12 December 2018

55 BARRETT ROAD, RIVERHEAD

GEOTECHNICAL COMPLETION REPORT

Cabra Developments Limited

Ref: AKL2017-0208AD Rev: 0

Table of Contents

Appendices

1. INTRODUCTION

In accordance with our instructions, this Geotechnical Completion Report has been prepared for Cabra Developments Limited as part of the documentation to be submitted to Auckland Council following earthworks to form the 55 Barrett Road development. Construction of this residential subdivision has been undertaken in accordance with the Auckland Council Resource Consent numbers BUN60313812, SUB60313262 and LUC60313815.

This report contains our Suitability Statement, specific comments related to items raised in the Resource Consent, relevant test data and the Cato Bolam Consultants as-built plan set as provided in Appendix B.

This report covers the construction period April 2018 to November 2018 and is intended to be used for certification purposes for new lots (listed below) created from Lot 2 DP 113728 as follows:

- 6 new residential lots numbered lots 2 to 7 inclusive. Lot 1 contains an existing dwelling and has therefore excluded from this reporting;
- 1 new right of way named Birchdale Close.

The 55 Barrett Road Development is located off Barrett Road, Riverhead. As can be seen from the as-built plans, all of the lots have been affected by filling as part of the earthworks operations to a maximum depth of approximately 3 metres, although maximum cuts and fills on building sites were 2 metres and 0.5 metres respectively.

2. PROJECT BACKGROUND

The geotechnical investigations were undertaken by CMW Geosciences as presented in the following report:

- Geotechnical Investigation Report for Residential Subdivision at 55 Barrett Road, Riverhead, prepared by CMW Geosciences, referenced AKL2017_0208AB Rev. 0, dated 5 December 2017.

3. DESCRIPTION OF EARTHWORKS

Works commenced in late April 2018 with the installation of sediment and environmental controls including a temporary silt pond on Lot 5. The temporary silt pond was constructed above the existing gully. All wet alluvial materials were removed prior to the placement of fill to form the pond. Once complete, stripping of topsoil across the site began. Topsoil stripping was limited to the areas of site to be affected by earthworks.

Earthworks began in early May 2018. Fill materials were sourced from onsite cuts. Lot 7 and the front entrance way were the first areas to be earth worked.

In late May and early June 2018, construction of the culverts crossing the gullies was carried out. The natural ground below the culverts was undercut to competent ground, which was usually the top of rock. Imported hardfill was used to fill in below and around the culverts.

In mid-July 2018 the right of way subgrade was formed, including the shaping of the batter below Lot 6. During these works, a soft area was observed in the right of way subgrade, to the north of Lot 7. This was subsequently undercut and replaced with imported hardfill. Upon the provision of subgrade testing results, the right of way subgrade was subsequently lime and cement stabilised. Once complete, pouring of the concrete right of way commenced.

In September and October 2018 earthworks within Lots 4 and 5 was carried out including the decommissioning and backfilling of the temporary silt pond. By late October 2018 the earthworks were complete and topsoil respreading commenced.

4. GEOTECHNICAL QUALITY CONTROL

4.1. Site Observations

During the earthworks site visits were typically undertaken several times each week to assess compliance with NZS 4431 and specific design recommendations and specifications.

Site visits were carried out to observe and confirm compliance relating to:

- Adequate topsoil stripping;
- Fill areas prior to the placement of fill materials to ascertain that all mullock and soft inorganic subsoils had been removed;
- Installation of underfill drains, excluding road under-channel drains;
- Placement and compaction of engineered fills.

4.2. Compaction Control

Compaction of engineered earth fills was controlled by undrained shear strength measured by hand held shear vane calibrated using the NZGS 2001 method and by air voids as defined by NZS4402.

The criteria for undrained shear strength were a minimum single value of 110 kPa and minimum average of any 10 consecutive tests of 140 kPa.

The criteria for air voids were a maximum single value of 12% and maximum average of any 10 consecutive tests of 10%.

Vane shear strength, water content and in situ density tests were carried out on all areas of the engineered filling to at least the frequency recommended by NZS 4431.

These tests showed on some occasions that the required compaction standards were not initially being achieved and to the best of our knowledge the failing areas of fill were re-worked as necessary. Subsequent testing confirmed compliance with the specification.

5. EVALUATION OF COMPLETED EARTHWORKS

5.1. Natural Hazards

The appended as-built drawings depict a designated building platform on each lot. We are satisfied that all designated building platform areas are not subject to the natural hazards described in section 71(3) if the Building Act, i.e. erosion, falling debris, subsidence, slippage, and inundation. Consideration of the inundation hazard was outside the scope of CMW's brief and has been assessed by others.

- No consideration of the geotechnical risks has been given to areas of the lots outside the designated building platform and therefore specific design of foundations and cuts/fills is required on all lots outside the designated building platform.
- Specific design of any cuts/fills in excess of 600mm is required on all lots within the designated building platform. This is to protect the slopes from inappropriate loading or undermining.

Full descriptions of the restrictions associated with each of the above are presented in the Suitability Statement (Appendix A).

5.2. Land Stability and Erosion Control

On all steep land surface stability can be compromised by indiscriminate disposal of stormwater onto the ground surface and/ or by removal of vegetation.

Building and landscape designers must ensure that all runoff from solid surfaces is directed into the building stormwater system. It is also important that care is paid to the disposal of stormwater during construction so that concentrated discharges (e.g. from unconnected spouting) are not directed towards steep ground.

Depths of mulch and topsoil applied to sloping areas should be limited to less than 150mm to minimise the risks of saturation leading to localised slumping on batter faces. Wherever practical on such land existing vegetation and grass cover should be well maintained. The roots of an established vegetation cover can serve to bind the surface soils while the foliage can reduce rain infiltration and soil saturation, resulting in better resistance to erosion and shallow slumping. Any vegetation cleared beyond the immediate area of building platforms for temporary construction purposes should be replanted or replaced as soon as possible.

5.3. Topsoil Landscaping Bunds

The appended Cato Bolam Limited as-built plan shows the positions of topsoil landscaping bunds which were constructed during the earthworks operation. These landscaping bunds are all positioned outside the designated building platforms and therefore any future building/earthworks associated with these bunds is also required to be specifically designed.

5.4. Fill Induced Settlement

On the basis of the relatively minor magnitude of fill depths on this site, together with the elapsed time since it was placed, we consider that remaining post-construction settlements will be within code limits.

5.5. Subsoil Drains

The appended Cato Bolam Limited as-built plan shows the positions of underfill drains which were constructed within minor gullies affected by the earthworks operations. The drains were installed to help control groundwater levels and extend to formed outlets within the main gullies. The ongoing operation of these drains is important to the overall stability conditions of the site. While not critical to slope stability considerations the location of the drains should be allowed for in any future developments, and adequate protective measures included.

5.6. Right of Way Subgrade

Penetration resistance testing was carried out on the road subgrades during construction and the results of this testing were forwarded to Cato Bolam Limited for pavement remedial design. Where soft ground with low equivalent CBR values was identified it was generally undercut and replaced with hardfill. All right of way subgrade areas were subsequently lime/ cement stabilised to achieve appropriate CBR values.

5.7. Wastewater Disposal

The subdivision did not include construction of reticulated wastewater systems and therefore all residential lots are to use onsite wastewater disposal methods

Based on the soils observed during the earthworks operations we have defined the site classification for effluent disposal as being Category 6 as defined in Table 5.1 of Auckland Council Technical Publication 58; Onsite Wastewater Systems. Table 5.2 of TP58 recommends construction of either

pressure compensating dripper irrigation or evapotranspiration seepage beds/aerobic soakage beds based on Category 6 soils.

All septic tanks should be buried to fully compensate for their weight influence. All system designers should ensure that treatment fields are positioned outside the required setback from boundaries, buildings and watercourses.

5.8. Stormwater Disposal

All lots require onsite stormwater disposal methods. Concentrated stormwater discharges can lead to scour and instability, especially on steeper portions of the site.

Should tanks be used to collect or detain rainwater or stormwater, these tanks should be partially buried to compensate for their weight influence. Any overflow systems must be outlet via a solid pipe to the stormwater outlet position. Stormwater discharge locations should be set at lower elevations well beyond building platform areas, with appropriate scour protection at the outlet.

The design of the stormwater disposal systems should be carried out with regard to the site geotechnical hazards. All excess stormwater from roofs, water tank overflows, retaining wall outlets, subsoil drains, decks and driveways should be piped to carefully considered outlet locations such as gully bases.

Under no circumstances should any concentrated stormwater runoff be allowed to discharge directly onto the ground or into soakpits.

5.9. Design of Shallow Foundations

5.9.1. Bearing Capacity

Once bulk earthworks and top-soiling of the building platforms had been completed, our staff drilled hand auger boreholes on platforms in natural ground to determine representative finished ground conditions and hence evaluate likely foundation options for future building development. Our assessments of bearing capacity for the design of shallow foundations on each building platform are contained in the appended Suitability Statement.

At current subgrade levels all lots have been assessed as having a geotechnical ultimate bearing capacity of 300 kPa within the influence of conventional shallow residential building foundation loads.

If higher geotechnical ultimate bearing capacities are required, further specific site investigation and design of foundations should be carried out prior to Building Consent application.

5.9.2. Foundation Settlements

At the bearing pressures specified above, and subject to the design requirements for soil expansiveness provided below, differential settlement of shallow foundations for buildings designed in accordance with NZS 3604 (including the 600mm subfloor fill depth limit) should be within code limits.

5.9.3. Soil Expansiveness Classification

Two sets of soil tests were carried out on samples taken from likely foundation level on lots within the development.

Testing was carried out in accordance with NZS 4402, "Methods of Testing Soils for Civil Engineering Purposes" test 2.2 and 2.6 and were used in conjunction with visual-tactile assessment of the site soils to determine expansive site Classes as defined in AS 2870, "Residential Slabs and Footings – Construction". All test results are appended.

On this basis we have assessed the AS 2870 Site Class for lots 2, 3, 4, 5, and 6 of the development to be M (moderate) and lot 7 to be H1 (high). Details of foundation options for these Classes are contained in the appended Suitability Statement.

In recent years in Auckland, there have been examples of concrete floors and/ or foundations that have been poured on dry, desiccated subgrades in summer months on expansive soils and have undergone heaving and cracking once the soil moisture contents have returned to higher levels. Foundation contractors need to be made aware of this issue and the need to maintain appropriate moisture contents in the footings and building platform subgrade between the time of excavation and the pouring of concrete.

Remedial actions that may be appropriate include platform protection with a hard fill layer, pouring of a blinding layer of concrete in footing bases and soaking of the building platform with sprinklers for an extended period.

Home owners need to be aware that the planting of high water demand plants where their roots may extend close to footings can also cause settlement damage.

5.10. Topsoil Depths

Topsoil depths have been checked by the drilling of a borehole within the building platform on each lot. The results are considered indicative for each lot, but may be subject to variations. Topsoil depths are between 200 and 300mm across the development.

Site specific findings are contained in the appended Suitability Statement Summary (Appendix A). However, it is possible that further levelling works have been undertaken since our investigations and accordingly, we strongly recommend that lot purchasers complete their own checks of topsoil depths.

6. CLOSURE

The appended Statement of Professional Opinion is provided to the Auckland Council and Cabra Developments Limited for their purposes alone on the express condition that it will not be relied upon by any other person. It is important that prospective purchasers satisfy themselves as to any specific conditions pertaining to their particular land interest.

Although regular site visits have been undertaken for observation, for providing guidance and instruction and for testing purposes, the geotechnical services scope did not include full time site presence. To this end, our appended Suitability Statement also relies on the Contractors' work practices and assumes that when we have not been present to observe the work, it has been completed to high standards and in accordance with the drawings, instructions and consent conditions provided to them.

Similarly it assumes that all as-built information and other details provided to the Client and/or CMW by other members of the project team are accurate and correct in all respects.

For and on behalf of CMW Geosciences

Prepared by:

Jack Mynett - Johnson

Project Engineering Geologist

Reviewed and Approved by:

Richard Knowles

Principal Geotechnical Engineer, CPEng

Appendix A

Statement of Professional Opinion as to the Suitability of Land for Building Development

STATEMENT OF PROFESSIONAL OPINION AS TO THE SUITABILITY OF LAND FOR BUILDING DEVELOPMENT

I, Richard Knowles, of CMW Geosciences (NZ) Limited Partnership, Auckland, hereby confirm that:

1. As a Chartered Professional Engineer experienced in the field of geotechnical engineering, I am a Geo-professional as defined in section 1.2.2 of NZS 4404 and was retained by the Developer as the Geotechnical Engineer on the 55 Barrett Road Development.

2. The extent of preliminary investigations carried out to date are described in the CMW Geosciences Geotechnical Investigation Report referenced AKL2017_0208AB Rev. 0, dated 5 December 2017. The conclusions and recommendations of those documents have been re-evaluated in the preparation of this report. The results of all tests carried out are also appended.

3. In my professional opinion, not to be construed as a guarantee, I consider that:

   (a) Apart from the topsoil landscaping bunds, the earth fills shown on the appended Cato Bolam As-built Plan have been placed in compliance with NZS 4431, the Auckland Council Unitary Plans and related documents.

   (b) The completed earthworks give due regard to land slope and foundation stability considerations on the building platform areas that are depicted on the appended Cato Bolam as-built plans.

   - No building construction and no earthworks (i.e. cut or fills of any depth) should take place outside the designated building platforms unless endorsed by a Chartered Professional Engineer experienced in geomechanics and familiar with the contents of this report. The endorsement will need to consider the implications of the proposals on both global stability conditions and soil creep on the building buildings, control of surface water, construction sequencing, timing and temporary support requirements construction of all earthworks, foundations and retaining walls and if necessary, comment on what aspects require engineering inspections and certification.

