FORM 21

Submission on the Notice of Requirement for the Rotokauri Strategic Infrastructure Designation

To:	Urban & Spatial Planning Unit Hamilton City Council Private Bag 3010 Hamilton 3240	Hamilton City Council Infrastructure & Assets Group C/O Beca PO Box 448, Waikato Mail Centre Hamilton 3240

Name of Submitter:	Hounsell Holdings Limited, Rotokauri Farming No3 Limited and Hamilton JV (N3) Limited
Address for Service:	PO Box 90003 Victoria Street Auckland 1142
Email:	victoria@kilroygroup.co.nz

INTRODUCTION

1. This Submission is regarding the notice of requirement ("**NoR**") made by Hamilton City Council (as the "Requiring Authority") – for the Rotokauri Strategic Infrastructure Designation: which includes the designation of land for 'strategic transportation and three waters infrastructure' purpose in the Rotokauri area for the construction and operation of a multimodal transportation and infrastructure corridor.

2. The Submitter is not a trade competitor for the purposes of Section 308A of the Resource Management Act 1991 ("**RMA**").

BACKGROUND

3. The Submitter is the legal owner of the following parcels of land which are directly affected by the **NoR**:
   a) Lot 53 DP 471831 (RT 694425)
   b) Lot 3 DP 4688484 (RT 628813)
   c) Part Lot 1 DP 30552 (RT SA5D/1082)
   d) Lot 2003 DP 576817 (RT1064310)

4. The affected parcels referenced above are highlighted green in Figure 1 below. As indicated, the proposed designation boundaries traverse across all four parcels of land.

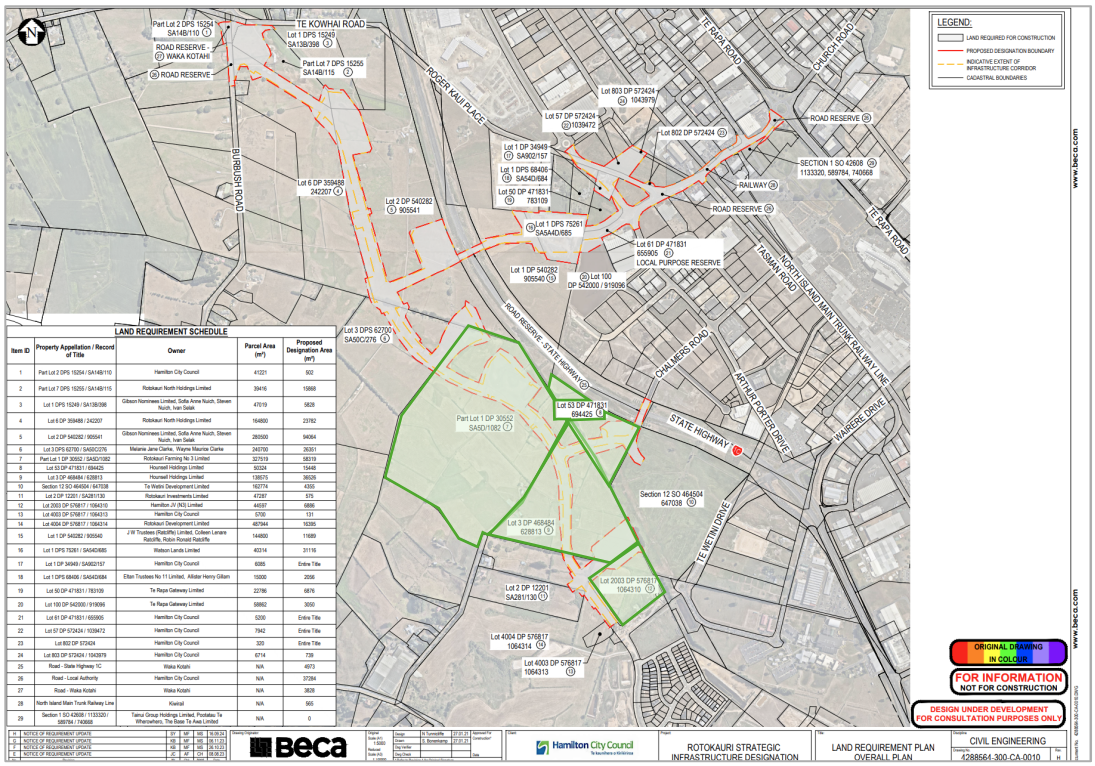

FIGURE 1 – NoR Land Requirement Plans (Source: Beca NoR application documents)

5. As indicated within the **NoR** application documents (Section 1.6 of the Beca Design Report-Appendix D – **NoR** Application), the Submitter has entered into a private development agreement with Hamilton City Council for the design and delivery of the Greenway and a portion of the Arterials south of Te Kowhai East Road.

6. Specifically, the Submitter as a joint applicant with Hamilton City Council, has obtained resource consents from the Environmental Protection Authority through the COVID-19 Recovery Fast Track Consenting Act 2020 (Fast Track). Regional resource consents were granted on the 14th July 2024 for the construction and operation of the greenway, artificial wetlands and the minor arterial road. In addition, resource consent for soil disturbance under NES-Contaminated Land has been granted through the same Fast Track process.

7. Various resource consent applications have also been applied for by the Submitter which have either been granted or are being processed by the relevant authority. These are summarised as follows:

   a) Resource consent application for Stage 1 bulk earthworks has been approved by Hamilton City Council (010.2019.00010606.001) on the 11th May 2020 and has been given effect to.

   b) Resource consents were granted for earthworks, diversions, and groundwater takes by Waikato Regional Council ("WRC") on the 3 February 2021. A further consent is currently being processed by WRC to reflect updates to earthworks as well as a consent application for stormwater diversion and discharge.

   c) Resource consent is currently being processed by Hamilton City Council for a Comprehensive Development Plan (CDP) including the creation of approximately 280 residential units, earthworks, infrastructure and concurrent subdivision. This application includes the design and construction of a portion of the Minor Arterial Road and Wetlands 4A/4B.

SCOPE OF SUBMISSION

8. This submission relates to the Rotokauri Strategic Infrastructure Designation in its entirety, but the Submitters interest is primarily on the general alignment and boundaries of the **NoR** as notified on the 7th October 2024.

9. The Submitter is generally supportive of the proposed **NoR** as it is necessary to service the Rotokauri growth cell in accordance with the Rotokauri Structure Plan. The Submitter also supports the **NoR** objectives "to provide a well-integrated multi modal transportation network that promotes a wide range of safe, responsive, efficient, and sustainable transport modes including walking, cycling, and public transport."

10. The Submitter has made significant progress in design and consenting including the Minor Arterial and the artificial wetlands and as such is seeking changes to the boundaries and levels of the designation to be consistent with the existing consents and design.

REASON FOR SUBMISSION

11. As acknowledged within the Beca Design Report (Appendix D - **NoR** Application), given the parallel work of the Fast Track process, the road and flood level modelling and design within the **NoR** may be superseded.

12. With the consents now being approved in July 2024 through the Fast Track process and updated modelling and design undertaken as a result, the Submitter requests that the updated road and flood levels and artificial wetland design and locations be reflected within this **NoR**. Comparison between the Fast Track consented design and **NoR** are shown in **Attachment 1**.

13. The Maven Associates vertical alignment of the Minor Arterial differs from the Beca **NoR** design to account for improvement to constructability and diversion of overland flows.

14. Section 4.5 of the Maven Infrastructure report provided with the Fast Track application (included in **Attachment 2**) details the adjustments made to Beca's design (including the Greenway designation design). In summary, the adjustments relate to the catchments and the corresponding size of the artificial wetlands. The current design of artificial wetlands prepared by Maven Associates is included in **Attachment 3**.

15. Furthermore, the CDP resource consent includes the design and construction of a portion of the Minor Arterial which will extend from Te Wetini Drive and Akoranga Road to Chalmers Road as indicated in Figure 2 below and artificial wetlands 4A/4B.

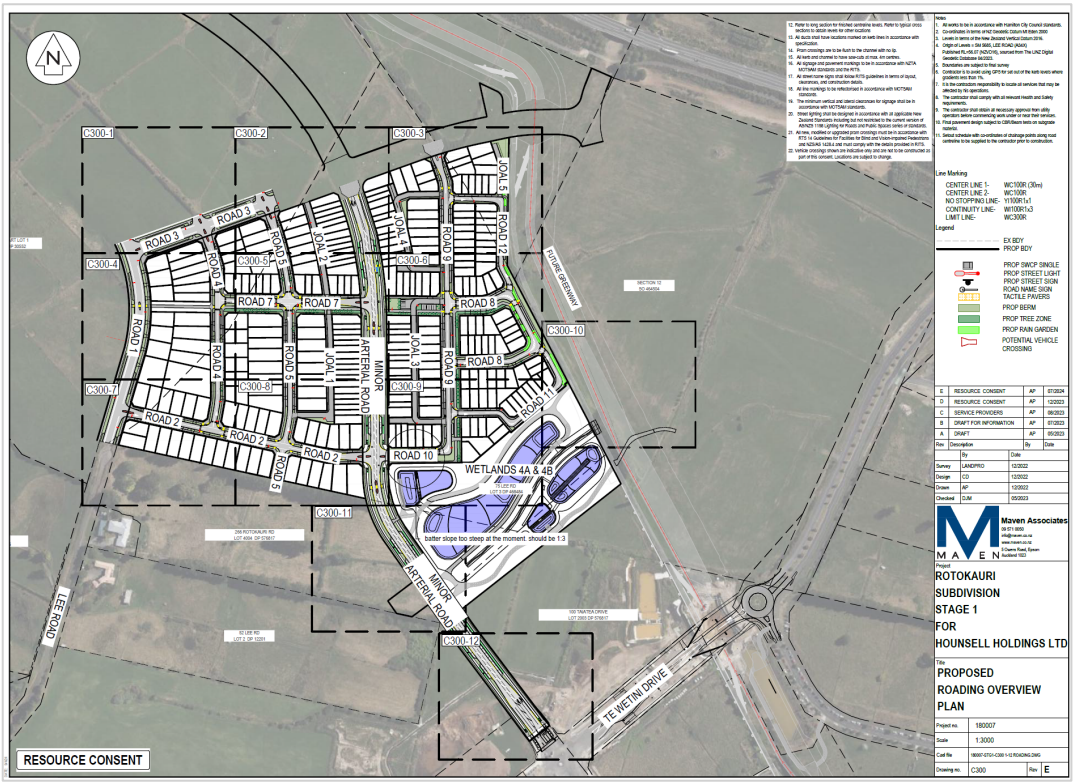

FIGURE 2 – Current Maven Associates CDP Roading overview Plan

16. The portion of the Minor Arterial and artificial wetlands (4A/4B) located within the CDP area are currently being assessed by Hamilton City Council and will be subject to engineering plan approval and constructed and vested through the subdivision process. The consent design for the CDP including arterial and artificial wetlands 4A/4B are based off the resource consents approved through the Fast Track process (see **Attachment 3**).

17. The Minor Arterial Road design proposed within the CDP, does not align with some of the roading typology zones included in the **NoR** Application (Appendices B and J- NoR Application)- specifically Zones 1 and 8. As indicated in Figure 3 below, Zones 1 (red), 3 (yellow) and 4 (green) and 8 (light purple) apply to the Submitters site.

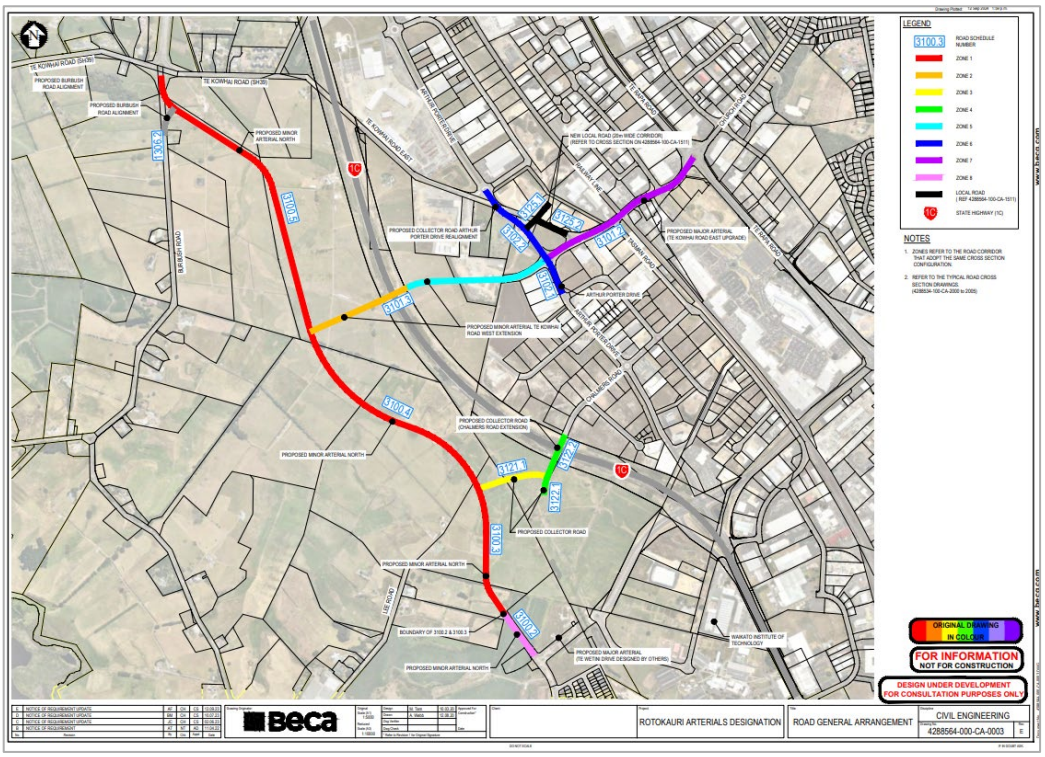

FIGURE 3 – NoR Application - Appendix B – Beca Road General Arrangement

18. Roading cross-section typologies for the CDP are shown in Figure 4 below. In summary the Submitter is proposing a 28.4m road width up to the Chalmers Road intersection with a 10m carriageway. The Submitter is seeking changes to these road typology zones within the **NoR** to align with those being proposed and considered within the CDP application.

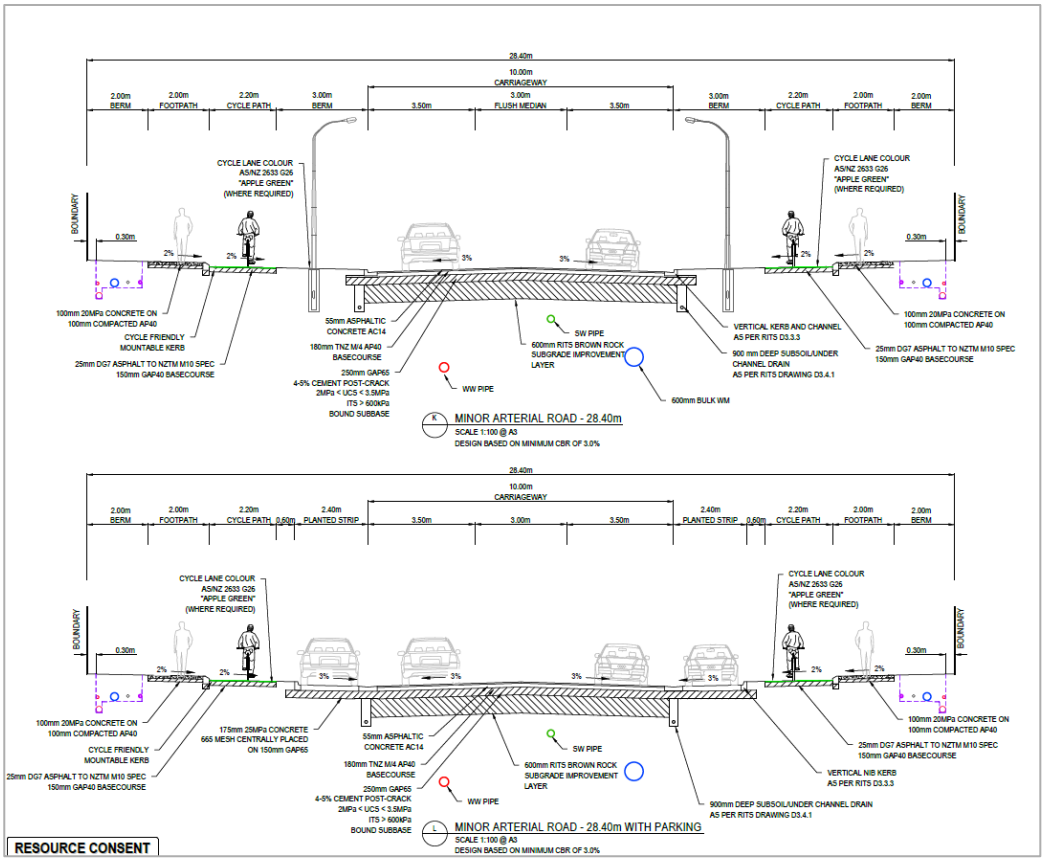

FIGURE 4 – CDP Resource Consent – Minor Arterial Road Typology Design

19. Furthermore, the Submitter notes there is disparity between some of the road typologies within Appendix B.2 and Appendix J of the **NoR**. Specifically, the plans for Zone 4 do not align between the appendices. The Submitter request that the plans within Appendix J align with plans within Appendix B.2 of the **NoR** (in addition to above changes re alignment with the CDP plans).

20. The Submitter considers that the misalignment between designs will not promote the sustainable management under Part 2 of the RMA as:
    a) The potential adverse effects (including transport, stormwater, flooding effects) from the proposed **NoR** on the use and development of the Submitters land (and associated costs) won't be avoided remedied or mitigated.
    b) The social, economic and cultural well-being of the community will not be provided for if the **NoR** results in an inefficient use and development of land that is already subject to consents and design.

RECOMMENDATIONS SOUGHT:

21. The Submitter seeks the following changes from Hamilton City Council for the Rotokauri Strategic Infrastructure Designation:
    a) Update the **NoR** levels and alignment to reflect the levels and design approved through the Fast Track process.
    b) Update the **NoR** road typology Zones 1 and 8 to reflect road typologies being considered through the CDP consent process.
    c) Consistency between plans within appendices provided in support of the **NoR**.
    d) Such further relief or consequential amendments as considered appropriate and necessary to address the matters raised above.

22. The Submitter wishes to be heard in support of this submission.

23. If others make a similar submission, the Submitter will consider presenting a joint case with them at a hearing.

Signature:

VMajoor

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Victoria Majoor
Principal Planner
Hounsell Holdings Ltd

Date: 7th November 2024

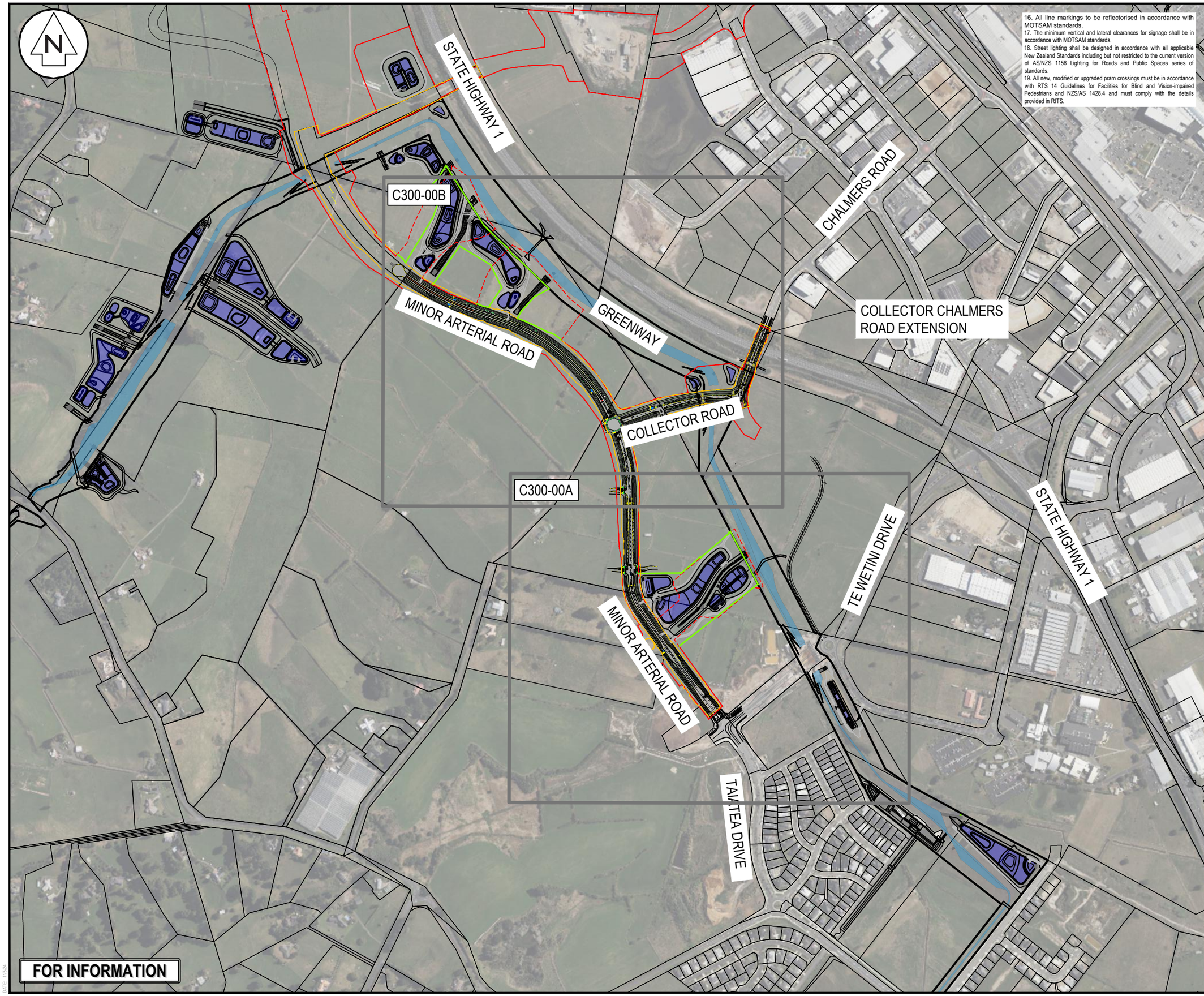
Enclosed:

Attachment 1 –NoR/Fast Track comparison plans

Attachment 2 –Fast Track Infra Report

Attachment 3- Fast Track Artificial Wetland Plans

Attachment 1 – NoR/FT Comparison Plans



16. All line markings to be reflectorised in accordance with MOTSAM standards.
17. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
18. 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.
19. 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 RITS.

Notes

1. All works to be in accordance with Hamilton City Council RITS standards.
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8. Final pavement design subject to CBR/Beam tests on subgrade material.
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12. Pram crossings are to be flush to the channel with no lip.
13. All kerb and channel to have saw-cuts at max. 4m centres.
14. All signage and pavement markings to be in accordance with NZTA MOTSAM standards and the RITS.
15. All street name signs shall follow RITS guidelines in terms of layout, clearances, and construction details.

Legend

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Rev	Description	By	Date
B	NOR NOTIFICATION	ABS	10/24
A	RESOURCE CONSENT	MA	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	AN	10/2022
Drawn	MA	07/2023
Checked	JZ	07/2023

Maven Associates
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info@maven.co.nz
www.maven.co.nz
5 Owens Road, Epsom
Auckland 1023

Project

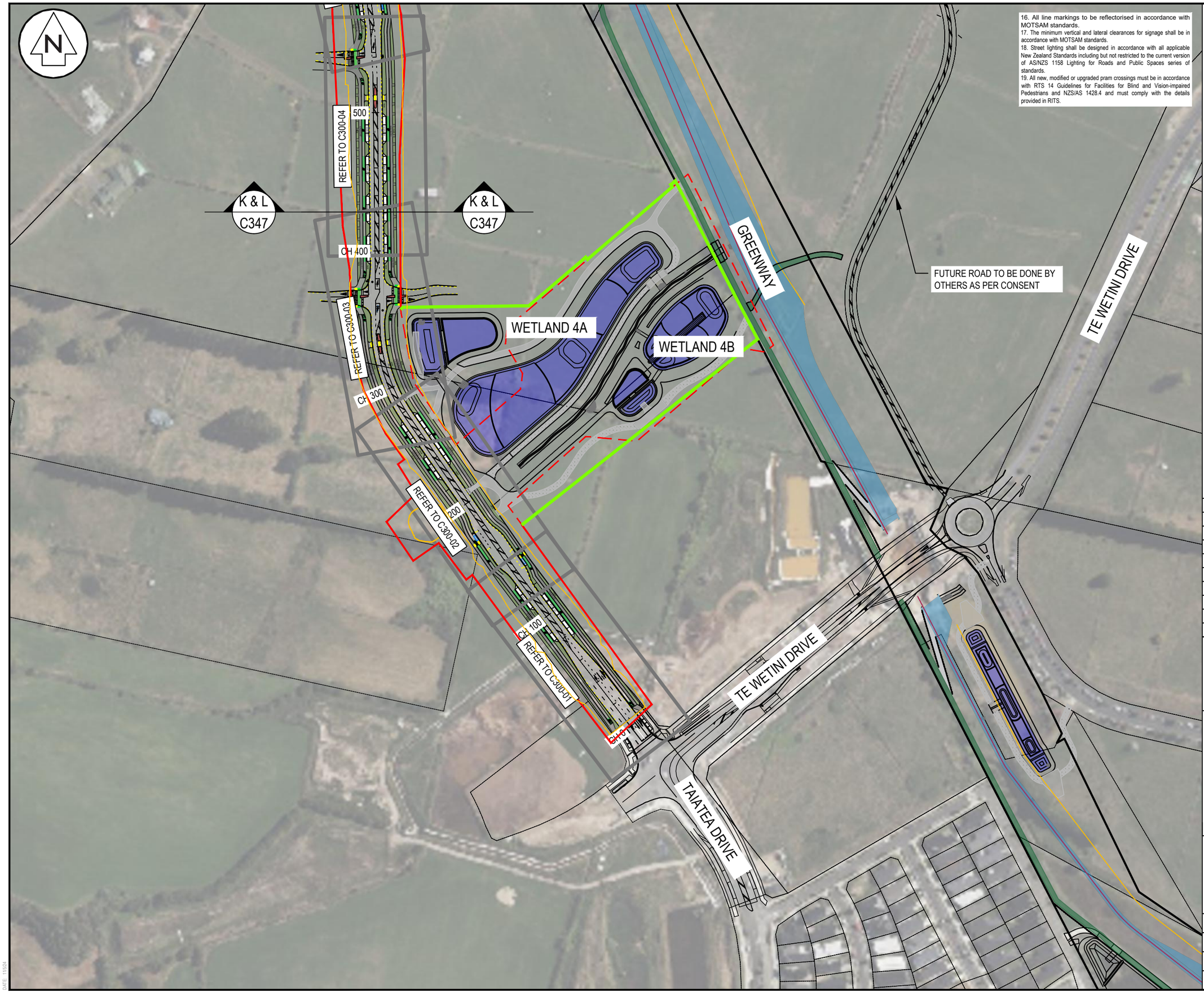
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title

PROPOSED ROADING OVERVIEW PLAN

Project no.	180006		
Scale	1:7500 @ A3		
Cad file	180006-C300 - RC.DWG		
Drawing no.	C300-00	Rev	B

DATE 11/24



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Cad file	180006-C300 - RC.DWG		
Drawing no.	C300-00A	Rev	B

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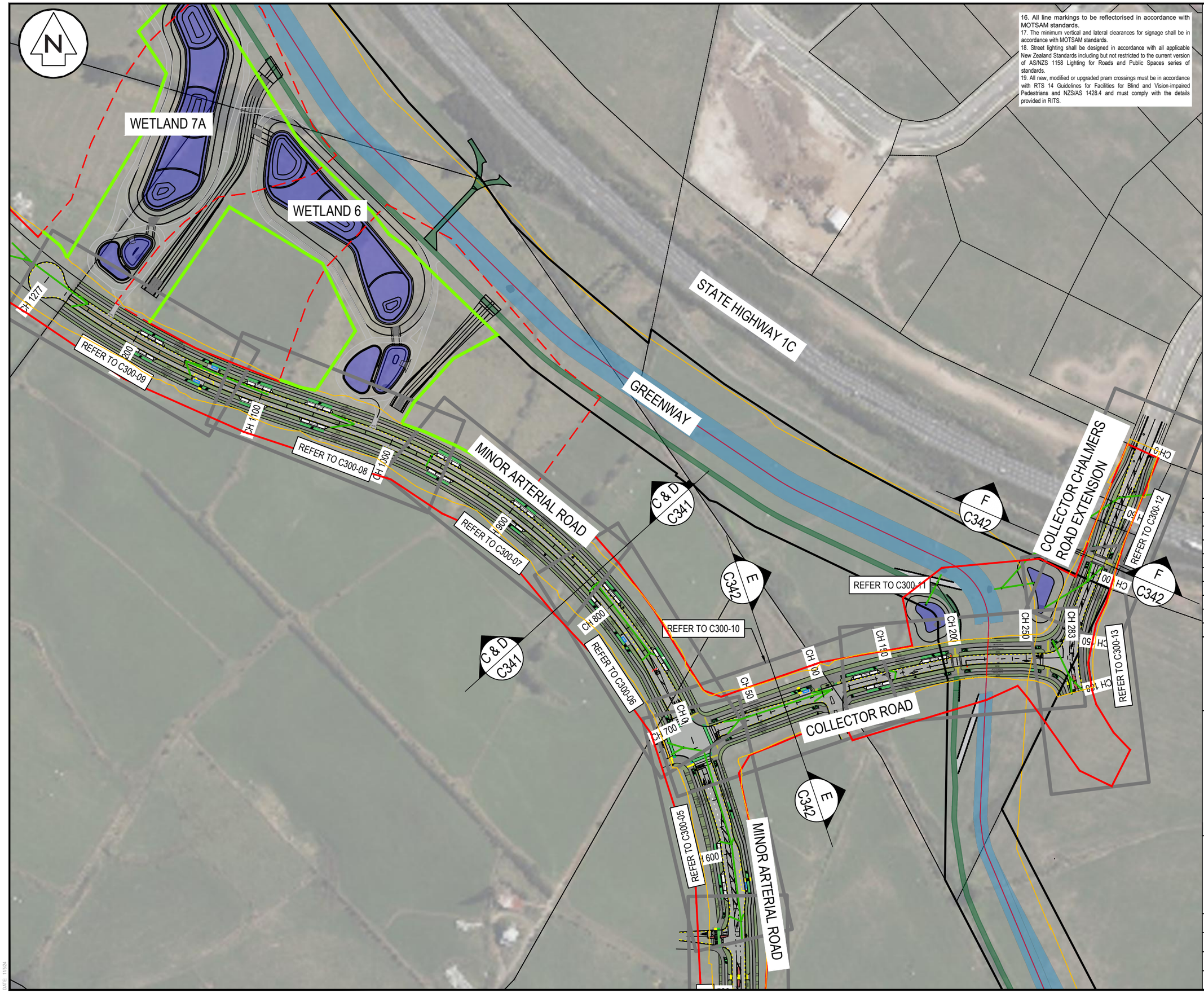

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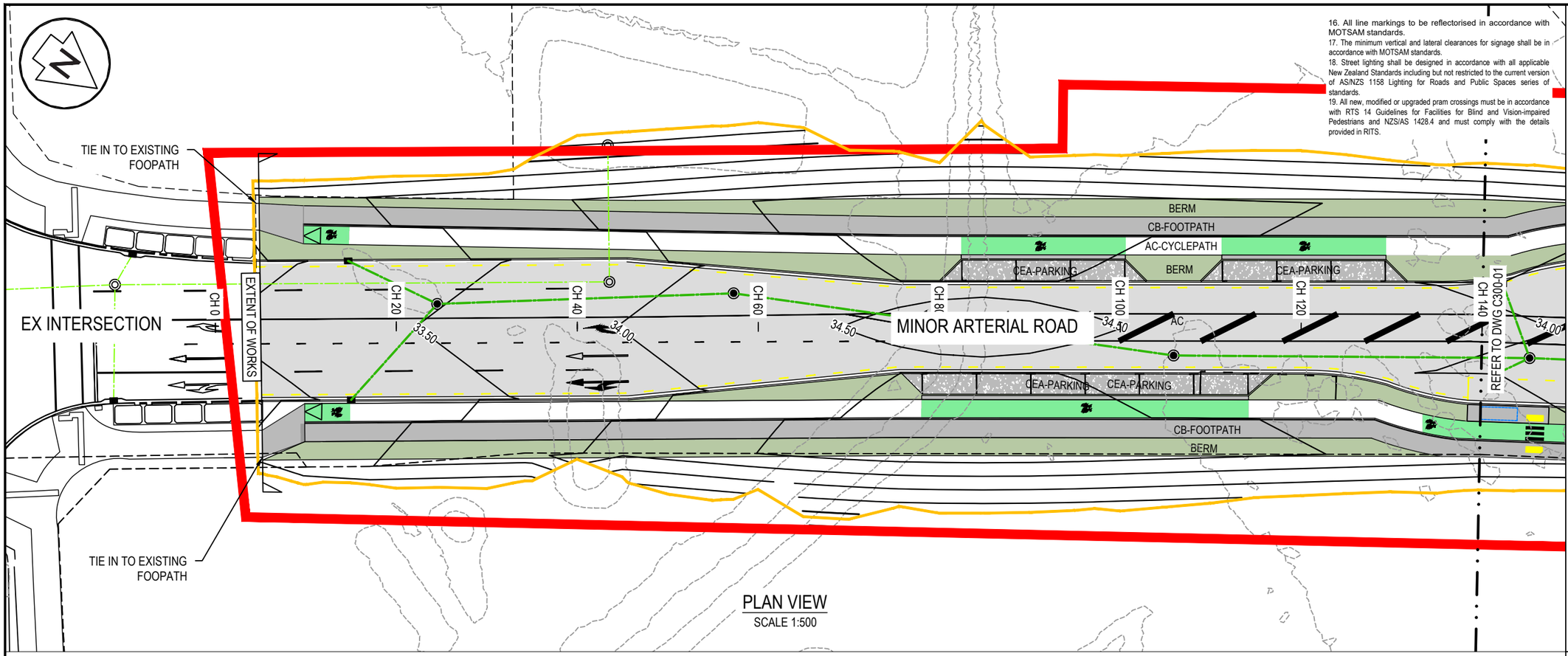
Scale	1:2500 @ A3
Cad file	180006-C300 - RC.DWG
Drawing no.	C300-00B Rev B

DATE 11/5/24



PLAN VIEW
SCALE 1:500

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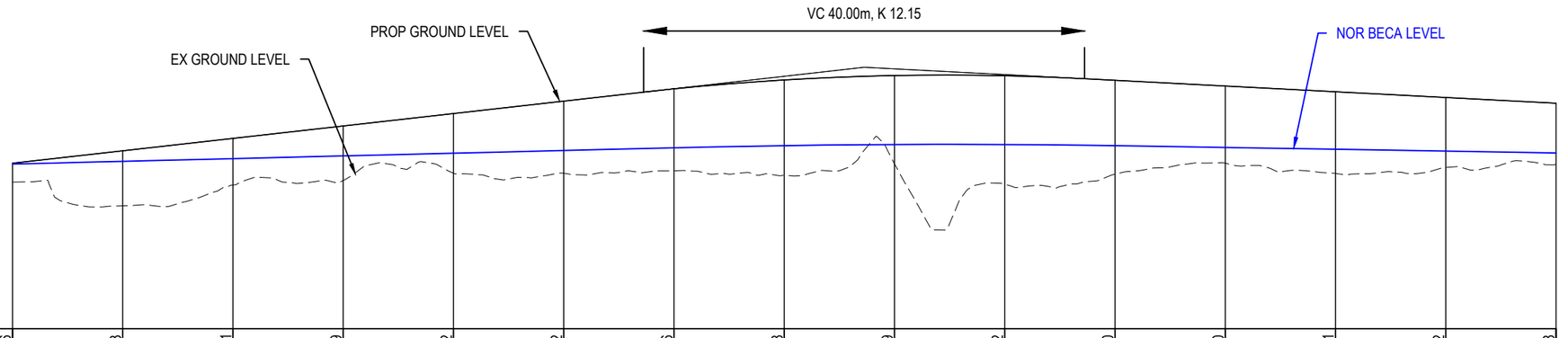

DATUM 30.00m

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DESIGN LEVELS	33.00	33.23	33.45	33.68	33.90	34.13	34.35	34.51	34.59	34.59	34.50	34.40	34.30	34.19	34.09
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VERTICAL GEOMETRY		57.24 2.3%						VC 40.00, A.D. -3.3% IP CH 77.24/RL 34.74				88.08 -1.0%			
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00
HORIZONTAL GEOMETRY	8.08m 321°48'12"	R 200.00 A 3.90	124.32m 322°55'16"												R 200.00 A 7.92

PROPOSED - Minor Arterial Road 1 CH 0+00.00 TO CH 1+40.00
SCALE: 1:1000 H / 1:200 V

Rev	Description	By	Date
C	NOR NOTIFICATION	ABS	10/24
B	LAND OWNER APPROVAL	JZ	03/24
A	RESOURCE CONSENT	MA	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	AN	10/2022
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Checked	JZ	07/2023

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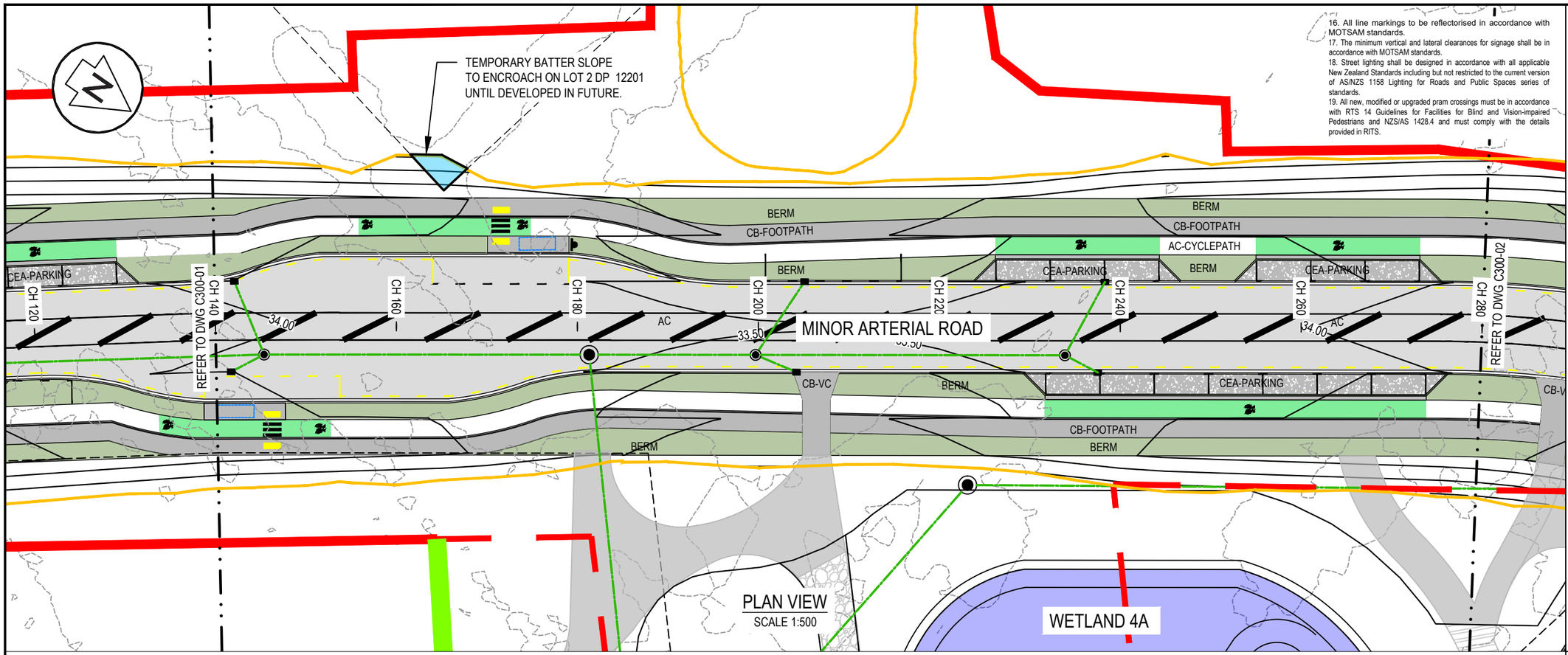
Project
ROTOKAURI ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LTD

Title
PROPOSED ROADING LONG SECTION

Project no.	180006		
Scale	1:500 @ A3		
Cad file	180006-C300 - RC.DWG		
Drawing no.	C300-01	Rev	C

DATE: 1/11/24



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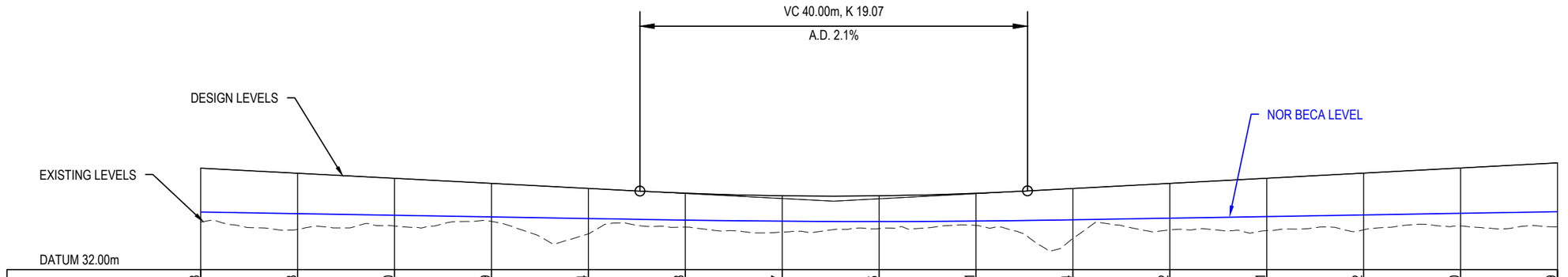
	ROAD NAME SIGN
	TACTILE PAVERS



EXISTING LEVELS	32.98	32.83	32.90	32.99	32.74	32.88	32.77	32.85	32.91	32.64	32.82	32.81	32.82	32.90	32.89
DESIGN LEVELS	34.09	33.98	33.88	33.78	33.67	33.57	33.52	33.52	33.57	33.67	33.78	33.88	33.99	34.09	34.20
CUT/FILL	1.11	1.16	0.98	0.78	0.94	0.70	0.75	0.67	0.66	1.03	0.96	1.08	1.17	1.19	1.31
VERTICAL GEOMETRY		88.08 -1.0%					VC 40.00, A.D. 2.1% IP CH 205.32/RL 33.41					174.68 1.1%			
CHAINAGE	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00	230.00	240.00	250.00	260.00	270.00	280.00
HORIZONTAL GEOMETRY	R 200.00 A 7.92	131.22m 325°11'28"													R 120.00 A 71.54

PROPOSED - Minor Arterial Road 1 CH 1+40.00 TO CH 2+80.00
SCALE: 1:1000 H / 1:200 V

Rev	Description	By	Date
C	NOR NOTIFICATION	ABS	10/24
B	LAND OWNER APPROVAL	JZ	03/24
A	RESOURCE CONSENT	MA	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	AN	10/2022
Drawn	MA	07/2023
Checked	JZ	07/2023

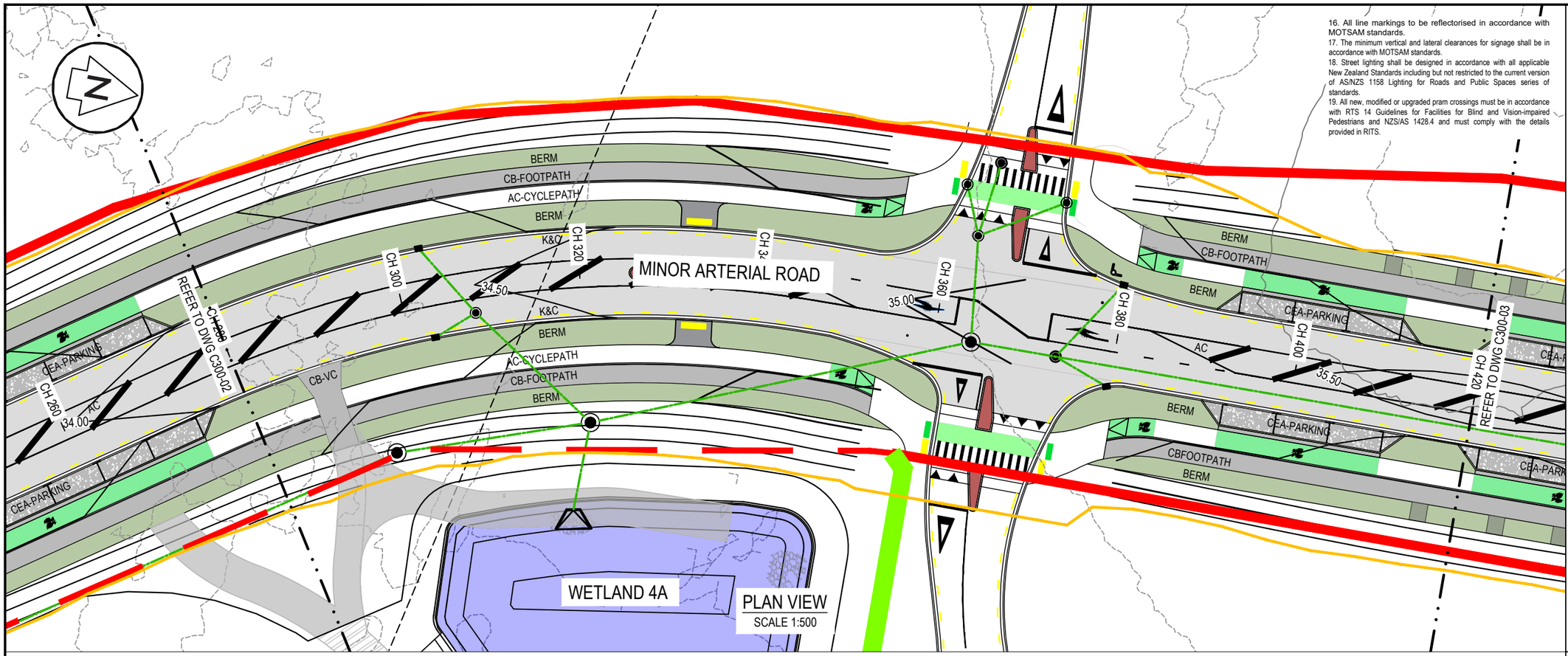
Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
5 Owens Road, Epsom
Auckland 1023

Project
ROTOKAURI ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LTD

Title
PROPOSED ROADING LONG SECTION

Project no.	180006
Scale	1:500 @ A3
Cad file	180006-C300 - RC.DWG
Drawing no.	C300-02 Rev C

DATE: 1/12/24



16. All line markings to be reflectorised in accordance with MOTSAM standards.
17. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
18. 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.
19. 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 RITS.

