Technical Guidelines: Characterising Surplus Soil for Disposal

Waste Management Institute New Zealand Incorporated (WasteMINZ)

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About WasteMINZ

WasteMINZ is the largest representative body of Aotearoa New Zealand's waste, resource recovery and contaminated land management sectors.

WasteMINZ works towards ongoing and positive development of our industry through strengthening relationships, collaboration, knowledge sharing and championing the implementation of best practice standards.

Disclaimer

Every effort has been made to ensure that these guidelines are as comprehensive and accurate as practicable at the time of publication, however, WasteMINZ will not be held responsible for any action arising from their use.

The information provided in this guideline does not alter the laws of Aotearoa New Zealand, other official guidelines, or requirements. It does not constitute legal advice, and users should take specific advice from qualified professionals before taking any action based on the information in this publication.

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Abbreviations

C&D	Construction and demolition
CLMG	Contaminated Land Management Guidelines
DSI	Detailed Site Investigation
HAIL	Hazardous Activities and Industries List
IANZ	International Accreditation New Zealand
ITRC	Interstate Technology and Regulatory Council
NES-CS	National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health
PSI	Preliminary Site Investigation
WAC	Waste Acceptance Criteria
SQEP	Suitably Qualified and Experienced Practitioner

1 Glossary and Definitions

Consignment	The surplus soil produced from a single source with a similar history/contamination potential.
Construction and Demolition (C&D) Waste	Non-putrescible, non-hazardous C&D wastes. Waste may be generated from the construction, renovation, repair, and demolition of structures such as residential and commercial buildings, roads, and bridges.
Disposal	Removal of surplus soil from the source site to another location.
Landfill	A waste disposal site used for the controlled deposition of solid wastes onto or into land.
Resource Consent	A discharge permit, land use consent, water permit or subdivision consent including all conditions.
Soil	Soil includes topsoil and sub-soil; deposits such as clays, silts, sands, gravels, cobbles, boulders, and organic matter and deposits such as peat.
Surplus Soil	Soil that is excess to site requirements and is being transported with the intention of depositing it at a receiving site.
Surplus Soil Producer	Anyone who is proposing to undertake works that will generate surplus soil.
Surplus Soil Receiver	Anyone who will accept surplus soil, including fill operators, landowners, composting, transfer stations and reuse facilities.
Suitably Qualified and Experienced Practitioner (SQEP)	An expert in the assessment and characterisation of contaminated land.
Waste	a) Anything disposed of or discarded; and b) Includes a type of waste that is defined by its composition or source (for example, organic waste, electronic waste, or C&D waste), and c) To avoid doubt, includes any component or element of diverted material, if the component or element is disposed of or discarded.

2 Introduction

2.1 Background

It is good practice for soil producers to characterise surplus soils* being disposed off-site to make sure they are suitable for the intended disposal location. However, while there are guidelines for landfill operators on disposal to land, there are no specific guidelines for surplus soil producers to assist them to adequately characterise these soils.

Why should surplus soils be characterised? During earthworks, soils that are surplus to requirements are often taken to another location for disposal or reuse. While surplus soils may be a relatively benign material, they may contain contaminants that require some form of treatment, management or containment because of hazards that the soil **may** present. Adequate sampling of these surplus soils informs the soil producer's decision making and provides assurance that the surplus soils are suitable and safe for the intended locations.

Contractors, regulators, and operators of disposal facilities are challenged by the need to characterise soils that are to be moved from the source site, either for beneficial reuse, or final (regulated) disposal. The land use history of source sites varies widely and is often unknown; therefore, some surplus soils sent to disposal facilities have the potential to be contaminated.

While the WasteMINZ Technical Guidelines for Disposal to Land[1] relates to the sampling and monitoring of landfills in Aotearoa New Zealand, there is no specific guidance for surplus soil producers on the sampling required to make informed decisions about the suitability of the material for disposal or reuse. The question then is 'how many samples should be taken?' followed by 'how would you take them?'. This was the starting point for the development of these technical guidelines, which will therefore be restricted to the subject of sample collection, as part of the question "How do we sample or characterise surplus soil that comes off a site for disposal or reuse?"

This guideline has been subject to a consultation process with the wider sector with reviewers being environmental consultants, local authority staff and industry representatives.

* The Soil Disposal Sampling and Re-use Working Group recognises the value of this soil as a finite resource for which management can be improved, hence referring to these soils as 'surplus' throughout this guidance (as opposed to waste).

2.2 Objective

The key objectives of this guidance are:

- To ensure surplus soils are adequately sampled,
- To enable maximisation of soil reuse and minimisation of soil disposal to landfill,
- To ensure that potential physical, chemical and biological hazards from surplus soils are properly considered to allow for disposal at facilities with appropriate control measures, and
- To develop and promote a consistent approach to assessing soils for disposal or reuse throughout the country.

Following this guidance will provide users with an evidence-based strategy that has been developed by a cross industry working group. For most soil movement in Aotearoa New Zealand, following this guidance would represent good practice. This guideline does not provide assurance that any landfill operator will accept the soil.

2.2.1 Target audience for this guidance

This guidance is written for (but not limited to):

- Anyone who is proposing to disturb or move soil. This may include, but is not limited to, landowners, developers, contractors, planners, consultants qualified as Suitably Qualified and Experienced Practitioners (SQEP),[2]
- Regulators to enable consistent application of soil management practices across territorial authorities and other relevant regulatory bodies, and
- Surplus soil receivers to improve the efficiency of discussions around the disposal of surplus soils.

