

File No.: 34300

15 June 2021

Sovereign Palms Limited PO Box 13 349 **CHRISTCHURCH 8141** 

Dear Chris,

# GEOTECHNICAL INVESTIGATION AND FOUNDATION RECOMMENDATIONS: XXXX. **STAGE 1, OAKBRIDGE SUBDIVISION.**

#### INTRODUCTION 1.0

Davis Ogilvie & Partners Ltd. (Davis Ogilvie) has been commissioned by Sovereign Palms Ltd to determine the ground bearing capacity and provide foundation recommendations for XXXX, Stage 1 of the Oakbridge Subdivision in Marshlands, Christchurch.

The published geology of the site has been identified as "Dominantly alluvial sand and silt overbank deposits" (Yaldhurst Member) of the Springston Formation<sup>1</sup>.

The underlying geotechnical report written by Davis Ogilvie<sup>2</sup> in August 2017 recommended a Ministry of Business, Innovation & Employment (MBIE) Residential Technical Category of TC2<sup>3</sup> be assigned to XXXX. The future expected performance for a TC2 site, in accordance with MBIE, is that "Minor to moderate land damage from liguefaction is possible in future large earthquakes".

Davis Ogilvie has undertaken engineering design and supervision throughout Stage 1 subdivision construction. Based on construction observation records, XXXX is underlain by up to 0.9 m of engineered fill<sup>4</sup> consisting of site sourced sand/silt. The fill was placed in accordance with NZS 4431:1989 (Code of practice for earth fill for residential development).

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<sup>&</sup>lt;sup>1</sup> Brown, L.J.;Weeber, J.H., (1992) "Geology of the Christchurch Urban Area" Institute of Geological and Nuclear Sciences.

<sup>&</sup>lt;sup>2</sup> Davis Ogilvie (August 2017) Geotechnical Report for Subdivision, 203 Prestons Road, Redwood, Christchurch.

<sup>&</sup>lt;sup>3</sup> Ministry of Business, Innovation & Employment (MBIE): Guidance for Repairing and Rebuilding Houses Affected by the Canterbury Earthquakes (December 2012), Reference Material. <sup>4</sup> Davis Ogilvie (June 2021) Engineering Design, Fill plan Stage 1. Ref 34300 FP01

#### 2.0 SUBSOIL TESTING AND RESULTS

DAVIS OGILVIE

ENGINEERS / SURVEYORS / PLANNERS

Prior to any filling, site inspections of the natural ground conditions were undertaken by Davis Ogilvie to confirm the presence of suitable subgrade soils. Any areas of unsuitable or soft soils were over excavated and backfilled with engineered fill as per NZS 4431:1989. During the inspection, Dynamic Cone Penetrometer (DCP) testing was undertaken on the subgrade to at least 1.0 m below the original ground level. The subgrade tests confirmed suitable material in the shallow underlying soils.

Following fill placement, two DCPs and one hand auger (HA) was undertaken on the lot to a maximum depth of 3.0 m below the final ground level (FGL). These test locations are presented in the attached Geotechnical Site Plan G23A, and DCP and HA logs are enclosed.

Based on the shallow testing undertaken on the site, the general subsurface profile consists of up to 0.4 m of topsoil underlain by engineered fill followed by natural deposits of silt. The indicative soil profile across the site is presented in Table 1.

Table 1: Summarised Soil Profile from Shallow Investigation							
Summary of Soil Type	DCP (blows / 100 mm)	Relative Density / Consistency	Depth Below EGL (m)				
			DCP 1*	DCP 2 + HA			
TOPSOIL	3 – 5	**	0.0 – 0.4	0.0 - 0.4			
SILT/SAND (Engineered Fill)	5 – 20	Stiff to Hard / Medium Dense to Very Dense	0.4 – 1.1	0.4 – 0.95			
SILT	3 – 11	Firm to Very Stiff	1.1 – 2.2	0.95 – 2.2			
	10 - 20	Very Stiff to Hard	2.2 – 2.8	2.2 - 3.0			
* Soil profile inferred from nearby testing logs.							

Groundwater was encountered during the Davis Ogilvie May 2021 shallow investigation at 1.4 m below FGL.

## 3.0 FOUNDATION RECOMMENDATIONS

Due to the TC2 categorisation of the site, specific engineering design, observation and certification will be required for the development of the lot. TC2 concrete slab foundation options provided in Section 5.3 of the MBIE 2012 guidance document are considered suitable for the site.

Based on in-situ soil testing, ultimate bearing capacities consistently in excess of 200 kPa<sup>5</sup> were encountered below the topsoil from 0.4 m below FGL. Topsoil should be removed from beneath the building footprint along with any other unsuitable materials, noting that the thickness of topsoil requiring removal can vary across the site from the test location.

All excavations on site should be examined by a suitably qualified and experienced Engineer or Engineering Geologist prior to any fill placement and foundation construction. The Engineer must be competent to judge whether the exposed subsoils are compatible with the inferred conditions on which the report has been based. Should soft, suspect, or unsuitable conditions differing to those outlined in this report be encountered, the builder should contact Davis Ogilvie or a suitably qualified and experienced Engineer to confirm foundation requirements.

## 4.0 CLOSURE

Should you have any queries regarding this report or wish to arrange a subgrade inspection at the time of construction, please contact the undersigned.

Yours faithfully DAVIS OGILVIE & PARTNERS LTD.