Notes

1. All works to be in accordance with Hamilton City Council RITS standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000.
3. Levels in terms of NZVD16.
4. Contractor is to avoid using GPS for set out of the kerb levels where gradients less than 1%.
5. It is the contractors responsibility to locate all services that may be affected by his operations.
6. The contractor shall comply with all relevant Health and Safety requirements.
7. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
8. Final pavement design subject to CBR/Beam tests on subgrade material.
9. Setout schedule with co-ordinates of chainage points along road centreline to be supplied to the contractor prior to construction.
10. Refer to long section for finished centreline levels. Refer to typical cross sections to obtain levels for other locations
11. All ducts shall have locations marked on kerb lines in accordance with specification.t
12. Pram crossings are to be flush to the channel with no lip.
13. All kerb and channel to have saw-cuts at max. 4m centres.
14. All signage and pavement markings to be in accordance with NZTA MOTSAM standards and the RITS.
15. All street name signs shall follow RITS guidelines in terms of layout, clearances, and construction details.

Legend

- EX BDY
- CURRENT ARTERIAL DESIGNATION BDY
- CURRENT ARTERIAL DESIGNATION BDY AMENDED
- PROPOSED ARTERIAL DESIGNATION BDY
- ROAD BATTER BDY
- EX SW
- PROP SW
- AC — AC PAVING
- CB — BRUSHED CONCRETE
- CEA — EXPOSED CONCRETE
- DC — DISH CHANNEL
- K&C — KERB AND CHANNEL
- K&N — KERB AND NIB
- PROP SWCP SINGLE
- PROP STREET LIGHT
- PROP STREET SIGN
- ROAD NAME SIGN
- TACTILE PAVERS

VC 40.00m, K 19.74
A.D. -2.0%

NOR BECA LEVEL

DESIGN LEVELS

EXISTING LEVELS

DATUM 32.00m

EXISTING LEVELS	32.89	33.06	33.05	33.32	33.25	33.28	33.37	33.46	33.73	34.39	34.26	34.32	34.85	35.04	35.06
DESIGN LEVELS	34.20	34.31	34.41	34.52	34.62	34.73	34.84	34.94	35.05	35.15	35.26	35.36	35.47	35.55	35.58
CUT/FILL	1.31	1.24	1.36	1.20	1.38	1.45	1.47	1.48	1.32	0.77	1.00	1.04	0.62	0.51	0.52
VERTICAL GEOMETRY		174.68 1.1%											VC 40.00, A.D. -2.0% IP CH 420.00/RL 35.68		
CHAINAGE	280.00	290.00	300.00	310.00	320.00	330.00	340.00	350.00	360.00	370.00	380.00	390.00	400.00	410.00	420.00
HORIZONTAL GEOMETRY		R 120.00 A 71.54						177.48m 359°20'59"							

PROPOSED - Minor Arterial Road 1 CH 2+80.00 TO CH 4+20.00
SCALE: 1:1000 H / 1:200 V

Rev	Description	By	Date
C	NOR NOTIFICATION	ABS	10/24
B	LAND OWNER APPROVAL	JZ	03/24
A	RESOURCE CONSENT	MA	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	AN	10/2022
Drawn	MA	07/2023
Checked	JZ	07/2023

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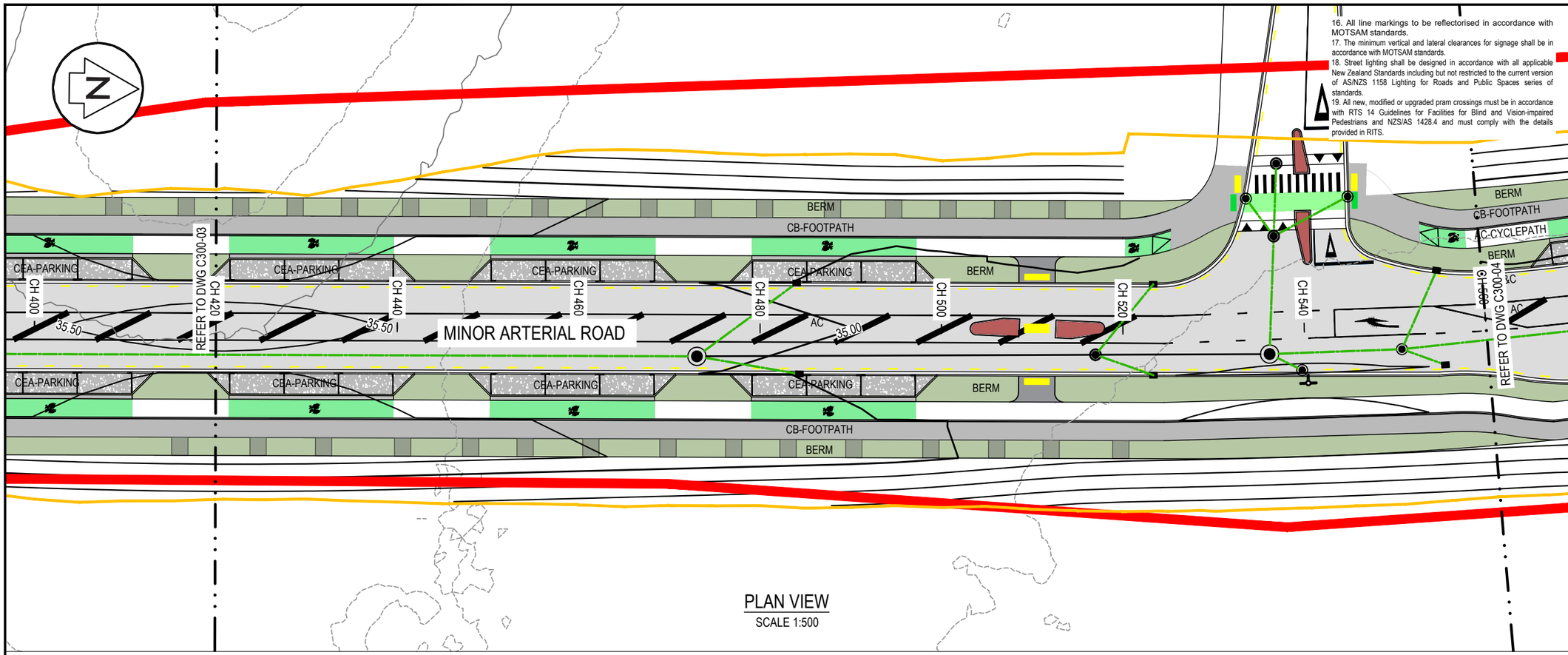
5 Owens Road, Epsom
Auckland 1023

Project
ROTOKAURI ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LTD

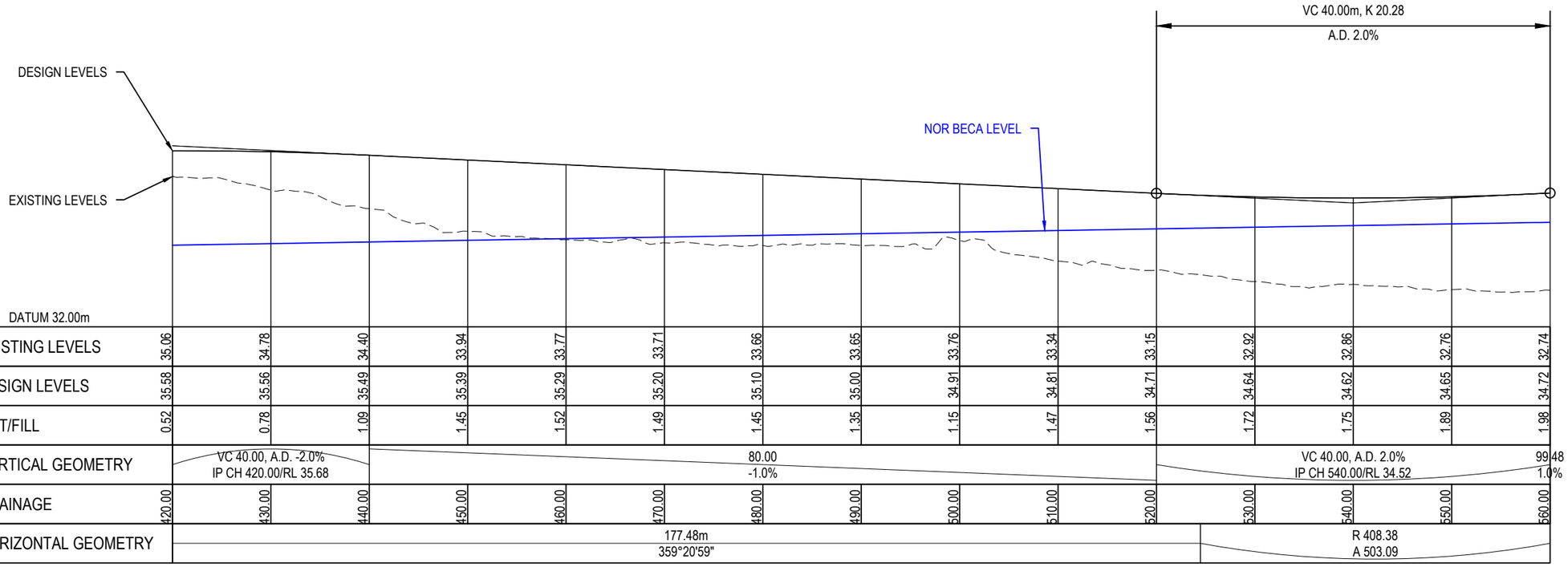
Title
PROPOSED ROADING LONG SECTION

Project no.	180006
Scale	1:500 @ A3
Cad file	180006-C300 - RC.DWG
Drawing no.	C300-03 Rev C

DATE: 1/11/24



PLAN VIEW
SCALE 1:500



EXISTING LEVELS	35.06	34.78	34.40	33.94	33.77	33.71	33.66	33.65	33.76	33.34	33.15	32.92	32.86	32.76	32.74
DESIGN LEVELS	35.58	35.56	35.49	35.39	35.29	35.20	35.10	35.00	34.91	34.81	34.71	34.64	34.62	34.65	34.72
CUT/FILL	0.52	0.78	1.09	1.45	1.52	1.49	1.45	1.35	1.15	1.47	1.56	1.72	1.75	1.89	1.98
VERTICAL GEOMETRY		VC 40.00, A.D. -2.0% IP CH 420.00/RL 35.68		80.00 -1.0%								VC 40.00, A.D. 2.0% IP CH 540.00/RL 34.52			99.48 1.0%
CHAINAGE	420.00	430.00	440.00	450.00	460.00	470.00	480.00	490.00	500.00	510.00	520.00	530.00	540.00	550.00	560.00
HORIZONTAL GEOMETRY		177.48m 359°20'59"										R 408.38 A 503.09			

PROPOSED - Minor Arterial Road 1 CH 4+20.00 TO CH 5+60.00
SCALE: 1:1000 H / 1:200 V

Notes

16. All line markings to be reflectorised in accordance with MOTSAM standards.
17. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
18. 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.
19. 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 RITS.

Notes

1. All works to be in accordance with Hamilton City Council RITS standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000.
3. Levels in terms of NZVD16.
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11. All ducts shall have locations marked on kerb lines in accordance with specification.t
12. Pram crossings are to be flush to the channel with no lip.
13. All kerb and channel to have saw-cuts at max. 4m centres.
14. All signage and pavement markings to be in accordance with NZTA MOTSAM standards and the RITS.
15. All street name signs shall follow RITS guidelines in terms of layout, clearances, and construction details.

Legend

- EX BDY
- CURRENT ARTERIAL DESIGNATION BDY
- CURRENT ARTERIAL DESIGNATION BDY AMENDED
- PROPOSED ARTERIAL DESIGNATION BDY
- ROAD BATTER BDY
- EX SW
- PROP SW
- AC — AC PAVING
- CB — BRUSHED CONCRETE
- CEA — EXPOSED CONCRETE
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- K&C — KERB AND CHANNEL
- K&N — KERB AND NIB
- PROP SWCP SINGLE
- PROP STREET LIGHT
- PROP STREET SIGN
- ROAD NAME SIGN
- TACTILE PAVERS

Rev	Description	By	Date
B	NOR NOTIFICATION	ABS	10/24
A	RESOURCE CONSENT	MA	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	AN	10/2022
Drawn	MA	07/2023
Checked	JZ	07/2023

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5 Owens Road, Epsom
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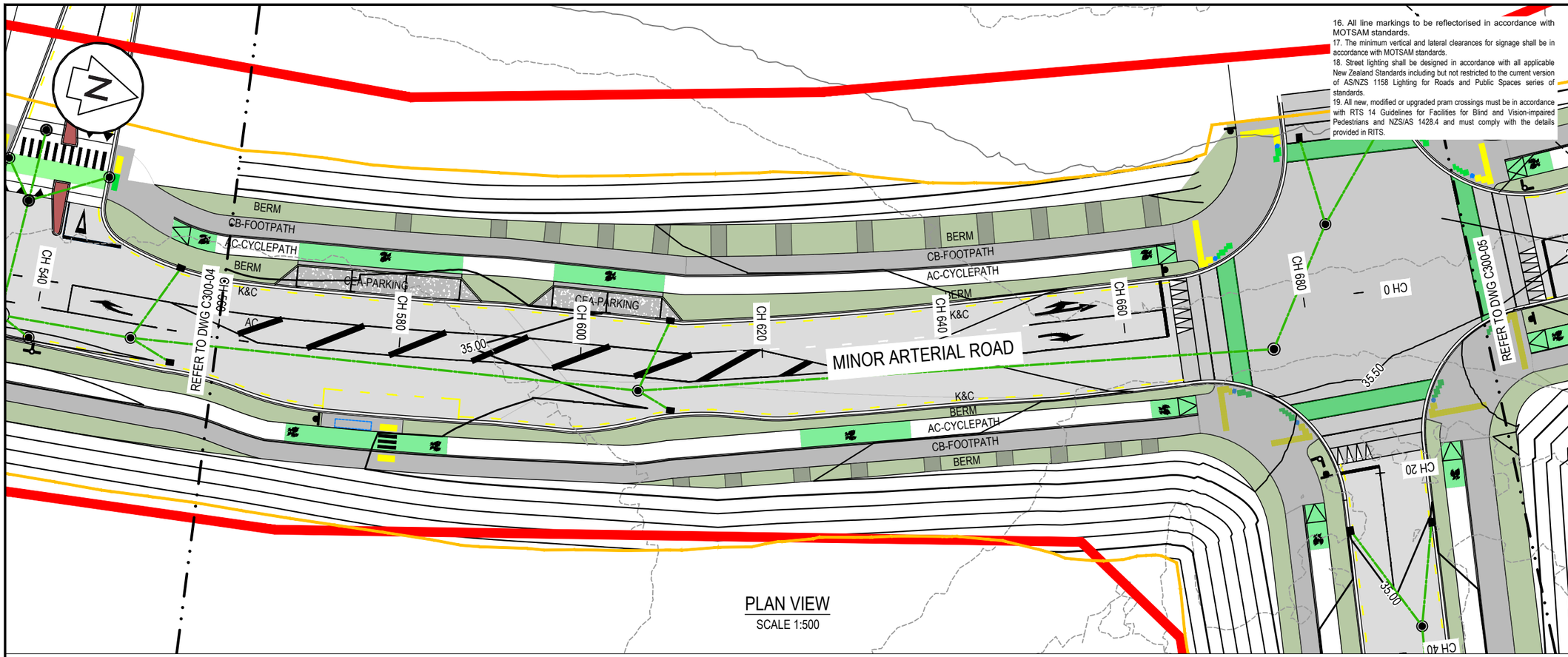
Project
ROTOKAURI ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LTD

Title
PROPOSED ROADING LONG SECTION

Project no.	180006		
Scale	1:500 @ A3		
Cad file	180006-C300 - RC.DWG		
Drawing no.	C300-04	Rev	B

DATE 11/0/24



PLAN VIEW
SCALE 1:500

16. All line markings to be reflectorised in accordance with MOTSAM standards.
17. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
18. 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.
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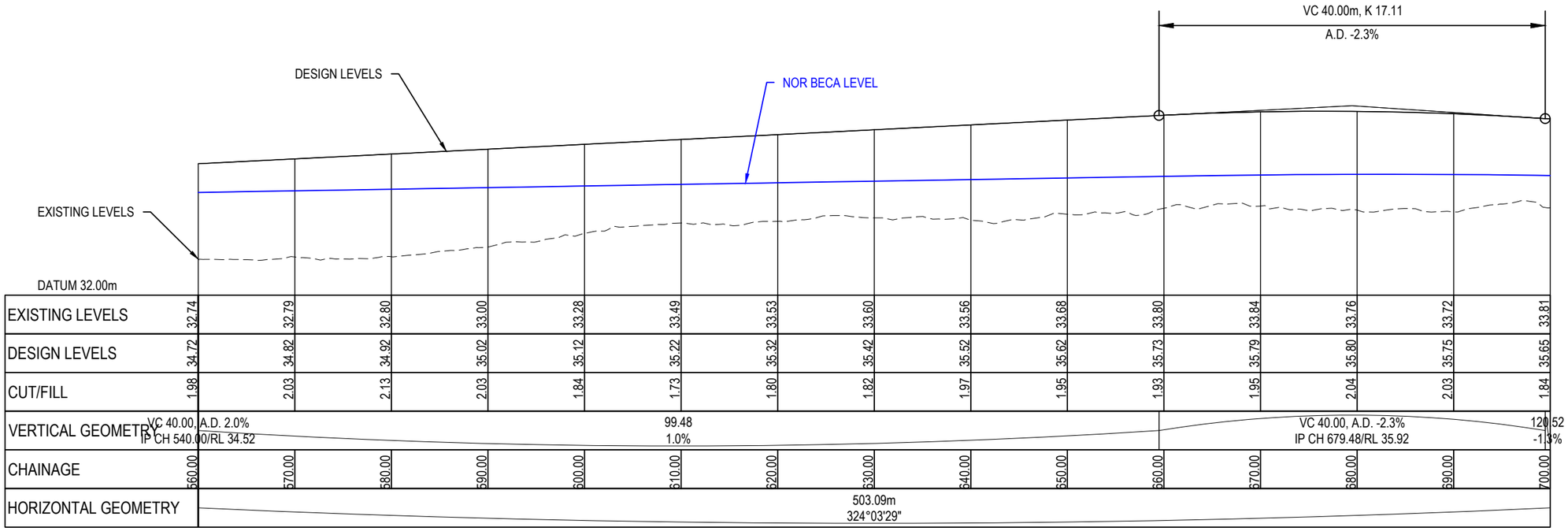
Legend

	EX BDY
	CURRENT ARTERIAL DESIGNATION BDY
	CURRENT ARTERIAL DESIGNATION BDY AMENDED
	PROPOSED ARTERIAL DESIGNATION BDY
	ROAD BATTER BDY
	EX SW
	PROP SW
AC	AC PAVING
CB	BRUSHED CONCRETE
CEA	EXPOSED CONCRETE
DC	DISH CHANNEL
K&C	KERB AND CHANNEL
K&N	KERB AND NIB
	PROP SWCP SINGLE
	PROP STREET LIGHT
	PROP STREET SIGN
	ROAD NAME SIGN
	TACTILE PAVERS



EXISTING LEVELS	32.74	32.79	32.80	33.00	33.28	33.49	33.53	33.60	33.56	33.68	33.80	33.84	33.76	33.72	33.81
DESIGN LEVELS	34.72	34.82	34.92	35.02	35.12	35.22	35.32	35.42	35.52	35.62	35.73	35.79	35.80	35.75	35.65
CUT/FILL	1.98	2.03	2.13	2.03	1.84	1.73	1.80	1.82	1.97	1.95	1.93	1.95	2.04	2.03	1.84
VERTICAL GEOMETRY	VC 40.00, A.D. 2.0% IP CH 540.00/RL 34.52					99.48 1.0%							VC 40.00, A.D. -2.3% IP CH 679.48/RL 35.92		120.52 -1.3%
CHAINAGE	560.00	570.00	580.00	590.00	600.00	610.00	620.00	630.00	640.00	650.00	660.00	670.00	680.00	690.00	700.00
HORIZONTAL GEOMETRY						503.09m 324°03'29"									

PROPOSED - Minor Arterial Road 1 CH 5+60.00 TO CH 7+00.00
SCALE: 1:1000 H / 1:200 V

Rev	Description	By	Date
B	NOR NOTIFICATION	ABS	10/24
A	RESOURCE CONSENT	MA	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	AN	10/2022
Drawn	MA	07/2023
Checked	JZ	07/2023

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5 Owens Road, Epsom
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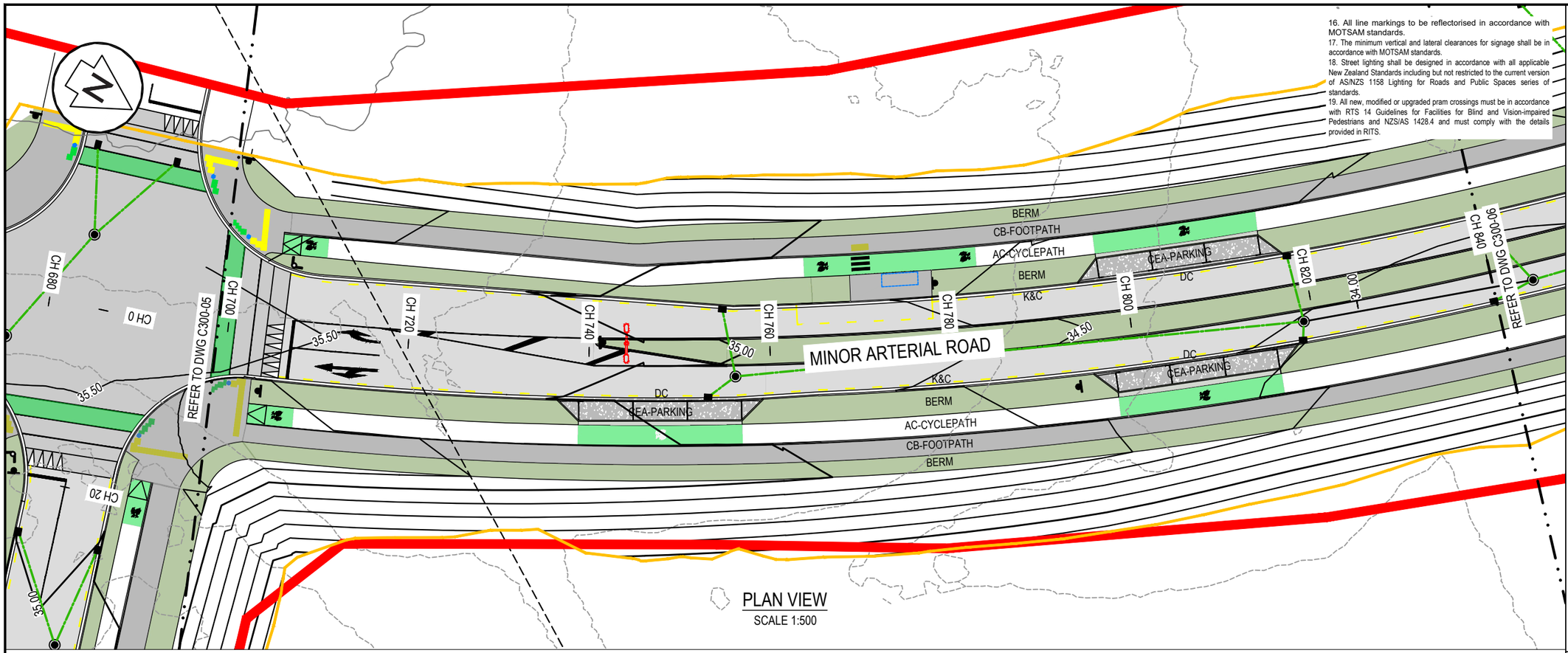
Project
ROTOKAURI ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LTD

Title
PROPOSED ROADING LONG SECTION

Project no.	180006
Scale	1:500 @ A3
Cad file	180006-C300 - RC.DWG
Drawing no.	C300-05 Rev B

DATE: 1/12/24



PLAN VIEW
SCALE 1:500

16. All line markings to be reflectorised in accordance with MOTSAM standards.
17. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
18. 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.
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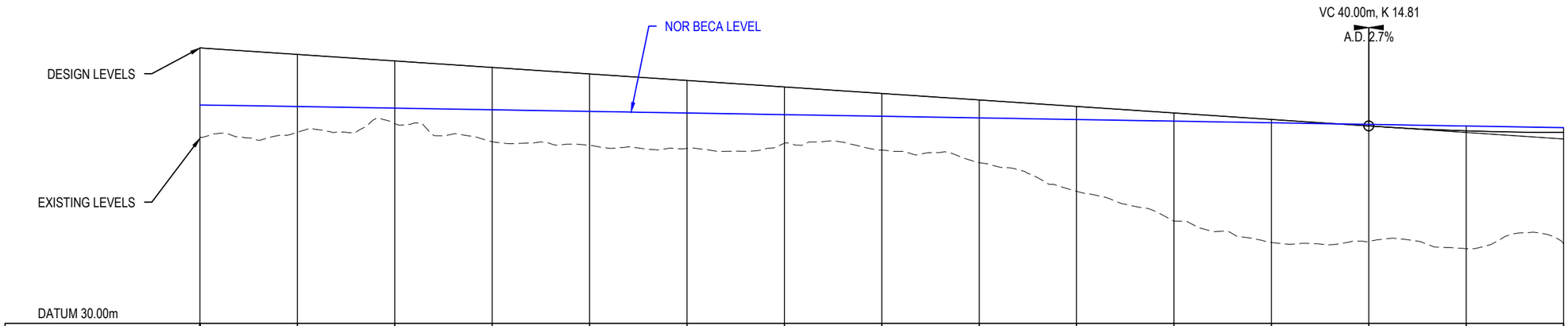
Legend

	EX BDY
	CURRENT ARTERIAL DESIGNATION BDY
	CURRENT ARTERIAL DESIGNATION BDY AMENDED
	PROPOSED ARTERIAL DESIGNATION BDY
	ROAD BATTER BDY
	EX SW
	PROP SW
AC	AC PAVING
CB	BRUSHED CONCRETE
CEA	EXPOSED CONCRETE
DC	DISH CHANNEL
K&C	KERB AND CHANNEL
K&N	KERB AND NIB
	PROP SWCP SINGLE
	PROP STREET LIGHT
	PROP STREET SIGN
	ROAD NAME SIGN
	TACTILE PAVERS



DATUM 30.00m

EXISTING LEVELS	33.81	33.92	34.10	33.72	33.65	33.59	33.69	33.55	33.30	32.71	32.10	31.66	31.68	31.53	31.64
DESIGN LEVELS	35.65	35.51	35.38	35.25	35.11	34.98	34.85	34.71	34.58	34.45	34.31	34.18	34.05	33.95	33.92
CUT/FILL	1.84	1.60	1.28	1.52	1.46	1.39	1.16	1.16	1.28	1.74	2.22	2.52	2.37	2.42	2.28
VERTICAL GEOMETRY		120.52 -1.3%											VC 40.00, A.D. 2.7% IP CH 840.00/RL 33.78		
CHAINAGE	700.00	710.00	720.00	730.00	740.00	750.00	760.00	770.00	780.00	790.00	800.00	810.00	820.00	830.00	840.00
HORIZONTAL GEOMETRY		503.09m 324°03'29"													

PROPOSED - Minor Arterial Road 1 CH 7+00.00 TO CH 8+40.00
SCALE: 1:1000 H / 1:200 V

Rev	Description	By	Date
B	NOR NOTIFICATION	ABS	10/24
A	RESOURCE CONSENT	MA	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	AN	10/2022
Drawn	MA	07/2023
Checked	JZ	07/2023

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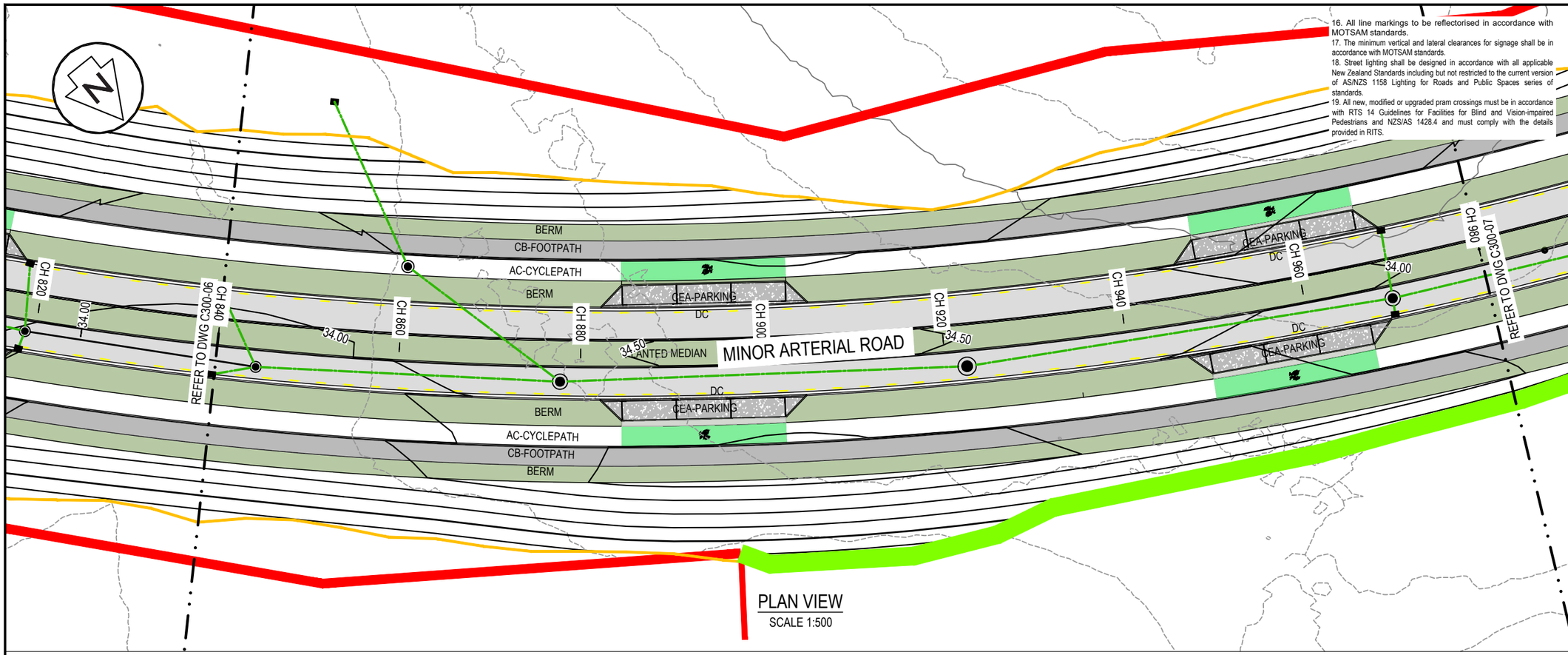
5 Owens Road, Epsom
Auckland 1023

Project
ROTOKAURI ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LTD

Title
PROPOSED ROADING LONG SECTION

Project no.	180006		
Scale	1:500 @ A3		
Cad file	180006-C300 - RC.DWG		
Drawing no.	C300-06	Rev	B

DATE 10/24



PLAN VIEW
SCALE 1:500

16. All line markings to be reflectorised in accordance with MOTSAM standards.
17. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
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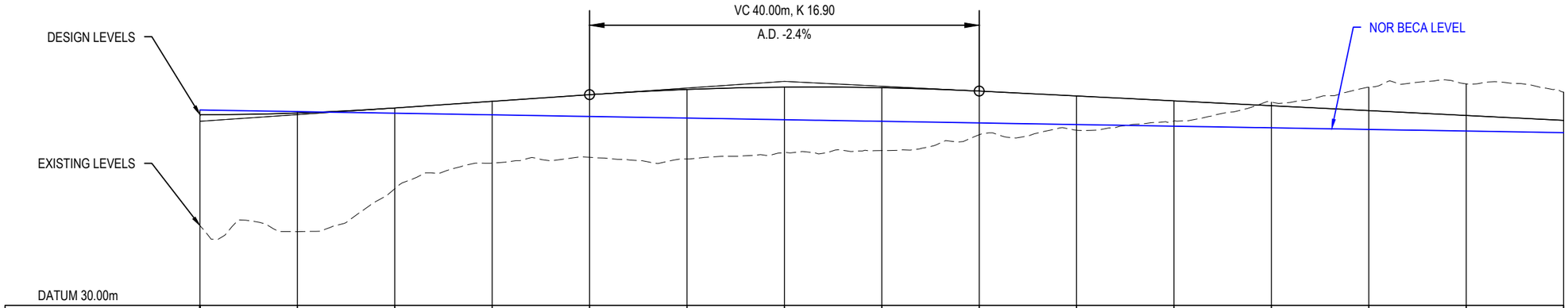
Legend

	EX BDY
	CURRENT ARTERIAL DESIGNATION BDY
	CURRENT ARTERIAL DESIGNATION BDY AMENDED
	PROPOSED ARTERIAL DESIGNATION BDY
	ROAD BATTER BDY
	EX SW
	PROP SW
AC	AC PAVING
CB	BRUSHED CONCRETE
CEA	EXPOSED CONCRETE
DC	DISH CHANNEL
K&C	KERB AND CHANNEL
K&N	KERB AND NIB
	PROP SWCP SINGLE
	PROP STREET LIGHT
	PROP STREET SIGN
	ROAD NAME SIGN
	TACTILE PAVERS



DATUM 30.00m

EXISTING LEVELS	31.64	31.51	32.40	32.92	33.04	33.01	33.14	33.18	33.50	33.60	33.79	34.17	34.48	34.55	34.38
DESIGN LEVELS	33.92	33.95	34.05	34.19	34.33	34.43	34.48	34.47	34.40	34.30	34.20	34.10	34.00	33.90	33.80
CUT/FILL	2.28	2.44	1.66	1.27	1.29	1.43	1.34	1.29	0.90	0.70	0.41	-0.07	-0.48	-0.65	-0.58
VERTICAL GEOMETRY		VC 40.00, A.D. 2.7% IP CH 840.00/RL 33.78		20.00 1.4%		VC 40.00, A.D. -2.4% IP CH 900.00/RL 34.60						80.00 -1.0%			
CHAINAGE	840.00	850.00	860.00	870.00	880.00	890.00	900.00	910.00	920.00	930.00	940.00	950.00	960.00	970.00	980.00
HORIZONTAL GEOMETRY	503.09m 324°03'29"														

PROPOSED - Minor Arterial Road 1 CH 8+40.00 TO CH 9+80.00
SCALE: 1:1000 H / 1:200 V

Rev	Description	By	Date
B	NOR NOTIFICATION	ABS	10/24
A	RESOURCE CONSENT	MA	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	AN	10/2022
Drawn	MA	07/2023
Checked	JZ	07/2023

Maven Associates
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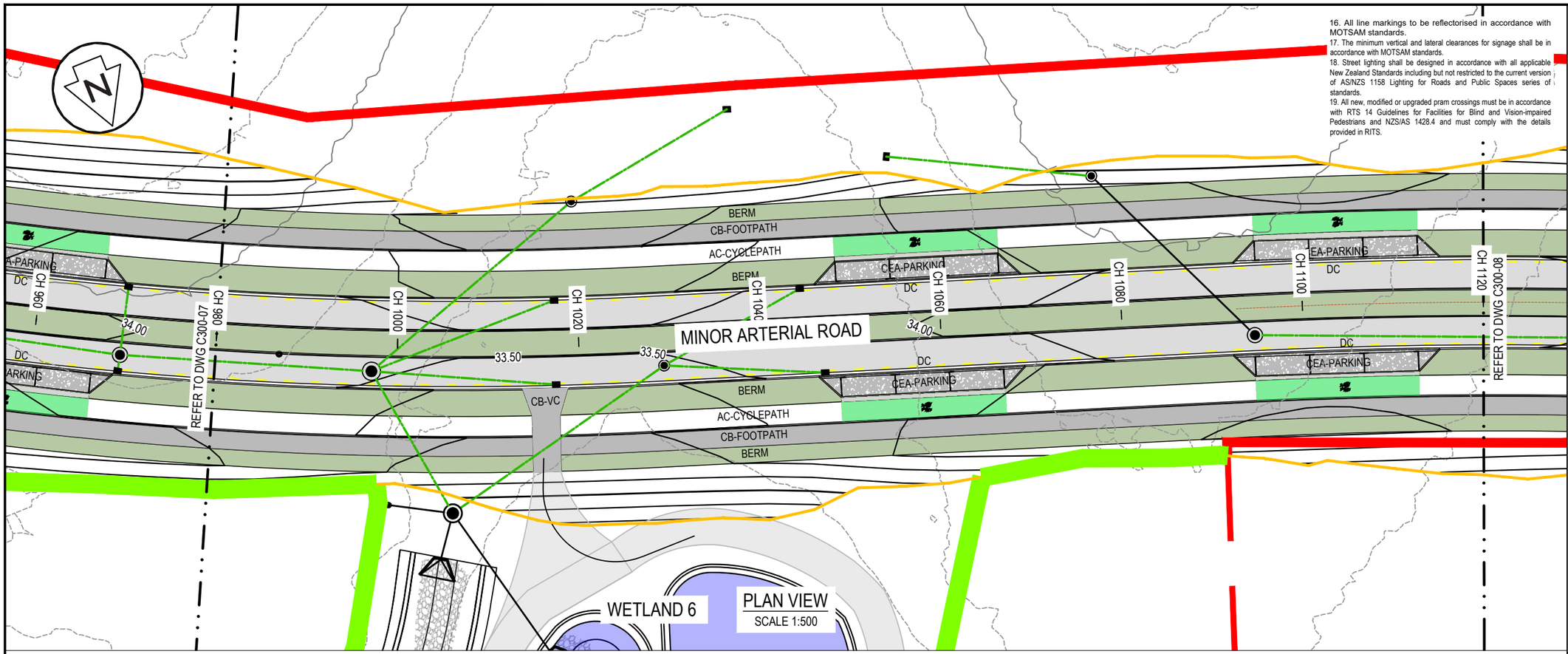
www.maven.co.nz
5 Owens Road, Epsom
Auckland 1023

Project
ROTOKAURI ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LTD

Title
PROPOSED ROADING LONG SECTION

Project no.	180006		
Scale	1:500 @ A3		
Cad file	180006-C300 - RC.DWG		
Drawing no.	C300-07	Rev	B

DATE 10/24

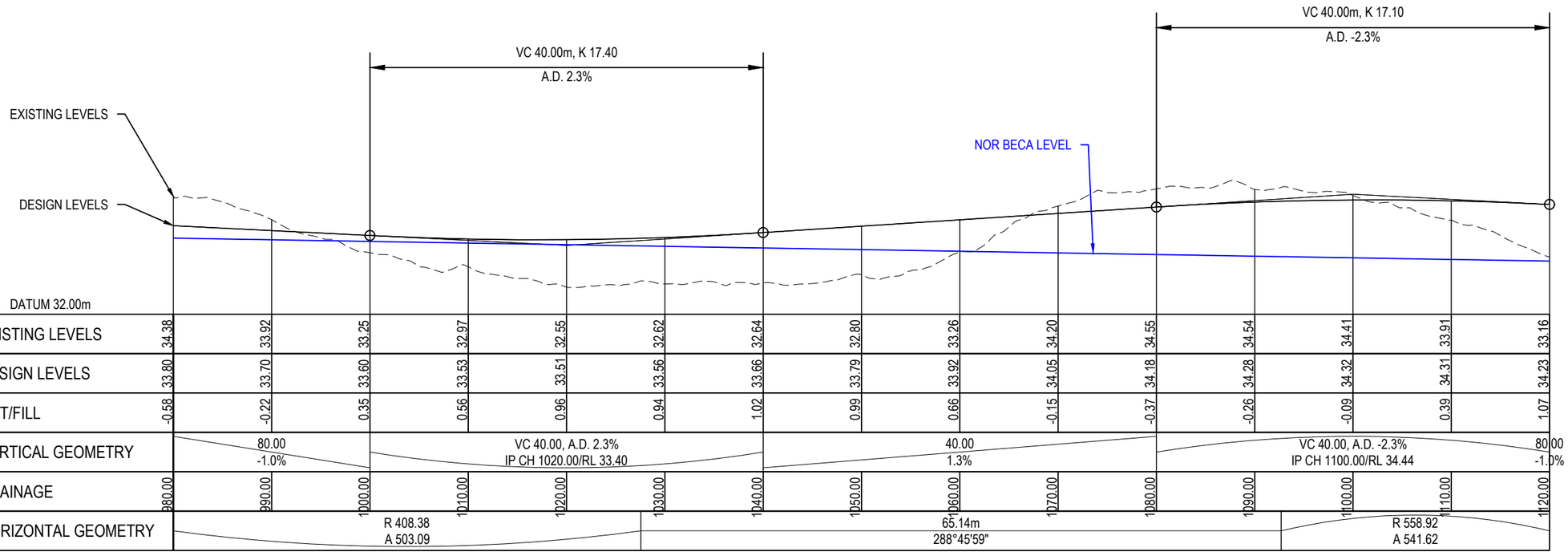


16. All line markings to be reflectorised in accordance with MOTSAM standards.
17. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
18. Street lighting shall be designed in accordance with all applicable New Zealand Standards including but not restricted to the current version of AS/NZS 1158 Lighting for Roads and Public Spaces series of standards.
19. 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 RITS.

Notes
1. All works to be in accordance with Hamilton City Council RITS standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000.
3. Levels in terms of NZVD16.
4. Contractor is to avoid using GPS for set out of the kerb levels where gradients less than 1%.
5. It is the contractors responsibility to locate all services that may be affected by his operations.
6. The contractor shall comply with all relevant Health and Safety requirements.
7. The contractor shall obtain all necessary approval from utility operators before commencing work under or near their services.
8. Final pavement design subject to CBR/Beam tests on subgrade material.
9. Setout schedule with co-ordinates of chainage points along road centreline to be supplied to the contractor prior to construction.
10. Refer to long section for finished centreline levels. Refer to typical cross sections to obtain levels for other locations
11. All ducts shall have locations marked on kerb lines in accordance with specification.t
12. Pram crossings are to be flush to the channel with no lip.
13. All kerb and channel to have saw-cuts at max. 4m centres.
14. All signage and pavement markings to be in accordance with NZTA MOTSAM standards and the RITS.
15. All street name signs shall follow RITS guidelines in terms of layout, clearances, and construction details.

