GUIDELINES FOR ENVIRONMENTAL MANAGEMENT

USE OF BIOSOLIDS AS GEOTECHNICAL FILL

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GLOSSARY OF TERMS

General definitions for biosolids management are listed in EPA publication 943, *Guidelines for Environmental Management: Biosolids land application*. The following additional terms are used in these guidelines:

Term	Definition
Amended biosolids	Biosolids treated with lime, cement or other substances to improve geotechnical properties.
'As-sampled' biosolids	Biosolids as sampled from the producer's stockpile (prior to amendment).
Biosolids	Organic solids derived from sewage treatment processes that are in a state that can be managed to sustainably utilise their geotechnical properties (and meet minimum standards for restricted grade classification).
Capping	Material of very low permeability compacted to form a layer to prevent water ingress and physical intrusion into underlying material. Road construction projects should also refer to Vic Roads Section 204 definition: A Type 'A' material layer of low permeability placed immediately below the pavement sub-base or selected material to minimise changes in moisture content in the material below the capping layer.
End user	The company or organisation that will ultimately use the biosolids for geotechnical fill, for example construction companies or site owners.
General fill	Fill material that is not required to possess any specific geotechnical properties for a proposed end use that also complies with EPA publication 448, classification of wastes.
Geotechnical fill	Fill material providing a geotechnical benefit to end use construction or earthworks projects.
Geotechnical reuse	Reuse of biosolids as geotechnical fill.
Groundwater	Any water contained in or occurring in a geological structure or formation.
Proponent	The party or joint group of parties proposing the biosolids reuse scheme and using the environment improvement plan (EIP) as their guiding document
Restricted grade	Biosolids material that requires an EPA-approved environment improvement plan (EIP) before reuse is permitted. Under these guidelines any biosolids that do not meet restricted-grade requirements require an EPA works approval and licence before use is permitted.
Reuse	Use of biosolids in a manner that derives value from a property of the material.
SEPP	State environment protection policy
Site owner	The company or organisation that will ultimately own the site where biosolids have been used for geotechnical fill; for example, VicRoads for road construction projects.
Supplier	The company or organisation supplying (including producing and reprocessing) biosolids to the end user.
Stormwater	Surface water runoff that originates from rainfall events.

1 INTRODUCTION

1.1 Scope

These *Guidelines for Environmental Management: Use of biosolids as geotechnical fill* ('these Guidelines') provide specific guidance for managing biosolids that can be reused as geotechnical fill material ('geotechnical reuse'). They are intended to provide an alternative option for biosolids reuse, in circumstances where land application is not practical.

EPA publication 943, *Guidelines for Environmental Management: Biosolids land application,* provides a framework for achieving safe and sustainable land application of biosolids to derive agronomic benefits from nutrients and organic matter.

These Guidelines should be read in conjunction with publication 943, because some of its content applies to geotechnical reuse. Publication 943 also provides background information on the legislation and state environmental protection policies (SEPPs) that underpin these Guidelines.

For ease of cross-referencing, these Guidelines follow the same general structure and topic headings as publication 943.

1.2 Sustainable biosolids use

The release and use of publication 943 has highlighted the existence of some biosolids stockpiles with properties that are not suitable for land application because of high clay content and low nutrient value. Considerable research and investigation has been undertaken within the water industry into alternative uses of these stockpiles. This has led to recognition that 'amended biosolids' (see Glossary) with suitable geotechnical properties may be used as geotechnical fill in construction projects, as a substitute for raw materials.

These Guidelines are focused on achieving safe and sustainable use of biosolids as a geotechnical fill required for construction projects such as in roadways, roadway embankments or building pads. To qualify for beneficial reuse, the biosolids will need to meet geotechnical standards required by the end user. Appendix B contains information regarding potential geotechnical assessment methods that may be required by an end user.

Where appropriate, applying biosolids to land remains the preferred option as organic matter and nutrients can be utilised. Reuse of biosolids as geotechnical fill is an alternative reuse option in some circumstances where it can be demonstrated to be more sustainable than land application. For example, where land application is not feasible due to practical constraints and/or properties of the biosolids (such as high clay content and low nutrient value).

