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

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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.

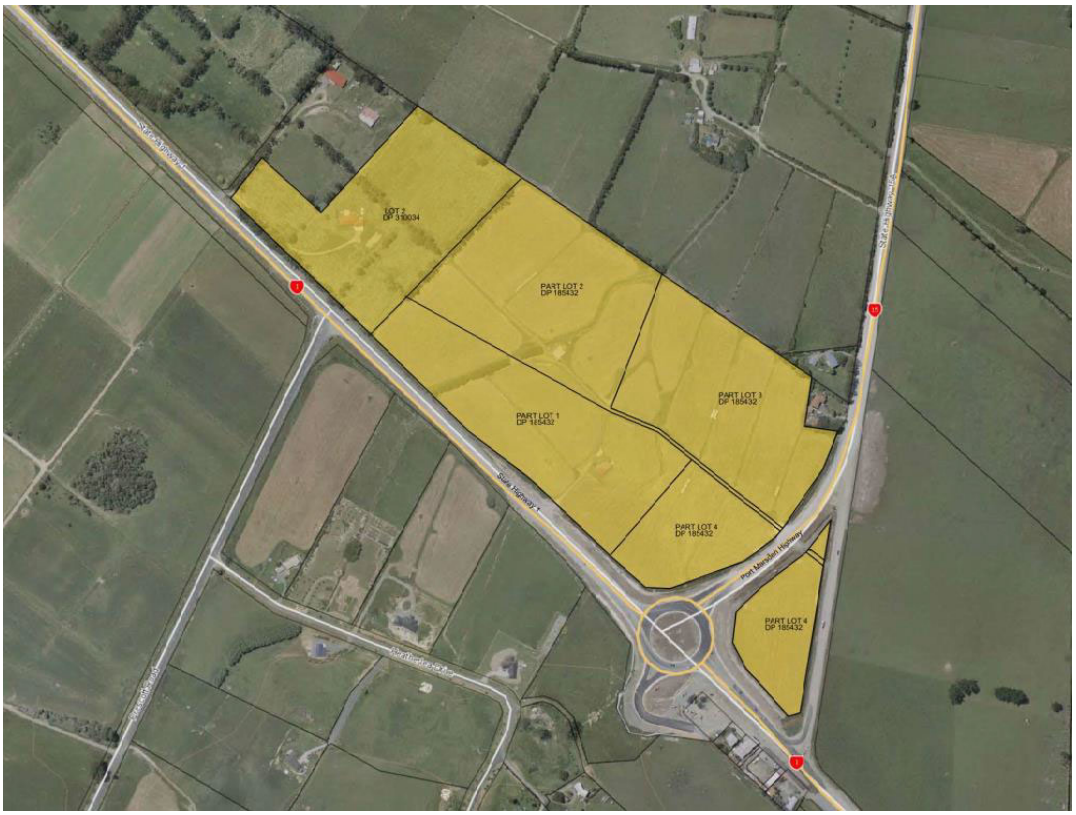


Figure 1: Site Location

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.

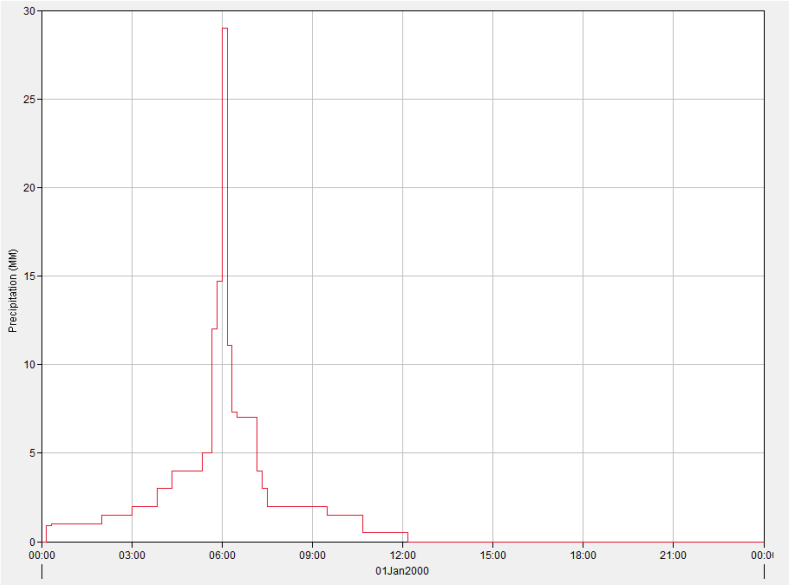


Figure 2.1 Rainfall distribution

Catchment size and time to peak

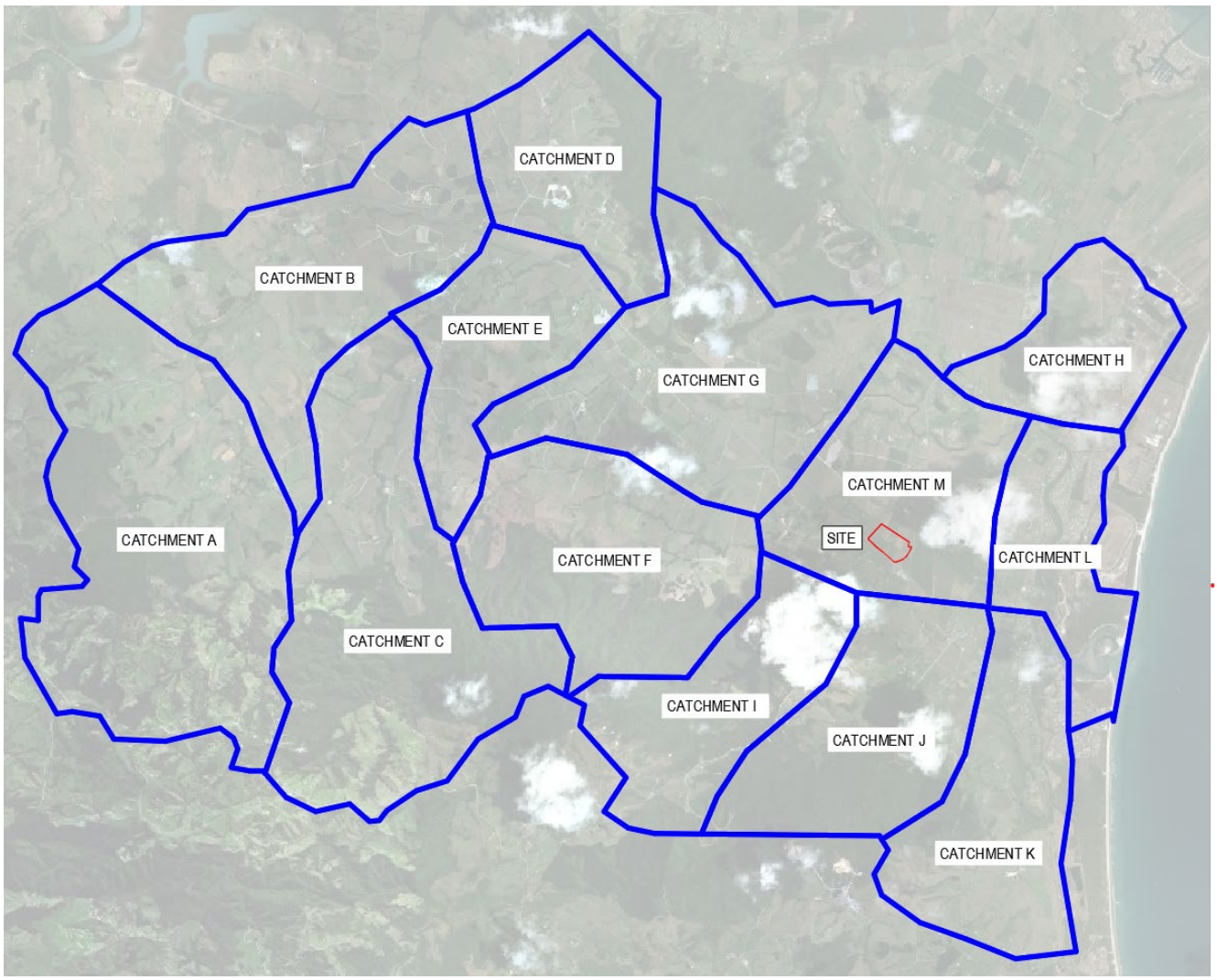


Figure 2.2 shows the approximate catchment and the sub-catchments

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

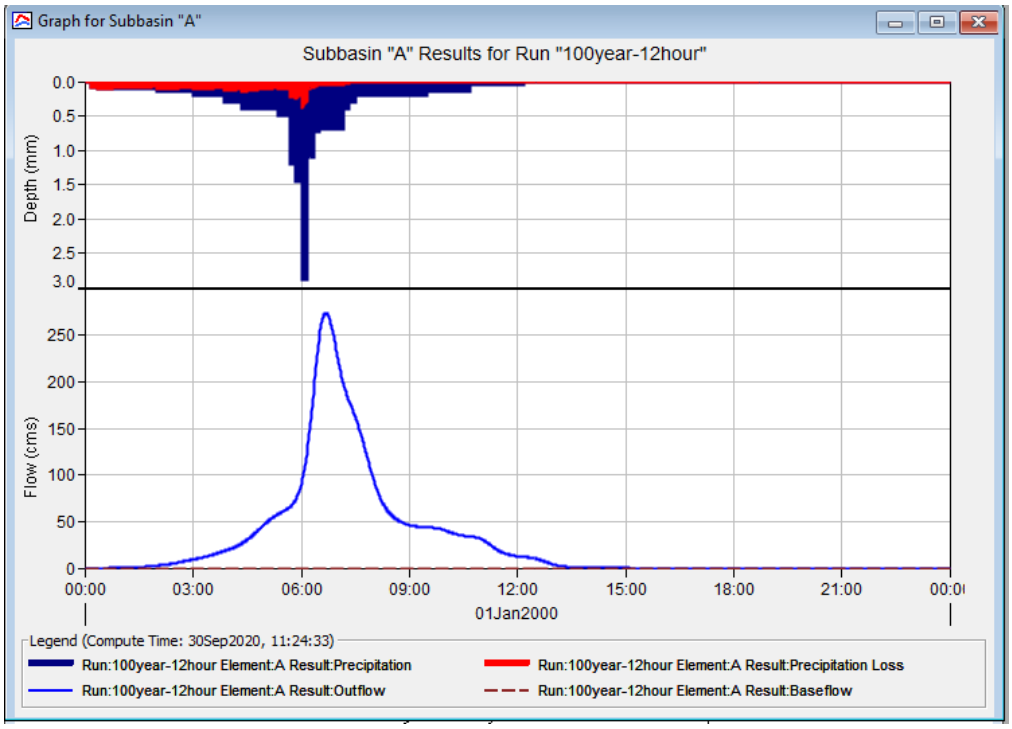


Figure 2.4 Sub-catchment A hydrograph - 100-year, 12-hour with climate change

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.

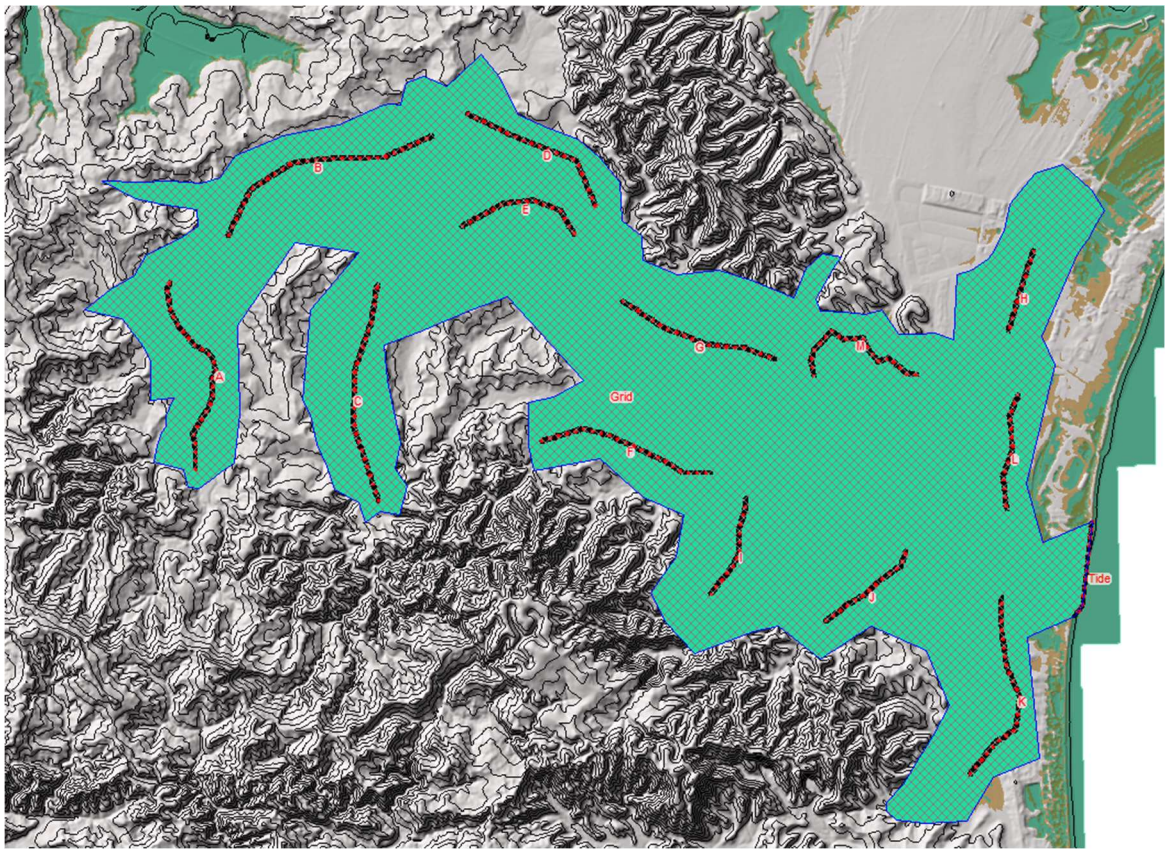


Figure 3.1 HEC-RAS model set up

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.

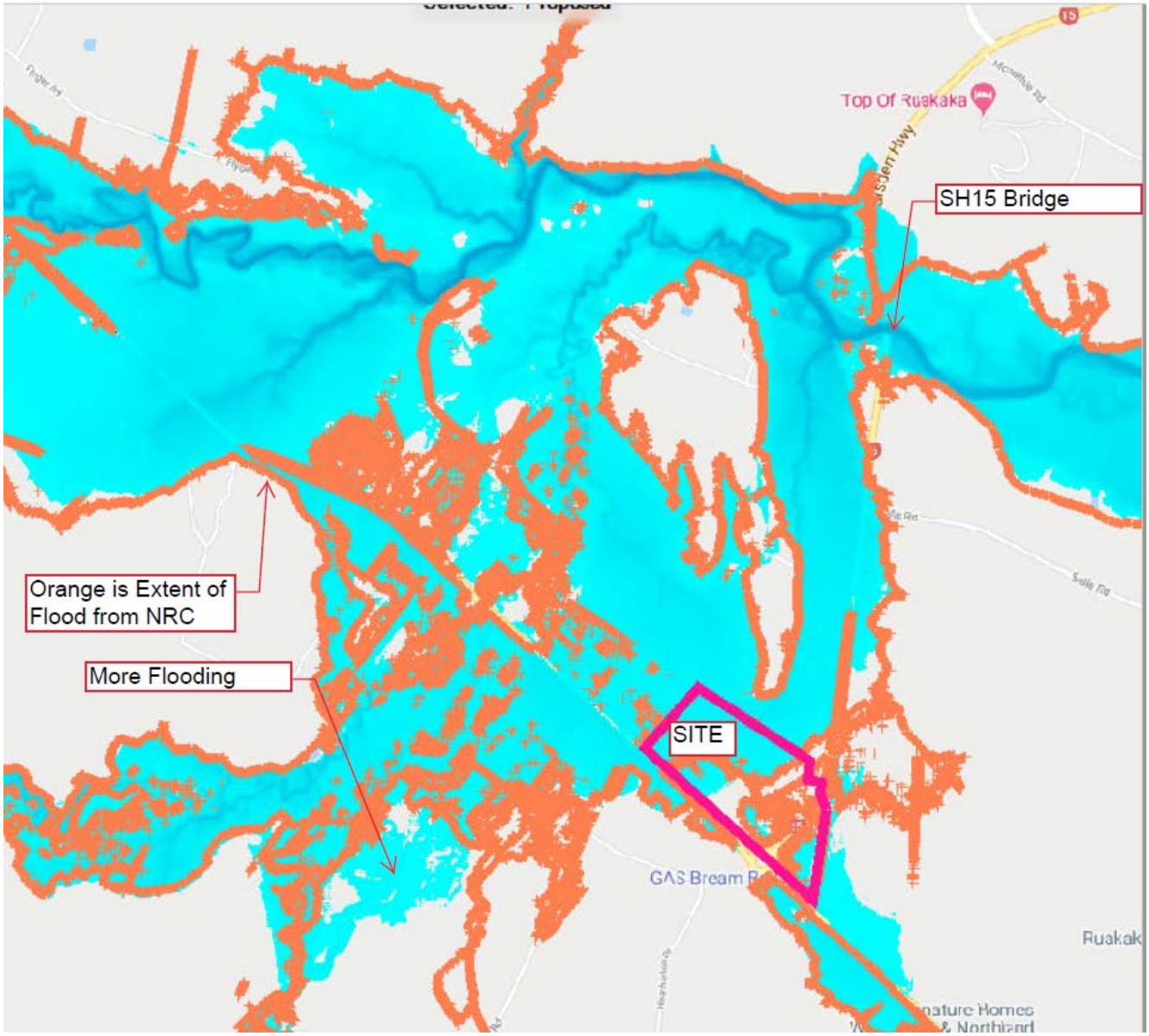


Figure 3.2 Flood Map at vicinity of the site with 100 year climate change

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.

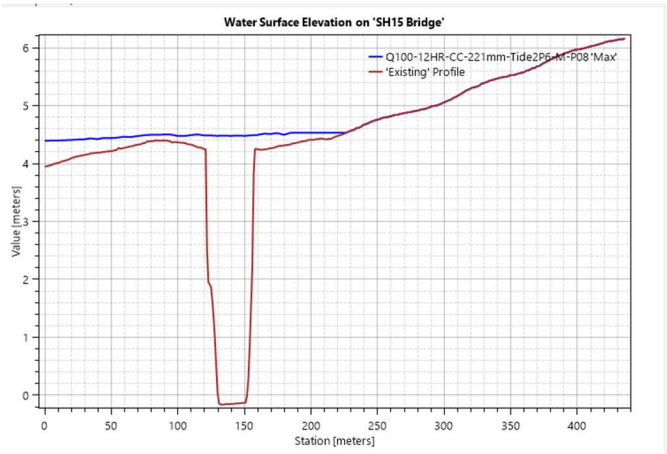


Figure 3.3 SH15 bridge cross-section – 100yr-climate change

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.

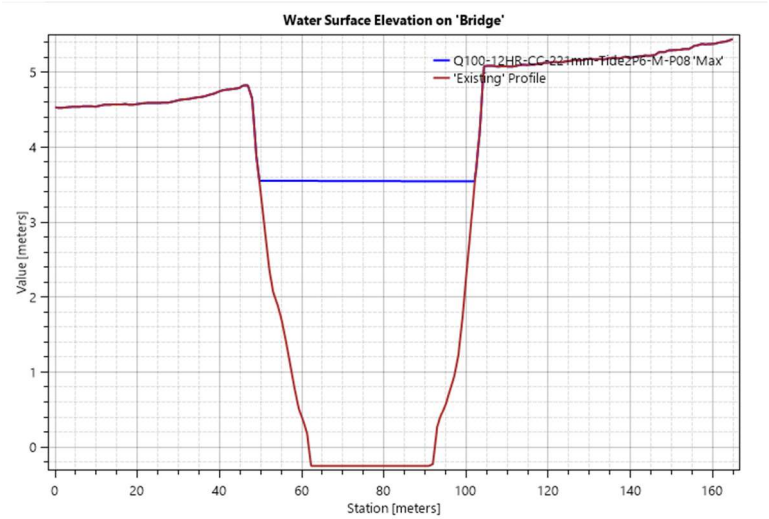


Figure 3.4 Flood-map for vicinity of the site – 100yr-climate change

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.

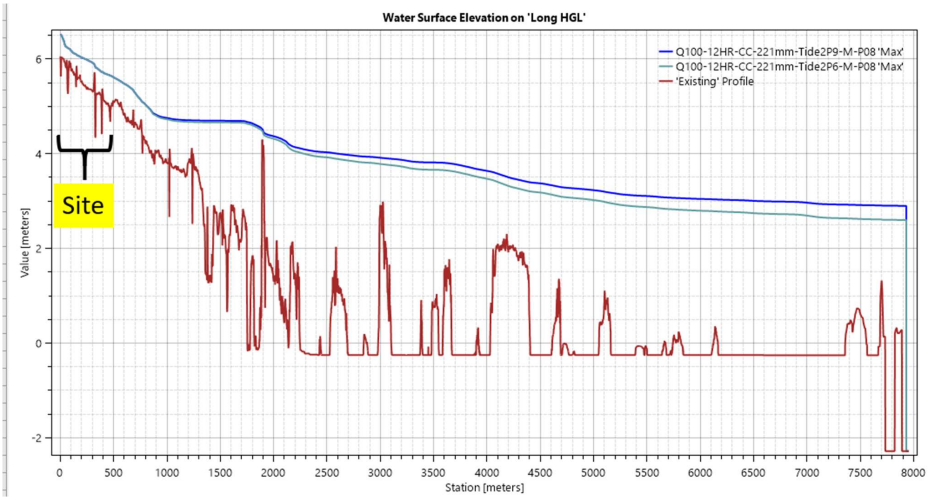


Figure 3. 5 HGL from Site (0m to 500m) to Sea, for SLR 1m and 1.3m – 100yr-climate Change