Legend

	EX BDY
	CURRENT ARTERIAL DESIGNATION BDY
	CURRENT ARTERIAL DESIGNATION BDY AMENDED
	PROPOSED ARTERIAL DESIGNATION BDY
	ROAD BATTER BDY
	EX SW
	PROP SW
AC	AC PAVING
CB	BRUSHED CONCRETE
CEA	EXPOSED CONCRETE
DC	DISH CHANNEL
K&C	KERB AND CHANNEL
K&N	KERB AND NIB
	PROP SWCP SINGLE
	PROP STREET LIGHT
	PROP STREET SIGN
	ROAD NAME SIGN
	TACTILE PAVERS



EXISTING LEVELS	34.38	33.92	33.25	32.97	32.55	32.62	32.64	32.80	33.26	34.20	34.55	34.54	34.41	33.91	33.16
DESIGN LEVELS	33.80	33.70	33.60	33.53	33.51	33.56	33.66	33.79	33.92	34.05	34.18	34.28	34.32	34.31	34.23
CUT/FILL	-0.58	-0.22	0.35	0.56	0.96	0.94	1.02	0.99	0.66	-0.15	-0.37	-0.26	-0.09	0.39	1.07
VERTICAL GEOMETRY		80.00 -1.0%		VC 40.00, A.D. 2.3% IP CH 1020.00/RL 33.40				40.00 1.3%			VC 40.00, A.D. -2.3% IP CH 1100.00/RL 34.44				80.00 -1.0%
CHAINAGE	980.00	990.00	1000.00	1010.00	1020.00	1030.00	1040.00	1050.00	1060.00	1070.00	1080.00	1090.00	1100.00	1110.00	1120.00
HORIZONTAL GEOMETRY		R 408.38 A 503.09				65.14m 288°45'59"						R 558.92 A 541.62			

PROPOSED - Minor Arterial Road 1 CH 9+80.00 TO CH 11+20.00
SCALE: 1:1000 H / 1:200 V

Rev	Description	By	Date
B	NOR NOTIFICATION	ABS	10/24
A	RESOURCE CONSENT	MA	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	AN	10/2022
Drawn	MA	07/2023
Checked	JZ	07/2023

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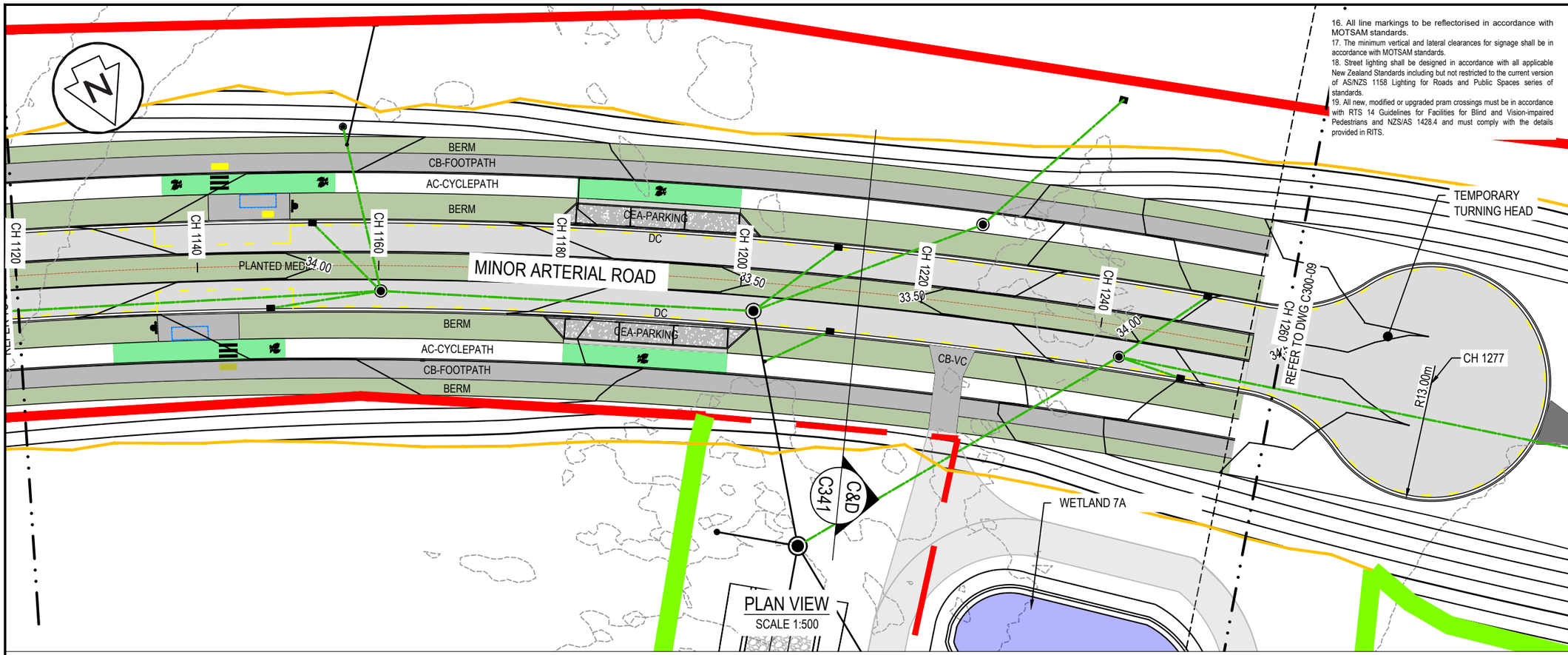
5 Owens Road, Epsom
Auckland 1023

Project
ROTOKAURI ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LTD

Title
PROPOSED ROADING LONG SECTION

Project no.	180006		
Scale	1:500 @ A3		
Cad file	180006-C300 - RC.DWG		
Drawing no.	C300-08	Rev	B

DATE: 10/24



16. All line markings to be reflectorised in accordance with MOTSAM standards.
17. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
18. 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.
19. 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 RITS.

Notes

1. All works to be in accordance with Hamilton City Council RITS standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000.
3. Levels in terms of NZVD16.
4. Contractor is to avoid using GPS for set out of the kerb levels where gradients less than 1%.
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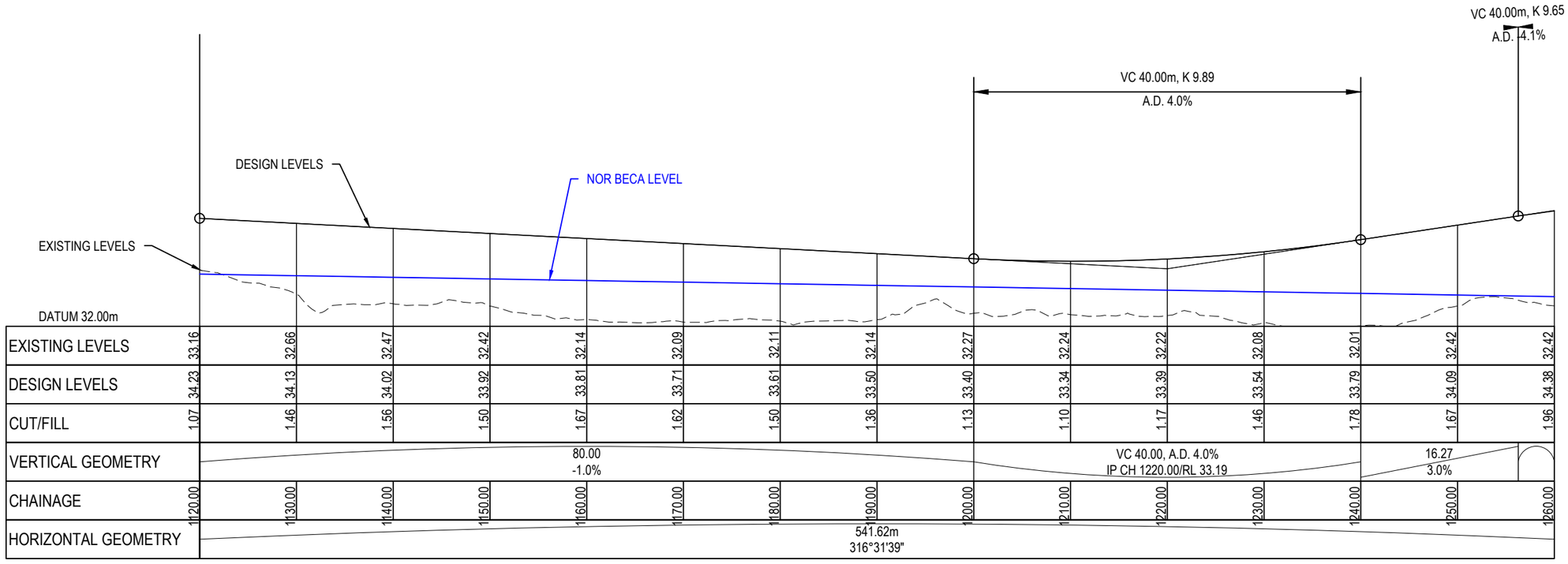
12. Pram crossings are to be flush to the channel with no lip.
13. All kerb and channel to have saw-cuts at max. 4m centres.
14. All signage and pavement markings to be in accordance with NZTA MOTSAM standards and the RITS.
15. All street name signs shall follow RITS guidelines in terms of layout, clearances, and construction details.

Legend

	EX BDY
	CURRENT ARTERIAL DESIGNATION BDY
	CURRENT ARTERIAL DESIGNATION BDY AMENDED
	PROPOSED ARTERIAL DESIGNATION BDY
	ROAD BATTER BDY
	EX SW
	PROP SW
AC	AC PAVING
CB	BRUSHED CONCRETE
CEA	EXPOSED CONCRETE
DC	DISH CHANNEL
K&C	KERB AND CHANNEL
K&N	KERB AND NIB
	PROP SWCP SINGLE
	PROP STREET LIGHT
	PROP STREET SIGN
	ROAD NAME SIGN
	TACTILE PAVERS



EXISTING LEVELS	33.16	32.66	32.47	32.42	32.14	32.09	32.11	32.14	32.27	32.24	32.22	32.08	32.01	32.42	32.42
DESIGN LEVELS	34.23	34.13	34.02	33.92	33.81	33.71	33.61	33.50	33.40	33.34	33.39	33.54	33.79	34.09	34.38
CUT/FILL	1.07	1.46	1.56	1.50	1.67	1.62	1.50	1.36	1.13	1.10	1.17	1.46	1.78	1.67	1.96
VERTICAL GEOMETRY		80.00 -1.0%							VC 40.00, A.D. 4.0% IP CH 1220.00/RL 33.19				16.27 3.0%		
CHAINAGE	1120.00	1130.00	1140.00	1150.00	1160.00	1170.00	1180.00	1190.00	1200.00	1210.00	1220.00	1230.00	1240.00	1250.00	1260.00
HORIZONTAL GEOMETRY								541.62m 316°31'39"							

PROPOSED - Minor Arterial Road 1 CH 11+20.00 TO CH 12+60.00
SCALE: 1:1000 H / 1:200 V

Rev	Description	By	Date
B	NOR NOTIFICATION	ABS	10/24
A	RESOURCE CONSENT	MA	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	AN	10/2022
Drawn	MA	07/2023
Checked	JZ	07/2023

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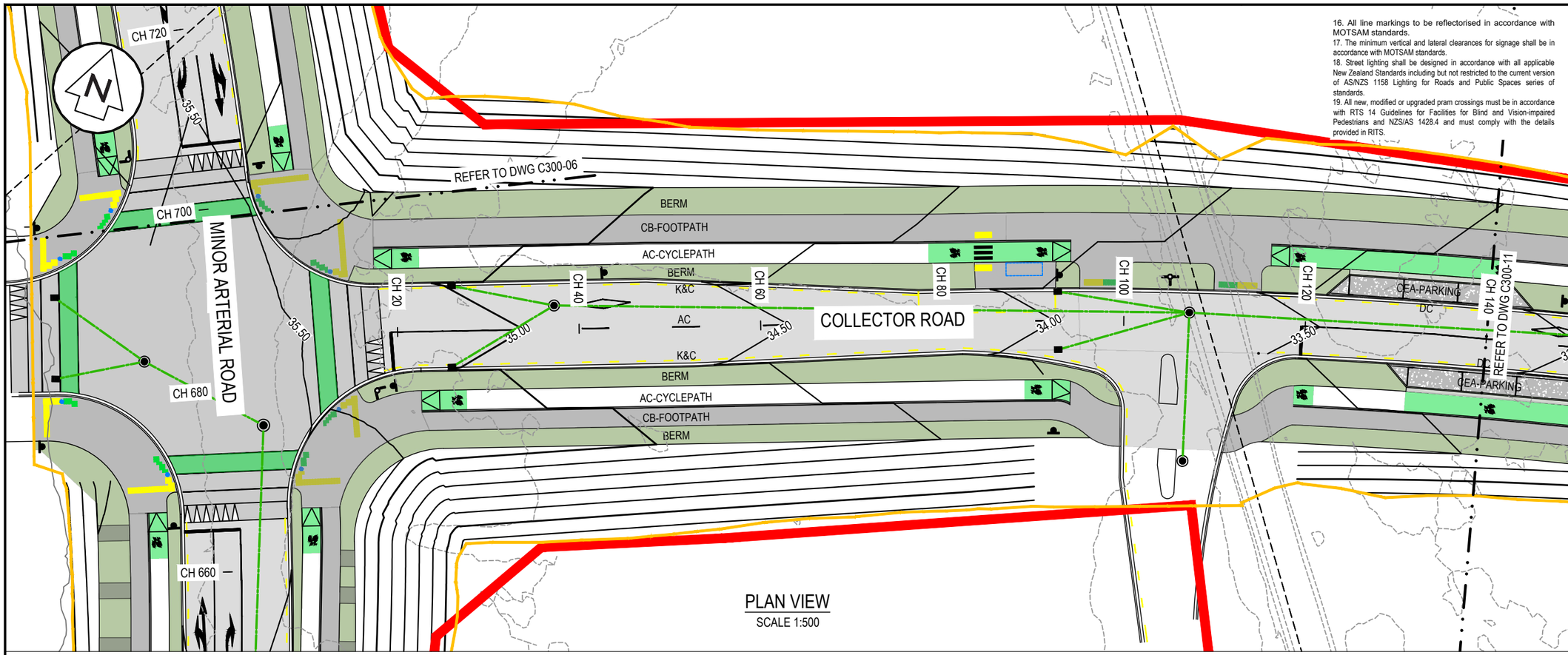
Auckland 1023

Project
ROTOKAURI ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LTD

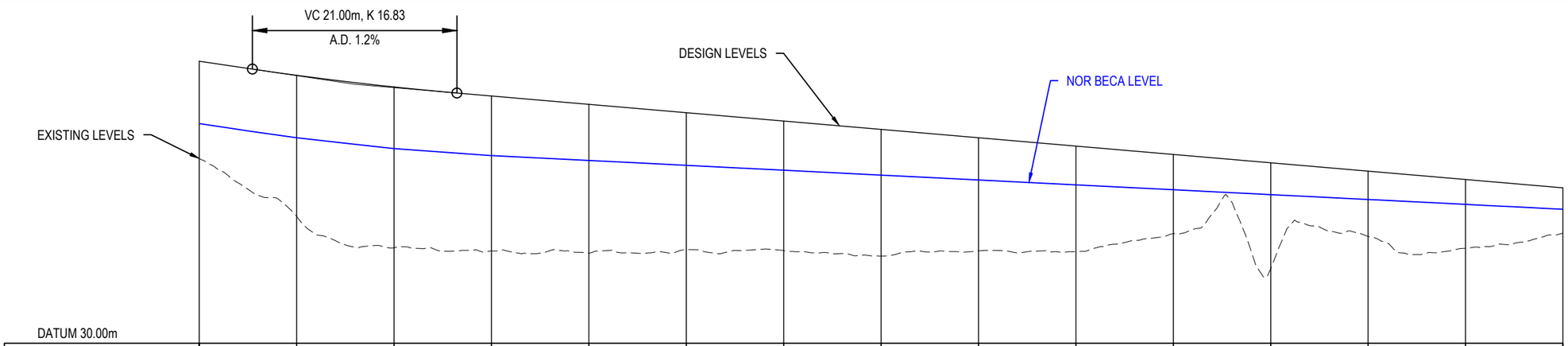
Title
PROPOSED ROADING LONG SECTION

Project no.	180006		
Scale	1:500 @ A3		
Cad file	180006-C300 - RC.DWG		
Drawing no.	C300-09	Rev	B

DATE 10/24



PLAN VIEW
SCALE 1:500



DATUM 30.00m

EXISTING LEVELS	33.79	32.60	31.96	31.89	31.85	31.92	31.90	31.79	31.89	31.88	32.24	31.53	32.19	31.95	32.26
DESIGN LEVELS	35.78	35.49	35.25	35.07	34.90	34.73	34.55	34.38	34.21	34.04	33.87	33.70	33.53	33.36	33.19
CUT/FILL	1.99	2.89	3.29	3.18	3.05	2.81	2.66	2.60	2.32	2.16	1.63	2.17	1.34	1.41	0.93
VERTICAL GEOMETRY	5.46 -3.0%	VC 21.00, A.D. 1.2% IP CH 15.96/RL 35.31								154.52 -1.7%					
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00
HORIZONTAL GEOMETRY	83.58m 70°16'33"											R 549.92 A 73.88			

PROPOSED - Collector Road 1 CH 0+00.00 TO CH 1+40.00
SCALE: 1:1000 H / 1:200 V

Notes

16. All line markings to be reflectorised in accordance with MOTSAM standards.
17. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
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19. 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 RITS.

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Legend

- EX BDY
- CURRENT ARTERIAL DESIGNATION BDY
- CURRENT ARTERIAL DESIGNATION BDY AMENDED
- PROPOSED ARTERIAL DESIGNATION BDY
- ROAD BATTER BDY
- EX SW
- PROP SW
- AC — AC PAVING
- CB — BRUSHED CONCRETE
- CEA — EXPOSED CONCRETE
- DC — DISH CHANNEL
- K&C — KERB AND CHANNEL
- K&N — KERB AND NIB
- PROP SWCP SINGLE
- PROP STREET LIGHT
- PROP STREET SIGN
- ROAD NAME SIGN
- TACTILE PAVERS

Rev	Description	By	Date
B	NOR NOTIFICATION	ABS	10/24
A	RESOURCE CONSENT	MA	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	AN	10/2022
Drawn	MA	07/2023
Checked	JZ	07/2023

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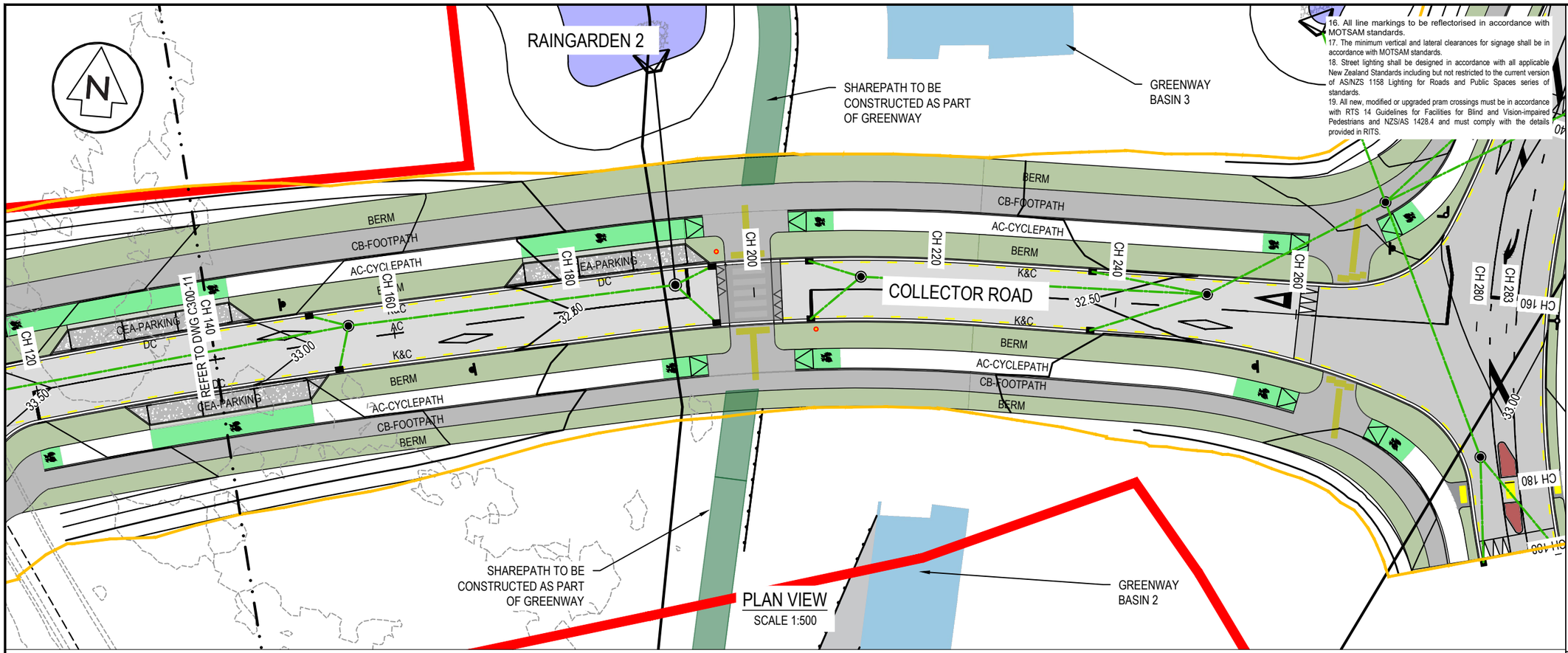
Project
ROTOKAURI ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LTD

Title
PROPOSED ROADING LONG SECTION

Project no.	180006		
Scale	1:500 @ A3		
Cad file	180006-C300 - RC.DWG		
Drawing no.	C300-10	Rev	B

DATE 11/0/24



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15. All street name signs shall follow RITS guidelines in terms of layout, clearances, and construction details.

Legend

- EX BDY
- CURRENT ARTERIAL DESIGNATION BDY
- CURRENT ARTERIAL DESIGNATION BDY AMENDED
- PROPOSED ARTERIAL DESIGNATION BDY
- ROAD BATTER BDY
- EX SW
- PROP SW
- AC — AC PAVING
- CB — BRUSHED CONCRETE
- CEA — EXPOSED CONCRETE
- DC — DISH CHANNEL
- K&C — KERB AND CHANNEL
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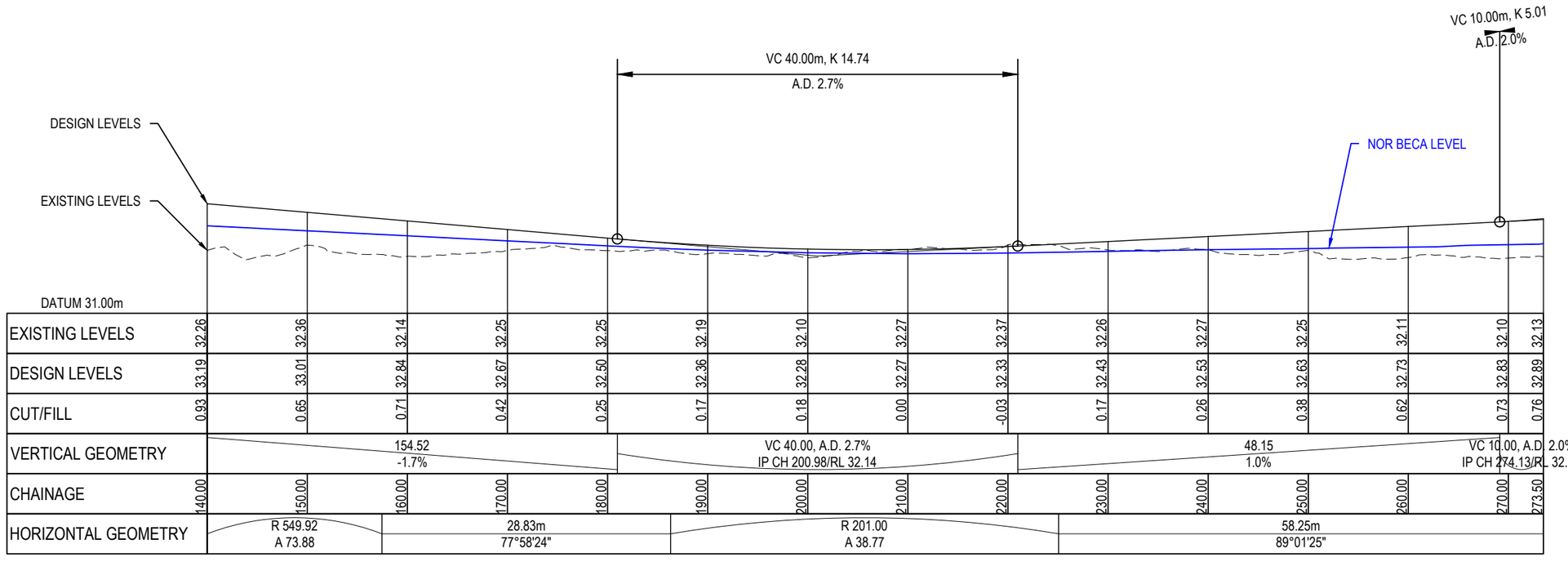
- PROP SWCP SINGLE
- PROP STREET LIGHT
- PROP STREET SIGN
- ROAD NAME SIGN
- TACTILE PAVERS



EXISTING LEVELS	32.26	32.36	32.14	32.25	32.25	32.19	32.10	32.27	32.37	32.26	32.27	32.25	32.11	32.10	32.13
DESIGN LEVELS	33.19	33.01	32.84	32.67	32.50	32.36	32.28	32.27	32.33	32.43	32.53	32.63	32.73	32.83	32.89
CUT/FILL	0.93	0.65	0.71	0.42	0.25	0.17	0.18	0.00	-0.03	0.17	0.26	0.38	0.62	0.73	0.76
VERTICAL GEOMETRY		154.52 -1.7%				VC 40.00, A.D. 2.7% IP CH 200.98/RL 32.14				48.15 1.0%				VC 10.00, A.D. 2.0% IP CH 274.13/RL 32.87	
CHAINAGE	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00	230.00	240.00	250.00	260.00	270.00	273.50
HORIZONTAL GEOMETRY		R 549.92 A 73.88		28.83m 77°58'24"			R 201.00 A 38.77					58.25m 89°01'25"			

PROPOSED - Collector Road 1 CH 1+40.00 TO CH 2+73.50
SCALE: 1:1000 H / 1:200 V

Rev	Description	By	Date
B	NOR NOTIFICATION	ABS	10/24
A	RESOURCE CONSENT	MA	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	AN	10/2022
Drawn	MA	07/2023
Checked	JZ	07/2023

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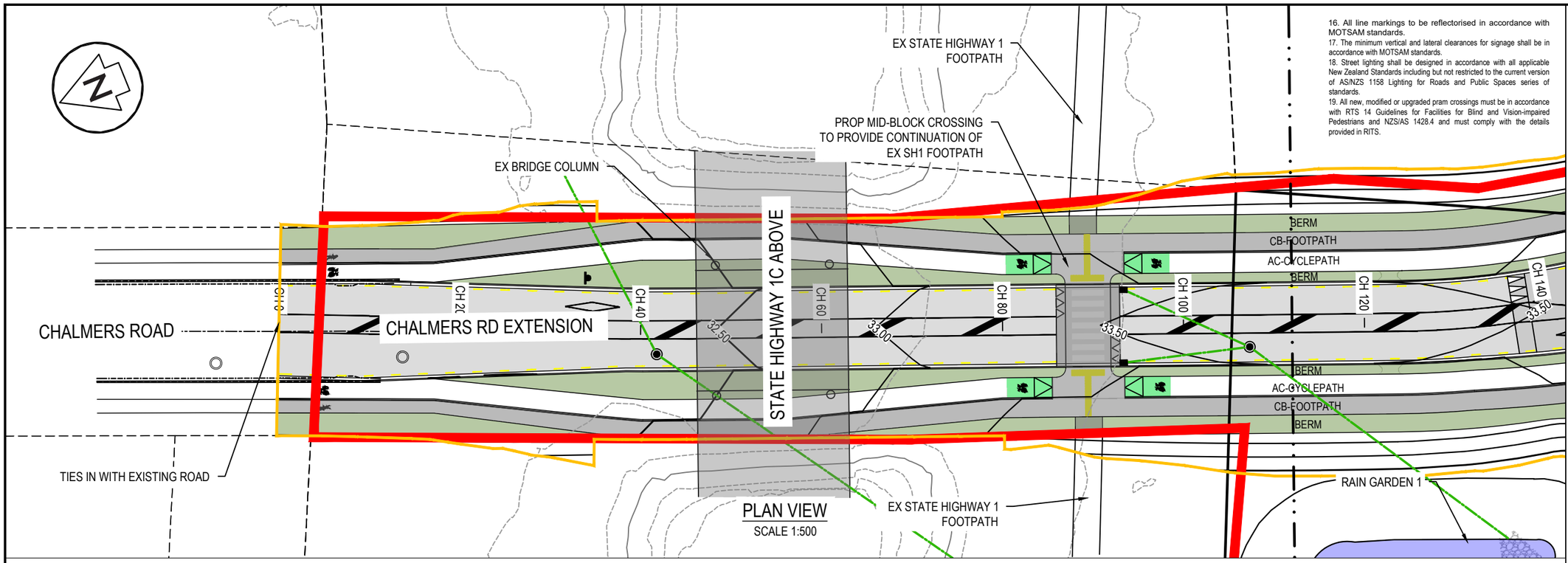
Auckland 1023

Project
ROTOKAURI ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LTD

Title
PROPOSED ROADING LONG SECTION

Project no.	180006		
Scale	1:500 @ A3		
Cad file	180006-C300 - RC.DWG		
Drawing no.	C300-11	Rev	B

DATE: 10/24



PLAN VIEW
SCALE 1:500

16. All line markings to be reflectorised in accordance with MOTSAM standards.
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Legend

	EX BDY
	CURRENT ARTERIAL DESIGNATION BDY
	CURRENT ARTERIAL DESIGNATION BDY AMENDED
	PROPOSED ARTERIAL DESIGNATION BDY
	ROAD BATTER BDY
	EX SW
	PROP SW
AC	AC PAVING
CB	BRUSHED CONCRETE
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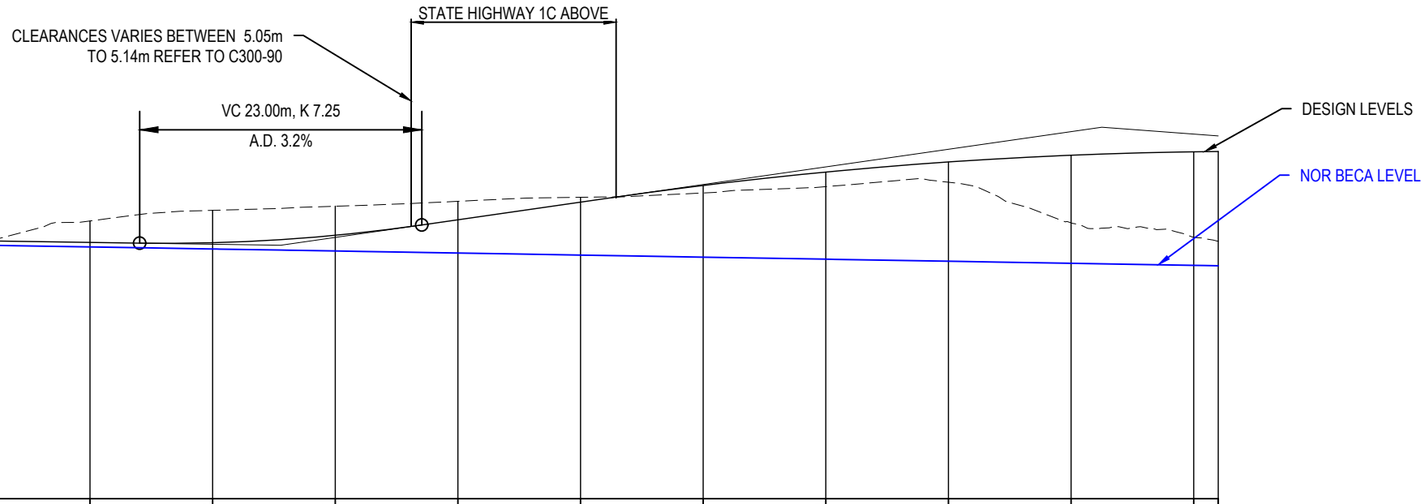
	PROP SWCP SINGLE
	PROP STREET LIGHT
	PROP STREET SIGN
	ROAD NAME SIGN
	TACTILE PAVERS



DATUM 28.00m

EXISTING LEVELS	32.24	32.21	32.53	32.70	32.77	32.85	32.91	32.98	33.09	33.16	32.50	32.26	32.20
DESIGN LEVELS	32.24	32.21	32.18	32.17	32.29	32.55	32.83	33.11	33.32	33.49	33.60	33.65	33.66
CUT/FILL	0.00	0.00	-0.35	-0.53	-0.47	-0.30	-0.08	0.12	0.24	0.33	1.10	1.39	1.46
VERTICAL GEOMETRY		24.05 -0.3%		VC 23.00, A.D. 3.2% IP CH 35.55/RL 32.13		15.46 2.9%		VC 80.00, A.D. -4.4% IP CH 102.51/RL 34.06					
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	112.00
HORIZONTAL GEOMETRY		30.54m 203°14'49"			R 464.33 A 15.00	35.16m 201°23'43"				R 8000.00 A 10.56	32.29m 201°28'16"		

PROPOSED - Collector Chalmers Road Extension CH 0+00.00 TO CH 1+12.00
SCALE: 1:1000 H / 1:200 V

Rev	Description	By	Date
B	NOR NOTIFICATION	ABS	10/24
A	RESOURCE CONSENT	MA	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	AN	10/2022
Drawn	MA	07/2023
Checked	JZ	07/2023

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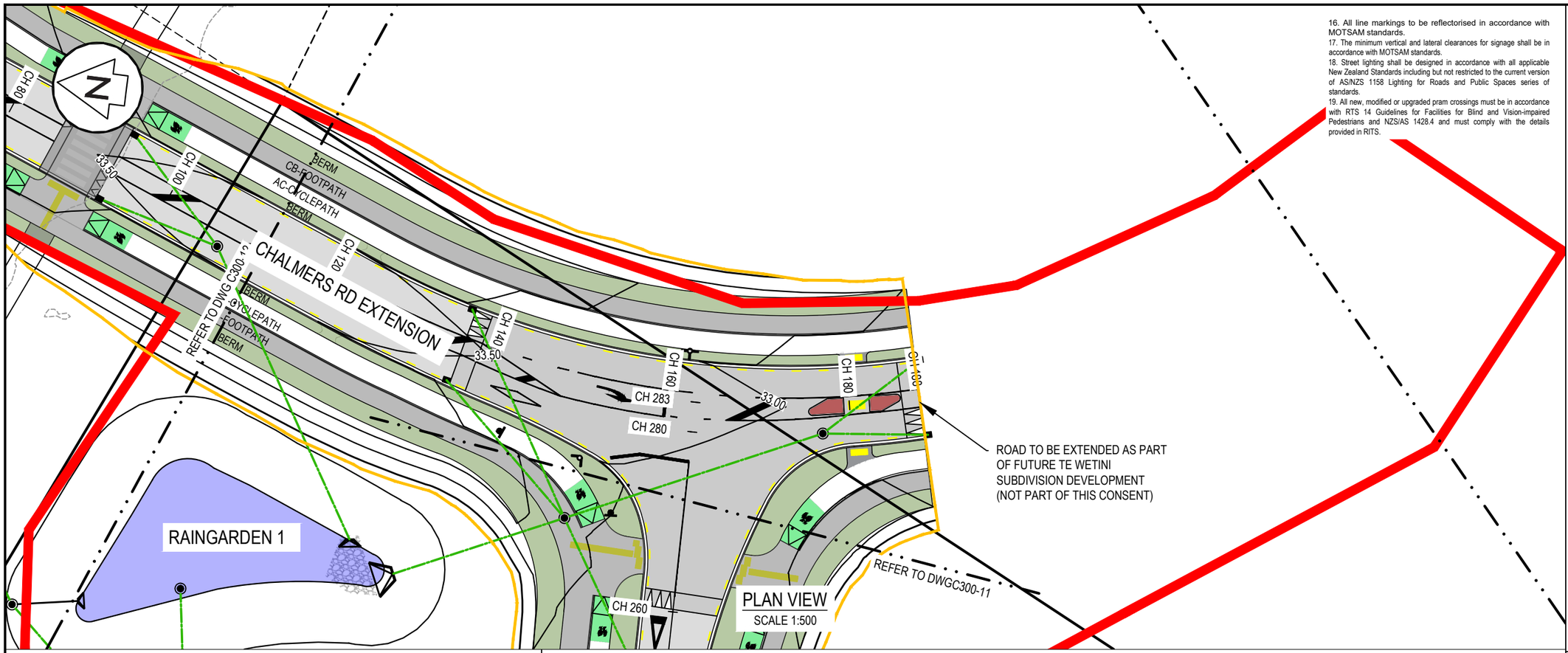
Auckland 1023

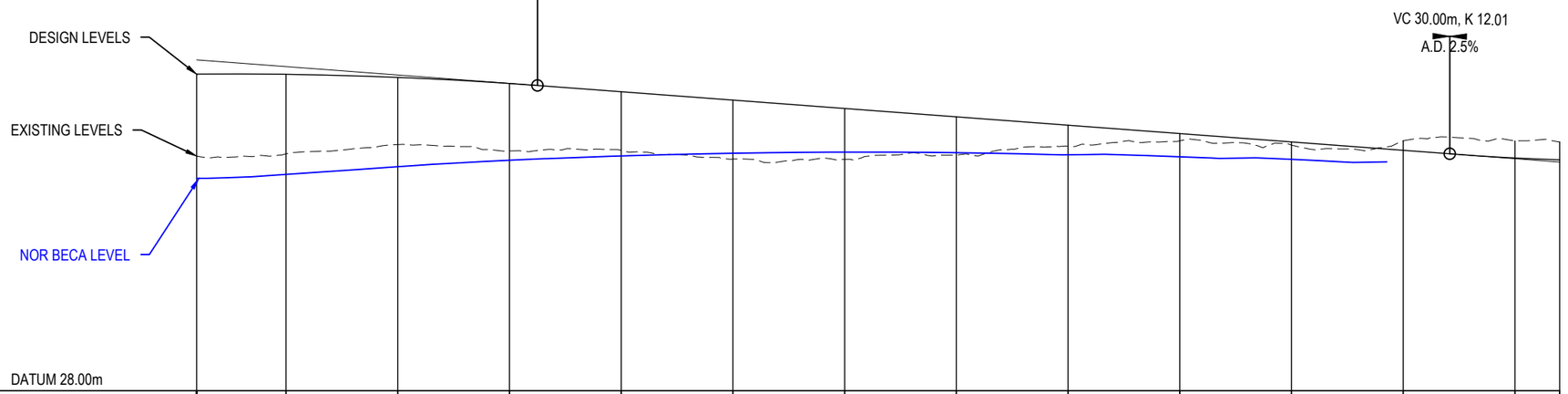
Project
ROTOKAURI ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LTD

Title
PROPOSED ROADING LONG SECTION

Project no.	180006		
Scale	1:500 @ A3		
Cad file	180006-C300 - RC.DWG		
Drawing no.	C300-12	Rev	B

DATE 11/5/24





DATUM 28.00m

EXISTING LEVELS	32.20	32.23	32.40	32.29	32.30	32.14	32.14	32.21	32.37	32.47	32.39	32.47	32.47	32.45
DESIGN LEVELS	33.66	33.65	33.60	33.49	33.34	33.19	33.04	32.89	32.75	32.60	32.45	32.30	32.16	32.13
CUT/FILL														
VERTICAL GEOMETRY	VC 80.00, A.D. -4.4% IP CH 102.51/RL 34.06							81.66 -1.5%					VC 30.00, A.D. 2.5% IP CH 239.17/RL 32.01	
CHAINAGE	112.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00	230.00	234.00
HORIZONTAL GEOMETRY	32.29m 201°28'16"					R 99.98 A 161.15								

PROPOSED - Collector Chalmers Road Extension CH 1+12.00 TO CH 2+34.00
SCALE: 1:1000 H / 1:200 V

16. All line markings to be reflectorised in accordance with MOTSAM standards.
17. The minimum vertical and lateral clearances for signage shall be in accordance with MOTSAM standards.
18. 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.
19. 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 RITS.

Notes
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3. Levels in terms of NZVD16.
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15. All street name signs shall follow RITS guidelines in terms of layout, clearances, and construction details.

Legend

	EX BDY
	CURRENT ARTERIAL DESIGNATION BDY
	CURRENT ARTERIAL DESIGNATION BDY AMENDED
	PROPOSED ARTERIAL DESIGNATION BDY
	ROAD BATTER BDY
	EX SW
	PROP SW
AC	AC PAVING
CB	BRUSHED CONCRETE
CEA	EXPOSED CONCRETE
DC	DISH CHANNEL
K&C	KERB AND CHANNEL
K&N	KERB AND NIB
	PROP SWCP SINGLE
	PROP STREET LIGHT
	PROP STREET SIGN
	ROAD NAME SIGN
	TACTILE PAVERS

Rev	Description	By	Date
B	NOR NOTIFICATION	ABS	10/24
A	RESOURCE CONSENT	MA	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	AN	10/2022
Drawn	MA	07/2023
Checked	JZ	07/2023

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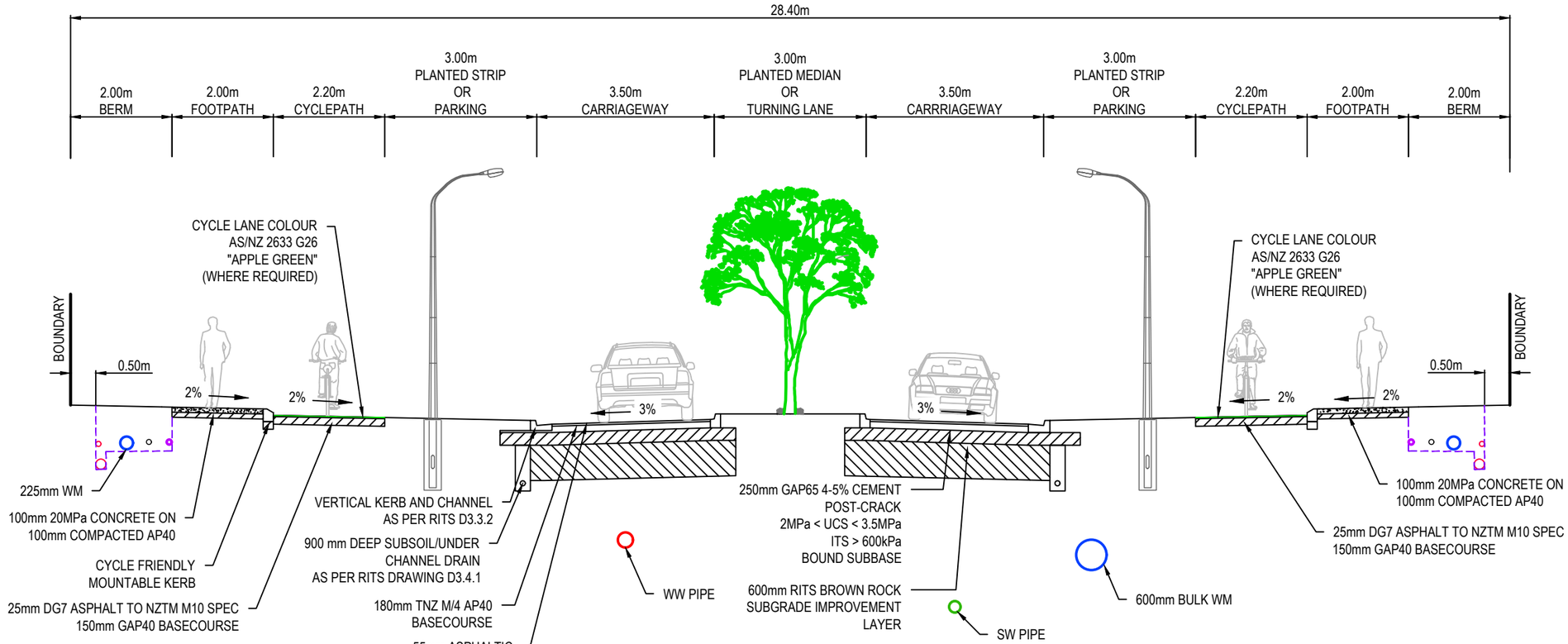
Auckland 1023

Project
ROTOKAURI ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LTD

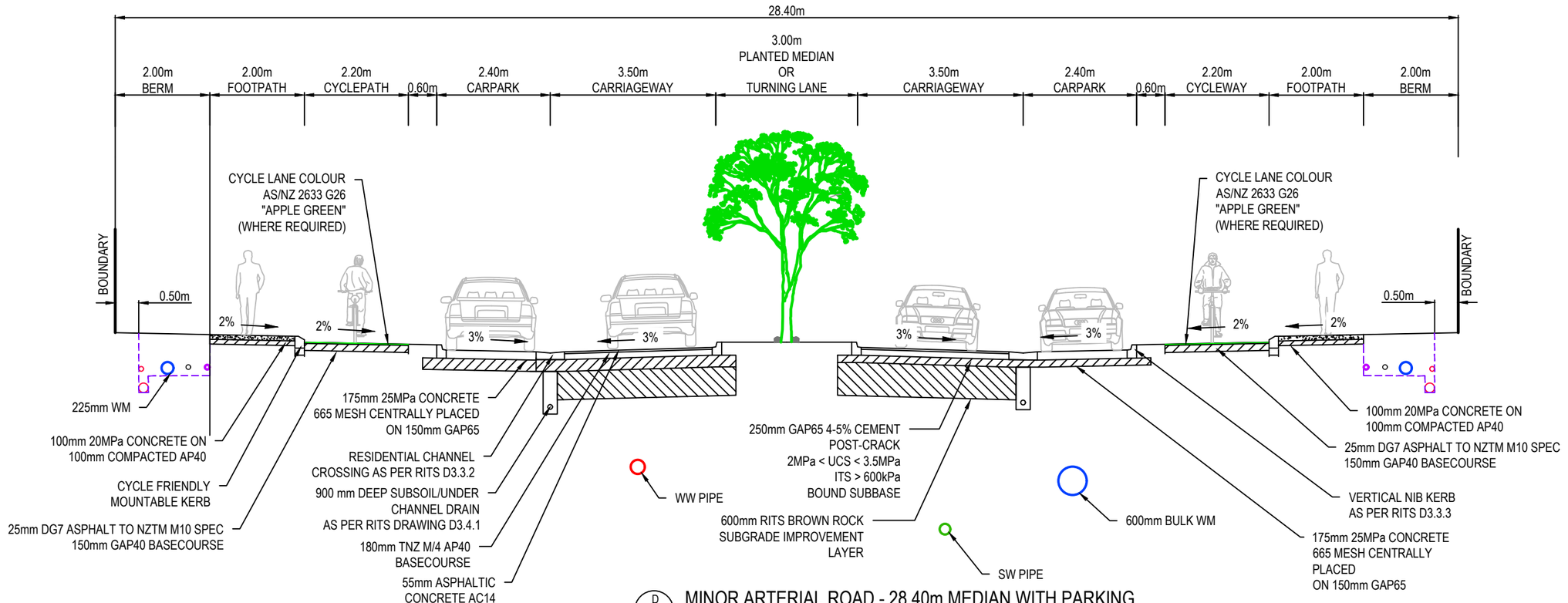
Title
PROPOSED ROADING LONG SECTION

Project no.	180006		
Scale	1:500 @ A3		
Cad file	180006-C300 - RC.DWG		
Drawing no.	C300-13	Rev	B

