



NZGS Specification

NZGS_100 PRELIMINARY AND GENERAL

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**NEW ZEALAND
GEOTECHNICAL
SOCIETY INC**

A Collaborating Technical Society
of Engineering New Zealand

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About the New Zealand Geotechnical Society

The New Zealand Geotechnical Society (NZGS) is the affiliated organisation in New Zealand of the International Societies representing practitioners in Soil Mechanics, Rock Mechanics and Engineering Geology. NZGS is also a collaborating Technical Society of Engineering New Zealand.

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Foreword

This long-form specification has been developed to be used in conjunction with:

- NZS3910:2013 Conditions of contract for building and civil engineering construction
- NZS4431:2022 Engineered fill construction for lightweight structures
- The other components of the NZGS Specification series, notably:
 - NZGS_000 Standard Specifications User Guide
 - NZGS_100 Preliminary and general
 - NZGS_200 Ground Investigations ¹
 - NZGS_110 Method of measurement
 - NZGS_520 Reinstatement
- The project-specific details in the form of NZGS_0100P

It may be used in conjunction with other specifications where appropriate.

This specification is intended to be appropriate for use on most residential or light commercial development projects with common soil and rock types found in New Zealand. It is also intended to be flexible enough to be used on major earthworks projects, but may require more significant additions to the project-specific details by the Geotechnical Designer.

A separate short-form version of this specification is being developed for smaller projects.

Acknowledgements

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- To be listed following feedback

¹ Currently presented as Volume 1 of the New Zealand Ground Investigation Specification, NZGS 2017

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NZGS_100.1 General

NZGS_100.1.1 Introduction and scope

This Specification covers preliminary and general requirements for Contracts that predominantly comprise geotechnical engineering works. It is expected to be used on projects where geotechnical elements make up all, or the majority, of the works. It is not suitable for general civil engineering projects, unless used only for the geotechnical elements. Where the contract includes other works, appropriate clauses from this document can be included in the project-specific preliminary and general specification for the Contract.

Notes for guidance are presented in blue boxes similar to this example. They do not form part of the Specification or contract.

NZGS_100.2 Other documentation

NZGS_100.2.1 Conditions of contract

This document shall be read together with all documents forming part of the Contract.

The order of precedence for the documents that together form the Contract, including the specification(s) should be defined in the Contract. They have not been repeated here in the Specification to avoid contradiction.

NZGS_100.2.2 Standards

The following New Zealand Standards, including all current amendments, shall be applied to relevant parts of the works, unless instructed otherwise by the Engineer.

- NZS 4431 Engineered fill construction for lightweight structures
- NZS 4402 Methods of testing soils for civil engineering purposes
- NZS 4407 Methods of sampling and testing road aggregates

These standards may in turn require reference to other standards.

NZGS_100.2.3 Acts, Regulations and Codes of Practice

The following acts, regulations, and CoP, including all current amendments, shall be applied to relevant parts of the earthworks, unless instructed otherwise by the Engineer.

These documents may in turn require reference to other standards, acts, regulations, and codes of practice.

- Heritage New Zealand Pouhere Taonga Act 2014 (HNZPT Act)
- Health and Safety at Work Act 2015 (HSW)
- Health and Safety in Employment (Mining Operations and Quarrying Operations) Regulations 2013
- WorkSafe NZ: Approved Code of Practice and guidance publications
- Some more to be considered...
- New Zealand Building Code and Act
- Hazardous Substances and New Organisms Act 1996
- Resource Management Act (RMA) 1991
- Regional and District Plans
- Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations (NES) 2011
- Construction Contracts Act 2002
- Utilities Access Act 2010
- National Code of Practice for Utilities' Operators Access to Transport Corridors
- NZ Transport Agency Code of Practice for Temporary Traffic Management

- NZ Transport Agency Quality Standard TQS1
- New Zealand Standards referred to within the Contract Documents

NZGS_100.2.4 Other specification elements

The NZGS Specification is designed to be used in conjunction with other compatible Specifications for non-geotechnical aspects of the Works.

