BEFORE THE INDEPENDENT HEARING COMMISSIONERS

UNDER	the Resource Management Act 1991 ("RMA" or "the Act")
IN THE MATTER OF	A hearing on submissions on the proposed Te Tai o Poutini Plan **Topic:** Rural Zone **Cape Foulwind Staple 2 Limited** Submitter Number: **568**

PLANNING EVIDENCE OF JANE BAYLEY

Dated 22 March 2024

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1.0 INTRODUCTION

1.1 My full name is Jane Rushton Bayley. I am a Resource Management Planning Consultant and hold the qualification of Master of Regional and Resource Planning from Otago University.

1.2 I have over 20 years experience as a Planner and Resource Management Consultant. This experience includes as a Council Planner with the Buller District Council from 2000 through to the start of 2008, when I moved into private practice. I am employed as a Resource Management Consultant at Staig & Smith Ltd which is a Surveying, Land Development and Planning Consultancy based in Nelson.

1.3 I am familiar with and have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note and I agree to comply with it. My evidence is within my area of expertise, however where I make statements on issues that are not in my area of expertise, I will state whose evidence/reports I have relied upon. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in my evidence.

1.4 I have prepared a planning assessment supporting the submission of Cape Foulwind Staple 2 Limited (CFS2) on the proposed Te Tai o Poutini Plan (TTPP).

1.5 CFS2 own the land formerly known as the Holcim New Zealand Ltd's 'non-production' land, being the areas not part of the processing plant or the quarry. This includes the parcels shown below.

1.6 CFS2's submission sought to either support or change zoning of their land, or land on which they had subdivision consents being undertaken at the time of the submissions.

1.7 In preparing this evidence, I have considered the following documents:

a. CFS2's original submission on the TTPP
b. The TTPP, in particular the General Rural Zone objectives, policies and rules
c. The section 32 reports for the General Rural and General Industrial Zones.

2.0 CFS2 ORIGINAL SUBMISSION 568

2.1 CFS2 made a submission on the TTPP, with a particular focus on the zoning of their land holdings at Omau, Cape Foulwind. The submission focussed on seven Rural Zoning matters:

S568-002	Sought that all of the Planning Maps accurately reflect the legal appellations at time of printing, and that Zones reflect appellation boundaries.
S568-003/004	Sought that zoning of the land shown as Area 1 Larsen Street in the map attached to the submission be changed from General Rural Zone to Settlement Zone - Rural Residential Precinct 4.
S568-005	Sought that the zoning of the land shown as Area 2 Inner Cape Foulwind Road in the map attached to the submission be changed from Settlement Zone - Rural Residential Precinct 4 to Coastal Settlement Zone Precinct 3 with use of existing wastewater system in Light Industrial Zone.
S568-006	Sought that the zoning of the 837m^2 allotment of Pt Sec 8 Blk I Steeples SD be changed from General Rural to Light Industrial Zone.
S568-007	Sought that the zoning of the land shown as Area 5 Limestone Road in the map attached to the submission be changed from Settlement Zone - Rural Residential Precinct 4 to Coastal Settlement Zone Precinct 3 with inclusion of a communal wastewater treatment system.
S557-009	Sought that the zoning of the two strips of land adjacent to Cape Foulwind and Limestone Roads, be changed from General Rural to reflect the adjacent zones.

3.0 PLANNING EVIDENCE

Submission S568-002

3.1 The Ministry for the Environment November 2019 National Planning Standards sets its purpose to improve the efficiency and effectiveness of the planning system by providing electronic functionality and accessibility.

3.2 Standard 16.B.2.a.ii requires ePlans to enable users to search for a specific property.

3.3 This supports CFS2's submission S568-002 to have all land parcels displayed on the Planning Maps.

3.4 The second portion of the submission sought that boundaries between zones reflect parcel boundaries rather than have mixed zoning within a parcel.

3.5 From a planning perspective, it is usually fraught for planners to deal with mixed zoning within a parcel. Unless the zones have been drawn to reflect underlying productivity requirements, zones are best to reflect actual parcel locations at the time the Plan is development. By using parcels as boundaries between zones, this reduces the potential for gradual creep of activities across the zones.

3.6 I note that that there are often scenarios that breach this, and acknowledge Submission 568-009 is one of those, where mixed zoning is appropriate.

3.7 I acknowledge that as time goes on and boundary adjustments occur, changes to parcels and zone boundaries change which then result in a conflict between occupation.

Submissions S568-003 and S568-004

3.8 In their submission, CFS2 sought to rezone the area of Larsen Street and a three lot subdivision adjacent to Larsen Street from General Rural to Settlement Zone-Rural Residential Precinct 4 on Planning Maps 22 and 152. The TTPP map referenced below:

3.9 Since issue of the submission, CFS2 have completed two subdivisions as shown on the Map below. The Larsen Street parcels range from 1,686m^2 to 4,000m^2, while the three sections adjacent are 4,836m^2 to 7,766m^2. As the clustered parcels are below the threshold of the General Rural Zone, and have been developed, or have been consented to be built upon, it is not appropriate to retain the General Rural Zone on these parcels.

3.10 The parcels are also located adjacent to an area to the west which has been notified to be Settlement Zone-Rural Residential Precinct 4. A change from the General Rural Zone will not adversely affect the Light Industrial Zone to the south, as this already has a boundary with Settlement Zone-Rural Residential Precinct 4.

Submission S568-005

3.11 CFS2 have advised that they **WITHDRAW Submission S568-005** seeking to change the zone of Inner Cape Foulwind Road. At the time of Submission, the Submitter was investigating the feasibility of utilising the existing wastewater system for the former Holcim Plant site, however the Submitter has decided to proceed with development in line with the Rules in the TTPP for the Settlement Zone-Rural Residential Precinct 4.

3.12 As such, CFS2 support the notified zoning of Settlement Zone-Rural Residential Precinct 4.

3.13 I acknowledge that whilst not part of the original submission, CFS2 did not mention a small sliver of land which they own to the south of Pt Sec 8. CFS2 seek that Sec 1 SO 14304, RT NL9A/1256 be included in Settlement Zone-Rural Residential Precinct 4.

3.14 I note that there is confusion in submissions as Tauranga Bay Limited in their submission 597, identified this parcel as part of their landholdings and sought that the land be General Rural. This in incorrect as shown in the owns map below:

3.15 Buller District Council, Submitter 538, Objected In Part (Page 45) against the zoning of Inland Cape Foulwind Road as they did not consider there to be sufficient information available regarding Natural Hazards. The CFS2, as part of gathering information on the potential subdivision of the site have provided a Geotechnical Assessment from Davis Ogilvie of the site, attached as Appendix 1 of my evidence, which concludes on Page 17 that:

"There are no geotechnical constraints across the gently undulating to relatively level grassy areas of the site that would prohibit rezoning to residential land use.

It is the professional opinion of Davis Ogilvie (not to be construed as a guarantee), based on the geotechnical site investigation and the assessment of potential natural hazards on-site in accordance with Section 106 of the RMA, that the site is suitable for plan change provided the recommendations outlined in this report are followed".

3.16 Therefore, I consider that Buller District Council's reasons for Opposing in Part the zoning of this land have been addressed by CFS2, and that the site is suitable for the notified zone of Settlement Zone-Rural Residential Precinct 4.

Submission S568-006

3.17 CFS2 did submit that they would like to change the zoning of a small triangle parcel of 837m^2 which has the application of Pt Sec 8 Blk I Steeples SD to be changed from General Rural to Light Industrial Zone, as shown in the Figure above. At the time CFS2 develop the Inner Cape Foulwind area, this parcel will be amalgamated with the Light Industrial land to the east.

Submission S568-007

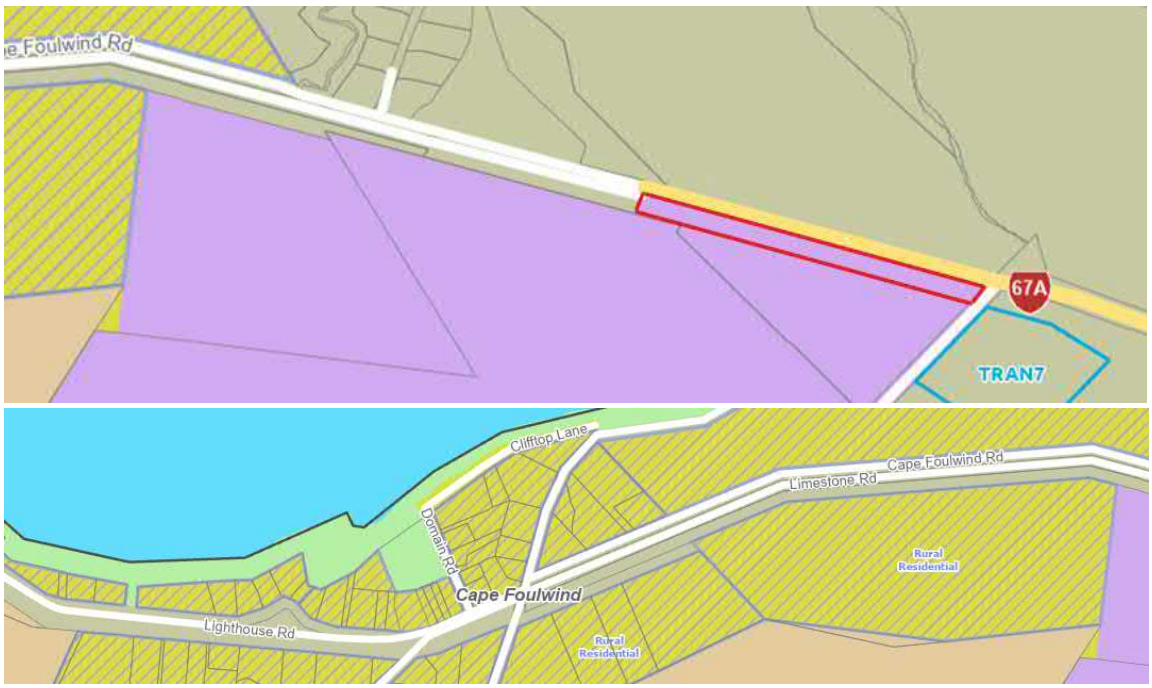
3.18 CFS2 have advised that they **WITHDRAW Submission S568-007** seeking to change the zone of Limestone Road. They support the notified zoning of Settlement Zone-Rural Residential Precinct 4.