     This limitation also applies to long term landscaping works, including any proposed minor cuts either on or near batter toes to be retained by new landscaping walls that might not normally require engineering, and to landscaping fills on or immediately above the batter slopes.

   - No earthworks in excess of 600mm cut or fill should take place inside the designated building platforms unless endorsed by a Chartered Professional Engineer experienced in geomechanics and familiar with the contents of this report. The endorsement will need to consider the implications of the proposals on both global stability conditions and soil creep on the building buildings, control of surface water, construction sequencing, timing and temporary support requirements construction of all earthworks, foundations and retaining walls and if necessary, comment on what aspects require engineering inspections and certification.

(c) The function of the subsoil drains installed beneath Lots 4 and 5 inclusive must not be impaired by any building development or landscaping works. Any bored or driven piles must be positioned to avoid damaging the draincoils. Where any subsoil drain is intercepted by building works, it must be reinstated under the direction of a Chartered Professional Engineer to ensure the integrity of the subsoil drainage system.

(d) A geotechnical ultimate bearing capacity of 300 kPa may be assumed for shallow foundation design within the building platforms of all lots inclusive.

If for any reason higher geotechnical bearing capacities are required, further specific site investigation and design of foundations should be carried out prior to Building Consent application.

(e) The expansive site Class for lots 2, 3, 4, 5, and 6 of the development to be M (moderate) and lot 7 to be H1 (high). We recommend that building designers note on the Building Consent drawings the need to maintain appropriate moisture levels across building subgrades and in footing excavations (as described in Section 5.9.3 of the Geotechnical Completion Report) for reference by foundation contractors.

(f) Subject to the geotechnical limitations, restrictions and recommendations contained in clauses 3(a), 3(b), 3(c), 3(d), and 3(e) above:

(i) The filled and natural ground is generally suitable for residential buildings constructed in accordance with NZS 3604 and the requirements of AS2870 for the appropriate expansive soil class.

(ii) Where shallow foundations are appropriate, design may be carried out in accordance with AS 2870 (Class M and H1) or alternately, a specific foundation and structural design may be undertaken by a Chartered Professional Engineer.

4. The right of way subgrade has been formed with appropriate regard for slope stability and settlement risks.

The following table summarises the conditions on each residential lot.

For and on behalf of CMW Geosciences

Richard Knowles

Principal Geotechnical Engineer, CPEng

GCR Summary Table

Condition	Subsoil Drains Present	Geotechnical Ultimate Bearing Capacity (kPa) within Building Platforms	AS2870 Expansive Class	Indicative Topsoil Depth (mm)
GCR SOPO Clause	**3(c)**	**3(d)**	**3(e)**	
Lot number				
2		300	M	300
3		300	M	300
4	●	300	M	300
5	●	300	M	250
6		300	M	300
7		300	H1	200

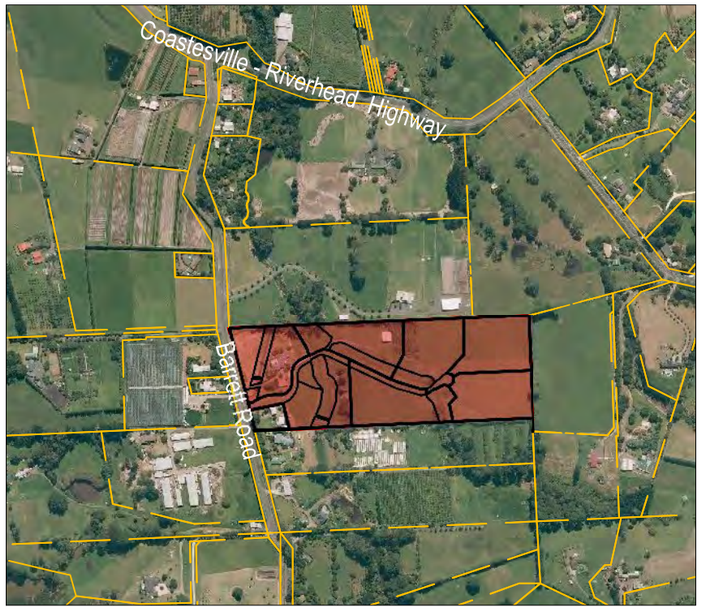
Appendix B

Drawings

Title	Reference No.	Date	Revision
Cato Bolam Consultants Earthworks As-Built Plans	41069-DR-SU-9000-9005	November 2018	1
Cato Bolam Consultants Right of Way As-Built Plans	41069-DR-SU-9100-9103	December 2018	0
Cato Bolam Consultants Stormwater As-Built Plans	41069-DR-SU-9300-9101	December 2018	0

Cabra Development Ltd - 55 Barrett Road, Riverhead

For Completion

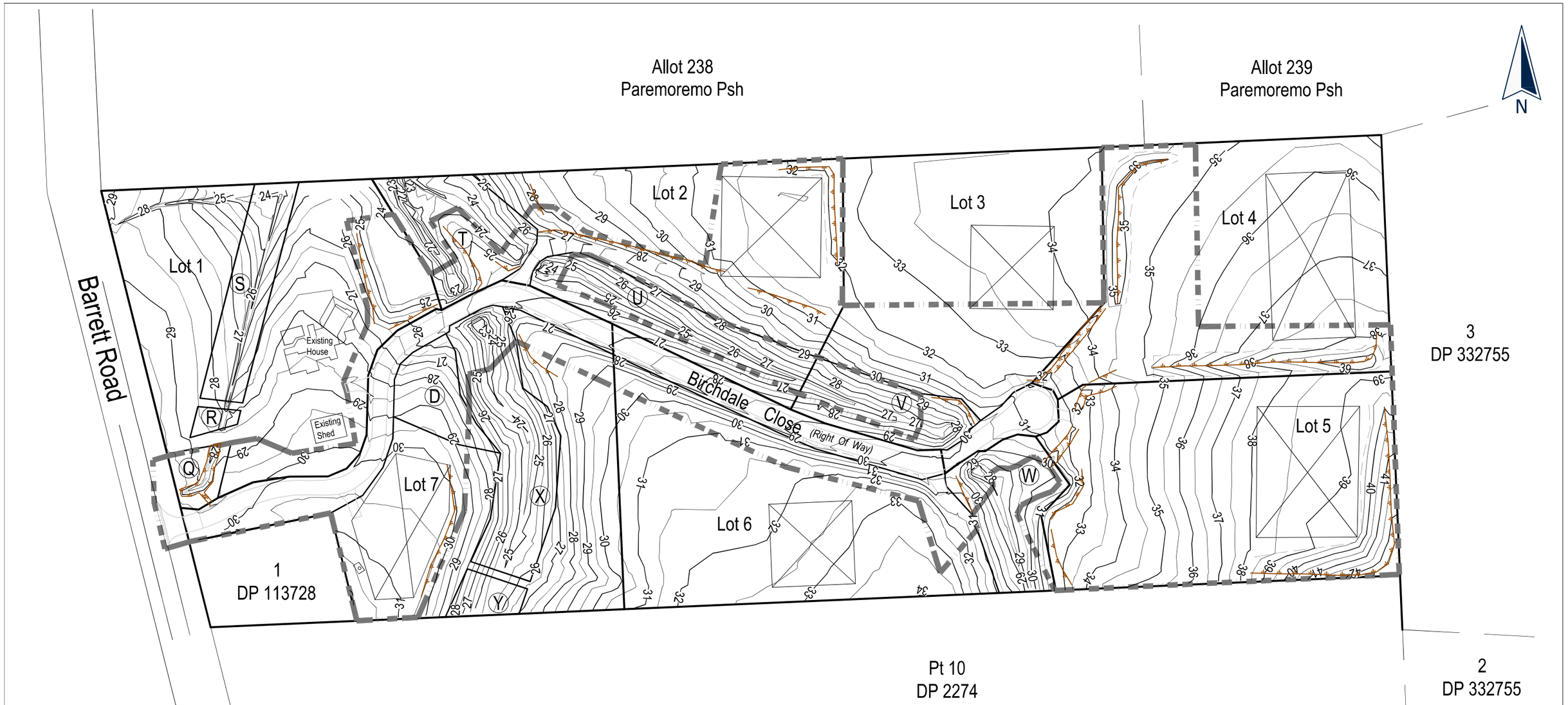


LOCATION DIAGRAM
Scale 1:10,000

Plan No	Rev	Plan Title
		Earthworks
9000	1	As Built Contours Sheet 1 of 3
9001	1	As Built Contours Sheet 2 of 3
9002	1	As Built Contours Sheet 3 of 3
9003	1	As Built Cut Fill Sheet 1 of 3
9004	1	As Built Cut Fill Sheet 2 of 3
9005	1	As Built Cut Fill Sheet 3 of 3
		Right of Way
9100	0	As Built Right of Way
9102	0	Right of Way As Built Long Section Sheet 1 of 2
9103	0	Right of Way As Built Long Section Sheet 1 of 2
		Stormwater
9300	0	As Built Stormwater Sheet 1 of 2
9301	0	As Built Stormwater Sheet 2 of 2

CATO BOLAM CONSULTANTS
PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

DATE December 2018
ORIGINAL SIZE A3
DRAWING NO. 41069-DR-SU-0000-0



As Built Earthworks Legend

- 10 — Contour (1.0m interval)
- Contour (0.5m interval)
- Top of Bank
- Bottom of Bank
- Extent of Earthworks
- Building Site
- (X) Covenant Areas

NOTES
1. Levels are in terms of LINZ Datum 1946.
2. Coordinates are in terms of NZTM2000.
3. Contours are finished ground levels as surveyed on 14/11/2018.

I certify that these As-Built Plans are an accurate record of the works undertaken and that:
* The Coordinates (X, Y) are in terms of NZTM on NZGD(2000), and are within ± 50mm.
* The levels (Z) are in terms of the Auckland 1946 (MSL) LINZ datum (DOSLI datum), and are within ± 10mm.

Signed: .....
Registered Professional Surveyor

Date: 6/12/2018

Name: Tom Lemon

Phone : (09) 427 0072
Email : catobolam@catobolam.co.nz

ENG60320183
SUB60313262
BUN60313812

CATO BOLAM CONSULTANTS
PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

PROJECT

Cabra Developments Ltd.
55 Barrett Road
Riverhead

DRAWING TITLE

As Built Final Contour Plan
Sheet 1 of 3

No.	REVISION (DESCRIPTIONS)	NAME	DATE
0	Issued for information	AA	19/11/18
1	Issued for completion	TL	6/12/18

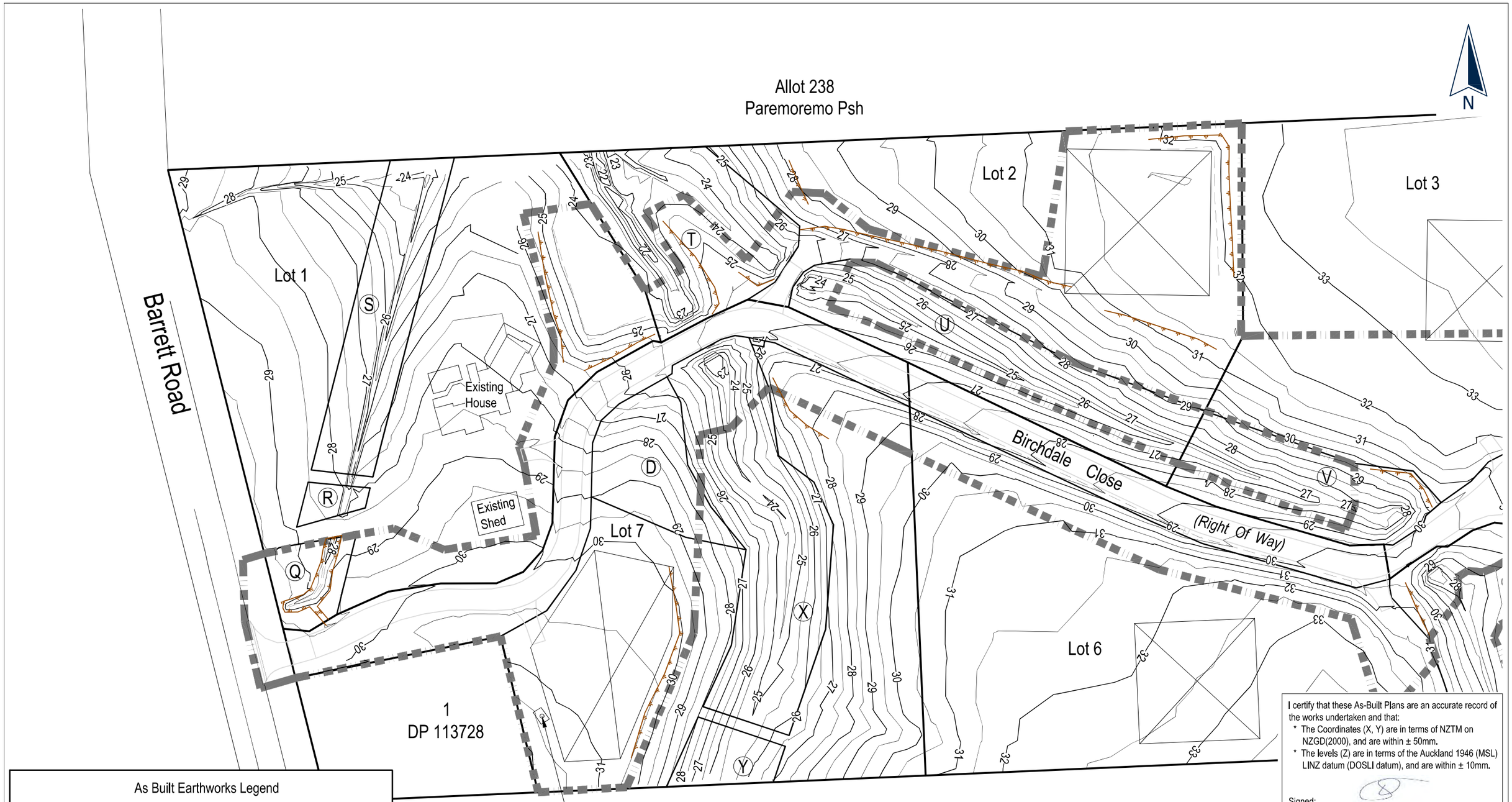
FOR COMPLETION

	NAME	DATE
SURVEYED	AA	14/11/18
DESIGNED	GW	18/12/17
DRAWN	AA	16/11/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
16/11/2018	1:1500	A3

DRAWING NO. 41069-DR-SU-9000

REVISION 1



As Built Earthworks Legend

- 10 — Contour (1.0m interval)
- Contour (0.5m interval)
- Top of Bank
- Bottom of Bank
- Extent of Earthworks
- Building Site
- (X) Covenant Areas

ENG60320183
SUB60313262
BUN60313812

NOTES
1. Levels are in terms of LINZ Datum 1946.
2. Coordinates are in terms of NZTM2000.
3. Contours are finished ground levels as surveyed on 14/11/2018.

