Riddolls Consultants Ltd

Mr John Edgar,
Community Liaison Group - Huia Water Treatment Plant Replacement,
AUCKLAND

20 November, 2017

Dear John,

GEOLOGICAL INFORMATION: COMMENTS

Further to your email of 29 August, 2017, requesting comment on previous reports, I am pleased to provide the following summary of my review.

1. Scope

The review is based on publicly available information, reports provided by and discussions with Mr Paul Jones (Principal Planner, Watercare Services Ltd), and site visits.

It focuses on the relevance of this information for development of credible geological models to accompany application for resource consent and, in due course, design investigations. Such models should be appropriate to demonstrate the nature and variability of geological factors relevant to the proposed development. They should also include recognition of active or recent geological processes which may present hazards to the works, and consideration of their risk.

Ultimately, model credibility is crucial to the definition of uncertainty and risk.

2. Previous Investigations

Both surface and subsurface investigations for determining upgrade options of the existing treatment plant extend over the last thirty years or so. Several engineering or geological organisations have been engaged over this period to provide professional advice.

3. Geological Setting

Situated at the head of Little Muddy Creek catchment, the site[1-4] is located on or adjacent to Cornwallis and Nihoputu Formations respectively, the latter forming the prominent ridge upon which Scenic Drive is locally situated. Both formations are predominantly weakly indurated (hardened) sandstone, derived by some 20 million years ago from the former Waitakere Volcano, the remnants of which form the western ranges. Cornwallis Formation is underlain by interbedded sandstone and mudstone of the East Coast Bays Formation, which forms all the terrain of Little Muddy Creek catchment south of the site.

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The ranges were tectonically uplifted along ENE and NNW-oriented faults, movement along which "may still be ongoing"[4].

4. Foundations

Attachments 1(existing site[5]); 2 (reservoir site[5]); and 3 (Manuka Road site[6]), are indicative cross-sections selected to illustrate present understanding of foundation geology, including stratigraphy, lithology, defects and weathering. They show how local ground conditions can vary both horizontally and vertically.

An uncertainty still to be resolved at the Manuka Road site is the possible existence of low-angle shear defects.[5] If persistent, such defects have the potential to adversely affect sliding stability.[7]

5. Slope Stability

5.1 General

A prominent arcuate escarpment forming the head of the Little Muddy Creek catchment has been interpreted as either the headscarp of a major inactive landslide[8] or the consequence of previous river erosion[9].

5.2 Reservoir site

Arising out of GIS hydrology mapping, observed ephemeral gullies may be "related to the large lobes of potential ancient landslide deposit."[10]

Large mounds in the vicinity have been considered to be rockfall debris[6,8,9], a process that apparently is still occurring.[8]

5.3 Manuka Road site

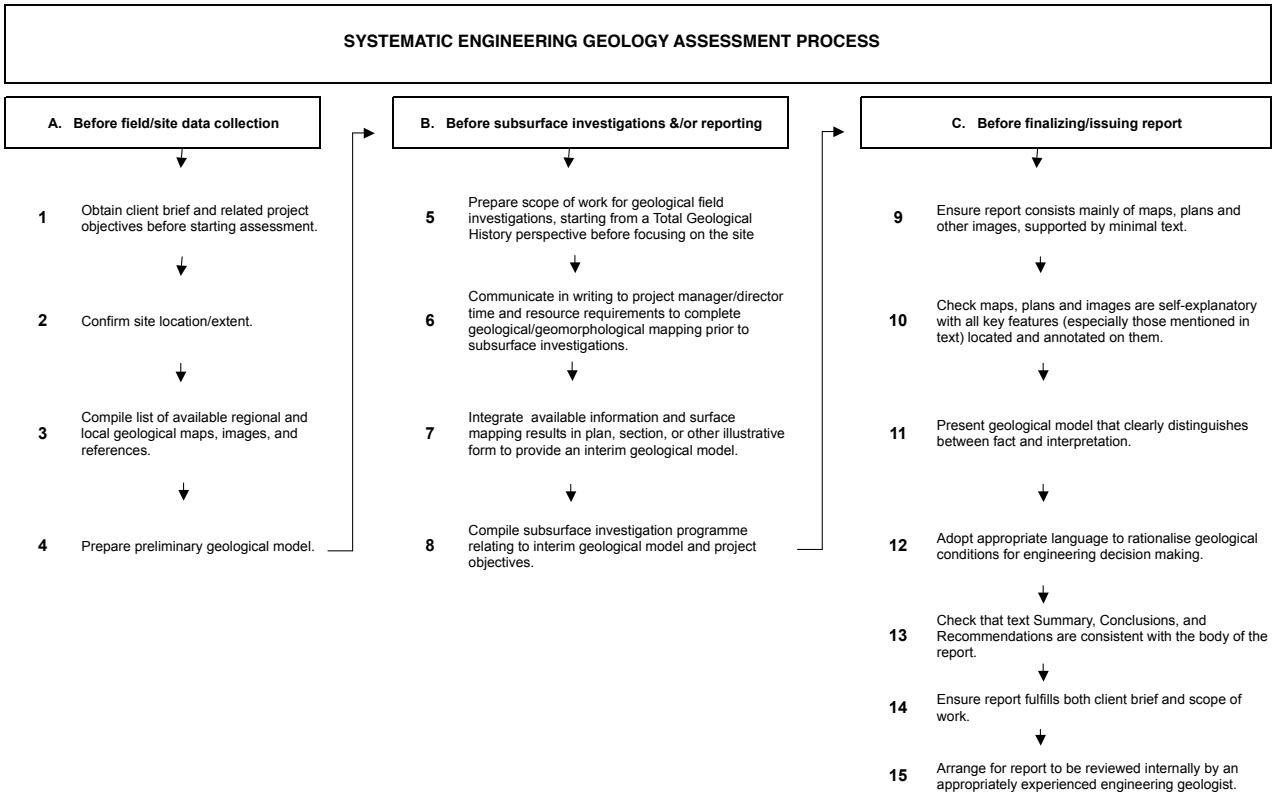
A recent study[10] describes the site topography as "lobate, being areas of uneven back tilted ground, that is suggestive of large scale land instability".

