Appendix 1

Record of Title

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General of Land

Identifier	**NA53D/1031**
Land Registration District	**North Auckland**
Date Issued	27 July 1983

Prior References
NA1985/76

Estate	Fee Simple
Area	4.9965 hectares more or less
Legal Description	Lot 2 Deposited Plan 99045
Registered Owners	

Onoke Heights Limited

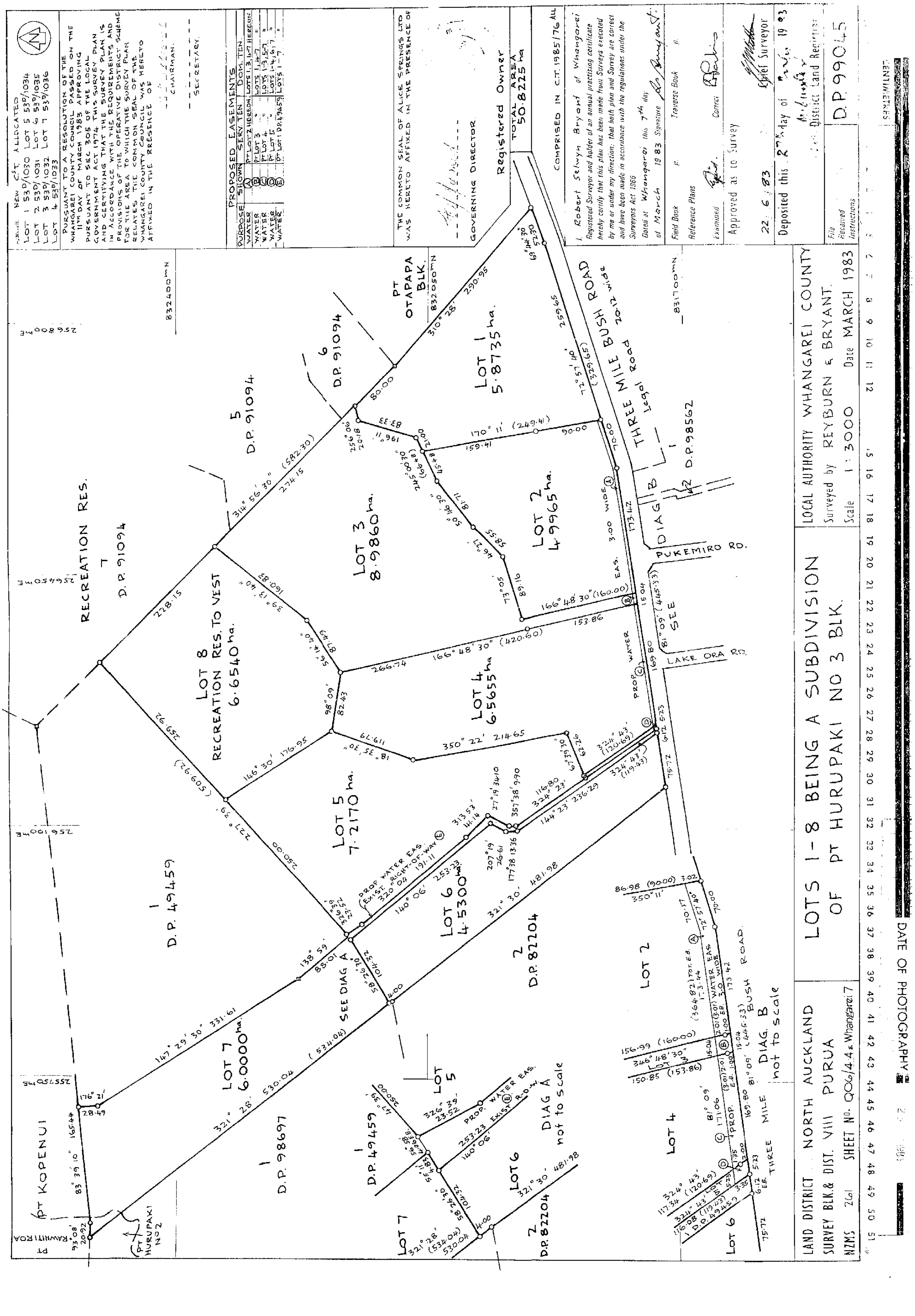
Interests

Appurtenant hereto is a water right created by Transfer B223481.1

Appurtenant hereto is a right of way created by Transfer 671343

Subject to a water right over part marked A on DP 99045 specified in Easement Certificate B199435.4 - 27.7.1983 at 2.20 pm

Appurtenant hereto are water rights specified in Easement Certificate B199435.4 - 27.7.1983 at 2.20 pm


LOTS 1 - 8 BEING A SUBDIVISION OF PT HURUPAKI NO 3 BLK.
LOCAL AUTHORITY WHANGAREI COUNTY
Surveyed by REYBURN & BRYANT.
Scale 1 : 3000
Date MARCH 1983
LAND DISTRICT NORTH AUCKLAND
SURVEY BLK.& DIST. VIII PURUA
THREE MILE BUSH ROAD
PUKEMIRO RD.
LAKE ORA RD.
RECREATION RES.
LOT 1 5.8735 ha.
LOT 2 4.9965 ha.
LOT 3 8.9860 ha.
LOT 4 6.5655 ha
LOT 5 7.2170 ha.
LOT 6 4.5300 ha
LOT 7 6.0000 ha
LOT 8 RECREATION RES. TO VEST 6.6540 ha.
Registered Owner
TOTAL AREA 50.8225 ha
DIAG A not to scale
DIAG B not to scale
PROPOSED EASEMENTS
DP 99045
DATE OF PHOTOGRAPHY

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General of Land

Identifier	**NA53D/1032**
Land Registration District	**North Auckland**
Date Issued	27 July 1983

Prior References
NA1985/76

Estate	Fee Simple
Area	8.9860 hectares more or less
Legal Description	Lot 3 Deposited Plan 99045
Registered Owners	

TMB 2 Limited

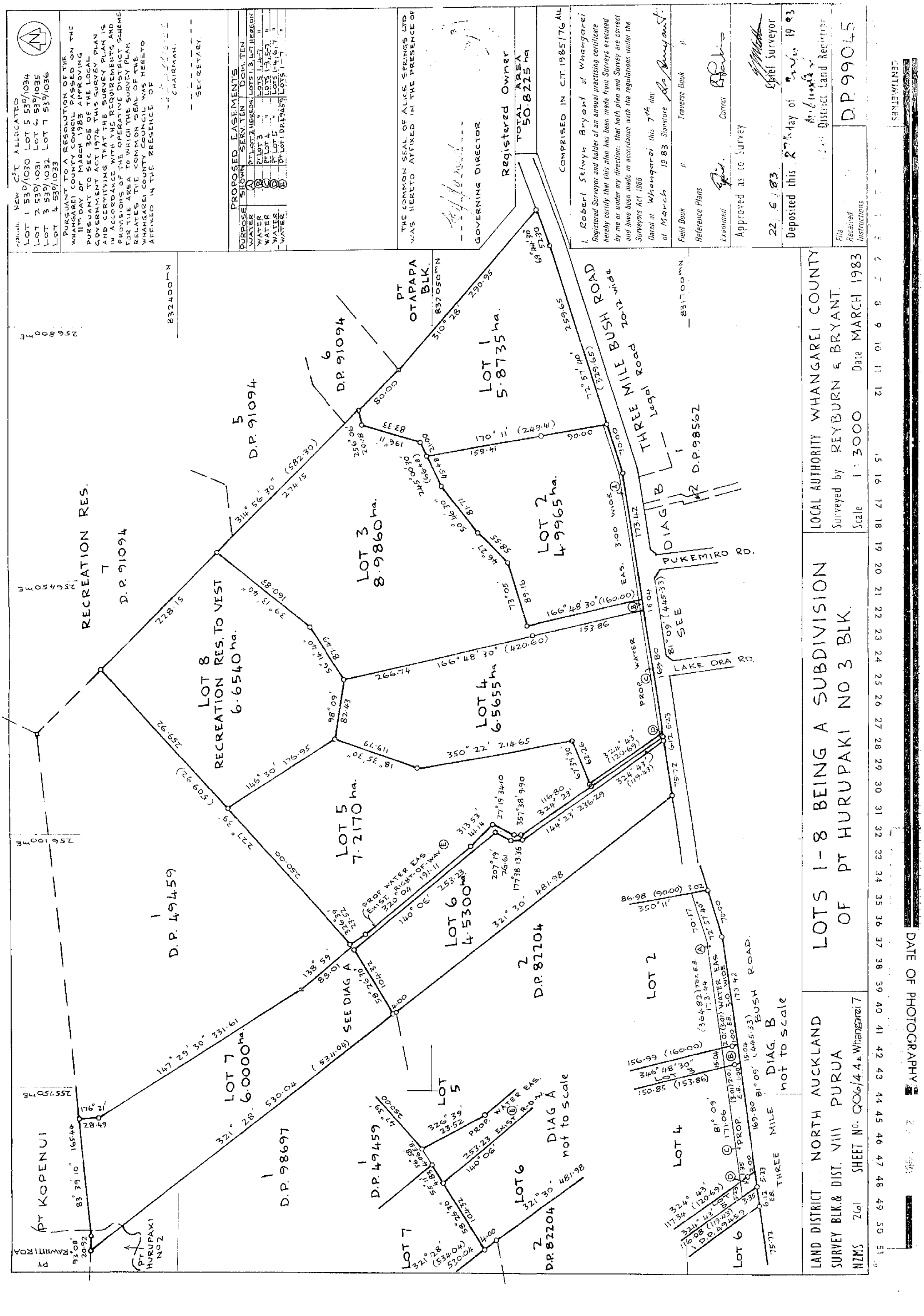
Interests

Appurtenant hereto is a water right created by Transfer B223481.1

Appurtenant hereto is a right of way created by Transfer 671343

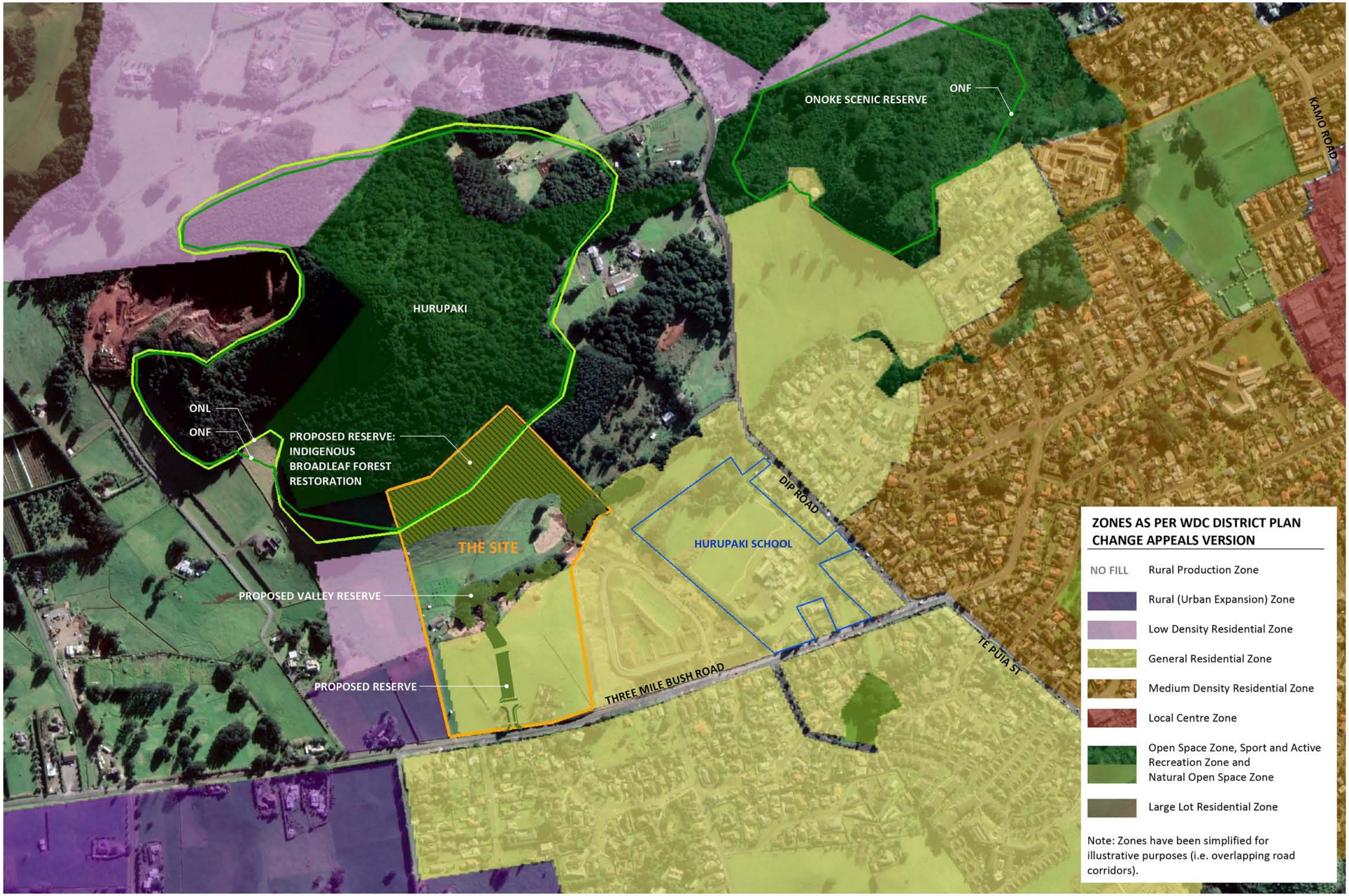
Appurtenant hereto are water rights specified in Easement Certificate B199435.4 - 27.7.1983 at 2.20 pm

Subject to a water right over part marked B on DP 99045 specified in Easement Certificate B199435.4 - 27.7.1983 at 2.20 pm


LOTS 1-8 BEING A SUBDIVISION OF PT HURUPAKI NO 3 BLK.
LOCAL AUTHORITY WHANGAREI COUNTY
Surveyed by REYBURN & BRYANT.
Scale 1:3000
Date MARCH 1983
LAND DISTRICT NORTH AUCKLAND
SURVEY BLK & DIST. VIII PURUA
NZMS 261 SHEET No. Q06/4.4 & Whangarei 7
D.P. 99045
Registered Owner
TOTAL AREA 50.8225 ha
LOT 1 5.8735 ha.
LOT 2 4.9965 ha.
LOT 3 8.9860 ha.
LOT 4 6.5655 ha
LOT 5 7.2170 ha.
LOT 6 4.5300 ha
LOT 7 6.0000 ha
LOT 8 RECREATION RES. TO VEST 6.6540 ha.
RECREATION RES. 7 D.P. 91094
5 D.P. 91094
6 D.P. 91094
PT OTAPAPA BLK.
1 D.P. 49459
1 D.P. 98697
2 D.P. 82204
1 D.P. 98562
PT KOPENUI
PT RAWHITIROA
PT HURUPAKI No 2
THREE MILE BUSH ROAD 20.12 wide Legal Road
PUKEMIRO RD.
LAKE ORA RD.
DIAG A not to scale
DIAG B not to scale
PROPOSED EASEMENTS
COMPRISED IN C.T. 1985/176 ALL
DATE OF PHOTOGRAPHY

Appendix 2

Locality Plan



0 50 100 150 200 m

scale as shown

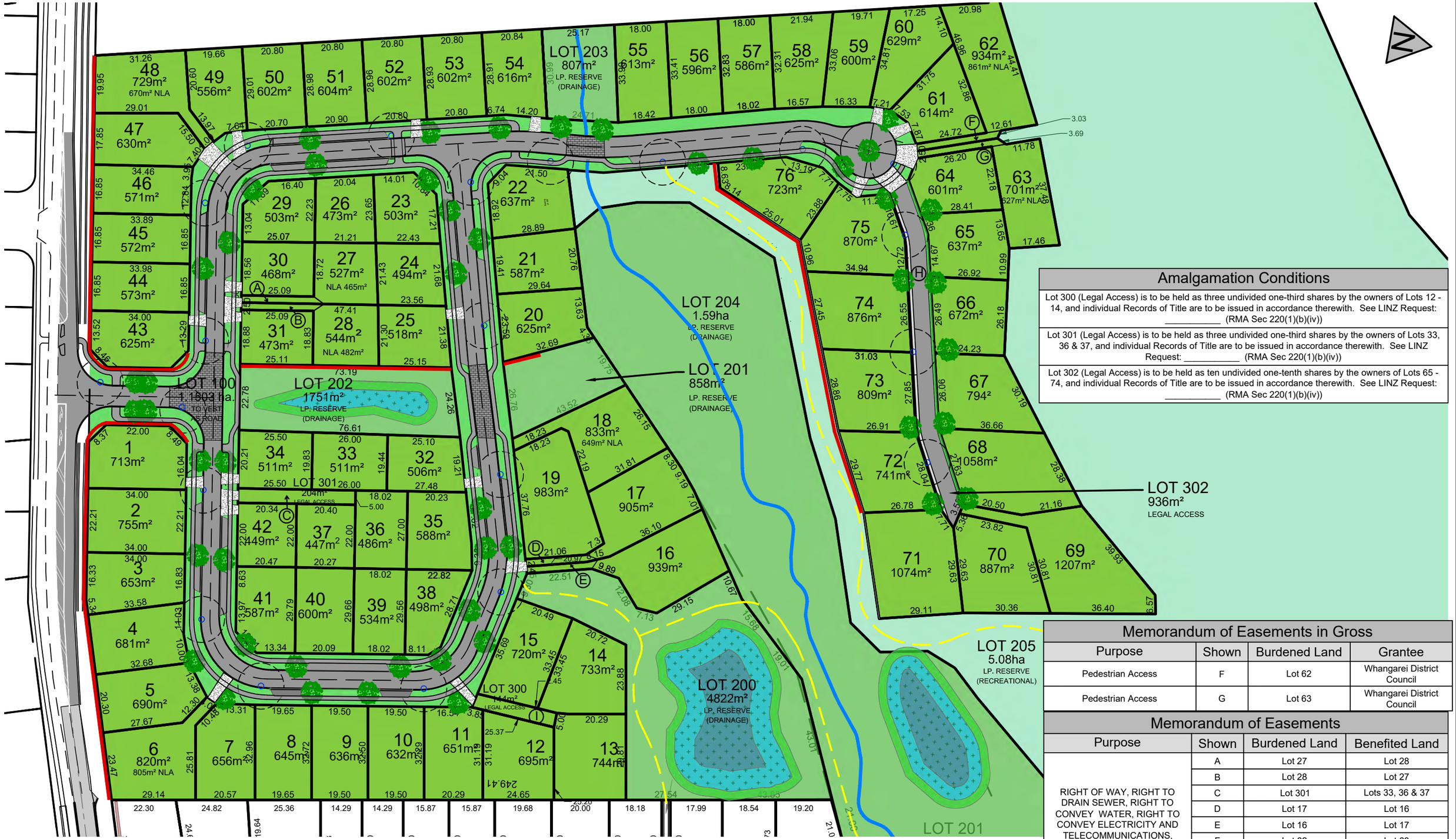
Ref: 1304_DPZones_20210812

LITTORALIS LANDSCAPE ARCHITECTURE

SITE CONTEXT - DP CHANGE APPEALS VERSION
THREE MILE BUSH RD/DIP RD AREA

Appendix 3

Engineering Plans



Amalgamation Conditions

Lot 300 (Legal Access) is to be held as three undivided one-third shares by the owners of Lots 12 - 14, and individual Records of Title are to be issued in accordance therewith. See LINZ Request: _____ (RMA Sec 220(1)(b)(iv))

Lot 301 (Legal Access) is to be held as three undivided one-third shares by the owners of Lots 33, 36 & 37, and individual Records of Title are to be issued in accordance therewith. See LINZ Request: _____ (RMA Sec 220(1)(b)(iv))

Lot 302 (Legal Access) is to be held as ten undivided one-tenth shares by the owners of Lots 65 - 74, and individual Records of Title are to be issued in accordance therewith. See LINZ Request: _____ (RMA Sec 220(1)(b)(iv))

Memorandum of Easements in Gross

Purpose	Shown	Burdened Land	Grantee
Pedestrian Access	F	Lot 62	Whangarei District Council
Pedestrian Access	G	Lot 63	Whangarei District Council

Memorandum of Easements

Purpose	Shown	Burdened Land	Benefited Land
RIGHT OF WAY, RIGHT TO DRAIN SEWER, RIGHT TO CONVEY WATER, RIGHT TO CONVEY ELECTRICITY AND TELECOMMUNICATIONS, RIGHT TO DRAIN STORM WATER	A	Lot 27	Lot 28
	B	Lot 28	Lot 27
	C	Lot 301	Lots 33, 36 & 37
	D	Lot 17	Lot 16
	E	Lot 16	Lot 17
	F	Lot 62	Lot 63
	G	Lot 63	Lot 62
	H	Lot 302	Lots 65 - 74
	I	Lot 300	Lots 12-14

Size A3 | Scale 1:1250 | Date MAY 2021

No.	Amendment	Init.	Date
16	Tree/Parking bays amended/colours added	JMC	30/08/21
17	Trees amended	CN	31/08/21
18	Lot 200's numbering amended	CN	31/08/21

Designed | Drawn | Checked | Approved

SCHEME PLAN

PROPOSED SUBDIVISION OF LOTS 2 & 3 DP 99045

131 THREE MILE BUSH ROAD, KAMO - WHANGAREI

Prepared for: HURUPAKI HOLDINGS LTD

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point

Resource Consent Number: .....

BW Ref. 20183-00-PL-100 | Stg. | Purp. | Dwg. # | Revision: 18

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PT LOT 4
DP 99045
(RT. NA93D/53)
HURUPAKI LTD.

LOT 205
LP. RESERVE
(RECREATIONAL)

LOT 302
LEGAL ACCESS

LOT 200
LP. RESERVE
(DRAINAGE)

LOT 204
LP. RESERVE
(DRAINAGE)

LOT 203
LP. RESERVE/
(DRAINAGE)

LOT 300
LEGAL ACCESS

LOT 202
LP. RESERVE
(DRAINAGE)

LOT 301
LEGAL ACCESS

LOT 100
TO VEST
AS ROAD

EXISTING STONE WALL
(TO REMAIN)
1.5m CLEARANCE SHOWN
EACH SIDE OF WALL

Existing stone wall
to be removed

THREE MILE BUSH ROAD
LEGAL ROAD (20.12 WIDE)

N

Contour Interval	
Major:	2.0m
Minor:	0.5m

Size	A3	Scale	1:1500	Date	May 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	10/05/21	Drawn	JMC		
2				Checked	CN		
3				Approved			

Resource Consent Plan
Existing Site
189 Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point Datum

Resource Consent Number:
.....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-EN-200				1

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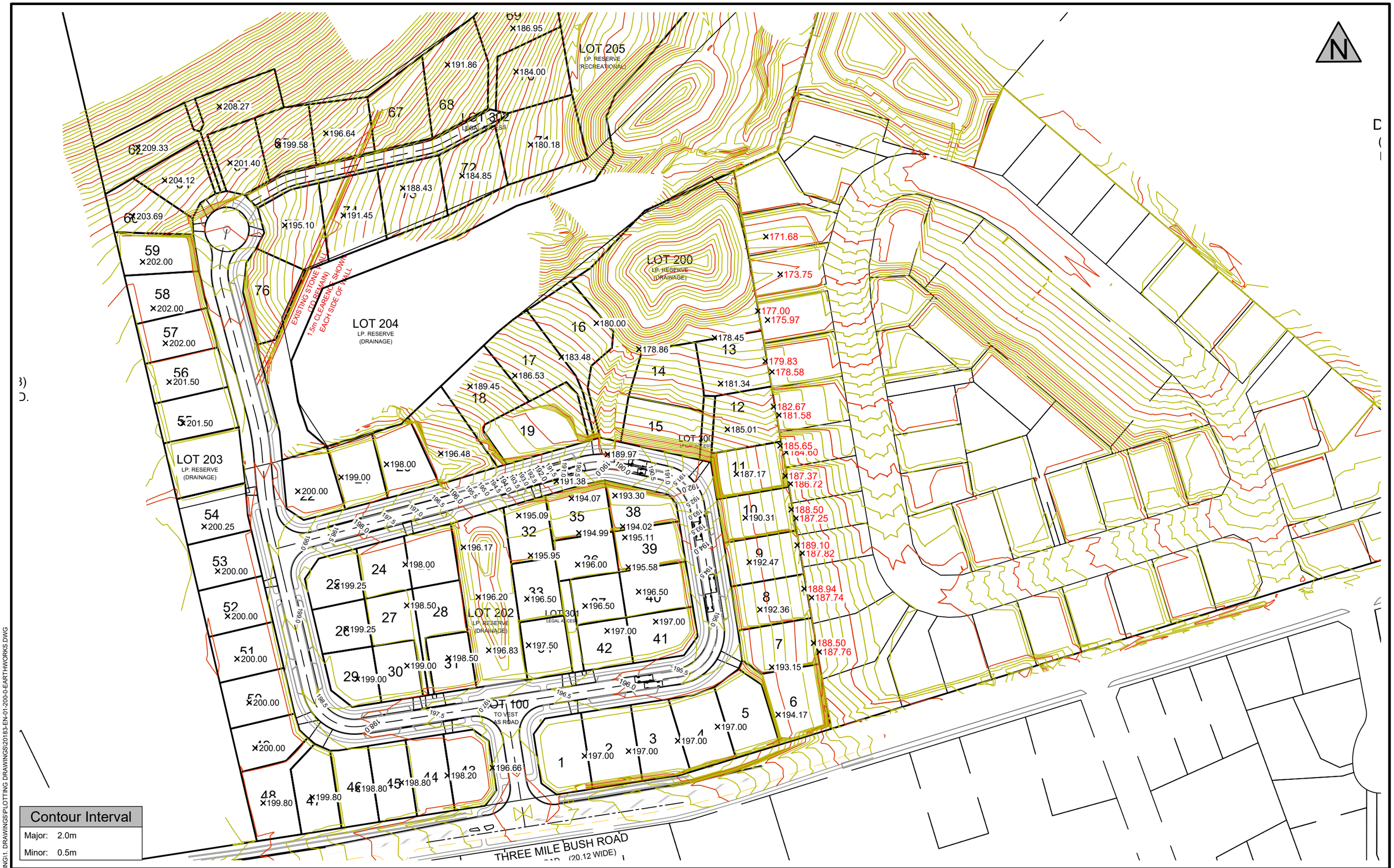

Contour Interval	
Major:	2.0m
Minor:	0.5m

Size	A3	Scale	1:1500	Date	May 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	10/05/21	Drawn	JMC		
2				Checked	CN		
3				Approved			

Resource Consent Plan
Design Contours
189 Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point Datum

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-EN-201				1

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PT LOT 4
DP 99045
(RT. NA93D/53)
HURUPAKI LTD.

Surface Analysis: Elevation Ranges				
Number	Colour	Minimum Depth (m)	Maximum Depth (m)	Volume (m³)
1		-4.12	-3.00	410
2		-3.00	-2.00	2673
3		-2.00	-1.00	8255
4		-1.00	-0.25	14673
5		-0.25	-0.05	5728
6		-0.05	0.05	2827
7		0.05	0.25	4286
8		0.25	1.00	8738
9		1.00	2.00	3197
10		2.00	3.00	587
11		3.00	4.35	78

Volume

Base Surface	EG 20210121 -200mm
Comparison Surface	Combined Finished Level Subgrade Surface
Cut Factor	1.000
Fill Factor	1.250
Cut volume (adjusted)	33317.817 Cu. M.
Fill volume (adjusted)	22668.437 Cu. M.
Net volume (adjusted)	10649.380 Cu. M.<Cut>
Cut volume (unadjusted)	33317.817 Cu. M.
Fill volume (unadjusted)	18134.750 Cu. M.
Net volume (unadjusted)	15183.068 Cu. M.<Cut>

Contour Interval	
Major:	2.0m
Minor:	0.5m

Size	A3	Scale	1:1500	Date	May 2021

No.	Amendment	Init.	Date
1	Issued For Resource Consent	JMC	10/05/21
2			
3			

Designed	JMC		
Drawn	JMC		
Checked	CN		
Approved			

Resource Consent Plan
Cut/Fill
189 Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point Datum

Resource Consent Number:
.....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-EN-202				1

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Legend

	Works Area	Area (m²)	Outlet
	Works Area 1	14220	Lot 202 SRP
	Works Area 2	21113	Lot 200 SRP
	Works Area 4	7061	DEB
	Works Area 5	4898	Lot 204 SRP

Legend

- Decanting Earth Bund
- Sediment Retention Pond/Forebay
- Grassed/Currently Stablilized Area
- Proposed Earth Bund
- Clean Water Drain
- Metal Bund
- Silt Fence (SF — SF)

Note: Proposed sediment retention ponds to be used as erosion sediment control ponds during construction to be designed appropriately with forebays or sediment control.

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Size	A3	Scale	1:1500	Date	September 2021

No.	Amendment	Init.	Date
1	Issued For Resource Consent	JMC	07809/21
2			
3			

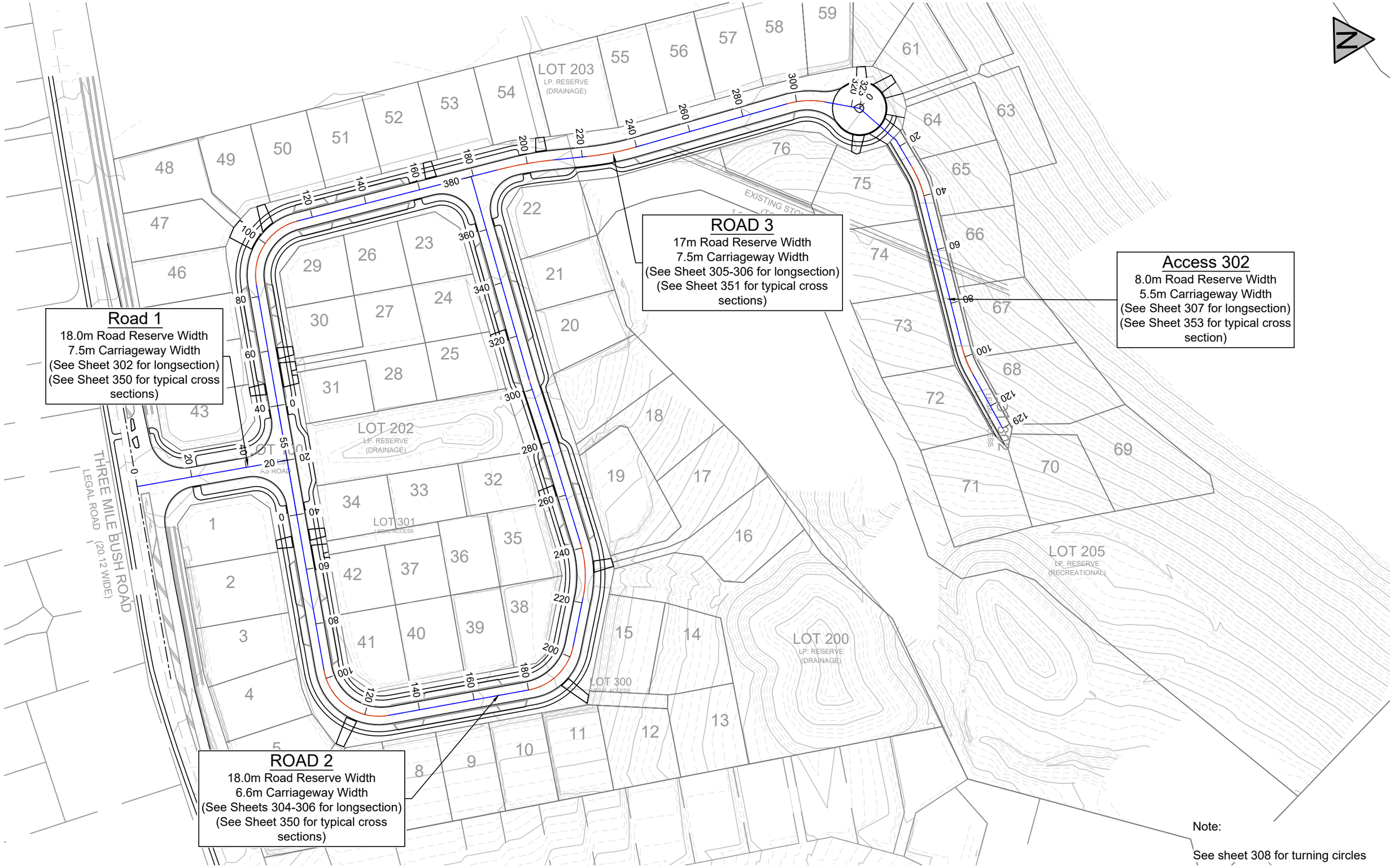
Designed	JMC	
Drawn	JMC	
Checked	CN	
Approved		

Resource Consent Plan
Erosion and Sediment Control
189 Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Circuit: Mt Eden 2000
Height: One Tree Point Datum
Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-EN-250				DRAFT



Note:

See sheet 308 for turning circles

Size	A3	Scale	1:1250	Date	JULY 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	29/07/21	Drawn	JMC		
2	Updated Road Curve Radii	JMC	19/08/21	Checked			
3				Approved			

Resource Consent Plan
Roading Overall Layout
189 Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point Datum

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-RC-300				2

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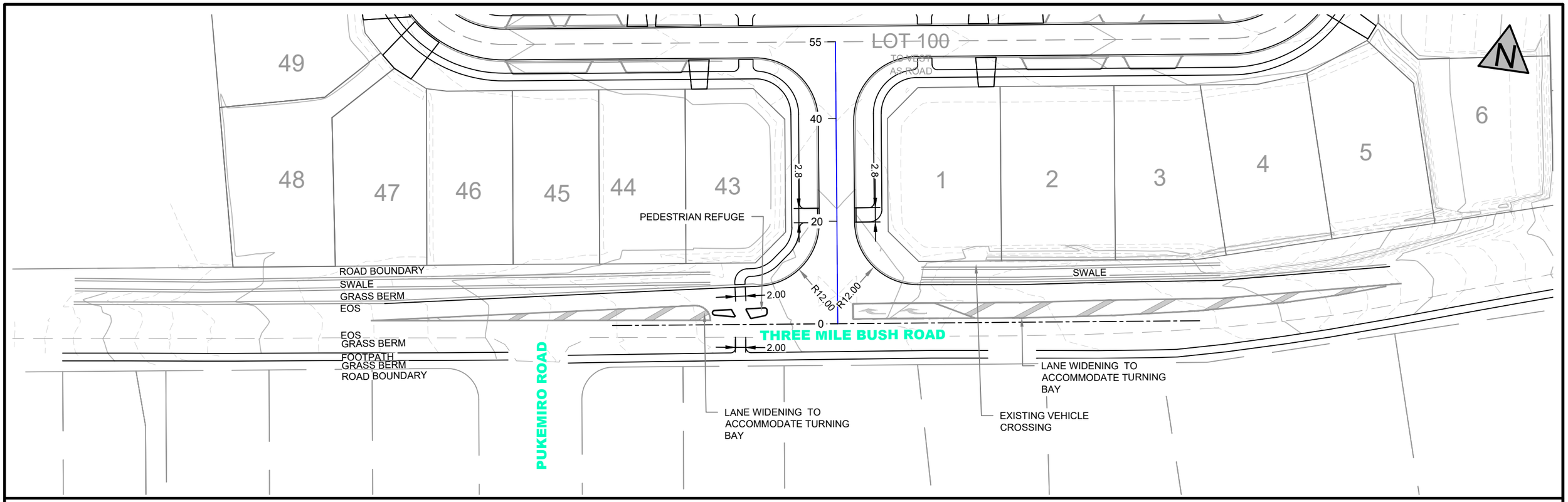

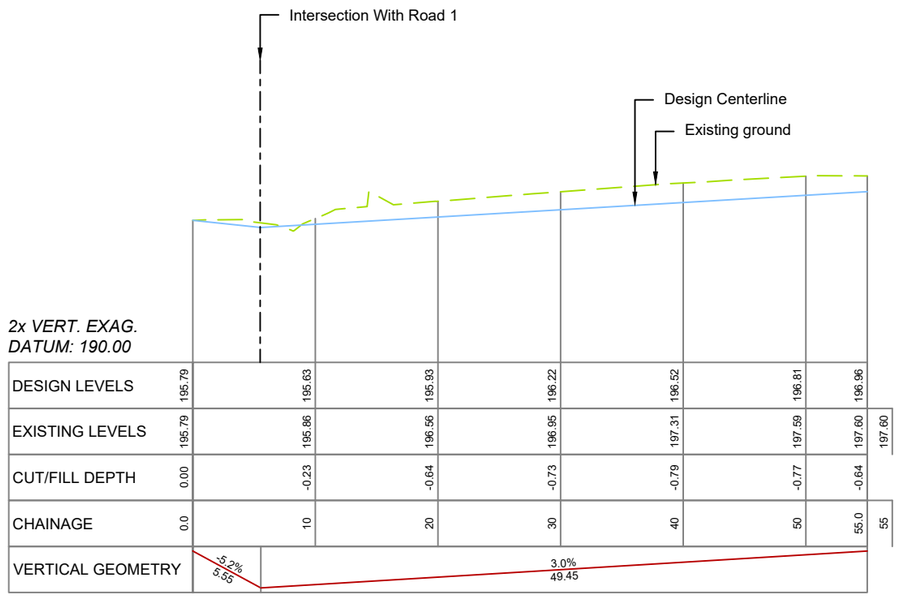

DESIGN LEVELS	195.79	195.63	195.93	196.22	196.52	196.81	196.96	
EXISTING LEVELS	195.79	195.86	196.56	196.95	197.31	197.59	197.60	197.60
CUT/FILL DEPTH	0.00	-0.23	-0.64	-0.73	-0.79	-0.77	-0.64	
CHAINAGE	0.0	10	20	30	40	50	55.0	55
VERTICAL GEOMETRY	-5.2% 5.55	3.0% 49.45						

ROAD 1 LONG SECTION

Size	A3	Scale	1:500	Date	JULY 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	29/07/21	Drawn	JMC		
2	Updated Road Curve Radii	JMC	19/08/21	Checked			
3				Approved			

Resource Consent Plan
Road 1 Longsection and Layout
189 Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point Datum

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-RC-301				2

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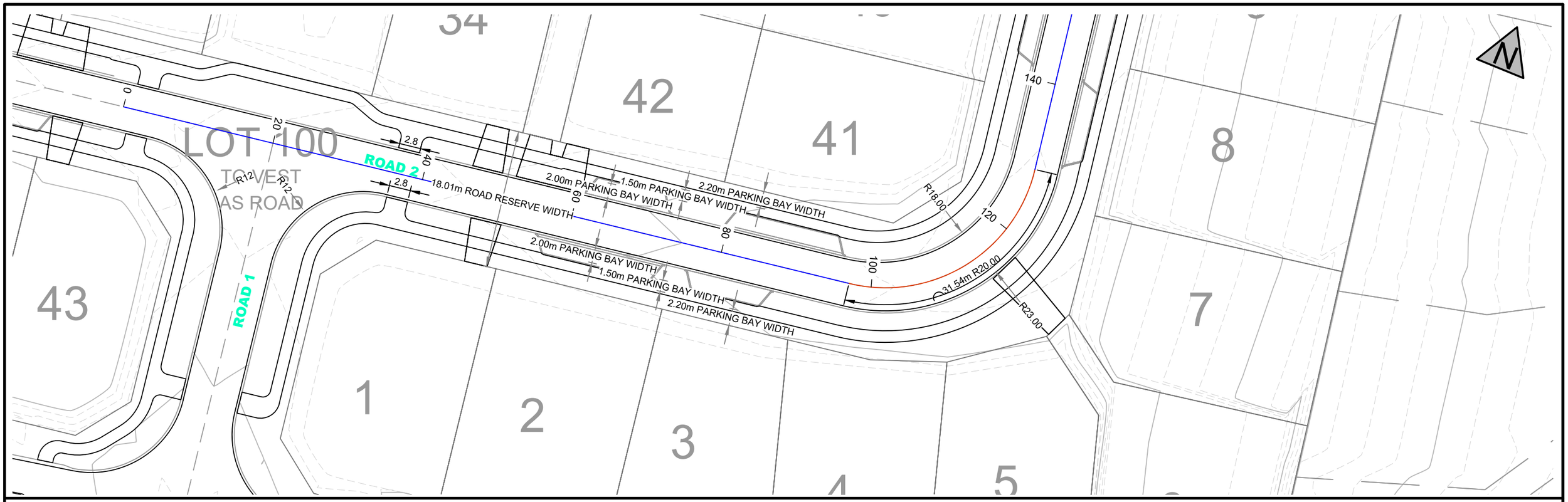

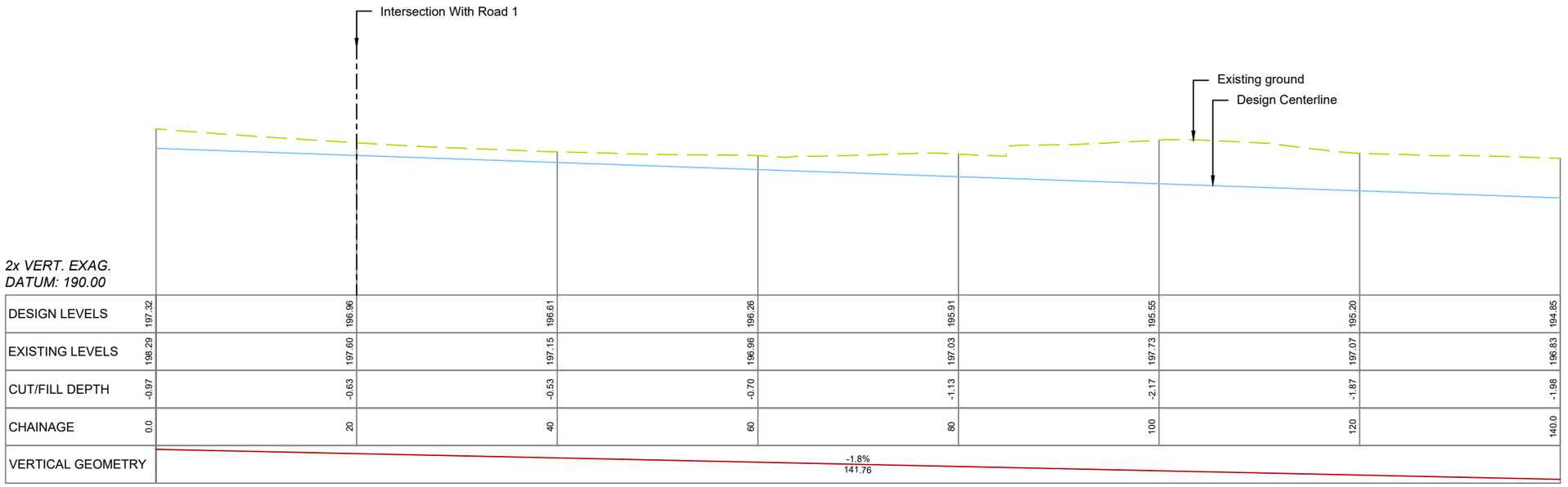

DESIGN LEVELS	197.32	196.96	196.61	196.26	195.91	195.55	195.20	194.85
EXISTING LEVELS	198.29	197.60	197.15	196.96	197.03	197.73	197.07	196.83
CUT/FILL DEPTH	-0.97	-0.63	-0.53	-0.70	-1.13	-2.17	-1.87	-1.98
CHAINAGE	0.0	20	40	60	80	100	120	140.0
VERTICAL GEOMETRY								

ROAD 2 LONG SECTION

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Size A3 | Scale 1:500 | Date JULY 2021

No.	Amendment	Init.	Date
1	Issued For Resource Consent	JMC	29/07/21
2	Updated Road Curve Radii	JMC	19/08/21
3			

Designed JMC | Drawn JMC | Checked | Approved

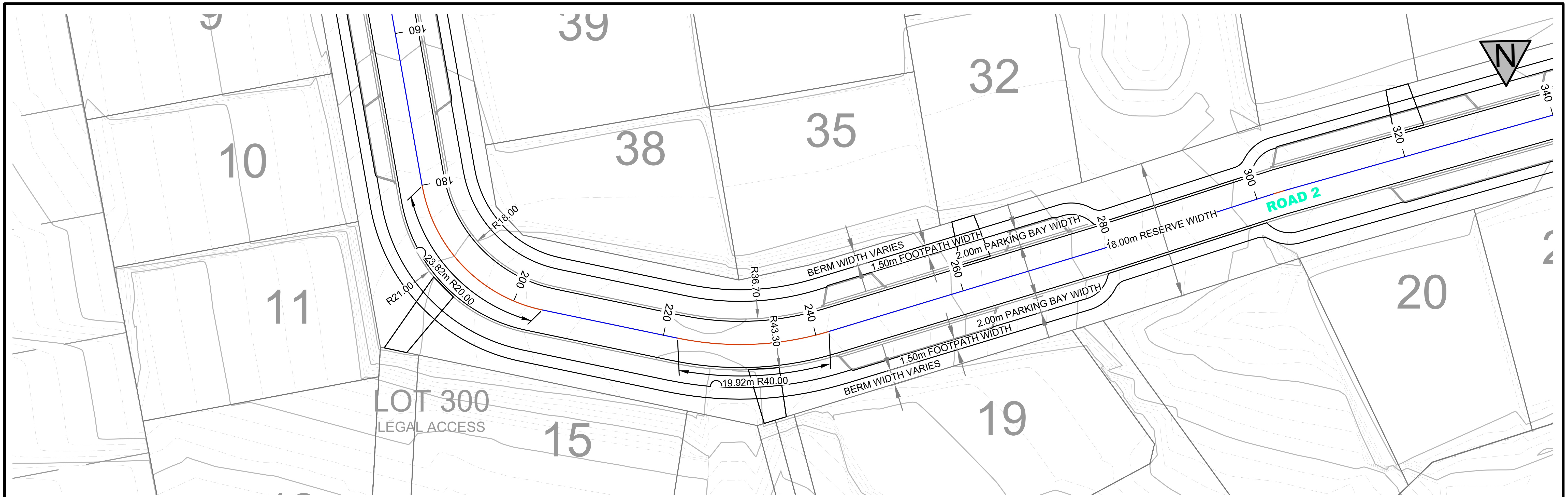
Resource Consent Plan
Road 2 Longsection and Layout (1 of 3)
189 Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

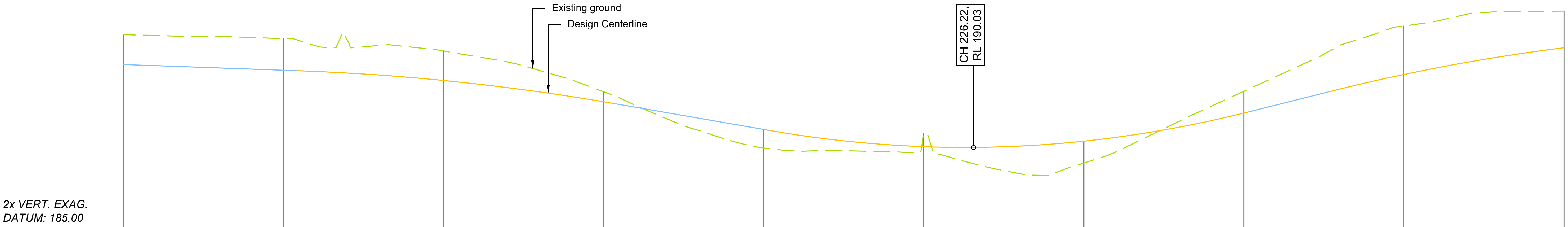
Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point Datum

Resource Consent Number: .....

BW Ref. 20183-01-RC-302 | Stg. | Purp. | Dwg. # | Revision: 2





DESIGN LEVELS	195.20	194.85	194.82	194.21	192.88	192.73	191.15	191.10	190.08	190.42	192.18	192.26	193.48	194.58	196.25
EXISTING LEVELS	197.07	196.83	196.72	196.05	193.51	193.17	190.00	189.95	190.90	189.06	193.54	193.69	195.96	197.61	198.54
CUT/FILL DEPTH	-1.87	-1.98	-1.91	-1.84	-0.62	-0.43	1.16	1.14	-0.82	1.36	-1.36	-1.43	-2.48	-3.03	-2.29
CHAINAGE	120.0	140	141.8	160	180	181.8	200	200.7	220	240	260	260.7	270.4	280	300.0

VERTICAL GEOMETRY: -1.8% 141.76 | VC L: 40.00 IP CH: 161.76/RL: 194.46 | -8.7% 18.92 | VC L: 60.00 IP CH: 230.68/RL: 188.50 | 12.5% 9.73 | VC L: 40.00 IP CH: 290.41/RL: 195.99

ROAD 2 LONG SECTION

Size A3	Scale 1:500		Date JULY 2021		
No.	Amendment	Init.	Date	Designed	JMC
1	Issued For Resource Consent	JMC	29/07/21	Drawn	JMC
2	Updated Road Curve Radii	JMC	19/08/21	Checked	
3				Approved	

Resource Consent Plan
Road 2 Longsection and Layout (2 of 3)
189 Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point Datum
Resource Consent Number: ....
BW Ref. Stg. Purp. Dwg. # 20183-01-RC-303
Revision: 2

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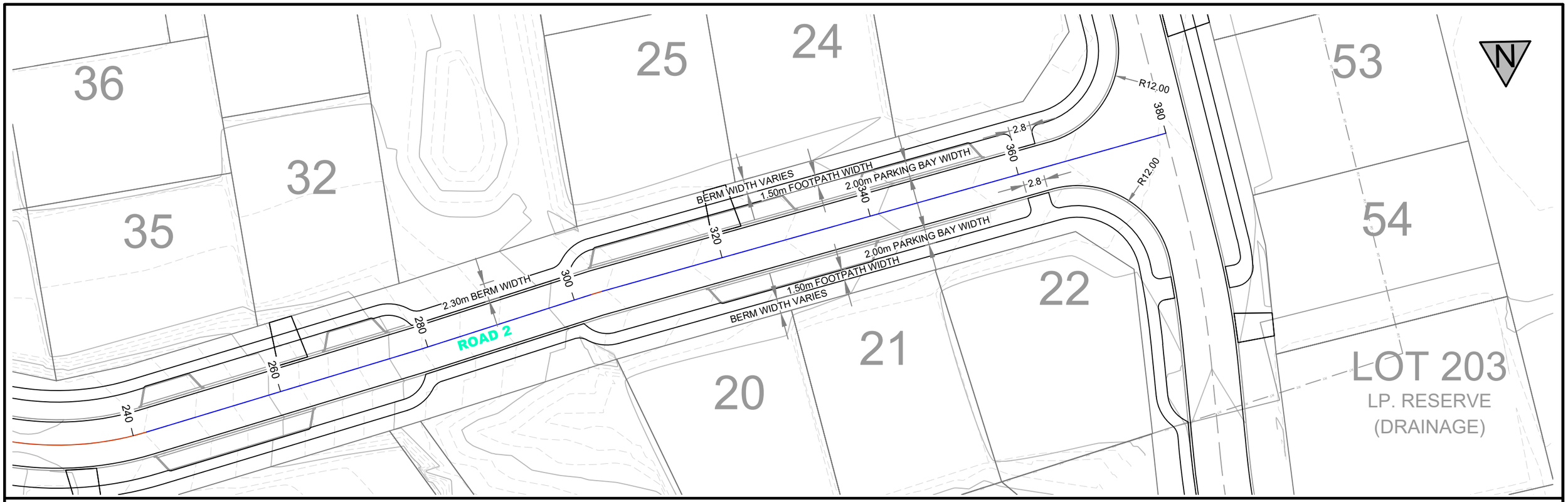

ROAD 2 LONG SECTION

Size	A3	Scale	1:500	Date	JULY 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	29/07/21	Drawn	JMC		
2	Updated Road Curve Radii	JMC	19/08/21	Checked			
3				Approved			

Resource Consent Plan
Road 2 Longsection and Layout (3 of 3)
189 Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point Datum

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-RC-304				2

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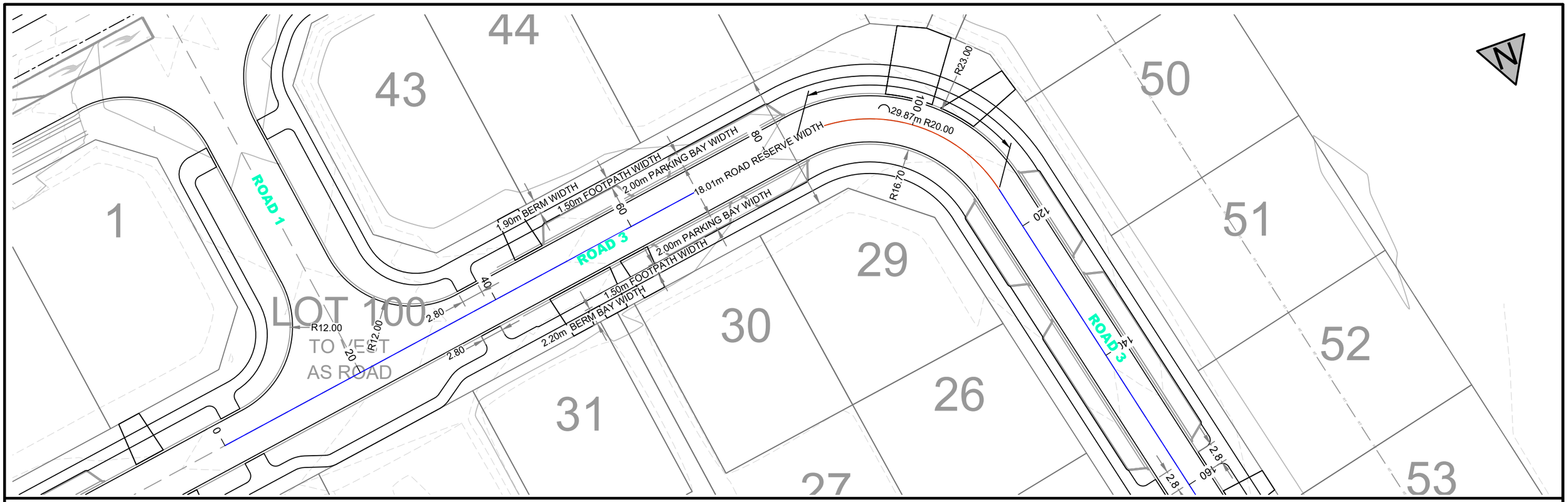

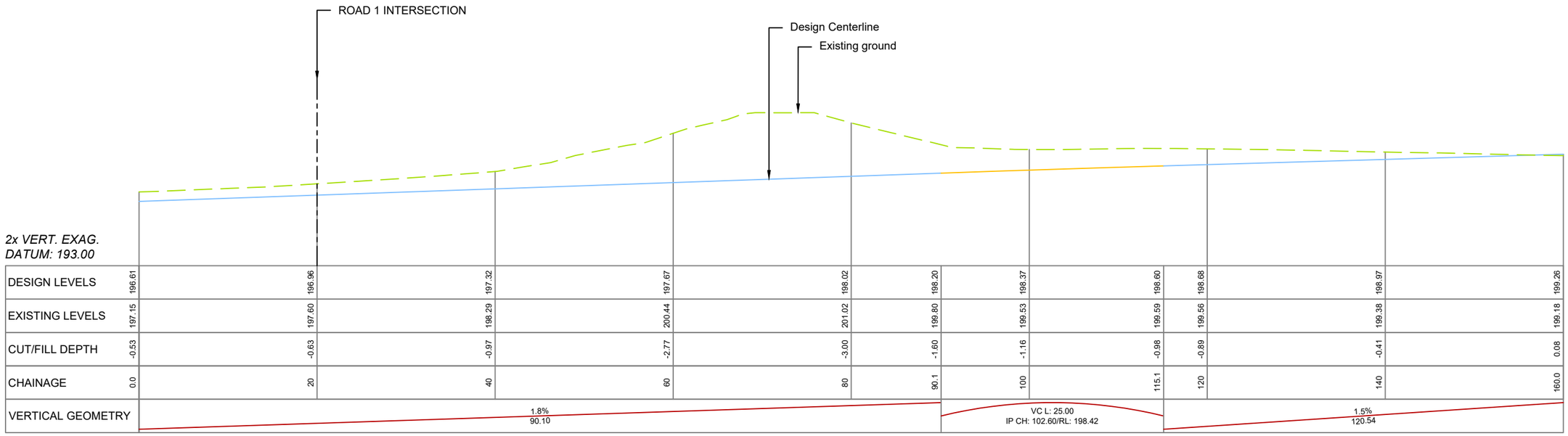

ROAD 3 LONG SECTION

Size	A3	Scale	1:500	Date	JULY 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	29/07/21	Drawn	JMC		
2	Updated Road Curve Radii	JMC	19/08/21	Checked			
3				Approved			

Resource Consent Plan
Road 3 Longsection and Layout (1 of 2)
189 Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point Datum
Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-RC-305				2

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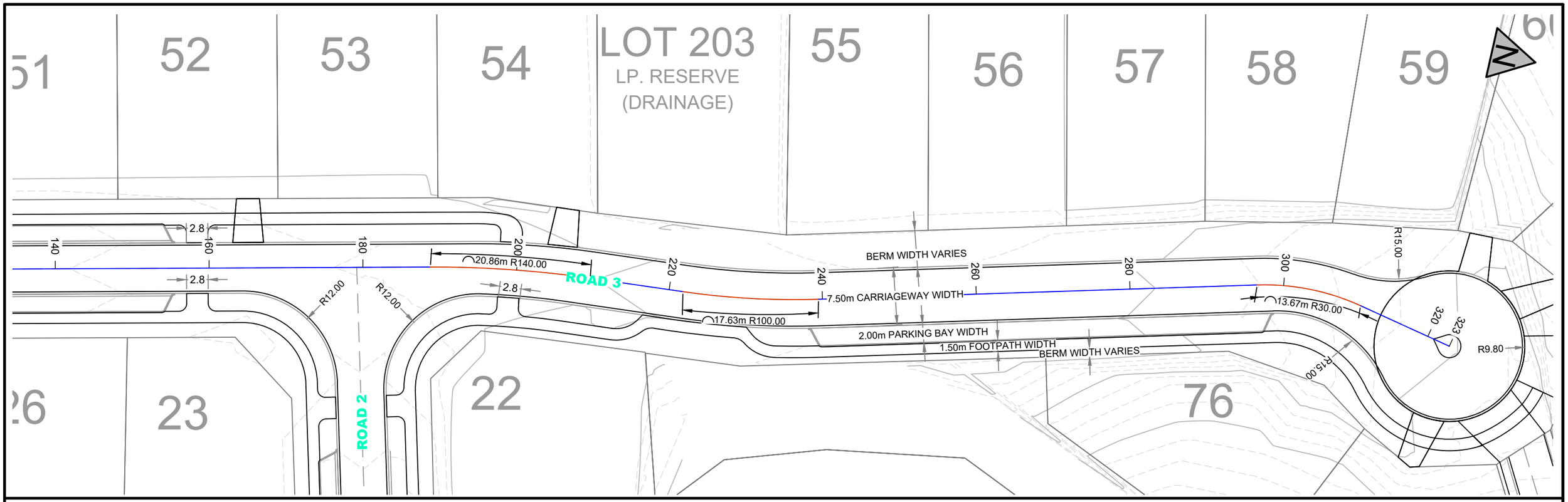

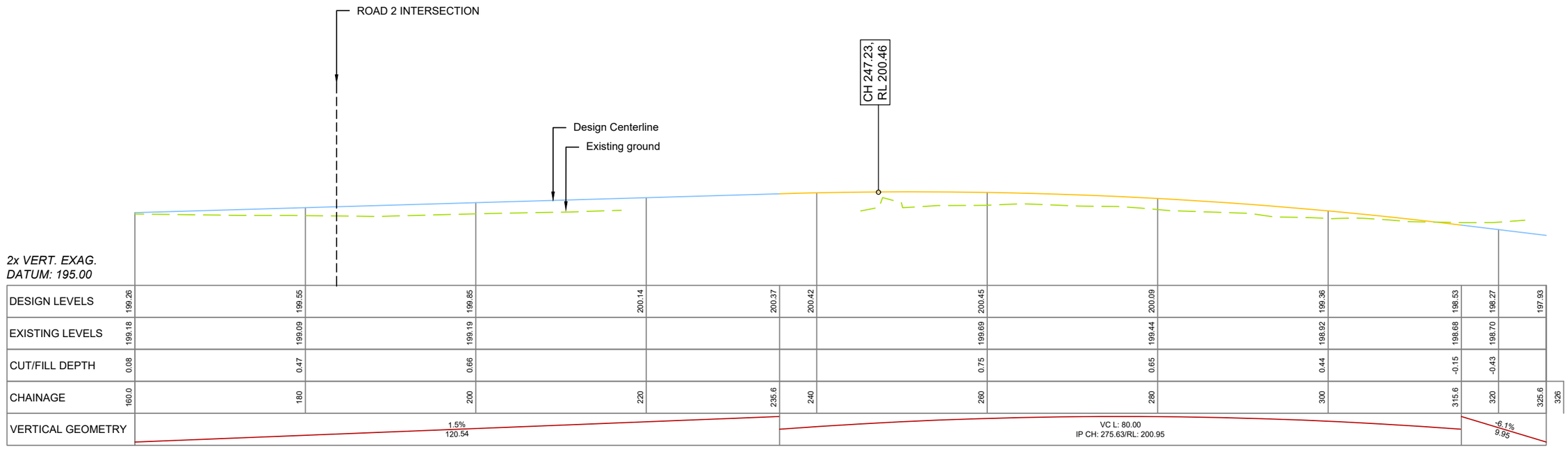

ROAD 3 LONG SECTION

Size	A3	Scale	1:500	Date	JULY 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	29/07/21	Drawn	JMC		
2	Updated Road Curve Radii	JMC	19/08/21	Checked			
3				Approved			

Resource Consent Plan
Road 2 Longsection and Layout (2 of 2)
189 Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point Datum

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-RC-306				2

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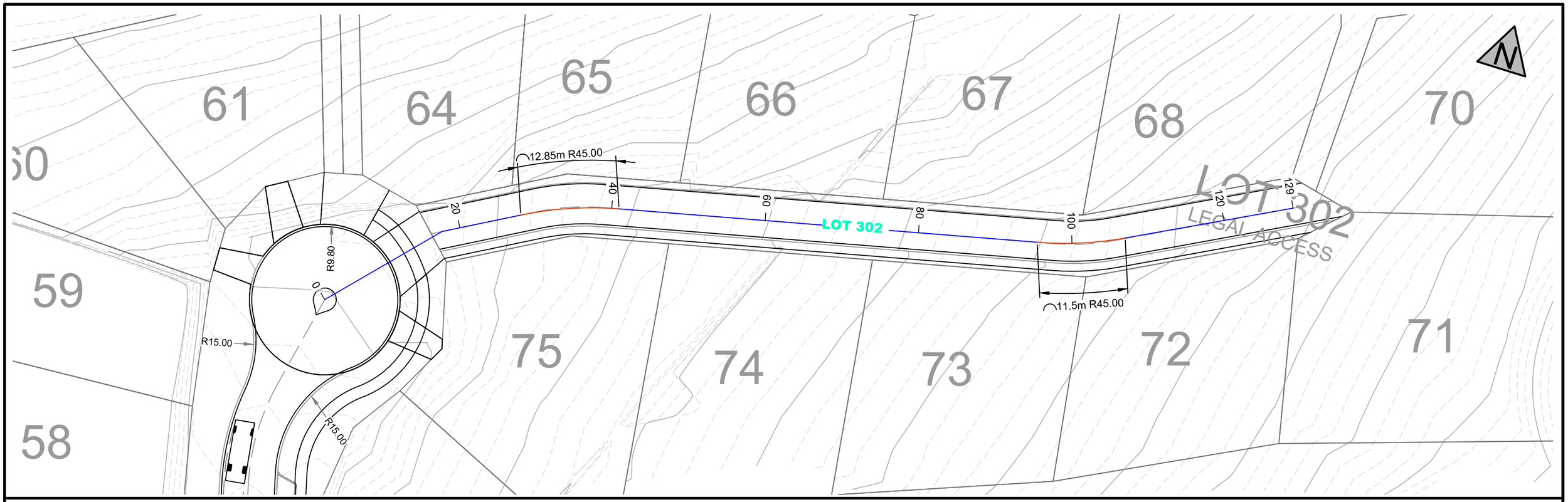

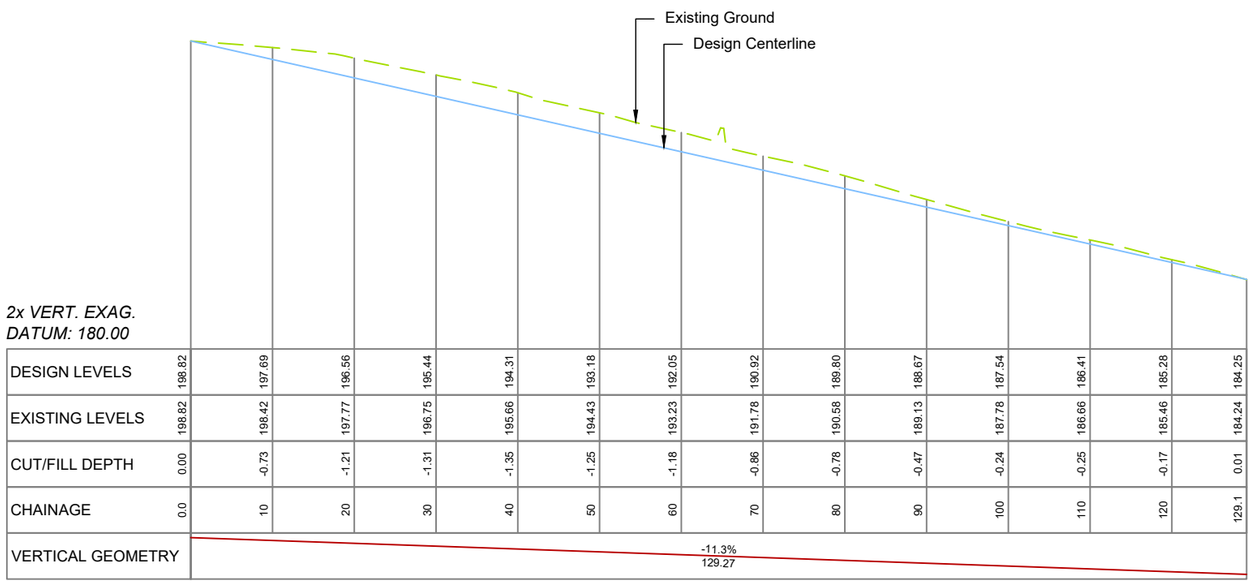

2x VERT. EXAG.
DATUM: 180.00

DESIGN LEVELS	198.82	197.69	196.56	195.44	194.31	193.18	192.05	190.92	189.80	188.67	187.54	186.41	185.28	184.25
EXISTING LEVELS	198.82	198.42	197.77	196.75	195.66	194.43	193.23	191.78	190.58	189.13	187.78	186.66	185.46	184.24
CUT/FILL DEPTH	0.00	-0.73	-1.21	-1.31	-1.35	-1.25	-1.18	-0.86	-0.78	-0.47	-0.24	-0.25	-0.17	0.01
CHAINAGE	0.0	10	20	30	40	50	60	70	80	90	100	110	120	129.1
VERTICAL GEOMETRY		-11.3% 129.27												

ROW 301 LONG SECTION

Size	A3	Scale	1:750	Date	JULY 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	29/07/21	Drawn	JMC		
2	Updated Road Curve Radii	JMC	19/08/21	Checked			
3				Approved			

Resource Consent Plan
Access Lot 302 Longsection and Layout
189 Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point Datum