This guidance is most applicable for volumes of 1,000 m^3 or less. For larger projects other sampling methodologies are available and may be more appropriate and cost effective, consultation with a SQEP is recommended.

2.3 Scope

2.3.1 What is in scope

This guidance covers surplus soils for disposal or reuse.

This guidance is intended to fill a key gap in the existing guidance for dealing with surplus soils. Site specific methodology (for instance a Waste Management Plan for earthworks sites meeting certain thresholds or a SQEP designed sampling plan) will usually have more context.

2.3.2 What is out of scope

This guidance does not:

- Replace any form of human health or environmental risk assessment for characterisation of a contaminated site. Guidance on conducting risk assessments can be found in Contaminated Land Management Guidelines (CLMG) 5,[2]
- Reduce the need for the involvement of a SQEP in contaminated land management,
- Cover the detail of:
    - Analysis methodologies,
    - Methodology of disposal excavation,
    - Waste acceptance criteria (WAC) for receiving sites,
    - On-site processes for managing soils (e.g., windrowing, stockpile formation, erosion, and sediment control, etc.),
    - Compliance with applicable consent conditions, and
    - The method of reuse of soil, and
- Provide guidance on managing work health and safety risks associated with handling soil contaminated by hazardous substances.

This guidance may therefore not be suitable for all situations. Each case must be considered on its merits, considering the information at hand.

2.3.3 Te Ao Māori

The working group is aware of the importance of the handling surplus soil to Māori. It is understood that Māori have a long and enduring relationship with soils in Aotearoa New Zealand, starting with the creation stories, and the making of the first woman Hine-ahu-one or Hine-hau-one (the female element) formed from soil, from which all human beings originate. The wellbeing and health of Māori is intrinsically linked and dependent on a healthy ecosystem.[3]

It is best to engage with mana whenua as early as possible, particularly on major projects or where significant disturbance of land is proposed. When engaging with Māori regarding the disposal and reuse of surplus soil, it is good practice to compare contaminant concentrations with the applicable waste classification criteria as well as the appropriate background levels, soil contaminant standards and ecological criteria applicable to the area of interest, so that a complete picture of the effects for all receptors can be evaluated.

However, to truly incorporate Te Ao Māori into waste classification and management, a standardised, national approach is needed, and this is beyond the scope of this document. The working group strongly recommends seeking further guidance on such issues.

2.4 How this Soil Assessment Interfaces with Other Investigations

Surplus soil disposal is one reason among many for sampling soil. Just as planning or risk-led investigations can be helpful to assess soil disposal options, the opposite is also true. Data generated to support surplus soil disposal options may also be useful for informing other purposes, but it would be very unlikely to fulfil the obligations of a detailed site investigation (DSI) under CLMG 1.[4]

This guidance is intended to be used by anyone involved in surplus soil disposal. Complying with legislation, implementing the CLMG and other guidance will often require the expertise of a skilled professional such as a SQEP.

2.5 Disclaimer

Application of this guidance does not guarantee that the soil characterised will meet the waste acceptance criteria of a specific approved facility nor the adequate characterisation of all soils, as there is always the potential for high levels of heterogeneity within site soils and this needs to be considered in context of the source site and the surplus soil material being characterised.

2.5.1 Limitations

This guidance is intended as a framework for producers and receivers of surplus soils to reach consensus on risks posed by the subject surplus soil. Consequently, this process is informed by sustainable, technical, legal and commercial drivers and represents what the working group considers a reasonable compromise in the absence of site-specific information.

This guide is intended to help inform a commercial agreement but should not be taken as being a legally compliant or binding guideline that ensures every surplus soil producer meets a particular surplus soil classification, or that every waste receiver can be satisfied that surplus soil complies with their WAC or consent conditions.

3 Describing Soils

3.1 Responsibilities

Soil movements between sites are frequently regulated through multiple legislative instruments including resource consents. Just as receiving sites hold permits and consents, generators will often need to seek approvals under these instruments before generating the surplus soil. Advice from councils or contaminated land professionals will often be helpful in this context.

Surplus soil producers are responsible for collecting information on their surplus soil materials. Ideally this would occur in advance of engaging with contractors so that contractors can provide robust costs for disposal and consider alternatives such as reuse on site. This section starts identification of potential contamination issues in the surplus soil to assist disposal options, followed by sampling and testing outlined in Sections 4 and 5 to enable characterisation of any contaminants.

Surplus soil receivers are responsible for ensuring that they have requested and received relevant information on the characterisation of the surplus soil material to be received to address WAC and/or resource consent compliance requirements.

3.2 Material Category

3.2.1 Contaminants Identified from Source Site Activities

Identifying the likely hazards posed in the soil and the ability for surplus soil to comply with the WAC of the receiving site(s) is a critical step.

The activity history on the surplus soil producer site(s) helps identify if contaminants are likely to be present. Both the surplus soil producer and the receiver need to ensure that they have a good understanding of this to assist characterisation of the soil for further use or disposal.

3.2.2 Sites Identified as HAIL

A good place to start to understand the potential for soil contamination is to check whether the site has, or is, being used for a "HAIL" activity. HAIL is the generic term used for an activity or industry that appears on the Ministry for the Environment's Hazardous Activities and Industries List (HAIL);[5] that may be associated with generating contaminants in soils. Local and/or regional councils may have identified potential HAIL activities on the source site, available on-line or through a contaminated site information request. Reports may also be available for previous site developments, sale/purchase, or for other purposes.

Soils should be investigated and sampled for example where they:

- Arise from sites where former uses include industrial, commercial, mining or agricultural activities,
- Have had manufactured chemicals applied,
- Have been mixed with any wastes, or
- Consist wholly or partly of soil of unknown origin imported onto a site.

