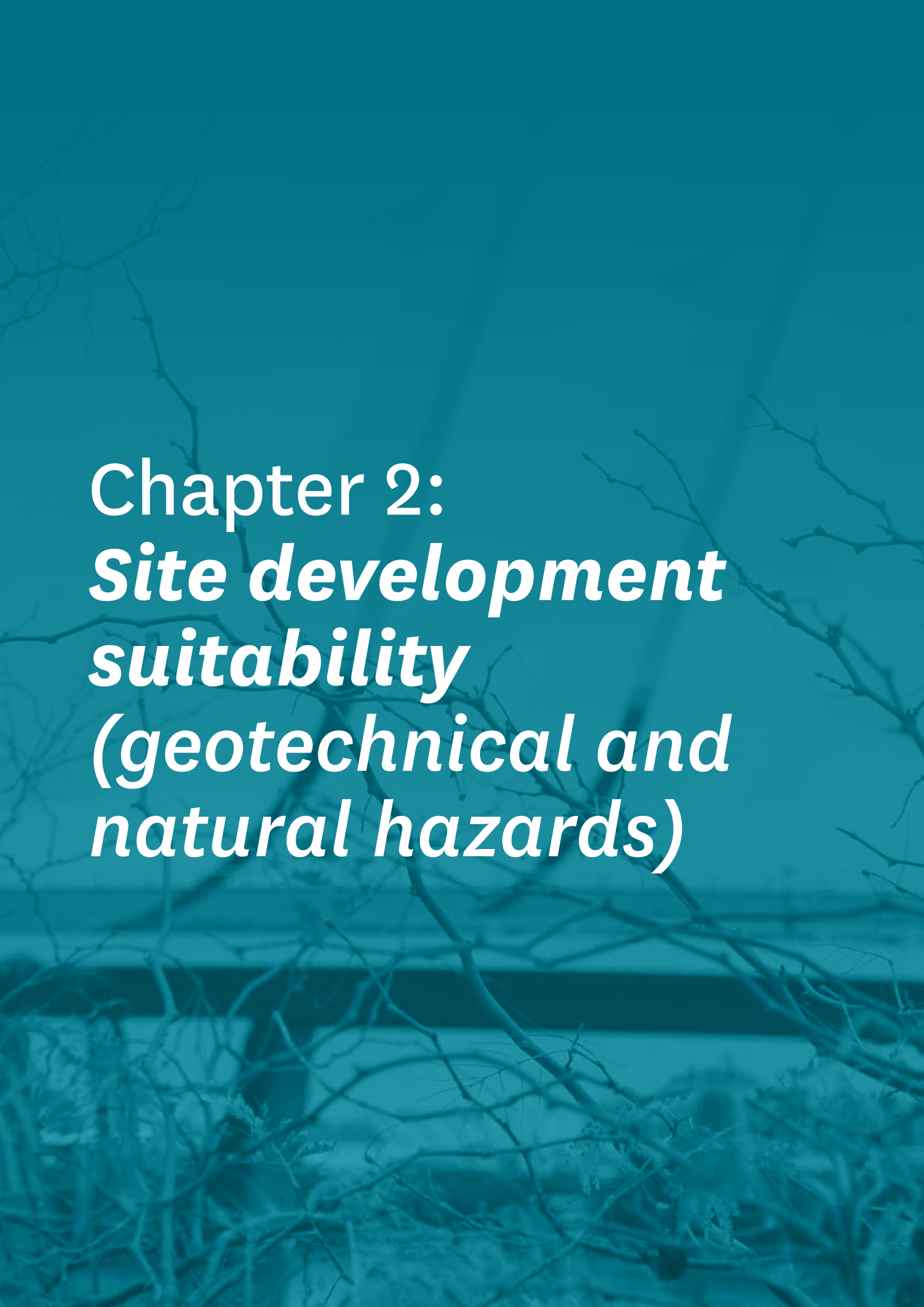

Chapter 2: ***Site development suitability*** *(geotechnical and natural hazards)*

2.1. Introduction

The WDC has chosen to incorporate the geotechnical requirements of NZS 4404:2010 into the ES.

Specific requirements relating to geotechnical assessments, testing and earthworks which shall be carried out in the Whangārei District are referenced in this chapter.

2.1.1. Scope

This section sets out the WDC's requirements for the assessment and reporting of site suitability and the design and control of earthworks. To meet these requirements the following shall be submitted, where relevant to the site:

a. Assessment of land stability and ground strength for the construction of roads and services and to ensure suitable platforms are available for buildings.

b. Design and control of earthworks.

c. Assessment of other hazards that may affect the development. This may include hazards identified in the District Plan or held by WDC or other engineering reports or hazards identified as part of the site investigation.

