Appendix 22
Comments on Proposed Bulk Earthworks

Douglas Partners

May 2009

Warner Industrial Park
Preferred Project Report
Concept Plan and Project Application

Precinct 14 WEZ

Sparks Rd and Hue Hue Rd
Warnervale
May 2009

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TERRACE
TOWER
GROUP

Warner Business Park Pty Ltd
Part of the Terrace Tower Group

Peter Andrews + Associates Pty Ltd
architecture planning urban design

Douglas Partners
Geotechnics • Environment • Groundwater

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Project: 41424.01
13 May 2009

Peter Andrews and Associates Pty Ltd
PO Box 494
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Attention: Mr Peter Andrews

Dear Sir,

COMMENTS ON PROPOSED BULK EARTHWORKS
WARNER BUSINESS PARK
HUE HUE ROAD, JILLIBY

1. INTRODUCTION

Your recent email correspondence included an extract from the Department of Planning (DOP) correspondence in relation to the Warner Business Park. It is understood that you require comments on geotechnical issues related to the DOP response and in particular comments on the proposed bulk earthworks for the development. This work was requested by Peter Andrews and Associates Pty Ltd acting on behalf of Warner Business Park Pty Ltd.

Douglas Partners Pty Ltd (DP) has undertaken previous investigations at the site, the findings of which are provided in the following two documents:

- "Report on Preliminary Geotechnical Investigation, Proposed Warner Industrial Park, Corner of Hue Hue Road and Sparks Road, Warnervale", Project 41615, dated May 2008; and
- "Report on Targeted Phase 2 Contamination Assessment, Warner Industrial Park, Corner of Hue Hue Road and Sparks Road, Warnervale, NSW", Project 41615.01 dated May 2008.

The extract of the DOP response contained as a dot point the query "geotechnical proposals and strategies for construction and management of earthworks (both cut and fill) to ensure ongoing stability of the site". DP interprets this query to require comment on the geotechnical testing and inspections generally required during bulk earthworks operations for the development and likely site preparation measures to allow the site to accept filling. Comments on suggested cut and batter slopes have also been provided as this information would also be useful when considering the earthworks for this project.

The general comments made within this letter are made based on geotechnical information obtained during the preparation of our previous report dated May 2008 and will require revision following additional investigation and analysis as recommended in our previous report to progress the development of the site. This letter provides brief comment on the geotechnical issues in relation to bulk earthworks at the site and summarises the recommendations and suggestions made in our previous geotechnical report (Project 41615 dated May 2008). It should be read in conjunction with our previous geotechnical report which provides more detailed comments on subsurface conditions and engineering recommendations.

2. COMMENTS

2.1 Proposed Development

During the preparation of the preliminary geotechnical report Douglas Partners Pty Ltd was provided with concept plans for the development. DP has not been provided with any further plans at this stage. Hence limited information has been provided to DP as to the final extent of cut and fill operations and the magnitude of the earthworks required.

Based on the concept plans, however, it is understood that in order to create the 91 lot industrial subdivision and six internal road pavements, the following bulk earthworks will be required:

- Bulk excavation from the western areas of the site and placement within the lower lying eastern areas of the site;
- Excavation of up to 5.2 m depth in the area of the proposed intersection with Hue Hue Road (approximately site Ch 1100 to Ch 1300);
- Excavation of up to 3 m depth in the area of proposed Lots 1 to 4, located near the intersection of Hue Hue Road and Sparks Road;
- Placement of up to 2 m of filling within the lower lying eastern area of the site. The area covered by the filling extends roughly from the southern to northern boundaries of the site and generally to the east of the proposed alignment of Road 1;
- Bulk excavation from the north-eastern area of the site and placement within the lower lying south-eastern area;
- Excavation of up to 6 m depth in the north-eastern area of the site (existing Lot 9);
- Placement of up to 2 m of filling within the lower lying south-eastern area of existing Lots 5 and 9.