DATE 10/24



C MINOR ARTERIAL ROAD - 28.40m MEDIAN
SCALE 1:100 @ A3



D MINOR ARTERIAL ROAD - 28.40m MEDIAN WITH PARKING
SCALE 1:100 @ A3

RESOURCE CONSENT

DATE 11/0/24

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Rev	Description	By	Date
A	RESOURCE CONSENT	DK	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	JZ	08/22
Drawn	DK	08/22
Checked	BV	08/22

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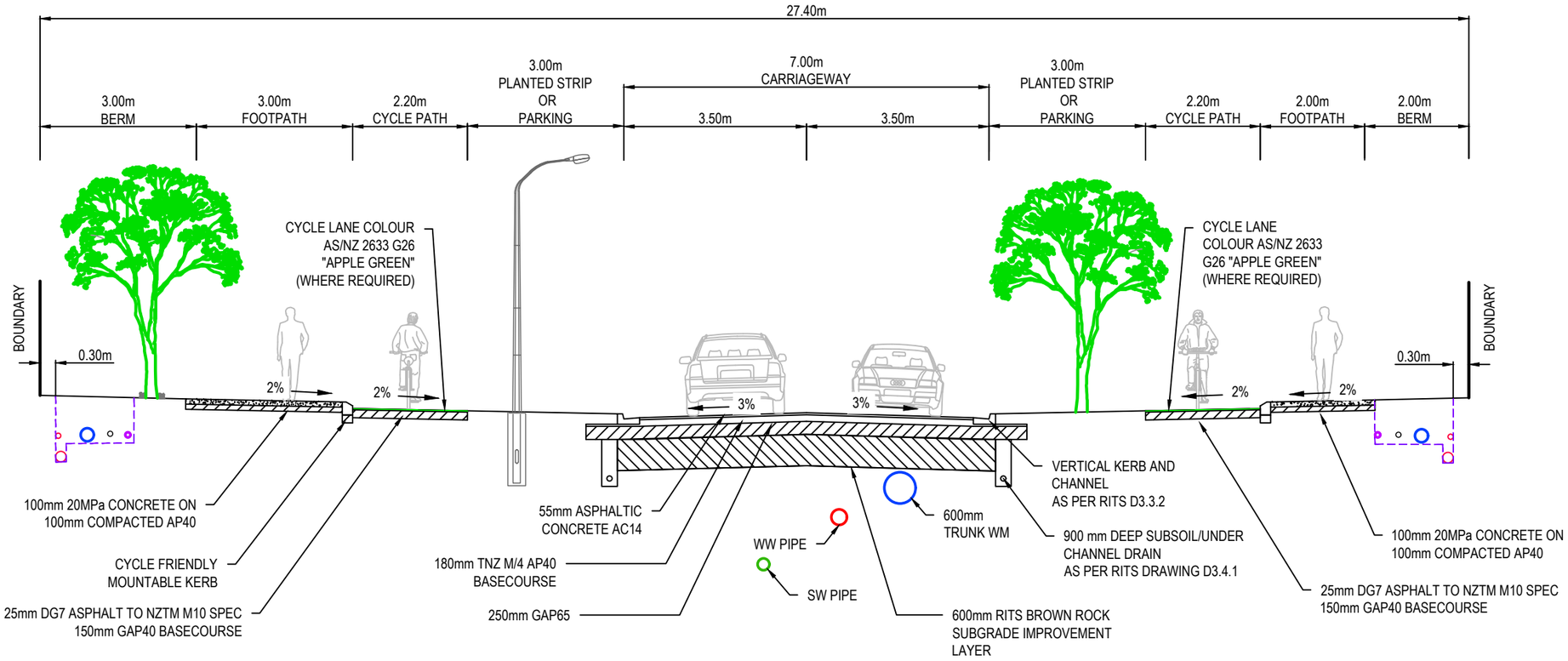
Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

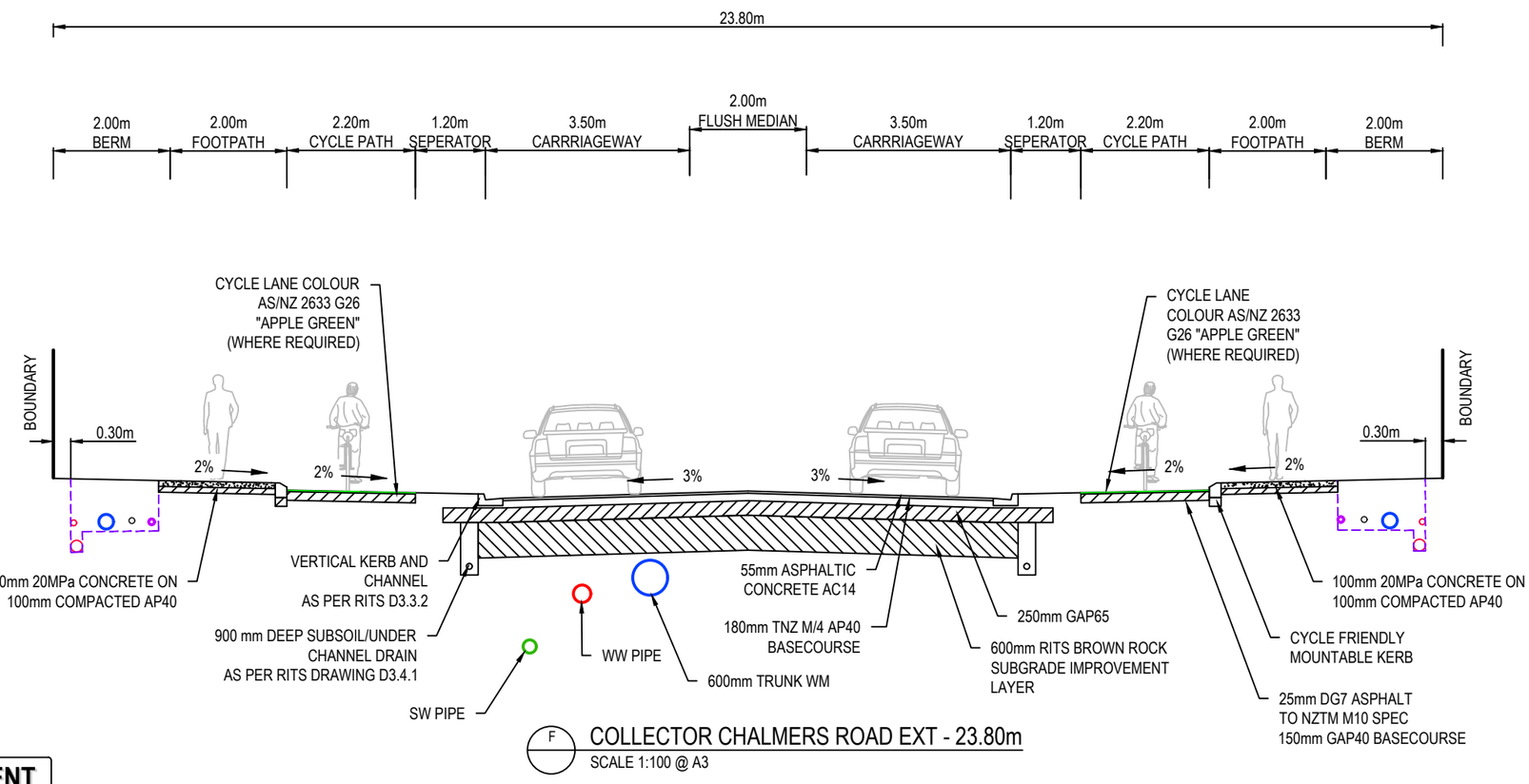
Title
PROPOSED ROADING TYPICAL CROSS SECTION

Project no.	180006		
Scale	1:100 @ A3		
Cad file	180006-C340 - RC2024.DWG		
Drawing no.	C341	Rev	A



E COLLECTOR ROAD 1 - 27.40m

SCALE 1:100 @ A3



F COLLECTOR CHALMERS ROAD EXT - 23.80m

SCALE 1:100 @ A3

RESOURCE CONSENT

DATE 10/22/24

Notes

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A	RESOURCE CONSENT	DK	10/23

	By	Date
Survey	LANDPRO	12/2022
Design	JZ	08/22
Drawn	DK	08/22
Checked	BV	08/22

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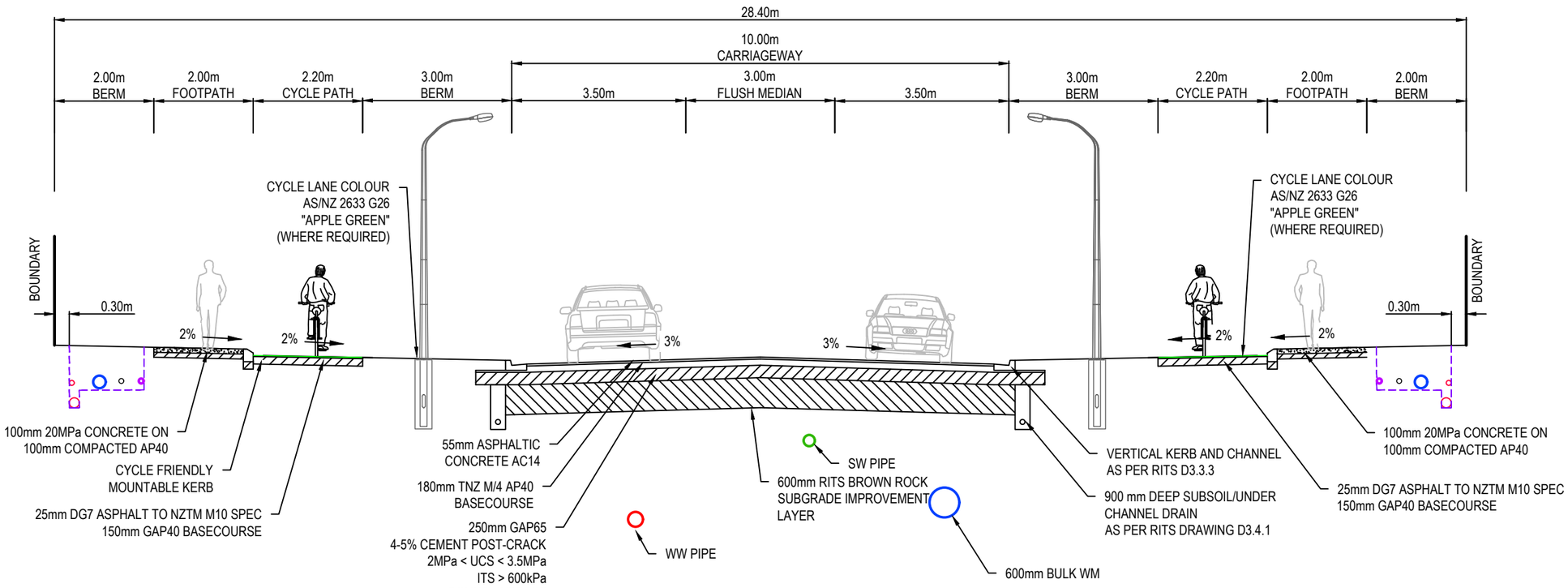
Project

ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title

PROPOSED ROADING TYPICAL CROSS SECTION

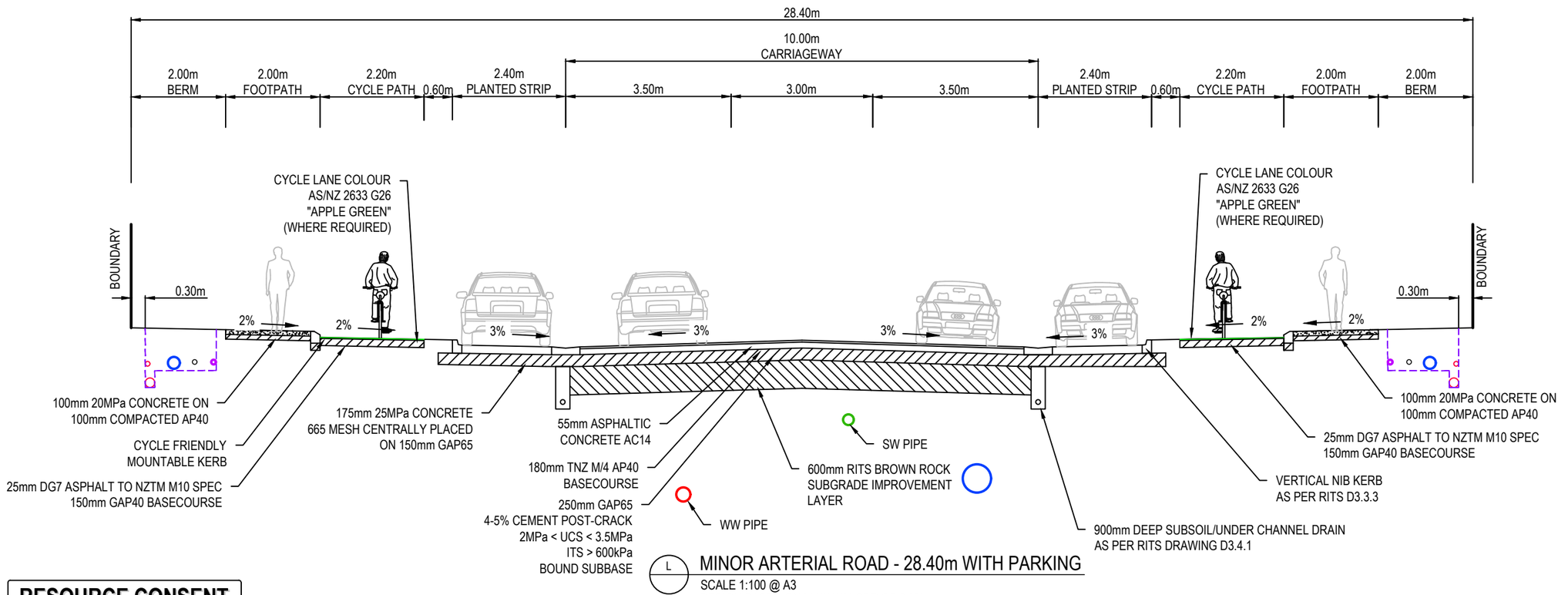
Project no.	180006		
Scale	1:100 @ A3		
Cad file	180006-C340 - RC2024.DWG		
Drawing no.	C342	Rev	A



K MINOR ARTERIAL ROAD - 28.40m

SCALE 1:100 @ A3

DESIGN BASED ON MINIMUM CBR OF 3.0%



L MINOR ARTERIAL ROAD - 28.40m WITH PARKING

SCALE 1:100 @ A3

DESIGN BASED ON MINIMUM CBR OF 3.0%

RESOURCE CONSENT

DATE: 11/5/24

Notes

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Rev	Description	By	Date
D	RESOURCE CONSENT	AP	12/2023
C	DRAFT - FOR SERVICES	AP	08/2023
B	DRAFT - FOR INFORMATION	CD	05/2023
A	DRAFT	CD	12/2022

	By	Date
Survey	LANDPRO	12/2022
Design	AA	12/2022
Drawn	AA	12/2022
Checked	BY	DATE

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Project

ROTOKAURI SUBDIVISION STAGE 1 FOR HOUNSELL HOLDINGS LTD

Title

PRPOSED ROAD CROSS SECTIONS PLAN ARTERIAL ROAD A&B

Project no.	180007		
Scale	1:50 @ A3		
Cad file	180007-STG1-C340 - CS.DWG		
Drawing no.	C347	Rev	D

Attachment 2 – Maven Associates Fast Track Infra Report

INFRASTRUCTURE REPORT

Rotokauri Greenway & Minor Arterial

PROJECT INFORMATION

CLIENT:	Hounsell Holdings Limited and Hamilton City Council
PROJECT:	180006

DOCUMENT CONTROL

DATE OF ISSUE:	1 December 2023
REVISION	C
AUTHOR	Joseph Zhu Senior Engineer
REVIEWED BY	Mitchell Smith Team Leader / Senior Engineer
APPROVED BY	Dean Morris Regional Director

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Auckland
New Zealand
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1. OVERVIEW

1.1 PROJECT BACKGROUND

Rotokauri is a greenfield housing and urban development growth cell of approximately 788 hectares on the north-western entrance to Hamilton City. Hamilton City Council (HCC) has taken the lead in the comprehensive planning of this region through the creation of guiding documents, most notably the Rotokauri Structure Plan (RSP). HCC envisions Rotokauri as a harmonious extension of Hamilton, emphasizing a holistic, interconnected, and human-centric mixed-use development rooted in leading urban design standards. Once fully developed, Rotokauri is projected to accommodate a population ranging from 16,000 to 20,000 residents.

To facilitate this urban progression, HCC in partnership with Hounsell Holdings Limited (HHL) has engaged Maven with the responsibility of designing the critical infrastructure to cater for the expansion of the Rotokauri residential and urban region. Specifically, Maven will be overseeing the design of the Rotokauri Greenway, a stormwater management corridor, artificial wetlands, Minor Arterial and collector transport corridors, and bulk stormwater, wastewater and water supply infrastructure.

The Rotokauri Greenway and Minor Arterial project scope and services are defined in schedule 2 of the Private Development Agreement (PDA) between HCC and HHL dated 21 July 2022. The Rotokauri Greenway and Minor Arterial project has been designed in accordance with Waikato Regional Infrastructure Technical Specifications (RITS) (published by CoLab) and other relevant standards including TR20-06 Waikato Stormwater Runoff Modelling Guideline (TR20-06) and TR20-07 Waikato Stormwater Management Guideline (TR20-07).

Beca's concept designs in the Notice of Requirement (NOR) Rotokauri Swale Greenway Corridor Project, 2019[1] and Rotokauri Minor Arterial Designation Project, 2023[2], the technical reports that support the Rotokauri Integrated Catchment Management Plan[3] (ICMP) and the Rotokauri Greenway Designation (A114) Conditions (included in this consent application) provided the basis for the design presented here.

1.2 PURPOSE OF THIS REPORT

The purpose of this report is to provide an assessment of the infrastructure and development that will be carried out for the proposed Rotokauri Minor Arterial and Greenway Project. The information provided herein outlines the methodology associated with the proposed infrastructure onsite. This report is to be read in conjunction with Maven engineering drawings found in APPENDIX A – ENGINEERING PLANS as well as the calculations APPENDIX G – ENGINEERING CALCULATIONS to accompany the resource consent application.

[1] Notice of Requirement Rotokauri Swale Greenway Corridor Project, 2019 D-4673369
[2] Notice of Requirement Rotokauri Minor Arterial Designation Project, 2023 D-4919211
(electronic copies can be made available on request by emailing mark.roberts@hcc.govt.nz with the above reference numbers)
[3] Rotokauri Integrated Catchment Management Plan, FINAL – June 2017

1.3 PROJECT DESCRIPTION

The scope of the project is to do the following on land in Rotokauri, Hamilton:

Construct a stormwater management corridor that is approximately 4.7 kilometres long, including by—

(i) constructing artificial wetlands; and

(ii) landscaping and planting; and

(iii) installing or constructing three waters infrastructure (for example, a water main, a wastewater pipeline, and a pump station):

Construct a transport corridor that includes—

(iv) a minor arterial road that is approximately 1.26 kilometres long; and

(v) a collector road (including an underpass that crosses under State Highway 1) that connects to the minor arterial road.

1.4 LEGAL DESCRIPTION

The proposed Rotokauri Greenway, Minor Arterial and artificial wetlands will be constructed through several different lots owned by various landowners. HHL owns a large area of 51.62ha in Rotokauri, which is described as:

Lot 6 Deposited Plan 359488
Lot 1 Deposited Plan 415616
Lot 1 Deposited Plan 449172
Lot 2000 Deposited Plan 519305
Lot 2 Deposited Plan 540282

Other lots that the Rotokauri Greenway and Minor Arterial will run through are as follows.

Rotokauri Greenway:

Lot 1 Deposited Plan 73878
Lot 2 Deposited Plan 567367
Lot 3 Deposited Plan 62700
Lot 1 Deposited Plan 449172
Lot 2 Deposited Plan 540282
Lot 1 Deposited Plan 30552
Lot 53 Deposited Plan 471831
Section 12 Survey Office Plan 464504
Section 7 Survey Office Plan 464504
Section 6 Survey Office Plan 464504
Section 2 Survey Office Plan 511350
Section 8 Survey Office Plan 478480
Lot 177 Deposited Plan 541928
Lot 190 Deposited Plan 541928
Lot 4 Deposited Plan 415616
Lot 1 Deposited Plan 415616

Lot 2 Deposited Plan 62537

Minor Arterial:

Lot 2 Deposited Plan 540282
Lot 3 Deposited Plan 62700
Lot 1 Deposited Plan 30552
Lot 3 Deposited Plan 468484
Lot 53 Deposited Plan 471831
Lot 1 Deposited Plan 535335
Lot 2000 Deposited Plan 519305
Lot 2 Deposited Plan 12201
Section 12 Survey Office Plan 464504

Refer to proposed Maven scheme plan drawings C110 and C111 for existing and proposed lots.

1.5 SITE DESCRIPTION

The topography of the site is predominantly level, featuring peripheral ridges and gullies that distinguish the catchment. The southern portion of the catchment houses the Waiwhakareke Natural Heritage Park, positioned in the upper headwaters. This region takes its name from Lake Waiwhakareke, which is drained through the modified 'Rotokauri Drain'. The Rotokauri drain serves as the primary stormwater conveyance for this catchment, passing beneath Exelby Road (which marks the jurisdictional boundary of the HCC) via an existing culvert before flowing into Lake Rotokauri. Beyond this confluence, the Ohote Stream becomes the lake's outlet, ultimately draining into the Waipa River. The Waipa River then converges with the Waikato River at Ngaruawahia. Conversely, the northern part of the catchment directly feeds into the Ohote Stream.

The scope of works for both the Rotokauri Greenway and Minor Arterial has been clearly outlined by the HCC in their NOR for these projects.

The Rotokauri Greenway (Designation A114) extent is irregular in shape, crossing multiple properties to link the downstream area of Lake Waiwhakareke to Lake Rotokauri. The project extent for the Rotokauri Greenway is predominantly level, low-altitude area and mainly follows the path of the existing Rotokauri Drain. Consequently, the Rotokauri Greenway's trajectory intersects several pre-existing farm drains dispersed across the Greenway's designated construction extent.

On the other hand, the proposed Minor Arterial designation for which the NOR has been lodged features an asymmetric layout, stretching from Te Wetini Drive to an area slightly south of the Te Kowhai East Arterial connection. The land contour for this Minor Arterial Road is undulating and crosses several major overland flow paths.

The project coordinate system is in NZ Geodetic Datum Mt Eden 2000.

All LiDAR, survey, and design levels within this project are in terms of New Zealand Datum 2016 (NZVD16). Stormwater modelling (by Te Miro Consultants) due to its' continuation of work undertaken by Beca and AECOM is in Moturiki 1953 vertical datum and results have been converted to NZVD16 for use in the design drawings. Vertical conversion for this site is 276mm (with 10mm variance across the site). NZVD datum is 276mm lower than Moturiki datum. It is also noted that historical information from Beca's NOR Rotokauri Swale Greenway Corridor Project was in Moturiki datum. Beca's Rotokauri Minor Arterial Designation Project was in NZVD16.

An overview subject site plan is shown in Figure 1 below.

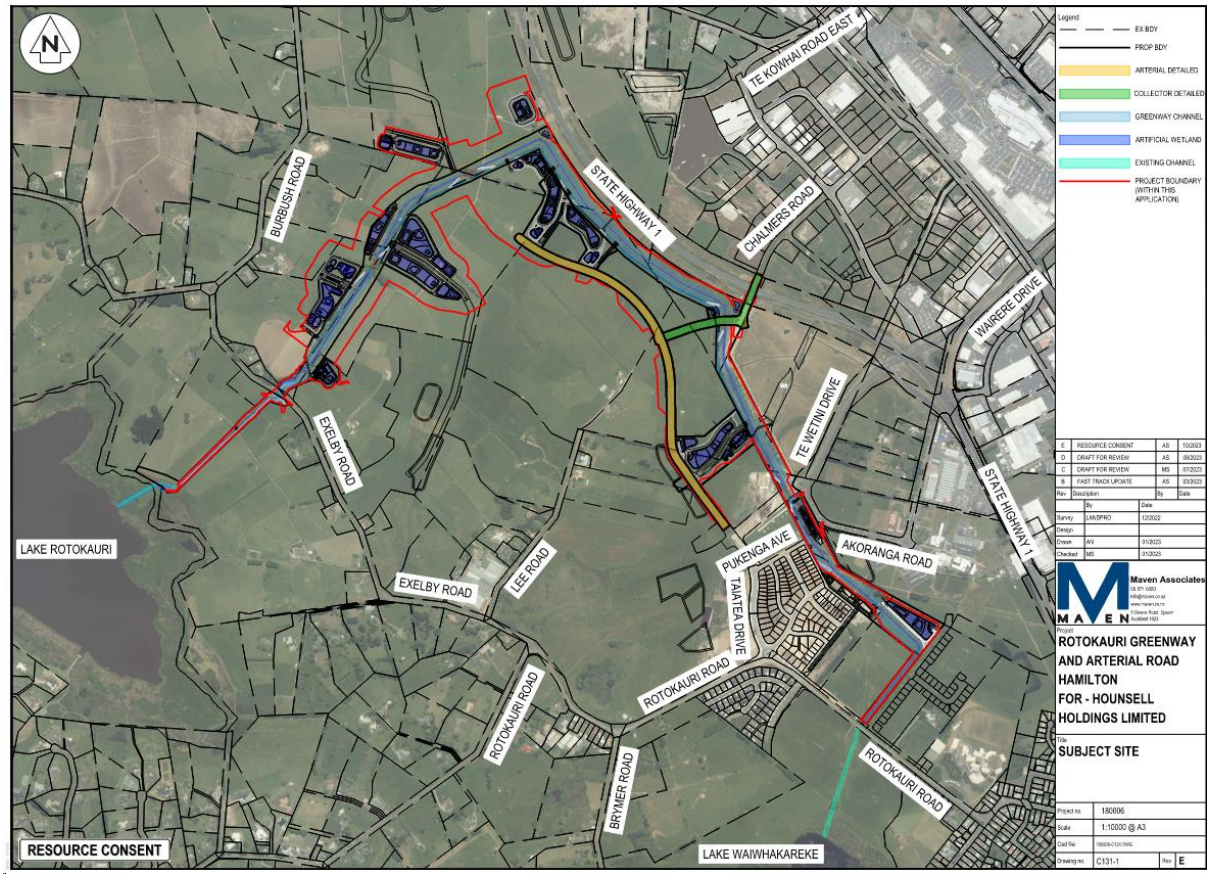


Figure 1 Development Overview Site Plan

2. EARTHWORKS

The importance of bulk earthworks in this project cannot be overstated, as it sets the groundwork for the Rotokauri Greenway's construction and moulds the formation of the Minor Arterial and Collector Road. The earthworks for this project have been segmented into five distinct sections, each of which can function independently from one another. The precise timing and sequence of these earthworks are contingent upon the construction sequence and the delivery timing of each individual area. Outlined below are the four areas of the earthworks:

- Rotokauri Greenway earthworks & Greenway Wetlands
- Minor arterial and collector roads earthworks
- Selected filling area
- Wastewater pump station
- Ancillary artificial wetlands

This project has been designed with the goal to minimise the carbon footprint. Several key strategies were employed to achieve this goal. Firstly, the route for the proposed greenway was thoughtfully selected, focusing on natural low-lying areas to significantly reduce the extent of excavation required for its construction. Furthermore, the arterial road was elevated above the existing ground, facilitating the concurrent elevation of the surrounding terrain. This design element allowed for the efficient incorporation of fill material obtained from the greenway's excavation. The location of the filling area was also chosen with great care, positioning it adjacent to the greenway to minimize travel distances during construction, thereby reducing emissions.

A critical aspect of this eco-conscious approach was the comprehensive modelling of the entire cut and fill operation. This rigorous modelling process ensured a precise balance between the movement of materials within the construction site. By preventing the unnecessary transportation of soil in and out of the site, the project significantly lessened its overall environmental impact and contributed to its goal of sustainability and carbon footprint reduction.

In-depth information regarding the operational specifics and construction methodology for these earthworks can be found in the Earthwork Construction Management Plan (CMP). Kindly refer to the CMP for a comprehensive overview.

2.1 BULK EARTHWORKS

The total bulk earthwork for each area is summarised in the table below:

Table 1 Bulk Earthwork Operation summary

	Works Area (m^2)	Cut Volume* (m^3)	Fill Volume* (m^3)	Net Volume* (m^3)
Minor Arterial and collector roads earthworks	117068	92755	78484	14271(cut)
Rotokauri Greenway &	215361	412030	527	411503(cut)

Greenway Wetlands				
Selected filling area	262911		413100	413100 (fill)
Ancillary Artificial Wetlands	98312	84760	23650	61110(cut)
Wastewater pump station	22,200	36,255	19,800	16,455(cut)
Total	715852	625800	535561	90239 (cut)

*Volumes indicated are solid measures in place, no bulking or compaction factors have been applied.

2.2 EROSION AND SEDIMENT CONTROL

Prior to commencing earthwork operations, it is anticipated that a pre-construction meeting with the HCC & WRC monitor team will take place. During this meeting, the erosion and sediment control measures will be discussed and confirmed to ensure that the potential impacts of earthworks and erosion are effectively mitigated.

It's expected that all sediment and erosion control measures will comply with TR2009-09 - Guidelines for Soil Disturbing Activities for the Waikato region. For a comprehensive understanding of the specific application of sediment and erosion control measures for each area of earthworks, please consult the Earthwork Construction Management Plan (CMP) which is included in Appendix B of this report, which provides detailed guidance on these measures.

2.3 PHASING OF EARTHWORKS

Each area of earthworks will have its own dedicated staging and phasing that aligns with the construction methodology. The objective is to ensure that the area of earthworks remains manageable to minimize potential adverse environmental impacts. Here is a high-level summary of the phasing for each area of earthworks:

Rotokauri Greenway:

- Basin 5: phase 1
- Basin 4 (includes wetland 10): phase 2
- Basin 3: phase 3
- Basin 2: phase 4
- Basin 1 (includes wetland 1 and 2B): phase 5
- Basin 6: phase 6

It is important to note that each basin will be further subdivided into respective stages for the earthwork sequence. Please refer to CMP section 4.1 for more information. The stated sequence of construction above can be adjusted as needed to align with project delivery goals. It is not a fixed sequence of work.

Minor Arterial and Collector Road:

- Minor Arterial Road Chainage 0- 580 and Wetland 4A&4B: phase 1
- Minor Arterial Chainage 580- 1030 & Collector Road: phase 2

- Minor Arterial Road Chainage 1030- 1258 and Wetland 6&7A: phase 3

The construction works of the Minor Arterial further subdivided into respective stages for the earthwork sequence. Please refer to CMP section 4.2 for more information. The stated sequence of construction above can be adjusted as needed to align with project delivery goals. It is not a fixed sequence of work.

Wastewater Pump station:

All works for the wastewater pump station will be conducted in a single-phase operation this includes any associated infrastructure to commission the pump station. Upstream wastewater pipes outside the extent of this project will be constructed progressively as the land is developed.

Ancillary Artificial Wetlands:

There are eight artificial wetlands that are part of this area of earthworks. The timing of their delivery will coincide with the land development within their respective catchments. The landowners where these wetlands are located will be responsible for their construction. It is anticipated that these wetlands will be built either concurrently with their discharge basins or after the completion of the Rotokauri Greenway, depending on the specific circumstances. Refer to Maven drawing C141-4 for identification of these ancillary wetlands.

Selected filling area:

The selected filling areas will be operational throughout the duration of the earthworks for this project. These areas will serve as the destination for the material generated from the cutting operations in other sections of the earthworks. However, there is a possibility of a shortage in terms of the available area for filling. To address this potential limitation, it is expected that additional earthwork consent will be sought in the future to extend the filling area if deemed necessary. This proactive approach ensures that adequate space is available for the efficient management of the earthwork materials generated during the project and minimises the volume of material requiring to be carted offsite.

2.4 TEMPORARY DIVERSION OF EXISTING STORMWATER DRAINS

The current earthworks area is dissected by the existing Rotokauri drain and a network of existing farm drains. To ensure water doesn't inundate the earthworks area, temporary stormwater diversion channels will be established. These channels will redirect the drains away from the areas under construction. Once the construction is completed, these farm drains will be directed towards the Greenway. For a detailed understanding of this system and other related measures, please consult the CMP.

3. ROADING

3.1 DESIGN STANDARDS

The proposed minor arterial and collector roads have been designed in accordance with Austroads and Waikato's Regional Infrastructure Technical Standards (RITS). There are departures from these standards to some degree to achieve the best practical outcomes and address site-specific constraints. For example, reduced carriageway and intersection widths to encourage slower speed and modal shift in line with the previously design submitted for Notice of Requirement (NOR) by Beca and recommendations by the transportation engineer CKL. As well as slightly higher 1% AEP flood depths and flow velocities in the roadways so the flows can be diverted to the Rotokauri Greenway through more desirable locations such as swales and adjoining accessways as opposed to through private properties. Further details are described in the following sub-sections and in appendices.

This section of the report provides civil related geometric design details of the proposed minor arterial and collector roads. Transportation and traffic related matters are discussed separately in CKL's Integrated Transportation Assessment.

The design provided is conceptual in nature for resource consent purpose only. Finer design details will be confirmed at engineering approval stage.

3.2 CROSS-SECTION

The proposed cross-sections of the minor arterial and collector roads are based on the previous design submitted for NOR and align with the recommendations provided by the peer review of the traffic engineers CKL. The key features of the proposed road cross-sections are:

- Two traffic lanes (one lane in each direction) on the proposed minor arterial Road. Dedicated right-turn lanes are allowed for at key intersections.
- 3.5 m wide carriageway lane width.
- Minimum 2.0 m wide footpath on both sides of the road
- Minimum 1.8 m wide cycle path. The cycle path is separated from the footpath with a mountable kerb.
- 2.4 m wide indented parking bays
- 3.0 m wide planted median in the northern portion of the minor arterial Road
- 2.0 m wide flush median on Chalmers collector road
- Green space including berm and planted median.
- Table 2 presents the details of the proposed road cross-sections and their dimensions. These are to be read in conjunction with the Maven engineering drawings in APPENDIX A – ENGINEERING PLANS.

Table 2 Proposed Road Cross sections

Chainage	Road Name and Class	Traffic Lanes	Green space	Footpaths and Cycle paths	Total Road Width
0-180	Rotokauri Minor Arterial Road	2 x 3.5 m single carriageway	2.5-2.65 m grass berm/trees with indented Parking	1 x 5.7 m footpath (east) 1 x 2.5 m footpath (west)	27.45 m (varies depending on existing road reserve width)

			3.3 m back berm (west)	2 x 1.8 m off-road cycle path (plus 0.2 m wide mountable kerb)	
180-700	Rotokauri Minor Arterial Road	2 x 3.5 m single carriageway	2 x 3.0 m grass berm/trees with indented Parking 2 x 3.3 m back berm	2 x 2.0 m footpath 2 x 2.2 m off-road cycle path (plus 0.2 m wide mountable kerb)	28.4 m
700-1277	Rotokauri Minor Arterial Road	2 x 3.5 m single carriageway	2 x 3.0 m grass berm/trees with indented Parking 2 x 1.8 m back berm 1 x 3.0 m planted median	2 x 2.0 m footpath 2 x 2.2 m off-road cycle path (plus 0.2 m wide mountable kerb)	28.4 m
0-283	Collector Road	2 x 3.5 m single carriageway	2 x 3.0 m grass berm/trees with indented Parking 3.0 m back berm (north) 2.0 m back berm (south)	1 x 3.0 m footpath (north) 1 x 2.0 m footpath (south) 2 x 2.2 m off-road cycle path (plus 0.2 m wide mountable kerb)	27.8 m
0-180	Chalmers Collector Road	2 x 3.5 m single carriageway 2.0 m flush median	2 x 1.2 m grass berm 2 x 2.0 m back berm	2 x 2.0 m footpath 2 x 2.2 m off-road cycle path (plus 0.2 m wide mountable kerb)	24.2 m

3.3 INTERSECTION

There are three intersections on the proposed minor arterial road and two on the proposed collector roads as confirmed with the traffic engineer CKL following discussion with HCC transport department. Rationales behind the design of these intersections are discussed in CKL's Integrated Transportation Assessment report.

These intersections are:

- A signalised intersection on a raised table between the proposed minor arterial and collector road as shown on Maven drawing C350-01.
- A give-way controlled T-intersection on a raised table between the proposed arterial and future local roads as shown on Maven drawing C350-05.
- A give-way controlled crossroad intersection on a raised table between the proposed minor arterial and future local roads as shown on Maven drawing C350-06.
- A give-way controlled T-intersection on the proposed collector as shown on Maven drawing C350-02.

- A give-way controlled T-intersection on a raised table between the proposed collector road and Chalmers Road extension as shown on Maven drawing C350-04.

3.4 WAIKATO EXPRESSWAY BRIDGES (STATE HIGHWAY 1C)

The proposed collector road alignment crosses beneath the existing Waikato Expressway. Existing ground levels, locations of the bridges columns, and the levels of the underside of the bridge deck where the collector road crosses have been obtained through site survey. The proposed road will be 5.1 m below the underside of the existing state highway as shown in Figure 2 to achieve the minimum clearance of 4.9 m required by NZTA.

Further discussions with NZTA are ongoing at the time of this report and a Section 176 approval is to be obtained from NZTA for this works.

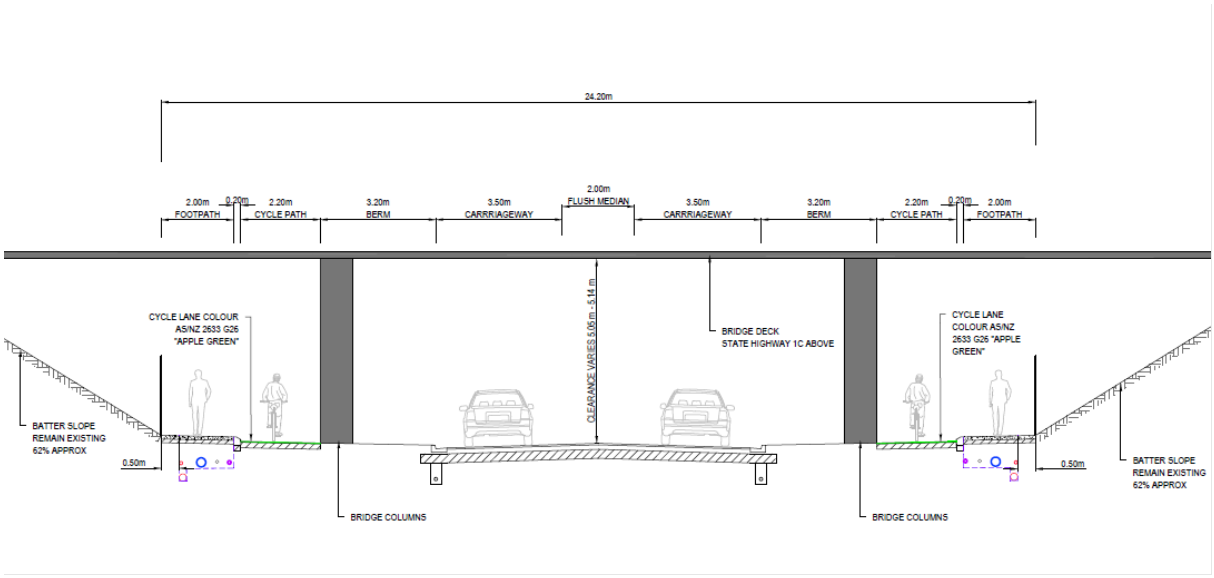


Figure 2 Proposed Collector Underpass - Chalmers Road

3.5 PAVEMENT DESIGN

Pavement design for the proposed minor arterial and collector roads have been undertaken. The proposed carriageway and cycleway will be asphalt surfacing. The proposed pedestrian footpaths and parking bays will be concrete finish. Asphaltic raised tables will be provided at the intersections and pedestrian crossing points.

A summary of the proposed pavements are shown in Table 3 Further design details can be found in APPENDIX C – PAVEMENT DESIGN MEMO.

Table 3 Proposed Pavement Profiles

Road Name and Class	Surface	Basecourse	Subbase	Subgrade Improvement
Minor Arterial Road	55 mm AC14	180 mm TNZ M/4 AP40	250 mm GAP65 (4-5% Cement Stabilised), Micro-Cracked	600 mm Brown Rock

Collector Road	55 mm AC14	180 mm TNZ M/4 AP40	250 mm GAP65	600 mm Brown Rock
Minor Arterial Intersection	55 mm SMA14	180 mm AC20	250 mm GAP65 (4-5% Cement Stabilised), Micro-Cracked	600 mm Brown Rock
Footpath	100 mm 20MPa Concrete	100 mm GAP40	-	-
Cycle path	25 mm DG7	150 mm GAP40	-	-

3.6 SERVICES

Utility service trenches will be provided in the back berm of the proposed minor arterial and collector roads. A bulk water supply main of 600 mm ID will be provided in the front berm on the eastern side of the minor arterial Road. Stormwater and wastewater infrastructure will be provided beneath the roadway as shown on drawing C340 series.

3.7 FOOTPATHS

Footpaths within the proposed Minor Arterial are designed in accordance with the Waka Kotahi pedestrian planning and design guide and RITS standards. The maximum crossfall for pedestrian footpaths will be 2% (1:50).

3.8 HORIZONTAL ALIGNMENT

The horizontal alignment of the proposed minor arterial and collector roads is consistent with the NOR design submitted to Hamilton City Council in September 2023. The intersection to the east of the Rotokauri Greenway near Chalmers extension however differs from the NOR design. The difference in design is to account for the neighbouring site subdivision development proposal at Te Wetini Drive site (Section 12 SO 464504) and to allow future road extension from this intersection.

3.9 VERTICAL ALIGNMENT

The vertical alignment of the proposed Minor Arterial is designed in accordance with RITS and Austroad, with the following design parameters:

- 1.0% minimum longitudinal gradient
- Maximum 4.4%
- Vertical curve length as per Austroad, minimum 40 m.

The proposed vertical alignment differs from the NOR design by Beca. This is done to improve constructability and diversion of overland flows.

3.10 OVERLAND FLOWPATH

The proposed minor arterial will be used to convey and discharge the 1% AEP overland flow into the Rotokauri Greenway. An assessment of the effects of overland flow paths on the minor arterial is in APPENDIX D – OLFP MEMO of this report, with the following departures from standard:

- The maximum 1% AEP flow depth is 0.19 m over sections of the proposed minor arterial, which exceeds RITS standard of maximum depth 0.15 m by 0.04 m.

- The maximum 1% AEP flow velocity is 1.1 m/s over sections of the proposed minor arterial. The velocity exceeds RITS standard of maximum velocity 1.0 m/s by 0.1 m/s.

4. STORMWATER

Stormwater will be managed within the site as follows:

- Stormwater within the catchment will be collected via a new public stormwater reticulation system. Within the scope of this project, this includes a new piped network constructed within the minor arterial and collector roadways. Stubbed connections are included for future tie in by upstream developments and have been sized accordingly.
- Each stormwater reticulation system will be directed to a series of treatment devices (a treatment train) in accordance with the ICMP. The treatment train, where site constraints allow, will consist of an integrated forebay, raingarden and artificial wetland system. Where site constraints do not allow, an artificial wetland with a forebay is provided and the upstream sub-catchment will require a form of at-source treatment per the ICMP to be designed and installed by future developers. These water quality devices are not required until the adjoining lots are developed but their overall stormwater flows have been allowed for in the design and modelling.
- Three smaller roadway catchments are treated via oversized raingardens to meet ICMP treatment requirements.
- After treatment, stormwater is then directed to the proposed Rotokauri Greenway stormwater management corridor. The Rotokauri Greenway in conjunction with artificial wetlands provides the overall flood storage and attenuation for the Rotokauri South catchment at Maximum Probable Development (MPD) (including climate change adjustments).
- The stormwater design allows for future development and full build out of the Rotokauri South Catchment.

Each step of the stormwater system is detailed further in the following sections.

The stormwater design has been undertaken through consultation with HCC and HCC's peer reviewers, Morphum Environmental (Morphum) and Catchment Engineering Solutions.

Te Miro Consultants (Te Miro) have undertaken the stormwater flood modelling analysis using TUFLOW which is detailed in their stormwater modelling report.

A Rotokauri ICMP Memorandum has been prepared by Barkers which includes inputs from all relevant disciplines and addresses table 5-5, means of compliance with the ICMP. This is included in APPENDIX H – ICMP RESPONSE MEMORANDUM.

4.1 DESIGN STANDARDS

Stormwater systems have been designed in accordance with Waikato's Regional Infrastructure Technical Specifications (RITS) and other relevant standards including TR20-06 Waikato Stormwater Runoff Modelling Guideline (TR20-06) and TR20-07 Waikato Stormwater Management Guideline (TR20-07). The technical reports that support the Rotokauri Integrated Catchment Plan (ICMP) have provided the basis for the design. This design is a development of Beca's concept designs completed in the NOR Rotokauri Swale Greenway Corridor Project and the NOR Rotokauri Arterials Designation Project.

The Rational Method as per RITS standards has been adopted for road drainage design including pipe networks, culverts, swales, and channels where catchments are small (less than 8 hectares).

The Natural Resources Conservation Service (NRCS) runoff curve number (CN) method as provided in WRC's TR20-06 has been adopted where catchments are large (greater than 8 hectares) for artificial wetlands, high-flow bypasses, culverts, and overland flow paths.