Not all sites or all portions of sites that match generic HAIL categories are necessarily contaminated, as this depends on the actual activities carried out. For example, the office area is unlikely to be contaminated, but bulk goods handling areas may well be. Each site must be assessed considering the information available. Often a SQEP will be involved with any project that involves a known or potential HAIL site, however this may not always be the case for all sites that may contain contaminants as discussed below. (Note that this guidance does not override any requirements for a SQEP to be involved in certifying investigation and reporting for preliminary or detailed site investigations for determining HAIL status, whether land meets soil contaminant standards, remediation of soils exceeding the standards or for subdivision or change of land use purposes. Refer to the NES-CS[6] and seek advice from a SQEP in those cases.)

Where a SQEP produces a site-specific certified report (PSI/DSI), the soil receiver may request a copy of the report(s) and review the information provided to make an assessment on whether they can receive the surplus soil.

The surplus soil producer should identify and disclose whether the current or previous activities on the site are included on the HAIL and forward reports and sampling results - where available. They may also ask for other information to build up a "picture" from different sources that may help decide if contamination is less or more likely to require further investigation.

3.2.3 Sites Not Identified as HAIL, But Having Elevated Contaminants

A significant volume of contaminated soil is generated from land which is not specifically identified on the HAIL. The site's full history may not be known despite research efforts. Contaminants may arise from seemingly minor activities e.g. burn areas, small waste deposits, historical lead paint discharges or drainage sediments. In addition, Aotearoa New Zealand's active geology results in naturally occurring potentially hazardous soils including arsenic, asbestos and acid sulphate soils.

The soil receiver will likely require further information from the surplus soil producer to help identify and characterise the material where contamination is suspected. Soil sampling will likely be needed where land use activity information is limited and will likely be required where this information is absent.

It is useful for the surplus soil producer to know what the disposal facilities requirements are before sampling is undertaken to clarify sampling numbers, depths, methods and the types of analysis to be undertaken – see Section 4. (For more detailed information

on soils sampling, refer to guidance including Soil Sampling for Waste Soil, Publication 702.2, Environment Protection Authority Victoria[7].)

3.3 Generating Activity and Description

3.3.1 Generating Activity

Secondary to the potential source of surplus soil, is the activity generating the surplus soil. Earthworks have different goals and different practices. Some contaminants may be limited to near surface soil, e.g., asbestos deposition from demolition works. Others may be related to deeper earthworks, e.g., leaks from underground tanks or pipes. Different activities will intersect different conditions on the same site.

For example, there would be value in assessing the material above the pipework separately from that below. The sampling therefore needs to reflect the source of the material within the site in addition to the history of contamination.

3.3.2 Description of Surplus Soils

Prior to and during sampling, it is important for the soil producer to keep a record of the description of surplus soil and collected samples to provide to the soil receiver. A description of surplus soils is important to:

- **Measure how representative the samples are** of the surplus soil being disposed, and
- **Provide additional confidence to the soil receiver** that the materials being received are the same or similar to the samples that have been analysed.

Descriptions of surplus soils and rock materials should be in general accordance with the New Zealand Geotechnical Society Inc Field Description of Soil and Rock, 2005.[8] The presence of any fill, concrete, asphalt, asbestos or other non-soil materials should also be noted in these records.*

3.4 Summary

The surplus soil must be described in a way that is understandable and related to its risk. The description must include:

- The source site and the history of that site,
- If the material came from a HAIL site or other contaminating activity,
- What the physical properties of the material are, and
- Any other information that supports characterisation.

* For describing fill, made ground, or traditional wastes the British Standard Code of practice for ground investigations (BS5930:2015+A1:2020)[9] could be used.

Appendix A outlines a process for describing soils and Appendix B provides a template and worked examples of the types of information required for describing surplus soils.

4 Sampling Requirements

Whether a site's history or natural geology is well or poorly understood, a degree of soil testing should be undertaken for every surplus soil producing site due to the heterogeneity of naturally occurring geological hazards, potentially undocumented historical site use, and a general responsibility to be protective of the environment that surrounds the receiving site.

4.1 Purpose

Historic testing rates of typically between one sample per 500 m^3 and one sample per 1,000 m^3 have been inconsistently applied throughout Aotearoa New Zealand. For reference, 1 sample per 1,000 m^3 would equate to roughly 1 sample per 60 truckloads or 1 sample when nearly 1 metre of soil removed across the entirety of a quarter-acre residential site. These metrics are not considered tenable for the long-term to identify soil related hazards or inform potential risk to surplus soil receiving sites. Recent international guidance[7] points to one sample per 25 m^3 for stockpiled material on industrially contaminated sites. During validation of extremely challenging contaminated sites rates of up to 1 sample per truck load (nominally 10 m^3, or one per skip (nominally 5 m^3)) have been observed.

There has been no previous consistent guidance on the expected baseline sampling rate for surplus soils, not associated with HAIL activities, being disposed off-site.

The honesty principle applies, and all parties are expected to act openly and fairly when using this guide and providing information to support soil disposal. If the works are occurring on a site that is the location of a HAIL activity, then the *National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health* (NES-CS)[6] investigation should be completed by a SQEP and supplied to support the consignor's declaration of characterisation.

The sampling rates outlined in Section 4.2 below are intended as an industry-wide acceptable agreed testing regime based on expediency, costs and expected contaminant risks from HAIL and non-HAIL sites alike.