2.2 Subsurface Profile

The subsurface conditions encountered throughout the site are described in detail in our previous report and included

- Relatively shallow sand or silty sand (up to 0.7 m depth) overlying initially firm to stiff clay soils overlying stiff or stronger clay soils;
- Extremely low strength either claystone or sandstone bedrock at depths ranging from 1 m to 3 m approximately, particularly within the western and northern areas of the site;
- Weaker subsurface conditions, characterised by either firm clay soils or loose sand soils within the upper 0.4 m to 0.8 m depth within the majority of pits excavated within the lower lying areas of the site, below approximately RL 20 m AHD;
- Localised filling anticipated to be present in the area of the existing dwellings within the filling platforms placed during construction and also within the existing dam embankments. It is likely that silt will be present within the base of the existing dams.
- Free groundwater at depths ranging from 0.4 m to 2.1 m within the lower eastern area of the site; and
- Further, elevated moisture contents within the upper soils in the lower eastern section of the site.

2.3 Site Preparation Measures to Bulk Earthworks

The following general recommendations for measures required on site to allow bulk earthworks were provided in our previous report.

- Provision of adequate surface and subsoil drainage for control of runoff and seepage was suggested as a significant part of the initial site development works to address the risk of periodic inundation and accumulation of moisture within the near surface soils.
- Traffickability of earthworks machinery on the weak soils present in the lower eastern area of the site will be highly dependant on the prevailing moisture condition at the time of construction. Further, given the low lying terrain over a significant portion of the site, it is possible that significant areas of the site may become inundated with surface water following rainfall events. Traffickability of the exposed soils after inundation will become difficult. Hence, it will be of critical importance to address surface water flows during construction. Therefore, it is suggested that the proposed open drain which is to extend from the northern boundary of the site and connect with Buttonderry Creek along the south-eastern boundary is constructed prior to stripping and placement of filling in the lower areas of the site. Other site drainage measures should also be installed early in the construction programme.
- Placement of filling from working platforms pushed out over the weak soils may be required depending on the conditions at the time of construction.
- Depending on the conditions exposed at the time of site stripping, consideration may be given to the placement of a suitable geofabric to allow compaction of the overlying filling. The requirement for such measures should be assessed by a geotechnical engineer at the time of construction.
- Filling platforms or stockpiles were observed in several areas throughout the site, including within the south-eastern corner of Lot 5 in DP259531 where filling, understood to have been won from excavations in connection with the construction of the F3 freeway, has been placed (refer Photo 6 below) and also surrounding a number of the existing residences, such as in Photo 7, located to the north of the residence in Lot 7. In absence of specific investigations of this filling, it is also considered unsuitable for the support of engineered filling, footings or pavements. Further assessment would be required to assess the suitability of the filling to either remain in place or for re-use as engineered filling elsewhere on site.

2.4 Excavation and Filling Batters

Comments were provided in our report of May 2008 on excavation and filling batters. Reference should be made to this previous report for more detailed comments in relation to the batters. Preliminary batter slopes for the proposed excavations were provided as shown in Table 1 below, subject to geotechnical inspection during excavation.

Table 1 – Suggested Safe Excavation Batter Slopes

Material	Safe Batter Slope (H:V)
Very stiff clay or better and extremely low strength bedrock	1.5:1
Very low strength sandstone or claystone	1:1
Low strength fractured sandstone or claystone	0.75:1
Medium and high strength slightly fractured sandstone	0.5:1

The following further comments were provided in relation to excavation batters at the site:

- provision of a mid height bench of at least 1 m in width was suggested in major cut areas to minimise the fall height of any loose joint blocks;
- Additional investigation was recommended in the area of the proposed 6 m cut along the northern boundary of the site (existing Lots 5 and 9); and
- It was noted that if the batter slopes are left bare, however, it is possible that minor erosion may occur.

For batters on placed filling embankments, it was suggested that long term slopes of 3H:1V are suitable for controlled filling, provided such batters are protected from erosion.

In the vicinity of the proposed bridge of Buttonderry Creek, consideration should be given to the protection of the creek bank and any batters created during the earthworks. The type and extent of protection required will be dependant on a number of key parameters, such as expected flow velocities, geometry of the batters and soils present. Design of protection measures should be carried out in the detailed design phase of the project.