3.19 CFS2 submission was based on an application that they had put into the IAF Fund for a communal wastewater system for the area. The application was declined, and the Submitter is proceeding to subdivide the site as non-serviced.

Submission S568-009

3.20 CFS2 own strips of land which were part of the former Haul Road and former railway links for mining, as shown highlighted below.

3.21 I note that the eastern strip, being Sec 6 SO 14770 has been zoned Light Industrial as shown below in the first figure, however the remainder of CFS2 strips have been notified as being Zoned General Rural. This is not consistent with the adjacent land holdings. The result of which is a 20m-40m wide strip of General Rural zoning, sandwiched between Settlement Zone-Rural Residential Precinct 4.



4.0 CONCLUSION

4.1 I support the notified zoning of CFS2's land in general as this consolidates development around an existing village.

4.2 I consider that the notified zoning for Larsen Street of General Rural is inappropriate for the existing allotments and land use of the Site. I consider that a more appropriate zoning for the site is Settlement Zone-Rural Residential Precinct 4.

4.3 I consider that the notified zoning of Settlement Zone-Rural Residential Precinct 4 for Inland Cape Foulwind Road and Limestone Road is appropriate. I note the addition of the strips between the Settlement Zone-Rural Residential Precinct 4 and Road boundaries should also be included to be consistent with adjacent zoning. Further I note that the addition of Sec 1 SO 14304, RT NL9A/1256 into the Settlement Zone-Rural Residential Precinct 4 is also appropriate.

Dated 22 March 2024

Jane Rushton Bayley

Appendix 1 to Planning Evidence
TTPP Rural Zone Hearing

DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

GEOTECHNICAL REPORT FOR PROPOSED PLAN CHANGE

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QUALITY ASSURANCE

Title:	Geotechnical Report for Proposed Plan Change: Cape Foulwind Development (Part Section 8 Block 1 Steeples SD)
Client:	Cape Foulwind Staple 2 Limited
File Location:	\\chsvr\JobData\projects\44s\44512 - Cape Foulwind Development\Geotech\003 Report\240308.RM.44512.Geotechnical Report.FINAL.docx
Version:	1
Date:	8 March 2024
Project No.:	44512

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BE Nat Res (Hons), CMEngNZ, CPEng,
Int PE (NZ), APEC Engineer
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DISCLAIMER

This report has been prepared at the specific instruction of Cape Foulwind Staple 2 Limited. It addresses the geotechnical conditions on property south of Cape Foulwind Road / Limestone Road near Cape Foulwind, West Coast. The property is legally identified as Part Section 8 Block 1 Steeples SD.

Davis Ogilvie did not perform a complete assessment of all possible conditions or circumstances that may exist at the site. Conditions may exist which were undetectable given the limited investigation of the site. Variations in conditions may occur between test locations, and there may be conditions on site which have not been revealed by the investigation, which have not been taken into account in the report.

Davis Ogilvie's opinions are based upon information that existed at the time of the production of the document. Assessments made in this report are based on the conditions found on site and published sources detailing the recommended investigation methodologies described. No warranty is included - either expressed or implied - that the actual conditions will conform to the assessments contained in this report.

Davis Ogilvie has provided an opinion based on observations, site investigations, and analysis methodologies current at the time of reporting. The report cannot be used by any third party without the written approval of Davis Ogilvie. The report cannot be used if there are changes in the referenced guidelines, analysis methodologies, laws, or regulations.

Only Cape Foulwind Staple 2 Limited and the Local and Regional Territorial Authorities are entitled to rely upon this engineering report. Davis Ogilvie & Partners Ltd. accepts no liability to anyone other than Cape Foulwind Staple 2 Limited in any way in relation to this report and the content of it and any direct or indirect effect this engineering report may have. Davis Ogilvie & Partners Ltd. does not contemplate anyone else relying on this report or that it will be used for any other purpose.

Information herein was created from maps and / or data from the New Zealand Geotechnical Database (https://www.nzgd.org.nz).

Should anyone wish to discuss the content of this report with Davis Ogilvie & Partners Ltd, they are welcome to contact us on (03) 366 1653 or at Level 1, 24 Moorhouse Avenue, Addington, Christchurch.

EXECUTIVE SUMMARY

Davis Ogilvie & Partners Ltd. (Davis Ogilvie) was engaged by Cape Foulwind Staple 2 Limited (the client) to undertake a geotechnical investigation on property south of Cape Foulwind Road / Limestone Road near Cape Foulwind, West Coast. The property is legally identified as Part Section 8 Block 1 Steeples SD.

The purpose of the investigation was to assess the underlying ground conditions; carry out a natural hazards assessment in accordance with Section 106 of the Resource Management Act (1991); and prepare a geotechnical report to support a submission to re-zone the land to allow minimum Lot sizes of 4,000 m^2.

Davis Ogilvie carried out a site walkover and shallow ground investigation comprising test pits to characterise the ground conditions. The test pit locations were chosen based on the scheme plan prepared by Staig and Smith (April 2023). The preliminary scheme plan has been prepared that identifies *"dwelling location areas"* (DLAs). The site can be superficially characterised as containing essentially level to gently undulating land and a series of gullies which feed Gibsons Creek. The DLAs have all been located on the gently undulating to relatively level ground, with a 20 m set back from the gullies. Some consistency was observed in the soil profile between test pits with medium dense to dense sandy soils generally present within 0.5 m to 1.0 m of ground surface. This sandy soil exhibits evidence of iron-oxide cementation. Groundwater was encountered at one test pit location only, at a depth of 2.9 m.

There are no geotechnical constraints across the gently undulating to relatively level grassy areas of the site that would prohibit rezoning to residential land use.

The site is considered suitable for plan change and residential development under Section 106 of the Resource Management Act (1991) regarding natural hazards.

TABLE OF CONTENTS

1.0 INTRODUCTION

Davis Ogilvie & Partners Ltd. (Davis Ogilvie) has been engaged by Cape Foulwind Staple 2 Limited (the client) to carry out a geotechnical investigation on property south of Cape Foulwind Road / Limestone Road near Cape Foulwind, West Coast. The property is legally identified as Part Section 8 Block 1 Steeples SD[1].

The purpose of the investigation was to assess the underlying ground conditions, carry out a natural hazards assessment in accordance with Section 106 of the Resource Management Act (1991), and prepare a geotechnical report to support a submission to re-zone the land to allow minimum Lot sizes of 4,000 m^2. Thirty-one residential lots are proposed for the site.

An aerial photograph of the site is provided in Figure 1.

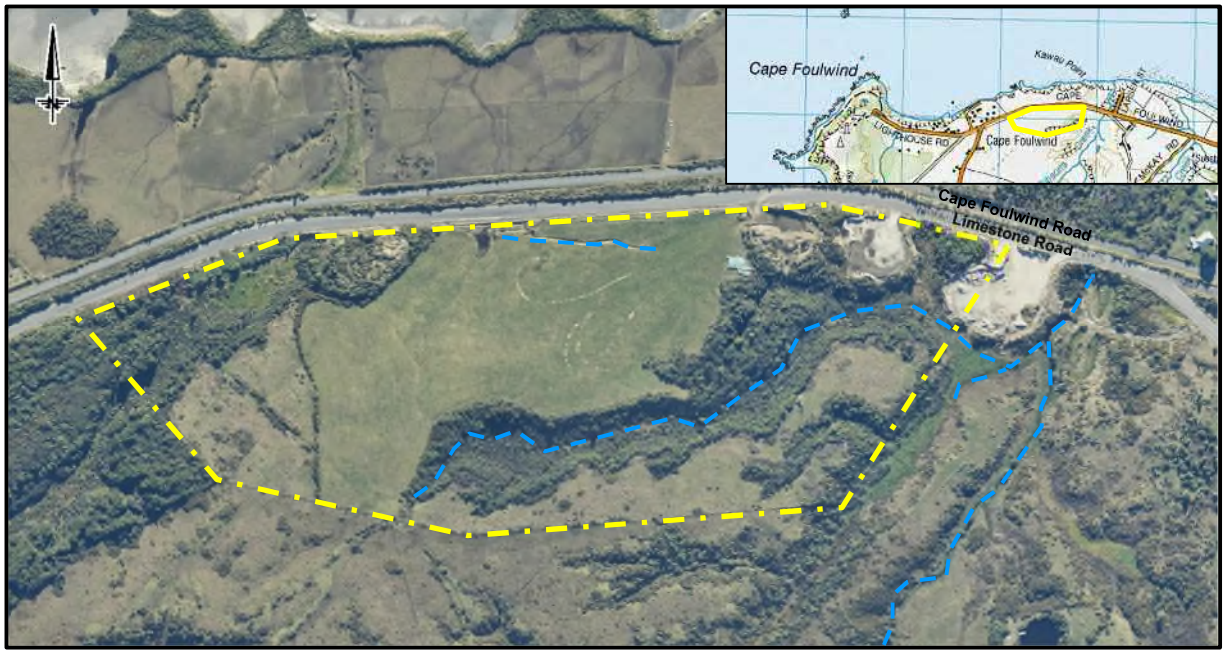


Figure 1: Recent aerial photograph showing approximate site boundary (yellow dashed line) and creek locations (blue dashed lines). Sourced from GRIP[2]. Not to scale. North as shown.

