
3.5			Depth of Excavation: 3.5 m Termination Condition: Target depth			S			
4.0									
4.5									
5.0									

Excavator met target depth
Standing water infilled hole at 3.2 m depth.
T = Topsoil

N/A = Not Assessed

LOG OF TEST PIT TP03

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei
16234.000.000

Client : SK Aotearoa Trust
Date : 11/07/2019
Max Test Pit Depth : 4.25 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : N/A

Shear Vane No : 2557
Logged By : BF
Reviewed By : NB
Latitude : -35.888368
Longitude : 174.43036

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	T		ML	Topsoil.					N/A		
0.5	ALLUVIUM		CH	Silty CLAY with trace organics; light orange brown. High plasticity.				M	VSt	176/80	
										145/82	
1.0			ML	Clayey SILT with trace organics; light greyish brown. Low plasticity. Organic amorphous to 50 mm branches and woody debris.					VSt		
1.5										118/59	
2.0			ML	Fine to corse sandy SILT; light brown. Low plasticity.					St	94/8	
2.5								W			
3.0			SW	Silty fine to coarse SAND; dark grey. Well graded.					VL	53/29	
3.5											
4.0				Becomes saturated at 4.0 m depth.			▼	S		63/25	
4.5				Depth of Excavation: 4.25 m Termination Condition: Target depth							
5.0											

Excavator met target depth
Standing water infilled hole at 4.0 m depth.
T = Topsoil

N/A = Not Assessed

LOG OF TEST PIT TP04

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei
16234.000.000

Client : SK Aotearoa Trust
Date : 11/07/2019
Max Test Pit Depth : 3.1 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : N/A

Shear Vane No : 2557
Logged By : BF
Reviewed By : NB
Latitude : -35.888673
Longitude : 174.429557

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TS		ML	Topsoil.					N/A		
0.5	ALLUVIUM		CH	Silty CLAY with trace rootlets; light grey with orange mottles. High plasticity.					St		
1.0			OL	Organic SILT; black. Low plasticity. Organics, wood and rootlets.				M	VSt	139/53	
1.5			CH	Silty CLAY with trace organics; light brownish grey. Organics, isolated tree remains.					St		
2.0			SW	Fine to coarse SAND; dark grey. Well graded.			▼	W	L	98/37 74/25	
2.5									MD	161/53	
3.0										176/49	
3.1				Depth of Excavation: 3.1 m Termination Condition: Target depth							

Scala Penetrometer Blows per 100mm: 2 4 6 8 10 12

Excavator met target depth
Standing water infilled hole at 2.5 m depth.
TS = Topsoil

N/A = Not Assessed

GEOTECH TEST PIT LOG TEST PITS.GPJ NZ MASTER DATA TEMPLATE.GDT 2/8/19

LOG OF TEST PIT TP05

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei
16234.000.000

Client : SK Aotearoa Trust
Date : 11/07/2019
Max Test Pit Depth : 4.5 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : N/A

Shear Vane No : 2557
Logged By : BF
Reviewed By : NB
Latitude : -35.888989
Longitude : 174.43004

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	T		ML	Topsoil.					N/A		
	ALLUVIUM		CH	Silty CLAY; orange brown with light grey streaks. High plasticity.					VSt	182/74	
0.5			ML	Clayey SILT with minor sand; orange brown. Low plasticity.					H	200+	
1.0			OL	Organic SILT; dark brown. Low plasticity. Organics, woody debris and fibrous.					VSt	165/63	
			CH	Silty CLAY with trace organics; light grey. High plasticity.					VSt	155/45	
2.0										141/41	
2.5			SW	Silty fine to coarse SAND with trace organics; dark grey. Well graded.			▼		L	57/8	
3.0										61/31	
3.5											
4.0											
4.5				Depth of Excavation: 4.5 m Termination Condition: Target depth							
5.0											

Excavator met target depth
Standing water infilled hole at 2.5 m depth.
T = Topsoil

N/A = Not Assessed

GEOTECH TEST PIT LOG TEST PITS.GPJ NZ MASTER DATA TEMPLATE.GDT 2/8/19

LOG OF TEST PIT TP06

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei
16234.000.000

Client : SK Aotearoa Trust
Date : 11/07/2019
Max Test Pit Depth : 4.5 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : N/A

Shear Vane No : 2557
Logged By : BF
Reviewed By : NB
Latitude : -35.888669
Longitude : 174.431006

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	Topsoil.					N/A		
	ALLUVIUM		CH	Silty CLAY; orange brown with grey streaks. High plasticity.					VSt	151/57	
0.5			ML	Clayey SILT with trace sand and organics; light grey. Low plasticity.					VSt	139/43	
1.0			OL	Organic SILT; dark brown. Low plasticity. Organics, fibers and woody debris.				M	VSt	120/74	
				Silty CLAY; light grey. Low plasticity.							
1.5			CH						VSt	149/49	
2.0										165/49	
2.5			SW	Fine to coarse SAND; dark grey. Well graded.			▼	S	L	48/11	
3.0											
3.5											
4.0											
4.5				Depth of Excavation: 4.5 m Termination Condition: Target depth							
5.0											