2.1.2. Objectives

The objectives of this section are to ensure that:

a. Geo-Professionals are involved in the design of landform for development when earthworks are other than minor or when stability hazards are present,

b. The development takes account of any geotechnical or natural hazard limitation of the land,

c. The WDC's duties in relation to Section 106 of the Resource Management Act 1991 and Section 71 of the Building Act 2004 have been discharged, and

d. Adequate information is provided to inform future owners of the land, the land's limitations and any special conditions that may be implemented at building consent stage.

2.1.3. Reference Documents

The following documents are referenced in this Chapter:

Note it is the responsibility of the Developer to ensure the most up to date referenced document is sourced.

2.1.3.1 Statutory

Building Act 2004

NRC Regional Plans

Operative District Plan

Resource Management Act 1991

Resource Management Regulations 2011

2.1.3.2 New Zealand Standards

NZS 3604:2011 - Timber-framed buildings

NZS 4229:2013 - Concrete masonry buildings not requiring specific engineering design

NZS 4404:2010 - Land development and subdivision infrastructure

NZS 4431:1989 - Code of practice for earth fill for residential purposes

2.1.3.3 WDC Documents

Acid Sulphate Soil Planning Policy Basic Guide 2015

Coastal Structure Plan - Slope Instability Hazard Potential and Effluent Disposal Potential: Oakura to Langs Beach 2005

Land Hazard Maps

Land Instability Maps

Policy #0129 - Land Development Stabilisation 2018 and Land Development Stabilisation – Technical Design Requirements 2018

Stormwater Catchment Management Plans *(To be provided by WDC on request)*

Liquefaction Vulnerability Study – Whangārei District 2020 (*To be provided by WDC on request*)

2.1.3.4 Regional Council Documents

Regional Policy Statement for Northland May 2016

Report - Coastal Flood Hazard Assessment for Northland Region 2019-2020

Report - Coastal Erosion Hazard Assessment for Selected Sites 2019-2020

2.1.3.5 Other Referenced Documents

Auckland Council GD2016/005: Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region

ENZ Producer Statement – PS4 Construction Review

MBIE Rockfall: Design considerations for passive protection structures 2016

Ministry for the Environment Contaminated Land Management Guidelines No. 1: Reporting on contaminated sites in New Zealand (June 2021)

NZ Geotechnical Society Inc; Field Description of Soil and Rock, Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes December 2005

2.2. Consents and Approvals

2.2.1. Northland Regional Council Requirements

2.2.1.1 General Requirements

The Northland Regional Council (NRC) plays a significant role in the management of earthworks and supporting sediment control management through the NRC Regional Plans. The Developer shall satisfy any NRC requirements applicable to their development activity in addition to the requirements in this Section.

Permitted Activities under the NRC Regional Plans may still require consent under the District Plan. The Developer shall refer to the NRC Regional Plans and District Plan when determining consent and engineering design requirements applicable to their development activity.

2.2.1.2 Northland Regional Council Consents

The Developer shall assess their proposed development activity against the NRC Regional Plans pertaining to earthworks activities, and shall identify, in their development application to WDC any NRC consents that may be required under those rules.

If a NRC consent is required for earthworks, the Developer shall consult with WDC to understand requirements required for earthworks prior to submitting the NRC consent application.

The consent shall be obtained prior to application to WDC for a development consent. This does not negate the requirement to obtain a WDC resource consent for earthworks, if applicable.

2.2.2. WDC Requirements

2.2.2.1 Geotechnical Reporting Requirements

The Developer's Geo-Professional shall carry out the following functions and any other specific geotechnical functions described in the ES:

a. Desktop study to check regional and district plans, records and requirements prior to commencing a geotechnical assessment,

b. Site inspection and investigations of subsurface conditions to satisfy the requirements of this chapter,

c. Review drawings and specifications defining earthworks or other construction for the proposed development,

d. Report to WDC on foundation and stability aspects of the proposed development,

e. Before construction, determine the extent of any further Geo-Professional services required to undertake the proposed development to the required standard,

f. Identify any work necessary to manage geotechnical risks during construction,

g. Determine the methods, locations and frequency of any geotechnical construction control testing required to ensure the final quality of earthworks,

h. Undertake regular inspection of the development earthworks during construction, and

i. Provide a Geotechnical Completion Report, in accordance with NZS 4431:1989 or other applicable specifications, on the compliance of earthworks and the suitability of the development for its proposed use.

