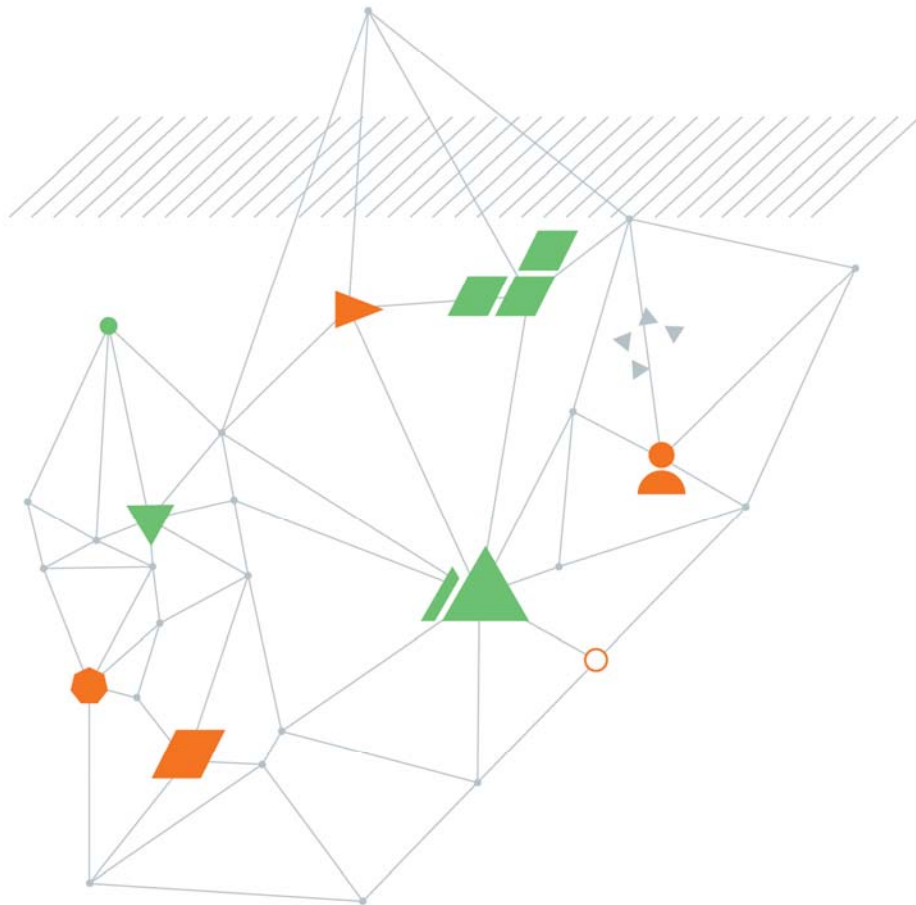


Real
potential
is uncovered
only when
you scratch
beneath
the surface



Progeni Ltd

**Geotechnical Report for Subdivision
Suitability**

68 Exploration Way, Whitby

GENZWELL16067AA-AA

3/12/2013



3/12/2013

Progeni Limited
68 Exploration Way
Whitby
Wellington

Attention: David Harpham

Dear David,

RE: Geotechnical Report for Subdivision Suitability for 68 Exploration Way, Whitby

This report presents the results of a subdivision suitability assessment on the above site in accordance with Coffey Geotechnics (NZ) Limited Short Form Agreement dated 11 November 2013. It has been prepared for Progeni Limited in accordance with their instructions.

If you have any queries or you require any further clarification on any aspects of this report, please do not hesitate to contact the undersigned.

For and on behalf of Coffey Geotechnics (NZ) Ltd

Yours sincerely

Coffey Geotechnics (NZ) Ltd

A handwritten signature in black ink, appearing to read "Nicholas Clendon". The signature is fluid and cursive, with the first name "Nicholas" and last name "Clendon" clearly distinguishable.

Nicholas Clendon

Engineering Geologist

Distribution: Electronic Copy for Progeni Ltd
Original held by Coffey Geotechnics (NZ) Limited

DOCUMENT CONTROL

For and on behalf of Coffey Geotechnics (NZ) Limited			
Action	Name	Signature	Date
Prepared:	Sarah Martin		29-12-2013
Checked:	Nicholas Clendon		29-12-2013
Reviewed & Authorised:	Kah-Weng Ho		29-12-2013

Revision History

Revision No.	Date	Description	Prepared	Authorised
1	29-12-2013	Draft	Sarah Martin	Kah-Weng Ho
2	29-12-2013	Draft	Nicholas Clendon	Kah-Weng Ho
3	3-12-2013	Final	Nicholas Clendon	Kah-Weng Ho

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Appendix A – Received Drawings

Appendix B – Figures Figure 1 – Site Location Plan

Figure 2 – Earthquake Risk Maps

Figure 3 – Identified Seismic Hazard

Appendix C - Photofile

1 INTRODUCTION

1.1 Project Brief

In November 2013 Coffey Geotechnics (NZ) Limited was commissioned by David Harpham on behalf of Progeni Limited to undertake a geotechnical assessment at 68 Exploration Way, Whitby for the purposes of assessing the suitability of the site for proposed subdivision to support a resource consent application.

This report presents the results of a Geotechnical Site Assessment as outlined in Coffey Geotechnics Short Form Agreement dated 11 November 2013.

We have received the following drawings from the client with respect to the proposed development:

- Scheme plan (drawing number 20131028 Rev A).
- Overall road layout (drawing number 20131028.2 Rev A).
- Sewer layout (drawing number 20131028.3 Rev A).
- Water reticulation layout (drawing number 20131028.4 Rev A).
- Contours and cuts and fills (drawing number 20131028.5 Rev A).
- Proposed vegetation protection areas (drawing number 20131028.10 Rev A).

These are included in Appendix A.

1.2 Objectives

The objectives of this report were to determine the likely subsurface conditions beneath the site in respect of:

- Suitability of the site for subdivision.
- Appropriateness of building sites.
- General earthworks cut and fill requirements.
- Identification and assessment of existing fill areas.
- Concept retaining wall design at two locations.
- Assessment of the suitability of the water reservoir location.
- Design of the new crossing over the Greater Wellington Regional Council water pipeline.

2 THE SITE

2.1 Site Description

The site is at the end of Exploration Way in the south end of Whitby, Porirua. The site comprises of land on 61 and 68 Exploration Way. A map of the site location and the received drawings are included in Appendix A and B. The following should be read in conjunction with these Appendices.

The site is semi-rural with farmland to the south and Duck Creek to the east. North of the site are the residential dwellings of Exploration Way and to the west are residential dwellings on large sections

similar to this site. This site is hilly and generally slopes down towards Exploration Way. There are a series of spurs and valleys with slope angles generally $\sim 20^\circ$ and ranging from flat to $\sim 42^\circ$. The site is currently predominately vegetated with scrub and trees as well as some grassed areas.