Where there is any contradiction between these Preliminaries & General requirements, and any other requirements in other specification elements, the following order of precedence shall apply unless otherwise stated in the Contract:

- The requirements of this documents shall take precedence for any geotechnical works
- The requirements of the other documents shall take precedence for any non-geotechnical works

NZGS_100.3 Definitions

These terms are additional to those defined in the Contract. These are selected definitions and are not intended to be comprehensive. Additional definitions specific to each sub-element of the specification may be provided in those individual sections.

Term	Definition
Archaeological site	An archaeological site is defined in the Heritage New Zealand Pouhere Taonga Act (HNZPT Act). It is any place in New Zealand (including buildings, structures, or shipwrecks) that is associated with pre-1900 human activity, where there is evidence relating to the history of New Zealand that can be investigated using archaeological methods
Certifier	The independent professional engineer or engineering geologist responsible for the certification of the completed earthworks in accordance with the design and consent conditions. The certifier needs to be independent of the Contractor or the developer and have suitable experience of earthworks in similar materials. The geotechnical designer can also take the role of certifier. Further details on the roles and responsibilities are defined in NZS4431.
Certifier's representative	The independent and suitably qualified person delegated by the certifier to represent them on the engineered fill construction site with the roles and responsibilities defined in NZS4431
Cleared ground level (CGL)	The ground level after completion of site excavation and removal of all harmful or unsuitable material and before any fill is placed
Contaminated site management plan	A site management plan prepared in accordance with the Ministry for the Environment's Contaminated land management guidelines no. 1
Contractor	The organisation leading the physical construction of the Works
Council	The relevant local Territorial Authority
CUSUM	Cumulative SUM method
Earthworks	The act of excavating natural soil and rock materials, transporting these materials, and placing these materials (or manufactured equivalents) in a controlled manner with or without the addition of reinforcement to form the engineered fill. The term earthworks can also refer to the finished product (a structure made from fill). Earthworks can be controlled (producing engineered fill) or uncontrolled.
Engineer	The Engineer to Contract, for projects using NZS3910 as the form of Contract. Where the Contract does not specify an Engineer, the term Engineer shall refer to the Certifier.

Term	Definition
Field Description of Soil and Rock (FDSR)	New Zealand Geotechnical Society Field Description of Soil and Rock
Finished ground level (FGL)	The level of the ground after all earthworks and any landscaping or surface paving are complete
Geotechnical Designer	The authorised representative of the organisation undertaking the earthworks design (including the earthworks specification). The geotechnical designer shall be a geotechnical engineer and/or engineering geologist who holds a current chartered registration under the Chartered Professional Engineers of New Zealand Act 2002, or equivalent as appropriate. Currently, the Chartered Professional Engineer (CPEng) and Professional Engineering Geologist (PEngGeol) quality marks are registered as being assessed and administered by Engineering New Zealand. The geotechnical designer can also take the role of certifier. The geotechnical designer shall have suitable experience of earthworks in similar materials
Hold point	A defined position in the construction/manufacturing stages of the Contract beyond which work shall not proceed without mandatory verification and acceptance by the Engineer or their delegate (e.g. they may delegate specific verification hold points to ecologists, arborists, or in the case of earthworks to the Certifier).
HSW Act	Health and Safety at Work Act 2015.
Independent	‘Independent’ in this context means able to act independently and with professional skill and judgement not compromised by any Contract, ownership structure, or other relationship.
Inspection and test plan (ITP)	The schedule of required inspections and tests to confirm that the engineered fill meets the requirements of the design, including the earthworks specification and other requirements that could require inspection or testing (for example, consent conditions)
Lightweight structure	A building or other structure that is designed in accordance with NZS 3604 or whose foundations imparts a bearing stress of no more than 100 kPa on the engineered fill and which is not highly sensitive to differential settlement
Non-compliance (NC)	Failure to meet the required standard or condition
Notifiable event	A notifiable event is defined by WorkSafe as when any of the following occurs as a result of work: a death, notifiable illness or injury, or a notifiable incident. See the WorkSafe NZ website for a full definition of these.
Method statement	Has the same meaning as Work Instruction.