Te Miro has undertaken flood modelling analysis for this project using TUFLOW modelling software. Maven provided inputs including Rotokauri Greenway, artificial wetlands, and culvert designs within the greenway.

Manning's equation and Colebrook-White's equations have been used for pipe sizing, overland flow paths, culverts, and swales via hand calculations and Hydraflow Express (Civil3D).

4.2 RAINFALL AND CLIMATE CHANGE

Rainfall data from NIWA High Intensity Rainfall Design System V4 (HIRDS) has been used at location longitude 175.2085, latitude: -37.7693.

Climate change projections for New Zealand allow for four scenarios, known as representative concentration pathways (RCPs) per Ministry of Environments (MoE) Climate Change Projections for New Zealand, 2nd edition (NIWA, 2018)[4]. These pathways are identified by their approximate total radiative forcing at 2100 relative to 1750:

- 2.6 W m-2 for RCP2.6
- 4.5 W m-2 for RCP4.5
- 6.0 W m-2 for RCP6.0
- 8.5 W m-2 for RCP8.5

A warmer atmosphere can hold more moisture, and so the potential for more intense rainfall events is increased (NIWA, 2018).

Waikato's RITS does not provide guidance on which HIRDS climate change RCP to use, however under section 4.2.4.4, notes the post-development design storm shall account for 2.1C climate change adjustment. Table 6 of MoE's climate change projection provides mean annual temperature increases for each region (2081-2100), an extract of which is included in Table 4 for Waikato.

Table 4 MoE Climate Change Projection for Waikato (Table 6)

RCP	Annual*
RCP 8.5	3.1 (2.3, 4.3)
RCP 6.0	1.9 (1.2, 2.9)
RCP 4.5	1.4 (0.9, 2.1)
RCP 2.6	0.7 (0.4, 1.3)

*The values in each column represent the ensemble average, and in brackets the range (5th percentile to 95th percentile)

As can be seen, RITS requirement corresponds closest to an RCP 6.0 (2081-2100) which has a mean annual temperature increase of 1.9C. RCP 6.0 has also been used in the Beca NOR Greenway and

[4] Climate Change Projections for New Zealand, 2018 2nd Edition

Arterials projects. Therefore, climate scenario RCP 6.0 (2081-2100) data from HIRDS has been used to determine the 24-hour rainfall depth for each design storm and has been adopted in this design.

24-hour rainfall depths for 2, 10, and 100-year ARI per HIRDS are as follows:

Table 5 24-hour rainfall depths

ARI	24-hour rainfall depth (mm)
2	70.6
10	108
100	168

Te Miro have used a slightly more conservative method for determining MPD rainfall depths allowing for a 2.3 degrees increase for climate change in their flood modelling. Te Miro have also undertaken a sensitivity analysis using RCP 8.5 and a projected change in temperature of 3.8 degrees in their flood modelling. This is referred to in their stormwater modelling report included in this consent application and discussed further in Section 4.8.3.

4.3 RUNOFF COEFFICIENTS

The rational method has been adopted to calculate pipe capacity design of catchments under 8 hectares as per RITS standards.

Runoff coefficients (C) obtained from Table 4-8 RITS were used in the design and are shown below:

C = 0.8 Residential Medium Density - for all future development areas.

C = 0.9 Asphaltic and Concrete Areas – for the proposed minor arterial and collector road.

4.4 CURVE NUMBERS

Te Miro's flood modelling uses curve numbers (CN) for each greenway sub-catchment which were also used in Beca's greenway model "A weighted curve number (CN) was determined for each sub catchment within the hydrology model. These were sourced from the HCC GIS dataset which was developed as part of their stormwater masterplan project1. Similar assessments undertaken by Beca has shown that this approach is consistent with the methodology in TR2018/02 (WRC, 2018)". Refer to Te Miro's stormwater modelling report for further information.

Due to wetland locations crossing various sub-catchments of the greenway, Maven have used a single conservative CN of 74 to represent post-development pervious areas which is the highest sub-catchment CN from the hydrology model at the location of proposed wetlands, raingardens and stormwater infrastructure. This number is also consistent with "Table 5-2: Runoff curve numbers for most urban and rural lands" in WRC's TR20-6. HCC Soil maps[5] suggest clay loam and loamy peat at the Rotokauri site, which is in line with Hydraulic Soil Group C. Pervious areas post-development are expected to be in good condition (grass cover >75%) under soil group C, which gives a CN of 74.

[5] HCC Soil Maps - Landcare Research via LRIS Portal

Impervious areas are assumed as parking lots, roofs, driveways, streets, and roads which gives a CN of 98. Impervious areas are conservatively assumed to cover 90% of the catchment, with 10% as pervious which is in line with Te Miro's and the original Beca flood modelling assumptions.

4.5 CATCHMENTS

The Rotokauri stormwater catchment is defined by topography and has been laid out in the ICMP and Beca's NOR Rotokauri Swale Greenway Corridor Project and Rotokauri Minor Arterial Designation Project. These are broken down into further sub-catchments for each Rotokauri Greenway basin and for each artificial wetland or raingarden. The existing topography is mostly flat with areas of ridgelines and gullies which defines the catchment extents. As mentioned in Beca's NOR Greenway Design report, the sub-catchments in the Rotokauri ICMP informed the basis of Beca's NOR design with slight refinements to reflect expected longer-term development of the area. Maven has then further refined the catchments based on feedback from Morphum, HCC, and HHL as well as the availability of the most recent HHL masterplan layout. More thought has been put into the wider masterplan area as well as more understanding of proposed levels which has led to catchment refinements which are detailed below.

Rotokauri Greenway basin catchments are found on Maven drawing C404-1. These follow Beca's Greenway basin catchments closely with slight modifications redistributing flows in basins 3, 4, and 5 based on the latest masterplan layout. The Rotokauri Greenway basin catchments also include a couple of small additions at both of State Highway 1C underpasses which have been included following developed design. Therefore, Maven's catchments are overall slightly larger than the catchments assumed in Beca's Greenway design. Maven's catchments were provided to Te Miro for input into their stormwater flood modelling using TUFLOW as detailed in their stormwater modelling report.

Artificial wetland catchments are found on Maven drawings C405. Beca's NOR Greenway and Arterial designs informed the basis of wetland and catchment locations, however, adjustments were made based on feedback from HCC, Morphum and HHL. Changes from Beca's NOR Greenway and Arterial designs include the following:

- Catchment for wetland 1 updated per option 2b in accordance with Morphum's memo "Rotokauri cc1a/cc1b node concept options" dated 17 Jan 2018.
- Catchment 2B did not appear to have been defined. This catchment is based on existing topography from 2022 LiDAR to treat a portion of Te Wetini Drive.
- Catchments for Wetland 4A and 4B increased to include HHL stage 1 masterplan layout and the updated wetland shape. This reduced a portion of the catchment directing to wetland 6 and catchment 9A.
- Catchment 6 was adjusted for wetland shape and HHL masterplan layout.
- Catchment 7 split into 7A and 7B to allow 7A to treat the minor arterial road and HHL lands whilst wetland 7B treating lands north of HHL can be constructed in the future. Catchments 7A and 7B also adjusted for wetland shapes and HHL masterplan layout.
- Catchment 8 split into 8A and 8B per HHC/Morphum request. This separates the portion of lands being treated by the minor arterial Road and future development to the west. This also eliminates an elongated catchment which caused difficulty in achieving drainage grades.
- Catchment 9 split into wetland 9A, 9B, future SWWP_397 and future SWWP_388 per HCC/Morphum request. This breaks up a very large catchment into smaller more manageable catchments.

- Catchment 10 was adjusted to match existing land ownership and optimize wetland size within the Rotokauri Greenway designation.
- Catchment 11 was adjusted to match existing land ownership and split into wetlands 11A and 11B to create more manageable catchments.
- Catchment 12 was adjusted to match the proposed HHL masterplan layout.

Artificial wetlands 7B, 8A, 8B, 9A, 9B, 11A, 11B, and 12 outside of the Rotokauri Greenway designation and proposed Minor Arterial designation are subject to change prior to construction to suit future development as it occurs. This includes adjustments to the catchments and the corresponding size of the wetlands. If changes occur, the overall flood storage provided by the wetlands must be maintained. This will require a review of the Rotokauri Greenway flood modelling. These wetlands are referred to as "Ancillary wetlands" throughout Maven reports and are identified on Maven drawing C141-4.

Catchments for artificial wetlands SWWP_397, SWWP_388, SWWP_379, RDL 7&8, and 4C&4D have been assumed based on available information to date, and these wetlands are shown indicatively only. These are outside the scope of this project and their design is to be carried out by future developers. These wetlands have been allowed for in Te Miro's flood modelling as "inland dummy wetlands" to provide additional flood storage. The flood storage requirements must be met by future developers, this is detailed in section 0 below.

Sub-catchments have been further broken down to determine size requirements for the proposed stormwater reticulation network within the minor arterial and collector roads.

4.6 PROPOSED ROTOKAURI GREENWAY

The proposed Rotokauri Greenway is the stormwater management corridor for the Rotokauri South catchment located between Lake Waiwhakareke and Lake Rotokauri. The Rotokauri Greenway consists of six basins separated by road crossings with respective culverts.

Beca's concept designs in the NOR Rotokauri Swale Greenway Corridor Project and the technical reports that support the Rotokauri ICMP have provided the basis for the design presented here. An area of land has been designated for the proposed Rotokauri Greenway as part of the NOR Rotokauri Swale Greenway Corridor Project and is shown on C136-1.

4.6.1 Geometry

The general Rotokauri Greenway geometry largely follows that which was proposed in Beca's NOR design with a few modifications:

- Basin 1 batter slopes from chainage (CH) 9 to CH 300 increased on the south side from 1V:5H up to 1V:3H to tie into newly constructed road and footpath and remain within designation extents.
- The longitudinal grade of basins 1 and 2 were reduced for a portion from 0.08% to 0% to tie into the as-builts provided for the now-constructed Te Wetini Culverts.
- Basins 1 and 2 were widened at the base to provide additional flood storage.
- Rotokauri Greenway extents of daylight tie-ins were adjusted to the most recent 2022 LiDAR and additional topographic survey.

HD Geo's geotechnical assessments on the batter slopes and following consultation with HCC and HHL resulted in maintaining the slopes proposed in Beca's NOR design with the exception of basin 1 CH 9 to CH 300 as mentioned above.

The majority of the Rotokauri Greenway has 1V:5H batter slopes with a few exceptions with steeper slopes:

- Basin 1, CH9 to CH300 = up to 1V:3H on south bank (to tie in to existing road)
- Basin 2, CH1510 to CH1580 = 1V:3H on eastern bank (to minimise impact on existing far western interceptor wastewater main)
- Basin 5, CH3250 to CH3655 = varying from 1V:3H to 1V:4H
- Basin 5, CH3655 to CH 3681 = 1V:2H to be offset from the edge of the Rotokauri Greenway designation or requires an engineered solution per HD Geo.
- Basin 5, CH3681 to CH3727 = 1V:1H batter slopes will require an engineered solution, for example, buried palisade wall, MSE wall, or similar approved per HD Geo.
- Basin 6, side slopes for the portion downstream of Exelby Road are shown at 2H:1V for long term stability.

Refer to HD Geo's Geotechnical Assessment Report on the Rotokauri Greenway for a detailed assessment of the batter slopes in regard to slope stability. There may be opportunities during construction to steepen portions of the Rotokauri Greenway batter slope following geotechnical review. This could also have the added benefit of creating a visual effect to mimic more natural meandering of the greenway. However, these alterations to the Greenway batter slopes will be contingent upon maintaining the overall stormwater storage volumes and will require a slope stability analysis. Any modifications to the approved plans for the Greenway slope should not be made without obtaining the necessary approvals from the engineering disciplines involved and an amendment approval from HCC. This ensures that any alterations made are in a manner that adheres to safety, environmental, and functional requirements.

The majority of longitudinal grade for the Rotokauri Greenway is at 0.08%, with a portion of basins 1 and 2 at 0% on either side of Te Wetini Drive. The minimal grade is dictated by the invert of the downstream Exelby culvert which is to be maintained by the replacement culvert. This results in lower velocities throughout the Greenway which is desirable from a scour and erosion perspective.

Downstream of Exelby Culvert (basin 6), the longitudinal grade increases to a maximum of 3.1% for a portion of approximately 110m. The proposed channel design follows the concept design in Beca's NOR project. The channel design follows the invert of the existing channel alignment from Exelby Culvert to an existing sediment pond. The length of channel downstream of Exelby Culvert is proposed to retain its existing channel profile provided further slumping of the channel side slopes does not occur during the development of the upstream Rotokauri Greenway. Side slopes for the portion downstream of Exelby Road are shown at 2H:1V for long term static stability which dictated the area of the Greenway designation. Physical works for this portion are proposed to be carried out in stages only as instability occurs. Riprap and check dams are proposed for this portion to mitigate higher flow velocities and are detailed on Maven drawings C401-16 and C418 and will be further refined and detailed in consultation with HCC during EPA.

4.6.2 Pathways

A cycle path is proposed for the length of the Rotokauri Greenway from Rotokauri Road to Exelby Road. This will also provide access for maintenance vehicles and pedestrians. The shared pathway will be constructed of either, asphalt, concrete, or compacted gravel and will be 3.5m in width with 0.75m berm on each side (a total of 5.0m width). A maintenance path is also proposed in basin 6 from Exelby Road to Lake Rotokauri. Additional maintenance paths are also included for main culvert inlets and outlets. These will include ramps at a 1V:12H minimum gradient. Ramp access is not provided where the vertical reach from the road is less than 2 m. Access to the pathways is allowed for from existing and proposed roads as well as to future roads adjacent to or crossing the Greenway. The cycle path may provide access during some rainfall events, however, is expected to overtop during the 10-year ARI rainfall event at selected locations.

4.6.3 Rotokauri Greenway Culverts

This section of the report relates to the culverts that connect the Rotokauri Greenway basins. These culverts are located between each basin and are critical to the stormwater system of the Greenway. The design of these culverts can be found on Maven drawings C420. The primary function of these culverts is to connect the different basins through embankments and road corridors. The culverts also enable the control of stormwater flow by constricting water, allowing the basins to act as storage providing attenuation and limiting the discharge of stormwater into Lake Rotokauri to meet requirements laid out in the ICMP.

Refer to Te Miro's stormwater modelling report for further details on the selection of the Exelby Road culvert pipe size to strike the optimal balance between peak Rotokauri lake levels and drain down times.

The culvert crossings are classified as 'dams' and the downstream impact of a flood wave resulting from the hypothetical breach of the proposed dams has been assessed by Enggeo Geotechnical Engineering Consultancy with the assistance from Te Miro in regard to the modelling aspect. Refer to Enggeo's PIC assessment and Te Miro's dam breach memo which are both included in this consent application.

All culverts have been designed in general accordance with RITS for the 1% Annual Exceedance Probability (AEP) post-development storm event. The culverts have been designed allowing for surcharge as the basins connected by the each culvert act as a stormwater detention device (i.e., providing flood storage) as per Section 4.2.12.2(i) of RITS.

The culvert length has been determined based on the road corridor length plus the length of the embankment batter with a 1V:3H batter slope as recommended by HD Geo. The culvert pipe material will need to provide robustness and durability for a 100-year design life. The appropriate material will be selected during detailed design in accordance with AS/NZS4058-2007 and AS/NZS3725-2007.

The major culverts are summarised in Table 6 below. The design flow and velocities entering and exiting each culvert that were provided by Te Miro are assumed to be equivalent.

Table 6 Culvert Summary

Culvert ID	Pipe Diameter (sized for fish passage) (m)	Catchment Area (Ha)	Design Flow Q_{100} (m^3/s)	Velocity V_{100} (m/s)
Te Wetini Culvert	1.80	212.20	3.99	1.96

Te Wetini Culvert	2.70		5.92	2.04
Culvert 1	1.80	40.70	2.52	1.00
Culvert 2	1.80	306.10	4.35	2.46
Culvert 2	1.60		4.35	2.46
Culvert 3	2.10	338.20	4.40	1.73
Culvert 4	2.10	443.00	5.06	1.99
Exelby Road Culvert	1.05	468.40	3.61	5.68

Preliminary culvert sizes were determined by Te Miro using TUFLOW to undertake a flood analysis of the catchment. The culverts used in the TUFLOW model are preliminary in nature and does not account for fish passage requirements.

The New Zealand Fish Passage Guidelines sets out recommended general best practices for the design of instream infrastructure to provide for fish passage. Guidance has been provided by Ecological Solutions on project specific requirements to ensure the proposed culverts provide fish passage. These requirements are:

- Provide for the same passage of fish upstream and downstream as would exist without the culvert.
- Laid parallel to the slope of the bed.
- Mean cross-sectional water velocity within the culvert being no greater than that immediately upstream and downstream.
- A minimum of 25% of the culvert diameter will be embedded into the streambed.
- Bed substrate will be present over the full length of the culvert over time.
- Provide for continuity of geomorphic process (e.g., movement of sediment, debris).

Refer to Ecological Solution's report for further information regarding the Rotokauri Greenway culvert's compliance with fish passage requirements.

The guideline recommends that a minimum of 25% of the culvert is to be permanently submerged in water. Embedding the culvert within the stream bed reduces the available pipe capacity and therefore, a larger pipe size was selected to guarantee a higher capacity for the upsized pipe compared to the original one. This design approach for upsizing pipe size was taken for all culverts apart from the Exelby Road culvert. Culvert 2 employs a multi-barrel configuration to ensure ample stormwater pipe capacity. According to the RITS guidelines, in such a setup, only one barrel needs to facilitate fish passage. The specific barrel designated for fish passage has been enlarged in diameter, designed to handle low flow, and will be positioned at the centre of the channel alignment. Consequently, the barrel that does not accommodate fish passage will be positioned away from the centre of the stream alignment.

While the Exelby Road culvert was upsized to meet the 25% embedment requirements, the culvert was further embedded to reduce the pipe capacity to match the original pipe's capacity. This adjustment was crucial to ensure that the upsized pipe maintained equivalent capacity to the original size, enabling the upstream basin to attenuate flow as per the design intentions.

Several scour and erosion measures are to be implemented to protect the culverts and Greenway immediately upstream and downstream of the culverts. All culverts will have concrete inlet and outlet wing walls to retain the embankment and prevent soil erosion. Wing walls, aprons and rock riprap will be installed at inlet and outlets to prevent the scour erosion that may be caused by concentrated flows

at the culverts. Riprap have been sized in accordance with two standards: WRC TR20-07 and Hydraulic Engineering Circular No. 14, Third Edition (HEC14) by the U.S. Department of Transportation. Each document provides different methods and equations to calculate riprap parameters. Both methods were used to calculate the riprap parameters and the most conservative parameter from each method was implemented in the design. The riprap schedule can be found on Maven drawing C421-01.

The two Te Wetini Drive culverts are existing culverts that were built as part of CKL's Stage 6 development. The culvert embankment has Te Wetini Drive crossing over and therefore was required to be built at the time of construction of the road reserve. The two Te Wetini culverts did not have inlet and outlet structures installed at the time of construction. These structures will be installed during construction of basin 1 and 2. As noted in section 4.6.1 above, the as-built inverts of Te Wetini culverts required alteration to the longitudinal grade of the Greenway to 0% for a portion of basin 1 and 2.

HCC have advised, the Te Wetini Drive project had a small volume of non-compliant fill which was identified post construction. This requires removal and replacement with compliant fill and will be addressed at the time basins 1 and 2 are constructed. This will be captured in the physical works contract.

Culvert 1 is proposed to support the future development of Rotokauri Development Limited's land when future artificial wetlands 4C and 4D are constructed. Refer to Maven drawing C405-5. Culvert 1 connects the future wetlands to basin 2 and crosses the proposed minor arterial road. As this portion of minor arterial road will be built during this consent, Culvert 1 will also be built but will not be fully utilised until future wetlands 4C and 4D are constructed.

Culvert 2 is located between basin 2 and basin 3 and has the proposed collector road crossing over. Culvert 2 features 2 culverts, a 1800m diameter culvert and 1600mm diameter culvert. These culverts will be built as part of the Greenway construction. The minor arterial road crossing Culvert 2 will be built as part of this proposal.

Culvert 3 is located between basin 3 and 4 and requires a 2100mm diameter culvert. The road corridor crossing Culvert 3 is part of a future consent and is not required to be built under the current proposal. Though the future road corridor does not require construction under this consent, the embankment must still be filled to an elevation that ensures that the embankment temporarily does not flood and has 300mm freeboard. Referring to Maven drawing C420-05, the 100-year flood for basin 4 is 31.4m, therefore the embankment/temporary road crossing must be filled to 31.7m.

A future collector road (not part of this consent) will cross the Culvert 4 embankment separating basin 4 and basin 5. In the absence of more information from the developer regarding this future collector road, the road reserve width has been assumed to be 25m as per Appendix 15, Table 15-6a)ii of the Hamilton City Operative District Plan.

The existing 1200mm diameter culvert crossing Exelby Road will be replaced with a smaller 1050mm diameter culvert. A smaller pipe is required to limit the stormwater discharge downstream. In addition to riprap, Exelby culvert outlet will also include a concrete wingwall and apron with baffle blocks to manage the high flow velocities. As per the Geotechnical Engineer's recommendation, the existing embankment at Exelby Road separating basin 5 and basin 6 is not in good condition due to the existing steep batter slopes and poor in-situ material. This embankment will be completely excavated and reinstated with more suitable material and stabler batter slopes. The construction of the dam will be in accordance with New Zealand Dam Safety Guidelines 2015 document. The existing road pavement that is above the culvert embankment will also be reinstated.

Further detailing of each of the culvert designs including dam design details by a Geotechnical Engineer will be provided during Engineering Plan Approval (EPA).

4.6.4 Existing channels and temporary culverts

Existing channels adjacent the proposed greenway will be rerouted and directed to the proposed greenway via open channels with riprap or temporary culverts where required to cross a proposed pathway. Refer to Maven drawings C401. Temporary culverts will be installed with the intent that they would be abandoned once the surrounding lands are developed as stormwater from these future developments will require treatment prior to entering the greenway and will need to be directed to the appropriate wetland prior to discharging to the greenway.

4.6.5 Overflow route north of Basins 3 and 4

The Rotokauri Greenway Designation (A114) Condition 42f requires the following matter be considered and incorporated into the design:

"Maintaining the overland flow route to the north of Basins 3 and 4 along the proposed Arterial Road. Documentation relating to the Rotokauri Arterial Transport Network design shall be provided to confirm this has been allowed for;"

RITS section 4.2.3.4 also requires a secondary system consisting of ponding areas and overland flow paths to manage excess runoff that caters for events exceeding the capacity of the primary system (in this case the Rotokauri Greenway).

Per Beca's Rotokauri Minor Arterial Designation design report, "The Greenway to Mangaheka overland flow path cannot run down the minor arterial carriageway due to limitations from the catchment boundary, pipe cover and the need for a low point above the Greenway culvert." HCC have advised options for this overflow route are:

• maintain the existing flow path down the paleo drain/farm drain tributary of the Mangaheka Stream or

• incorporate a new flow path through the PC7 development.

This Fast-track RC includes in the design an allowance for a 20m wide spillway set at the 100-year flood level in basin 4 of RL 31.3m (NZVD16) to convey 4.5m^3/s peak flow during emergency Exelby Culvert blockage at a peak water level of 31.6m as detailed on Maven drawing C401-12. This scenario was modelled by Te Miro assuming Exelby Culvert is 100% blocked during a 100-year ARI event and is detailed further in their stormwater modelling report. The model uses existing ground levels using existing LiDAR and shows flows can be directed to the Mangaheka catchment to the north in this emergency scenario. The proposed spillway is located just upstream of wetland 8B's discharge into the highflow bypass and will be stabilised with riprap. The spillway is to be constructed at the time wetland 8B is built.

The overflow route north of the spillway is to be maintained and allowed for as part of the future PC7 subdivision development to convey flows north and west to the Mangaheka catchment. Any future road crossing the proposed overflow route will need to be designed to allow for the emergency overland peak flow of 4.5m3/s under or over the road to maintain a peak water level of 31.6m. Refer to Maven drawings C401-12 and 17.

4.6.6 Low-flow channel

A low-flow channel within the base of the Rotokauri Greenway is proposed to support permanent base flows and mimic the flows of the existing Rotokauri drain. The low-flow channel meanders throughout the base of the Greenway. The low-flow channel ranges from 1.5m to 2.8m in wetted width in accordance with the ICMP. The average depth for most of the Greenway is 0.5m in line with Beca's NOR Rotokauri Swale Greenway Corridor Project and the Rotokauri ICMP - Ecological Assessment and Inputs by Kessels, 2016. Some sections will be shallower with some areas of deeper pools suitable for certain fish species (e.g. giant kōkopu, eel) as proposed by the Ecologist.

The low flow channel is sized to contain the anticipated groundwater winter inflows provided in Table 3 of WGA's Hydrogeology Assessment of Effects report which is included in this consent application. Maven confirms the low flow channel cross section has capacity to convey the winter baseflows determined by WGA.

Consideration has been made to ensure minimum setbacks from the bottom of batter slopes on each side of the Greenway are maintained to meet geotechnical recommendations by HD Geo. HD Geo recommended maintaining a minimum offset of 2.5m (assuming 1V:5H batter slopes and 0.5m deep low flow channel). Where the Greenway base width is limited, this has required a reduction in low-flow channel depth. From chainages CH9 to CH335 a low-flow channel dimension of 0.25m depth x 1.5m width has been adopted. Chainages CH2470 to CH2750 includes a reduced depth to 0.45m. Dimensions of the low-flow channel at both locations have been coordinated with HD Geo to improve stability of batter slopes.

The proposed low-flow channel will have maximum slopes of 1.0V:1.5H in areas where the base of the channel is at its narrowest. These areas will be stabilised with the use of "Bio-socks Edge Saver" vegetated soft armouring or a similar approved product. Reference to this product can be found here https://www.goodrich.nz/bio-socks. In areas where the greenway base is wider, the low flow channel slopes will vary and be made gentler and will be reviewed on site with the Geotechnical Engineer and Ecologist on the requirement for stabilisation.

The minimal longitudinal grade of the Greenway at 0.08% or 0% in some locations results in minimal capacity of the low-flow channel during rainfall events. Therefore, the low-flow channel will allow for baseflow but is anticipated to overflow in most rainfall events at full development of the catchment. This is expected given the increase in impermeable surfaces from pre-development to post-development and therefore increase overall flows discharging into the low flow channel which is sized to mimic the existing Rotokauri drain.

Other natural channel design elements will be incorporated in the EPA design and/or construction such as :

- Streambed substrate.
- Aquatic habitat.
- Woody debris.

These are discussed further in Ecological Solutions Ecological Management Plan which is included in this consent application.

Refer to Maven drawings C402 for details.

4.7 TREATMENT

The Rotokauri ICMP requires a greater than 70% removal of total phosphorous (TP) achieved via overall treatment train/system (source controls and central sub-catchment wetlands). The ICMP requires an average 40% TP removal to be achieved via source controls (upstream of central sub-catchment wetlands) per Table 5-3 as shown in Figure 3 below.

Table 5-3: Design parameters for stormwater management – Southern Development Area

SOUTHERN DEVELOPMENT AREA		
ITEM / PARAMETER	**REQUIREMENT**	
WATER QUALITY		
Stormwater Discharges (achieved at point of discharge) *Note: refer to Section 8.2 for discussion on proposed monitoring requirements*	Treatment / contaminant removal rates	
Total Phosphorous (TP)	Greater than 70% removal achieved via overall treatment train/system (source controls and central sub-catchment wetlands)	
TP / Source Controls	An average 40% removal achieved via source controls (upstream of central sub-catchment wetlands)	
TP / Central Sub-catchment Wetlands	An average of 50% removal achieved via central sub-catchment wetlands on a catchment-wide basis	
Total Suspended Solids (TSS)	Greater than 90% removal achieved via overall treatment system (including erosion and sediment controls during development and housing construction)	
Receiving Waterbodies (achieved after reasonable mixing)	Guideline values	
	Cu (µg/L)	Zn (µg/L)

Figure 3 Design parameters for stormwater management per the ICMP Table 5-3

Morphum investigated and modelled different treatment train alternatives in line with the ICMP toolbox for HCC in their report, Rotokauri Water Quality Model Alternative Treatment Concepts, September 2022.

Morphum concluded that a pre-treatment bioretention device (raingarden) with a surface area 0.5% of contributing catchment area will provide 40% TP removal achieving the requirements laid out in the ICMP. The artificial wetlands provide an additional 50% TP removal of the remaining TP, which equates to a total of 70% TP being removed via this treatment train approach.

Morphum concluded that an amalgamated raingarden arrangement is more cost effective than on-lot and in-road pre-treatment raingardens and has the benefit of reducing the maintenance requirements that would otherwise be required with a large number of raingardens in each catchment.

In addition, following workshops between Maven and Morphum, it was proposed to incorporate a forebay prior to discharging to the raingarden. This has the advantages of capturing coarse sediments and reducing the maintenance requirements for the raingarden. Where considered feasible and advantageous, this methodology has been adopted for the majority of catchments within the scope of this project. This includes catchments to artificial wetlands 4A, 4B, 6, 7A, 7B, 8B, 9A, 9B, 11A and 11B.

The proposed treatment train includes the following:

1. Forebay
2. Amalgamated Raingarden
3. Artificial Wetland

Proposed device engagement targets are as follows:

- Baseflow enters the forebay and bypasses the raingarden to the wetland.
- Small storms equivalent to approximately a quarter of the 2-year flow (suitable to engage the infiltration and freeboard storage of the undersized raingarden (sized for 25% of normal) flow through the raingarden media and discharge to the wetland.
- Medium sized storms between one quarter of the 2-year flow and the 2-year peak flow bypass the raingarden and enter the wetland.
- Large storms greater than 2-year ARI peak flow bypass all treatment to the high-flow channel.

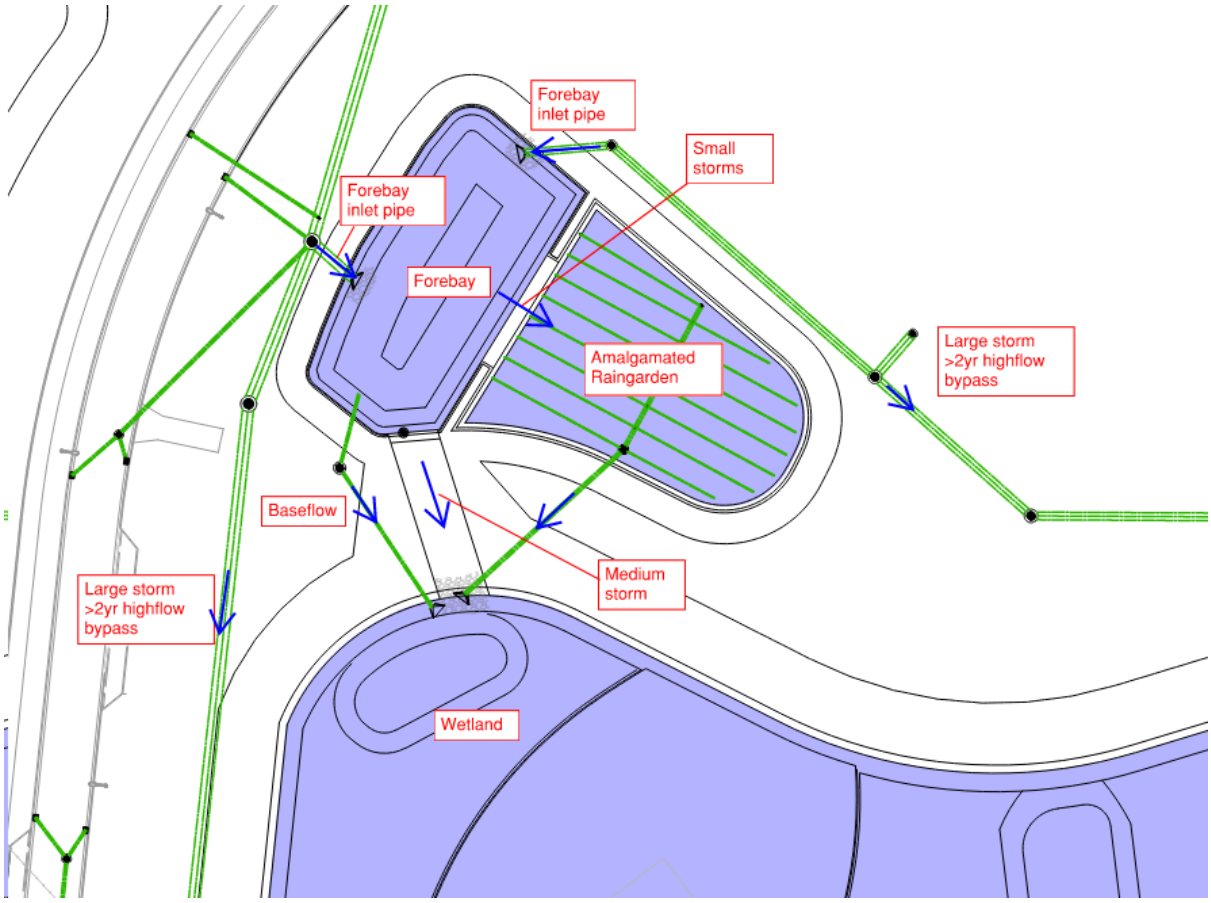


Figure 4 Treatment train with Amalgamated Raingarden

Each stormwater treatment device in the treatment train process is discussed further in the sections below.

Note, the amalgamated raingarden treatment train approach was not deemed feasible for a few specific catchments due to topography or designation constraints. The catchments draining to artificial wetlands 8A, 10 and 12 will require at source treatment in the form of raingardens or similar approved devices to meet the ICMP water quality objectives by future developers. These at source treatment

devices must remove 40% total phosphorous per the ICMP. These water quality devices are not required until the adjoining lots are developed but their overall stormwater flows have been allowed for in the design and modelling. The catchment draining to wetland 1 includes a subdivision which has already been constructed and has been sized to meet ICMP treatment requirements without an amalgamated raingarden, per Morphum's memo "Rotokauri CC1a/ CC1b node concept options" dated 17 January 2018 and attached in APPENDIX F – REPORTS BY OTHERS. Wetland 2B servicing a portion of Akoranga Road is a replacement to the existing SWWP_019 pond and available grades and space does not allow for an amalgamated raingarden, however, provides treatment equal to that being provided currently.

In addition, 3 standalone raingardens are proposed for smaller road catchments where conveyance to nearby wetlands is not feasible. Refer to section 4.7.2 for more details.

4.7.1 Forebay

Forebays have been sized to meet a minimum area of 10% of the wetland per RITS. Where the actual wetland area exceeds the minimum area requirements, the minimum forebay area is considered more appropriately sized based on 10% of the minimum wetland area, rather than 10% of the actual wetland area. WRC TR20-07 requires a forebay sized to minimum 15% of the WQV. Both RITS and WRC requirements are achieved for each wetland. Rainfall events less than the 2year event is directed to the forebays.

Forebay areas are as follows:

Table 7 Forebay areas

Artificial Wetland	Minimum Area (m^2)	Actual Area (m^2)	Min WQV (m^3)	Actual WQV (m^3)
1	680	682	475	488
2B	106	253	53	64
4A	648	764	324	477
4B	216	263	108	118
6	426	508	213	224
7A	254	315	127	144
7B	161	221	80	93
8A	246	292	123	127
8B	440	510	220	315
9A	736	742	368	589
9B	690	716	345	498
10	419	419	210	219
11A	186	287	93	152
11B	434	515	217	331
12	265	405	132	138

4.7.2 Raingardens

Proposed amalgamated raingardens are raingardens which have been incorporated within the forebay and artificial wetland arrangement. As mentioned in 4.7 above, Morphum concluded that a pre-

treatment bioretention device (raingarden) with a surface area 0.5% of contributing catchment area will provide 40% TP removal achieving the requirements laid out in the ICMP.

Raingardens for catchments 4A, 4B, 6, 7A, 7B, 8B, 9A, 9B, 11A and 11B have been sized with a surface area 0.5% of the contributing catchment areas per Morphum's report. Amalgamated Raingardens will treat small storms equivalent to approximately a quarter of the 2-year flow suitable to engage the infiltration and freeboard storage of the undersized raingarden flow through the raingarden media. The stormwater is then conveyed through a series of pipes spaced at a min. of 3m apart per RITS and directed to a manhole with access for cleaning. From here a collector pipe directs flows to the wetlands.

Amalgamated raingarden sizes are as follows:

Table 8 Amalgamated Raingarden Areas

Amalgamated Raingarden	Minimum Area (m^2)	Actual Area (m^2)
4A	810	825
4B	270	272
6	533	536
7A	317	329
7B	201	202
8B	551	553
9A	921	926
9B	862	935
11A	232	257
11B	543	561

In addition, 3 standalone raingardens are proposed for sub-catchments RG1, RG2 and RG3. These smaller sub-catchments have no way or are impractical to connect to any of the wetlands due to topographical constraints. These raingardens have been oversized to enable 70% Total phosphorous removal in consultation with Morphum. Raingardens are assigned 60% TP removal when sized per RITS standards. To achieve 70% the below table from ARC TP10, 2003 is used. The efficiency column on the table is for 75% sediment at 100% device volume would be replaced by 60% and therefore 150% of design size would give 66% phosphorous and extrapolates to approximately double the size for 70%.

Table 3-1 Relative levels of removal efficiency	
Practice Volume	Efficiency
150% of WQV	82%
100% of WQV	75%
75% of WQV	70%
50% of WQV	60%
25% of WQV	50%
10% of WQV	40%
5% of WQV	30%

Figure 5 ARC TP10 Table 3-1

RITS typically sizes raingardens at 2% of the catchment area. Therefore, sizing based on 4% catchment area would yield and meet the required 70% target total phosphorous removal for treatment.

The current raingarden designs are based on in-situ media filled raingardens as shown on Maven drawings C445.

4.7.3 Artificial wetlands

15 Artificial wetlands are proposed adjacent the proposed Rotokauri Greenway to provide treatment and extended detention attenuation prior to discharging to the Greenway.

Wetlands have been designed in accordance with Waikato's Regional Infrastructure Technical Specifications (RITS) and other relevant standards including TR20-06 Waikato Stormwater Runoff Modelling Guideline (TR20-06) and TR20-07 Waikato Stormwater Management Guideline (TR20-07). The technical reports that support the Rotokauri ICMP have provided the basis for the design presented here. This design includes the development of Beca's concept designs completed in the NOR Rotokauri Swale Greenway Corridor Project and the Rotokauri Arterials Designation Project.

Each wetland has been sized to treat the full water quality volume (WQV) as permanent storage and includes extended detention to protect the downstream natural receiving environment. The wetlands are also sized to route the 2-year rainfall event. Any rainfall event larger than the 2-year event will bypass the wetland and be directed via a high-flow bypass to the proposed Greenway.

Wetland bathymetry is banded and consists of a mix of deep and shallow pools to allow for dispersed flow through vegetated areas per RITS guidelines. The zones have been modified from the standard RITS marsh depth to meet the ICMP requirement for an average permanent water depth of 0.3m as detailed in Morphum's report "Rotokauri ICMP Water Quality Treatment". The extended detention level or live storage zone (LSZ) is set at a maximum depth of 0.35m above the permanent water level to support healthy plants per table 4-21 of the RITS document. Flows greater than this level will discharge freely via a weir.

Wetland lining requirements are per HD Geo's geotechnical engineering recommendations:

- A liner will be needed where groundwater is below the proposed wetland invert (to maintain a constant wetland level).
- A non-lined wetland is recommended where groundwater is above the invert.

A liner has been assumed in the hydrogeology assessment where the invert of the wetland will be above the long-term groundwater table per WGA's report. A liner would be needed in these materials to maintain a baseline level. Lining requirements are specified in RITS. It is expected geosynthetic clay liners will be required. A non-lined wetland is recommended by the Geotechnical Engineer where groundwater is above the invert of the wetland. Specifics on wetland liner design will be detailed during EPA in consultation with HCC.

Wetland maintenance access pathways will be 4.0m in width around at least 50% of the perimeter of each wetland per RITS. Maintenance access to forebays includes ramps at 1V:12H minimum gradient including a maintenance bench and turning head per RITS requirements.

In addition, the wetlands have been designed to accommodate flood storage for large rainfall events. The wetland designs allow for backflow of water from the Rotokauri Greenway through the high-flow bypass and over low-lying maintenance/cycle paths during larger 10 and 100yr rainfall events.

Each wetland has been sized based on the below water quality treatment requirements:

- Treatment requirements for the wetlands include storing the WQV. The RITS document refers to the WRC TR20-07 for this calculation. The WQV is the stormwater runoff volume determined by calculating the runoff volume from 1/3 of the 2-year 24-hour rainfall (including an allowance for climate change). WQV has been calculated separately for pervious and impervious areas and allows for a reduction in volume due to initial abstraction.

- WRC TR20-7's recommended approach for wetland design is to be conservative and have the surface area of the wetland at the permanent water level as 3% of the overall catchment area draining to the wetland when imperviousness of the contributing catchment is less than or equal to 70%. Once imperviousness exceeds 70% the surface area requirement increases to 4% of the overall catchment area. The imperviousness for the catchments discharging to the wetlands has conservatively been assumed at 90%. This matches Te Miro's flood modelling assumption for the Rotokauri Greenway project.

- The ICMP requires an average wetland normal water depth of 300mm.

Wetlands have therefore been sized to contain the water quality volume, with an average 300mm normal water depth and a minimum wetland area of 4% of the catchment. The areas and Water Quality Volume is the sum of the area and storage provided by both the wetland and the forebay respectively. See summary below.

Table 9 Wetland Area and Water Quality Volumes

Wetland	Min. wetland area (4% catchment) (m^2)	Actual wetland area (m^2)	Min. Water Quality Volume (m^3)	Actual Water Quality Volume (m^3)
1	6,800	6,805	3,168	3,189
2B	1,055	1,288	351	377
4A	6,481	7,189	2,159	2,754
4B	2,156	2,375	718	909
6	4,263	5,065	1,420	1,667
7A	2,535	4,729	844	1,484
7B	1,605	2,536	535	792

8A	2,456	2,871	818	934
8B	4,405	4,958	1,467	1,765
9A	7,364	8,320	2,453	3,094
9B	6,898	7,851	2,298	2,876
10	4,194	4,195	1,397	1,443
11A	1,857	2,165	618	707
11B	4,342	5,037	1,446	1,677
12	2,650	2,949	882	762

Wetlands with the built-in treatment train will receive baseflow directly from the forebay to maintain the health of wetland vegetation. Small storms will be directed from the raingarden via a collector pipe. Medium sized storms between one quarter of the 2-year flow and the 2-year peak flow will bypass the raingarden and enter the wetland directly via a weir and swale.

The proposed outlet for each of the wetlands consist of a weir and swale, with an orifice sized for the extended detention volume released over 24-hours per WRC requirements. Orifice sizes for the wetlands are shown in the Table 10 below. Outlet swales connects either to the high-flow bypass before discharging to the Wetland or directly to the Greenway.

Table 10 Wetland outlet designs

Artificial Wetland	ED Orifice (mm)	Orifice invert (m)*	Broad Crested Weir width (m)	Top of weir (m)*
1	230	30.72	9.0	31.07
2B	90	30	1.0	30.35
4A	240	29.85	6.0	30.2
4B	130	29.85	2.0	30.2
6	190	29.55	4.0	29.9
7A	140	29.55	2.4	29.9
7B	110	29.55	1.5	29.9
8A	145	29.55	2.3	29.9
8B	190	29.55	4.1	29.9
9A	280	29.55	6.8	29.9
9B	330	29.55	6.2	29.9
10	200	29.55	3.9	29.9
11A	110	29.4	1.8	29.75
11B	190	29.4	4.1	29.75
12	145	29.4	2.5	29.75

*Reduced levels provided in the table above are based on NZVD16 Vertical Datum

A key aspect of the wetland design to work in conjunction with the adjacent Rotokauri Greenway, was to ensure the wetland elevation in relation the greenway flood levels enable water to leave the wetland and flow into the greenway in smaller storm events. The Extended Detention level must be at or above the 2-year water level in the relevant Greenway cell to ensure the EDV functions for the channel forming critical erosion design storm (approx. 1.5-year ARI). Therefore, the PSZ water level must be no lower than 350mm below the Greenway 2yr water level. This was the basis for the original ICMP wetland

design concept levels and has been adopted for the wetland designs. Proposed wetland levels in relation to Greenway basins are summarised in the Table 11 below:

Table 11 Artificial Wetland levels vs Rotokauri Greenway levels

		Wetland			Rotokauri Greenway			
Artificial Wetland	**Basin**	**PWL (m)**	**EDL (m)**	**2yr**	**2yr**	**10yr**	**100yr**	**EDL-2YR (m)**
1	1	30.72	31.07	31.37	30.2	30.8	31.6	0.8
2	1	32.22	32.57	32.87	30.2	30.8	31.6	2.3
2B	1	30.00	30.35	30.65	30.2	30.8	31.6	0.1
4A&4B	2	29.85	30.20	30.50	30.1	30.6	31.5	0.2
6	3	29.55	29.90	30.20	29.9	30.5	31.4	0.0
7A&B	3	29.55	29.90	30.20	29.9	30.5	31.4	0.0
8A	3	29.55	29.90	30.20	29.9	30.5	31.4	0.0
8B	4	29.55	29.90	30.20	29.8	30.4	31.4	0.1
9	4	29.55	29.90	30.20	29.8	30.4	31.4	0.1
10	4	29.55	29.90	30.20	29.8	30.4	31.4	0.1
11	5	29.40	29.75	30.05	29.7	30.2	31.0	0.1
12	5	29.40	29.75	30.05	29.7	30.2	31.0	0.1

4.8 FLOOD STORAGE

4.8.1 Design Criteria

The overall flood storage volume required within the Rotokauri South development shall be provided partly within the main Greenway channel/basins, partly above the wetlands and partly in future 'inland' wetlands whilst meeting the discharge parameters and flood storage as required in Table 5-3 of the ICMP. Flood storage requirements are presented in Table 12.