[1] Te Tai o Poutini Plan, https://westcoast.isoplan.co.nz, accessed 20/02/2024.
[2] GRIP - https://app.grip.co.nz/. Retrieved February 20234.

2.0 SITE DESCRIPTION

The property is located approximately 1 km east of Cape Foulwind and 13 km west of Westport, on the West Coast. It is bounded (and accessed) by Limestone Road / Cape Foulwind Road to the north; to the east by undeveloped land and land historically used by the Holcim Cement Plant as a laydown area for quarried limestone; and to the south and west by undeveloped land. The site occupies approximately 20.1 hectares (Figure 2).

In accordance with the proposed Te Tai o Poutini Plan (TTPP)[3], the site is intended to be zoned *"Settlement Zone - Rural Residential Precinct"*; it is understood that this zoning facilitates Lots of 4,000 m^2. According to the operative Buller District Plan, the site is currently zoned as *"Cement Production"*[4]. It is understood that any residential development is a Discretionary Activity, and a geotechnical investigation report is required to support the proposed zone change needed to enable rural-residential development.

The site is described in further detail in Section 5.1.

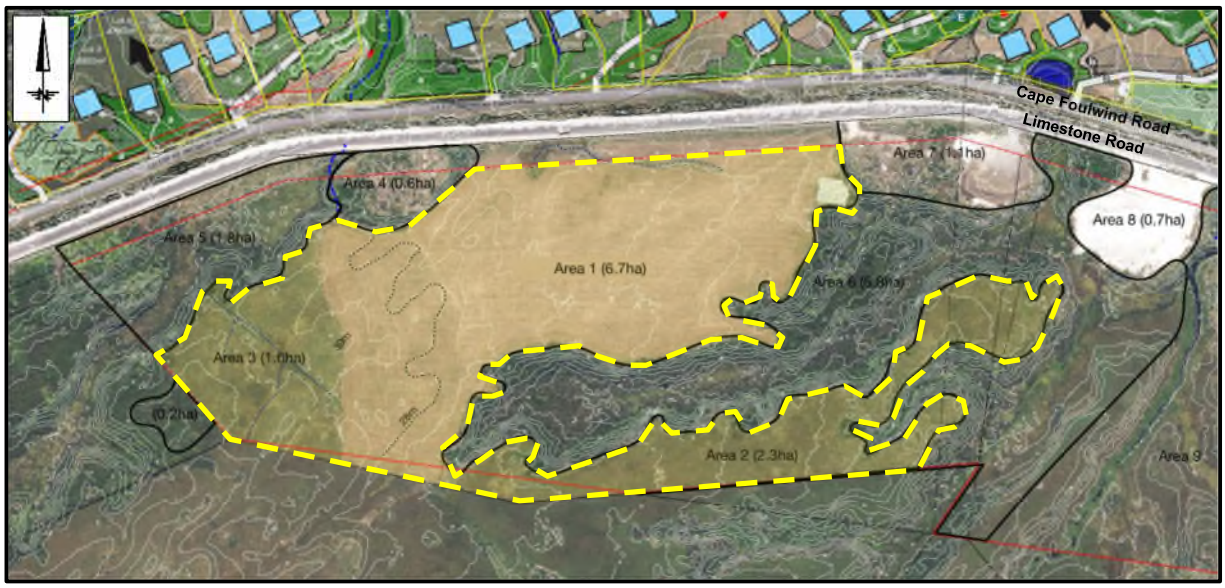


Figure 2: Aerial image showing the focus of the investigation area for the proposed residential development (outlined and shaded in yellow). Not to scale. North as shown. Source: DWG 1, 'Possible Development Area', Tasman Carter Limited, 17 March 2023.

[3] Te Tai o Poutini Plan, https://westcoast.isoplan.co.nz/eplan. Accessed 26/02/2024.
[4] West Coast Maps, Buller District Plan, https://gis.westcoast.govt.nz/WestMapsViewer. Accessed 26/02/2024.

3.0 DEVELOPMENT PROPOSAL

Davis Ogilvie understands that, subject to the zoning change, the land could be subdivided into thirty-one lots (Lot 1 – 31). The Lots will be accessed via Limestone Road. The proposed scheme plan is shown in Figure 3 and attached in **Appendix A**.

Figure 3: Aerial image of site showing the locations of proposed Lots 1 through 31. Not to scale. North as shown. Source: Staig and Smith, April 2023[5].

4.0 REVIEW OF PUBLISHED INFORMATION

A review of published information has been undertaken for the site and surrounding area. A summary is presented in the following sections.

4.1 Site History

A summary of the site history dating back to the earliest available aerial photograph (1951) is provided:

- 1951. The site is undeveloped and vegetated[6]. The main topographical features characterising the site are evident (grassy areas, a prominent gully, and topographical lows).
- 1950s to 1970s. No changes to the site. A cement plant commenced operating east of the site, with an associated laydown / temporary staging area to the northeast.

[5] Staig & Smith. Cape Foulwind Staple 2 Ltd Inland Cliffs, 4,000m^2 Settlement Zone Compliant Layout (for consultation only). Issue A. April 2023.
[6] Retrolens historical image resource, available at: http://retrolens.nz/, accessed 20/02/2024.

- 2003. No changes to the site. Several surface depressions and a creek orientated roughly east-west are visible north of the gully[7]. Two new laydown/staging areas are present to the north of the site.
- 2012. Some agricultural activity had commenced on the relative level to gently undulating grassy areas on the northern part of the site.

4.2 Published Geology and Hydrogeology

According to the published geological map, the site is underlain by near-surface geology described as *"marine sand and gravels"* (Pleistocene)[8]. A geological boundary where *"blue-grey; micaceous muddy sandstone grading up into yellow-brown sandstone"* (O'Keefe Formation, Blue Bottom Group) is mapped approximately 100 m north of the site.

The nearest natural surface water features include a creek approximately 50 m east of the site which drains from the gully towards Gibsons Creek approximately 100 m east of the site, Tasman Sea approximately 200 m north of the site, and a surface water body approximately 250 m southeast of the site.

4.3 Available Geotechnical Information

A review of the New Zealand Geotechnical Database (NZGD) shows test pits excavated approximately 600 m west of the site encountered topsoil and uncontrolled fill in the upper 0.4 m to 1.3 m of the soil profile, below which fine to medium sand with trace silt was present to depths ranging from 0.7 m (refusal) to 3.0 m depth (target depth). This sandy soil was generally medium dense to very dense and stained with iron oxide[9].

The client provided us with a copy of a report prepared by WSP New Zealand Limited in August 2021 titled *"Geotechnical Assessment Report, Omau Cliffs Subdivision"*, property located immediately north of the site, opposite Limestone Road / Cape Foulwind Road[10]. At that property, test pits encountered a veneer of topsoil (0.2 m thick) overlying very loose to loose sand / silty sand and very soft to firm sandy silt up to 1.9 m depth, below which dense to very dense sandy soils were present to at least 2.7 m depth (limit of excavation). WSP refer to *"iron pans"* (iron oxide cementation) throughout the site area and logged these soils as 'sandstone'. Groundwater was encountered at one test pit location, at a depth of 1.5 m.

[7] Google Earth – historical imagery, accessed 20/02/2024.
[8] Nathan, S., Rattenbury, M.S., Suggate, R.P. (compilers) 2002. Geology of the Greymouth area. Institute of Geological and Nuclear Sciences 1:250 000 geological map 12. 1 sheet + 58 p. Lower Hutt, New Zealand. Institute of Geological and Nuclear Sciences Limited.
[9] New Zealand Geotechnical Database, https://www.nzgd.org.nz/arcgismapviewer/mapviewer, accessed 13/02/2024.
[10] WSP New Zealand Limited, 2021. Geotechnical Assessment Report, Omau Cliffs Subdivision, Project No. 6-WCAPO.02.035GG.

4.4 Seismicity

The published geological map and GNS Active Fault database indicates that there are no identified active faults on the site. The Cape Foulwind Fault is located approximately 10 km west of the site, offshore. The nearest active fault is the Lower Buller Fault located approximately 14 km southeast of the site[11]. This fault has an estimated recurrence interval of 5,000 to 10,000 years.

The Alpine Fault, located approximately 90 km southeast of the site, has a recurrence interval in the order of 291 ± 23 years (Cochran et al. 2017[12]). The last major fault rupture occurred in 1717, and recent research suggests the probability of a rupture of the central section of the Alpine Fault occurring within the next 50 years to be in the order of 75%[13].