Upon carrying out these functions, reporting shall be provided to WDC at the following stages of the development:

2.2.2.1.1. Resource Consent Application

A Geotechnical Assessment Report as per Section 2.3.3 Geotechnical Assessment Report shall be provided with an application for resource consent, which shall include all relevant information, guidance and recommendations that:

a. Relate to the geotechnical suitability of the land for the proposed development,

b. Result from a site inspection and/or investigation undertaken in order to identify geotechnical hazards affecting the land, including any special ground conditions that may impact on the design,

c. Inform the design of future development earthworks, services, structures, etc.,

d. Identify information gaps or specific requirements for further geotechnical investigation needed prior to design or construction,

e. Relate to the management of the geotechnical risk of the proposed development, or,

f. Relate to the foundation and stability aspects of the proposed development.

The Developer shall also identify, assess and provide any relevant information, guidance and recommendations for the mitigation of any other hazards (including but not limited to potential flooding, erosion, seismic, liquefaction, contaminated land, aggressive soil conditions, and rockfall), both within the site or on neighbouring land where it may affect

the site. Assessment of other hazards shall be provided either as part of the Geotechnical Assessment Report or as stand-alone specialist reports as required.

2.2.2.1.2. WDC Consents

The Developer shall assess their proposed development against the District Plan, and shall identify whether a WDC resource consent is required for the proposed development earthworks activities.

Any WDC resource consents that are required shall be obtained prior to application for Engineering Design Approval (EDA) under the ES.

2.2.2.1.3. Engineering Design Approval

A Geotechnical Design Report and supporting information shall be submitted for EDA and shall include any relevant information, guidance and recommendations that:

a. Arise from a Geo-Professional review of the Geotechnical Assessment Report, design or construction drawings and/or specifications for the proposed development,

b. Identify information gaps or specific requirements for further geotechnical investigation prior to or during construction,

c. Relate to management of geotechnical risk during construction,

d. Specify the construction or compliance criteria of proposed earthworks,

e. Identify methods, location and frequency of construction control tests, or,

f. Is required to be considered during construction of the design in order to mitigate the effects of natural hazards.

2.2.2.1.4. Completion of Works

After construction, any relevant information that:

a. Identifies information gaps or specific requirements for further geotechnical investigation,

b. Documents construction inspections, test results and reliability/significance of geotechnical investigation undertaken,

c. Assesses and documents the quality of the finished work, or

d. Otherwise substantiates and verifies the compliance of earthworks against these standards, the recommendations made in applicable reports by Geo-Professional(s), and any other applicable New Zealand Standards (e.g. NZS 4431:1989),

shall be provided to WDC for their records along with the Geotechnical Completion Report (Section 2.6.1.1 Geotechnical Completion Report).

This information shall also include appropriate certification of the works in accordance with Section 1.5.3.3.4 Certification or equivalent approved form from NZS 4404:2010.

2.2.2.2 Reference Documents

Reference shall be made to the following WDC documents:

a. Coastal Structure Plan - Slope Instability Hazard Potential and Effluent Disposal Potential,

b. WDC Stormwater Catchment Management Plans,

c. NRC Regional Policy Statement for Northland,

d. NRC Coastal Flood Hazard Assessment for Northland Region 2019-2020,

e. NRC Coastal Erosion Hazard Assessment for Selected Sites 2019-2020,

f. WDC Acid Sulphate Soil Planning Policy Basic Guide,

g. WDC Policy #0129 - Land Development Stabilisation 2018,

h. WDC Land Development Stabilisation – Technical Design Requirements 2018,

i. Liquefaction Vulnerability Study – Whangarei District 2020,

j. Rockfall: Design considerations for passive protection structures 2016, and

k. Other relevant WDC documents available on the Land Hazards page of the WDC website.

2.2.2.3 Historic Investigations

WDC may have copies of geotechnical (or other) investigations completed in support of previous development proposals. Reports on adjacent sites may be available, subject to limitations on their use.

2.2.2.4 Hazard Mapping

The Developer shall obtain and review information from the WDC's GIS, NRC's GIS, NZGD and other available sources, regarding hazards and development limitations that may affect the proposed development, as part of the desktop study for the Geotechnical Assessment Report (see Section 2.3.3 Geotechnical Assessment Report), including:

a. Coastal Erosion and Instability,

b. Earth movements (including but not limited to rockfall, landslide and soil creep),

c. Mine zones,

d. Flood zones,

e. Contaminated sites,

f. Subsidence and Settlement, and

g. Acid sulphate soils.

Where the proposed development site is outside of an area covered by the WDC Land Hazard Maps, an assessment shall be made by a SQEP, as to which hazard(s) and to what level(s) are applicable to the site.