4.2 Baseline Sampling Rates

In cases where a consignment is more than 1,000 m^3, a conversation between the producer and the receiver should be held with a view to reducing the sampling frequency. Many other methodologies are available and a SQEP will be able to advise on these together with the surplus soil receiver, including the incremental sampling methodology as described by the Interstate Technology and Regulatory Council (ITRC).[10]

Because soil contaminants can vary by depth and soil type, a surplus soil consignment must not contain highly variable soils e.g. subsurface heavy clay mixed with loose loam topsoil, sandy aggregate fill with peat etc.

For example: a swimming pool excavation at a residential site would contain two consignments; one of topsoil and one of underlying clay (see Appendix B) and both would be sampled and analysed independently.

For the purpose of categorising the surplus soils, the site should be assessed in line with the proposed earthworks and if appropriate, divided into consignments based on similar areas with similar site history/contamination potential.

For sites with multiple consignments of less than 25 m^3 it will generally be impractical to sample each consignment separately and the materials may be combined and sampled as a single consignment for disposal purposes.

The baseline sampling is adopted from the Environment Protection Agency Victoria *Soil sampling for waste soils* (IWRG702).[7] To avoid complication, a single baseline sampling rate has been adopted. The baseline sampling rate is 1 sample per 25 m^3 with a minimum of 3 samples per consignment (so if less than 75 m^3 is in a consignment, 3 samples are still required).

We note that for small volumes (significantly less than 75 m^3) testing could become relatively onerous (for example spoil arising from establishing a garden bed on a residential property, or soil arising from the installation of a single road sign). In these cases, we would expect transfer of the soil and the risk to a refuse transfer station who could consolidate soil into a larger volume more viable for testing.

This baseline sampling rate is expected to be followed irrespective of in-situ or stockpile sampling, adjusted as appropriate by the baseline multiplier rate. Any variations or deviations from the baseline sampling rate are to be discussed and agreed with the receiver/disposal facility. Results from previous investigations are likely to be relevant. It is expected that these will be used and supplemented where appropriate.

4.3 Baseline Multiplier

The baseline sampling rate provides the starting rate of soil samples per consignment, as discussed above. Based on the risk decision outcomes and discussion, or results of sampling and analysis, the producer or receiver may request application of a multiplier of the baseline rate. Typically:

- Where the site history or consistent sampling results indicate that the overall risk of contamination or variability is lower, the producer may request a drop in the baseline sampling rate by using the multiplier, and
- Where the risk decisions process highlights potential issues in variability or where sample results or visual assessments of loads are inconsistent, the receiver may require an increased sample multiplier.

However, the receiver/disposal facility makes the final decision on whether a multiplier is able to be increased/decreased from the baseline rate. Table 1 provides an overview of multipliers that are considered to be generically appropriate.

Table 1. Sampling Multiplier

Criteria	Multiplier	Sampling Rate*
Material represents mixed geologies (e.g topsoil and subsoil, or basecourse and clay)	0.5	1 in 12.5 m^3
Contaminant concentrations are significantly heterogenous (e.g if the standard deviation for a contaminant of concern exceeds the mean for that data set)#	0.5	1 in 12.5 m^3
Material produced has a consistent description. No obvious contamination but long history of urban land use	1	1 in 25 m^3
No previous contaminating activity (without SQEP produced supporting evidence)	5	1 in 125 m^3
Contamination arising from diffuse sources	5	1 in 125 m^3
No previous contaminating activity, as determined by a Preliminary Site Investigation (PSI) done by a SQEP	10	1 in 250 m^3

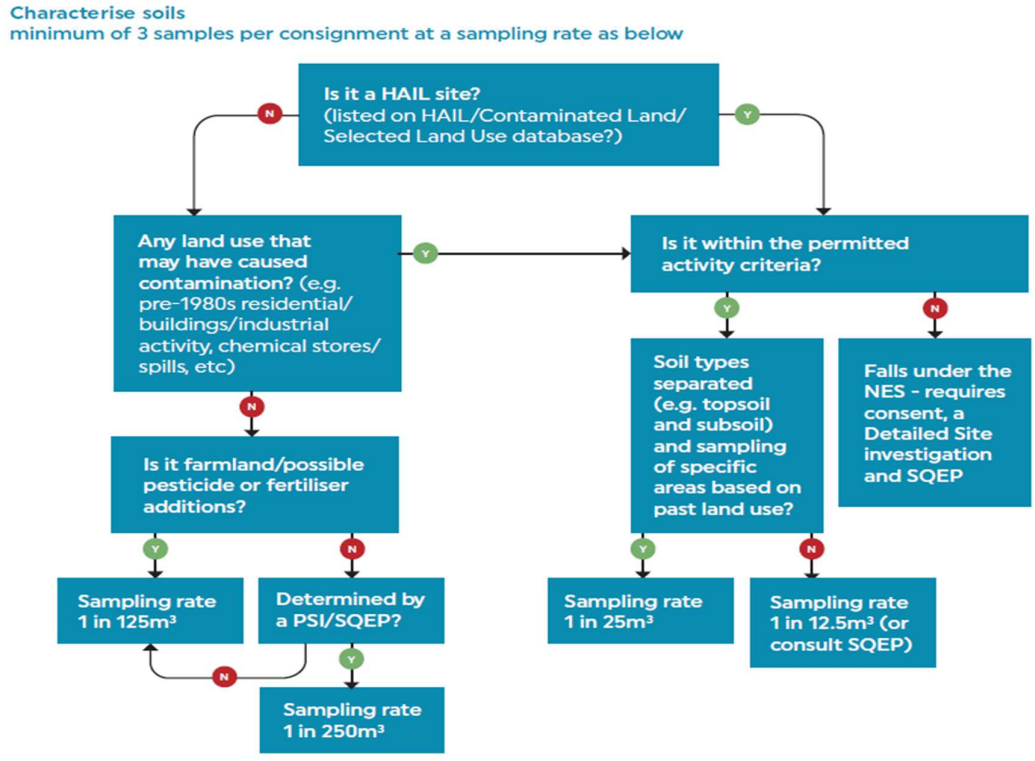
*Note that a minimum of three samples per consignment is always required to manage the worst effects of heterogeneity and sampling bias.

