

8 July 2021

Infinity Yaldhurst Limited
PO Box 390
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RE: Stage 4 Completion Report - Yaldhurst Park, Yaldhurst , Christchurch
(Our Reference: 15518.000.000_24)

1 Introduction

ENGEO Ltd was requested by the developer, Infinity Yaldhurst Limited, to undertake construction monitoring of the subdivision development at Yaldhurst Park, Yaldhurst , Christchurch. ENGEO has been requested to produce a completion report for Stage 4 (this document).

ENGEO has provided the following deliverables pertaining to the site development. These documents should be read in conjunction with this report.

- Geotechnical Investigation report for Stage 1 of the subdivision development at Yaldhurst Park (dated 9 November 2018, reference: 15518.000.000_01).
- Geotechnical Investigation report for Stages 2 to 6 of the subdivision development at Yaldhurst Park (dated 6 December 2018, reference: 15518.000.000_02).
- RFI document for the subdivision development at Yaldhurst Park (dated 12 February 2019, reference: 15518.000.000_03).
- Earthworks specification for the subdivision development at Yaldhurst Park (dated 15 March 2019, reference: 15518.000.000_05).
- Stage 1 Subgrade Observations Progress Report for the subdivision development at Yaldhurst Park (dated 26 June 2019, reference: 15518.000.000_06).
- Stage 1 Earthworks Completion Report for the subdivision development at Yaldhurst Park (dated 14 January 2020, reference: 15518.000.000_21).
- Stage 2 Earthworks Completion Report for the subdivision development at Yaldhurst Park (dated 12 June 2020, reference: 15518.000.000_22)
- Stage 3 Earthworks Completion Report for the subdivision development at Yaldhurst Park (dated 5 November 2020, reference: 15518.000.000_23).

The proposed Stage 4 development involves subdividing the existing land (approximately 3 ha area) into 44 residential lots in the approximate area shown in Figure 1.

Site grading included topsoil stripping, general cutting and filling to achieve design site grades, and subgrade preparation and fill placement in accordance with the earthworks Code of Practice for Earth Fill of Residential Development (NZS4431).

Figure 1: Subdivision Plan

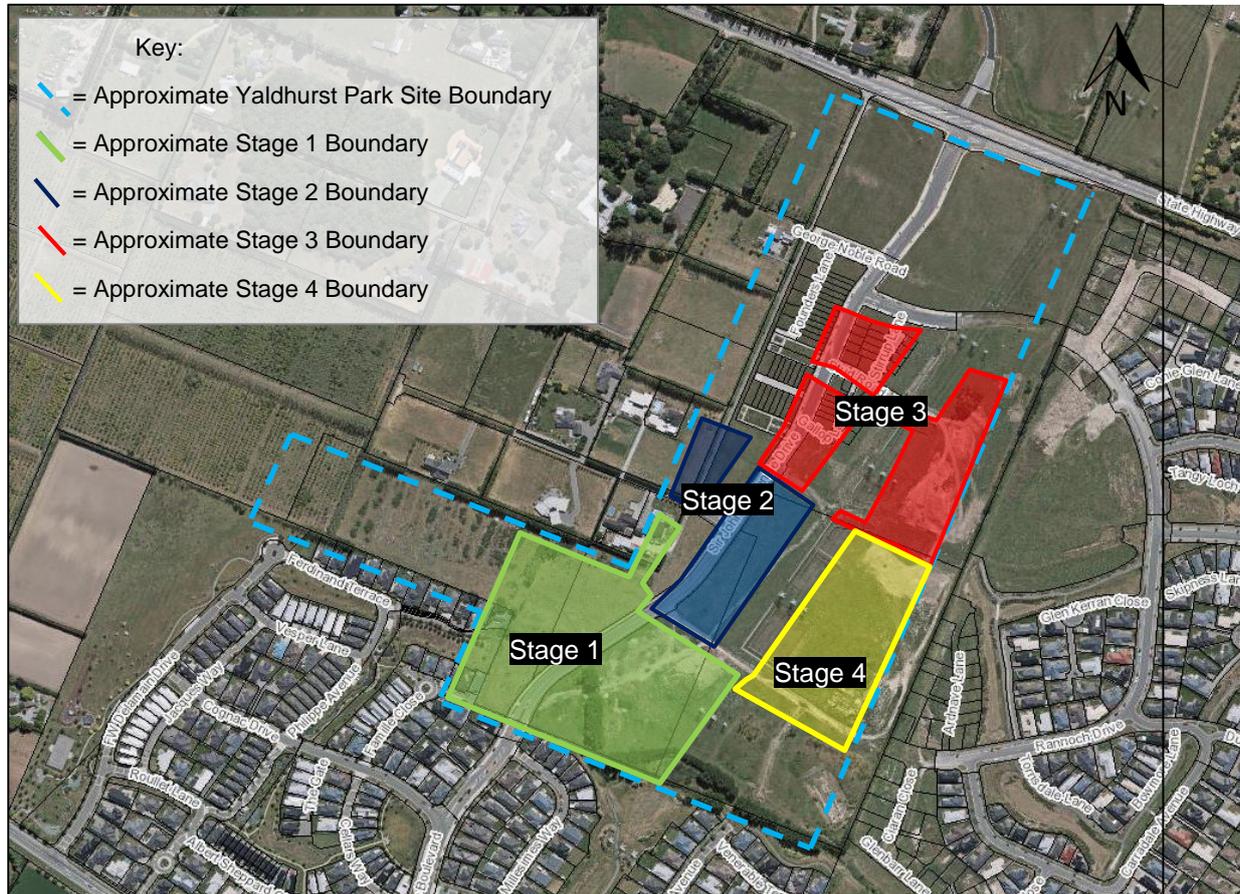


Image sourced from Canterbury Maps. Not to scale.