Term	Definition
Principal	The person named as such in the Contract special conditions and includes its executors, administrators, and successors. This is commonly the person or organisation who has engaged Contractor.
Quality management plan (QMP)	The plan, incorporating the ITP, to enable the Contractor to integrate the statutory, technical, and performance framework requirements for the engineered fill construction with the Contractor's quality systems during delivery of the specified works
Random verification tests	Tests carried out by an independent party in addition to what is required by the ITP. Random verification testing is risk-based and carried out to confirm inspection and test results, or where areas of concerns have been identified
Recognised laboratory	The independent accredited engineering laboratory engaged to sample and test the earthworks in accordance with recognised New Zealand standards. The laboratory shall hold current IANZ accreditation for any tests undertaken which are listed in the IANZ publication Specific Criteria for Accreditation – Mechanical Testing and shall be ISO9001 certified.
Suitably qualified and experienced practitioner (SQEP)	A suitably qualified and experienced practitioner as per the Ministry for the Environment's Contaminated land management guidelines no. 1
Temporary works	Temporary works are parts of the works that either enable the construction or protection of the permanent works or support or provide access to the permanent works, and which are not expected to remain in place at the completion of the works
Work instruction	A document that specifies the key steps and sequences in the manufacture/construction for an activity: what, how and by whom it shall be done and what materials and equipment shall be used to achieve the required quality standards.

NZGS_100.4 Abbreviations

The abbreviations below are intended to be consistent with those found in Section 1.5 of NZS4431. In the event of a conflict the abbreviations below preside unless otherwise instructed.

Abbreviation	Definition
ACM	Asbestos-containing materials
AP	All passing. Used as an equivalent for GAP. GAP is the preferred term
CBR	California bearing ratio
CCC	Continuous compaction control
CGL	Cleared ground level
CPT	Cone penetration test
CPTu	Cone penetration test with pore water pressure measurement
DCP	Dynamic cone penetrometer
EMP	Environmental management plan
FGL	Finished ground level
GAP	General all passing
HAIL	Hazardous activities and industries list
HNZPT	Heritage New Zealand Pouhere Taonga
HSNO Act	Hazardous Substances and New Organisms Act 1996.
HSW Act	Health and Safety at Work Act 2015.
IC	Intelligent compaction
ITP	Inspection and test plan
IV	Impact value
MDD	Maximum dry density
NC	Non-compliance
NDM	Nuclear Density Meter
NGL	Natural ground level
NZGS	New Zealand Geotechnical Society
NZQA	New Zealand Qualification Authority.
OMC	Optimum moisture content

Abbreviation	Definition
PPE	Personal protective equipment.
PSD	Particle size distribution
QA	Quality assurance
QMP	Quality management plan
RVT	Random verification test
SMAA	Services, maintenance, and access area
SPC	Statistical process control
SPT	Standard penetration test
SQEP	Suitably qualified and experienced practitioner
VENM	Virgin excavated natural material
WK	Waka Kotahi (NZ Transport Agency)

NZGS_100.5 Archaeological authority and accidental discovery protocol

The requirements for an archaeological authority and accidental discovery protocol shall be in accordance with Sections 2 and 4 of NZS4431.

Before work commences, the Contractor shall establish whether an authority under the HNZPT Act is required to modify or destroy an archaeological site, and if necessary obtain one². The Contractor shall ensure that staff working on the site are briefed on the requirements of the archaeological authority.

If an archaeologist has determined that no archaeological authority is required, the following protocol shall at least apply to any accidental discovery of an archaeological site, archaeological material, artefacts, or potential human remains (kōiwi).

1. Work shall cease immediately and within 20m around the site.
2. The Contractor must shut down all machinery, secure the area, and notify the nearest Heritage New Zealand Regional Office²F3.
3. If the Archaeologist determines that the site is of Māori origin, the Contractor shall notify the appropriate iwi groups or kaitiaki representative of the discovery and ensure site access to enable appropriate cultural procedures and tikanga to be undertaken.
4. If human remains (koiwi) are uncovered the Contractor shall advise the Heritage New Zealand Regional Archaeologist, iwi and the NZ Police.
5. Heritage New Zealand will determine if an archaeological authority under the Heritage New Zealand Pouhere Taonga Act 2014 is required for works to continue.
6. Works affecting the archaeological site and any human remains (koiwi) must not resume until appropriate authority and protocols are in place.