There is currently one residential property (68 Exploration Way) on the site accessed up a long driveway off Exploration Way. There are stables to the south of the existing house and a horse training area to the north. There are a number of four-wheel drive tracks across the site. A Greater Wellington Regional Council (GWRC) water pipeline and easement runs through the north east of the property. Individual lot descriptions for the proposed subdivision are presented in Table 1 below. Refer to Appendix B for lot locations.

Table 1 – Lot Descriptions

Lot	Description
1	Adjacent to Exploration Way and on the eastern side of the driveway with tree and scrub cover. The east of the lot is a spur which slopes to the north $\sim 20^\circ$ and at the west the lot slopes down 35° to a gully. This gully appears to be a natural drainage path for secondary flow.
2	Adjacent to and south of Lot 1. The eastern side is a continuation of the spur, grassed and sloping to the north $\sim 10^\circ$. The lot slopes down 28° to the west into the gully as described above.
3	Predominately a continuation of the grassed spur sloping down $<5^\circ$ to 20° to the north, at the south east corner is the head of the gully and the north west corner is another densely vegetated gully.
4	On the western side of the existing driveway. The GWRC easement and an existing four-wheel drive track cross the east of the lot. The lot slopes down to the north and west at 10° to 30° . An area of fill is evident in the north west corner and appears very loose to loose, likely dumped from pipeline construction, it is slumping and creeping.
5	Adjacent to and west of Lot 4. This is a flat area currently used as a horse training area. This is an area of cut and fill with the cut at the south and east end of the lot and fill at the north and west side.
6	South of and elevated above Lot 5. An area of patchy scrub with a spur in the middle of the lot sloping down to the west at 5° to 20° . To the south and north east the lot slopes down to gullies at 20° to 35° degrees.
7	South west of Lot 6 and a continuation of the spur and valley morphology. Predominately a spur, vegetated with trees, which slopes down to the north west at 15° to 20° . To the north east and south west slopes down to densely vegetated gullies at 15° to 25° .
8	Existing dwelling for 68 Exploration Way. The house is located on near level ground likely created through a cut and fill platform. Beyond the house the land dips moderately steeply

Lot	Description
	to the northwest.
9	This lot is at the south east of the site. The GWRC water pipeline crosses through the north end of this lot. The lot slopes down to the north ~12° and to the east 15° to 40°, becoming steeper to the east. An existing logging track runs south through this lot.

2.2 Geology

The geology of the site is shown on the 1:50,000 scale Geology of the Wellington Area, 1996. The map indicates the site is underlain by Wellington Belt Greywacke.

Outcrops at the site typically comprised residually weathered greywacke (silt some clay, brown orange).

2.3 Existing Site Information

From the Porirua City Council (PCC) District Plan, the site is identified within a Seismic Hazard Zone. A copy of this is included in Appendix C.

From the GWRC website hazard map, the following risks have been identified:

Table 2: Risks Identified

Earthquake Ground Shaking	Low
Earthquake Liquefaction	None
Earthquake Induced Slope Failure	Low at the northern end of the site. Low to moderate for the majority of the site. Moderate at the south eastern corner.
Combined Earthquake Hazard	Low to moderate at the northern end of the site. Moderate for the majority of the site. High at the south eastern corner.

The site has not been identified on the Selected Land Use Register by the Greater Wellington Regional Council.

From the GNS Database – Active Faults, the nearest fault is the Moonshine Fault ~ 1.5 km to the southeast. The Wellington Fault is approximately 7.3 km to the southeast.

3 PRELIMINARY GEOTECHNICAL ASSESSMENT

3.1 General

From the information gathered during the site walkover and from existing available information, a preliminary geotechnical assessment has been carried out. The geotechnical assessment provides general guidelines.

3.2 Suitability of the site for subdivision

The site is generally suitable for the proposed subdivision as detailed in the plans we have received, subject to the recommendations listed below and the additional work required outlined in Section 3.4.

The lots as identified in the supplied plans are suitable for residential dwellings. The indicative building sites on the plans are generally located in low risk areas on gently sloping ground on or near the tops of spurs. Higher risk areas such as steep gullies have been identified as zones for native vegetation.

3.3 Preliminary Slope Hazard Line

The hazard maps from the GWRC GIS database shows the eastern portion of the site is classified as a high seismic combined hazard, while the PCC District Plan has the whole site identified as a Seismic Hazard Zone. From the available information it is clear that the seismic hazard identified relates to the steep slopes on the eastern portion of the site. The majority of the site is gentle to moderately sloping and considered of low risk.

To clarify the expected area of High Seismic Hazard the boundary has been extrapolated from the GWRC GIS maps and along with site observations and local topography a preliminary assessment has been made and a "Preliminary Slope Hazard Line" developed. The line has been delineated onto Figure 3 – Slope Hazard Area and overlaid on the Water Reticulation Layout (drawing number 20131028.4 Rev A). It should be noted that this line is not based on a detailed slope stability assessment and that further investigation & assessment would likely further refine the location of the Slope Hazard Line.

As a precaution due to the preliminary nature of the Slope Hazard Line, works that modify the ground conditions (loading from areas of fill) or modify drainage paths (roads/access tracks) should be reviewed with respect to their potential impact on the slope below. The following distances from the Slope Hazard Line are recommended to initiate a review:

- Any proposed building platforms should be placed a minimum of 15m
- Access tracks or low risk structures (such as water mains) should be placed a minimum of 10m.

Where works are to be carried out within the Slope Hazard Area then a detailed assessment will be required by a suitable qualified geotechnical engineer or engineering geologist.

It should be noted that the hazard comes from loss of support to structures and not from inundation as all of the development is above the Slope Hazard Line.

3.4 Earthworks

The material on site is residually weathered to completely weathered greywacke (grade V and VI) and is generally suitable for fill. Earthworks are to be carried out as specified in NZS4431:1989, NZS4404:2010 and the PCC Code for Land Development and Subdivision Engineering and comply with the following conditions:

- Cut batters less than 6 metres high are to be at a maximum angle of 1 vertical to 1.5 horizontal as specified in the PCC Code of Land Development and Subdivision Engineering.
- The upper 1 metre of cuts to be rounded off.
- Fills to be at a maximum angle 1 vertical to 2 horizontal as specified in the PCC Code of Land Development and Subdivision Engineering C2.12.1.
- The material is to be placed and compacted in lifts of no greater than 230mm.
- Earthworks to be supervised by a suitably qualified geotechnical professional.

Any earthworks outside the above criteria will require specific engineering design.

3.5 Items requiring Specific Engineering Design

3.5.1 Water Reservoir

A water reservoir comprising three tanks with 30m³ of storage is proposed at the south of the site near the top of a spur. These tanks are proposed to be set in a hollow two metres below the original ground level. The foundations for these tanks should be reviewed and designed at the civil works design stage.