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

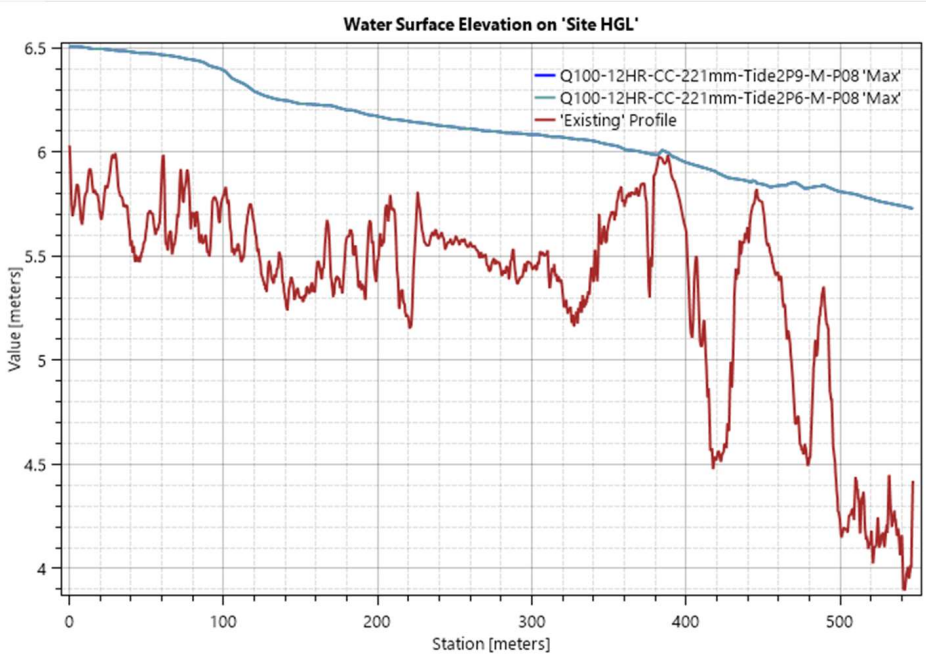


Figure 3.6 Site HGL comparing SLR of 1m and 1.3m – 100yr-climate change

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

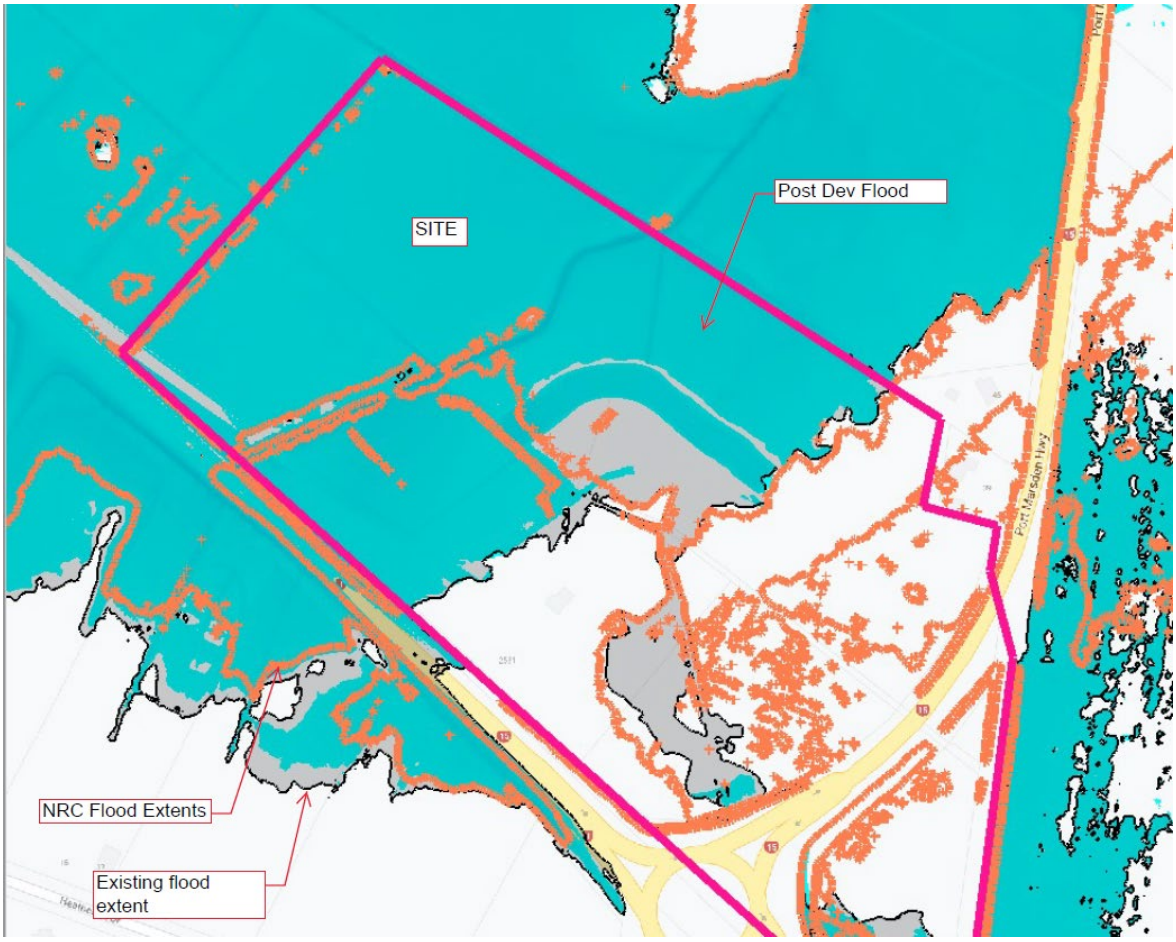


Figure 3.9 Pre and Post Development flooding overlayed

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

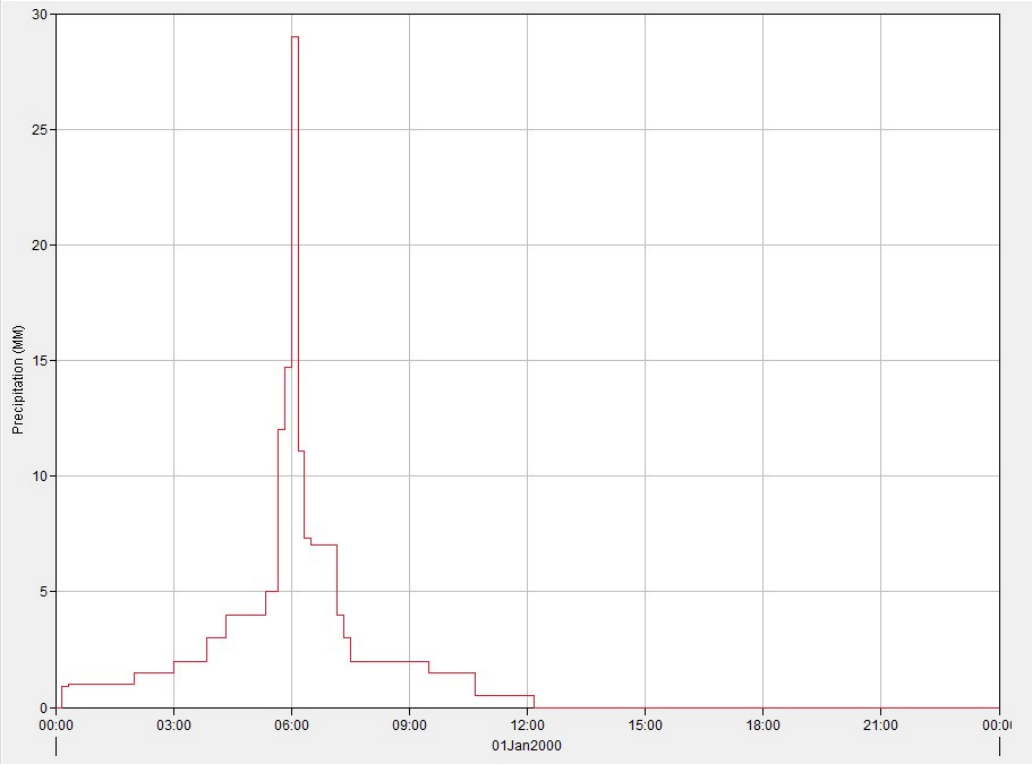
The purpose of this report is to provide an assessment of stormwater runoff volumes and design parameters for attenuation of runoff to control the following rainfall event:

- 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

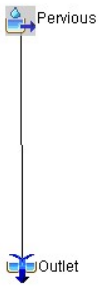
Runoff Factors – Type C Soils

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

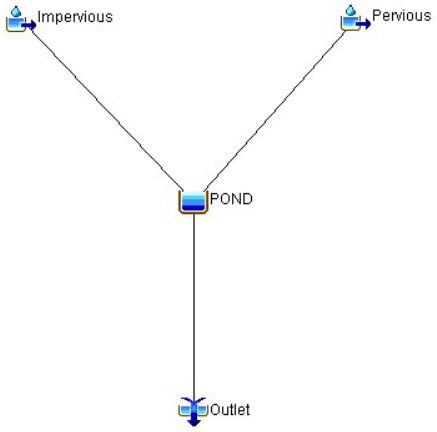
Runoff Factors – Type C Soil (Clay soils)

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

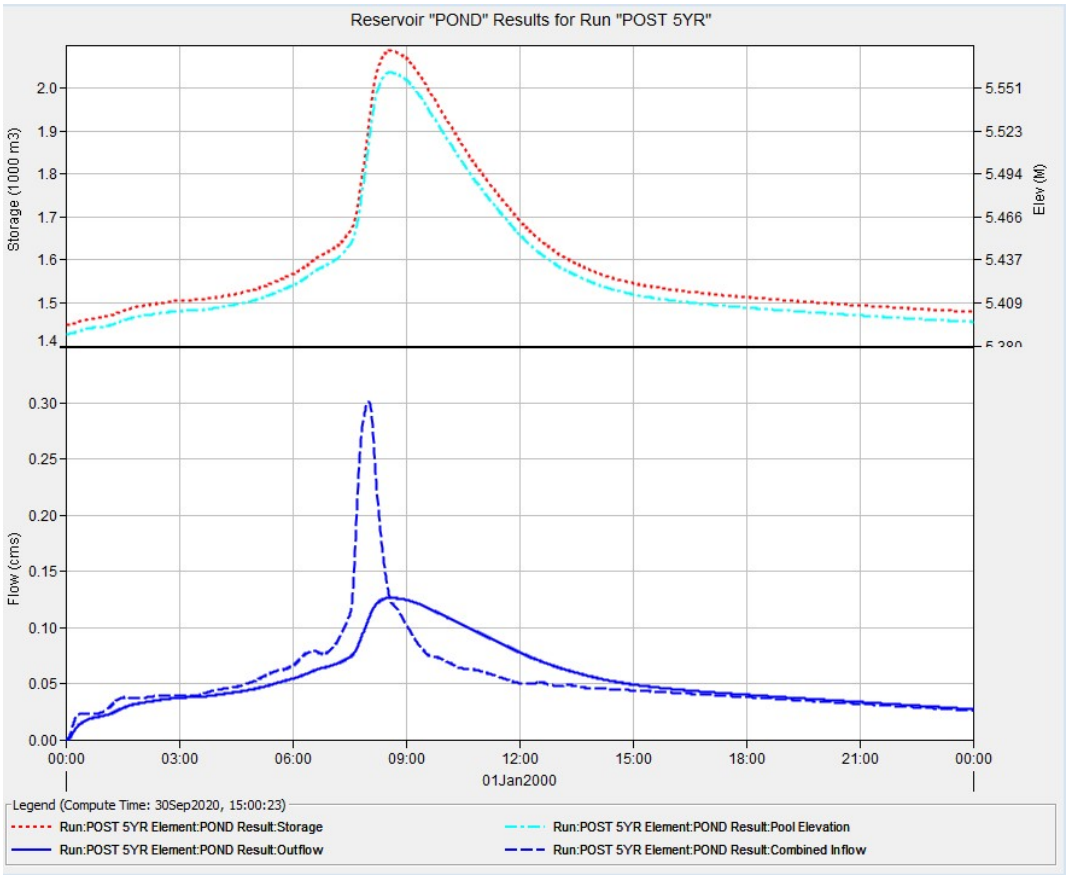
Start of Run: 01Jan2000, 00:00 Basin Model: Post Dev
End of Run: 02Jan2000, 00:00 Meteorologic Model: 5YR
Compute Time: 30Sep2020, 14:59:35 Control Specifications: 24 hour

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

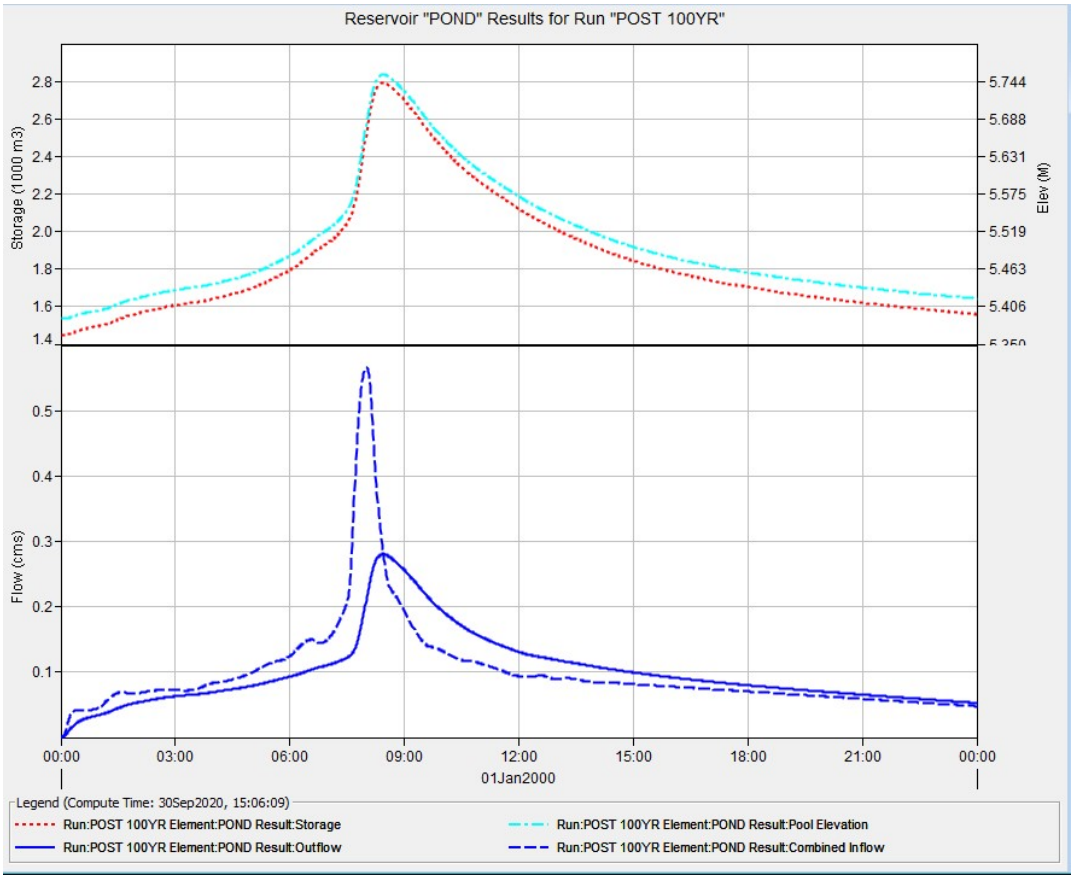
Basin Model: Post Dev
Meteorologic Model: 100+cc
Control Specifications: 24 hour

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

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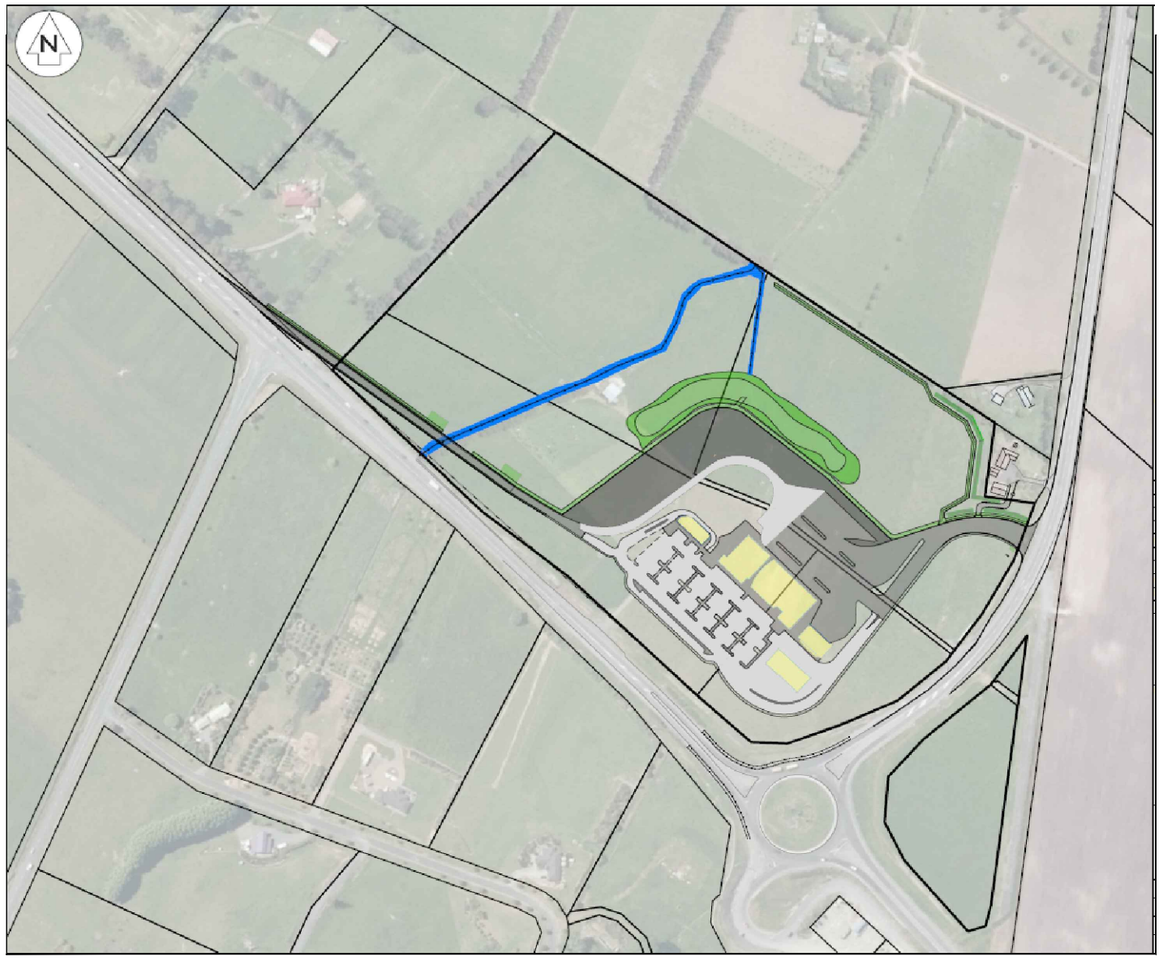
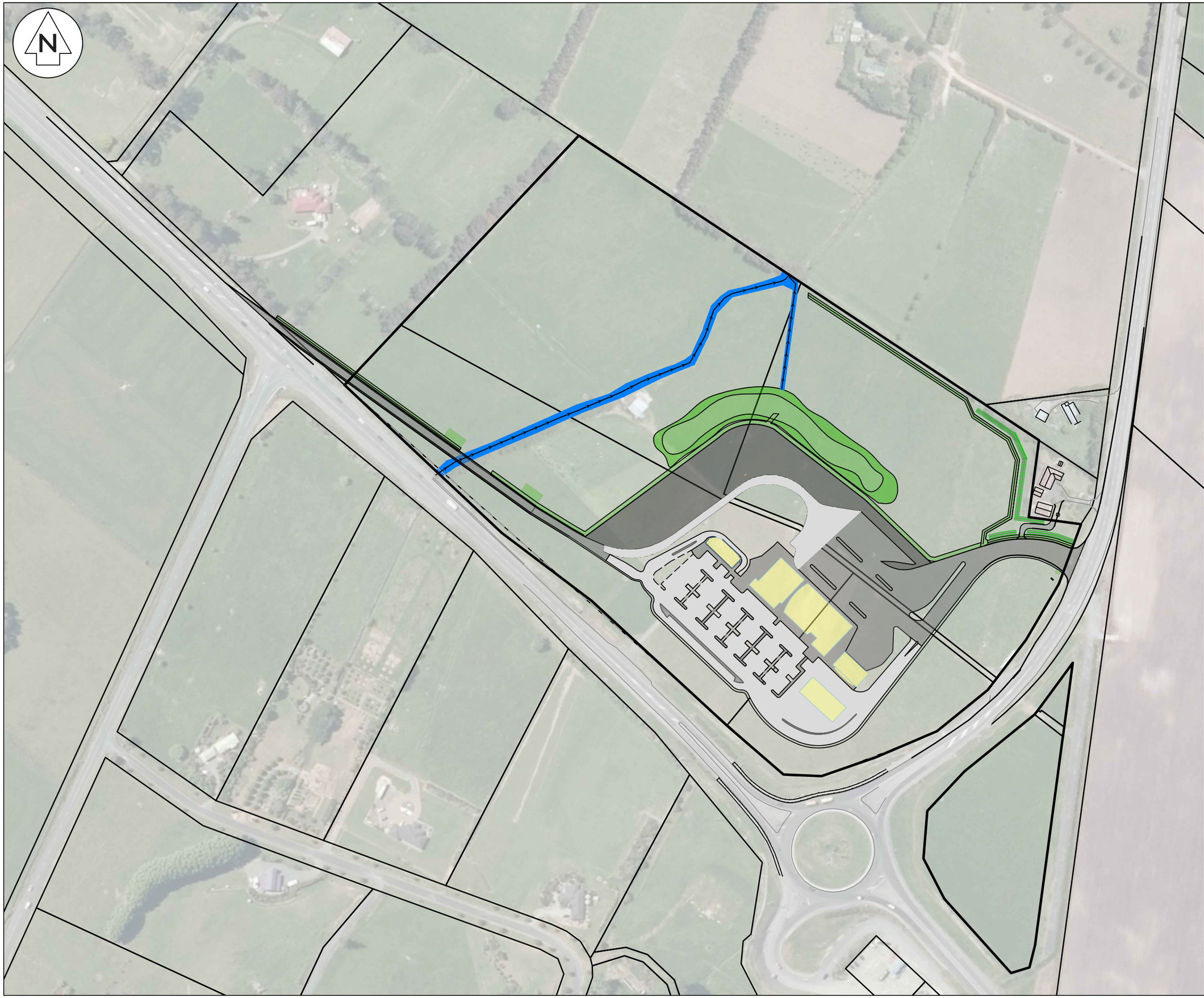


LOCALITY PLAN

SCALE 1:100 @ A3

DRAWINGS



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Legend

EX BDY

PROP BDY

Rev	Description	By	Date
A	RC	JK	10/20

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Survey	LANDS & SURVEY	06/19
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PROPOSED CONCEPT OVERVIEW PLAN

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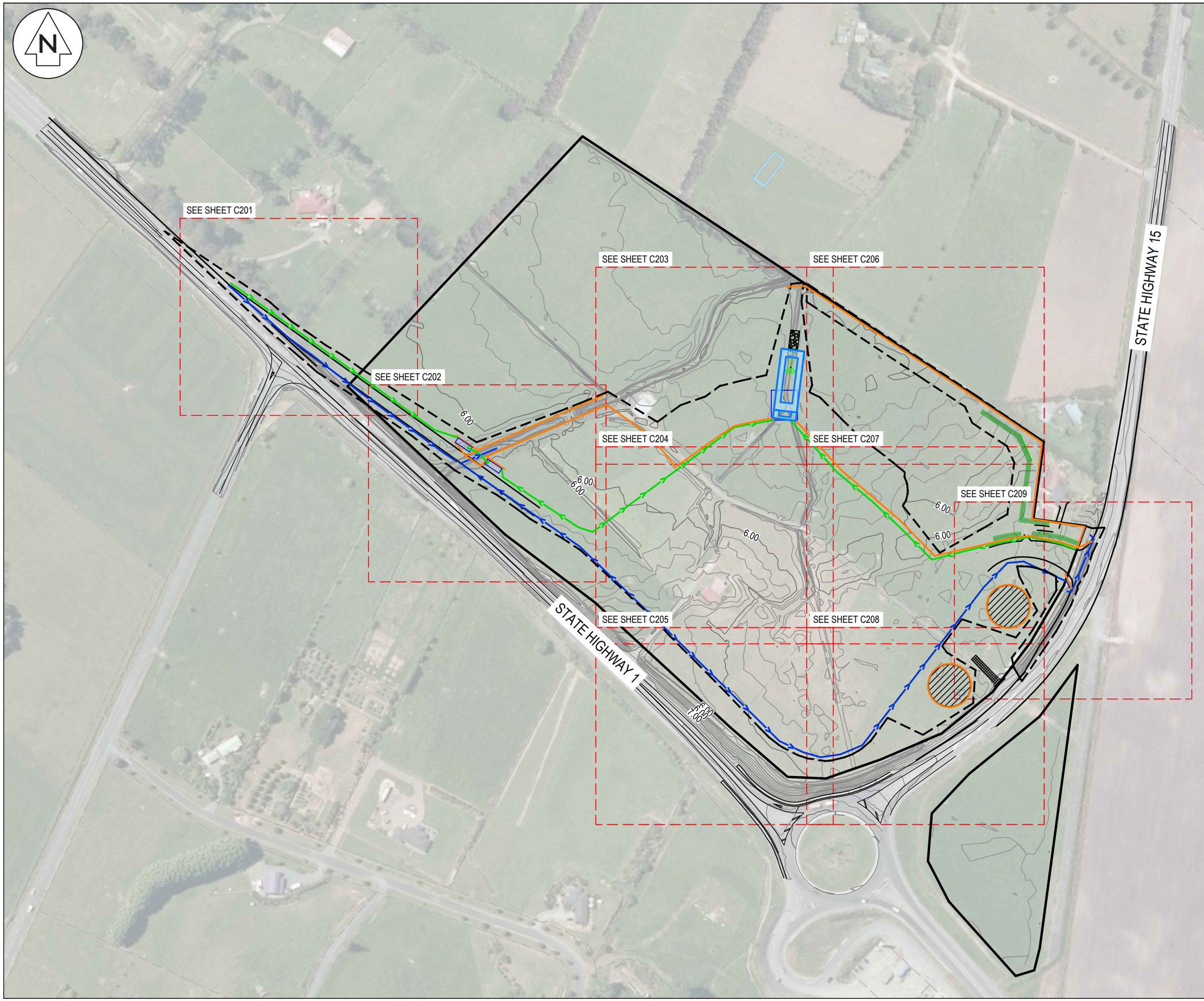
Scale	1:2500 @ A3		
Cad file	C100 CONCEPT.DWG		
Drawing no.	C100	Rev	A



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Rev	Description	By	Date
A	RC	KH	09/20