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-RC-307				2

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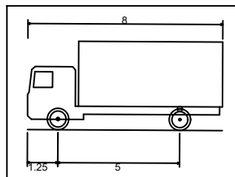
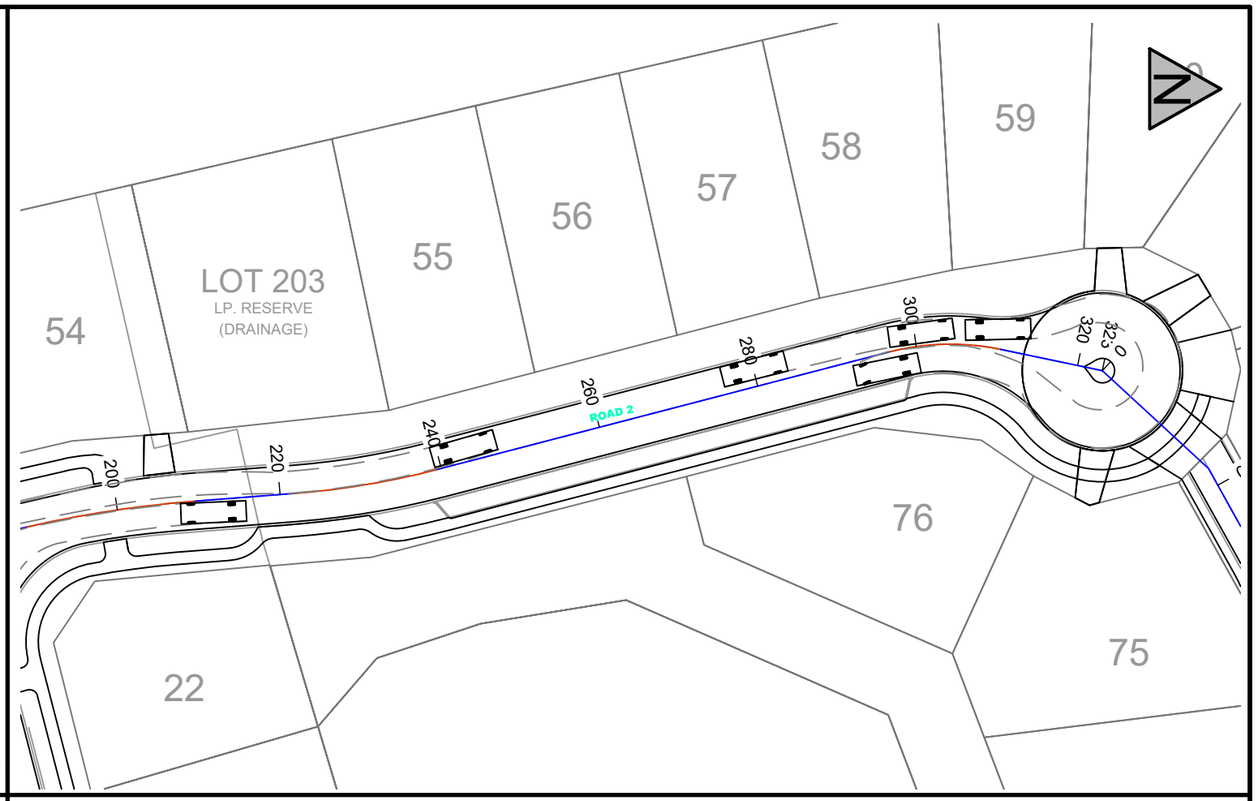
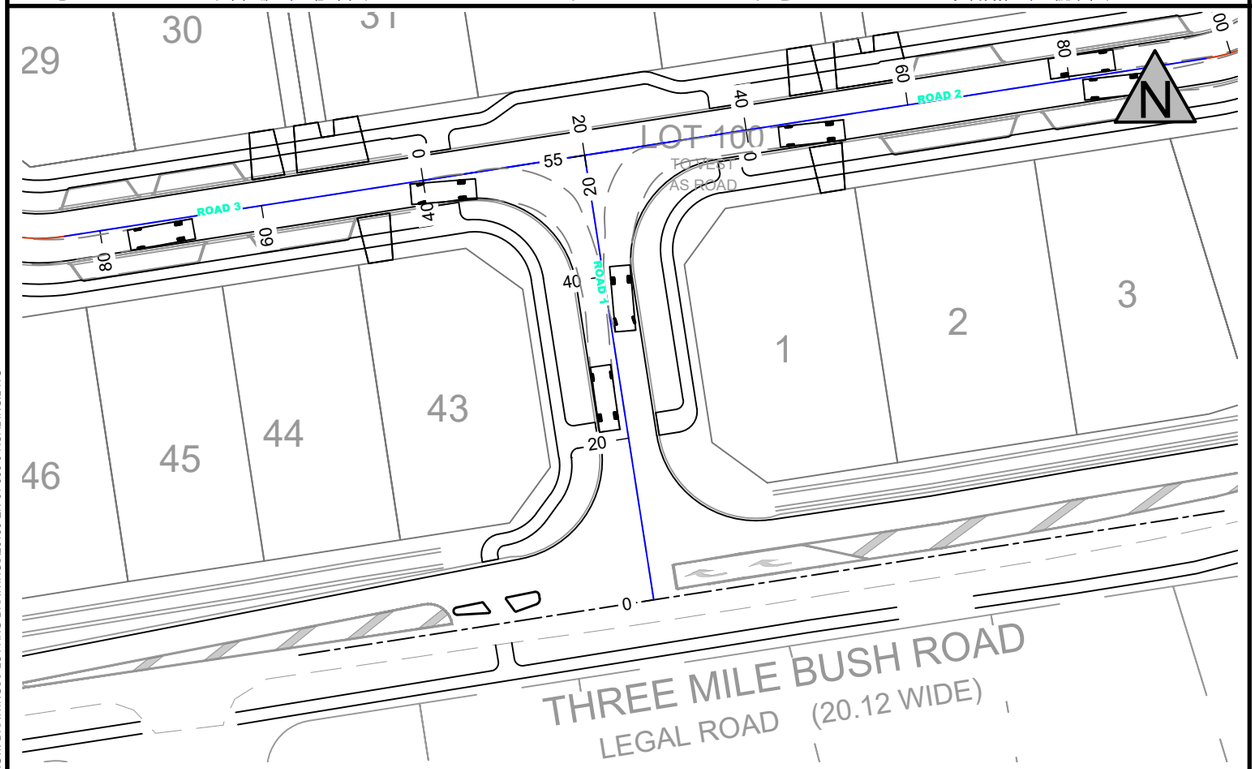
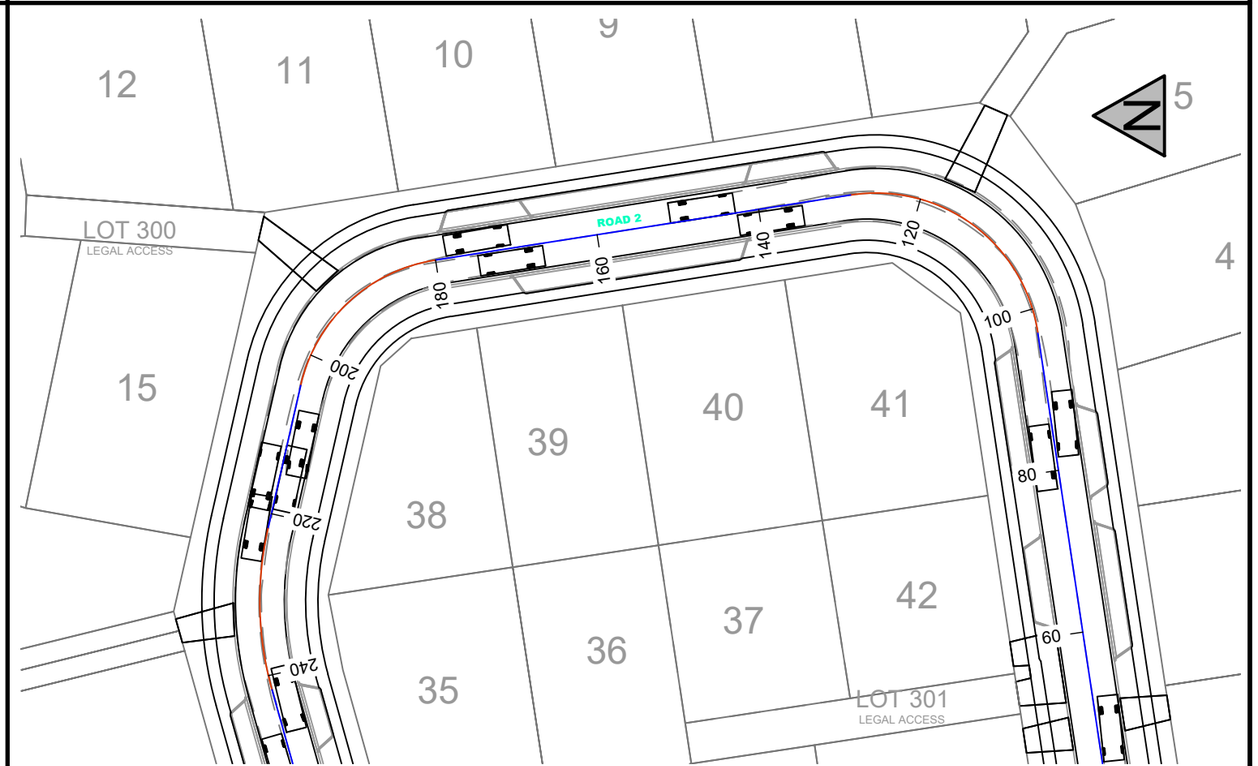


Medium Rigid Truck	
Overall Length	8.000m
Overall Width	2.500m
Overall Body Height	3.632m
Min Body Ground Clearance	0.427m
Track Width	2.500m
Lock-to-lock time	6.00s
Wall to Wall Turning Radius	10.000m







Size	A3	Scale	1:750	Date	JULY 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	29/07/21	Drawn	JMC		
2	Updated Road Curve Radii	JMC	19/08/21	Checked			
3				Approved			

Resource Consent Plan
Turning Circles
189 Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point Datum

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-RC-308				2

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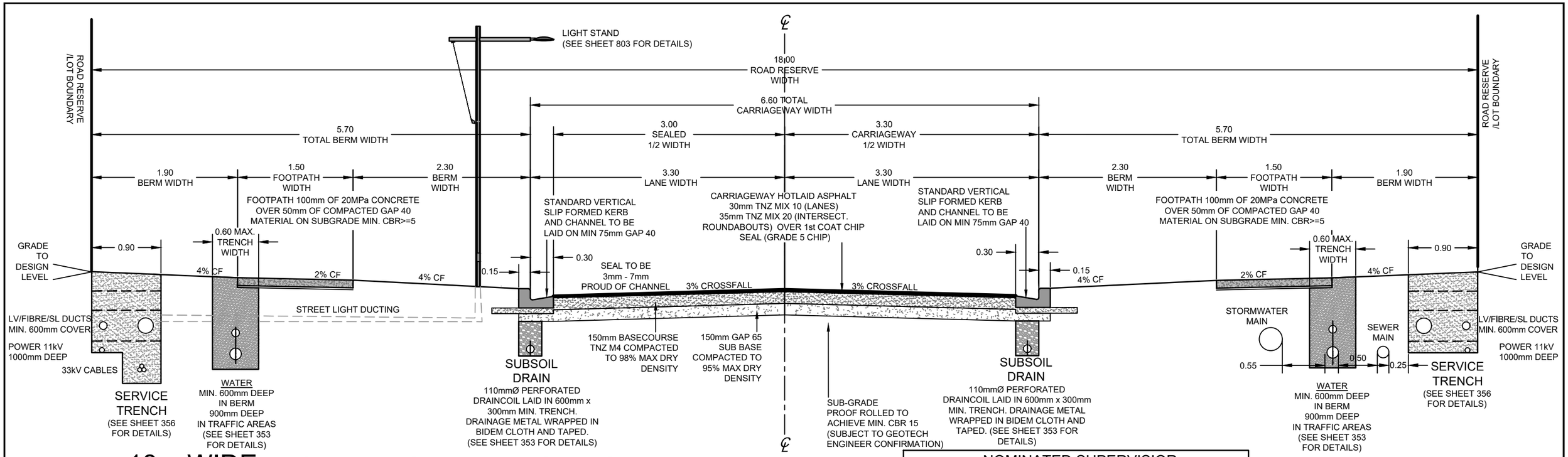
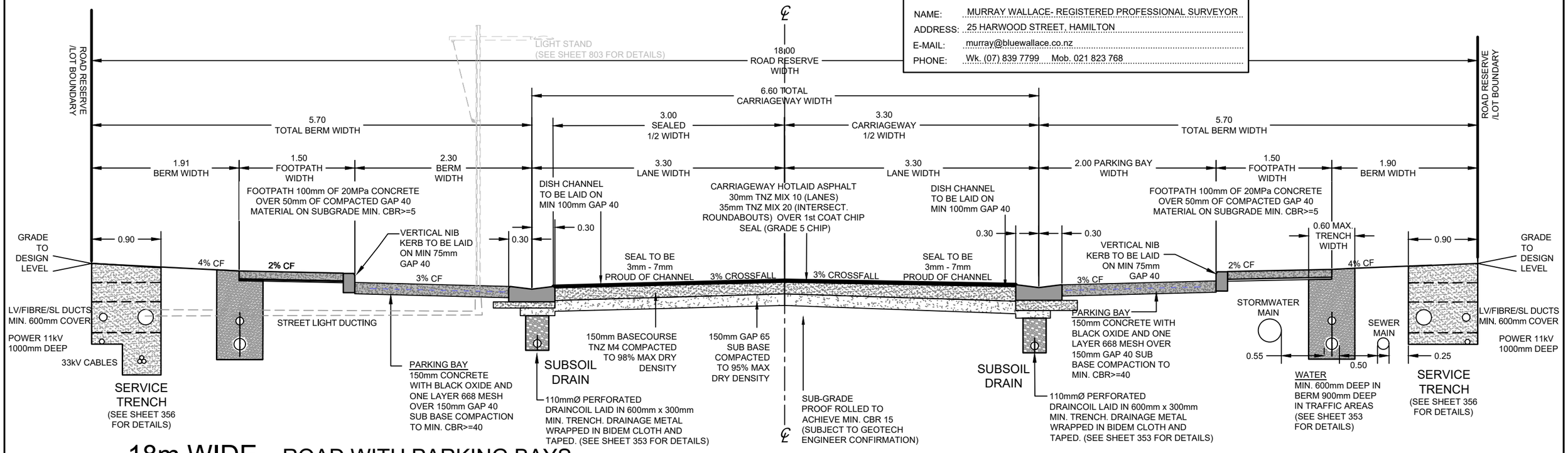


18m WIDE - ROAD WITHOUT PARKING BAYS



18m WIDE - ROAD WITH PARKING BAYS

NOMINATED SUPERVISIOR
ENGINEERING PLANS FOR CONSTRUCTION

NAME: MURRAY WALLACE- REGISTERED PROFESSIONAL SURVEYOR
ADDRESS: 25 HARWOOD STREET, HAMILTON
E-MAIL: murray@bluewallace.co.nz
PHONE: Wk. (07) 839 7799 Mob. 021 823 768

Size A3 | Scale 1:50 | DATE: JULY 2021

No.	Amendment	Init.	Date
0	Issued for Resource Consent	JMC	28/07/21
1	Issued for Resource Consent	JMC	19/08/21

Designed	JMC	28/07/21
Drawn	JMC	28/07/21
Checked		
Approved		

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Engineering Works

Roading Typical Cross Sections

189 Three Mile Bush Road, Kamo, Whangarei

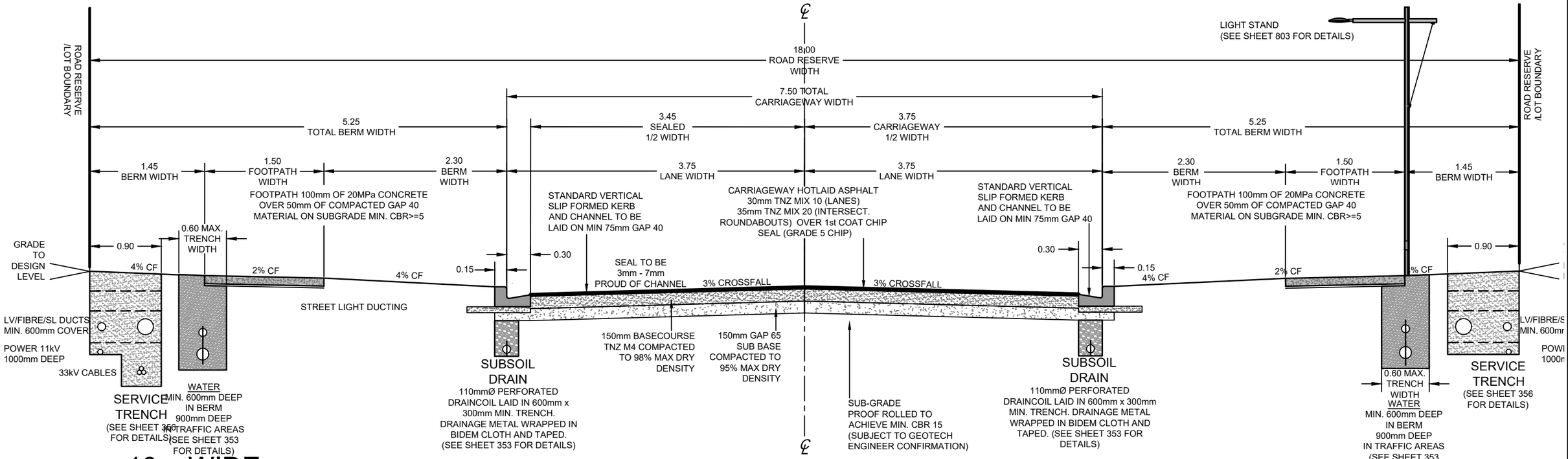
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

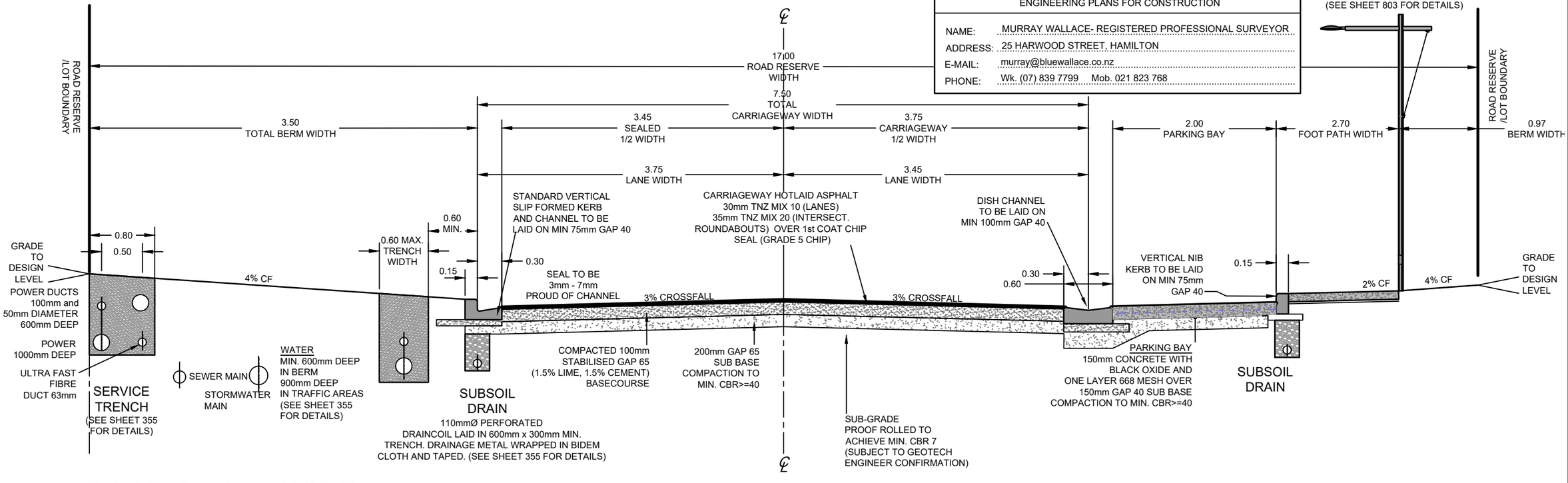
Datum: Circuit: Mount Eden 2000
Height: One Tree Point Datum

Resource Consent Number:

BW Ref. 20183-00-EN-350 | Stg. | Purp. | Dwg. # | Revision: 1



18m WIDE - ROAD 1



ROAD 3 - 17m WIDE- ROAD WITH PARKING CH 200.00 - END

NOMINATED SUPERVISIOR
ENGINEERING PLANS FOR CONSTRUCTION

NAME: MURRAY WALLACE- REGISTERED PROFESSIONAL SURVEYOR
ADDRESS: 25 HARWOOD STREET, HAMILTON
E-MAIL: murray@bluewallace.co.nz
PHONE: Wk. (07) 839 7799 Mob. 021 823 768

Size	A3	Scale	1:50	DATE:	JULY 2021		
No.	Amendment	Init.	Date	Designed	JMC	28/07/21	
0	Issued for Resource Consent	JMC	28/07/21	Drawn	JMC	28/07/21	
1	Issued for Resource Consent	JMC	19/08/21	Checked			
				Approved			

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Engineering Works

Roading Typical Cross Sections

189 Three Mile Bush Road, Kamo, Whangarei

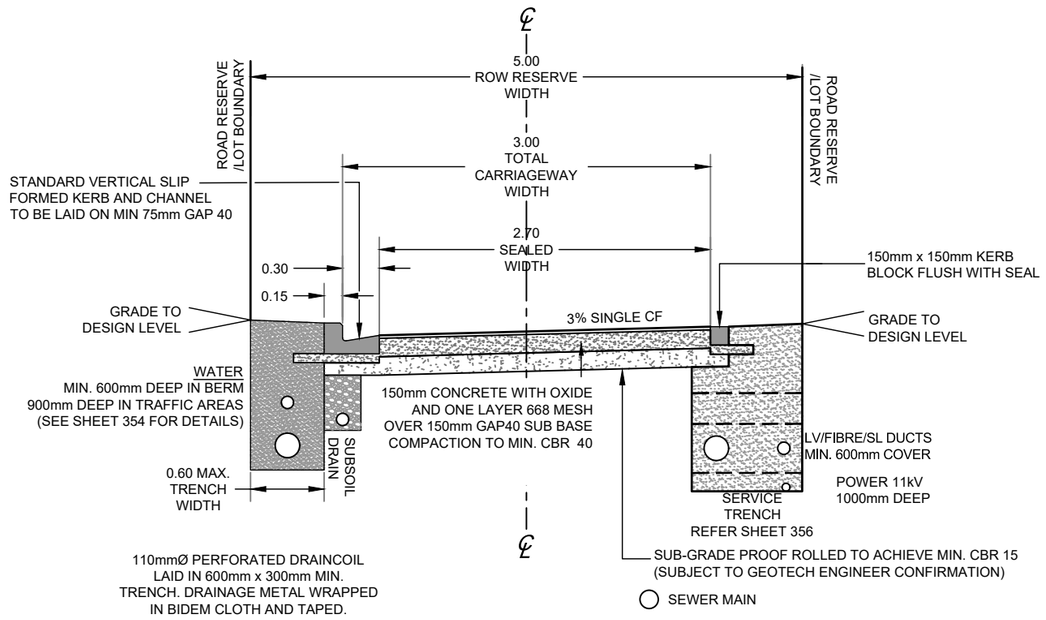
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38, Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

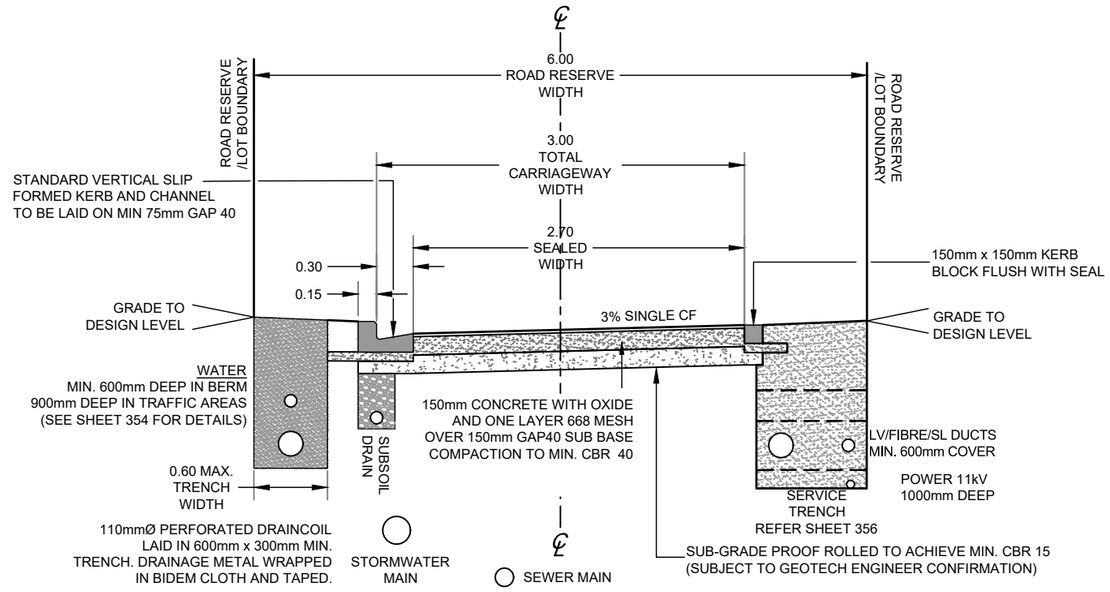
Datum: Circuit: Mount Eden 2000
Height: One Tree Point Datum

Resource Consent Number:

BW Ref. 20183-00-EN-351 | Stg. | Purp. | Dwg. # | Revision: 1



R.O.W. - 5.0m WIDE



R.O.W. - 6.0m WIDE

NOMINATED SUPERVISIOR
ENGINEERING PLANS FOR CONSTRUCTION

NAME: MURRAY WALLACE- REGISTERED PROFESSIONAL SURVEYOR
ADDRESS: 25 HARWOOD STREET, HAMILTON
E-MAIL: murray@bluewallace.co.nz
PHONE: Wk. (07) 839 7799 Mob. 021 823 768

Size A3 | Scale 1:50 | DATE: JULY 2021

No.	Amendment	Init.	Date
0	Issued for Resource Consent	JMC	07/21
1	Issued for Resource Consent	JMC	19/08/21

Designed	JMC	28/07/21
Drawn	JMC	28/07/21
Checked		
Approved		

Engineering Works

Roading Typical Cross Sections

189 Three Mile Bush Road, Kamo, Whangarei

Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mount Eden 2000
Height: One Tree Point Datum

Resource Consent Number:

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-00-EN-352				1

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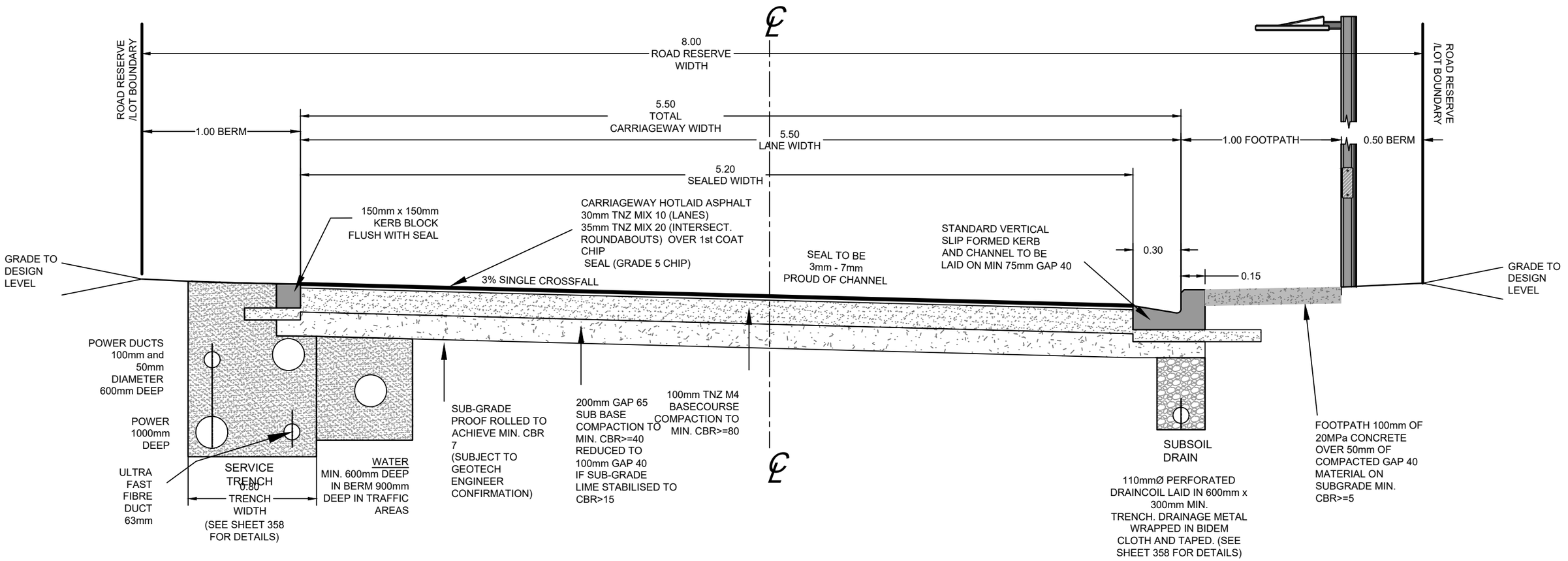

ACCESS 302 - 8m WIDE

NOMINATED SUPERVISIOR
ENGINEERING PLANS FOR CONSTRUCTION

NAME: MURRAY WALLACE- REGISTERED PROFESSIONAL SURVEYOR
ADDRESS: 25 HARWOOD STREET, HAMILTON
E-MAIL: murray@bluewallace.co.nz
PHONE: Wk. (07) 839 7799 Mob. 021 823 768

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Size A3 | Scale 1:50 | DATE: JULY 2021

No.	Amendment	Init.	Date
0	Issued for Resource Consent	JMC	07/21
1	Issued for Resource Consent	JMC	19/08/21

Designed	JMC	28/07/21
Drawn	JMC	28/07/21
Checked		
Approved		

Engineering Works

Roading Typical Cross Sections

189 Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mount Eden 2000
Height: One Tree Point Datum

Resource Consent Number:

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-00-EN-353				1

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Size	A3	Scale	1:1250		Date	May 2021	
No.	Amendment	Init.	Date		Designed	JMC	
1	Issued For Resource Consent	JMC	17/05/21		Drawn	JMC	
2	Service Location In Berm	JMC	19/08/21		Checked		
3					Approved		

Resource Consent Plan
Sanitary Sewer
Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number:
.....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-RC-400				2

Legend

W	Existing Manhole
SS	Existing Pipe System
W	Proposed Manhole
SS	Proposed Pipe System

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Size	Scale	Date
A3	1:1250	May 2021

No.	Amendment	Init.	Date
1	Issued For Resource Consent	JMC	17/05/21
2	Service Location In Berm	JMC	19/08/21
3			

Designed	JMC		
Drawn	JMC		
Checked			
Approved			

Resource Consent Plan
Sanitary Sewer
Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-RC-401				2

Legend

- Existing Manhole
- Existing Pipe System (SW)
- Proposed Manhole
- Proposed Catchpit
- Proposed Headwall
- Proposed Pipe System (SW)

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Size A3 | Scale 1:1250 | Date May 2021

No.	Amendment	Init.	Date
1	Issued For Resource Consent	JMC	17/05/21
2	Updated Stormwater Line Locations	JMC	19/08/21
3			

Designed | Drawn | Checked | Approved

Resource Consent Plan
Stormwater Plans
Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref. 20183-01-RC-500 | Stg. | Purp. | Dwg. # | Revision: 2

Legend

- Existing Manhole
- Existing Pipe System
- Proposed Manhole
- Proposed Catchpit
- Proposed Headwall
- Proposed Pipe System

Size	A3	Scale	1:1250	Date	May 2021

No.	Amendment	Init.	Date
1	Issued For Resource Consent	JMC	17/05/21
2	Updated Stormwater Line Locations	JMC	19/08/21
3			

Designed | Drawn | Checked | Approved

Resource Consent Plan
Stormwater Plans
Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-RC-501				2

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PT LOT 4
DP 99045
(RT. NA93D/53)
HURUPAKI LTD.

Legend

- Existing Water Main
- Existing Fire Hydrant
- Proposed Lot Connection
- Proposed Sluice Valve
- Proposed Peet Valve
- Proposed Fire Hydrant
- Proposed Water Main
- Proposed Rider Main

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Size	A3	Scale	1:1500	Date	May 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	17/05/21	Drawn	JMC		
2	Services Locations Updated,	JMC	19/08/21	Checked			
3				Approved			

Resource Consent Plan
Water Reticulation
Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number:
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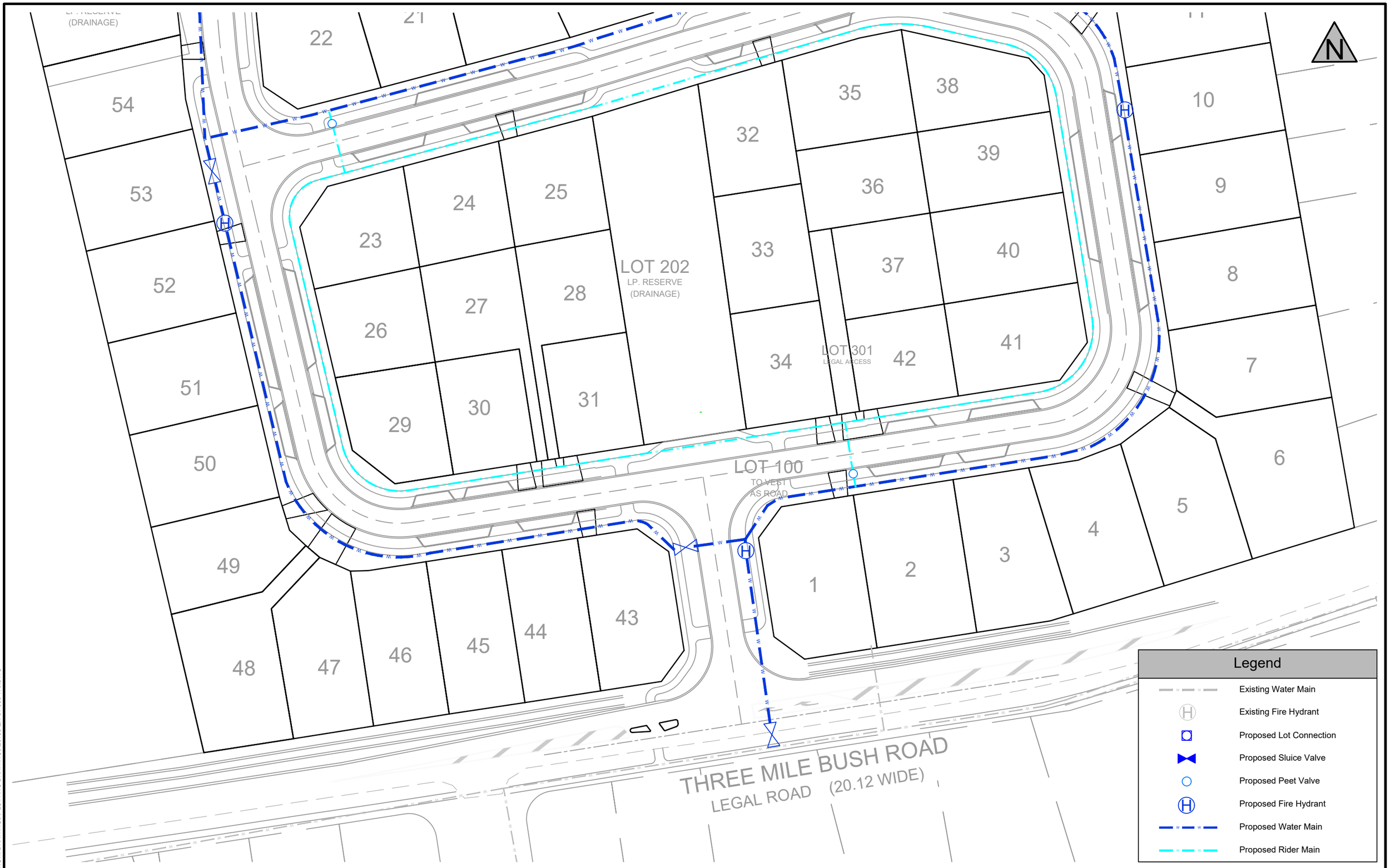
BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-RC-600				2



Legend

- Existing Water Main
- Existing Fire Hydrant
- Proposed Lot Connection
- Proposed Sluice Valve
- Proposed Peet Valve
- Proposed Fire Hydrant
- Proposed Water Main
- Proposed Rider Main

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Size	A3	Scale	1:750	Date	May 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	17/05/21	Drawn	JMC		
2	Services Locations Updated,	JMC	19/08/21	Checked			
3				Approved			

Resource Consent Plan
Water Reticulation
Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-RC-601				2

Legend

- Existing Water Main
- Existing Fire Hydrant
- Proposed Lot Connection
- Proposed Sluice Valve
- Proposed Peet Valve
- Proposed Fire Hydrant
- Proposed Water Main
- Proposed Rider Main

N

LOT 204
LP. RESERVE
(DRAINAGE)

LOT 200
LP. RESERVE
(DRAINAGE)

LOT 203
LP. RESERVE
(DRAINAGE)

LOT 300
LEGAL ACCESS

LOT 202

73 74 75 76 57 56 55 54 53 22 21 20 19 18 17 16 15 14 13 12 11 10 9 40 39 38 37 36 35 33 32 25 24 23

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Size	A3	Scale	1:750	Date	May 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	17/05/21	Drawn	JMC		
2	Services Locations Updated,	JMC	19/08/21	Checked			
3				Approved			

Resource Consent Plan
Water Reticulation
Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

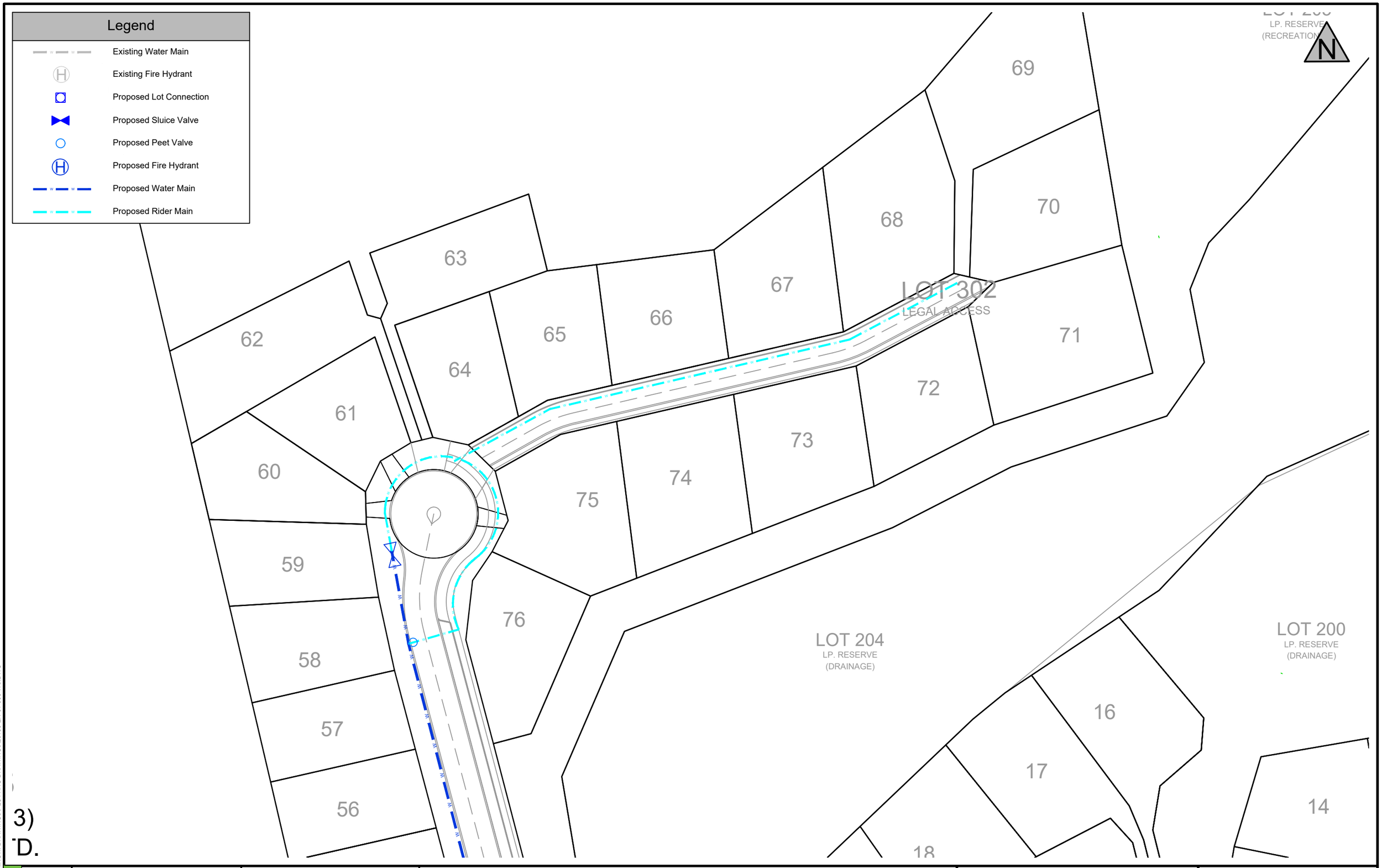
Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-RC-602				2

Legend

- Existing Water Main
- Existing Fire Hydrant
- Proposed Lot Connection
- Proposed Sluice Valve
- Proposed Peet Valve
- Proposed Fire Hydrant
- Proposed Water Main
- Proposed Rider Main



3)
D.

Size	A3	Scale	1:750	Date	May 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	17/05/21	Drawn	JMC		
2	Services Locations Updated,	JMC	19/08/21	Checked			
3				Approved			

Resource Consent Plan
Water Reticulation
Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number:
.....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-RC-603				2

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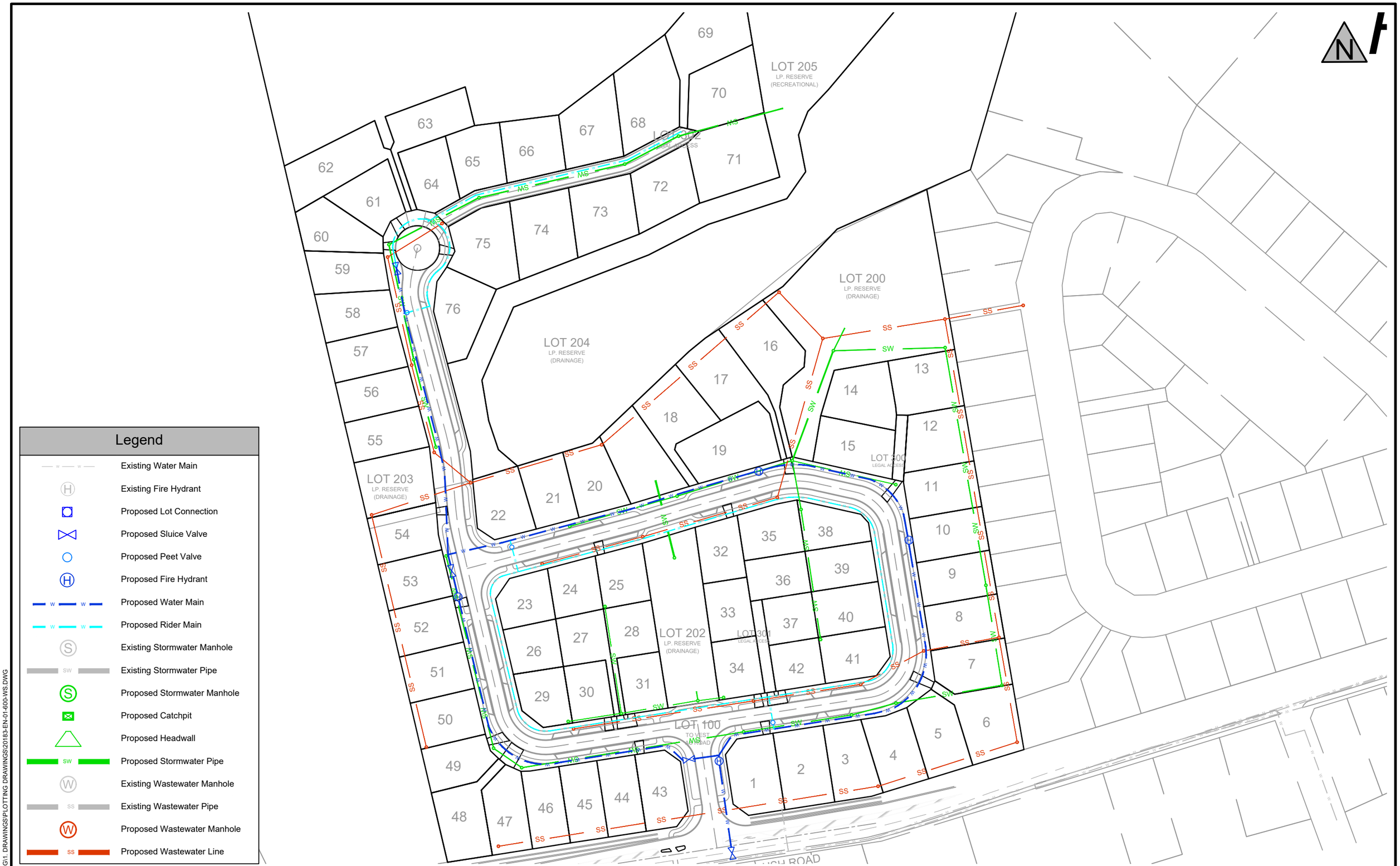

Legend

- Existing Water Main
- Existing Fire Hydrant
- Proposed Lot Connection
- Proposed Sluice Valve
- Proposed Peet Valve
- Proposed Fire Hydrant
- Proposed Water Main
- Proposed Rider Main
- Existing Stormwater Manhole
- Existing Stormwater Pipe
- Proposed Stormwater Manhole
- Proposed Catchpit
- Proposed Headwall
- Proposed Stormwater Pipe
- Existing Wastewater Manhole
- Existing Wastewater Pipe
- Proposed Wastewater Manhole
- Proposed Wastewater Line

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Size	A3	Scale	1:1500	Date	May 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	17/05/21	Drawn	JMC		
2	Services Locations Updated,	JMC	19/08/21	Checked			
3				Approved			

Resource Consent Plan
Combined Services
Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number:
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BW Ref.	Stg.	Purp.	Dwg. #	Revision:
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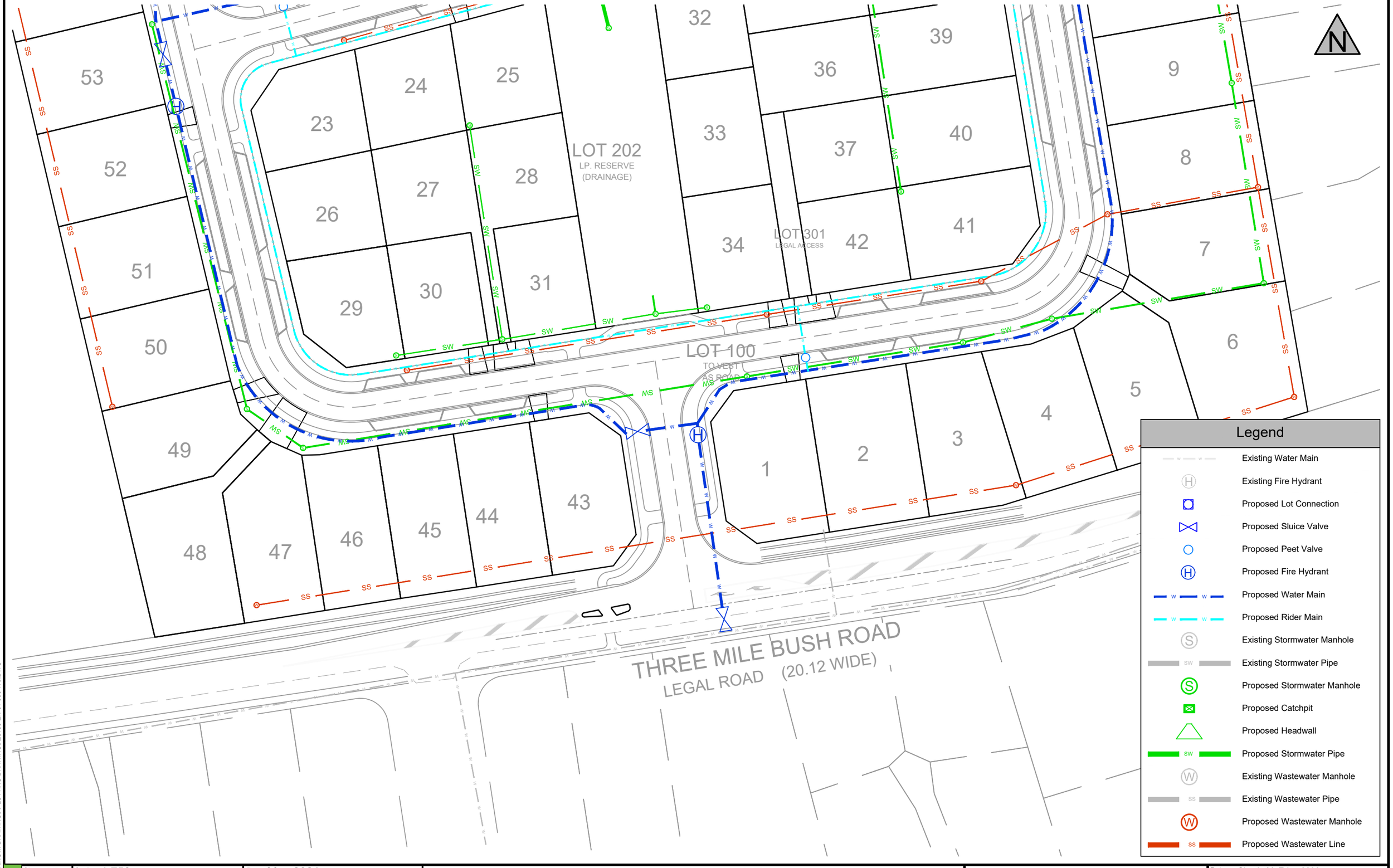

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Size	A3	Scale	1:750	Date	May 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	17/05/21	Drawn	JMC		
2	Services Locations Updated,	JMC	19/08/21	Checked			
3				Approved			

Resource Consent Plan
Combined Services
Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number:
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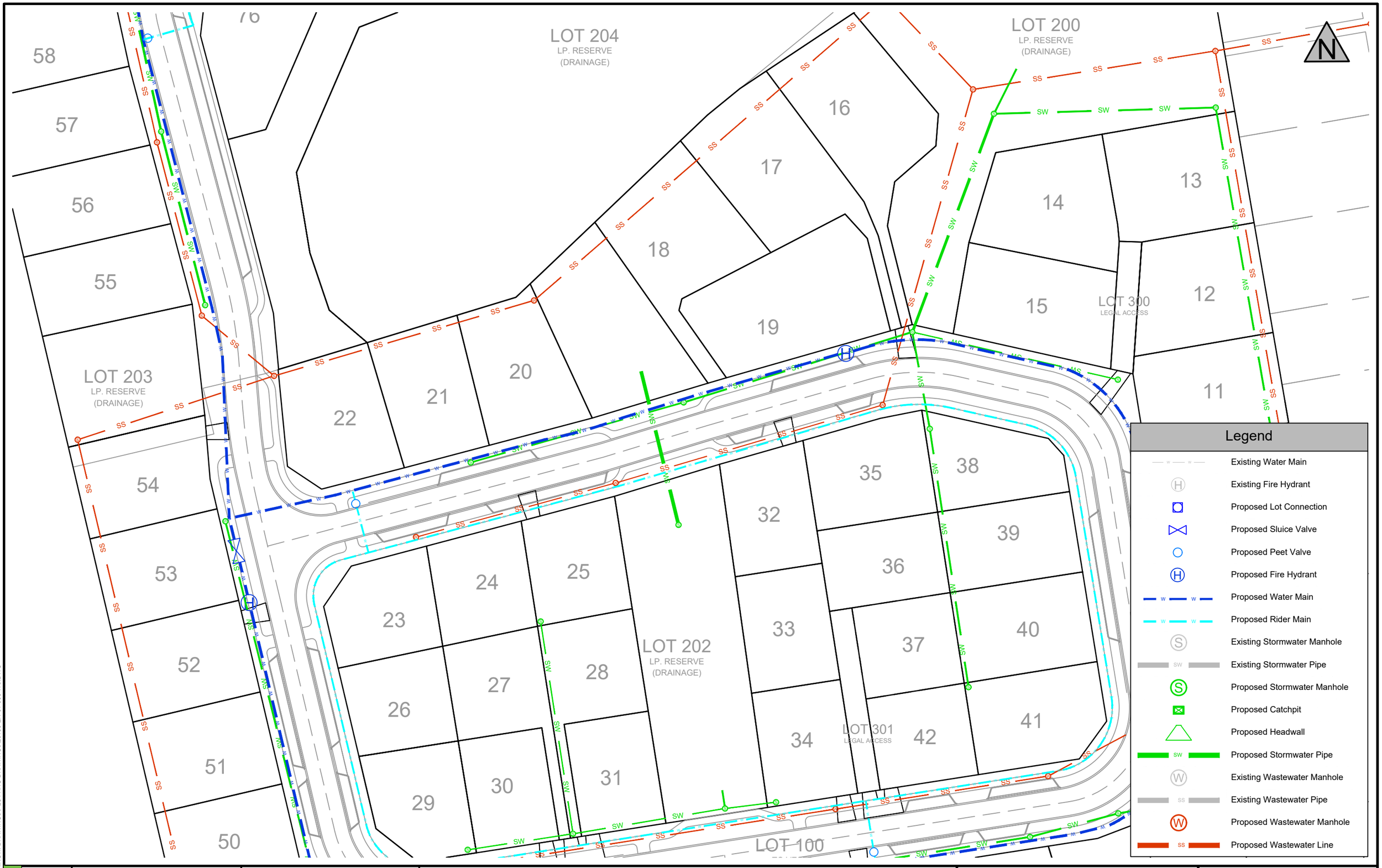

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Size	A3	Scale	1:750	Date	May 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	17/05/21	Drawn	JMC		
2	Services Locations Updated,	JMC	19/08/21	Checked			
3				Approved			

Resource Consent Plan
Combined Services
Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number:
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BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-RC-702				2

Legend

- Existing Water Main
- Existing Fire Hydrant
- Proposed Lot Connection
- Proposed Sluice Valve
- Proposed Peet Valve
- Proposed Fire Hydrant
- Proposed Water Main
- Proposed Rider Main
- Existing Stormwater Manhole
- Existing Stormwater Pipe
- Proposed Stormwater Manhole
- Proposed Catchpit
- Proposed Headwall
- Proposed Stormwater Pipe
- Existing Wastewater Manhole
- Existing Wastewater Pipe
- Proposed Wastewater Manhole
- Proposed Wastewater Line

Size A3 | Scale 1:750 | Date May 2021

No.	Amendment	Init.	Date
1	Issued For Resource Consent	JMC	17/05/21
2	Services Locations Updated,	JMC	19/08/21
3			

Designed	JMC		
Drawn	JMC		
Checked			
Approved			

Resource Consent Plan
Combined Services
Three Mile Bush Road, Kamo, Whangarei
Prepared for: TMB Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
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Size	A3	Scale	1:2000	Date	AUG 2021

No.	Amendment	Init.	Date		
0	For Approval	CN	25/08/21	Designed	
1	Trees amended	CN	02/09/21	Drawn	
2				Checked	
				Approved	

Lighting and Planting Plan

Proposed Subdivision

131 Three Mile Bush Road

Prepared for: Hurupaki Developments

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point Datum

Resource Consent Number:
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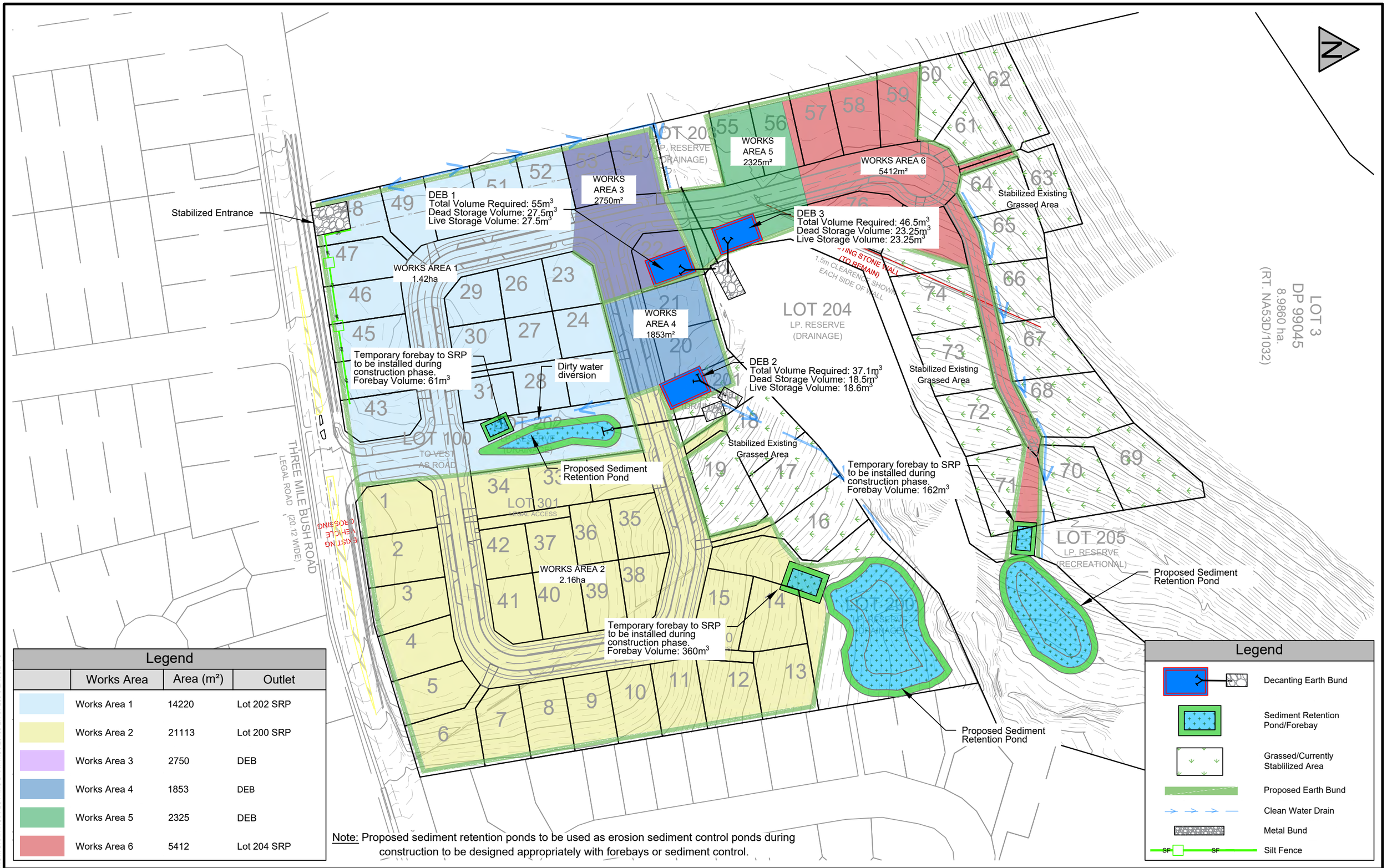
BW Ref. Stg. Purp. Dwg. #	Revision:
20-183-01-EN-801	1



Legend			
	Works Area	Area (m²)	Outlet
	Works Area 1	14220	Lot 202 SRP
	Works Area 2	21113	Lot 200 SRP
	Works Area 3	2750	DEB
	Works Area 4	1853	DEB
	Works Area 5	2325	DEB
	Works Area 6	5412	Lot 204 SRP

Legend

- Decanting Earth Bund
- Sediment Retention Pond/Forebay
- Grassed/Currently Stablilized Area
- Proposed Earth Bund
- Clean Water Drain
- Metal Bund
- SF — SF Silt Fence

Note: Proposed sediment retention ponds to be used as erosion sediment control ponds during construction to be designed appropriately with forebays or sediment control.

Size	A3	Scale	1:500	Date	September 2021			
No.	Amendment	Init.	Date	Designed	JMC			
1	Issued For Resource Consent	JMC	07809/21	Drawn	JMC			
2				Checked	CN			
3				Approved				

Resource Consent Plan
Erosion and Sediment Control
189 Three Mile Bush Road, Kamo, Whangarei
Prepared for: Hurupaki Holdings Ltd

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Circuit: Mt Eden 2000
Height: One Tree Point Datum
Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20183-01-EN-250				DRAFT

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Appendix 4

Three Waters Design Report

PROPOSED RESIDENTIAL DEVELOPMENT
AT 131 & 189 THREE MILE BUSH ROAD, WHANGAREI
HURUPAKI SUBDIVISION

THREE WATERS DESIGN REPORT

Project Number: 18733

Date: 24 August 2021

Revision: 0

1 INTRODUCTION

LDE Ltd was engaged by Hurupaki Holdings Limited to provide a report covering the three waters management for the proposed residential development on 131 & 189 Three Mile Bush Road, Whangarei.

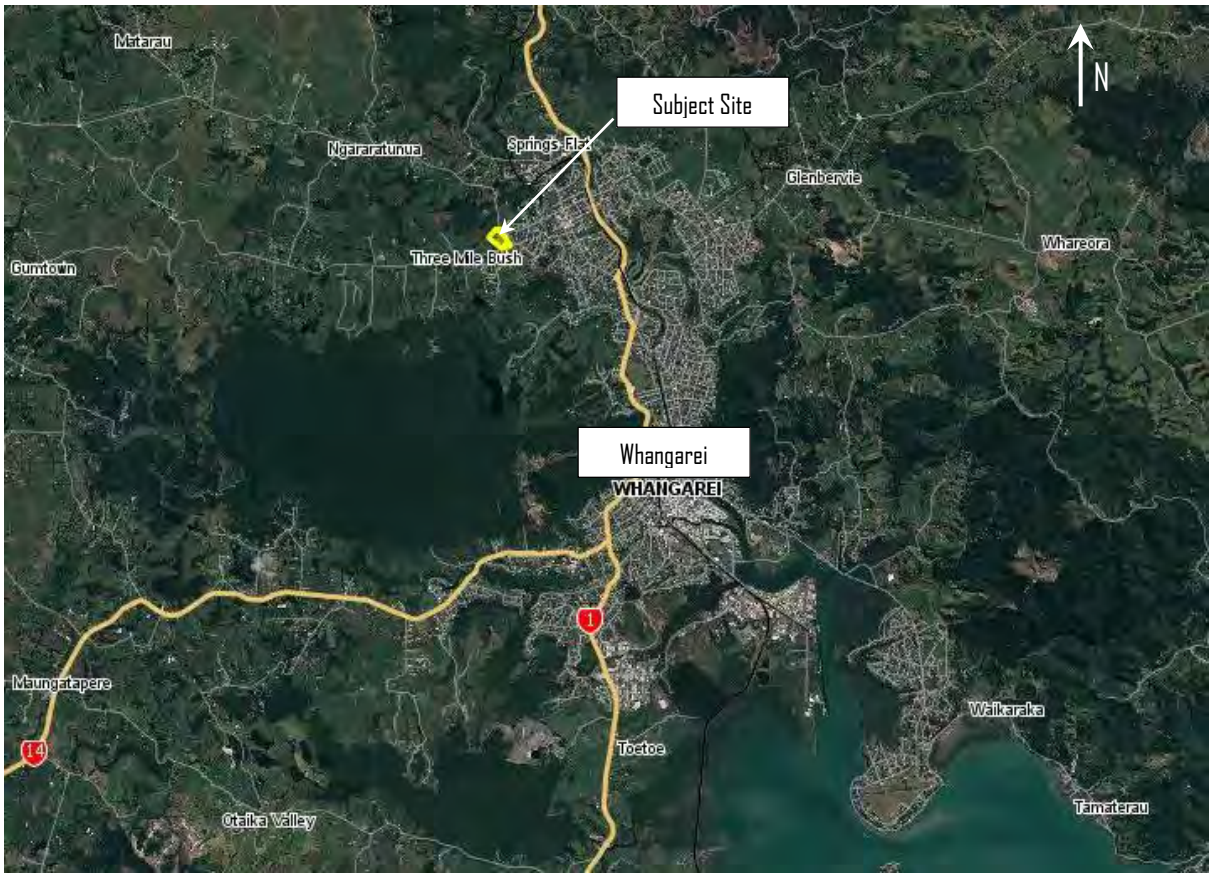


Figure 1 - Site location plan with reference to Whangarei CBD. From Whangarei District Council IntraMaps.

As with any new development water, wastewater and stormwater servicing and management is required.

The water supplies additional demand can be serviced either on the public network or with an onsite water supply which can consist of either an extension of the public system or the use of water tanks or water bores. As this development is to be smaller urban sized lots, an extension of the water network is proposed with wastewater disposal connection to a public system is proposed due to the smaller lot sizes. Smaller lot areas below about 2000m² are not generally suitable for OSW disposal systems as there is generally insufficient land area available to install suitable disposal fields.

With stormwater new impervious areas are created, and these areas require stormwater management devices to be utilised to minimise their impact on the environment. To attenuate runoff for new impervious areas within the proposed site, the pre-development and post-development scenarios were modelled in HEC-HMS software. Additionally, the quality of stormwater runoff from high contaminant generating surfaces such as roads and carparks must be treated before discharge to minimise their impact on the health of the receiving ecosystem.

The design presented in this report is in accordance with Whangarei District Council's and Northland Regional Council's requirements in terms of mitigating stormwater runoff from impervious areas, with the three ponds providing water quality, extended detention, and stormwater attenuation to predevelopment levels for the 2, 10 and 100yr storms, including an allowance for 20% climate change.

2 WATER

Water supply will be an extension of the public water mains into the development. This will provide both water supply to the new dwellings and firefighting water supply for the new dwelling.

The 78 new lots will require the following additional water supply capacity assuming 300ltrs/day/person with 4 people per dwelling.

Peak day demand = 2.0 x PF

- 2.0 x 300(l/day) x 4(people) x 78(lots) = 187,200ltrs/day

Peak hourly demand = 5 x PF/24hrs

- 5 x 300(l/day) x 4(people) x 78(lots)/24(hrs)= 19,500ltrs/hour

Council have advised that until the new reservoir is constructed further along Three Mile Bush Road the water pressure is likely to be less than desirable with some of the lots. The reservoir is located at an elevation of RL220m, with the sections at the rear of the property elevated at RL210m. For the adjacent site (being 115 Three Mile Bush Road) council modelling indicated the water pressure at node 46560 would be approximately 450kPa(46m) head with the development elevation being up to RL190m at its highest point, this modelling indicates that the pressure that could be expected at the proposed developments rear site could drop as low as 250-300kPa, which is a similar elevation level to the properties at the start of Lake Ora Road.

Therefore it is proposed that should council not have upgraded the reservoir (currently expected to be at least 2 years away) then the following could be implemented if necessary for those

dwellings that do not have sufficient water pressure because of the elevation between the reservoir and the new dwellings.

Figure 2

Install a small 5000 litre water tank for each dwelling which is trickle fed off the public water main. The water supply for those affected dwellings would then use this tank in conjunction with a water pump providing the boosted water pressure that most modern desire being unaffected by the low pressure available on the sites.

Alternatively, the dwellings could install larger rain water tanks with a pump and suitable filtration system. (We would recommend at least two 25,000 litre tanks unless there is a low pressure connection to the public system to refill tanks during drier summers and that every lot have a water connection to enable a future connection)

3 WASTEWATER

The wastewater servicing the development will be an extension of the existing public reticulation. The network will connect through the recent adjacent development which has installed a 150 gravity pipeline across the boundary into the proposed development.

As the lots on the northern side of the stream are isolated from the gravity pipe network, it is intended to require individual on site pump stations, likely to be necessary on Lots 65-78, with 24 hours storage to be installed on each lot. These will pump wastewater in individual private lines up to the top of the development into a central manhole serving as the collection point for the individual discharges, which will then drain via gravity into a manhole within the proposed public gravity system.

This will enable both sides of the stream to be serviced and extend the public network as far as practical without the complication of crossing the stream with a pipe bridge for the wastewater. The network will extend across to the cul-de-sac on the proposed plans.

The additional wastewater flows that will be generated by the development are as follows

Dry weather peak daily flow = 2.5 x ADWF

- 2.5 x 200(l/day) x 4(people) x 78(lots) = 156,000ltrs/day

Peak wet weather flow (PWWF) = 5 x ADWF

- 5 x 200(l/day) x 4(people) x 78(lots) = 312,000ltrs/day

Council have confirmed that the waste water network has sufficient capacity for this additional level of development.

4 HYDROLOGICAL ASSESSMENT

4.1 Pre-Development

The subject site, shown in the aerial photo in Figure 3, has an area of approximately 11ha which is currently covered in grass with some trees and is used for grazing. The site comprises of a central gully with moderate side slopes either side (11-16 degrees). The southern end of the site is relatively flat. The northern side of the site has steep scoria cone slopes (approximately 27 degrees).

Figure 3 - Aerial photo of sites (red) with the adjacent flow paths indicated in blue. Sourced WDC GIS.

4.2 Post-Development

It is proposed to subdivide the site into residential lots with majority of the areas between 550m^2 and 1000m^2. A loop road with foot paths will provide access to and around the subdivision. The proposed scheme plan can be seen in Figure 4 below.