The Contractor shall ensure all staff working on the site understand and always follow these requirements.

It is an offence under S87 of the Heritage New Zealand Pouhere Taonga Act 2014 to modify or destroy an archaeological site, recorded or unrecorded, without an authority from Heritage New Zealand Pouhere Taonga irrespective of whether the works are permitted, or consent has been issued under the Resource Management Act.

³ <https://www.heritage.org.nz/contact-us>

NZGS_100.6 Quality assurance

Quality assurance (QA) inspection, sampling, testing and certification of construction shall be in accordance with Section 5 of NZS4431, and the clauses below.

The Contractors Quality Management Plan (QMP) shall describe how the Works will be constructed in accordance with this specification, the design, drawings, and relevant Standards.

The QMP shall include the Contractor's Inspection and Test Plan (ITP) that shall detail all requirements for inspection, sampling, testing, including Hold Points.

NZGS_100.6.1 Formation and Foundation Conditions

The ITP shall always include inspection of the formation and foundation conditions before filling starts. Natural ground shall be tested, proof rolled and inspected by the Certifier (in accordance with the Geotechnical Designers requirements) prior to placement of any fill. The Contractor shall give the Engineer & Certifier at least 24 hours' notice of the time when proof rolling shall take place to allow them (or their nominated representative) to witness the proof roll.

Any natural ground suspected of being of a poorer quality than that specified shall be tested further to this specification and removed or improved as instructed by the Engineer.

NZGS_100.6.2 Incoming materials

All materials received on site shall be inspected to ensure they are the correct materials, comply with the specification and are in good condition. Material(s) test data and certificates as required by the ITP shall be supplied to the Engineer for all materials prior to incorporating such materials in the Works.

Where sample approval is specified, samples of materials shall be provided, and the Engineer's approval obtained prior to incorporating such materials in the Works. For all soil and rock materials at least two 25kg samples of each approved material shall be retained in sealed bags on site for comparison with those being used in the Works over subsequent stages of the construction.

NZGS_100.6.3 Excavation

Records shall be kept in accordance with the ITP of each area of excavation detailing the location, date, plant used, description and quantity of excavated material, testing undertaken, and the destination of material excavated.

NZGS_100.6.4 Fill

Records shall be kept in accordance with the ITP of each area of fill detailing the location, date, plant used, description and quantity of material placed, material classification testing undertaken, and compaction testing undertaken.

NZGS_100.6.5 On-site tests

The locations of each test undertaken on site in accordance with the ITP shall be recorded to a spatial accuracy in accordance with NZS4431.

NZGS_100.7 Construction and as-built survey

As-built survey shall be in accordance with Section 6 of NZS4431.

Unless otherwise agreed with the Engineer, survey controls to confirm the construction meets the design shall be recorded for level with an accuracy of ± 25 mm, and for spatial location with an accuracy of ± 100 mm.

NZGS_100.8 **Final documentation and Certification**

The earthworks completion report and earthworks certification shall be in accordance with Section 7 of NZS4431.

NZGS_100.8.1 **Safety in design**

Safety in Design (SiD) information will be supplied to the Contractor with the Tender Documents. The Contractor shall take full account of the SiD information in the planning and execution of the Works and will follow SiD protocols in the design of any temporary works required.

Where there are any changes to temporary or permanent works or installation methods the Contractor shall obtain agreement from the Engineer that all implications for the future operation, maintenance and decommissioning of the works have been considered. The Contractor shall update the SiD records accordingly.

On completion of the works, the updated SiD records shall be submitted to the Engineer.

NZGS_100.9 **Site management**

NZGS_100.9.1 **Maintenance of the site**

The Contractor shall maintain the site in a clean and tidy manner throughout the Works, including the Maintenance Period.

All materials are to be kept safely within the perimeter of the site.