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PROPOSED EARTHWORKS OVERVIEW PLAN

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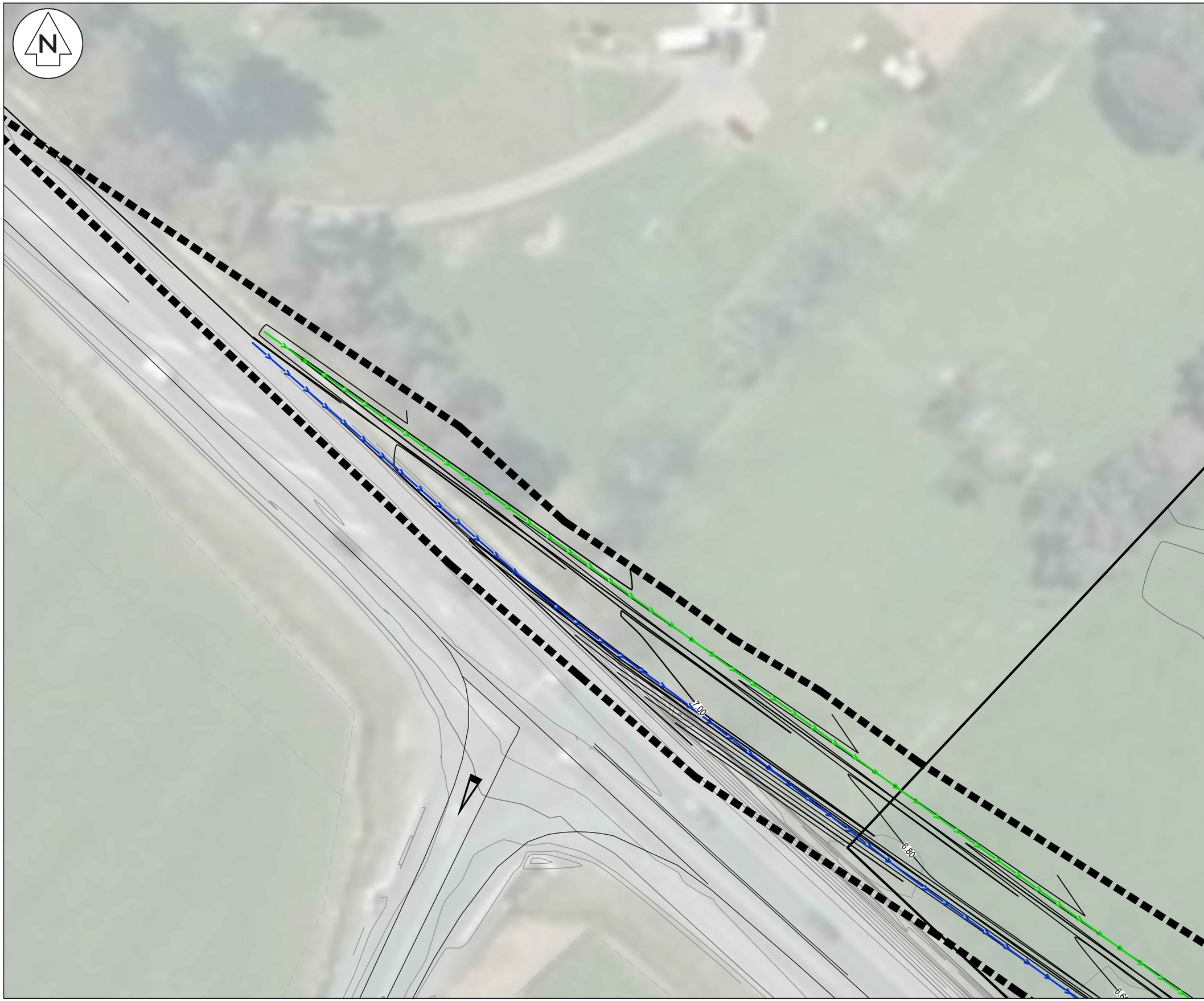
Scale	1:2500 @ A3		
Cad file	C200 EW.DWG		
Drawing no.	C200	Rev	A



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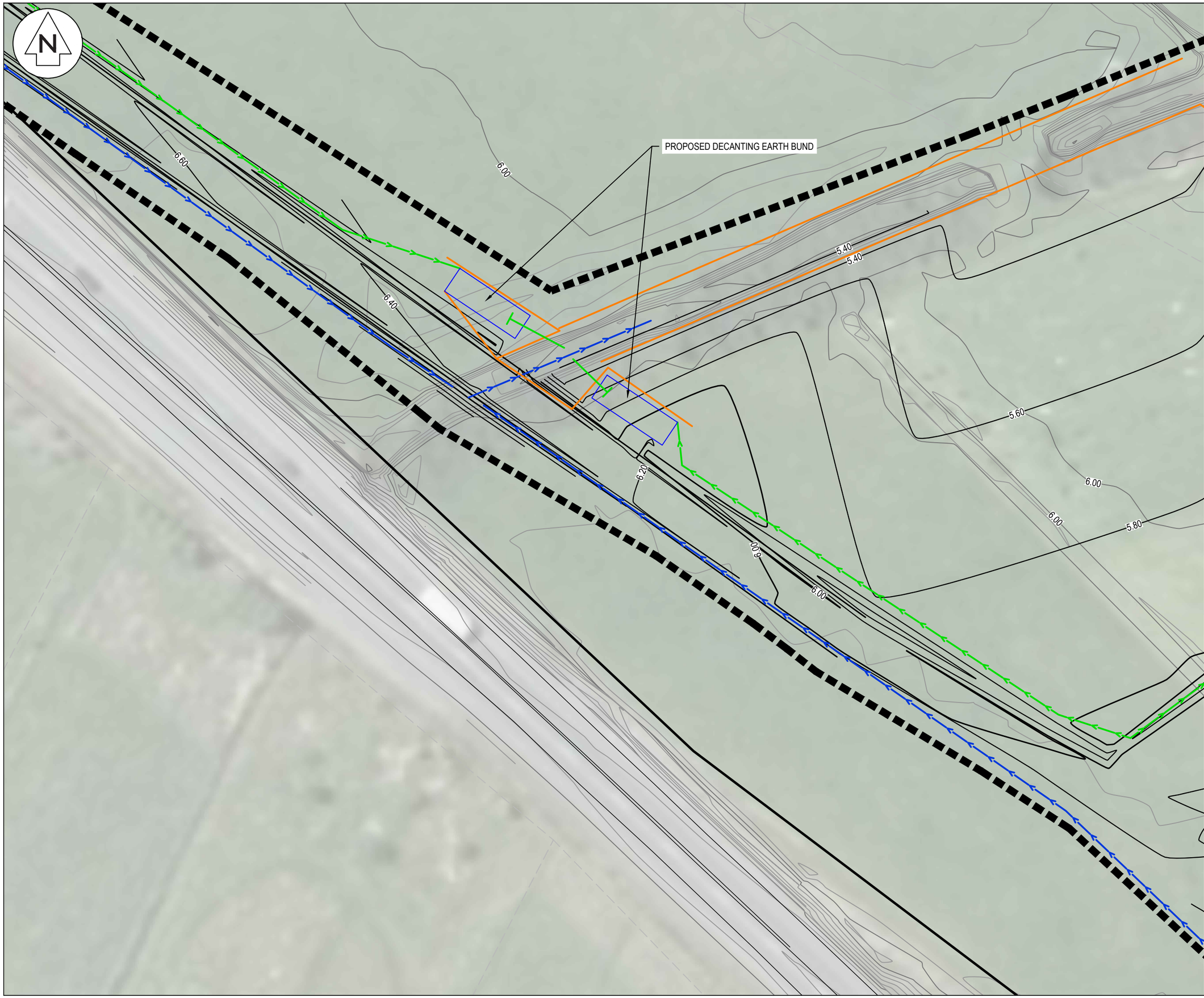

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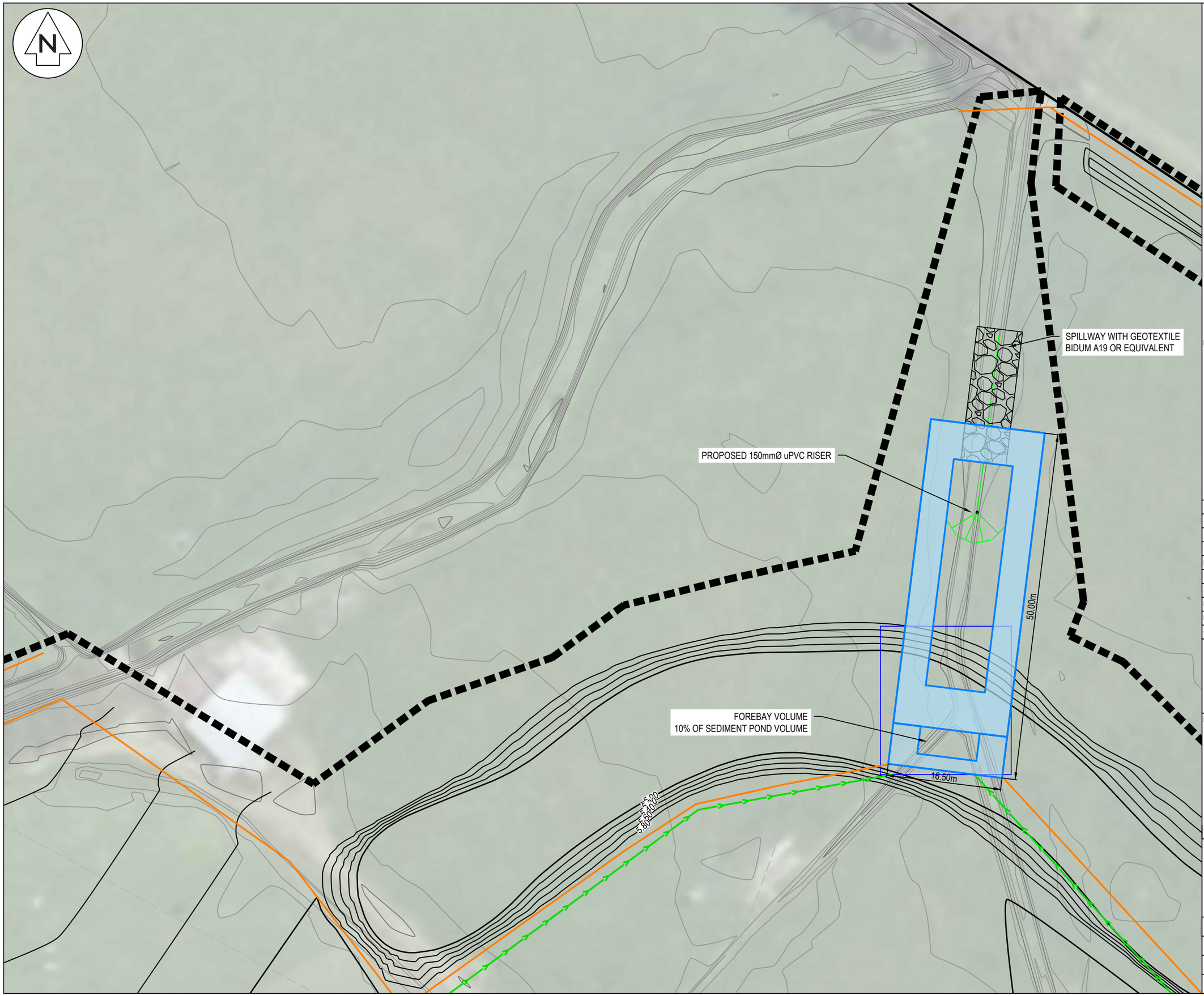
Drawing no.	C202	Rev	A



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Drawing no.	C203	Rev	A

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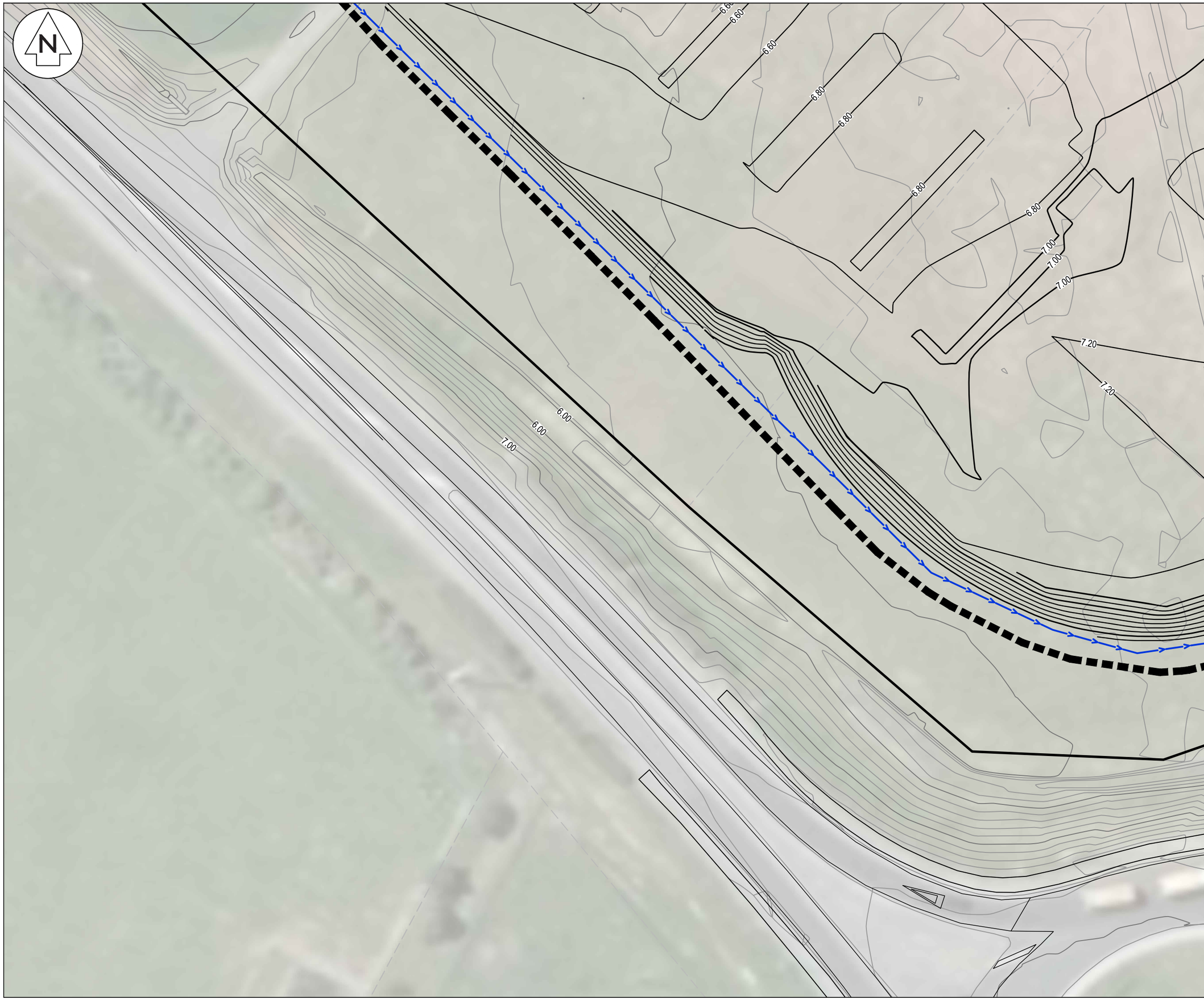
Cad file	C200 EW.DWG		
Drawing no.	C204	Rev	A



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Drawing no.	C205	Rev	A

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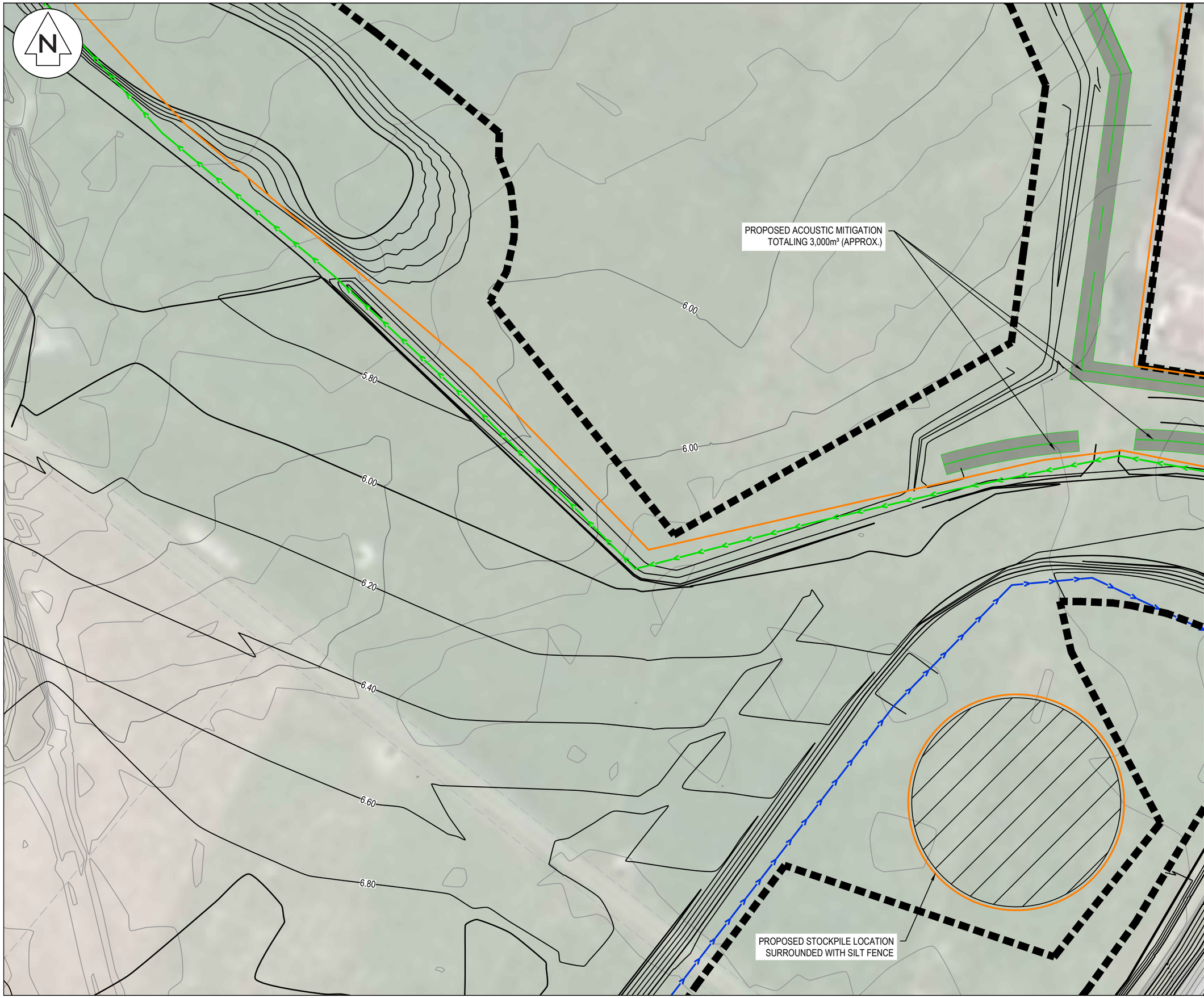
Cad file	C200 EW.DWG		
Drawing no.	C206	Rev	A



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

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- 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

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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

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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 m³
FILL VOLUME		26289 m³
NET FILL		21700m³
TOPSOIL STRIPPED (200mm)	=	10,845 m³
EARTHWORKS AREA	=	57629m²

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

Notes

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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

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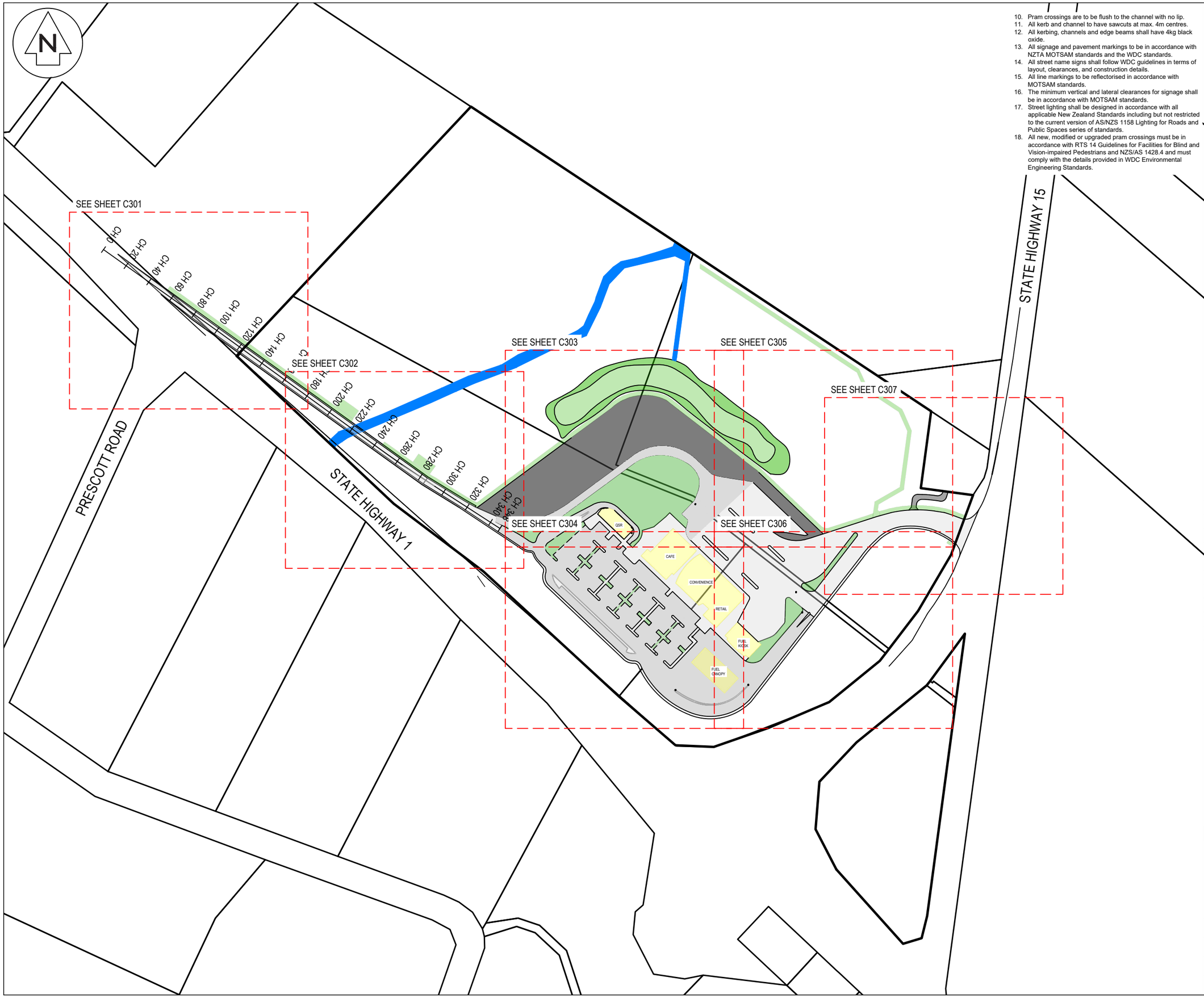
Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

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.
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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

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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

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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

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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