#Note in many cases this will not be apparent until after the information is received. More than one investigation may therefore be necessary, or a surplus of samples could be collected to enable additional testing if this is encountered.

General Note that in cases where a consignment is more than 1,000 m3, a conversation between the producer and the receiver should be held with a view to reducing the sampling frequency.

The flow chart (Figure 1) below presents a typical decision flow using these multipliers.

Figure 1. Multipliers decision making flow



4.4 Sampling Locations

CLMG 5[2] Sections 4.2.3/4.2.4 contain specific guidance on in-situ and stockpile sampling strategy and depth, noting that samples from in-situ and stockpiled soils should consider likely contaminant depths, soil heterogeneity, etc.

Sampling of **in-situ soils** may be completed using a systematic grid-style approach with samples being collected at various depths along transects which support the division of the total volume of surplus soil into approximately equal portions. For **stockpiled soils** CLMG 5[2] notes:

"It is best practice to sample within the body of stockpiles, rather than just from the surface. This takes account of heterogeneity caused by grain-size segregation that is likely to occur at the surface when the stockpiles are built. To sample within the body of stockpiles, cut a series of appropriately spaced transects through the stockpile and take multiple samples at different distances and heights at each transect. The number of transects, and the number of samples per transect will be a matter for judgement at the time, the shape of the stockpile and the source and nature of the material, etc".

4.5 Sample Collection

Samples should be collected in such a way as to ensure that the sample is not affected by other materials such as previous samples or the sampling equipment. Samples should be representative of the surplus soil and not targeted to a particular colour, moisture content or particle size. Good samples arise from the following process:

- The volume to be sampled is identified on a drawing and a plan is developed to collect samples as per Section 4.6,
- Tools for sample collection that can be cleaned are prepared if needed along with enough disposable gloves to ensure one glove set per sample. Implements for cleaning these tools between samples are available, such as clean buckets with brushes and detergent. Tools are to be washed in soapy water then rinsed in clean drinking water,
- Sample jars sourced from the analytical laboratory are to be made ready,
- Samples are collected direct from the tool or the source using a gloved hand. The glove is applied immediately before sample collection. For samples collected from a mechanical excavator bucket or similar the sample is collected from within the soil mass from an area which has not contacted the bucket,
- Sampling is direct into a sample jar. Once the jar is closed the gloves are disposed of, and
- Sample jars are labelled with the date, depth of collection and the sample name which is reflected on the plan.

4.6 Composite Sampling

If the surplus soil is considered to be relatively homogeneous, it may be appropriate to analyse samples as one or more composite samples to manage sampling costs (see CLMG5[2] Section 4.2.6).

Composite sampling reduces the cost of testing but increases the uncertainty of the individual results. It tends to work well for homogenous uncontaminated soils.

The minimum number of results reported must still be 3 per consignment (i.e. a minimum of 3 composite samples must be analysed).

Compositing must be undertaken in accordance with CLMG 5.[2] In particular, compositing **must be undertaken by the analytical laboratory from individual samples collected** from the surplus soil, and the maximum number of sub-samples that may be composited together is **four**. Composite sampling is **not suitable for volatile contaminants or sites where asbestos is known or suspected to be present**.

4.7 Visual Verifications and Spot Sampling

The soil producer should visually assess every load of surplus soil to ensure it matches the description prior to it being removed from the source site; for example, as it is excavated. In addition, the soil receiver reserves the right to visually assess every consignment that is received at their site(s) and if necessary to undertake spot sample collection and analysis to verify the validity and accuracy of the information provided to them by the soil producer.

5 Testing Requirements

Various contaminants and/or naturally occurring hazardous materials may be present in any surplus soil material. Consideration should be given to geological characteristics, the source/potential source of anthropogenic contaminants and impacts/potential impacts which the material may have originated and/or been exposed to prior to its characterisation.

Many reference documents – including the HAIL List Guidance[5] – and advisors – including SQEPs and/or receivers – are available to support or assist surplus soil producers in determining what analytical testing requirements should be undertaken on the subject material.

5.1 Contaminants

Potential contaminants which frequently occur in the surplus soil, hereafter referred to as Contaminants of Potential Concern, are summarised into six broad groups for the purposes of this guidance:

- **Inorganic Elements**: commonly occurring and also present as contamination. The presence of these elements can vary by geological area, proximity to volcanic activity, region or catchment, and by regulator acceptance. They most commonly include the heavy metal suite (arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc); but may include boron, tin, sulphate and others.
- **Construction materials**: treated timber, painted wood, galvanised metal, and other construction materials, such as electrical components (including wiring), fire resistant products and stain resistant fabrics, containing a wide variety of contaminants including heavy metals and specialist contaminants. As such advice from a SQEP should be sought in dealing with these materials.
- **Solvents and volatile or semi-volatile organics**: generally associated with industrial activities such as paint manufacturing, printing, degreasing, and engineering workshops.
- **Hydrocarbons**: generally associated with all hydrocarbon formulation, storage, and use including coal tar.[11] Likely to occur on sites storing or distributing diesel and petrol products, transport yards, asphalt yards, airstrips, motor vehicle workshops or servicing and scrap yards.
- **Pesticides**: these are generally associated with large scale commercial agricultural operations but may also include smaller rural properties, market gardens and small orchards etc.
- **Asbestos**: was widely used in Aotearoa New Zealand from the 1940s, and a preferred construction material during the 1950s, 1960s and 1970s in most residential and commercial/industrial buildings and continued to be used until the early 2000s.