Also noted[10] is "colluvial soil related to slope movement at depths of 3-8 m across the site posing "a risk of instability due to future development, from loading the ground, or removing the toe support".

6. Conclusions and Recommendations

While the various geotechnical/geological documents prepared over past decades for treatment plant upgrade provide a useful indication of the nature and variability of factors likely to influence design and construction, unresolved differences of opinion mean that uncertainties remain with the geological modelling to date. This could cause difficulties for objective assessment of environmental effects in the resource consent application process. For example, unfavourable geological conditions encountered either during design or construction might result in a larger earthworks footprint than proposed, with potentially greater adverse ecological consequences.

These uncertainties should be addressed prior to seeking resource consent by compiling a summary of relevant information from the previous reports together with significant additional surface work. The latter should include production of engineering geological maps and sections of features such as landforms, outcrops, lithology, bedding, and defect orientations. In particular, the existence, nature, and risk of slope instability requires attention both locally and catchment wide. It is recommended that the following systematic process be followed for this and subsequent phases of the project:



Yours sincerely
RIDDOLLS CONSULTANTS LTD

Bruce Riddolls

References

1. Kermode, L.O. 1982: Sheet N42/7- Cornwallis. Geological map of New Zealand 1:25 000 (industrial series). Wellington NZ, DSIR.

2. Kermode, L.O. 1992: Geology of the Auckland urban area. Scale 1:50 000 geological map 2, Inst. Geol. & Nucl. Sciences Ltd. Lower Hutt NZ.

3. Edbrooke, S.W. (Compiler) 2001: Geology of the Auckland area. Scale 1:250 000 geological map 3, Inst. Geol. & Nucl. Sciences Ltd, Lower Hutt.

4. Hayward, Bruce, 2008: Land, sea, and sky - geology of the West, *in* Macdonald, Finlay, & Kerr, Ruth (Eds): West, the history of Waitakere.

5. Tonkin & Taylor Ltd, October 2010: Huia water treatment plant rebuild, geotechnical investigation and assessment. (Watercare report 7535).

6. Ormiston Associates Ltd, September 2008: Engineering geological assessment of the Little Muddy Creek catchment for proposed Titirangi no. 3 reservoir *in* Tower Foundations Ltd, October 2008: Titirangi no. 3 reservoir geotechnical report - Appendix A, JN005/08. (Watercare report 5336).

7. Grocott, G., Horrey, P., Riddolls, B., Foster, P., Sylvester, P., 2010. Retrospective geological modelling for gravity dam foundation stability analysis, Roxburgh, New Zealand. Int. Ass. Eng. Geol. & Env. Congress pp1895-1902

8. Opus International Consultants Ltd, 28 March 2014: Woodlands Park Road reservoirs, geotechnical interpretation report GS13/433. (Watercare report 11209).

9. Mansergh, G.D. September 1988: Engineering geological report on investigations, Nihotupu and Huia filter station sites. DSIR NZ Geological Survey Engineering Geology Immediate Report 88/052. (Watercare report 0334).

10. GHD Ltd September 2016: Site selection study, Huia water treatment plant.

ATTACHMENTS 1-3