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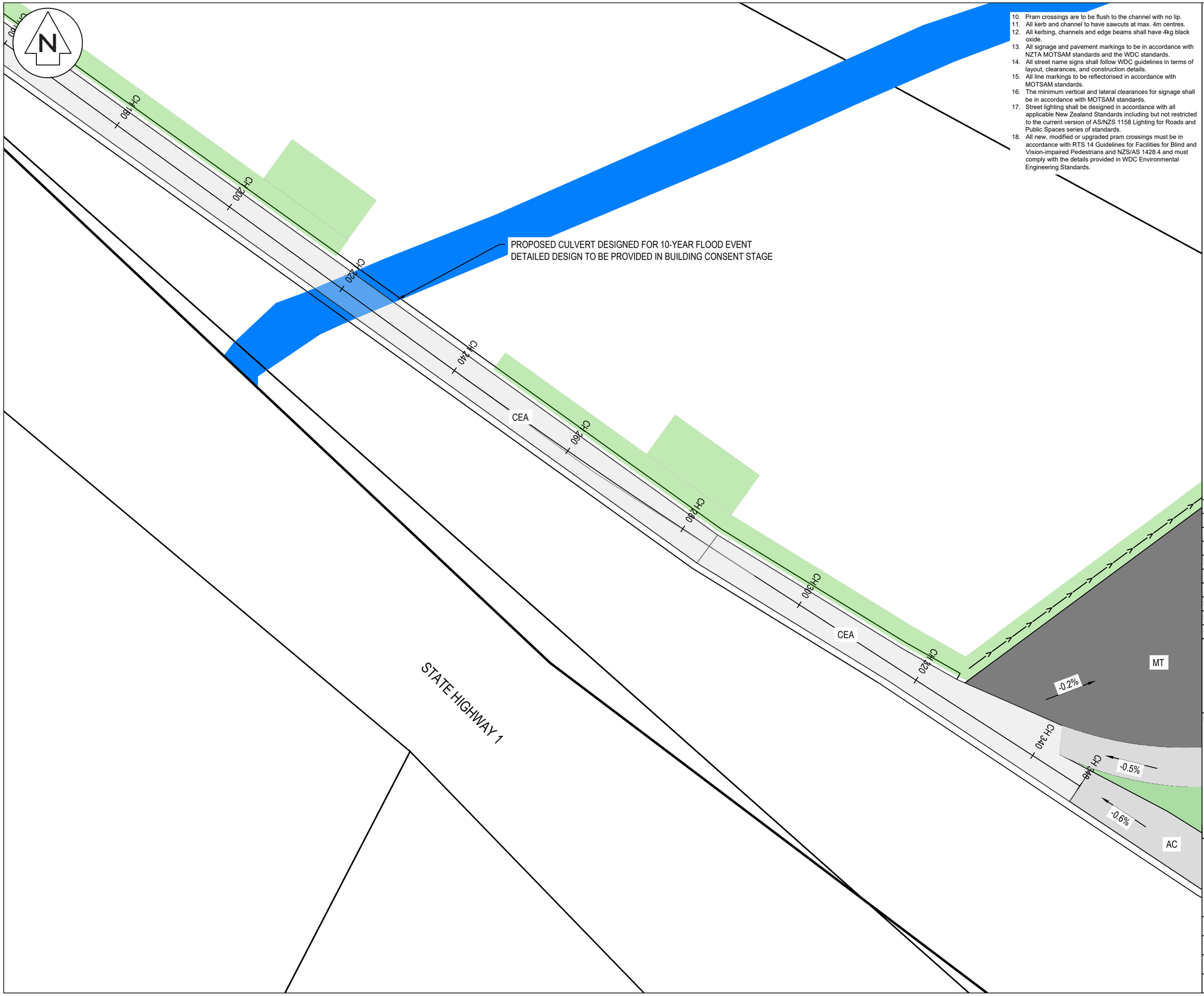
Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED ROADING PLAN

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



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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

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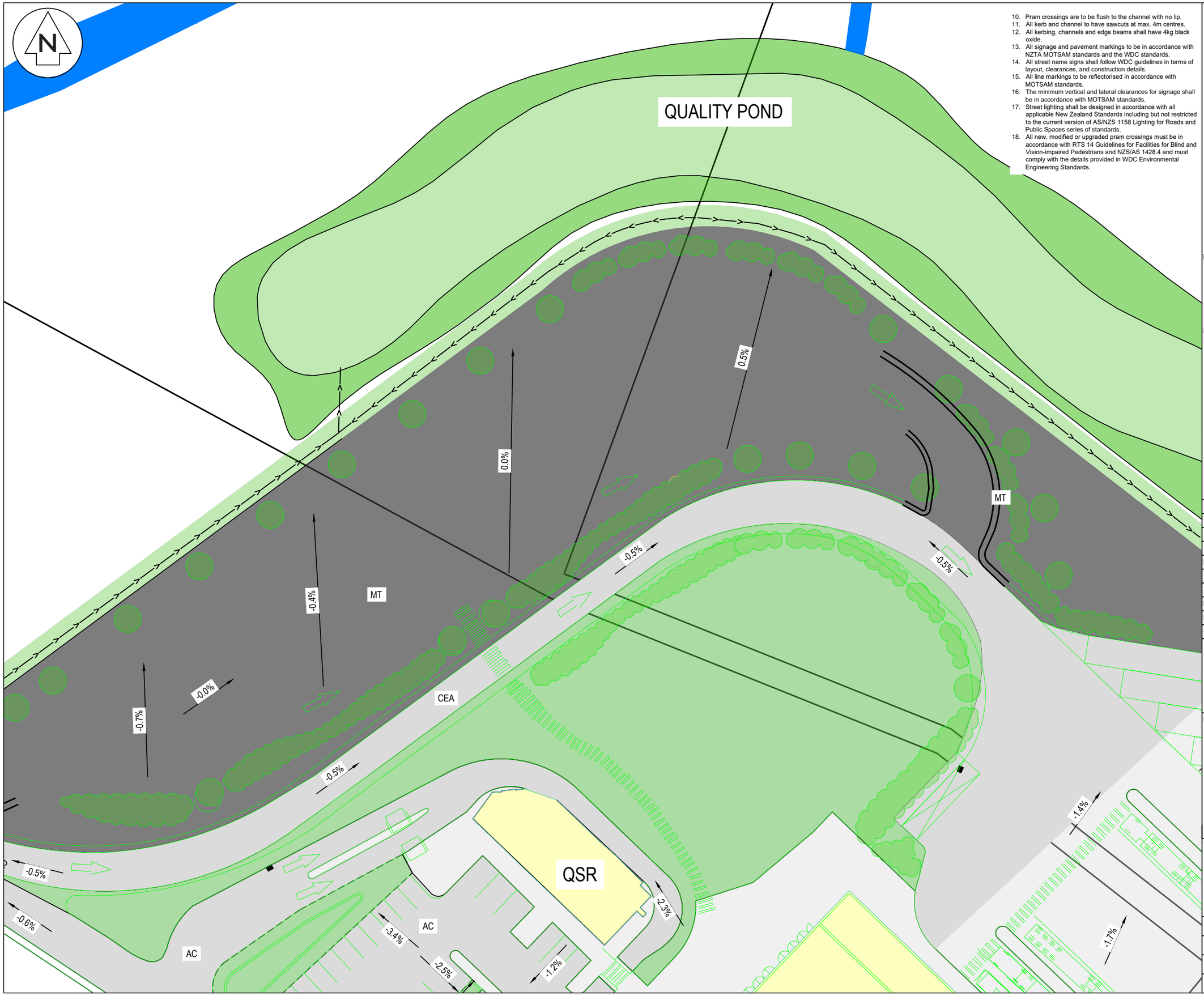
Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED ROADING PLAN

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



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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

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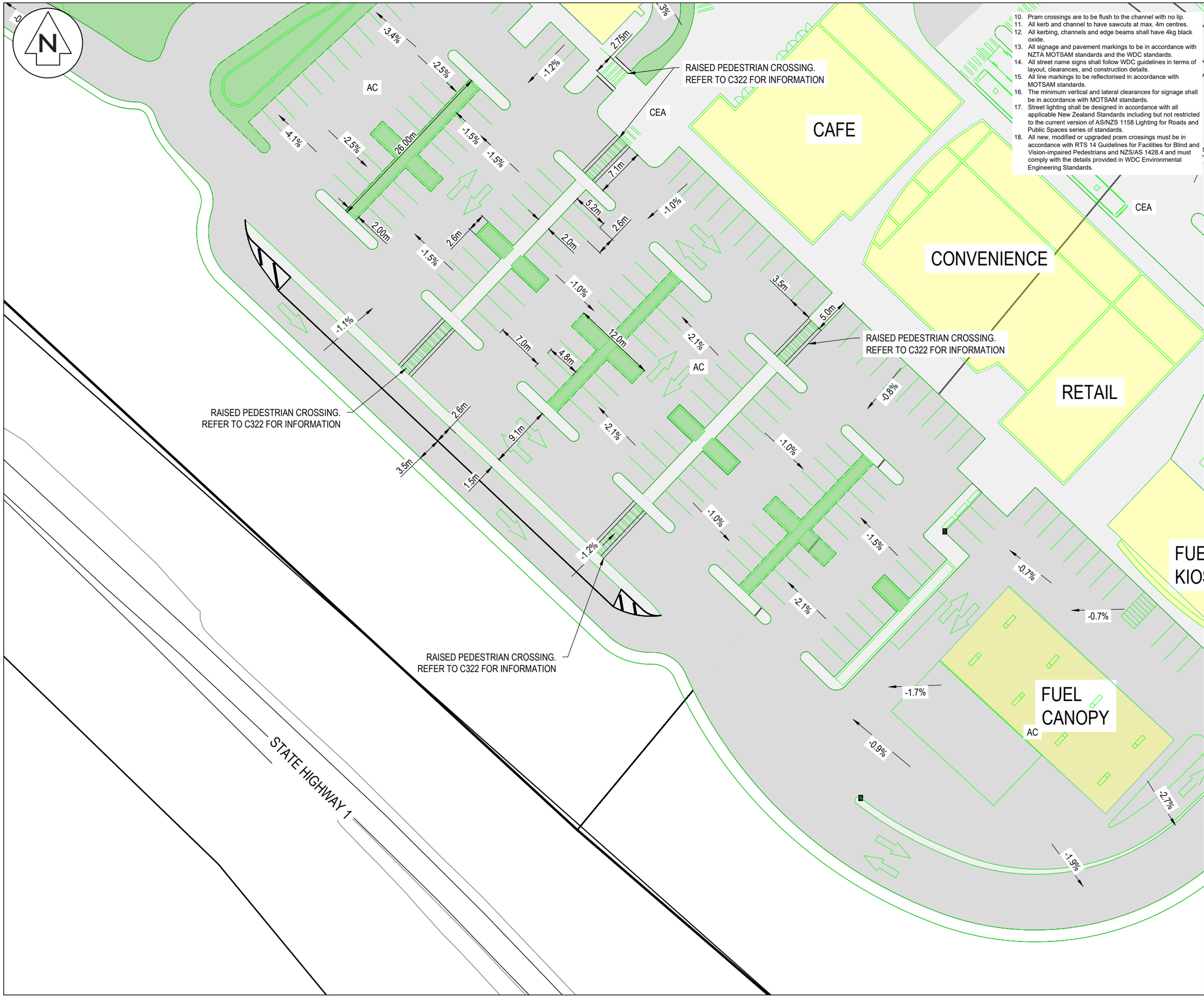
Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED ROADING PLAN

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



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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
B	S92	KH	02/21
A	RC	KH	09/20

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

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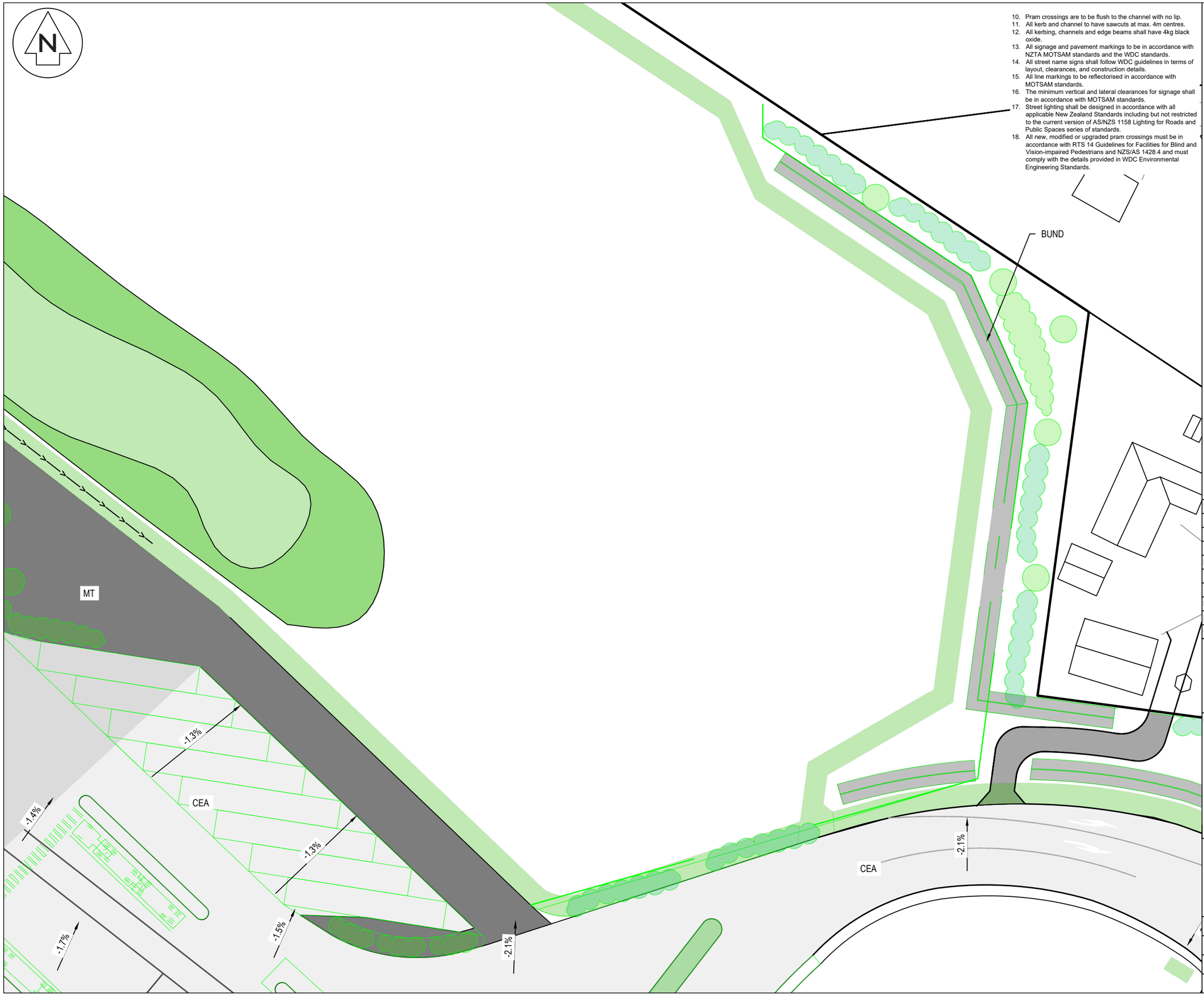
Project

RUAKAKA SERVICE CENTER FOR RUAKAKA DEVELOPMENT LIMITED

Title

PROPOSED ROADING PLAN

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



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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
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	PROP ASPHALT
	PROP RAINGARDEN
	PROP CONCRETE
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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

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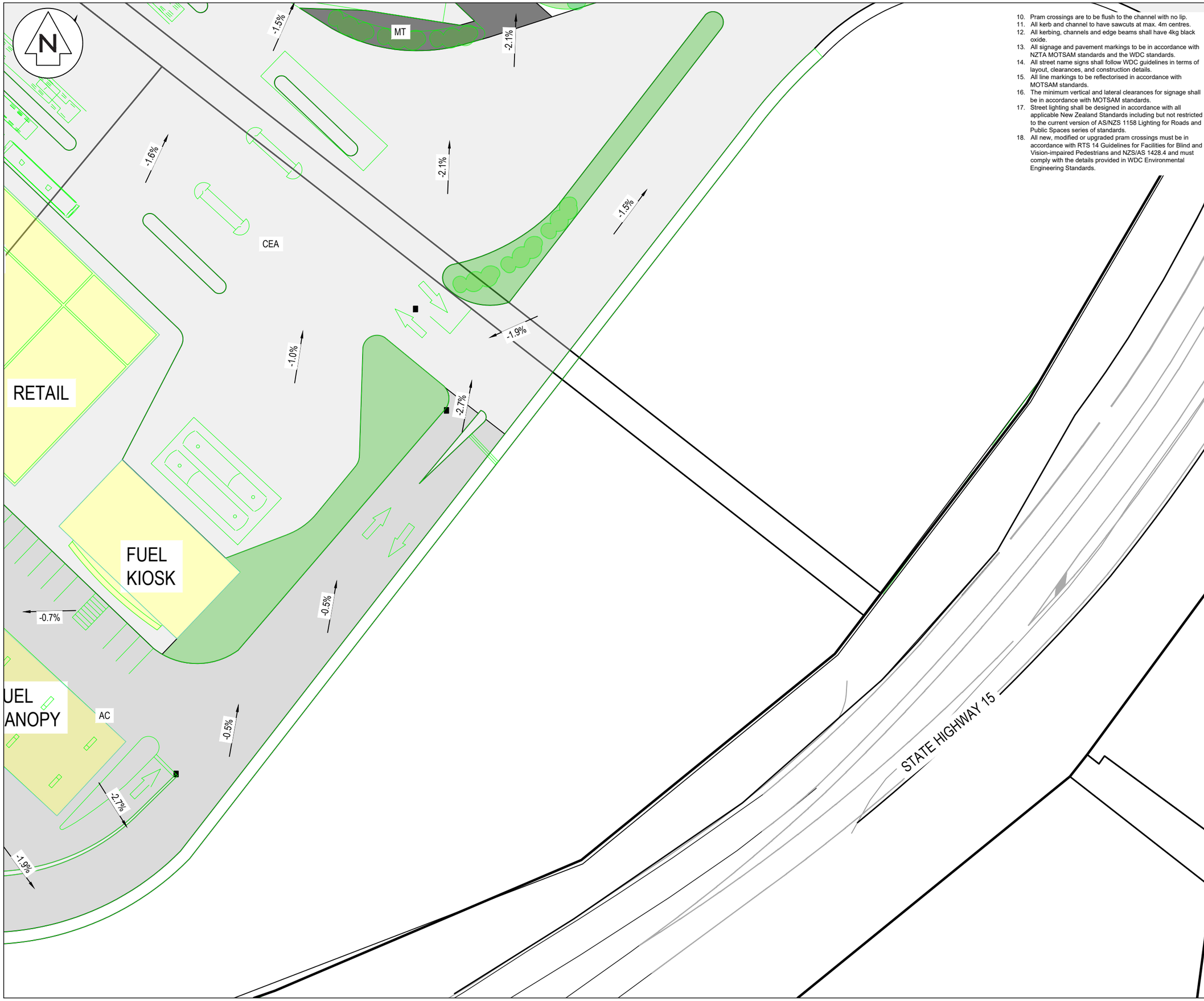
Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED ROADING PLAN

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



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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
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	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

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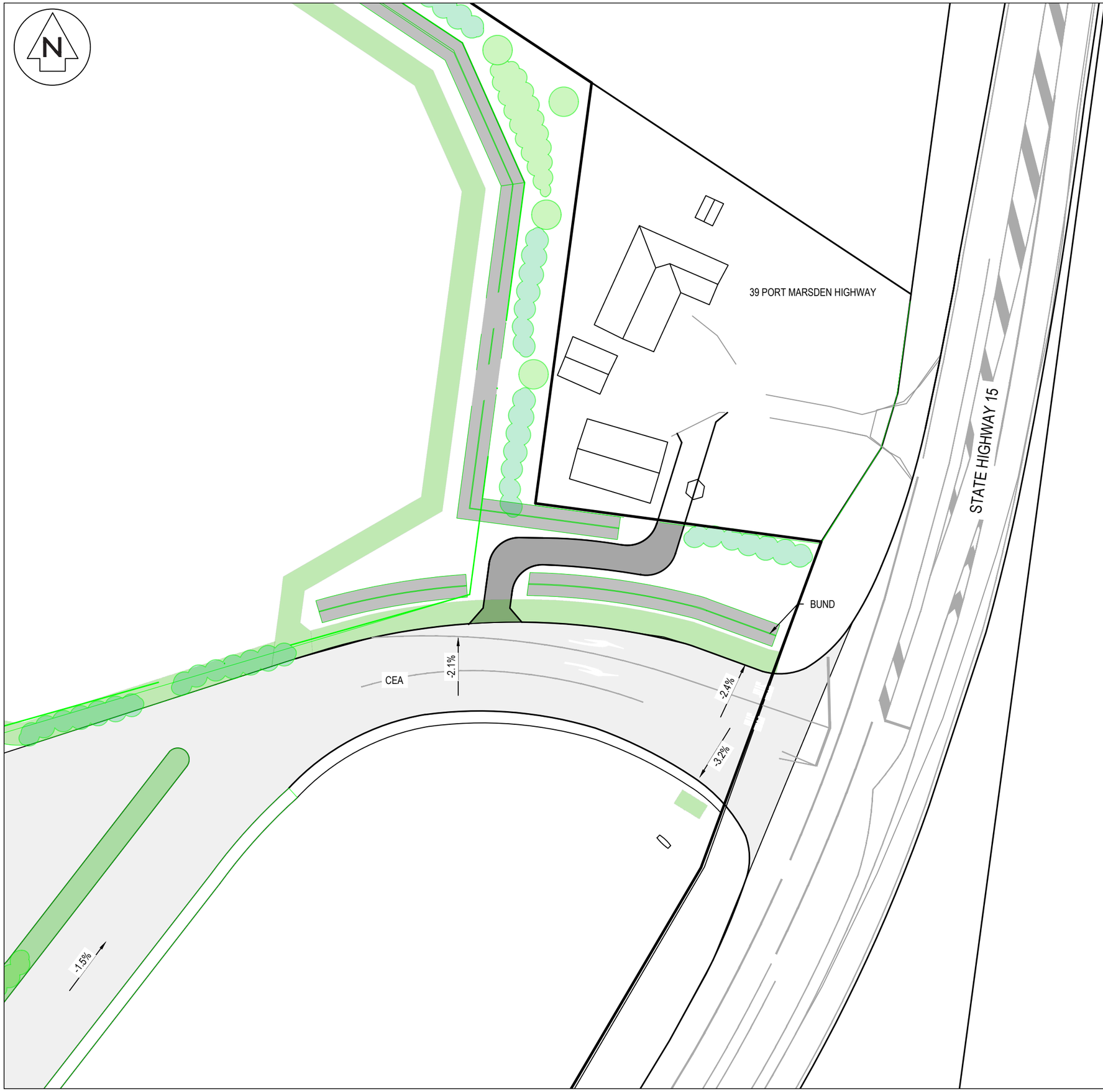
Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

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

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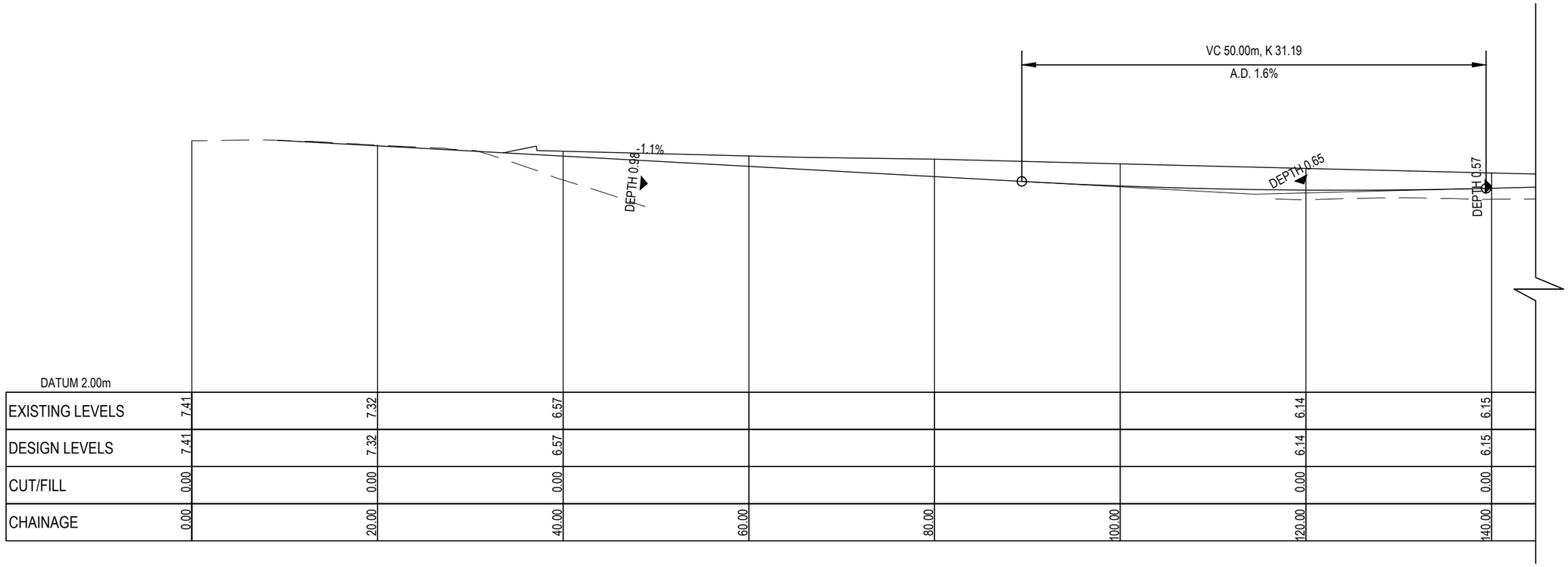
Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED ROADING PLAN