Stockpiling of excess material on site is not allowed on site unless agreed with the Engineer and as documented in the Quality Plan. All unsuitable or excess materials and waste are to be removed from site to a safe disposal location.

Waste is to be minimised (see NZGS_100.11 - Construction waste minimisation).

NZGS_100.9.2 **Site safety**

The Principal has designated the responsibility for control of the place of work, as defined in the Health and Safety at Work Act 2015 (HSW), to the Contractor.

The Contractor shall manage site safety in accordance with the General Conditions of Contract and the approved site-specific safety plan.

An Improvement Notice or Stop Work Notice may be issued if, in the opinion of the Engineer or officer authorised by the Principal, there are any activities, situations or conditions on the site or under the control of the Contractor that have caused or have the potential to cause harm to the public and/or workers. If a Stop Works Notice is issued, all Works shall stop immediately except those required to make the site safe. If either notice is issued, an investigation shall be undertaken by the Contractor. At the conclusion of an investigation, the basis of the breach shall be reported to the Engineer. Works shall only recommence with the approval of the Engineer.

The Contractor shall provide adequate first aid facilities and staff with current and relevant first aid training as required under legislation and based on a risk assessment of site hazards and potential emergencies.

The Contractor shall immediately stop all work and notify the Engineer if a Notifiable event occurs on the Works.

NZGS_100.9.3 **Damage to property**

The Contractor shall take all reasonable steps to avoid damaging property beyond the site. Where the Contractor becomes aware of a risk of damage to property, they shall notify the Engineer as soon as practicable and implement such mitigation and or monitoring as appropriate.

NZGS_100.9.4 Dust control

Works shall be carried out and maintained to minimise any dust nuisance. If dust is blown over the working area or neighbouring properties, Works will be halted until such time as the mitigations applied have removed the nuisance.

NZGS_100.9.5 Erosion and sediment controls

The requirements for erosion and sediment controls shall be in accordance with Section 4 of NZS4431, and the General Conditions of Contract.

The Contractor shall always:

- Comply with consent conditions for excavation and the control of erosion and sediment.
- Liaise and cooperate with officers or representatives of the relevant Council in respect of any consent requirements.

NZGS_100.9.6 Surface and subsurface water controls

The requirements for surface and subsurface water controls shall be in accordance with Section 4 of NZS4431, and the General Conditions of Contract.

The Contractor shall always:

- Comply with consent conditions for surface and subsurface water controls.
- Liaise and cooperate with officers or representatives of the relevant Council in respect of any consent requirements.

NZGS_100.9.7 Contaminated ground

The requirements for the management and control of contaminated ground shall be in accordance with Sections 3 and 4 of NZS4431, and the General Conditions of Contract.

The Contractor shall always:

- Comply with consent conditions for surface and subsurface water controls.
- Liaise and cooperate with officers or representatives of the relevant Council in respect of any consent requirements.
- Visually monitor for contamination, and promptly inform the Engineer if there are signs of contamination during the works.

Advice on the levels of contaminants in soil and rock materials likely to render them unsuitable are given in the tables below and should always be reviewed and confirmed by a SQEP.

Contaminant of Concern	Unit (total recoverable)	Fill/Soil maximum allowable concentration
Organic content	%	Backfill within 2 m of structure or pipe <1 All other fill <5
pH		Backfill within 2 m of structure or pipe 6-8 All other fill 5-8.5
Oxidisable sulphides	% as SO ₄	<0.06
Water soluble sulphate	mg/litre as SO ₄	Backfill within 2 m of structure or pipe <1500 All other fill <2000
Arsenic	mg/kg	12
Cadmium	mg/kg	0.65
Chromium	mg/kg	55
Copper	mg/kg	45
Cyanide (total)	Mg/kg	1
Lead	mg/kg	65
Mercury	mg/kg	0.45
Nickel	mg/kg	35
Zinc	mg/kg	180
Total Petroleum Hydrocarbons (TPH) C7-C9	mg/kg	120⁴
TPH C10-C14	mg/kg	58 ⁵
Benzo(a)pyrene (equivalent)-note 1)	mg/kg	2 ⁶
Total DDT	mg/kg	0.7 ⁷

⁴ For benzo(a)pyrene, the equivalent BaP concentration is calculated as the sum of each of the detected concentrations of nine carcinogenic PaHs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene and indeno(1,2,3-cd)pyrene), multiplied by their respective potency equivalency factors.

