On-site Wastewater Management Training Course

Site Assessment: Desktop Study

Land Capability Assessment Site and Soil Evaluation (SSE)

Aim:

- Identify and consider site-specific attributes significant in the selection, design, location and sizing of an on-site sewage management system
- Assess the capacity of the land to sustainably manage sewage within lot boundaries
- Identify public and environmental health risks of on-site sewage management, especially the effect on groundwater and surface water receptors

Objectives

- To demonstrate the site has sufficient space for:
  - The treatment system
  - The land application system, and
  - Appropriate buffers
- To demonstrate the soil is appropriate and of sufficient depth to:
  - Install the preferred land application system, and
  - Treat the quantity and quality of effluent to be dispersed

Land Capability Classification

- Defines biogeophysical capacity of land to support a given land use
- Groups landform and soils into units according to their suitability
- Often developed by agencies for agriculture and development, but less-commonly for on-site wastewater management suitability
- Can be developed for individual regions, catchments etc. using GIS

Land Capability Classification

- Land suitability also introduces engineering, social and economic considerations
- Designs should aim to be:
  - Sustainable (long-term benefit)
  - Achievable (practically constructible)
  - Acceptable (minimal impact)
  - Affordable (value for money)

Stages of Data Collection

- Desktop study
- Site and soil check
- Soil description and profile assessment
- Calculations
- Collection of additional data
- Identify site and soil opportunities and constraints
- Selection of appropriate system/s

Desktop Study

- Collects preliminary data from readily available sources
- Provides an overview of opportunities and constraints
- Determines what information is relevant
- Identifies information gaps exist and what additional information is required

Site and Soil Evaluation

Site and Soil Evaluation (AS/NZS 1547) refers to the procedural investigation of land for the purposes of evaluating its potential for on-site sewage management, including land application of effluent

- Should be undertaken by an appropriately qualified person with specific experience in wastewater applications
- Specific advice regarding field investigation procedures in AS/NZS 1547:2012 (Section 5.2) and Auckland Regional Council OWS Design Manual (TP58, Section 5.2)

Site and Soil Evaluation

The technical guideline **On-site Wastewater Management in the Auckland Region** (GD06, 2021) is currently under review and includes updated Site Assessment procedures, with specific focus on:

- Report consistency (SSE template and checklist)
- Appropriate soil information and investigation rigour (depth, description and site coverage)
- Designing for risk prevention
- Climate information and climate change impacts
- System suitability (dwelling usage, power etc.)
- Sensitive features (environmental, cultural etc.)

Level of Investigation

Guidance documents (AS/NZS 1547 and ARC GD06, 2021) recommend different 'levels of investigation' depending on project intent or scale

- **Subdivision or Rezoning** – investigation will focus on regional or site-wide implications of OSSM (soil characterisation, system suitability, system density, cumulative impacts, planning considerations etc.)
- **Single-lot Development** – at this scale investigation will focus on site-specific attributes (buffers, soil controls, drainage etc.) and optimising OSSM (treatment / application) options

Site and Soil Characteristics

- GD06 (ARC, 2021) provides a guide to site (Section B.2 and B3) and soil (Section B4) characteristics that should be considered in on-site wastewater investigations
- AS/NZS 1547:2012 provides similar information in Appendices B-D
- Other matters may also warrant consideration based on site-specific requirements and information

SSE Assessment Criteria

- AS/NZS 1547:2012 recommends a 'risk-based' approach in assessing the impact of site and soil conditions
- GD06 (ARC, 2021) provides guidance on the 'degree of constraint' posed by a range of site (Table 12 and 13) and soil (Table 11) attributes
- Risk reduction measures (following AS/NZS 1547:2012) to mitigate identified constraints are outlined in Table 65 of GD06 (ARC, 2021)

Site Characteristics

- Flood potential
- Exposure
- Slope (%)
- Landform
- Run-on and seepage
- Erosion potential
- Drainage (indicative)
- Fill
- (Available) Land Area
- Geology and rock outcrops
- Vegetation

Other Considerations:

- Built Features
- Setbacks/Buffers
- Adjacent land-use
- Climate impacts

Imagery

Information sources include:

- Satellite imagery *www.google.com/earth/*
- Free to download and activate
- Image quality varies
- Provides information on location (latitude/longitude), elevation and has capacity for measurement and historical imagery
- Images can be rotated for different views (including Street View)