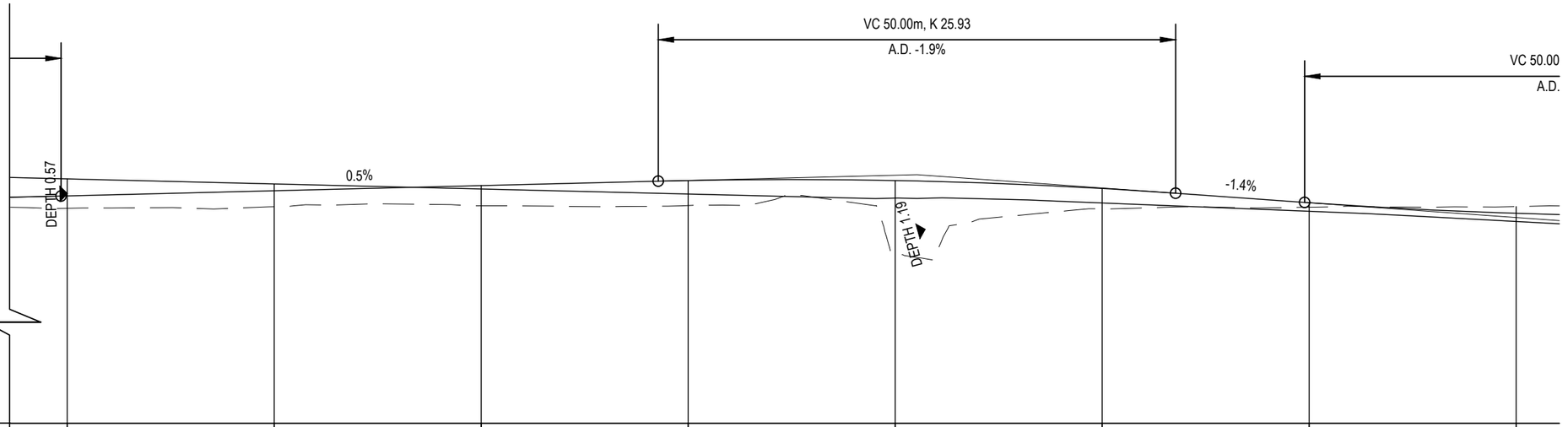
Project no.	117019		
Scale	1:500 @ A3		
Cad file	C300 ROADING.DWG		
Drawing no.	C307	Rev	A



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

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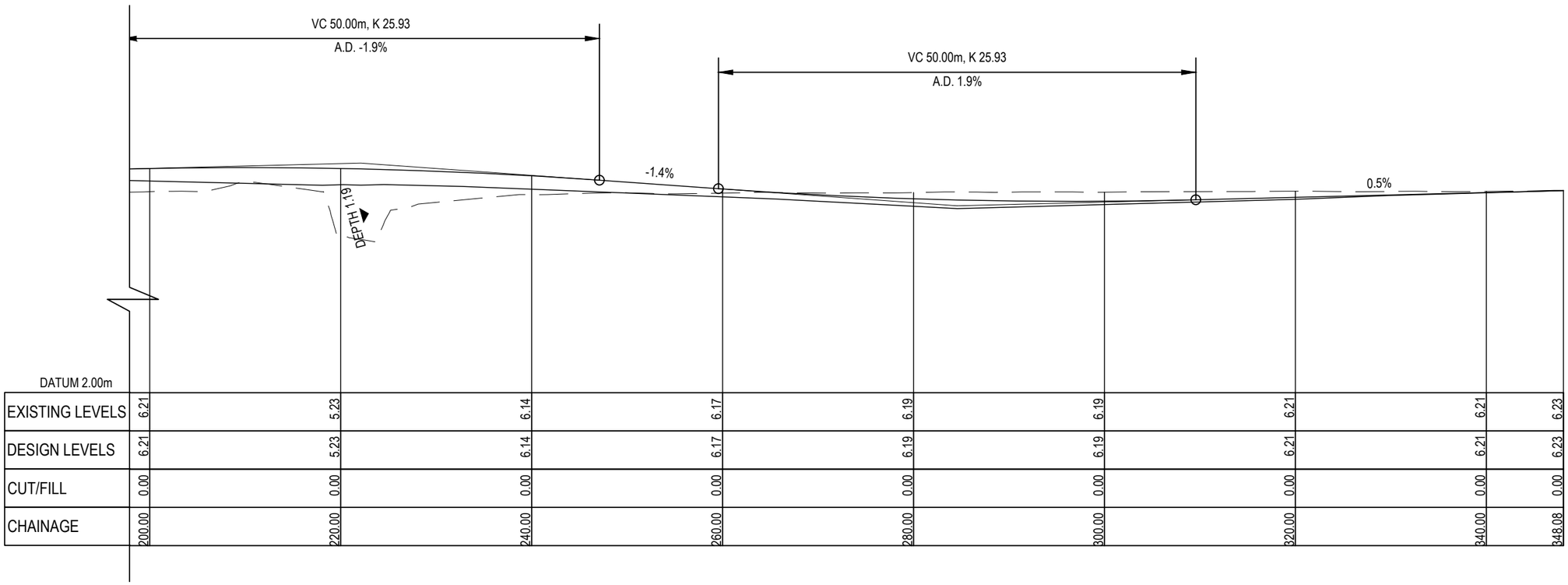
Project
RUAKAKA SERVICE CENTRE FOR S K AOTEAROA TRUST

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

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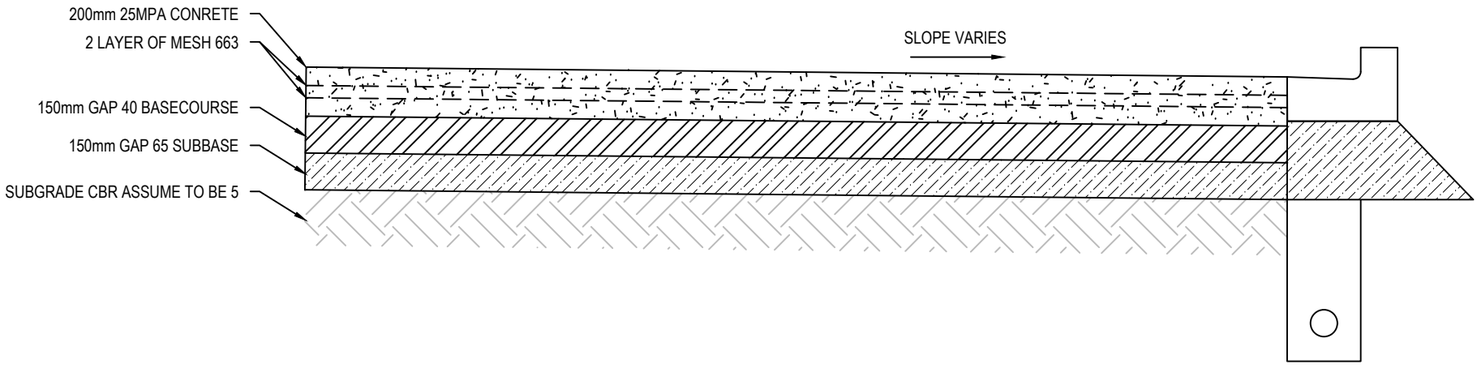
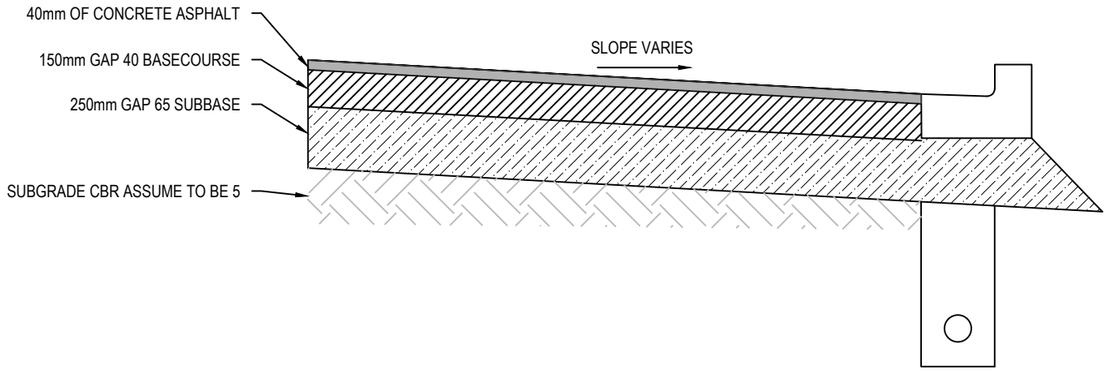
Project
RUAKAKA SERVICE CENTRE FOR S K AOTEAROA TRUST

Title
PROPOSED RAMP LONG SECTION

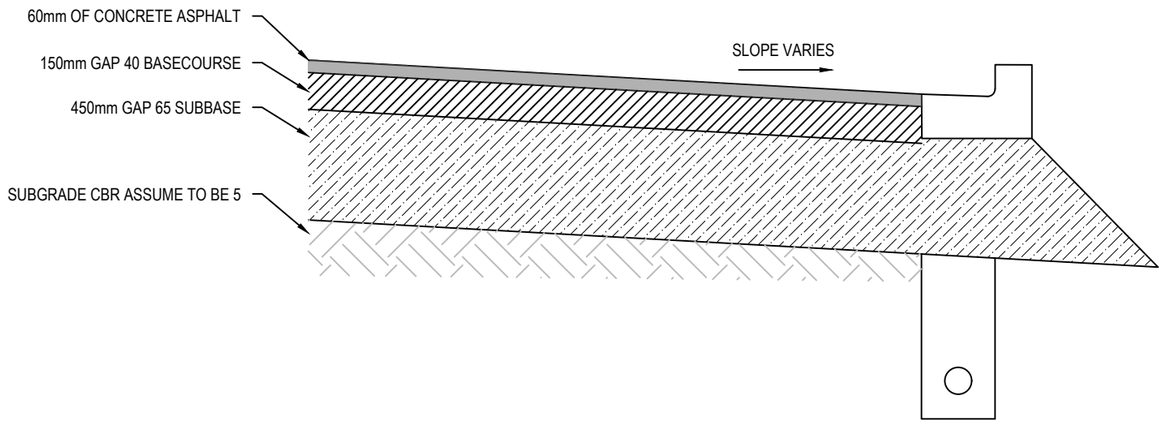
Project no.	117019		
Scale	-		
Cad file	C300 ROADING.DWG		
Drawing no.	C311	Rev	A



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

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

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Project
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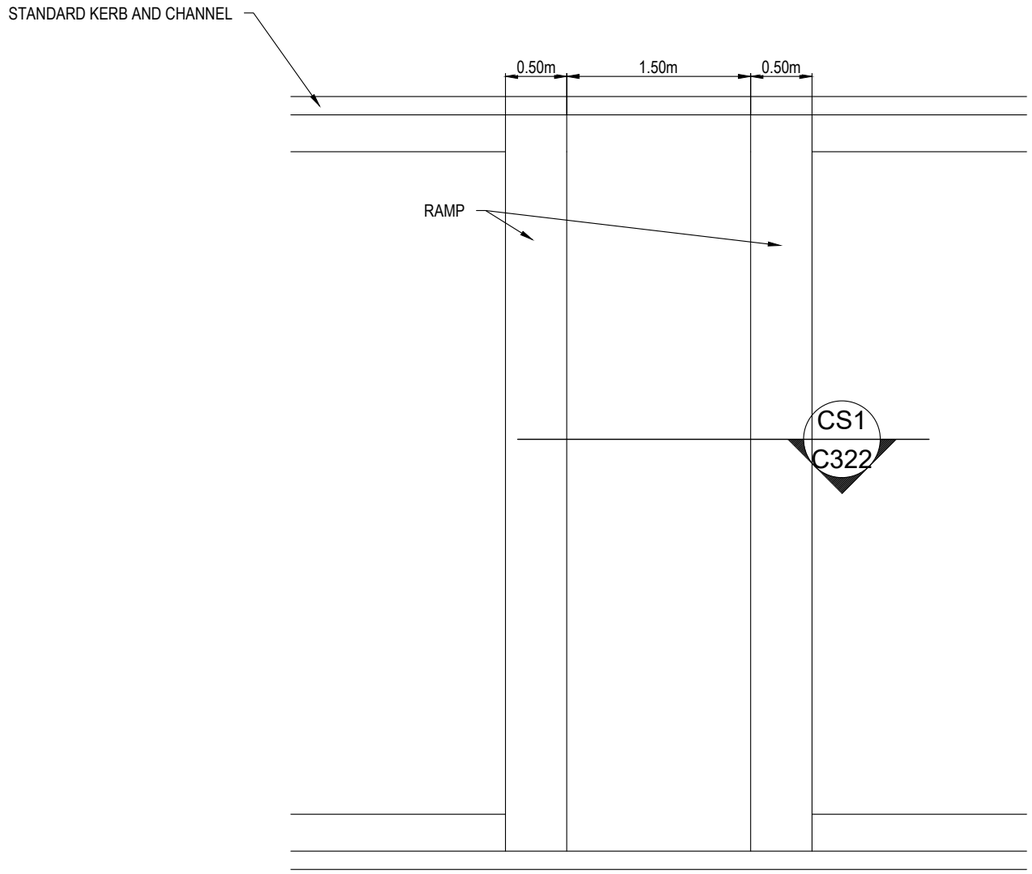
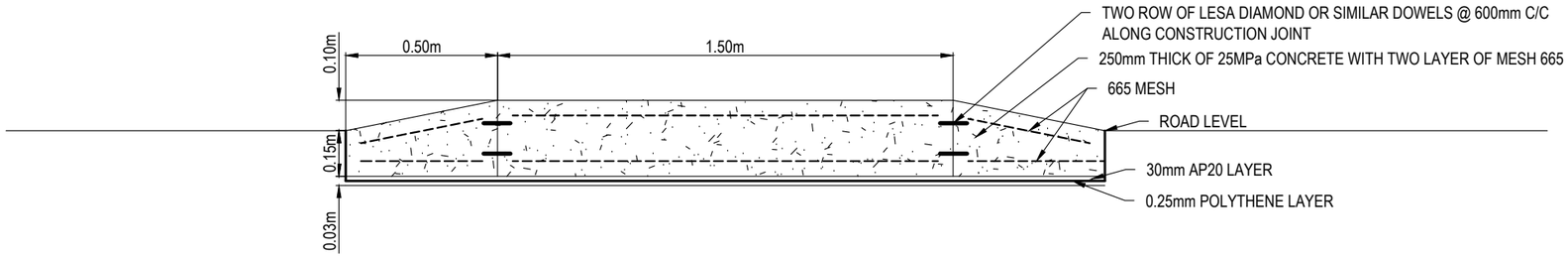
Title
PROPOSED ROADING PAVEMENT DETAIL

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



TYPICAL RAISED PEDESTRIAN CROSSING DETAIL

SCALE 1:50 @ A3



CROSS SECTION 1: RAISED PEDESTRIAN CROSSING

SCALE 1:20 @ A3

Notes

1. Detail design will be provided at building consent stage

Rev	Description	By	Date
A	S92	KH	02/21

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

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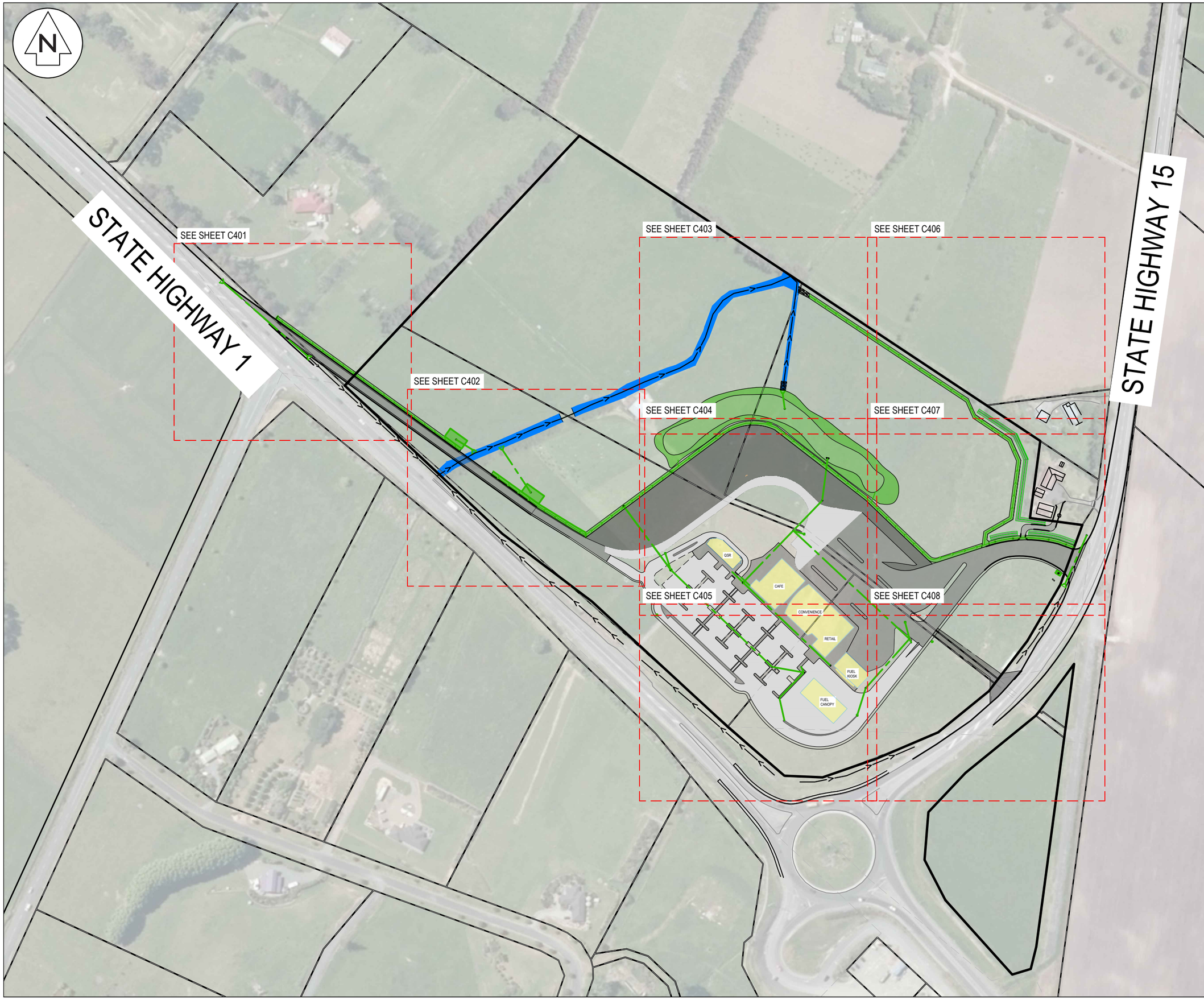
RUAKAKA SERVICE CENTER FOR RUAKAKA DEVELOPMENT LIMITED

Title

PROPOSED RAISED PEDESTRIAN CROSSING DETAIL

Project no.	117019		
Scale	1:500 @ A3		
Cad file	C300 ROADING.DWG		
Drawing no.	C322	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. All bends and connections to be no more than 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
B	EX FARM CROSSING	KH	03/21
A	RC	KH	09/20

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

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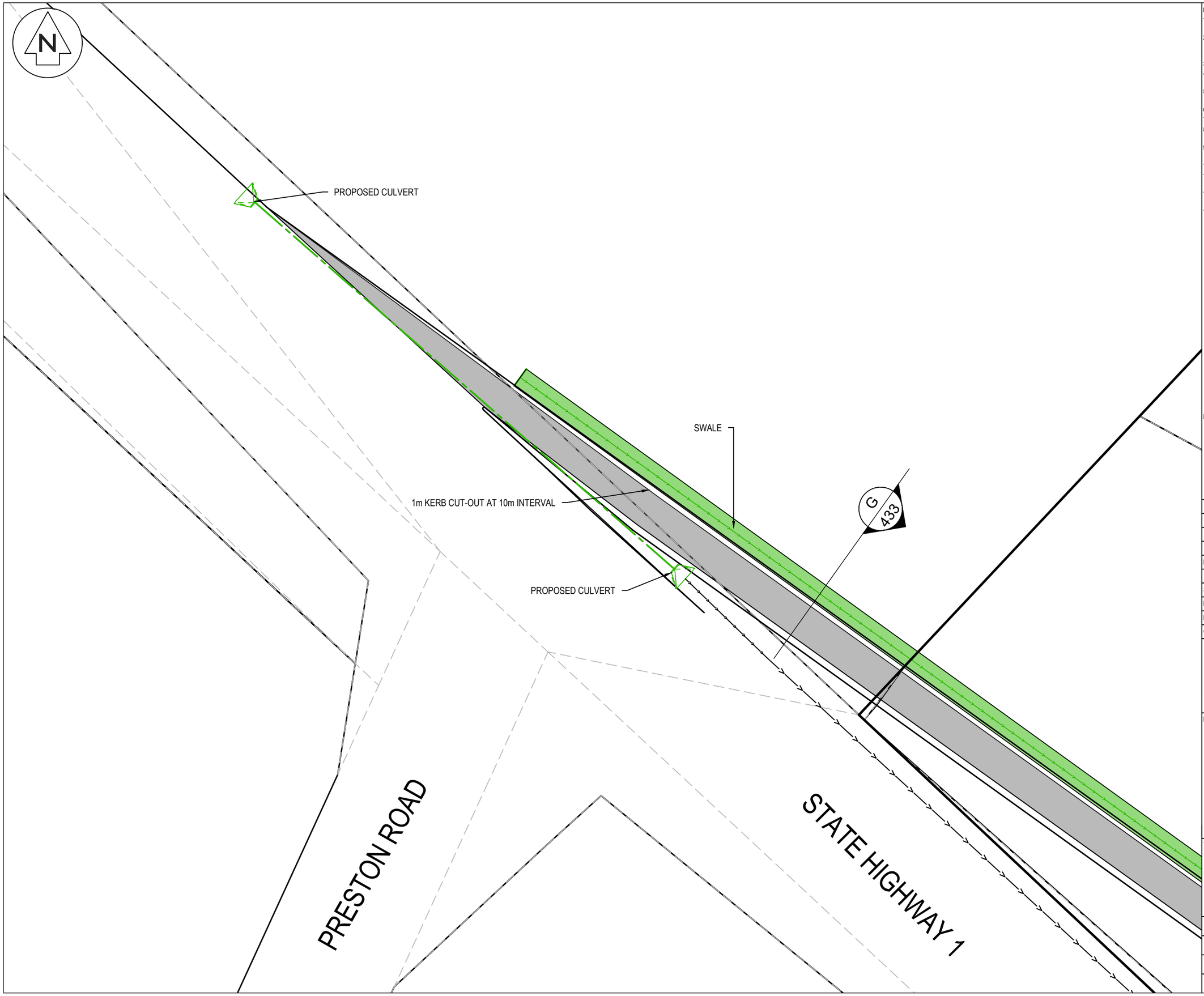
Project

RUAKAKA SERVICE CENTER FOR RUAKAKA DEVELOPMENT LIMITED

Title

PROPOSED PRIVATE STORMWATER DRAINAGE OVERVIEW PLAN

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



Notes

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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