I certify that these As-Built Plans are an accurate record of the works undertaken and that:
* The Coordinates (X, Y) are in terms of NZTM on NZGD(2000), and are within ± 50mm.
* The levels (Z) are in terms of the Auckland 1946 (MSL) LINZ datum (DOSLI datum), and are within ± 10mm.

Signed: .....
Registered Professional Surveyor

Date: 6/12/2018

Name: Tom Lemon

Phone : (09) 427 0072
Email : catobolam@catobolam.co.nz

CATO BOLAM CONSULTANTS
PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

PROJECT

Cabra Developments Ltd.
55 Barrett Road
Riverhead

DRAWING TITLE

As Built Final Contour Plan
Sheet 2 of 3

No.	REVISION (DESCRIPTIONS)	NAME	DATE
0	Issued for information	AA	23/11/18
1	Issued for completion	TL	6/12/18

FOR COMPLETION

	NAME	DATE
SURVEYED	AA	14/11/18
DESIGNED	GW	18/12/17
DRAWN	AA	16/11/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
23/11/2018	1:1000	A3

DRAWING NO. 41069-DR-SU-9001

REVISION 1

Allot 238
Paremoremo Psh

Lot 2

Lot 3

Lot 4

Lot 5

Lot 6

Topsoil
landscape bund

Topsoil
landscape bund

Birchdale Close
(Right Of Way)

N

3
DP 332755

Pt 10
DP 2274

As Built Earthworks Legend

- 10 — Contour (1.0m interval)
- Contour (0.5m interval)
- Top of Bank
- Bottom of Bank
- Extent of Earthworks
- Building Site
- (X) Covenant Areas

ENG60320183
SUB60313262
BUN60313812

NOTES
1. Levels are in terms of LINZ Datum 1946.
2. Coordinates are in terms of NZTM2000.
3. Contours are finished ground levels as surveyed on 14/11/2018.

I certify that these As-Built Plans are an accurate record of the works undertaken and that:
* The Coordinates (X, Y) are in terms of NZTM on NZGD(2000), and are within ± 50mm.
* The levels (Z) are in terms of the Auckland 1946 (MSL) LINZ datum (DOSLI datum), and are within ± 10mm.

Signed: .....
Registered Professional Surveyor

Date: 6/12/2018

Name: Tom Lemon

Phone : (09) 427 0072
Email : catobolam@catobolam.co.nz

CATO BOLAM CONSULTANTS
PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

PROJECT

Cabra Developments Ltd.
55 Barrett Road
Riverhead

DRAWING TITLE

As Built Final Contour Plan
Sheet 3 of 3

No.	REVISION (DESCRIPTIONS)	NAME	DATE
0	Issued for information	AA	23/11/18
1	Issued for completion	TL	6/12/18

FOR COMPLETION

	NAME	DATE
SURVEYED	AA	14/11/18
DESIGNED	GW	18/12/17
DRAWN	AA	16/11/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
23/11/2018	1:1000	A3

DRAWING NO. 41069-DR-SU-9002

REVISION 1

Allot 238
Paremoremo Psh

Allot 239
Paremoremo Psh

Refer to Diagram 1

Undercut backfilled with hardfill

Undercut backfilled with hardfill

Barrett Road

Lot 1

Lot 2

Lot 3

Lot 4

Lot 5

Lot 6

Lot 7

Existing House

Existing Shed

Birchdale Close

Undercut backfilled with hardfill

1
DP 113728

3
DP 332755

2
DP 332755

Pt 10
DP 2274

Underfill drain discharges into existing stream.

Temporary sediment pond removed & backfilled with certified fill

Existing bore cut off & capped with bentonite pellets approximately 1m below finished level

Diagram 1
Scale 1:500

Undercut backfilled with hardfill

Culvert under Driveway

Culvert under ROW

Under channel drain

Undercut backfilled with hardfill

NOTES

1. Levels are in terms of LINZ Datum 1946.
2. Coordinates are in terms of NZTM2000.
3. Cut/fill contours are from the original ground level, to finished ground level as suveyed on 14/11/2018.

Cut to Fill Legend

- 0 — Zero Contour
- -1.0 — Cut Contours & Area
- 1.0 — Fill Contours & Area
- Extent of Earthworks
- X — Covenant Areas
- 1.5 UFD — Underfill drain & depth *(150Ø highway grade perforated drain coils with SAP50 surround & geotextile cloth cover)*
- Under channel drain *(100Ø perforated drain coils with metal surround)*
- Undercut
- Building Site

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

* The Coordinates (X, Y) are in terms of NZTM on NZGD(2000), and are within ± 50mm.
* The levels (Z) are in terms of the Auckland 1946 (MSL) LINZ datum (DOSLI datum), and are within ± 25mm.

Signed: .....
Registered Professional Surveyor

Date: 6/12/2018

Name: Tom Lemon

Phone : (09) 427 0072
Email : catobolam@catobolam.co.nz

ENG60320183
SUB60313262
BUN60313812

CATO BOLAM CONSULTANTS
PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

PROJECT

Cabra Developments Ltd.
55 Barrett Road
Riverhead

DRAWING TITLE

As Built Cut Fill
Sheet 1 of 3

No.	REVISION (DESCRIPTIONS)	NAME	DATE
0	Issued for information	AA	19/11/18
1	Issued for completion	TL	6/12/18

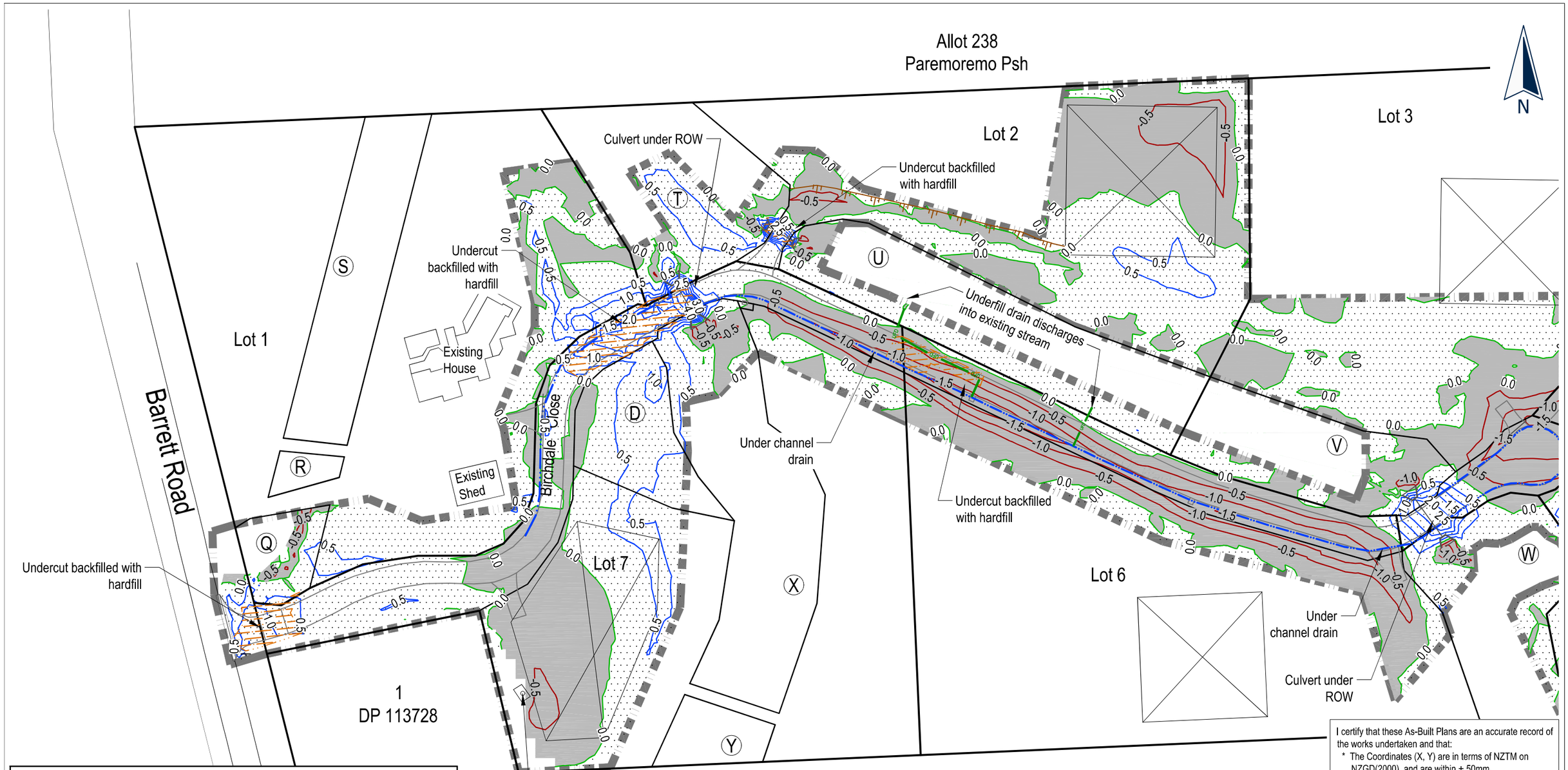
FOR COMPLETION

	NAME	DATE
SURVEYED	AA	14/11/18
DESIGNED	GW	18/12/17
DRAWN	AA	16/11/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
16/11/2018	1:1500	A3

DRAWING NO. 41069-DR-SU-9003

REVISION 1



Cut to Fill Legend

- Zero Contour
- Cut Contours & Area
- Fill Contours & Area
- Extent of Earthworks
- Covenant Areas
- Underfill drain & depth (150Ø highway grade perforated drain coils with SAP50 surround & geotextile cloth cover)
- Under channel drain (100Ø perforated drain coils with metal surround)
- Undercut
- Building Site

ENG60320183
SUB60313262
BUN60313812

NOTES
1. Levels are in terms of LINZ Datum 1946.
2. Coordinates are in terms of NZTM2000.
3. Cut/fill contours are from the original ground level, to finished ground level as suveyed on 14/11/2018.

I certify that these As-Built Plans are an accurate record of the works undertaken and that:
* The Coordinates (X, Y) are in terms of NZTM on NZGD(2000), and are within ± 50mm.
* The levels (Z) are in terms of the Auckland 1946 (MSL) LINZ datum (DOSLI datum), and are within ± 25mm.