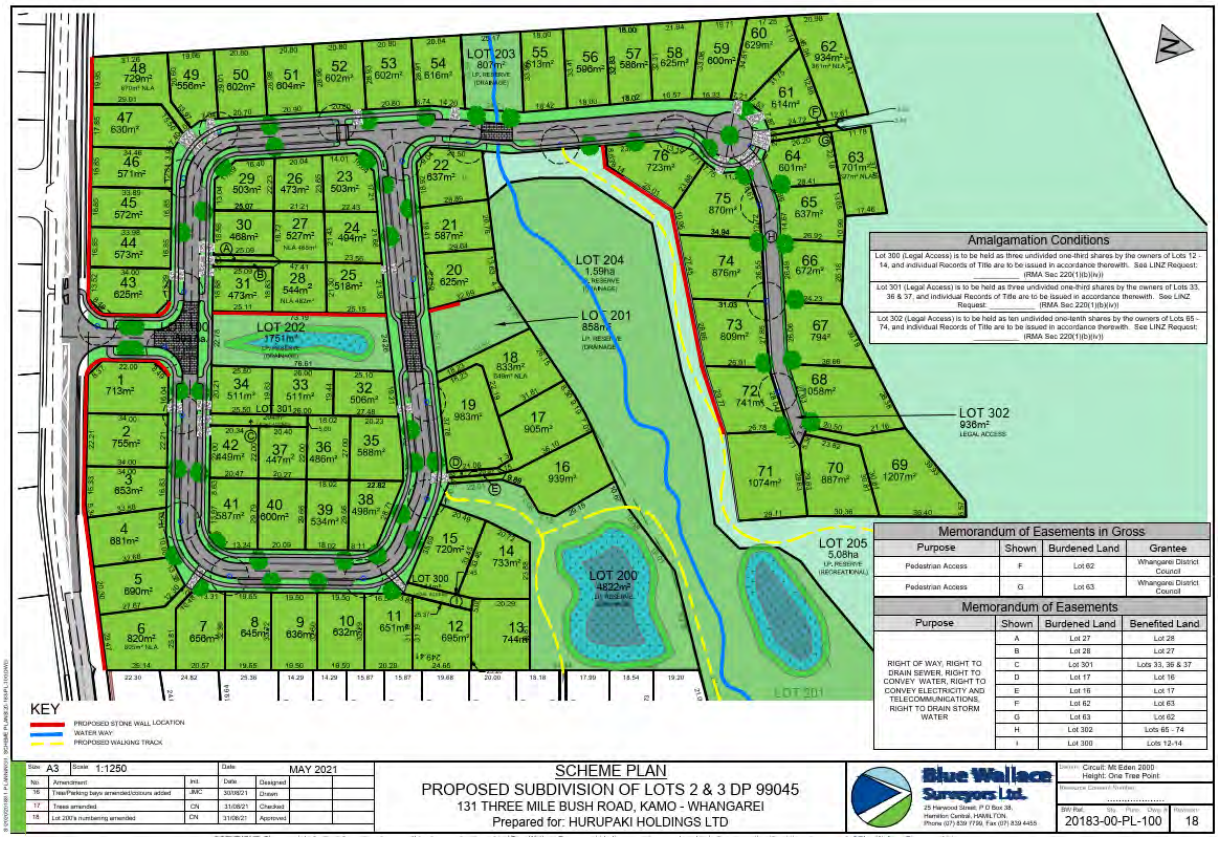


Figure 4 - Proposed scheme plan.

It is proposed to construct 3 stormwater ponds within the subdivision to provide attenuation and water quality treatment for runoff from the development. To achieve this, the ponds have been designed to meet the requirements of Auckland Council's GD01. Additionally approximately 9060m2 of catchment area will be treated in the front pond, reducing the flows through the neighbouring stormwater pond providing additional stormwater benefits which have not been modelled.

The proposed lots have been divided into impervious and pervious components with 60% of the lot area being nominated as impervious and the remaining 40% pervious. The road reserve area has used 85% impervious and 15% pervious. The steep cone area on the northern side of the site will be revegetated providing a small reduction in the total runoff from the site which has been considered within the design and managing flows to below predevelopment levels. Refer to Figure 4 below for catchment areas and pond locations.

Table 1 –Pre and Post Development catchment areas and curve numbers.

Pre-Development		
Description	Curve Number (CN)	Area (m^2)
Grassed areas - pervious	70	69, 875

Post Development		
Description	Curve Number (CN)	Area (m^2)
Residential Lots - Impervious	98	33,484
Residential Lots - Pervious	70	22,323
Road Reserve (Road, Footpaths, Berms)	98	69,875
Revegetated hillside	64	40,093

Catchments C and D are assumed to be connected into the pond via the reticulated networks but not all flows, specifically being those from the sites pervious areas would be captured and flow into the ponds, so for the purpose of the modelling these areas are considered unmitigated even though some of these flows would be routed through the stormwater ponds.

4.3 Soil Classification

From the LDE geotechnical investigation of the site, the site is underlain by Pleistocene basalt lava flows from the Kerikeri Volcanic Group which is described as clay and silt. For the purpose of stormwater modelling, we have assessed these soils beneath the site as being between Soil Class C and B soils as defined in the Whangarei Environmental Engineering Standards. The site is underlain by pockets of very high soakage areas, and others with slow draining soils, so a number of CN70 was chosen for the site in its predevelopment state as grazed pasture.

5 Council Requirements

5.1 Northland Regional Council SW requirements

Water and Soil Plan

8.3.5 Stormwater

During dry weather, contaminants such as dirt, oil, grease, and heavy metals tend to accumulate on the streets, footpaths, carparks, roofs and similar hard surfaces within urban areas. When it rains, the stormwater carries the accumulated contaminants with it into the stormwater drainage systems which in turn flow directly into nearby streams, rivers or estuaries. Such urban stormwater runoff receives little or no treatment before being discharged into natural water bodies. Heavy metals have been found in the Upper Whangarei Harbour sediments that exceed the standards recommended for aquatic life.

These contaminants will remain in the receiving environment and will accumulate over time as stormwater discharges continue. Stormwater discharges are generally authorised by discharge permits based on a stormwater management plan. Stormwater management plans are widely

used in terms of the design of the stormwater system. However, these have focused on the capacity of the stormwater system to accept runoff, with little or no attention given to stormwater quality. The plans, however, provide a useful basis upon which to institute quality controls which are available and used both in New Zealand and overseas.

8.5.6 Issues Relating to Stormwater Discharges

1. The levels of heavy metals, sediments and other contaminants, which are potentially harmful to aquatic life, in stormwater runoff.
2. The lack of attention to quality controls in stormwater system design.
3. The contribution of runoff from industrial sites to contaminant loadings in urban stormwater, including those from ancient spills.
4. The deliberate or careless disposal of oil and other household and commercial wastes to stormwater systems.

8.17 Specific Policies for Stormwater Diversions and Discharges

1. To manage the diversion and discharge of stormwater in a way that provides safeguards against flooding and maintains or enhances water quality.
2. To require the inclusion of water quality controls as far as practicable in existing stormwater management systems that are known to be causing concentrations of contaminants within the receiving environment that are in excess of applicable water quality and/or sediment quality guidelines.
3. To manage the diversion and discharge or stormwater in urban areas through long duration resource consents that are supported by comprehensive stormwater management plans.
4. To promote best practice for stormwater management design, including low impact options.
5. To promote stormwater management practices that avoid or minimise the discharge of contaminants from industrial and trade premises into stormwater drainage systems.
6. To encourage activities to operate in accordance with industry standards and/or environmental guidelines where these are intended to avoid, remedy or mitigate the adverse effects of stormwater contamination.
7. To permit the discharge of stormwater from hazardous substance storage areas and industrial or trade premises if sufficient safeguards are adopted to avoid, remedy or mitigate the potential adverse effects associated with stormwater contamination.
8. To promote public awareness of the adverse effects of stormwater discharges on natural waters, including awareness of the adverse effects of household waste introduced into stormwater systems.

5.2 Proposed Northland Regional Plan July 2021

C.4.1 Land drainage and flood control

The proposed development is considered a permitted activity based on the following rules, with the intention to mitigate the 100yr storm to avoid any adverse effects downstream.

C.4.1.1 Land drainage – permitted activity

The damming, diversion and discharge of water associated with land drainage are permitted activities, provided:

1) the activity complies with all relevant conditions of Rule C.4.1.9 Land drainage and flood control general conditions, and

2) any resulting land subsidence or slumping does not cause adverse effects on structures or infrastructure on other property, and

3) the discharge is in or from the same catchment in which the water would naturally flow, and

4) a new drain is not constructed within 15 metres of an existing wastewater disposal area.

C.4.1.9 Land drainage and flood control general conditions

General conditions apply to activities when referred to in the rules of Section C.4.1.

1) There is no adverse flooding, erosion or over-drainage effects on other property.

2) The activity does not alter the course of a lake or continually or intermittently flowing river.

3) New land drainage does not occur within 50 metres of any natural wetland.

4) Drainage does not cause any change to the seasonal or annual range in water level of a natural wetland to an extent that may adversely affect the wetland's natural ecosystem.

5) No vegetation, soil or other debris generated from the activity is placed in a position where it may be carried into a river or natural wetland, lake or the coastal marine area.

6) There is no damage to a flood defence or any other authorised structure.

7) Fish passage is maintained, unless an existing authorisation provides otherwise, or temporary works to enable repair and replacement works are being carried out.

8) Eels, fish (other than pest fish), kōura (freshwater crayfish) and kākahi (freshwater mussels) unintentionally removed during mechanical clearing of drainage channels are returned to the drainage channel as soon as practicable, but no later than one hour after their removal.

9) Refuelling of machinery does not take place in the bed of a river or lake.

10) Where a discharge from land drainage enters an outstanding freshwater body or coastal water beyond the zone of reasonable mixing, the discharge does not:

a) result in any conspicuous oil or grease films, scums or foams, or floatable or suspended material except where caused by natural events in the receiving water, and

b) cause the pH of the receiving water to fall outside the range of 6.5 to 9.0 (except where

caused by natural events, or when natural background levels fall outside that range), and

c) cause any emission of objectionable odour in the receiving water, and

d) cause any conspicuous change in colour or visual clarity of the receiving water, and

e) cause the natural temperature of the receiving water body to be changed by more than three degrees Celsius.

11) Any discharge of sediment associated with repair and maintenance activities does not occur for more than five consecutive days and must not occur for more than 12 hours on any one day.

C.6.4 Stormwater discharges

The proposed development is considered a permitted activity based on the following rules

C.6.4.1 Stormwater discharges from a public stormwater network – permitted activity

The diversion and discharge of stormwater from a public stormwater network into water or onto or into land where it may enter water is a permitted activity, provided:

1) the discharge is not from a public stormwater network servicing an urban area listed in *Table 10: Urban areas*, and

2) the diversion and discharge does not cause permanent scouring or erosion of the bed of a water body at the point of discharge, and

3) the discharge is not within 100 metres of a geothermal surface feature, and

4) the discharge does not contain contaminants used, stored or generated in trade or industrial premises, and

5) the discharge does not contain more than 15 milligrams per litre of total petroleum hydrocarbons, and

6) the discharge does not cause any of the following effects in the receiving waters beyond the zone of reasonable mixing:

a) the production of conspicuous oil or grease films, scums or foams, of floatable or suspended materials, or

b) a conspicuous change in the colour or visual clarity, or

c) an emission of objectionable odour, or

d) the rendering of fresh water unsuitable for consumption by farm animals, or

e) the rendering of freshwater taken from a mapped priority drinking water abstraction point (refer I Maps | Ngā mahere matawhenua) unsuitable for human consumption after existing treatment.

C.6.4.2 Other stormwater discharges – permitted activity

The diversion and discharge of stormwater into water or onto or into land where it may enter water from an impervious area or by way of a stormwater collection system, is a permitted activity, provided:

1) the discharge or diversion is not from:
    a) a public stormwater network, or
    b) a high-risk industrial or trade premises, and
2) the diversion and discharge does not cause or increase flooding of land on another property in a storm event of up to and including a 10 percent annual exceedance probability, or flooding of buildings on another property in a storm event of up to and including a one percent annual exceedance probability, and
3) where the diversion or discharge is from a hazardous substance storage or handling area:
    a) the stormwater collection system is designed and operated to prevent hazardous substances stored or used on the site from entering the stormwater system, or
    b) there is a secondary containment system in place to intercept any spillage of hazardous substances and either discharges that spillage to a trade waste system or stores it for removal and treatment, or
    c) if the stormwater contains oil contaminants, the stormwater is passed through a stormwater treatment system designed in accordance with the *Environmental Guidelines for Water Discharges from Petroleum Industry Sites in New Zealand (Ministry for the Environment, 1998)* prior to discharge, and
4) where the diversion or discharge is from an industrial or trade premises:
    a) the stormwater collection system is designed and operated to prevent any contaminants stored or used on the site, other than those already controlled by condition 3) above, from entering stormwater unless the stormwater is discharged through a stormwater treatment system, and
    b) any process water or liquid waste stream on the site is bunded, or otherwise contained, within an area of sufficient capacity to provide secondary containment equivalent to 100 percent of the quantity of any process water or liquid waste that has the potential to spill into a stormwater collection system, in order to prevent trade waste entering the stormwater collection system, and
5) the diversion or discharge is not into potentially contaminated land, or onto potentially contaminated land that is not covered by an impervious area, and
6) the diversion and discharge does not cause permanent scouring or erosion of the bed of a water body at the point of discharge, and
7) the discharge does not contain more than 15 milligrams per litre of total petroleum hydrocarbons, and

8) the discharge does not cause any of the following effects in the receiving waters beyond the zone of reasonable mixing:

a) the production of conspicuous oil or grease films, scums or foams, of floatable or suspended materials, or

b) a conspicuous change in the colour or visual clarity, or

c) an emission of objectionable odour, or

d) the rendering of fresh water unsuitable for consumption by farm animals, or

e) the rendering of fresh water taken from a mapped priority drinking water abstraction point (refer I Maps | Ngā mahere matawhenua) unsuitable for human consumption after existing treatment.

C.8.3 Earthworks

Earthworks to construct the stormwater ponds (damming), proposed subdivision and road network are considered a controlled activity based on the following rules and will be managed in accordance with GD005 current guidelines.

C.8.3.1 Earthworks – permitted activity

Earthworks outside the bed of a river, lake, wetland and the coastal marine area, and any associated damming and diversion of stormwater and discharge of stormwater onto or into land where it may enter water, are permitted activities provided:

1) the area and volume of earthworks at a particular location or associated with a project complies with the thresholds in Table 13:

Table 13: Permitted activity earthworks thresholds

Table 13: Permitted activity earthworks thresholds

Location	Earthworks thresholds
Within 10m of a natural wetland, the bed of a continually or intermittently flowing river or lake	200 square metres of exposed earth at any time, and 50 cubic metres of moved or placed earth in any 12-month period.
Catchment of an outstanding lake	2500 square metres of exposed earth at any time.
Erosion-prone land	2500 square metres of exposed earth at any time.
High-risk flood hazard area	50 cubic metres of moved or placed earth in any 12-month period.
Coastal riparian and foredune management area	Excluding for coastal dune restoration, 200 square metres of exposed earth at any time.
Flood hazard area	100 cubic metres of moved or placed earth in any 12-month period.
Other areas	5000 square metres of exposed earth at any time.

2) the discharge is not within 20 metres of a geothermal surface feature, and

3) except for coastal dune restoration activities, good management practice erosion and sediment control measures equivalent to those set out in the *Erosion and Sediment Control Guidelines for Land Disturbing Activities in the Auckland Region 2016 (Auckland Council Guideline Document GD2016/005),* are implemented for the duration of the activity, and

4) batters and side castings are stabilised to prevent slumping, and

5) exposed earth is stabilised upon completion of the earthworks to minimise erosion and avoid slope failure, and

6) earth and debris are not deposited into, or in a position where they can enter, a natural wetland, a continually or intermittently flowing river, a lake, an artificial watercourse, or the coastal marine, and

7) the earthworks activity does not:

a) reduce the height of a dune crest in a coastal riparian and foredune management area, except where dunes are recontoured to remove introduced materials or to remediate dune blow-outs as part of coastal dune restoration work, or

b) exacerbate flood or coastal hazard risk on any other property, or

c) create or contribute to the instability or subsidence of land on other property, or

d) divert flood flow onto other property, and

8) any associated damming, diversion and discharge of stormwater does not give rise to any of the following effects in the receiving waters beyond the zone of reasonable mixing:

a) any conspicuous change in colour or visual clarity, or

b) the rendering of fresh water unsuitable for consumption by farm animals, or

c) contamination which may render freshwater taken from a mapped priority drinking water abstraction point (refer I Maps | Ngā mahere matawhenua) unsuitable for human consumption after existing treatment, and

9) information on the source and composition of any clean fill material and its location within the disposal site are recorded and provided to the Regional Council on request, and

10) the Regional Council's Compliance Manager is given at least five working days' notice (in writing or by email) of any earthworks activity being undertaken within a high-risk flood hazard area, flood hazard area, where contaminated land will be exposed, or in sand dunes within a coastal riparian and foredune management area.

C.8.3.2 Earthworks – controlled activity

Earthworks outside the bed of a river or lake, wetland and the coastal marine area that exceed 5000 square metres of exposed earth at any time at a particular location or associated with a project area, and any associated damming and diversion of stormwater and discharge of stormwater onto or into land where it may enter water, are controlled activities, provided the earthworks are not located:

1) within 10 metres of a natural wetland, the bed of a continually or intermittently flowing river or lake, or

2) within 10m of an īnanga spawning site, or

3) in a catchment of an outstanding lake, or

4) on erosion-prone land, or

5) in a flood hazard or high-risk flood hazard area, or

6) in the coastal riparian and foredune management area.

C.8.3.3 Earthworks in a flood hazard area – controlled activity

Earthworks in a flood hazard area that involve more than 50 cubic metres, but not more than 1000 cubic metres, of earth being moved or placed in any 12-month period, and any associated damming and diversion of stormwater and discharge of stormwater onto or into land where it may enter water, are controlled activities.

C.8.3.4 Earthworks – discretionary activity

Earthworks outside the bed of a river or lake, a wetland, or the coastal marine area, and any associated damming and diversion of stormwater and discharge of stormwater onto or into land where it may enter water, that are not a permitted or controlled activity under another rule in section C.8.3 of this Plan.

5.3 Whangarei District Council Three Water Management

Three Waters Management implements provisions to manage the impact of land use and subdivision on water resources, namely stormwater, wastewater and water supply:

- Stormwater systems manage the quality and quantity of stormwater runoff to minimise flood damage and to protect people, land, infrastructure and the receiving environment from adverse effects.
- Wastewater systems collect and convey wastewater for subsequent treatment and disposal. This will normally consist of either connection to the reticulated wastewater network, or on-site treatment and disposal (either individual or communal in nature).
- A water supply is necessary to ensure that a sufficient quality and quantity of water is available to all properties.

Whangarei district council three waters policy objectives are as follows:

1. TMW-01 Connections - Ensure that connection to reticulated three waters networks is provided for within a reticulated area.

2. TWM-O2 – Reticulated Networks - Maintain the effectiveness, efficiency and sustainability of reticulated three waters networks.
3. TWM-O3 – Integrated Infrastructure - Plan and provide for three waters infrastructure in an integrated and comprehensive manner.
4. TWM-O4 – Private Systems - Ensure that private three waters systems are provided where connections are not provided to reticulated networks
5. TWM-O5 – Adverse Effects - Minimise adverse effects from stormwater and wastewater on people, property, infrastructure, the receiving environment and cultural values.

TWM-REQ1

All Zones Any consent application where connection will be provided to reticulated three waters network(s) shall include an assessment detailing (where relevant):

a. Provision made for connections to reticulated three waters networks.
    - See Table 2
b. Confirmation that sufficient capacity exists within reticulated three waters networks to service the proposed development.
    - See Table 2, noting that water supply may require on site tanks on some of the more elevated lots to enable sufficient pressure until the new proposed reservoir is constructed.
c. Any upgrades and/or extensions to existing reticulated three waters infrastructure that are proposed or necessary.
    - See Table 2
d. Consideration of the elevation of each proposed lot to establish a service envelope where that lot is able to be serviced without the need for on-site pumping. Reference shall be made to any part of the lot that is outside the service envelope.
    - See Table 2, noting that individual on site sewer pump stations will be required for some of the lots on the northern side of the stream, expected to be Lots 65-76.
e. Land and infrastructure to be vested in the Council.
    - See Table 2

TWM-REQ3

Any application under rules TWM-R6 – R7 shall include an Integrated Three Waters Assessment which details:

a. How the proposal is consistent with the recommendations, measures and targets of any relevant Council approved Catchment Management Plan
    - The proposed stormwater network and three ponds provide water quality treatment and stream/peak flow protection which is consistent with the wider catchment management plan. See section 6 and plans for further details.
b. An assessment of any potential effects (including cumulative effects) of the development in relation to the site, any adjoining sites, the wider catchment and cultural values.
    - The proposed stormwater network and three ponds provide water quality treatment and stream/peak flow protection which mitigates the effects of the development. See section 6 and plans for further details.
c. Information on how wastewater (including trade waste) will be managed to minimise any impacts on the reticulated network or from on-site discharges.
    - A public wastewater network extension is proposed, with each lot connecting to the public network through this mitigating any effects. The wastewater network has sufficient capacity for this extension. See Table 2 and plans for further details.
d. The provision of water supply, wastewater disposal and/or stormwater disposal reticulation through the proposed development or subdivision to a standard necessary to provide adequate reticulation to adjacent land zoned for reticulated development.
    - A public stormwater, waste water and water supply is proposed.
e. Any low impact design, green infrastructure or water sensitive design solutions that are proposed, what benefits these will provide, and how they will be operated and maintained to ensure ongoing water efficiency benefits.
    - Three stormwater ponds are proposed which will provide the necessary stormwater mitigation, additionally these will also provide amenity value being incorporated into a series of walkways, recreational areas.
f. Consideration of opportunities to integrate three waters infrastructure and informal or passive recreation opportunities.
    - Three stormwater ponds are proposed which will provide the necessary stormwater mitigation, additionally these will also provide amenity value being incorporated into a series of walkways, recreational areas.
g. Any proposed conditions.
    - Lots 65-76 will require individual private sewer pump stations to be installed on each lot discharging into the proposed public network extension.

Whangarei district council policies are as follows

Table 2

Policies	Explanation	Development Assessment
TWM-P1 – Three waters Infrastructure	To ensure that three waters resources are appropriately managed by requiring subdivision and development to provide three waters infrastructure that: • Is coordinated, integrated and compatible with the existing infrastructure and capacities. • Enables the existing network to be expanded or extended to adjacent land where that land is suitable for future reticulated development.	The proposed stormwater ponds will limit peak flows to predevelopment level for the 2, 10 and 100yr storm events, with a 20% allowance for climate change. They will include an extended detention volume to address erosion effects on the stream network that they discharge into and provide water quality treatment for the roads within the development, based on 1/3rd of the 2yr storm.
TWM-P2 – Reticulated Areas	To sustainably and efficiently manage three waters resources by avoiding private three waters systems where connection to the reticulated network is practicable or where failure to connect may compromise the future extension of the reticulated network.	The development will provide stormwater, water and wastewater connections for each lot. Water and wastewater will connect to the existing public systems, with additional public network extensions undertaken as part of the development. Stormwater will discharge into a new public SW network that discharges into the stream. There will be three outlet points one from each of the three ponds, which drain to similar locations as they presently do.
TWM-P3 – Capacity	To manage the scale and design of subdivision and development where connection is provided to reticulated three waters networks	The water and wastewater networks will be extended to service the development. The new public stormwater system including the

	to ensure that there is sufficient capacity in the reticulated networks, and where necessary require upgrades and/or extensions to the reticulated networks.	proposed three SW ponds, will mitigate effects for up to a 1% AEP. This will minimise additional effects on downstream areas which have flooding issues within the stream wider catchment.
TWM-P4 – Future Development	To ensure that reticulated three waters infrastructure is designed to accommodate planned and future development.	The development is on the boundary of the urban development area. It is currently proposed to provide a Ø150 wastewater connection to the neighbouring lot upstream of the property which is zoned for urban development. The water network already extends past the boundary of the proposed development so it is not considered necessary to extend this network other than to service the proposed development. The stream extends into the upstream property and as such no extension of the proposed stormwater network is considered necessary.
TWM-P5 – Vested Assets	To require vested assets, and connections to vested assets, to be designed and constructed in a manner that protects the ongoing operation, maintenance and upgrading of that asset.	All three waters infrastructure will be designed in accordance with relevant councils and NZ engineering standards and will be vested to council as part of the development.
TWM-P6 – Private Systems	To ensure that where connection to a reticulated three waters network is not available or	The lots to the rear of the properties will require individual on-site wastewater pump stations with 24hrs storage. These will each have their

	practicable that provision can be made for: 1. A water supply. 2. The treatment, disposal, and where appropriate attenuation, of stormwater in a way that does not lead to significant adverse effects on or off site. 3. Management of wastewater via: a. An on-site wastewater treatment system; or b. Approval to connect to a private wastewater system.	own 25mm rising main which extends up the right of way and discharges into a manhole which collects all the discharges and gravity feeds into the proposed public wastewater system. The water, stormwater and gravity wastewater systems will be vested to council.
TWM-P7 – Flooding	To reduce the risk of flood hazards or increased upstream and downstream flood levels resulting from stormwater discharges.	Flows from the development will be reduced to below predevelopment levels for up to a 1% AEP, and will include a 20% rainfall increase for climate change. Stormwater flows within the development will include both a piped reticulation system and secondary flow paths to manage stormwater flows up to a 1% AEP.
TWM-P8 – Integrated Three Waters Assessments	To require Integrated Three Waters Assessments for large scale developments to: 1. Manage three waters in an integrated and comprehensive manner. 2. Enable and recognise the benefits of green infrastructure and low	Three stormwater ponds will be installed as part of the development which will protect the receiving environment and also become part of the developments walkways and park areas creating a great amenity in the area. The water and wastewater will be connected to the public systems to mitigate the effects of more intensive urban

	impact and water sensitive design.	development. As part of the development it is planned to plant the steeper areas of the hillside, creating a bush reserve with walking tracks which will also reduce runoff from this steeper hillside area.
TWM-P9 – Infrastructure	To require subdividers and developers to meet the costs of any upgrades or extensions of reticulated three waters infrastructure which are attributed to the impacts of the subdivision or development.	The subdivision will install the infrastructure necessary to service the proposed development as part of its construction. With the exception of the councils planned water reservoir, no network upgrades are required as part of the development. A solution for those properties that are affected by the lower water has been proposed within this report, which can be either a short term option or a long term one.

With reference to Whangarei District Council's engineering standards, ponds should be designed generally in accordance with TP10/GD01, which are Auckland Council's standards for stormwater design for development and are considered a suitable set of guidelines for Northland with similar catchments and geology.

The design the stormwater ponds generally requires the following:

- An extended detention volume of 34.5mm for the site to be released over a 24hr period, This slow release volume is to minimise stream erosion and increase water quality in the pond. In accordance with the technical guidance on pond design that GD01 is based upon (TR2013-024) a 70mm (to minimise blockage risks) or larger orifice has been used to manage these flows.
- The ponds are designed with capacity to mitigate post development flows to equal or less than the pre-development 24 hour 2, 10 and 100 year storm events to prevent the development increasing the flooding risks downstream.
- The Whangarei District Council's engineering standards also require new developments to apply a 20% increase to the design storm runoff figures to address

future increases resulting from climate change effects this has been incorporated into the post development model.

6 PROPOSED STORMWATER MITIGATION METHODOLOGY

6.1 Proposed Devices

Due to the constraints of the site, it is proposed to mitigate the effects of the development using the following devices:

- Three stormwater ponds have been designed to collect the stormwater runoff from impervious and pervious areas of each lot and the road reserve. The ponds have been designed with the necessary outlet configuration to mitigate the 2yr, 10yr and 100yr storm events to equal or less than pre-development rates, which ensures that it does not affect downstream areas with any increases in flow rates. The water will discharge from these ponds into the Waitaua stream catchment into the headwaters of the catchment.
- Additional to the 2,10 and 100yr storm event mitigation an extended detention volume has been allowed for in the pond with a 24hr drain down period designed in accordance with Auckland Council's GD01. The extended detention reduces the stream erosion and increases water quality in the pond for the runoff from all the individual lots and road reserve areas and will help improve the overall quality of the stream the pond discharges to.
- Approximately 4 hectares of hillside planting is proposed as part of the development on the steeper slopes. This will improve water quality, and reduce runoff from the steeper hillside area. This also provides a slight improvement for the overall flows from the site which has been added into the model.
- The full water quality treatment volume for all areas of the development is provided within each of the ponds. A forebay is included in the pond designs aid maintenance of each pond. The ponds are also likely to drain completely through soakage during the drier periods, as the stream only flows during heavier rainfall events, remaining dry for a lot of the drier summer period.

6.2 Modelling Inputs

A HEC-HMS model was developed based on a SCS Type 1A storm profile determined from HIRDS V4 rainfall data for the site, and the hydrological parameters outlined in Table 1 above.

A nested storm was also run through the ponds as a check which contains all the storm durations from a 10min storm through to the 24hr storm event.

A time of concentration of 10 minutes was used due to the small catchment lengths, with the stream located in the centre of the development.

The rainfall data was increased by 20% in the post development scenario to account for the increases in storm intensity and frequency as a result of climate change.

6.3 Results

Table 3 below shows the pre-development and post-development peak flow rates produced by the proposed design. The full output tables from the HEC-HMS modelling are appended to this report.

Table 3 - Pre and Post Development peak flow rates from the development.

Storm Event (ARI)	Pre Development (m^3/s)	Bush planting improvements (m^3/s)	Allowable Post Development (m^3/s)	Post Development (m^3/s)
2yr	0.282	0.026	0.308	0.308
10yr	0.510	0.039	0.549	0.549
100yr	1.022	0.057	1.079	0.952
100yr check (All Nested storms)	1.464			1.281

The results show that the proposed design attenuates post-development peak flows to equal or less than the pre-development peak flows including the overall improvements from the hillside planting.

If impermeable areas greater than those analysed in this design are proposed, then a revision of the design presented in this report will be required.

6.4 Stormwater Device Design

6.4.1 Front Pond

- The footprint of the permanent pond water level covers an area of approximately 2260m^2 at RL173.6m, with the depth being approximately 4.8m. The base of the pond will be at RL168.7m.
- The volumes and elevations for the various storm event storage are summarised in Table 4 below.

Table 4 - Pond volumes and respective elevations for storm event storage.

Storage Event	Elevation (RL)	Cumulative Pond Volume (m^3)
Dead Storage	171.2	740
Extended Detention	172	1420
2 year Live Storage	172.5	2260
10 year Live Storage	172.7	2530
100 year Live Storage	173.2	3140
Total Pond Capacity	173.6	3600

- The pond will incorporate a 1m wide bench as a safety precaution to allow anyone to exit the water should anyone inadvertently enter the pond at the permanent water level.
- The dead storage volume (740 m^3) will provide water quality treatment most of which will slowly drain through soakage in the drier months.
- A low flow outlet will control the permanent pond levels around RL171.2m, with the extended detention volume being above this level.
- The top of the pond bank is a 3m width to allow for maintenance access at RL173.5m, this allows 0.3m freeboard from the 100yr storm event level. Additionally, the pond has a 3m wide emergency spillway into the stream installed at 173.25m. This is capable of discharging events in the unlikely event that the ponds emergency spillway is blocked.
- The outfall structure of the pond will have outlets as shown in Table 5 below. A drawing of the outlet structure and pond dimensions is appended to this report.

Table 5 - Pond outlet structure summary.

Outlet	Elevation (RL)	Description
Outlet 1	171.18	Ø70mm orifice outlet
Outlet 2	172	Ø300mm orifice outlet
Emergency Spillway	173.25	Manhole overflow

- A forebay with a minimum volume of 110 m^3 shall be provided at the inlet to the pond to capture coarse sediments entering the pond. Access shall be provided to the forebay such that sediments can be cleaned out.
- A 3m wide access track shall be formed around the top of the pond down with access onto this track via a shared concreted accessway at a maximum grade of 1:4 which will also serve as the overland flow path into the pond.
- A capped 150mm PVC outlet will be installed at the base of the pond discharging into the outlet manhole, this outlet is to be only used if de-watering the pond is required for maintenance purposes.
- The pond will be grassed upon completion and the grass will provide additional water quality treatment as the lower water levels in the pond soak away, which we expect to happen over drier periods as testing indicates that soakage rates where the scoria pockets are exposed are in excess of 200mm/hr, reducing to mod/slow draining in soils where these pockets are not exposed.

6.4.2 **Middle Pond**

- The footprint of the permanent pond water level covers an area of approximately 675m^2 at RL196.5m, with the depth being approximately 2.0m. The base of the pond will be at RL194.5m.
- The volumes and elevations for the various storm event storage are summarised in Table 6 below.

Table 6 - Pond volumes and respective elevations for storm event storage.

Storage Event	Elevation (RL)	Cumulative Pond Volume (m^3)
Dead Storage	195.5	120
Extended Detention	195.7	220
2 year Live Storage	195.75	230
10 year Live Storage	195.8	270
100 year Live Storage	196.2	450
Total Pond Capacity	196.5	615

- As the pond is only pond being only 10-12m in width, has a normal water depth of 1m or less and side slopes 1:3, a safety bench is not proposed as the surrounding land above pond crest is gently sloping in most locations.
- The dead storage volume (120 m^3) will provide water quality treatment most of which will drain completely through soakage in the drier months.

- A low flow outlet will control the permanent pond levels around RL195.5m, with the extended detention volume being above this level.
- The top of the pond bank is a at RL196.5m, this allows 0.3m freeboard from the 100yr storm event level with the surrounding areas gently sloping towards the pond along most of the embankment. Additionally, the pond will have a 2m wide emergency spillway into adjacent installed at 196.25m. This is capable of discharging events in the unlikely event that the ponds outlets are blocked.
- The outfall structure of the pond will have outlets as shown in Table 7 below. A drawing of the outlet structure and pond dimensions is appended to this report.

Table 7 - Pond outlet structure summary.

Outlet	Elevation (RL)	Description
Outlet 1	195.5	Ø70mm orifice outlet
Outlet 2	195.7	Ø200mm orifice outlet
Emergency Spillway	196.25	Manhole overflow

- A forebay with a minimum volume of 20 m^3 shall be provided at the inlet to the pond to capture coarse sediments entering the pond. Access shall be provided to the forebay such that sediments can be cleaned out.
- A 3m wide access track shall be formed around the top of the pond down with access onto this track via a shared concreted accessway at a maximum grade of 1:4 which will also serve as the overland flow path into the pond.
- A capped 150mm PVC outlet will be installed at the base of the pond discharging into the outlet manhole, this outlet is to be only used if de-watering the pond is required for maintenance purposes.
- The pond will be grassed upon completion and the grass will provide additional water quality treatment as the lower water levels in the pond soak away, which we expect to happen over drier periods as testing indicates that soakage rates where the scoria pockets are exposed are in excess of 200mm/hr, reducing to mod/slow draining in soils where these pockets are not exposed.

6.4.3 **Rear Pond**

- The footprint of the permanent pond water level covers an area of approximately 1400m^2 at RL168.5m, with the depth being approximately 3.7m. The base of the pond will be at RL164.8m.

- The volumes and elevations for the various storm event storage are summarised in Table 8 below.

Table 8 - Pond volumes and respective elevations for storm event storage.

Storage Event	Elevation (RL)	Cumulative Pond Volume (m^3)
Dead Storage	166.8	390
Extended Detention	167.4	680
2 year Live Storage	167.7	960
10 year Live Storage	167.9	1140
100 year Live Storage	168.2	1370
Total Pond Capacity	168.5	1620

- The pond will incorporate a 1m wide bench as a safety precaution to allow anyone to exit the water should anyone inadvertently enter the pond at the permanent water level.
- The dead storage volume (390 m^3) will provide water quality treatment most of which will slowly drain through soakage in the drier months.
- A low flow outlet will control the permanent pond levels around RL166.8m, with the extended detention volume being above this level.
- The top of the pond bank is a 3m width to allow for maintenance access at RL168.5m, this allows 0.3m freeboard from the 100yr storm event level. Additionally, the pond has a 3m wide emergency spillway into the stream installed at 168.25m. This is capable of discharging events in the unlikely event that the ponds emergency spillway is blocked.
- The outfall structure of the pond will have outlets as shown in Table 9 below. A drawing of the outlet structure and pond dimensions is appended to this report.

Table 9 - Pond outlet structure summary.

Outlet	Elevation (RL)	Description
Outlet 1	166.8	Ø70mm orifice outlet
Outlet 2	167.4	Ø250mm orifice outlet
Outlet 3	167.9	Ø300mm orifice outlet
Emergency Spillway	168.2	Manhole overflow

- A forebay with a minimum volume of 60 m^3 shall be provided at the inlet to the pond to capture coarse sediments entering the pond. Access shall be provided to the forebay such that sediments can be cleaned out.
- A 3m wide access track shall be formed around the top of the pond.

- A capped 150mm PVC outlet will be installed at the base of the pond discharging into the outlet manhole, this outlet is to be only used if de-watering the pond is required for maintenance purposes.
- The pond will be grassed upon completion and the grass will provide additional water quality treatment as the lower water levels in the pond soak away, which we expect to happen over drier periods as testing indicates that soakage rates where the scoria pockets are exposed are in excess of 200mm/hr, reducing to mod/slow draining in soils where these pockets are not exposed.

7 STREAM ROAD CROSSING

The subdivisions proposed road crosses the stream at the upper end of the development where the current driveway crossing culvert is installed. A new box culvert will be installed that accommodates the 10yr flows (2m3/s) with the 100yr flows (4.1m3/s) overtopping the road. The box culvert will be partially buried beneath the stream bed to allow the base of the culvert to mimic natural stream bed conditions and allow the passage of fish etc (even though there is a waterfall about 10m further down stream. It is expected the box culvert will be about 1m high with about 300-400mm of the base submerged to achieve this.

8 OTHER CONSIDERATIONS

This report has been prepared exclusively for Hurupaki Holdings Limited with respect to the particular brief given to us. Information, opinions and recommendations contained in it cannot be used for any other purpose or by any other entity without our review and written consent. LDE Ltd accepts no liability or responsibility whatsoever for or in respect of any use or reliance upon this report by any third party. This report should be read in its entirety and in conjunction with the construction drawings for the development.

For and on behalf of LDE Ltd

Aaron Holland
CPEng
Civil Engineer
Civil/Structural/Geotechnical Engineer

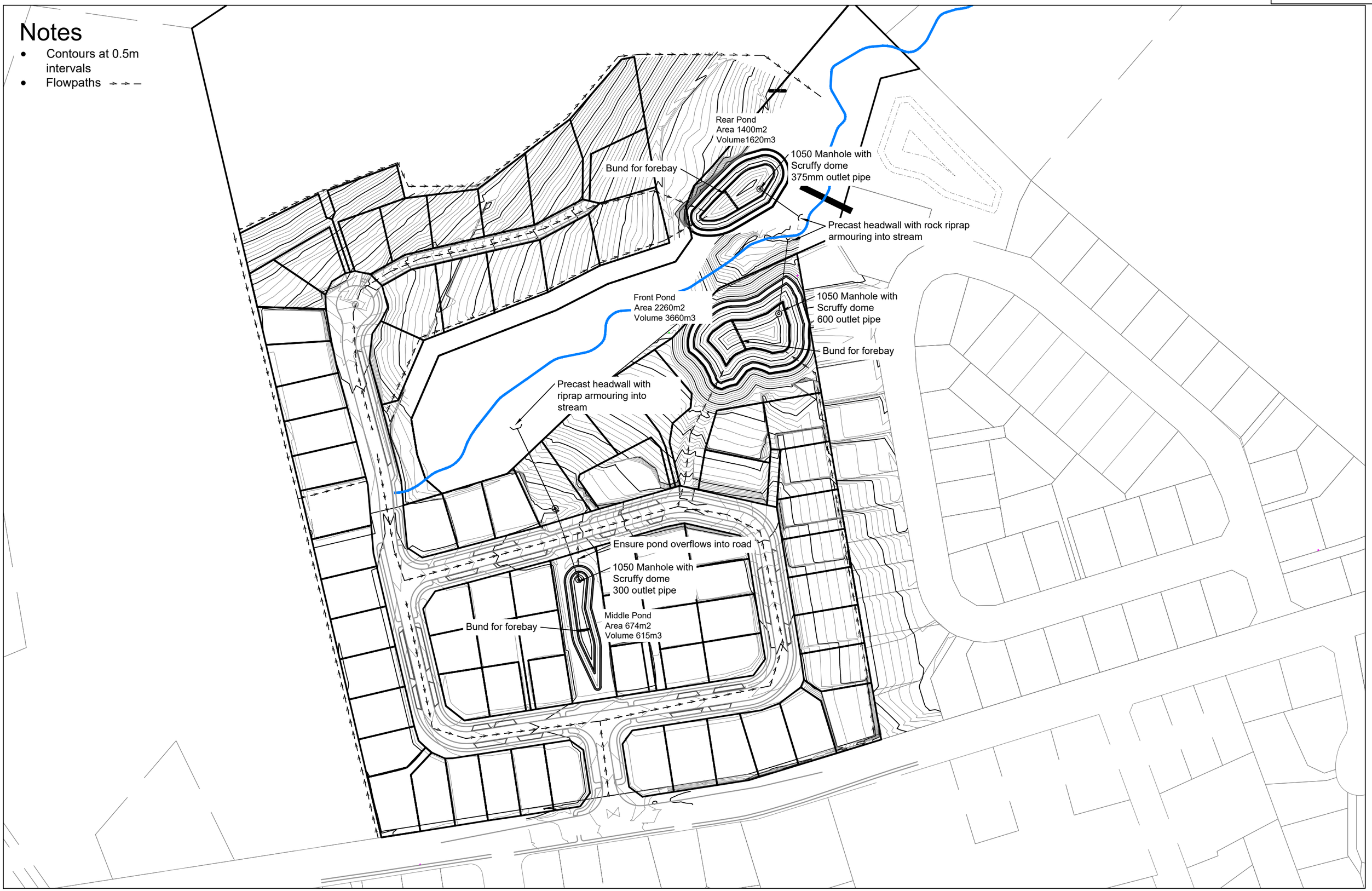
APPENDIX A

STORMWATER MITIGATION DESIGN DRAWING

Contractor shall check all dimensions on site prior to work commencing ©

Notes

- Contours at 0.5m intervals
- Flowpaths



CLIENT

Hurupaki Holdings Limited

PROJECT

Stormwater Ponds
189 &131 Three Mile Bush Road
Whangarei

DRAWING TITLE

Stormwater Ponds

LAND DEVELOPMENT & ENGINEERING LTD.

No.	REVISION	BY	DATE
3	Updated lot layout	AH	01/09/21
2	For consent	AH	19/08/21

DESIGN:	AH
DRAWN:	AH
DATE:	19/06/21
CHECKED:	
SCALE A3:	1:1750@A3

PROJECT STATUS: Consent

PROJECT: 18733

SHEET: 01 of 03

DRAWING No: P01

REV: 03

Contractor shall check all dimensions on site prior to work commencing

Notes

- Contours at 0.5m intervals
- Flowpaths

CLIENT	Hurupaki Holdings Limited
PROJECT	Stormwater Ponds 189 &131 Three Mile Bush Road Whangarei
DRAWING TITLE	Pond Catchments

LDE LAND DEVELOPMENT & ENGINEERING LTD.

No.	REVISION	BY	DATE
3	Updated catchment areas	AH	01/09/21
2	For consent	AH	19/08/21

DESIGN:	AH
DRAWN:	AH
DATE:	19/06/21
CHECKED:	
SCALE A3:	1:1750@A3

PROJECT STATUS: Consent

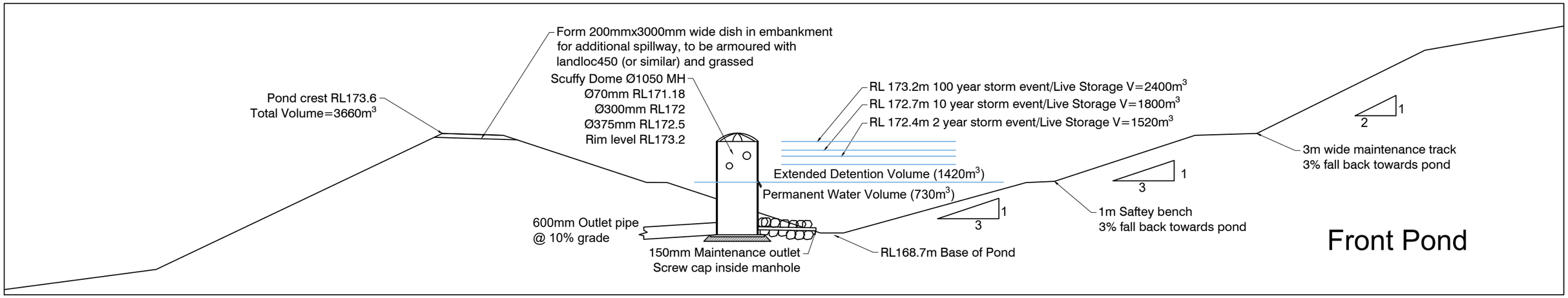
PROJECT: 18733

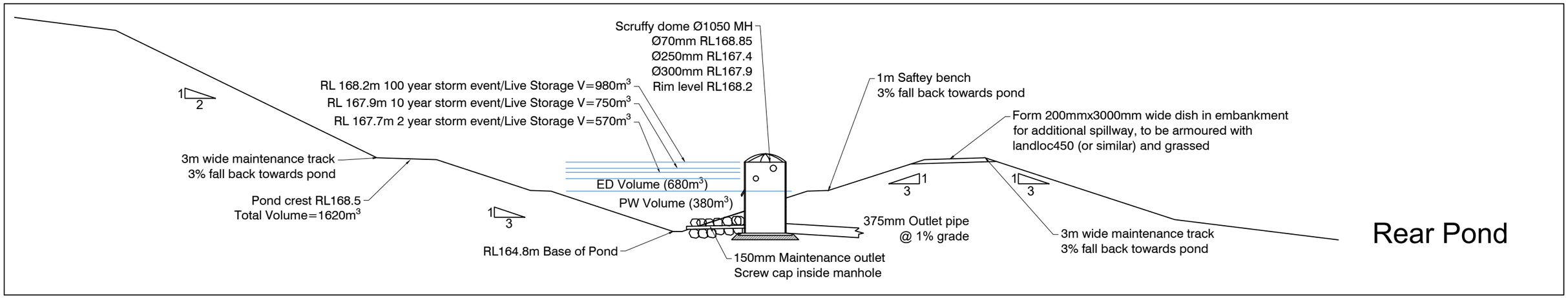
SHEET: 02 of 03

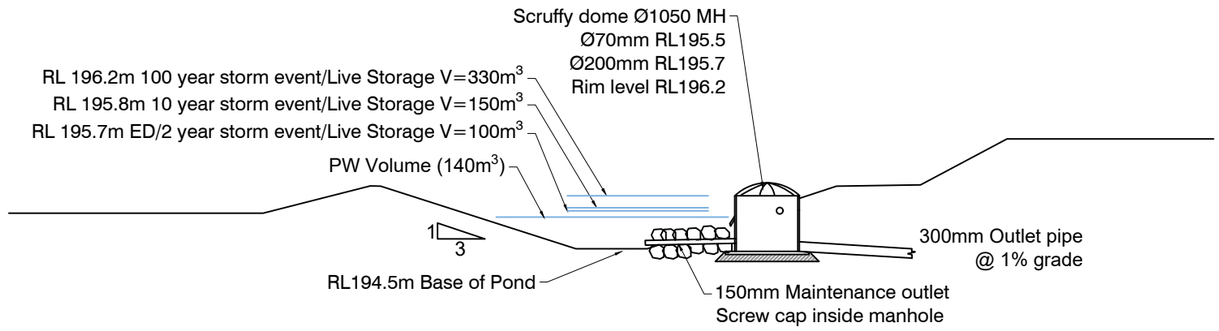
DRAWING No: P02

REV: 03

Contractor shall check all dimensions on site prior to work commencing ©







CLIENT: Hurupaki Holdings Limited	PROJECT: Stormwater Ponds, 189 &131 Three Mile Bush Road, Whangarei	DRAWING TITLE: Typical Pond sections	LAND DEVELOPMENT & ENGINEERING LTD.	2 Consent — AH 23/08/21 (No. / REVISION / BY / DATE)	DESIGN: AH	DRAWN: AH	DATE: 23/08/21	CHECKED:	SCALE A3: 1:200@A3	PROJECT STATUS: Consent; PROJECT: 18733; SHEET: 03 of 03; DRAWING No: P03; REV: 2

APPENDIX B

HEC-HMS OVERALL DEVELOPMENT MODEL OUTPUTS

Global Summary Results for Run "2yr pre"

Project: 18733 Stormwater design Simulation Run: 2yr pre

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time:16Aug2021, 13:31:59

Basin Model: Pre development
Meteorologic Model: 2yr pre
Control Specifications:24hr

Show Elements: All Eleme... Volume Units: MM 1000 M3 Sorting: Hydrolo...

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
Front areas	0.043585	0.176	01Jan2000, 08:00	2.88
Rear	0.018297	0.074	01Jan2000, 08:00	1.21
Middle areas	0.007289	0.029	01Jan2000, 08:00	0.48
Unmitigate areas	0.000704	0.003	01Jan2000, 08:00	0.05
Hillside post planted	0.040093	0.136	01Jan2000, 08:00	2.31
Hillside area	0.040093	0.162	01Jan2000, 08:00	2.65
Runoff reduction	0.080186	0.298	01Jan2000, 08:00	4.97
Stream	0.069875	0.282	01Jan2000, 08:00	4.62

2yr Pre- Development (Add bush planting improvements)

Global Summary Results for Run "2yr post"

Project: 18733 Stormwater design Simulation Run: 2yr post

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time:DATA CHANGED, RECOMPUTE

Basin Model: Post development
Meteorologic Model: 2yr post
Control Specifications:24hr

Show Elements: All Eleme... Volume Units: MM 1000 M3 Sorting: Hydrolo...

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
A Impervious	0.0138636	0.136	01Jan2000, 08:00	2.08
Front road	0.0097954	0.096	01Jan2000, 08:00	1.47
A Pervious	0.0092424	0.050	01Jan2000, 08:00	0.80
C Impervious	0.0028392	0.028	01Jan2000, 08:00	0.43
D Impervious	0.0024864	0.024	01Jan2000, 08:00	0.37
Front road pervious	0.0017286	0.009	01Jan2000, 08:00	0.15
Front Pond A	0.0399556	0.163	01Jan2000, 08:30	4.33
F, G Impervious	0.009348	0.092	01Jan2000, 08:00	1.40
F, G pervious	0.006232	0.034	01Jan2000, 08:00	0.54
Rear Road	0.0022967	0.023	01Jan2000, 08:00	0.34
E Impervious	0.0004338	0.004	01Jan2000, 08:00	0.07
Rear Road pervious	0.0004053	0.002	01Jan2000, 08:00	0.04
E Pervious	0.0002892	0.002	01Jan2000, 08:00	0.03
Rear Pond	0.0190050	0.089	01Jan2000, 08:25	2.04
B Impervious	0.0043734	0.043	01Jan2000, 08:00	0.66
B Pervious	0.0029156	0.016	01Jan2000, 08:00	0.25
Middle pond B	0.0072890	0.039	01Jan2000, 08:20	0.82
C Pervious	0.0018928	0.010	01Jan2000, 08:00	0.16
D Pervious	0.0016576	0.009	01Jan2000, 08:00	0.14
Stream	0.0698000	0.301	01Jan2000, 08:25	7.49

2yr Post- Development

Global Summary Results for Run "10yr pre"

Project: 18733 Stormwater design Simulation Run: 10yr pre

Start of Run: 01Jan2000, 00:00 Basin Model: Pre development
End of Run: 02Jan2000, 00:00 Meteorologic Model: 10yr pre
Compute Time:16Aug2021, 13:34:12 Control Specifications:24hr

Show Elements: All Eleme... Volume Units: MM 1000 M3 Sorting: Hydrolo...

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
Front areas	0.043585	0.318	01Jan2000, 08:00	4.99
Rear	0.018297	0.134	01Jan2000, 08:00	2.09
Middle areas	0.007289	0.053	01Jan2000, 08:00	0.83
Unmitigate areas	0.000704	0.005	01Jan2000, 08:00	0.08
Hillside post planted	0.040093	0.254	01Jan2000, 08:00	4.11
Hillside area	0.040093	0.293	01Jan2000, 08:00	4.59
Runoff reduction	0.080186	0.547	01Jan2000, 08:00	8.69
Stream	0.069875	0.510	01Jan2000, 08:00	7.99

10yr Pre- Development (Add bush planting improvements)

Global Summary Results for Run "Post 10yr piped"

Project: 18733 Stormwater design Simulation Run: Post 10yr piped

Start of Run: 01Jan2000, 00:00 Basin Model: Post development
End of Run: 02Jan2000, 00:00 Meteorologic Model: 10yr post
Compute Time:DATA CHANGED, RECOMPUTE Control Specifications:24hr

Show Elements: All Eleme... Volume Units: MM 1000 M3 Sorting: Hydrolo...

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
A Impervious	0.0138636	0.198	01Jan2000, 08:00	3.05
Front road	0.0097954	0.140	01Jan2000, 08:00	2.16
A Pervious	0.0092424	0.088	01Jan2000, 08:00	1.36
C Impervious	0.0028392	0.041	01Jan2000, 08:00	0.62
D Impervious	0.0024864	0.036	01Jan2000, 08:00	0.55
Front road pervious	0.0017286	0.017	01Jan2000, 08:00	0.25
Front Pond A	0.0399556	0.348	01Jan2000, 08:20	7.01
F, G Impervious	0.009348	0.134	01Jan2000, 08:00	2.06
F, G pervious	0.006232	0.060	01Jan2000, 08:00	0.92
Rear Road	0.0022967	0.033	01Jan2000, 08:00	0.51
E Impervious	0.0004338	0.006	01Jan2000, 08:00	0.10
Rear Road pervious	0.0004053	0.004	01Jan2000, 08:00	0.06
E Pervious	0.0002892	0.003	01Jan2000, 08:00	0.04
Rear Pond	0.0190050	0.132	01Jan2000, 08:25	3.30
B Impervious	0.0043734	0.063	01Jan2000, 08:00	0.96
B Pervious	0.0029156	0.028	01Jan2000, 08:00	0.43
Middle pond B	0.0072890	0.054	01Jan2000, 08:20	1.30
C Pervious	0.0018928	0.018	01Jan2000, 08:00	0.28
D Pervious	0.0016576	0.016	01Jan2000, 08:00	0.24
Stream	0.0698000	0.549	01Jan2000, 08:25	12.13

10yr Post- Development

Global Summary Results for Run "100yr pre A"

Project: 18733 Stormwater design Simulation Run: 100yr pre A

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 16Aug2021, 13:34:24

Basin Model: Pre development
Meteorologic Model: 100yr pre A
Control Specifications: 24hr

Show Elements: All Eleme... Volume Units: MM 1000 M3 Sorting: Hydrolo...

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
Front areas	0.043585	0.638	01Jan2000, 08:00	9.60
Rear	0.018297	0.268	01Jan2000, 08:00	4.03
Middle areas	0.007289	0.107	01Jan2000, 08:00	1.61
Unmitigate areas	0.000704	0.010	01Jan2000, 08:00	0.16
Hillside post planted	0.040093	0.530	01Jan2000, 08:00	8.15
Hillside area	0.040093	0.587	01Jan2000, 08:00	8.83
Runoff reduction	0.080186	1.117	01Jan2000, 08:00	16.98
Stream	0.069875	1.022	01Jan2000, 08:00	15.39

100yr Pre- Development (Add bush planting improvements)

Global Summary Results for Run "100yr post"

Project: 18733 Stormwater design Simulation Run: 100yr post

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Post development
Meteorologic Model: 100yr Post A
Control Specifications: 24hr

Show Elements: All Eleme... Volume Units: MM 1000 M3 Sorting: Hydrolo...

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
A Impervious	0.0138636	0.323	01Jan2000, 08:00	5.01
Front road	0.0097954	0.228	01Jan2000, 08:00	3.54
A Pervious	0.0092424	0.172	01Jan2000, 08:00	2.57
C Impervious	0.0028392	0.066	01Jan2000, 08:00	1.03
D Impervious	0.0024864	0.058	01Jan2000, 08:00	0.90
Front road pervious	0.0017286	0.032	01Jan2000, 08:00	0.48
Front Pond A	0.0399556	0.549	01Jan2000, 08:20	12.43
F, G Impervious	0.009348	0.218	01Jan2000, 08:00	3.38
F, G pervious	0.006232	0.116	01Jan2000, 08:00	1.73
Rear Road	0.0022967	0.054	01Jan2000, 08:00	0.83
E Impervious	0.0004338	0.010	01Jan2000, 08:00	0.16
Rear Road pervious	0.0004053	0.008	01Jan2000, 08:00	0.11
E Pervious	0.0002892	0.005	01Jan2000, 08:00	0.08
Rear Pond	0.0190050	0.280	01Jan2000, 08:15	5.88
B Impervious	0.0043734	0.102	01Jan2000, 08:00	1.58
B Pervious	0.0029156	0.054	01Jan2000, 08:00	0.81
Middle pond B	0.0072890	0.080	01Jan2000, 08:30	2.30
C Pervious	0.0018928	0.035	01Jan2000, 08:00	0.53
D Pervious	0.0016576	0.031	01Jan2000, 08:00	0.46
Stream	0.0698000	0.952	01Jan2000, 08:15	21.59

100yr Post- Development

Global Summary Results for Run "WQV"

Project: 18733 Stormwater design Simulation Run: WQV

Start of Run: 01Jan2000, 00:00 Basin Model: Post development
End of Run: 02Jan2000, 00:00 Meteorologic Model: WQV
Compute Time: 01Sep2021, 14:55:13 Control Specifications: 24hr

Show Elements: All Eleme... Volume Units: MM 1000 M3 Sorting: Hydrolo...

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
A Impervious	0.0138636	0.041	01Jan2000, 08:00	0.61
Front road	0.0097954	0.029	01Jan2000, 08:00	0.43
A Pervious	0.0092424	0.006	01Jan2000, 08:05	0.12
C Impervious	0.0028392	0.008	01Jan2000, 08:00	0.13
D Impervious	0.0024864	0.007	01Jan2000, 08:00	0.11
Front road pervious	0.0017286	0.001	01Jan2000, 08:05	0.02
Front Pond A	0.0399556	0.010	01Jan2000, 22:35	0.62
F, G Impervious	0.009348	0.028	01Jan2000, 08:00	0.41
F, G pervious	0.006232	0.004	01Jan2000, 08:05	0.08
Rear Road	0.0022967	0.007	01Jan2000, 08:00	0.10
E Impervious	0.0004338	0.001	01Jan2000, 08:00	0.02
Rear Road pervious	0.0004053	0.000	01Jan2000, 08:05	0.01
E Pervious	0.0002892	0.000	01Jan2000, 08:05	0.00
Rear Pond	0.0190050	0.007	01Jan2000, 14:00	0.44
B Impervious	0.0043734	0.013	01Jan2000, 08:00	0.19
B Pervious	0.0029156	0.002	01Jan2000, 08:05	0.04
Middle pond B	0.0072890	0.004	01Jan2000, 09:40	0.22
C Pervious	0.0018928	0.001	01Jan2000, 08:05	0.02
D Pervious	0.0016576	0.001	01Jan2000, 08:05	0.02
Stream	0.0698000	0.020	01Jan2000, 13:25	1.32

Water quality volumes

Appendix 5

Rules Assessment

OPERATIVE REGIONAL WATER AND SOIL PLAN FOR NORTHLAND (RWSP)

Rule	Compliance	Comment
Chapter 21 – Rules for stormwater discharges		
21.1.1 Diversion and discharge of stormwater by way of an open constructed stormwater collection system or piped for which resource consent exists.	Does not comply. **Permitted Activity under Rule 21.1.2.**	The proposal includes the establishment of a stormwater system that discharges to Waitaua Stream which does not have an existing resource consent.
21.1.2 – Permitted stormwater diversions and discharges (a) For new subdivision and development, the best practicable option for on-site stormwater disposal shall be identified and incorporated into the stormwater management design to avoid or minimise changes to stormwater flows after development for the 1 in 5 year return period storm event. (b) Where the diversion and/or discharge drains a hazardous substance storage area… (c) Where the diversion and/or discharge drains an industrial or trade premise… (d) The stormwater collection system is designed to cater for stormwater flows resulting from not less than a 1 in 5 year return period storm event and a stabilised overland flow path is provided for to allow flows up to and including a 1 in 50 year storm event in excess of the capacity of the primary collection system. (e) For discharges to water, the discharge does not: (i) Increase the natural temperature of the receiving water by more than 3° Celsius at or beyond a 20 metre radius from the discharge point. (ii) Cause the pH of the receiving water to fall outside of the range 6.5 to 9 at or beyond a 20 metre radius of the discharge point. (iii) Cause the production of any conspicuous oil or grease films,	Complies **Permitted Activity**	The proposal includes the best practicable option for onsite stormwater management for the proposed subdivision designed to accommodate the 2, 10 and 100 year storm events. The proposed stormwater diversion will not drain from a hazardous substance storage area, industrial or trade premise. The stormwater will be treated as detailed in the Three Waters Report (**Appendix 4**) The Erosion and Sediment Control Plan and stormwater detail submitted with the application as **Appendix 3** will ensure that compliance is achieved during construction with the standards set out in Rule 21.1.2(a) – 21.1.2(i).

Rule	Compliance	Comment
scums or foams, or floatable or suspended materials in the receiving water at or beyond a 20 metre radius of the discharge point. (iv) cause any emission of objectionable odour in the receiving water at or beyond a 20 metre radius of the discharge point. (v) contain more than: • 20 g/m³ of total petroleum hydrocarbons • 10 mg/m³ of total copper • 10 mg/m³ of total lead • 100 mg/m³ of total zinc • 100 g/m³ of suspended solids. (f) The discharge does not cause scour or erosion of the beds or banks of the receiving water body. (g) For diversion and/or discharges onto or into land, stormwater quality control measures or treatment systems such as silt, oil and grease traps are incorporated to minimise the level of contaminants prior to final disposal. (h) The stormwater management or treatment systems, and any associated works or equipment shall be operated and maintained in an effective operating condition. (i) The diversion and/or discharge does not cause flooding of adjacent properties.		
Chapter 22. Rules for stormwater discharges and diversions from roads and from land disturbance activities.		
22.1.1 Permitted Activities The following diversions and discharges associated with stormwater from roads and land disturbance activities are permitted activities: 1. The diversion and discharge of stormwater into water or onto or into land where it may enter water from any land disturbance activity, which is permitted under a land disturbance activity rule in this Plan is a permitted activity, provided that: (a) The stormwater is diverted	Does not comply. **Controlled Activity under 22.2.1**	The proposed development includes the construction of a new public road to service the residential allotments. Stormwater from the road will be diverted into the proposed stormwater system. Land disturbance proposed is not a permitted activity.

Rule	Compliance	Comment
or discharged in the catchment from which it originates. (b) Water and sediment control measures (e.g. rock rip-rap, cut-off drains, sediment traps) are installed and maintained, to avoid or minimise erosion and to avoid or minimise sediment discharges to any adjacent water bodies or to any coastal waters. (c) The diversion and discharge has a no more than minor adverse effect (as determined by the relevant water quality guidelines in Section 7) on aquatic ecosystems and/or on neighbouring or downstream landowners/occupiers (e.g. deposition of sediment, exacerbation of flooding).		
22.1.2 Diversion of discharge from any road or track by way of stormwater collection system for which a resource consent exists.	Does not comply **Controlled Activity under 22.2.1**	No resource consent exists for the proposed stormwater system.
22.1.3 The diversion and discharge of stormwater, not otherwise permitted by Rule 22.01.02 from any road or track into water or onto or into land where it may enter water is a permitted activity, provided that: (a) The road does not form part of a stormwater collection system that is designed to divert or discharge stormwater from any of the sources otherwise regulated by rules contained in Section 21 of this Plan.	Complies **Permitted Activity**	The proposed road will form part of the stormwater system designed to divert or discharge stormwater from the proposed residential units which is regulated under Section 21 of this plan.
22.2.1 Controlled Activities The following diversion and discharge associated with land disturbance activities or from roads is a controlled activity: 1. The diversion and discharge of stormwater into water or onto or into land where it may enter water: (1) from any land disturbance activity, where that activity is a controlled activity under a Land Disturbance Activity Rule in this Plan (refer also Section 33); or (2) from any road that does not meet the requirements of permitted activity Rule 22.01.02 and 22.01.03;	Complies **Controlled Activity**	The proposed road will form part of the stormwater system designed to divert or discharge stormwater from the proposed residential units. The proposed road will not comply with 22.01.02.

Rule	Compliance	Comment
Chapter 29 – Rules for Structures in, on, under or over the bed of a river or lake		
29.1.1 and .2 Existing structures	Does not comply **Permitted Activity under rule 29.1.1.3**	The proposal seeks to construct a new box culvert crossing, across Waitaua Stream.
29.1.1.3 The use, placement, replacement, repair or alteration of a culvert crossing on the bed of a river or lake and any associated excavation or disturbance of the bed, and diversion of water through the structure, is a permitted activity, provided that: (a) The length of the culvert crossing does not exceed 25 metres and is of sufficient size to contain the bankfull flow without causing flooding onto neighbouring properties. (b) There are no adverse flooding or erosion effects on any upstream, adjoining or downstream properties as a result of the activity. (c) The works shall include the provision of an overland flowpath on the same property to ensure the safe passage of a 1 in 100 year period flood flow event. (d) During the disturbance of the bed, upstream flow up to a 1 in 5 year return period storm event, is temporarily diverted around the area of disturbance except where the temporary damming of the water is undertaken in accordance with Rule 28.01.05. (e) The activity does not take place in any dune lake listed in Schedule E; or in an indigenous wetland; or a river, or section of river or lake, deemed to have outstanding values as shown in Appendix 18. (f) It is not regulated by Rule 27.03.02. (g) The activity complies with the Environmental Standards in 29.01.11.	Complies **Permitted Activity**	A culvert crossing is proposed to be installed across Waitaua Stream to provide for road access to the northern portion of the subject site. The catchment is approximately 46ha in area. A new box culvert will be installed, which is less than 25m in length that accommodates the 10yr flows (2m3/s) with the 100yr flows (4.1m3/s) overtopping the road. The box culvert will be partially buried beneath the stream bed to allow the base of the culvert to mimic natural stream bed conditions and allow the passage of fish etc (even though there is a waterfall about 10m further down stream). It is expected the box culvert will be about 1m high with about 300 400mm of the base submerged to achieve this. Waitaua Stream is not mapped as Outstanding Natural Character Area, or Outstanding Natural Feature or Site or Area of Significance to tangata whenua.
Chapter 33 - Rules for land disturbance activities		

Rule	Compliance	Comment
33.1.3 – Earthworks that are not in a Riparian Management Zone	Does not comply Refer to chapter 34	Portions of the proposed earthworks extend into the riparian management zone and the works will result in more than 5,000m^3 of earthworks in a 12 month period. Compliance with the relevant section of s32 environmental standards will be achieved.
33.2.1(1) Any earthworks which are not located in the riparian management zone where not located on erosion prone land of more than 5,000m^3 in any 12-month period	Does not comply Refer to chapter 34	Portions of the proposed earthworks extend into the riparian management zone and the works will result in more than 5,000m^3 of earthworks in a 12 month period. Compliance with the relevant section of s32 environmental standards will be achieved.
Chapter 34 – Rules for land disturbance activities within the Riparian Management Zone		
34.1.3 Earthworks in the Riparian Management Zone are a permitted activity, provided that: (a) The Environmental Standards in Section 32 are complied with; (b) The earthworks are the minimum necessary; (i) to give effect to the permitted activity rules in this Plan; and (ii) the area of exposed soil is less than 200 m² and the volume of earth disturbed is less than 50 m³; or (iii) for track or road maintenance; (c) Following the completion of any earthworks those parts of the Riparian Management Zone that are not required for the permitted activity are reinstated to a stable contour and revegetated as soon as practicable; and (d) As a result of the earthworks in the Riparian Management Zone there are no adverse flooding or drainage effect on any property owned or occupied by another person.	Does not comply **Discretionary Activity under rule 34.3.1**	Portions of the proposed earthworks extend into the riparian management zone and the works will result in more than 5,000m^3 of earthworks in a 12 month period. Compliance with the relevant section of s32 environmental standards will be achieved.
34.3.1 Discretionary Activities The following land disturbance activities within the Riparian Management Zone are discretionary activities: 1. Any activity which cannot comply with, or is outside the scope of, the permitted rules, or	**Discretionary Activity**	Portions of the proposed earthworks extend into the riparian management zone and the works will result in more than 5,000m^3 of earthworks in a 12 month period.