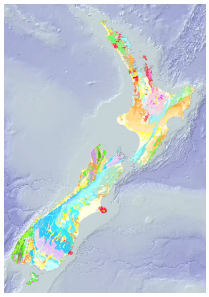
Google Earth - example

Maps and Spatial Information

- Geology *https://data.gns.cri.nz/geology/*
- Land Info *https://data.linz.govt.nz/data/*
- Soils Mapping and Information *https://smap.landcareresearch.co.nz/maps-and-tools/app*
- Climate *https://niwa.co.nz/climate-and-weather*
- Groundwater *https://catalogue.data.govt.nz*

Geological Maps

- 1:250,000 geological maps of New Zealand available from GNS Science *https://data.gns.cri.nz/geology/*
- Solid geology
- Superficial deposits
  - Alluvium
  - Beach deposits
  - Colluvium



Geological Map - example

GNS – data services
Primary Geology 1:250,000

Topographic Maps

Show:

- Landscape
- Contours
- Anthropogenic (human) features
- Cadastral boundaries
- Grid references
- 1:25,000 maps have 10m contours

Topographic Maps

Can determine:

- Shape of land
- Drainage direction
- Water bodies and drainage lines
- Slope
- Relief (difference in elevation)
- Aspect (facing direction)

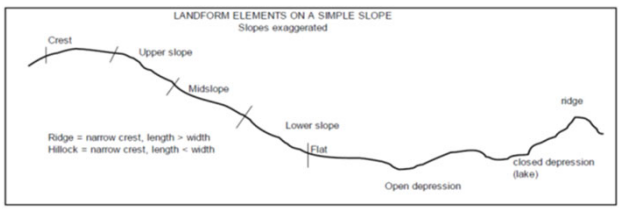
Topographic Maps

Land Information NZ – data services
1:50,000

Topographic Maps – example

Land Information NZ – data services
Property Title (9/24)

Site Landform



Major geomorphic positions on the landscape

Slope Configuration

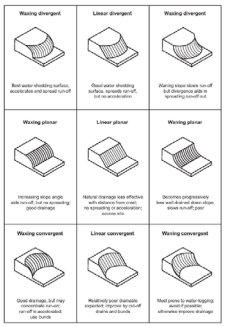
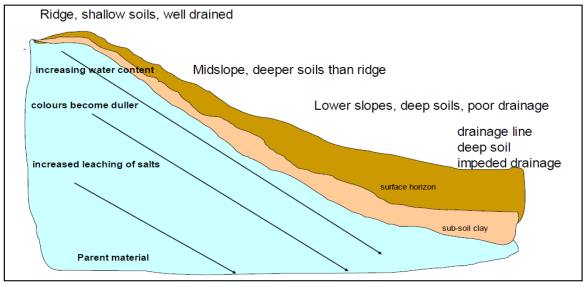


FIGURE C2 SLOPE CONFIGURATION AND SURFACE DRAINAGE

- AS/NZS 1547:2012 (Section C3)
  - Slope (gradient and shape)
  - Terrain-Soil combinations; important to understand how surface water will flow in or near available EMA
- Waxing / waning / linear
- Converging or diverging

Soil Properties and Topography

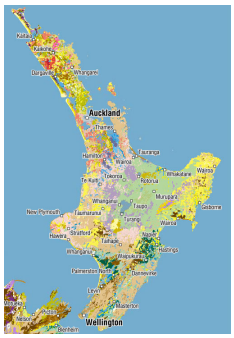


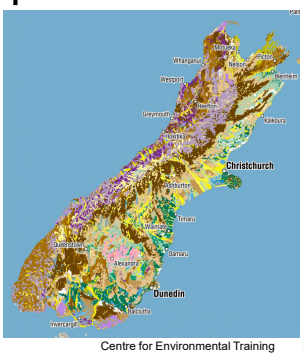
Position in landscape significant in forming soil profile characteristics

Soil Landscape Resources

- Landcare Research New Zealand, New Zealand Soil Classification System mapping
- 15 Soil Orders (approximate coverage %):
  - Brown (43%); Podzols (13%); Pallic (12%);
  - Allophanic (5%); Recent (6%); Pumice (7%);
  - Raw (3%); Gley (3%); Ultic (3%); Semi-arid (1%); and
  - Granular (1%); Melanic (1%); Organic (1%); Anthropic (<1%) and Oxidic (<1%)