- **Specialist contaminants**: there are many specialist processes and other Contaminants of Potential Concern that may apply in certain situations too numerous to detail in this guide. Should the outcome of the risk decision process indicate that specialist analysis is required, this will likely require the involvement of a SQEP. Specialist Contaminants of Potential Concern are highly varied and if suspected to be present in surplus soil materials, engagement of a SQEP to support the characterisation process is strongly recommended.

At a minimum, it is expected that any surplus soil would be characterised for the concentrations of heavy metals. Additional analysis requirements may be necessary for specific receiving sites and based on the source and potential impacts for the subject material.

All analysis is required to be completed using International Accreditation New Zealand (IANZ) accredited methods by an independent laboratory.

6 Information Interpretation

6.1 Engaging with Soil Receiving Sites

It is the responsibility of the surplus soil producer to provide sufficient information characterising each consignment of soil to the receiver, when requesting a quote and approval prior to transport for disposal.

Appropriate generic identification of the materials, their source and potential for contamination, plus any supporting sampling and analysis (for example as shown in Appendix B) will enable the producer to consider the suitability for various classes of receiving sites, and for a receiving site operator to make decisions around acceptance.

The receiving site operator has the ultimate ability to accept or reject materials based on information presented plus any other relevant evidence or knowledge to ensure they can comply with their consents, regulatory and operational requirements. This may include the completeness of information, including sampling methodologies and data analysis including the use of statistics, and the conclusions drawn.

Suffice to say, the more complex the material or the background of the site it has come from, the greater the requirement for information and likely technical support such as from a SQEP.

Soil disposal sites vary significantly in their capability, risk profile and availability with respect to acceptance of surplus soils. Most receiving sites will have responsibilities associated with multiple resource consents or permitted activity rules and obligations under the Waste Minimisation Act[12] with regards to the levy. These requirements encompass the chemical composition of the materials and many other aspects of what they can receive and how they operate. To the non-expert, these responsibilities can appear to be conflicting, and it is up to each receiver to understand their obligations in total.

Therefore, direct engagement with any proposed receiving site is required before determining if the material can be sent there. In addition to the usual commercial requirements, receiving sites will typically want:

- The approximate volumes along with the production rate to be delivered to their site,
- The site address and the HAIL status of that address and the relevant work area,
- Copies of the chemical testing and material description,
- Statistical assessments if appropriate,
- Supporting letters/reports from a SQEP or other professionals involved in describing the material if from a HAIL site, and
- Any other relevant information.

6.2 Use of 95% Upper Confidence Level (UCL)

EPA Victoria guidance on sampling for waste soil[7] indicates that it may be appropriate to use a 95% Upper Confidence Level (95% UCL) to characterise surplus soil in some situations. However, it is important to discuss this with the waste receiver as some resource consents and regional rules are based upon the highest concentration in the waste, and a UCL approach may not be appropriate.

If a 95% UCL is going to be used, it is important that sampling is undertaken systematically, and that the dataset is appropriate for the use of the statistical tool. It is recommended that a SQEP who understands the use of statistical tools such as a 95% UCL is engaged to undertake the work.

7 References

1. WasteMINZ. 2023. *Technical Guidelines for Disposal to Land – Revision 3.1*

2. Ministry for the Environment, 2021. *Contaminated Land Management Guidelines No. 5: Site Investigation and Analysis of Soils (Revised 2021)*. Wellington: Ministry for the Environment

3. Harmsworth GR, Awatere S 2013. Indigenous Māori knowledge and perspectives of ecosystems *In* Dymond JR ed. Ecosystem services in New Zealand – conditions and trends. Manaaki Whenua Press, Lincoln, New Zealand.

4. Ministry for the Environment, 2021. *Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Sites in New Zealand (Revised 2021)*. Wellington: Ministry for the Environment

5. Ministry for the Environment. 2023. *Hazardous Activities and Industries List guidance: Identifying HAIL land.* Wellington: Ministry for the Environment.

6. Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011

7. EPA Victoria, 2024. *Soil sampling for waste soils.* (Publication 702.2)

8. New Zealand Geotechnical Society Inc. 2005. *Field description of soil and rock.*

9. British Standard Code of practice for ground investigations (BS5930:2015+A1:2020)

10. The Interstate Technology & Regulatory Council. 2020. *Incremental Sampling Methodology (ISM) Update*

11. WasteMINZ. 2023. *Guidelines for assessing and managing coal tar contamination in roading*

12. Ministry for the Environment. 2023. *Waste Minimisation Act 2008*

Appendix A - Process for describing anthropogenic ground from British Standard Code of practice for ground investigations

"Good descriptions should include information on the following aspects, as well as on the soil constituents (this list is not exhaustive):

a) Origin of the material,

b) Presence of large objects such as concrete, masonry, old motor cars, etc.,

c) Presence of voids or collapsible hollow objects,

d) Chemical waste, and dangerous or hazardous substances,

e) Organic matter, with a note on the degree of decomposition,

f) Odours,

g) Striking colour tints,

h) Any dates readable on buried papers, etc.,

i) Signs of heat or combustion underground, e.g., steam emerging from borehole,

j) Structure, variability and any indications of the method of placement,

k) Presence of potentially reactive or expansive materials such as chert or some types of steel making slag, and

l) Any signs of gas such as by odour or bubbling through water."