Signed: .....
Registered Professional Surveyor

Date: 6/12/2018

Name: Tom Lemon

Phone : (09) 427 0072
Email : catobolam@catobolam.co.nz

CATO BOLAM CONSULTANTS
PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

PROJECT
Cabra Developments Ltd.
55 Barrett Road
Riverhead

DRAWING TITLE
As Built Cut Fill
Sheet 2 of 3

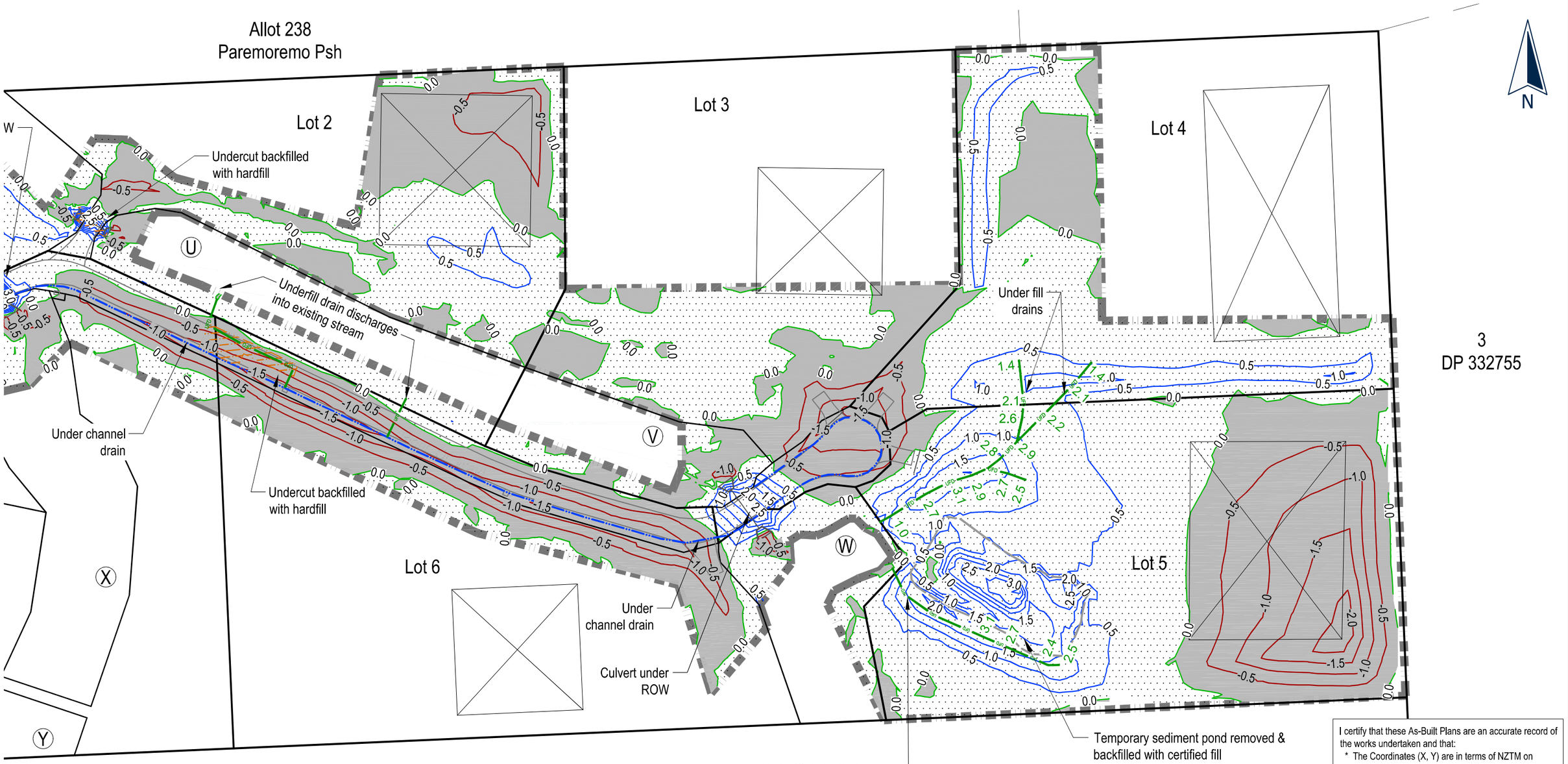
No.	REVISION (DESCRIPTIONS)	NAME	DATE
0	Issued for information	AA	19/11/18
1	Issued for completion	TL	6/12/18

FOR COMPLETION

	NAME	DATE
SURVEYED	AA	14/11/18
DESIGNED	GW	18/12/17
DRAWN	AA	16/11/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
16/11/2018	1:1000	A3

DRAWING NO. 41069-DR-SU-9004
REVISION 1



3
DP 332755

Pt 10
DP 2274

Cut to Fill Legend

- Zero Contour
- Cut Contours & Area
- Fill Contours & Area
- Extent of Earthworks
- Covenant Areas
- Underfill drain & depth *(150Ø highway grade perforated drain coils with SAP50 surround & geotextile cloth cover)*
- Under channel drain *(100Ø perforated drain coils with metal surround)*
- Undercut
- Building Site

ENG60320183
SUB60313262
BUN60313812

NOTES
1. Levels are in terms of LINZ Datum 1946.
2. Coordinates are in terms of NZTM2000.
3. Cut/fill contours are from the original ground level, to finished ground level as suveyed on 14/11/2018.

I certify that these As-Built Plans are an accurate record of the works undertaken and that:
* The Coordinates (X, Y) are in terms of NZTM on NZGD(2000), and are within ± 50mm.
* The levels (Z) are in terms of the Auckland 1946 (MSL) LINZ datum (DOSLI datum), and are within ± 25mm.

Signed: .....
Registered Professional Surveyor

Date: 6/12/2018

Name: Tom Lemon

Phone : (09) 427 0072
Email : catobolam@catobolam.co.nz

CATO BOLAM CONSULTANTS
PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

PROJECT
Cabra Developments Ltd.
55 Barrett Road
Riverhead

DRAWING TITLE
As Built Cut Fill
Sheet 3 of 3

No.	REVISION (DESCRIPTIONS)	NAME	DATE
0	Issued for information	AA	19/11/18
1	Issued for completion	TL	6/12/18

FOR COMPLETION

	NAME	DATE
SURVEYED	AA	14/11/18
DESIGNED	GW	18/12/17
DRAWN	AA	16/11/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
16/11/2018	1:1000	A3

DRAWING NO. 41069-DR-SU-9005
REVISION 1

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

* The Coordinates (X, Y) are in terms of NZTM on NZGD(2000), and are within ± 50mm.
* The levels (Z) are in terms of the Auckland 1946 (MSL) LINZ datum (DOSLI datum), and are within ± 10mm.

Signed: .....
Registered Professional Surveyor

Date: 10/12/2018

Name: Tom Lemon

Phone : (09) 427 0072
Email : catobolam@catobolam.co.nz

Vehicle crossing 150mm thick 20MPa broom finished concrete with 8kg/m³ black oxide on 150mm thick GAP65.

Stone Boxes 4m x 0.5m x 1.2m

200mm thick GAP65 Metal formed driveway with rip rap table drain

Lot 2

Vehicle crossings 150mm thick 20MPa broom finished concrete with 8kg/m³ black oxide on 150mm thick GAP65.

N

Stone Boxes on boundary 9m x 0.5m x 1.2m

Lot 1

3% crossfall

5.5m wide, 150mm depth 25MPa exposed aggregate concrete drive with 5kg/m³ black oxide & 1 layer of 665 mesh on 150mm depth compacted GAP65 sub base.
(Chainage 180-409m lime 7kg/m² & cement 7kg/m² stabilized subgrade 250mm depth).
(Chainage 130-340m one layer of Cirtex Geogrid Geotextile and one layer of non woven Geotextile filter fabric under Subase).

Lot 3

Lot 4

Power transformer

Birchdale Close

Right of Way

Lot 5

Cul-de-sac with 7.7m radius

Lot 6

Table drain captures stormwater from upper catchment

Stone Boxes on boundary 9m x 0.5m x 1.2m

200mm thick GAP65 Metal formed driveway with rip rap table drain

Vehicle crossings 150mm thick 20MPa broom finished concrete with 8kg/m³ black oxide on 150mm thick GAP65.

Refer to Diagram 1

1 DP 113728

Lot 7

Barrett Road

Pt 10 DP 2274

Diagram 1
Scale 1:500

Lot 1

5.5m wide, 150mm depth 25MPa exposed aggregate concrete drive with 5kg/m³ black oxide & 1 layer of 665 mesh on 150mm depth compacted GAP65 subbase.

Broom finished concrete with 5kg/m³ of black oxide

1.0m wide 40mm DG hotmix on emulsion coat on 150mm deep AP40 on 200mm GAP65

Vehicle crossing in accordance with ATCOP standard drawing GD020A-1B

100x100x40mm bluestone Paving on 150mm 25MPa concrete on 150mm of compacted GAP65 sub base.

Street sign 'Birchdale Close'

1 DP 113728

Roading As Built Legend

- Trees
- Planting
- Stormwater
- Cesspits (Semi recessed)
- Existing streams & drains
- Table drains
- Covenant area
- Exposed concrete ROW
- Concrete
- Rock Rip Rap
- Metal driveway
- Top of Bank / Bottom of Bank

ENG60320183
SUB60313262
BUN60313812

Notes:

General
All infrastructure is private unless otherwise shown.

Right of Way
5.5m - 6.0m wide, 150mm depth 25MPa exposed aggregate concrete drive with 5kg/m³ black oxide & 1 layer of 665 mesh on 150mm depth compacted GAP65 sub base.

Vehicle Crossing - Road
Vehicle Crossing in accordance with ATCOP standard drawing GD020A-1B. 150mm depth 25MPa broom finished concrete with 5kg/m³ of black oxide.
1.0m wide 40mm DG hotmix on emulsion coat on 150mm deep AP40 on 200mm GAP65.

Vehicle Crossings - Lot Access
150mm thick 20MPa broom finished concrete with 8kg/m³ black oxide on 150mm thick GAP65.

CATO BOLAM CONSULTANTS
PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

PROJECT
Cabra Developments Ltd.
55 Barrett Road
Riverhead

DRAWING TITLE
As Built Right of Way

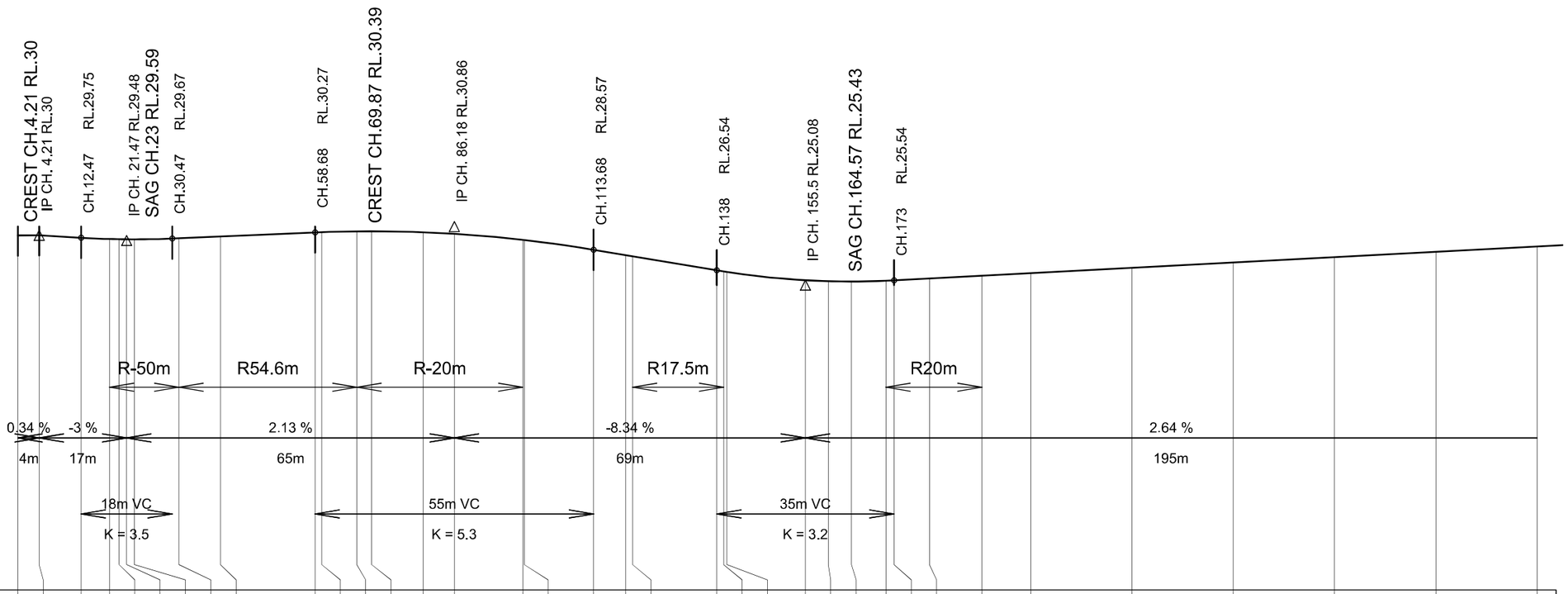
No.	REVISION (DESCRIPTIONS)	NAME	DATE
0	Issued for completion	TL	10/12/2018

FOR COMPLETION

	NAME	DATE
SURVEYED	AA	14/11/18
DESIGNED	GW	18/12/17
DRAWN	AA	7/12/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
7/12/2018	1:1000	A3

DRAWING NO. 41069-DR-SU-9100
REVISION 0



Finished Levels	29.98	30.00	29.75	29.63	29.60	29.60	29.59	29.70	29.87	30.27	30.30	30.38	30.39	30.29	30.14	29.54	29.53	28.57	28.04	27.92	26.54	26.43	26.38	25.56	25.46	25.43	25.50	25.54	25.73	26.00	26.26	26.78	27.31	27.84	28.37	28.90	
Chainage	0.00	4.21	12.47	18.08	20.00	21.47	23.00	31.78	40.00	58.68	60.00	66.95	69.87	80.00	86.18	99.71	100.00	113.68	120.00	121.37	138.00	139.36	140.00	155.50	160.00	164.57	171.40	173.00	180.00	190.38	200.00	220.00	240.00	260.00	280.00	300.00	

DRIVEWAY 1 - RS RD 01

Horizontal Scale 1 : 1000
Vertical Scale 1 : 500

ENG60320183
SUB60313262
BUN60313812

CATO BOLAM CONSULTANTS
PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

PROJECT

Cabra Developments Ltd.
55 Barrett Road
Riverhead

DRAWING TITLE

Right of Way As Built
Long Section
Sheet 1 of 2

No.	REVISION (DESCRIPTIONS)	NAME	DATE
0	Issued for completion	AA	10/12/18

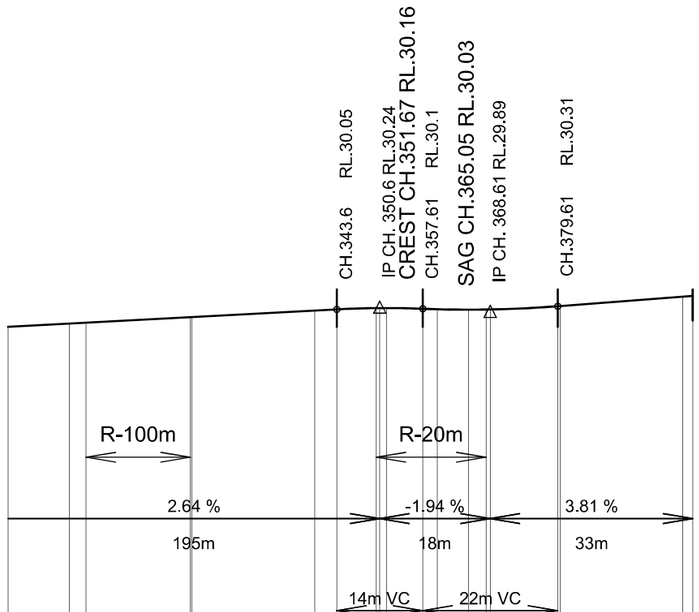
FOR COMPLETION

	NAME	DATE
SURVEYED	AA	14/11/18
DESIGNED	GW	18/12/17
DRAWN	AA	07/12/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
7/12/2018	1:1000	A3