The associated pipeline running from the reservoir to the GWRC pipeline runs through an area within the 10m zone from the Preliminary Slope Hazard Line. It is recommended that one of the two following options is undertaken:

1. The pipeline be shifted so it lies outside the recommended 10m zone
2. The access track running along the pipeline route is constructed only in 'cut' where it passes within 10m of the Slope Hazard Line (no fill placed within the 10m). Storm/surface water collected by the track is taken down the access track and placed into the site storm water system.

We recommend the use of non-return valves where possible to reduce water flow in the case of a pipe break.

3.5.2 Entrance Ramp Retaining Structure

A retaining structure 1 metre high is proposed at the north end of the site at the entrance to the proposed subdivision. This structure will support the western right of way. This will require specific engineering design at the civil works design stage due to the surcharge from the western right of way. It is anticipated that there will not be any stability issues at this site due to the level nature of the site.

3.5.3 Gully Crossing Retaining Structure

A retaining structure 2 metres high is proposed to support the western right of way to cross a gully south of Lot 5. The gully crossing will require specific design at the civil works stage.

This retaining structure will require specific engineering design due to surcharge by the right of way and under drainage will be required. Intercepting and diverting the secondary flow or installing a culvert may be required.

3.5.4 Pipeline Crossing

There are two locations where driveways are proposed to cross the GWRC water pipeline easement. These are the proposed driveways for Lots 4 and 9.

These will require specific engineering design to comply with the GWRC requirements.

3.5.5 Existing Fill

There are some areas of existing fill on the site in Lots 4, 5 and adjacent to Lot 9. At Lot 4, the fill is very loose to loose silt that is currently at a 28° to 42° slope and appears to be creeping and slumping. This will need to be excavated and re-compacted / replaced prior to lot development (site construction) as it is currently unstable.

The fill at Lot 5 (horse training area) is classified as uncertified fill and could either be investigated and its quality assessed or specific design for the foundations could be completed.

4 CONCLUSIONS

The following conclusions have been made:

- The development is considered low risk and low impact.
- The site is considered suitable for subdivision based on the enclosed drawings.

5 LIMITATIONS

This report has been prepared solely for the use of our client, Progeni Limited their professional advisers and the relevant Territorial Authorities in relation to the specific project described herein. No liability is accepted in respect of its use for any other purpose or by any other person or entity. All future owners of this property should seek professional geotechnical advice to satisfy themselves as to its on-going suitability for their intended use.

For and on behalf of Coffey Geotechnics (NZ) Limited

Prepared By:



Sarah Martin

Project Engineering Geologist

Reviewed / Authorised By:

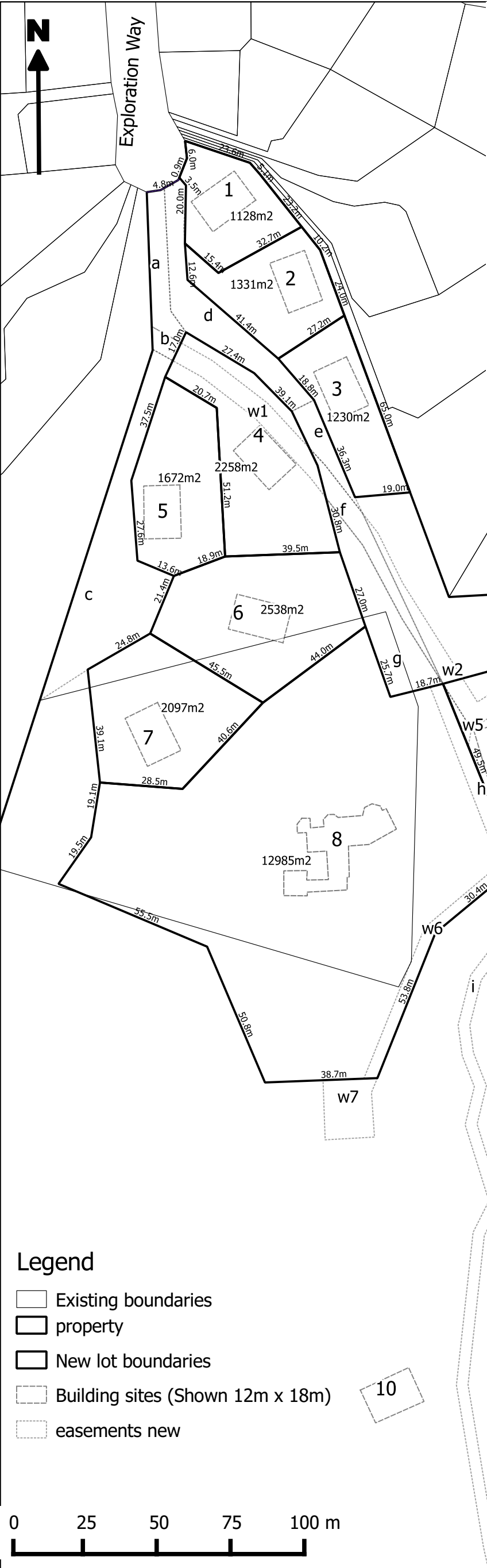


Kah-Weng Ho

Principal Geotechnical Engineer

Appendix A

Received Information



Memorandum of Proposed Easements			
Purpose	Shown	Servient Tenement	Dominant Tenement
Right of way; Rights to convey water, gas, electricity, telecommunications and computer media; Rights to drain water and sewage.	a, b	Lot 10 hereon	Lots 4, 5, 6, 7 hereon
	c		Lots 5, 6, 7 hereon
	d		Lots 2, 3, 8, 9 hereon
	e, f, g		Lots 8, 9 hereon
Right of Way	d, e, f, g, i	Lot 10 hereon	Part Lot 3 DP 426821 being land comprised in CT 568466 Lot 4 DP 426821 being CT 505670 Lot 5 DP 426821 being CT 505671 Lot 6 DP 426821 being CT 505671
Right of Way	h	Lot 8 hereon	

Memorandum of Proposed Easements in Gross			
Purpose	Shown	Servient Tenement	Grantee
Right to convey water	b, f, w2, w4, w7	Lot 10 hereon	Greater Wellington Regional Council
	w1	Lot 4 hereon	
	w3, w5	Lot 9 hereon	
	h, w6	Lot 8 hereon	
	a, b, c, d, e, f, g, w7	Lot 10 hereon	Porirua City Council
	h, w6	Lot 8 hereon	
Right to convey electricity	d, e, f, g, w7	Lot 10 hereon	Porirua City Council
	h, w6	Lot 8 hereon	
Right to drain sewer	a, b, c, d	Lot 10 hereon	
Right to convey electricity	a, b, c, d, e, f, g	Lot 10 hereon	Wellington Electricity Lines Ltd