Suppliers seeking to provide biosolids for use as geotechnical fill will need to identify all possible reuse options and demonstrate why amendment and geotechnical reuse is appropriate. This should be demonstrated through a Life Cycle Assessment and Triple Bottom Line Analysis. Contact EPA for further guidance on conducting these, or refer to International Organisation for Standardisation (ISO) Standards 14040:2006 and 14044:2006 for more guidance on conducting a life cycle analysis.

These Guidelines have been published with the primary aim of allowing the reuse of older biosolids stockpiles that have a high clay content and have lost their nutrient value. However, due to improvements in biosolids management in the water industry, the majority of new biosolids being produced have a low clay content and a lower contaminant content, making them more suitable for land application. If geotechnical reuse is appropriate due to inadvertent mixing of biosolids with clay (for example, from drying pans, or sewerage network), the supplier will need to demonstrate to EPA how they will avoid and manage such mixing in the future.

Proposals for general filling of voids, noise mounding and landscaping that do not demonstrate a beneficial use of the geotechnical properties of biosolids are not permitted under these Guidelines and may be subject to EPA works approval and licensing.

1.3 Objective

The overall objective of these Guidelines is to maximise the sustainable use of biosolids as geotechnical fill by documenting good practice for matching biosolids quality and beneficial properties with best practice end-use activities whilst minimising any associated risks.

2 STATUTORY FRAMEWORK

Biosolids disposal is a 'scheduled activity' under the *Environment Protection (Scheduled Premises and Exemptions) Regulations 2007* and, unless used in accordance with these Guidelines and publication 943, require an EPA works approval and licence. However, biosolids end-use schemes managed in accordance with these Guidelines and publication 943 are exempt from EPA works approval and licensing. All schemes using biosolids in accordance with these Guidelines must develop an environment improvement plan (EIP) as described in Section 8.

Biosolids are not classed as a prescribed industrial waste (PIW) under the *Environment Protection (Industrial Waste Resource) Regulations 2009*. Restricted grade biosolids may have similar contaminant concentrations to Category C contaminated soils[1] and hence need to be managed carefully in accordance with this guideline and publication 943.

Please note that Category C contaminated soils are a PIW and need to be managed in accordance with the *Environment Protection (Industrial Waste Resource) Regulations 2009*.

Acts, Regulations and policies relevant to biosolids management are discussed further in Section 2 of publication 943.

Proponents need to be aware that there may be other relevant statutory approvals or permits required for the construction work associated with using biosolids as geotechnical fill. For example, local councils may require a construction or building permit to be obtained for the construction work.

[1] Category C contaminated soils are defined by EPA publication IWRG621, *Soil hazard categorisation and management*, as amended from time to time.

3 ROLES, RESPONSIBILITIES AND RISK

3.1 Roles and responsibilities

It is important that suppliers and end users of biosolids understand and meet their obligations under these Guidelines.

It is the responsibility of both the supplier and end user to develop an EIP in partnership, to ensure that both supplier and end-user obligations are clearly defined in the EIP. Whilst the effective operation of a scheme may require separate documentation for the supplier and end user, these should be referred to in the scheme EIP.

These Guidelines are not prescriptive in who develops the EIP and related documents. However, it is important that all parties involved in a scheme are aware of and agree to their roles and responsibilities. In some cases, not all parties will have been finalised (for example, during an ongoing tender process for the construction contract) when the EIP is submitted to EPA, in which case appropriate standard supply/user agreements should be referred to in the EIP.

3.1.1 Supplier

Suppliers (including producers and reprocessors) of biosolids must ensure the product meets the biosolids classification required for the intended use (see Section 4). They need to identify all possible reuse options and demonstrate why amendment and geotechnical reuse is the most sustainable option. This should be demonstrated through a Life Cycle Assessment and Triple Bottom Line Analysis.