DRAWING NO. 41069-DR-SU-9102

REVISION 0



Horizontal Curve Data

Vertical Geometry Grade (%)

Vertical Grade Length

Vertical Curve Length (m)

Vertical Curve Radius (m)

DATUM R.L. -2.00

Finished Levels	28.64	28.90	28.97	29.42	29.43	29.96	30.05	30.15	30.16	30.16	30.10	30.06	30.03	30.04	30.05	30.31	30.32	31.08	31.14
Chainage	290.00	300.00	302.71	319.71	320.00	340.00	343.60	350.02	350.60	351.67	357.61	360.00	365.05	367.93	368.61	379.61	380.00	400.00	401.62

DRIVEWAY 1 - RS RD 01

Horizontal Scale 1 : 1000

Vertical Scale 1 : 500

ENG60320183
SUB60313262
BUN60313812

CATO BOLAM CONSULTANTS

PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

PROJECT

Cabra Developments Ltd.
55 Barrett Road
Riverhead

DRAWING TITLE

Right of Way As Built
Long Section
Sheet 2 of 2

No.	REVISION (DESCRIPTIONS)	NAME	DATE
0	Issued for completion	AA	10/12/18

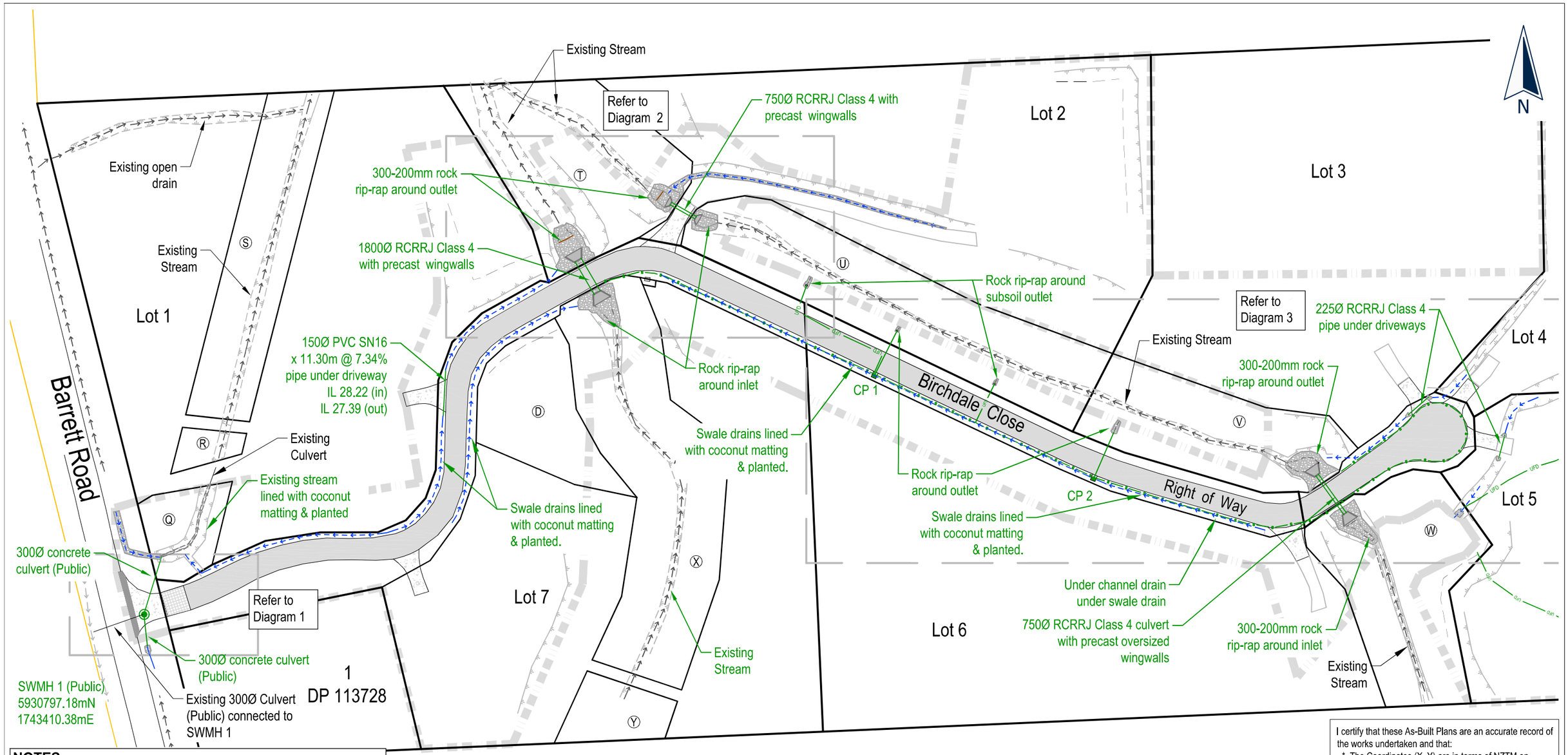
FOR COMPLETION

	NAME	DATE
SURVEYED	AA	14/11/18
DESIGNED	GW	18/12/17
DRAWN	AA	07/12/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
07/12/2018	1:1000	A3

DRAWING NO. 41069-DR-SU-9103

REVISION 0



NOTES

GENERAL

1. Levels are in terms of LINZ Datum 1946.
2. Coordinates are in terms of NZTM.
3. All infrastructure is private unless otherwise shown.

STORMWATER

1. All pipes are Class 4 reinforced concrete rubber ring jointed (RCRRJ), unless otherwise shown.
2. All manholes are 1050mmØ concrete flange base and riser, unless otherwise shown.
2. Bedding is H2 type unless otherwise stated.
3. All catchpits are 675mm x 450mm steel grate lids semi recessed unless otherwise shown.
4. All 150Ø pipes are uPVC SEH-C SN16.

Drainage Legend

Existing	New - As Constructed
Stormwater	Stormwater
Catchpit	Catchpit
Under Channel Drain (100Ø perforated drain coils with metal surround)	Under Channel Drain (100Ø perforated drain coils with metal surround)
Open Drain/Stream	Open Drain/Stream
Covenant Area (X)	Covenant Area (X)

Rock Rip Rap	
Top of Bank	
Bottom of Bank	
Extent of Earthworks	
Underfill Drains	(150Ø highway grade perforated drain coils with SAP50 surround & geotextile cloth cover)

Pt 10
DP 2274

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

* The Coordinates (X, Y) are in terms of NZTM on NZGD(2000), and are within ± 50mm.
* The levels (Z) are in terms of the Auckland 1946 (MSL) LINZ datum (DOSLI datum), and are within ± 10mm.

Signed: .....
Registered Professional Surveyor

Date: 7/12/2018

Name: Tom Lemon

Phone : (09) 427 0072
Email : catobolam@catobolam.co.nz

ENG60320183
SUB60313262
BUN60313812

CATO BOLAM CONSULTANTS
PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

PROJECT

Cabra Developments Ltd.
55 Barrett Road
Riverhead

DRAWING TITLE

As Built Stormwater
Sheet 1 of 2

No.	REVISION (DESCRIPTIONS)	NAME	DATE
0	Issued for completion	TL	7/12/2018

FOR COMPLETION

	NAME	DATE
SURVEYED	AA	14/11/18
DESIGNED	GW	18/12/17
DRAWN	AA	7/12/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
7/12/2018	1:1000	A3

DRAWING NO. 41069-DR-SU-9300

REVISION 0

Diagram 1
Scale 1:250

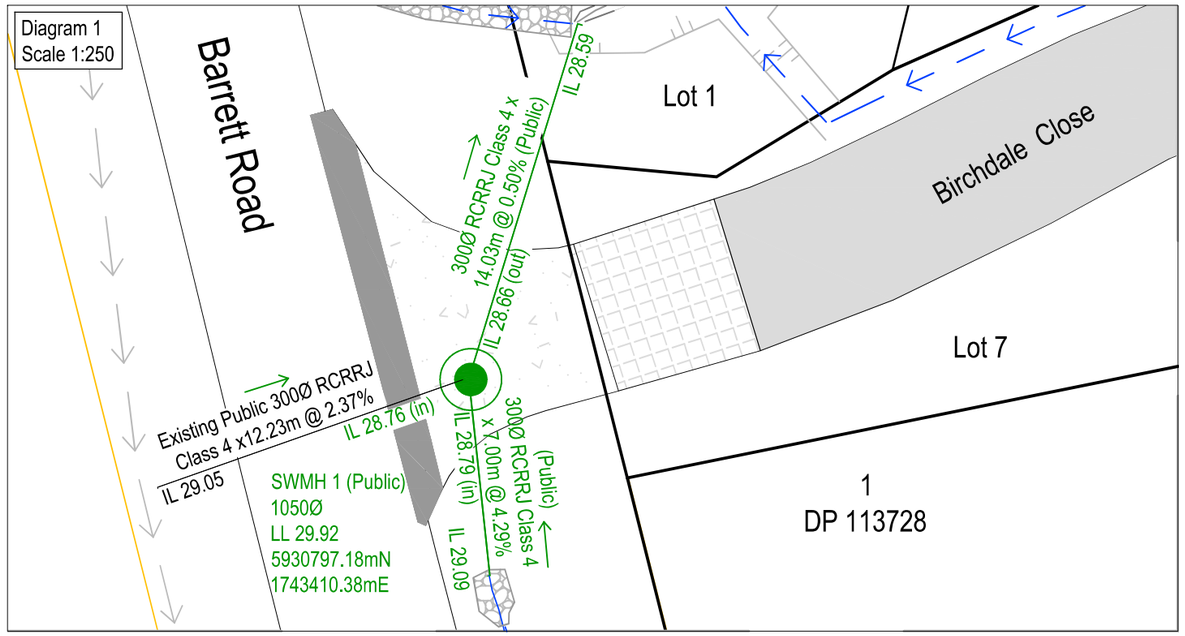


Diagram 2
Scale 1:500

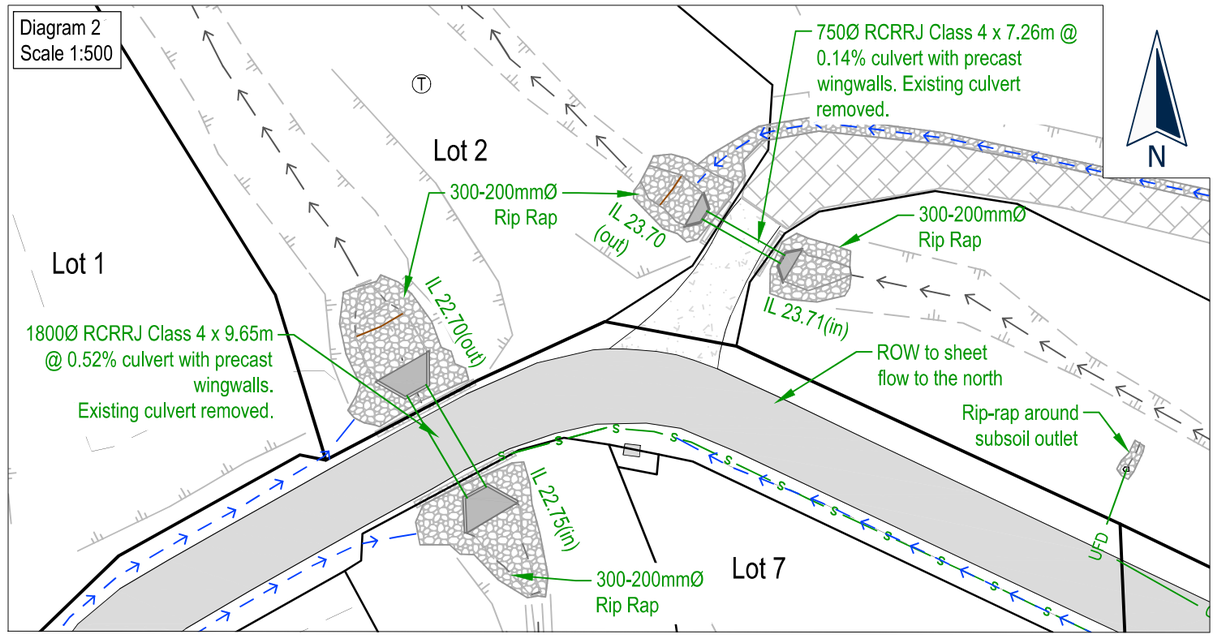
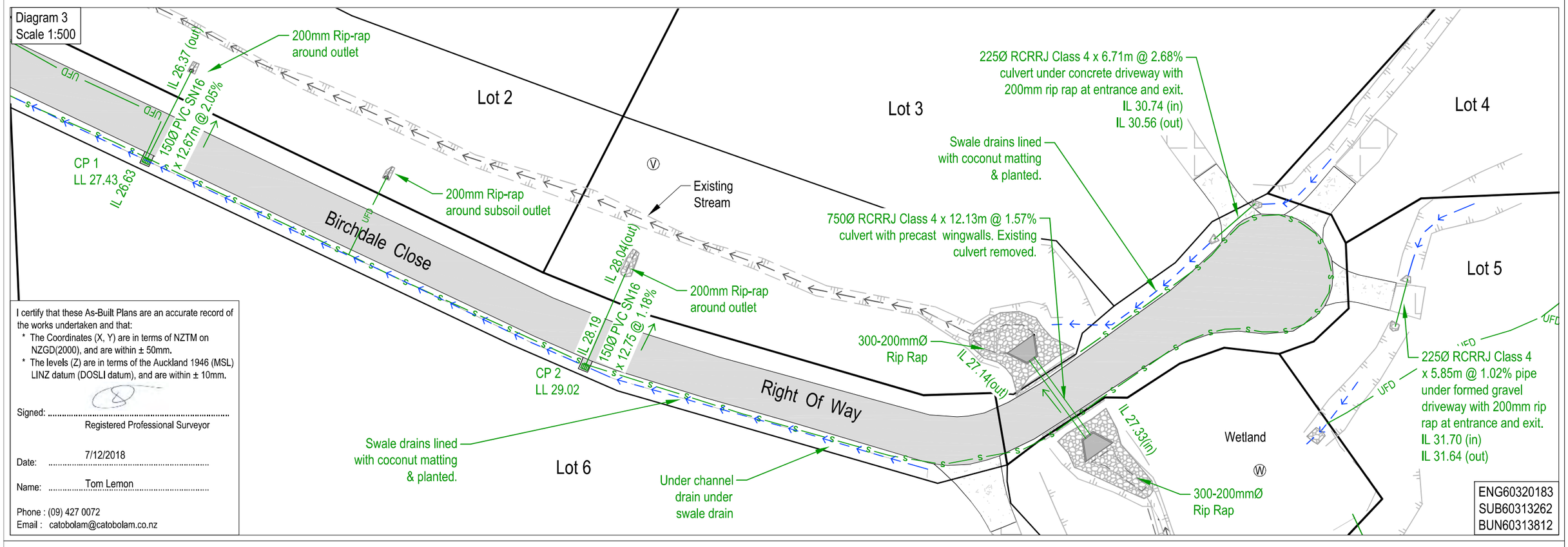