The Buller District Council's (BDC) '2006 Alpine Fault Earthquake Scenario Lifelines Study' provides information on the likely impact of an Alpine Fault earthquake on the district[14]. The modelled Modified Mercalli (MM) intensities indicate MM VII intensity shaking in the vicinity of the site, as well as Peak Ground Accelerations of ~0.1 g. The National Seismic Hazard Model estimates that there is a 10% chance of a PGA of 0.4 g occurring in the vicinity of the site in the next 50 years[15].

4.5 Liquefaction Potential

According to a November 2021 liquefaction assessment report prepared by Beca Limited (BECA)[16], the site is mapped in an area where liquefaction vulnerability is considered *"unlikely"* and *"where there is sufficient conclusive information that the underlying deposit is not susceptible to liquefaction, such as the presence of shallow rock."*

4.6 Flood Hazard

The Te Tai o Poutini Plan (TTPP) GIS web map indicates the site is not located within the West Coast Regional Council (WCRC) flood hazard zone[17]. A review of available Buller District Council maps (online) does not indicate that the site is in a flood hazard zone[18].

[11] GNS New Zealand Active Faults Database, https://data.gns.cri.nz/af/, accessed 13/02/2024.
[12] Cochran et al. 2017. A plate boundary earthquake record from a wetland adjacent to the Alpine fault in New Zealand refines hazard estimates. Earth and Planetary Science Letters. Volume 464, 15 April 2017, Pages 175-188.
[13] Jamie D. Howarth, Nicolas C. Barth, Sean J. Fitzsimons, Keith Richards-Dinger, Kate J. Clark, Glenn P. Biasi, Ursula A. Cochran, Robert M. Langridge, Kelvin R. Berryman, Rupert Sutherland. Spatiotemporal clustering of great earthquakes on a transform fault controlled by geometry**.** *Nature Geoscience*, 2021.
[14] Buller District Council (2006). Buller District Council Lifelines Study, Alpine Fault Earthquake Scenario.
[15] National Seismic Hazard Model accessed via https://nshm.gns.cri.nz/HazardMaps.
[16] West Coast Regional Liquefaction Assessment. Prepared for West Coast Regional Council by Beca Limited. Map 18, referenced DWG GIS-3160181-01-18. Dated 1 November 2021.
[17] Te Tai o Poutini Plan, https://westcoast.isoplan.co.nz, accessed 13/02/2024.
[18] https://gis.westcoast.govt.nz/WestMaps/, accessed 27/02/2024.

5.0 GEOTECHNICAL SITE INVESTIGATION

A geotechnical investigation was undertaken by Davis Ogilvie on 14 – 16 February 2024 and comprised the following:

- Site walkover assessment of the proposed dwelling location areas (DLAs) and accessible parts of the gully.
- Soil testing including eleven test pits, twelve Dynamic Cone Penetrometer (DCP) tests, one hand auger, and two soil soakage tests. DCP tests were carried out adjacent to test pit and hand auger locations. Test pits were excavated utilising an 8-ton track-mounted excavator.

The soil testing was carried out across the generally flat area as outlined in yellow in Figure 2 where the proposed DLAs will be located. The test locations confirmed the consistency of the ground conditions across this broad area. The test locations are shown in **Appendix B**.

5.1 Site Walkover

The site, accessed via Limestone Road to the north, is characterised by a gently undulating to relatively level grassy area with several more densely vegetated (tree / bush) gullies and topographical lows containing standing water, particularly in the southeastern corner of the site. The overall fall of the site is towards the east. Site photographs are included in **Appendix C**.

The broad grassy area of the site has recently been cut for baleage and stacked near the entrance to the site on its northeastern side. This area was generally soft underfoot, particularly in the southern and western parts of the site. The proposed DLAs are generally sited in this grassy area.

A gully orientated roughly west to east-northeast is present near the southern central part of the site. The gully is densely vegetated with native trees and shrubs. The slopes of the gully were vegetated and showed no apparent evidence of instability, nor was there evidence of tension cracks near the crest of the gully.

The accessible parts of the gully bottom are approximately 5.0 – 6.0 m lower than the crest and characterised by bog conditions with gently-flowing water in places, areas of standing water, and ground cover characterised by silt, sand and decaying organic debris. At the western-most extent of the gully, some groundwater seepage was observed near the bottom. At this location, the gully slope consisted of stable, near-vertical, dense sandy soils (with iron-oxide staining).

A topographical low containing standing water was observed in places along the southern edge of the gully and to the east where a small stream is present. A shallow, roughly linear surface depression (topographical low) is present in the northern part of the site, oriented roughly east-west, with localised standing water.

The approximate locations of topographical features present on site and referenced above are shown on Figure 4.

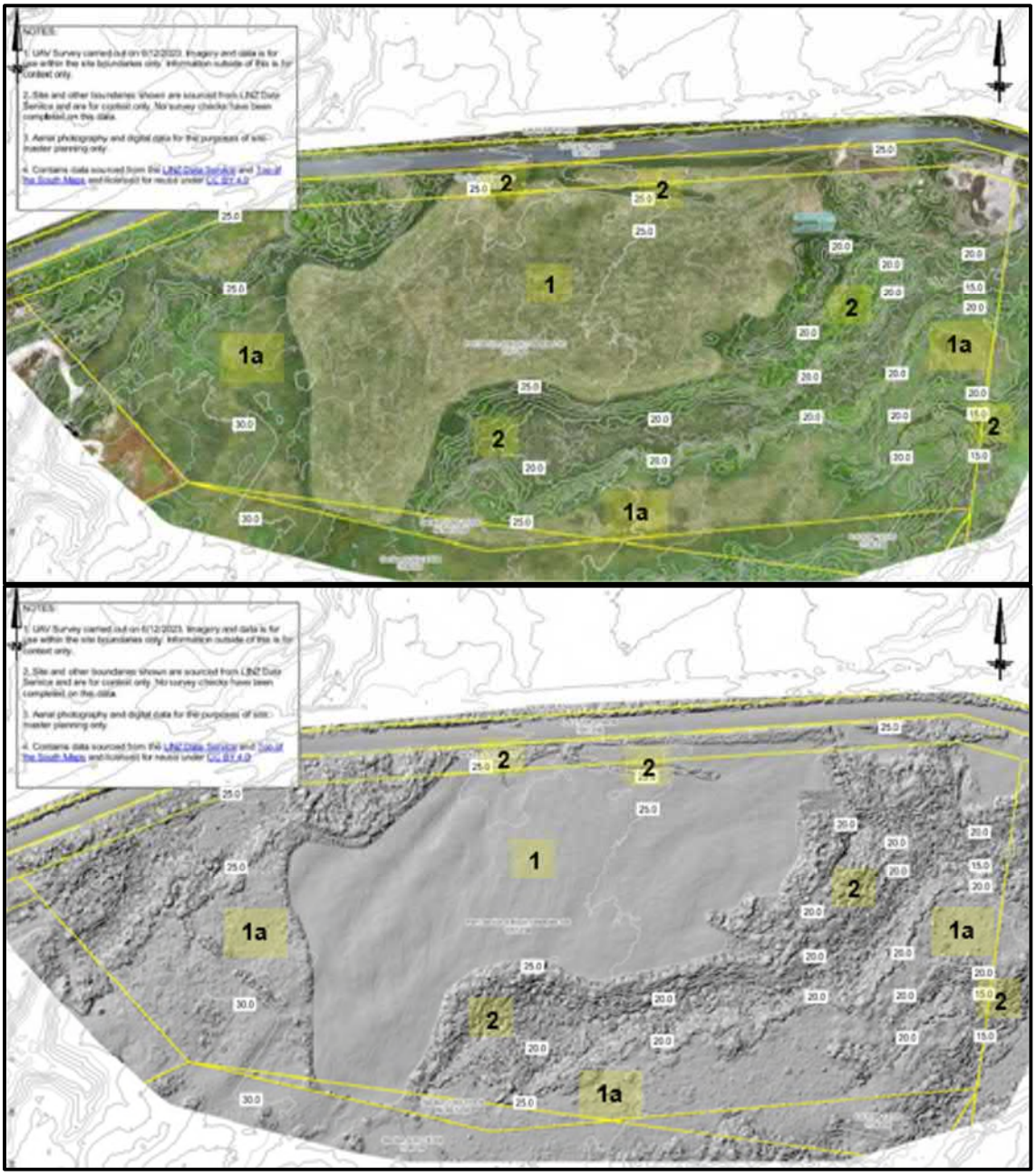


Figure 4: Gently undulating to relatively level grassy areas (1), grassy areas with some dense vegetation and soft ground conditions underfoot (1a), and gully and topographical low containing standing water (2). Aerial images from UAV Aerial Survey (Staig & Smith, 14 December 2023); contours added by Davis Ogilvie.

5.2 Shallow Ground Investigation Results

Some consistency was observed in the soil profile between test pit locations. A summary of site soil conditions is presented in Table 1 and the logs are attached to this report in **Appendix D**.

Table 1: Summary of Site Soil Conditions

Soil Type	DCP (blows/100 mm)	Depth to Bottom of Layer (m below EGL)	Relative Density
TOPSOIL	0 – 4	0.15 – 0.5	-
Silty SAND, contains roots and rootlets	0 – 30 (Typically 1 – 7)	0.5 – 0.9	Loose to medium dense
SAND, with iron-oxide cementation	7 – 30 +	1.1 – 1.7	Medium dense to very dense
SAND, with iron-oxide nodules	14 – 30 +	> 3.0 – 4.0	Dense to very dense

Relative density not assigned to topsoil.