2.5 Site Preparation Measures

General site preparation measures for the placement of filling were provided in our previous report. It is noted, however, that the site preparation measures required during construction will be dependant on the design level, type of footing or pavement proposed and the soil conditions exposed at the time of construction. The site preparation measures for the placement of filling, the support of high level spread footings or pavements are likely to include the following:

- Excavation to design subgrade or formation level in areas of new construction or placement of filling;
- Removal of all existing topsoil or deleterious material;
- Proof rolling the subgrade to receive filling with at least six passes of a minimum 6 tonne deadweight roller, with a final proof rolling pass accompanied by careful visual inspection by an experienced geotechnical consultant to allow detection and treatment of any soft or compressible zones. In this regard, special measures such as placement of a geofabric prior to placement of the first layer of bulk filling or placement of filling from fill platforms may be required;
- Additional excavation and replacement with suitable select filling, if required, based on the results of the proof rolling and inspection of the exposed subgrade. Typically on the Central

Coast, ripped sandstone is used as a select layer under pavements and preliminary design could then be based on an assumed CBR of 15% for this material;

- If weathered rock is encountered within 300 mm of subbase layer, then the upper 250 mm of rock should be scarified and compacted in order to destroy the rock structure and provide a relatively uniform subgrade stiffness.
- Moisture conditioning of the upper 300 mm of the exposed subgrade and compaction to 100% dry density ratio (Standard compaction – AS1289.5.1.1 [Ref 1])
- Additional layers of filling or replacement select filling (if required) should be placed in near horizontal layers no thicker than 250 mm (loose thickness) and each layer compacted to the 95% dry density ratio (Standard compaction) for general filling and 100% dry density ratio (Standard compaction) within the upper 0.5 m. Moisture contents of scarified subgrade and filling should be maintained within -3% (dry) to 1% (wet) of optimum moisture content (OMC) to OMC for Standard compaction;
- Protection of the area after subgrade preparation for both roads and areas of general filling to maintain moisture content as far as practicable. The placement of the select subgrade, subbase gravels or overlying filling would normally provide adequate protection.

2.6 Geotechnical Inspection and Testing during Earthworks

Geotechnical inspection and testing will be required during preparation of subgrades within areas to accept filling or in areas of pavement subgrades as well as during the placement of the bulk filling. These inspections and testing should be undertaken as outlined in AS3798 – 2007 "Guidelines on earthworks for commercial and residential developments" (Ref 2). The level of inspection and testing will be governed by the level of confidence required in the future performance of the earthworks at the site.

Level 1 inspection and testing, defined in AS3798 as involving full time attendance by the geotechnical inspection and testing authority during earthworks operation will provide the greatest level of confidence. At the completion of Level 1 testing, the testing authority will be in a position to express an opinion that the works (as far as it has been able to determine) comply with the specification and drawings.

Level 2 inspection and testing involves attendance to site at the request of the site superintendent, whose responsibility it is to ensure that sufficient samples and tests are taken over the project. Under a Level 2 regime, the geotechnical testing authority will not be in a position to express any opinion beyond the location and results of testing as to the compliance of the works with the specification or their suitability for any purpose.

2.7 Limitations to the Geotechnical Report

It should be noted that the works to date carried out by DP are limited to a preliminary geotechnical investigation to assist with the preliminary design of the proposed development. Owing to the topography and geomorphology of the site, it is anticipated that subsurface conditions will vary throughout the site. A detailed geotechnical investigation has not been completed and would be required once the design of the development has been progressed. In relation to the bulk earthworks at this site, this would include additional geotechnical investigation in the area of the proposed 6 m cut, located along the northern boundary of the site (existing Lots 5 and 9).

These comments should also be read in conjunction with our previous report (Project 41615 dated May 2008) which contains more detailed comments in relation to the subsurface conditions and engineering recommendations at this site.

We trust that this meets your current requirements.

DOUGLAS PARTNERS PTY LTD Reviewed by

Michael Gawn
Senior Associate

Terry Wiesner
Principal

References:

1. AS3708-2007, Guidelines on earthworks for commercial and residential developments, Standards Australia.
2. AS1289.0 , “Method of testing soils for engineering purposes”, Standards Australia