Rule	Compliance	Comment
is not a non-complying activity, is a discretionary activity		

PROPOSED NORTHLAND REGIONAL PLAN

Relevant rules are detailed below:

Rule	Compliance	Comment
C.2 Activities in the beds of lakes and rivers		
C.2.1.8 Construction and installation of structures – permitted activity 3) for culvert crossings: a) the contributing catchment is less than 300 hectares, and b) the culvert length under the crossing parallel to river flow must not exceed 25 metres when necessary for a road or railway line, otherwise it must not exceed 10 metres, and c) the culvert is designed such that flow velocity will not impede fish passage during normal flow conditions, and d) culvert approaches and fill placed on the river or lake bed must be free of organic matter, and e) the total height of the crossing crest must be: i. no more than 3.5 metres above the invert level of the culvert inlet, and ii. within the manufacturer's maximum height specifications for the culvert, and iii. below the riverbank level unless it is necessary for a road, and f) the culvert must be either open bottomed or installed so that the base is set a minimum of 25 percent and a maximum of 50 percent of the culvert diameter below the stream bed, and g) on request by the Regional Council, records of structure design and flow calculations must be made available within 10 working days of the request, and h) the culvert is not in a significant wetland, an outstanding freshwater body or mapped (refer I Maps | Ngā mahere matawhenua): i. Outstanding Natural Character Area, or ii. Outstanding Natural Feature, or iii. Site or Area of Significance to tangāta whenua… *Appealed*	Complies **Permitted Activity**	A culvert crossing is proposed to be installed across Waitaua Stream to provide for road access to the northern portion of the subject site. The catchment is approximately 46ha in area. A new box culvert will be installed, which is less than 25m in length that accommodates the 10yr flows (2m3/s) with the 100yr flows (4.1m3/s) overtopping the road. The box culvert will be partially buried beneath the stream bed to allow the base of the culvert to mimic natural stream bed conditions and allow the passage of fish etc (even though there is a waterfall about 10m further down stream). It is expected the box culvert will be about 1m high with about 300 400mm of the base submerged to achieve this. Waitaua Stream is not mapped as Outstanding Natural Character Area, or Outstanding Natural Feature or Site or Area of Significance to tangata whenua.
C.4 Land drainage and flood control		

Rule	Compliance	Comment
C.4.1.1 Land drainage – permitted activity The damming, diversion and discharge of water associated with land drainage are permitted activities, provided: 1) the activity complies with all relevant conditions of Rule C.4.1.9 Land drainage and flood control general conditions, and 2) any resulting land subsidence or slumping does not cause adverse effects on structures or infrastructure on other property, and 3) the discharge is in or from the same catchment in which the water would naturally flow, and 4) a new drain is not constructed within 15 metres of an existing wastewater disposal area. *Appealed*	Complies **Permitted Activity**	As detailed below the proposed stormwater system will comply with Rule C.4.1.9. No land subsidence or slumping will cause adverse effects to any structure or infrastructure onsite as per the design detailed in the Three Waters Report **(Appendix 4).** The discharge is in the same catchment from which the water would naturally flow. The proposed stormwater system will not be located within proximity to an existing waste water disposal system in the area (noting that the existing residential unit and wastewater disposal area within 189 Three Mile Bush Road will be removed).
C.4.1.9 Land drainage and flood control general conditions General conditions apply to activities when referred to in the rules of Section C.4.1. 1) There is no adverse flooding, erosion or over-drainage effects on other property. 2) The activity does not alter the course of a lake or continually or intermittently flowing river. 3) New land drainage does not occur within 50 metres of any natural wetland. 4) Drainage does not cause any change to the seasonal or annual range in water level of a natural wetland to an extent that may adversely affect the wetland's natural ecosystem. 5) No vegetation, soil or other debris generated from the activity is placed in a position where it may be carried into a river or natural wetland, lake or the coastal marine area. 6) There is no damage to a flood defence or any other authorised structure. 7) Fish passage is maintained, unless an existing authorisation provides otherwise, or temporary works to enable repair and replacement works are being carried out. 8) Eels, fish (other than pest fish), kōura (freshwater crayfish) and kākahi (freshwater mussels) unintentionally removed during mechanical clearing of drainage channels are returned to the	Complies **Permitted Activity**	1) The proposed stormwater system has been designed to mitigate the 2yr, 10yr and 100yr storm events to equal or less than pre-development rates, which ensures that it does not affect downstream areas with any increases in flow rates. Additional to the 2, 10 and 100yr storm event mitigation an extended detention volume has been allowed for in the pond with a 24hr drain down period designed in accordance with Auckland Council's GD01. 2) The proposed stormwater system does not alter the course of Waitaua Stream. 3) There are no natural wetlands within 50m of the proposed system. 4) The proposed stormwater system will not cause any change to water levels of natural wetlands. 5) Proposed works will comply. 6) No damage to a flood defence will occur. 7) Fish passage will be maintained.

Rule	Compliance	Comment
drainage channel as soon as practicable, but no later than one hour after their removal. 9) Refuelling of machinery does not take place in the bed of a river or lake. 10) Where a discharge from land drainage enters an outstanding freshwater body or coastal water beyond the zone of reasonable mixing, the discharge does not… 11) Any discharge of sediment associated with repair and maintenance activities does not occur for more than five consecutive days and must not occur for more than 12 hours on any one day. *Appealed*		8) Proposal will comply. 9) Proposal will comply. 10) Waitaua Stream is not identified as an outstanding freshwater body. 11) Proposal will comply.
C.6 Discharges to land and water		
C.6.4.1 Stormwater discharges from a public stormwater network – permitted activity The diversion and discharge of stormwater from a public stormwater network into water or onto or into land where it may enter water is a permitted activity, provided: 1) the discharge is not from a public stormwater network servicing an urban area listed in Table 10: Urban areas, and 2) the diversion and discharge does not cause permanent scouring or erosion of the bed of a water body at the point of discharge, and 3) the discharge is not within 100 metres of a geothermal surface feature, and 4) the discharge does not contain contaminants used, stored or generated in trade or industrial premises, and 5) the discharge does not contain more than 15 milligrams per litre of total petroleum hydrocarbons, and 6) the discharge does not cause any of the following effects in the receiving waters beyond the zone of reasonable mixing: a) the production of conspicuous oil or grease films, scums or foams, of floatable or suspended materials, or b) a	Does not comply. **Controlled Activity under rule C.6.4.3**	The proposed stormwater system will be vested with Council and will form a public stormwater network[1] within the urban area of Whangarei City.

[1] **Public Stormwater Network:**
A system of stormwater pipes, open channels, devices and associated ancillary structures owned and/or operated by a local authority and used for conveying, diverting, storing, treating, or discharging stormwater.

Rule	Compliance	Comment
conspicuous change in the colour or visual clarity, or c) an emission of objectionable odour, or d) the rendering of fresh water unsuitable for consumption by farm animals, or e) the rendering of freshwater taken from a mapped priority drinking water abstraction point (refer I Maps | Ngā mahere matawhenua) unsuitable for human consumption after existing treatment		
C.6.4.3 Stormwater discharges – controlled activity The diversion and discharge of stormwater into water or onto or into land where it may enter water that is not a permitted activity or discretionary activity in section C.6.4 of this Plan is a controlled activity. Matters of control: 1) The maximum concentration or load of contaminants in the discharge. 2) The size of the zone of reasonable mixing. 3) The adequacy of measures to minimise erosion. 4) The adequacy of measures to minimise flooding caused by the stormwater network. 5) The design and operation of the stormwater system and any staging of works.	Complies **Controlled Activity**	The proposed stormwater system will be vested with Council as a public stormwater network. The proposal is not a discretionary activity in section C.6.4.
C.8 Land Use and Disturbance Activities		
C.8.3.1.1) Earthworks – Permitted Activity	Does not comply **Discretionary Activity under rule C.8.3.4**	1) The amount of earthworks at a particular location or associated with a project does not comply with the thresholds in Table 8 which restricts: The earth exposed in any one time is less than 200m^2 of exposed earth within 10m of an intermittently flowing river[2] (Waitaua Stream) and the earth exposed at any one time to 5000m^2. **The proposed works will occur over an area of 55,700m^2.** The Erosion and Sediment Control Measures submitted with the application in **Appendix 3** will ensure that compliance is achieved with the

[2]**Intermittently flowing river or stream:**
A river that is naturally dry at certain times of the year and has two or more of the following characteristics: 1) it has natural pools, and 2) it has a well-defined channel, such that the bed and banks can be distinguished, and 3) it contains surface water more than 48 hours after a rain event which results in river flow, and 4) rooted terrestrial vegetation is not established across the entire cross sectional width of the channel, and 5) it appears as a blue line on topographical maps at 1:50,000 scale.

Rule	Compliance	Comment
		standards set out in Rule C.8.3.1.1.2 – C.8.3.1.1.8.
C.8.3.2) Earthworks – Controlled Activity	Does not comply **Discretionary Activity under rule C.8.3.4**	1) The amount of earthworks will exceed 5000m^2 of exposed earth at any one time within 10m of Waitaua Stream.
C.8.3.3) Earthworks in a flood hazard area – Controlled Activity	Not applicable	Earthworks within the flood hazard area will not exceed 50m^3 as detailed in **Appendix 3.**
C.8.3.4) Earthworks – discretionary activity.	**Discretionary Activity**	Earthworks infringe rules C.8.3.1.1 and C.8.3.2.

Appendix 6

Potentially Contaminated Site Search

Whangarei District Council
Private Bag 9023, Whangarei 0148, New Zealand
P +64 9 430 4200 | 0800 WDC INFO | 0800 932 463 F +64 9 438 7632
E mailroom@wdc.govt.nz www.wdc.govt.nz

Report of the outcome of a "Potentially Contaminated Site" Property search under Section 6 of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.

Application No: PCS210131

Mark Holland
108 Osborne Rd
RD 1
Hamilton 3281

Date report compiled: 05/08/2021

Property Search Details:

Address:	131 Three Mile Bush Road
	Kamo 0112
Legal Description:	LOT 2 DP 99045
PID NO:	3557
LLP NO:	35801

The search undertaken on Council records for this property has not identified any indication of current or previous activities in the area of the site that are included on the current version of the Hazardous Activities and Industries List (HAIL) issued by the Ministry for the Environment.

****

DISCLAIMER

This Report has been prepared for the purposes of Section 6 of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 and contains all information known to the Whangarei District Council to be relevant to the land as described. It is based on a search of Council records only and there may be other information relating to the land which is unknown to Council. The Council has not undertaken any inspection of the land or any building on it for the purposes of preparing this report.

Signed

Leanne Macnay
Project Assessment Coordinator

Whangarei District Council
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Report of the outcome of a "Potentially Contaminated Site" Property search under Section 6 of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.

Application No: PCS210132

Mark Holland
108 Osborne Rd
RD 1
Hamilton 3281

Date report compiled: 05/08/2021

Property Search Details:

Address:	189 Three Mile Bush Road Kamo 0112
Legal Description:	LOT 3 DP 99045
PID NO:	160746
LLP NO:	74939

The search undertaken on Council records for this property has not identified any indication of current or previous activities in the area of the site that are included on the current version of the Hazardous Activities and Industries List (HAIL) issued by the Ministry for the Environment.

****

DISCLAIMER

This Report has been prepared for the purposes of Section 6 of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 and contains all information known to the Whangarei District Council to be relevant to the land as described. It is based on a search of Council records only and there may be other information relating to the land which is unknown to Council. The Council has not undertaken any inspection of the land or any building on it for the purposes of preparing this report.

Signed

Leanne Macnay
Project Assessment Coordinator

Appendix 7

Archaeological Assessment

Archaeological Assessment

The James Subdivision

115, 131 and 189 Three Mile Bush Road, Kamo

8 April 2021

Prepared for:

TMB Ltd

-c/o Blue Wallace Ltd

First Floor
25 Harwood Street
Hamilton

Prepared by:

Geometria Limited

PO Box 1972
Whangarei 0140

Geometria

Quality Information

Document: Archaeological Assessment. 115, 131 and 189 Three Mile Bush Road. Kamo

Ref: 2021-106

Date: 8 April 2021

Prepared by: Jonathan Carpenter

Revision History

Revision	Revision Date	Details	Authorized Name
Client draft v0.1	3 March 2021		J. Carpenter
Client draft v0.2	8 April 2021		J. Carpenter

File ref.:
I:\Documents\2021\2021_106_115_Three_Mile_Bush_Road\Reports\Working\20210315_The_James_Archaeological_Assessment_Assessment.docx

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Glossary

Classic	The later period of New Zealand settlement
Fire scoop	Fireplace used for various reasons (cooking, warming, etc.)
Hangi	An earth oven for cooking food
Midden	The remains of food refuse usually consisting of shells, and bone, but can also contain artefacts
Pa	A site fortified with earthworks and palisade defences
Pit	Rectangular excavated pit used to store crops by Maori
Radiocarbon	Method of absolute dating using known rates of decay of a carbon isotope
Terrace	A platform cut into the hill slope used for habitation
Wahi tapu	Sites of spiritual significance to Maori

1.0 Introduction

Geometria Ltd was commissioned by Blue Wallace Ltd on behalf of their client TMB Ltd to undertake an archaeological assessment of The James subdivision. This assessment includes a damage assessment of shell midden and stone walls affected by the subdivision of 115 Three Mile Bush Road, and an archaeological assessment for the future development of the neighbouring properties at 131 and 189 Three Mile Bush Road, west of Kamo in Whangarei.

Under the Heritage New Zealand Pouhere Taonga Act 2014 all archaeological sites are protected from any modification, damage or destruction except by the authority of the Heritage New Zealand Pouhere Taonga. Dry stacked stone walls are scheduled in the Whangarei District Plan with rules covering their modification.

This assessment uses archaeological techniques to assess archaeological values and does not seek to locate or identify wahi tapu or other places of cultural or spiritual significance to Maori. Such assessments may only be made by Tangata Whenua, who may be approached independently of this report for advice.

Likewise, such an assessment by Tangata Whenua does not constitute an archaeological assessment and permission to undertake ground disturbing activity on and around archaeological sites and features may only be provided by Heritage New Zealand Pouhere Taonga, and may only be monitored or investigated by a qualified archaeologist approved through the archaeological authority process.

1.1 The Heritage New Zealand Pouhere Taonga Act 2014

Under the Heritage New Zealand Pouhere[2] Taonga Act 2014 (HNZPTA; previously the Historic Places Act 1993) all archaeological sites are protected from any modification, damage or destruction except by the authority of the Historic Places Trust. Section 6 of the HNZPTA defines an archaeological site as:

> *" any place in New Zealand, including any building or structure (or part of a building or structure), that—*
>
> > *(i) was associated with human activity that occurred before 1900 or is the site of the wreck of any vessel where the wreck occurred before 1900; and*
> >
> > *(ii) provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand; and*
>
> *(b) includes a site for which a declaration is made under section 43(1)"*

To be protected under the HNZPTA an archaeological site must have physical remains that pre-date 1900 and that can be investigated by scientific archaeological techniques. Sites from 1900 or post-1900 can be declared archaeological under section 43(1) of the Act.

If a development is likely to impact on an archaeological site, an authority to modify or destroy this site can be sought from the local Heritage New Zealand Pouhere Taonga office under section 44 of the Act. Where damage or destruction of archaeological sites is to occur Heritage New Zealand usually requires mitigation. Penalties for modifying a site without an authority include fines of up to $300,000 for destruction of a site.

Most archaeological evidence consists of sub-surface remains which are often not visible or obvious and indications of an archaeological site are often very subtle and hard to distinguish on the ground surface. Sub-surface excavations on a suspected archaeological site can only take place with an authority issued under Section 56 of the HNZPTA issued by the Heritage New Zealand.

1.2 The Resource Management Act 1991.

Archaeological sites and other historic heritage may also be considered under the Resource Management Act 1991 (RMA). The RMA establishes (under Part 2) in the Act's purpose (Section 5) the matters of national importance (Section 6), and other matters (Section 7) and all decisions by a Council are subject to these provisions. Sections 6e and 6f identify historic heritage (which includes archaeological sites) and Maori heritage as matters of national importance.

Councils have a responsibility to recognise and provide for the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, wahi tapu, and other taonga (Section 6e). Councils also have the statutory responsibility to recognise and provide for the protection of historic heritage from inappropriate subdivision, use and development within the context of sustainable management (Section 6f). Responsibilities for managing adverse effects on heritage arise as part of policy and plan preparation and the resource consent processes.

2.0 Location

The James subdivision is located at 115, 131 and 189 Three Mile Bush Road, on the north side of the road, two kilometres west of central Kamo and south of the Hurapaki volcanic cone (Figure 1).

Lot 1 DP 99045 at Three Mile Bush road is a flat to rolling property of 5.8ha, falling from approximately 188m above sea level near the south west boundary, to the north east. The property is currently being re-contoured and have in services established for the consented subdivision. There is an existing house remaining near the road frontage.

Lot 2 DP 99045 at 131 Three Mile Bush Road is a flat to rolling property of 4.9ha, currently in pasture with an existing dwelling and outbuildings, and an older house near the road frontage. The property drops to the north and north east.

Lot 3 DP 99045 at 189 Three Mile Bush Road is a flat to steep property of 9.0ha accessed via a narrow driveway extending north of Three Mile Bush Road, with the bulk of the property on the north side of the stream and rising to the upper slopes of the south side of Hurupaki. Most of the property is in pasture, with a fringe of remnant and regenerating native forest on the southern boundary/steep stream gully.

3.0 Proposed Development

3.1 115 Three Mile Bush Road

The consented subdivision of 115 Three Mile Bush Road is for 60 residential lots with a road lot and a reserve lot for drainage. The residential lots are 450-919m, with one larger lot of 4522m for future development. The subdivision is served by a single road crossing and loop road from Three Mile Bush Road, and a number of internal road crossings. Earthworks for the project comprise 106,000m^3 of cut, fill and topsoil stripping.

The subdivision scheme plan called for the closing of two existing gateways/crossings to Three Mile Bush Road through the dry stacked stone wall fronting Three Mile Bush Road, on the southern boundary of the property. A new 25m wide crossing would be formed through the wall to provide access to the subdivision, with the boundary wall and old crossings repaired/filled using the surplus rock from the new crossing.

The former owners, the James family, along with Catherine Ballard's (2010) book on the stone walls of the Whangarei District suggested that stone walls on the property dated to the 1930s. This was accepted by Whangarei District Council when processing the original consent, an archaeological Authority was not deemed necessary, and the effects on the walls were taken as not more than minor or less than minor.

Ngati Kahu O Torongare provided a cultural impact assessment (Olsen 2019) of the subdivision as part of the consent application. The assessment noted the project was in an area of high cultural and traditional significance for Ngati Kahu O Torongare, with the vicinity of the project area near a significant wahi tapu, traversed by an ancient pathway, used as a mahinga kai and that a significant knoll used as a gathering place or Tau Rangatira is located near Three Mile Bush Road. Ngati Kahu O Torongare opposed the application in its entirety.

Subsequent to the granting of the original subdivision consent, problems with the original design became apparent and a further landuse consent was sought and granted from the Whangarei District Council, including the removal and relocation of 40m of dry stacked stone wall on the Three Mile Bush Road frontage, and the removal and relocation of 3.5m of stone wall on the north eastern boundary with Hurupaki School.

3.2 131 Three Mile Bush Road and 189 Three Mile Bush Road

The subdivision scheme plan for 131 and 189 Three Mile bush Road proposes amalgamating the existing lots 2 and Lot 3 DP 99045, and undertaking a staged subdivision of the new property.

Stage 1 will comprise 57 residential lots 560-1040m^2 in size largely on what is currently Lot 2 DP 99045 (seven lots will be partly located on what is currently the access to Lot 3 DP 99045). In addition there will be one road reserve lot, one access lot, one pedestrian access lot to the neighbouring The James subdivision, and a local purposes reserve lot for drainage purposes on the low lying ground adjacent to the stream in the north east corner of the property. There will be a single road crossing to Three Mile Bush Road, providing access to a loop road through the subdivision, and to the second stage to the north contained within a balance lot of 8.78ha.

Stage 2 will comprise 20 residential lots of 640-1290m^2 in the south east corner of the property, one road reserve lot connecting with Stage 1, one access lot, one local purposes drainage reserve lot containing the stream on the southern boundary, and a balance lot of 4.88ha on the steep slope on the south side of Hurupaki.

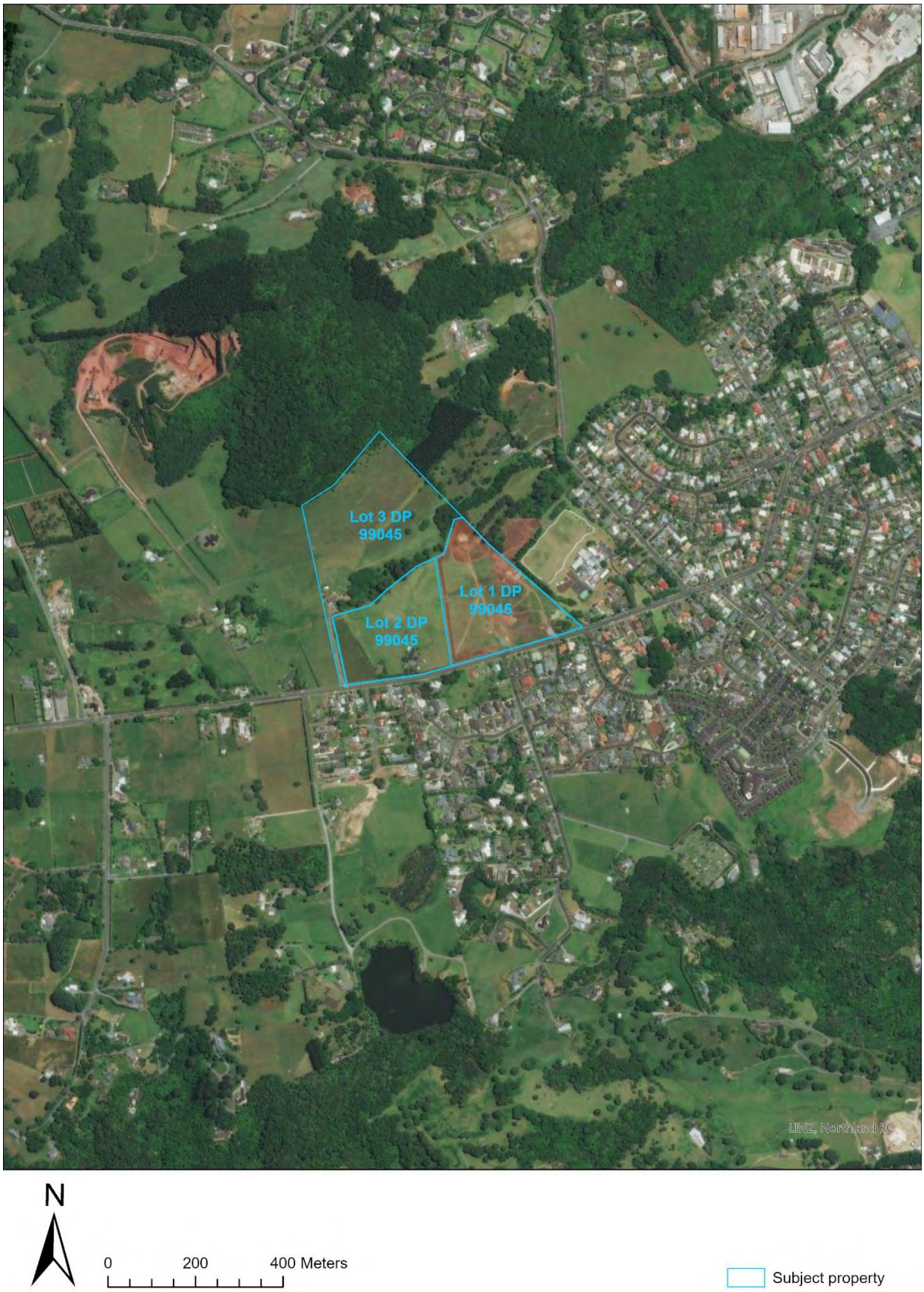

Figure 1: Location of 115 Three Mile Bush Road (in blue; WDC GIS).

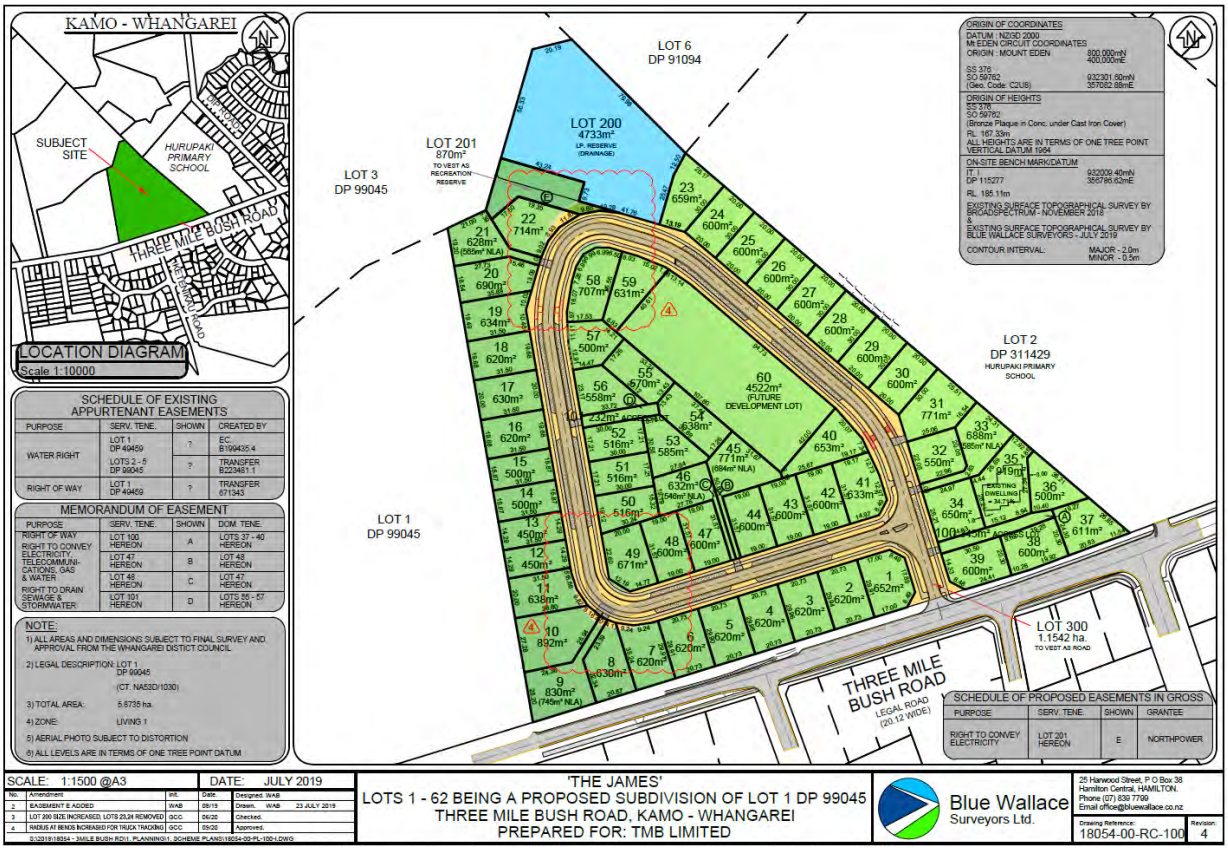

Figure 2: Subdivision of 115 Three Mile Bush Road.

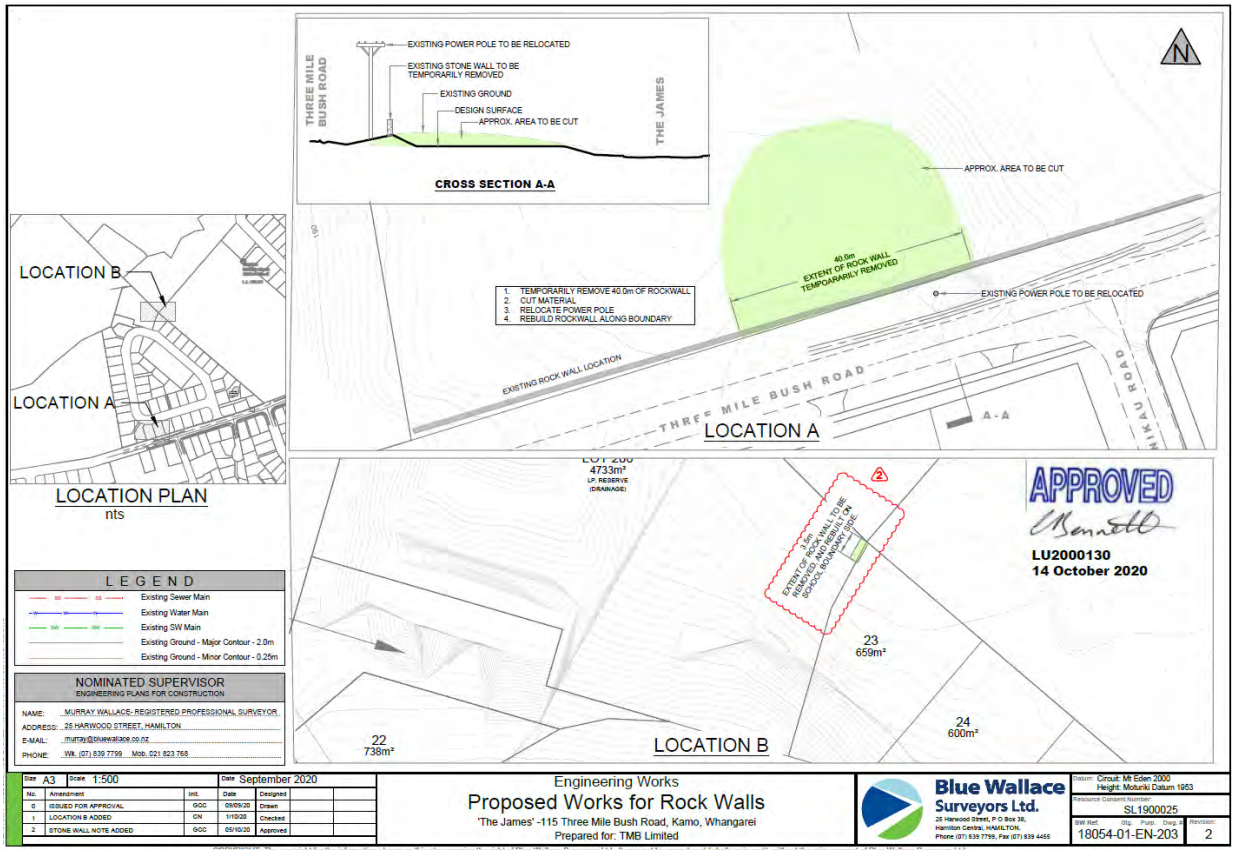

Figure 3: Changes to stone walls, 115 Three Mile Bush Road.

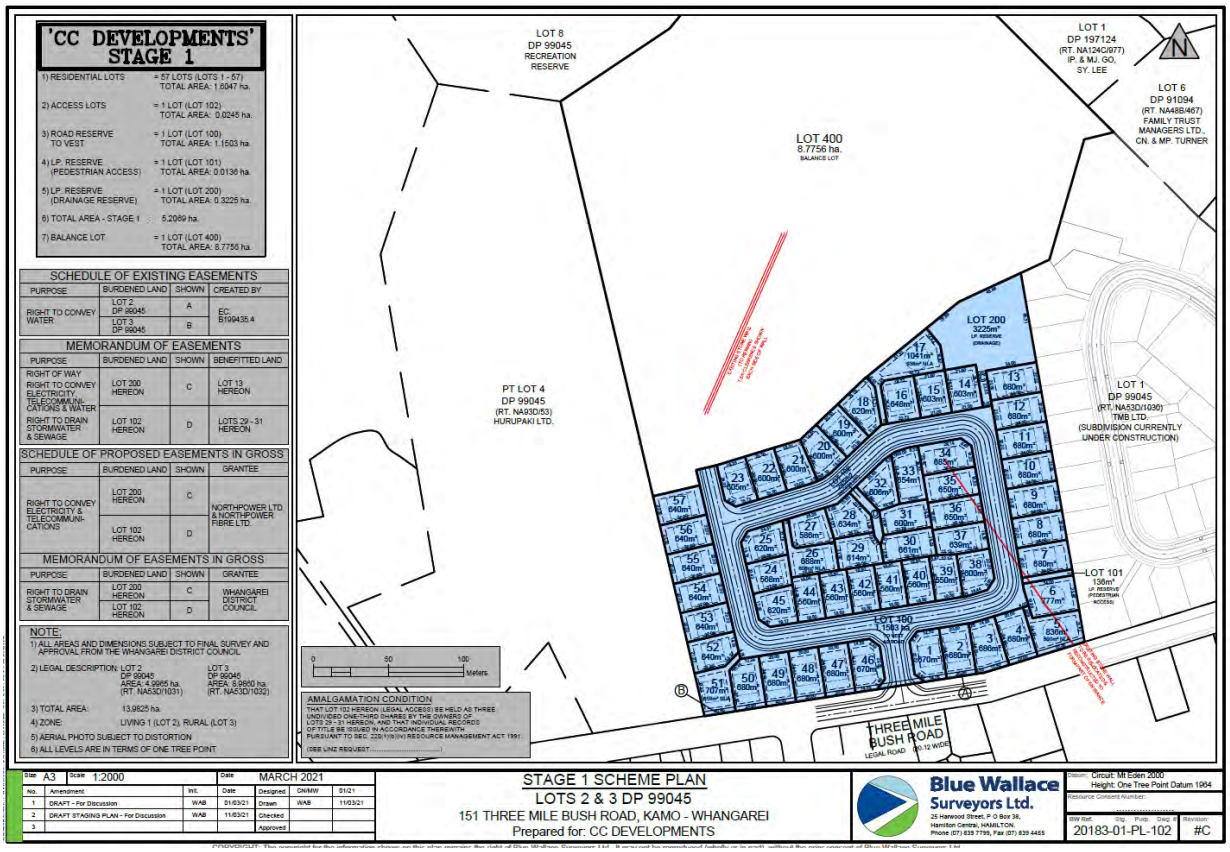

Figure 4:Subdivision of 131 Three Mile Bush Road.

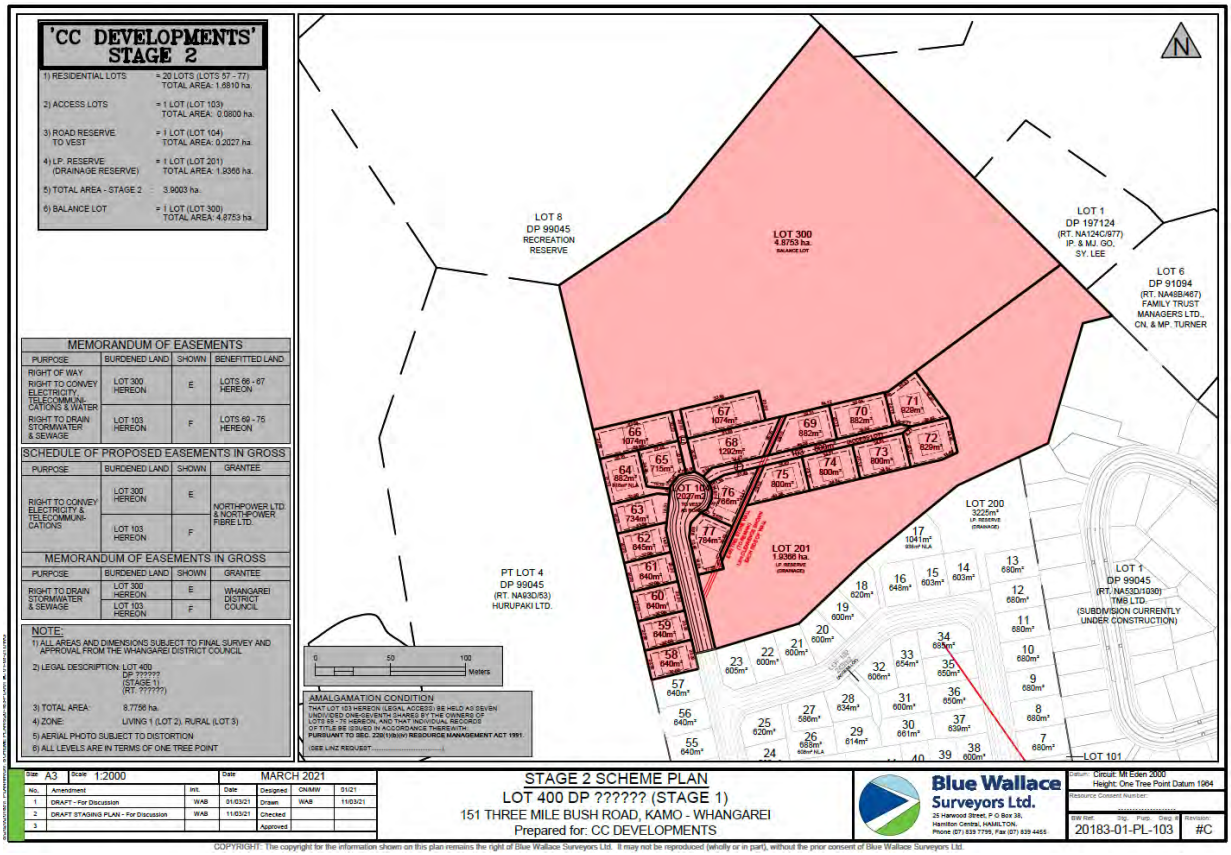

Figure 5: Subdivision of 189 Three Mile Bush Road.

4.0 Methodology

The methods used to assess the presence and state of archaeological remains on the property included both a desktop review and field survey. The desktop survey involved an investigation of written records relating to the history of the property. These included regional archaeological publications and unpublished reports, New Zealand Archaeological Association Site Record Files (NZAA SRF) downloaded via the ArchSite website, and land plans held at Land Information New Zealand. The Whangarei District Plan and NZ Historic Places Trust Register were also consulted.

Site visits involved examination of the existing ground surface. No probing or spade test pitting was undertaken.

5.0 Background

5.1 Archaeological sites on the subject property

There are no recorded archaeological sites on the subject property, although no archaeological survey has been previously undertaken in the immediate vicinity. The nearest known prior archaeological assessment was at the corner of Lake Ora and Three Mile Bush Road, undertaken by the author of this report in 2008 (Carpenter 2008).

The nearest recorded site is Pa Q06/208 which is 500m to the north west on the summit and north eastern slope of Hurupaki maunga. This pa was first recorded by D. Willoughby in 1963. In 1970 a plan of the whole site was drawn tape and compass survey, by J. McKinley of the then Historic Places Trust and in the late 1970s of early 1980s, the archaeological site recorders prepared another sketch of the site.

In 1990 S. Hakaraia and M. Jellick, facilitated by D. Nevin, undertook a plane-table and alidade survey on the site on behalf of the Whangarei District Council. That survey carried out between April and May 1990, produced a contoured site plan of all the visible features. The survey began at the trig which is 349m above sea level. The pa site spreads over the top of the breached crater, down the ridge to 30m below the trig on the north eastern side of the cone.

The pa is well defended by five ditches, and contains 82 storage pits over approximately 50 terraces with the largest pit measuring 8.8 x 7.4 x 1.5m deep and the smallest 2 x 1 x 0.20m. The native bush on the eastern side is dense and varied, half of it being intertwined with supplejack. From the trig west to the quarry, there is a fine pole stand of totara trees. The pa itself, a half hour walk uphill from Dip Road is well preserved and has a commanding view to the west along Three Mile Bush Road to Ruatangata. There is no indication of other features on the mid and lower slopes of the pa.

The pa is an archaeological sites of the highest significance, based on the size of the site and the state of the internal features. Along with the equally impressive Pa of Parihaka, Kauika/Pukenui and Maungatapere in particular, it points to the great value and carrying capacity of the soils of the Whangarei volcanic field in the prehistoric period.

The next nearest recorded archaeological sites are the pa on Onoke Reserve to the north east. This site, Q06/379 was recorded by G. Nevin in 1988. It consisted of the remnants of a pa site which had been heavily modified by bulldozing, located between the reservoir and Tuatara Drive. The remnants features were in excellent condition at

the time they were recorded, being under grass with the property owned by Warren Smith. They consisted of four terraces and six pits with seven other vague depressions on the upper terrace. These features are just visible in aerial photographs taken in 1947 and 1954. Recorded nearby is the railway ballast pit, two inclined tramways and other structures and features associated with the establishment of the Kamo-Hikurangi railway in the 1880s and 1890s, Q06/632.

In 1998, D. Nevin undertook a survey and assessment of a proposed 30-hectare redevelopment on the north eastern slope of Hurupaki and north slope of Onoke, between Dip, Pipiwai and Waipanga Road. At that time the area was in a mix of small house lots, former kiwifruit orchard, and unploughed steep pasture. A single site was recorded, a storage pit Q06/469 near Waipanga Road.

Pa Q06/525, terraces Q06/526 and pits Q06/528 and Q06/538 are recorded 1500m to the north on the northern slopes of Ngararatunua and Rawhiti Roa maunga. Pa site Q06/249 and coal mining site Q06/392, between the cemetery and Whau Valley, are located to the south east..

A large number of sites are recorded between Te Puia Street and Fairway Drive in Kamo, including substantial pa on the ridge that Fairway Drive ascends, multiple terrace and storage pit complexes, a chiefly meeting place at the point known as Ketenikau, the original burial ground of mid-19th century Chief Te Puia, and wooden artefact finds from the swamp below (now the vicinity of Braintree Street and Fairway Drive). Pa site Q06/377 consisted of a ridgeline with terraces, storage pits and possible defensive ditches, running for approximately 90m, and bulldozed into the swamp below as fill during the development of Fairway Drive in the late 1970s.

5.2 Other Heritage Sites and Features

There are no scheduled historic heritage sites or features or Maori Sites of Significance on the subject properties in the Whangarei District Plan. Neither are there any registered Historic Places, Historic Areas or Wahi Tapu or Wahi Tapu Areas on the Heritage New Zealand Pouhere Taonga List. The Hurupaki cone and Lake Ora are scheduled Outstanding Natural Feature and Outstanding Landscape Feature in the District Plan.

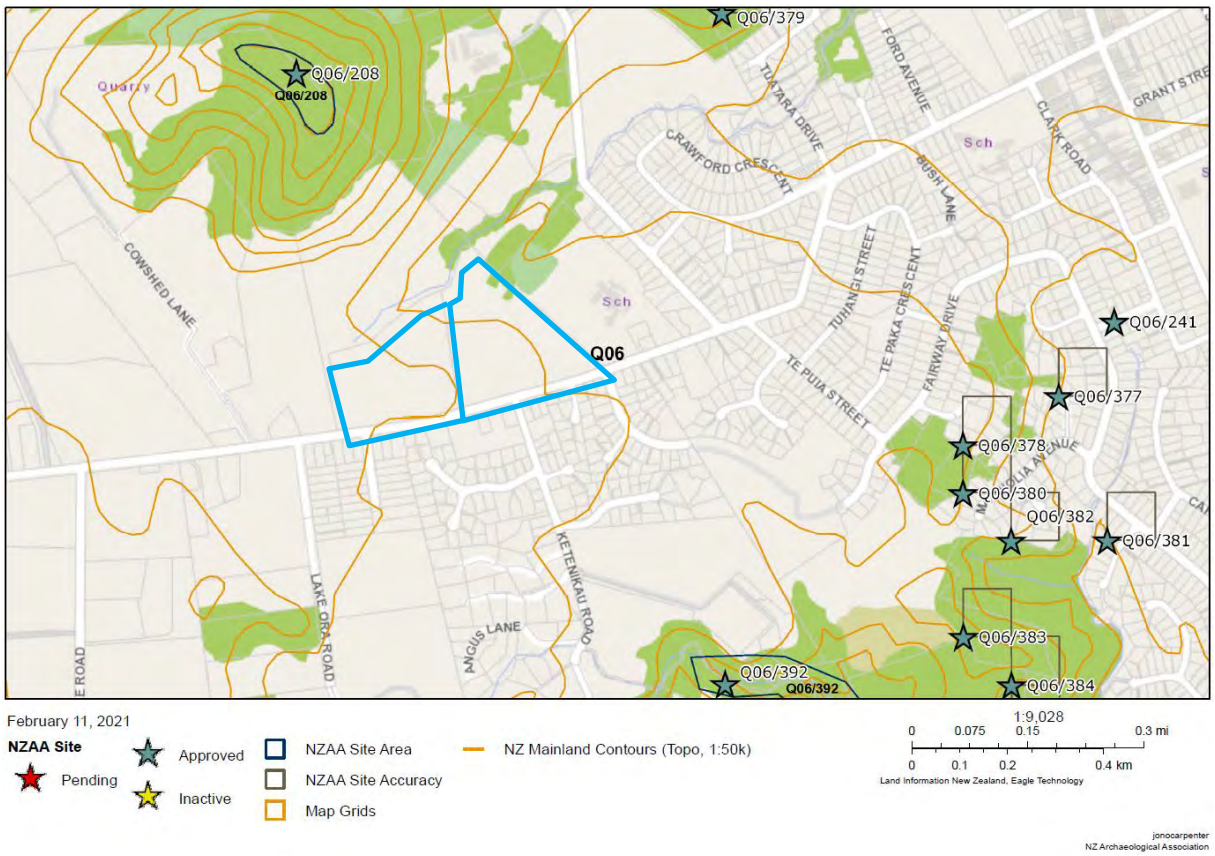

Figure 6: Archaeological sites in the vicinity of 115 Three Mile Bush Road (in blue).

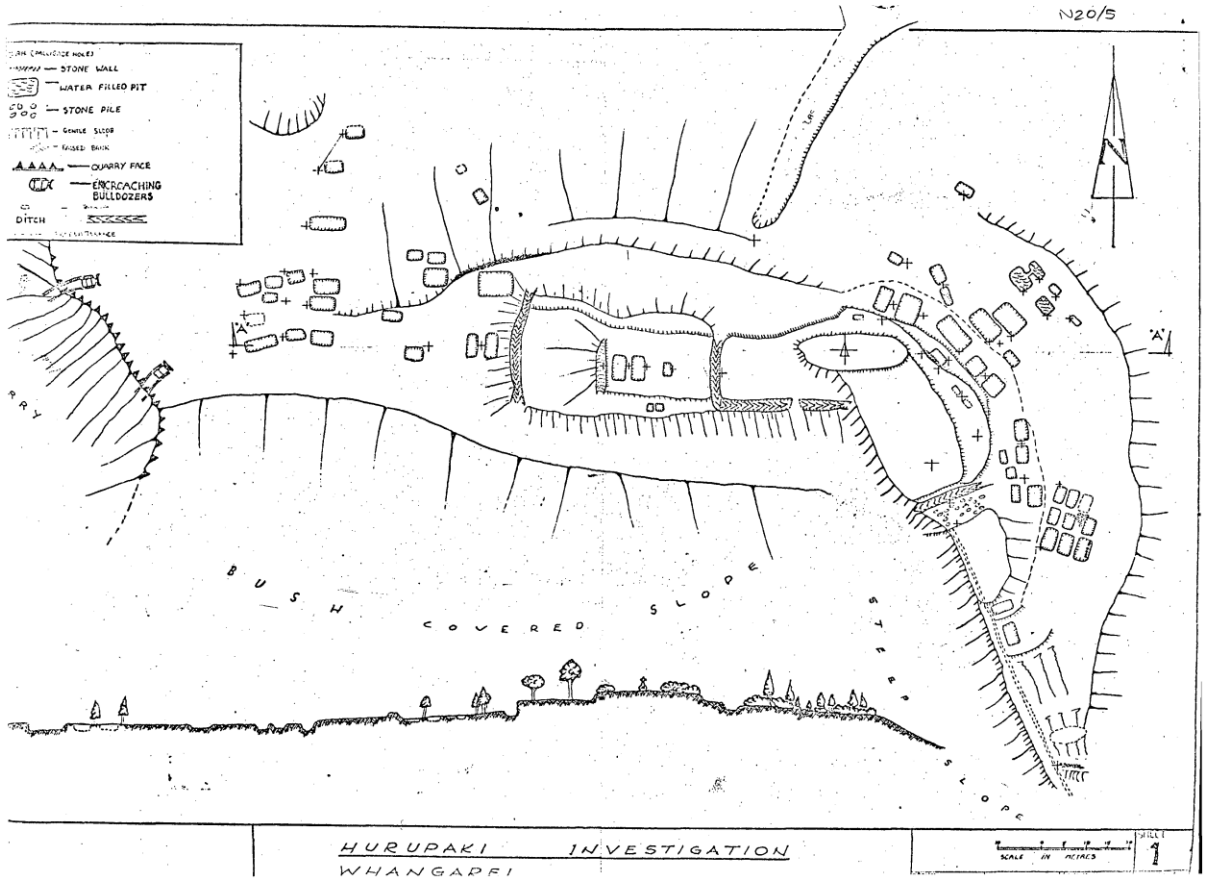

Figure 7: Pace and compass sketch plan of Hurupakia Pa, Archaeological Site Recorders (ArchSite).

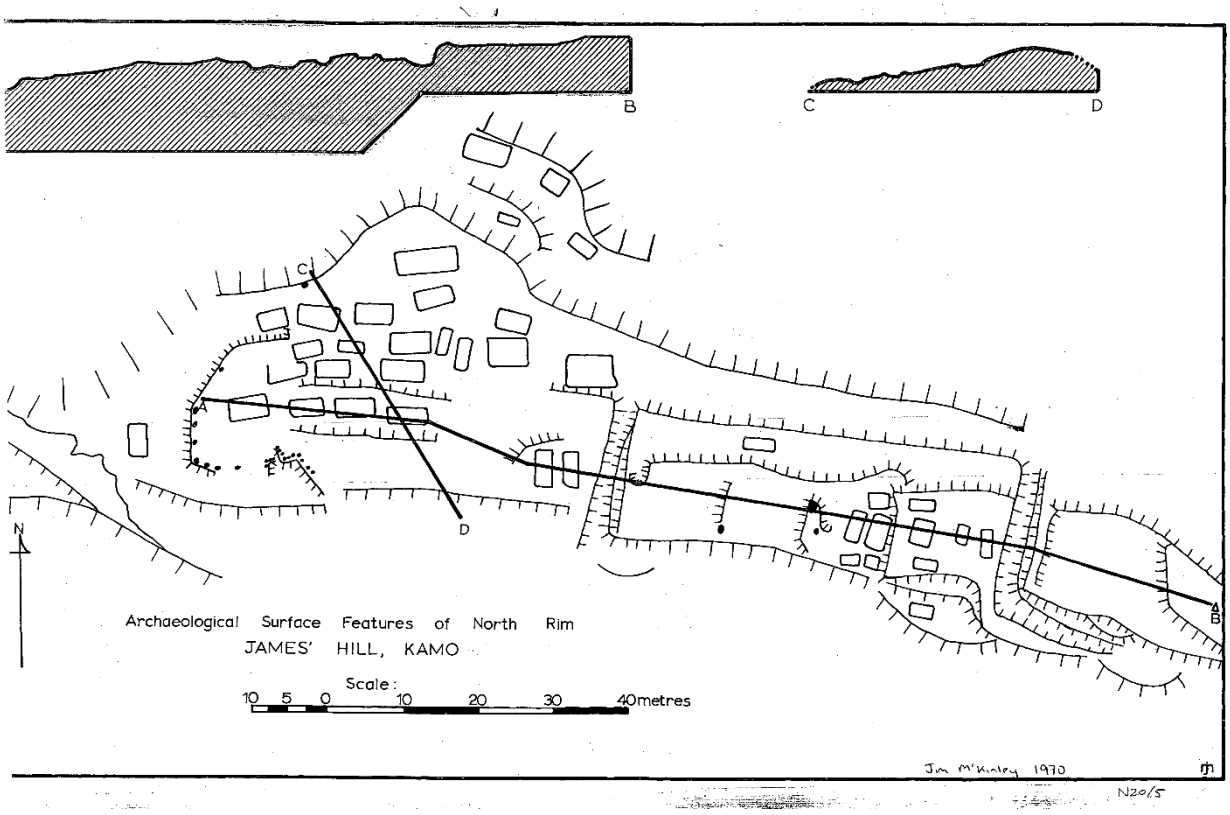

Figure 8: Tape and compass plan of Hurupaki Pa, J. McKinley (ArchSite).

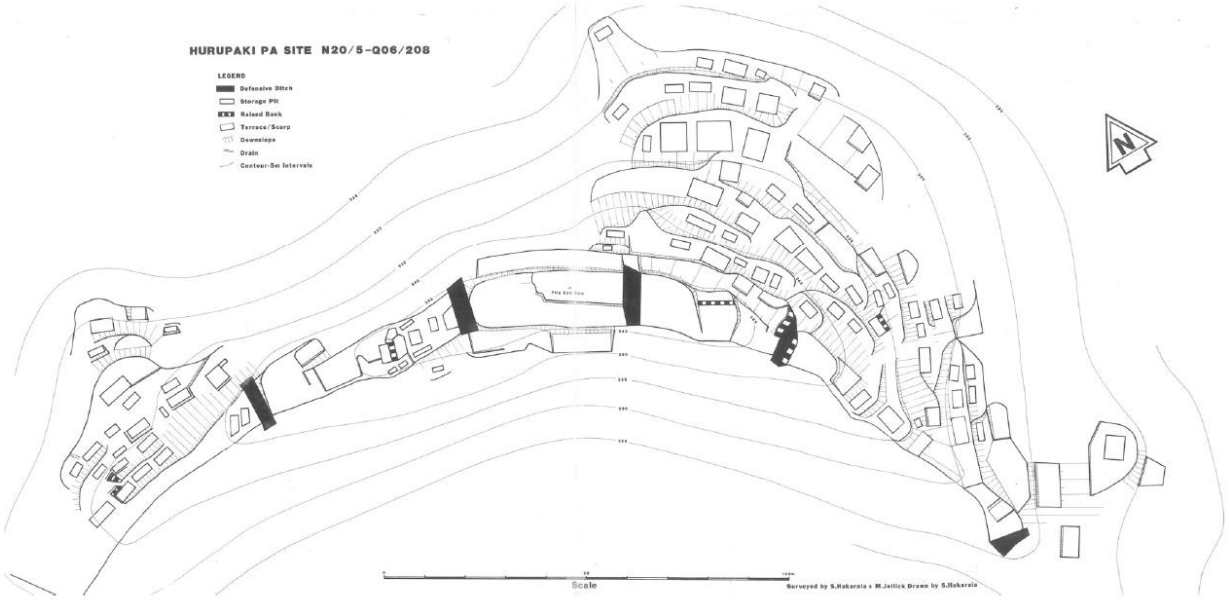

Figure 9: Plan table and alidade plan of Hurupaki Pa, S. Hakaraia and M. Jellick (Whangarei Library).

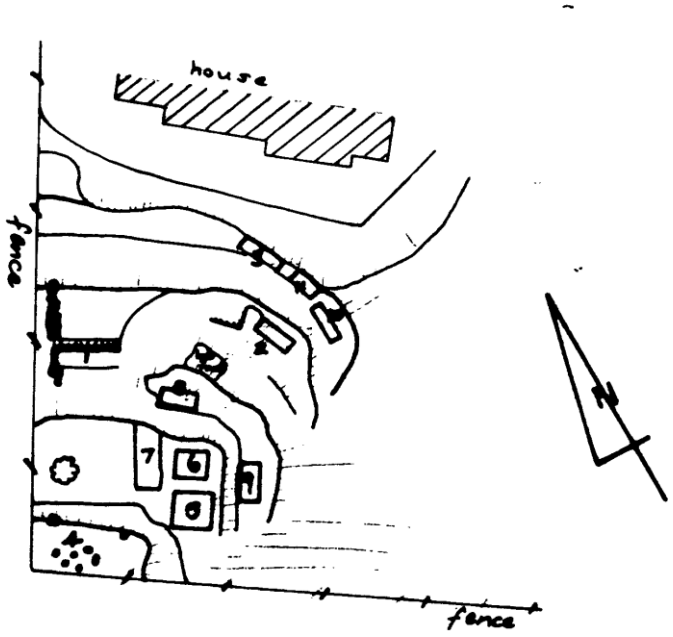

Figure 10: Sketch plan of Onoke Pa Q06/379 from archaeological site record (G. Nevin 1988).

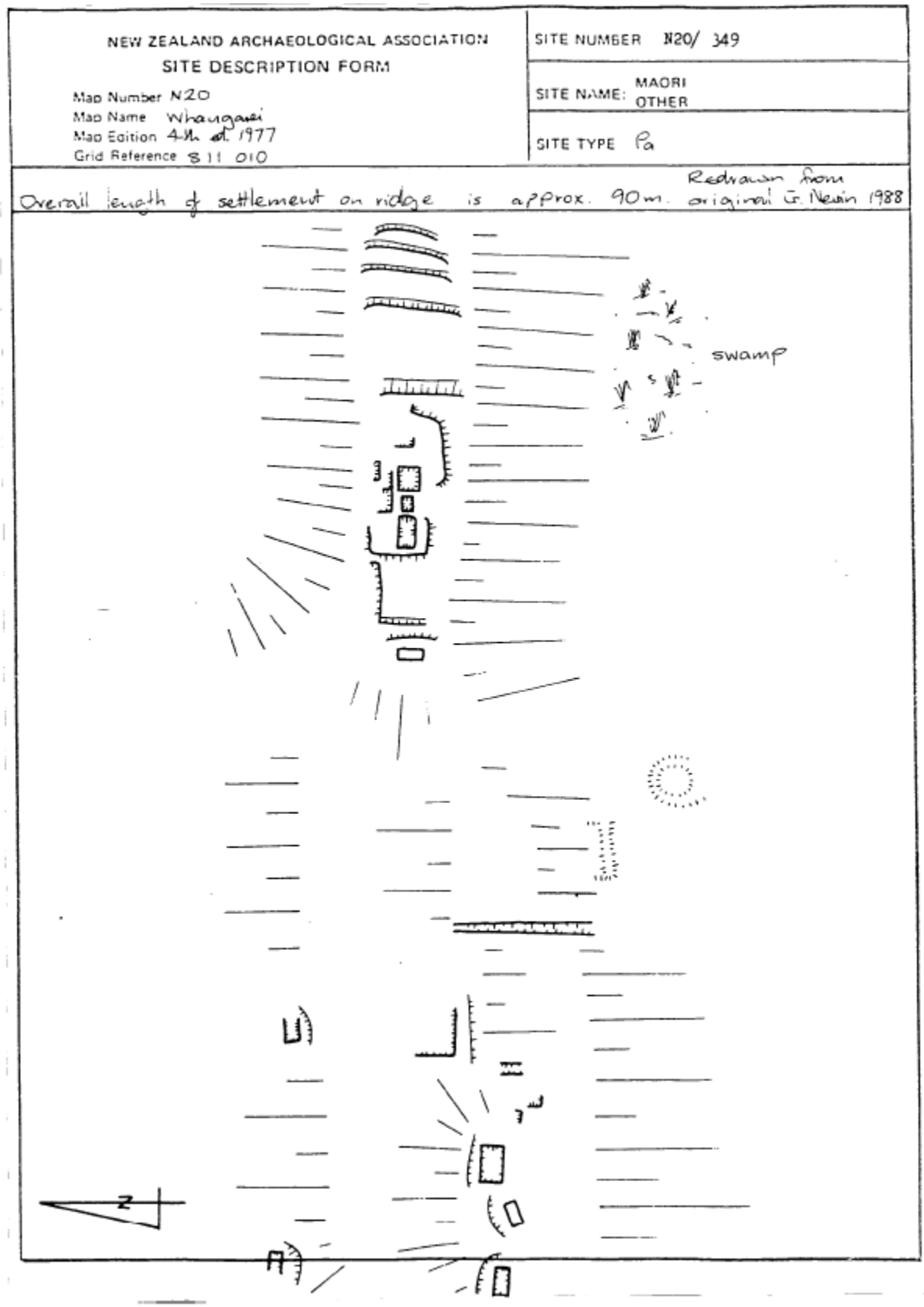

Figure 11: Q06/377 Fairway Drive Pa.

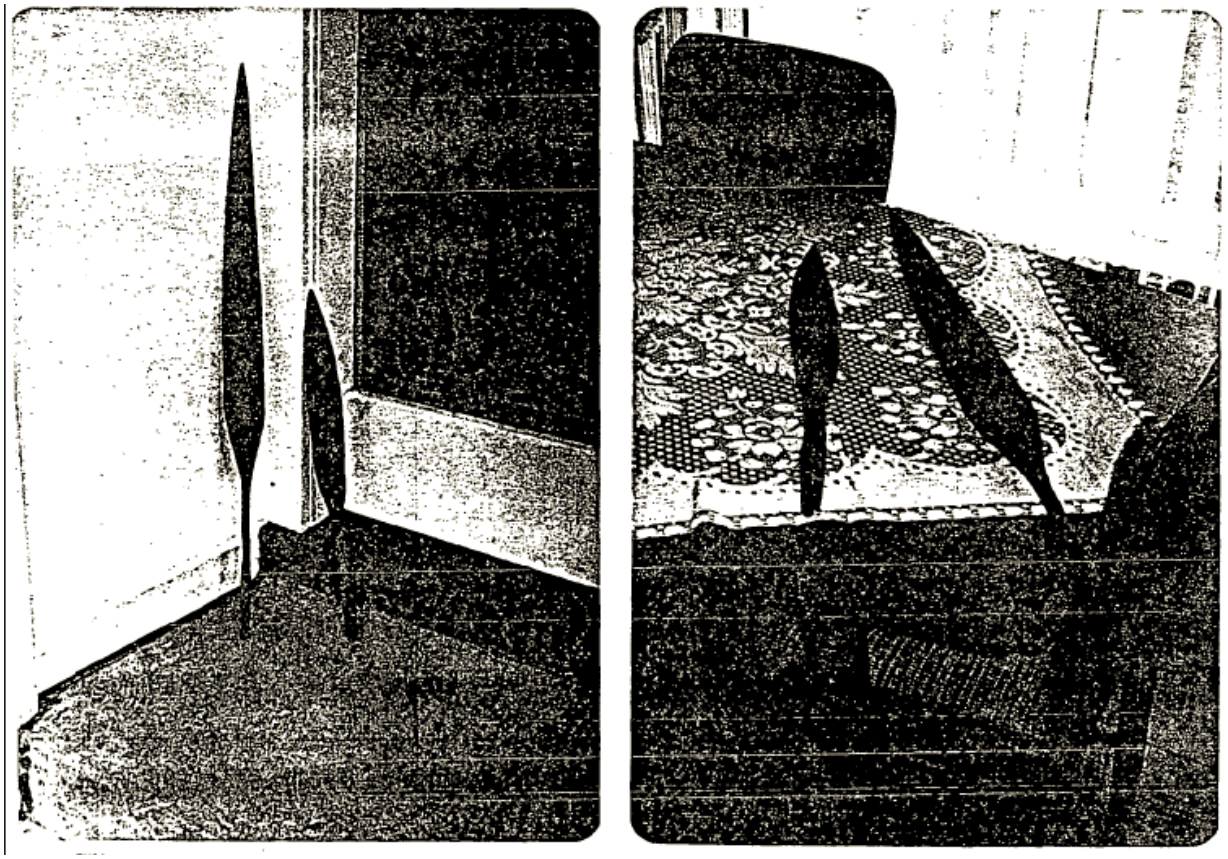

Figure 12: Q06/241 kumara weeders found by Mr. Granich during extension of Braintree to Clark Road, near the site of the Fairway Drive/Braintree swamp.

5.3 Historic Background

The Maori archaeological sites recorded in the vicinity of Three Mile Bush Road are a remnant of prehistoric and protohistoric Maori habitation and horticultural activities on the rich volcanic soils of the Kamo area. Along with Maungatapere, Maunu, and Whatatiri to the south east and Glenbervie to the west, Kamo was a centre of intensive Maori gardening in the prehistoric and protohistoric period.

A Maori village called Ketinikau was located on the western side of modern Kamo and was associated with extensive cultivations in the early historic period. Potato, maize, kumara and gourds were being cultivated near Ketinikau with wooden gardening implements in 1839, when this activity was observed by William Carruth when he journeyed through the area.

In 1839 Gilbert Mair Senior, one of Whangarei's earliest settlers, made a speculative purchase of 1800 acres from Corks Road in Kamo to the upper Whangarei Harbour. Sometime after 1844, when the Old Land Claims Commission reduced Mair's claim SO996a. The northern 400 acres of Mair's Grant was sold to George Burnett in 1853 and became his farm 'Cairnfield, while the 119ha Te Kamo Block which was the balance of Mair's claim not awarded to him, was purchased by the Crown in 1858 for £50. It was then purchased by William Carruth.

The part of Te Kamo immediately west of Burnett's property was purchased in 1871 by Thomas Wakelin and became his farm, 'Koraokaihau'. Wakelin arrived in New Zealand

from Braintree, Essex in 1860 and undertook several jobs including collector for the Whangarei Highways Board, before settling in Kamo on Koraokaihau. Wakelin soon expanded his holdings by purchasing adjoining land, including parts of the Ketenikau Block.

Other settlers soon followed and purchased land from the Maori owners, often shortly after title was granted. As the historic village of Kamo developed and spread, eventually becoming a suburb of Whangarei, most of the archaeological remains associated with the earlier Maori occupation have been destroyed, except in reserves or other pockets of land not economic to develop.

The construction of stacked drystone walls by European settlers from the mid-19th century has served to obscure and destroy the earlier Maori horticultural landscape which, on the basis of such landscapes preserved elsewhere, would have consisted of an elaborate network of low stone alignments marking out garden plots, paths providing access through the gardens, gardened mounds of stone and soil, and clearance mounds of bare stone, along with undefended settlements or kainga and pa.

Remnants of the pattern of land tenure associated with the early Wakelin and Burnett's farms are still visible in the form of stacked dry stone boundary walls adjacent to the Kamo State Highway 1 Bypass and around Wakelin's homestead at Elsies Way near Fairway Drive. Later stone walls from the expansion of European settlement are visible along Three Mile Bush Road.

5.3.1 Review of Historic Maps, Plans and Aerials.

A review of land plans and transactions is provided below. The subject property was originally encompassed within the Hurupaki Block but by the early 1890s was part of an extensive estate owned by settler James Whitelaw.

ML 2630 shows the original survey of the 362 acre Hurupaki Block in 1872. The entire block is shown in forest, apart from a small area adjacent to the 20 acre Otapapa Block on the south east boundary, the Whangarei-Ruatangata/Three Mile Bush Road alignment, and a clearing on the north west boundary with the Rawhitiria Block. The Otapapa Block appears to be cleared, does most of the Kopenui Block to the north of the Hurupaki maunga. Subsequent annotations show the subdivision of a 200 acre western block (later divided into Hurupaki No. 1 and No. 2), and an eastern block (Hurupaki No. 3) in 1887.

ML 5227 shows the survey of the Otapapa Block in 1881. Annotations describe the block as approximately 19 acres of rich pasture land, indicating it has been cleared and broken in for farming prior to this time. Stone walls are present on the Ruatangata/Three Mile Bush Road frontage to the south, and the Dip Road frontage to the east. The northern boundary is fenced.

ML 2630-A shows the subdivision of the Hurupaki Block into No. 1, 2 and 3, Blocks, in 1886. The No. 1 and No. 2 Blocks are in forest, apart from the Three Mile Bush Road frontage to the south, the area adjacent to the Rotomate Block at the south west boundary of Hurupaki No.1, and a clearing at the north western corner of that block and extending into the Rauwhitiroa (or Rawhitiroa) Block.

The adjacent Hurupaki No. 3 Block is cleared and shown as being owned/occupied by J. Whitelaw, but the southern half of the cone up to the fenced boundary with the Kopenui Block on the north side is still forested. The subject properties are in the south east corner of the Hurupaki No. 3 Block. The road boundary is annotated with "Fence and Wall".

According to subsequent annotations on the ML 2630-A plan, the Blocks came before the Native Land Court in 1891 and were partitioned at that time. The Hurupaki No. 1 Block of approximately 161 acres was partitioned into four smaller blocks of 30-60 acres each (Hurupaki No.1 A, B C, and D) along with the No.2 Block of approximately 40 acres shown as being owned or occupied by Wiki Pirihi.

ML 2630-B shows the survey of the Hurupaki No. 3 Block of 163 acres, in 1887. The Otapapa Block is shown immediately to the east, and the Hurupaki No. 2 Block to the east. Three Mile Bush Road is the southern boundary, with the Rawhiti Roa and Kopenui Blocks to the north west and north respectively; the Hurupaki maunga itself straddles Hurupaki No. 3 and Kopenui.

ML 9581 from 1914 shows the stone walls either side of Three Mile Bush Road at the Pukemiro Road intersection, including those along the Hurupaki No. 2 frontage.

DP 49459 from 1961 shows the subdivision and access to the Hurupaki quarry on Hurupaki No. 2. The plan shows the stone wall along the boundary with Three Mile Bush Road, along with an annotation stating "Stone wall at least 70 years old". The boundary between Hurupaki No. 2 and No. 3 is shown as a post and wire fence at least 60 years old at the southern end of the boundary; at the northern end is a stone wall at least 25 years old, and a post and wire fence at least 60 years old. The boundary with the Otapapa Block is shown as a stone wall but with no indication as to age, although the fence extending north along the boundary with the Ngatapapa block is shown with a post and wire fence at least 60 years old.

The Pahunuhunu and Ketinikau Blocks lie to the south of Three Mile Bush Road. The granting of title for Ketenikau to Te Puia and the Pa, chiefly meeting place and other historic features have already been noted above.

Maori land plan ML 29 shows the Ketenikau Block survey from 1865. The Block comprised 272 acres when originally granted to Te Puia, Manihere Teiwitahi, Hirawani, Tapene Hare, Pakia Hirini, Tipene, Hepi Monariki, Makere, Hemi Kohitaro, and Tamati Pehi. The land plan puts the location of Ketenikau itself immediately east of the top of Fairway Drive, at the point where the hill drops away and offers views east and south towards central Whangarei and the upper harbour. This is in the vicinity of the chiefly gathering place, Te Puia's burial ground and the Pa destroyed by Fairway Drive in the 1970s as noted above, and was obviously an important settlement in the mid-19th century and earlier, based on the presence and form of the destroyed Pa.