Hazards and other limitations that are applicable to the site shall be addressed in accordance with Section 2.3 Geotechnical/ Hazard Assessment.

Note: Levels of stability hazard are also identified in the WDCs commissioned reports on slope stability.

Note: The mapped hazard zones are "high level" classifications and will need to be confirmed through site specific investigations.

2.2.2.5 Erosion, Sediment and Dust Control

The Developer shall be responsible for compliance with any NRC and WDC permitted rules or consent requirements regarding erosion, sediment or dust control which may be applicable to the proposed development.

2.2.1. Heritage New Zealand

The Developer is responsible for liaison with Heritage New Zealand Pouhere Taonga (HNZ) and shall identify any additional authorities that may be required for the proposed development earthworks activities.

2.3. Geotechnical/ Hazard Assessment

2.3.1. Criteria for Assessment

Specific assessment of geotechnical or other hazards applicable to a site shall be undertaken by a SQEP, wherever:

a. Hazard mapping or other assessment (refer section 2.2.2.4 Hazard Mapping) has identified that geotechnical or other hazards are actually or potentially applicable to the site,

b. Assessment of land stability requires specialist expertise,

c. Earthworks for development requires planning and design to ensure that cut and/or fill batters remain stable and can support future imposed loads,

d. Weak, compressive or unstable ground may be present, or is identified on the site, (e.g. historical fill where the fill is not documented as having been completed to any published standard),

e. Assessment of ground for the design of foundations of buildings, roads, services and other infrastructure requires specialist expertise due to the presence of weak or unstable ground, or

f. The wide range of soil types, physical conditions and environmental factors applying in different areas make it difficult to specify precise or prescriptive requirements for land stability assessment or earthworks.

2.3.2. Assessment Considerations

Geotechnical assessment of land development shall include the factors from section 2.3.1 of NZS 4404:2010, repeated here for convenience:

a. Preliminary site evaluation,

b. Identification of special features to be retained / protected,

c. Low impact design considerations,

d. Selection of the choice of landform,

e. Stability assessment, including stability and accessibility for building where new slopes are proposed,

f. Assessment of special soil types where applicable,

g. Setting of compaction standards for fill material,

h. Erosion, sediment and dust control,

i. Seismic considerations, or

j. Geothermal issues where applicable.

Geotechnical assessment, and assessment of other hazards, shall also include:

a. Review of the proposed development against any requirements or recommendations in the reference documents (Section 2.2.2.2 Reference Documents),

b. Assessment of the applicability and accuracy of any high-level hazard zone mapping on/adjacent to the site, and,

c. The factors in this section where applicable.

For future building development, ground conditions should be investigated to the extent necessary at the particular stage of development, to ensure:

a. (for residential development) that a suitable building site is available for each lot where it is viable to construct foundations in accordance with NZS 3604:2011 or NZS 4229:2013, and

b. (for residential development), where foundations are not covered by NZS 3604:2011, any requirements for Specific Design of foundations have been identified for the building site, and

c. (for commercial development) that any limitations of the ground conditions relevant to the construction of commercial buildings have been identified.

Where geotechnical assessment is being undertaken for a site that is not mapped on the WDC Land Instability Maps, or covered by a WDC commissioned assessment report, then the geotechnical assessment shall consider the classification of the site in terms of Section 2.3.3.2 Low Stability Hazard, 2.3.3.3 Moderate Stability Hazard and 2.3.3.4 High Stability Hazard.

2.3.3. Geotechnical Assessment Report

2.3.3.1 General Requirements

The Geotechnical Assessment Report shall be submitted with the resource consent application, and shall:

a. Address the reporting requirements in Section 2.2.2.1 Geotechnical Reporting Requirements,

b. Address the expected risks of the proposed development with regard to geotechnical hazards, earthworks and foundations, and

c. Make any specific recommendations that the SQEP considers necessary in order to achieve the objectives in Section 2.1.2 Objectives.

Special requirements apply when the development land is or is likely to be subject to erosion, avulsion, alluvium, falling debris, subsidence, slippage, rotation, creep, or inundation from any source. In these situations, reference shall be made in the assessment report to the requirements of Section 106 of the Resource Management Act 1991.

Where the geotechnical assessment has been undertaken for a development that relies directly on the findings of the Geotechnical Assessment Report for subsequent building work (e.g. for a Land use development application), then reference in the Geotechnical Assessment Report shall also be made to the limitations contained in Section 71 of the Building Act 2004.

Levels of stability hazards are identified in the WDCs commissioned reports on slope stability and are included as a Hazard Mapping layer in WDC's GIS which is accessible through the WDC website.