We note a correlation between DCP blow counts and the degree of iron-oxide cementation in the natural sandy soils. Higher DCP blow counts are generally indicative of more dense, well-cemented sandy soils.

Rock was not encountered with the depth achieved during the ground investigation (i.e., not within 3.0 to 4.0 m of ground surface). In places, sandy soils are chemically cemented due to the presence of iron-oxide.

5.3 Groundwater

Groundwater was encountered at one (1) test pit location only, TP1, at a depth of 2.9 m below existing ground level (EGL). Groundwater seepage was encountered at the interface of dense natural sands (iron-oxide cementation) and the overlying topsoil and loose silty sand (with rootlets) in TP8, TP10 and TP11. These dense sands impede the rate of groundwater percolation down through the soil column; hence, perched groundwater conditions can develop close to ground surface.

5.4 Soakage Testing

Soakage testing was carried out at two locations - TP2 and TP5 - to determine an indicative soakage rate within the sandy soils for preliminary civil design purposes. The results are discussed in Section 7.0.

6.0 SECTION 106 RESOURCE MANAGEMENT ACT (1991)

Section 106 of the Resource Management Act (RMA) requires that the potential for material damage from natural hazards be addressed as a condition for obtaining subdivision consent. The relevant geotechnical aspects pertaining to proposed DLAs are discussed in Table 2.

Table 2: Resource Management Act Considerations

Natural Hazard	Potential Effects on Subdivision Site
Erosion	The proposed dwelling location areas (DLAs) are generally located on level to gently undulating, grass covered land. The risk of surface erosion is considered low. No evidence of significant erosion was observed at the DLAs.
Slippage and Falling Debris	The DLAs are located on essentially level land. No evidence of slippage and falling debris was observed at the DLAs, nor were any source areas for falling debris or slippage (e.g. scarps or unstable rock outcrops) observed on-site. The accessible parts of the gully slopes were vegetated and showed no apparent evidence of recent instability. A review of published resources including historical aerial photographs and TTPP and West Coast Regional Council (WestMaps) online maps show the site as being at negligible risk of landslide, and aerial imagery does not indicate evidence of historic landslides. Minimum setbacks from any gully, surface water body or topographical low capable of containing standing water must be confirmed during Lot-specific geotechnical testing at building consent stage.
Subsidence	Groundwater was encountered at one test pit location only, TP1, at a depth of 2.9 m below EGL. The risk of seismically induced liquefaction is low because the site is underlain by dense to very dense sandy soils and rock (O'Keefe Formation) at depths greater than 3.0 m below EGL at the site.
Inundation	The DLAs are not within any inundation/flood hazard zone according to published resources including TTPP and WestMaps. Inundation is not considered a risk to the DLAs due to their current elevation above the surrounding lower lying topography, setback from known areas of standing water on-site, and proximity to surface water bodies. Due to undulating site topography, associated topographical lows, and dense soils at shallow depth, localised areas of standing water could be expected to develop following heavy and/or prolonged rainfall at the site. Evidence of such ground conditions was observed on the northern part of the site, near proposed Lots 4 through 8 where a shallow surface depression is present. As a minimum, finished floor level requirements shall comply with New Zealand Building Code (NZBC) Section E1 with appropriate freeboard. Furthermore, it is recommended that appropriate stormwater control measures are designed once the final location and size of the DLAs are confirmed, potentially incorporating the existing surface drainage channel(s).
Seismic	There are no mapped active faults within the site. Therefore, the risk of the proposed development being affected by fault rupture is considered low. The proposed DLAs are considered at risk from damage due to earthquake-induced ground shaking. This is expected to be addressed by appropriate foundation design in accordance with NZS 1170.5:2004, NZS 3604:2011, and applying an appropriate site Subsoil Class for Importance Level 2 (IL2) structures.

The site is considered geotechnically suitable for residential development subject to the recommendations of this report being incorporated into the design and construction of earthworks, infrastructure, and future buildings at the site.

7.0 PRELIMINARY DESIGN CONSIDERATIONS AND RECOMMENDATIONS

The following section provides geotechnical design considerations, parameters for design and general foundation recommendations for future dwellings within the proposed BLAs.

7.1 Design Criteria

Any buildings constructed on site shall be designed to the appropriate New Zealand standard, NZS 3604:2011 (Earthquake Zone 3), NZS 4229: 2013, or if specific design is required this must be done in accordance with NZS 1170.5:2004. In terms of the latter, the subsoil is classified as Class C *"shallow soil"* site.

7.2 Geotechnical Ultimate Bearing Capacities

With reference to the DCP test results, in accordance with NZS 3604:2011 and the MBIE Guidance[19], a geotechnical ultimate bearing capacity of 300 kPa ('Good Ground') is generally available at depths ranging from 0.5 m to 1.0 m below EGL in dense natural sandy soils.

7.3 Indicative Soil Properties

Estimated soil properties for the encountered natural soils are provided in Table 3 for structural design purposes.

Table 3: Estimated Soil Properties

Soil Description	Unit Weight[20] (γ)	Internal Angle of Friction[21] (ϕ)	Cohesion (c)
TOPSOIL	-	-	-
Silty SAND, contains roots and rootlets	16 – 18	27 – 30°	0 kPa
SAND, with iron-oxide cementation	18 – 20	30 - 34°	0 kPa
SAND, with iron-oxide nodules			

7.4 Foundations

A NZS3604:2011 timber pile or concrete floor foundation will most likely be appropriate for foundation design. Foundations should be designed by a Chartered Professional Engineer.

[19] Ministry of Building, Innovation and Employment, December 2012. Technical Guidance, Version 3.
[20] Look, B.G. (2007) Handbook of Geotechnical Investigation and Design Tables, Taylor & Francis Group, London, UK.
[21] Bowles, J.E. (2001) Foundation Analysis and Design, McGraw-Hill International Editions – 5th Edition, Table 2-6 pp108.

7.5 Soakage Test Results

For preliminary design purposes an ultimate infiltration rate of 225.0 mm per hour (calculated allowing an infiltration factor of safety of 3) may be assumed in the dense sandy soils. However, the rate of soakage will depend on the density of iron-oxide cemented sandy soils encountered at each proposed DLA; therefore, Lot-specific soakage testing will be required at detailed design stage.

8.0 PRELIMINARY CIVIL INFRASTRUCTURE RECOMMENDATIONS

Ground conditions encountered on-site indicate consistency between the test locations. The presence of natural, iron-oxide cemented sandy soils (medium dense to very dense) within approximately 1.0 m of existing ground level is considered beneficial for road construction; however, these soils may have a low permeability and be poorly suited to stormwater and wastewater soakage. Lot-specific soakage testing will be required at the detailed design stage.

8.1 Road Pavement Design

All road construction shall be carried out in accordance with NZS 4404:2010[22]. The proposed roads may be constructed on cut ground and/or engineered fill.

8.2 On-site Disposal of Stormwater and Household Effluent

The Regional Land and Water Plan[23] provides a framework for the integrated and sustainable management of the West Coast's natural and physical resources as they apply in the context of land and water. On-site disposal of stormwater and household effluent is covered by the Plan and contains permitted activity rules for activities that have no more than minor adverse effects on the environment. For other activities, resource consent is required.

Rules in the Plan which must be adhered to for the development include:

- Rule 63: Discharge of stormwater from reticulated systems.
- Rule 71: Discharge of any contaminant, or water to water, not complying with Rules 63 to 70.
- Rule 79: On-site discharge of sewage effluent.
- Rule 81: Discharge of stormwater runoff.
- Rule 91: Discharge to land discretionary activity Rule.

[22] Standards New Zealand. Land Development and Subdivision Infrastructure. Superseding NZS 4404:2004.
[23] The West Coast Regional Council, May 2014. Regional Land and Water Plan.

8.2.1 Stormwater Management

Stormwater needs to be adequately controlled on the site to prevent localised erosion and inundation. Careful consideration and design of site drainage will be required, and drainage systems must be designed by a suitably qualified and experienced engineer, and include regard for the following:

- Maintenance of natural drainage flow paths where possible.
- Direction of stormwater toward existing natural flow paths (and road swales along Limestone Road).

It is recommended that a suitably sized and located retention tank and / or drainage channels are incorporated into the final design at subdivision consent stage to manage runoff from hardstand areas. The most suitable means of effective disposal of stormwater, from any proposed impervious surfaces, is to discharge runoff into existing on-site surface water channels, such as the gully in the central part of the site. An alternative solution could include the use of an attenuation basin infiltration system.

Any new culverts and swales will need to be appropriately sized in accordance with the New Zealand Building Code and relevant New Zealand standards, while stormwater swales and pipe networks will require maintenance to ensure the design capacity is maintained.

8.2.2 On-site Wastewater Management

The system chosen for a residential dwelling shall be approved by the WCRC/BDC and be designed and installed by a suitably qualified and experienced person in accordance with the requirements of NZS 1547:2012 *"On site Domestic Wastewater Management."*

Options for on-site wastewater management may include a trench or mounded evapotranspiration wastewater management system, septic tanks, or decentralised wastewater treatment plant. At 4,000 m^2 lots, we consider there is adequate space to site a disposal field.

9.0 CONCLUSIONS

There are no geotechnical constraints across the gently undulating to relatively level grassy areas of the site that would prohibit rezoning to residential land use.