The plan also shows the name Otapapa in the vicinity of the southern boundary of what would later be surveyed out at the Otapapa Block, and an area of cultivations to the south of Otapapa and west of Ketinikau. The western side of the block beyond the cultivations are shown in forest. The purchase of approximately 55 of this block by Thomas Wakelin have already been noted, and over the next 15 years approximately another 130 acres was alienated to settlers and the Crown.

5.3.2 Review of Land Records

A review of the Hurupaki and adjacent Otapapa Native Land Court records was undertaken to identify what form of pre-1900 occupation may have occurred on those blocks in the vicinity of the subject property, who the traditional owners were, and how the blocks came to be alienated.

The Hurupaki title investigation came before the Native Land Court on 27 November 1873 (Maori Land Court Whangarei Minute Book No. 2: 115). Hira Taurau of Ngatikahu and resident at Ketinikau testified that he had seen the survey, knew the land, and the claimants named in the public notice were the right people, namely himself, Tipene Hari, Hone Rakete, Eruera Pohe and Hape Moanariki.

Eru Nehua also appeared and made a claim on Hurupaki, unless the neighbouring Otapapa was awarded to him, in which case he would withdraw.

Netana Ripa also appeared before the court and noted that he lived at Te Wairoa with the Hirorohi (Te Urioroi?) and had come to Ketinikau to stay with Ngati Kahu with Heke. Ripa, while sharing a whare with those involved, stated that Tauraurangi (?) a great man of Ngati Kahu gave the land to Heke and the whole second night of the visit was given over to discussing this transfer, although the boundaries were not marked by Heke at the time and none of his 50 followers asked for any land. He understood the land at-issue to be at Ketinikau and didn't know anything about Otapapa, but Tauraurangi wished Heke would come back permanently, and Heke said he would.

The Court went on to find with regard to title to Hurupaki and Otapapa, that some gift of land was made to Heke by Ngati Kahu at Ketinikau but that the boundaries were not pointed out and that the gifting was left in an uncomplete state. The Court found that the northern and southern boundaries were not set, but those to the west and east might be approximated. The court could not say whether Hurupaki or Otapapa were in the gift, only that Ketinikau was the place the gifting occurred, and subsequently could not include the counter-claimants in any grant. The Court went on to state it would make no order in grant to either of the blocks until such time as Ngati Kahu surveyed out a piece of land in execution of the gift. The Court then adjourned until the next morning, and if no agreement could be reached, would adjourn again and make no order.

When the court re-convened the next day, Hira Taurau reported that they had come to an arrangement with Eruera and Kereama, giving them 20 acres for their claim on the west boundary of Hurupaki, bounded on the east by Hurupaki, on the south by the Ruatangata Road, and the western and northern boundaries by agreement. Eruera agreed to the new block of land in exchange for the extinguishment of the original gift, stating he had been out to the land in question that morning.

Wiremu Pomare Kingi stated that Tipene Hari had given his agreement the day before. The Court made grants to Hurupaki and Otapapa Blocks to Hira Taurua, Rikihana Takurua, Tipene Hari, Hirawanu Te Puia, Hone Rakete, Hepi Moanariki, Mere Wharenikau, Wiki Pirihi, Te Reweti Hori Kingi and Eruera Pohe. The Court also ruled that 200 acres on the western side of the block should be inalienable except by lease for a period of not more than 20 years, and that the rest should be unrestricted.

The 20 acres block granted to Eru Nehua as a result of the original gift to Heke was the Rotomate Block immediately west of Hurupaki, and that title was investigated and

granted in 1882 without challenge (Maori Land Court Whangarei Minute Book No. 2: 293, 295).

The claim to the 20 acre Otapapa Block was heard on 26 November 1873, just prior to the Hurupaki investigation. Hira Tauru of Ketenikau claimed the land. The claim was contested, on behalf of the descendants of Hone Heke on account of the gifting noted above, represented by Eru Nehua and Keremenita Peia, the son of Heke's brother. Peia indicated the land given was near to but not exactly on the Otapapa Block. However Hepi Moanariki testified the land was never occupied, and the gift was only a temporary offer of accommodation after the battle at Ruapekapeka and Hira Tauru would not budge.

As noted above, the investigation was ultimately adjourned until the counter claims over Otapapa were satisfied by the agreement over Hurapaki and Rotomate. The Otapapa Block was ultimately granted to Hira Taurua, Rikihana Takurua, Tipene Hari, Hirawanu Te Puia, Hone Rakete, Hepi Moanariki, Mere Wharenikau, Wiki Pirihi, Te Reweti Hori Kingi and Eruera Pohi.

Another claim by descendants of Hone Heke was made to land one kilometre further to the west two years earler. The Pahunuhunu Block was claimed by Wi Taungahuru and Hika Tauku. It notes the area of the subject property as being in open taraire forest. Two surveyed road alignments are shown but little other relevant historical detail. The claim was heard on 15 September 1871 but the claimants were not present and the claim was adjourned and reheard on 18 September.

Te Hira Tauru of Ngatikahu claimed the land for himself and Rikihana te Hua, Wi Taungahuru, Rikihana Te Rua, and Hepi Moanariki. The claim was derived from their ancestors Ngarohe Te Uru, Te Tongotongo, Taionga, Tauru and Te Hera. Te Hira stated the land was held since the days of Ngarohe te Uru and had never been disputed, and that their fathers grew kumara on the land. They wished to sell the land and had plenty of land elsewhere for cultivation and occupation.

The claim was disputed by Heremenita Peia who stated that the people of Te Hira had given a portion of the land to his uncle Hone Heke after the war of 1845-46, who in turn had left it in the charge of Puriri. This was in return for land given up at Pouerua near Pakaraka. Heremenita had lived on the land and had been dispute with the claimants previously over ownership. The counter claim was supported by Eru Nehua of Ngati Hau at Whakapara but no other evidence was produced.

In answer, the original claimants stated that Heke was allowed to live on the land for a short time after the war as he was afraid of the Pakeha, but that he was then to return to his land when the danger was past. They went on to state that in-fact Heke had only visited the area for three days after the war, staying at Keitinikau near Kamo. The land exchanged at Pouerua was utilised under a similar agreement and these were not supposed to be a permanent arrangement. The title was subsequently issued to the original claimants without restriction. It is not clear if the visit by Heke referred to in the Pahunuhunu investigation was separate to that described for Hurupaki and Otapapa, but regardless indicates the connection to the area held by Heke.

The first partition of the Hurupaki Block is recorded on 24 November 1885, although the transaction happened ten years previously, shortly after the original title investigation (Maori Land Court Minute Book No. 3: 135, 137, 139). Wiki Pirihi appeared for the subdivision, stating that there were then 10 owners of the Block, five who had already

sold their share and five who still owned the block but wanted to partition. Pirihi stated they had agreed amongst themselves that those who had already sold had a share of 162 acres, and those who retained their interest had the 200 acre balance. Those who had not already sold were Hira Taurua, Rikihana Takurua, Tipene Hari, Hone Rakete and Wiki Pirihi himself, retaining 200 acres on the western side of the block, with Pirihi wishing to divide his 40 acre share from the eastern part of that portion.

Pomare Kingi appeared for himself and the other four original owners, Hirawanu Te Puia, Hepi Moanariki, Mere Wharenikau, Te Reweti, and Eruera Pohe. While originally objecting, subsequently the owners made further arrangements amongst themselves. Kingi would go on to state that he and the other four named had sold their 162 acre share on the eastern side of the Hurapaki Block ten years earlier to James Whitelaw, had received full payment for it, and requested that title to Hurapaki No. 3 be made over to him. Subsequently Hurupaki No. 2 was partitioned for Wiki Pirihi, and No. 3 made over to Whitelaw.

James Whitelaw went on to purchase an additional 60 acres of the Hurapaki No. 1 block in 1885, according to a Notification of Purchase in 1887 under the Native Land Administration Act 1886 (Archives New Zealand ref.: R25694183. James Whitelaw, Kamo Received: 4 April 1887 Subject: Notification of purchase of Hurapaki No.1 Block). He did this by purchasing the share of Hira Taurau, and a quarter share of Hone Rakete. This would go on to be partitioned or subdivided as the Hurapaki No. 1D block. The notification certificate states that the Native Land Court adjudicated the title in November 1885 after which Whitelaw purchased the land, began making payments on it for which he had receipts, and began clearing and fencing it.

Partition of the Hurapaki No. 1 Block was undertaken by Hone Rakete and the other owners in 1887 (Maori Land Court Minute Book No. 3: 145). Pomare Kingi appeared on the claimants behalf, noting that he himself no longer had a claim but was appearing at their behest with a written order for partition signed by the others and witnessed by Mr Mair.

Hurupaki No. 1 A was awarded to Tipene Hare, No. 1B to Hone Rakete, No. 1C to Rikihana Takurua and No. 1D to James Whitelaw, which had belonged to the child Hira Taurau.

5.3.3 James Whitelaw

James Whitelaw was a prominent Kamo settler and shopkeeper who ended up with substantial holdings, including the Onoke Block between Hurupaki and the railway, and the Otapapa and Hurupaki Blocks. He also owned other land further west along Three Mile Bush Road on the Pahunuhunu Block, and in Kamo itself.

Whitelaw was also involved in the purchase of part of the Ketenikau Block adjacent to the urupa for use as a European cemetery, following the death of his granddaughter Ada Holman. Her farther, married to Whitelaw's daughter, was unable to be buried in the Christ Church cemetery in Whangarei as she wasn't christened and Henry Holman sough land from chief Te Puia for this purpose.

James Whitelaw was hit hard by the economic depression of the early 1890s. His holdings at Kamo went up for sale in 1894 after he went bankrupt. At the time the auctioned estate included 162 acres at Hurupaki No.3 which had previously been the residence of J. H. Davis and described as being subdivided in good wall and post and

wire fences, and 101 acres of Hurupaki 1D and No.2 described as fenced, half in grass and half in bush and also previously the residence of J. H Davis, along with the 20 acre Otapapa Block, described as fenced all around with stone walls (Northern Advocate, 27 October 1894). No further information has been forthcoming about Davis, but he appears to have sold his Kamo properties in 1891 and left the area at the time Whitelaw was expanding, just before his bankruptcy.

Also included in the Whitelaw estate auction was land at Onoke, Pahuhuhunu, Ngamokotuiatara, Ketenika, Te Tiawhenua, Pukemirau and village sections in Kamo itself including Whitelaw's store, stable and other buildings, and a butchers and tailors, and three cottages all leased to others.

On 2 November 1894 the Auckland Star reported on the results of the sale, noting that the Bank of New Zealand purchased the 162 acre Hurupaki block for £931, while the Colonial Bank purchased the remaining parts of Whitelaw's Hurupaki holdings and Otapapa for £656 and £412 respectively.

The 1902 Cyclopaedia of New Zealand describes Whitelaw at the turn of the century as very much a man trying to get back on his feet:

> "General Storekeeper, Gum and Produce Merchant, Kamo. Bankers, Bank of New Zealand, Whangarel. Mr. Whitelaw established his business in 1880. His shop has a frontage of fourteen feet to the main road and does a very steady trade. Formerly he had a very extensive business, but through the Bank of New Zealand crisis, he had the misfortune to lose the larger portion of his property and connections. Mr. Whitelaw is now gradually re-building his fortunes"

5.4 Summary

The subject properties were part of the Hurupaki Block, to which titles were granted to various owners affiliated with Ngati Kahu and surveys undertaken, from 1873 onwards. At that time all but the eastern boundary with the neighbouring Otapapa Block appears to have still been forested. No particular historical or cultural features of note are identified within the blocks based on the land court testimony and survey plans, but the Otapapa Block was contested by descendants of Hone Heke who may have occupied an area near that block briefly after the Northern War of 1845-1846.

The land was progressively partitioned and sold or leased (and later sold) to European settlers by the Maori owners over the next 20 years, as were many of the neighbouring Maori blocks. By 1894 large areas of land either side of Three Mile Bush Road, including most of the Hurupaki Block, were owned by settler James Whitelaw. The land had been broken in for farming and stone walls had been built along the Three Mile Bush Road frontage by the early 1890s.

Whitelaw appears to have expanded his holdings too fast and was hit hard by the economic depression of the early 1890s. His approximately 800 acre estate, which included a ribbon of properties from central Kamo west along Three Mile Bush Road to Church Road, broken up and auctioned off to a number of different buyers in late 1894, while he ultimately retained his domestic and commercial premises in Kamo itself.

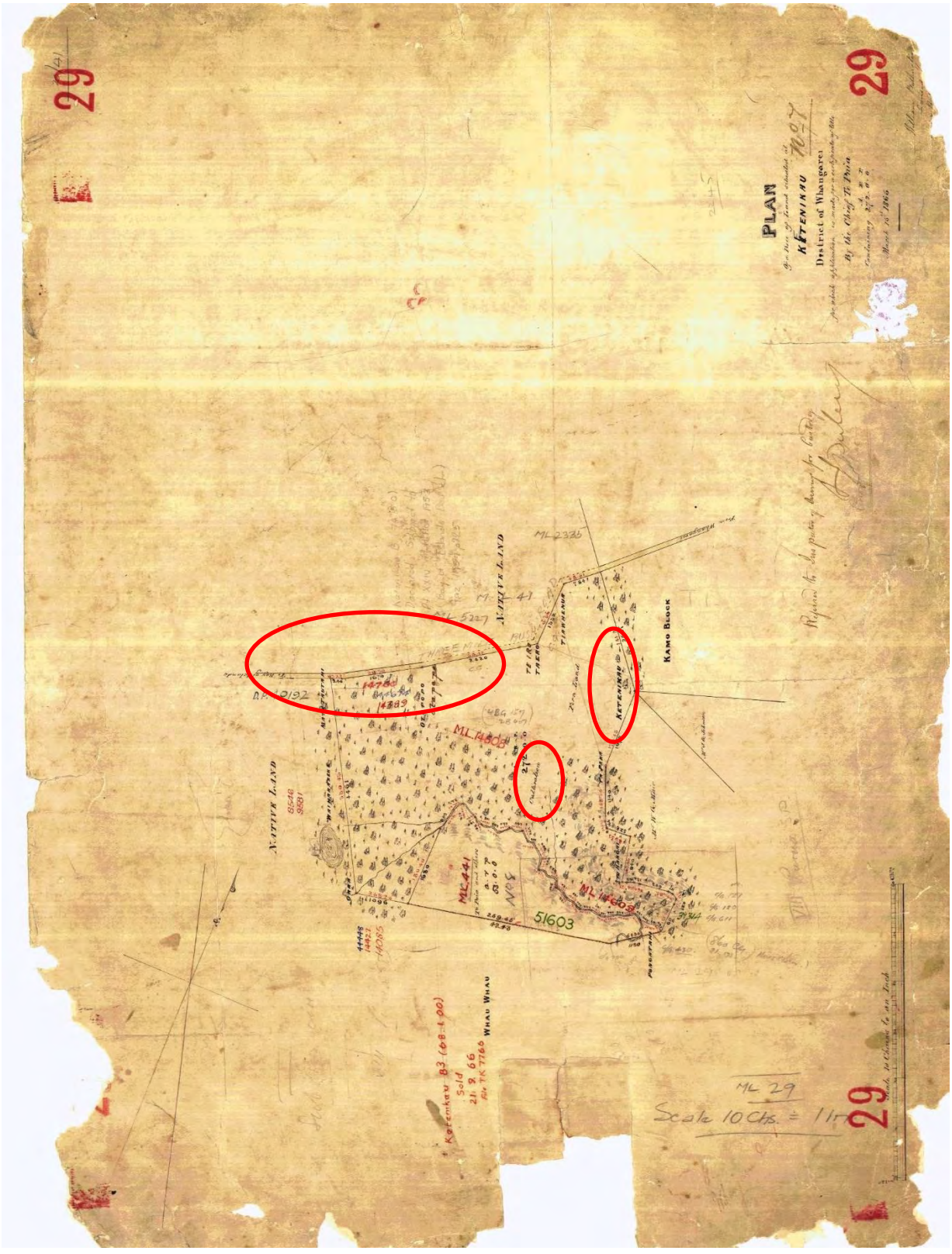

Figure 13: ML 29 Ketenikau Block with 1865 bush lines, and Otapapa, cultivations and Ketenikau (circled, left to right).

Figure 14: ML 2630 Hurupaki with 1873 bush line near the Hurupaki/Otapapa boundary.

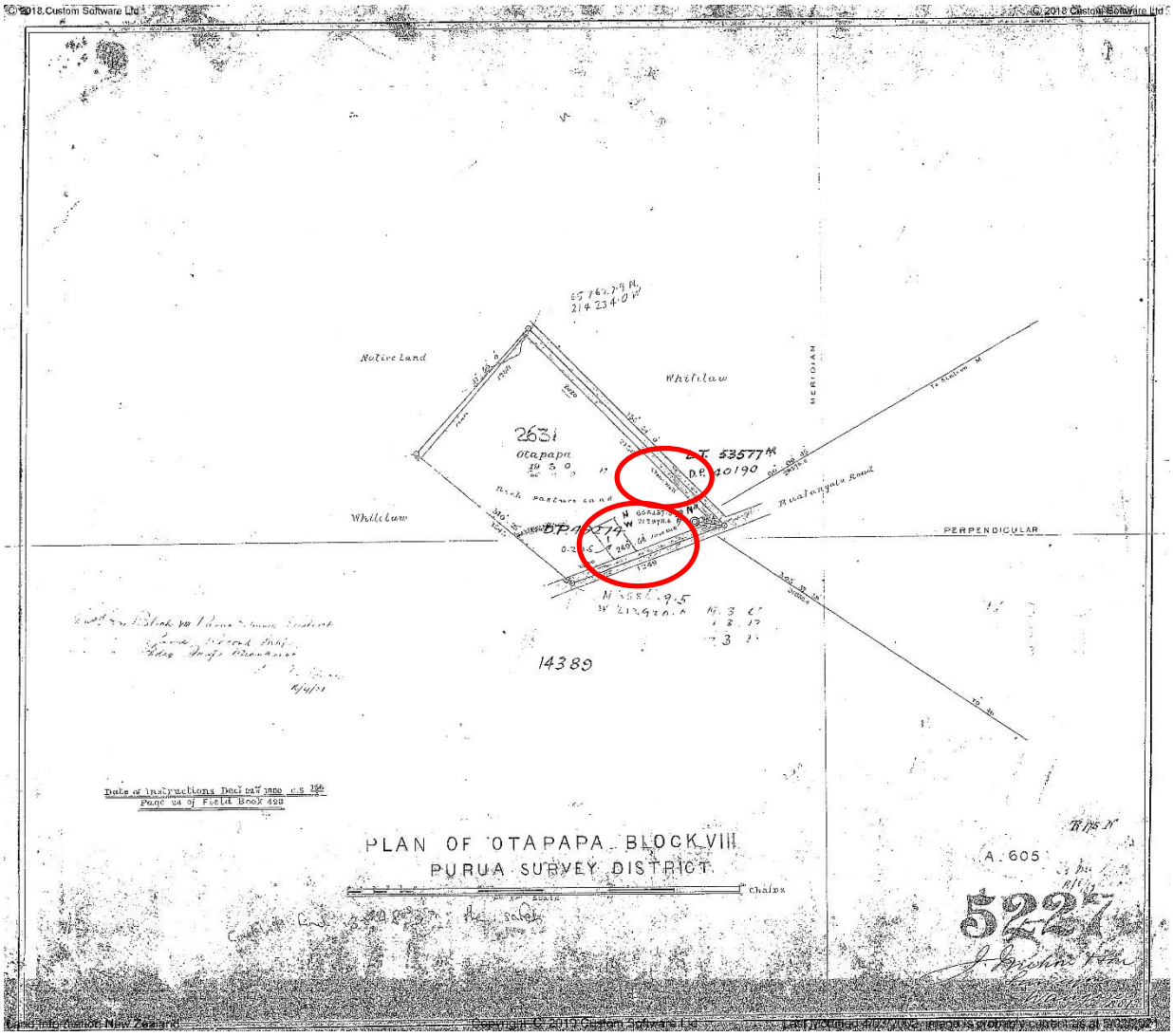

Figure 15: ML 5227 Otapapa Block 1881, with stone walls circled.

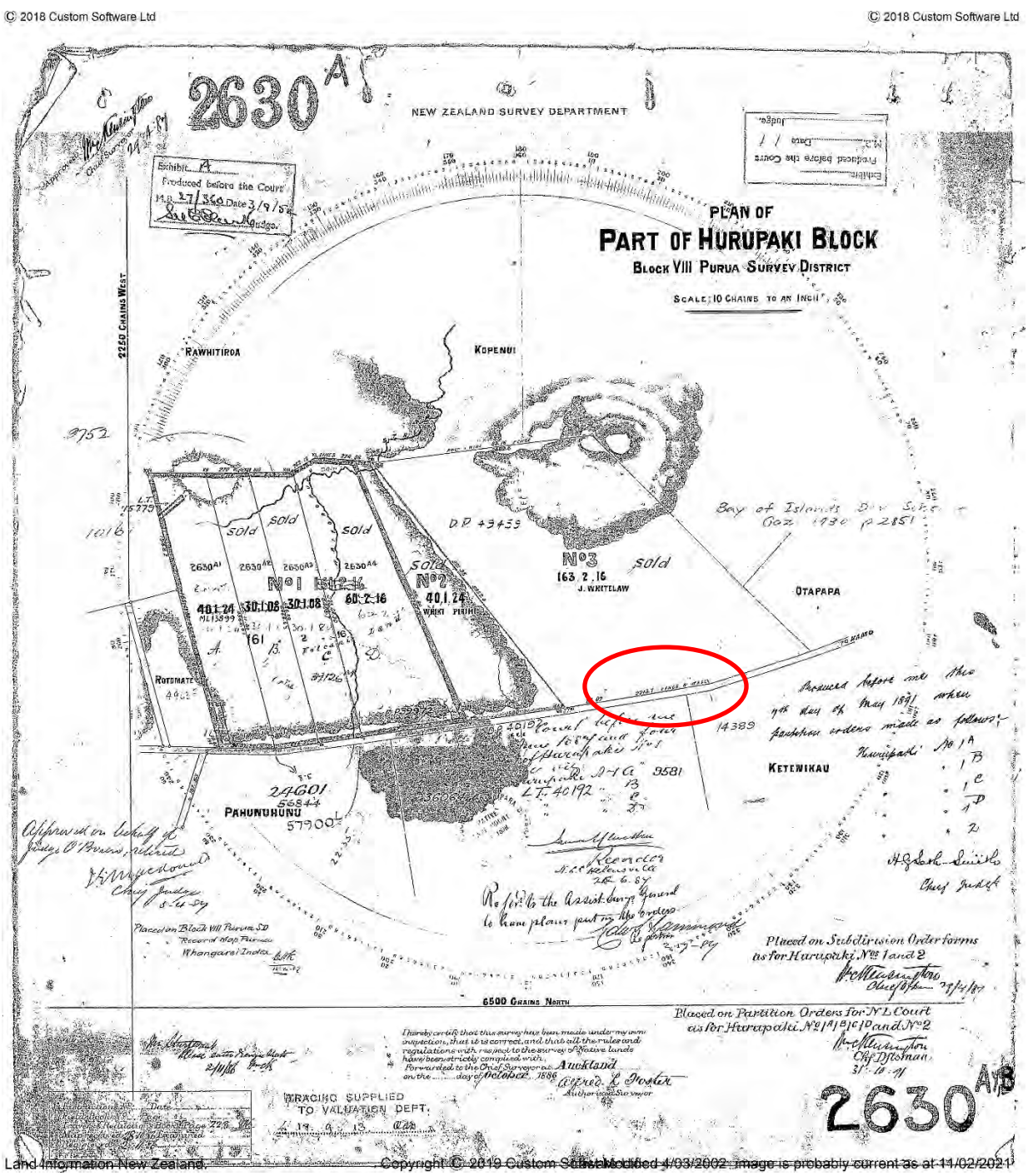

Figure 16: ML 2630A Hurupaki with 1886 bush lines and Thre Mile Bush road boundary at the subject property with wall and fence.

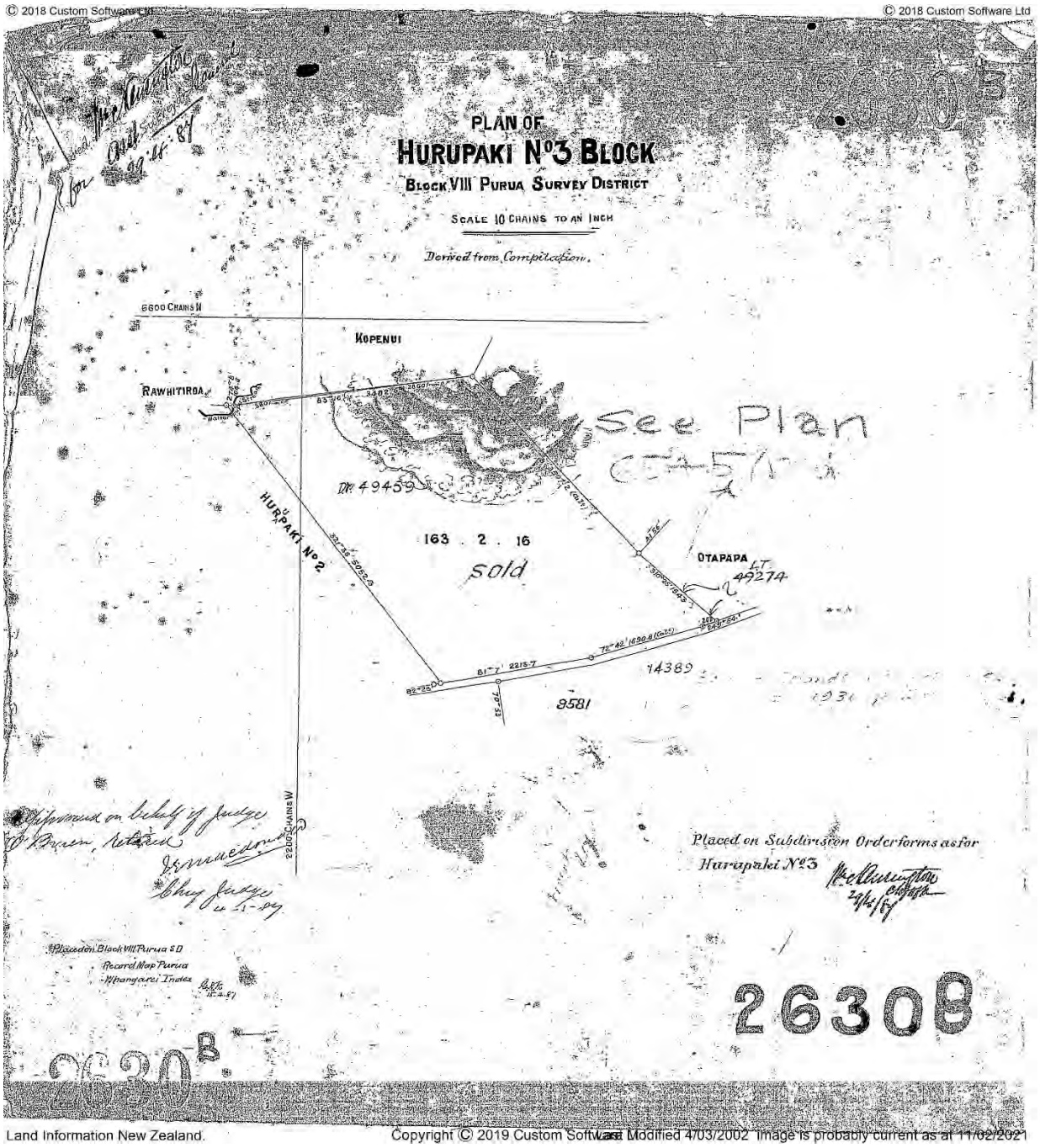

Figure 17: ML 2630B Hurupaki No. 3 in 1887.

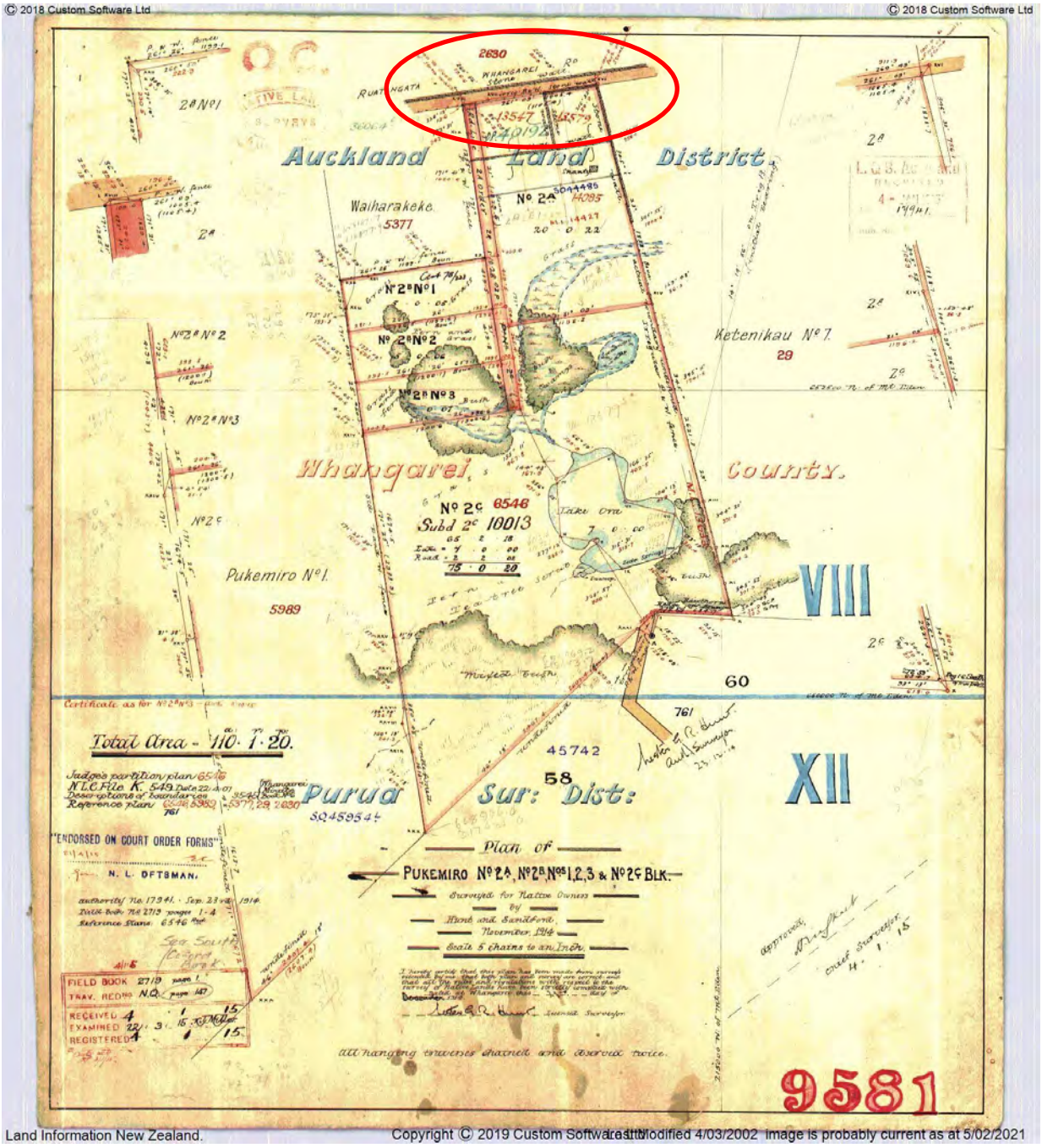

Figure 18: ML 9581 from 1914 with stone walls either side of Three Mile Bush Road on the south western boundary of the subject property.

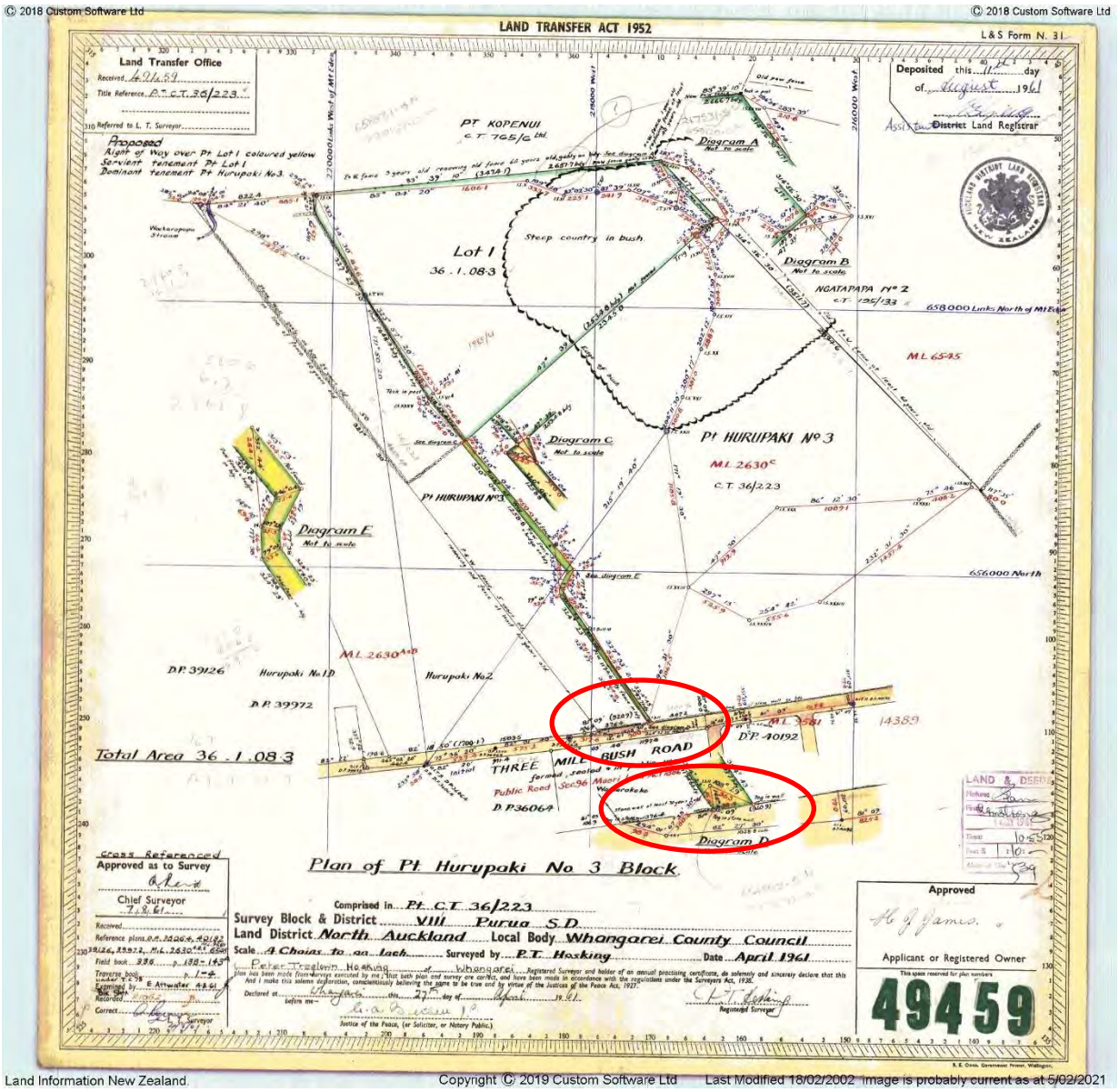

Figure 19: DP 49459 from 1961 showing stone walls on the Three Mile Bush Road boundary at least 70 years old, immediately west of the subject property.

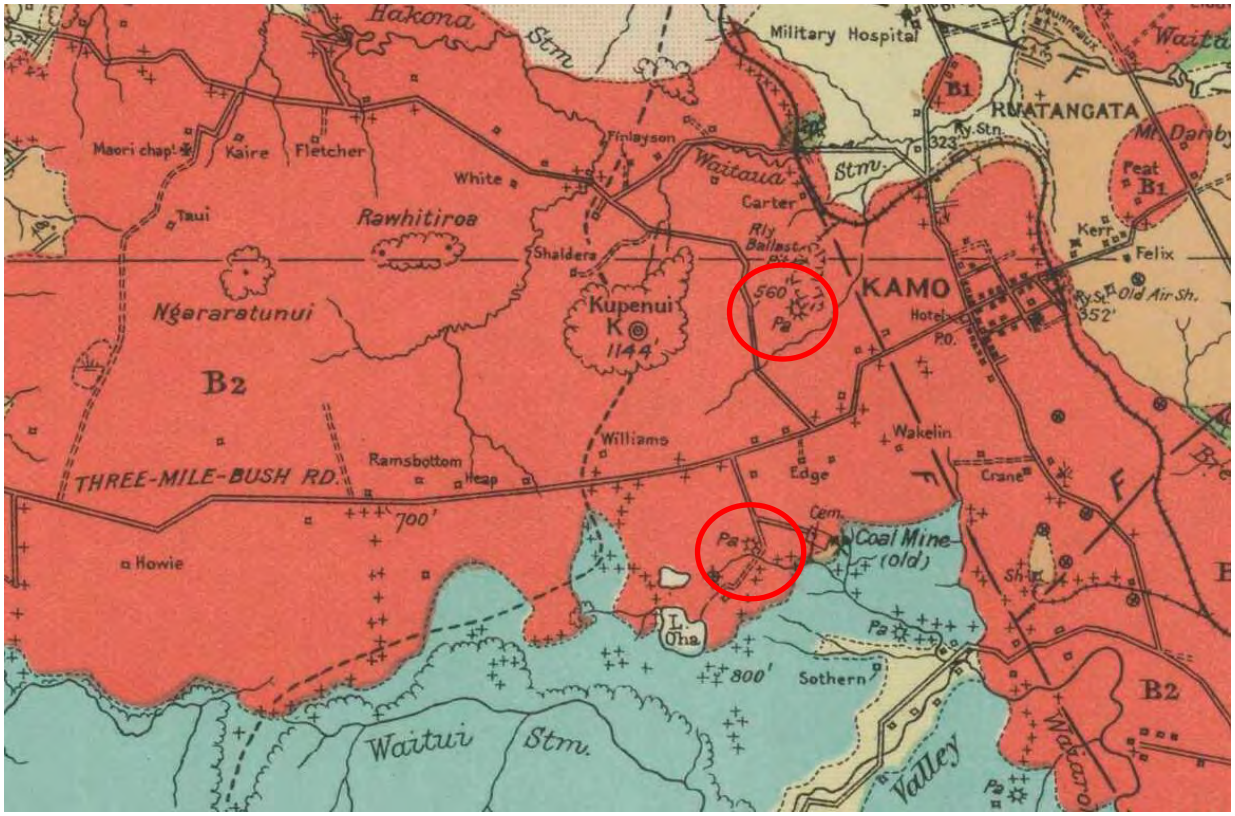

Figure 20: Detail from Ferrar's 1922 Geological Survey of the Purua District, with Onoke and Ketenikau Road Pa circled.

Figure 21: Detail from aerial SN 209 Run 402/24, 1942, with Onoke and Fairway Drive Pa circled.

6.0 Results

6.1 115 Three Mile Bush Road

115 Three Mile Bush Road was visited on two occasions, the first in response to a reported accidental discovery of midden on 2 February 2021, and the second as a result of further investigation of the history of the area suggesting the dry stacked stone walls were pre-1900 and thus subject to the archaeological provisions of the Heritage New Zealand Act 2014, on 12 February 2021.

The midden inspected on 2 February comprised a 1 x 1m scatter of medium-sized tuatua in orange-red silty stony volcanic soil. There was no depth to the deposit, no sign of charcoal, fire-cracked rock or an associated occupation layer around the scatter on the surface or the adjacent trench and other exposed areas in the vicinity.

Three spade test units were excavated either side of the exposed shell did not suggest any additional intact subsurface midden extending towards the adjacent stone wall. A small grab sample of shell was taken for potential radiocarbon dating but the feature was assessed as being essentially destroyed with no further information or context available.

A broken, green bottle base fragment was noted lying in the base of the trench directly below the shell. Additional glass from two other bottles was noted on the upper edge of the trench cut, at the same level of shell, three metres to the west. The green glass base was from a thick-walled champagne style bottle with a pronounced kick-up, other fragments were from a thin-walled olive green bottle with a rounded shoulder, and a clear glass bottle. No other diagnostic information was available.

Subsequent radiocarbon dating undertaken by the Waikato Radiocarbon Dating Laboratory indicated the sample contained atom bomb carbon and returned a modern date for the shell (A. Hogg to J. Carpenter pers. comm., 8 April 2021):

Sample No.	Lab No.	dC13	F14C%	Result
Q06/652-1	Wk52582	0.0 +/- 2.0	101.6 +/- 0.5	101.6 +/- 0.6 % (PMC) - no 13C

A second visit was made to 115 Three Mile Bush Road to examine the stone walls once information suggesting they were a pre-1900 archaeological feature came to light. Approximately 310m of stone wall were noted on the southern boundary with Three Mile Bush Road, and 35m on the northern boundary. Examination of the 1942 aerial imagery of the area indicates there was once an internal stone wall at least 225m long on the eastern side of the property, approximately parallel to the internal wall on 131 Three Mile Bush Road as discussed in the next section.

Current modifications to the stone walls comprise the 40m section removed and reconstructed along Three Mile Bush Road, the in-infilled gate on Three Mile Bush Road, minor changes to the existing gate/road crossing, and the re-orientation and relocation of a 3.5m section of stone wall from the subject property to a neighbouring property (Hurupaki School). As yet, the new road crossing into the subdivision requiring the removal of 25m of wall has yet to occur.

Upon inspection, the existing stone walls on the property were found to be in varied condition. The wall on the Three Mile Bush road frontage is generally in good condition,

and excellent condition where it has been recently reconstructed. However the wall is typically 1-1.2m high, somewhat shorter than usual and suggestive of prior modification.

The rest of the property has been comprehensively recontoured, with a small area of unmodified stone wall and mature native trees remaining along the stream on the northern boundary.

There was no indication of any other archaeological sites and features were present on the property by the time of the inspection.

Figure 22: Shell exposed in trench, immediately north of existing 115 Three Mile Bush Road crossing.

Figure 23; Detail of shell

Figure 24: Test units around shell to determine extent of any subsurface component.

Figure 25: Scatter of green and clear bottle glass at same level as shell.

Figure 26: Detail of bottle glass.

Figure 27: 115 Three Mile Bush Road crossing, prior to works commencing (Google Streetview).

Figure 28: Current 115 Three Mile Bush Road crossing, to be closed.

Figure 29: Current 115 Three Mile Bush Road crossing, to be closed with new crossing opening to the west.

Figure 30: East site of current Three Mile Bush Road crossing, to be closed.

Figure 31: 115 Three Mile Bush Road northern road crossing, prior to work commencing.

Figure 32: Northern road crossing gate, after infilling.

Figure 33: Northern road crossing gate after infilling.

Figure 34: Northern hillock, prior to re-contouring and relocation of power pole.

Figure 35: Northern hillock, after re-contouring and relocation of power pole.

Figure 36: Reconstruction of stone wall.

Figure 37: Northern hillock, prior to re-contouring and relocation of power pole.

Figure 38: Northern hillock, after re-contouring and relocation of power pole.

Figure 39: Northern hillock, after re-contouring and relocation of power pole.

Figure 40: Otapapa boundary wall relocation.

Figure 41: Otapapa boundary wall relocation.

Figure 42: Section of wall in fair condition along northern boundary.

Figure 43: Section of stone wall in poor condition on northern boundary.

6.2 131 Three Mile Bush Road

The property was visited over the course of two hours on 19 February. The weather was sunny and hot. The property was in grazed pasture, with landscaped gardens around the existing and original dwelling, and along the road frontage to Three Mile Bush Road.

Approximately 175m of stone wall is present along the southern boundary/road frontage, with two crossings. The stone wall along the road frontage is in fair condition. The southern side is largely obscured by vegetation but the north side is clear of vegetation in parts. The coping rocks are mostly absent from along the wall, and the wall has been affected by general wear, stock rubbing, and tree growth. Some sections of wall have been repaired but in the absence of the coping stones to hold the wall together, will continue to fail over time.

At both the driveway crossings, the walls have been lowered and capped with cement, presumably to aid visibility entering and exiting the property. Both these crossings are absent in the 1942 aerial suggesting they are relatively recent. The wall is 1.0-1.4m over most of its length, but sections with copping still present are 1.4-1.6m high.

A 50m long internal stone wall is present on the eastern side of the property, offset 5-70m (south to north) from the surveyed boundary. The 1942 aerial imagery suggests that the wall extended an additional 60m north to the stream but this section has since been removed.

The internal stone wall is also only in fair condition. It is built up against the road boundary wall and does not appear to be keyed into the wall as might be expected if they were built at the same time. Most of the copping stones are absent, leading to the poor state of the wall. The wall is 1.0-1.4m over most of its length, but sections with copping still present are 1.4-1.6m high.

No other archaeological sites or features were observed on the surface, or in otherwise eroded or exposed areas. There was no sign of the typical features associated with Maori horticultural activity in stony volcanic landscapes, such as stone gardening or clearance mounds, alignments, sunken paths or drains.

Likewise there was no suggestion of habitation, as might be indicated by terraces cut into steeper slopes, or storage pits for crops. The grass was very light with occasional bare patches and small eroded areas across the pasture and there was no suggestion of shell midden or other occupation deposits in the observed areas.

A number of in-filled geotechnical test pits were noted across the property. There was no sign of any archaeological material in the visible spoil at the top of these pits.

Figure 44: Looking north from south east corner of property.

Figure 45: Looking south to south west from north east corner of property.

Figure 46: Looking east from north east corner of property, towards 115 Three Mile Bush Road.

Figure 47; Looking south towards Three Mile Bush Road from north east corner of property.

Figure 48: Three Mile Bush Road boundary wall, landscaping and services.

Figure 49: Wall at driveway crossing modified by lowering and chip seal coping.

Figure 50: Three Mile Bush Road boundary wall.

Figure 51; Poorly repaired section of Three Mile Bush Road boundary wall.

Figure 52; Internal wall built against Three Mile Bush Road boundary wall.

Figure 53: Section of wall in poor condition.

Figure 54; Gate.

Figure 55: Northern termination of wall, looking north.

Figure 56: Northern termination of stone wall, looking south.

Figure 57: Concrete slabs and blocks pushed into small swale.

6.3 189 Three Mile Bush Road

The property was visited over the course of three hours on 9 March 2021. The property was in a mix of mown or recently grazed or rank pasture, recent native plantings above the stream, and landscaped gardens around the existing dwelling. Surface visibility was good around the plantings, areas of rank grass, and within the forested margin of the stream, to excellent in recently mown or grazed areas.

Approximately 150 of internal stone wall is present on the central western part of the property, running north east from the existing dwelling. The wall is in good condition, with one gate, and as for the other walls observed on neighbouring properties is typically 1.2-1.4m high and 1.2m wide.

The stone wall is present in the 1942 aerial image, in which it is shown as extending eastwards from its current eastern terminus, towards the stream and the stub of wall adjacent to the stream recorded at 115 Three Mile Bush Road. The wall is not shown on any of the historic survey plans and does not align with any existing or historic property boundaries or other land tenure features. However the eastern extension which has been removed, parallels the line of Three Mile Bush Road and its boundary wall.

Approximately 10m of stone wall is present at the road crossing to Three Mile Bush Road, bisected by the road crossing/driveway. This wall is also in good condition and 1.2-1.4m high by 1.2m wide.

No other archaeological sites or features were observed on the surface of the property, or in otherwise eroded or exposed areas. There was no sign of the typical features associated with Maori horticultural activity in stony volcanic landscapes, such as stone gardening or clearance mounds, alignments, sunken paths or drains on the more level or rolling ground.

Likewise there was no suggestion of habitation, as might be indicated by terraces cut into steeper slope on the south side of Hurupaki, or storage pits for crops. There were a number of small slips or terracettes from stock tracking or trees on the slope, which might appear to be archaeological from a distance, but are not. The grass was very light with occasional bare patches and small eroded areas across the pasture and there was no suggestion of shell midden or other occupation deposits in the observed areas.

Figure 58: Looking north along access across Lot 3 DP 99045 from Three Mile Bush Road crossing.

Figure 59: Lot 3 DP 99045 road crossing, looking south.

Figure 60: Detail of stone road boundary wall adjacent to road crossing.

Figure 61: South west end of internal stone wall.

Figure 62: Looking south west along internal wall.

Figure 63: Terminus at north eastern end of stone wall.

Figure 64: Looking south over stream to stone wall stubb at 115 Three Mile Bush Road.

Figure 65: Looking south over southern slope of Hurupakiand across stream to 131 Three Mile Bush Road.

Figure 66: Looking south across Hurupaki slope and stream, towards 115 and 131 Three Mile Bush Road.

6.3 Summary

On the balance of probabilities, the road boundary walls and a number of internal walls on the subject properties are pre-1900, and they have been recorded as archaeological site Q06/652 Stone walls. The James family recollection of walls being built in the 1930s may reflect the expansion of the internal wall system and/or repairs to existing walls at that time.

With regard to the stone walls at 115 and 131 Three Mile Bush Road, DP 49459 (1961) shows the boundary wall on the north side of Three Mile Bush Road on the property immediately to the west of 115 Bush Road being present for at least 70 years. ML 9581 (1914) shows the road boundary wall 131 Three Mile Bush Road already present by 1914, along with the walls on the south side of the road opposite.

ML 5227 (1881) shows the stone walls on the boundary of the Otapapa Block (at Three Mile Bush Road and Dip Road present in 1881. The Block was described as having boundaries completely in stone walls when sold in 1894. ML 2630A (1886) shows wall sand fence on the Three Mile Bush Road boundaries of the Hurupaku No. 3 Block including the subject properties.

James Whitelaw began purchasing parts of the Hurupaki Block in the 1870s, and owned substantial estate on both sides of Three Mile Bush Road by the early 1890s including the Otapapa Block and Onoke Block to the east and parts of the Pahuhuhun Block to the west. He was a prominent settler in Kamo with numerous other business interests including the original tramway to the Hikurangi mines. He went bankrupt in 1894 and sold his Three Mile Bush Road and other holdings at that time. His Hurupaki land is

described as being subdivided with stone walls and wire fences, and Otapapa as fully fenced in stone walls, in the real estate advertisements for the bankruptcy sale in 1894.

The internal walls are more difficult to date but given their parallel alignment with each other and the original Otapapa/Hurupaku/Dip Road boundaries, in comparison to current property boundaries, they appear to pre-date the mid-20th and subsequent subdivisions and are consistent with the management of the Hurupaki No. 1 and Otapapa Block as a single unit prior to 1894.

Prior research undertaken further west at Karanui and Amalin Road also indicates that the Three Mile Bush Road boundary walls were generally present prior to 1900 along most of the road from central Kamo westwards, with non-road boundary walls being built next, and then internal walls, with most of the latter being built from the early 20th century onwards until the 1950s, with a great number built as work schemes to use up surplus labour from the gumfields and latter, the Depression..

With regard to prior use of the subject property by Maori, there is no indication from the site visits, radiocarbon dating of possible archaeological shell midden, or historic research that there was any permanent occupation of the area. Undoubtedly the forest resources available were utilised by local communities, and the line of Three Mile Bush Road is of some antiquity, but there is no indication of Maori archaeological sites and features.

Isolated subsurface archaeological features may be present, such as small midden deposits, or fire scoops and ovens, or artefact findspots and associated with short term use of the area. These are unlikely to be identifiable/avoidable prior to large scale topsoil stripping and a similar level of probability exists for most of Whangarei

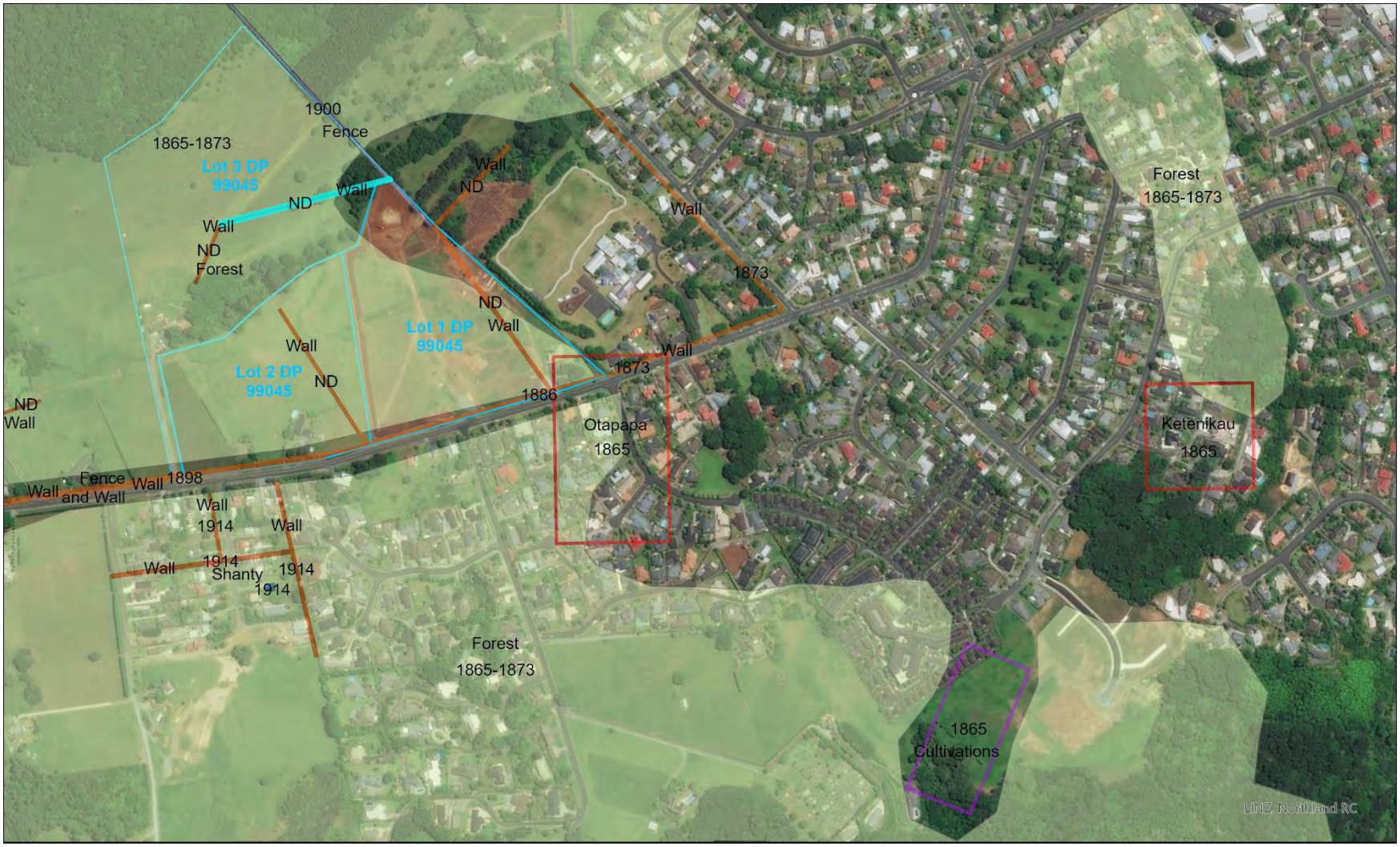

Figure 67: Archaeological and historic features.

7.0 Significance Assessment

7.1 Assessment Criteria

The archaeological significance archaeological sites recorded on the subject property will be assessed using the following criteria.

The first set of criteria assess the potential of the site to provide a better understanding of New Zealand's past using scientific archaeological methods. These categories are focussed on the intra-site level.

How complete is the site? Are parts of it already damaged or destroyed? A complete, undisturbed site has a high value in this section, a partly destroyed or damaged site has moderate value and a site of which all parts are damaged is of low value.

How diverse are the features to be expected during an archaeological excavation on the site? A site with only one or two known or expected feature types is of low value. A site with some variety in the known or expected features is of moderate value and a site like a defended kainga which can be expected to contain a complete feature set for a given historic/prehistoric period is of high value in this category.

How rare is the site? Rarity can be described in a local, regional and national context. If the site is not rare at all, it has no significance in this category. If the site is rare in a local context only it is of low significance, if the site is rare in a regional context, it has moderate significance and it is of high significance it the site is rare nationwide.

The second set of criteria puts the site into its broader context: inter-site, archaeological landscape and historic/oral traditions.

What is the context of the site within the surrounding archaeological sites? The question here is the part the site plays within the surrounding known archaeological sites. A site which sits amongst similar surrounding sites without any specific features is of low value. A site which occupies a central position within the surrounding sites is of high value.

What is the context of the site within the landscape? This question is linked to the one above, but focuses onto the position of the site in the landscape. If it is a dominant site with many features still visible it has high value, but if the position in the landscape is ephemeral with little or no features visible it has a low value. This question is also concerned with the amenity value of a site and its potential for on-site education.

What is the context of the site within known historic events or people? This is the question of known cultural association either by Tangata Whenua or other descendant groups. The closer the site is linked with important historic events or people the higher the significance of the site. This question is also concerned with possible commemorative values of the site.

An overall significance value derives from weighing up the different significance values of each of the six categories. In most cases the significance values across the different categories are similar.

7.2 Significance Assessment of Stone Walls and Associated Features

Table 1 below assess the archaeological significance of Q06/631, the stone walls at 115 and 131 Three Mile Bush Road. They are assessed as being of low archaeological significance.

They walls are only in fair or good condition and have little information potential, only a single feature type is present (the walls themselves), they are common in the area, and have little contextual value in the absence of other features typical associated with such sites (such as clearance and consumption piles, standing historic farm structures etc). The stone wall network on the property has been previously modified by the removal of the internal wall on 115 Three Mile Bush Road and part of the internal wall on 131 Three Mile Bush Road, and the opening of new gates for the three residences.

On the other hand the walls have moderate to high amenity value and elicit strong community feeling and are highly valued for their visual and heritage appeal.

The Whangarei District Council undertook a study on the significance and condition of the stone walls in Whangarei District in 1997 and another study, the Dry Stone Wall Project, in 2005. The purpose of those projects was to manage and mitigate the effects of future development on stone walls by identifying them, reviewing and enhancing rules in the District Plan.

There is no survey methodology statement and the survey of stone walls in the 2005 Heritage Study appears to be based on observations from roads and other publicly accessible areas. This undercounts stone walls that can't be observed from public places. The assessment of stone walls is also limited by being focussed largely on the visual or landscape amenity of the walls, and specifically their visibility though vegetation or otherwise from public roads, with no concern for other heritage values.

The condition of the stone walls was classified into four categories in the course of the District Council study. "Excellent" refers to walls that are in good condition with no detracting features. "Collapsed - no vegetation" describes walls that are partially falling down but are not located near or covered by vegetation that obscures them from view. "Collapsed - vegetation" means walls that are partially falling down and their visibility is limited because of vegetation growth on or around them. The final category, "Good - by vegetation" outlines those walls that are in good condition but are located near vegetation, such as shelter belts or are covered by weeds and so on, which minimises their visibility from the road. When last assessed in 1997, 79% of the observed stone walls were in excellent condition with an additional 9% in good condition but obscured by vegetation.

In the context of the values identified by the Whangarei District Council, the stone walls on the subject property are in good condition.

In terms of their wider heritage significance, they are a small component of a significant stone wall pastoral landscape in the Three Mile Bush Road area. They are not rare at a local or regional level and are only a fair example of the type and form of this historic heritage established in the second stage of stone wall building in Whangarei which followed the established of the earliest farm walls by the first European settlers in the mid-19th century, with the expansion of farm settlements in the 1870s-1880s.

Table 1: Significance assessment of stone walls

Significance Category	Value	Comment
Integrity, condition and Information potential	Low	The walls and associated features are in a good to fair state of preservation. The walls have been subject to on-going damage from stock rubbing and general wear, exacerbated by the lack of cap stones along some of he walls. There is little informational potential within the walls themselves and individual sections are generally of a standard form and construction. Any informational potential is likely to be at a landscape level of analysis, examining the development of the walls and their spread across the landscape and how this changed over time, and how those changes are associated with changing land tenure.
Diversity	Low	The dry stacked stone wall features are the only features present. There are no field clearance piles, consumption platforms, or other stone work features as known from other, more comprehensive stone wall landscapes.
Rarity and Uniqueness	Low	The walls and associated features are not rare at a local or regional level; such stone walls are a common feature of volcanic landscapes in Northland and other regions of geologically recent volcanic activity. They are present on neighbouring properties at Three Mile Bush and the wider Kamo area, as well as at Maunu, Glenbervie, Maungatapere and Whatatiri. Remnant sections of wall are present within urban Whangarei and Kamo.
Archaeological Context	Moderate	The features lie within a wider landscape of European pastoral farming characterised by fields bound by stone walls and the use of the local rock in everything from road beds to culverts, bridges and railway embankments. Parts of this landscape overly and largely obscure an older Maori horticultural landscape which made use of the same geological and pedological resources albeit in different form and scale. Other areas were formed by European settlers clearing primary forest
Landscape Context and Amenity Value	Moderate-High	The landscape values of the stone walls and associated features are moderate to high. The walls on the subject properties are visible from the road, obvious at ground level from across the properties, and are equally visible from elevated positions on and off the property. Along with their landscape and visual amenity, the walls have educational value and there are opportunities to interpret the development of the walls and associated features, along with the history of the farm.

Historical and Community Associations	High	The stone walls and other features are associated with prominent local settler James Whitelaw, who established a large number of local business interests in the 1870s and 1880s before being ruined financially in the economic depression of the 1890s. The local and wider Whangarei community values the stones walls, and this is reflected in their status in the Whangarei District Plan and the care with which the walls Three Mile Bush Road, and many other walls in the wider area, have been maintained. They appeal both in a visual sense and as a tangible link to a farming past that stretches back through the 19th century settlement of the Whangarei District and beyond to the European homelands of those who built the walls.

Figure 19. Stone Walls in Three Mile Bush

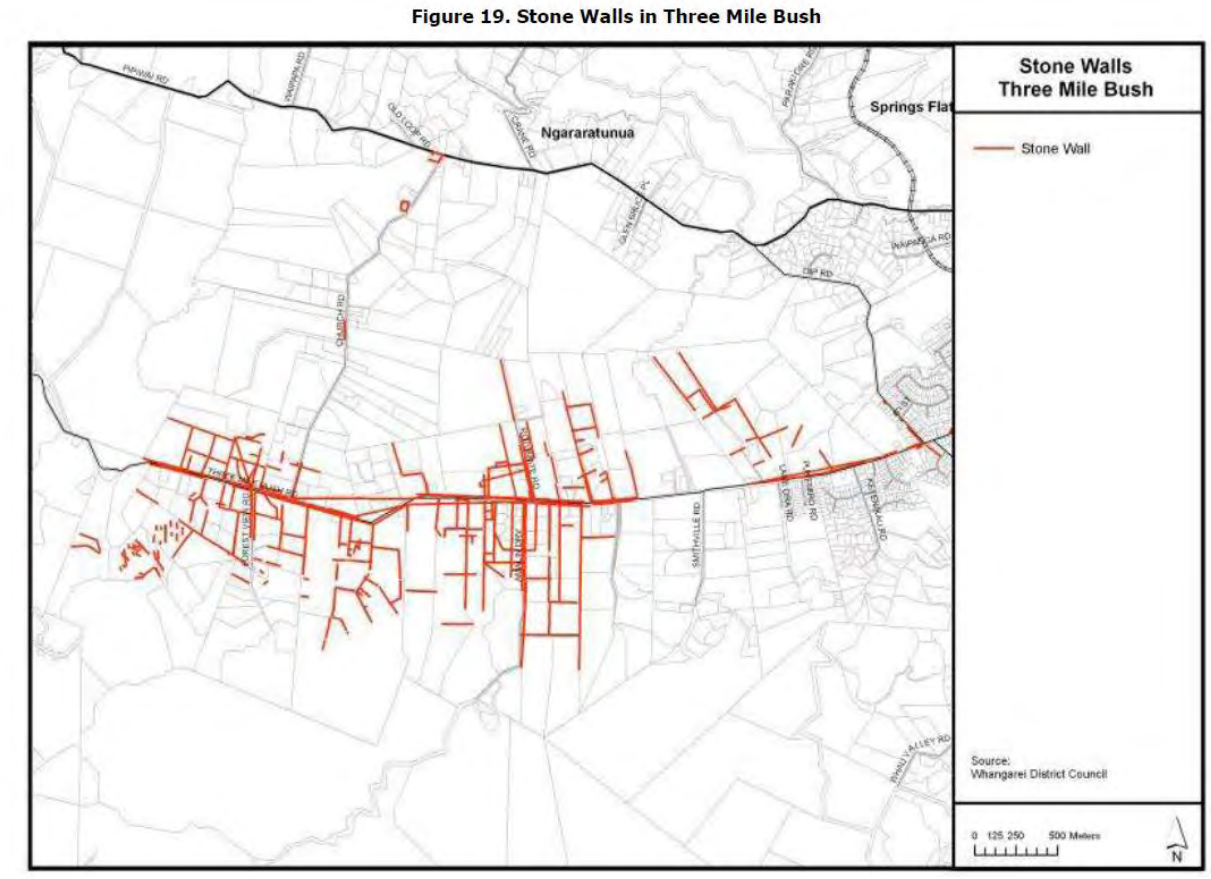

Figure 68: recorded stone walls at Three Mile Bush Road (Liang 2009: 35).

8.0 Assessment of Effects

On the balance of probabilities, pre-1900 stone walls have been modified without an archaeological Authority at 115 Three Mile Bush Road. These modifications include:

1) Infilling an existing gateway.
2) Deconstructing and then reconstructing a 40m section of wall on the same alignment to allow for recontouring and re-locating power poles.
3) Deconstructing and then relocation a 3.5m section of wall 90° to the original alignment on the neighbouring property in order to allow construction of a retaining wall.

4) Possible destruction of a small shell midden of unknown date/origin.

Of the approximately 350m of stone wall on the property, 50m have been modified by the current work, with an additional 25m to finish the new road crossing. The modifications to the stone walls have all been undertaken in a professional manner and little of their archaeological value has been lost.

On a similar basis, any subdivision proposal for 131 Three Mile Bush Road is likely to have similar effects on the dry stacked stone walls on that property. While the amenity values of the walls are recognised, the existing road crossings are unlikely to be of a form, size, and potential location to adequately service the subdivision and may require modification similar to those on the neighbouring property.

The internal stone wall is also not located in a practical location in terms of future development will be deconstructed, with the stone to be reused elsewhere.

As noted in prior reports involving stone walls in Whangarei District, it is the overall extent, pattern and condition of the stone walls across a landscape which provides most of their heritage value; as working elements of historic farms the walls were continuously opened and closed throughout their history, according to the needs of the farmer and the changing organisation of the farm and fields.

The Whangarei District Historic Heritage Study (Liang 2007: 25) states

> *"The Three Mile Bush area has approximately 31 kilometres of stone wall, which accounts for 20% of the stone walls located in the district. There are two walls running parallel to Three Mile Bush Road on either side for approximately 3 kilometres heading west from Smithville Road (Figure 19). This area has the greatest number of walls located in gardens and driveways. This may be as a result of smaller lot sizes in subdivision that have fragmented the walls."*

The changes to the walls have affected approximately 75m of wall at 115 Three Mile Bush Road, excluding more minor repairs to the walls which have or may be undertaken as part of the project. At 131 Three Mile Bush Road, a similar closing of three existing crossings and the opening of a new crossing to meet the required engineer standards is likely to effect approximately 50m of wall, with 120m of internal wall to be deconstructed.

Now part of the rural-urban landscape, so long as the changes to the boundary walls are undertaken by an appropriate specialist, and recorded appropriately, the opening of new gateways, closing of others, and repairing and maintaining the walls as necessary as they become the boundaries of a subdivision rather than a paddock has low adverse effects on heritage value. However In terms of the wider heritage landscape these effects are less than minor.

Removal of the internal wall at 131 Three Mile Bush Road is a more significant effect as this wall is a remnant of the historic pattern of land tenure on the north side of Three Mile Bush Road, although part of the wall has been removed previously.

While the overall archaeological and heritage effects of the redevelopment of 115 Three Mile Bush Road and the proposed redevelopment of 131 Three Mile Bush Road are minor these effects still result in the ongoing, slow decline of the stone wall resource,

as larger properties in the stone wall country of Whangarei are progressively subdivided and developed. There is currently no adequate baseline from which we can track that decline as the WDC study referenced above was not comprehensive and was largely restricted to publicly visible walls, and there is no formal system of recording changes to the stone walls in the District.

There are unlikely to be other, subsurface archaeological features on the property as most of the area appears to have been still under primary forest when it was surveyed and first surveyed in the 1870s, with early historic Maori period occupation concentrated around Ketenikau to the east and pre to protohistoric occupation on Hurupaki and its northern slopes, Ngararatunua and Onoke to the north, north west and north east, and the land between Ketenikau and modern Kamo.

The land was sold to James Whitelaw progressively from shortly after title was issued to Maori owners, with the subject property part of Hurupaki No. 3 sold to and cleared by Whitelaw in 1875 and while the area was farmed, there was no homestead or other farm related infrastructure on the subject property.