Excavator met target depth
Standing water infilled hole at 2.7 m depth.
TS = Topsoil

N/A = Not Assessed

GEOTECH TEST PIT LOG TEST PITS.GPJ NZ MASTER DATA TEMPLATE.GDT 2/8/19

LOG OF TEST PIT TP07

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei
16234.000.000

Client : SK Aotearoa Trust
Date : 11/07/2019
Max Test Pit Depth : 4.2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : N/A

Shear Vane No : 2557
Logged By : BF
Reviewed By : NB
Latitude : -35.888411
Longitude : 174.431502

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	T		ML	Topsoil.					N/A		
	ALLUVIUM		ML	Clayey SILT; light grey with brown streaks. Low plasticity.					N/A		
0.5			ML	Clayey SILT; light grey with orange streaks. Low plasticity.					VSt	147/71	
1.0			OL	Organic SILT; dark brown with black streaks. Low plasticity.				M	VSt	178/49	
			CH	Silty CLAY with trace organics. light grey with orange streaks. High plasticity					VSt	141/82 151/80	
2.0			ML	Clayey SILT with minor sand and trace organics; light grey. Low plasticity.					F	25/20	
2.5								W		37/8	
3.0										79/15	
3.5				Ground water flowing at 3.4 m depth.			▼	S	St		
4.0											
				Depth of Excavation: 4.2 m Termination Condition: Target depth							
4.5											
5.0											

Excavator met target depth
Standing water infilled hole at 3.5 m depth.
T = Topsoil

N/A = Not Assessed

GEOTECH TEST PIT LOG TEST PITS.GPJ NZ MASTER DATA TEMPLATE.GDT 2/8/19

LOG OF TEST PIT TP08

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei
16234.000.000

Client : SK Aotearoa Trust
Date : 11/07/2019
Max Test Pit Depth : 3.5 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : N/A

Shear Vane No : 2557
Logged By : BF
Reviewed By : NB
Latitude : -35.887914
Longitude : 174.431963

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	T	ML	Topsoil.				N/A		
	ALLUVIUM	ML	Clayey SILT with trace organics; dark brown. Low plasticity.				VSt		
0.5		CH	Silty CLAY; light grey with orange streaks. High plasticity.				VSt	141/49	
		CH	Silty CLAY with minor woody organics; dark brown. Low plasticity.				VSt	176/49	
1.0		CH	Silty CLAY; light grey with occasional grey streaks. High plasticity.			W	VSt - H	200+	
1.5		ML	Clayey SILT with minor fibrous organics; dark brown with grey and orange streaks. Low plasticity.				VSt	167/59 147/20	
2.0		SW	Fine to medium SAND with some silt and clay; dark brown. Well graded. Becomes greenish grey at 2.0 m depth.					74/20	
2.5					▼	S	L - MD		
3.0									
3.5			Depth of Excavation: 3.5 m Termination Condition: Target depth						
4.0									
4.5									
5.0									

Excavator met target depth
Standing water infilled hole at 2.8 m depth.
T = Topsoil

N/A = Not Assessed

LOG OF TEST PIT TP09

Geotechnical Investigation
Corner of SH1 and Port Marsden Highway, Ruakaka, Whangarei
16234.000.000

Client : SK Aotearoa Trust
Date : 11/07/2019
Max Test Pit Depth : 3.8 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : N/A

Shear Vane No : 2557
Logged By : BF
Reviewed By : NB
Latitude : -35.889059
Longitude : 174.432122

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	T		ML	Topsoil.					N/A		
	ALLUVIUM		ML	Clayey SILT with trace sand; grey with brown streaks. Low plasticity.					H		
0.5			CH	Silty CLAY with trace organics; light grey. High plasticity.					H	200+	
			PT	Amorphous PEAT; black.					N/A	196/123	
1.0			CH	Silty CLAY with trace rootlets; light grey with occasional black streaks. High plasticity.					VSt	200+ 172/104	
1.5	RUARANGI FORMATION		ML	Clayey SILT with trace siltstone; dark bluish grey. Low plasticity. Highly fractured and sheared.				M	H	167/49 UTP UTP	
2.0											
2.5											
3.0											
3.5											
4.0				Depth of Excavation: 3.8 m Termination Condition: Target depth							
4.5											
5.0											

Excavator met target depth
Standing groundwater was not encountered
T = Topsoil

N/A = Not Assessed

GEOTECH TEST PIT LOG TEST PITS.GPJ NZ MASTER DATA TEMPLATE.GDT 2/8/19