2 Discussions and Communications

We were requested by Dormer Construction, on behalf of Infinity Yaldhurst Limited to visit the site to undertake construction observations during site grading. During each of the subgrade observation visits discussed in the following sections, ENGEO completed Scala penetrometer (Scala) testing of the native subgrade, and assessed general fill and topsoil placement. We provide a location plan as an attachment to this report (Appendix 1).

2.1 Site Visits

During the construction and earthworks associated with Stage 4 of the subdivision development at Yaldhurst Park, we completed 10 site visits between 24 November 2020 and 21 January 2021. Pertinent observations and discussions are summarised below.

Visit No.	Date	Topic	Discussions and Summary
1	24.11.20	Excavation of northern end of road	Initial topsoil strip in accordance with the ENGEO earthworks specification. Over-excavation of topsoil required to expose native silt. Scalas undertaken within the excavated area indicated that the subgrade was stiff.
2	25.11.20	Excavation of southern end of road	Topsoil strip and cut to final grade. Native silt observed at the base of the excavation. Scalas undertaken within the excavated area indicated that the subgrade was stiff.
3	01.12.20	Observations of existing stormwater basins	Site visit to observe existing stormwater basin subgrade and filling progress (lots 162 to 163 and 175 to 180). Native silt or gravel was observed at the base of the excavation. Scalas undertaken within the excavated area indicated that the subgrade was stiff or medium dense.
4	09.12.20	Subgrade of lots	Topsoil strip of Lots 164 to 190. Native silt observed at the base of the excavation. Scalas undertaken within the excavated area indicated that the subgrade was stiff.
5	14.12.20	Fill placed within lots	Observed placed fill on northeast side of Stage 4. Fill comprised of sandy silt and was smooth and non-yielding.
6	16.12.20	Fill placed within lots	Observed placed fill on northwest side of Stage 4. Fill comprised of sandy silt and was smooth and non-yielding.
7	16.12.20	Subgrade of lots	Topsoil strip of Lots 171 to 174 and 49. Native silt observed at the base of the excavation. Scalas undertaken within the excavated area indicated that the subgrade was stiff.
8	18.01.2021	Subgrade of lots	Topsoil strip of Lots 191 to 201. Native silt observed at the base of the excavation. Scalas undertaken within the excavated area indicated that the subgrade was stiff.
9	21.01.21	Fill placed within lots	Observed placed fill on eastern side of Stage 4. Fill comprised of sandy gravel with minor silt and was smooth and non-yielding.
10	29.01.21	Subgrade of lots	Topsoil strip of lots 201 to 205. Native silt and sand observed at the base of the excavation. Scalas undertaken within the excavated area indicated that the subgrade was stiff.

3 General Fill Placement

ENGEO recommended that all site-won fill and hardfill be compacted in lifts no greater than 200 mm thick. The degree of compaction should be tested in accordance with NZS4407:2015 using a nuclear density meter (NDM). Compaction testing of the fill was performed by Dormer Construction.

ENGEO has been provided with compaction testing results undertaken by Dormer of the material regarded as general fill. This generally consisted of site-won silty, sandy alluvium that was free of topsoil or organic material. The test results indicate that at the locations tested, the engineered fill material was compacted to at least 95% of the MDD and within five percentage points of the optimum moisture content (OMC). Based on the data provided, we conclude that the backfill was placed and compacted in general conformance with the project specifications. As outlined in Section 2.1 of this report, ENGEO attended site to observe the general fill prior to placement of the topsoil. Scalas were completed through the fill and we assessed that the fill had been placed in general accordance with our specification.

We recommended that all topsoil be placed and compacted (track rolled or statically compacted) to create a firm surface prior to grass seeding. The Christchurch City Council specification suggests a minimum thickness of 200 mm of topsoil and a maximum thickness of 300 mm. During future site development and construction of foundations, we recommend that all topsoil be removed within the building footprint to expose either native soil, or the compacted general fill.

4 Conclusions

Based on our site observations, we consider the subsurface conditions observed to date to be consistent with those anticipated from our earlier Stage 2-6 Geotechnical Investigation dated 6 December 2018 (Ref. 15518.000.000_02).

Accordingly, we consider the lots within Stage 4 which have been assessed to be geotechnically suitable for the proposed development subject to recommendations outlined in our geotechnical report and this completion report. ENGEO has also provided a Statement of Suitability of Earth Fill for Residential Development presented as an attachment to this document (Appendix 2).

5 References

ENGEO (NZ) Ltd, December 2018: Stage 2-6 Geotechnical Investigation of Yaldhurst Park, Yaldhurst, Christchurch (Ref: 15518.000.000_02).

ENGEO (NZ) Ltd, March 2019: Earthworks Guidance Document of Yaldhurst Park, Yaldhurst, Christchurch (Ref: 15518.000.000_05).

Ministry of Business, Innovation and Employment, December 2012: Repairing and Rebuilding Houses affected by the Canterbury Earthquakes (<http://www.dbh.govt.nz/guidance-on-repairs-after-earthquake>).

Standards Association of New Zealand (2015), Methods of sampling and testing road aggregates, NZS4407:2015, Standards New Zealand, Wellington.

6 Limitations

- i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Infinity Yaldhurst Limited, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.
- ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited 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 should be appreciated that actual conditions could vary from the assumed model.
- iii. 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.
- iv. This Limitation should be read in conjunction with the Engineering NZ / ACENZ Standard Terms of Engagement.
- v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by



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Engineering Geologist

Report reviewed by



Don Bruggers, CMEngNZ (CPEng)

Principal Engineer

Attachments:

- *NDM testing provided by Dormer Construction*
- *Statement of Suitability of Earthfill*