DAVIS OGILVIE

ENGINEERS / SURVEYORS / PLANNERS



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Enclosed:

1 x Geotechnical Site Plan (DWG G23A)

2 x Dynamic Cone Penetrometers and 1 x Hand Auger Log

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<sup>&</sup>lt;sup>5</sup> Defined by MBIE (2012) as a minimum of 2 DCP blows per 100 mm penetration for ground deemed to have 200 kPa geotechnical ultimate bearing capacity.

The bearing capacities presented in this report are static geotechnical ultimate bearing capacities. In accordance with MBIE guidance the "structural" Ultimate Limit State (ULS) bearing capacity, to be used in conjunction with fully factored loads as per AS/NZS 1170, should be derived using a strength reduction factor of 0.5. The allowable bearing capacity to be used in conjunction with Serviceability Limit State (SLS) loads should be derived using a strength reduction factor of 0.33.



#### Limitations

Davis Ogilvie did not complete an assessment of all possible conditions or circumstances that may exist at the site. The report and findings are based on the information provided. Conditions may exist which were undetectable given the limited investigation of the site. Variations in conditions may occur, and there may be conditions onsite which have not been revealed by the investigation, which have not been taken into account in the report. No warranty is included—either expressed or implied—that the actual conditions will conform to the assessments contained in this report. If any unexpected suspect soils are encountered during earthworks onsite, Davis Ogilvie should be notified to confirm or reassess the foundation recommendations.

This report has been prepared solely for the purposes of Sovereign Palms Limited. The information contained herein is confidential, and shall not be passed on to any third party without prior written permission of Davis Ogilvie & Partners Ltd. No responsibility is accepted for any use outside the scope of this report. This report does not cover suitability of the site (e.g., flooding), or potential future liquefaction.

#### **Important Notice:**

Information included in this report was obtained/created from maps and/or data extracted from the New Zealand Geotechnical Database (<u>https://www.nzgd.org.nz</u>), which were prepared and/or compiled for the Earthquake Commission (EQC) to assist in assessing insurance claims made under the Earthquake Commission Act 1993. The source maps and data were not intended for any other purpose. EQC and its engineers, Tonkin & Taylor, have no liability for any use of the maps and data or for the consequences of any person relying on them in any way.



Disclaimer: This document shall only be reproduced in full with approval from a Davis Ogilvie engineer, contractor to locate all existing services & verify all dimensions before commencing work

Test locations are approximate. 0m 10m 15m 20m 25m 30m 2011 2011 Boundaries are taken from Davis Ogilvie Civil Design Drawing DWG C106. Scale 1:300 Aerial image obtained from drone by DO Survey 16/04/21

#### 05/21 Geotechnical Report Diagram А MS date issue reason approved

CAD ref: 210112.34300.MasterPlan



Davis Ogilvie & Partners Ltd Engineers - Surveyors - Planners 24 Moorhouse Ave, Addington P.O. Box 589 Christchurch, NZ Ph. 03 366-1653 - 0800 999 333 Also - Nelson, Timaru, Greymouth

Geotechnical Site Plan	design MS	drawn IZ	QA check MS	dwg issue
XXXX, Stage 1 Oakbridge Subdivision	scale @ A4	date	file	G23 A
Oakbridge Suburvision	1:300	05/21	34300	

Level 1, 24 Moorhouse Avenue,Addington, Christchurch 8140 Office 0800 999 333 Email hello@do.nz DAVIS OGILVIE Job Nº /34300\_XXXX DCP 2 www.do.nz Test Nº /+HA DCP 1 Project: XXXX, Stage 1, Oakbridge Subdivision, Christchurch Date: 21/05/21 Client: Sovereign Palms Ltd Time: 10:00 am Test Location: Refer to attached Geotechnical Site Plan (G23A) Excavation Method: HA + DCP BLOWS / 100 mm D D E P T Graphic Log STRATA DESCRIPTION Е uscs Water Table P T H Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005 DCP 2 DCP 1 н (m) Auger at DCP 2 2 3 4 56 7 8 9 2 3 4 5 6 7 8 9 (m) SILT; dark brown. Moist, contains rootlets (TOPSOIL). [0.40m] т s <u>ал</u> Т S  $\Delta L$  $\underline{ab}$ TS TS MA ß  $\Delta D_{\rm c}$ т<u>ык</u> т.s . Т S <sup>дду</sup> SILT with trace sand; yellowish brown with trace orange mottling. Stiff, moist. Sand is fine (ENGINEERED FILL). FIL 0.5 0.5 [0.20m] Fine SAND with trace silt; grey with light iron oxide staining. Dense to very dense, moist (ENGINEERED FILL). [0.35m] 14 16 11 FILL 12 16 20 SILT; grey and brown with orange mottling. Stiff, moist, low plasticity. [0.35m] 1.0 1.0 12 ۲ 21/05/2021 SILT with some clay; grey and brown with orange mottling. Stiff to very stiff, wet, moderate plasticity, contains organics. [0.90m] ¥ 1.7m - 2.0m: Large tree roots throughout 11 2.0 2.0 SILT with some clay; bluish grey. Very stiff to hard, saturated, 15 moderate plasticity. [0.80m] 11 11 13 14 2.5m: Hole collapse 2.5 25 13 20 F 13 20 20 14 14 15 Auger terminated at 3.00m - Target depth achieved 3.0 3.0 Logged By: ΙZ Notes: Dynamic Penetrometer Test and logs give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building. Plotted By: ΙZ Checked By: KL Dynamic Cone Penetrometer Test performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

**Davis Ogilvie & Partners Limited** 

SHALLOW INVESTIGATION RESULTS

th Core-GS by Geroc

Produced with Core-GS