There are unlikely to be effects on archaeological sites under features protected by the Heritage New Zealand Pouhere Taonga Act 2014 although as with most of this area such finds are always possible. Any accidental archaeological discoveries should be managed through an accidental discovery protocol.

9.0 Findings and Recommendations

9.1 115 Three Mile Bush Road

1) The stone walls probably date to before 1900 and have been modified without an archaeological authority under the Heritage New Zealand Pouhere Taonga Act 2014.

2) The walls are of low archaeological significance, but moderate overall heritage significance.

3) The modifications to-date are of a minor nature, consisting of relocating a short section of internal wall, closing an existing gate/crossing and widening an existing gate/crossing on a road boundary wall, relocating a longer section of road boundary wall.

4) The modification of the walls to-date, and other repairs/restoration have been undertaken to a high standard and will serve to stabilise the walls and conserve them into the future.

5) A small, potentially pre-1900 shell midden deposit has been destroyed without an archaeological authority, but was later found to be a modern feature on the basis of radiocarbon dating.

9.2 131 Three Mile Bush Road

1) The stone wall on the road boundary and the internal wall probably date to before 1900 and an archaeological authority under the Heritage New Zealand Pouhere Taonga Act 2014 is required to modify or destroy them.

2) The walls are of low archaeological significance, but moderate heritage significance.

3) The modification to the road boundary wall is likely to be of a minor nature, such as infilling existing crossings, opening a new crossing, and repairing the wall.

4) The internal wall will be deconstructed and used for the stone walls at the subdivision entrance, and this wall may be archaeological.

5) An archaeological authority under the Heritage New Zealand Pouhere Taonga Act 2014 will be required to modify or destroy the stone walls.

6) Modification of the stone walls should be undertaken by an experienced local dry stone wall mason.

7) A photographic record should be made of the deconstruction and modification of the stone walls as it occurs, along with a record of where the changes were made in the wall system. This information should be archived with Heritage New Zealand and within the Whangarei Library system/Northland Room.

8) There are unlikely to be other archaeological effects but an accidental discovery protocol should be in place to manage any unanticipated finds.

9.3 139 Three Mile Bush Road

1) The stone wall on the road boundary probably dates to before 1900 and an archaeological authority under the Heritage New Zealand Pouhere Taonga Act 2014 is required to modify or destroy them.

2) There is no indication of age of the internal wall, but this will remain in-situ and be repaired.

3) The walls are of low archaeological significance, but moderate heritage significance.

4) The modification to the road boundary wall is likely to be of a minor nature, such as infilling the existing crossing and repairing the wall.

5) An archaeological authority under the Heritage New Zealand Pouhere Taonga Act 2014 will be required to modify or destroy the stone walls.

6) Modification of the stone walls should be undertaken by an experienced local dry stone wall mason.

7) A photographic record should be made of the deconstruction and modification of the stone walls as it occurs, along with a record of where the changes were made in the wall system. This information should be archived with Heritage New Zealand and within the Whangarei Library system/Northland Room.

8) There are unlikely to be other archaeological effects but an accidental discovery protocol should be in place to manage any unanticipated finds.

10.0 Summary

Geometria Ltd was commissioned by Blue Wallace Ltd on behalf of TMB Ltd to undertake an archaeological survey and assessment of 115, 131 and 139 Three Mile Bush Road.

The subject properties are part of a historic European pastoral landscape characterised by stacked dry stone field and boundary walls, which pre-date 1900. An archaeological authority under the Heritage New Zealand Pouhere Taonga Act 2014 is required for any further modification or destruction of the stone walls.

There is no evidence based on historic research or archaeological survey of a permanent Maori occupation of the area, which appears to have been in primary forest until the 1870s. However the route of Three Mile Bush Road appears to have been used for some time as a foot track to Ruatangata and important Maori settlements from the prehistoric and historic period are located short distances away. Title to the land was issued in 1873 after which it was progressively partitioned and sold to European settlers, cleared and broken in for farming. Accidental discoveries of subsurface archaeological features are unlikely.

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Appendix A – Site Record Form

Appendix 8

Geotechnical Report

GEOTECHNICAL INVESTIGATION REPORT

FOR

PROPOSED RESIDENTIAL DEVELOPMENT,

131 AND 189 THREE MILE BUSH ROAD, KAMO, WHANGAREI

Project Reference: 18733
24 June 2021

CONTENTS

1 INTRODUCTION

LDE Ltd was engaged to assess a proposed medium density residential development at 131 and 189 Three Mile Bush Road, Kamo, Whangarei (Figure 1).

No scheme plan for the development is presently available, however it is expected to comprise moderate density (~500-700m^2) residential lots serviced by a series of vested public roads and private right of ways.

The purpose of the assessment was to determine the geotechnical suitability of the land for development, consider geotechnical hazards posed to the development, and provide engineering recommendations for subdivision design and future residential construction, in accordance with Section 106 of the Resource Management Act (1991) and the Whangarei District Council (WDC) Environmental Engineering Standards (EES).

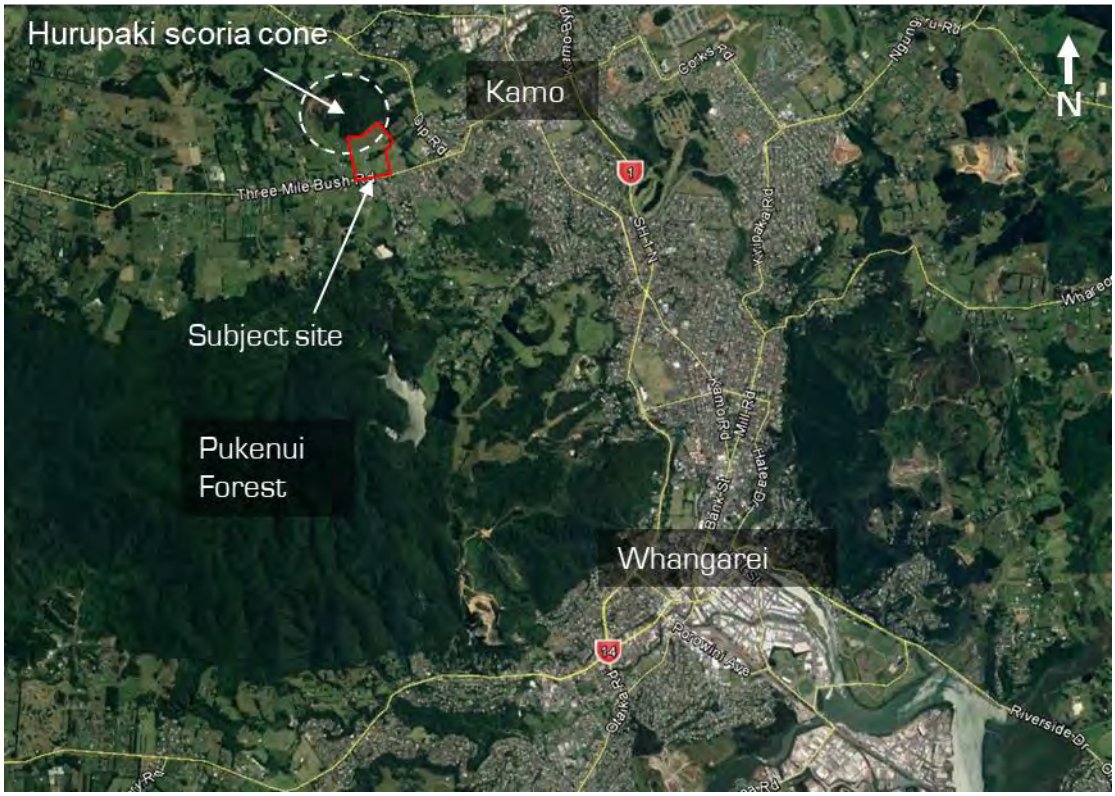

Figure 1: Location of site (Source Google Earth)

2 SITE SETTING

The proposed development encompasses two properties legally described as Lot 2 and Lot 3 DP 99045, being 131 and 189 Three Mile Bush Road, respectively. The properties, referred to hereafter collectively as 'the site', comprise a total area of approximately 13.98ha, positioned to the west of an on-going residential development ('The James', 115 Three Mile Bush Road) and immediately south of the Hurupaki scoria cone, approximately 5.5km northwest of Whangarei CBD (Figure 1).

The site is located at the urban boundary of Kamo township, with the area to the east of the site being entirely developed as residential housing. To the west the surrounding area is predominantly in lifestyle block type properties generally in pasture.

2.1 Site Features and Topography

The site can broadly be divided in to four topographic areas, as described below and shown on the plan in Figure 2 below. The topography has been assessed based on our walkover assessment and desktop study using NRC LiDAR topographic data (2018 survey).

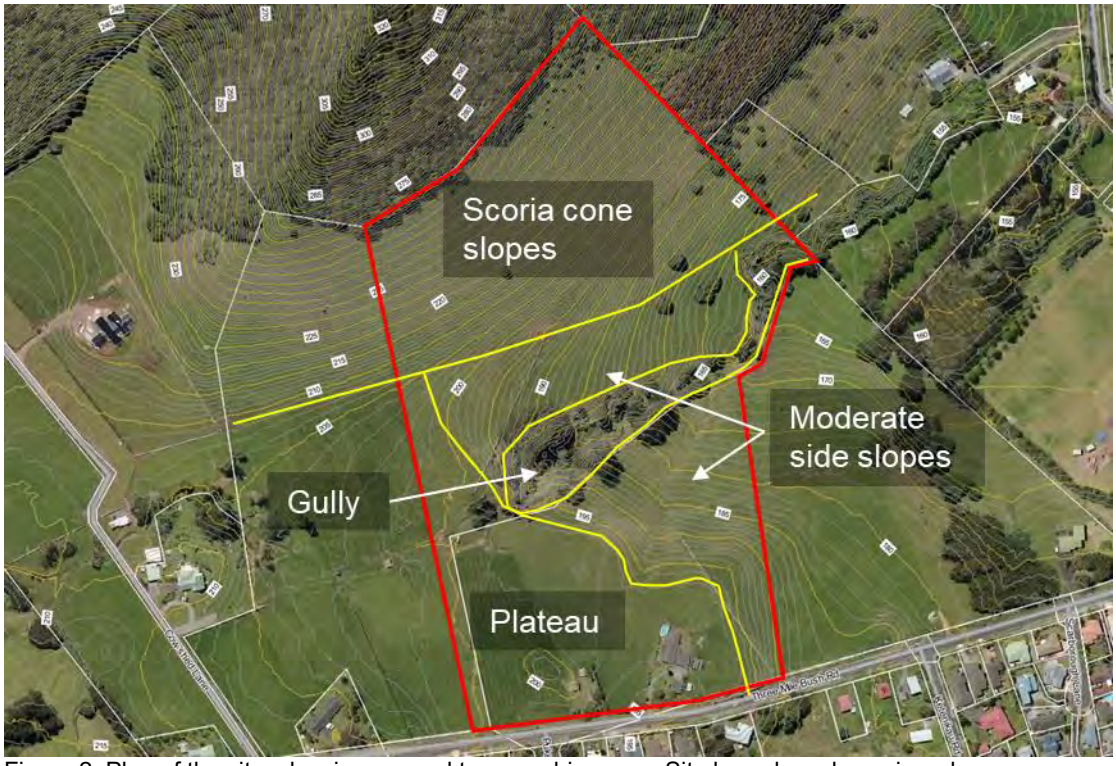

Figure 2: Plan of the site, showing general topographic areas. Site boundary shown in red.

2.1.1 Plateau (southwest of site)

The south-western part of the site comprises a broad, nearly level plateau landform of approximately 3.2ha. There are no notable topographic features within this area.

At the southern edge of this area, adjacent to Three Mile Bush Road, there are two existing dwellings, one main dwelling and one smaller dwelling, each within a fenced area isolated from the surrounding farmland. The larger dwelling (addressed as #131) is approximately 220m^2 in area with several detached sheds and a pool in its vicinity. It is understood that the septic system for this dwelling is located within the fenced area. The smaller dwelling is an old cottage of approximately 55m^2, to the west has a single detached garage. The septic system for this dwelling is understood to lie in the paddock to the east.

At the north-western end of the plateau area is the dwelling at #189. This appears to have been recently constructed and is situated at the end of the panhandle access to #189 and immediately above the head of the gully feature (described below). There is some landscaping and planting around and to the north of the dwelling.

2.1.2 Moderate Side Slopes (central-east of site)

To the north and east of the plateau area there is a sharp break in slope with slopes descending to the north and east beyond this. The upper part of these slopes is moderately steep at up to 1V:3.5H (16°), becoming more gentle through the middle and lower slopes (1V:5H, 11°).

These slopes are smooth and linear and display no features indicative of past or recent instability. There are several small 'bull holes' of exposed earth in the upper slopes.

The slopes are crossed by several fences including two dry-stone walls, one to the southeast and one to the northwest.

A gentle depression through the length of these side slopes appears to form an overland flow path which may drain part of the plateau area. The area appears stable with no active erosion. It is expected that this rarely has any flow.

2.1.3 Scoria Cone Slopes

Above the moderate side slopes, the northern third (approx.) of the subject site covers the lower and middle side slopes of the Hurupaki scoria cone. The slopes are steep (approx. 1V:2H, 27°) but have a smooth and linear geomorphology. The slopes are gently diverging, facing south-east to south, and wane towards the lower slopes. These slopes are entirely in pasture within the property and go into bush above the north-eastern boundary.

The slopes present no evidence of past or recent instability. Some evidence of minor erosion is present around troughs and fence lines, expected to be associated with livestock. No significant soil creep was apparent on the steep slopes.

2.1.4 Gully (central)

A well-defined gully area crosses the site from west to east (draining eastward), with its head at the edge of the plateau. The gully is deeply incised at the western end (approximately 20m depth) and gradually shallows to the east as the surrounding ground slopes down to meet it, becoming only a few metres deep at the eastern edge of the site. The gully invert is very gently sloping (shallower than 1V:10H).

The gully side slopes area very steep around the head at approximately 1V:1.5H (34°) and generally 1V:2H (27°) beyond this. The gully slopes present no signs of significant active or recent instability, and it appears from the topography of the feature that it has been formed through steady erosion rather than periodic regression through instability. However, some evidence of shallow creep type movement was noted on the southern side of the gully, where the fence appears to have been gradually undermined.

Several exposures of large basalt boulders are noted around the crest at the western end of the gully. Several areas of tephra soils are exposures through the mid-section of the steeper slopes. The gully floor is covered by cobble to boulder sizes clasts of loose basalt, with some possibly in situ basalt at the base of the gully head.

Figure 3: View west from the gully floor towards the gully head, showing basalt exposed beneath red tephra soils at the base of the gully slopes.

Figure 4: View west across the southern gully slope, showing large basalt promontory at crest of slope (top left), tephra soils immediately below, and boulders of basalt over the gully floor.

The gully is fed by overland flows through formed drains, originating to the west of the site, and sheet flows from the slopes to the north and south, forming a headwater of the Waitaua Stream. It is likely that groundwater seepage occurs at the head of the gully where it is most deeply incised. It appears to only flow during wet winter conditions and, during and immediately after heavy rainfall.

The gully is vegetated with mature trees, comprising a stand of Puriri on the northern side and a mixture of natives to the south. Several large pines have been removed from the area in preparation for the development.

2.2 Desktop Study

2.2.1 Geological Setting

The site is mapped as being underlain by Pleistocene basalt lava flows of the Kerikeri Volcanic Group (Puhipuhi – Whangarei Volcanic Field). This unit comprises basaltic lava flows stemming from nearby volcanic vents, constrained by modern topography. Lava flows are known to be up to 85m thick (over the Kamo coalfield), however are more typically 20-50m thick. The nearby Hurupaki scoria cone is one of the youngest in the field, and has an approximate age of 300,000 years (White & Perrin, 2003[1]).

[1] P.J. White and N.D. Perrin, 2003. *Geology of the Whangarei Urban Area*, GNS Science.

The volcanic field in the vicinity of the subject site comprises broad flat to gently east-ward sloping lava fields, forming elevated plateaus of the Kamo and Three Mile Bush suburbs, punctuated by a series of three scoria cones aligned west to east, of which Hurupaki is the eastern and largest. The central scoria cone (Rawhitiroa) has an in-tact crater lake, while Hurupaki and the western most scoria cone (Ngararatunua) appear to both have breached craters, indicated by arcuate depressions in the side of the otherwise conical form (Figure 3). The local volcanic field is confined to the south by the greywacke bedrock hills of the Pukenui Forest, and to the north by an older Pleistocene age rhyolite/dacite volcanic dome (Parakiore).

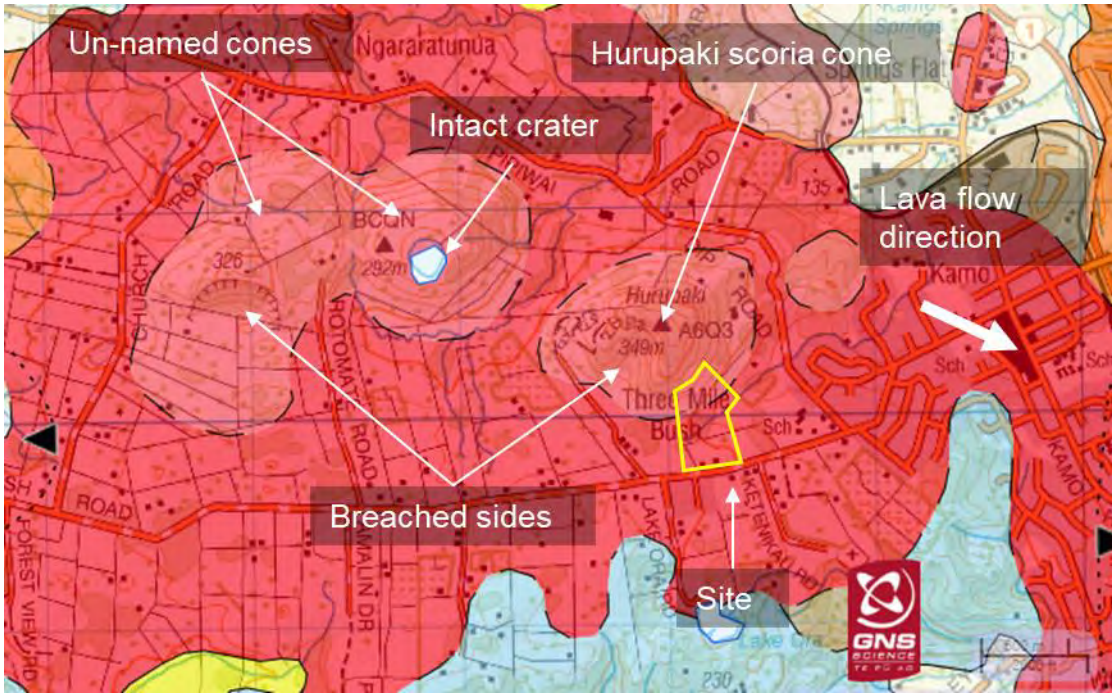

Figure 5: Clip of the NZ Geology Web Map, showing the mapped geological units in the vicinity of the site (outlined yellow). Dark red indicates lava flows, light red indicates scoria cones. Blue to the south indicates greywacke bedrock of the Pukunui Forest, confining the lava flow.

2.2.2 Mapped Hazards

The WDC Hazards Maps show the site as being predominantly low instability hazard through the plateau and side slope areas. The gully is mapped as moderate instability, as are the lower parts of the scoria cone slopes. The middle and upper scoria cone slopes, extending partially within the site boundary, are mapped as high instability hazard.

No flood hazard is mapped at the site, however the water course downstream from the site is mapped as flood susceptible from beyond Dip Road. This eventually drains to the Springs Flat flood plain.

The site is not mapped as being within an acid sulphate soil risk area or a mine subsidence hazard area.

2.2.3 Historical Aerial Imagery

Aerial imagery sourced from Retrolens[2] and Google Earth show no significant changes in site use over the period of available imagery (to 1942). The site appears to have remained in pasture over this period.

Aerial images show some relatively minor earthworks in the vicinity of the dwelling at no. 189, carried out through 2015-2017. This appears to include the placement of fill extending into the head of the gully.

3 Ground Conditions

3.1 Subsurface Investigation Summary

Our investigation of the site included the following work:

- 16 hand augered boreholes (HA01 – HA16) generally taken to 3m depth or refusal across the site, with measurements of undrained shear strength taken at 200mm intervals with a shear vane.
- 13 machine excavated test pits (TP01 – TP13) taken to a target depth of 4.0m using 22t and 14.5t excavators.
- Supplementary Scala penetrometer tests carried out various test pit and hand auger borehole locations, generally to 3m depth or refusal.
- Collection of three disturbed soil samples taken from select test pits (TP02, TP04 and TP05). All samples were taken from 0.5m to 0.7m depth. All samples were tested for Atterberg limits and and linear shrinkage for classification of plasticity and expansive soils properties.

The locations of the subsurface investigations are shown on the attached geotechnical investigation plan (Appendix A). Test logs, including test pit photos are attached as Appendix B, and laboratory test certificates are attached as Appendix C. The field work was completed through December 2020 and January 2021.

Test pits TP01 to TP10 were located by machine GPS calibrated to the bucket, and are therefore expected to be highly accurate for re-location if ever required. TP11 to TP13, and all hand auger boreholes have been located by phone GPS, expected to be accurate to +/-3m.

Table 1: Summary of subsurface geotechnical investigations carried out. Bold indicates Scala carried out from the base of boreholes, while the remainder were generally carried out from the surface adjacent to the relevant test site.

2 http://retrolens.nz/

Test ID	Depth (m)	Scala depth
HA01	0.35	0.25
HA02	0.6	0.80
HA03	0.55	1.35
HA04	1.7	2.4
HA05	3.0	-
HA06	0.9	**1.55**
HA07	3.0	-
HA08	1.1	**1.4**
HA09	0.3	**0.65**
HA10	2.9	-
HA11	0.35	**0.8**
HA12	3.0	-
HA13	3.0	-
HA14	3.0	-
HA15/15A	0.4	-
HA16	4.0	-

Test ID	Depth (m)	Scala depth
TP01	4.1	3.25
TP02	4.0	0.85
TP03	3.5	1.3
TP04	2.3	3.95
TP05	3.0	1.4
TP06	3.6	2.95
TP07	3.0	0.4
TP08	4.0	2.9
TP09	4.0	2.25
TP10	4.0	2.95
TP11	4.2	-
TP12	4.8	-
TP13	4.2	-

3.2 Subsurface Conditions

In summary, the site was found to be underlain by various volcanic deposits of the Kerikeri Volcanic Group, shown as the mapped geology of the site.

3.2.1 Topsoil

Topsoil was encountered across the surface of the site to 0.1 to 0.3m depth, comprising generally dry, slightly organic friable silt. The lower boundary of this unit was not well defined, with a gradational change into the underlying volcanic soils at most test sites. Organic content was predominantly within the upper 50-100mm, with the underlying topsoil being relatively competent silt.

3.2.2 Kerikeri Volcanic Group Soils

The upper soil profile generally comprised very stiff to hard, homogenous silt and clay, inferred to be residually weathered ash soils. These soils were assessed in the field as generally highly plastic, which is consistent with their USCS classification determined from lab testing (summarised below).

Within the plateau area, the shallow soils became gravelly with cobbles and boulders of weak to strong basalt and basalt scoria. Scala penetrometer testing through this unit indicated consistently high densities (moderately dense or greater), generally with refusal met with a short distance of encountering larger gravels. This depth varied between 0.35m and 2.0m, but averaged approximately 1.0m. It appears from the testing that this depth undulates across the plateau somewhat randomly, and that in some cases the tests were able to miss boulders to reach significant depth (e.g. HA10). In several cases the depth varied between tests undertaken in close proximity (e.g TP05 and HA04). At two locations the boulder surface protruded above ground level forming mound type landforms. Shallow pitting in these areas indicate that these are natural, rather than being stockpiled rocks collected from farm paddocks.

Over the moderate side slopes, the upper soils transitioned to generally sensitive silt or silty clay with increasing sand and gravel clasts of basalt scoria and lapilli, inferred to be weathered lapilli tephra (airfall deposit). Some low shear strengths were recorded within this lower unit, including from 2.4m in HA07 (~80kPa), below 2.6m in HA05, below 2.2m in HA14 and below 3.0m in HA16. These deeper sensitive soils appear to be somewhat allophanic and crushable, reducing significantly in volume on retrieval. The size and quantity of gravel clasts appears to generally increase with depth, consistent with the vertical grading of an airfall deposit.

No testing was carried out within the gully. Basalt is exposed on the upper side slopes as large, disjointed boulders. One large promontory of basalt is exposed on the south and may represent a section of flow remnant, with tephra soils exposed at lower elevation beneath this (Figure 4). The base of the gully is largely infilled with *ex-situ* basalt cobbles and boulders, with some possibly *in-situ* basalt at the base of the gully head.

3.3 Soil Moisture Profile and Groundwater Conditions

The soils across the site were generally dry to moist from the surface to termination or 2m to 2.7m, with isolated wet to saturated zones encountered below these depths. The permanent groundwater table was not encountered in our investigation, however based on the elevation of the site relatively to the stream to the north, it is expected that the groundwater table lies at some 3-4m below the lowest point of the site during summer months and is subject to significant seasonal fluctuation.

The moisture content of the near surface soils is expected to be higher during the winter months or extended periods of wet weather resulting in their saturation at times. The extent of the wetting front will be dependent on the duration of the period of rainfall, but may extend down some 1m to 2m of the surface. In our opinion complete saturation of the ground is unlikely to occur.

3.4 Laboratory Testing

Samples taken from the shallow subsoils were tasted for Atterberg limits and linear shrinkage, for the purpose of classifying plasticity and expansive soil characteristics. Testing was undertaken by an IANZ accredited soils laboratory (GeoCivil).

The results were consistent across samples, with liquid limits in the range of 80 to 87%, plasticity index in the range of 37 to 39%, and linear shrinkage in the range of 19 to 22%. Results are tabulated below (Table 2) and test certificates are appended.

The results have been plotted on a Casagrande plasticity chart for classification in accordance with the USCS. This is shown below as Figure 4. All samples plot below the 'A line' as MH soils.

Table 2: Summary of Atterberg limit and linear shrinkage results. All samples taken from 0.5m to 0.7m depth at the respective test site.

Sample	Liquid Limit %	Plasticity Index %	Linear Shrinkage %
TP02	83	39	19
TP04	80	38	22
TP08	87	37	21

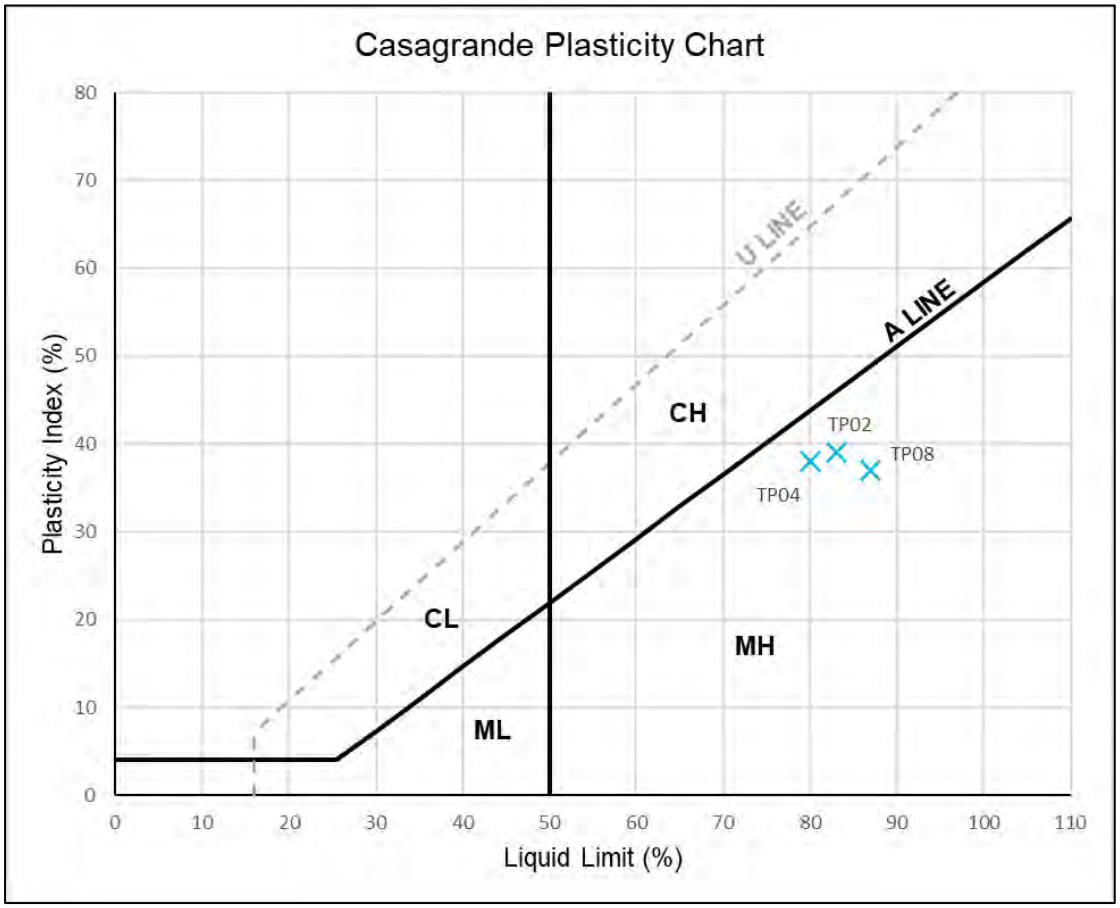

Figure 6: Test results shown against Casagrande plasticity chart for USCS classification.

3.5 Ground Model and Material Strength Parameters

The subsurface profile appears weathering basalt flow remnants across the plateau area, underlain by deeply weathered lapilli and boulder tephra (airfall) deposits which are near the surface across the moderate side slopes. These deposits are capped by a relatively thin layer of generally high strength, residually weathered ash.

The lava flow appears to have been limited in extent by the scoria cone, with the northern portion of the site expected to be underlain by scoria at depth.

Our idealised model of the ground conditions is shown in the attached stability model cross sections.

Based on our knowledge and experience of the subsoil at the site, the material strengths encountered on the site have been assessed against various published and unpublished correlations. Strengths have been factored to design conditions to account for seasonal variations in moisture content. These values are presented in Table 3 below.

Some low strength values were indicated by *in-situ* testing of the tephra deposit. However, in our experience with these materials, *in-situ* testing generally fails to characterise their strength due to their collapsible soil structure. Based on previous lab testing, back analyses and observations of slope performance, the below strength parameters are considered appropriate for stability analysis.

Table 3: Material strength parameters. *Basalt modelled with anisotropic strength to account for persistent vertical discontinuities.

Material	**γ (kN/m^3)**	**C' (kPa)**	**Ø' (°)**	**S_u (kPa)**
Weathered ash (clay/silt)	17.5	5	30	120
Gravelly/lapilli tephra (sensitive silt with scoria/basalt gravel and lapilli)	13	10	30	100
Bouldery basalt (remnant lava flow)*	24	20	40	-

3.6 Seismic Subsoil Category

We consider that the site is a Class C shallow soil site as defined by NZS 1170.5 (2004) "Structural Design Actions: Part 5: Earthquake actions – New Zealand", based on the depth of soil (including fragmented basalt) being generally greater than 3.0m.

4 NATURAL HAZARDS AND GROUND DEFORMATION POTENTIAL

4.1 General

This section summarises our assessment of the natural hazards within the property as generally defined in Section 106 of the Resource Management Act (1991 and subsequent amendments) and the Building Act (2004) and the potential risk that these present to the proposed building in terms of vertical and lateral ground deformation. This section also includes our assessment of ground beneath the building site which is outside the definition of "Good Ground" as defined by the Compliance Document for the NZ Building Code, NZS3604 (2011) "Timber Framed Buildings" and NZS4229 (2013) "Concrete Masonry Buildings Not Requiring Specific Engineering Design". This is any ground which could foreseeably experience movement of 25mm or greater for any reason including one or a combination of compressible ground, land instability, ground creep, subsidence, seasonal swelling and shrinking, frost heave, changing groundwater level, erosion, dissolution of soil in water, and the effect of tree roots.

4.2 Slope Instability

The stability hazard for the various site areas have been assessed below through both qualitative, geomorphological assessment and qualitative (numerical) stability analysis where appropriate.

Numerical stability analysis has been carried out using RocScience software Slide v9. Cuckoo search was used to find critical failure surfaces. As the groundwater table was not encountered, and the near surface soils appear well draining, the Ru parameter was used to model pore pressures as a function of vertical stress.

Factor of safety criteria have been adopted from WDC *Land Development Stabilisation – Technical Design Requirements*[3] document dated April 2018, prepared by Tokin and Taylor.

4.2.1 Plateau and Moderate Side Slopes

The site comprises mostly flat to gently sloping land, with some areas of broad moderate slopes. These areas present no evidence of past instability, and given the high strength of the underlying ground and relatively low slope angles, we considered these areas to have a low instability hazard, consistent with the council hazard mapping.

[3] http://old.wdc.govt.nz/PlansPoliciesandBylaws/Policies/Documents/Land-Development-Stabilisation-Technical-Design-Requirements.pdf

We expect the proposed development will have minimal impact on the stability of these areas, provided the depth of unsupported cut and fill batters is limited as outlined in Section 5. Any proposed earthworks beyond these limitations should be subject to specific geotechnical assessment to confirm that any negative effects on slope stability are mitigated.

4.2.2 Gully

The gully area, extending east-ward through the centre of the site, is mapped as moderate instability hazard on the WDC hazard maps. The gully has very steep and tall side slopes which appear generally stable but show evidence of soil creep at their crest.

The gully feature appears to have formed through gradual erosion rather than periodic instability, giving it a relatively uniform shape with no evidence of active instability. The slopes are however expected to have eroded to a natural equilibrium and are therefore likely to have an existing factor of safety below acceptable criteria for residential development.

To assess the stability hazard of the gully feature, numerical slope stability analysis has been carried out for a critical side slope section (CS-2), on the southern side of the gully head. Back analysis was used to calibrate modelled groundwater conditions and material strength parameters, using an assumed minimum factor of safety of just above 1.0 under extreme conditions.

The remnant basalt flow was modelled using an anisotropic strength, with the design parameters used for horizontal strength and reduced strength in line with a weak soil used for vertical failure. This reflects the expected nature of failures through this unit, which would follow vertical joints which are expected to be relatively continuous through the unit. This is a conservative assumption given the basalt, where exposed, was not pervasively jointed.

The stability analysis was used to determine minimum setback distances from the slope crest to meet factor of safety criteria. Results are summarised below.

Table 4: Stability analysis results to determine minimum gully setback.

Scenario	Minimum FoS[3]	Setback required
Normal (design conditions)	1.5	14m
Extreme groundwater	1.3	8m
Seismic (500-year/ULS)	1.1	10m

The analysis has been undertaken at the critical point where the gully slope is steepest and highest (~15m). Towards the east the slope height tapers down to a minimum of approximately 4m, and the slope angle gradually becomes shallower. The minimum setback requirement from this slope may be reduced in line with the slope height, to a minimum of 5m from the top of bank without site specific assessment.

The northern side of the gully is generally less steep with the slope rounding over at the crest. A nominal 7m setback from the crest is recommended across the upper slopes without specific assessment.

Building close to the slope may be possible if mitigation measures are incorporated into the development of individual lots. Mitigation measures could include down-cutting of the lots or slope retention.

The building setback line has been plotted on the attached plan. This should be accounted for in development plans. The setback line and any further stability requirements should be reaffirmed on completion of subdivision works and referenced by way of title notice on any affected lots, unless otherwise mitigated as part of the subdivision works.

4.2.3 Scoria Cone

The development is expected to extend across the moderate slopes immediately below the scoria cone, with some lots extending onto the base of the cone. As a result, the risk of inundation from the scoria cone slopes onto the development area has been assessed.

The nature of scoria cone deposition makes them fundamentally stable features when undisturbed. Scoria is deposited as viscous molten rock through fire-fountaining and hardens over time. During the eruption period failure of the cone can occur resulting in breaches (such as that to the west of the site). However, as the deposited scoria solidifies, the factor of safety of the slope is expected increase rapidly from a minimum of 1, and therefore is inferred to be significantly greater than 1 in its present state.

The scoria quarry on the western side of Hurupaki serves as a test of the slopes' stability. The quarry is cut into a series of benches directly into the cone. The batters between benches are cut near-vertical to heights of 10 to 15m. In our review of recent aerial imagery, no evidence of past slope failure at the quarry was observed.

As a result, we consider that the existing cone slopes are stable and have a factor of safety well above acceptable criteria. Bulk earthworks associated with the proposed development are not expected to have an appreciable effect on global stability. However deep cuts into the toe of the slope as part of individual lot development may result in an increased risk of shallow instability.

As a result it is recommended that all cuts into the steep scoria cone slopes be retained or otherwise subject to specific geotechnical assessment to confirm stability.

4.3 Compressible Ground and Consolidation Settlement

The soils encountered in the subsurface investigation comprised silt and clay soils of high strength, which are expected to have very low compressibility, underlain by clast supported basalt cobbles/boulders in a silt/clay matrix, which is expected to be practicably incompressible.

The development is expected to involve the construction of conventional single level residential dwellings of light timber frame construction, with distributed loads up to approximately 10kPa. Earthworks are expected to involve cutting and fillings several metres in depth across the sloping areas of the site. Imposed loads from filling are expected to be limited to approximately 70kPa (i.e. up to approximately 4m of fill).

Under the expected loads from the development, the risk presented by consolidation settlement is expected to be negligible.

4.4 Ground Shrinkage and Swelling Potential

Plastic soils can be subject to shrinkage and swelling due to soil moisture content variations which can result in apparent heaving and settlement of buildings, particularly between seasons.

Laboratory testing of linear shrinkage and liquid limit was carried out on three discrete samples collected from across the subject site, to inform the expansive soils classification.

Lab results are presented in Section 3.5 (Table 2) above. All samples showed liquid limits and linear shrinkage values in excess of the criteria for expansive soils as outlined in NZS3604 (2011). The soils therefore lie outside of the definition of good ground and required classification in accordance with AS2870 (2011) and B1/AS1. Direct laboratory testing of shrink swell index (I_{ss}) has not been adopted as suggested in AS2870 and B1/AS1, due to recent published data on the limitations of this testing, particularly during summer.

The shrinkage and swelling potential of the shallow soils depends on both the clay fraction of the soil, and the activity (or reactivity) of the clay fraction. This is further augmented by climatic conditions and local topographic factors such as water table and rock head depth, cut to fill, and the presence of trees.

The soils appear to be generally silt dominated from field assessment and fall below the Casagrande ‘A-line’ as shown on Figure 5. The soils plot as very highly plastic on the basis on liquid limit (70% < LL < 90%).

The findings of the investigation and laboratory testing generally indicate moderate clay fraction and high clay activity. We consider the shallow soils to be broadly consistent with Class M –

Moderately Expansive soils as described in AS2870 (2011) with an upper bound design characteristic surface movement (Y_s) of 44mm (factored for the 500-year drought event).

Where the soil mass becomes gravel dominated within 1.5m of finished ground level, the site class can be reduced on the assumption that gravel dominated soil masses are broadly non- or very slightly expansive. This is likely the case over much of the plateau area.

Where finished ground level is cut or filled, design characteristic surface movements should be factored in accordance with AS2870.

Final expansive soil site classes should be specified as part of earthworks completion reporting for the subdivision, based on finished cut-fill depths and any further testing carried out.

4.5 Conclusions

From our assessment of the natural hazard and ground deformation risks presented to the proposed development we consider that the land is adequately safe from natural hazards, provided that the recommendations given in Section 5 are adhered to.

5 ENGINEERING RECOMMENDATIONS

5.1 General

It should be appreciated that the recommendations given below are based on the surface and subsurface conditions encountered at the time of the investigation. In addition to the possible variations in the subsurface conditions away from the investigation points within and around the site, changes to the site levels can have a dramatic effect on the recommendations given. We should be contacted immediately should the ground conditions encountered vary from that described in this report.

5.2 Building Platform Development

It is anticipated that as part of the subdivision works, level building platforms will generally be provided in each lot.

Within the plateau area minimal earthworks will be required to form level platforms. Minor re-levelling may be required to provide stormwater flow paths and to take down the slight mounds present within the area. Earthworks are expected to involve cuts and fills up to approximately 1m in depth.

On the moderate side slopes, more significant earthworks will be required to provide level platforms. Slopes within this area are generally at about 1V:5H and locally up to approximately

1V:4H. For a nominal building platform width of up to 15m, platforms are expected to cover an elevation range of up to approximately 3-4m. Cut/fill depths between platforms are expected to be around this figure, although this may vary where there is bulk re-levelling of the site (i.e. to flatten to moderate slope through cutting down significantly at the crest).

Preliminary, simplified stability checks indicate that terracing of the site into building platforms of 15m width with cut and fill batters, while maintaining the existing average slope gradient, will not significantly impact the factor of safety for localised failures or global instability. It is however recommended that this be re-affirmed during the subdivision earthworks design process though further stability checks.

Engineered retaining walls may be used to support batter slopes and increase flat areas within sites, and may be required with design beyond the cut and fill batter limitations. Recommendations for retaining wall design are given below.

Careful construction of building platforms will be required to ensure their long term stability and to ensure good founding soil is available for the future dwellings at each site. To achieve this the following recommendations should be adopted.

5.2.1 Cuts

Permanent cut slopes are expected to remain stable at 1V:2H (27°), for vertical heights up to 3.0m. For vertical heights up to 4.0m the batter slope should be reduced to 1VL2.5H (22°). Cuts in excess of 4.0m should be subject to specific assessment, with retaining or benching potentially required.

5.2.2 Fills

Earth-fills should be limited to a maximum height of 4m without specific geotechnical assessment. The slope of the fill needs to be kept below a maximum gradient of 1V:2H (27°), or otherwise may be retained.

The near surface residually weathered ash material (clay and silt) is considered to be suitable for use as earth-fill.

Cobbly soils comprising a high proportion of basalt rock clasts are considered generally unsuitable for earthfill without processing to screen out larger clasts or otherwise crush this material into a suitably graded PSD curve. It is generally recommended that the cut-fill design for the subdivision avoid deep cuts (>1.0m) into the plateau area wherever possible.

Cuts within the moderate slopes to a depth of 3.5m to 4.0m are expected to yield relatively clean fine soil which is considered suitable for use as engineered earthfill. Below 3.5 - 4.0m the soils are expected to become cobbly and likely bouldery. Cutting below this depth should be avoided.

All fill forming part of the building platform needs to be placed in a controlled manner to an engineering specification that follows the general methodology given in NZS 4431 (1989) "Code of practice for earthfill for residential development". This includes the design, inspection and certification of the fill by a Chartered Professional Engineer or Professional Engineering Geologist. This will be particularly important to enable the building proposed for the site to be able to be constructed in accordance with NZS3604 (2011) "Timber Framed Buildings" or NZS 4229 (2013) "Concrete Masonry Buildings Not Requiring Specific Design".

The following specification is recommended:

1. All topsoil and unsuitable materials, including low strength ground, uncontrolled fill, rubbish etc shall be stripped from the footprint area of the fill.
2. The toe of all fill slopes should be checked into sloping subgrade with a level pad at least the width of the roller. Filling over subgrades steeper than 1V:4H should be subject to specific assessment.
3. The fill footprint area shall be inspected by the certifying engineer's representative prior to the placement of fill.
4. The fill shall be placed uniformly in horizontal layers not exceeding 200mm in thickness at the optimum moisture content recommended by the suppliers of the material. Alternatively, the material should be inspected and approved as suitable material by a Suitably Qualified Professional. Material which is wet or saturated shall not be placed unless that is the optimum moisture content for the fill.
5. The fill should be compacted to achieve the criteria given in the Table 4 below.

Table 4: Recommended fill compaction criteria.

Undrained shear strength for cohesive fill (measured by *in situ* vane to plasticity corrected shear strength values)		
	Average not less than	140kPa
	Minimum single value	110kPa
Dynamic penetrometer (non-cohesive fill)		
	Average value not less than	2 blows/50mm
	Minimum single value	1.5blows/50mm
Air voids percentage		
	Average value not more than	10%
	Maximum single value	12%
Maximum dry density percentage		

	Average value not less than	95%
	Minimum single value	92%

Provision should be made to ensure that the earthworks are conducted with due respect for the weather. The fill should not be placed on to wet ground, especially if ponded water is present.

5.2.3 Site Contouring and Topsoiling

As soon as possible, all final cut-slopes and fill slopes should be covered with topsoil a minimum of 0.10m thick to prevent the ground from drying out readily resulting in the development of cracks. This is particularly important for the fill materials that are particular to this site due to their high reactivity (shrink – swell behaviour).

The finished ground level should be graded so that water cannot pond on building platforms or against any retaining walls. To achieve this it will be important that the building platform beneath the topsoil grades away from the site.

Contouring should avoid the potential for concentration and discharge of surface water over point locations which could result in soil erosion or instability.

5.2.4 Retaining Walls

The following recommendations are made to assist with the engineering design of any retaining walls:

1. The wall design should assume material strength parameters has given in Section 3.6. The appropriate material parameters should be selected based on location, and if there is any uncertainty specific geotechnical advice should be sought, and in some cases it may be appropriate to carry out specific geotechnical investigations for retaining walls.
2. Retaining wall systems should be selected as appropriate for the ground conditions at the proposed location. Embedded pile walls may not be feasible in areas underlain by shallow bouldery ground.
3. Allowances should be made for sloping ground above and below the walls, and for any surcharge loads that may be applied to the wall.
4. Enhanced behind wall drainage is recommended. The excavation for the drainage unit should be lined in a non-woven geotextile (filter cloth) prior to placement of the drainage metal to minimise the potential for siltation. A 100mm diameter slotted drainage coil surrounded with at least 50mm of drainage metal should be placed at the base of the drainage unit. Drainage metal should comprise clean 10mm to 20mm angular durable

gravel (drainage metal) which should extend up to 70% of the wall height. The top of the drainage unit should be wrapped in filter cloth.

5. Low permeability soil should be placed into the top of the excavation above the drainage unit. The soil should be compacted in layers not exceeding 200mm using a small compactor (e.g. “wacker packer”) to achieve a minimum strength of 1 blow per 50mm using a Scala penetrometer or 80kPa using a hand held shear vane.
6. The drainage coil should be connected to the stormwater system for the development.

At the construction stage the pole holes or foundation excavation should be checked by a Building Inspector or Suitably Qualified Professional to ensure that the soils encountered are consistent with those described in this report and that the depth of the excavation meets or exceeds the engineering design requirements. The wall designer should be contacted immediately should differing conditions be encountered. Alteration of the design may be required.

5.3 Building Setback Lines

The slopes around the head of the gully feature in the centre of the site have been found to be of marginal stability, not meeting acceptable factor of safety criteria for residential development. Building setback lines have been determined to provide safe building sites meeting the minimum factor of safety criteria.

The building setback has been specified as 10m from the top of bank line at the head of the gully, tapering to 5m at the eastern end of the gully.

Structural fills supporting dwellings should be kept behind the setback line, and no landscaping fill should be placed within the setback area.

Building or filling within the setback area may be possible subject to site specific assessment to ensure the instability hazard adequately mitigated.

5.4 Foundation Design and Construction Recommendations

Preliminary recommendations for foundation design are given below based on the existing site condition and our general understanding of the earthworks likely to be carried out. The foundation design recommendations should be reaffirmed or amended at the earthworks completion stage on a lot by lot basis. Due to the variability in ground conditions and ground strength across the site, it is recommended that verification testing within each building platform is carried out at the completion stage of the development or at the building consent stage of development of individual lots.

Due to the expansive nature of the soils across the site, and the presence of variable weak sensitive soils at depth, we consider that raft-slab foundations designed in accordance with AS2870 (2011) to be most appropriate for the site.

Foundations should be designed to accommodate the expansive soils at the site. Site specific classification will be required to account for final cut and fill depths and to incorporate any further testing to be carried out during earthworks as part of geotechnical completion reporting. The shallow soils appear consistent with Class M, and it is expected that most sites will fall into this category on completion.

Foundation design should account for 500 and 1000-year drought events in accordance with B1/AS1 and BRANZ Study Report SR120A, which provide factors for design characteristic surface movements above those given in AS2870.

A geotechnical ultimate bearing capacity in excess of 300kPa is expected to be available for shallow bearing slab foundations on cut natural ground or engineered fill.

5.5 Surface Water Disposal

The subdivision will be serviced by a reticulated stormwater system vested in council. The stormwater system is expected to discharge to the natural watercourse at the low point of the site. All runoff from impervious areas should be collected by this primary stormwater system.

A site specific stormwater assessment and attenuation design will be required to support the resource consent for the development. It is expected that a stormwater pond/ponds will be utilised to control runoff from the site and meet WDC EES and catchment management plan requirements. Conceptual design for the stormwater system is not yet available.

The design and siting of any stormwater pond should be subject to geotechnical assessment. Site specific investigation and assessment is recommended for the sites of any large embankments to form ponds, following preliminary design.

5.6 Roading

It is expected that the development will be served by one or several public roads and a series of private right of ways.

Earthworks for the road should be carried out in general accordance with the recommendations above for building platforms.

Based on the Scala penetrometer testing carried out across the site, a subgrade CBR in excess of 7% is expected to be available. This should be confirmed once the proposed roading layout is available.

6 SUMMARY OF CONCLUSIONS

Following development of the site in accordance with our recommendations, we consider that:

(a) The land in respect of which a consent is sought, or any structure on the land built in accordance with our recommendations, is unlikely to be subject to material damage by erosion, falling debris, subsidence, slippage, or inundation from any source; and

(b) Any subsequent use that is likely to be made of the land is unlikely to accelerate, worsen, or result in material damage to the land, other land, or structure by erosion, falling debris, subsidence, slippage, or inundation from any source; and

(c) Sufficient provision has been made for physical access to each allotment to be created by the subdivision.

7 OTHER CONSIDERATIONS

This report has been prepared exclusively for Hurupaki Holdings Ltd with respect to the particular brief given to us. Information, opinions and recommendations contained in it cannot be used for any other purpose or by any other entity without our review and written consent. Land Development & Exploration Ltd accepts no liability or responsibility whatsoever for or in respect of any use or reliance upon this report by any third party.

This report was prepared in general accordance with current standards, codes and practice at the time of this report. These may be subject to change.

Opinions given in this report are based on visual methods, and subsurface investigations at discrete locations. It must be appreciated that the nature and continuity of the subsurface materials between these locations are inferred and that actual conditions could vary from that described herein. We should be contacted immediately if the conditions are found to differ from that described in this report.

This report should be read in its entirety to understand the context of the opinions and recommendations given.

This report has been prepared for Resource Consent purposes. As such, recommendations given may be conservative to allow for differing ground conditions that may not have been identified in the level of investigation carried out for this purpose. The recommendations given may be able to be refined at the Building Consent Stage with detailed subsurface investigation and analysis that is specifically undertaken for the particular structures proposed for the sites.

For and on behalf of LDE Ltd

Report prepared by:

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Report reviewed & authorised by:

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Chartered Professional Engineer – Geotech/Civil/Structural

Find out more about LDE professionals

L:\18700 to 18799\18733 131 and 189 Three Mile Bush Road, Whangarei\05 Reporting\18733 GIR 131 - 139 Three Mile Bush Road_final.docx

APPENDIX A

GEOTECHNICAL INVESTIGATION PLAN

Building setback line

Crest of slope

Three Mile Bush Rd

Lake Ora Rd

Pukemiro Rd

Ketenikau Rd

Bonselaar Dr

0 40 80 120 160 m

LDE LAND DEVELOPMENT & ENGINEERING LTD.

Geotechnical Investigation Plan

131 and 189 Three Mile Bush Road, Whangarei

Project Number:	18733
Date:	18/03/2021
Drawn by:	Finlay Wallen
Scale A3:	1 : 2000

APPENDIX B

SUBSURFACE INVESTIGATION DATA

1. HAND AUGER BOREHOLE LOGS

2. TEST PIT LOGS

Hand Auger Borehole Log

Method: 50mm Hand Auger & Scala Penetrometer Tests

Test ID:	**HA01**				
Project ID:	18733				
Sheet:	1 of 1				
Client:	CC Developments LTD	**Coordinates:**	6049848mN, 1716125mE	**Test Date:**	11/12/2020
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2864

Depth (m)	Graphic Log	Material Description	Geology	Water
0.0	TS	Organic silty SAND (OL); brown. Dry; non plastic.	Topsoil	Groundwater Not Encountered
0.5		Sandy SILT (ML); light brown. Dry; low plasticity.	Kerikeri Volcanic Group	
1.0				
1.5				
2.0				
2.5				
3.0				

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm)

2 4 6 8

Shear Vane, Su (kPa)

50 100 150 200

Test Values
79 / 20
10

Hole Depth: 0.35m **Termination:** inferred underlying boulders

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger & Scala Penetrometer Tests

Test ID:	**HA02**				
Project ID:	18733				
Sheet:	1 of 1				
Client:	CC Developments LTD	**Coordinates:**	6049792mN, 1716122mE	**Test Date:**	11/12/2020
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	

Depth (m)	Material Description	Geology
0.0	Organic sandy SILT (OL); brown. Dry; non plastic. Friable.	Topsoil
0.5	SILT (MH), with minor clay; brown. Dry; high plasticity. Friable.	Kerikeri Volcanic Group
1.0		
1.5		
2.0		
2.5		
3.0		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values: ▶12, ▶20

Hole Depth: 0.60m

Termination: inferred underlying boulders

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger & Scala Penetrometer Tests

Test ID:	**HA03**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049819mN, 1716177mE	**Test Date:**	11/12/2020
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	

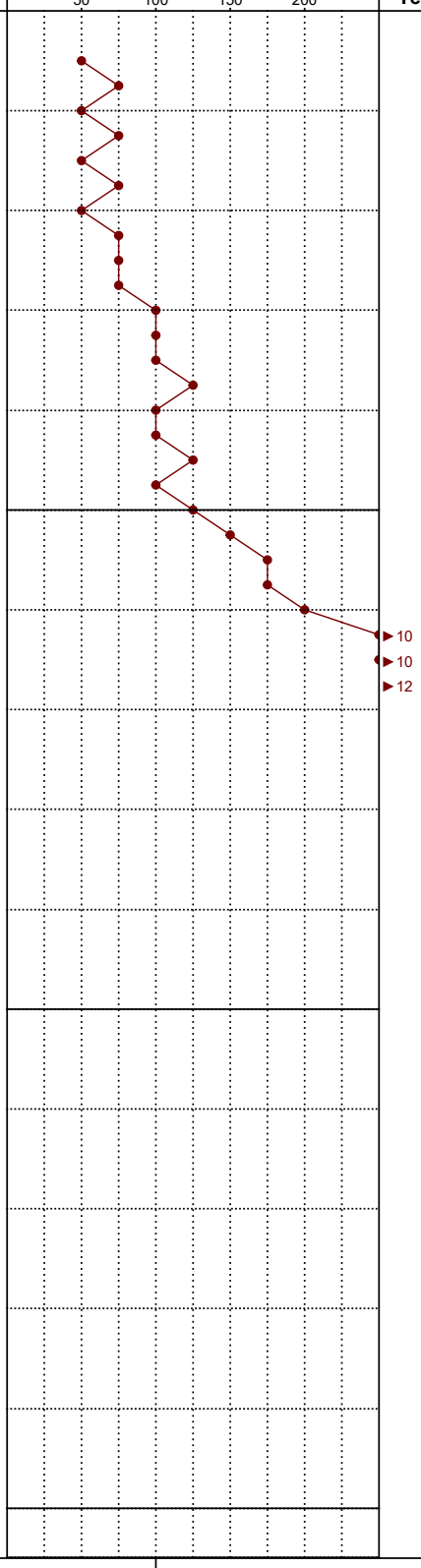
Depth (m)	Graphic Log	Material Description	Geology
0.0	TS	Organic sandy SILT (OH); brown. Dry; non plastic. Minor rootlets.	Topsoil
0.5		SILT (MH), with some clay; light brown. Very stiff; dry; high plasticity. 0.4m: becomes dry to moist and mottled yellow.	Kerikeri Volcanic Group

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm)

Shear Vane, Su (kPa)



Test Values

Depth (m)

Hole Depth: 0.55m **Termination:** inferred underlying boulders

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

Vane peak | Vane residual | Vane UTP | Standing water level | Groundwater inflow | Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger & Scala Penetrometer Tests

Test ID:	**HA04**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049766mN, 1716162mE	**Test Date:**	11/12/2020
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	1945

Depth (m)	Material Description	Geology
0.0	Organic SILT (OH); brown. Dry, high plasticity.	Topsoil
0.5	SILT (MH), with minor clay and trace gravel; brown. Very stiff; moist; high plasticity. Gravel, fine; friable.	Kerikeri Volcanic Group
	0.8m: becomes sandy and minor gravel. Sand, fine to coarse; gravel, fine.	
1.0	1.0m: becomes some sand and dark brown. Sand, fine to coarse.	
	1.1m: becomes sandy and minor gravels; brownish grey. Sand, fine to coarse; gravel, fine.	
1.5	Gravelly sandy SILT (MH); dark brown. Very stiff; moist; high plasticity. Gravel, fine to medium; sand, fine to coarse.	
2.0		
2.5		
3.0		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values	Depth (m)
255+	-0.5
219 / 55	-1.0
223 / 55	-1.5
UTP	-2.0
164 / 64	-2.5
UTP	-3.0
▶10	
▶10	

Hole Depth: 1.70m

Termination: impenetrable material (boulders)

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA05**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049804mN, 1716246mE	**Test Date:**	11/12/2020
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	1945

Depth (m)	Material Description	Geology
0.0	Clayey SILT (MH); brown. Very stiff, dry, high plasticity.	Topsoil
0.5	SILT (MH), some clay and trace sand; brownish orange. Stiff; moist to dry; high plasticity. Sand, coarse.	Kerikeri Volcanic Group
1.0	0.9m - 2.6m: becomes orangish brown.	
1.5		
2.0	2.1m: becomes minor clay and minor sand. Sand, fine to coarse.	
2.5	SILT (ML), with minor sand and trace clay; greyish brown with black and purple mottling. Very soft; wet; low plasticity. Sand, fine to coarse.	
	2.8m - 2.9m: becomes brownish orange.	
3.0	Silty sandy GRAVEL (GP); brownish orange. Stiff; wet. Gravel, medium to coarse; sand, fine to medium.	

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Depth (m)	Test Values
0.0	201 / 62
-0.5	255+
	255+
	255+
-1.0	128 / 27
	137 / 36
	150 / 29
-1.5	142 / 36
	150 / 49
-2.0	128 / 53
	99 / 36
	142 / 26
-2.5	15 / 0
	128 / 33
-3.0	128 / 27

Hole Depth: 3.00m

Termination: Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

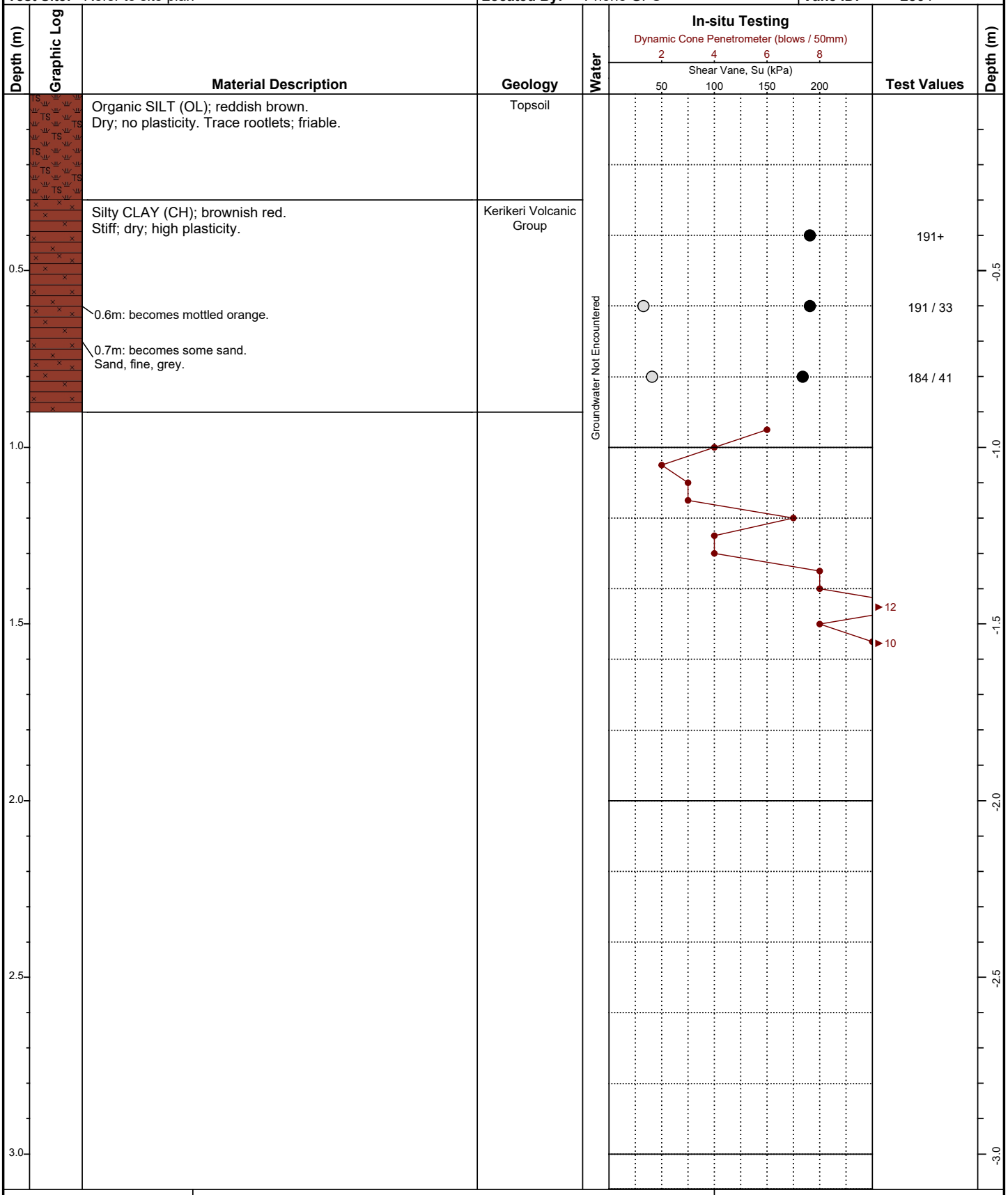
Hand Auger Borehole Log

Method: 50mm Hand Auger & Scala Penetrometer Tests

Test ID:	**HA06**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049893mN, 1716159mE	**Test Date:**	22/01/2021
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	HM
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2864

Depth (m)	Material Description	Geology
0.0	Organic SILT (OL); reddish brown. Dry; no plasticity. Trace rootlets; friable.	Topsoil
0.5	Silty CLAY (CH); brownish red. Stiff; dry; high plasticity.	Kerikeri Volcanic Group
	0.6m: becomes mottled orange.	
	0.7m: becomes some sand. Sand, fine, grey.	
3.0		



Hole Depth: 0.90m **Termination:** impenetrable material (boulders)

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

Vane peak | Vane residual | Vane UTP | Standing water level | Groundwater inflow | Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA07**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049949mN, 1716231mE	**Test Date:**	22/01/2021
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	HM
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2864

Depth (m)	Material Description	Geology
0.0	Organic SILT (OL); reddish brown. Dry; non plastic. Trace rootlets; friable.	Topsoil
	CLAY (CH), with some silt; brownish red with some black mottling. Stiff; dry to moist; high plasticity.	Kerikeri Volcanic Group
0.5	0.5m: becomes moist. Black mottling ceases.	
1.0		
1.5	1.6m: becomes trace gravel. Gravel, medium to coarse.	
2.0	1.9m - 2.2m: becomes trace gravel; brown. Gravel, fine, yellow.	
	Clayey SILT (ML), with trace gravel; brownish orange. Stiff; moist to wet; low plasticity. Gravel; medium; black.	
2.5	2.4m: becomes mottled brownish orange.	
3.0		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values	Depth (m)
82 / 30	-0.5
65 / 27	
191+	
191+	-1.0
157 / 33	
191+	-1.5
163 / 49	
191+	
191+	-2.0
191+	
82 / 22	-2.5
79 / 18	
76 / 22	
82 / 26	-3.0

Hole Depth: 3.00m

Termination: Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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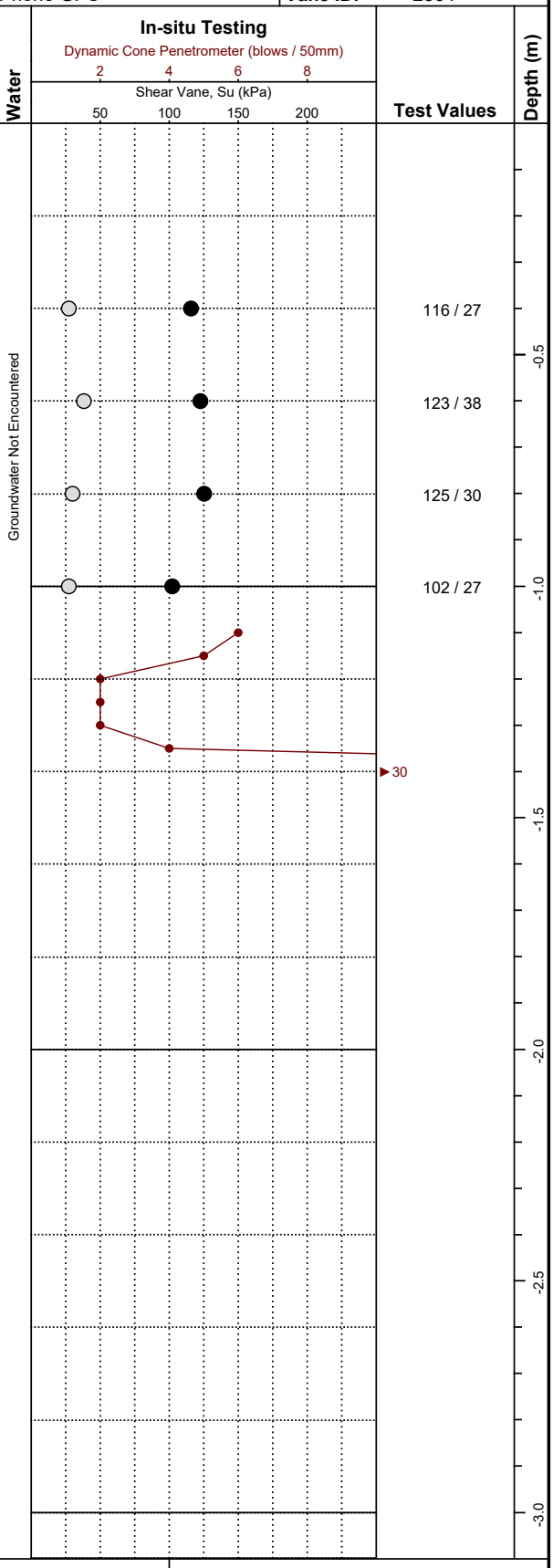
Hand Auger Borehole Log

Method: 50mm Hand Auger & Scala Penetrometer Tests

Test ID:	**HA08**				
Project ID:	18733				
Sheet:	1 of 1				
Client:	CC Developments LTD	**Coordinates:**	6049868mN, 1716158mE	**Test Date:**	22/01/2021
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	HM
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2864

Depth (m)	Material Description	Geology
0.0	SILT (ML); brown. Dry; non plastic. Trace rootlets; friable.	Topsoil
0.5	Silty CLAY (CH); reddish brown. Stiff; dry to moist; high plasticity.	Kerikeri Volcanic Group
0.9	0.9m: becomes mottled orange and brown.	
1.0		
1.5		
2.0		
2.5		
3.0		



Hole Depth: 1.10m **Termination:** impenetrable material (boulders)

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

Vane peak | Vane residual | Vane UTP | Standing water level | Groundwater inflow | Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger & Scala Penetrometer Tests

Test ID:	**HA09**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049861mN, 1716222mE	**Test Date:**	22/01/2021
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	HM
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	

Depth (m)	Graphic Log	Material Description	Geology
0.0	TS	SILT (ML); brown. Dry; non plastic. Trace rootlets; friable.	Topsoil
0.3		SILT (MH); brown. Dry; high plasticity. Friable.	Kerikeri Volcanic Group