The Geotechnical Assessment Report may require peer review, refer to NZS 4404:2010 Section 2.3.2(g).

2.3.3.2 Low Stability Hazard

Land erosion or land slippage is not apparent. However, sloping areas may be sufficiently sensitive to erosion or slippage that could occur due to inappropriate cutting, filling, and/or site disposal of stormwater and/or effluent wastewater and natural events (e.g. cyclonic short-term high intensity rainfall events). These slopes could also be subject to soil creep.

Where:

a. The result of a visual assessment in accordance with Section 1.5.2 Information Requirements - Resource Consent Applications indicates that a more detailed assessment of land currently mapped as Low Stability Hazard is appropriate, or

b. The land is not currently mapped on WDC Land Instability Maps, then

Applications for development of this land should be accompanied by a brief geotechnical assessment report which summarises the results of a walk-over survey and a

geological/geomorphological assessment (which describes how the particular landform has been formed, what it is made up of and what slope processes are, or are likely to be occurring) and provides an informed opinion on the suitability of the land for the intended purpose.

The geological/geomorphological assessment shall entail most or all of the following steps, and the brief report shall specifically address the expected effects of the subdivisional and/or building development on the land.

The Geotechnical Assessment Report of low risk land shall include:

a. Walk-over inspection of the site and the surrounding land,

b. Inspection of historical aerial photographs taken at various times to provide insight into the local geomorphology and evidence of any previous instability,

c. Review of geological data (maps, bulletins),

d. Any local information about stability of the ground,

e. Any existing data about the soil and rock profile (look for nearby exposures) or perform some simple subsurface investigation,

f. Examination of the soil profile to confirm that if the soil is in-situ and not colluvium (slide debris),

g. Examination of the existing survey records for evidence of movement (slippage or erosion),

h. A Geo-Professional's opinion as to the stability and suitability of the land for development (including an assessment of the effects of development such as excavation, filling, removal of vegetation, disposal of stormwater or effluent wastewater into or over the area), and

i. Definite conclusions and recommendations on any development restrictions and further test requirements.

2.3.3.3 Moderate Stability Hazard

This land does not exhibit any evidence of recent instability but does display 'relic' landslide geomorphology, or is sufficiently sloping to be potentially subject to instability due to either natural events (e.g. high intensity rainfall events or earthquake), or as a result of inappropriate cutting, filling, and/or site disposal of stormwater and/or effluent waste water.

Applications for development (such as excavation, filling, removal of vegetation, disposal of stormwater or domestic wastewater into or over the area) may be appropriate to proceed subject to consent conditions provided that a geotechnical assessment includes a stability assessment demonstrating that the proposed development will not accelerate, worsen or result in the land being subject to, or likely to be subject to, erosion or slippage, to the satisfaction of WDC.

The Geotechnical Assessment Report of moderate risk land shall include the following requirements, in addition to the requirements of Section 2.3.3.2 Low Stability Hazard:

a. Topographic survey (if not already available) or slope profiles,

b. A description of the geology and geomorphology of the area, including comments on the areas surrounding the development site,

c. Definition of the nature and continuity of the strata over the whole area of land which is proposed to be developed (buildings, access and services) and to a depth below which slipping is most unlikely, by means of test pit and/or drilling and/or augering (unless existing exposures are adequate),

d. Assessment of the relative strength and the sensitivity of the soil in each stratum in which, or interface on which, sliding is practicable,

e. Assessment of likely groundwater levels and piezometric pressures in the strata during extreme infiltration conditions,

f. The Geo-Professional's opinion as to the stability and suitability of the land for development, including the stability of the whole slope (upon which the site may only form a part of), and the effects of the development (such as excavation, filling, removal of vegetation, disposal of stormwater or effluent waste water into or over the area) on the whole slope, and

g. Definite conclusions and recommendations on any development restrictions and further test requirements.

2.3.3.4 High Stability Hazard

This land exhibits evidence of recent or present slippage or erosion and/or is subject to processes where slippage or erosion is considered likely to occur within the next 100 years. Development of this land presents an identifiable hazard to property and could also, in some circumstances, threaten life.

On, above and especially below this land, no subdivision, building or other development including excavation, filling, removal of vegetation, disposal of stormwater or domestic wastewater into or over the area should occur unless a Geotechnical Assessment Report, including an appropriate and adequately detailed stability analysis, is produced to the satisfaction of WDC.

The Geotechnical Assessment Report shall demonstrate that the proposed development area will not be subject to erosion, slippage, or inundation by debris from upslope. It shall also show how the proposed development, through preventative works or other measures, will ensure that any structure will not become damaged by erosion or slippage arising on or off the site, and that development will not accelerate, or worsen, erosion or slippage.