⁵ Derived from Ministry for the Environment Guidelines for Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand 1999, revised 2011. Table 4.15 Tier 1 soil acceptance criteria for TPH, residential use, 'all pathways' agricultural use.

⁶ Based on the available information, an interim value in the absence of national soil background values of 2 mg/kg BAPTE is proposed as a background level for urban soils where a region's specific value is not available (page 55 of Appendix C of Technical Guidelines for Disposal to Land, Waste Management Institute New Zealand (WasteMINZ), April 2016).

⁷ US EPA (2006) ecological receptors.

Contaminant of Concern	Unit (total recoverable)	Fill/Soil maximum allowable concentration ⁸
Benzene	mg/kg	0.0054- 0.66
Ethylbenzene	mg/kg	1.1
Toluene	mg/kg	1.0
Total Xylene	mg/kg	0.61

If signs of unforeseen contamination are encountered or suspected, works shall cease, the Engineer shall be notified immediately, and agreed protocols followed (including if required the engagement of a SQEP) to ascertain the type and extent of contamination with the aim of providing a site-specific remedial action plan if required

See NZS4431 C4.2.3 for further information

⁸ Derived from Ministry for the Environment Guidelines for Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand 1999, revised 2011. Table 4.20 Soil acceptance criteria for protection of groundwater quality (clay). We note the 0.66 mg/kg value in Table 4.20- assumes that depth of contamination is <1 m and groundwater table is 4 m. The criteria for Benzene of 0.0057 mg/kg is for depth of contamination < 1m and groundwater table at 2 m and assumes that "contaminated soil layer is in direct contact with groundwater and hence no attenuation associated with vertical migration through the soil column occurs."

NZGS_100.10 Utility Services

NZGS_100.10.1 General

The requirements for working with existing or new utility services shall be in accordance with Sections 2 and 4 of NZS4431,.

The location and condition of existing utilities and services following consultation with the providers/owners during design shall be shown on drawings. The completeness of the drawings is not guaranteed, and the positions shown of utilities are indicative only.

The Contractor shall continue to liaise with all providers/owners, obtain service plans, proactively locate all utilities prior to commencement of work on site, and shall advise the Engineer immediately of any conflict between the design and existing utility services.

There shall be no interference with any existing utilities (including three waters utilities) without express approval from the utility owner.

The Contractor shall obtain all necessary permits from the relevant utility authorities for works affecting existing utilities, hold copies of these permits on site, and comply with any conditions set by the utility providers/owners.

Where un-recorded utilities are discovered during the works, their position shall be surveyed and recorded to ensure that they are accounted for in the execution of the works and recorded in the as built drawings for future reference.

NZGS_100.10.2 Damage to utilities and survey marks

The Contractor shall notify the utility owner and the Engineer as soon as practical if any utility is damaged or disturbed, or if any un-recorded utilities are 'discovered' during operations.

Any boundary peg or survey mark disturbed shall be brought to the attention of the Engineer. Reinstatement or relocation of any disturbed boundary peg or survey mark shall be undertaken by a Licensed Cadastral Surveyor at no cost to the Principal.

NZGS_100.10.3 Work by utility providers

Where work is required by utility providers/owners to relocate their utility as part of the Contract Works, the Contractor is responsible for their co-ordination and integration with the rest of the Contract Works.

NZGS_100.10.4 Access to utilities

Access to all existing and new hydrants, valves, sumps, manholes, inspection chambers, cabinets or other access point for services shall always be made available to emergency services, utility owners and their agents.

NZGS_100.11 Construction waste minimisation

The Contractor shall ensure that all opportunities to source, recycle and re-use materials in a manner that reduces waste are taken in accordance with the design and this specification, and during the works, in agreement with the Engineer.