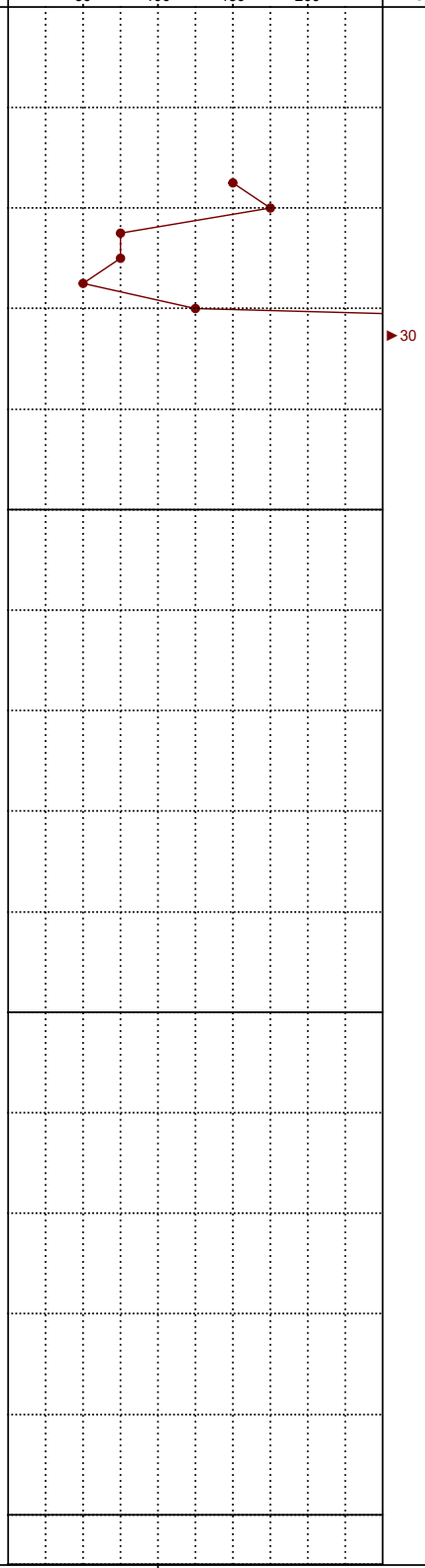
Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values



Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 (-0.5, -1.0, -1.5, -2.0, -2.5, -3.0)

Hole Depth: 0.30m **Termination:** impenetrable material (boulders)

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA10**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049751mN, 1716092mE	**Test Date:**	22/01/2021
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	HM
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2864

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8; Shear Vane, Su (kPa) 50 100 150 200	Test Values	Depth (m)
0.0	Organic SILT (OL); brown. Dry; non plastic. Trace rootlets; friable.	Topsoil	Groundwater Not Encountered			0.0
0.5	Silty CLAY (CH); brown. Stiff; dry to moist; high plasticity. 0.4m - 2.0m: becomes reddish brown.	Kerikeri Volcanic Group			191+ 163 / 41 123 / 27 UTP UTP 136 / 19 163 / 23 140 / 29 129 / 20 109 / 25 106 / 27 104 / 20 UTP	-0.5 -1.0 -1.5 -2.0 -2.5
2.0	Gravelly CLAY (CL), with some silt; reddish brown. Stiff; wet; low plasticity. Gravel; fine to coarse; orange.					
3.0						-3.0

Hole Depth: 2.90m

Termination: impenetrable material (boulders)

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger & Scala Penetrometer Tests

Test ID:	**HA11**				
Project ID:	18733				
Sheet:	1 of 1				
Client:	CC Developments LTD	**Coordinates:**	6049800mN, 1716312mE	**Test Date:**	25/01/2021
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	HM
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	

Depth (m)	Material Description	Geology
0.0	Organic SILT (ML); dark brown. Dry; non plastic. Trace rootlets; friable.	Topsoil
0.3	Clayey SILT (MH); dark brown. Stiff; dry to moist; high plasticity.	Kerikeri Volcanic Group
0.5		
1.0		
1.5		
2.0		
2.5		
3.0		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values: ▶30

Hole Depth: 0.35m

Termination: impenetrable material (boulders)

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA12**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049850mN, 1716295mE	**Test Date:**	25/01/2021
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	HM
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2249

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8; Shear Vane, Su (kPa) 50 100 150 200	Test Values	Depth (m)
0.0	Organic SILT (ML); dark brown. Dry; non plastic. Trace rootlets; friable.	Topsoil	Groundwater Not Encountered			0.0
0.5	Clayey SILT (MH); reddish brown. Stiff; dry; high plasticity. Friable; water content below plastic limit.	Kerikeri Volcanic Group			UTP	-0.5
	0.7m: becomes black mottling				210+	
					120 / 27	
1.0					UTP	-1.0
	1.3m: becomes minor gravel and moist. Gravel; fine to medium.				165 / 36	
					150 / 21	
1.5						-1.5
					180 / 27	
2.0					165 / 52	-2.0
	2.2m: becomes moist to wet				165 / 90	
2.5	2.5m: becomes minor gravel. Gravel; fine to medium.				150 / 36	-2.5
	2.8m: becomes wet				97 / 21	
3.0					96 / 25	-3.0

Hole Depth: 3.00m **Termination:** Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

Vane peak | Vane residual | Vane UTP | Standing water level | Groundwater inflow | Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA13**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049984mN, 1716284mE	**Test Date:**	25/01/2021
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	HM
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2249

Depth (m)	Material Description	Geology
0.0	Organic SILT (OL); dark brown. Dry; non plastic. Trace rootlets; friable.	Topsoil
0.5	Clayey SILT (CH); dark reddish brown. Very stiff; dry to moist; high plasticity. 0.5m: becomes black mottling	Kerikeri Volcanic Group
1.0	Silty CLAY (CH); reddish brown. Stiff; moist; high plasticity. 1.2m: becomes minor gravel. Gravel; fine to coarse.	
2.5	CLAY (CH), with some silt; dark brown. Very stiff; moist to wet; high plasticity. 2.8m: becomes wet	
3.0		

Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm) — 2, 4, 6, 8

Shear Vane, Su (kPa) — 50, 100, 150, 200

Depth (m)	Test Values
0.5	UTP
0.5	UTP
0.5	UTP
1.0	210+
1.0	150 / 42
1.5	168 / 48
1.5	180 / 60
1.5	165 / 45
2.0	UTP
2.0	UTP
2.5	156 / 31
2.5	165 / 33
3.0	111 / 22

Hole Depth: 3.00m

Termination: Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA14**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049980mN, 1716034mE	**Test Date:**	18/06/2021
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	FWH
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2249

Depth (m)	Material Description	Geology	Test Values
0.0	Organic SILT; dark brown. Moist.	Topsoil	
0.5	SILT, with minor clay, with trace sand and gravel; homogeneous. Very stiff; low plasticity; sand, fine to coarse, gravel, fine; friable.	Kerikeri Volcanic Group	121 / 46 99 / 46 202 / 52 190 / 79
1.0	Silty CLAY; dark reddish brown; homogeneous. Very stiff; high plasticity; moist.		167 / 90 155 / 73
1.5			127 / 64 155 / 36
2.0	Clayey SILT, with trace sand. Stiff to very stiff; high plasticity; moist to wet; sand, fine to coarse; highly sensitive; greasy/allophanic. 2.0m: minor clay, minor fine to coarse sand, trace fine gravel. Sand/gravel is weak scoria/lapilli clasts.	Kerikeri Volcanic Group (Lapilli Tephra)	108 / 24 95 / 23
2.5			108 / 32 148 / 23 83 / 42
3.0			67 / 35 115 / 29
3.5			
4.0			
4.5			

Water: Groundwater Not Encountered

In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8; Shear Vane, Su (kPa) 50 100 150 200

Hole Depth: 3.00m **Termination:** Reached target depth

Remarks: Shear vanes through lapilli tephra expected to be unreliable..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

Vane peak; Vane residual; Vane UTP; Standing water level; Groundwater inflow; Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA15**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049953mN, 1716083mE	**Test Date:**	18/06/2021
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	FWH
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8; Shear Vane, Su (kPa) 50 100 150 200	Test Values	Depth (m)
0.0	TS TP	Organic SILT; dark brown. Moist.	Topsoil	dwater Not Encou			0.0
		SILT, with minor clay; dark reddish brown; homogeneous. Very stiff; low plasticity; moist.	Kerikeri Volcanic Group				
0.5							-0.5
1.0							-1.0
1.5							-1.5
2.0							-2.0
2.5							-2.5
3.0							-3.0
3.5							-3.5
4.0							-4.0
4.5							-4.5

Hole Depth: 0.40m **Termination:** impenetrable material (boulders)

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA15A**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049945mN, 1716074mE	**Test Date:**	18/06/2021
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	FWH
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing	Test Values	Depth (m)
0.0		Organic SILT; dark reddish brown. Moist.	Topsoil	dwater Not Encou	Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8; Shear Vane, Su (kPa) 50 100 150 200		0.0
		Clayey SILT; dark reddish brown; homogeneous. High plasticity; moist.	Kerikeri Volcanic Group				
0.5							-0.5
1.0							-1.0
1.5							-1.5
2.0							-2.0
2.5							-2.5
3.0							-3.0
3.5							-3.5
4.0							-4.0
4.5							-4.5

Hole Depth: 0.40m **Termination:** impenetrable material (boulders)

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA16**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049994mN, 1716161mE	**Test Date:**	18/06/2021
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	FWH
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**		**Vane ID:**	2249

Depth (m)	Material Description	Geology
0.0	Organic SILT; dark brown. Moist.	Topsoil
	SILT, with minor clay; dark reddish brown; homogeneous. Very stiff to hard; low plasticity; moist.	Kerikeri Volcanic Group
0.5	0.6m: becomes clayey, highly plastic	
2.5	Silty CLAY; dark reddish brown; homogeneous. Very stiff to hard; high plasticity; moist.	
3.0	Silty CLAY, with trace sand and gravel. Stiff; wet; sand, fine to coarse, gravel, fine, weak scoria/ lapilli; very sensitive, collapsing structure, greasy/allophanic.	Kerikeri Volcanic Group (Lapilli Tephra)
3.5	SILT, with some sand, with minor clay and gravel. Low plasticity; wet; sand, fine to coarse; gravel, fine, weak scoria/lapilli; very sensitive; collapsing structure, greasy/allophanic..	
4.0		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Depth (m)	Test Values
0.0	175 / 52
	194 / 65
0.5	210+
	210+
1.0	181 / 82
	210+
1.5	210+
	205 / 120
	208 / 108
2.0	169 / 93
	210
2.5	210
	186 / 73
	169 / 67
3.0	105 / 35
	79 / 32
3.5	64 / 38
4.0	61 / 32
4.5	

Hole Depth: 4.00m

Termination: Reached target depth

Remarks: Shear vanes through lapilli tephra expected to be unreliable..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

Method: 22t Excavator

Test ID:	**TP01**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049775mN, 1716279mE	**Test Date:**	14/12/2020
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	FWH
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	197.56m	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Excavator GPS	**Vane ID:**	2864

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm)	In-situ Testing: Shear Vane, Su (kPa)	Test Values	RL (m)
0.0	Organic SILT (OL); dark brown. Dry; containing rootlets.	Topsoil	Groundwater Not Encountered	2 4 6 8	50 100 150 200	UTP	197.56
0.5	SILT (ML), with some clay; reddish brown. Low plasticity; dry; containing rare basalt/scoria gravels and cobbles.	Kerikeri Volcanic Group				UTP UTP UTP UTP	197.0
1.0	1.0m: increasing gravels and cobbles to 20%					UTP	
1.5						150 / 76 143 / 98	196.0
2.0							
2.5	Clayey SILT (ML), with minor gravel and cobbles; reddish brown. Low plasticity; moist; gravel, fine to coarse; (approximately 20% Gravel / Cobbles).					91 / 25	195.0
3.0							
3.5	GRAVEL (GM), with some silt and cobbles. Gravel, fine to coarse; cobbles, up to 200mm; Mixture of red weak & some grey strong weathered basalt & scoria.					▶14	194.0
4.0							
4.5							193.0

Hole Depth: 4.10m

Termination: Reached target depth

Remarks:

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005). No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

Method: 22t Excavator

Test ID:	**TP02**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049830mN, 1716263mE	**Test Date:**	14/12/2020
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	197.09m	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Excavator GPS	**Vane ID:**	

Depth (m)	Material Description	Geology
0.0	Organic SILT (OL); dark brown. Dry; containing rootlets.	Topsoil
0.5	Clayey SILT (ML), with minor gravel and cobbles; dark reddish brown. Dry; gravel, coarse.	Kerikeri Volcanic Group
1.5	Cobbly GRAVEL (GW), with some silt; dark brown. Moist; well graded; gravel, fine to coarse; soft to stiff soil matrix (variable). 2.2m: encountering large boulders (approximately 0.5m dia.) 3.6m: 90% Gravel / Cobbles, with some boulders. Mixture of Red weak weathered basalt / scoria, and grey very strong basalt / scoria in a silt matrix. Silt Matrix is wet to saturated, no groundwater present.	
4.0		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values

UTP

10

UTP

RL (m): 197.0, 196.0, 195.0, 194.0, 193.0

Hole Depth: 4.00m

Termination: large boulders/rock, unable to

Remarks:

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005). No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

Method: 22t Excavator

Test ID:	**TP03**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049828mN, 1716218mE	**Test Date:**	14/12/2020
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	196.71m	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Excavator GPS	**Vane ID:**	2864

Depth (m)	Material Description	Geology	Water	In-situ Testing	Test Values	RL (m)
0.0	Organic SILT (OL); dark brown. Dry; containing rootlets.	Topsoil	Groundwater Not Encountered	Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8 Shear Vane, Su (kPa) 50 100 150 200	106 / 14 177 / 41 123 / 48 10 106 / 27	196.0 195.0 194.0 193.0 192.0
0.5	SILT (ML), with minor clay and gravel, with trace cobbles; brownish orange. Low plasticity; moist; gravel, coarse; 10% Gravels & Cobbles present.	Kerikeri Volcanic Group				
1.0	1.0m: becoming clayey					
1.5						
2.0						
2.5	Silty cobbly GRAVEL (GM), with some boulders; brownish grey. Moist; gravel, fine to coarse; boulders, up to 400mm; (70% Gravel/cobbles, 5% boulders). Mainly Grey strong basalt & scoria.					
3.0						
3.5						
4.0						
4.5						

Hole Depth: 3.50m

Termination: large boulders/rock, unable to

Remarks:

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005). No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

Method: 22t Excavator

Test ID:	**TP04**				
Project ID:	18733				
Sheet:	1 of 1				
Client:	CC Developments LTD	**Coordinates:**	6049774mN, 1716206mE	**Test Date:**	14/12/2020
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	197.11m	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Excavator GPS	**Vane ID:**	

Depth (m)	Material Description	Geology
0	Organic SILT (OL), with trace clay; dark brown. Dry; containing rootlets.	Topsoil
0.5	SILT (ML), with some clay, with minor gravel, with trace cobbles; brownish orange. Low plasticity; moist; gravel, coarse; cobbles, up to 200mm.	Kerikeri Volcanic Group
1.0	Cobbly GRAVEL (GW), with some silt; brownish orange. Well graded; gravel, fine to coarse; cobbles, up to 200mm; 50% Gravel / Cobbles, generally grey strong basalt & scoria.	
1.5	1.0m - 1.2m: becoming grey and gravel/cobbles increasing to 80% with some boulders	
	1.2m - 1.8m: Gravels, cobbles and boulders increasing to 95%, avg. 200mm	
2.0	1.8m - 2.3m: increasing in average size of boulders (avg. 350mm, max. 600mm)	
2.5		
3.0		
3.5		
4.0		
4.5		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values: 10, 10

RL (m): 197.0, 196.0, 195.0, 194.0, 193.0

Hole Depth: 2.30m

Termination: large boulders/rock, unable to

Remarks:

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005). No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

Method: 22t Excavator

Test ID:	**TP05**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049820mN, 1716180mE	**Test Date:**	14/12/2020
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	197.82m	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Excavator GPS	**Vane ID:**	

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing	Test Values	RL (m)
0	TS TS TS TS	Organic gravelly SILT (OL), with minor cobbles; dark brown. Dry; gravel, coarse; cobbles, up to 200mm; containing rootlets.	Topsoil	Groundwater Not Encountered	Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8 Shear Vane, Su (kPa) 50 100 150 200	10	197.0
0.5		Silty cobbly GRAVEL (GM), with some boulders; brownish grey. Dry; cobbles, up to 200mm; boulders, up to 400mm; generally comprised of a mixture of strong grey, and weak reddish brown basalt / scoria. Approximately 50% of soil are gravels, cobbles. 0.5m - 2.5m: gravels, cobbles and boulders increase to 90% of material. Average size 200mm, Max. 400mm.	Kerikeri Volcanic Group				
1.0							196.0
1.5							
2.0							195.0
2.5		2.5m: encountering either larger boulders or solid rock					
3.0							194.0
3.5							
4.0							193.0
4.5							

Hole Depth: 3.00m

Termination: large boulders/rock, unable to

Remarks:

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005). No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

Method: 22t Excavator

Test ID:	**TP06**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049772mN, 1716162mE	**Test Date:**	14/12/2020
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	198.43m	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Excavator GPS	**Vane ID:**	

Depth (m)	Material Description	Geology
0.0	Organic SILT (OL); brown. Dry to moist; containing rootlets.	Topsoil
0.5	SILT (ML), with some gravel and cobbles, with minor clay; dark brown. Low plasticity; moist; gravel, fine to coarse, cobbles, up to 200mm; gravels and cobbles approximately 25% of soil.	Kerikeri Volcanic Group
1.0	Silty cobbly GRAVEL (GM), with some boulders; brown. Moist; boulders, up to 250mm; gravels and cobbles approximately 60%, and consist of mainly grey strong basalt and scoria.	
1.5	1.0m: increasing to 90% gravels, cobbles and boulders up to 400mm	
3.5	3.5m - 3.6m: silt matrix becoming wet to saturated	

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values: 10, 12, 10

RL (m): 198.0, 197.0, 196.0, 195.0, 194.0

Hole Depth: 3.60m

Termination: large boulders/rock, unable to

Remarks:

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005). No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

Method: 22t Excavator

Test ID:	**TP07**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049870mN, 1716117mE	**Test Date:**	14/12/2020
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	198.5m	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Excavator GPS	**Vane ID:**	

Depth (m)	Graphic Log	Material Description	Geology
0	TS TS	Organic SILT (OL); brown. Moist.	Topsoil
0.5		SILT (ML), with some gravel, with minor clay and cobbles; brownish orange. Low plasticity; moist; gravel, fine to coarse; cobbles, up to 150mm; approximately 25% gravel / cobbles.	Kerikeri Volcanic Group
1.0		Silty cobbly GRAVEL (GM), with some sand, with minor boulders; brownish orange. Moist; cobbles, up to 150mm; sand, fine to coarse; boulders, up to 300mm; gravels and cobbles approximately 60% of soil. 1.0m: Average size of gravel, cobbles and boulders increased to 300mm. 1.5m: increasing to 90% gravels, cobbles and boulders. larger boulders increasing to 600mm	
1.5			
2.0			
2.5			
3.0			
3.5			
4.0			
4.5			

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values: ▶10, ▶20

RL (m): 198.0, 197.0, 196.0, 195.0, 194.0

Hole Depth: 3.00m

Termination: large boulders/rock, unable to

Remarks:

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005). No correlation is implied between shear vane and DCP values.

- ● Vane peak
- ○ Vane residual
- ◆ Vane UTP
- ▼ Standing water level
- ◁ Groundwater inflow
- ▷ Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

Method: 22t Excavator

Test ID:	**TP08**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049906mN, 1716207mE	**Test Date:**	14/12/2020
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	186.73m	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Excavator GPS	**Vane ID:**	2864

Depth (m)	Material Description	Geology	Water	In-situ Testing	Test Values	RL (m)
0.0	Organic SILT (OL), with minor clay; dark brown. Moist; containing rootlets.	Topsoil	Groundwater Not Encountered	Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8; Shear Vane, Su (kPa) 50 100 150 200	UTP	186.73
0.5	SILT (ML), with minor clay and gravel; reddish brown. Hard; low plasticity; dry to moist; gravel, fine to coarse; Gravel content less than 10%. 0.5m - 3.5m: Becoming orange	Kerikeri Volcanic Group			UTP	186.0
1.0					UTP	
1.5						185.0
2.0						
2.5						184.0
3.0	3.0m: containing minor sand and becoming wet					
3.5	Sandy SILT (ML), with minor clay and gravel; brownish orange. Low plasticity; wet to saturated; sand, fine to coarse; gravel, fine; no groundwater encountered (no free water).					183.0
4.0						
4.5						182.0

Hole Depth: 4.00m

Termination: Reached target depth

Remarks:

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005). No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

Method: 22t Excavator

Test ID:	**TP09**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049935mN, 1716271mE	**Test Date:**	14/12/2020
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	178.07m	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Excavator GPS	**Vane ID:**	2864

Depth (m)	Material Description	Geology
0	Organic SILT (OL); dark brown. Dry; containing rootlets.	Topsoil
0.5	SILT (ML), with some clay; reddish brown. Hard; low plasticity; dry to moist.	Kerikeri Volcanic Group
2.5	SILT (ML), with some sand, with trace clay; brownish orange. Low plasticity; wet to saturated; sand, fine to medium.	
4.5		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values
UTP
UTP
191+
98 / 14
▶10
▶10
▶10
191+

RL (m): 178.0, 177.0, 176.0, 175.0, 174.0

Hole Depth: 4.00m

Termination: Reached target depth

Remarks:

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005). No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

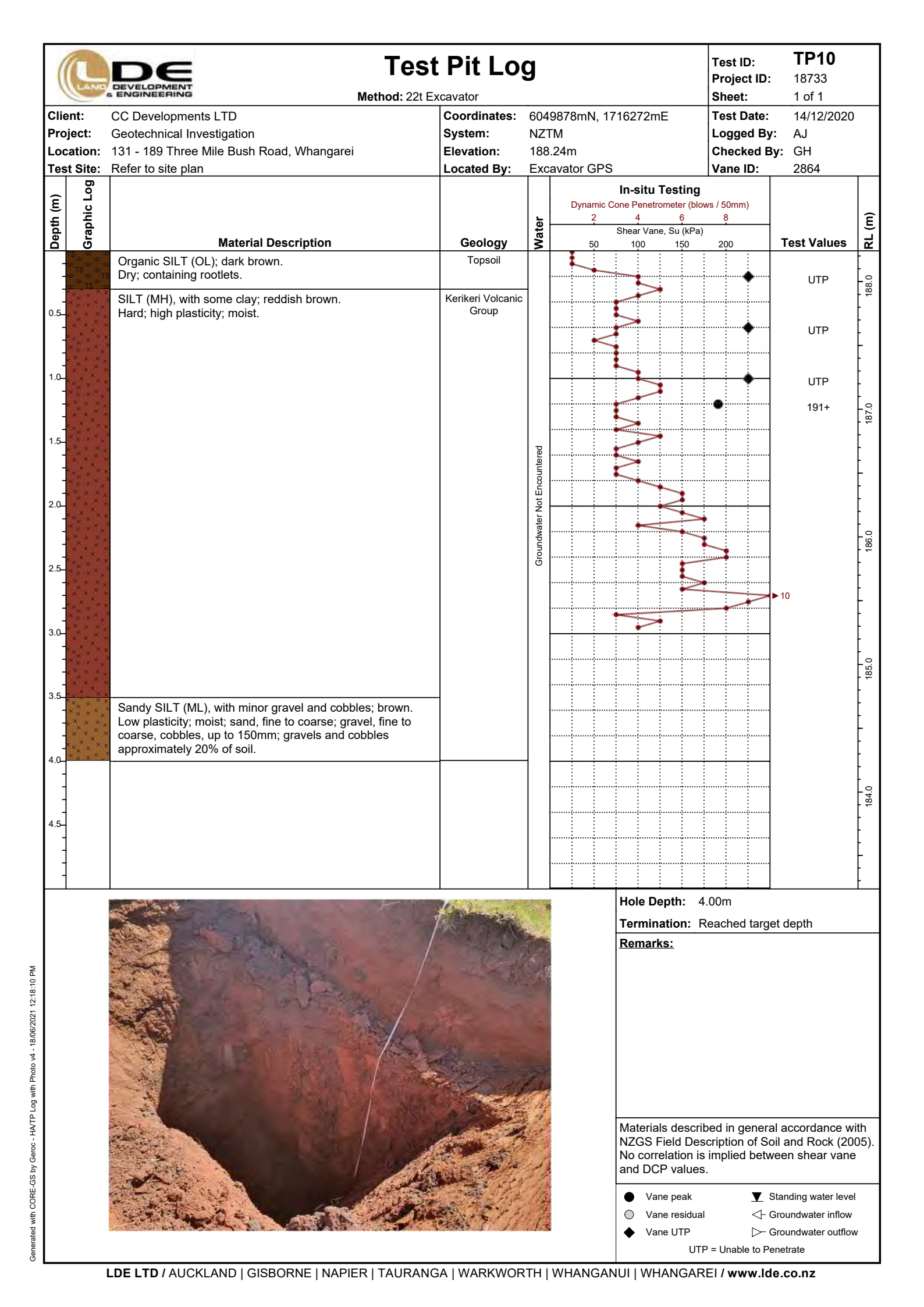
Test Pit Log

Method: 22t Excavator

Test ID:	**TP10**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049878mN, 1716272mE	**Test Date:**	14/12/2020
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	188.24m	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Excavator GPS	**Vane ID:**	2864

Depth (m)	Graphic Log	Material Description	Geology
0.0		Organic SILT (OL); dark brown. Dry; containing rootlets.	Topsoil
0.5		SILT (MH), with some clay; reddish brown. Hard; high plasticity; moist.	Kerikeri Volcanic Group
1.0			
1.5			
2.0			
2.5			
3.0			
3.5		Sandy SILT (ML), with minor gravel and cobbles; brown. Low plasticity; moist; sand, fine to coarse; gravel, fine to coarse, cobbles, up to 150mm; gravels and cobbles approximately 20% of soil.	
4.0			
4.5			



Hole Depth: 4.00m

Termination: Reached target depth

Remarks:

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005). No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

Method: 14.5t Excavator

Test ID:	**TP11**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6050017mN, 1716218mE	**Test Date:**	19/05/2021
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2249

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm)	In-situ Testing: Shear Vane, Su (kPa)	Test Values
0.0	Organic SILT (OL), with some clay; dark brown. Moist; friable.	Topsoil	Groundwater Not Encountered	2 4 6 8	50 100 150 200	
0.5	Organic SILT (OL), with some clay, with minor sand, with trace boulders; brownish orange. Stiff; moist; sand, coarse; boulders, up to 200mm, Basalt scoria; friable.	Kerikeri Volcanic Group				93 / 35
1.0						196 / 71
1.5						137 / 23
2.0	2.0m - 4.2m: becoming reddish brown					79 / 35
2.5						101 / 20
3.0						137 / 35
3.5						UTP
4.0						
4.5						

Hole Depth: 4.20m

Termination: Reached target depth

Remarks:

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005). No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

Method: 14.5t Excavator

Test ID:	**TP12**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6050035mN, 1716159mE	**Test Date:**	19/05/2021
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2249

Depth (m)	Material Description	Geology
0.0	Organic SILT (OL), with some clay; dark brown. Moist; friable.	Topsoil
0.5	SILT (ML), with some clay, with minor sand; brownish orange. Stiff to very stiff; low plasticity; moist; sand, medium; friable.	Kerikeri Volcanic Group
2.0	2.0m - 2.5m: containing trace boulders (max. 300mm diameter) 2.1m - 3.0m: becoming brown	
3.0	3.0m - 4.8m: becoming brownish orange	
4.5		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Depth (m)	Test Values
0.5	108 / 23
1.0	167 / 35
1.5	93 / 23
2.0	199 / 49
2.5	137 / 35
3.0	196 / 49
3.5	105 / 41
4.0	
4.5	

-1.0, -2.0, -3.0, -4.0

Hole Depth: 4.80m

Termination: Reached target depth

Remarks:

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005). No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Test Pit Log

Method: 14.5t Excavator

Test ID:	**TP13**
Project ID:	18733
Sheet:	1 of 1

Client:	CC Developments LTD	**Coordinates:**	6049987mN, 1716119mE	**Test Date:**	19/05/2021
Project:	Geotechnical Investigation	**System:**	NZTM	**Logged By:**	AJ
Location:	131 - 189 Three Mile Bush Road, Whangarei	**Elevation:**	Ground	**Checked By:**	GH
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2249

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8; Shear Vane, Su (kPa) 50 100 150 200	Test Values	Depth (m)
0.0	Organic SILT (OL), with some clay; dark brown. Moist; friable.	Topsoil	Groundwater Not Encountered			0.0
0.5	Clayey SILT (ML), with minor sand, with trace boulders; brownish orange. Stiff to hard; low plasticity; moist; sand, coarse; boulders, up to 200mm; friable.	Kerikeri Volcanic Group			181 / 57	-0.5
1.0					174 / 49	-1.0
1.5					123 / 20	-1.5
2.0					UTP	-2.0
2.5	2.5m - 3.0m: minor cobbles and boulders encountered (max. 150mm diameter)				UTP	-2.5
3.0					UTP	-3.0
3.5					UTP	-3.5
4.0						-4.0
4.5						

Hole Depth: 4.20m

Termination: Reached target depth

Remarks:

Materials described in general accordance with NZGS Field Description of Soil and Rock (2005). No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

APPENDIX C

LABORATORY TEST CERTIFICATES

Whangarei Laboratory
166 Bank Street
Whangarei
M: 027 656 5226
E: info@geocivil.co.nz

TEST REPORT

Lab Job No: 8334-019

Your ref.: 18733

Date of Issue: 21/01/2021

Date of Re-Issue: -

Page: 1 of 7

Test Report No. W21-059

PROJECT: **Soil Classification Testing**

CLIENT: LDE Ltd
192 Bank Street,
Regent, Whangarei 0110

ATTENTION: Conor Pullman

TEST METHODS: Determination of the liquid & plastic limits, Plasticity index and water content
NZS 4402:1986 Tests 2.1,2.2,2.3,2.4
Determination of the Linear Shrinkage
NZS 4402:1986 Test 2.6

SAMPLING METHOD: Sampled by client - sampling not accredited
Hand bore hole sampled

TEST RESULTS: As per attached sheets

D. Krissansen
Technical Director

S. Kokich
Approved Signatory

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

Whangarei Laboratory
166 Bank Street
Whangarei
P: 09 438 4417
E: info@geocivil.co.nz

DETERMINATION OF THE LIQUID & PLASTIC LIMITS, PLASTICITY INDEX & WATER CONTENT

NZS 4402:1986 Test 2.2,2.3,2.4

Lab Job No:	8334-019	**Sample No.:**	21-003
Client:	LDE	**Tested By:**	N.K
Location:	-	**Date Tested:**	13/01/2021
	TP2 0.5 - 0.7m	**Checked By:**	D.K.
Date Received:	18/12/2020	**Date Checked:**	21/01/2021
Report No:	W21-059	**Page:**	2 of 7
REF:	18733		
Sampling Method:	Sampled by client – Sampling not accredited	**Sampled By:**	Client
Date Sampled:	14/12/2020		

Test Details:

Test performed on: Fraction passing 425μm sieve

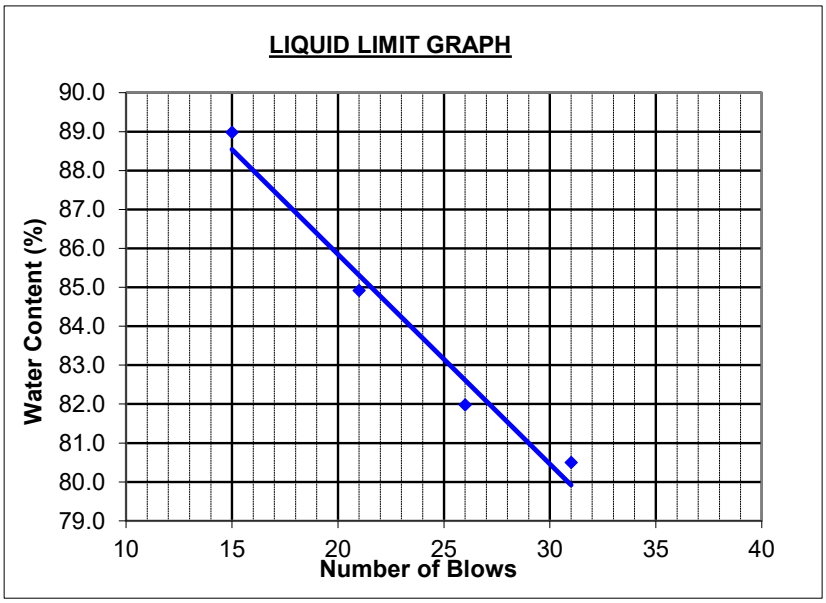
Sample history: Natural state

Description of Sample: Clayey SILT, traces of rootlets and gravels up to 10mm, damp, red brown

	Liquid Limit			
No. of blows	15	21	26	31
Water content (%)	89.0	84.9	82.0	80.5

Plastic Limit	
44.3	44.6

NWC	**42.6**
Liquid Limit	**83**
Plastic Limit	**44**
Plasticity Index	**39**



S. Kokich
Approved Signatory

Whangarei Laboratory
166 Bank Street
Whangarei
P: 09 438 4417
E: info@geocivil.co.nz

DETERMINATION OF THE LINEAR SHRINKAGE

NZS 4402:1986 Test 2.6

Lab Job No:	8334-019	**Sample No:**	21-003
Client:	LDE	**Tested By:**	N.K
Location:	-	**Date:**	13/01/2021
	TP2 0.5 - 0.7m	**Checked By:**	D.K.
Date Received:	18/12/2020	**Date:**	21/01/2021
Report No:	W21-059	**Page:**	3 of 7
REF:	18733		

Test performed on: Fraction passing 425mm sieve
History: Natural state

Description of Sample: Clayey SILT, traces of rootlets and gravels up to 10mm, damp, red brown

Linear shrinkage	**19**

S. Kokich
Approved Signatory

Whangarei Laboratory
166 Bank Street
Whangarei
P: 09 438 4417
E: info@geocivil.co.nz

DETERMINATION OF THE LIQUID & PLASTIC LIMITS, PLASTICITY INDEX & WATER CONTENT

NZS 4402:1986 Test 2.2,2.3,2.4

Lab Job No:	8334-019	**Sample No.:**	21-004
Client:	LDE	**Tested By:**	N.K
Location:	-	**Date Tested:**	12/01/2021
	TP4 0.5 - 0.7m	**Checked By:**	D.K.
Date Received:	18/12/2020	**Date Checked:**	21/01/2021
Report No:	W21-059	**Page:**	4 of 7
REF:	18733		
Sampling Method:	Sampled by client – Sampling not accredited	**Sampled By:**	Client
Date Sampled:	14/12/2020		

Test Details:

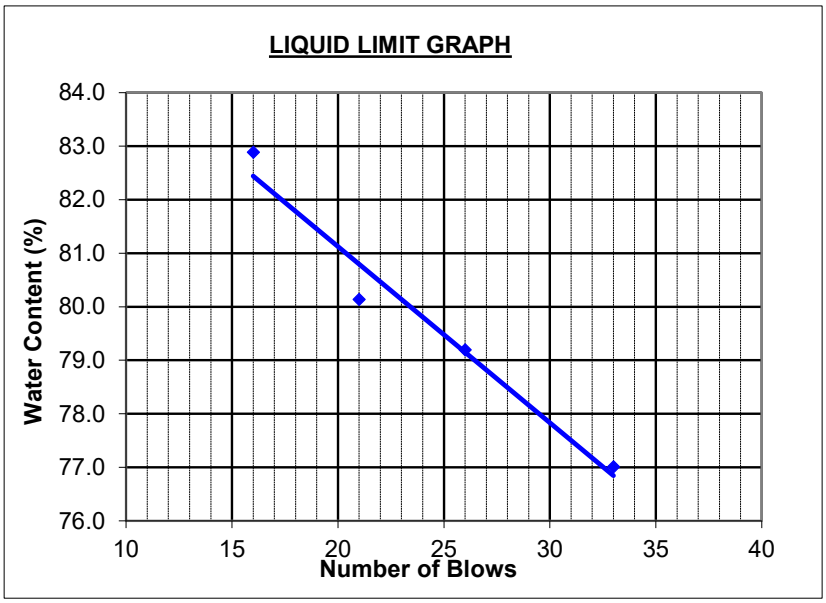
Test performed on: Fraction passing 425μm sieve

Sample history: Natural state

Description of Sample: Clayey SILT, traces of rootlets and fine sands, damp, brown

	Liquid Limit				Plastic Limit	
No. of blows	16	21	26	33		
Water content (%)	82.9	80.1	79.2	77.0	42.1	41.8

NWC	**36.1**
Liquid Limit	**80**
Plastic Limit	**42**
Plasticity Index	**38**



S. Kokich
Approved Signatory

Whangarei Laboratory
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Whangarei
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DETERMINATION OF THE LINEAR SHRINKAGE

NZS 4402:1986 Test 2.6

Lab Job No:	8334-019	**Sample No:**	21-004
Client:	LDE	**Tested By:**	N.K
Location:	-	**Date:**	12/01/2021
	TP4 0.5 - 0.7m	**Checked By:**	D.K.
Date Received:	18/12/2020	**Date:**	21/01/2021
Report No:	W21-059	**Page:**	5 of 7
REF:	18733		

Test performed on: Fraction passing 425mm sieve
History: Natural state

Description of Sample: Clayey SILT, traces of rootlets and fine sands, damp, brown

Linear shrinkage	**22**

S. Kokich
Approved Signatory

Whangarei Laboratory
166 Bank Street
Whangarei
P: 09 438 4417
E: info@geocivil.co.nz

DETERMINATION OF THE LIQUID & PLASTIC LIMITS, PLASTICITY INDEX & WATER CONTENT

NZS 4402:1986 Test 2.2,2.3,2.4

Lab Job No:	8334-019	**Sample No.:**	21-005
Client:	LDE	**Tested By:**	N.K
Location:	-	**Date Tested:**	13/01/2021
	TP8 0.5 - 0.7	**Checked By:**	D.K.
Date Received:	18/12/2020	**Date Checked:**	21/01/2021
Report No:	W21-059	**Page:**	6 of 7
REF:	18733		
Sampling Method:	Sampled by client – Sampling not accredited	**Sampled By:**	Client
Date Sampled:	14/12/2020		

Test Details:

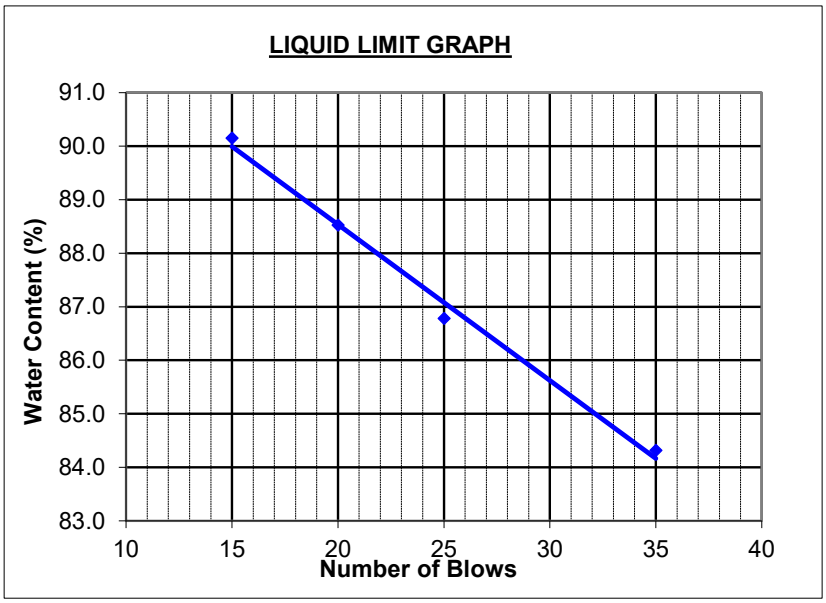
Test performed on: Fraction passing 425μm sieve

Sample history: Natural state

Description of Sample: Clayey SILT, traces of rootlets, moist, red orange brown

	Liquid Limit				Plastic Limit	
No. of blows	15	20	25	35		
Water content (%)	90.2	88.5	86.8	84.3	49.8	49.3

NWC	**47.4**
Liquid Limit	**87**
Plastic Limit	**50**
Plasticity Index	**37**



S. Kokich
Approved Signatory

Whangarei Laboratory
166 Bank Street
Whangarei
P: 09 438 4417
E: info@geocivil.co.nz

DETERMINATION OF THE LINEAR SHRINKAGE

NZS 4402:1986 Test 2.6

Lab Job No:	8334-019	**Sample No:**	21-005
Client:	LDE	**Tested By:**	N.K
Location:	-	**Date:**	13/01/2021
	TP8 0.5 - 0.7	**Checked By:**	D.K.
Date Received:	18/12/2020	**Date:**	21/01/2021
Report No:	W21-059	**Page:**	7 of 7
REF:	18733		

Test performed on: Fraction passing 425mm sieve
History: Natural state

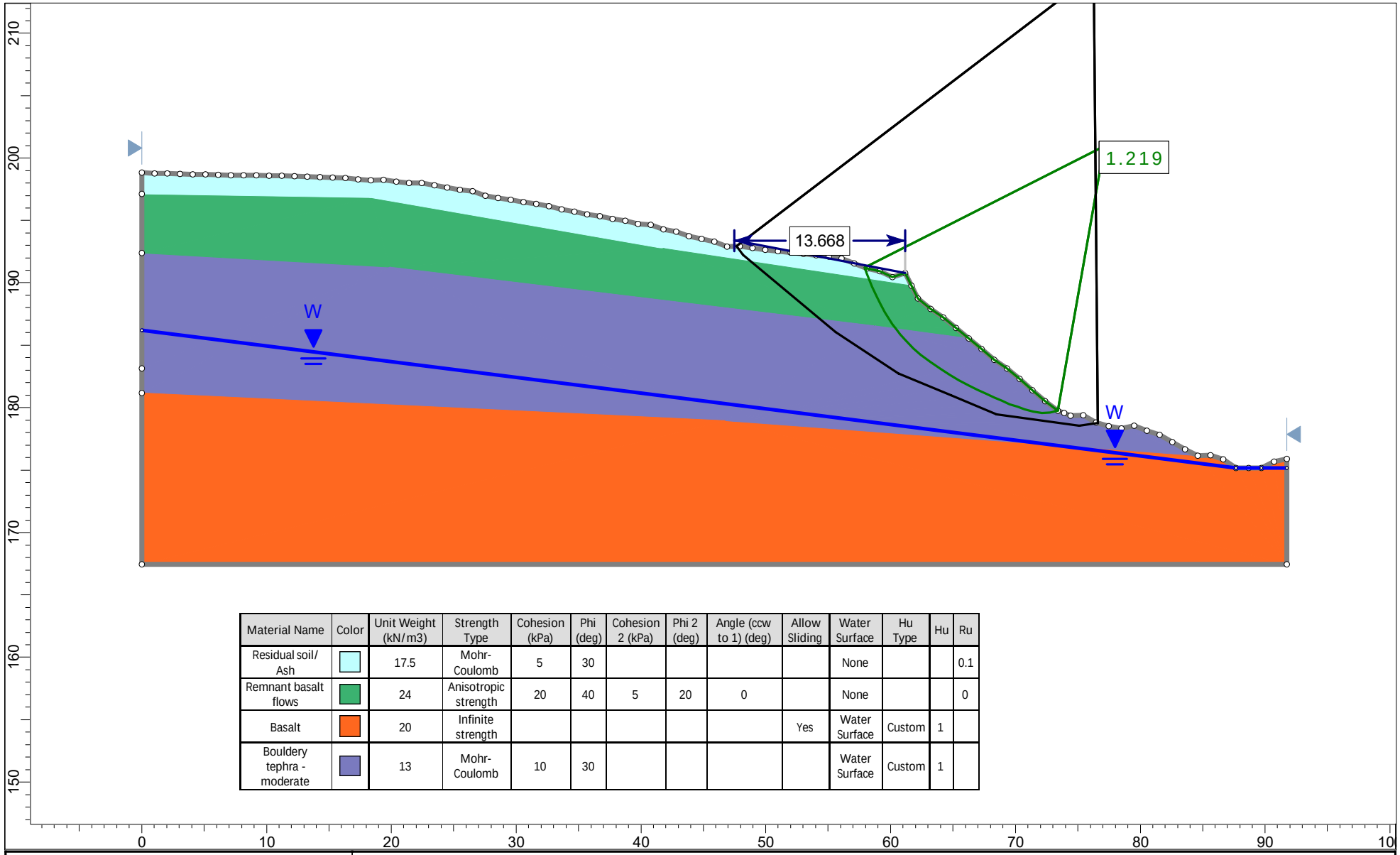
Description of Sample: Clayey SILT, traces of rootlets, moist, red orange brown

Linear shrinkage	**21**

S. Kokich
Approved Signatory

APPENDIX D

STABILITY ANALYSES

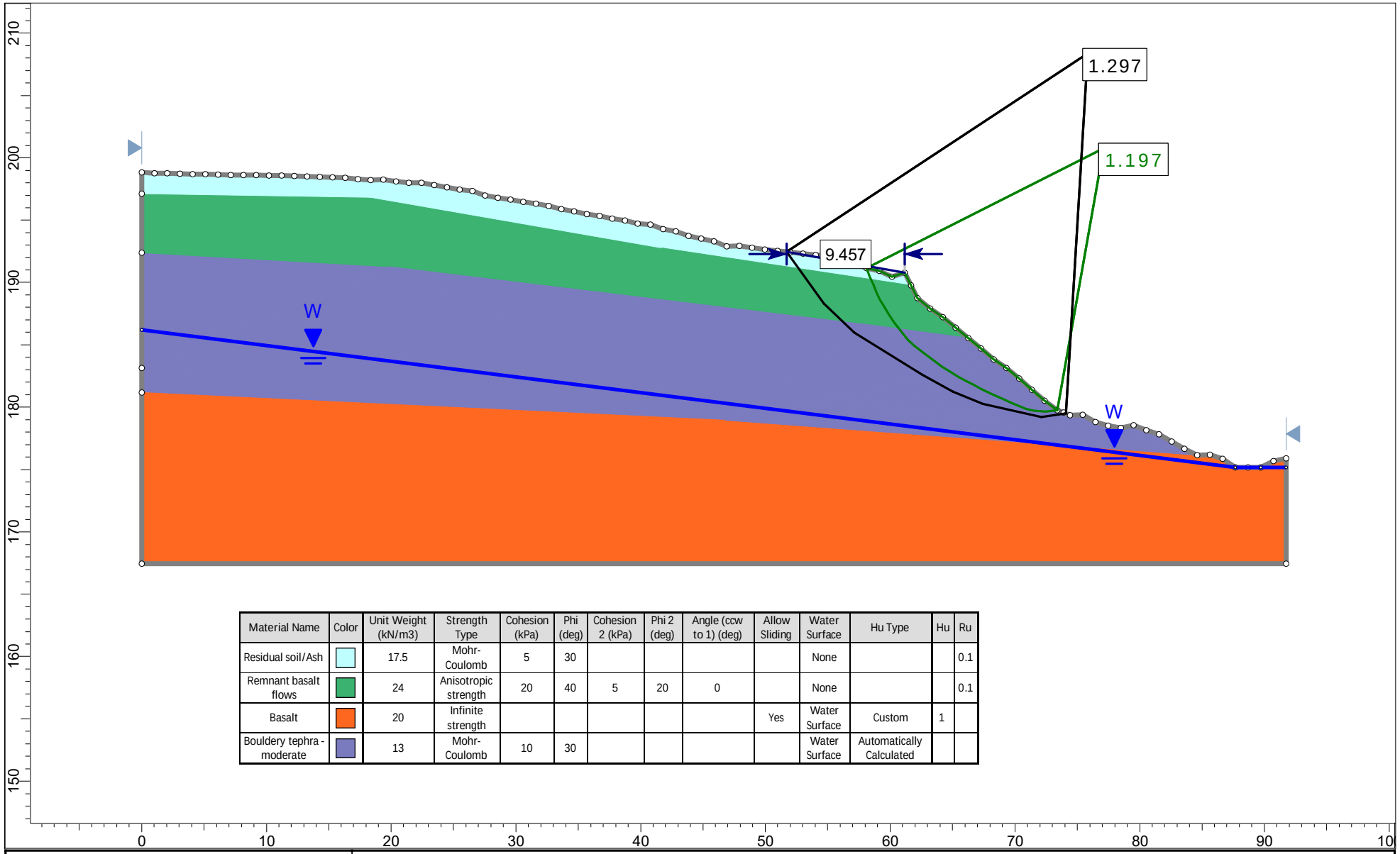


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Cohesion 2 (kPa)	Phi 2 (deg)	Angle (ccw to 1) (deg)	Allow Sliding	Water Surface	Hu Type	Hu	Ru
Residual soil/ Ash		17.5	Mohr-Coulomb	5	30					None			0.1
Remnant basalt flows		24	Anisotropic strength	20	40	5	20	0		None			0
Basalt		20	Infinite strength						Yes	Water Surface	Custom	1	
Bouldery tephra - moderate		13	Mohr-Coulomb	10	30					Water Surface	Custom	1	

LAND DEVELOPMENT & ENGINEERING LTD.

SLIDEINTERPRET 9.012

Project	131 and 189 Three Mile Bush Road		
Analysis Description	CS-2 - Design conditions		
Drawn By FWH	*Scale* 1:430	*Company* LDE Ltd	
Date 22/06/2021		*File Name* 18733.slmd	

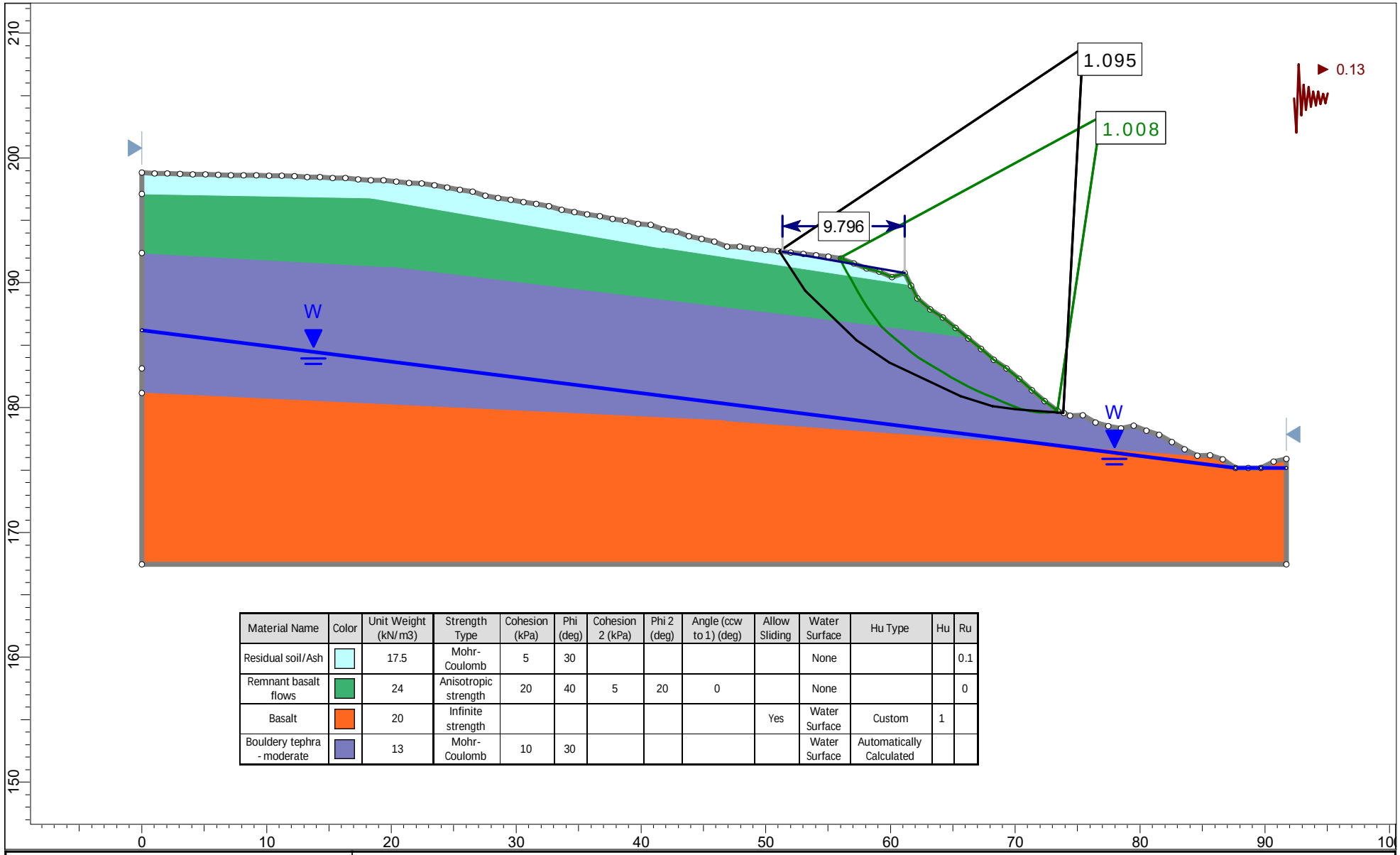


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Cohesion 2 (kPa)	Phi 2 (deg)	Angle (ccw to 1) (deg)	Allow Sliding	Water Surface	Hu Type	Hu	Ru
Residual soil/Ash		17.5	Mohr-Coulomb	5	30					None			0.1
Remnant basalt flows		24	Anisotropic strength	20	40	5	20	0		None			0.1
Basalt		20	Infinite strength						Yes	Water Surface	Custom	1	
Bouldery tephra - moderate		13	Mohr-Coulomb	10	30					Water Surface	Automatically Calculated		

LAND DEVELOPMENT & ENGINEERING LTD.

SLIDEINTERPRET 9.012

Project	131 and 189 Three Mile Bush Road		
Analysis Description	CS-2 - Extreme groundwater		
Drawn By	FWH	*Scale* 1:430	*Company* LDE Ltd
Date	22/06/2021		*File Name* 18733.slmd



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Cohesion 2 (kPa)	Phi 2 (deg)	Angle (ccw to 1) (deg)	Allow Sliding	Water Surface	Hu Type	Hu	Ru
Residual soil/Ash		17.5	Mohr-Coulomb	5	30					None			0.1
Remnant basalt flows		24	Anisotropic strength	20	40	5	20	0		None			0
Basalt		20	Infinite strength						Yes	Water Surface	Custom	1	
Bouldery tephra - moderate		13	Mohr-Coulomb	10	30					Water Surface	Automatically Calculated		

LAND DEVELOPMENT & ENGINEERING LTD.

SLIDEINTERPRET 9.012

Project	131 and 189 Three Mile Bush Road		
Analysis Description	CS-2 - Seismic		
Drawn By	FWH	*Scale* 1:430	*Company* LDE Ltd
Date	22/06/2021		*File Name* 18733.slmd

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Appendix 9

Ecological Report

RURAL DESIGN SINCE 1984

ECOLOGICAL ASSESSMENT PERTAINING TO A PROPOSED SUBDIVISION

at

Lot 2 DP 99045 & Lot 3 DP 99045

131 & 189 Three Mile Bush Road, Kamo

September 2021

CONTENTS

1.0 INTRODUCTION

1.1 Background & Proposed Subdivision

Hurupaki Holdings Limited ('the Client') wish to conduct a subdivision on 131 & 189 Three Mile Bush Road (Lot 2 DP 99045 & Lot 3 DP 99045), Kamo ('the subject site'). Rural Design 1984 Limited (RDL) has been engaged by the Client to undertake an ecological assessment to identify and assess existing ecological values of the site, and outline opportunities, constraints and potential mitigation strategies associated with the proposed subdivision proposal.

The site is situated approximately 2 km west of Kamo town centre (Figure 1). The subject site is split between two separate titles being Lot 2 DP 99045 (total area 4.99 ha) (from herein referred to as 'Lot 2') and Lot 3 DP99045 (total area 8.98 ha) (from herein referred to as 'Lot 3') and is approximately 13.9825 ha in size across the two titles (Figure 2).

The subject site is accessed from Three Mile Bush Road, Kamo and is currently zoned a mixture of General Residential Zone (Lot 2) and Rural Production Zone (Lot 3) under Whangarei District Council District Plan (Appeals Version). The subject site contains an existing dwelling on each title and both titles are predominantly in pasture. The site abounds a residential subdivision development (The James) and the Hurupaki School to the east, Natural Open Space Zone to the north, Rural (Urban Expansion) Zone and Low-Density Residential Zone to the west, and Rural (Urban Expansion) Zone to the south.

Figure 1: Showing the subject site in relation to Kamo

Figure 2: Showing the separate titles making up the subject site

The site is proposed to be subdivided resulting in the creation of 76 lots, alongside several reserve areas, in accordance with the Scheme Plan (dated May 2021) provided by Blue Wallace Surveyors Ltd (Figure 3)

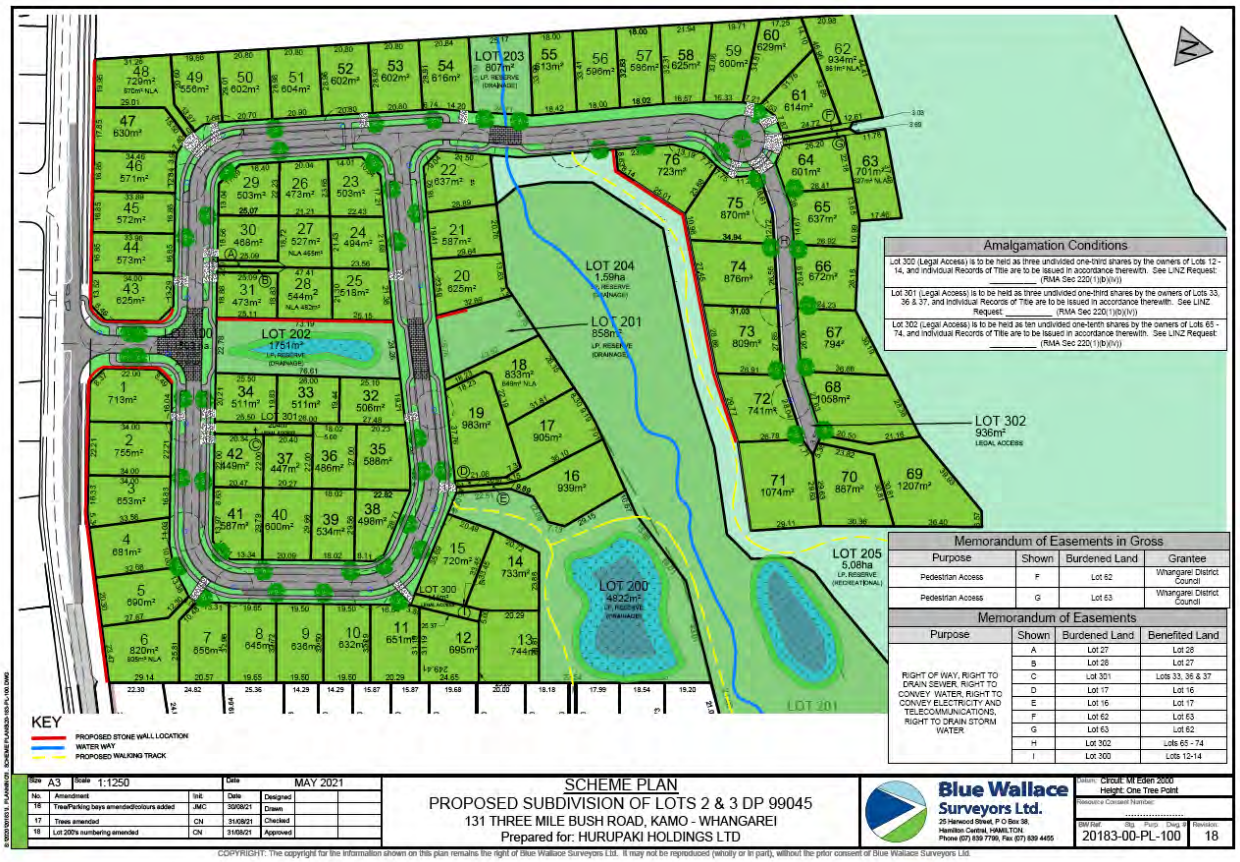

Figure 3: Scheme Plan for the proposed subdivision at 131 and 189 Three Mile Bush Road, Kamo (Blue Wallace Surveyors - May 2021)

2.0 ECOLOGICAL CONTEXT

2.1 Whangarei Ecological District

The subject site is situated within the Whangarei Ecological District (Northland Conservancy) and is abounded by Whangaruru Ecological District to the north and east, Tangihua Ecological District to the west and both the Tokatoka and Waipu Ecological district to the south. The Whangarei ED covers 81,800 hectares across the wider Northland Region.

Indigenous natural areas make up one fifth of the District (19%) but only 9 % of land if the Whangarei Harbour is excluded. Of the identified natural areas 43 % are forest, 9% are shrubland 47% estuarine and less than 1 % are freshwater wetlands. Almost the entire District has been modified and most notably the once extensive Hikurangi Swamp associated with the Wairua River flood plain. The main features of the district include the Whangarei Harbour, which is a large, drowned river estuarine ecosystem of international importance, distinctive volcanic broadleaf forest associated with rich volcanic soils of the scoria cones and surrounding flats. Pukenui Forest dominates the Whangarei landscape and is the largest forest tract remaining in the Ecological District which supports populations of long-tailed baits (Manning 2001).

There are 205 threatened species present in the Whangarei District. Forty-five are described as ‘Threatened’ and 160 ‘At Risk’. These include animals such as the New Zealand Fairy Tern, Brown Teal

(Pateke), North Island Brown Kiwi and Long-Tailed Bat, along with plants such as the kakabeak and Royal Fern.

National and regional state of the environment reports indicate a continuing loss of biodiversity. There are several main threats to biodiversity and reasons why it is in decline. The first of these is population growth and increased loss of indigenous habitat. Ecosystem degradation and habitat loss occurs as humans expand their activities and alter land uses (WDC 2020).

Considering the above circumstances, any land development proposal that works with the existing natural features present within the development footprint and aims to restore, strengthen, and protect habitats of ecological significance should be supported. The development proposal for the subject site presents an opportunity to reintroduce appropriate plant species that were once common in specific ecotypes, retire sensitive habitats from grazing pressures, and manage and eradicate problematic weeds and pest animal species.

2.2 Site background and ecological overview

The subject property is located on the urban fringe boundary of Kamo. The subject site is predominately in pasture, and contains pockets of remnant indigenous vegetation, primarily encompassing the Waitaua Stream, which flows through the central aspect of the site and acts as an ecological corridor through the subject site. To the north, the site adjoins Hurupaki Cone, which is noted for its geological, cultural, and ecological significance.

2.2.1 Changes in Land Use

Originally the site would have been a continuation of forestry sequence of the Hurupaki Cone and associated vegetation of the wider volcanic fields. Forestry, agricultural activities and, more recently urbanisation, have highly modified the native vegetation and hydrology paths through the removal of trees, channelized drainage, dams and intensive earth moving. By analysing historic aerial imagery from Retrolens it appears that subject property and surrounds was dominated by pasture and horticultural activities with scattered regenerating forest remnants in the most historic aerial imagery accessible 1942 (Figure 4). By 1981 further improvements in agricultural can be observed (Figure 5). Although the change is minimal between 1981 and 2017 (Figure 6) there appears to be some natural regeneration and expansion of some of the native forest remnants within the central aspect of the site.

Figure 4: Showing the subject property and surrounds in 1942 (Source: Retrolens)

Figure 5: Showing the subject property and surrounds in 1981 (Source: Retrolens)

Figure 6: Showing the subject property and surrounds in the most recent aerial imagery for Northland 2017 (Source: LINZ)

The site and surrounds as described above have been largely modified, with most existing natural features on site having been modified by Maori and European settlement. At present day most of the site comprises of exotic grassland that is relatively uniform across the site, primarily dominated by kikuyu (*Cenchrus clandestinus*). Much of the native vegetation has historically been cleared with small, scattered remnants of native broadleaf forest, most notably large stands of puriri on the north-western edge of the Waitaua Stream running through the central aspect of the site (Figure 7). Of note was the presence of exotic specimen trees such as Radiata pine (*Pinus radiata*), Monterey cypress (*Cupressus macrocarpa*) and an abundance of exotic pest plants within the riparian margins of the Waitaua Stream, which have since been controlled, felled and removed as a part of the initial site weed control.

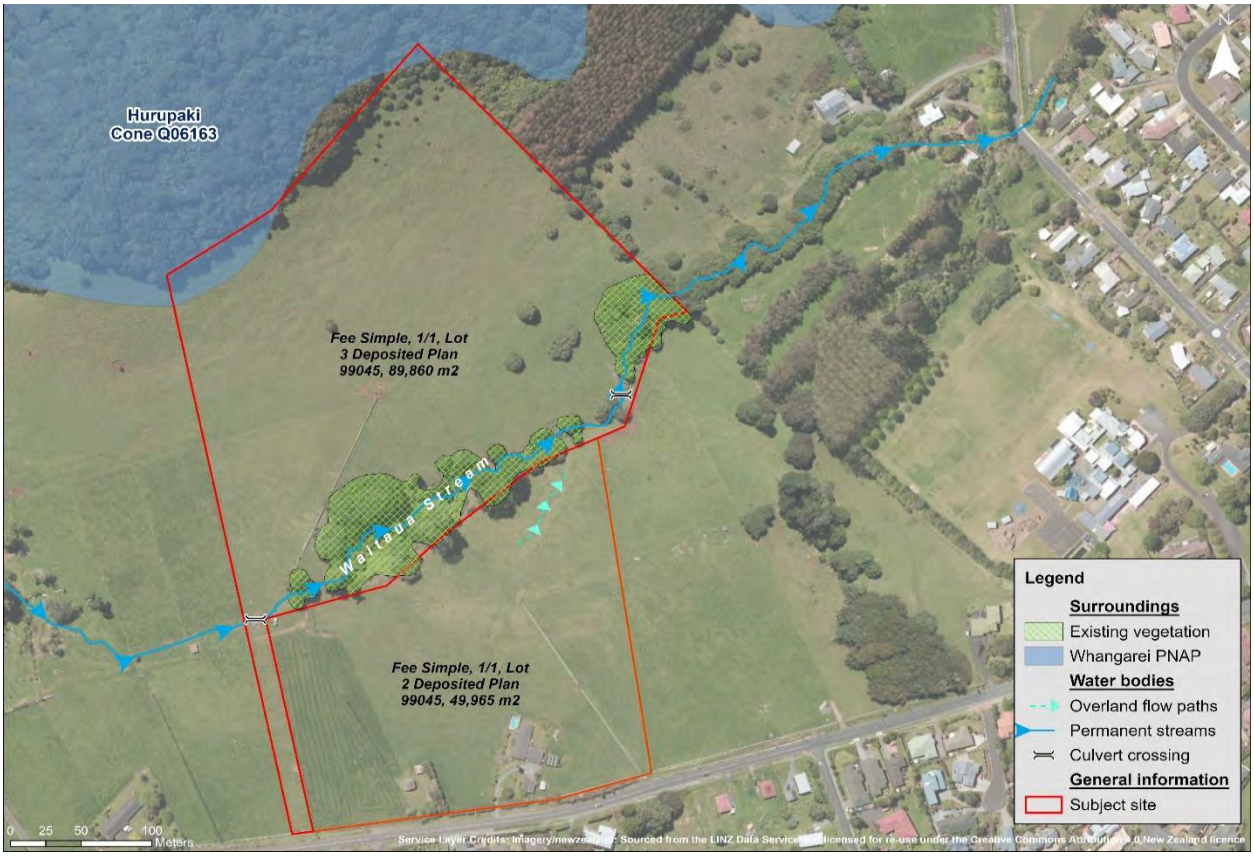

Figure 7: Showing the basic features of the site and surrounds

Under Land Environments of New Zealand (LENZ) the majority of the subject site and immediate surrounds is primarily within the 'Category 5 Threatened Land Environment', where there is >30% indigenous cover left, with>20% of it being protected, with a smaller portion of land on the southern boundary being identified as 'Category 1 Threatened Land Environment' with only 10-20% indigenous cover remaining (Figure 8). Indigenous biodiversity in these 'At Risk' environments are more at risk of loss and decline if little of the environment has formal protection for natural heritage purposes. As such, proposals to further protect and enhance indigenous vegetation in this area is a high priority.