Diagram 3
Scale 1:500



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

* The Coordinates (X, Y) are in terms of NZTM on NZGD(2000), and are within ± 50mm.
* The levels (Z) are in terms of the Auckland 1946 (MSL) LINZ datum (DOSLI datum), and are within ± 10mm.

Signed: .....
Registered Professional Surveyor

Date: 7/12/2018

Name: Tom Lemon

Phone : (09) 427 0072
Email : catobolam@catobolam.co.nz

ENG60320183
SUB60313262
BUN60313812

CATO BOLAM CONSULTANTS
PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

See Sheet 9300 for notes and legend

PROJECT

Cabra Developments Ltd.
55 Barrett Road
Riverhead

DRAWING TITLE

As Built Stormwater
Sheet 2 of 2

No.	REVISION (DESCRIPTIONS)	NAME	DATE
0	Issued for completion	TL	7/12/2018

FOR COMPLETION

	NAME	DATE
SURVEYED	AA	14/11/18
DESIGNED	GW	18/12/17
DRAWN	AA	07/12/18

DATE	ORIGINAL SCALE	ORIGINAL SIZE
07/12/2018	As Shown	A3

DRAWING NO. 41069-DR-SU-9301

REVISION 0

Appendix C

Laboratory Test Data

ROADTEST LTD

Revision: 1

Report No: 17 0274 00
Page: 1 of 1

DETERMINATION OF THE LIQUID LIMIT & LINEAR SHRINKAGE
TEST METHOD NZS 4402 : 1986 TEST 2.2 & 2.6

Job:	**55 Barrett Road**		
Date of order:	30.10.17	Sample origin:	-
Sample method:	HA	Sample Description:	-
Sample By:	MC	Date:	20.10.17

Test Details :

Test performed on : Whole Sample
History : Natural

Sample No.	Location	Depth (m)	Liquid Limit	Linear Shrinkage	Natural Water Content (%)
634F	Lot 7	-	101	22	45.5
635F	Lot 4	-	52	15	32.8

Comments :

Tested By:	EC	Date :	3.11.17
Calculated By :	EC	Date :	6.11.17
Checked By :	EC	Date :	7.11.17

LF41 Rev.2 **Atterberg Lab Report**

Auckland Laboratory
CMW Geosciences (NZ) Ltd Partnership
Building C, 9 Piermark Drive, Rosedale, NZ 0632
PO Box 300206, Albany, Auckland, NZ 0752
Phone: +64 (09) 4144 632

Project:	Barrett Road
Project No:	AKL2017-0208
Material Description:	Silty CLAY
Report No:	AKL2017-0208LAD Rev.0
Report Date:	27/08/2018
Sample Date:	23/08/2018
Client:	Cabra Developments
Client Address:	
Client Reference:	

Test Methods:	Notes:	
NZS 4402.2.2:1986	Sample Method:	Hand Auger
NZS 4402.2.3:1986	Sample History:	Natural
NZS 4402.2.6:1986	Test Performed:	Whole
NZS 4407.4.2:2015		

Sample No.	Location	Depth (m)	Liquid Limit	Plastic Limit	Linear Shrinkage (%)	Natural Moisture Content (%)
AKL1808-003	Lot 6	0.4 - 0.8m	40	20	10	28.6

Created by:	JLM	Date: 27/08/2018
Checked by:	JLM	Date: 28/08/2018
Signed by:	Jack Mynott-Lee	Date: 28/8/2018

Appendix D

Field Test Data

CMW Geosciences

LF14 Rev.9 Dynamic Cone Penetration (DCP) Test Report

NZS 4402: Test 6.5.2: 1988

Report No:	AKL2017-0208LAA Rev.0
Project Name:	Barrett Road
Project Location:	Riverhead
Project Number:	AKL2017-0208
Test Date:	2/05/2018
Tested By:	MMC
Client:	Cabra Developments Limited
Client Address:	
Client Reference:	

Auckland Laboratory
CMW Geosciences (NZ) Ltd Partnership
Building C, 9 Piermark Drive, Rosedale, NZ 0632
PO Box 300206, Albany, Auckland, NZ 0752
Phone: +64 (09) 4144 632

Testing Locations Selected By: CMW Field Staff

IANZ ACCREDITED LABORATORY

Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Equivalent CBR Values are not accredited and are outside the scope of the laboratory's accreditation

Test No.	1		2		3		4		5	
Test Location	Right of way		Right of way		Right of way		Right of way		Right of way	
Chainage & Offset	CH90 R		CH80 L		CH70 R		CH60 L		CH50 R	
Material & Layer:	CLAY/SG (as per contractor)		CLAY/SG (as per contractor)		CLAY/SG (as per contractor)		CLAY/SG (as per contractor)		CLAY/SG (as per contractor)	
Depth (mm)	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100	1	2	1	2	1	2	2	4	2	4
100 - 200	2	4	1	2	2	4	1	2	2	4
200 - 300	2	4	2	4	2	4	1	2	2	4
300 - 400	2	4	2	4	2	4	2	4	3	6
400 - 500	2	4	4	8	4	8	2	4	2	4
500 - 600	3	6	5	10	2	4	2	4	2	4
600 - 700	3	6	5	10	3	6	3	6	2	4
700 - 800	4	8	7	15	3	6	3	6	3	6
800 - 900	4	8	6	13	3	6	3	6	3	6
900 - 1000										

Test No.										
Test Location										
Chainage & Offset										
Material & Layer:										
Depth	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100										
100 - 200										
200 - 300										
300 - 400										
400 - 500										
500 - 600										
600 - 700										
700 - 800										
800 - 900										
900 - 1000										

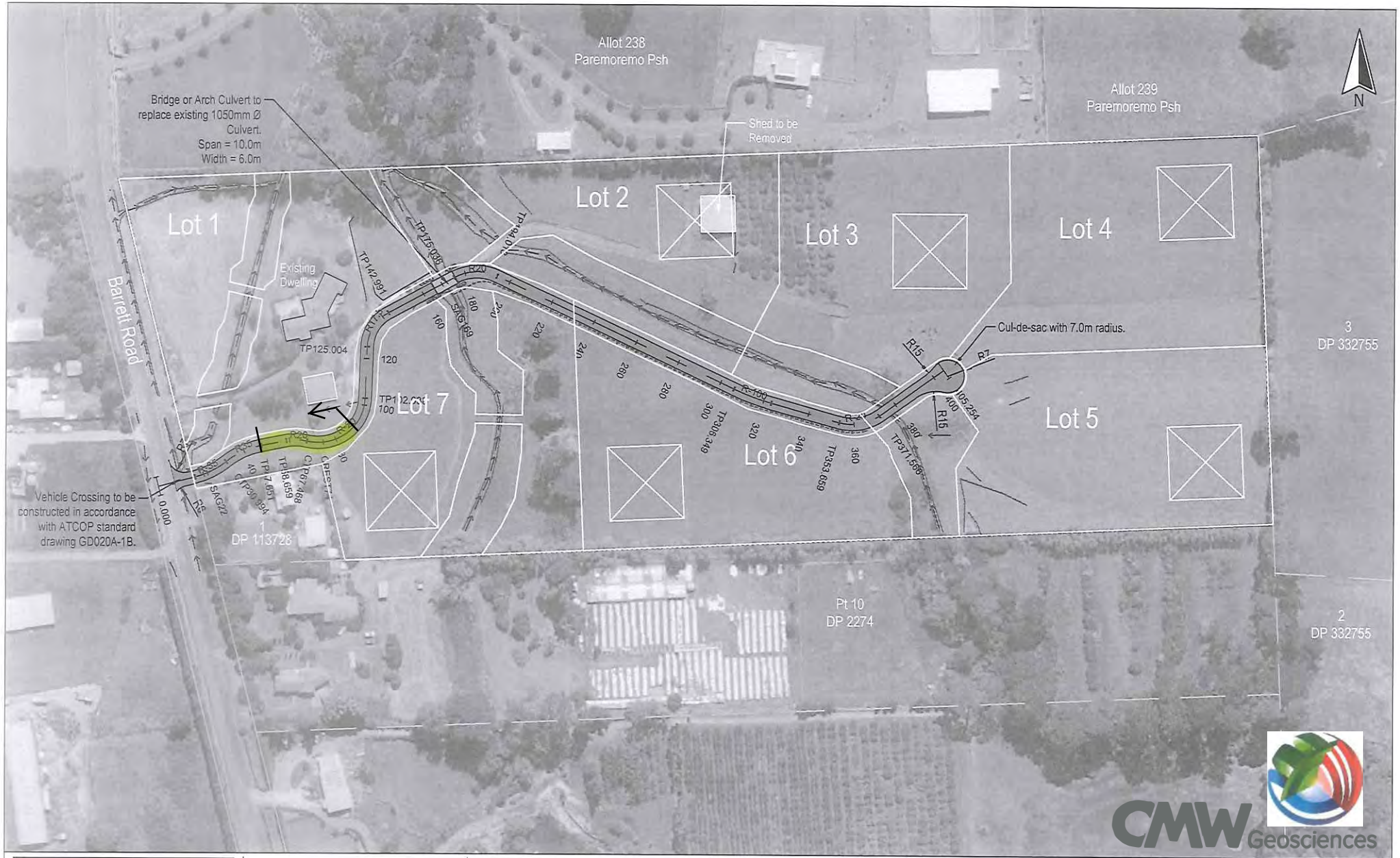
Prepared by: JLM Date: 2/05/2018

Checked by: JLM Date: 7/05/2018

Authorised Signatory: Date: 14/5/2018

This report should only be reproduced in full

*Equivalent CBR values calculated using AUSTROADS (2010) Guide to Pavement Technology Part 2, Figure 5.3, For Fine Grained Cohesive Soils, and are relevant to fine grained cohesive soils only.