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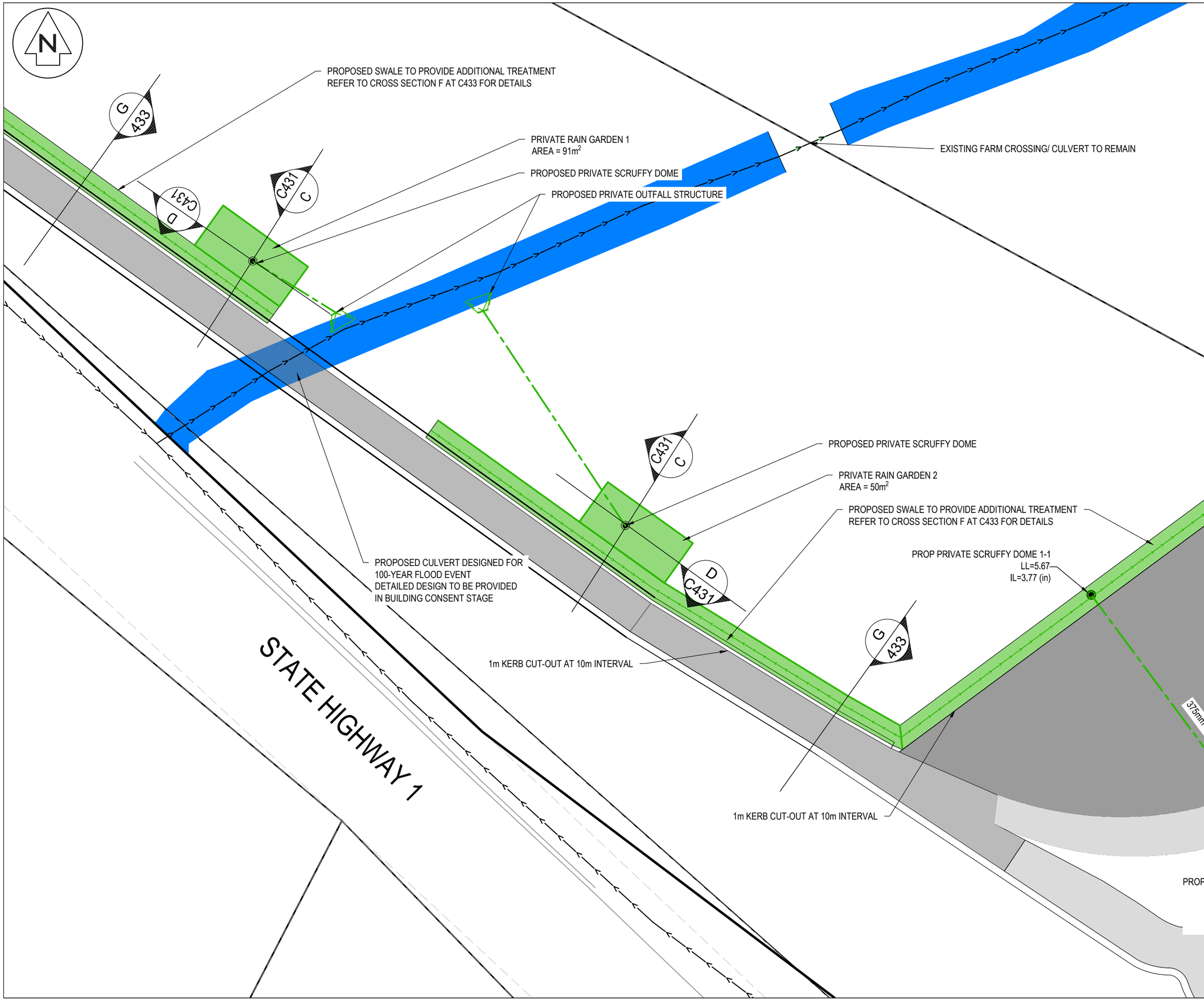
Project

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

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Legend

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

Rev	Description	By	Date
B	EX FARM CROSSING	KH	03/21
A	RC	KH	09/20

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

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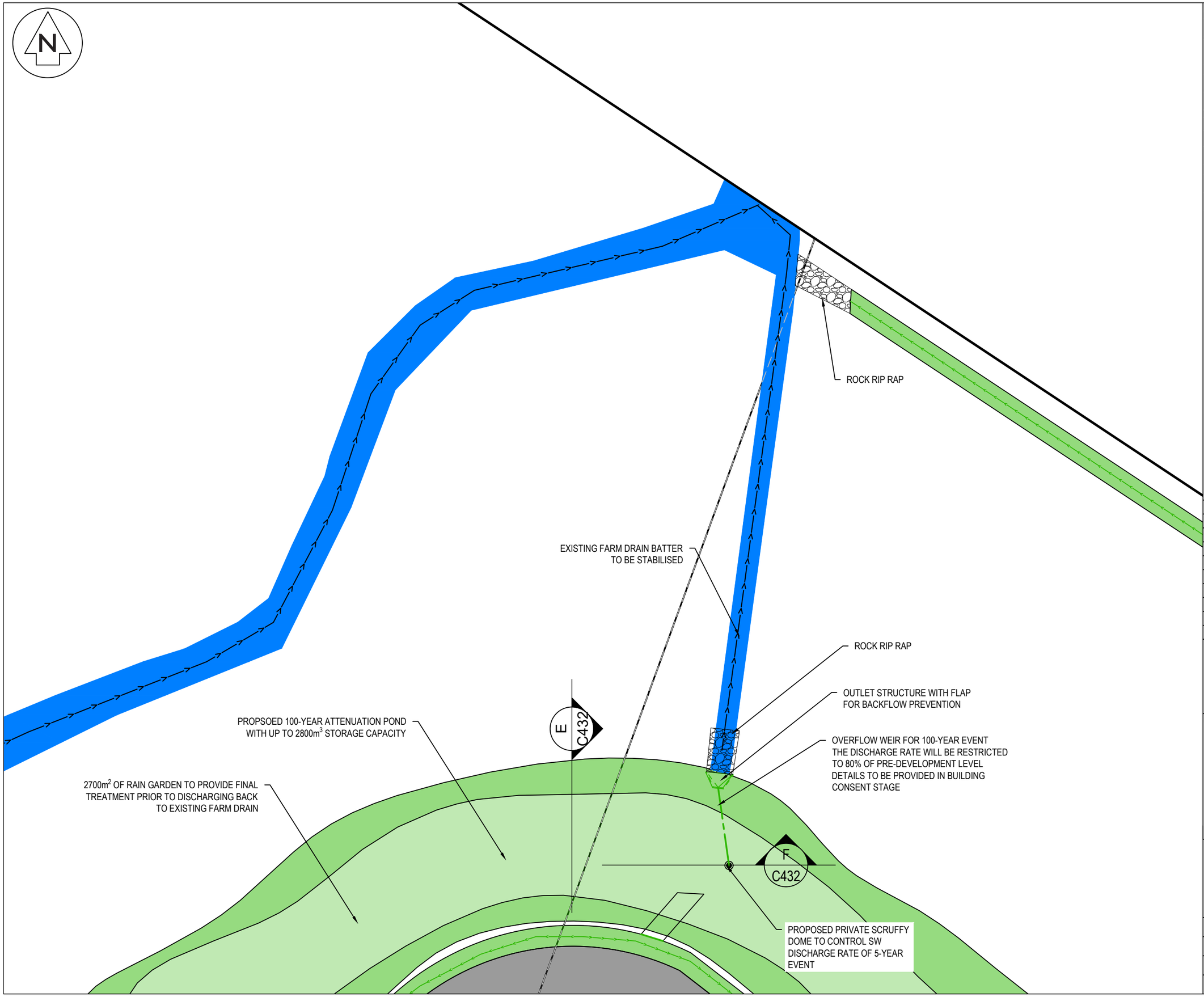
Project

RUAKAKA SERVICE CENTER FOR RUAKAKA DEVELOPMENT LIMITED

Title

PROPOSED PRIVATE STORMWATER DRAINAGE PLAN

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



Notes

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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

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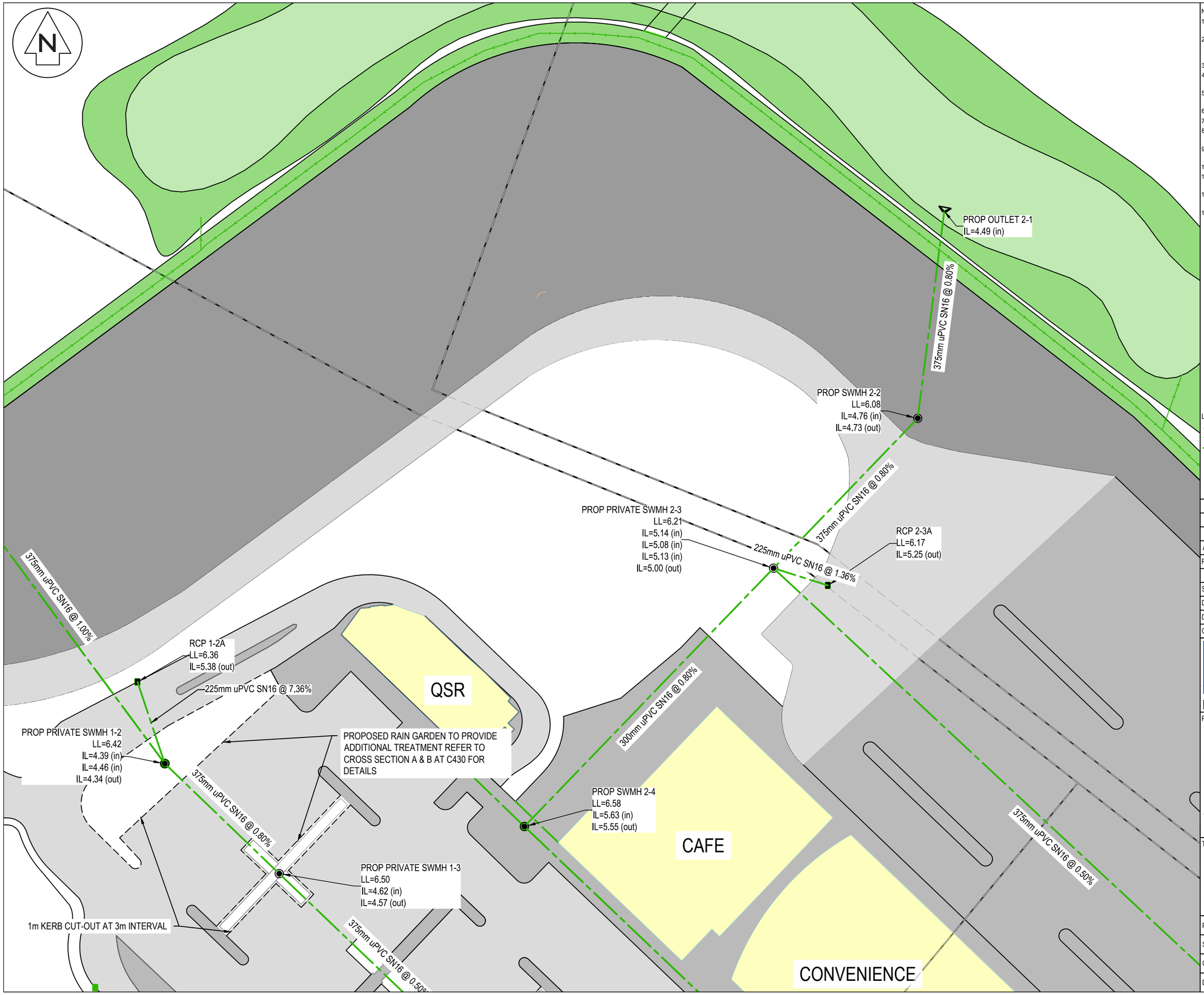
Project

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

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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

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Project
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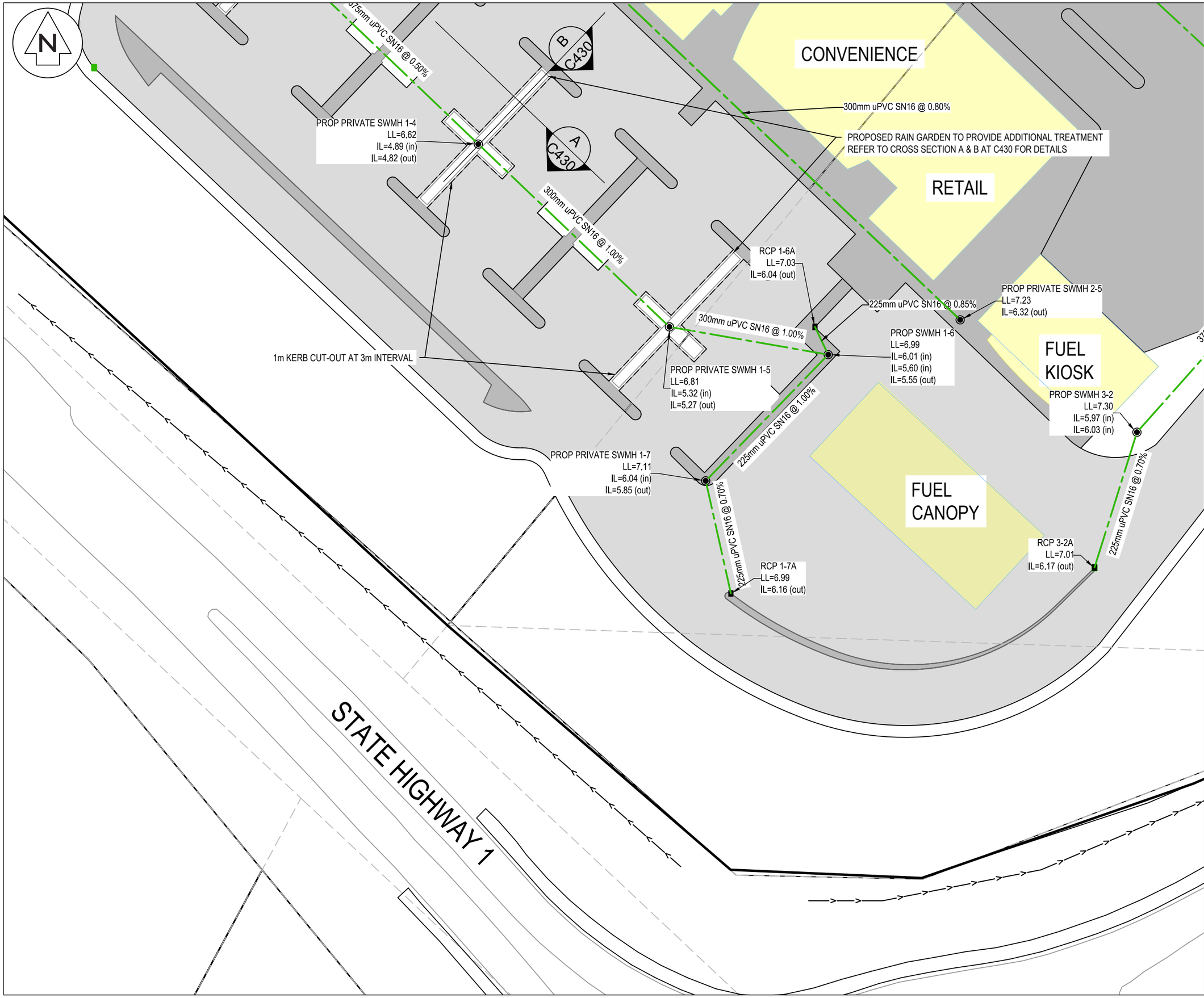
Title
PROPOSED PRIVATE STORMWATER DRAINAGE PLAN

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



Notes

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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

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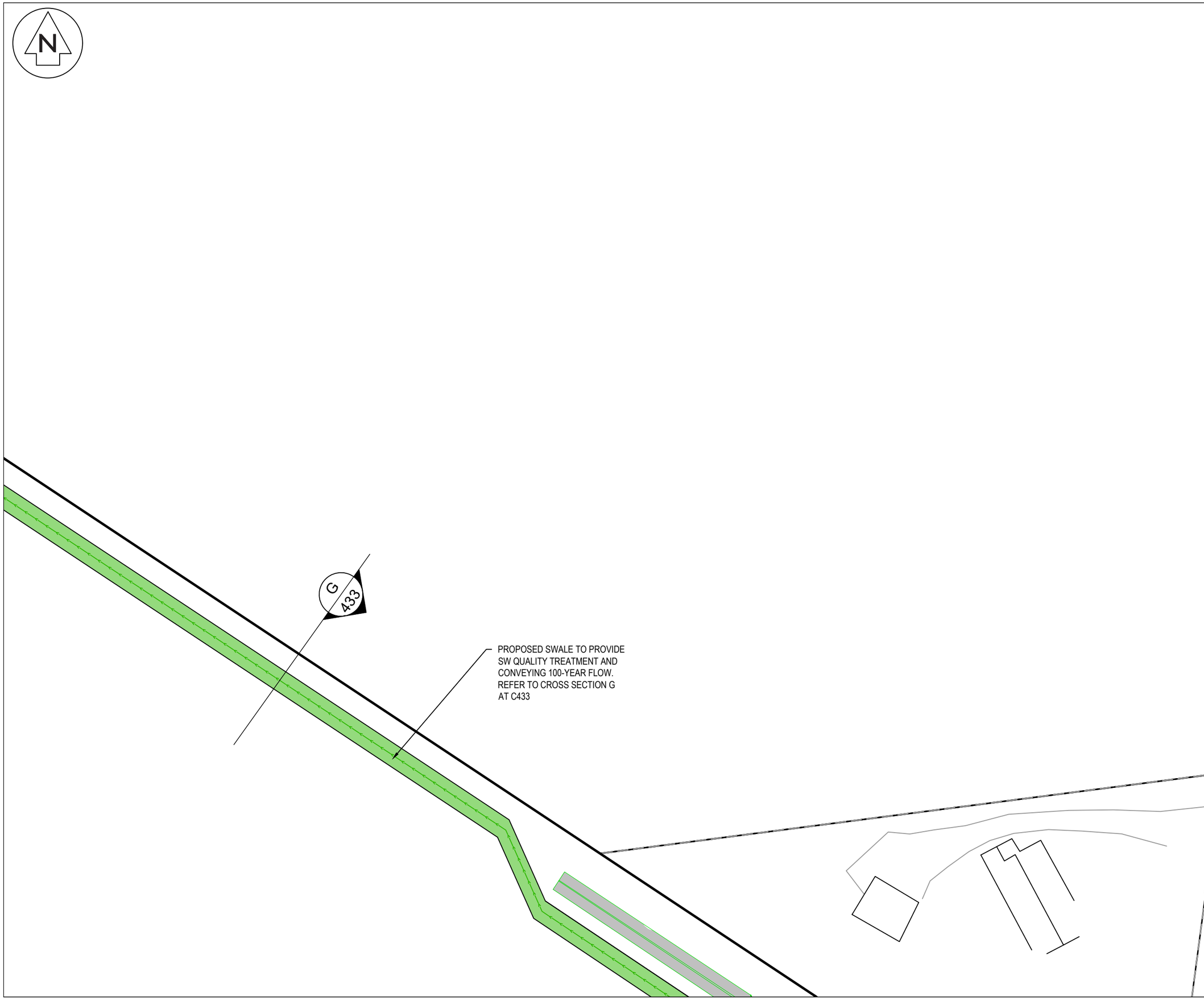
Project

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

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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

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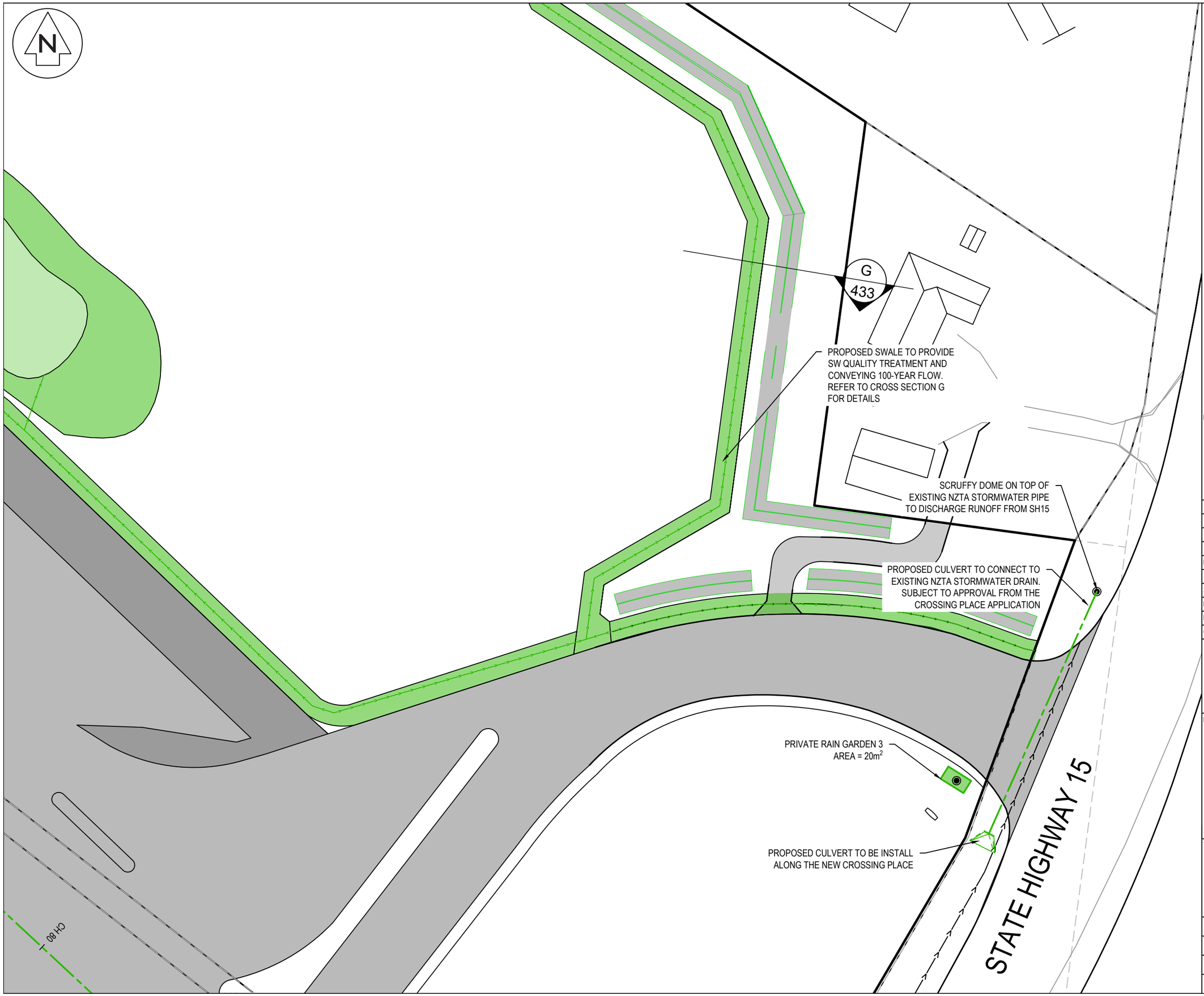
Project

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

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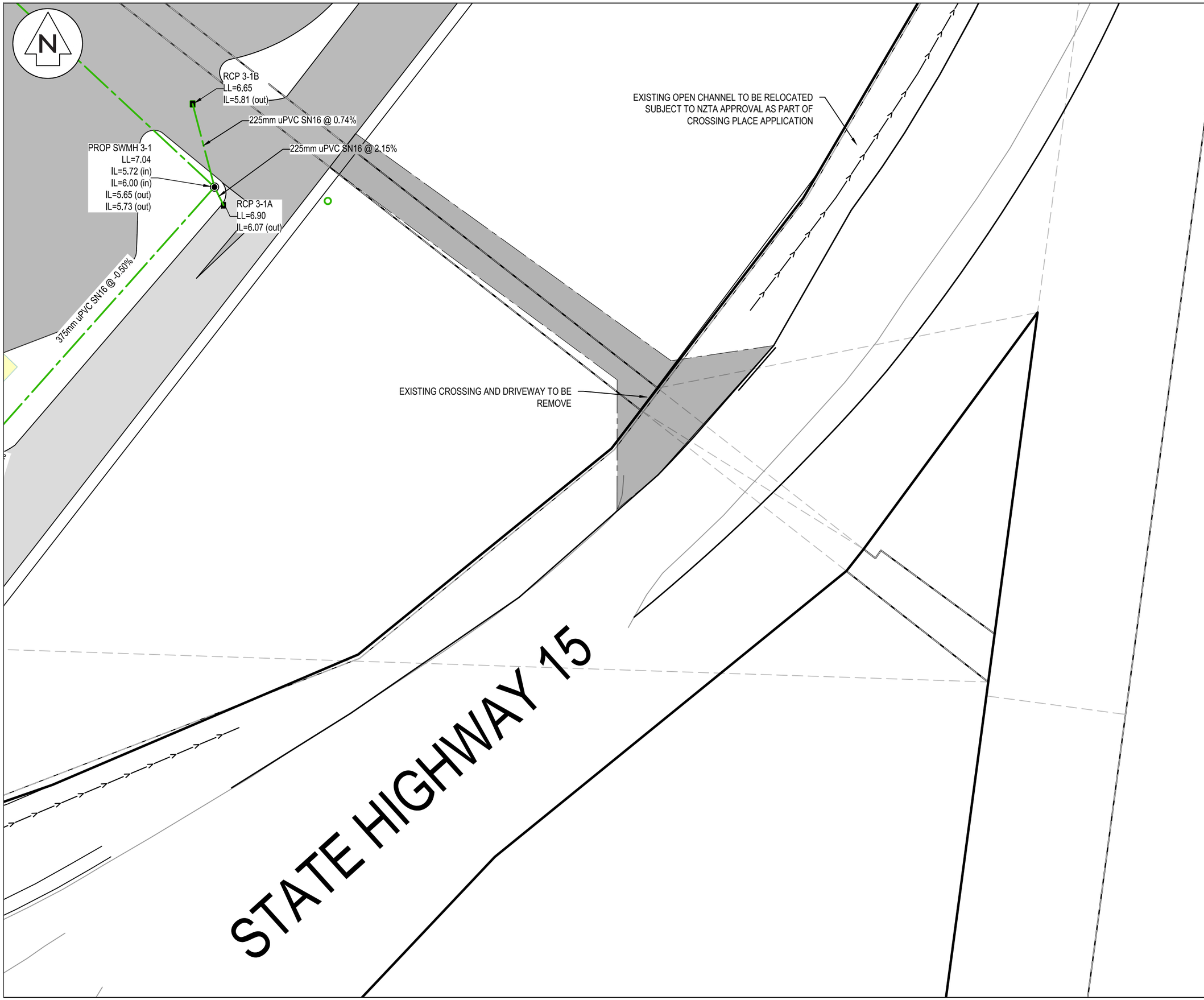
Project