And

"Some types of Made Ground have a wide range or particle types and sizes; it can be very useful to provide approximate proportions of the different materials. For example, "Made Ground comprising:

50% pockets up to 1.0 m by 0.4 m of black partially decomposed paper, newspapers (1962), garden refuse and ash; 25% multicoloured (bright colours) clays (possible dyes); 20% concrete slabs up to 1.5 m by 0.2 m lying at 45°; 5% 1 No 200-litre drum slightly corroded, apparently empty, no labels, hydrocarbon odour."

Appendix B – Surplus soil information sheet

Material Description

Site Address	
Plan of proposed works (drawing/map/aerial etc.)	
History of Site Activity	
Expected number of consignments	

Consignment Description

Material Description			
Expected date of delivery commencement		Expected duration of delivery	
Expected frequency of deliveries		Expected solid volume of consignment	

Details of soil sampling completed – one per consignment

Number of samples taken	How were samples taken	Soil categorised by highest concentration or using $95\%UCL_{average}$
	In-situ	High conc.
	Stockpiles	$95\%UCL_{average}$

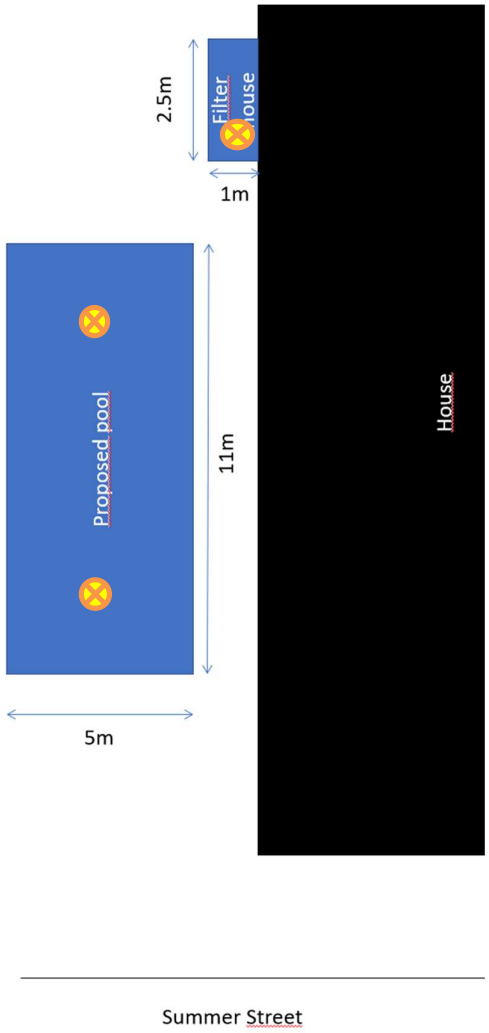
Analytical summary sheet - one per consignment

Contaminant	Soil analytical results			
	Maximum reported Contaminant concentration (total) mg/kg dry weight	Minimum reported Contaminant concentration (total) mg/kg dry weight	Average reported Contaminant concentration (total) mg/kg dry weight Or 95%$UCL_{average}$	If available: Maximum Leachable Concentration (mg/L) (Seek advice of disposal/ reuse site, generally TCLP for disposal and SPLP for reuse within 1m of ground surface)
Contaminants analysed: Arsenic Cadmium Copper Chromium Mercury Nickel Zinc Asbestos P/A				

Worked Example 1:

Scenario: Swimming pool being excavated into an 800m^2 section with a standalone home.

Material Description

Site Address	100 Summer Street, Marshlands, Northland
Plan of proposed works (drawing/map/areal etc.)	
History of Site Activity	House was constructed in 1984, history of renovations since, previously cow pasture
Expected number of consignments	2

Consignment Description

Material Description	Consignment 1 topsoil		
Expected date of delivery commencement	4/12/23	Expected duration of delivery	1 day
Expected frequency of deliveries	1 per 4 hours	Expected solid volume of consignment	18m^3 approx.

Details of soil sampling completed – one per consignment

Number of samples taken	How were samples taken	Soil categorised by highest concentration or using 95%UCL$_{average}$
3, as shown on drawing	In-situ. Hand trowel	High conc.

Analytical summary sheet - one per consignment

Contaminant	Soil analytical results			
	Maximum reported Contaminant concentration (total) mg/kg dry weight	Minimum reported Contaminant concentration (total) mg/kg dry weight	Average reported Contaminant concentration (total) mg/kg dry weight Or 95%UCL$_{average}$	If available: Maximum Leachable Concentration (mg/L) (Seek advice of disposal/ reuse site, generally TCLP for disposal and SPLP for reuse within 1m of ground surface)
Contaminants analysed:				
Arsenic	7	<2	5	N/A
Cadmium	<0.1	<0.1	<0.1	N/A
Copper	21	<2	8	N/A
Chromium	27	6	14	N/A
Lead	2,204	21	208	N/A
Mercury	0.11	<0.1	<0.1	N/A
Nickel	54	11	24.6	N/A
Zinc	97	74	83	N/A
Asbestos P/A	Present	Absent	N/A	N/A

Material Description	Consignment 2 clay		
Expected date of delivery commencement	4/12/23	Expected duration of delivery	3 days
Expected frequency of deliveries	1 per hour	Expected solid volume of consignment	120 m^3 approx

Details of soil sampling completed – one per consignment

Number of samples taken	How were samples taken	Soil categorised by highest concentration or using 95%$UCL_{average}$
3	In-situ. Hand auger	High conc.