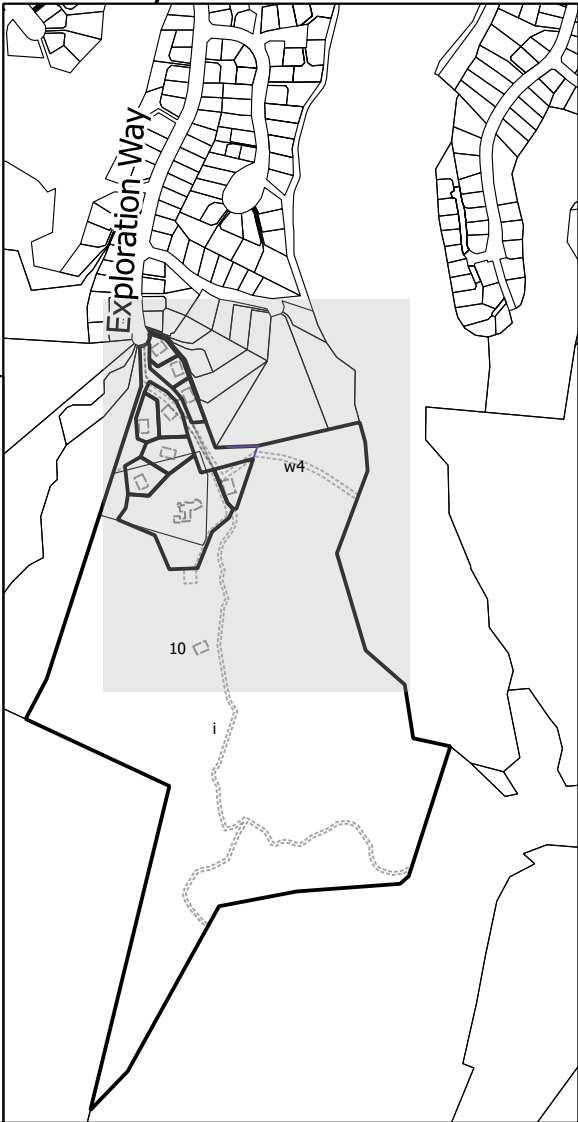
Legend

- Existing boundaries
- property
- New lot boundaries
- Building sites (Shown 12m x 18m)
- easements new

Notes:
1. This plan to be used for Resource Consent purposes only.
2. The balance lot (lot 10) may be further divided by the Transmission Gully Waitangirua link road before final titles issue.
3. Easement route b, w1, f, w2, w3, w4 is to be equivalent to the existing Wellington Regional Council water pipeline easement.
4. Easement i for its length is to be the same as the existing 4wd forestry right of way easement, but connecting to Exploration Way via a different route.

EXISTING TITLES:
Title 237194 Lot 2 DP 358205: Area = 1.3003 ha
Title 505668 Lot 1 DP 426821: Area =26.4252 ha
Total area = 27.7255 ha

PROPOSED TITLES:
Adjusted title 237194 (Lot 8): Area = 1.2985 ha
Suburban lots 1 - 7, 9: Area = 1.4167 ha
Balance suburban/rural (Lot 10): Area =25.0103 ha



Progeni Ltd

68 Exploration Way,
Porirua 5024
Ph 64 022 0819600

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Project:
Subdivision of Lot 2 DP 356205 and Lot 1 DP 426821

Title:
Scheme plan

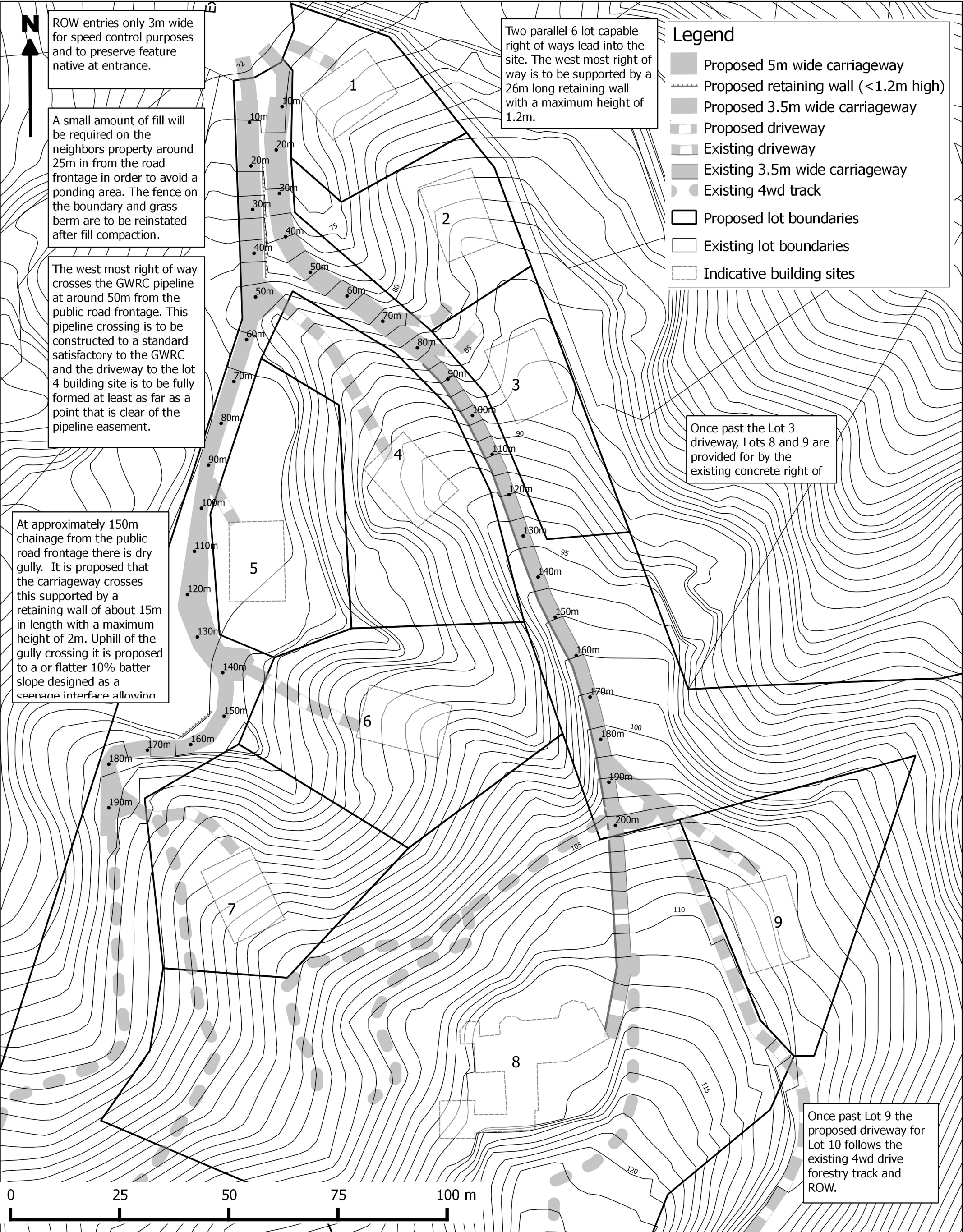
Approvals:

