2 EARTHWORKS AND GEOTECHNICAL REQUIREMENTS

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2.1 **Introduction**

Hamilton City Council has chosen to adopt the geotechnical requirements of NZS 4404. This section shall be read in conjunction with NZS4404. Any specific requirements relating to geotechnical assessments, testing and earthworks which are to be carried out in Hamilton City are referenced here.

2.1.1 **Objectives**

The objective of this section is to set out some, but not necessarily all, of the matters which need to be considered in the planning and construction of a land development project.

2.1.2 **Waikato Regional Council Requirements**

The Waikato Regional Council (WRC) plays a significant role in the management of earthworks and the supporting sediment control management systems.

Reference shall be give to the following WRC guidelines:

a) Erosion and Sedimentation Control Guidelines
b) Erosion and Sedimentation Control Plan and Preparation Guideline
c) Winter Works Guideline
d) Pre-construction Meeting Checklist
e) As-built Certification Sheets

2.1.2.1 **WRC Consents**

Resource Consents from WRC will typically be required for the following:

a) The discharge of contaminants during construction work
b) The diversion of natural water during construction work
c) The permanent diversion of natural water as a consequence of the development
d) The discharge of stormwater into natural waterways
e) Large scale groundwater takes (dewatering) during construction work
f) Placement of structures in or adjacent to a bed in a waterway (e.g. outfalls, culverts, bridges, dams)
g) Tracking and vegetation removal during construction
h) Works within a high risk erosion area

2.1.3 **Hamilton City Council Requirements**

Consents for earthworks may be required from HCC, refer to the relevant District Plan for requirements. Dust mitigation is also a requirement of the District Plan.

In addition to subdivision resource consents from the Council, the following additional consents may also be required:

a) Working within 5m of a waterway in an EPO layer
b) Earth removal works and Vegetation removal
c) Works within a high risk erosion area
2.1.4 **Historical Places Trust**

Some sites may require consent from the Historical Places Trust.

2.1.5 **Geotechnical Requirements**

The Developer shall appoint a geo-professional to carry out functions as described in NZS4404:2010 Section 2.2.4.

2.2 **Design**

The design process for geotechnical assessments and reports is as per NZS 4404:2010 Section 2.3 with the following additions.

2.2.1 **Land Contamination**

Regional Council and City Council maintain databases of sites that have been used for industrial activities that have the potential to cause land contaminations. If the site is listed in one of these databases, or if signs of potential contamination are observed, the developer shall engage a suitably qualified professional to investigate contamination potential and required remedial measures as set out in Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES). Early liaison with the Council contaminated land officers and staff is highly recommended in these circumstances.

It should be noted that such registers are not fully comprehensive and that developers should also make their own enquiries as to past site uses. Potentially contaminative hazardous activities are listed in the Ministry of Environment ‘HAIL’ list.

If contamination is present on site then supervision and sampling and testing of soil and groundwater must be undertaken as set out in the NES. The assessment report shall detail the contamination and include a remediation action plan shall then be prepared and submitted to the City and Regional Councils with the geotechnical assessment report.

2.2.2 **Erosion, Sediment and Dust Control**

2.2.2.1 **Erosion and Sediment Control**

Section 2.3.7 of NZS 4404:2010 shall be read in conjunction with Waikato Regional Council’s guidelines. Where ambiguity exists between documents Waikato Regional Council requirements shall take precedence.

2.2.2.2 **Dust Control**

Refer to the relevant District Plan.

2.2.3 **Geotechnical Assessment Report**

A geotechnical assessment report shall be used to inform landuse/subdivision layout and infrastructure design. The report shall be submitted to Council for approval prior to any earthworks taking place on the site.

The report shall include but not be limited to:

a) A brief description of the site.

b) WRC and HCC resource consent requirements.

c) Preliminary site evaluation and findings.
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d) Evaluation of the foundation design parameters for building development, road and infrastructure design.

e) Recommendations regarding the stability and accessibility for building where new slopes are proposed.

f) Identification of the existence and extent of any previous filling activities on the site, and comment on the quality and suitability of such fills for development purposes.

g) Evaluation of earthworks requirements in terms of area, volume, earth working methods, disposal of unwanted excavated material and specification for earthworks control, dust and silt management.

h) Description of the type and methodology of fill to be used on the site. This shall include the source of the material, what testing has been carried out to prove that it is fit for design purpose, details of the compaction methodology and acceptance criteria, the end product specification, frequency of testing and site supervision requirements.

i) Descriptions of any specific requirements regarding cuttings and embankments.

j) Identification of any work necessary to manage the risk of geotechnical issues during the construction process i.e. temporary stability of excavations, fills and haul roads.

k) If contamination of the site is found provide a detailed assessment of the contamination and recommend a remedial action plan.

l) Erosion and Sediment Control Plan as per WRC guidelines.

m) Identification and remedial recommendations for any potential flooding, erosion, seismic, liquefaction and other natural hazards both within the site or on neighbouring land.

n) Recommendations for site supervision and testing to be undertaken during construction.