Table 12 ICMP Table 5-3 Flood storage

Flood Storage Permanent central flood storage (post development of the Central Green Corridor)	
All areas draining to the Central Green Corridor	Flood storage within the Central Green Corridor. Note: discharge control (peak flow attenuation) is not required for any storm event as this will be controlled via Exelby Road culvert outlet
Localised Flood Storage (residual flooding)	Flood storage within local conveyance swales, road reserves and public reserve areas - subject to detailed assessment - sufficient to store residual flooding below the central corridor MPD 100 year + CC flood level
Overland Flow	Overland flow in roads or designated drainage reserves to convey MPD 100-year flow to conveyance swales and the

	Central Green Corridor, as per the ITS. Note: this requirement extends to the upper reaches of all sub-catchment areas

ICMP figure 3-13 below (Figure 6) illustrates the embedded concept of using the volume in the wetlands above the 2-year ARI event as part of the overall flood storage which has been adopted in the design.

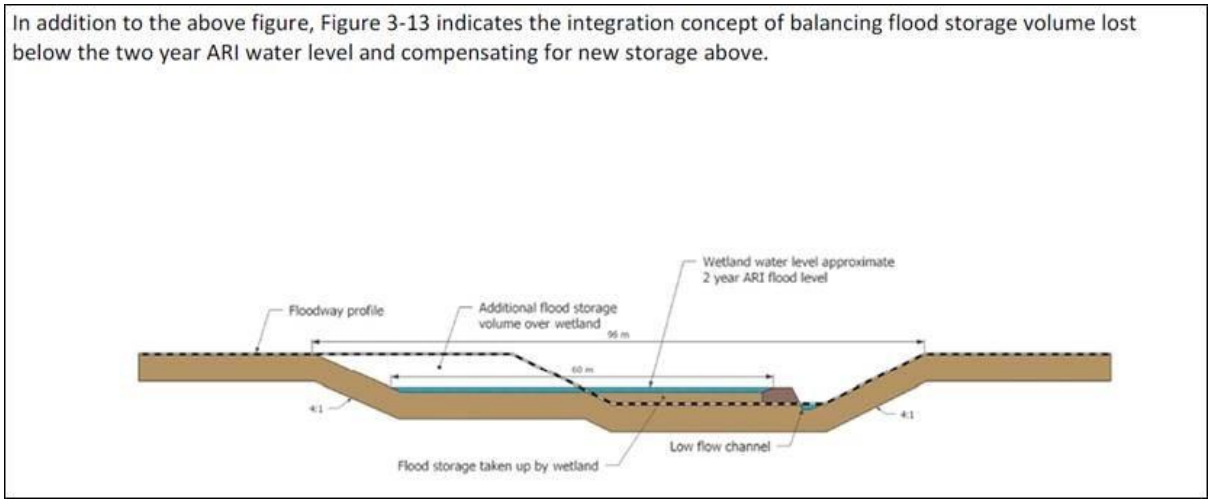


Figure 6 ICMP Figure 3-13

Table 21 of ICMP Appendix C2 Major Drainage Preferred Option Stomwater Manage Solution Report (Aecom, 2016) highlights the assumption that additional storage will be designed into sub-catchment wetlands and conveyance swales. These are referred to in this design as future inland wetlands. Extract of this table is shown in Table 13 below.

Table 13 Extract from Table 21 of ICMP Appendix C2

Item	Name	Description / comment
4	Residual flooding storage	The proposed solution assumes that additional storage will be designed into sub-catchment wetlands and conveyance swales, below the basin design flood levels, to assist in storing and controlling residual flooding.

4.8.2 Design Methodology

Te Miro have undertaken flood modelling of the development with inputs from Maven including the 3D surface of the Rotokauri Greenway, artificial wetlands, and raingardens as well as the Greenway main culvert details. Te Miro detail their flood modelling results in their stormwater modelling report which is included in this consent application.

The Rotokauri Greenway channel/basins provides flood attenuation and storage via a series of throttle culverts. Refer to section 4.6.3 on Greenway culvert designs.

The artificial wetlands have been designed to provide flood storage in the event of large rainfall events. Rainfall events larger than the 2-year event bypass the treatment train (forebay, raingarden and wetlands) and are conveyed via a high-flow bypass to the Rotokauri Greenway. However, during larger

rainfall events, water from the Greenway will backflow through the high-flow bypass finding its way into the wetlands, where the wetlands will assist in providing flood storage to the Greenway.

Flood storage in future 'inland' wetlands are to be constructed by future developers and have been quantified based on 4% of their sub-catchment area with a wetland extended detention level at or above the 2yr flood level in the greenway.

The total storage requirement is based on TUFLOW modelling by Te Miro Water Ltd using Maven's design surface and assuming a "glass wall" scenario to simulate final infill of lands adjacent the Rotokauri Greenway. A "glass wall" scenario creates a vertical wall around the surface of the greenway and wetlands in the model. This has been used in the absence of final design levels for the lands outside of the greenway/wetlands which will be determined by future developers. The glass wall allows the total flood storage to be incorporated within the modelled greenway and wetlands without spillage and therefore provides expected future flood levels within the greenway post development. The resulting flood levels are somewhat conservative, as in reality the future lands adjacent the greenway and wetlands will have batter slopes extending from the greenway (rather than vertical). The model allows for stormwater discharging via a 900mm diameter Exelby Culvert into Lake Rotokauri (prior to upsizing for embedment due to fish passage).

4.8.3 Flood Levels and Freeboard

Stormwater and flood modelling design has been undertaken using climate change projections RCP 6.0 in accordance with RITS and as described in section 4.2. Flood levels for the 2-, 10- and 100-year rainfall event allowing for RCP6.0 climate change per Te Miro's TUFLOW model based on the methodologies discussed in the sections above are provided below:

Table 14 Basin Flood levels

	2yr	10yr	100yr
Basin 1	30.2	30.8	31.6
Basin 2	30.1	30.6	31.5
Basin 3	29.9	30.5	31.4
Basin 4	29.8	30.4	31.4
Basin 5	29.7	30.2	31.0

A sensitivity check undertaken by Te Miro using RCP8.5 to determine 100yr flood levels would result in an average increase of 300mm in peak 100yr levels along the Greenway (Basin 1-5). Freeboard requirements per RITS have been reviewed should the increase in rainfall due to climate change using the more conservative projection of RCP 8.5 eventuate increasing flood levels on average by 300mm:

- Freeboard requirements for Future Habitable dwellings = 500mm minimum height per RITS. RCP 8.5 100yr flood levels would still be below future habitable dwelling floor levels. I.e. water levels would be contained within the available freeboard.
- Freeboard requirements for Future Commercial and industrial buildings = 300mm minimum height per RITS. RCP8.5 100yr flood levels would be at the future commercial and industrial buildings floor level. I.e. water levels would not be contained within the available freeboard.

- Non-habitable residential buildings and detached garages = 200mm minimum height per RITS. RCP8.5 100yr flood levels would be above freeboard levels to non-habitable residential buildings and detached garages
- Pump station lid levels shall be provided with a minimum freeboard of 300mm above the estimated flood level per RITS. RCP8.5 100yr flood levels would be at pump station lid level. I.e. water levels would not be contained within the available freeboard posing a risk to pump station.

In reality, a large percentage of the catchment will include freeboard levels higher than the minimum heights required per RITS. This is due to necessary fill requirements to allow stormwater and wastewater to drain by gravity. Approximate fill requirements are provided in Maven drawings C405.

It is noted that RCP 8.5 assumes very high greenhouse gas concentrations and is the most conservative of the four RCP projections. Conservativism has been allowed for in other aspects of the stormwater flood modelling including:

- Assumption that 90% of the catchment is impervious (including future urban)
- Model does not account for the additional storage that will be available in roadways and pipe networks.
- 50% catchpit blockage in existing Nawton urban generating more overland flow to Greenway.

Our recommendation following this sensitivity check is as follows:

Given conservatism has been allowed in other aspects of the stormwater modelling we recommend maintaining RCP6.0 as the climate change adjustment for design, where freeboard requirements are measured above the RCP6.0 100yr ARI peak levels.

We recommend an adaptive management approach is adopted for Rotokauri South. Should future climate uncertainty result in rainfall trending towards RCP 8.5 and increasing 100yr flood levels, a review and study is recommended to further investigate the impact of climate change on the 100yr flood levels and adaptive solutions.

Possible adaptation options to manage flood risk from climate uncertainty are:

- Adjustments to the Lake Rotokauri weir outlet structure to optimise Lake Storage and Greenway drain down. Downstream Ohete Stream is incised with no current flood ponding issues and this option can be investigated including any downstream impacts.
- Adjust the weir structure for the Greenway emergency overflow north of basin 4. An analysis of the downstream impact of these adjustments is recommended in future.

Both options above effectively provide a ‘pressure release value’ for the entire catchment.

An analysis of the downstream impact of these adjustments is recommended in future.

Another solution would be to raise freeboard requirements on individual lots.

Based on the above, we recommend maintaining RCP6.0 as the climate change adjustment for this design and an adaptive management approach is adopted to address any climate change beyond the RCP6.0 projection.

4.8.4 Storage Volumes

Storage volumes as outputs from Te Miro's flood modelling using the methodologies discussed above are provided in this section.

Storage volumes provided in each Rotokauri Greenway basin are shown in Table 15 below.

Table 15 Basin storage volumes at 100yr flood level

Basins	Storage Volume at 100yr Flood level (m3)
Basin 1	36,000
Basin 2	58,000
Basin 3	121,000
Basin 4	45,000
Basin 5	73,000
Total	333,000

Storage volumes provided in each wetland within the scope of this resource consent are shown in the Table 16 below.

Table 16 Wetland storage volumes at 100yr flood level

Artificial wetlands	Storage Volume at 100yr Flood level (m^3)
Wetland 1	6,000
Wetland 2B	3,000
Wetland 4A&B	25,000
Wetland 6	16,000
Wetland 7A	15,000
Wetland 7B	6,000
Wetland 8A	8,000
Wetland 8B	10,000
Wetland 9A&B	43,000
Wetland 10	9,000
Wetland 11	20,000
Wetland 12	7,000
Total	167,000

Future dummy inland wetlands (not part of this consent) have been included in Te Miro's model as 'dummy' wetlands (geometric shapes in the surface) with an area of 4% of the sub-catchment and will be required to be built as part of future development. Each wetland must provide storage volumes at the 100yr flood level per the Table 17 below:

Table 17 Future dummy inland wetland storage volume at 100yr flood level

Future Dummy Inland Artificial Wetlands (not part of this application)	Storage Volume at 100yr Flood level (m^3)
SWWP_379	20,000
4C4D	10,000
SWWP_397	14,000
SWWP_388	19,000
RDL7&8	31,000
Total	94,000

The storage volumes required by the future inland artificial wetlands correspond to the size of the catchment they are servicing and are equitable to the storage volumes being provided by the wetlands within the scope of this project.

Future dummy inland wetland as assumed in Te Miro's model are shown in the figure below.

Figure 7 Inland wetland location and assumptions

Refer to Maven C405 drawings for inland wetland catchments and indicative future inland wetland locations. It may make sense for future developers to provide more than one device in their respective catchment in place of the indicative future inland wetlands shown to achieve the flood storage required. Proposed methods of achieving the required water quality treatment and the flood storage required will be detailed by future developers and reviewed by HCC during the relevant consent

applications. If catchment assumptions change, a review of the impact on flood storage volumes will be required.

Summarised total flood volumes stored during the peak 100yr ARI flood event are as follows.

Table 18 Summary storage volumes at 100yr flood level

Asset	100yr ARI Flood storage Volume (m3)
Rotokauri Greenway	333,000
Artificial Wetlands (in scope)	167,000
Total Greenway + Wetlands (in scope)	500,000
Future Dummy Inland Artificial Wetlands (not part of this application)	94,000
Overall Total	594,000

As per the Table 18 above, the total required storage volume within the Rotokauri South development during the peak 100yr ARI flood event is 594,000m^3. All volumes have been rounded to the nearest 1000 m^3. As a comparison the ICMP concept design completed by AECOM in appendix C2 required 503,320m^3. Table 5.2 of Beca's Greenway NOR design report required 431,696m^3 in total.

It is noted the required design volumes exceed the storage volume that was allowed for in the original Beca NOR design (the approved concept design as per the PDA). The Beca final model result shows residual ponding areas. Beca noted in their 2021 modelling report that "further inland/conveyance areas are likely needed to manage these residual ponding areas in addition to the wetlands." We are now at the point whereby these residual areas needed to be encapsulated within the design, hence resulting in additional storage volumes formally 'wrapped up' into future inland wetlands.

Refer to Te Miro's stormwater modelling report which is included in this consent application for further detail around the stormwater modelling aspects of the design.

4.9 HIGH-FLOW BYPASS CHANNEL

High-flow bypasses are proposed for each sub-catchment which diverts high-flows larger than the 2-year event, up to the 100-year event around the treatment train (forebay, raingarden and wetlands) in accordance with RITS secondary system design section 4.2.3.4.

Each high-flow bypass includes flow splitters to divert high and low flows. Flow splitters will consist of either a manhole with a weir, or a weir structure installed within the high-flow swale. The weir height will overtop during flows larger than the 2-year event. This design element is not fixed and may be altered during EPA as required by HCC.

High-flow bypass swales connect to the greenway via either an open channel (with a shared path bridge if crossing the cycle path) or a culvert with wingwalls and riprap. Open channels are HCC's preference

for high-flow bypasses/secondary systems. In most cases open channels have been proposed, however a few specific locations require piping. Justification for high-flow bypasses requiring a piped solutions is included below:

Open channel high flow bypasses are included for wetlands 2B, 4A, 4B, 6, 7A, 7B, 8B, 9A, 9B, 10, 11A and 11B. Piping is used where open channel is not possible as described below:

1. Wetland 2B – south connection has inadequate room for both path + open channel therefore piped.

2. Wetland 4A – Majority of catchment is directed to open channel located between Wetland 4A and 4B. Catchment to Northeast is directed via a pipe network due to lack of space and an open channel would significantly affect Landscape Plaza and Open recreational area. This is also consistent with original designs proposed by Beca in the NOR Arterial project.

3. Wetland 8A – highflow bypass crosses future road, open channel not possible.

4. Wetland 12 - existing grades are steep, location of paths and future road would require culverts in future for access to forebays. The recommendation is to pipe.

High-flow bypass swales connect to the greenway via either an open channel (with a shared path bridge if crossing the cycle path) or a culvert with wingwalls and riprap. Further detailing of these devices will be provided during EPA.

High-flow bypass swales and outlet culverts have been sized for the 100-year event to allow for overland flow paths from the catchments above. Refer to section 3.10 for details on overland flow path design within the minor arterial and collector road. Overland flow paths within future development areas will be verified/designed by future developers.

Artificial wetland 4A and 4B high-flow bypass has been sized to also convey flows from the future RDL development catchment above (future Wetlands 4C and 4D). Flows from this catchment are directed to the high-flow bypass via a culvert which runs beneath the proposed minor arterial road. Refer to figure below and drawing C405-13 for location.

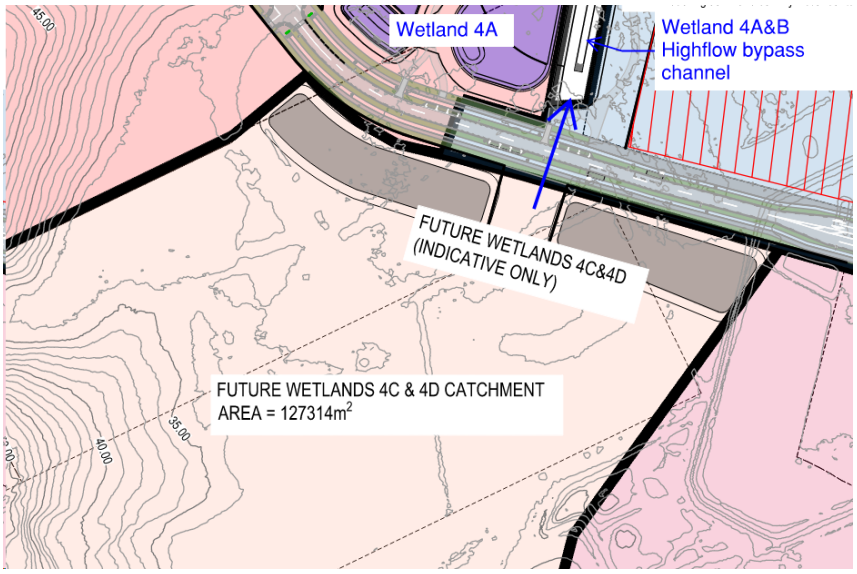


Figure 8 Future Wetlands 4C & 4D catchment discharge to high-flow bypass channel

The high-flow bypass/conveyance channel for Wetlands 9A and 9B will be extended in future to service catchments/wetlands SWWP_397 and SWP_388 as illustrated in Figure 9.

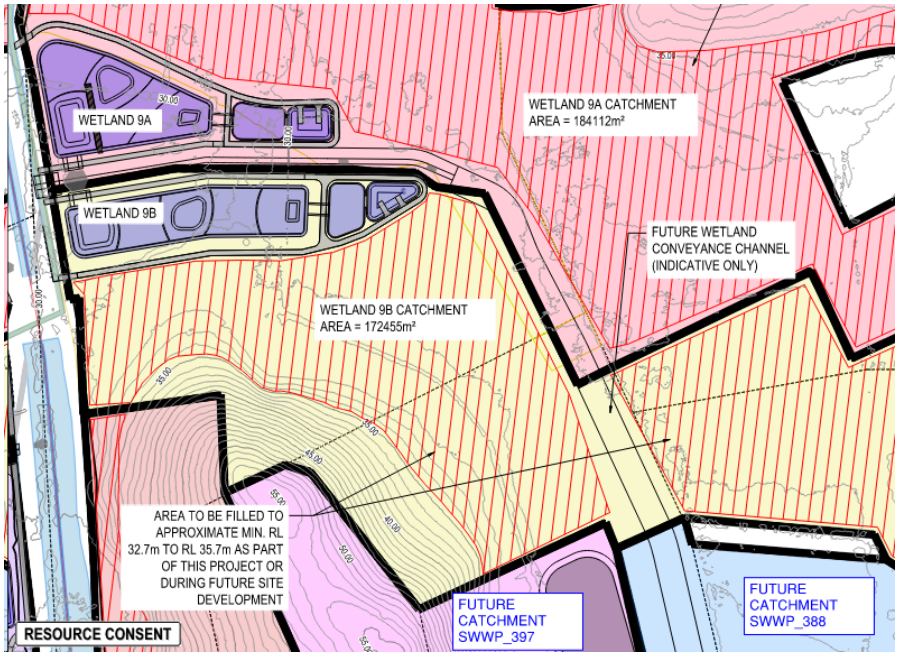


Figure 9 Future high-flow bypass/conveyance for Catchments SWWP_397 and 388

4.10 PROPOSED STORMWATER RETICULATION

The proposed stormwater network primarily composes of new stormwater manholes, cesspits and pipes which will be installed along the proposed Minor Arterial Road corridor. New concrete wingwall inlets and outlets will be placed for pipes located at secondary stormwater system raingarden forebays, artificial wetland and the Greenway. With the purpose to minimise flood effects and stormwater quality on the subject site and the environment, the gravity stormwater network will collect runoff from trafficable surfaces and discharge to the proposed stormwater forebays, raingardens and wetlands. The

proposed stormwater system will service as extension points for future development, comprising of residential and commercial subdivision.

In accordance with RITS, stormwater manholes shall be located within the proposed roadway. RITS requires minimum 600mm cover for stormwater pipes. All pipes within the minor arterial and collector roads will be installed with at least 1000mm cover for constructability. Stormwater pipes outside minor arterial and collector roadways will be installed with minimum 600mm cover per RITS.

At selected manholes, flow splitters will be allocated for stormwater quality treatment as described in section 4.9 above.

Along the northern portion of the minor arterial (past the collector road), there will be stubs branching off the minor arterial that will be installed allowing for the future stormwater networks to connect into the proposed stormwater network. An example is shown in the figure below.

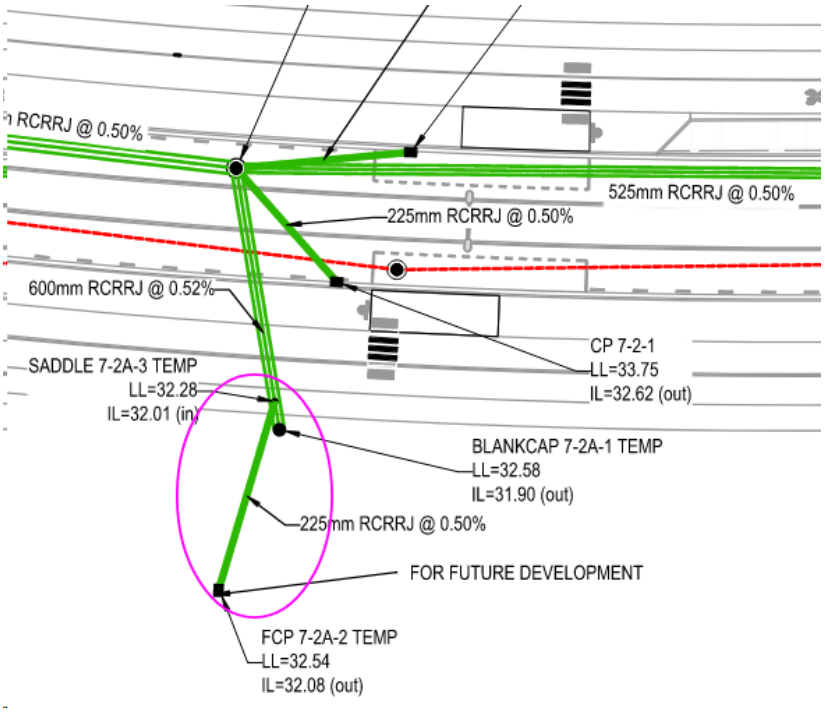


Figure 10 Stormwater network example of stub for future development connection

As the minor arterial and collector road will be built prior to the adjacent areas being developed and with the road mostly being in fill, the stormwater runoff from the masterplan area in a few specific locations south of the road will cause flow paths to be 'blocked' by the proposed road corridor. This is the case for chainages 980 to 1260 where runoff from the wider catchment will not be able to discharge to the north/north-eastern direction to the Rotokauri Greenway due to the elevated levels of the minor arterial compared to the surrounding area. To mitigate this, the earthworks proposal is to place fill in low lying areas with positive grade to the minor arterial (refer to Maven drawing C210). In addition, low points along southern boundary of the minor arterial at future stub locations will include temporary field catchpits/scruffy domes sized for the 10-year storm event to prevent flooding of the minor arterial as detailed in Maven drawing series C450. See figure 8 above for an example.

Referring to Maven drawing C450-11, an existing swale along State Highway 1C is proposed to discharge stormwater to the Rotokauri Greenway. Prior to the development of Chalmers Road, this swale would discharge stormwater to a nearby catchpit to the east of State Highway 1C. Though with the development and regrading of the Chalmers Road in the proposal, this requires an inlet structure and pipe network to capture the stormwater runoff from this existing swale. The exact extents and catchment for the swale will be determined during the detailed design stage.

4.11 STORMWATER CAPACITY

RITS standards, intensity rainfall HIRDS Niwa data (including climate change) and 10-year rainfall intensity return period (ARI) are used to determine and verify the primary stormwater network capacity. Velocity of at least 0.6m/s and not greater than 3.0m/s are followed to minimise erosion mitigation.

Calculations demonstrate that pipe sizes of 300mm up to 1200mm and cesspit leads of 225mm at the minimum 0.5% gradient will be utilised to achieve the required velocity and flow capacity.

Manholes on stormwater pipelines have been sized to a minimum DN1050 per RITS. Manholes on stormwater pipelines more than DN600 are sized with a minimum diameter equal to the largest pipe size plus 600mm and 300mm minimum distance between pipes.

4.12 ALTERNATE OPTION PRE-GREENWAY

A stormwater management solution is proposed for an alternate option in which the Minor Arterial and Collector roads and their associated treatment devices are constructed and commissioned prior to the completion of the Rotokauri Greenway.

As detailed in the CMP, the construction of the greenway is proposed to start at the downstream end (basin 5) at Exelby Road and continue upstream with one basin anticipated to be completed per earthworks season. The proposed minor arterial and associated strategic infrastructure, however, is proposed to start at existing roads Te Wetini and Taiatea Drive which are adjacent basin 2. Therefore, to enable surrounding development to commence earlier, our clients may wish to construct and commission the minor arterial and collector roads before basin 5, 4, 3 and 2 of the greenway is complete.

Wetlands 4A, 4B, 6 and 7A and raingardens 1 and 2 provide water quality treatment, attenuation and flood storage for the minor arterial and collector roads and will be required to be built at the same time as their respective portion of road. The wetlands will also service future adjacent development areas as illustrated on wetland catchment plans C405 of the Maven drawings. The invert levels of the proposed treatment devices are lower than the invert of the existing Rotokauri drain. Wetland 4A and B outlet has the largest difference, at 0.85m below the invert of the adjacent Rotokauri drain. Therefore, to allow gravity discharge from the treatment devices the following is proposed:

- Construct basin 5. Basin 5 longitudinal grade is 0.08% providing a lower tie in point (than the existing Rotokauri drain) upstream of basin 5.
- Construct an interim channel (deeper than the existing Rotokauri drain) within the greenway designation connecting outlets from Wetlands 4A, 4B, 6 and 7A and Raingardens 1 and 2 to basin 5. The proposed interim channel is 1924m in length from Wetland 4A and 4B to basin 5 at a longitudinal grade of 0.13%. The channel has been sized at a minimum to meet the existing surveyed cross section of the adjacent Rotokauri drain.

Stormwater will therefore discharge from the proposed treatment devices into the interim channel which directs flows into basin 5 before discharging through Exelby Culvert into the existing Rotokauri drain.

The interim channel would be constructed in stages commencing from the downstream tie-in location at basin 5. The existing upstream Rotokauri drain and any secondary drains would be diverted into the interim channel as each section is completed.

The channel is required to commission Wetlands 4A and 4B initially. Wetlands 6 and 7A and raingardens 1 and 2 could then be connected at the time they are constructed.

The interim channel will be positioned where possible along the edge of the greenway designation to allow future works to construct each greenway basin whilst utilising the interim channel as a diversion of clean water flows around the worksite. After each basin has been constructed, flows will be diverted into the basins, the interim channel will then be decommissioned and any final works to install the shared path and planting can be completed. A typical section for basin 3 where this option is proposed is provided in Figure 11 below.

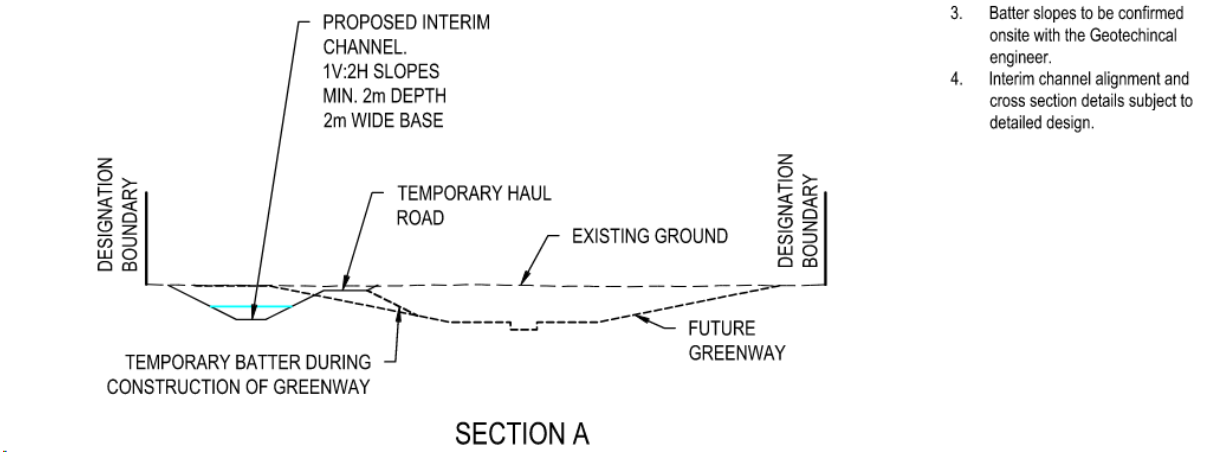


Figure 11 Typical section of proposed Interim Channel

Where the proposed interim channel location prevents construction of a portion of greenway basin, the existing rotokauri drain may be re-utilized as a diversion channel, whilst works in the basin take place. The existing rotokauri drain would require re-grading to deepen the channel before it can be re-used as a diversion channel. A typical section for basin 2 where this option is proposed is provided in Figure 12 below.

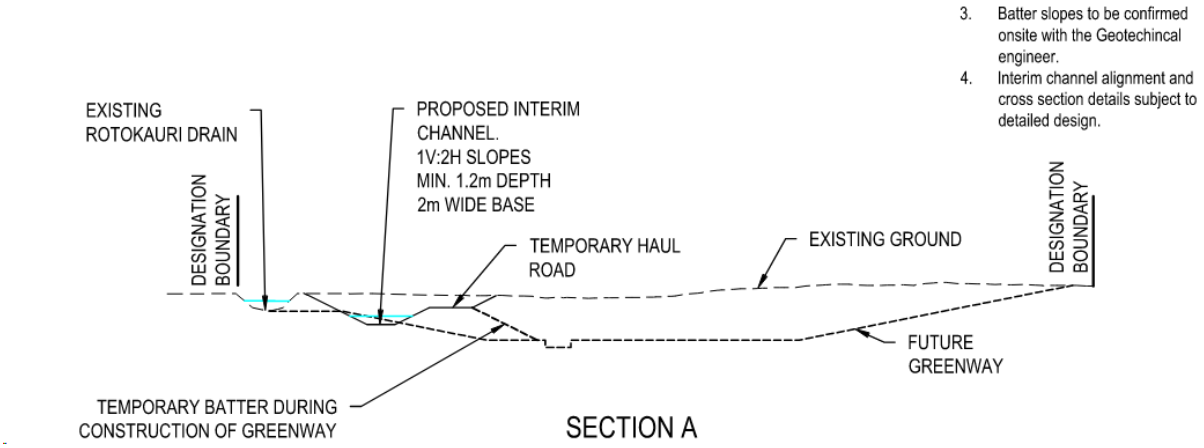


Figure 12 Typical section of proposed Interim Channel in basin 2

This alternate option results in basin 5, wetlands 4A, 4B, 6 and 7A providing interim flood storage. ICMP Table 5-3 requires interim flood storage be provided equivalent to 1,200m^3 per hectare of developed land prior to the greenway being built. The combined area of minor arterial, collector road, wetlands 4A, 4B, 6, 7A, raingardens 1 and 2 and basin 5 is 14.7ha which would require 17,700m^3 of flood storage. There will also be displacement of existing flood areas due to the extent of the developed land listed above which equates to 15,000m^3. Wetlands 4A, 4B, 6 and 7A and basin 5 collectively provide 129,000m^3 of flood storage using final design MPD 100yr levels which far exceeds the ICMP requirement. This is due to the wetlands and basin 5 being designed to also provide flood storage for future adjacent development areas. A review of the interim flood storage required verse what is being provided for each stage of future adjacent developments will be required and provided under separate consent applications. A summary of flood storage volumes for the alternate option is provided in Table 19 below.

Table 19 Alternate Option Flood Storage Summary Table

ICMP Interim Storage required	17,700m^3
Displaced volume	15,000m^3
Total Flood Storage required	32,700m^3
Total Flood Storage provided	129,000m^3

Refer to Maven drawings C441 for the proposed alternate interim channel design. Refer to Maven drawings C401-13 to 15, C410-05 and C415-22 to 26 for basin 5 design. This alternative option will be further detailed in EPA, should HCC and HHL wish to proceed.

5. WASTEWATER

5.1 DESIGN STANDARDS

Waikato's Regional Infrastructure Technical Specification sets out design and construction standards for wastewater and requires all land development projects to be provided with a mean of wastewater disposal.

The proposal also follows the Rotokauri Integrated Catchment Plan (ICMP) by Hamilton City Council which sets out the specific requirements for wastewater design in the Rotokauri catchment area.

5.2 PROPOSED CATCHMENT

Referring to Maven Drawing C550-1, the proposed Rotokauri Greenway and Minor Arterial lie within ICMP sub catchment B and C.

The proposed development will adhere to the ICMP requirements.

5.2.1 ICMP Sub Catchment B

A wastewater network is proposed on the northern portion of the Minor Arterial (outside of ICMP sub catchment C and within ICMP sub catchment B) that will discharge via gravity to a new wastewater pump station (WWPS 3).

The ICMP sub-catchment B has been subdivided into several smaller catchments (Maven sub-catchments B1, B2, and B3), as delineated in Maven drawing C550-5. This division is a consequence of the design and layout of the Rotokauri Greenway and Minor Arterial Road as well District Plan zoning. The proposed plan for Maven sub-catchments B2 and B3 is to facilitate their discharge through a gravity network leading to WWPS 3. However, since Maven sub-catchment B1 is situated on the northern side of the proposed Greenway, it will not flow through WWPS 3. Instead, it will bypass the pump station and discharge via gravity to manhole A-6 which connects to the existing Far Western Interceptor.

To mitigate uncertainty surrounding future development plans and finished levels within the catchment, we have undertaken a conceptual design which can be used and refined by future developers. These plans are included in APPENDIX E – CONCEPT FOR INFORMATION PLANS. The conceptual plans offer a conservative estimate of the tie-in invert levels for the wastewater network along the northern section of the Minor Arterial. These estimates are based on key locations for a potential future gravity wastewater network that would serve the catchment of WWPS 3. It is envisaged that this network would connect via gravity to the proposed wastewater network on the Minor Arterial Road at manhole A-12, as indicated on Maven drawing C500-8.

To achieve the tie-in invert levels at this designated location, it will be necessary to infill certain low-lying areas within Maven sub-catchment B2. This aligns with the need to fill these lands to meet freeboard requirements for the 100-year ARI (Annual Recurrence Interval) event and to facilitate future stormwater networks discharging into future wetlands for treatment. It's worth noting that some locations within sub-catchment B2 may require localized wastewater pump stations if filling the land cannot be achieved to facilitate a gravity wastewater network. Though it must be noted that Hamilton City Council's preference is not to install additional wastewater pump stations. The precise extent of filling and any need for such localized pump stations will be determined by future developers as the specific development plans and requirements are further defined.

WWPS 3 is a newly proposed pump station that will be constructed as part of this development's delivery. This pump station is designed to serve any future developments within Maven sub-catchments B2, B3, and D near the northern portion of the minor arterial road. It is engineered to handle a peak wet weather flow of 99.72 litres per second (L/s) originating from a 159-hectare catchment with a population equivalent of 10,856. Hamilton City Council's preference is for the pump station to use as short of a rising main as possible. This infrastructure is essential for managing wastewater effectively in the envisioned development area.

5.2.2 ICMP Sub Catchment C

The southern section of the Minor Arterial Road, located within ICMP sub-catchment C, will utilize a gravity network for wastewater discharge to WWPS 2 on Te Wetini Drive. A new 225mm diameter pipe wastewater network is proposed along this portion of Minor Arterial to support future developments. The future developments within this area contain Maven sub-catchments C1 and C5 as indicated in Maven drawing C550-3. A new 225mm diameter wastewater pipe network is planned for this area. This new gravity network will connect to a 150mm diameter stub from the existing wastewater manhole with GIS ID WWM11009 at the intersection of Te Wetini Drive.

Initial calculations suggest there might be a potential capacity bottleneck in the 150mm diameter stub at the Te Wetini Drive Intersection, particularly if the future development in Maven sub-catchment C5 leads to increased wastewater demand. However, whether this capacity is exceeded will depend on the density and scale of the future development in Maven sub-catchment C5.

As a precaution, in case the future development in Maven sub-catchment C5 does indeed surpass the capacity of the 150mm diameter stub, a future-proofed wastewater route has been proposed. This involves the installation of a 225mm diameter wastewater pipe network that circumvents the perimeter of 100 Taiatea Drive (Lot 1 DP 535335) and directly discharges wastewater into WWPS 2. This alternative route ensures that wastewater demands from future developments can be accommodated without overburdening the existing infrastructure.

WWPS 2 is an existing pump station on Te Wetini Drive which has been designed and commissioned under the Rotokauri Rise development Stage 3-5. This pump station will be utilised to support the future residential and commercial developments near the southern portion of the proposed Minor Arterial Road. The pump station has been designed to cater for a peak wet weather flow of 87.18 L/s from a 178Ha catchment with a population equivalent of 8,042.

5.2.3 ICMP Sub Catchment D

The existing Te Wetini Drive pump station (WWPS 2) was originally designed and approved by Hamilton City Council to service ICMP Sub Catchment D. However, due to the anticipated increase in density following zoning changes, HCC requested Maven investigate the option of changing the ICMP sub catchment D's ultimate discharge location.

Subject to HCC's decision, ICMP sub catchment D may discharge wastewater to WWPS 3. Given the existing topography of this catchment, a localised pump station will be required to elevate wastewater to the top of the ridge line (between ICMP sub catchment D and B), then utilise a gravity network to discharge wastewater from sub catchment B to WWPS 3.

5.3 FUTURE DEVELOPMENT

To account for the future intensification of the Hamilton region under Plan Change 12 which at the time of writing this report is yet to be made operative as part of the district plan, Hamilton City Council have unofficially provided to Maven Associates Ltd the proposed population equivalent intensities to use for the wastewater calculations for any future undeveloped area within the catchment. These values differ from the current RITS standard.

Table 86: Population equivalent

HAMILTON CITY ZONES	POPULATION EQUIVALENT
General Residential	70 persons per hectare, or not less than 2.7 persons per dwelling
Special Purpose Zones including Special Character & Historic Heritage and any other Precincts	
Medium Density Residential	120 persons per hectare
High Density Residential	150 persons per hectare
Central City Zone	>300 persons per hectare
Large Lot Residential	45 persons per hectare
All business zones	
Community facilities zone	
All industrial zones	
Major facilities zone	
Future urban zones	70 persons per hectare
Other establishments should be treated as follows:	
Primary schools	45 persons per hectare
Secondary schools	150 persons per hectare
Hospitals	3.5 persons/bed
Motels	0.6 persons/bed

Figure 13 Proposed Changes to Population Equivalent

5.4 WASTEWATER RETICULATION

The proposed wastewater reticulation network includes a combination of gravity and pressurised pipes and pump stations. Wastewater pipes will be installed within the proposed road corridor. These pipes will collect wastewater from the future adjoining residential and commercial properties and discharge into the respectable pump station before pumped to a higher elevation and finally discharging by gravity into the Far Western Interceptor to the east of State Highway 1C.

It should be noted the portion of proposed wastewater main which runs from the northern HHL boundary; to WWPS 3; across the Greenway over culvert 3; and along future Te Kowhai Road to connect into the Far Western Interceptor will run beneath a proposed future road which is not included in this consent. A temporary haul road will be included to provide access until such a time the road is constructed. Refer to the CMP in APPENDIX B – EARTHWORKS CONSTRUCTION MANAGEMENT PLAN (CMP) which provides further detail.

Refer to Maven drawings C500 series for details on wastewater reticulation.

5.5 WASTEWATER CAPACITY

Calculations show that the maximum flow rate the gravity pipe will need to cater for will be 99.7 L/s. The largest proposed wastewater pipe will be 375 mm in diameter at 0.33% gradient. It will have a capacity of 144.2 L/s; therefore, it will have sufficient capacity to service the future development.

Manholes on wastewater pipelines have been sized to a minimum DN1050 for depths of 1.0m or more per RITS. Manholes with depths more than 3m are sized to DN1200, manholes with depths more than 6m are sized to DN1500 and manholes with depths more than 8m are sized to DN1800.

The existing pump station WWPS 2 has been designed to cater for a peak flow rate of 87.2 L/s with a maximum storage of 113 m^3. The capacity of the WWPS 2 to service future development is subject to investigation by Hamilton City Council and future developers.

The proposed pump station WWPS 3 is designed to cater for a peak flow rate of 100.2 L/s in accordance with the ICMP. It will also be provided with 1,005 m^3 of storage volume. The peak flow rate from its upstream catchment will be 99.7 L/s and therefore will provide sufficient capacity based on the assumptions above.

Future developers of lands within the catchments above will be required to review and validate the assumptions made for each sub-catchment at the time of development to confirm wastewater infrastructure still meets capacity requirements. This approach will be implemented by HCC.

5.6 WASTEWATER PUMP STATION

5.6.1 Layout and RITS requirements

This section of the report relates to the new proposed WWPS 3 within the ICMP sub catchment B. The specification and design of the new wastewater pump station has been developed in partnership with HCC asset owners. The proposed pump station will comprise of a collection manhole, inlet pipes, a wet well, control cabinet, odour biofilter and emergency storage tanks situated near the future Minor Arterial Road and Te Kowhai East intersection. The pump station site will also include a 5.0 m wide paved all weather access road and turning head to provide maintenance access. Detailed descriptions of the pump station and compliance check in accordance with RITS is presented in Table 20 below. In consultation with Hamilton City Council, the preference was for WWPS 3 to be located near the Rotokauri Greenway to minimise the length of rising main. This is consistent with the proposed location in the ICMP. WWPS 3 will lift wastewater to a higher elevation in a short length of rising main to allow for a gravity discharge using a new network over the proposed Greenway culvert 3 and along future Te Kowhai East Road, to connect back to the Western Interceptor.

Table 20 Pump station RITS requirements

Requirements	Requirements check
a) Area around the pump station shall be graded to prevent surface water flowing onto or over the pump station cover slabs.	The pump station area will be graded to ensure that water will be directed towards the Minor Arterial Road. The pump station pavement and ground surrounding will be at a higher elevation than the nearby Minor Arterial Road and Rotokauri Greenway.

b) Free of secondary flow paths for 1% AEP flood level, and the pump station lid levels shall be provided with a minimum freeboard of 300mm above the estimated flood level.	As the pump station will be sitting at a higher elevation than the Minor Arterial Road, this will ensure that the minimum freeboard will be achieved. The pump station lid level will be at least 300mm above the overland flow path on the road and 300mm above the 100-year flood level in the Rotokauri Greenway.
c) Pumping systems shall a. Have a pumping capacity of N+1 with a minimum of two identical pedestal mounted submersible sewage pumps. b. Each pump shall be capable of discharging the design peak wet weather flow rate from the catchment. c. Include sufficient well volume to operate under normal conditions without surcharge to the incoming wastewater network.	Maven Associates have engaged Pump and Valve to design the pumping systems to ensure the pump specifications comply with RITS.
d) The station shall be located to ensure that the entire design catchment can be serviced.	The pump station has been designed for the entire catchment and for future development intensifications as per Plan Change 12.
e) All stations shall be contained within a separate local purpose reserve - drainage title set out to provide safe and easy operation and maintenance of the site without impacting on public activities surrounding the site and is designated in accordance with the relevant District Plan or vested as part of a subdivision.	A designated local purpose reserve has been proposed to allow for the operation and maintenance of the pump station.
f) The station shall be designed to service the entire catchment area of land beyond the reach of the existing gravity system. Refer to clause 5.1.6.	The pump station has been designed to account for the catchment areas as per ICMP requirements.
g) In staged construction, guidance from the Council is required to ensure the correct sizing of the pump station and associated rising mains and storage facilities meet the short- and long-term requirements of the catchment.	Hamilton City Council to review and provide feedback.
h) A minimum emergency storage capacity of nine hours average dry weather flow, measured between the High-Level alarm & the point of overflow.	The pump station has been designed to account for a minimum emergency storage capacity of 9 hours.
i) It is recommended that prior to submission of the detailed design, consultation is undertaken with Council to ensure that the design is fit for purpose.	Hamilton City Council to review and provide any comments on Maven Associates' wastewater pump station proposal prior to EPA submission.

5.6.2 Collection manhole

Immediately upstream of the pump station and within the local purpose reserve, a single collection manhole will be provided to collect all wastewater flows from the catchment. The collection manhole is situated near the entrance of the pump station site to provide ease of access for future maintenance.

The collection manhole will be constructed with a sump to trap gravel, rocks and other solid objects and prevent them from entering the pump station wet well. The manhole will be an 1800 mm diameter and have a sump of 500 mm as measured form the invert of the outlet pipe as per RITS requirements.

The volume of the collection manhole is 13,100L which is over 10 times the peak wet weather flow (minimum 5 times required as per RITS).

5.6.3 Inlet pipe and wet well

Only one gravity pipe will discharge into the wet well and an isolation valve will be provided.

The proposed pump station WWPS 3 comprises a wet well of 3500mm inside diameter. This is designed to cater for a maximum pump rate of 100.2 L/s from the peak wet weather flow. This will also meet the minimum separation distances of the pump supplier (Pump and Valve) and provide sufficient operational capacity to meet the maximum number of starts per hour. Detailed design will be approved via HCC's assessment of engineering plans process (EPA) with the intent to lodge in January 2024.

The invert level of the gravity inlet pipe and emergency storage well are to be minimum 100mm above the standby pump start level to prevent surcharge of the system during normal operation.

The distance between duty pump starts and stop levels will be a minimum 400mm to satisfy the RITS requirement.

The design stop level will be 50 mm above the pump manufacturer's minimum continuous operating levels.

The pump station wet well will have negative buoyance when the well is empty. The chamber will be fitted with mass concrete in the bottom to contour buoyancy forces in accordance with manufacture's specification.