The Geotechnical Assessment Report of high-risk land shall include the following requirements, in addition to the requirements of Section 2.3.3.3 Moderate Stability Hazard:

a. Topographic Survey (if not already available),

b. A description of the geology and geomorphology of the area and immediate surrounding areas,

c. Definition of the nature and continuity of the strata over the whole area of land involved, and to a depth below which slipping is most likely, by means of test pits and/or continuous recovery core drilling (unless existing exposures are adequate),

d. Determination of the peak and residual shear strength parameters (either from laboratory tests or back analysis of relevant slope failures) and the sensitivity of the soil in each stratum in which, or interface on which, sliding is practicable,

e. Assessment of groundwater levels and piezometric pressures in the strata during extreme infiltration conditions,

f. Analysis of practicable failure mechanisms relevant to the specific geology and geomorphology of the site using effective stresses,

g. The Geo-Professional's opinion as to the stability of the ground and the preventative (or remedial) measures to be incorporated in the development,

h. The Geo-Professional's opinion as to the stability and suitability of the land for development, including the stability of the whole slope (upon which the site may only form a part of), and the effects of the development (such as excavation, filling, removal of vegetation, disposal of stormwater or effluent waste water into or over the area) on the whole slope, and

i. Definite conclusions and recommendations on any development restrictions and further test requirements, specifically addressing Section 106 of the Resource Management Act 1991.

Site development works in particular shall be carefully planned to ensure the development does not result in slippage or erosion.

2.3.3.5 Stabilisation Works

Where necessary, the Developer's Geo-Professional shall provide recommendations for any necessary works required to protect or restore the stability of the site during any particular stage of the development.

This may include earthworks (to reduce slope angles or place buttress fills), drainage works (trench drains, buttress or counterfort drains aligned down the true slope angle), retaining structures, erosion protection structures, and planting.

In particular, where cutting or embankments are proposed as part of development works, the Geo-Professional shall assess short and long term stability of these, and provide specific recommendations to protect the stability of the land that may be affected by the proposed cutting / embankments.

Where subsoil drainage is recommended as a stabilisation measure, design and future operation / maintenance shall be in accordance with WDC Policy #0129 – Land

Development Stabilisation 2018 and Land Development Stabilisation – Technical Design Requirements 2018 .

2.3.3.6 Special Soil Types

Special soil types are known to exist in the Whangārei District.

The Developer's Geo-Professional shall assess the proposed development site for the presence of special soil types and provide specific advice and recommendations on appropriate measures for incorporating these soils into the proposed development.

Special soil types to be assessed include, but are not limited to:

a. Expansive soils,

b. Compressible soils,

c. Volcanic soils,

d. Soils subject to liquefaction,

e. Acidic soils,

f. Soils prone to dispersion, and

g. Previous fill material.

2.3.3.7 Seismic Considerations

An assessment shall be made of the potential for seismic events to increase slope stability risk, to affect the strength of foundations soils, or other effects on the proposed development site.

The Developer's Geo-Professional shall detail any specific recommendations or limitations on the proposed development with regard to the seismic assessment.

2.3.4. Assessment of Other Hazards

2.3.4.1 Coastal Hazards

Specific investigation and design shall be carried out for all coastal sites and particularly where potential development lies within coastal hazard notations, including coastal erosion and coastal flooding (refer to Section 4.3.5.2 Coastal Flood Hazard Assessment).

2.3.4.2 Aggressive Ground Conditions

For all sites containing waterlogged soils or with the potential to contain aggressive ground conditions (e.g. acid sulphate soils), the Developer shall engage a Geo-Professional to carry out investigations of the site and assess and report on the following:

a. The potential for saturated or aggressive soil conditions on the site under consideration,

b. The risk of saturated or aggressive soil conditions impacting on proposed (future) built structures, and

c. Specific conclusions, recommendations and proposed mitigation to address the assessed risk.

This site-specific hazard assessment report shall be included with the consent application, (see Section 1.5.2 Information Requirements - Resource Consent Applications).

Note: Many areas of coastal Northland are undergoing rapid expansion and development of rural and urban land uses. Accompanying such development are many soil related problems, including acid sulphate soils. The development of this land shall incorporate a full understanding of the problems associated with such soils.

Note: Acid sulphate soils are extremely acidic soil horizons or layers resulting from the aeration of soil materials that are rich in iron sulphites, primarily pyrite (FeS). When drainage or excavation brings oxygen into these previously waterlogged soils, the pyrite is oxidised to sulphuric acid.