CATO BOLAM CONSULTANTS
PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

PROJECT
Cabra Developments Ltd.
55 Barrett Road
Riverhead

DRAWING TITLE
Right of Way Layout Plan

No.	REVISION (DESCRIPTIONS)	NAME	DATE
A	Issued for Resource Consent	GW	20/12/17
B	Entrance Alignment Amended	GW	03/03/18

FOR RESOURCE CONSENT

		NAME	DATE
SURVEYED			
DESIGNED		GW	18/12/17
DRAWN		AA	18/12/17
DATE 18/12/17	ORIGINAL SCALE 1:1500	ORIGINAL SIZE A3	
DRAWING NO. 41069-DR-C-3000		REVISION B	

CMW Geosciences

LF11 Rev 6 Soil Field Density NDM Direct Transmission with VSS Report

Auckland Laboratory
CMW Geosciences (NZ) Ltd Partnership
Building C, 9 Piermark Drive, Rosedale, NZ 0632
PO Box 300206, Albany, Auckland, NZ 0752
Phone: +64 (09) 4144 632

Project:	Barret Road
Project No:	AKL2017-0208
Location:	Riverhead
Report No:	AKL2017-0208LAB Rev.0
Report Date:	23/11/2018
Client:	Cabra Developments Limited
Client Address:	
Client Reference:	

Test Methods:
NZS 4402.2.1:1986
NZS 4407.4.2.2:2015
NZGS:August 2001

Notes:
Solid Density: Assumed
Testing Locations Selected By: CMW Field Staff

IANZ ACCREDITED LABORATORY

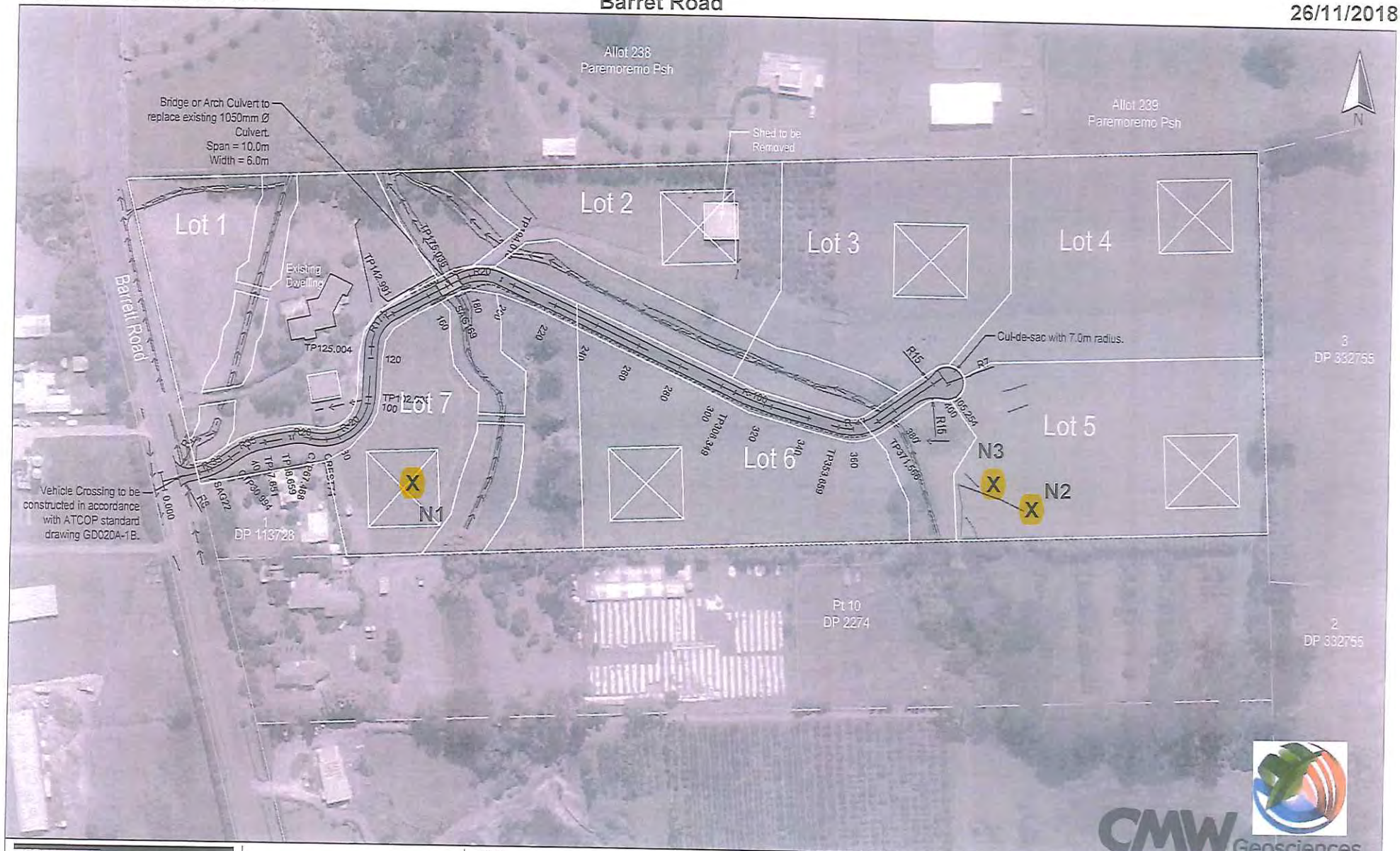
Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Measurements marked * are not accredited and are outside the scope of the laboratories accreditation

Date Sampled	Sample No.	Test Location *	Soil Description *	Vane ID		In-situ Vane Shear Strengths					Field and Laboratory Testing Data									Comments
				Head #	Blade # ①	Test 1 (kPa)	Test 2 (kPa)	Test 3 (kPa)	Test 4 (kPa)	Ave.	Gauge Wet Density (t/m^3) **	Gauge Dry Density (t/m^3)	Gauge Water Content (%)	Gauge Air Voids (%)	Gauge Probe Depth	Oven Water Content (%)	Solid Density (t/m^3) *	Oven Dry Density (t/m^3)	Calculated Air Voids (%) *	
7/05/2018	N1	Refer to site plan	CLAY	1620	1620	186+	UTP	133	147	155+	1.84	1.34	36.9	0.80	300	31.6	2.7	1.40	4.2	
3/10/2018	N2	Refer to site plan	CLAY	1620	1620	UTP	UTP	UTP	UTP	UTP	1.91	1.47	29.6	1.89	300	26.9	2.7	1.50	3.8	
	N3	Refer to site plan	CLAY	1620	1620	UTP	UTP	UTP	UTP	UTP	1.89	1.45	30.5	2.06	300	28.6	2.7	1.48	3.5	

** Gauge Wet Densities outside of the calibrated range of 1.728 to 2.756 t/m^3 are not accredited and are outside the laboratories scope of accreditation.

Created By: JLM Date: 7/05/2018
Checked By: JLM Date: 26/11/2018
Authorised Signatory: Jack Miguel Johnson Date: 26/11/2018



CATO BOLAM CONSULTANTS

PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

PROJECT

Cabra Developments Ltd.
55 Barrett Road
Riverhead

DRAWING TITLE

Right of Way Layout Plan

No.	REVISION / DESCRIPTION	NAME	DATE
A	Issued for Resource Consent	GW	20/12/17
B	Entrance Alignment Amended	GW	03/03/18

FOR RESOURCE CONSENT

	NAME	DATE
SURVEYED		
DESIGNED	GW	15/12/17
DRAWN	AA	15/12/17

DATE	ORIGINAL SCALE	ORIGINAL SIZE
18/12/17	1:1500	A3

DRAWING NO. 41069-DR-C-3000

REVISION B

CMW Geosciences

LF14 Rev.9 Dynamic Cone Penetration (DCP) Test Report

NZS 4402: Test 6.5.2: 1988

Report No:	AKL2017-0208LAC Rev.0
Project Name:	Barrett Road
Project Location:	Riverhead
Project Number:	AKL2017-0208
Test Date:	13/07/2018
Tested By:	JMJ/MMC
Client:	Cabra Developments
Client Address:	
Client Reference:	

Auckland Laboratory
CMW Geosciences (NZ) Ltd Partnership
Building C, 9 Piermark Drive, Rosedale, NZ 0632
PO Box 300206, Albany, Auckland, NZ 0752
Phone: +64 (09) 4144 632

Testing Locations Selected By: CMW Field Staff

IANZ ACCREDITED LABORATORY — Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Equivalent CBR Values are not accredited and are outside the scope of the laboratory's accreditation

Test No.	1		2		3		4		5	
Test Location	Right-of-way		Right-of-way		Right-of-way		Right-of-way		Right-of-way	
Chainage & Offset	CH180L		CH190R		CH200L		CH210R		CH220L	
Material & Layer:	LS CLAY/SG		LS CLAY/SG		LS CLAY/SG		LS CLAY/SG		LS CLAY/SG	
Depth (mm)	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100	5	10	5	10	5	10	6	13	0	0
100 - 200	5	10	4	8	4	8	3	6	1	2
200 - 300	3	6	3	6	4	8	4	8	0	0
300 - 400	2	4	2	4	5	10	4	8	1	2
400 - 500	2	4	2	4	3	6	4	8	0	0
500 - 600	2	4	2	4	5	10	3	6	1	2
600 - 700	2	4	2	4	2	4	2	4	0	0
700 - 800	2	4	2	4	2	4	2	4	2	4
800 - 900	2	4	2	4	2	4	2	4	2	4
900 - 1000										

Test No.	6		7		8		9		10	
Test Location	Right-of-way		Right-of-way		Right-of-way		Right-of-way		Right-of-way	
Chainage & Offset	CH230R		CH240L		CH250R		CH260L		CH270R	
Material & Layer:	LS CLAY/SG		LS CLAY/SG		LS CLAY/SG		LS CLAY/SG		LS CLAY/SG	
Depth	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100	2	4	1	2	3	6	4	8	2	4
100 - 200	2	4	1	2	4	8	3	6	2	4
200 - 300	2	4	2	4	2	4	3	6	1	2
300 - 400	2	4	2	4	2	4	3	6	2	4
400 - 500	2	4	1	2	4	8	4	8	1	2
500 - 600	2	4	2	4	2	4	5	10	2	4
600 - 700	2	4	2	4	3	6	3	6	1	2
700 - 800	2	4	2	4	3	6	3	6	1	2
800 - 900	2	4	2	4	2	4	4	8	2	4
900 - 1000										

Prepared by: JLM Date: 13/07/2018

Checked by: JLM Date: 13/07/2018

Authorised Signatory: Josh Mynett-Johnson Date: 16/07/2018

*Equivalent CBR values calculated using AUSTROADS (2010) Guide to Pavement Technology Part 2, Figure 5.3, For Fine Grained Cohesive Soils, and are relevant to fine grained cohesive soils only.

CMW Geosciences

LF14 Rev.9 Dynamic Cone Penetration (DCP) Test Report

NZS 4402: Test 6.5.2: 1988

Report No:	AKL2017-0208LAC Rev.0
Project Name:	Barrett Road
Project Location:	Riverhead
Project Number:	AKL2017-0208
Test Date:	13/07/2018
Tested By:	JMJ/MMC
Client:	Cabra Developments
Client Address:	
Client Reference:	

Auckland Laboratory
CMW Geosciences (NZ) Ltd Partnership
Building C, 9 Piermark Drive, Rosedale, NZ 0632
PO Box 300206, Albany, Auckland, NZ 0752
Phone: +64 (09) 4144 632

Testing Locations Selected By: CMW Field Staff

IANZ ACCREDITED LABORATORY — Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Equivalent CBR Values are not accredited and are outside the scope of the laboratory's accreditation

Test No.	11		12		13		14		15	
Test Location	Right-of-way		Right-of-way		Right-of-way		Right-of-way		Right-of-way	
Chainage & Offset	CH280L		CH290R		CH300L		CH310R		CH320L	
Material & Layer:	LS CLAY/SG		LS CLAY/SG		LS CLAY/SG		LS CLAY/SG		LS CLAY/SG	
Depth (mm)	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100	4	8	4	8	4	8	2	4	1	2
100 - 200	3	6	3	6	2	4	2	4	1	2
200 - 300	2	4	1	2	2	4	2	4	2	4
300 - 400	2	4	1	2	2	4	1	2	2	4
400 - 500	3	6	1	2	2	4	2	4	2	4
500 - 600	2	4	1	2	2	4	2	4	2	4
600 - 700	2	4	2	4	2	4	2	4	3	6
700 - 800	2	4	2	4	2	4	2	4	3	6
800 - 900	2	4	2	4	2	4	2	4	3	6
900 - 1000										

Test No.	16		17		18		19		20	
Test Location	Right-of-way		Right-of-way		Right-of-way		Right-of-way		Right-of-way	
Chainage & Offset	CH330R		CH340L		CH350R		CH360L		CH370R	
Material & Layer:	LS CLAY/SG		LS CLAY/SG		LS CLAY/SG		LS CLAY/SG		LS CLAY/SG	
Depth	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100	4	8	5	10	5	10	5	10	6	13
100 - 200	3	6	3	6	9	20	4	8	7	15
200 - 300	2	4	2	4	7	15	4	8	6	13
300 - 400	3	6	2	4	2	4	5	10	3	6
400 - 500	2	4	2	4	3	6	6	13	1	2
500 - 600	2	4	3	6	2	4	13	20+	1	2
600 - 700	3	6	3	6	2	4			0	0
700 - 800	3	6	3	6	2	4			1	2
800 - 900	2	4	3	6	2	4			2	4
900 - 1000										

Prepared by: JLM Date: 13/07/2018

Checked by: JLM Date: 13/07/2018

Authorised Signatory: Joeli Myrtl-Johnson Date: 16/07/2018

*Equivalent CBR values calculated using AUSTROADS (2010) Guide to Pavement Technology Part 2, Figure 5.3, For Fine Grained Cohesive Soils, and are relevant to fine grained cohesive soils only.