Soil Landscape Resources

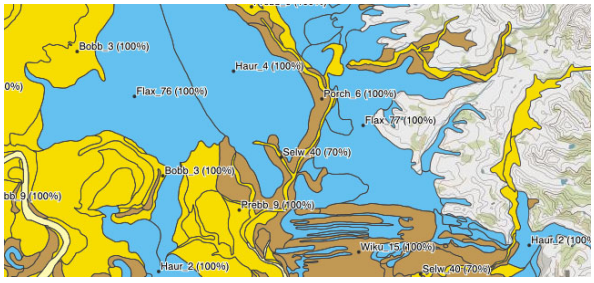




Soils Data Online

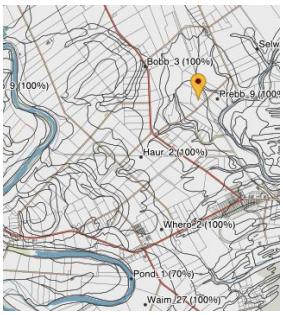
- Soils Map (S-Map) Online, Landcare Research, New Zealand provides a substantial database of information including:
- NZSC soil order information
- Soil Map unit descriptions
- Soil drainage and chemistry information
- S-Map Online accessed via:
  https://smap.landcareresearch.co.nz/maps-and-tools/app

Soil Units – example



S-Map Online – NZSC Soil Orders

Soil Units – Gisborne



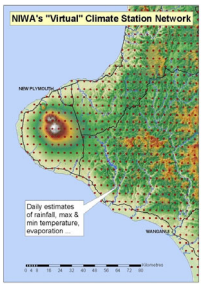
- **Soil Map Unit Fact Sheets:**
  - Soil Texture
  - Permeability
  - Drainage Class
  - Soil physical and chemical properties

Climate Data

- NZ Meteorology Service (MetService) *https://www.metservice.com/national*
  - Rainfall (~90 stations, 3-hourly)
- National Institute of Water & Atmospheric research (NIWA) *https://niwa.co.nz/climate-and-weather/mean-monthly-rainfall-mm*
  - Rainfall Averages and summaries (30 locations)
- Statistics New Zealand (StatsNZ) *https://www.stats.govt.nz/indicators/rainfall/*
  - Long-term climate statistics

Virtual Climate Station Network (VCSN)

- NIWA *https://niwa.co.nz/climate-and-weather/virtual-climate-station-data-and-products*
- 11,491 Statistically valid, interpolated climate data sets on 5km grid – updated daily
  - Daily rainfall, potential evapotranspiration, soil moisture (modelled)
  - Suitable for water balance modelling



Groundwater

- NZ Data Sharepoint (Data.govt.nz) *https://catalogue.data.govt.nz/dataset/?q=groundwater+wells*
- 63 datasets recorded:
  - Greater Wellington, Marlborough District, Environment Canterbury, Environment Canterbury, Environment Southland, Waikato RC, Bay of Plenty RC, Hawke's Bay RC and Auckland Council
  - Other local coverage and private well information may be available

Sensitive Receptors

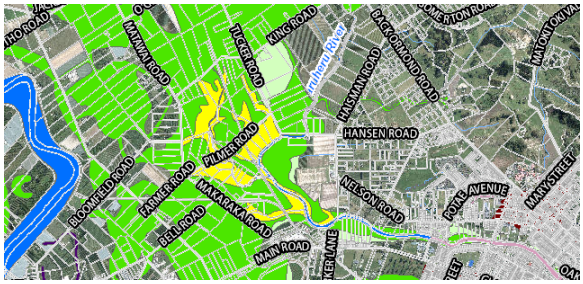
Our Environment Online, Landcare Research, New Zealand provides database of information including:

- Wetlands and Marine Reserves
- Protected Areas
- Endangered Ecological Communities
- Threatened Species
- OurEnvironment Online accessed via: *https://ourenvironment.scinfo.org.nz/maps-and-tools/app/Habitats/lenz_prot_areas*

Hazards

- Local 'hazard' mapping can be sourced through: *https://www.naturalhazardsportal.govt.nz/s/natural-hazard-risk/natural-hazards-in-your-area*
  - Flooding
  - Slope stability
- Information will be accessed through regional (Council) IntraMaps services
  - Also useful for planning overlays, property information, utility information etc.