Note: Whether or not a particular land use will contribute to any acidification hazard in an area by exposing acid sulphate soils will depend on the depth of soil disturbance and the depth of occurrence of acid sulphate soil materials. Therefore, the environmental risk associated with disturbing acid sulphate soils will depend on the type and depth of land use activity undertaken. Refer to WDC Acid Sulphate Soil Planning Policy Basic Guide for the classification of low, moderate and high risk activities.

2.3.4.3 Flood Hazard

For all sites subject to, or potentially subject to flood hazard(s), the Developer shall engage a SQEP to undertake a site-specific assessment of the flood hazard and risk associated with the proposed development as per Section 4.3.5.1 Flood Hazard Assessment.

2.3.4.4 Mine Subsidence Hazard

For all sites subject to, or potentially subject to mine subsidence hazards, the Developer shall engage a SQEP to undertake a site-specific assessment of the mine subsidence hazard and risk associated with the proposed development, and report on the following:

a. Desktop review of the mine subsidence hazard data available, e.g. from Council(s) mapping, third party reports, etc,

b. Provide an evaluation of the ground conditions and potential severity of subsidence, and assess the appropriateness of proposed or future structures for the inferred level of hazard,

c. Assess the subsidence risk associated with the proposed development,

d. Provide clear recommendations for the proposed development, including mitigation measures for the subsidence hazard (where applicable), and,

e. Provide assessment against section 106 of the Resource Management Act 1991.

This site-specific mine subsidence hazard assessment report shall be included with the resource consent application, (see Section 1.5.2 Information Requirements - Resource Consent Applications).

2.3.4.5 Rockfall Hazard

For all sites subject to, or potentially subject to rockfall, the Developer shall engage a SQEP to undertake a site-specific assessment of rockfall hazards and risks associated with the proposed development, and report on the following:

a. Desktop review of rockfall hazard data available, e.g. from Council(s), survey data and owners or witnesses, and

b. Carry out a field investigation that assesses the site-specific nature of the rockfall source areas, run-out zone and past rockfall events.

For further guidance refer to MBIE Rockfall: Design considerations for passive protection structures 2016.

This site-specific rockfall hazard assessment report shall be included with the resource consent application, (see Section 1.5.2 Information Requirements - Resource Consent Applications).

2.3.5. Setting of Compaction Standards for Fill Material

Compaction of fill material shall be as per NZS 4431:1989 or an alternative specification by the Developer's Geo-Professional where NZS 4431:1989 is not applicable or suitable.

Where fill is proposed, the Developer's Geo-Professional shall confirm the recommended fill compaction standards and testing requirements, in the Geotechnical Assessment Report.

All documentation on the testing of the compacted soils shall be submitted with the Geotechnical Completion Report (Section 2.6.1.1 Geotechnical Completion Report).

2.3.6. Geotechnical Assessment Drawings

Drawings shall be submitted in support of the Geotechnical Assessment Report which shall include:

a. Site plan showing:

i. Positions of borehole/test pit/penetrometer etc., and

ii. Areas of concern (including but not limited to slip scarps, unstable ground, rockfall etc.),

b. Location of any adjoining land/river/ocean details which might affect the stability etc. of the subject land, and

c. Concept layouts and/or details of any works proposed to mitigate the effects of any issues identified by the geotechnical assessment.

2.4. Geotechnical Design

2.4.1. Geotechnical Design Report

2.4.1.1 General Requirements

A Geotechnical Design Report shall inform the EDA when earthworks are included in the design. The report shall be submitted to WDC for approval prior to any earthworks taking place on the site.

The Geotechnical Design Report shall detail the Specific Design of any works recommended in the Geotechnical Assessment Report, and reference relevant information provided in that report (Section 2.2.2.1 Geotechnical Reporting Requirements).

The Geotechnical Design Report shall include (where relevant) but not be limited to:

a. A brief description of the site.

b. NRC and WDC resource consent requirements.

c. Reference to the key requirements of the Geotechnical Assessment Report.

d. Evaluation of the foundation design parameters for road and infrastructure/services design and, where applicable, for buildings included as part of the development.

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

f. Description of the type and methodology of fill to be used on the site as per 2.4.1.2 Specification for Fill Material, Placement and Compaction.

g. 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.

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

i. Erosion and Sediment Control Plan as per WDC and NRC guidelines.

j. Identification and recommendations for any remedial construction work to address potential erosion, seismic, liquefaction and other natural hazards within the site or on neighbouring land.

k. Recommendations for supervision and testing of earthworks to be undertaken during construction, including qualifications of the supervisor and/or accreditations of the testing laboratory.