LF14 Rev.9 Dynamic Cone Penetration (DCP) Test Report

NZS 4402: Test 6.5.2: 1988

Report No:	AKL2017-0208LAC Rev.0
Project Name:	Barrett Road
Project Location:	Riverhead
Project Number:	AKL2017-0208
Test Date:	13/07/2018
Tested By:	JMJ/MMC
Client:	Cabra Developments
Client Address:	
Client Reference:	

Auckland Laboratory
CMW Geosciences (NZ) Ltd Partnership
Building C, 9 Piermark Drive, Rosedale, NZ 0632
PO Box 300206, Albany, Auckland, NZ 0752
Phone: +64 (09) 4144 632

Testing Locations Selected By: CMW Field Staff

IANZ ACCREDITED LABORATORY — Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Equivalent CBR Values are not accredited and are outside the scope of the laboratory's accreditation

Test No.	21		22		23					
Test Location	Right-of-way		Right-of-way		Right-of-way					
Chainage & Offset	CH380L		CH290R		CH300L					
Material & Layer:	LS CLAY/SG		LS CLAY/SG		LS CLAY/SG					
Depth (mm)	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100	4	8	3	6	4	8				
100 - 200	3	6	3	6	2	4				
200 - 300	3	6	3	6	3	6				
300 - 400	2	4	3	6	1	2				
400 - 500	2	4	3	6	1	2				
500 - 600	1	2	3	6	2	4				
600 - 700	2	4	3	6	2	4				
700 - 800	2	4	3	6	2	4				
800 - 900	2	4	3	6	4	8				
900 - 1000										

Test No.										
Test Location										
Chainage & Offset										
Material & Layer:										
Depth	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*	Blow Count	Equiv CBR*
0 - 100										
100 - 200										
200 - 300										
300 - 400										
400 - 500										
500 - 600										
600 - 700										
700 - 800										
800 - 900										
900 - 1000										

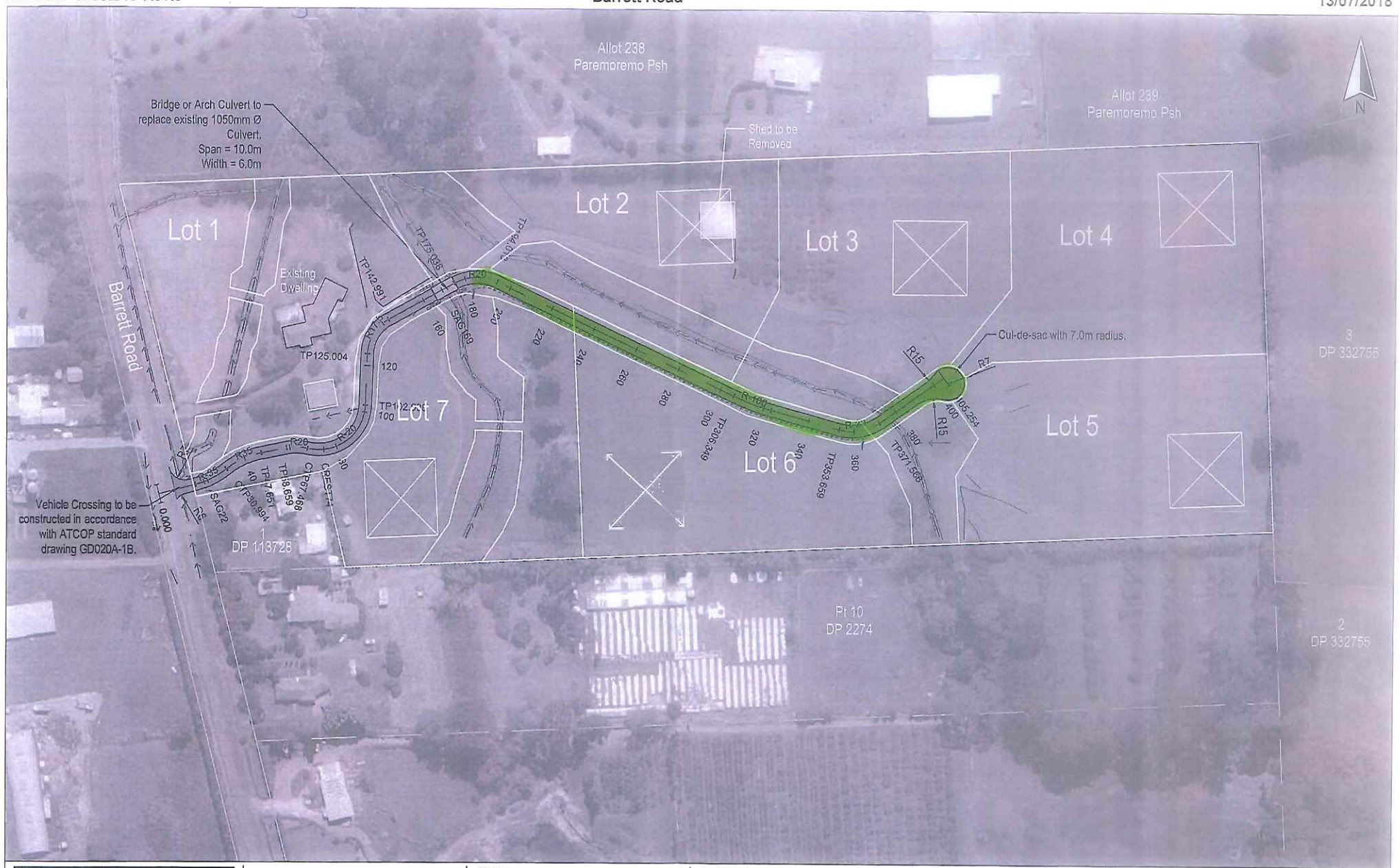
Prepared by: JLM Date: 13/07/2018

Checked by: JLM Date: 13/07/2018

Authorised Signatory: Date: 16/07/2018

This report should only be reproduced in full

*Equivalent CBR values calculated using AUSTROADS (2010) Guide to Pavement Technology Part 2, Figure 5.3, For Fine Grained Cohesive Soils, and are relevant to fine grained cohesive soils only.



CATO BOLAM CONSULTANTS
PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

CMW Geosciences

PROJECT
Cabra Developments Ltd.
55 Barrett Road
Riverhead

DRAWING TITLE
Right of Way Layout Plan

No.	REVISION/DESCRIPTION(S)	NAME	DATE
A	Issued for Resource Consent	GW	20/12/17
B	Entrance Alignment Amended	GW	03/03/18

FOR RESOURCE CONSENT

	NAME	DATE
SURVEYED		
DESIGNED	GW	18/12/17
DRAWN	AA	18/12/17

DATE 18/12/17 | ORIGINAL SCALE 1:1500 | ORIGINAL SIZE A3

DRAWING NO. 41069-DR-C-3000 | REVISION B

LF11 Rev.8 Soil Field Density NDM Direct Transmission with VSS Report (Cohesive Soils)

Auckland Laboratory
CMW Geosciences (NZ) Ltd Partnership
Building C, 9 Piermark Drive, Rosedale, NZ 0632
PO Box 300206, Albany, Auckland, NZ 0752
Phone: +64 (09) 4144 632

Project:	Barret Road
Project No:	AKL2017-0208
Location:	Riverhead
Report No:	AKL2017-0208LAE Rev.0
Report Date:	23/11/2018
Client:	Cabra Developments Limited
Client Address:	
Client Reference:	

Test Methods:
NZS 4402.2.1:1986
NZS 4407.4.2.2:2015
NZGS:August 2001

Notes:
Solid Density: Assumed
Testing Locations Selected By: CMW Field Staff
① Blade size of 19mm used.

IANZ ACCREDITED LABORATORY

Tests indicated as not accredited are outside the scope of the laboratory's accreditation

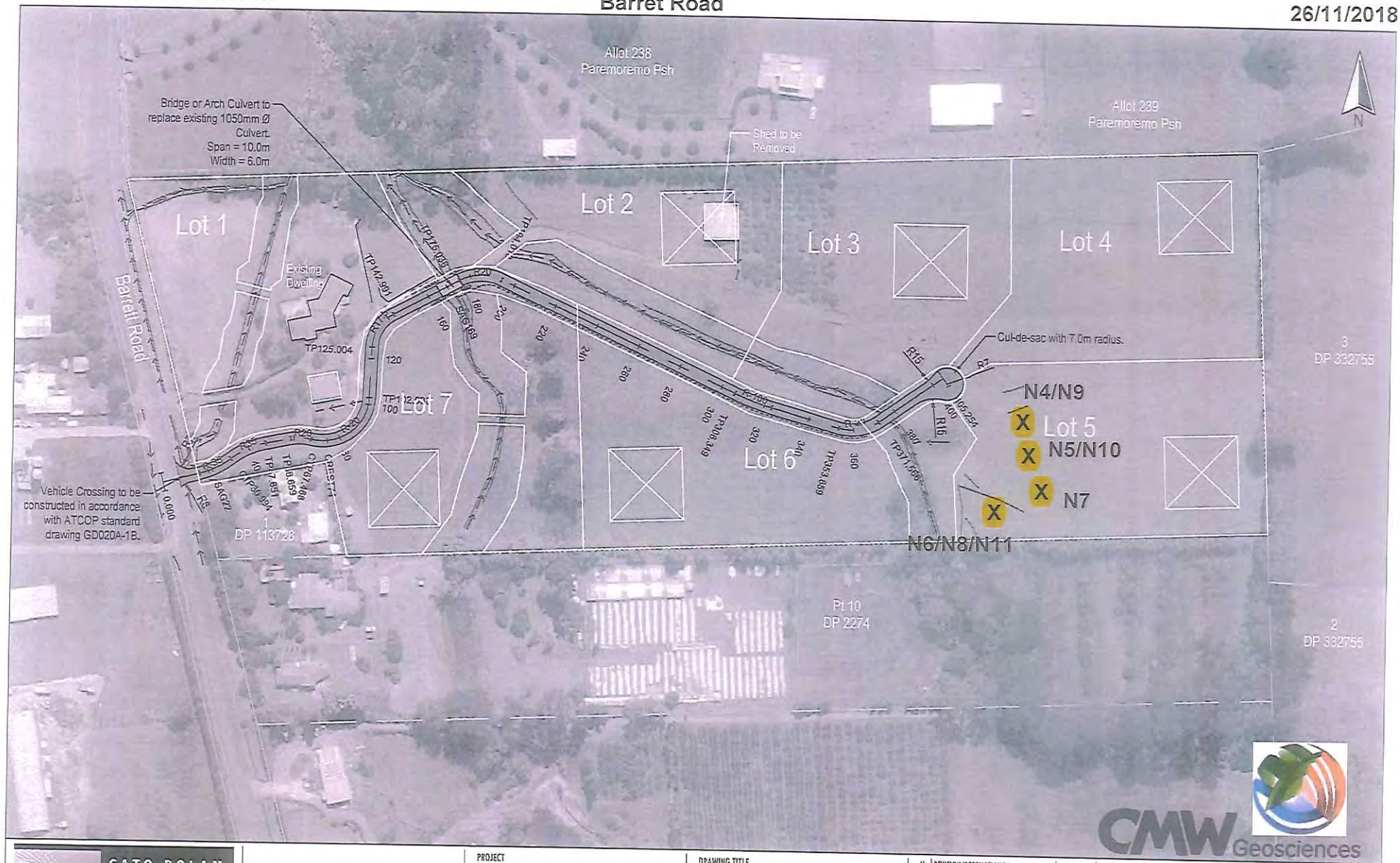
Measurements marked * are not accredited and are outside the scope of the laboratories accreditation

Date Sampled	Sample No.	Test Location*	Soil Description*	Vane ID		In-situ Vane Shear Strengths					Field and Laboratory Testing Data									Comments
				Head #	Blade # ①	Test 1 (kPa)	Test 2 (kPa)	Test 3 (kPa)	Test 4 (kPa)	Ave.	Gauge Wet Density (t/m^3) **	Gauge Dry Density (t/m^3)	Gauge Water Content (%)	Gauge Air Voids (%)	Gauge Probe Depth	Oven Water Content (%)	Solid Density (t/m^3) *	Oven Dry Density (t/m^3)	Calculated Air Voids (%) *	
9/10/2018	N4	Refer to site plan	CLAY	1620	1620	UTP	147	141	186+	158+	1.97	1.66	22.2	4.37	300	20.9	2.7	1.64	5.6	
	N5	Refer to site plan	CLAY	1620	1620	160	155	139	173	157	1.90	1.51	26.0	4.65	300	24.4	2.7	1.54	6.0	
	N6	Refer to site plan	CLAY	1620	1620	160	133	147	168	152	1.87	1.44	29.3	3.82	300	29.3	2.7	1.44	4.3	
10/10/2018	N7	Refer to site plan	CLAY	1589	1589	139	126	117	111	123	1.69	1.19	40.4	7.04	300					No Sample Taken
	N8	Refer to site plan	CLAY	1589	1589	123	120	139	123	126	1.81	1.31	38.9	0.72	300					No Sample Taken
16/10/2018	N9	Refer to site plan	CLAY	1589	1589	UTP	169	148	154	157+	1.78	1.30	36.3	4.27	300	41.3	2.7	1.26	1.4	Retest of N7
	N10	Refer to site plan	CLAY	1589	1589	139	154	UTP	UTP	147+	1.78	1.25	43.2	0.80	300	38.8	2.7	1.28	2.5	Retest of N8
	N11	Refer to site plan	CLAY	1589	1589	157	UTP	139	164	153+	1.78	1.28	38.9	2.38	300	43.1	2.7	1.24	0.1	

** Gauge Wet Densities outside of the calibrated range of 1.728 to 2.756 t/m^3 are not accredited and are outside the laboratories scope of accreditation.

Created By: JLM Date: 8/10/2018
Checked By: JLM Date: 26/11/2018
Authorised Signatory: Date: 26/11/2018

Barret Road



CATO BOLAM CONSULTANTS
PLANNERS | SURVEYORS | ENGINEERS | ENVIRONMENTAL

PROJECT
Cabra Developments Ltd.
55 Barrett Road
Riverhead

DRAWING TITLE
Right of Way Layout Plan

No.	REVISION/DESCRIPTIONS	NAME	DATE
A	Issued for Resource Consent	GW	20/12/17
B	Entrance Alignment Amended	GW	03/02/18

FOR RESOURCE CONSENT

	NAME	DATE
SURVEYED		
DESIGNED	GW	18/12/17
DRAWN	AA	18/12/17

DATE	ORIGINAL SCALE	ORIGINAL SIZE
18/12/17	1:1500	A3

DRAWING NO. 41069-DR-C-3000 REVISION B

CMW Geosciences