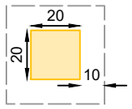
It is the professional opinion of Davis Ogilvie (not to be construed as a guarantee), based on the geotechnical site investigation and the assessment of potential natural hazards on-site in accordance with Section 106 of the RMA, that the site is suitable for plan change provided the recommendations outlined in this report are followed

APPENDIX A

Preliminary Scheme Plan

NOTES:

LEGAL ROAD WIDTH >20 DWELLINGS = 15m
LEGAL ROAD WIDTH <20 DWELLINGS = 9m
CUL-DE-SAC HEADS = 9.5m RADIUS
RIGHT OF WAY WIDTH = 6m
DO NOT SCALE FROM DRAWING.
AREAS AND DIMENSIONS ARE APPROXIMATE ONLY AND SUBJECT TO FINAL SURVEY.
THIS IS A CONCEPT PROPOSAL PLAN ONLY.
A SUBDIVISION CONSENT HAS NOT ISSUED FOR THIS PROPOSED LAYOUT. CONFIRMATION OF THE LAYOUT CAN ONLY BE ACHIEVED THROUGH THE ISSUE OF A SUBDIVISION CONSENT.
ADDITIONAL EASEMENTS MAY BE REQUIRED.
AERIAL PHOTOGRAPHY IS FOR CONTEXT ONLY.



DWELLING LOCATION AREA
20m X 20m WITH 10m OFFSET

ORIGINAL SIZE A3

STAIG & SMITH LTD
81 Selwyn Place, Nelson
248 Montreal St, Christchurch
Ph: 0800 807 818
www.staigsmith.co.nz
enquiries@staigsmith.co.nz

AMENDMENT | DATE

JOB/CLIENT
Cape Foulwind Staple 2 Ltd
Inland Cliffs

DRAWING
For Consultation Only
4,000m² Settlement Zone
Compliant Layout

NORTH

Survey:
Drawn: TS
Checked:
Approved:

ISSUE A
DATE April 2023

PROJECT NO. 12510E-CPT-01
SCALE: A3 A1
Hz 1:2500
Vt -

SHEET 1 OF 1

APPENDIX B

Geotechnical Site Plan (DWG G01A)

CAPE FOULWIND ROAD
LIMESTONE ROAD

Proposed Lot 1
Proposed Lot 2
Proposed Lot 3
Proposed Lot 4
Proposed Lot 5
Proposed Lot 6
Proposed Lot 7
Proposed Lot 9
Proposed Lot 10
Proposed Lot 11
Proposed Lot 12
Proposed Lot 13
Proposed Lot 14
Proposed Lot 15
Proposed Lot 16
Proposed Lot 17
Proposed Lot 18
Proposed Lot 19
Proposed Lot 20
Proposed Lot 21
Proposed Lot 22
Proposed Lot 23
Proposed Lot 24
Proposed Lot 25
Proposed Lot 26
Proposed Lot 27
Proposed Lot 28
Proposed Lot 29
Proposed Lot 30
Proposed Lot 31

TP 01
TP 02 + I
TP 03
TP 04
TP 05
TP 06
TP 07
TP 08
TP 09
TP 10
TP 11
HA 01

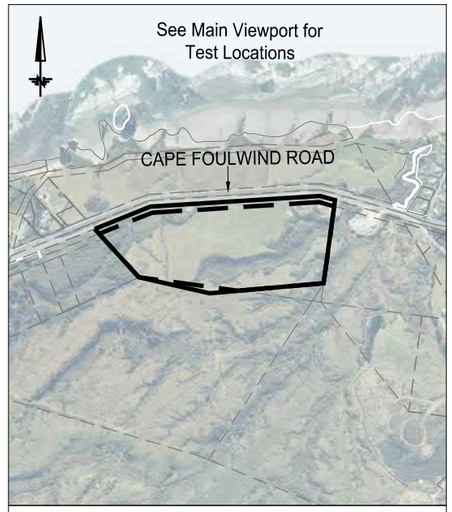
25.0
20.0
15.0
30.0

Section 46
VILL OF Omau

Section 2
SO 14304

Lot 1
DP 12325

Part Section 8
Block I Steeples SD



Scale 1:20,000

Key:

- : Site Boundary
- : Abuttal Boundary
- : Road Boundary
- : Dynamic Cone Penetrometer (DCP) + Hand Auger (HA)
- : Test Pit (TP)
- : Test Pit + Infiltration Test (TP+I)
- : Proposed Boundary
- : Proposed Dwelling Location Area 20m X 20m With 10m Offset

Test and building locations are approximate (scaled and aligned using aerial imagery).
Shallow geotechnical testing undertaken 14, 15 & 16 February 2024.
Aerial image and boundaries obtained from GRIP®.
Boundaries are indicative only.
Proposed boundaries, dwellings and dwelling offsets obtained from Staig & Smith plan dated April 2023 and are indicative only.
Contours obtained from LINZ are in Buller 2000 circuit vertical datum in NZVD 2016 and are indicative only.

0m 50m 100m 150m 200m 250m
Scale 1:2500

CAD ref: 44512.Geotechnicalsiteplan.dwg

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Geotechnical Site Plan
Cape Foulwind Development
Part Section 8 Block I Steeples SD, Section 1 So 14304 & Section 5 SO 14770

/ design	/ drawn	/ QA check	/ dwg
SW	TM	RM	G01
/ scale @A3	/ date	/ file	/ issue
1:2500	03/24	44512	A

APPENDIX C

Site Photographs

Figure 1: Photographs of the site taken near test pit TP10's location looking east (top) and west (bottom). In the photograph on top, the dense tree vegetation in the left of the photograph marks the approximate crest of the gully. Photographs taken by Davis Ogilvie, 14 February 2024.

Figure 2: Photographs taken near test pit TP7's location looking southeast (top) and west (bottom). Photographs taken by Davis Ogilvie, 15 February 2024.

Figure 3: Photographs taken near test pit TP3's location looking west (top) and east (bottom). Photographs taken by Davis Ogilvie, 15 February 2024.

Figure 4: Photographs taken from the bottom of the gully, at its western-most extent. The photograph on the left is looking west towards a steep gully slope characterised by moss-covered dense sand. It is estimated that from the bottom of the gully to the crest is approximately 5.0 – 6.0 m elevation difference. The photograph on the right is looking east from the same location, showing standing water and dense vegetation characteristic of much of the accessible parts of the gully. Photographs taken by Davis Ogilvie, 16 February 2024.

APPENDIX D

Shallow Investigation Results

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SHALLOW INVESTIGATION RESULTS

Job N° / **44512**
Test N° / **HA 01**

Project: Cape Foulwind Development
Date: 16/02/24
Client: Cape Foulwind Staple 2 Limited
Time: 9:00 am
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)
Excavation Method: Hand Auger

DEPTH (m)	SOIL DESCRIPTION (Soil 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)	USCS	Graphic Log	Ground Water	DCP RESULTS: HA/DCP 01 (Blows / 100mm)	RL (m)
0	0.00 - 0.05m: Silty fine to medium SAND; grey black. Moist, contains trace rootlets and fine organics.	SM			0	
	0.05 - 0.30m: Silty fine to medium SAND; grey brown. Very soft, moist, contains trace rootlets.	SM			1	
	0.30 - 0.50m: No recovery.			0.3m (16-Feb-24)	0 0	
0.5	0.50 - 0.60m: Silty fine to medium SAND; grey brown. Very soft to soft, saturated.	SM			0 1	
	0.60 - 0.75m: No recovery.				4	
	0.75 - 0.82m: Silty fine to medium SAND; orange brown. Medium dense, wet to saturated, possible iron oxide staining.	SM			3	
	Auger terminated at 0.82m - Poor recovery.				4	
1.0					8	
					14	
					26 >>	
					21 >>	
					18 >>	
1.5					16	
					17 >>	
					14	
					19 >>	
					15	
2.0					20 >>	
					33 >>	
					30 >>	
2.5						

Logged By: RM
Plotted By: TM
Checked By: RM

Notes:

Dynamic Cone Penetrometer (DCP) tests and logs give an indication of the ground conditions at the location of the tests only. While they may be 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.

Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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SHALLOW INVESTIGATION RESULTS

Job N° / **44512**
Test N° / **TP 01**

Project: Cape Foulwind Development
Date: 15/02/24
Client: Cape Foulwind Staple 2 Limited
Time: 1:10 pm
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)
Excavation Method: 8T Excavator

DEPTH (m)	SOIL DESCRIPTION	USCS	Graphic Log
0.0	0.00 - 0.15m: Silty fine to medium SAND; brown. Dry to moist, contains trace rootlets (TOPSOIL).	TS	TS TS TS
0.15	0.15 - 0.60m: Silty fine to medium SAND; grey brown. Medium dense to very dense, moist, contains trace roots and rootlets.	SM	
0.6	0.60 - 1.40m: Medium to coarse SAND; grey orange brown. Moist, contains black laminations and iron oxide cementation.	SP	
1.3	1.30m - 1.40m: Red and orange staining (ferricrete).		
1.4	1.40 - 3.00m: Medium to coarse SAND; brown. Moist, contains trace black nodules (iron oxide).	SP	
2.9	2.90m: Sand becomes wet. Groundwater seepage.		
3.0	Test Pit terminated at 3.00m - Target depth achieved.		