2.4.1.2 Specification for Fill Material, Placement and Compaction

2.4.1.2.1. Fill Material

The Geotechnical Design Report shall:

a. Include the source of the imported material and demonstrate that the imported material comes from land that is not contaminated as defined in the Resource Management Regulations 2011.

b. Describe the fill material in engineering terms in accordance with NZ Geotechnical Society Inc; Field Description of Soil and Rock, Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes December 2005.

c. State what testing has been undertaken on the source material to prove it is fit for the design purpose. This shall 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:

   i. NZ Standard Compaction Testing

   ii. Shear Vane Testing

   iii. Moisture Content Determination

   iv. Plasticity Index Testing

   v. Particle Size Distribution

   vi. California Bearing Ratio (CBR) Tests

d. Include details of any geosynthetics used in the design and drawing(s) showing where these shall be used, the type of geosynthetics and the function of the geosynthetic.

2.4.1.2.2. Compaction Criteria and Methodology

Details of the compaction methodology to be adopted for the placement of fill shall be presented in the Geotechnical Design Report together with the compaction acceptance criteria proposed for the works.

The acceptance criteria may be based on any combination of the following and applicability to the given material type:

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, and

d. A maximum and minimum shear strength of the material.

The basis upon which the chosen criteria are selected shall be presented in the Geotechnical Design Report.

Note: Type of testing is dependent on the materials used for filling (i.e. granular or clay/cohesive fill). For Clay/cohesive fill air voids are important not just relying on shear vanes. The dry cohesive material can be hard (e.g. high shear strength), but air voids can control potential longer-term settlement.

2.4.1.2.3. End Product Specification

Where the desired compaction criteria of the placed and compacted fill are specified in the Geotechnical Design Report, the earthworks should confirm the method of compaction they wish to adopt to achieve the targets specified by the engineer.

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

2.4.1.2.4. Frequency of Tests

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

2.4.1.2.5. Site Supervision

The Geotechnical Design Report shall state the level of site supervision to be undertaken to ensure that the compaction of the material meets the earthworks specification.

2.4.1.3 Cuttings and Embankments

For cuttings and embankments formed as part of the earthworks, the Geotechnical Design Report shall include:

a. Details of analytical methods used to determine slope stability, including the engineering properties and relevant ground investigation information,

b. Details of drainage required with respect to groundwater and surface run off, or to ensure stability,

c. Settlement calculations and justified ground investigation data for embankments, and

d. Details of any special measures to analyse slope or control settlements.

2.4.2. Geotechnical Design Drawings

2.4.2.1 Earthwork Design Drawings

Earthworks design drawings showing existing and proposed contours, areas of cut and fill, batter slopes, drainage details, etc. shall be provided as part of the Geotechnical Design Report and supporting information submitted for EDA.

2.4.2.2 Erosion, Sediment and Dust Control

A SQEP shall prepare an Erosion and Sediment Control Plan, with associated design drawings, which shall be provided as part of the Geotechnical Design Report and supporting information submitted for engineering design approval.

The Erosion and Sediment Control Plan shall be in accordance with Auckland Council GD2016/005.

2.5. Construction

2.5.1. General

During construction, site supervision and/or testing shall be undertaken in accordance with the Geotechnical Assessment and/or Design Reports, which may require a suitability qualified Geo-Professional.

2.5.2. Tsunami Sirens

Where developments are located within a tsunami evacuation zone (as identified by the NRC), and the sections are more than 400 m from an existing tsunami siren, the Developer shall install tsunami sirens so that the entirety of each section is no more than 400 m from a siren. Tsunami sirens shall be supplied and installed by Northpower.

Note: Tsunami evacuation zones can be found at https://www.nrc.govt.nz/civildefence/tsunami-evacuation-zones/

2.5.3. Erosion and Sediment Control Maintenance

Construction and ongoing maintenance of any erosion and sediment control devices shall be carried out by the Contractor as detailed in the approved Erosion and Sediment Control Plan.

2.6. Completion of Works

2.6.1.1 Geotechnical Completion Report

The Developer's Geo-Professional shall submit a Geotechnical Completion Report as per NZS 4404:2010 Section 2.6. The report shall be accompanied by a statement of professional opinion on the suitability of land for building construction (NZS 4404:2010 Schedule 2A) and where applicable producer statement (PS4-Construction Review). If a development contains more than 10 lots, a matrix of geotechnical recommendations for each new lot should be attached to the Geotechnical Completion Report.

2.6.1.2 Contaminated Site Validation Report

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

As a minimum, this shall contain the data and all test results listed in the Contaminated Land Management Guidelines 2021.

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

2.6.2. Resource Consents

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

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