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

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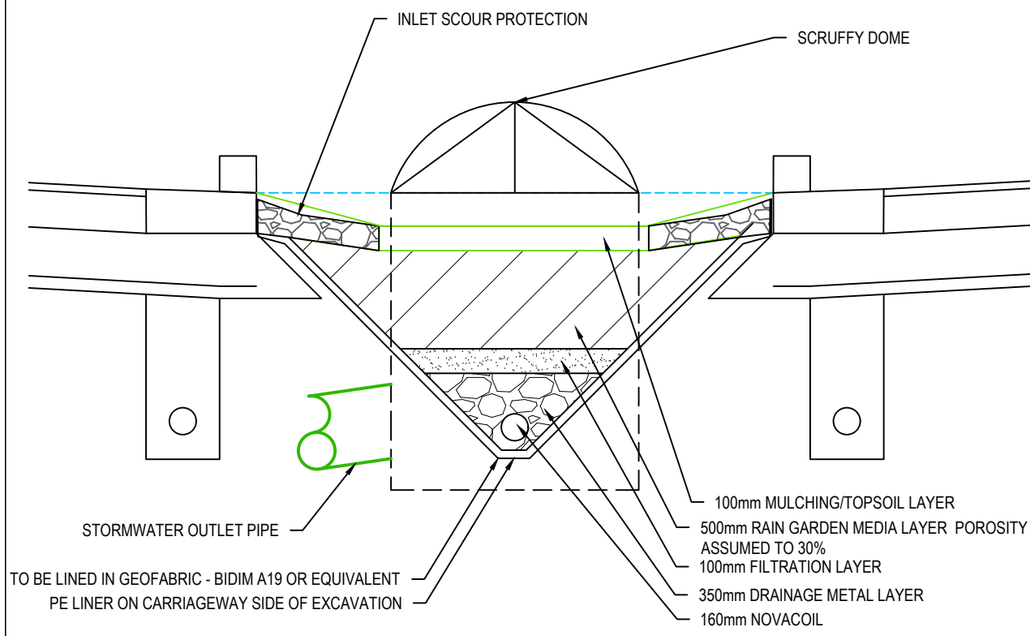
Project

RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

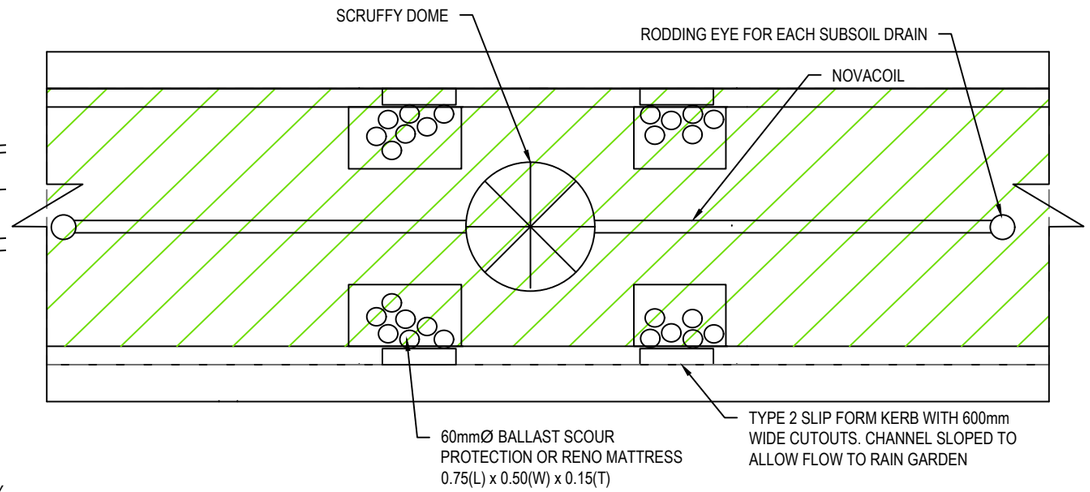
Title

PROPOSED PRIVATE STORMWATER DRAINAGE PLAN

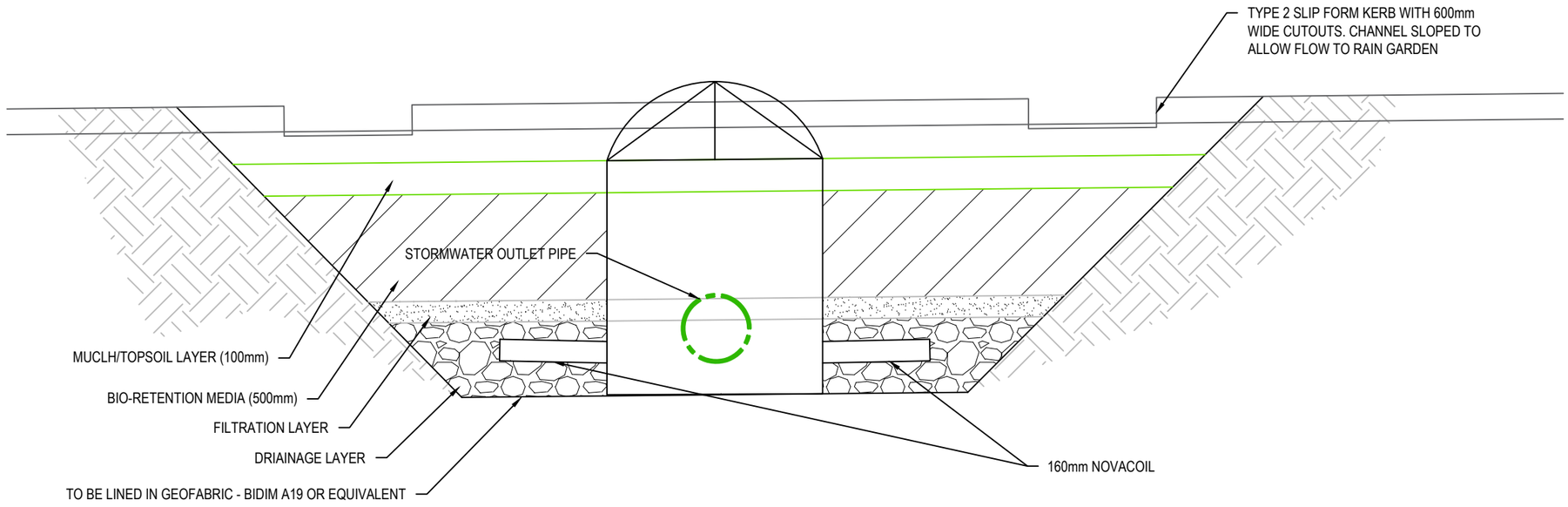
Project no.	117019		
Scale	1:500 @ A3		
Cad file	C400 SW.DWG		
Drawing no.	C408	Rev	A



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. All bends and connections to be 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

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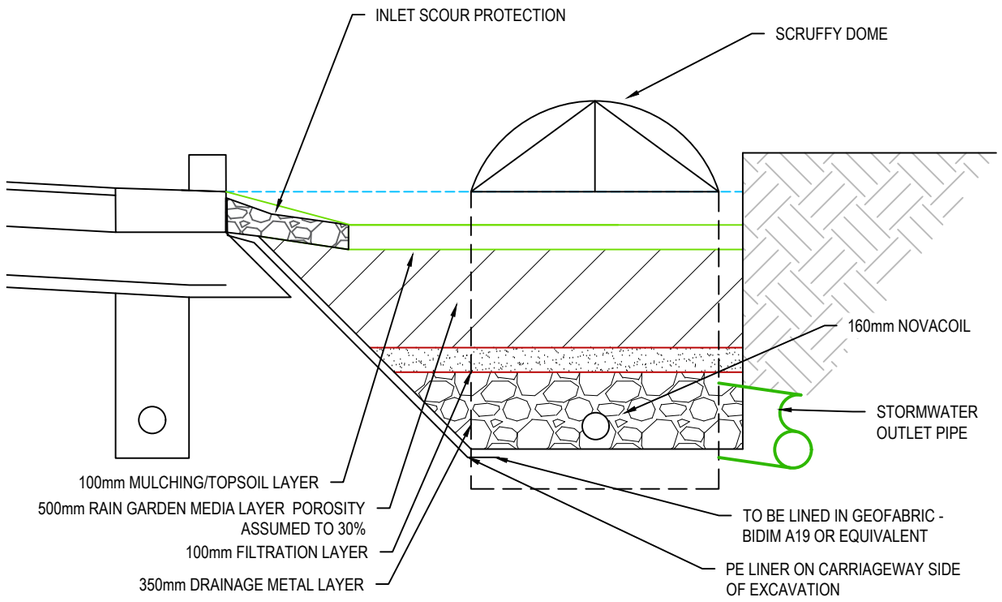
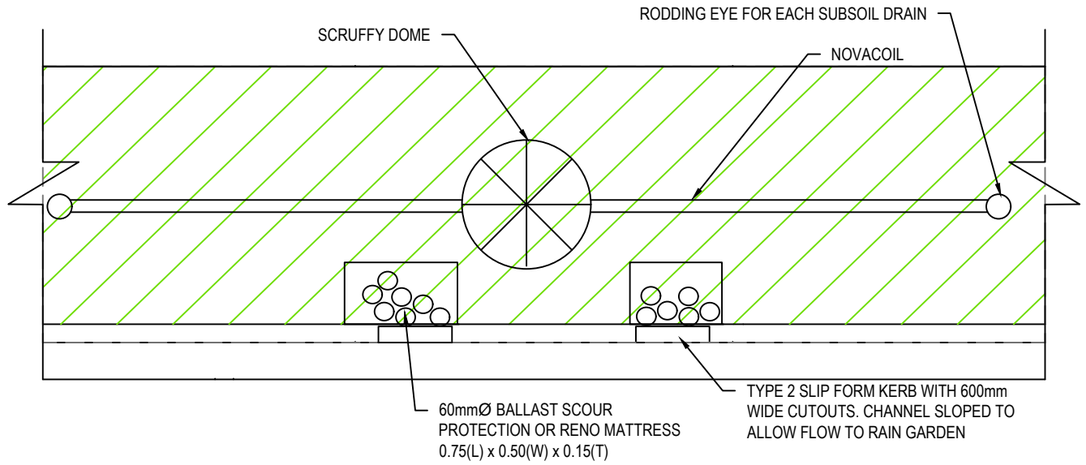
Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

Title
PROPOSED TYPICAL CAR PARK RAINGARDEN DETAILS

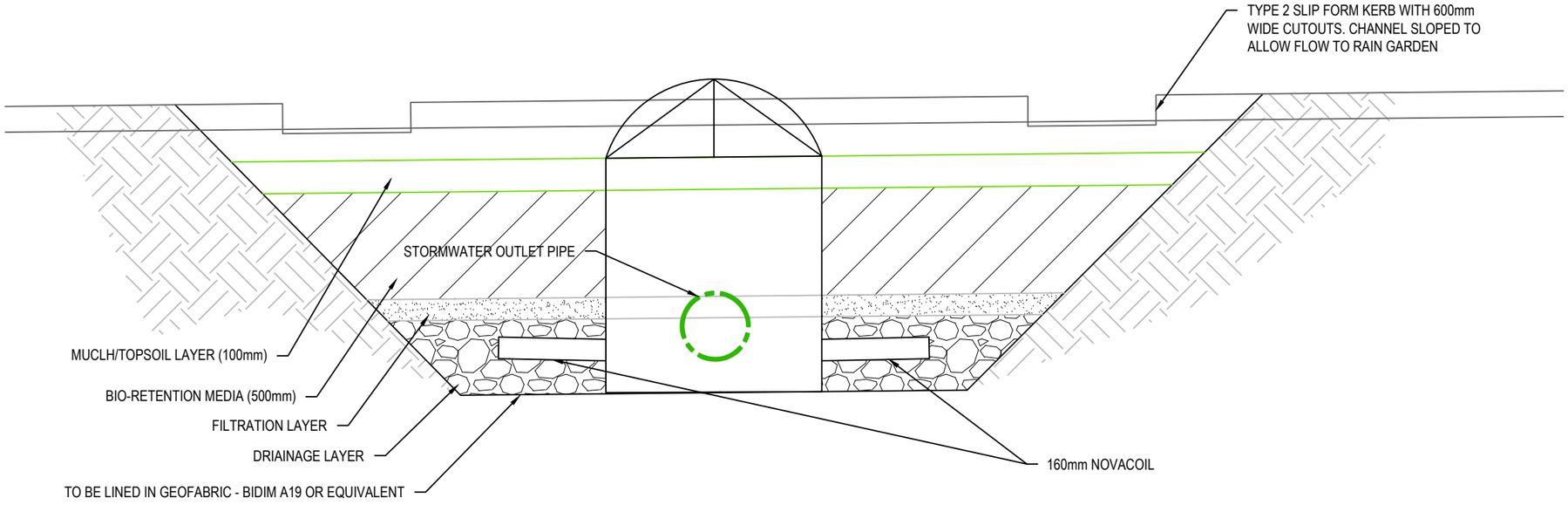
Project no.	117019		
Scale	AS SHOWN		
Cad file	C400 SW.DWG		
Drawing no.	C430	Rev	A



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 to be 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

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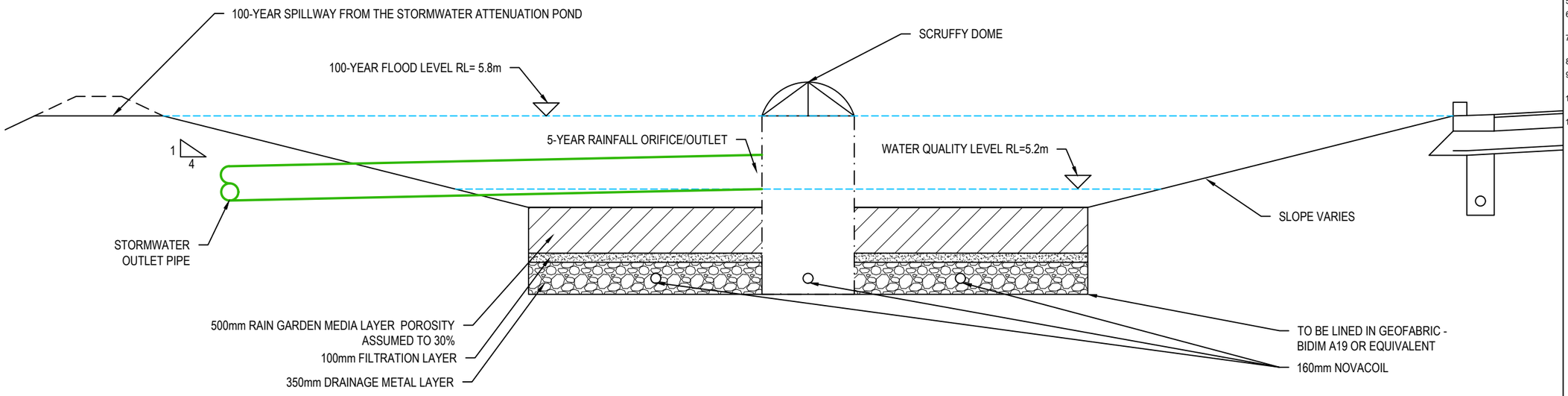
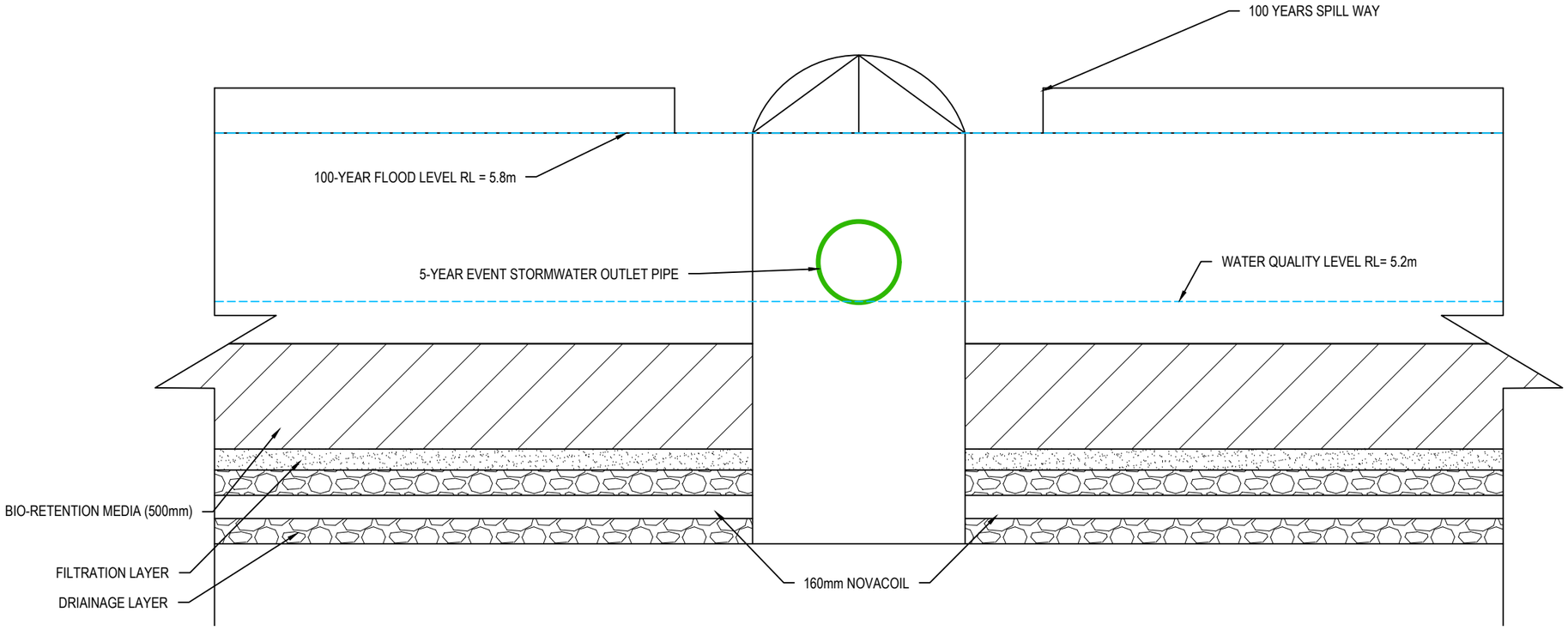
Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

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 to be 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.
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8. All pipes shall be SN16 grade unless otherwise stated.
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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

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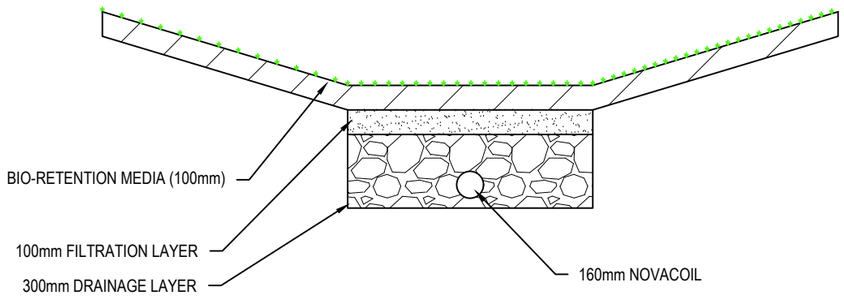
Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

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 to be 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.
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8. All pipes shall be SN16 grade unless otherwise stated.
9. Drainlayer shall locate and confirm connection invert before starting building works.
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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

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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).
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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
B	EX FARM CROSSING	KH	03/21
A	RC	KH	09/20

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

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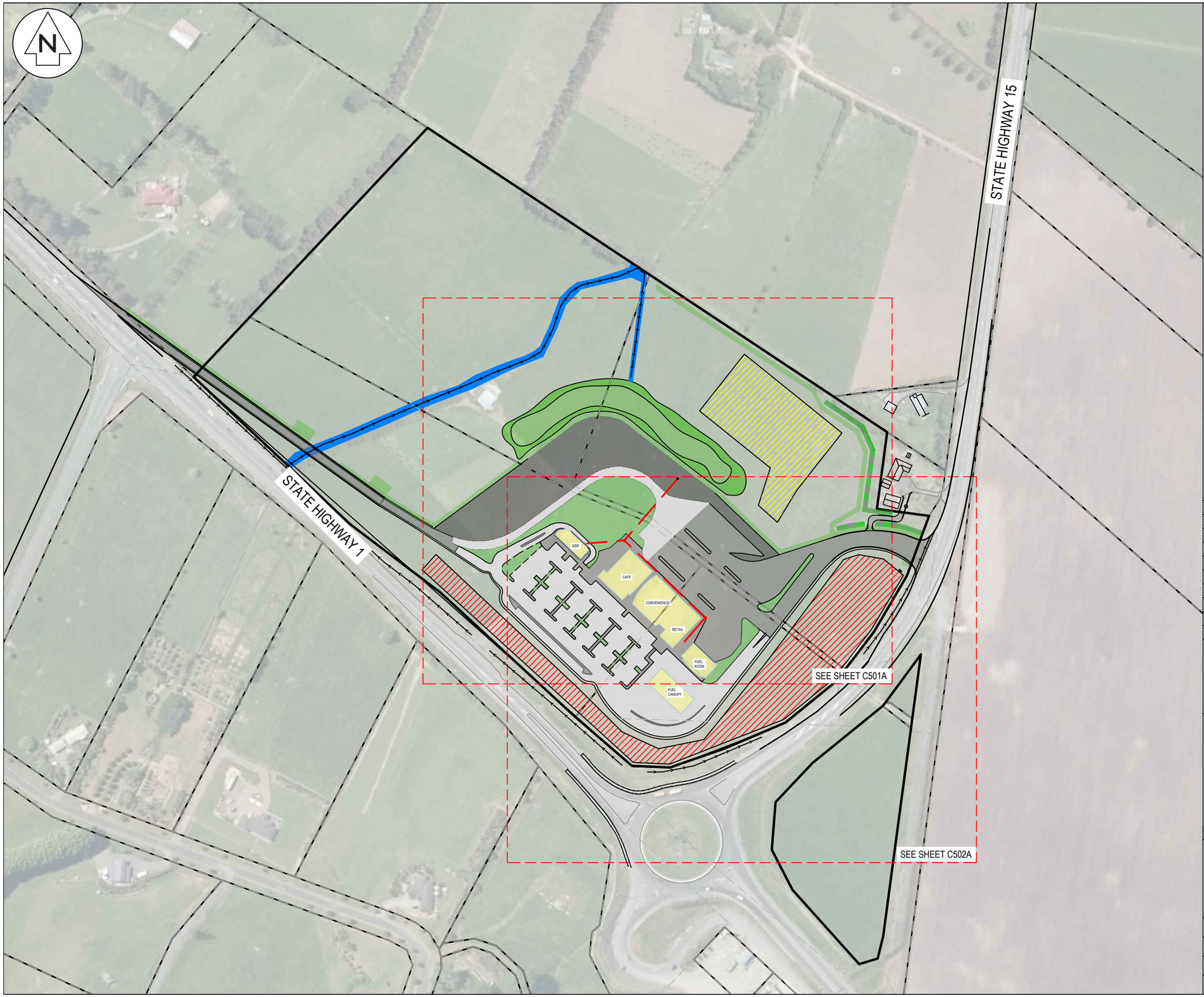
Project

RUAKAKA SERVICE CENTER FOR RUAKAKA DEVELOPMENT LIMITED

Title

PROPOSED OVERLAND FLOW PATH PLAN

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



Notes

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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