Hazards – example



Gisborne / Te Tairawhiti – Council IntraMaps – Flood Overlays

Desktop Summary

- Tabulate data
- Assessment – Describe the level of 'constraint' or 'limitation' posed by individual Site features with respect to OSSM
  - Design on most limiting feature/s,
  - Engineer out limiting features, or
  - Provide mitigation to address limitation.
- Designs should aim to reduce all Site limitations to 'low' or 'minor'

Preliminary Constraints Mapping

- Identify 'potentially' available area for effluent dispersal (LAA)
- Undertaken in advance of, and to prepare for, field study
- Guides field study
- Identifies data gaps to be filled by field study
- Most importantly, saves time and money

Setbacks or Buffers

- Provide mitigation against unidentified or unintended hazards
- Reduce potential pathways for human and environmental exposure
- Valuable and cost-effective risk management strategy for OSSM
- Appropriate setback/buffer selection based on local guidelines and AS/NZS 1547:2012

NZ Setbacks

- Common local setbacks in NZ, based on effluent quality (primary → tertiary) and soil type:
  - Buildings (1.5m – 3.0m)
  - Boundaries (1.5m)
  - Surface waters (10m – 20m)
  - Water supply bore/well (10m – 20m)
  - Seasonal GW (0.6m – 1.5m)
  - Flooding (outside 1% to 5% AEP)
  - Retaining structures (3m or 45 degrees from toe)

AS/NZS 1547:2012 Buffers

TABLE R1
GUIDELINES FOR HORIZONTAL AND VERTICAL SETBACK DISTANCES
(to be used in conjunction with Table R2)

Site feature	Setback distance range (m) (See Note 1)	Site constraint items of specific concern (from Table R2) (see Note 1)
	Horizontal setback distance (m)	
Property boundary	1.5 – 50 (see Note 2)	A, D, J
Buildings/houses	2.0 – > 6 (see Note 3)	A, D, J
Surface water (see Note 4)	15 – 100	A, B, D, E, F, G, J
Bore, well (see Notes 5 and 6)	15 – 50	A, C, H, J
Recreational areas (Children's play areas, swimming pools and so on) (see Note 7)	3 – 15 (see Notes 8 and 9)	A, E, J
In-ground water tank	4 – 15 (see Note 10)	A, E, J
Retaining wall and Embankments, escarpments, cuttings (see Note 11)	3.0 m or 45° angle from toe of wall (whichever is greatest)	D, G, H
	Vertical setback distance (m)	
Groundwater (see Notes 5, 6, and 12)	0.6 – > 1.5	A, C, F, H, I, J
Hardpan or bedrock	0.5 – ≥ 1.5	A, C, J

NOTES:
1 The overall setback distance should be commensurate with the level of risk to public health and the environment. For example, the maximum setback distance should be adopted where site/system features are on the high end of the constraint scale. The setback distance should be based on an evaluation of the constraint items and corresponding sensitive features in Table R2 and how these interact to provide a pathway or barrier for wastewater movement.
2 Subject to local regulatory rules and design by a suitably qualified and experienced person, the separation of a drip line system from an upslope boundary, for slopes greater than 5%, may be reduced to 0.5 m.

TABLE R2
SITE CONSTRAINT SCALE FOR DEVELOPMENT OF SETBACK DISTANCES
(used as a guide in determining appropriate setback distances from ranges given in Table R1)

Item	Site/system feature	Constraint scale (see Note 1) LOWER ← → HIGHER Examples of constraint factors (see Note 2)		Sensitive features
A	Microbial quality of effluent (see Note 3)	Effluent quality consistently producing ≤ 10 cfu/100 mL *E. coli* (secondary treated effluent with disinfection)	Effluent quality consistently producing ≥ 10^5 cfu/100 mL *E. coli* (for example, primary treated effluent)	Groundwater and surface pollution hazard, public health hazard
B	Surface water (see Note 4)	Category 1 to 3 soils (see Note 5) no surface water down gradient within > 100 m, low rainfall area	Category 4 to 6 soils, permanent surface water <50 m down gradient, high rainfall area, high resource/environmental value (see Note 6)	Surface water pollution hazard for low permeable soils, low lying or poorly draining areas
C	Groundwater	Category 5 and 6 soils, low resource/environmental value	Category 1 and 2 soils, gravel aquifers, high resource/environmental value	Groundwater pollution hazard
D	Slope	0 – 6% (surface effluent application) 0 – 10% (subsurface effluent application)	> 10% (surface effluent application), > 30% subsurface effluent application	Off-site export of effluent, erosion
E	Position of land application area in landscape (see Note 6).	Downgradient of surface water, property boundary, recreational area	Upgradient of surface water, property boundary, recreational area	Surface water pollution hazard, off-site export of effluent
F	Drainage	Category 1 and 2 soils, gently sloping area	Category 6 soils, sites with visible seepage, moisture tolerant vegetation, low lying area	Groundwater pollution hazard
G	Flood potential	Above 1 in 20 year flood contour	Below 1 in 20 year flood contour	Off-site export of effluent, system failure, mechanical faults
H	Geology and soils	Category 3 and 4 soils, low porous regolith, deep, uniform soils	Category 1 and 6 soils, fractured rock, gravel aquifers, highly porous regolith	Groundwater pollution hazard for porous regolith and permeable soils
I	Landform	Hill crests, convex side slopes, and plains	Drainage plains and incise channels	Groundwater pollution hazard, resurfacing hazard
J	Application method	Drip irrigation or subsurface application of effluent	Surface/above ground application of effluent	Off-site export of effluent, surface water pollution