The geotechnical assessment report may require peer review, refer to NZS 4404:2010 Section 2.3.2(g).

2.2.3.1 Specification for Material, Placement and Compaction

Fill Material

The report must state the source of the material, whether it is to be imported or sourced on site.

A description of this material in engineering terms must be given and be in accordance with New Zealand Geotechnical Society publication, 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.

The report must state what testing has been undertaken on the source material to prove it is fit for the design purpose. This must include the type of test, what testing standards the testing has been carried out to, the number of tests undertaken, and the test results.

This testing may consist of, but not be limited to:

a) NZ Standard Compaction Testing

b) Shear Vane Testing

c) Moisture Content Determination

d) Plasticity Index Testing

e) Particle Size Distribution
f) California Bearing Ratio (CBR) Tests

Details of any geosynthetics used in the design and plan showing where these are to be used, the type of geosynthetics and the function of the geosynthetic must be included.

2.2.3.2 Compaction Criteria and Methodology

Details of the compaction methodology to be adopted for the placement of fill must be presented together with the compaction acceptance criteria proposed for the works.

The acceptance criteria may be based on any combination of the following:

a) A target percentage of the maximum dry density of the compacted material
b) A range of suitable moisture contents of the material
c) A maximum air voids of the material
d) A maximum and minimum shear strength of the material

The basis upon which the chosen criteria are selected must be presented in the report.

2.2.3.3 End Product Specification

In this case the desired compaction criteria of the placed and compacted fill are specified and the earthworks contractor is free to choose whatever method of compaction they wish to achieve the targets specified.

A test area of fill material is usually placed to determine compaction characteristics and performance of the fill and prove method of compaction chosen will achieve the desired end product. Samples of compacted fill can be taken and tested in a laboratory or in-situ tests can be undertaken to analyse the compaction performance. The method determined by the trial is then used to provide the desired compaction performance across the entire earthworks project.

2.2.3.4 Frequency of Tests

During the earthworks, soil tests need to be undertaken on the placed fill to ensure the necessary degree of compaction is being achieved. The methods of testing and frequency of tests shall be specified and included in the Fill Design Report.

2.2.3.5 Site Supervision

The report must state what level of site supervision is to be undertaken to ensure the compaction of the material meets the earthworks specification.

2.2.3.6 Cuttings and Embankments

For cuttings and embankments formed as part of the earthworks, details of analytical methods used to determine slope stability are to be included. As part of this, the engineering properties and relevant ground investigation information is required.

As these earthwork features can affect the groundwater and surface run off, or need drainage measures to ensure stability, details of the drainage must be included.

If embankments form part of the proposed site works, settlement calculations must be included and justified from ground investigation data.

Details of any special measures to analyse slope or control settlements shall be included.
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2.3 Construction and Final Documentation

2.3.1 Construction
During construction site supervision and or testing maybe required to be undertaken by a suitability qualified geo-professional. The requirements for which will be outlined in the geotechnical assessment report.

2.3.2 Erosion and Sediment Control Maintenance
Maintenance of any erosion and sediment control devices shall be carried out as detailed in the approved Erosion and Sediment Control Plan.

2.3.3 Final Documentation

2.3.3.1 Geotechnical Completion Report
The geo-professional engaged by the Developer shall submit a geotechnical completion report as per NZS4404:2010 Section 2.6. The report shall be accompanied by a statement of professional opinion on the suitability of land for building construction (NZS4404:2010 Schedule 2A).

2.3.3.2 Contaminated Site Validation Report
When earthworks have been undertaken on a potentially contaminated sites or a site known to be contaminated, a Site Validation Report shall be prepared.

As a minimum this must contain the data and all test results listed in the Contaminated Land Management Guidelines No1, Reporting on Contaminated Sites in New Zealand (MfE October 2003).

A post construction Management and Monitoring Plan will form part of the Site Verification Report that is required on completion of any remedial works undertaken.

2.3.4 Resource Consents
The Developer is responsible for completing any requirements under any Resource Consents that have been issued for the development.
Appendix A
Checklists

Refer Schedule 2 A, NZS 4404:2010 – Statement of Professional Opinion on Suitability of Land for Building Construction