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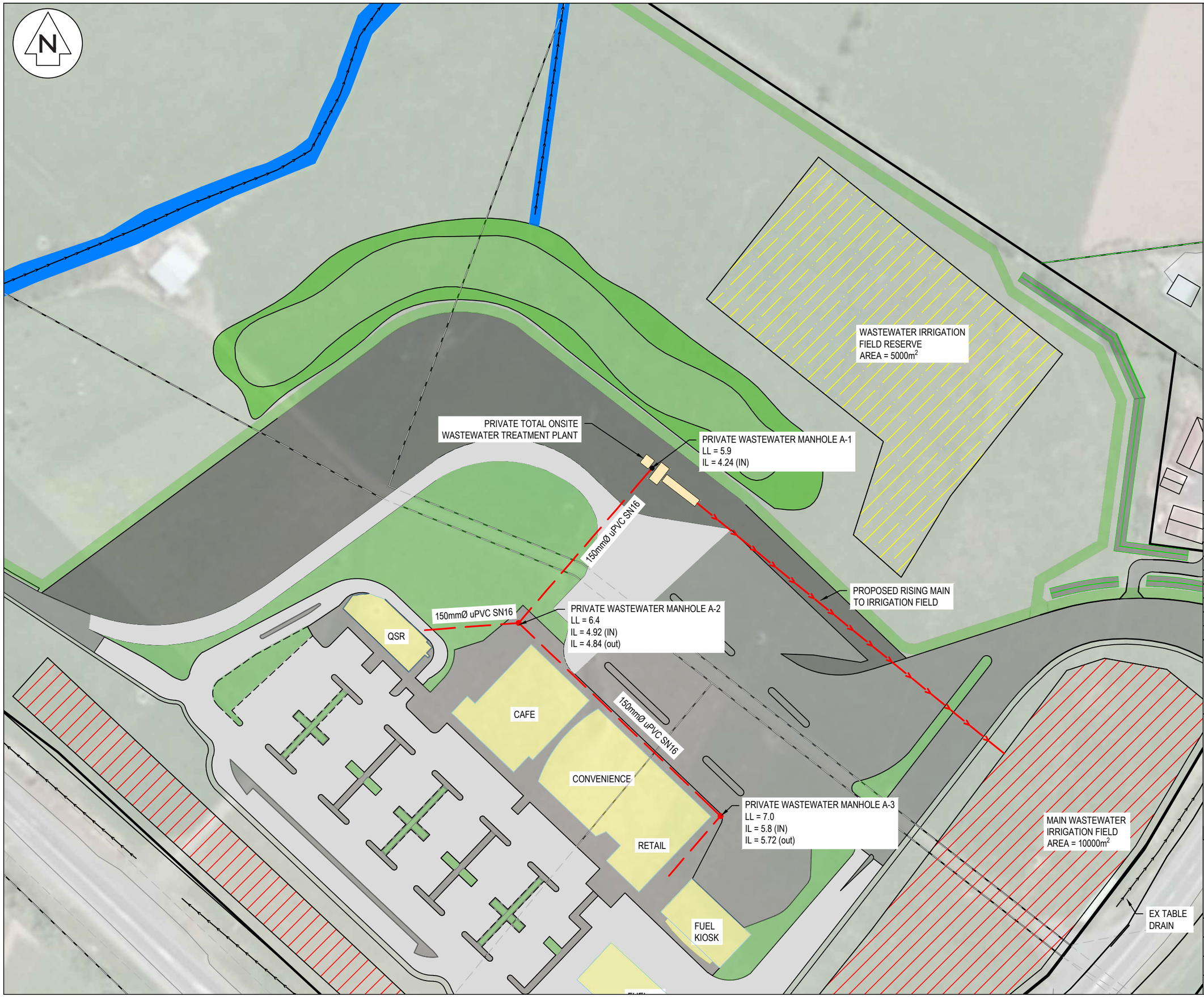
Project

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.
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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

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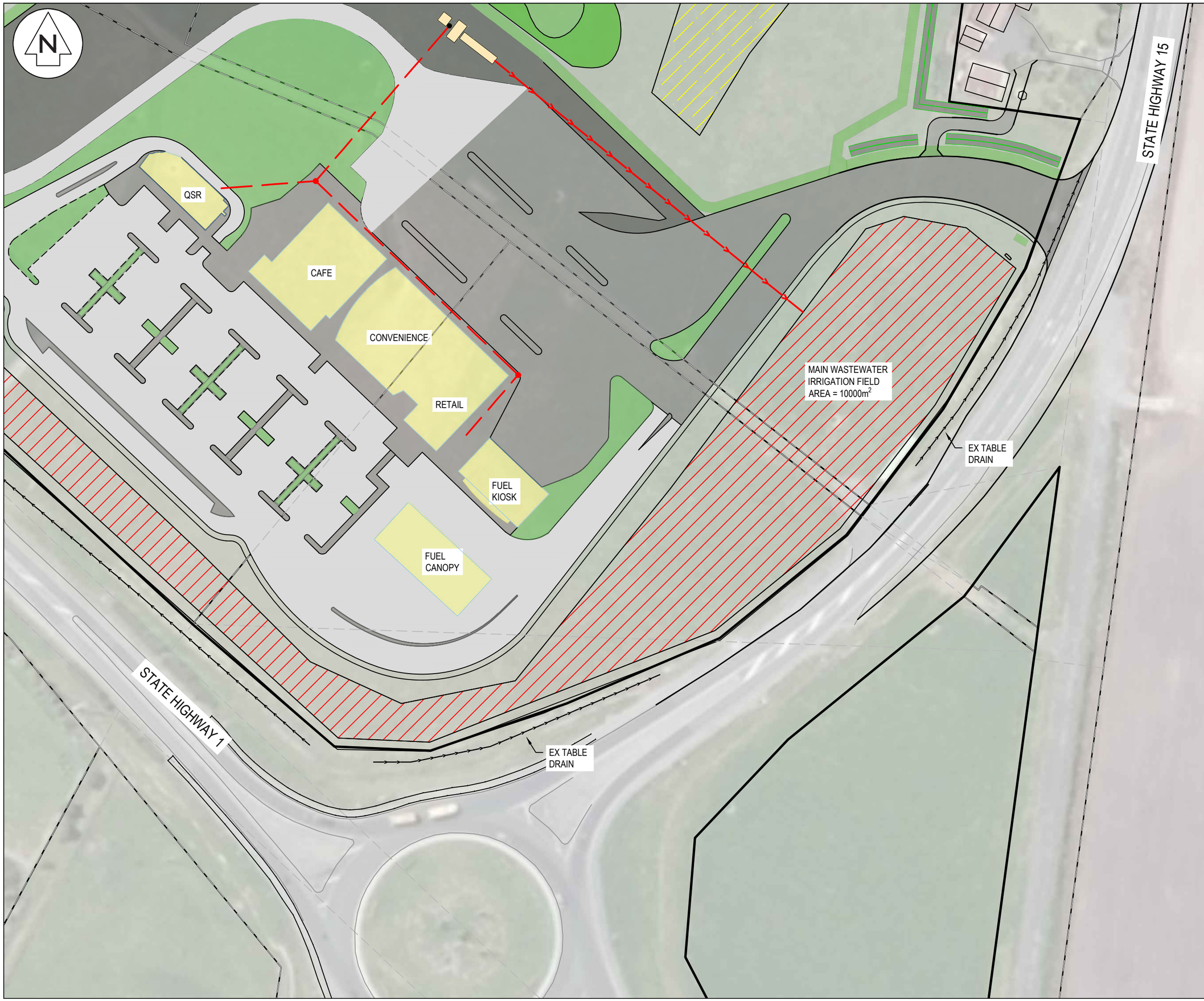
Project

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.
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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

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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

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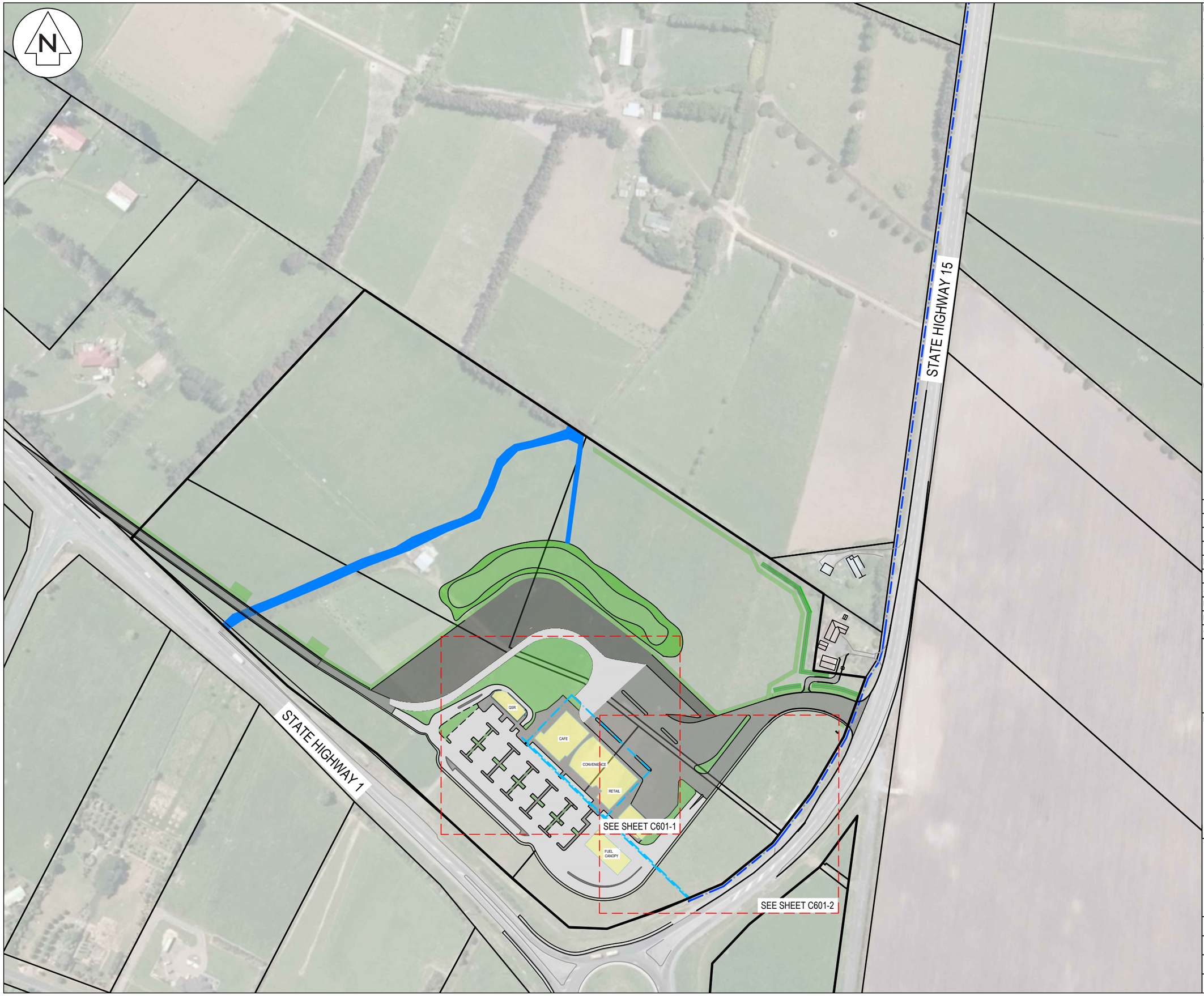
Project

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

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3. Minimum cover shall be:
   - Roads, footpaths,crossings: 1000mm
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Legend

- EX BDY
- PROP BDY
- EX WATERMAIN
- PROP WATERMAIN
- FH EX/PROP HYDRANT
- WM 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

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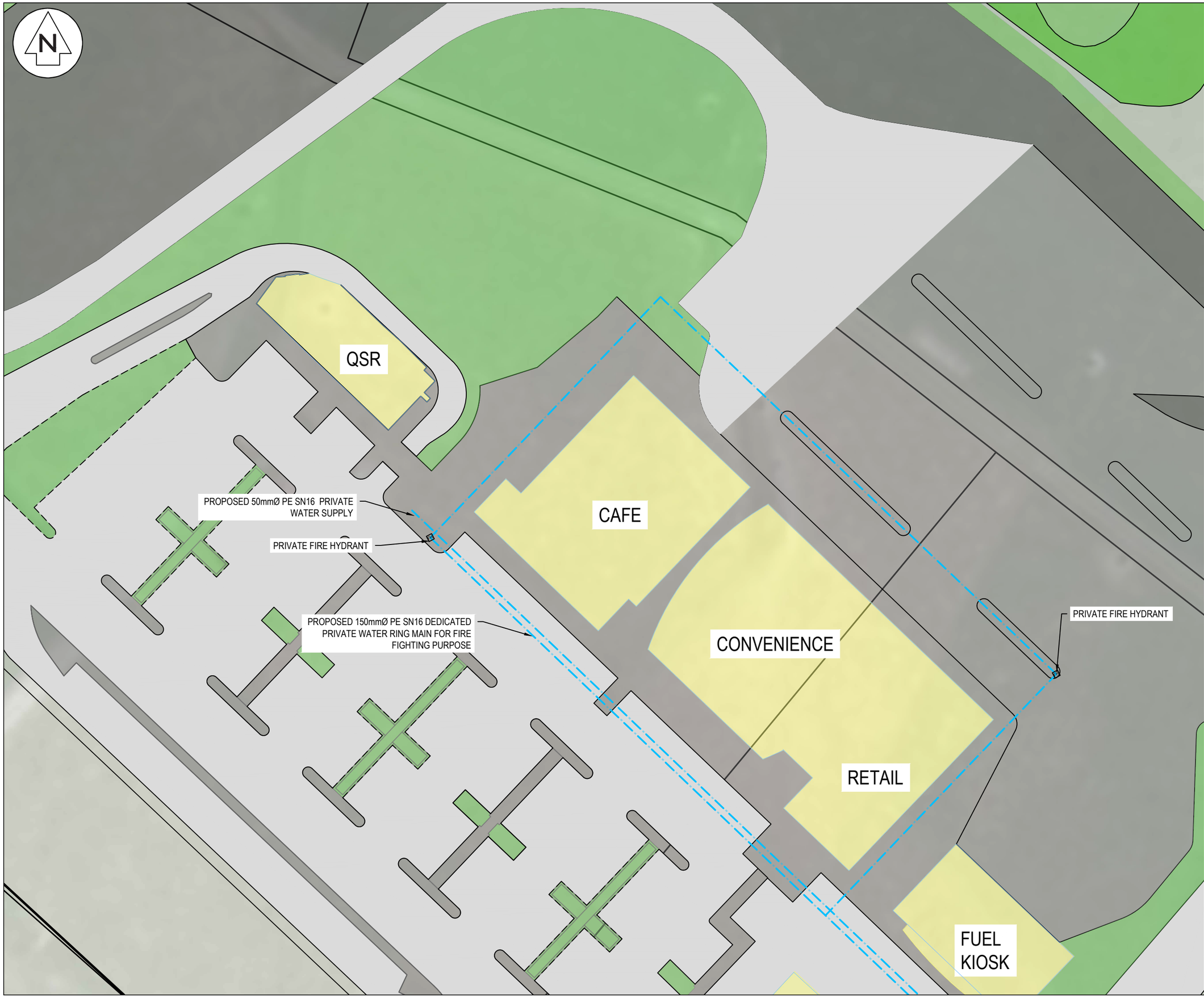
Project

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

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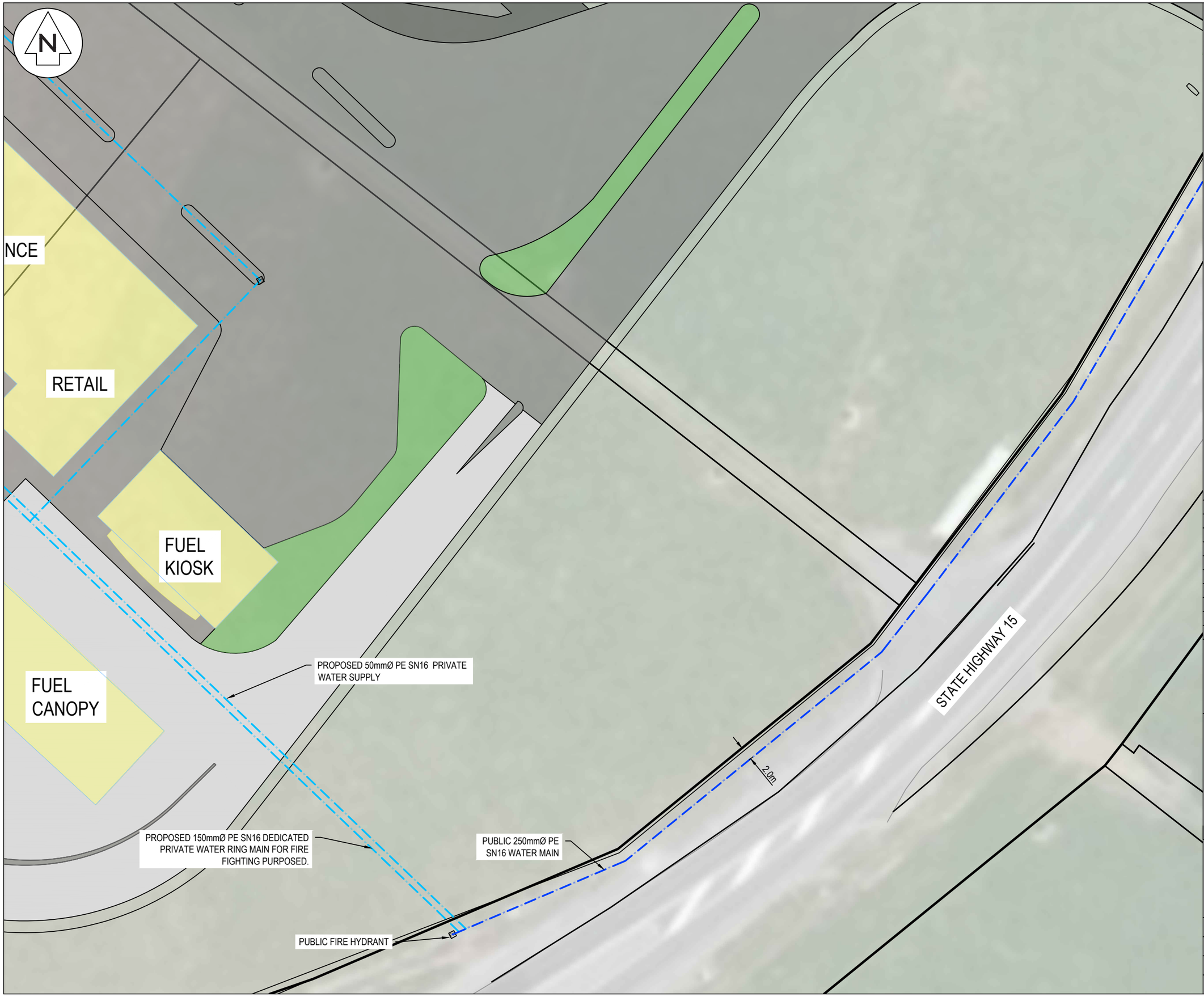
Project
RUAKAKA SERVICE CENTER FOR S K AOTEAROA TRUST

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

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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

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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

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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.
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8. Pipes shall be bedded and surrounded to 150mm above the pipe soffit with sand or ap20.
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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
- FH EX/PROP HYDRANT
- WM 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

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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
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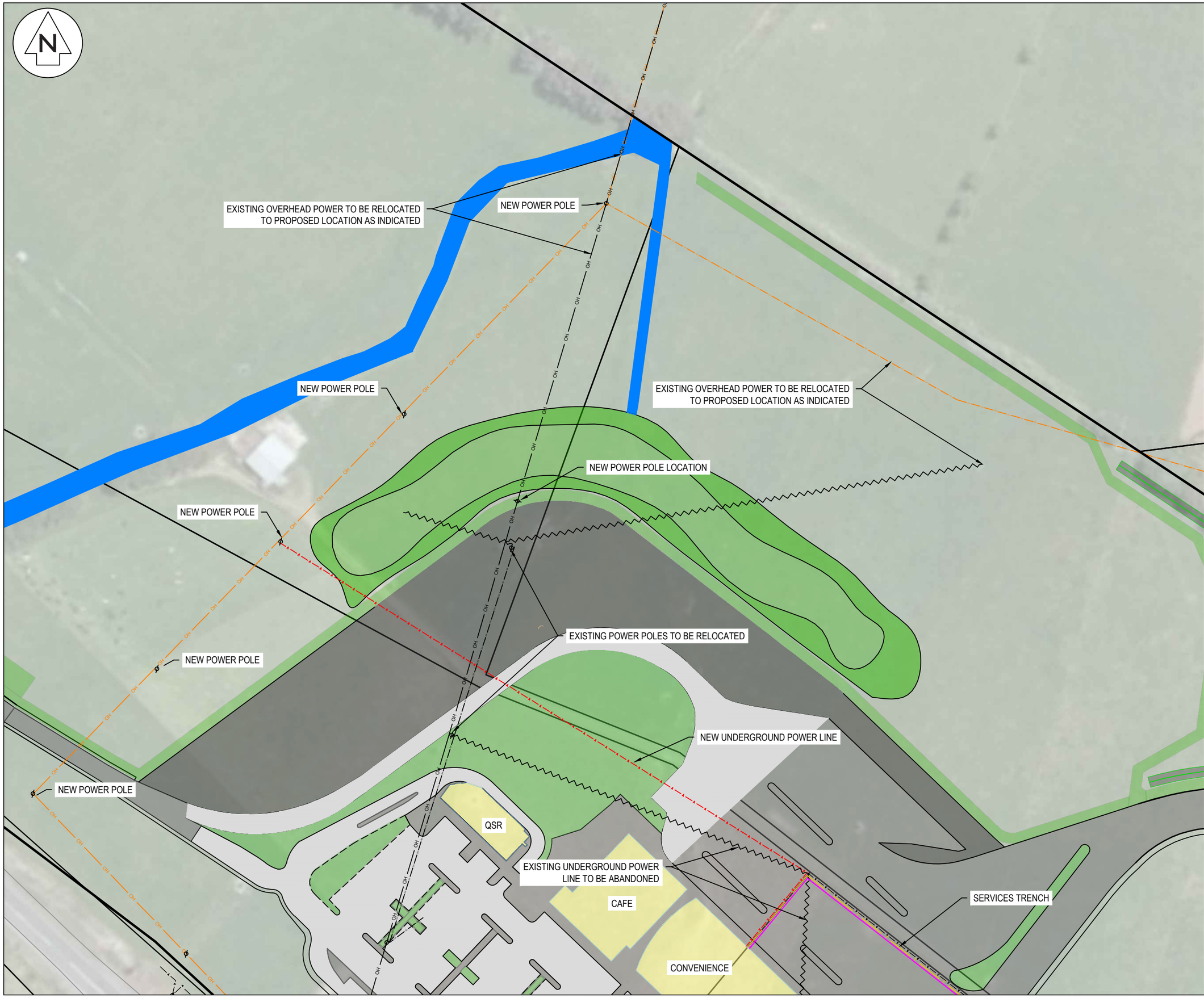
Project

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

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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
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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

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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

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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 Calc Title	2581 SH1 RUAKAKA 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 / Calc Title: 2581 SH1 RUAKAKA / 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		***HEC-HMS Check***
7.	Peak flow rate, $q_p=q^*A^*P_{24}$		**0.001**		Pre-Dev
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)	
	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

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

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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.

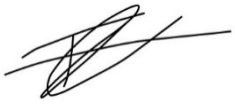
We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (09) 972 2205 if you require any further information.

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		
		CH	Silty CLAY; light grey with orange streaks. High plasticity.					St	55/26 65/26	
		OL	Organic SILT with minor fine to coarse sand; black and brown. Low plasticity. Organics, amorphous, rootlets and bark.				W	St	60/17	
2.0		ML	Clayey SILT with minor fine to coarse sand; dark brown. Low plasticity.					St	75/34	
	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

GEOTECH HAND AUGER - NO SCALA HA.GPJ NZ DATA TEMPLATE 2.GDT 7/11/19

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

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
0	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	
									109/27	
2.5								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

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 62/21	
1.5			Encountered 100 mm of organic material at 1.7 m depth.						79/23	
2.0	RUARANGI FORMATION	ML	Fine to medium sandy SILT; brown. Low plasticity.				S	St	66/29 157/27	
2.5								H	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 0.8 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