

GORE DISTRICT COUNCIL
SUBDIVISION AND LAND DEVELOPMENT BYLAW

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SECTION 5

EARTHWORKS

5.1 SCOPE

This section shall apply for any works involving more than 0.6 metre depth or 50 cubic metres of filling or more than 1 metre depth of cut.

5.2 OBJECTIVE

The practices specified or advised in this section are intended to minimise the risks associated with earthworks, including:

- Collapses that can hurt and potentially kill;
- Downstream effects on waterways; and
- Subsidence and damage following completion of projects.

5.3 PERFORMANCE STANDARDS

In undertaking any investigation, design or construction which involves earthworks Council shall require the Developer to conform to the following performance standards:

- (a) Modifications to the existing natural environment are to be minimised or avoided in order to preserve the existing landscape and habitat features as far as practicable.
- (b) The land is to be stable at all times.
- (c) Modified land within a subdivision or land development is suitable for the purpose for which it will be required without detrimental effects on the users or on adjacent landowners.
- (d) Modifications shall be such that the land can be easily maintained and will be resistant to erosion.

Dispensation may only be permitted subject to approval of Council (see Section 15).

5.4 RESPONSIBILITY FOR EARTHWORKS

Where any proposed subdivision or land development involves the construction of earth fills on any part of a proposed housing lot, then an inspecting engineer shall be engaged by the Developer to ensure that the earthworks are suitable for their intended use. The inspecting engineer shall specify the relevant compaction standards to be achieved, the test methods, and the construction practices to be used, and shall carry out the following functions:

- (a) Before work commences or during construction, to determine whether further specialist services such as geological or soil engineering services are required to achieve satisfactory performance of the earth fills;
- (b) Before work commences, to prepare or approve the drawings and specification defining the earth fill;
- (c) During construction to ensure that regular inspection is provided. While a daily

visit might be regarded as a reasonable minimum during earthwork construction on minor projects, inspection on a near full-time basis is often necessary;

- (d) During construction, to determine the methods and frequency of construction control tests to be carried out, determine the reliability of the testing and to evaluate the significance of test results and of his Inspector's reports in assessing the quality of the finished work;
- (e) On completion, to submit a report as to the compliance of the earthworks with this Standard.

5.5 SITE INVESTIGATIONS

Prior to any detailed planning or design, the Inspecting Engineer should undertake a preliminary evaluation of the general nature and character of the site in sufficient detail to determine the likely requirements for earthworks and/or the need for further investigations into the suitability of foundation conditions, and the stability of the natural ground. The preliminary evaluations should be carried out in the context of the total surroundings of the site and should not be influenced by details of land tenure, political or other boundary considerations. The scale of investigation shall be commensurate with the scale and potential effect of the works to be carried out.

5.6 EARTHWORKS

(a) CONSTRUCTION STANDARDS

Earthworks shall be carried out in compliance with NZS 4431:Code of Practice for Earthfill for Residential Development and with the relevant New Zealand Transport Agency specification for earthworks as appropriate.

During construction the Developer will be responsible for:

- (i) Control of dust so as not to cause a nuisance to adjacent landowners and/or occupiers or to existing infrastructure including high voltage electricity transmission lines.
- (ii) Control of stormwater to ensure that silt from works under construction is not carried beyond the boundaries of the work site. The Developer will be responsible for constructing and maintaining adequate silt traps until such time as the land is fully stabilised with adequate ground cover.

Details of controls shall be submitted as part of the engineering plans and specifications.
- (iii) During construction to ensure that regular inspection is provided. While a daily visit might be regarded as a reasonable minimum during earthwork construction on minor projects, inspection on a near full-time basis is often necessary;
- (iv) During construction, to determine the methods and frequency of construction control tests to be carried out, determine the reliability of the testing and to evaluate the significance of test results and of his Inspector's reports in assessing the quality of the finished work;
- (v) On completion, to submit a report as to the compliance of the earthworks with the Standard, and any relevant specifications.