5.6.4 Emergency storage

The proposed pump station will be provided with emergency storage tanks to store wastewater in the event of pump failure. A minimum 9-hour emergency storage based on average daily flow will be provided prior to emergency overflow occurring in accordance with RITS. This equates to a volume of 948 m^3 which will be stored across the wet well, additional ancillary storage chambers, and pipelines including the upstream network. The ancillary storage chambers will connect to the collection manhole via pipes which will be laid at a gradient of 1% towards the manhole to allow self-draining.

5.6.5 Connection to downstream wastewater system

The pump station will discharge wastewater to the discharge manhole A-6 before discharging (into the existing downstream gravity network, the Far Western Interceptor to the east of State Highway 1C, which will have sufficient capacity to cater for the discharge from the pump station.

5.6.6 External services

The successful operation of the wastewater pump station is reliant on the provision of adequate external services including:

- Wash water
- Power
- Stormwater
- Wastewater (receiving environment)
- Telemetry wireless pathways

Wash water

The proposed pump station will be provided with a DN50 PE rider main off the proposed 250 mm trunk main in the proposed Minor Arterial Road. They will provide the water supply required for wash down purpose for the pump station.

Power

A reticulated power network will be designed and installed in the proposed Minor Arterial Road to provide a point of connection for power for the proposed pump station.

Stormwater/overland flow

The proposed pump station will be elevated from the ground and situated away from the overland flow paths and floodplain.

Electrical and telemetry

The electrical and telemetry requirements for the proposed pump station will be confirmed with HCC. The alarm and operational data control system will be installed by the developer, or by HCC at the developer's cost.

6. WATER SUPPLY

6.1 DESIGN STANDARDS

HCC's RITS sets out design and construction standards for water supply system and requires all land development projects to be provided with a means of water supply including firefighting supply.

The proposed development which sits within the Rotokauri catchment area will also need to adhere to the ICMP by HCC which sets out the specific requirements for water supply in the Rotokauri catchment area.

6.2 POTABLE WATER RETICULATION

HCC GIS shows that there is an existing water supply point at the Te Wetini Drive and Taiatea Drive intersection. The existing water network comprises a 450 mm trunk main, a 150 mm principal main in Te Wetini Drive and a 250 mm trunk main and a 150 mm principal main in Taiatea Drive.

The proposed water network will see the existing 150 mm principal main and 250 mm trunk main extended from Taitea Drive, laid along the proposed road extent and connected to the existing mains in Chalmers Road. The proposed 150 mm principal main will be laid in the southern side of the proposed Minor Arterial, and the 250 mm trunk main on the eastern side. These mains will be utilised to provide potable water supply to support future residential and commercial development along the proposed Minor Arterial.

It is confirmed with HCC Water team during the preparation of this resource consent that a 600 mm diameter (ID) bulk water main will need to be provided as part of this development to support future developments in the wider Rotokauri catchment area. This bulk main will be extended from the existing 450 mm diameter trunk main in Te Wetini Drive and placed along the proposed Minor Arterial alignment. The bulk main will connect to the proposed principal and trunk mains in the Minor Arterial at various points and eventually terminate at the Hounsell holding boundary.

6.3 FIRE FIGHTING SUPPLY

Hydrants will be installed in the proposed water reticulation network for firefighting purpose. These hydrants will be located in the road berms on the proposed 250 mm diameter trunk mains at no more than 135 m interval within the residential zone, and no more than 90 m within the commercial zone with additional hydrants provided on both sides of the road. Flow rate and pressure of the proposed network will be tested to confirm that the minimum requirements for water and firefighting supply stipulated in SNZPAS 4509:2008 can be achieved to support future development along the Minor Arterial .

7. OTHER SERVICES

Power and telecommunications services are available near the development area and will be extended along the proposed Minor Arterial to provide a point of connection for future residential and commercial development. The power service is managed by WEL network and telecommunication service is managed by Chorus. The detailed design of these services is underway and it anticipated to be completed by end of 2023.

8. CONCLUSION

This engineering report provides an assessment of the civil infrastructure associated with the Rotokauri Greenway and Minor Arterial Project. We consider that the proposed Rotokauri Greenway, artificial wetlands, minor arterial and collector roading network and bulk stormwater, wastewater and water supply infrastructure can be accommodated at the subject site without generating any adverse effects on the existing infrastructure and stormwater receiving environment.

The portion of the minor arterial from Te Wetini Drive to HHL's northern boundary including the collector road to the Chalmers Road underpass is proposed. Proposed roadways have been designed in accordance with Austroads and Waikato's Regional Infrastructure Technical Standards (RITS). There are departures from these standards to some degree to achieve the best practical outcomes and address site-specific constraints as detailed in this report and appendices.

Stormwater will be managed via a new stormwater system which includes pipe networks located within the proposed roadway; a series of treatment devices including forebays, raingardens and wetlands; and a Greenway stormwater management corridor. Proposed stormwater pipe networks have been designed in accordance with RITS. Proposed Greenway and wetland designs includes the development of Beca's concept designs completed in the NOR Rotokauri Swale Greenway Corridor Project and the Rotokauri Arterials Designation Project. The technical reports that support the Rotokauri ICMP and the RITS formed the basis of the design with adjustments to the treatment train approach as detailed in section 4.7.

Wastewater drainage is proposed for the full length of minor arterial and collector road. The southern ICMP sub-catchment C ties into existing wastewater pump station 2. The northern ICMP sub-catchment B directs flows to a proposed wastewater pump station WWPS3. Each pumpstation conveys flows to the Far Western Interceptor to the east of State Highway 1C. Proposed wastewater pipe networks and wastewater pump station WWP3 have been designed in accordance with RITS and the ICMP and are sized to support the demands from future developments in the wider Rotokauri South catchment area.

Principal and trunk mains are proposed for the full length of minor arterial and collector road which are extensions of existing water infrastructure located. In addition, a 600 mm diameter (ID) bulk water main is to be provided. The proposed water infrastructure has been designed in accordance with RITS and the ICMP and are sized to support the demands from future developments in the wider Rotokauri South catchment area.

Power and telecommunications services are available near the development area and will be extended along the proposed minor arterial Road to provide a point of connection for future residential and commercial development. The power service is managed by WEL network and telecommunication service is managed by Chorus.

The project team are working towards submitting the detailed design for Engineering Plan Approval (EPA) in January 2024. Subdivision consents from HHL for the lands adjacent the Rotokauri Greenway and Minor Arterial will be lodged following the fast track consent application. Earthworks is planned to commence for the Rotokauri Greenway and Minor Arterial on 1st October 2024.

Therefore, information gathered to-date confirms the site is suitable for the proposed project works.

9. APPENDICES

9.i APPENDIX A – ENGINEERING PLANS

9.ii APPENDIX B – EARTHWORKS CONSTRUCTION MANAGEMENT PLAN (CMP)

9.iii APPENDIX C – PAVEMENT DESIGN MEMO

9.iv APPENDIX D – OLFP MEMO

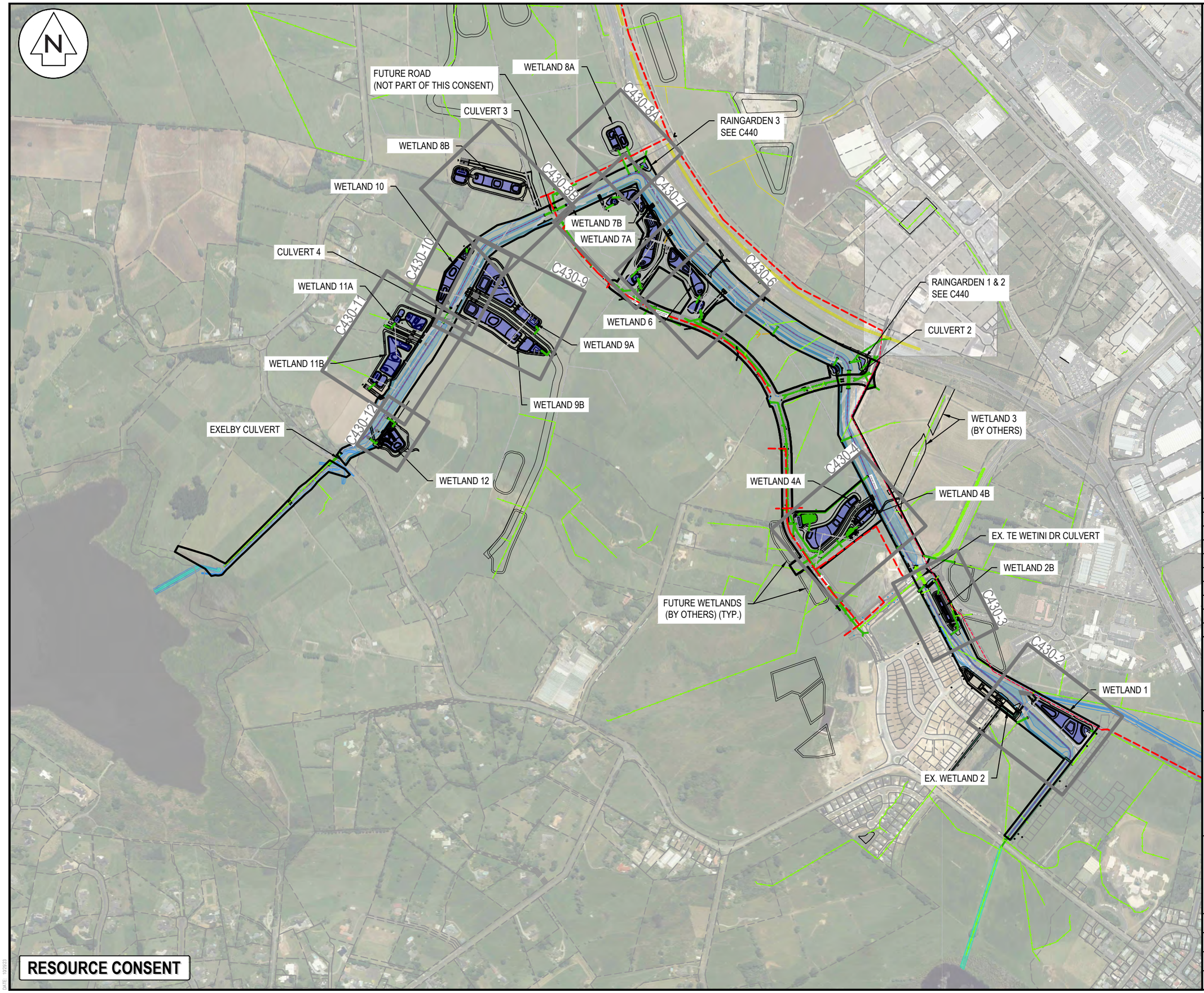
9.v APPENDIX E – CONCEPT FOR INFORMATION PLANS

9.vi APPENDIX F – REPORTS BY OTHERS

9.vii APPENDIX G – ENGINEERING CALCULATIONS

9.viii APPENDIX H – ICMP RESPONSE MEMORANDUM

Attachment 3 – Fast Track Artificial Wetland Design Plans



GREENWAY

ARTIFICIAL WETLAND

Notes

1. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000.
2. Levels in terms of NZVD16 Vertical Datum

Rev	Description	By	Date
A	RESOURCE CONSENT	KY	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	MHS	07/2023
Drawn	RA	07/2023
Checked	MHS	07/2023

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Project

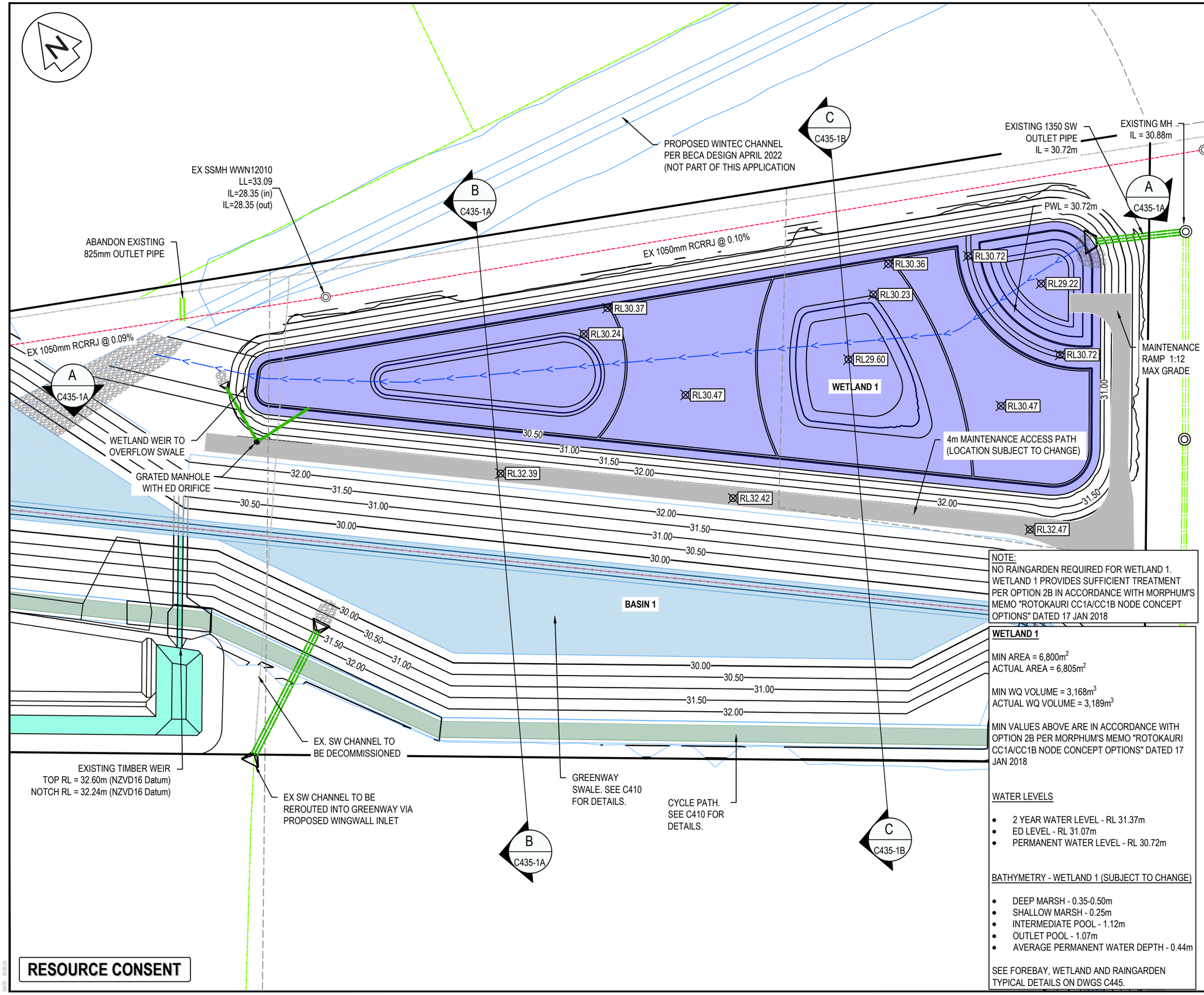
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title

PROPOSED WETLANDS OVERVIEW PLAN

Project no.	180006		
Scale	1:10000 @ A3		
Cad file	180006-C430 WETLANDS.DWG		
Drawing no.	C430-1	Rev	A

DATE: 12/05/23



RESOURCE CONSENT

DATE: 9/25/23

Notes
1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the New Zealand Vertical Datum 2016.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. All concrete SW pipe to be installed in accordance with AS/NZS 3725:2007 for buried concrete pipes and AS/NZ 4058:2007 for precast concrete pipes (pressure and non-pressure) as stipulated in the RITS 2018.
5. Approved hardfill is to be used in backfilling of all stormwater lines within the road reserve.
6. Heavy duty manhole lids and frames to be used in trafficked areas.
7. All catchpit leads shall have min cover 0.9m.
8. All catchpit leads shall be laid at 1% unless otherwise specified.
9. All concrete lines are to be Class4 RCRRJ unless otherwise specified.
10. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with Council staff.
11. Pipe lengths shown on plan are from upstream pipe invert to downstream pipe invert.

Legend
- EX BDY
- PROP BDY
- EX WASTEWATER
- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

NOTE:
NO RAINGARDEN REQUIRED FOR WETLAND 1. WETLAND 1 PROVIDES SUFFICIENT TREATMENT PER OPTION 2B IN ACCORDANCE WITH MORPHUM'S MEMO "ROTOKAURI CC1A/CC1B NODE CONCEPT OPTIONS" DATED 17 JAN 2018

WETLAND 1

MIN AREA = 6,800m^2
ACTUAL AREA = 6,805m^2

MIN WQ VOLUME = 3,168m^3
ACTUAL WQ VOLUME = 3,189m^3

MIN VALUES ABOVE ARE IN ACCORDANCE WITH OPTION 2B PER MORPHUM'S MEMO "ROTOKAURI CC1A/CC1B NODE CONCEPT OPTIONS" DATED 17 JAN 2018

WATER LEVELS

- 2 YEAR WATER LEVEL - RL 31.37m
- ED LEVEL - RL 31.07m
- PERMANENT WATER LEVEL - RL 30.72m

BATHYMETRY - WETLAND 1 (SUBJECT TO CHANGE)

- DEEP MARSH - 0.35-0.50m
- SHALLOW MARSH - 0.25m
- INTERMEDIATE POOL - 1.12m
- OUTLET POOL - 1.07m
- AVERAGE PERMANENT WATER DEPTH - 0.44m

SEE FOREBAY, WETLAND AND RAINGARDEN TYPICAL DETAILS ON DWGS C445.

Rev	Description	By	Date
A	RESOURCE CONSENT	KY	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	MHS	08/2023
Drawn	KY	08/2023
Checked	MHS	08/2023

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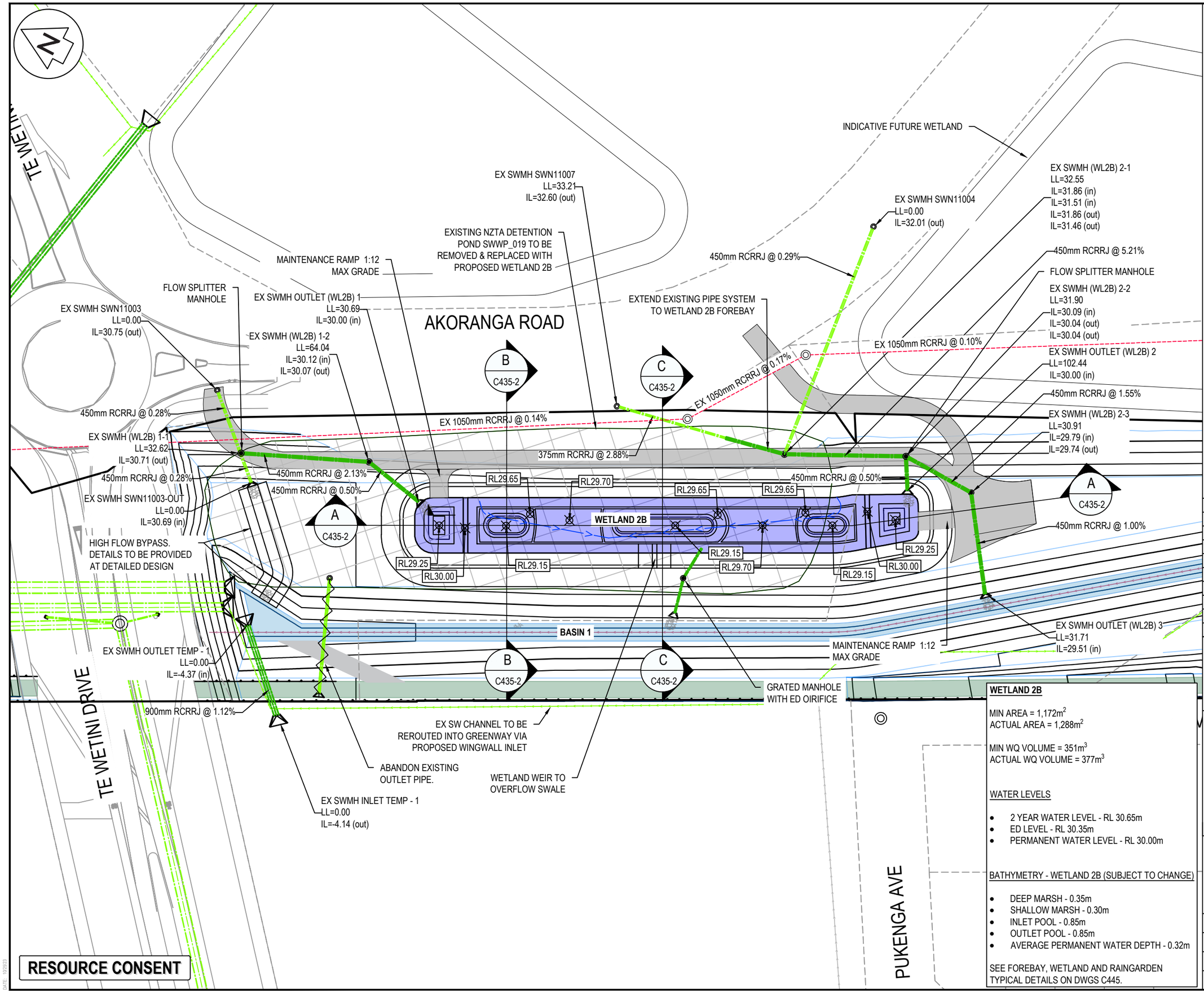
Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title
PROPOSED WETLAND 1

Project no.	180006		
Scale	1:750 @ A3		
Cad file	180006-C430 WETLANDS.DWG		
Drawing no.	C430-2	Rev	A



Notes
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2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the New Zealand Vertical Datum 2016.
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4. All concrete SW pipe to be installed in accordance with AS/NZS 3725:2007 for buried concrete pipes and AS/NZ 4058:2007 for precast concrete pipes (pressure and non-pressure) as stipulated in the RITS 2018.
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6. Heavy duty manhole lids and frames to be used in trafficked areas.
7. All catchpit leads shall have min cover 0.9m.
8. All catchpit leads shall be laid at 1% unless otherwise specified.
9. All concrete lines are to be Class4 RCRRJ unless otherwise specified.
10. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with Council staff.
11. Pipe lengths shown on plan are from upstream pipe invert to downstream pipe invert.

Legend
- EX BDY
- PROP BDY
- EX WASTEWATER
- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

Rev	Description	By	Date
A	RESOURCE CONSENT	KY	09/2023

	By	Date
Survey	LANDPRO	12/2022
Design	-	-
Drawn	RA	07/2023
Checked	MHS	07/2023

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Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title
PROPOSED WETLAND 2B

WETLAND 2B

MIN AREA = 1,172m^2
ACTUAL AREA = 1,288m^2

MIN WQ VOLUME = 351m^3
ACTUAL WQ VOLUME = 377m^3

WATER LEVELS

- 2 YEAR WATER LEVEL - RL 30.65m
- ED LEVEL - RL 30.35m
- PERMANENT WATER LEVEL - RL 30.00m

BATHYMETRY - WETLAND 2B (SUBJECT TO CHANGE)

- DEEP MARSH - 0.35m
- SHALLOW MARSH - 0.30m
- INLET POOL - 0.85m
- OUTLET POOL - 0.85m
- AVERAGE PERMANENT WATER DEPTH - 0.32m

SEE FOREBAY, WETLAND AND RAINGARDEN TYPICAL DETAILS ON DWGS C445.

RESOURCE CONSENT

DATE: 12/2023

Project no.	180006		
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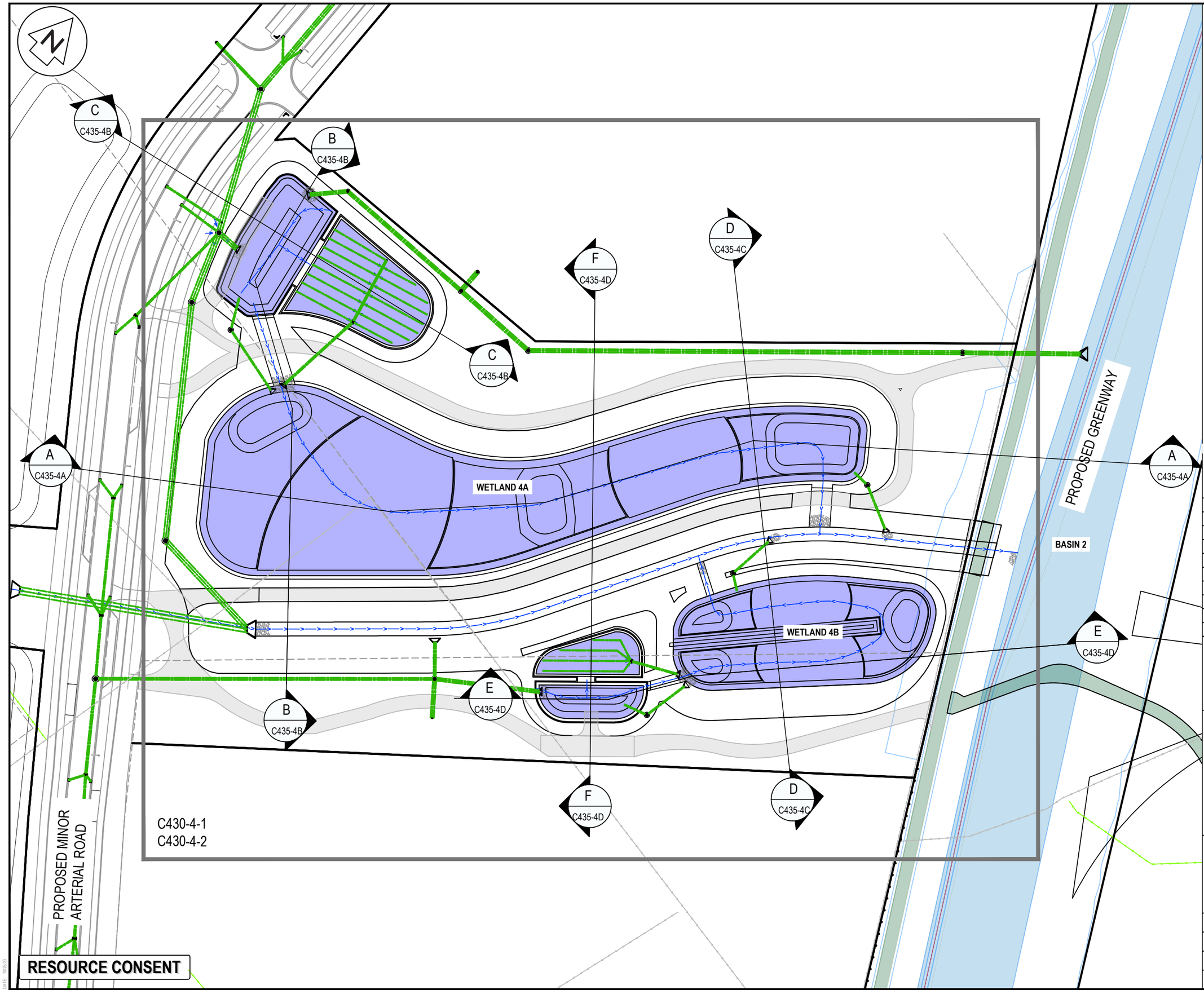
Cad file	180006-C430 WETLANDS.DWG		
Drawing no.	C430-3	Rev	A



Notes
1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the New Zealand Vertical Datum 2016.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. All concrete SW pipe to be installed in accordance with AS/NZS 3725:2007 for buried concrete pipes and AS/NZ 4058:2007 for precast concrete pipes (pressure and non-pressure) as stipulated in the RITS 2018.
5. Approved hardfill is to be used in backfilling of all stormwater lines within the road reserve.
6. Heavy duty manhole lids and frames to be used in trafficked areas.
7. All catchpit leads shall have min cover 0.9m.
8. All catchpit leads shall be laid at 1% unless otherwise specified.
9. All concrete lines are to be Class4 RCRRJ unless otherwise specified.
10. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with Council staff.
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- PROP BDY
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- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

Rev	Description	By	Date
A	RESOURCE CONSENT	MHS	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	MHS	05/2023
Drawn	RA	07/2023
Checked	MHS	07/2023

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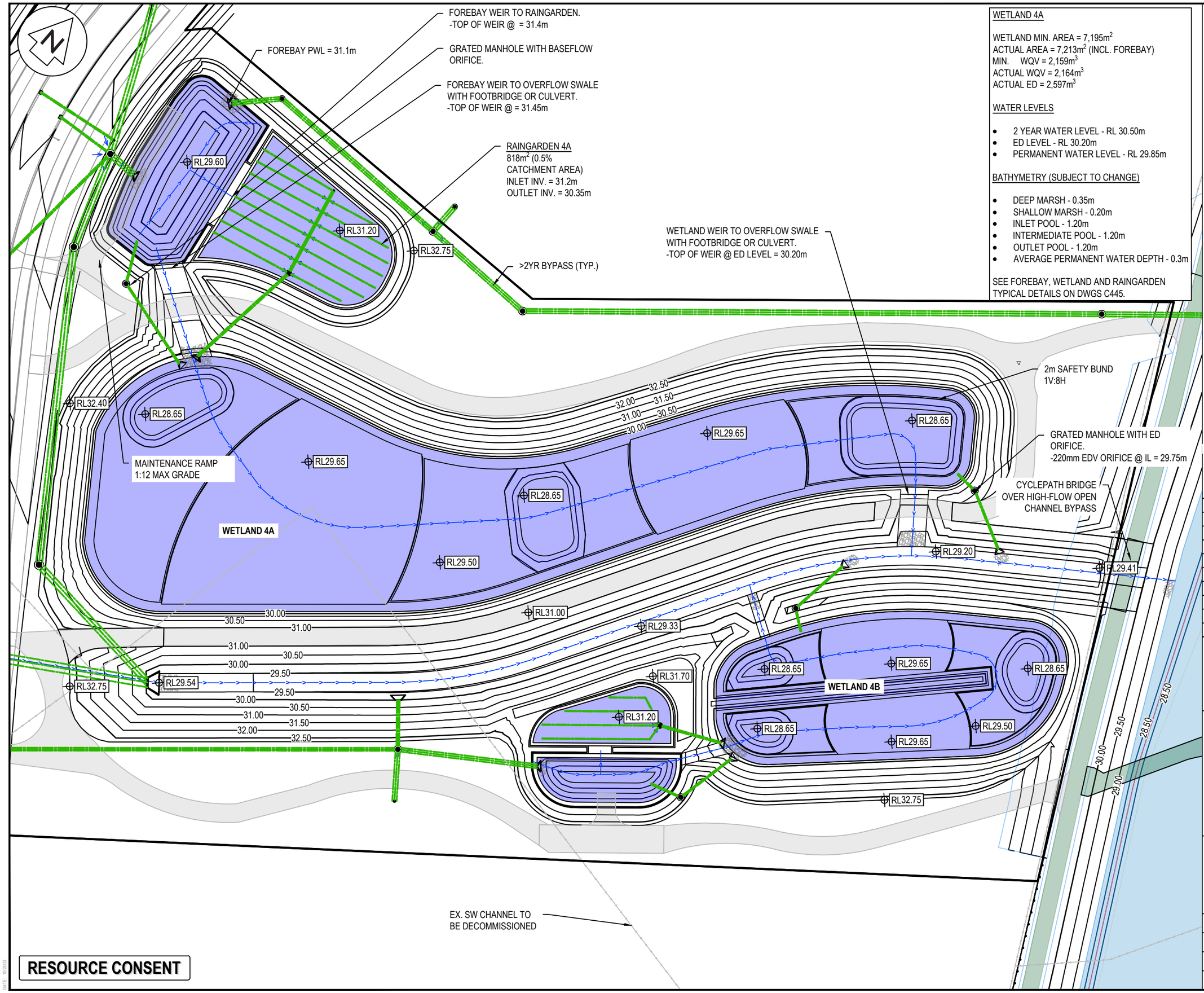
Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title
PROPOSED WETLAND 4A & 4B

Project no.	180006		
Scale	1:1000 @ A3		
Cad file	180006-C430 WETLANDS.DWG		
Drawing no.	C430-4	Rev	A

DATE 10/2023



WETLAND 4A

WETLAND MIN. AREA = 7,195m²
ACTUAL AREA = 7,213m² (INCL. FOREBAY)
MIN. WQV = 2,159m³
ACTUAL WQV = 2,164m³
ACTUAL ED = 2,597m³

WATER LEVELS

- 2 YEAR WATER LEVEL - RL 30.50m
- ED LEVEL - RL 30.20m
- PERMANENT WATER LEVEL - RL 29.85m

BATHYMETRY (SUBJECT TO CHANGE)

- DEEP MARSH - 0.35m
- SHALLOW MARSH - 0.20m
- INLET POOL - 1.20m
- INTERMEDIATE POOL - 1.20m
- OUTLET POOL - 1.20m
- AVERAGE PERMANENT WATER DEPTH - 0.3m

SEE FOREBAY, WETLAND AND RAINGARDEN TYPICAL DETAILS ON DWGS C445.

Notes
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7. All catchpit leads shall have min cover 0.9m.
8. All catchpit leads shall be laid at 1% unless otherwise specified.
9. All concrete lines are to be Class4 RCRRJ unless otherwise specified.
10. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with Council staff.
11. Pipe lengths shown on plan are from upstream pipe invert to downstream pipe invert.

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- EX WASTEWATER
- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

Rev	Description	By	Date
A	RESOURCE CONSENT	MHS	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	MHS	05/2023
Drawn	RA	07/2023
Checked	MHS	07/2023

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Project
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Title
PROPOSED WETLAND 4A

Project no.	180006
Scale	1:750 @ A3
Cad file	180006-C430 WETLANDS.DWG
Drawing no.	C430-4-1 Rev A

RESOURCE CONSENT

DATE: 10/2023

WETLAND 4B

WETLAND MIN. AREA = 2,394m^2
ACTUAL AREA = 2,395m^2 (INCL. FOREBAY)
MIN. WQV = 718m^3
ACTUAL WQV = 718m^3
ACTUAL ED = 862m^3

WATER LEVELS

- 2 YEAR WATER LEVEL - RL 30.50m
- ED LEVEL - RL 30.20m
- PERMANENT WATER LEVEL - RL 29.85m

BATHYMETRY (SUBJECT TO CHANGE)

- DEEP MARSH - 0.35m
- SHALLOW MARSH - 0.20m
- INLET POOL - 1.20m
- INTERMEDIATE POOL - 1.20m
- OUTLET POOL - 1.20m
- AVERAGE PERMANENT WATER DEPTH - 0.3m

SEE FOREBAY, WETLAND AND RAINGARDEN TYPICAL DETAILS ON DWGS C445.

Notes
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2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the New Zealand Vertical Datum 2016.
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6. Heavy duty manhole lids and frames to be used in trafficked areas.
7. All catchpit leads shall have min cover 0.9m.
8. All catchpit leads shall be laid at 1% unless otherwise specified.
9. All concrete lines are to be Class4 RCRRJ unless otherwise specified.
10. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with Council staff.
11. Pipe lengths shown on plan are from upstream pipe invert to downstream pipe invert.

Legend
- EX BDY
- PROP BDY
- EX WASTEWATER
- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

RL29.60
RL31.20
RL32.75
RL32.40
RL28.65
RL29.65
RL28.65
RL29.65
RL28.65
RL29.50
RL31.00
RL29.33
RL29.20
RL29.41
RL32.75
RL29.54
RL31.70
RL31.20
RL28.65
RL29.65
RL28.65
RL28.65
RL29.50
RL29.65
RL32.75
32.50
32.00
31.50
31.00
30.50
30.00
29.50
29.00
28.50

WETLAND 4A
WETLAND 4B
CYCLEPATH BRIDGE OVER HIGH-FLOW OPEN CHANNEL BYPASS
HIGH FLOW BYPASS

4m WIDE MAINTENANCE ACCESS TRACK. MIN 2% GRADE TO SWALE/WETLAND

>2YR FLOW DIRECTED TO BYPASS

RAINGARDEN 4B
270m^2 (0.5% catchment area)
INLET INV. = 31.2m
OUTLET INV. = 30.35m

FOREBAY PWL = 31.1m

FOREBAY WEIR TO RAINGARDEN.
-TOP OF WEIR @ = 31.4m

EX. SW CHANNEL TO BE DECOMMISSIONED

MAINTENANCE RAMP & TURNAROUND. 1:12 MAX GRADE

FOREBAY WEIR TO OVERFLOW SWALE.
-TOP OF WEIR @ = 31.45m

GRATED MANHOLE WITH BASEFLOW ORIFICE.

GRATED MANHOLE
-120mm EDV ORIFICE @ IL = 29.85m

WETLAND WEIR TO OVERFLOW SWALE.
-TOP OF WEIR @ ED LEVEL = 30.20m

RESOURCE CONSENT

DATE: 10/5/23

Rev	Description	By	Date
A	RESOURCE CONSENT	MHS	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	MHS	05/2023
Drawn	RA	07/2023
Checked	MHS	07/2023

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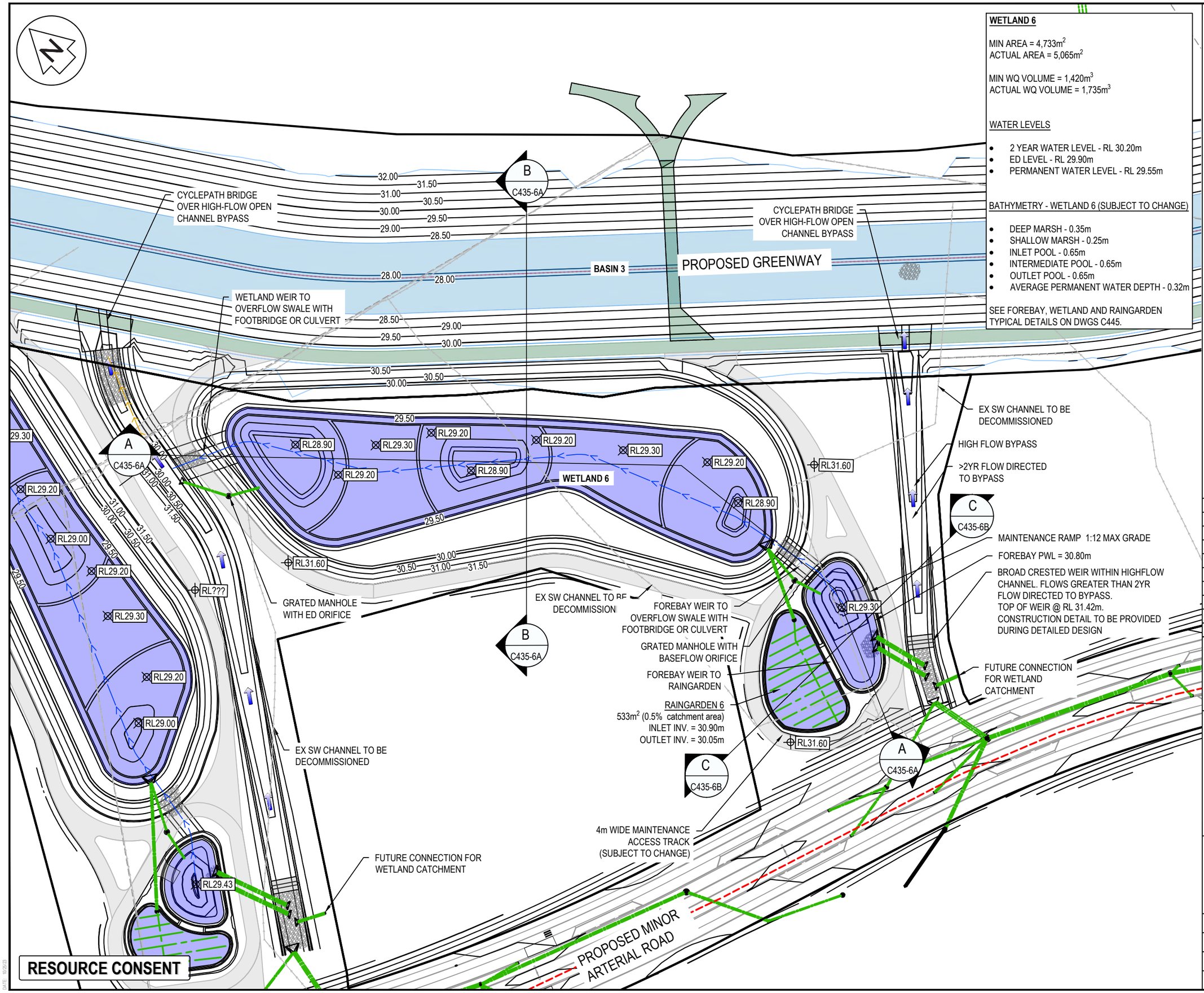
Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title
PROPOSED WETLAND 4B

Project no.	180006		
Scale	1:750 @ A3		
Cad file	180006-C430 WETLANDS.DWG		
Drawing no.	C430-4-2	Rev	A



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- PROP BDY
- EX WASTEWATER
- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

Rev	Description	By	Date
A	RESOURCE CONSENT	KY	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	MHS	07/2023
Drawn	KY	07/2023
Checked	MHS	07/2023

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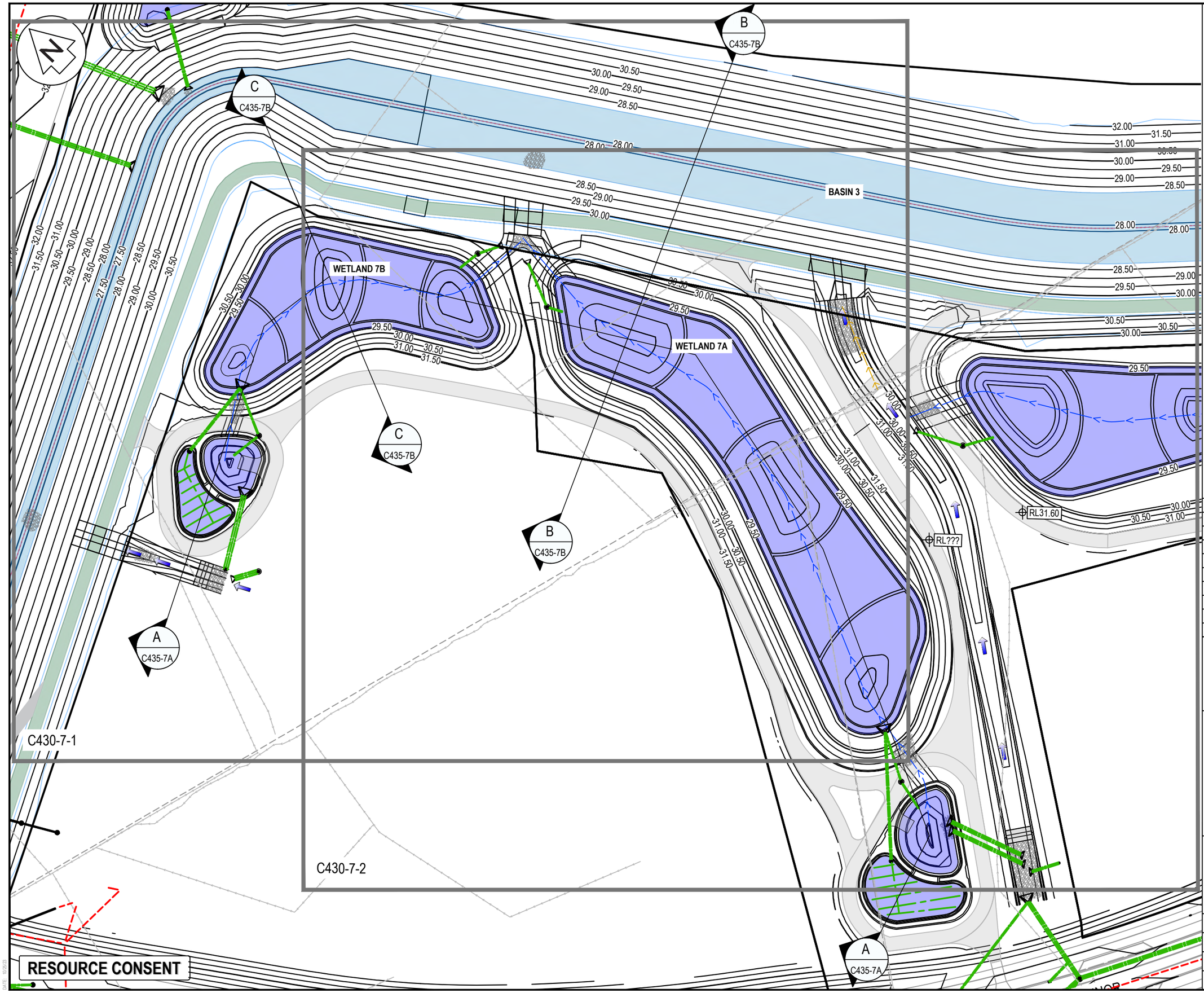
Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title
PROPOSED WETLAND 6

Project no.	180006
Scale	1:1000 @ A3
Cad file	180006-C430 WETLANDS.DWG
Drawing no.	C430-6 Rev A

DATE: 10/20/23



Notes

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Legend

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- PROP BDY
- EX WASTEWATER
- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

Rev	Description	By	Date
A	RESOURCE CONSENT	KY	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	MHS	07/2023
Drawn	KY	07/2023
Checked	MHS	07/2023

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Project

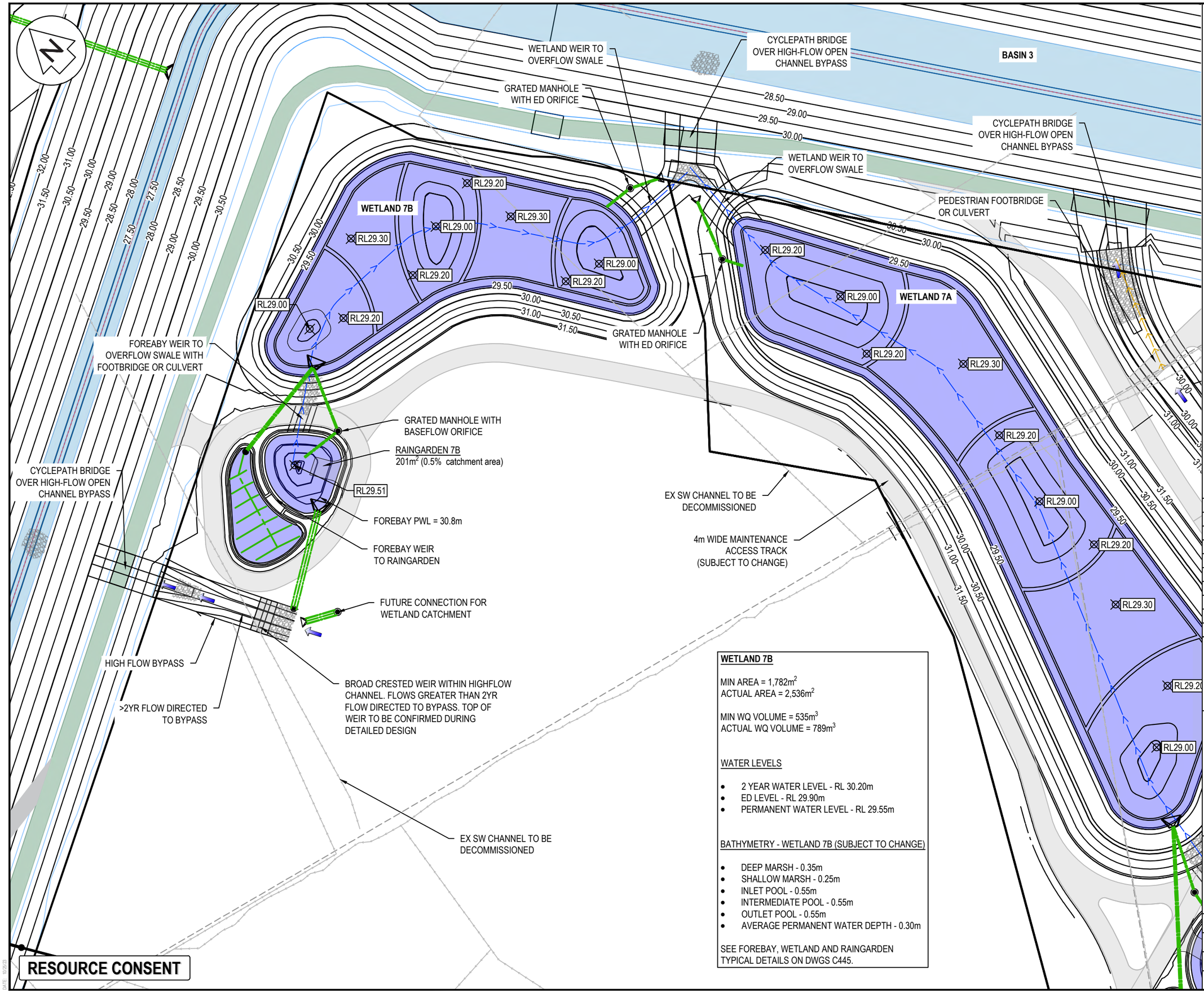
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title

PROPOSED WETLAND 7A&7B

Project no.	180006		
Scale	1:1000 @ A3		
Cad file	180006-C430 WETLANDS.DWG		
Drawing no.	C430-7	Rev	A

DATE: 9/25/23



WETLAND 7B

MIN AREA = 1,782m²
ACTUAL AREA = 2,536m²

MIN WQ VOLUME = 535m³
ACTUAL WQ VOLUME = 789m³

WATER LEVELS

- 2 YEAR WATER LEVEL - RL 30.20m
- ED LEVEL - RL 29.90m
- PERMANENT WATER LEVEL - RL 29.55m

BATHYMETRY - WETLAND 7B (SUBJECT TO CHANGE)

- DEEP MARSH - 0.35m
- SHALLOW MARSH - 0.25m
- INLET POOL - 0.55m
- INTERMEDIATE POOL - 0.55m
- OUTLET POOL - 0.55m
- AVERAGE PERMANENT WATER DEPTH - 0.30m

SEE FOREBAY, WETLAND AND RAINGARDEN TYPICAL DETAILS ON DWGS C445.

