

The Warehouse  
C/o - Stiffe Hooker  
PO Box 1964  
Auckland, 1140

Attention: Mr. Tony Rogers

Dear Tony

## **The Warehouse Balmoral - Preliminary Geotechnical Assessment Report PT 1 DP46543 & LOT9 DP4365**

### **1 Introduction**

Tonkin & Taylor Ltd (T&T) were engaged by The Warehouse<sup>1</sup> to undertake a preliminary geotechnical assessment for the two subject properties proposed to be rezoned from Residential 6a and 6b to Business 2. These two sites are part of a larger site at the corner of Dominion Road and Balmoral Roads owned by Eldamous Investments (part of The Warehouse Group) for which T&T have previously carried out a preliminary geotechnical assessment. We understand that this assessment is required to accompany a request for a private plan change for the rezoning. This letter report summarises historical geotechnical information from the site and provides preliminary geotechnical considerations for these two properties. For simplicity, the subject property to the north (PT 1 DP46543 at 178 Balmoral Road) and south (Lot9 DP4365 at 16 Rocklands Avenue) will be referred to as 'Site A' and 'Site B' respectively for the remainder of this report.

The scope of the work carried out included:

- A review of published geology for the subject area;
- A review of historical geotechnical data from the T&T database;
- A site walk-over inspection by a Geotechnical Engineer;
- Preparation of this report.

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<sup>1</sup> Tonkin & Taylor Ltd, Letter of Engagement (15/12/09), *The Warehouse Balmoral – Preliminary Geotechnical Assessment*.  
Ref. 473



## 2 Background

Tonkin & Taylor initially undertook site investigations and reporting for the general site in January 1995 and February 2006. Specifically, the west side of the site was investigated in 1995 and the southern and eastern sides (including Site A) in 2006. Site B is currently occupied with a residential dwelling has had no previous geotechnical investigations.

The results of the above site investigations and testing are documented in our reports dated January 1995 (ref: 12941) & February 2006 (ref: 23223) and have been summarised and reviewed as part of this report.

## 3 Site Conditions & proposed Development

The overall TWL site is located near the intersection of Balmoral Road and Dominion Road. There is an existing service station located in the north eastern corner of the site and we understand that this will remain in the interim. Other than this the site is generally level and is surrounded by 1-2 storey residential/retail developments.

Site A is currently a car park (not used), which is sealed with a thin layer of asphalt. Site B is currently a residential property (16 Rocklands Ave) and has a timber framed residential dwelling occupying the site.

We understand that the two subject properties assessed in this report are encompassed by the proposed developments and will likely be used for future on-grade car parking. We understand that no basement excavations are proposed.

## 4 Regional Geology

Others have geologically mapped the area<sup>2</sup> and these publications show the site to be on the boundary of a basalt lava flow, associated with the Auckland Volcanic Field. The lava flow overlies interbedded sandstones and mudstones of the Waitemata Group.

## 5 Field Investigations

To date there have been 14 No. machine drilled boreholes, 5 No. Hand augered boreholes and a window sampler borehole put down across the general site (refer Appendix A, Plan drawing, *Previous Geotechnical Investigations*).

Historical investigations indicate the site is likely to be wholly underlain by basalt rock at shallow depths. Measured depths to the top of the basalt rock range from 0.2 – 1.6m below the existing ground surface (refer Appendix A). All investigations have proven the basalt thickness to be greater than or equal to 1 m.

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<sup>2</sup> Kermode, L (1992). *Geology of the Auckland Urban Area*. Institute of Geological and Nuclear Sciences Ltd.

## 6 Subsurface Conditions

Previous investigations indicate that Site A is underlain by competent basalt rock at shallow depths with a varying layer of fill (non-engineered) above this. Approximate 'depth to rock' contours have been generated and these are shown on the site plan drawing in Appendix A. The thickness of the basalt rock has not been measured however a competent thickness of 1m has been proven in all historical boreholes.

Generally the fill is of greater thickness towards the southern and eastern boundaries of Site A, and comprises loose to medium dense gravels/sands and firm to stiff sandy silts.

The site walkover inspection confirms the likely presence of non-engineered fill material at Site A, with an existing concrete-crib retaining wall along the southern boundary. This crib wall was most likely constructed to retain the fill material during its placement. The existing ground level is considerably higher (up to 2m) than the property to the south (Site B), which shows the likely extent of the fill that has been placed.

Site B shows no signs of fill placement and the existing dwelling is likely to be founded in natural ground. We expect that the site is underlain by basalt rock at shallow depth, with a relatively thin layer of volcanic tuff/ash above this.

## 7 Geotechnical Recommendations

Recommendations and opinions contained in this report are based on historical investigations, put down at point locations and information from our geotechnical database and geological maps. The nature and continuity of the subsoil away from the test locations is inferred, but it must be appreciated that actual conditions could vary from the assumed model.