(b) **SITE INVESTIGATION**

The objectives of a site investigation are to:

- Assess the suitability of a site for its proposed use.
- Foresee construction difficulties.
- Collect enough information for satisfactory design.

A site investigation should address the following factors:

- (i) Ownership.
- (ii) Geology.
- (iii) Groundwater.
- (iv) Subsoil conditions, foundation conditions and stability.
- (v) Services.
- (vi) Access.

A review of the existing information is essential, and which may include:

- (i) Geographical maps and reports.
- (ii) Data from adjacent sites – i.e. previous investigations.
- (iii) Aerial photographs.
- (iv) Performance of related and/or adjacent developments.

Geotechnical investigation reports should generally cover, but not necessarily be restricted to, the following:

- (i) **Purpose**
To investigate, examine and report on the suitability of a site for its proposed use including an evaluation of slope stability, foundation conditions, earthwork requirements, natural hazard and groundwater.
- (ii) **Soils**
Investigate and report on the geology and soil characteristics of the site with regard to foundation and construction condition.
- (iii) **Foundation Requirements**
Consider the types of building likely and their load requirements, and evaluate the foundation conditions for each allotment. Consider the type of road and evaluate the foundation at sub grade level.
- (iv) **Effluent Disposal**
In areas where sewage disposal is by means of septic tanks, the report should also comment on the suitability of the site to accept septic tank effluent disposal and its influence on land stability including an assessment of soil permeability.
- (v) **Non-Engineered Fills**
Identify the existence of previous filling activities on the site, and comment on the quality and suitability of such fills for development purposes, especially settlement and stability.
- (vi) **Slope Stability**
Where appropriate, carry out a slope stability appraisal to determine whether the development will provide stable and accessible building sites.

- (vii) **Water Table**
The ground water table must be established in terms of MSL for both winter and summer conditions. In the case of land adjacent to rivers and streams, the ground water table must be established with reference to the average water level of the river or stream in winter.
- (viii) **Natural Hazards**
Evaluate the risk from natural hazards, including falling debris, earthquake, flooding, or tsunami.
- (ix) **Earthworks Development and Control**
Discuss earthworks aspects of the site and provide a specification for earthworks control and the installation of services.
- (x) **Conclusions and Recommendations** Set out the findings of the investigation and provide recommendations for:-
 - Restriction on use of the land if all or part of the land is unsuitable for some uses.
 - Suggested changes to a sub divisional layout to achieve better use of the site, and/or minimise construction difficulties.
 - Control during construction.
 - Further investigation where required.
 - Regulation and control, or future action necessary to maintain suitability.

(c) **GENERAL**

- (i) Where land filling is to be undertaken, the areas affected, together with dimensions relative to the created property boundaries, shall be shown on the "As Built" plans to be supplied to Council.
- (ii) Any areas of fill or earthworks not certified in accordance with NZS 4431: Code of Practice for Earth Fill for Residential Development shall, together with sufficient dimension to locate the feature from property boundaries, be registered on the land transfer title plans and shown on the "As Built" plans.
- (iii) Reserves are to be shaped to Council's requirements so that the areas are suitable for mowing and the control of stormwater.
- (iv) All lots are to be reshaped to slope to the roadside kerb and channel or to the Right of Way serving each lot, or to an approved outfall. The minimum gradient shall be 1 in 500.

(d) **EMBANKMENTS**

Where fill batters:

- (i) Are steeper than 2 horizontal to 1 vertical, or
- (ii) Exceed 3 metre in height, or
- (iii) Are constructed using moisture content susceptible soils, or
- (iv) Have features that Council deems to be unusual

A suitably qualified person shall provide a site-specific design (including benching if appropriate) for approval by Council.

The minimum width of any bench should be 1.8 metres. Stormwater should be controlled to a point clear of the filling to discharge in such a manner as to

prevent erosion. Minimum stability batters produce areas which are difficult to maintain and remain in unsightly condition. Batter slopes of 6 horizontal to 1 vertical are more readily maintained.