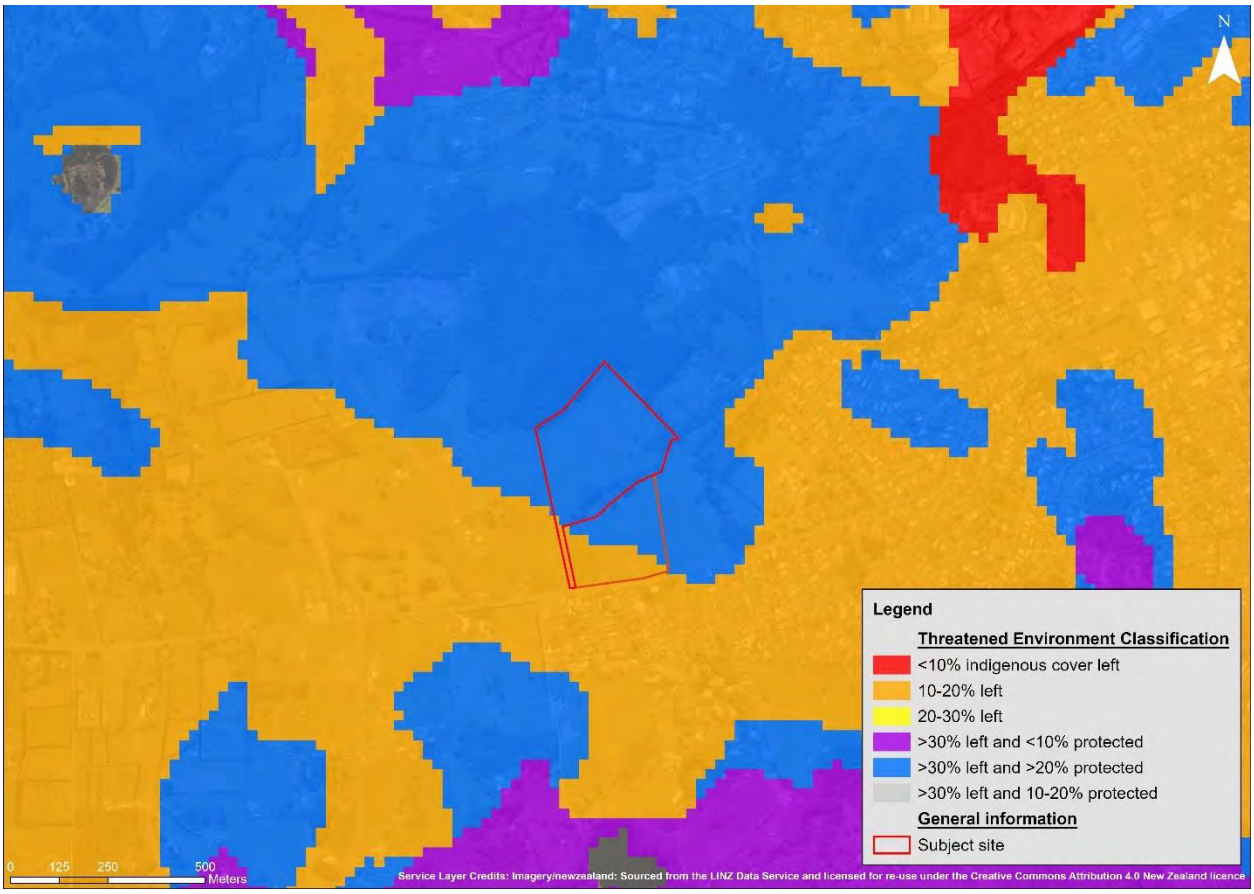

Figure 8: Showing the subject site and Threatened Environment Classification for New Zealand (2012)

The geology of the site and immediate surrounds is characterized by the Kerikeri Volcanic Group Pleistocene scoria/basalt of Puhipuhi -Whangarei Volcanic Field (GNS 2021). The soil type present on the property consists of orthic allophanic (LO) (Landcare Research 2021). The topography of Lot 2 is generally flat and falls away towards the Waitaua Stream at is northern extent. Lot 3 falls steeply away (>60m drop in elevation) from the northern boundary (Hurupaki Cone) down to the Waitaua Stream.

Figure 9: Showing the steep gradient downhill of the Hurupaki Cone

The Land Use Classes (LUC) on site (Figure 10) in the northern aspect encompassing the Hurupaki Cone as LUC Class 6 which is generally suitable for low production pastoral or forestry land. The sites eastern aspect and the remainder of the site has been identified as LUC Class 3 with moderate-low arable cropping suitability, and moderate pastoral grazing suitability (Landcare Research 2010).

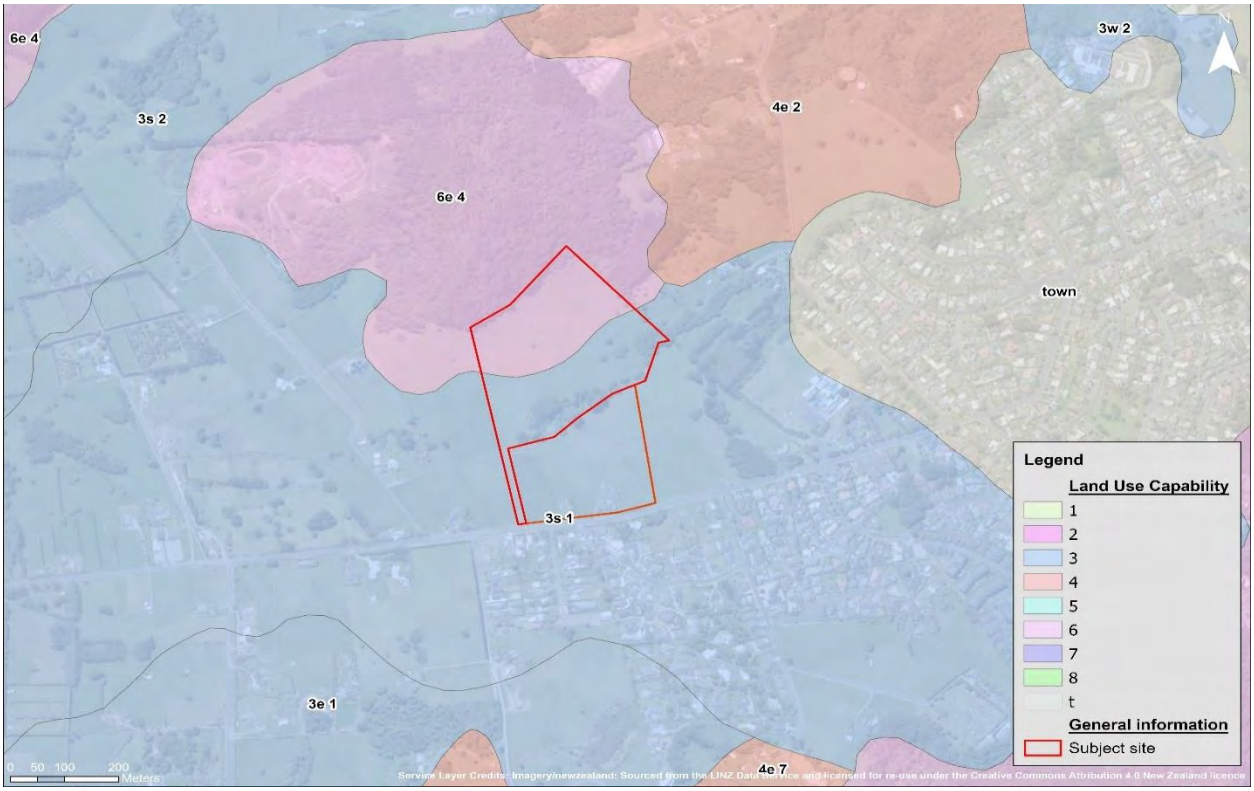

Figure 10: Showing the LUC classification for the site

2.2.2 Protected Natural Areas

The site directly adjoins and is in close vicinity to several Protected Natural Areas (PNAP's) as designated in the Natural Areas of Whangarei Ecological District Reconnaissance Survey Report (Mannin 2001). The northern most aspect of the site directly adjoins Hurupaki Cone (Q06163) and is located within 1km radius of Pukenui Forest (Q07022), Lake Ora (Q06165), Rotomate Road Volcanic Cones (Q06161), and Lower Whau Valley Forest (Q06164) (Figure 11). It is thought that historically all these areas would have formed an uninterrupted habitat sequence and have been modified and isolated by agricultural activities and urbanisation over time, as well as introduction of pest plant and animal species which has also resulted in modification and degradation of indigenous habitats on site and surrounds.

Figure 11: Map showing the subject property and PNAP areas as identified in Manning 2001

3.0 ECOLOGICAL SURVEY RESULTS

3.1 Flora & Fauna field survey methodology

A field survey was undertaken on the 22nd of April 2021 with a repeat site visit undertaken on August 17th, 2021 to observe the post weed control works. To provide an assessment of the vegetation making up the relevant habitat types the entire site was investigated. A rapid fauna survey was also conducted to record the presence of avifauna and assess the potential habitat for ichthyofauna, herpetofauna and chiroptera. The study of historic and recent aerial imagery, and ground truthing was utilised to delineate the ecosystem types and flora on the site and surrounds.

3.2 Existing vegetation

The varying underlying geology, soil types, anthropogenic activities have influenced the current vegetation composition and habitats found within the subject site and surrounds. The sites vegetation sits upon a combination of basalt and scoria (GNS 2021) and would have historically consisted of the broadleaved forest variant (WF7.2) 'rock forest' (Singer *et al.* 2017).

Lot 2 contains no indigenous forest remnants and has largely been reduced to a pastoral sward of kikuyu (*Cenchrus clandestinus*) with some landscape planting around the existing dwellings and some old shelter belts associated with the historic stone walls and paddocks (Figure 12).

Figure 12: Showing general vegetation composition of Lot 2

Lot 3 contains some examples of broadleaf forest remnants encompassing the Waitaua Stream, including a large significant stand of puriri (*Vitex lucens*) (Figure 13 & Figure 14) with scattered canopy trees such as karaka (*Corynocarpus laevigatus*), kohekohe (*Dysoxylum spectabile*), taraire (*Beilschmiedia taraire*), pohutukawa (*Metrosideros exsela*) and a single rimu (*Dacrydium cupressinum*).

The more degraded and anthropically induced vegetation near the eastern boundary is dominated by totara (*Podocarpus totara*). The native under canopy and shrub layer was sparse but typical broadleaf forest species such as kawakawa (*Piper excelsum*), hangehange (*Geniostoma ligustrifolium*), mahoe (*Melicytus ramiflorus*), pate (*Schefflera digitata*), mapou (*Myrsine australis*), whau (*Entelea arborescens*), pigeonwood (*Hedycarya arborea*), nikau (*Rhopalostylis sapida*) and mamaku (*Cyathea medullaris*) could be found.

The ground tier had largely been eliminated by historic browsing but on less accessible stream edges fern species such as rosy maiden hair fern (*Adiantum hispidulum*), small maidenhair (*Adiantum diaphanum*), rasp fern (*Doodia australis*), gully fern (*Pneumatopteris pennigera*), *Diplazium australe, Deparia petersenii* subsp. *congrua,* smooth shield fern (*Parapolystichum glabellum*), shaking break (*Pteris tremula*) and jointed fern (*Arthropteris tenella*) (Figure 15). Some ground tier species were noted including mercury bay weed (*Dichondra repens*) and basket grass (*Oplismenus hirtellus*).

Figure 13: Showing a large stand of puriri on the northern side of Waitaua Stream

Figure 14: Showing trunks of large puriri

Figure 15: Showing fern regeneration around steep sections of Waitaua Stream

Although the site does provide for some fine examples of broadleaf habitat, it has been degraded through historic vegetation clearance, grazing and the introduction of exotic pest plants. The bush remnants surrounding the Waitaua Stream contain a vast array and abundance of highly invasive pest plants. Of note the existing bush area contains several large old radiata pine (*Pinus radiata*) (>40m in height) (Figure 16) and Monterey cypress (*Cupressus macrocarpa*) (on Lot 3) with some more recently planted poplar (*Populus* sp.) (on Lot 2) surrounding an overland flow path.

Pest plants of concern that were dominating large areas of the existing vegetation included but were not limited to climbers including Mignonette vine (*Andrea cordifolia*), Elaeagnus (*Elaeagnus* x *reflexa*) (Figure 17) and moth plant (*Araujia sericifera*). A thick shrub layer being formed by queen of the night (*Cestrum nocturnum*), purple cestrum (*Cestrum elegans*), lantana (*Lantana carnara*), woolly nightshade (*Solanum mauritianum*), Jerusalem cherry (*Solanum pseudocapsicum*) and Taiwan cherry (*Prunus campanulata*) was observed within the bush area (Figure 18). Weeds were also present in the ground tier including wild ginger (*Hedychium gardnerianum*), periwinkle (*Vinca major*) and wandering willie (*Tradescantia fluminensis*).

The large exotic pine trees and pest plants have been removed and/or controlled as a part of the initial pest plant control works, in preparation for enhancement planting. Ongoing pest weed control will be required as a part of the works, given the persistence and longevity of some of the weedy species noted above.

Figure 16: Showing large mature Radiata pine – these have since been felled and chipped on site

Figure 17: Showing an abundance of exotic pest plants dominated by Elaeagnus – these have since been controlled

Figure 18: Showing an abundance of exotic pest plants dominated by queen of the night – these have since been controlled

The remainder of the site rises steeply from the northern side of the bush edge up Hurupaki Cone. The small extent of the PNAP area of Hurupaki Cone within the site is largely dominated by pastoral species and has been grazed for some time. Some totara can be found dotted up the slope and become more common around the boundary of the Natural Open Space Zone (Figure 19). It appears the forested area of the Hurupaki Cone has been fenced for some time as it boasts a more diverse array of native broadleaved forest species in each tier and likely represents natural regeneration from Maori occupation (Figure 20). A complete overview of the general composition of the vegetation on site especially that surrounding the Waitaua Stream is depicted in Figure 21.

Figure 19: Showing the pastoral area looking north up the Hurupaki Cone

Figure 20: Showing the general forest composition of the southern side of the Hurupaki Cone

Figure 21: Showing an overview of the subject site looking south from Hurupaki Cone

3.3 Freshwater ecology

3.3.1 Habitat description

The subject site provides for an interesting study of hydrology and ecology. A section of the Waitaua Stream flows along the southern boundary of Lot 3, flowing through the natural depression in the land within the remnant bush area which was historically formed by volcanic activity and lava flows. The section of the Waitaua Stream, while flowing through the subject site, is best described as an intermittent stream (I1). An overland flow path (OFP1) was noted on Lot 2. The watercourses on the subject site were delineated using a handheld GPS, while the wider stream systems were obtained from LINZ Data Service. A basic overview of the hydrological features on the site is provided below in (Figure 22). No wetland habitats (as defined under the Resource Management Act 1991 (RMA) and National Policy Statement for Freshwater Management 2020 (NPSFM) were identified on site during the field surveys.

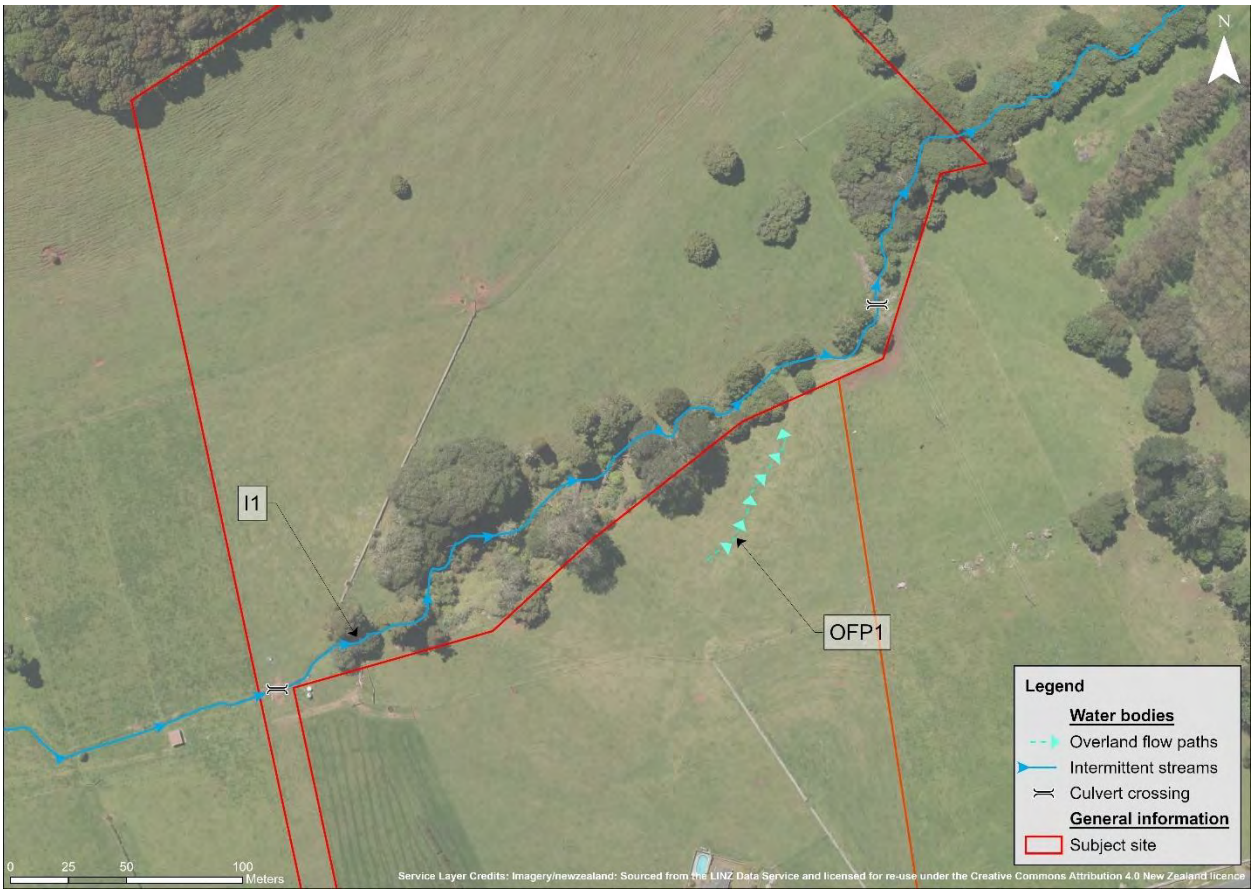

Figure 22: Showing the general hydrology of the subject site

A defined channel of the Waitaua Stream originates approximately 670 m west of the subject site and is likely fed by a combination of spring and several smaller tributary streams and overland flow paths. Waitaua Stream flows in an easterly direction through the sites existing bush remnant for approx. 400m and falls in elevation steeply though the site (approx. 29m drop in elevation between the sites western and eastern boundaries). The stream follows its course through a combination of bush remnants, grazed pasture, residential and industrial areas for approximately 7 km where it enters the Hatea River and eventually discharges into the Whangarei Harbour.

The stream at its western extent enters the subject site with a stream channel of approx. 1m in width moderately shallow (<0.3m), with several deeper pools (>0.4m), with the stream channel averaging 1-1.5m wide and bank height averaging approximately 0.3-0.5m (Figure 23). It was apparent that the stream has been historically modified though straightening of the channel. This upper section of stream has an existing 400m diameter concrete culvert crossing which services the existing dwelling (Figure 24). The stream also has been historically dammed to service a household hydro wheel. The section of stream is interesting in the fact that on its course approx. 50m from the western boundary the water seeps into the volcanic soil due to a rise in the topography before falling steeply away (approximately >10m drop). No apparent free flowing water was observed in the remainder of the course of the stream while flowing through the subject site in April 2021. This could be attributed to a range of factors including the high permeability of underlying soils and geology, and dry weather conditions prior to the survey. The stream was observed to have flowing water along its entirety during a site visit in August 2021, following a number of heavy inter rainfall events.

Figure 23: The western extent of the stream where it enters the western boundary of the subject site

Figure 24: Showing the existing stream crossing associated stream and where stream seeps into soil and drops for about 10-15m (yellow arrow)

The mid-section of the stream was observed to have a scoria gravel substrate with occasional large rocks, no free-flowing surface water (at the time of survey visit in April 2021), but there was evidence of debris and streambank erosion to suggest heavy flows in rain events (as observed during a repeat site visit in August 2021). The eastern extent of the stream consisted of a basalt stream bed. The stream channel is approx. 1.5m-3m in width with a series of small waterfall and associated pools (>0.4m) with bank height averaging approximately >5m (Figure 25).

Figure 25: Showing general stream morphology in the eastern extent during a repeat site visit in August 2021

A small overland flow path (OFP1) was observed within the northern aspect of Lot 2 near the Waitaua Stream (Figure 26). The overland flow path follows a small natural depression in the land and was completely dry at the time of the site visit. It is anticipated that in high rainfall events some overland surface water flows may occur. Currently the flow path is part of the open pastoral area dominated by kikuyu with sparse buttercup (*Ranuculus repens*) and has been more recently planted with poplar (*Populus* sp.).

Figure 26: Showing the overland flow path (OFP1) observed on site

3.3.2 Aquatic diversity

A quantitative search of the New Zealand Freshwater Fish Database (NZFFD, accessed April 2021 revealed records of five native fish and one native invertebrate species (Table 1) being present within the wider Waitaua Stream catchment.

Table 1: Freshwater fish and invertebrate species recorded within the wider Waitaua Stream catchment

Scientific name	Common name	Conservation status
Anguilla australis	Shortfin eel	Endemic and Not Threatened
Anguilla dieffenbachii	Longfin eel	Native & Declining (At risk)
Galaxias fasciatus	Banded kokopu	Endemic and Not Threatened
Gobiomorphus basalis	Cran's bully	Native and Not Threatened
Gobiomorphus cotidianus	Common bully	Native and Not Threatened
Paranephrops spp.	Koura	Native & Declining (At risk)

The records show that two Native & Declining (At risk) aquatic fauna species have been previously recorded within the wider Waitaua Stream catchment, and some are likely to also be present within the onsite stream during periods of heavy rainfall. It should be noted that during the initial site visit the stretch of the Waitaua

Stream running through the subject site was almost completely dry during site visit in April 2021 apart from some deep pool areas towards the sites lower lying eastern boundary.

Some suitable habitat for native ichthyofauna is present on site, albeit the streams freely draining geomorphology and associated volcanic geology would limit the species presence to periods of heavy winter flows, which could potentially be suitable for more adaptable species such as banded kokopu.

3.4 Avifauna

The birds observed on site are representative of the modified and fragmented habitat type representative of urban and peri-urban areas. Some common introduced and native bird species such as house sparrow (*Passer domesticus*) and myna (*Acridotheres tristis*) were observed in abundance throughout the pastoral areas. Several New Zealand fantail (*Rhipidura fuliginosa*) and kingfisher (*Todiramphus sanctus*) were observed along the riparian margin of the Waitaua Stream. Grey warbler (*Gerygone igata*) and silvereye (*Zosterops lateralis*) were observed feeding on the Mignonette vine within the onsite bush area. Flocks of Eastern rosella (*Platycercus eximius*) were observed flying overhead. Other common species utilizing the pasture area were pukeko (*Porphyrio melanotus*) and paradise shelduck (*Tadorna variegata*). A few swamp harriers (*Circus approximans*) were observed flying over the site during site visits. It is thought that they are likely to be nesting within the wider area.

Reviewing data from the PNAP Report some other noteworthy species to consider that have been previously recorded within 1km of the site are kereru (*Hemiphaga novaeseelandiae*) recorded from the Hurupaki Cone, North Island (NI) brown kiwi (*Apteryx mantelli*), NI kaka (*Nestor meridionalis),* kakariki (*Cyanoramphus novaezelandiae),* NI tomtit (*Petroica macrocephala toitoi*) along with other more common bird species being recorded from the nearby Pukenui Forest. It is likely that some of these species may periodically rest within the onsite bush area or the adjacent Hurupaki Cone while moving within the wider landscape. It is noted that while population of NI brown kiwi is present within 1km radius from the site within Pukenui Forest, there are no known habitat linkages between the subject site and the Pukenui forest, therefore it is unlikely that kiwi would be present or utilising the subject site for commuting within the wider area.

The only avifauna species recorded at Hurupaki Cone previously is kereru (Mannin 2001). Kereru is classified as ‘Not Threatened’ under the NZ Threat Classification System (Hugh *et al.* 2016). During a brief walkover survey within Hurupaki Cone, no kereru were observed or recorded within the area.

Weed and pest control within the onsite bush area in addition to revegetation planting is likely to enhance the habitat for the above-mentioned species and act as a ‘stepping stone’ for other bird species. Stepping stone and corridor features such as the Waitaua Stream corridor and onsite bush area on the subject property and surrounds already provide key feeding, breeding and resting areas for indigenous bird species, and the proposed habitat enhancement on the subject site will allow to protect this area in perpetuity and provide for enhanced connectivity within and allow for uninterrupted movement within the landscape.

3.5 Herpetofauna

No quantitative lizard survey was undertaken although a diurnal habitat search inspecting areas likely to be utilized by native lizards for sheltering or foraging (e.g., beneath dense vegetation, logs, boulders, and manmade objects) was conducted.

During the initial site visit several rainbow skinks (*Lampropholis delicata*) were observed basking along the edge of the onsite bush area. All lizards, except for the introduced rainbow skink are legally protected under an amendment to the Wildlife Act 1953 and their habitats by the Resource Management Act 1991 (Anderson *et al.* 2012). A significant component of our lizard fauna (~85%) are recognised as 'Threatened' or 'At Risk' in Threat Ranking Lists (Hitchmough *et al.* 2015).

Records held in the PNAP Report (Manning 2001) indicate that the Hurupaki Cone adjacent to the north is habitat to Auckland green gecko (*Naultinus elegans*). Records from iNaturalist database within 5 km of the site includes the following native lizards - copper skink (*Oligosoma aeneum*), and forest gecko (*Hoplodactylus granulatus*).

Given the lack of suitable habitat on the subject site and isolated nature between the Hurupaki Cone and the proposed development area it is not anticipated the development would have an impact on native herpetofauna. The current ecological value for native herpetofauna on the site itself is therefore considered to be low, this is associated with a long history of land disturbance, land clearance, predation and habitat fragmentation. It is deemed that a comprehensive pest management plan and restoration of indigenous habitats will significantly improve the sites potential to support viable herpetofauna populations. Consultation and working alongside adjacent landowners will be key to ensure a coordinated and thorough program for pest management.

Figure 27: Species likely to be present within the wider area (note rainbow skink easily confused used with the native copper skink)

3.6 Chiroptera (Bats)

New Zealand has two extant native bat species, the long-tailed bat (*Chalinolobus tuberculatus*) and the lesser short-tailed bat (*Mystacina tuberculata),* both of which are endemic microbat species. Long-tailed bats is listed as "Nationally Critical" (Donnell *et al.* 2017). The subject site lies within vicinity (<2km) from confirmed recent records of long-tailed bats in Pukenui Forest. In addition, long-tailed bat activity in 2019 was also recorded nearby Onoke Scenic Reserve, approximately 500m east of the subject site (Carr 2019).

During the primary site walkover on April 22nd, some suitable habitat for bat commuting and roosting (primarily old growth native and exotic trees), was noted on site, therefore both a visual assessment for potential roost sites and a preliminary presence/absence survey using an Automatic Bat Monitor (ABM) was undertaken.

Trees on site were assessed for their potential to support bat roosts during the initial site visit on April 22nd, and again on a repeat site visit on May 4th, 2021. The assessment comprised a ground based visual inspection using binoculars to identify any features potentially suitable for roosting bats. Such features may

include holes, frost cracks, deadwood, knot holes and limb wounds. The site contains a number of mature/over-mature/dead puriri and Radiata pine and Monterey cypress trees within the boundaries of the site which have features with the potential to support roosting bats, including branch splits, knot holes, and lifted bark. Therefore, a further assessment using an ABM was undertaken. The ABM is able to register any bat activity approximately 50m from the recording station, so this would ensure good coverage of the entire bush feature on site.

An ABM was set on the subject site between the period April 22nd and May 4th, 2021. The ABM was programmed to begin recording 30 minutes before sunset and continue to record until 30 minutes after sunrise. No long-tailed bat activity was recorded during the survey period which indicates that it is unlikely that there are any potential bat roosts on site and the bush/riparian corridor is not currently utilized as a commuting route within the wider landscape.

While autumn would generally be considered 'shoulder season' to survey bat activity, the weather conditions (night-time temperature over >10ºC, low wind and no rain) during the time of deployment was seen as suitable and therefore the preliminary data obtained during the survey can be treated as a good indicator relating to species absence from the subject site.

The mature exotic pine trees have since been felled and chipped as a part of the initial pest weed control works. Felling was undertaken during the active bat season to avoid possible impacts to hibernating bats.

It should be noted that the proposed ecological enhancement works on site to result as a part of the development is likely to enhance both roosting and foraging habitat suitability for bats through the retention of mature puriri trees and comprehensive pest animal control, which will be complementary to the habitat enhancement works already undertaken within the nearby Pukenui Forest.

4.0 ECOLOGICAL EFFECTS

4.1 Potential ecological effects

While there are ecological benefits that would arise as a part of the subdivision application, consideration needs to be given to the potential adverse effects associated with increased human pressures. We believe that these impacts can be appropriately avoided or mitigated through comprehensive planning controls and creation of an integrated subdivision proposal largely focused on the protection and enhancement of natural features on site and surrounds.

Generally, the potential adverse effects can be divided into negative effects resulting from

- Direct effects (resulting from physical development of the application area including land clearance, earthworks, construction, stormwater).
- Secondary effects (resulting from increased activities and the operational phase (resulting from increased activities and habitat modifications within the application area and the surrounding area, following proposed development).
- Cumulative effects (resulting from future development that might occur, and additional to the effects that can be expected to have already occurred as a result of development of the wider area which will also increase in the future

During the construction phase of the proposed works, the adverse impacts of the development will comprise habitat loss and potential disturbance of the existing native habitats on site. The subject site contains several highly modified habitats and is adjacent to Hurupaki Cone, an area considered to be of ecological significance. It is understood that the proposed layout of the new lots resulting from the proposed subdivision aims to concentrate the development on the flatter sections of the site which is dominated by exotic pasture considered to be of low ecological value. The species that utilise the open exotic grassland habitat on site (e.g., spur-winged plover and pukeko) are highly mobile and common.

Mature pine trees along with several exotic weedy plant species within the proposed enhancement areas have been removed as a part of the initial weed control works. None of the trees on the subject site are identified as protected trees under the District Plan. Additionally, no long tailed bat presence was recorded on the subject site during the initial survey period, all trees were inspected for roosting potential prior to felling. Given that this area is to be enhanced through enhancement planting, we did not have any concerns relating to the initial pest weed control works.

In terms of the existing habitats of ecological value on site (existing bush remnant and intermittent stream habitat), an extensive integrated ecological enhancement is proposed for this area including pest weed and animal control, revegetation using native species which were once common and are adjacent to the site, and that any proposed stream crossings will be conductive of fish passage both up and downstream.

During the operational phase of the proposed works, adverse impacts will comprise potential increased levels of disturbance through increased levels of lighting, noise and human presence. The increase of traffic and human presence within the site may also result in increased mortality of common fauna present on site (e.g. pukeko) due to road traffic collisions and predation by domestic cats and dogs.

When considering cumulative effects, there are a few practical and policy barriers to be considered. It is difficult to predict and assess cumulative effects with a high degree of certainty, due to complex ecological interactions, the lack of environmental baseline data, and the scale at which District and Regional Councils plan. However, consideration of existing and reasonably foreseeable activities must be given to ensure that standalone effects of the proposal will not result in “tipping the balance” in the wider ecological context.

These may include:

- Earthworks and associated sediment discharges
- Stormwater and wastewater management
- Increased human disturbance
- Predation by domestic pets
- Increased invasion of pest species
- Increased noise
- Increased light
- Increased fire risk

4.1.1 Earthworks

Earthworks associated with the development of the site have the potential to result in sediment runoff to the Waitaua Stream. The addition of fine sediment to stream environments during construction phase of the development has the potential to alter water chemistry, increase turbidity and decrease light penetration

that affects primary production and feeding for some fish species. The deposition of sediment can also smother instream surfaces and decrease the amount of suitable habitat available for benthic invertebrates.

It is proposed that all earthworks on site and carried out in accordance with best practice erosion and sediment control plans. This should ensure that any sediment/erosion related effects on water quality and habitat in the downstream receiving environment will be negligible (i.e., minimal sediment mobilization). With the implementation of appropriate silt controls during the construction phase, the effects of earthworks on water quality in the receiving environment during construction will be avoided and the overall level of effect is assessed as low.

4.1.2 Wastewater management

According to the Three Waters Design Report prepared for the development by Land Development & Engineering Ltd (dated 24 August 2021) wastewater servicing for the development will be an extension to the existing public reticulation. As such, if the system is installed as per the recommendations outlined in the associated Three Waters Report prepared for the site, and any associated technical guidance notes, no adverse effects on freshwater ecology relating to the wastewater management on site are anticipated.

4.1.3 Stormwater management

Discharges of contaminants to freshwater environments can severely impact ecosystem health values through acute (short-term) effects and chronic (long-term) effects. The cumulative effects of multiple contaminants being discharged to an aquatic environment may also be highly significant; some contaminants discharged in isolation may have little influence on ecosystem health but when discharge alongside other contaminants, can have serious consequences.

According to the Three Waters Design Report prepared for the development by Land Development & Engineering Ltd (dated 24 August 2021) it is proposed to construct 3 stormwater ponds within the subdivision to provide attenuation and water quality treatment for runoff from the development. To achieve this, the ponds have been designed to meet the requirements of Auckland Council's GD01.

Having reviewed the Three Waters Design Report and associated subdivision Scheme Plan, it is deemed that an integrated stormwater management is proposed within the application site to manage any potential negative environmental effects (both source and cumulative). Stormwater management on site will utilise a number of methods to manage surface water in a holistic way which aims to mimic nature and typically manage rainfall close to where it falls. The stormwater network for the development has been designed to transport surface water, slow runoff down before it enters watercourses, provide areas to store water in natural contours and can be used to allow water to soak (infiltrate) into the ground or evaporated from surface water and lost or transpired from vegetation.

All of the stormwater networks will be appropriately integrated within the wider landscaping proposal. In addition, the proposed landscape and ecological enhancement plantings on site will provide further reduction in the total runoff from the site entering the Waitaua Stream.

It is understood that all three waters infrastructure will be designed in accordance with relevant Whangarei District Council's and NZ engineering standards and flows from the development will be reduced to below predevelopment levels for up to a 1% AEP and will include a 20% rainfall increase for climate change, further reducing any potential negative environmental effects on the existing identified ecological values on

site and further downstream. Any works near Waitaua Stream or its margins will have to abide by strict sediment controls to ensure that the release of fine sediment into the stream during construction phase is minimised.

Therefore, the potential for adverse effects relating to the implementation of the proposed stormwater network are low. In fact, the proposed new stormwater ponds are likely to provide habitat for common native avifauna species moving within the landscape such as pukeko, and paradise shelduck, among others.

4.1.4 Provision of fish passage

According to Scheme Plan prepared by Blue Wallace Surveyors (Appendix 1) access into the proposed lots to the north of Waitaua Stream will require a stream crossing. It is expected that as a part of the installation of the proposed access road an appropriate structure that is conductive of fish passage both up and downstream will be installed below the access road. The structure should ideally incorporate the stream bed and allow movement of in stream biota up and down stream (Figure 28). While no fish species were recorded as being present within this section of the stream during the initial assessment, maintaining sufficient fish passage on site will be beneficial for common fish such as eels, and banded kokopu, which are likely present within the wider Waitaua Stream catchment.

These works will need to be confirmed and in be accordance with Whangarei District Council, Northland Regional Council Environmental Engineering Standards and the New Zealand Fish Passage Guidelines (Franklin *et al.* 2018).

Figure 28: Order of preference for road crossing design, based on the degree of connectivity (left), and (right) showing an example of a stream simulation culvert design (most preferable option)

4.1.5 Increased human disturbance

The proposal is reflective of the surrounding land use which has become increasingly urbanised and developed since the early 2000's. A number of residential subdivision proposals are in the process or have been recently consented within the immediate area. Additional people in the area are likely to have an impact on the wildlife in the area through disturbance of feeding, breeding and nesting areas unless appropriate management measures and controls are put in place. While the subject site itself is not thought to provide significant breeding or nesting habitat for any threatened avifauna due to significant anthropogenic modification and disturbance by current land use activities, the Hurupaki Cone is known to support kereru. Kereru are tree nesting species (as opposed to ground nesting) therefore the chick survival would be less affected by increased presence of pet animals such as dogs.

The proposal aims to enhance public access and connectivity within the development proposal, with an extensive network of pedestrian walkways proposed throughout the site and leading up to the Hurupaki Cone. Increased human disturbance to the Hurupaki Cone area and the proposed Waitaua Stream enhancement zone is therefore inevitable, however will be somewhat limited by the steep topography of these areas. Human disturbance on wildlife values will be limited through the provision of defined paths within the areas, as well as revegetation planting which will form a natural barrier for human and pet movement within the wider core landscape and therefore concentrate their impact to small, localised areas.

4.1.6 Predation by domestic pets

Domestic pets are some of the main predators for native fauna species, in particular avifauna and herpetofauna. Other more uncommon domestic pets include mustelids (e.g. stoats and ferrets) which are known predators of indigenous herpetofauna as well as birds and their eggs. Wild mustelids, while common within the area, are prohibited from being kept as pets in New Zealand, therefore an increased abundance of mustelids as a part of the subdivision process poses a lower risk.

It is proposed that the impacts of the likely increase of domestic pets resulting from land development on site and within the immediate area are managed through appropriate controls, such as informative signage and controls on dogs (e.g. keeping dogs on lead) within the proposed ecological/landscape enhancement areas. No susceptible ground nesting bird species were identified as being present during the initial survey period, therefore the potential effects on breeding success are assessed as low.

4.1.7 Increased invasion of pest species

Whilst the subject site and surrounds contains some invasive pest plant species, the proposed development could become another source of pest weeds through planting of exotic plants within garden areas or as screen planting. Dumping of garden waste is also an aspect which should be considered, given the sites close proximity to natural areas. It is believed that this can addressed through appropriate controls such as prohibiting the cultivation of invasive weed species listed under the National Pest Plant Accord (NPPA) and Northland Regional Pest Management Strategy (NRPMS).

4.1.8 Noise

Increases of anthropogenic noise has the potential to negatively affect bird fitness as it may interfere with communication and for instance, decrease predator detection or breeding activity. Regular exposure to high levels of anthropogenic noise may cause changes in bird communities and influence local distribution

patterns. There are extremely limited number of studies investigating the impacts of changes in anthropogenic noise on bird fitness and breeding success in New Zealand. Factors that should be taken into consideration when assessing likely impacts of anthropogenic noise on bird species should be directly related to the nature of the proposed development project. It is thought that due to the scale of the proposed development it is likely to contribute to increase noise levels to a moderate level.

It is thought that this can be mitigated through a sustainable design of the subdivision and limiting anthropogenic noise through buffer planting and the provision of diversity of vegetation cover throughout the site. This will expand the habitat available for birds to freely move within the landscape with low noise effects anticipated.

4.1.9 Light

The potential adverse effects from light on the surrounding habitats and species using these areas are considerable. Many New Zealand avifauna, herpetofauna and insects are fully or partially nocturnal. Introduction of increased unrestricted light levels within the area are likely to disrupt species movements. Impacts may relate to changes in flight patterns, extension of “day-light” hours through introduction of street lights which has been shown to affect timing of mating behaviours and reproduction in birds. Invertebrates may also be negatively affected through disorientation, and thus may cause changes in species movements within the wider landscape. The potential impacts of the effects of artificial lighting can be significantly minimised through the use of using appropriate lighting with longer wavelengths, at the orange-red end of spectrum, which is now standard practice for Councils.

4.1.10 Fire

Fire risk has to be considered when introducing residential dwellings into an area that contains existing mature vegetation. By reviewing the Landscape Plan prepared by Littoralis Landscape Architecture for the proposal it is understood that the boundary of residential lots grading into the proposed Hurupaki Cone buffer planting area are to be planted using low flammability species to reduce fire risk. To protect ecological values identified on site and the immediate surrounds, building setbacks and buffer areas are proposed between the new lot boundaries and the existing vegetation and proposed new enhancement planting.

5.0 MITIGATION AND ENHANCEMENT STRATEGY

5.1 Ecological enhancement areas

Following the ecological assessment, basic mapping of the ecological values on site two main areas have been identified that benefit from enhancement as part of the subdivision process, being the Waitaua Stream Corridor Enhancement Areas and Hurupaki Cone Enhancement area (Figure 29). The Waitaua Stream Corridor Enhancement area will span across approximately 1.13 ha, while the Hurupaki Cone Enhancement Area would extend over approximately 3.85 ha. These are to serve as multipurpose reserves, promoting both ecological linkage and pedestrian access in the process.

The benefits of this proposal include the following:

- Provide an enhanced stream linkage and habitat for wildlife including a source of food for bird life;
- Retire these areas from stock access;
- Enhance the riparian corridor of an upper catchment area of the Waitaua Stream;
- Provide a buffer area between the proposed development footprint and the adjacent Hurupaki Cone;
- Enhance habitat for native flora and fauna across the site;
- Enhance this area in perpetuity through revegetation, pest plant and animal control.

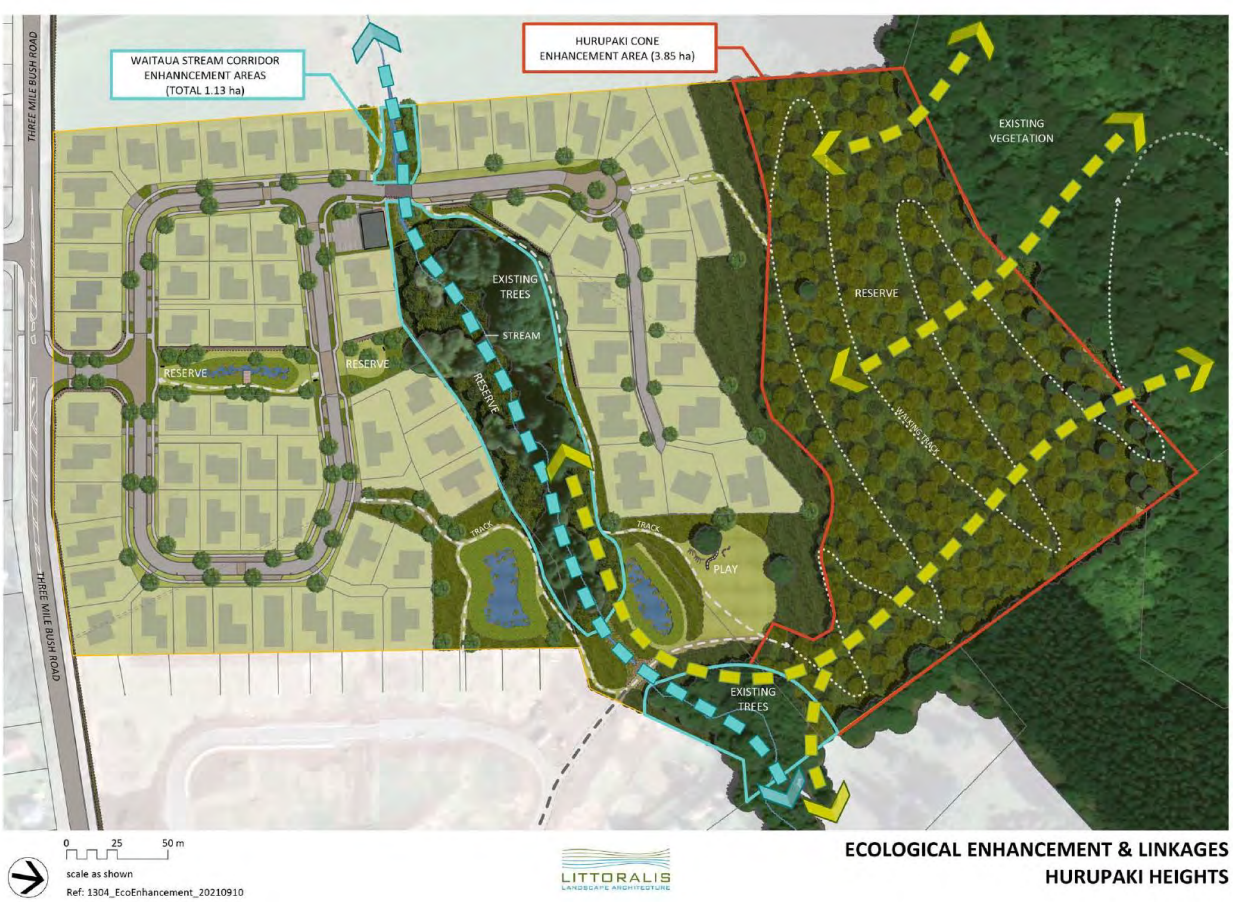

Figure 29: Showing the proposed Waitaua Stream Corridor Enhancement Area and Hurupaki Cone Enhancement Area (plan prepared by Littoralis Landscape Architecture)

It is proposed a standalone document such as an Ecological and Landscape Enhancement Plan, that sets out delineation of ecological planting requirements, as well as overall management of these areas, is to be conditioned as a part of the Resource Consent.

5.1.1 Waitaua Stream Corridor Enhancement

The Waitaua Stream Corridor Enhancement area would extend over approximately 1.13 ha, noting that the area will act as a multipurpose reserve, promoting both ecological enhancement, and accessibility, with several interconnected pedestrian access tracks proposed through this area.

As a part of the development proposal, it is proposed to protect and enhance the existing native vegetation and associated Waitaua Stream corridor. Initial weed and mature exotic tree clearance has already taken place, and it proposed that ongoing pest plant maintenance takes place, and a pest animal control network is established. The exotic weed control works have opened up gaps in canopy where enhancement planting is to take place. The planting is to serve multiple purposes from enhancing the riparian and bush habitat, to stabilising soils and reducing erosion risk within this area. Over time the proposed planting will develop a more diverse understory and reduce edge effects, enhancing the habitat for both flora and fauna alike.

The exact management actions along with a site-specific planting schedule should be addressed in a standalone Ecological and Landscape Enhancement Plan to be conditioned as a part of the consent.

5.1.2 Hurupaki Cone Enhancement

The Hurupaki Cone Enhancement area would extend southwards form Hurupaki Cone and extend over approximately 3.85 ha. This area would connect the Cone with the wider pedestrian access tracks among landscape and ecological enhancement planting.

To enhance the ecological values of the adjacent Hurupaki Cone, this area is planted using appropriate native revegetation species. This will ensure that a suitable buffer area is provided between the development and the core bush area and thus reduce any potential impacts of the proposed development on any susceptible species present within the Hurupaki Cone.

The removal of livestock, exotic species paired with the planting of suitable native species will quickly enhance this area and assist natural regeneration. It is proposed to utilise a basic mix of plans consistent with the more intact existing vegetation. There is suitable seed source available in the Hurupaki Cone to ensure natural regeneration and viability of the planting in the long term. A robust weed control and pest management programme will enhance this area for species already utilising the area for feeding, resting and breeding. Protection and ongoing management will ensure these values are enhanced and extended.

The exact management actions along with a site-specific planting schedule should be addressed in a standalone Ecological and Landscape Enhancement Plan to be conditioned as a part of the consent.

5.2 Pest animal management

Evidence of rat species (*Rattus sp*) and possum (*Trichosurus vulpeca)* presence was observed within the bush area during the field work. It is likely that other common mammalian pest species are present on the site and surrounds, including European rabbit (*Orycotolagus cuniculus*), mustelids (*Mustela* spp.), wild cat (*Felis catus*) and hedgehog (*Erinaceus europaeus*).

Possums and rodents disrupt ecological processes therefore can impact entire forest ecosystems (Cowan, 2001). Possums are selective feeders and deplete species like pohutukawa, rata and kohekohe and interfere with flowering and fruiting periods. This subsequently can have negative impacts on seed dispersers such as New Zealand pigeon. Meanwhile rodents can have severe negative impact on populations of invertebrates, lizards, some birds. Possums and rodents also feed on seeds and seedlings on the ground, therefore depleting food availability for native fauna.

Goats, rabbits, hares, and grazing livestock can impact on native plant assemblages and native regeneration generally. Where livestock are allowed to graze in forest remnants and riparian areas, it results in the destruction of vegetation preventing regeneration as well as negatively impacting riparian and aquatic habitats.

Mustelids (ferret, stoat, and weasel), cats and uncontrolled dogs can have severe negative impacts on a variety of native species. For ground nesting birds to breed successfully, effective control of mustelids and rats is key.

Introduced lizards, such as rainbow skink recorded on site during a manual habitat search, could have adverse effects on indigenous fauna but their impacts are generally less known than those of introduced mammals.

A control programme including a combination of trapping and poisoning should be carried out on the subject site. It is recommended that given the sites proposed residential nature and likelihood of pet animal presence on site, where possible, automated predator traps (such as AT220 for possum and rat control), are used.

It is advised that a trapping, baiting and monitoring program is developed within the Ecological and Landscape Enhancement Plan to ensure continued pest control operation over a longer period of time. The above should include location of traps and bait stations, types of baiting and poison with a record template sheet for monitoring purposes.

5.3 Pest plant management

Weeds identified under the National Pest Accord, Northland Regional Pest and Marine Pathway Management Plan (2017) or those known to pose a potential invasive threat were recorded. Due to the riparian features found within the proposed enhancement area it is proposed to utilize both manual and chemical controls of weeds.

A range of weeds are present on the subject property, primarily within the existing bush area and along the Waitaua stream channel. See an indicative list of pest plant species present in these areas under Section 3.2 of this report. It is proposed that the preparation of a comprehensive Ecological and Landscape Enhancement Plan is prepared for the site to address the eradication and control of these species in more detail including identification of pest plants and animals, control techniques, and ongoing monitoring to ensure ongoing eradication efforts of pest species over the entire subject site.

5.4 Boundary issues

Reinvasion of pest plants and animals from adjacent areas is likely, especially from adjacent properties and roadside verges that are not controlled. In addition, streams often act as a vector for weed spread between sites. The only way to address this issue is by cooperative working with the proprietors of the adjacent properties, interest groups, WDC, NRC and DoC.

5.5 Summary

The current terrestrial and aquatic ecological values of the subject site reflect the highly modified nature of the environment. The proposed development proposal for the site provides the opportunity to restore, protect and enhance the current ecological values. Implementing the recommendations set out in Section 6 of this report will enhance and extend ecological values within the subject site and immediate surrounds.

6.0 PLANNING CONSIDERATIONS

6.1 Whangarei District Plan (Operative)

This section addresses the following objectives and policies relating to the proposed development and any associated ecological or environmental effects under the Whangarei District Plan (Operative):

- Chapter 11 – Riparian and Coastal margins
- Chapter 12 – Waterbodies
- Chapter 17 – Indigenous Vegetation and Habitat

OBJECTIVE	POLICY	DISCUSSION
Chapter 11 – Riparian and Coastal margins		
11.3.1 Preservation of the natural character of riparian margins and the coastal environment. **11.3.2** Protection of Significant Ecological Areas, Built Heritage, Sites of Significance to Māori, riparian habitats and Outstanding Landscapes and natural features, within the coastal environment and alongside rivers and streams. **11.3.3** Maintain and enhance public access, where appropriate, to and along the coast and rivers. **11.3.4** Recognise and protect riparian margins and the coastal environment as natural hazard buffers. **11.3.5** The relationship of tangata whenua with their sites and other taonga is enhanced	**11.4.1 Riparian Management** To avoid the adverse effects of land use activities on the natural character and functioning of riparian margins of water bodies and the coast.	The proposal works within the natural confines of the site and aims to reduce any adverse effects on freshwater habitats and their margins identified on site through sustainable design principles and incorporating any freshwater bodies noted on site within the proposed landscape or ecological enhancement areas. Any stream crossings proposed to be installed as a part of the development seek to avoid freshwater and riparian margin habitat loss, whilst ensuring that crossings are fit for purpose. The crossings are proposed to be in designed in accordance with WDC Environmental Engineering Standards and New Zealand Fish Passage Guidelines.
	11.4.2 Separation Distances To ensure that land use activities avoid, remedy or mitigate adverse effects on water quality, by means which may include separating land use activities from water bodies and coastal waters and by encouraging the retention and enhancement of riparian vegetation as buffer areas.	The proposal has been designed in a manner that promotes and enhances the natural features of the site. Development setbacks are considered appropriate to avoid any adverse effects on water quality. Sufficient sediment and development controls are proposed that are in line with industry best practice to limit erosion processes and sediment inputs into the aquatic environments.
	11.4.4 Allotments Less than Four Hectares To set aside esplanade reserves or strips on the subdivision of allotments of less than four hectares where the land involved will serve one or more of the purposes of esplanade reserves or strips set out in Section 229 of the Resource Management Act 1991.	The proposal will result in approximately 7.5 ha of land (including proposed Lots 200, 201, 202, 203, 204, and 205) to be vested as Local Purpose Reserves, including the riparian margins of the Waitaua Stream.
Chapter 12 - Waterbodies		
12.3.1 The preservation of the natural character of water bodies and their margins, and the protection of them from the adverse effects of inappropriate subdivision, use and development.	**12.4.1 Adverse Effects** To ensure that the adverse effects of subdivision, use and development adjoining water bodies or the coastal marine area, or activities on the surface of water bodies or the coastal marine area, on water quality and	The proposal aims to preserve and enhance the Waitaua Stream corridor flowing through the subject site through enhancement and revegetation planting, and ongoing pest plant and pest animal control. Site preparation and development is to be carried out as per technical reports prepared for the proposed development, and if best practice

	quantity (including ground water), natural character, and cultural and ecological values of water bodies and the coastal marine area, are avoided, remedied or mitigated.	is followed, no more than minor ecological effects are anticipated on the stream habitat noted on site.
	12.4.2 Water Margins To ensure that land use activities avoid, remedy or mitigate more than minor adverse effects on water quality, by means which may include separating land use activities from water bodies and coastal waters and by encouraging the retention and enhancement of riparian vegetation as buffer areas.	The sites topography largely dictates the natural setbacks between the development and Waitaua Stream. Sufficient controls relating to erosion, surface water runoff and sediment management will need to be adhered to during construction phase of the development to avoid any adverse effects on the stream environment. The proposed enhancement planting will strengthen riparian protection, provide for a buffer area to protect core values identified on site, and further elevate its functionality as a 'stepping stone corridor' feature within the landscape for species that have larger home ranges and require functional and structural habitat linkages within the wider hostile countryside and urbanised areas. Protection and management will ensure these values are linked and extended and that the bush remnant, aquatic environment and associated riparian zones are enhanced as a result of the sites development.
Chapter 17 – Indigenous Vegetation and Habitat		
17.3.1 Maintenance and enhancement of the life-supporting capacity of ecosystems, and the biodiversity of the District. **17.3.2** Protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna from inappropriate subdivision, use and development.	**17.4.1 Significant Indigenous Vegetation and Significant Habitats of Indigenous Fauna** To recognise as significant, and provide protection for, indigenous vegetation and habitats of indigenous fauna, including indigenous wetlands, which are of Moderate, Moderate-High, High and Outstanding value using the criteria set out in Schedule 17A.	The current terrestrial and aquatic ecological values of the subject site reflect the highly modified nature of the environment. The proposed development proposal for the site provides the opportunity to restore, protect and enhance the current ecological values through appropriate revegetation planting, and ongoing pest weed and pest animal control. The site directly adjoins Hurupaki Cone, which is classified as a Protected Natural Area in the Whangarei ED, and the development proposal will allow for the values of the Hurupaki Cone to be further protected through buffer planting, and provision of wider vegetated corridor linkages in the wider landscape thus enhancing connectivity and undisturbed species movement. Pest plant and pest animal control proposed as a part of the development will further enhance the habitat for local fauna. No indigenous wetland habitats are present on the subject site.

	17.4.2 Significant Ecological Areas To maintain the ecological values of significant indigenous vegetation and the significant habitats of indigenous fauna in the Low Density Residential and Open Space and Recreation Zones.	Ecological values over the entire site will be enhanced as a result of the development proposal. Two areas are proposed for Ecological Enhancement being the Waitaua Stream Enhancement Zone and Hurupaki Cone Enhancement Zone, these areas are proposed to be vested as Local Purpose Reserves.
	17.4.3 Enhancement To promote the enhancement of areas of significant indigenous vegetation and significant habitats of indigenous fauna that have been, or may be, degraded by inappropriate subdivision, use and development.	The entirety of the subject site has been highly modified from its former ecosystem. The proposal will allow for the remaining areas of ecological significance to be enhanced through appropriate revegetation planting and comprehensive pest weed and pest animal controls.
	17.4.4 Effects To avoid, remedy or mitigate the adverse effects of land use activities on areas of indigenous vegetation and significant habitats of indigenous fauna, including areas of value to tangata whenua, as determined by Schedule 17A , so as to maintain its ecological values.	The development proposal has been designed in a manner that has been largely designed to work around the natural features identified on site and aims to promote and enhance the existing ecological values. Overall, it is considered that if appropriate stormwater, wastewater and associated earthworks controls are imposed during site development as per current WDP (OP) controls and associated best practice, the potential for adverse effects on the environment are assessed as no more than minor.

6.1.1 Net Environmental Benefit

Lot 3 is currently zoned as Rural Production Zone (Lot 3 DP 99045) under Whangarei District Council District Plan (Appeals Version). Therefore, brief consideration was given to the potential 'Net Environmental Benefit' that could be achieved as a part of development of the site.

It is considered that the development of the site is generally consistent with the objectives of the WDCDP, as it would enable rehabilitation of ecological and biodiversity values and allow for additional protection of adjacent areas of ecological significance.

The proposal would allow for buffer planting to be established extending south of Hurupaki Cone. The revegetation planting will provide for multiple ecosystem services through reducing erosion risk on the steep hillslope extending southwards form Hurupaki Cone, reducing edge effects of the Cone's core bush area, enhancing habitat connectivity within the subject site and surrounds, and extending habitat availability for avifauna.

The proposal would also allow to exclude stock from the proposed enhancement areas in perpetuity and with that result in positive flow on effects in terms of reducing erosion pressures on steep, erodible land. A comprehensive long-term management of pest plant and pest animal species is proposed for the area, which would benefit biodiversity values on the site as well as immediate surrounds, which include the directly adjacent Hurupaki Cone to the north of the site.

The ecological enhancement area will be protected via legal protection mechanism through vesting the area as Local Purpose Reserve.

This will ensure that regulating, supporting and cultural ecosystem services are to be enhanced as a part of the development proposal.

6.2 National Environmental Standards for Freshwater Regulations (NESF 2020)

No 'natural inland wetlands' as defined under the National Environmental Standards for Freshwater Regulations (2020) were identified on site.

The term "natural wetland" is defined as follows (at [3.21]):

natural wetland means a wetland (as defined in the Act) that is not:

a) wetland constructed by artificial means (unless it was constructed to offset impacts on, or restore, an existing or former natural wetland); or
b) geothermal wetland; or
c) any area of improved pasture that, at the commencement date, is dominated by (that is more than 50% of) exotic pasture species and is subject to temporary rain derived water pooling.

6.3 National Policy Statement for Freshwater Management (NPSFM 2020)

The Essential Freshwater package, including the National Environmental Standards for Freshwater (NESF), Freshwater National Policy Statement for Freshwater Management (NPSFM) and Stock Exclusion Regulations, that came into force in September 2020 introduced strong new policies and regulations to protect natural wetlands on a national scale.

The NPSFM sets out the objectives and policies for freshwater management under the Resource Management Act 1991. It came in effect on 3 September 2020 and replaces the National Policy Statement for Freshwater Management 2014 (amended 2017).

The development proposal is largely in line with Policies 1-15 of the National Policy Statement for Freshwater Management (NPSFM 2020), ensuring that natural and physical resources on site are managed in a way that prioritises the health and well-being of water bodies and freshwater ecosystems, the health needs of people, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future. The following is a generalist assessment relating to the development proposal under the key policies of the NPSFM (detailed under Policies 1-15 of the Freshwater NPS) as follows:

Policy 1: Freshwater is managed in a way that gives effect to Te Mana o te Wai.

Each community will decide what Te Mana o te Wai means to them at a freshwater management unit scale, based on their unique relationship with fresh water in their area or rohe. While Northland Regional Council has published a small memo outlining the programme for implementing the National Policy Statement for Freshwater Management (dated March 2018) as far as we are aware of, Northland Regional Council has yet to publish a region wide Freshwater Management Plan other than what is already provided in the proposed Northland Regional Plan. This is outside the scope of this application.

Policy 2: Tangata whenua are actively involved in freshwater management (including decision making processes), and Māori freshwater values are identified and provided for.

Every local authority must actively involve tangata whenua (to the extent they wish to be involved) in freshwater management (including decision-making processes), however this is out-with the scope of this application.

Policy 3: Freshwater is managed in an integrated way that considers the effects of the use and development of land on a whole-of-catchment basis, including the effects on receiving environments.

The proposal involves protection and enhancement of terrestrial and aquatic ecosystems within the boundaries of the subject site. Stock exclusion from sensitive land and aquatic environments, as well as protection and enhancement of riparian areas is proposed. It also provides protection and enhancement of habitat for instream fauna. The onsite riparian areas on site have been subject to historic unrestricted stock access. Therefore, we are protecting a water feature that is already in a precarious state and will be enhanced following weed control and enhancement planting. Stock exclusion will allow for natural regeneration to take place once more, and with that enhance canopy cover for the Waitaua Stream. This will help to moderate water temperatures, act as an important food source for instream organisms, reduce sedimentation, and form an important buffer for diffuse pollution from the surrounding landscape.

Policy 4: Freshwater is managed as part of New Zealand's integrated response to climate change.

The proposal is largely in line with the collective efforts of reducing the impacts of climate change. The proposed sensitive land and aquatic environment retiring from grazing coupled with enhancement planting will result in environmental benefits to the existing habitats noted on site.

Policy 5: Freshwater is managed through a National Objectives Framework to ensure that the health and well-being of degraded water bodies and freshwater ecosystems is improved, and the health and well-being of all other water bodies and freshwater ecosystems is maintained and (if communities choose) improved.

Currently the Waitaua Stream flowing through the subject site and the wider Whangarei Harbour catchment is subject to several diffuse pollution sources notably from urban development with enhanced levels of sediment and contaminant run-off. The enhancement of upper catchment as a part of the development proposal is an example of managing diffuse pollution.

If appropriate design and engineering guidelines are followed during the establishment and operational stages of the proposed development of the site, the associated environmental effects are deemed as no more than minor. The overall proposal will in fact result in a net positive environmental benefit through appropriate revegetation, pest plant and animal control and stock exclusion in perpetuity.

Policy 6: There is no further loss of extent of natural inland wetlands, their values are protected, and their restoration is promoted.

The site does not contain any wetland habitats.

Policy 7: The loss of river extent and values is avoided to the extent practicable.

No loss in river extent is proposed as a part of this application.

Policy 8: The significant values of outstanding water bodies are protected.

No outstanding waterbodies have been recorded on the subject site. For a waterbody to be considered as 'outstanding', it would need to a contain a mixture of outstanding ecological, landscape, recreational and spiritual values. Generally speaking, the water body should be located in a catchment where there is currently little or no development and would have a combination of values (rather than being deemed outstanding on the basis of a single value such as ecological significance).

Policy 9: The habitats of indigenous freshwater species are protected.

The proposal involves protection and revegetation of degraded freshwater ecosystems within the boundaries of the subject site, and with that the protection of any freshwater species contained within these habitats. The proposal seeks stock exclusion, pest plant and animal control, and revegetation planting which will result in increased habitat quality indigenous freshwater species.

Policy 10: The habitat of trout and salmon is protected, insofar as this is consistent with Policy 9.

No trout or salmon have been identified as being present within the site or surrounds, therefore this is not applicable.

Policy 11: Freshwater is allocated and used efficiently, all existing over-allocation is phased out, and future over-allocation is avoided.

This is outside the scope of the application, and this is the role of local and regional authorities.

Policy 12: The national target for water quality improvement is achieved.

The national target is to increase proportions of specified rivers and lakes that are suitable for primary contact to at least 80% by 2030, and 90% no later than 2040, but also to improve water quality across all categories. It is not envisioned any of the waterbodies within the subject site would be utilized for primary contact. The on-site stream will become stabilized through natural regeneration, revegetation, and permanent stock exclusion. It is likely that the proposal will make a small incremental positive change for primary contact activities such as swimming downstream.

Policy 13: The condition of water bodies and freshwater ecosystems is systematically monitored over time, and action is taken where freshwater is degraded, and to reverse deteriorating trends.

This is outside the scope of the application and this is the role of local and regional authorities. We are not aware that detailed monitoring records or bottom-line targets are available from either the Whangarei District Council or Northland Regional Council for this freshwater unit.

Policy 14: Information (including monitoring data) about the state of water bodies and freshwater ecosystems, and the challenges to their health and well-being, is regularly reported on and published.

This is outside the scope of the application, and this is the role of local and regional authorities.

Policy 15: Communities are enabled to provide for their social, economic, and cultural wellbeing in a way that is consistent with this National Policy Statement.

This is outside the scope of the application, and this is the role of local and regional authorities.

7.0 CONCLUSION

An ecological field survey was undertaken at a proposed subdivision site at 131 & 189 Three Mile Bush Road (Lot 2 DP 99045 & Lot 3 DP 99045), Kamo. The sites and immediate surrounds existing ecological characteristics and significance were reviewed, surveyed, mapped and analyzed.

Based on the field assessment and desktop research it was established that much of the native vegetation on site has historically been cleared with only a small section of what could be best described as broadleaf

habitat with severe pest plant encroachment extending along the Waitaua Stream along the central aspect of the site. Initial pest plant control within the proposed enhancement zone has been complete in preparation for revegetation enhancement planting.

The site is primarily used by common native and introduced fauna, with no indication of the site being used as a commuting or roosting habitat by any 'Threatened' or 'At Risk' species such as long-tailed bats or NI brown kiwi. Given the lack of suitable habitat on site it is unlikely that any native herpetofauna is present within the site itself or the development footprint. It is likely that the onsite stream system is habitat to several common ichthyofauna and aquatic invertebrates.

It is proposed to protect and enhance two areas identified for ecological enhancement, being the Waitaua Stream Corridor Enhancement Areas and Hurupaki Cone Enhancement Area. The Waitaua Stream Corridor Enhancement area will span across approximately 1.13 ha, while the Hurupaki Cone Enhancement area would extend over approximately 3.85 ha. These areas will be enhanced through comprehensive pest plant and animal control and planting of suitable indigenous species. The proposed enhancement will strengthen ecological values within the local area which is vitally important to provide further habitat for wildlife and food for native birdlife.

The proposed development of the site has been designed to incorporate and promote ecological enhancement of the site. The development and associated infrastructure has been designed in a manner that recognizes the existing ecological and environmental values and constraints of the site and immediate surrounds and aims to strengthen the ecological values of these features through appropriate revegetation planting and ongoing pest weed and pest animal control.

In conclusion, it is considered that the potential adverse effects of the associated subdivision proposal can be secured through best practice sediment and erosion control measures, and comprehensive ecological and landscape design principles, as well as appropriate planning and development controls. Provided that they are implemented successfully during construction and operational phases of the development, adverse effects on the environment would be minimised, and would, in fact, allow for the enhancement of the habitats identified on site and immediate surrounds.

8.0 RECOMMENDATIONS

It is considered that the proposed management actions described within the body of this report will minimise adverse effects associated with the development proposal on the habitats and species recorded on site and immediate surrounds. The proposal will, in fact, enhance the overall ecological habitat complexity and quality across the site, through enhancement of the existing riparian margins and associated indigenous vegetation, as well as through the extension of the values of the adjacent Hurupaki Cone.

In relation to the proposal, the following recommendations are made:

- That a standalone Ecological and Landscape Enhancement Plan (ELEP) is prepared and submitted to the Council for approval (in a certifying capacity) considering the recommendations outlined within the body of this report and any subsequent addendum reports to ensure long term environmental benefit objectives are achieved. The ELEP shall, as a minimum, contain or provide for the following:

(i) Prior to planting, the removal or management of all invasive weed species and their replacement with native, eco-sourced species considering the recommendations made within this report.

(ii) A revegetation maintenance and pest control programme to be undertaken annually for at least five years, to include weed maintenance, inspection of plants for losses and replacement planting during the planting season.

(iii) Works undertaken for maintenance should include weed control, cultivation, control of pests and diseases, removal of litter, checking of stakes and ties, trimming, pruning, and other works required to ensure planting maintains healthy growth and form.

• The measures to be adopted to achieve, as far as is practicable 90% survivorship of planted species.

(iv) The identification and control of pests (including but not limited to rats, mustelids, possums and freshwater pests) to ensure, as far as practicable, that the ecological gains achieved via the EREP are not compromised.

(v) A planting hygiene protocol to be imposed while all planting is being undertaken to ensure that plant diseases e.g. kauri dieback and myrtle rust are not brought to the site.

- All plant material to be used in the ecological enhancement planting works should be eco-sourced from the Whangarei Ecological District and within proximity to the site. Growing in advance is highly recommended given the limited availability of some species recommended. It is advised that a planting hygiene protocol is drawn up to ensure that the plants are free of disease and pathogens such as myrtle rust and kauri dieback (PTA).

- That any works requiring stream crossings are to be in accordance with Whangarei District Council and Northland Regional Council Environmental Engineering Standards and the New Zealand Fish Passage Guidelines (Franklin *et al.* 2018) to ensure that fish passage on site is maintained.

- That appropriate signage is erected at the public walkway entrance points into the proposed Ecological Enhancement Areas to inform users that all dogs must be on leads at all times when entering these areas.

- In relation to the Ecological Enhancement Area protection in perpetuity the owners (or their successors) of the newly created titles as a part of the subdivision consent shall:

    - Preserve the native vegetation and wildlife habitats and the natural landscape within the Ecological Enhancement Area where they abound their lot boundaries;
    - Not (without the proper consent of the Council and then only in strict compliance with any conditions imposed by the Council) cut down, damage or destroy, or permit the cutting down, damage or destruction of the vegetation or wildlife habitats within the Ecological Enhancement Areas;
    - Not do anything that would prejudice the health or ecological value of the Ecological Enhancement Area, their long term viability and/or sustainability;
    - Ensure dogs are on lead when entering these areas.

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Rural Design 1984 Ltd

9.0 REFERENCES

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APPENDIX 1 – SUBDIVISION SCHEME PLAN PREPARED BY BLUE WALLACE SURVEYORS

APPENDIX 2 – ECOLOGICAL ENHANCEMENT AND LINKAGES (LITTORALIS LANDSCAPE ARCHITECTURE)