### 7.1 Stability & Retention

The site is generally flat, and slope stability is not an issue. Due to the subject sites (A & B) having different ground elevations, cutting and filling is likely to be required to create a level building platform for the development. We expect that the existing concrete-crib wall will be demolished as part of this works, and that fill will be placed upon Site B.

All temporary excavations on site (including foundation excavations) greater than 1m in height should be battered back at 1V:1H in the short term and 1V:3H in the long term.

Any retaining walls required should be specifically designed during the detailed design stage.

### 7.2 Foundations

We consider that commercial development may be constructed on shallow footings on either the basalt rock or rubble, or piled foundations, extending to the moderately weathered to unweathered basalt. It may be beneficial to use a combination of both types of foundation given the varying depth (0.2-1.7m) to competent basalt.

We do not consider the non-engineered fill encountered on Site A is a suitable founding material.

Settlements are expected to be within normally accepted tolerances provided foundations are designed in accordance with the recommendations given below.

Please refer to the Tonkin & Taylor Report<sup>3</sup> dated March 2006 for shallow foundation and piled foundation design parameters and considerations.

### **7.3 Fill Specification**

Fill is likely to be required on 'Site B' to create a level building platform. Material removed from 'Site A' (non-engineered fill) is not considered suitable to be used as fill on 'Site B'. Material should be acquired from an external source and inspected and approved by a geotechnical engineer prior to any placement.

Once the fill has been approved a specification outlining placement and quality control testing should be developed by a geotechnical engineer.

### **7.4 Floor Slabs & Pavement Design**

We understand that development is likely to be founded on grade with the ground floor being used for car parking.

We consider the existing fill (non-engineered, Site A) is not suitable for supporting a floor slab/pavement subjected to the expected vehicle loads. Existing fill should be removed and replaced with a suitable material (GAP 65 or similar). A design CBR of 5% can be used where slabs/pavements are founded upon the underlying natural soils (ash/tuff). Alternatively, where slabs/pavements are founded upon engineered fill a higher value could be adopted, once the source and characteristics of this material is known.

### **7.5 Settlements**

Where foundations or floor slabs are bearing directly upon the underlying competent basalt rock settlements are expected to be virtually nil. Where they bear upon either engineered fill or natural soils (ash/tuff) the settlements are expected to be within generally accepted values.

'Site B' is expected to have slightly greater settlements than 'Site A,' assuming fill will be placed creating a surcharge on the underlying soils. However, depth to basalt rock at 'Site B' is expected to be less than 1m and therefore these are also expected to be within generally accepted values.

Specific settlement analyses should be undertaken by an experienced geotechnical engineer once foundation dimensions become available. Consideration should be given to potential differential settlement if shallow foundations are founded on differing geological units, over the extent of the site.

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<sup>3</sup> Tonkin & Taylor Ltd (March 2006) Report, *Geotechnical Report for the Proposed Warehouse Development Balmoral Shopping Centre*. Ref. 23223

## 7.6 Contaminated Fill

Tonkin & Taylor has previously undertaken an environmental assessment on 'Site A'. Fill used on the site has been considered to be contaminated and these issues are discussed fully in the Tonkin & Taylor environmental report<sup>4</sup>.

## 8 Conclusions

A preliminary geotechnical assessment has been undertaken for the two subject properties in Balmoral, Auckland. Based upon historical investigation data and information from our geotechnical database, the following conclusions and recommendations are provided:

- We consider both sites are suitable for development;
- Any temporary or permanent excavations should be designed based upon recommendations provided in Section 7.1;
- Shallow or piled foundations are considered suitable for development;
- Non-engineered fill should be removed from 'Site A', and is not considered suitable for placement on 'Site B'. A fill specification should be developed later in the design stage;
- The existing non-engineered fill is not considered suitable for a slab on grade. This material should either be removed and/or replaced with suitable materials outlined in Section 7.4;
- Settlements, both total and differential are expected to be within acceptable values but should be analysed in detail once foundation dimensions are available;
- The non-engineered fill on 'Site A' should be treated as contaminated based upon historical environmental drilling and sampling results. All fill removed from the site should meet the recommendations outlined in the Tonkin & Taylor Environmental Report<sup>4</sup>.

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<sup>4</sup> T&T December 2009, *Desk Study and Intrusive Ground Contamination Assessment, Balmoral Shopping Centre*. Ref. 23166

## 9 Applicability

This report has been prepared for the benefit of The Warehouse with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

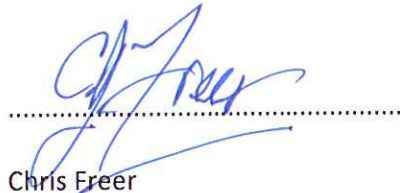
Report prepared by:

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23-Feb-10  
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## **Appendix A:           Site Plan**

- **Site Plan showing subject sites A & B and historical investigation locations**