The edge of the batter should be generally a minimum of 600 mm behind the kerb or back edge of the footpath. Where topography restricts normal berm width a safety fence will be required for the minimum distance situation.

(e) **CUTTINGS**

The slope of batter cut will vary from locality to locality dependent upon the type of material to be cut. Slopes steeper than 1 to 1 can be adopted, based upon experience and soil tests, but the more commonly expected maximum slope is 1.5 horizontal to 1 vertical.

Where cut batters:

- (i) Are steeper than 2 horizontal to 1 vertical, or
- (ii) Exceed 3 metre in height, or
- (iii) Are constructed using moisture content susceptible soils, or
- (iv) Have features that Council deems to be unusual

a suitably qualified person shall provide a site-specific design (including benching if appropriate) for approval by Council.

The minimum width of bench should be 1.8 metres. Stormwater shall be controlled to a point clear of the filling to discharge in such a manner as to prevent erosion.

The distance from kerb face or footpath to toe of cut should be a minimum of 600 mm but this will be permitted only in situations where the full berm width cannot be provided.

(f) **BERM SLOPES**

Grassed berms shall be sloped and shaped for easy maintenance. Where berms are of a slope that cannot be safely mowed then provision shall be made for maintenance of the slopes and any associated walls.

Berms shall be formed with at least 75 mm depth of good quality topsoil, with lawn fertiliser applied at the rate of 20 gm/m² and then sown with a fine fescue/NZ brown top grass seed mix at a minimum rate of 30 gm/m².

Seed shall be raked in and rolled. All areas are to be watered and maintained until a full sward is established.

5.7 QUALITY ASSURANCE AND CONTROL

The quality control of earthworks is an essential phase of land development, and is aimed at providing a uniform construction in terms of engineering performance. Earthworks should be certified as to the way in which they have been carried out and their suitability for their end use. The form of quality control will evolve from the earthworks appreciation and will generally be developed about:

- (a) Adequate strength.
- (b) Limited volume change.

The engineering performance of soils depends on their condition at the time of compaction and cannot be adequately reflected in a single parameter.

Judgement is required in determining quality control criteria.

5.8 SETTLEMENT

Settlement of soils (consolidation) is a complicated natural phenomenon, which is influenced by a number of factors, including the nature and mineralogy of the soil, the soil particle arrangement, whether the soil is undisturbed or remoulded, its past stress history, the drainage conditions affecting the particular circumstances, etc.

For land development works, the pre-development soils investigations should identify areas of risk, such as organic soils, swampy areas, etc. and the likely performance of the foundation under earth fills.

Settlement will also occur within earth fills due to the self-weight of the fill.

The consolidation settlement and elastic compression of fill are a function of time, albeit of long or short duration, thus in some cases it may be necessary to allow a period of time to elapse from the placement of fill the commencement of building construction.

5.9 EARTHWORKS AND LAND STABILITY COMPLETION REPORT

A earthworks and land stability completion report should cover, but not necessarily be restricted to, the following:

- (a) Purpose
To report on the development after completion of the works with a view to recording construction information and extending the site investigation report if appropriate, and expressing an opinion on the suitability of all lots within any subdivision for their intended use.
- (b) Scope
The report should describe all activities from the preliminary site investigation, to the completion of the physical works, including earthworks compaction control testing.

The report should cover, and re-evaluate where necessary, the requirements of the Geotechnical Investigation Report, the requirements of NZS 4431: Code of Practice for Earth Fill for Residential Development, where appropriate, and requirements that are set out in the conditions of any subdivision or land use consent.

The description should include sufficient test results, site inspection data, and other information to enable an independent assessment to be made as to the suitability of the development.

The emphasis of the report should be on stating what happened during construction, supported by detailed field notes, test results, and construction reports to provide an accurate detailed "as-built" record.