Analytical summary sheet - one per consignment

Contaminant	Soil analytical results			
	Maximum reported Contaminant concentration (total) mg/kg dry weight	Minimum reported Contaminant concentration (total) mg/kg dry weight	Average reported Contaminant concentration (total) mg/kg dry weight Or 95%$UCL_{average}$	If available: Maximum Leachable Concentration (mg/L) (Seek advice of disposal/ reuse site, generally TCLP for disposal and SPLP for reuse within 1m of ground surface)
Contaminants analysed:				
Arsenic	6.5	<2	4.8	N/A
Cadmium	<0.1	<0.1	<0.1	N/A
Copper	22	<2	9.6	N/A
Chromium	22	6	13.2	N/A
Lead	44	20.5	30.1	N/A
Mercury	<0.1	<0.1	<0.1	N/A
Nickel	58	10	23	N/A
Zinc	88	71	76	N/A
Asbestos P/A	Present	Absent	N/A	N/A

Worked Example 2:

Scenario: Lane widening for cycleway and opportunistic stormwater upgrades (1km of urban road, replacement of old 600mm main with new 1050mm main)

Material Description

Site Address	Kings Ave.
Plan of proposed works (drawing/map/areal etc.)	
History of Site Activity	Pre-1950s – paddocks and farmland 1950s -1960s – residential and commercial creep from the south replacing farming land 1960s – 1970s – further expansion of residential. Commercial sites dwindling as sites converted to new residences. 1970s – 1980s – greater densification, marginalised commercial in south. 1980s – present – Increasing residential subdivisions and densification. Three sites of interest identified during HAIL review: Purple site on figure: Clandestine lab. House fire in 2010 as a result of chemical reaction on site. House destroyed. Site was cleared and rebuilt into two properties in early 2012. Council records all topsoil to a depth of 300 mm removed from site. No testing results on file. Red Site on Figure: Owner reported as water blasting asbestos roof in 2019. Site was investigated by Council and found to contain asbestos fibres exceeding a guideline criteria. Owner ordered to remediate site to Councils satisfaction. Reports on file indicate site was validated by external consultant as not exceeding a guideline criteria. Blue site on figure: Council reports the site as an illegal vehicle workshop, currently under investigation by Council officers.
Expected number of consignments	2

Consignment Description

Material Description	Consignment 1 - Loose aggregate containing fill beneath pavement		
Expected date of delivery commencement	3 June 2024	Expected duration of delivery	6 weeks
Expected frequency of deliveries	2 - 3 per day intermittent frequency	Expected solid volume of consignment	Aggregate and pavement for off-site crushing and re-use not part of consignment ~ 1,200 m3 Loose aggregate fill ~ 1,500 m3

Details of soil sampling completed – one per consignment

Number of samples taken	How were samples taken	Soil categorised by highest concentration or using 95%$UCL_{average}$
24 (3 samples x 8 test-pits)	In-situ: Hydrovac pothole test-pitting along alignment with spot samples collected by hand auger from pit.	High conc.

Analytical summary sheet - one per consignment

Contaminant	Soil analytical results			
	Maximum reported Contaminant concentration (total) mg/kg dry weight	Minimum reported Contaminant concentration (total) mg/kg dry weight	Average reported Contaminant concentration (total) mg/kg dry weight Or 95%$UCL_{average}$	If available: Maximum Leachable Concentration (mg/L) (Seek advice of disposal/ reuse site, generally TCLP for disposal and SPLP for reuse within 1m of ground surface)
Arsenic	15	<2	5	N/A
Cadmium	0.28	<0.1	0.24	N/A
Copper	59	<2	12.3	N/A
Chromium	21	<2	6	N/A
Lead	340	1	25.6	N/A
Mercury	0.35	<0.1	0.15	N/A
Nickel	7	<2	4.3	N/A

Zinc Asbestos P/A	192 N/A	5 N/A	29 N/A	N/A N/A

Consignment Description

Material Description	Consignment 2 - Silt and clay underlying		
Expected date of delivery commencement	3 June 2024	Expected duration of delivery	6 weeks
Expected frequency of deliveries	2 - 3 per day intermittent frequency	Expected solid volume of consignment	Silt and clay ~ 965 m3

Details of soil sampling completed – one per consignment

Number of samples taken	How were samples taken	Soil categorised by highest concentration or using 95%$UCL_{average}$
24 (3 samples x 8 test-pits)	In-situ: Hydrovac pothole test-pitting along alignment with spot samples collected by hand auger from pit.	High conc.

Analytical summary sheet - one per consignment

Contaminant	Soil analytical results			
	Maximum reported Contaminant concentration (total) mg/kg dry weight	Minimum reported Contaminant concentration (total) mg/kg dry weight	Average reported Contaminant concentration (total) mg/kg dry weight Or 95%$UCL_{average}$	If available: Maximum Leachable Concentration (mg/L) (Seek advice of disposal/ reuse site, generally TCLP for disposal and SPLP for reuse within 1m of ground surface)
Arsenic	12	<2	4	N/A
Cadmium	0.14	<0.1	0.11	N/A
Copper	36	<2	12.3	N/A
Chromium	18	<2	5	N/A
Lead	65	2	18	N/A
Mercury	0.15	<0.1	0.1	N/A
Nickel	9	<2	3.6	N/A

Zinc	87	3	16	N/A
Asbestos P/A	N/A	N/A	N/A	N/A