Date:	Function:	By:	Signature:
2013-10-28	Design	DWH	
2013-10-28	Drawn	DWH	
	Checked		
	Checked		

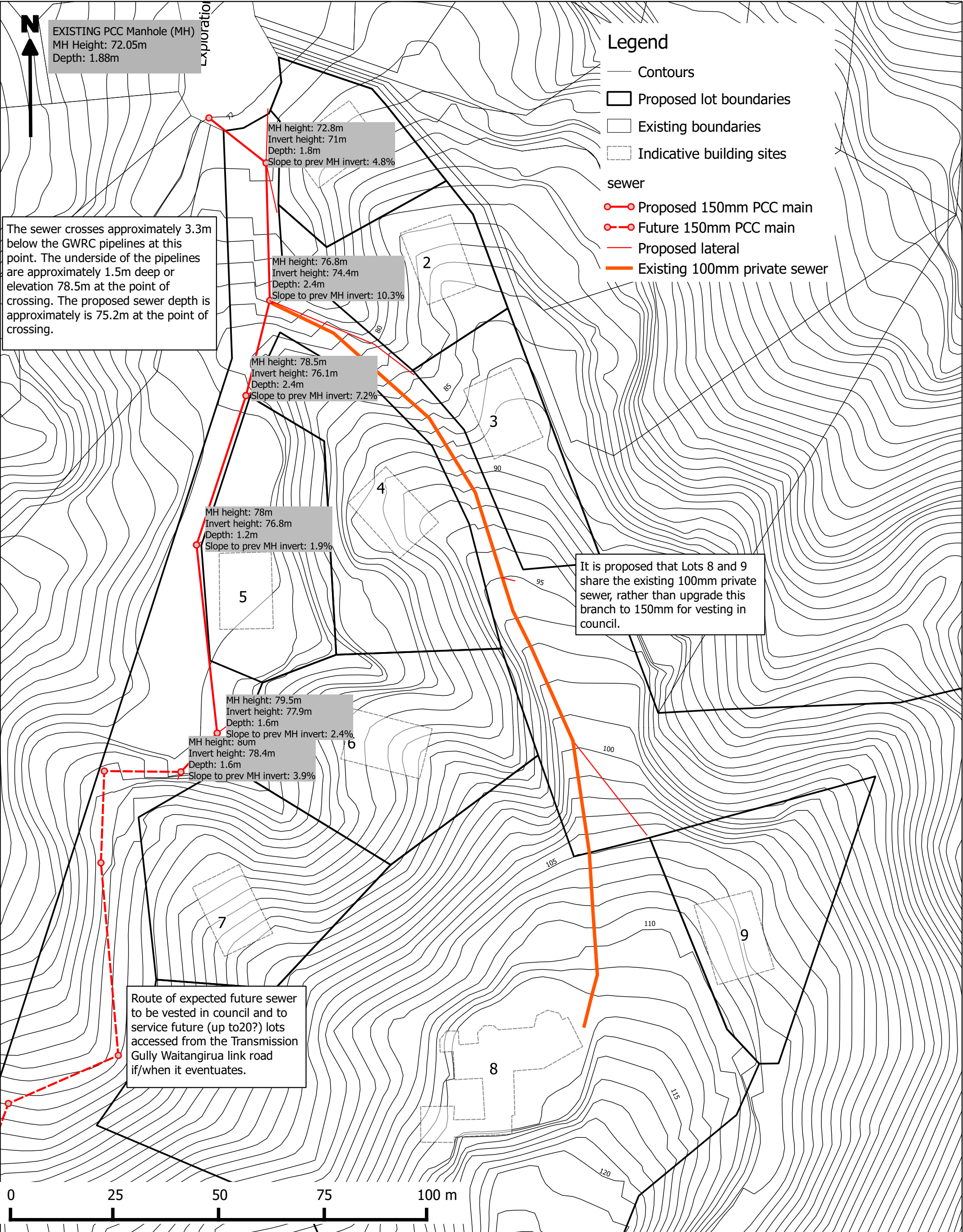
Versions:

Rev:	Amendment:	By:	Date:
A	Initial issue	DWH	2013-10-28

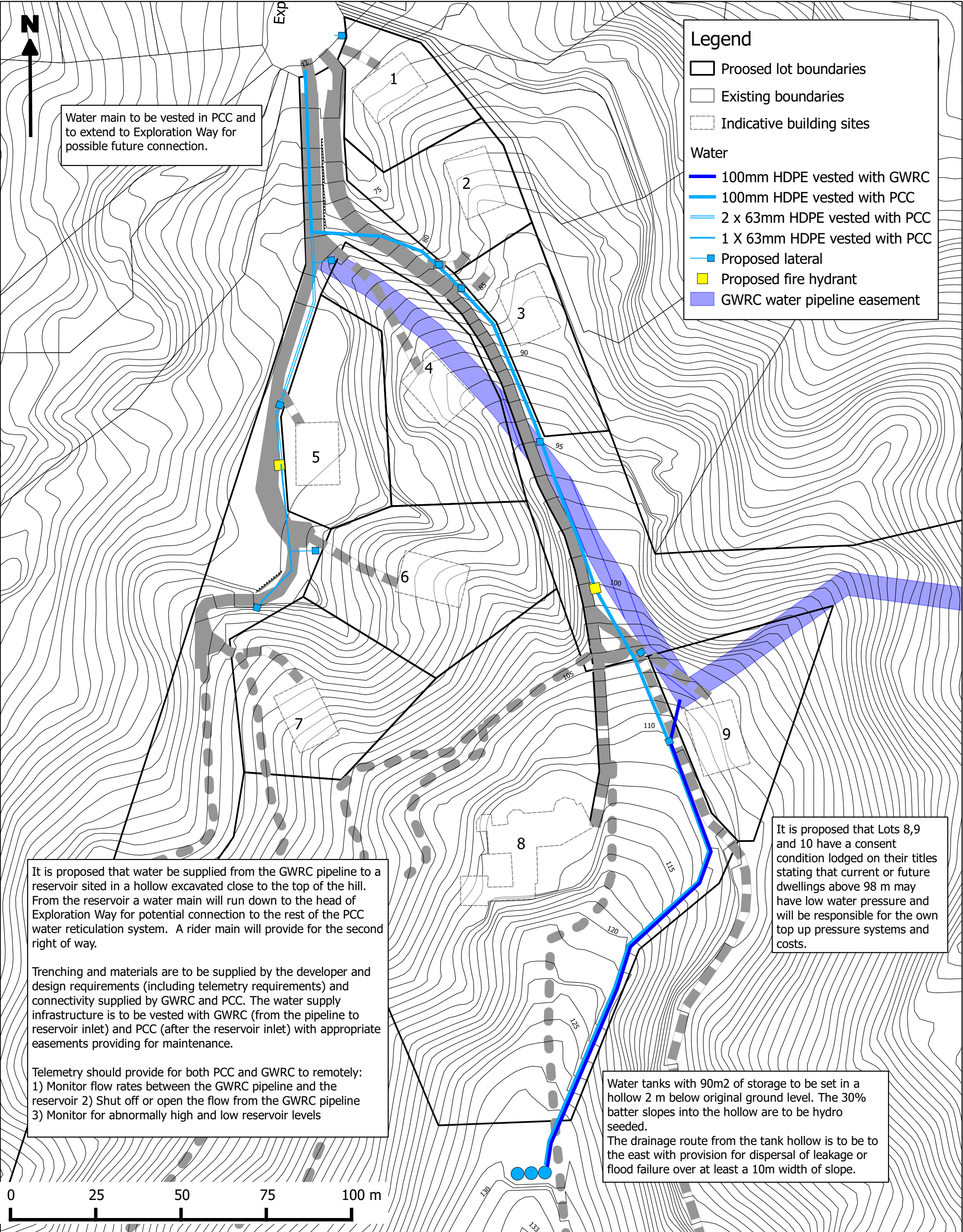
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20131028 Rev A
A3 scale 1:1500