NOTES:
1 Scale shows the level of constraint to siting an on-site system due to the constraints identified by SSE evaluator or regulatory authority. See Figures R1 and R2 for examples of on-site system design boundaries and possible site constraints.
2 Examples of typical siting constraint factors that may be identified either by SSE evaluator or regulatory authority. Site constraints are not limited to this table. Other site constraints may be identified and taken into consideration when determining setback distances.

Into the Field We Go………..

Desktop Study – the study will have identified potentially suitable effluent management areas (EMAs) from available information sources. A preliminary constraints map will also identify:

- Appropriate setback areas from natural or built features (existing and proposed)
- Identified physical constraints (e.g. bedrock, fill etc.)
- Data gaps (areas for investigation)
- Regional soil landscapes (including boundaries)
- Recommended soil (test pit/hole) locations
- Indicative groundwater depth

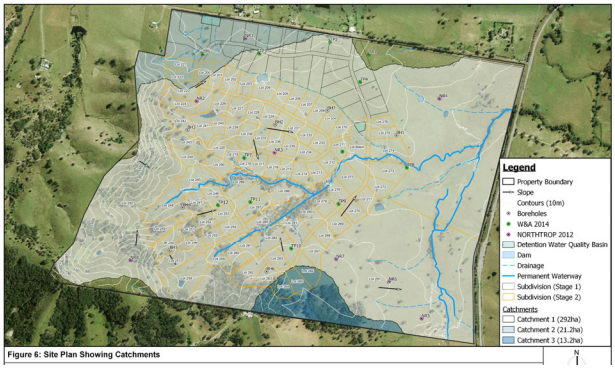


Figure 6: Site Plan Showing Catchments

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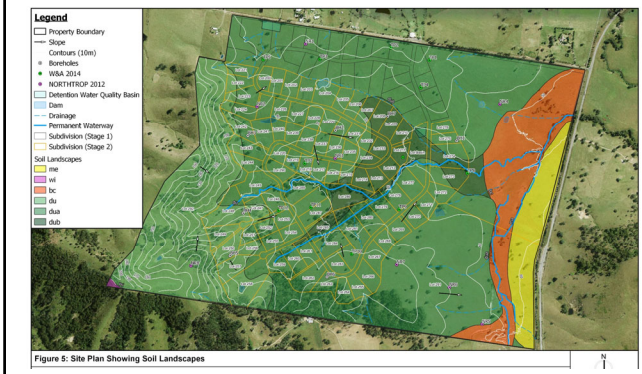

Figure 5: Site Plan Showing Soil Landscapes

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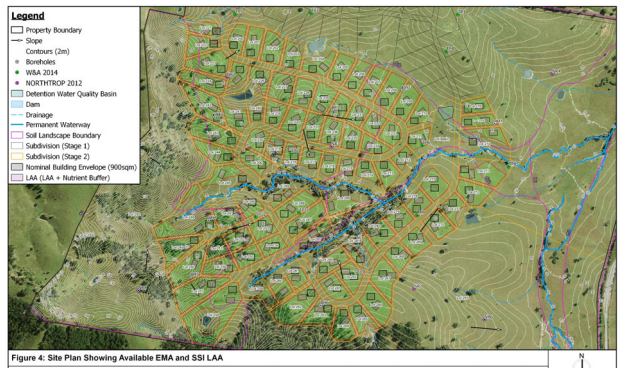

Figure 4: Site Plan Showing Available EMA and SSI LAA

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Figure 3: Site Plan Showing Proposed OSSM

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Figure 4: Site Plan Showing Proposed OSSM (Pavilion / Function Centre)

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