Ground Water: Groundwater Not Encountered

DCP RESULTS: DCP 01

(Blows / 100mm)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	3	4	3	10	30 >>	30 >>								

Hammer Bouncing

RL (m)

PHOTO(S)

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Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

Ground Water	
Standing	
Out flow	
In flow	

Logged By: RM
Plotted By: TM
Checked By: RM

Notes:

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SHALLOW INVESTIGATION RESULTS

Job N° / **44512**
Test N° / **TP 02**

Project: Cape Foulwind Development
Client: Cape Foulwind Staple 2 Limited
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)

Date: 15/02/24
Time: 2:00 pm
Excavation Method: 8T Excavator

DEPTH (m)	SOIL DESCRIPTION	USCS	Graphic Log	Ground Water
0.00				
	0.00 - 0.15m: Silty fine to medium SAND; brown. Dry to moist, contains trace rootlets (TOPSOIL).	TS	TS TS TS	Groundwater Not Encountered
	0.15 - 0.85m: Silty fine to medium SAND; grey brown. Loose to medium dense to very dense, moist, contains trace roots and rootlets.	SM		
0.5				
	0.85 - 1.65m: Medium to coarse SAND; grey orange brown. Very dense, moist, contains black laminations, iron oxide cementation.	SP		
1.0				
1.5				
	1.65 - 3.00m: Medium to coarse SAND; grey brown. Moist, contains trace black nodules (iron oxide).	SP		
2.0				
2.5				
3.0				
	Test Pit terminated at 3.00m - Target depth achieved.			
3.5				
4.0				

DCP RESULTS: DCP 02

(Blows / 100mm)

Depth (m)	Blows / 100mm
0.0	2
0.1	4
0.2	6
0.3	3
0.4	1
0.5	2
0.6	2
0.7	7
0.8	17 >>
0.9	25 >>
1.0	30 >>

RL (m)

PHOTO(S)

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Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

Ground Water	
▼	Standing
▷	Out flow
◁	In flow

Logged By:	RM
Plotted By:	TM
Checked By:	RM

Notes: Infiltration test at 2.0 m depth.
Piezometer installed at 2.0 m.

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SHALLOW INVESTIGATION RESULTS

Job N° / **44512**
Test N° / **TP 03**

Project: Cape Foulwind Development
Client: Cape Foulwind Staple 2 Limited
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)

Date: 15/02/24
Time: 1:35 pm
Excavation Method: 8T Excavator

DEPTH (m)	SOIL DESCRIPTION	USCS	Graphic Log	Ground Water
0.0	0.00 - 0.20m: Silty fine to medium SAND; brown. Dry to moist, contains trace rootlets (TOPSOIL).	TS	TS	Groundwater Not Encountered
0.2	0.20 - 0.55m: Silty fine to medium SAND; grey brown. Loose to medium dense, moist, contains trace roots and rootlets.	SM		
0.5	0.55 - 1.30m: Medium to coarse SAND; orange brown. Dense to very dense, moist, contains black laminations, iron oxide cementation.	SP		
1.5	1.30 - 3.10m: Medium to coarse SAND; brown. Moist, contains trace black nodules (iron oxide).	SP		
3.1	Test Pit terminated at 3.10m - Target depth achieved.			

Soil 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 RESULTS: DCP 03

(Blows / 100mm)

Depth (m)	Blows / 100mm
0.0	2
0.1	4
0.2	4
0.3	2
0.4	1
0.5	14
1.0	20 >>
1.1	26 >>
1.2	37 >>
1.3	30 >>

Hammer Bouncing

RL (m)

PHOTO(S)

Dynamic Cone Penetrometer (DCP) tests and logs give an indication of the ground conditions at the location of the tests only. While they may be 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.

Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

Ground Water	
Standing	
Out flow	
In flow	

Logged By:	RM
Plotted By:	TM
Checked By:	RM

Notes:

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SHALLOW INVESTIGATION RESULTS

Job N° / **44512**
Test N° / **TP 04**

Project: Cape Foulwind Development
Date: 15/02/24
Client: Cape Foulwind Staple 2 Limited
Time: 11:15 am
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)
Excavation Method: 8T Excavator

DEPTH (m)	SOIL DESCRIPTION (Soil 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)	USCS	Graphic Log	Ground Water
0.0	0.00 - 0.10m: Silty fine to medium SAND; brown. Dry to moist, contains trace rootlets (TOPSOIL).	TS	TS TS	Groundwater Not Encountered
	0.10 - 0.90m: Silty fine to medium SAND; grey brown. Loose to dense, moist, contains trace roots and rootlets.	SM		
1.0	0.90 - 1.20m: Medium to coarse SAND; orange brown. Loose to very dense, moist, contains black laminations, iron oxide cementation.	SP		
	1.20 - 3.30m: Medium to coarse SAND; brown. Moist, contains trace black nodules (iron oxide). 1.20m - 1.30m: Red and orange staining (ferricrete).	SP		
3.5	Test Pit terminated at 3.30m - Target depth achieved.			

DCP RESULTS: TP 04

(Blows / 100mm)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	RL (m)
			4												
						7									
			3												
								9							
			2												
			3												
			2												
			2												
			3												
			2												
														25 >>	
														30 >>	

Hammer Bouncing

PHOTO(S)

Dynamic Cone Penetrometer (DCP) tests and logs give an indication of the ground conditions at the location of the tests only. While they may be 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.

Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

Ground Water	
Standing	
Out flow	
In flow	

Logged By:	RM
Plotted By:	TM
Checked By:	RM

Notes:

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SHALLOW INVESTIGATION RESULTS

Job N° / **44512**
Test N° / **TP 05**

Project: Cape Foulwind Development
Date: 15/02/24
Client: Cape Foulwind Staple 2 Limited
Time: 8:35 am
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)
Excavation Method: 8T Excavator

DEPTH (m)	SOIL DESCRIPTION	USCS	Graphic Log
0.0	0.00 - 0.20m: Silty fine to medium SAND; brown. Dry to moist, contains trace rootlets (TOPSOIL).	TS	TS TS TS TS
0.2	0.20 - 0.80m: Silty fine to medium SAND; grey brown. Loose to very dense, moist, contains trace roots and rootlets.	SM	
0.8	0.80 - 1.40m: Medium to coarse SAND; orange brown. Dense to very dense, moist, contains weak black laminations, iron oxide cementation.	SP	
1.3	1.30m - 1.40m: Red and orange staining (ferricrete).		
1.4	1.40 - 3.00m: Medium to coarse SAND; brown. Dense to very dense, moist, contains trace black nodules (iron oxide).	SP	
3.0	Test Pit terminated at 3.00m - Target depth achieved.		

Groundwater Not Encountered

DCP RESULTS: TP 05

(Blows / 100mm)

Depth (m)	Blows / 100mm
0.0	2
0.1	3
0.2	1
0.3	6
0.4	19 >>
0.5	25 >>
0.6	7
0.7	6
0.8	10
0.9	11
1.0	15
1.1	22 >>
1.2	38 >>
1.3	30 >>
1.4	14
1.5	20 >>
1.6	30 >>

Hammer Bouncing

RL (m)

PHOTO(S)

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Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

Ground Water	
Standing	
Out flow	
In flow	

Logged By:	RM
Plotted By:	TM
Checked By:	RM

Notes: Infiltration test at 3.0 m depth.
Piezometer installed at 2.0 m.

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SHALLOW INVESTIGATION RESULTS

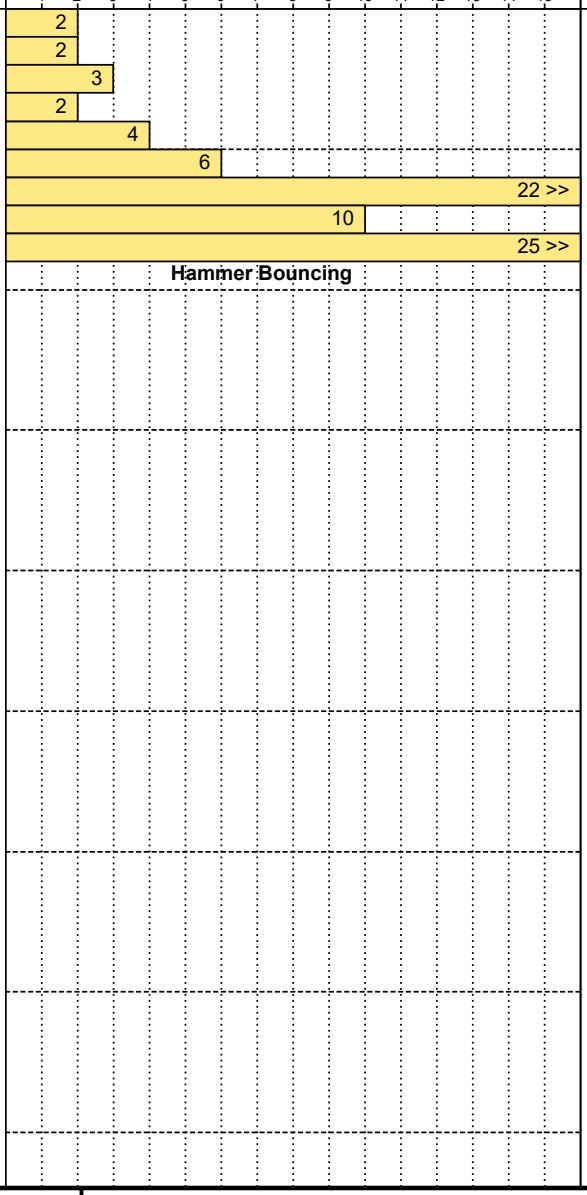
Job N° / **44512**
Test N° / **TP 06**

Project: Cape Foulwind Development
Date: 15/02/24
Client: Cape Foulwind Staple 2 Limited
Time: 10:15 am
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)
Excavation Method: 8T Excavator