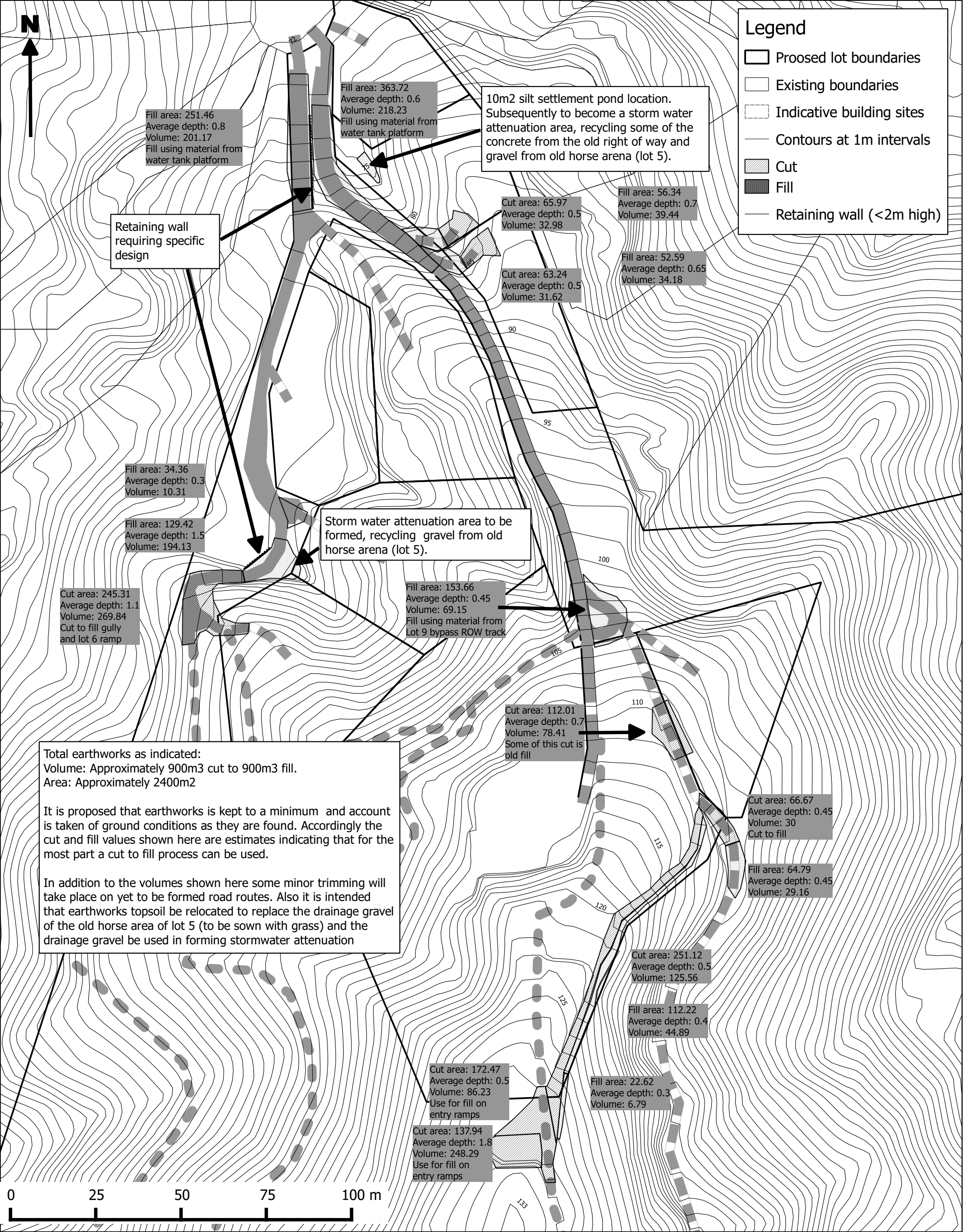
<div>Progeni Ltd</div> <div>68 Exploration Way, Porirua 5024 Ph 64 022 0819600</div> <div>Copyright 2013 Progeni Ltd. All rights reserved</div>	Project: Subdivision of Lot 2 DP 356205 and Lot 1 DP 426821	Approvals:				Versions:			
	Title: Overall Road Layout	Date:	Function:	By:	Signature:	Rev:	Amendment:	By:	Date:
		2013-10-28	Design	DWH		A	Initial issue	DWH	2013-10-28
		2013-10-28	Drawn Checked Checked	DWH					
						Drawing No: 20131028.2 Rev A A3 Scale 1:800			



<div>Progeni Ltd</div> <div>68 Exploration Way, Porirua 5024 Ph 64 022 0819600</div> <div>Copyright 2013 Progeni Ltd. All rights reserved</div>	Project: Subdivision of Lot 2 DP 356205 and Lot 1 DP 426821	Approvals:				Versions:			
	Title: Sewer layout	Date:	Function:	By:	Signature:	Rev:	Amendment:	By:	Date:
		2013-10-28	Design	DWH		A	Initial issue	DWH	2013-10-28
		2013-10-28	Drawn Checked Checked	DWH					
					Drawing No: 20131028.3 Rev A A3 Scale 1:800				



<div>Progeni Ltd</div> <div>68 Exploration Way, Porirua 5024 Ph 64 022 0819600</div> <div>Copyright 2013 Progeni Ltd. All rights reserved</div>	Project: Subdivision of Lot 2 DP 356205 and Lot 1 DP 426821		Approvals:				Versions:			
	Title: Water reticulation layout		Date:	Function:	By:	Signature:	Rev:	Amendment:	By:	Date:
			2013-10-28	Design	DWH		A	Initial issue	DWH	2013-10-28
			2013-10-28	Drawn Checked Checked	DWH					
						Drawing No: 20131028.4 Rev A A3 Scale 1:1000				



<div>Progeni Ltd</div> <div>68 Exploration Way, Porirua 5024 Ph 64 022 0819600</div> <div>Copyright 2013 Progeni Ltd. All rights reserved</div>	Project: Subdivision of Lot 2 DP 356205 and Lot 1 DP 426821	Approvals:				Versions:			
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		2013-10-28	Design	DWH		A	Initial issue	DWH	2013-10-28
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Appendix B

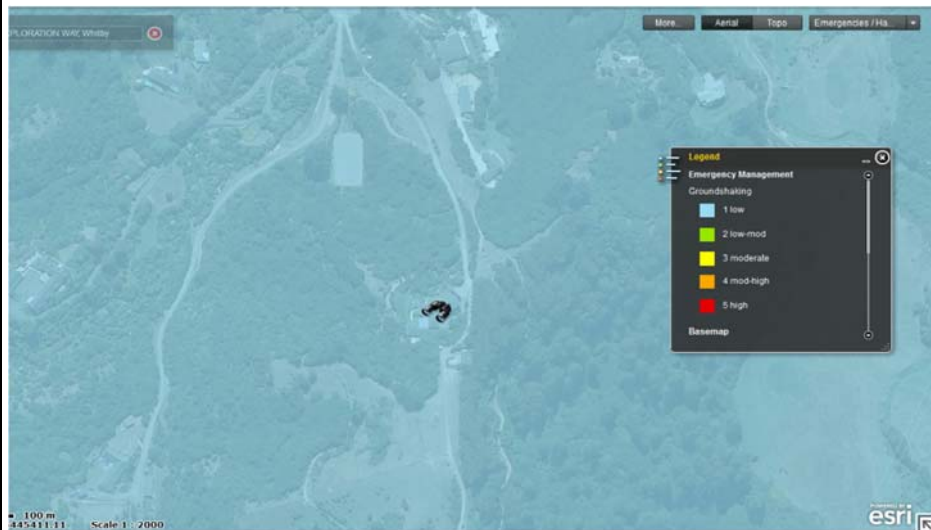
Figures



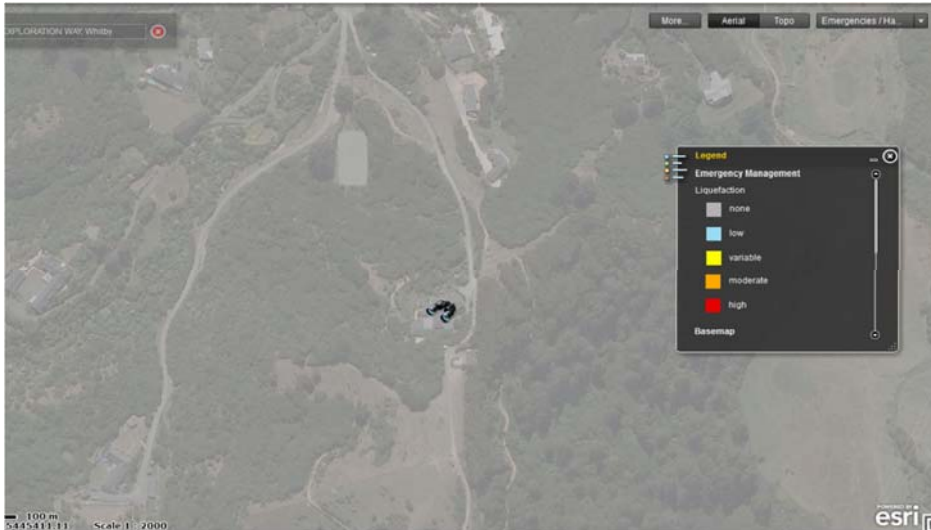
CLIENT:
Progeni Limited
PROJECT TITLE:
Geotechnical Report for Subdivision Suitability

PROJECT: GENZWELL16067AA
DATE: 27/11/2013
REVISION: A
SCALE: NTS
DESIGNED: SM
DRAWN: SM
CHECKED: NKC
STATUS: FINAL

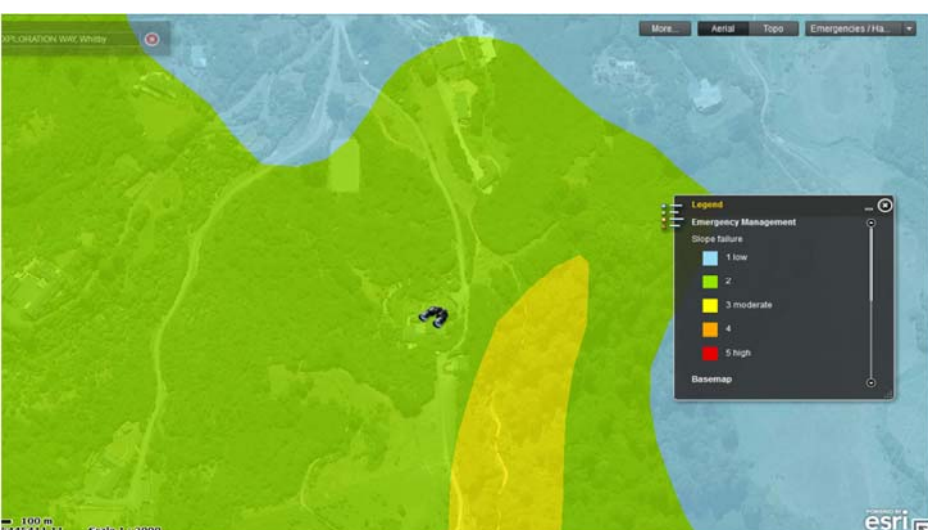
FIGURE TITLE: Site Location Plan
FIGURE NO: 1
NOTES: map courtesy of Greater Wellington Regional Council



Groundshaking Risk



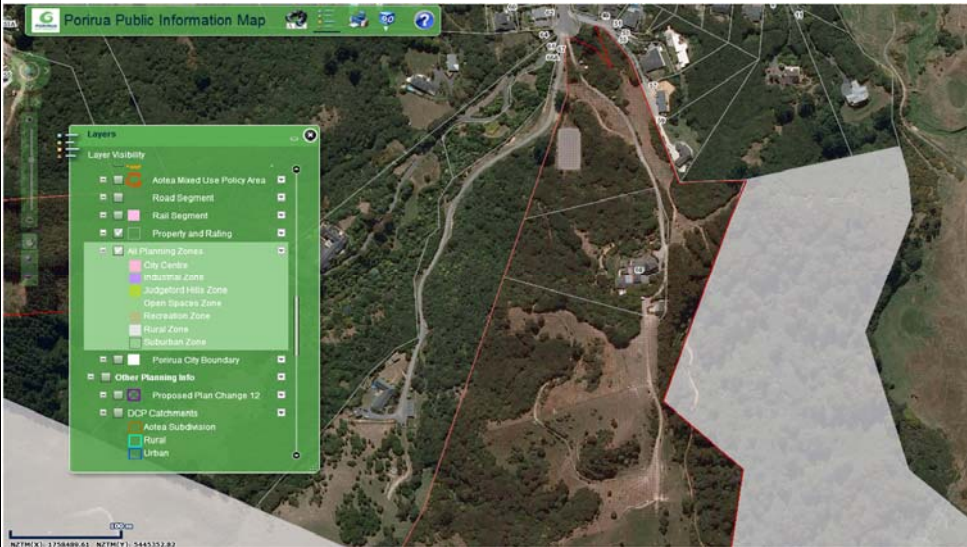
Liquefaction Risk



Earthquake Induced Slope Failure Risk



Earthquake Combined Hazard

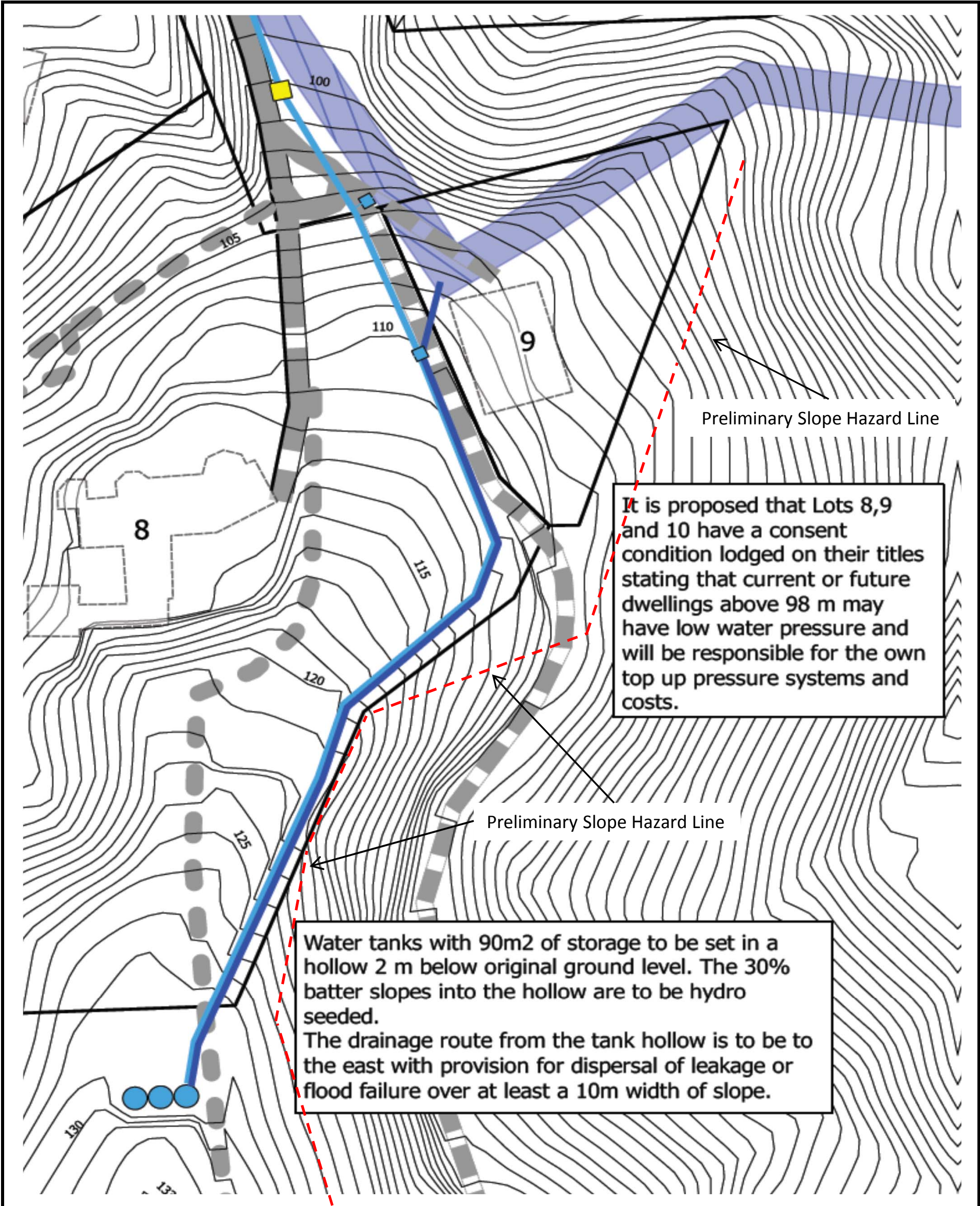


Porirua City Council District Plan Seismic Hazard Zone


<http://mapping.gw.govt.nz/gwrc/>; <http://gis.pcc.govt.nz/PublicViewer/>

accessed 27/11/2013

	CLIENT:	PROJECT:	DESIGNED:	FIGURE TITLE: Earthquake Risk Maps
	Progeni Limited	GENZWELL16067AA	SM	
	PROJECT TITLE:	DATE:	DRAWN:	
	Geotechnical Report for Subdivision Suitability	27/11/2013	SM	
		REVISION:	CHECKED:	
		A	NKC	NOTES: Maps courtesy of Greater Wellington Regional Council GIS Viewer and Porirua City Council Public Information Map
		SCALE:	STATUS:	
		NTS	FINAL	








map courtesy of Progeni Ltd - 20131028.4 Rev A

		CLIENT:	FIGURE TITLE:		Slope Hazard Area		
		Progeni Ltd	PROJECT:		GENZWELL16067AA		
			FIGURE NO:	3	REVISION:	B	
		PROJECT TITLE:		DATE:		2/12/2013	
		Geotechnical Report for Subdivision Suitability		DESIGNED		SM	
DRAWN:				NKC			
CHECKED:				KWH			
STATUS:		Final					
SCALE:		NTS					

Appendix C

Photofile

					
CAPTION:		CAPTION:		CAPTION:	
Lot 1		Lot 2		Lot 3	
					
CAPTION:		CAPTION:		CAPTION:	
Lot 4		Lot 5		Lot 6	
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	project:	Geotechnical Report for Subdivision Suitability			GENZWELL16067AA
	title:	Photofile 1			date:
					figure no:
					27/11/2013
					SM

				<p>CAPTION:</p>	
<p>CAPTION:</p> <p>Lot 7</p>		<p>CAPTION:</p> <p>Lot 9</p>		<p>CAPTION:</p>	
				<p>CAPTION:</p>	
<p>CAPTION:</p> <p>Entrance Ramp Retaining Structure Location</p>		<p>CAPTION:</p> <p>Gully Crossing Location</p>		<p>CAPTION:</p>	
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	project:	Geotechnical Report for Subdivision Suitability		GENZWELL16067AA	
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