Notes
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8. All catchpit leads shall be laid at 1% unless otherwise specified.
9. All concrete lines are to be Class4 RCRRJ unless otherwise specified.
10. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with Council staff.
11. Pipe lengths shown on plan are from upstream pipe invert to downstream pipe invert.

Legend
- EX BDY
- PROP BDY
- EX WASTEWATER
- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

Rev	Description	By	Date
A	RESOURCE CONSENT	KY	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	MHS	07/2023
Drawn	KY	07/2023
Checked	MHS	07/2023

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Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title
PROPOSED WETLAND 7B

Project no.	180006
Scale	1:750 @ A3
Cad file	180006-C430 WETLANDS.DWG
Drawing no.	C430-7-1 Rev A

WETLAND WEIR TO OVERFLOW SWALE WITH FOOTBRIDGE OR CULVERT

CYCLEPATH BRIDGE OVER HIGH-FLOW OPEN CHANNEL BYPASS

PEDESTRIAN FOOTBRIDGE OR CULVERT

WETLAND 7B

WETLAND 7A

GRATED MANHOLE WITH ED ORIFICE

4m WIDE MAINTENANCE ACCESS TRACK (SUBJECT TO CHANGE)

HIGH FLOW BYPASS

FOREBAY WEIR TO OVERFLOW SWALE WITH FOOTBRIDGE OR CULVERT

GRATED MANHOLE WITH BASEFLOW ORIFICE

BROAD CRESTED WEIR WITHIN HIGHFLOW CHANNEL. FLOWS GREATER THAN 2YR FLOW DIRECTED TO BYPASS. TOP OF WEIR @ RL 31.27m

FOREBAY PWL = 30.80m

FUTURE CONNECTION FOR WETLAND CATCHMENT

FOREBAY WEIR TO RAINGARDEN

RAINGARDEN 7A
317m^2 (0.5% catchment area)
INLET INV. = 30.90m
OUTLET INV. = 30.05m

WETLAND 7A

MIN AREA = 2,815m^2
ACTUAL AREA = 4,729m^2

MIN WQ VOLUME = 844m^3
ACTUAL WQ VOLUME = 1,477m^3

WATER LEVELS

- 2 YEAR WATER LEVEL - RL 30.20m
- ED LEVEL - RL 29.90m
- PERMANENT WATER LEVEL - RL 29.55m

BATHYMETRY - WETLAND 7A (SUBJECT TO CHANGE)

- DEEP MARSH - 0.35m
- SHALLOW MARSH - 0.25m
- INLET POOL - 0.55m
- INTERMEDIATE POOL - 0.55m
- OUTLET POOL - 0.55m
- AVERAGE PERMANENT WATER DEPTH - 0.30m

SEE FOREBAY, WETLAND AND RAINGARDEN TYPICAL DETAILS ON DWGS C445.

RESOURCE CONSENT

DATE: 10/25/23

Notes
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- PROP WASTEWATER
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- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

Rev	Description	By	Date
A	RESOURCE CONSENT	KY	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	MHS	07/2023
Drawn	KY	07/2023
Checked	MHS	07/2023

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Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title
PROPOSED WETLAND 7A

Project no.	180006		
Scale	1:750 @ A3		
Cad file	180006-C430 WETLANDS.DWG		
Drawing no.	C430-7-2	Rev	A

RECOMMENDED ALLOWANCE FOR EMERGENCY OVERFLOW ROUTE (NOT A DESIGN REQUIREMENT OF THIS CONSENT)

FUTURE ROAD (NOT PART OF THIS CONSENT)

B C435-8A

SCRUFFY DOME MANHOLE WITH ED ORIFICE. DETAILS TO BE PROVIDED AT DETAILED DESIGN

EX SWMH OUTLET (WL8A) 1-2
LL=31.90
IL=29.55 (out)

A C435-8A

WETLAND DISCHARGE PIPE

RAINGARDEN 3, SEE C440 FOR DETAILS.

WETLAND 8A

RL29.30
RL29.20
RL28.90
RL29.20
RL28.90
RL29.30
RL29.55
RL29.20
RL28.35
RL29.55

31.50
31.00
30.50
30.00
29.50
29.50
30.00
30.50
31.00
31.50
32.00
32.50

FOREBAY PWL = 30.80m

MAINTENANCE RAMP
1:12 MAX GRADE

675mm RCRRJ @ 0.50%

B C435-8A

OUTLET 9-12
LL=31.07
IL=29.57 (in)

9-11
LL=32.49
IL=29.75 (out)
IL=29.54 (out)

FLOW SPLITTER MANHOLE

HIGH FLOW BYPASS

A C435-8A

BASIN 3

32.00
32.50
33.00
33.50
31.50
32.00
31.00
30.50
30.00
29.50
29.00
28.50
28.00
27.50
28.00
28.50
29.00
29.50
30.00
30.50
30.50
30.00
29.50
RL29.30
RL29.20
RL29.00
RL29.20

FUTURE ROAD (NOT PART OF THIS CONSENT)

RESOURCE CONSENT

DATE: 10/2023

WETLAND 8A

MIN AREA = 2,726m^2
ACTUAL AREA = 2,871m^2

MIN WQ VOLUME = 818m^3
ACTUAL WQ VOLUME = 934m^3

WATER LEVELS

- 2 YEAR WATER LEVEL - RL 30.20m
- ED LEVEL - 29.90m
- PERMANENT WATER LEVEL - RL 29.55m

BATHYMETRY - WETLAND 8A (SUBJECT TO CHANGE)

- DEEP MARSH - 0.35m
- SHALLOW MARSH - 0.25m
- IINTERMEDIATE POOL - 0.65m
- OUTLET POOL - 0.65m
- AVERAGE PERMANENT WATER DEPTH - 0.31m

SEE FOREBAY, WETLAND AND RAINGARDEN TYPICAL DETAILS ON DWGS C445.

NOTE:
AMALGAMATED RAINGARDEN WITHIN WETLAND 8A NOT POSSIBLE DUE TO VERTICAL HEIGHT AVAILABLE BETWEEN ARTERIAL ROAD AND GREENWAY SWALE

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- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

Rev	Description	By	Date
A	RESOURCE CONSENT	KY	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	KY	07/2023
Drawn	KY	07/2023
Checked	MHS	07/2023

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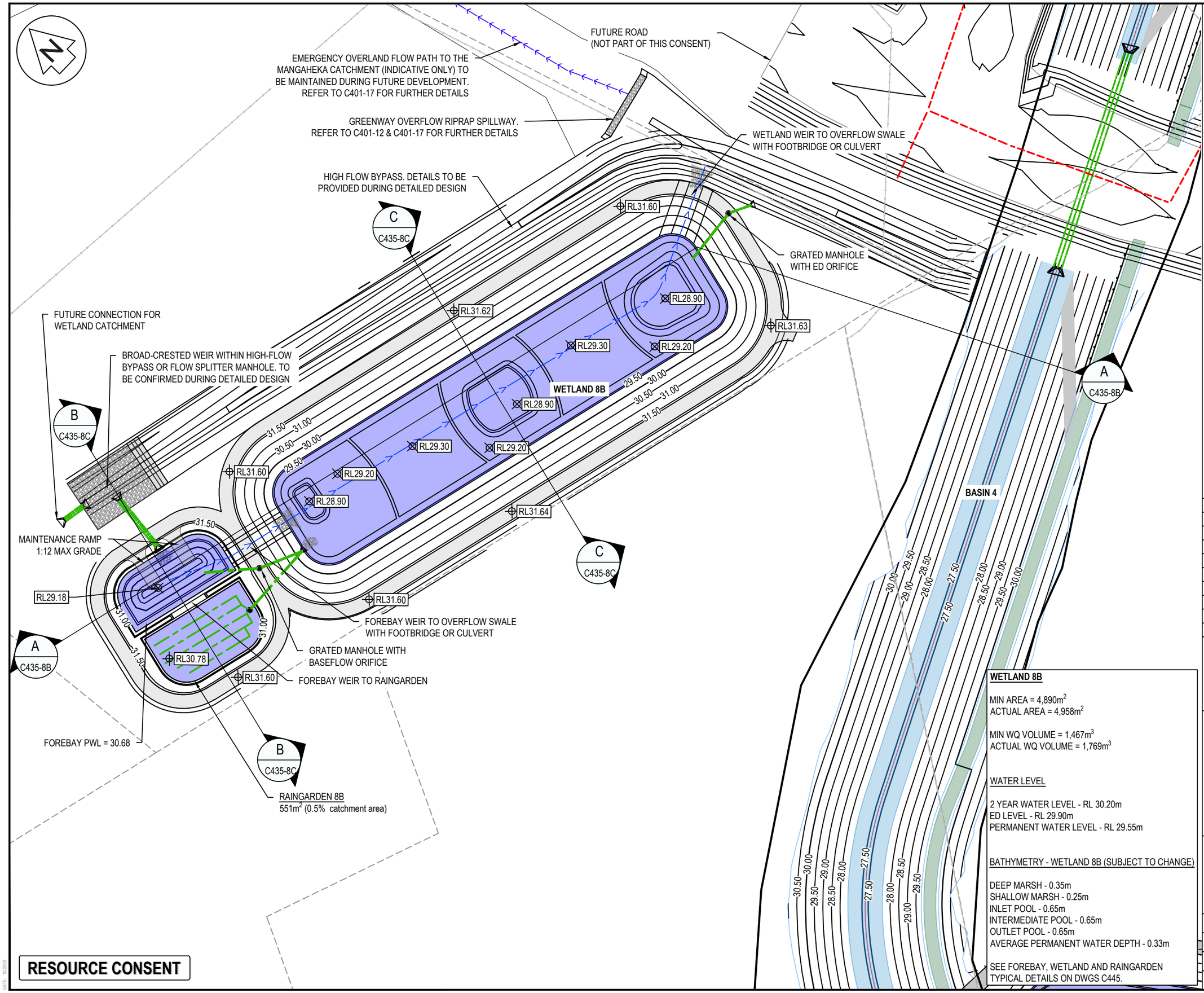
Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title
PROPOSED WETLAND 8A

Project no.	180006		
Scale	1:750 @ A3		
Cad file	180006-C430 WETLANDS.DWG		
Drawing no.	C430-8A	Rev	A



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- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

Rev	Description	By	Date
A	RESOURCE CONSENT	KY	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	KY	08/2023
Drawn	KY	08/2023
Checked	MHS	08/2023

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Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title
PROPOSED WETLAND 8B

WETLAND 8B

MIN AREA = 4,890m²
ACTUAL AREA = 4,958m²

MIN WQ VOLUME = 1,467m³
ACTUAL WQ VOLUME = 1,769m³

WATER LEVEL

2 YEAR WATER LEVEL - RL 30.20m
ED LEVEL - RL 29.90m
PERMANENT WATER LEVEL - RL 29.55m

BATHYMETRY - WETLAND 8B (SUBJECT TO CHANGE)

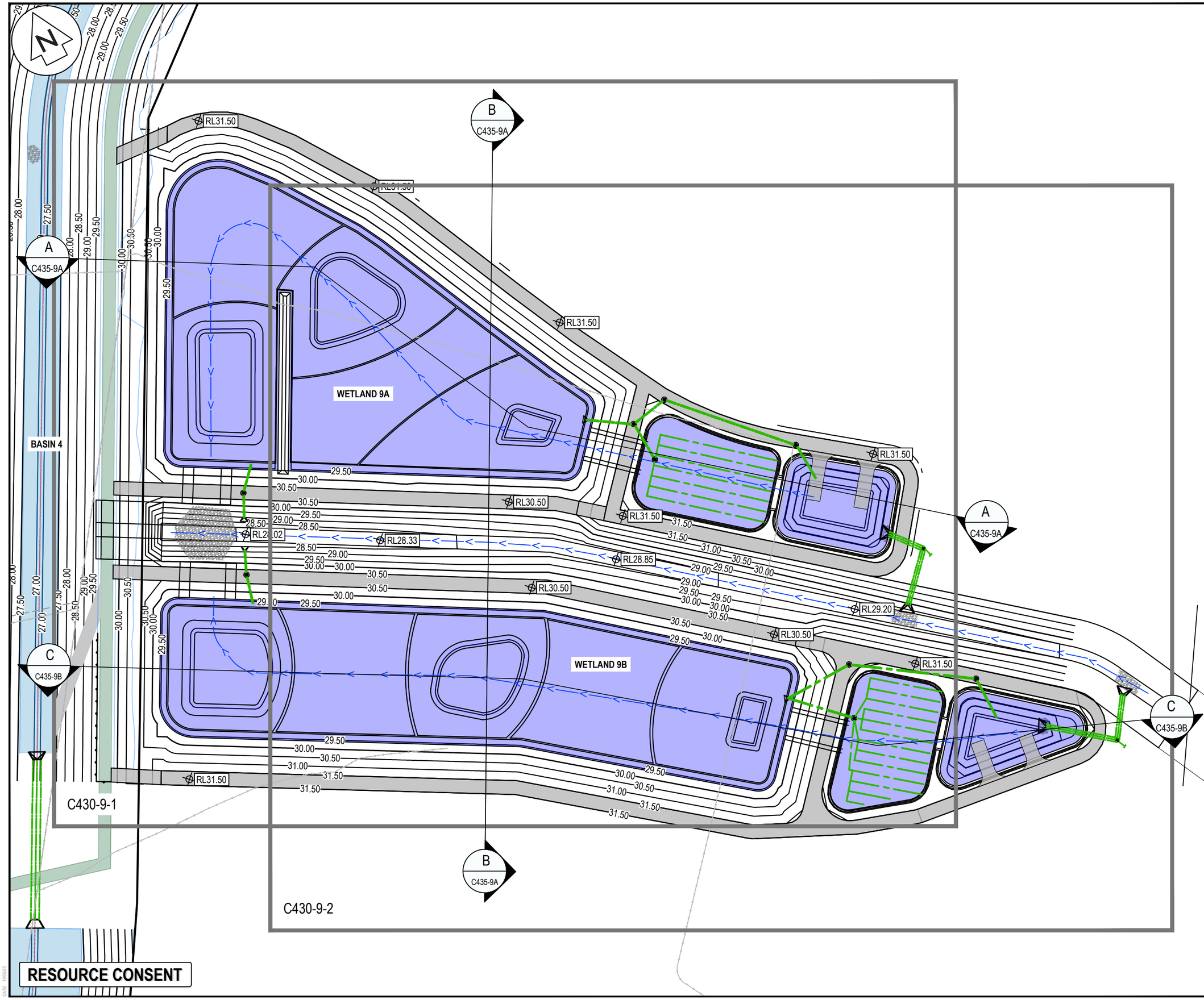
DEEP MARSH - 0.35m
SHALLOW MARSH - 0.25m
INLET POOL - 0.65m
INTERMEDIATE POOL - 0.65m
OUTLET POOL - 0.65m
AVERAGE PERMANENT WATER DEPTH - 0.33m

SEE FOREBAY, WETLAND AND RAINGARDEN TYPICAL DETAILS ON DWGS C445.

Project no.	180006
Scale	1:1000 @ A3
Cad file	180006-C430 WETLANDS.DWG
Drawing no.	C430-8B Rev A

RESOURCE CONSENT

DATE: 10/5/23



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- PROP BDY
- EX WASTEWATER
- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

Rev	Description	By	Date
A	RESOURCE CONSENT	KY	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	MHS	07/2023
Drawn	KY	07/2023
Checked	MHS	07/2023

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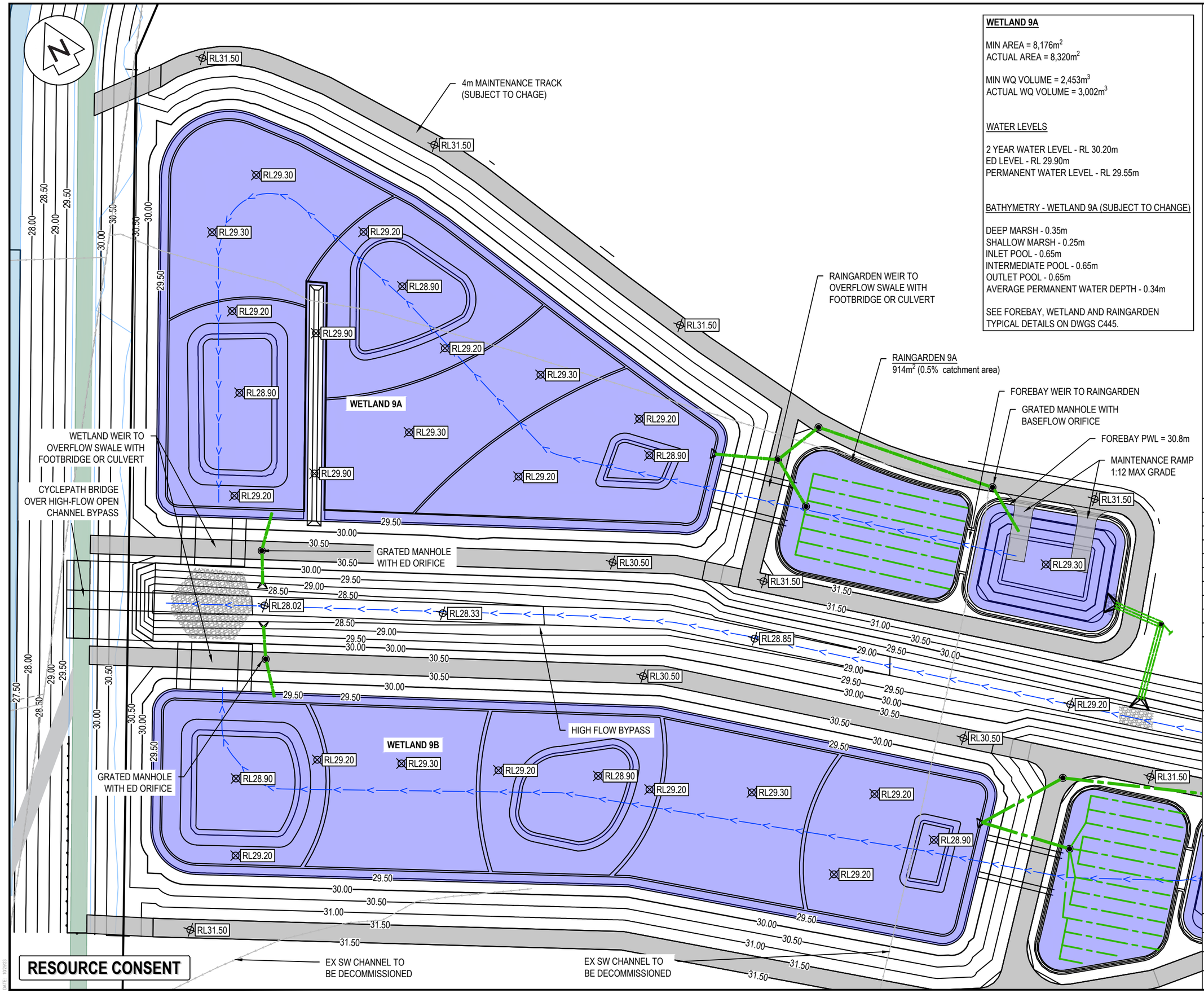
Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title
PROPOSED WETLANDS 9A & 9B

Project no.	180006
Scale	1:1000 @ A3
Cad file	180006-C430 WETLANDS.DWG
Drawing no.	C430-9 Rev A

DATE: 10/25/23



WETLAND 9A

MIN AREA = 8,176m^2
ACTUAL AREA = 8,320m^2

MIN WQ VOLUME = 2,453m^3
ACTUAL WQ VOLUME = 3,002m^3

WATER LEVELS

2 YEAR WATER LEVEL - RL 30.20m
ED LEVEL - RL 29.90m
PERMANENT WATER LEVEL - RL 29.55m

BATHYMETRY - WETLAND 9A (SUBJECT TO CHANGE)

DEEP MARSH - 0.35m
SHALLOW MARSH - 0.25m
INLET POOL - 0.65m
INTERMEDIATE POOL - 0.65m
OUTLET POOL - 0.65m
AVERAGE PERMANENT WATER DEPTH - 0.34m

SEE FOREBAY, WETLAND AND RAINGARDEN TYPICAL DETAILS ON DWGS C445.

Notes
1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the New Zealand Vertical Datum 2016.
3. It is the contractors responsibility to locate all services that may be affected by his operations.
4. All concrete SW pipe to be installed in accordance with AS/NZS 3725:2007 for buried concrete pipes and AS/NZ 4058:2007 for precast concrete pipes (pressure and non-pressure) as stipulated in the RITS 2018.
5. Approved hardfill is to be used in backfilling of all stormwater lines within the road reserve.
6. Heavy duty manhole lids and frames to be used in trafficked areas.
7. All catchpit leads shall have min cover 0.9m.
8. All catchpit leads shall be laid at 1% unless otherwise specified.
9. All concrete lines are to be Class4 RCRRJ unless otherwise specified.
10. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with Council staff.
11. Pipe lengths shown on plan are from upstream pipe invert to downstream pipe invert.

Legend
- EX BDY
- PROP BDY
- EX WASTEWATER
- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

Rev	Description	By	Date
A	RESOURCE CONSENT	KY	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	MHS	07/2023
Drawn	KY	07/2023
Checked	MHS	07/2023

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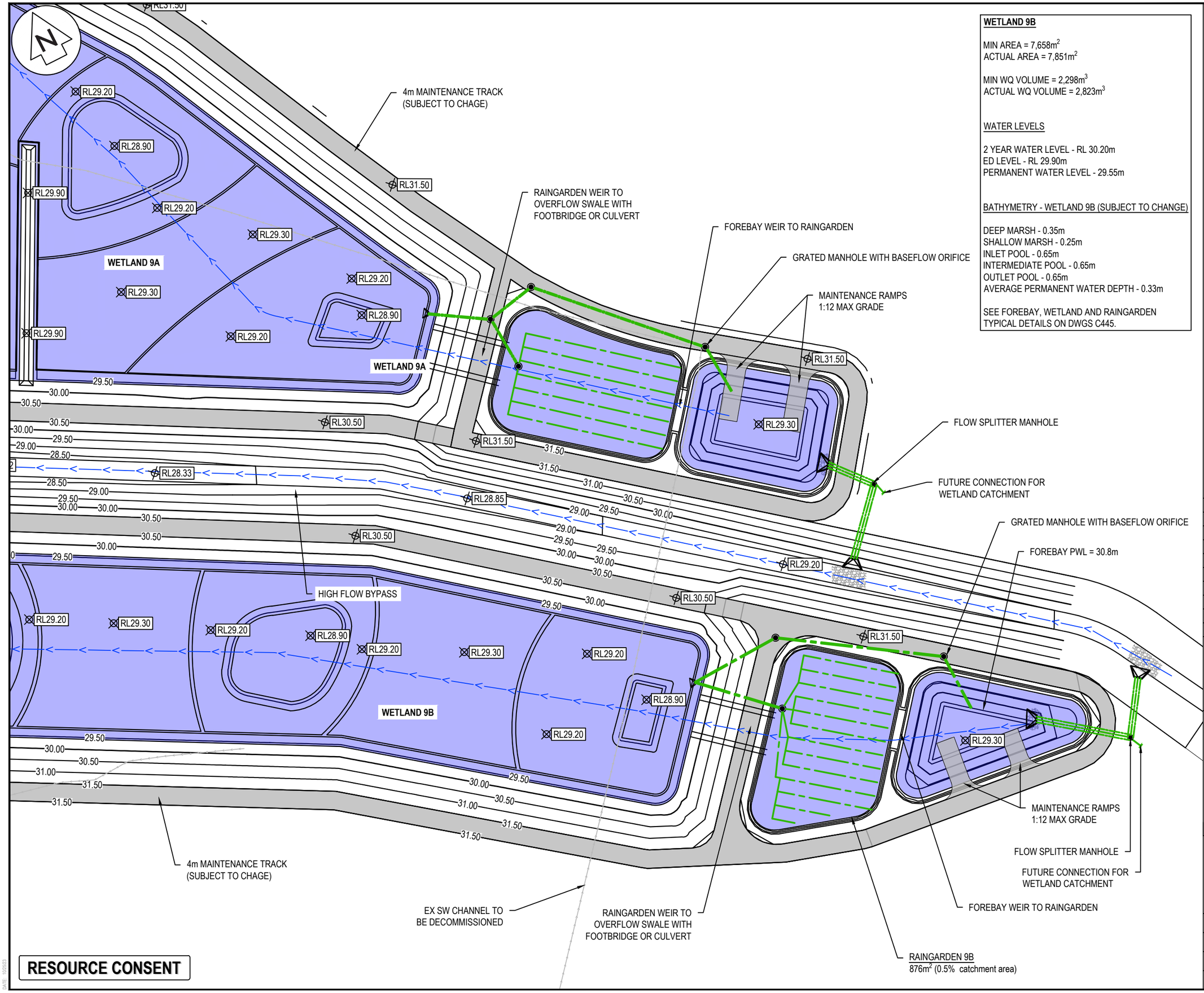
Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title
PROPOSED WETLANDS 9A & 9B

Project no.	180006
Scale	1:750 @ A3
Cad file	180006-C430 WETLANDS.DWG
Drawing no.	C430-9-1 Rev A



WETLAND 9B

MIN AREA = 7,658m^2
ACTUAL AREA = 7,851m^2

MIN WQ VOLUME = 2,298m^3
ACTUAL WQ VOLUME = 2,823m^3

WATER LEVELS

2 YEAR WATER LEVEL - RL 30.20m
ED LEVEL - RL 29.90m
PERMANENT WATER LEVEL - 29.55m

BATHYMETRY - WETLAND 9B (SUBJECT TO CHANGE)

DEEP MARSH - 0.35m
SHALLOW MARSH - 0.25m
INLET POOL - 0.65m
INTERMEDIATE POOL - 0.65m
OUTLET POOL - 0.65m
AVERAGE PERMANENT WATER DEPTH - 0.33m

SEE FOREBAY, WETLAND AND RAINGARDEN TYPICAL DETAILS ON DWGS C445.

Notes
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4. All concrete SW pipe to be installed in accordance with AS/NZS 3725:2007 for buried concrete pipes and AS/NZ 4058:2007 for precast concrete pipes (pressure and non-pressure) as stipulated in the RITS 2018.
5. Approved hardfill is to be used in backfilling of all stormwater lines within the road reserve.
6. Heavy duty manhole lids and frames to be used in trafficked areas.
7. All catchpit leads shall have min cover 0.9m.
8. All catchpit leads shall be laid at 1% unless otherwise specified.
9. All concrete lines are to be Class4 RCRRJ unless otherwise specified.
10. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with Council staff.
11. Pipe lengths shown on plan are from upstream pipe invert to downstream pipe invert.

Legend
- EX BDY
- PROP BDY
- EX WASTEWATER
- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

Rev	Description	By	Date
A	RESOURCE CONSENT	KY	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	MHS	07/2023
Drawn	KY	07/2023
Checked	MHS	07/2023

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Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title
PROPOSED WETLANDS 9A & 9B

Project no.	180006
Scale	1:750 @ A3
Cad file	180006-C430 WETLANDS.DWG
Drawing no.	C430-9-2 Rev A

DATE: 10/25/23

WETLAND 10 DOES NOT INCLUDE A RAINGARDEN DUE TO AVAILABLE AREA WITHIN EXISTING TOPOGRAPHY. THE CATCHMENT DRAINING TO WETLAND 10 WILL REQUIRE AT SOURCE TREATMENT IN THE FORM OF RAINGARDENS OR SIMILAR APPROVED DEVICES TO MEET THE ICMP WATER QUALITY OBJECTIVES

WETLAND 10

MIN AREA = 4,196m^2
ACTUAL AREA = 4,196m^2

MIN WQ VOLUME = 1,397m^3
ACTUAL WQ VOLUME = 1,443m^3

WATER LEVELS

2 YEAR WATER LEVEL - RL 30.20m
ED LEVEL - RL 29.90m
PERMANENT WATER LEVEL - RL 29.55m

BATHYMETRY - WETLAND 10 (SUBJECT TO CHANGE)

DEEP MARSH - 0.35m
SHALLOW MARSH - 0.25m
INTERMEDIATE POOL - 0.65m
OUTLET POOL - 0.65m
AVERAGE PERMANENT WATER DEPTH - 0.32m

SEE FOREBAY, WETLAND AND RAINGARDEN TYPICAL DETAILS ON DWGS C445.

EX SW CHANNEL TO BE DECOMMISSIONED & ROUTED INTO WETLAND DURING DETAILED DESIGN

EX SW CHANNEL TO BE DECOMMISSIONED & ROUTED INTO WETLAND DURING DETAILED DESIGN

B C435-10

A C435-10

WETLAND 10

RL29.20 RL29.30 RL28.90 RL29.20 RL29.20 RL29.30 RL29.55 RL28.35 RL29.55

FOREBAY PWL = 29.55m

BROAD CRESTED WEIR WITHIN HIGHFLOW CHANNEL. FLOWS GREATER THAN 2YR FLOW DIRECTED TO BYPASS. TOP OF WEIR TO BE CONFIRMED DURING DETAILED DESIGN

4m MAINTENANCE TRACK (SUBJECT TO CHANGE)

WETLAND WEIR TO OVERFLOW SWALE WITH FOOTBRIDGE OR CULVERT

GRATED MANHOLE WITH ED ORIFICE

MAINTENANCE RAMP 1:12 MAX GRADE

OVERFLOW SWALE WITH FOOTBRIDGE OR CULVERT

BASIN 4

RL31.50 RL29.20 RL28.90 RL29.20 RL28.02 RL29.20 RL28.90 RL29.20 RL29.30 RL29.30 RL29.90 RL29.90 RL29.20 RL31.50

RESOURCE CONSENT

DATE: 10/2023

Notes
1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000. Levels in terms of the New Zealand Vertical Datum 2016.
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5. Approved hardfill is to be used in backfilling of all stormwater lines within the road reserve.
6. Heavy duty manhole lids and frames to be used in trafficked areas.
7. All catchpit leads shall have min cover 0.9m.
8. All catchpit leads shall be laid at 1% unless otherwise specified.
9. All concrete lines are to be Class4 RCRRJ unless otherwise specified.
10. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with Council staff.
11. Pipe lengths shown on plan are from upstream pipe invert to downstream pipe invert.

Legend
- EX BDY
- PROP BDY
- EX WASTEWATER
- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

Rev	Description	By	Date
A	RESOURCE CONSENT	KY	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	KY	07/2023
Drawn	KY	07/2023
Checked	MHS	07/2023

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Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title
PROPOSED WETLAND 10

Project no.	180006
Scale	1:750 @ A3
Cad file	180006-C430 WETLANDS.DWG
Drawing no.	C430-10 Rev A

WETLAND 11B

MIN AREA = 4,821m^2
ACTUAL AREA = 5,037m^2

MIN WQ VOLUME = 1,446m^3
ACTUAL WQ VOLUME = 1,677m^3

WATER LEVELS

- 2 YEAR WATER LEVEL - RL 30.05m
- ED LEVEL - RL 29.75m
- PERMANENT WATER LEVEL - RL 29.40m

BATHYMETRY (SUBJECT TO CHANGE)

- DEEP MARSH - 0.35m
- SHALLOW MARSH - 0.25m
- INLET POOL - 0.50m
- INTERMEDIATE POOL - 0.50m
- OUTLET POOL - 0.50m
- AVERAGE PERMANENT WATER DEPTH - 0.3m

SEE FOREBAY, WETLAND AND RAINGARDEN TYPICAL DETAILS ON DWGS C445.

WETLAND 11A

MIN AREA = 2,061m^2
ACTUAL AREA = 2,165m^2

MIN WQ VOLUME = 618m^3
ACTUAL WQ VOLUME = 707m^3

WATER LEVELS

- 2 YEAR WATER LEVEL - RL 30.05m
- ED LEVEL - RL 29.75m
- PERMANENT WATER LEVEL - RL 29.40m

BATHYMETRY (SUBJECT TO CHANGE)

- DEEP MARSH - 0.35m
- SHALLOW MARSH - 0.25m
- INLET POOL - 0.50m
- INTERMEDIATE POOL - 0.50m
- OUTLET POOL - 0.50m
- AVERAGE PERMANENT WATER DEPTH - 0.3m

SEE FOREBAY, WETLAND AND RAINGARDEN TYPICAL DETAILS ON DWGS C445.

FOREBAY (11A) PWL = 30.65m
FUTURE CONNECTION FOR WETLAND CATCHMENT
BROAD CRESTED WEIR WITHIN HIGHFLOW CHANNEL. FLOWS GREATER THAN 2YR FLOW DIRECTED TO BYPASS. TOP OF WEIR TO BE CONFIRMED DURING DETAILED DESIGN
EX SW CHANNEL TO BE DECOMMISSIONED & ROUTED INTO WETLAND DURING DETAILED DESIGN
4m MAINTANENCE PATH (SUBJECT TO CHANGE)
MAINTENANCE RAMP 1:12 MAX GRADE
FUTURE CONNECTION FOR WETLAND CATCHMENT
BROAD CRESTED WEIR WITHIN HIGHFLOW CHANNEL. FLOWS GREATER THAN 2YR FLOW DIRECTED TO BYPASS. TOP OF WEIR TO BE CONFIRMED DURING DETAILED DESIGN
EX SW CHANNEL TO BE DECOMMISSIONED & ROUTED INTO WETLAND DURING DETAILED DESIGN
MAINTENANCE RAMP 1:12 MAX GRADE
FOREBAY (11B) PWL = 30.65m
FOREBAY WEIR TO OVERFLOW SWALE
FOREBAY WEIR TO RAINGARDEN
RAINGARDEN 11A
232m^2 (0.5% catchment area)
INLET INV. = 30.75m
OUTLET INV. = 29.90m
FOREBAY WEIR TO OVERFLOW SWALE
GRATED MANHOLE WITH BASEFLOW ORIFICE
GRATED MANHOLE WITH BASEFLOW ORIFICE
RAINGARDEN 11B
543m^2 (0.5% catchment area)
INLET INV. = 30.75m
OUTLET INV. = 29.90m
HIGH FLOW BYPASS. DETAILS TO BE PROVIDED AT DETAILED DESIGN
WETLAND WEIR TO OVERFLOW SWALE WITH FOOTBRIDGE OR CULVERT
GRATED MANHOLE WITH ED ORIFICE
WETLAND WEIR TO OVERFLOW SWALE WITH FOOTBRIDGE OR CULVERT
CYCLEPATH BRIDGE OVER HIGH-FLOW OPEN CHANNEL BYPASS
CYCLEPATH BRIDGE OVER HIGH-FLOW OPEN CHANNEL BYPASS
WETLAND 11B
WETLAND 11A
BASIN 5
A C435-11A
B C435-11A
C C435-11B
D C435-11B
E C435-11C
RL31.35 RL31.50 RL31.15 RL30.35 RL30.60 RL28.90 RL29.15 RL29.05
31.00 30.50 30.00 29.50 30.00 29.50 29.00 28.50 28.00 27.50 27.00 27.50 28.00 28.50 29.00 29.50

Notes
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8. All catchpit leads shall be laid at 1% unless otherwise specified.
9. All concrete lines are to be Class4 RCRRJ unless otherwise specified.
10. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with Council staff.
11. Pipe lengths shown on plan are from upstream pipe invert to downstream pipe invert.

Legend
- EX BDY
- PROP BDY
- EX WASTEWATER
- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

Rev	Description	By	Date
A	RESOURCE CONSENT	KY	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	KY	07/2023
Drawn	KY	07/2023
Checked	MHS	07/2023

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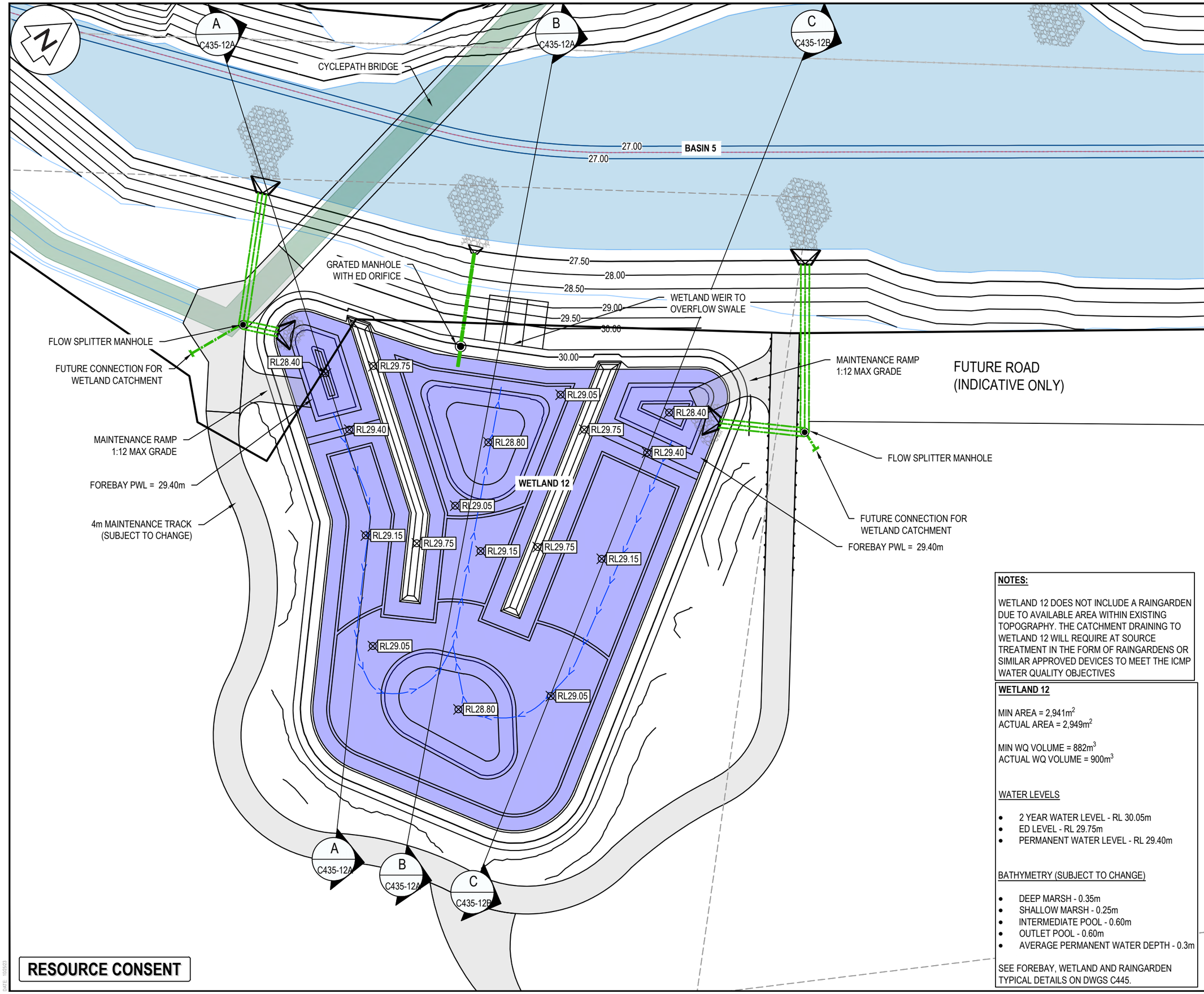
Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title
PROPOSED WETLANDS 11A & 11B

Project no.	180006
Scale	1:1000 @ A3
Cad file	180006-C430 WETLANDS.DWG
Drawing no.	C430-11 Rev A

RESOURCE CONSENT

DATE: 10/25/23



Notes
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Legend
- EX BDY
- PROP BDY
- EX WASTEWATER
- PROP WASTEWATER
- PROP WASTEWATER FUTURE PROOFING
- EX/PROP MANHOLE
- EX STORMWATER
- PROP STORMWATER
- FLOW ARROWS
- GREENWAY
- ARTIFICIAL WETLAND

NOTES:

WETLAND 12 DOES NOT INCLUDE A RAINGARDEN DUE TO AVAILABLE AREA WITHIN EXISTING TOPOGRAPHY. THE CATCHMENT DRAINING TO WETLAND 12 WILL REQUIRE AT SOURCE TREATMENT IN THE FORM OF RAINGARDENS OR SIMILAR APPROVED DEVICES TO MEET THE ICMP WATER QUALITY OBJECTIVES

WETLAND 12

MIN AREA = 2,941m^2
ACTUAL AREA = 2,949m^2

MIN WQ VOLUME = 882m^3
ACTUAL WQ VOLUME = 900m^3

WATER LEVELS

- 2 YEAR WATER LEVEL - RL 30.05m
- ED LEVEL - RL 29.75m
- PERMANENT WATER LEVEL - RL 29.40m

BATHYMETRY (SUBJECT TO CHANGE)

- DEEP MARSH - 0.35m
- SHALLOW MARSH - 0.25m
- INTERMEDIATE POOL - 0.60m
- OUTLET POOL - 0.60m
- AVERAGE PERMANENT WATER DEPTH - 0.3m

SEE FOREBAY, WETLAND AND RAINGARDEN TYPICAL DETAILS ON DWGS C445.

RESOURCE CONSENT

DATE: 10/25/23

Rev	Description	By	Date
A	RESOURCE CONSENT	KY	10/2023

	By	Date
Survey	LANDPRO	12/2022
Design	KY	07/2023
Drawn	KY	07/2023
Checked	MHS	07/2023

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Project
ROTOKAURI GREENWAY AND ARTERIAL ROAD HAMILTON FOR - HOUNSELL HOLDINGS LIMITED

Title
PROPOSED WETLAND 12

Project no.	180006
Scale	1:500 @ A3
Cad file	180006-C430 WETLANDS.DWG
Drawing no.	C430-12 Rev A