DEPTH (m)	SOIL DESCRIPTION (Soil 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)	USCS	Graphic Log	Ground Water
0.0	0.00 - 0.30m: Silty fine to medium SAND; brown. Dry to moist, contains trace rootlets (TOPSOIL).	TS	TS	Groundwater Not Encountered
0.5	0.30 - 0.80m: Silty fine to medium SAND; grey brown. Loose to very dense, moist, contains trace rootlets.	SM		
1.0	0.80 - 1.30m: Medium to coarse SAND; grey orange brown. Very dense, moist, contains black laminations, iron oxide cementation.	SP		
1.5	1.30 - 3.00m: Medium to coarse SAND; brown. Moist, contains trace black nodules (iron oxide).	SP		
2.0				
2.5				
3.0	Test Pit terminated at 3.00m - Target depth achieved.			
3.5				
4.0				

DCP RESULTS: DCP 06

(Blows / 100mm)



RL (m)

PHOTO(S)

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Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

Ground Water	
▼	Standing
▷	Out flow
◁	In flow

Logged By:	RM
Plotted By:	TM
Checked By:	RM

Notes:

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SHALLOW INVESTIGATION RESULTS

Job N° / **44512**
Test N° / **TP 07**

Project: Cape Foulwind Development
Date: 14/02/24
Client: Cape Foulwind Staple 2 Limited
Time: 4:15 pm
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)
Excavation Method: 8T Excavator

DEPTH (m)	SOIL DESCRIPTION	USCS	Graphic Log	Ground Water	DCP RESULTS: DCP 07 (Blows / 100mm)	RL (m)
0.5	0.00 - 0.50m: Silty fine to medium SAND; grey brown. Moist to wet, contains trace rootlets (TOPSOIL).	TS	TS	Groundwater Not Encountered	DCP sunk under weight of hammer	
1.0	0.50 - 1.30m: Medium to coarse SAND; orange brown. Dense to very dense, moist, contains iron oxide cementation.	SP			7	
1.5					23 >>	
2.0	1.30 - 3.00m: Medium to coarse SAND; brown. Very dense, moist, contains trace black nodules (iron oxide).	SP			27 >>	
2.5					26 >>	
3.0					15	
3.5	Test Pit terminated at 3.00m - Target depth achieved.				15	
4.0					17 >>	
					25 >>	
					25 >>	
					26 >>	
					25 >>	
					30 >>	

DCP Blows / 100mm: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

PHOTO(S)

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Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

Ground Water		Logged By:	RM
▼	Standing	Plotted By:	TM
▷	Out flow	Checked By:	RM
◁	In flow		

Notes:

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SHALLOW INVESTIGATION RESULTS

Job N° / **44512**
Test N° / **TP 08**

Project: Cape Foulwind Development
Date: 14/02/24
Client: Cape Foulwind Staple 2 Limited
Time: 4:45 pm
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)
Excavation Method: 8T Excavator

DEPTH (m)	SOIL DESCRIPTION	USCS	Graphic Log	Ground Water
	Soil 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			
0	0.00 - 0.40m: Silty fine to medium SAND; brown. Moist to wet, contains trace roots and rootlets (TOPSOIL).	TS	TS	Groundwater Not Encountered
0.5	0.40 - 0.90m: Silty fine to medium SAND; grey brown. Medium dense, moist, contains trace roots and rootlets.	SM		
	0.90m: Localised groundwater seepage.			
1.0	0.90 - 1.10m: Medium to coarse SAND; orange brown. Medium dense to very dense, moist, contains iron oxide staining.	SP		
	1.10 - 4.00m: Medium to coarse SAND; brown. Very dense, moist, contains trace black nodules (iron oxide).	SP		
1.5				
	1.90m: Localised groundwater seepage.			
2.0				
2.5				
3.0				
3.5				
4.0	Test Pit terminated at 4.00m - Target depth achieved.			

DCP RESULTS: DCP 08

(Blows / 100mm)

Depth (m)	Blows / 100mm
0	0
0	DCP sunk under weight of hammer
0	
	3
	3
	4
	5
	6
	14
	7
	10
	25 >>
	26 >>
	21 >>
	22 >>
	30 >>

RL (m)

PHOTO(S)

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Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

Ground Water	
Standing	
Out flow	
In flow	

Logged By:	RM
Plotted By:	TM
Checked By:	RM

Notes:

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SHALLOW INVESTIGATION RESULTS

Job N° / **44512**
Test N° / **TP 09**

Project: Cape Foulwind Development
Date: 14/02/24
Client: Cape Foulwind Staple 2 Limited
Time: 3:45 pm
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)
Excavation Method: 8T Excavator

DEPTH (m)	SOIL DESCRIPTION (Soil 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)	USCS	Graphic Log	Ground Water
0.5	0.00 - 0.30m: Silty fine to medium SAND; grey brown. Moist to wet, contains trace rootlets (TOPSOIL).	TS	TS	Groundwater Not Encountered
	0.30 - 0.60m: Organic silty fine to medium SAND; grey brown. Very loose to very dense, moist, contains trace roots and rootlets.	SM		
1.0	0.60 - 1.10m: Medium to coarse SAND; orange brown. Very dense, moist, contains iron oxide staining.	SP		
1.5	1.10 - 3.20m: Medium to coarse SAND; brown. Very dense, moist, contains trace black nodules (iron oxide).	SP		
2.0				
2.5				
3.0				
3.5	Test Pit terminated at 4.00m - Target depth achieved.			
4.0				

DCP RESULTS: DCP 09

(Blows / 100mm)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	RL (m)
DCP sunk under weight of hammer															
0															
0															
0															
0															
1															
9															
17 >>															
16															
25 >>															
17 >>															
30 >>															

PHOTO(S)

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Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

Ground Water		Logged By:	RM
▼	Standing	Plotted By:	TM
▷	Out flow	Checked By:	RM
◁	In flow		

Notes:

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SHALLOW INVESTIGATION RESULTS

Job N° / **44512**
Test N° / **TP 10**

Project: Cape Foulwind Development
Date: 14/02/24
Client: Cape Foulwind Staple 2 Limited
Time: 3:00 pm
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)
Excavation Method: 8T Excavator

DEPTH (m)	SOIL DESCRIPTION	USCS	Graphic Log
	Soil 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		
0	0.00 - 0.30m: Silty fine to medium SAND; grey. Moist to wet, contains trace rootlets (TOPSOIL).	TS	TS TS TS TS TS TS
0.5	0.30 - 0.50m: Silty fine to medium SAND; grey brown. Very dense, moist, contains trace roots and rootlets.	SM	
	0.50 - 1.40m: Medium to coarse SAND; orange brown. Very dense, moist, contains weak laminations and iron oxide cementation. 0.50m: Localised groundwater seepage.	SP	
1.5	1.40 - 3.00m: Medium to coarse SAND; brown. Moist, contains trace black nodules (iron oxide).	SP	
3.0	Test Pit terminated at 3.00m - Target depth achieved.		

Ground Water: Groundwater Not Encountered

DCP RESULTS: DCP 10

(Blows / 100mm)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	DCP sunk under weight of hammer													
1														
10														
26 >>														
33 >>														
28/50														

RL (m)

PHOTO(S)

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Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

Ground Water	
▼	Standing
▷	Out flow
◁	In flow

Logged By: RM
Plotted By: TM
Checked By: RM

Notes:

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SHALLOW INVESTIGATION RESULTS

Job N° / **44512**
Test N° / **TP 11**

Project: Cape Foulwind Development
Date: 14/02/24
Client: Cape Foulwind Staple 2 Limited
Time: 2:45 pm
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)
Excavation Method: 8T Excavator

DEPTH (m)	SOIL DESCRIPTION	USCS	Graphic Log
	Soil 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		
0.0	0.00 - 0.20m: Silty fine to medium SAND; grey brown. Moist to wet, contains trace rootlets (TOPSOIL).	TS	TS TS TS TS TS
	0.20 - 0.50m: Silty fine to medium SAND; grey brown. Very loose to loose, moist to wet, contains trace roots and rootlets.	SM	
0.5	0.50 - 1.40m: Medium to coarse SAND with minor to trace silt; grey brown. Loose to very dense, moist, contains trace roots and rootlets.	SP	
1.0	1.10m: Trace roots or rootlets absent.		
	1.40m: Localised groundwater seepage.		
1.5	1.40 - 3.00m: Medium to coarse SAND; orange brown. Dry to moist, contains trace black laminations and iron oxide staining.	SP	
2.0			
2.5			
3.0	Test Pit terminated at 3.00m - Target depth achieved.		
3.5			
4.0			

Ground Water: Groundwater Not Encountered

DCP RESULTS: DCP 11

(Blows / 100mm)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	RL (m)
DCP sunk under weight of hammer															
0															
0															
0															
1															
1															
2															
1															
1															
2															
2															
9															
10															
22 >>															
25 >>															
30 >>															
Hammer Bouncing															

PHOTO(S)

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Ground Water			
▼	Standing	**Logged By:**	RM
▷	Out flow	**Plotted By:**	TM
◁	In flow	**Checked By:**	RM

Notes: