

5 May 2016

Fulton Hogan Land Development Limited  
c/o Evolve Land Limited

Via email: greg@evolveland.nz

Attention: Greg Dewe

Dear Greg

**Geotechnical Completion Report – Knights Stream Park Stage 8A Development  
(Lots 800 to 830, 857 to 872, 875 to 883, 887 to 890, 1001, 1050 and 1051)**

This geotechnical completion report is submitted in accordance with Section 12.4.1 of the Christchurch City Council Infrastructure Design Standard.

**Introduction**

Fulton Hogan Land Development Limited (FHLD) is in the process of developing the Knights Stream Park Residential development in Halswell in southwest Christchurch, with Stage 8A of the development nearing completion. During the geotechnical investigation parts of Stage 8A were identified as being susceptible, to a limited degree, in places to the effects of seismically induced liquefaction.

The liquefaction risk at the site was assessed as being with acceptable levels that a mixture of Technical Category 1 (TC1) and Technical Category 2 (TC2) classification of the site was applicable. As such no site specific liquefaction mitigation measures were required for the site development.

The conditions of Aurecon's engagement are as per our original agreement relating to initial geotechnical investigation carried in October 2010, and are set out in our letter of engagement dated 29 September 2010.

**Previous Investigation**

Aurecon undertook a geotechnical site investigation across the wider 117ha FHLD Halswell West residential development site in October 2010 to support a plan change application. This investigation is described in the Aurecon Report *Geotechnical Site Investigation and Liquefaction Assessment, Halswell West Rezoning, Rev1* dated 29 November 2010 prepared for Fulton Hogan Land Development Limited (Aurecon, 2010).

Aurecon undertook further geotechnical investigations to support a subdivision application for Stages 6 to 8 of the Knights Stream Park development between October 2011 and October 2014. This included testing in areas that are now included in Stages 8A. This investigation is described in the Aurecon Report *Knights Stream Park Stages 7 and 8 Geotechnical Assessment, Rev3* dated 18 November 2014 (Aurecon, 2014).

**Liquefaction Hazard Assessment**

In the days immediately following both the 4 September 2010 Darfield Earthquake and the 22 February 2011 Christchurch Earthquake, Aurecon undertook site walk overs and mapping of surface manifestation of liquefaction across the entire Halswell West development (including Knights Stream

Park Stage 8A). No surface manifestation of liquefaction was observed in the area of Stage 8A after either the Darfield or Christchurch Earthquakes.

A liquefaction hazard assessment was carried out as part of the site assessments using the method prescribed in the Ministry of Business, Innovation, and Employment (MBIE, 2012) guidelines for residential development in Canterbury following the Canterbury earthquake sequence.

### Technical Category Classification

We have assessed the liquefaction hazard at the site using the method compliant with the recently prescribed by MBIE guidelines, observed site performance during the major seismic events in the Canterbury earthquake sequence. Based upon this assessment and observed site performance we believe:

- **Lots 803 to 825, 830, 857 to 872, and 887 to 890 fulfil the requirements of TC1 Classification.**
- **Lots 800 to 802, 826 to 829, and 875 to 883 fulfil the requirements of TC2 Classification**
- **Lots 1001, 1050 and 1051 are roading and reserve areas; therefore no Technical Category Classification is applicable for these lots.**

A TC1 Classification effectively means that the MBIE believe that '*Future land damage from liquefaction is unlikely, and ground settlements are expected to be with normally accepted tolerances.*' Standard type foundations (e.g. NZS3604, NZS3229 etc.) are acceptable subject to shallow geotechnical investigation.

A TC2 Classification effectively means that the MBIE believe that '*Minor to moderate land damage from liquefaction is possible in future significant earthquakes.*' House foundations and site specific geotechnical investigations are required in accordance with the MBIE (2012) guideline documents '*Repairing and rebuilding houses affected by the Canterbury earthquakes*' released in December 2012.

### References

Aurecon, 2010. *Geotechnical Site Investigation and Liquefaction Assessment, Halswell West Rezoning, Fulton Hogan Land Development Limited, Revision 1* - dated 29 November 2011. Aurecon New Zealand Limited, Christchurch, New Zealand.

Aurecon, 2014. *Knights Stream Park Stages 7 and 8 Geotechnical Assessment, Rev3* dated 18 November 2014. Aurecon New Zealand Limited, Christchurch, New Zealand.

MBIE, 2012. *Repairing and rebuilding houses affected by the Canterbury earthquakes*. Ministry of Business, Innovation and Employment, Wellington, New Zealand.

### Limitations

We have prepared this report in accordance with the brief as provided. The contents of the report are for the sole use of the Client and no responsibility or liability will be accepted to any third party. Data or opinions contained within the report may not be used in other contexts or for any other purposes without our prior review and agreement.

The recommendations in this report are based on data collected at specific locations and by using suitable investigation techniques. Only a finite amount of information has been collected to meet the specific financial and technical requirements of the Client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground

between test locations has been inferred using experience and judgement and it must be appreciated that actual conditions could vary from the assumed model.

Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

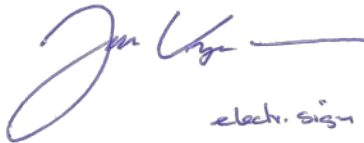
Subsurface conditions, such as groundwater levels, can change over time. This should be borne in mind, particularly if the report is used after a protracted delay.

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This conclusions in this report draws on investigations, analysis and conclusions from various investigations stages and numerous reports. For specific details please refer to the above mentioned references or contact the writers.

If you have any queries regarding the content of this letter, please do not hesitate to contact the undersigned.

Yours sincerely



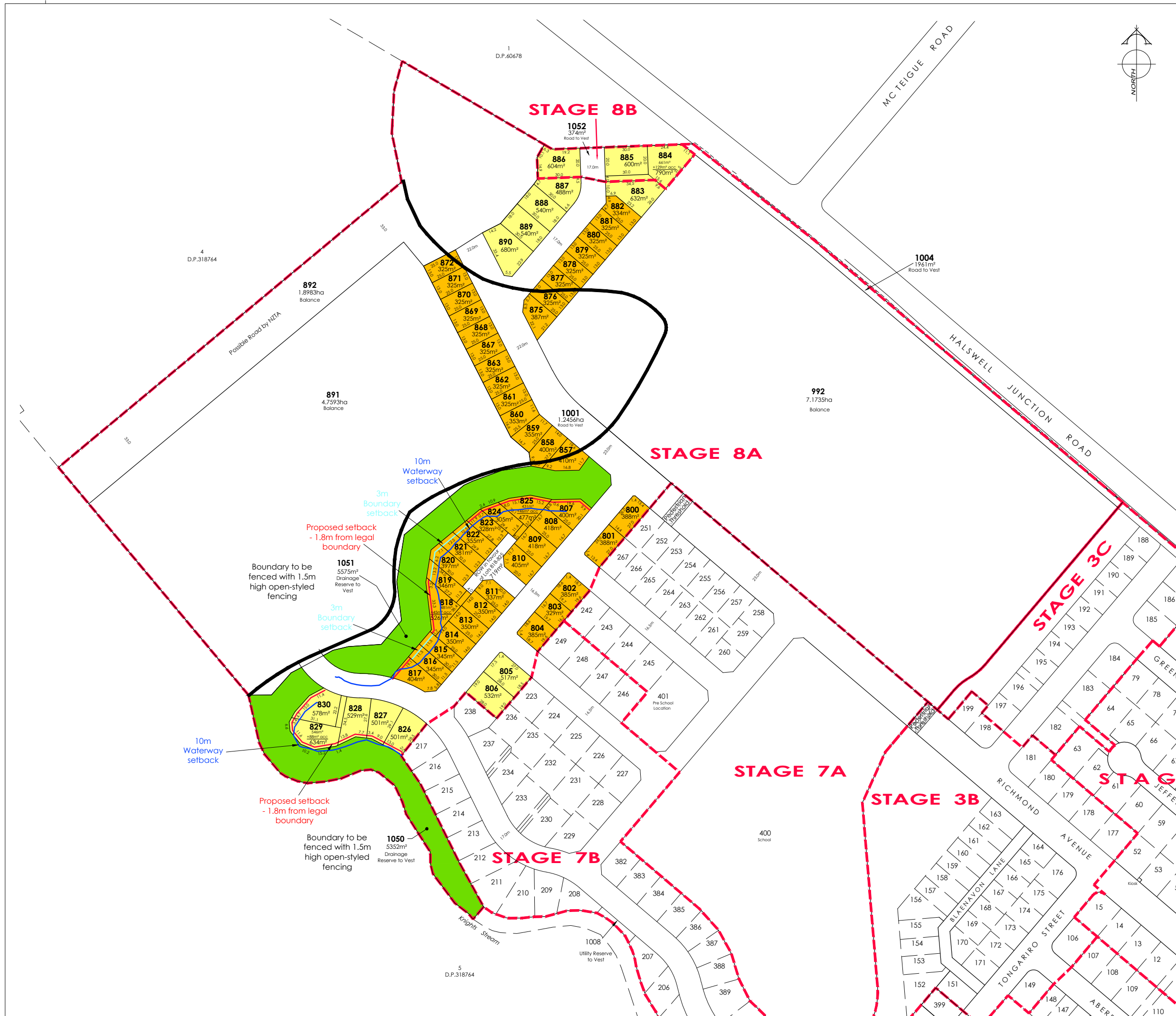
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








**Dr Jan Kupec**

*PhD MSc candIng MIPENZ CPEng IntPE MRSNZ | NZGS IGS ISSMGE NZSEE*

*Chartered Professional Geotechnical Engineer – Technical Director*




Inc: Knights Stream Park Stage 8A Site Layout Plan  
Knights Stream Park Stage 8A Technical Category Plan

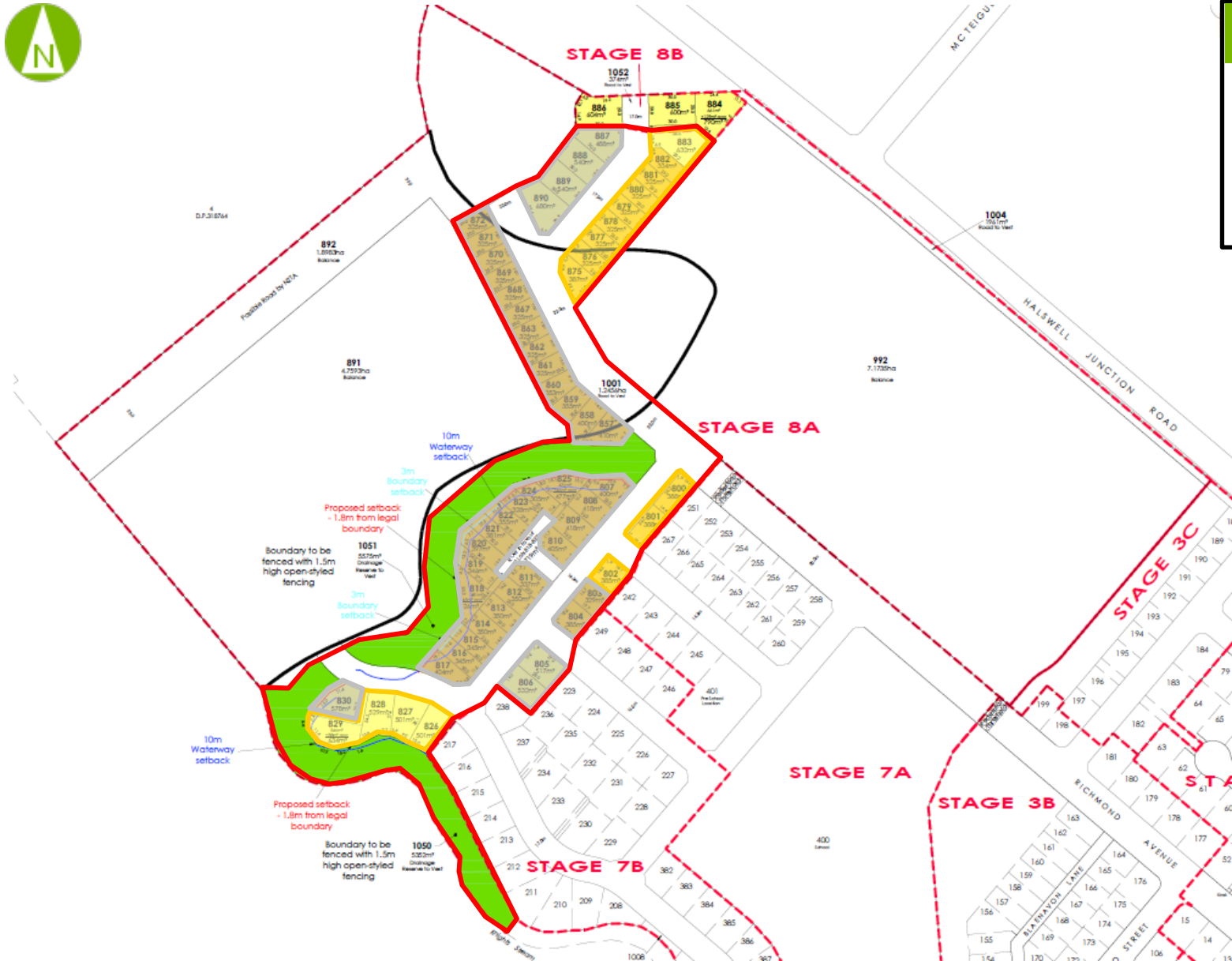


AMENDMENTS :		
AMENDMENT	DATE	DESCRIPTION
R1	8-4-15	STAGE BOUNDARY AMENDED
R2	17-4-15	LOT 818 AMENDED
R3	14-5-15	SETBACK LINES ADDED
R4	28-5-15	LOT 992 AMENDED
R5	4-6-15	LOTS 882 & 883 AMENDED
R6	29-6-15	LOTS 892 ADDED
R8	9-7-15	WATERWAY SETBACK LINES ADDED
R9	11-8-15	LOTS 800, 801, 804 & 805 AMENDED
R10	26-11-15	LOT 1001 AMENDED, LOT 1052 & STAGE 8B ADDED
NOTES :		
1) Areas and dimensions subject to final survey and deposit of plans.		
2) Service easements to be created as required.		
3) This plan has been prepared for subdivision concept purposes only. No liability is accepted if the plan is used for any other purpose.		
LEGEND		
	DENSITY B	
	DENSITY C	
	DRAINAGE RESERVE	
	STAGE BOUNDARY	
	ZONE BOUNDARY	
	1.8m BOUNDARY SETBACK	
	3m BOUNDARY SETBACK	
	10m WATERWAY SETBACK	
SCHEDULE OF AREAS		
Description		Area
Residential Lots ( Lots 800-830, 857-863, 867-872 & 875-890 )		2.4584ha
Road to Vest in Christchurch City Council ( Lots 1001, 1004 & 1052 )		1.4791ha
Local Purpose (Drainage) Reserve to Vest in Christchurch City Council ( Lots 1050 & 1051 )		1.0927ha
Access Lots ( Lots 818, 825, 829 & 884 )		308m²
Right of Way ( In favour of Lots 818-825 )		719m²
Balance ( Lot 891 )		4.7593ha
Balance ( Lot 892 )		1.8983ha
Balance ( Lot 992 )		7.1735ha
Total Area: 18.9640ha		
Comprised in: C.F.R 616567		
		
		
116 Wrights Road P O Box 679 Christchurch 8140, New Zealand Telephone: 03 379-0793 Website: www.dls.co.nz E-mail: office@dls.co.nz		
JOB TITLE:		
Fulton Hogan Land Development Ltd Knights Stream Park		
SHEET TITLE:		
Stages 8A & 8B		
DRAWING STATUS		
Subdivision Consent		
SCALE : 1:1250@A1 1:2500@A3		DATE : November 2015
CAD FILE : J:\18447\KSP_STAGE 8ab_SUBCON_R10.dwg		REVISION :
DRAWING No : E.18447		SHEET No: R10



## Legend

-  Stage 8A Site Boundary
-  TC1 Equivalent
-  TC2 Equivalent



CLIENT

PRELIMINARY NOT FOR CONSTRUCTION

ALL DIMENSIONS APPROXIMATE ONLY

SCALE

SIZE

TITLE

TECHNICAL CATEGORY CLASSIFICATION  
ZONES

FIGURE

FIGURE 1

BY

D. MAHONEY

APPROVED

J. KUPEC

REFERENCE

BACKGROUND IMAGE: DAVIE LOVELL-SMITH DRAWING  
E.18447 R10

PROJECT

KNIGHTS STREAM PARK  
STAGE 8A

DATE

5 MAY 2016

FIGURE No.

PROJECT

200376

WBS

002

TYPE

FIG

DISC

INF

NUMBER

04

REV

1