If geotechnical reuse is appropriate due to inadvertent mixing of biosolids with clay (for example, from drying pans, or sewerage network), the supplier will need to demonstrate to EPA how they will avoid and manage such mixing in the future.

The supplier must ensure that any scheme supplied with biosolids for use as a geotechnical fill has either:

- an EIP (Section 8) approved by EPA as complying with publication 943 or these Guidelines

or

- an EPA works approval or licence.

The supplier must ensure that there are mechanisms (such as independent monitoring, construction management and quality assurance plans or contractual arrangements) for ensuring end-use schemes supplied with biosolids comply with an approved EIP.

Suppliers must keep a register of all schemes they supply with biosolids used for geotechnical fill (Section 7.1).

3.1.2 End users

In some cases the end user may change throughout the project phases. For example, during the civil works phase the construction contractor will be the end user, whereas the site owner will be the end user at completion of the project and is responsible for ensuring ongoing management and monitoring of the works. Therefore, record keeping and information transfer is an important part of any scheme to ensure appropriate ongoing management and monitoring (see Sections 6 and 7).

Biosolids end users must ensure that the site and scheme are managed in accordance with publication 943 or these Guidelines. Particular attention should be paid to the quality assurance and control aspects of complying with an approved EIP (for example, assessment of the biosolids' geotechnical suitability for the end use and recording of end-use details).

As part of the EIP approval process (see Appendix B), the end user must provide evidence to the supplier and EPA that the scheme will beneficially reuse the biosolids' geotechnical properties.

3.1.3 Local community liaison

Biosolids suppliers and users should ensure that the local community is well informed throughout all stages of the project. The extent and form of information provided should reflect the site circumstances (for example, proximity to sensitive land uses or level of community interest). The main goal is to provide stakeholders and the broader public with balanced and objective information to assist them in understanding the scheme, biosolids and how the use of biosolids will be managed.

Where there is significant community interest, any concerns should be acknowledged with feedback on how the issues will be managed and how community input has influenced the EIP and management of the biosolids. In such high-interest situations, a summary table of issues raised and responses to them should be provided to EPA.

Throughout the scheme, it is important that the user and/or supplier maintain records of all complaints and rectification actions. Complaint records should include the details of the incident (including the nature of the complaint, time and date), the outcome of the investigation and actions taken. The names and contact details of complainants should be recorded; however, access to any complainant's personal details must be restricted. Complaint records should be made available, on request, to EPA.

EPA's Community and Stakeholder Engagement team can provide further advice to businesses on how to plan and conduct community consultation that will meet EPA's requirements.

3.1.4 Agreements

A formal agreement should be developed between the supplier and end user of the biosolids. An agreement should also be in place with the site owner to demonstrate who will be responsible for the ongoing management of the land once construction activities are completed.

Topics that should be addressed in the agreement include:

- definition of roles and responsibilities
- cost of biosolids, contract duration and provisions for contract variations
- biosolids characteristics (source, quality, quantity and supply reliability)
- when, where and for what purpose the biosolids are to be used
- responsibility for site operation, maintenance, monitoring, site ownership and auditing processes
- the implementation of management controls in the EIP
- other issues relevant to the parties.

While the details of these formal agreements do not need to be included in the EIP, they should be referred to for details as appropriate in relevant Sections of the EIP.

3.1.5 EPA Victoria

It is EPA's responsibility to ensure that these Guidelines are implemented effectively throughout Victoria by assessing proposed EIPs and undertaking inspections of selected end-use schemes during construction.

EPA is also responsible for reviewing these Guidelines from time to time to reflect additional relevant information or research.

Other government departments also have roles relevant to biosolids management, as outlined in Section 3.1 of publication 943.

3.2 Risk identification and management

The risks posed will vary depending on the end-use location, construction type, biosolids volume and contaminants, and degree of biosolids amendment required.

3.2.1 Environmental risk

Biosolids end-use schemes must protect beneficial uses of soils, groundwater and surface waters as outlined in the relevant SEPPs (see publication 943, Section 2.1).

Unlike in land applications, the nutrient content of geotechnical fill biosolids is not utilised and needs to be managed for the long term.

The risk of nutrients or other contaminants leaching or eroding from the geotechnical fill must be identified and managed, to ensure there are no detrimental impacts to surface waters or groundwater. Environmental risks are expected to be less where biosolids are capped (for example, beneath a sealed road surface), elevated above ground level (for example, in an overpass) or where biosolids are amended with a stabilising agent or additive (such as cement) to improve structural properties.

To mitigate risks to the environment, biosolids used for geotechnical fill must be managed in accordance with Section 6.2. They should be contained and managed in a similar manner to Category C prescribed waste (see EPA publication 788, *Siting, design, operation and rehabilitation of landfills*).

3.2.2 Human health risk

Human health risks will need to be assessed, including risks to site workers placing the biosolids, maintenance workers (after development) and incidental site users. Refer to Section 3.2 of publication 943 for further information.

3.2.3 Legal risks

Biosolids used for geotechnical fill are expected to remain in place for the lifetime of the structure, with negligible natural attenuation of nutrients or contaminants. Therefore, in addition to legal requirements outlined in publication 943 (Section 3.2), proponents should make specific plans to address the legal implications of long-term monitoring and management requirements for geotechnical fill biosolids, including issues that may arise from change of land ownership or change in land use.

3.2.4 Engineering risks

The EIP approval process requires confirmation that the end use will beneficially utilise geotechnical properties of the biosolids. However, the EIP process should not be relied on to guarantee that geotechnical properties of biosolids are suitable for any specific end use.

It is the responsibility of the end user to determine whether the biosolids have geotechnical properties suitable for a specific end use (before or after amendment). Similarly, it is the end user's responsibility to ensure that geotechnical fill is placed appropriately to meet construction specifications.

ROLES, RESPONSIBILITIES AND RISK CHECKLIST

Objective

To ensure that suppliers and users of biosolids understand and meet their obligations in terms of compliance with these guidelines.

Suggested measures to meet objective

Supplier

- Ensure end-use schemes have an EPA approved EIP including auditor assessments.
- Adhere to the EIP in partnership with the end user.
- Conduct adequate sampling and analysis to confirm biosolids quality (Section 4).
- Develop an agreement covering the respective interests and obligations of suppliers and users.
- Identify and assess risks posed by the supply of biosolids.
- Monitor, report and audit biosolids schemes it supplies in accordance with these Guidelines.
- Maintain a register of biosolids users it supplies and submit this information to EPA as required.
- Ensure staff and end-user awareness of the legislation, codes and Guidelines relevant to the use of biosolids.

User

- Enter into and adhere to an agreement with the supplier.
- Adhere to the EIP in partnership with the supplier.
- Identify and assess risks posed by the use of biosolids.
- Ensure an EPA works approval and licence or a site-specific exemption is obtained if the end use does not meet the Guidelines' requirements.
- Ensure staff and site owner awareness of the legislation, codes and Guidelines relevant to the use of biosolids.

4 BIOSOLIDS CLASSIFICATION

In these Guidelines, classification of biosolids is based on contaminant concentrations in the biosolids and the treatment grade of the biosolids. There will also be geotechnical requirements the end user will need the biosolids to meet as part of contractual arrangements.

Biosolids classification is largely the responsibility of the supplier. However, it will have implications for the end user in terms of management and possible onsite storage.

To ensure the environment and human health are protected, all biosolids intended for use as geotechnical fill are classed as 'restricted grade'. As a restricted-grade product, an EPA-approved EIP (or works approval and licence) is required before use is permitted. There is currently no unrestricted grade classification for geotechnical reuse (see Section 9).

4.1 Contaminant grade

4.1.1 Sampling and analysis

Sampling of biosolids stockpiles for contaminant grading should follow EPA publication IWRG621, *Soil hazard categorisation and management*.

The key sampling and analysis requirements of publication 1178 are:

- For each stockpile, a minimum of 10 samples should be collected to allow calculation of the 95% upper confidence limit (UCL) of the stockpile's average concentration.
- Larger stockpiles should meet a sampling frequency of at least one sample per 250 cubic meters.
- Samples should be analysed for all parameters listed in Table 1 below.
- Both concentration and leachable fractions (ASLP) data should be measured for those contaminants listed.
- A 95% UCL of the average concentration and leachable fraction should be calculated for each contaminant.

For very large biosolids stockpiles (more than 5000 m^3) a producer can apply to EPA for a reduced sampling rate. To obtain EPA approval, the producer must demonstrate that the stockpile is homogeneous (with an expected low variation in contaminant concentrations).

4.1.2 Contaminant grading

To be acceptable for geotechnical reuse, the biosolids must meet the contaminant concentration and leachable fraction criteria listed in Table 1 below. The criteria are defined as the 95% UCL of the average (mean) concentration and leachable fraction for those contaminants listed.

Biosolids that exceed any of the contaminant or leachable concentrations listed in Table 1 are not permitted for geotechnical reuse in accordance with these Guidelines.

The Table 1 contaminant concentration limits are less stringent than the limits described in EPA publication 943, as the latter is designed to protect sensitive end uses, such as food crops, whereas geotechnical applications are a less sensitive end use. However, for geotechnical reuse the biosolids must also meet leachable concentration limits that are not required by publication 943. These additional leachable concentration limits are necessary to limit the potential for leaching of contaminants from biosolids that remain as a geotechnical fill deposit for a long period of time.

There is no need to conduct leaching fraction tests in cases where total concentration data are less than 20 times the relevant Australian Standard Leaching Procedure (ASLP) thresholds. This reflects the effect of dilution resulting from the use of the ASLP (Australian Standards AS4439.2 and 44396.3).

Table 1: Maximum contaminant concentrations and leachable fractions for restricted-grade classification.

Contaminant	Concentration (total) mg/kg[1,3,4]	Leachable concentration ASLP[2,3,4] mg/L
Arsenic	500	0.7
Cadmium	100	0.2
Chromium (VI)	500	5.0
Copper	5000	200
Lead	1500	1.0
Mercury	75	0.1
Nickel	3000	2.0
Zinc	35,000	300
Cyanide	2500	8.0
Fluoride	10,000	150
Monoaromatic hydrocarbons	70	–
Polyaromatic hydrocarbons	100	–
Total petroleum hydrocarbons C_6 to C_9	650	–
Total petroleum hydrocarbons C_9 to C_{36}	10,000	–
Polychlorinated biphenyls	2	–
Organochlorine pesticides	1	–

Notes

1 Values are dry weight.

2 Australian Standard Leaching Procedure (acetate buffer) as specified in Australian Standards 4439.2 and 4439.3.

3 Values to be compared to 95% UCL of mean concentration or leachable fraction.

4 Limits adopted from EPA publication IWRG621, *Soil hazard categorisation and management* (Category C contaminated soils criteria).

4.1.3 Other contaminants

The supplier must investigate other contaminants where the sewage treatment plant receives trade waste discharges that could affect biosolids quality. This investigation should focus on contaminants that are discharged in large quantities and/or are considered high risk and are not listed in Table 1.

Sewage treatment plants receiving significant quantities of chlorinated trade wastes or other potential sources of dioxins should undertake a dioxin screen. Dioxins and furans have been detected in biosolids stockpiles. Levels should be calculated using World Health Organisation recommendations (den Berg et al., 1998).

4.1.4 Nutrients

Biosolids nutrients do not need to meet classification criteria for use as geotechnical fill. However, the concentration and leaching fraction of total nitrogen and total phosphorus must be measured and documented in the EIP.

Further, the EIP must include appropriate controls to manage the risks posed by nutrients to the environment and human health.

4.1.5 Biosolids amendment

Biosolids may be amended with materials such as clay, cement or lime to improve geotechnical properties. In most cases the amendment process would be expected to stabilise the biosolids and reduce associated human health and environmental risks.

Proponents need to demonstrate to EPA that the amended biosolids do not pose any risk to human health or the environment that is over and above the risk identified from 'as-sampled' biosolids.

4.1.6 Improving contaminant grading

Amendment processes that produce restricted-grade biosolids by diluting higher grade biosolids with more contaminated material will not typically be accepted by EPA.

4.2 Treatment grade

4.2.1 Acceptance criteria

The characteristics of biosolids used for geotechnical fill must meet at least T3 restricted-grade treatment criteria (in other words, T1, T2 or T3 criteria defined by publication 943). T3 criteria are reproduced in Table 2 below.

The treatment grade requirement aims to satisfy three main criteria:

- the adoption of a prescribed treatment process with minimum performance criteria (for example, temperature/time)
- microbiological limits to demonstrate that the defined treatment processes are operating effectively
- measures for controlling bacterial regrowth, vector attraction (for example, insects, birds, vermin) and generation of nuisance odours.

Table 2: Minimum treatment grade requirements for geotechnical reuse of biosolids.

Treatment grade T3
Routine monitoring (of prescribed processes listed below) <2,000,000 E.coli MPN/g (dw) (90th percentile). **Alternative process** Based on E.coli criteria and 1 log reductions in Salmonella and enteric viruses. Vector attraction reduction controls also required (see Table 3).
Anaerobic digestion ≥15 days at ≥35 °C or ≥60 days at ≥15 °C.
Aerobic digestion ≥40 days at ≥20 °C or ≥60 days at ≥15 °C.
Composting aerobic conditions maintained ≥5 days at ≥40 °C including ≥4 hours at ≥55 °C.
For all grade T3 treatment processes: Relevant vector attraction reduction controls (see Table 3) and biosolids that, coupled with management controls, does not generate offensive odours.

For T3 biosolids, *E.coli* samples should initially be taken every 100 dry tonnes, but can be reduced to periodic samples (for example, 200-500 tonnes) once a stable process has been demonstrated.

Alternative treatment processes not listed in Table 2 which achieve T3 treatment grade or better will also be considered by EPA.

Biosolids that exceed the restricted grade treatment criteria (in other words, T4) are not covered by publication 943 or these Guidelines and may be subject to EPA works approval and licensing.

4.2.2 Reducing vector attraction and odour

The US EPA defines 'vectors' as any living organisms that are capable of transmitting pathogens from one organism to another, either:

- mechanically, by transporting the pathogen

or

- biologically, by playing a role in the life cycle of the pathogen.

Vectors include flies, mosquitos or other insects, birds, rats, and other vermin. The transport of pathogens by vectors can be controlled by any of the following:

- biological processes, which break down volatile solids, reducing the available food nutrients for microbial activities and odour-producing potential
- chemical or physical conditions, which stop microbial activity
- physical barriers between vectors and volatile solids in biosolids.

Vector attraction reduction ('VAR') options are summarised in Table 3.

Biosolids must satisfy both the relevant VAR process and the treatment (pathogen reduction) process to determine the specific treatment grade of the product. In some cases, achieving the defined treatment process for pathogen reduction will also provide compliance with the appropriate VAR measure. To inhibit pathogenic regrowth VAR requirements (particularly for grade T1 and T2 biosolids) should be met after or concurrent with pathogen reduction.

Some VAR methods are only effective for biosolids produced from certain treatment or stabilisation processes (see third column of Table 3).

Processes other than those listed can be used, but they require case-by-case verification and subsequent EPA approval.

Important note: the VAR measures listed in Table 3 are not developed specifically for the control of offensive odours, although some of them might reduce odour.

A generic requirement to avoid generation of offensive odours applies to all biosolids application schemes and, accordingly, this requirement may necessitate additional stabilisation to that suggested in Table 3.

Table 3. Suggested vector attraction reduction requirements (derived from US EPA 2003).

#	Suggested VAR requirements	Suitable biosolids process
1	Biosolids treatment process reduces volatile solids by ≥38%	All biological anaerobic or aerobic processes
2	Biosolids containing stabilised solids only, dried to ≥75% solids content	Fully stabilised by anaerobic or aerobic process
3	Biosolids containing unstabilised solids, dried to ≥90% solids content	Heat-dried biosolids
4	Aerobic treatment for ≥14 days at minimum 40 °C and average >45 °C	Composted
5	Biosolids pH raised to ≥12, and without addition of further alkali pH maintained at ≥12 for 2 hours and then at pH ≥11.5 for an additional 22 hours	pH (alkali/lime addition) and temperature

4.2.3 Sampling and analytical QA/QC

Sampling frequency should follow EPA publication IWRG621, *Soil hazard categorisation and management*. Sample collection methods and analysis should be done under the direction of suitably qualified persons in accordance with EPA publication IWRG701, *Sampling and analysis of water, wastewater, wastes and soils*. All sample testing must be undertaken by a National Associated Testing Authorities (NATA)-accredited laboratory.

4.3 Classification summary

Classification of biosolids for geotechnical reuse is summarised in Table 4. All of the criteria listed in Table 4 and any specific end user requirements must be met for biosolids to be considered suitable for geotechnical reuse in accordance with these Guidelines.

Table 4: Biosolids classification summary for geotechnical reuse.

Criteria	Restricted grade
Contaminants	Table 1 criteria
Nitrogen & Phosphorus	Managed in EIP controls
Amendment process	No new or increased human health or environmental risk
Treatment grade	T1, T2 or T3 criteria (Table 2 and Table 3)

Biosolids that meet all restricted-grade criteria listed in Table 4 will require an EPA-approved EIP to be permitted for use as geotechnical fill.

Biosolids that do not meet all restricted-grade criteria outlined in Table 4 are not covered by these Guidelines and may require EPA works approval and licensing.

BIOSOLIDS CLASSIFICATION

Objective

To ensure that biosolids quality is appropriate for geotechnical reuse.

Suggested measures to meet objective

- Conduct biosolids stockpile sampling and analysis in accordance with EPA publication IWRG621.
- Ensure that the biosolids meet Table 1 concentration and leachable fraction criteria.
- Ensure nutrients are measured and managed appropriately by the EIP.
- Ensure biosolids amendment processes do not pose an environmental or human health risk.
- Ensure that other contaminants are not introduced to biosolids from trade waste.
- Ensure that the biosolids meet at least T1, T2 or T3 treatment process requirements, microbiological standards, vector attraction reduction requirements and odour management.

5 PERMITTED END USES AND RESTRICTIONS

5.1 Background principles

For biosolids used as geotechnical fill to qualify as 'sustainable use', the properties of the biosolids must be utilised in a beneficial way. A thorough analysis of all potential beneficial uses of biosolids must be undertaken to determine the optimal use that maximises resource efficiency outcomes. Uses that demonstrate multiple benefits such as beneficial use of organic matter and nutrient content are generally preferred to geotechnical reuse.

Assessment of beneficial uses of biosolids should be undertaken prior to any amendment process - to prevent having the beneficial use of the biosolids' nutrients or organic matter excluded by a pre-emptive amendment process. The amendment process should be considered as part of the assessment of beneficial uses.

Examples of circumstances in which geotechnical reuse may be identified as the optimal reuse option include those where:

- unintentional mixing of biosolids with clay has occurred during the sludge drying process
- land application is not a viable option, or is prohibited due to the contaminant grade
- Life Cycle Analysis indicates geotechnical reuse will provide the best practicable environmental outcome.

In situations where unintentional mixing of biosolids with clay has occurred, the EIP should identify ways in which inadvertent mixing of biosolids can be reduced or avoided in future, to maximise reuse potential.

For a proposal to qualify as a sustainable use for geotechnical purposes, the properties of the biosolids must be used in a beneficial way to substitute for non-renewable materials such as quarried fill material. Biosolids schemes for general filling of voids that do not demonstrate a beneficial use of the geotechnical properties of biosolids are not permitted under these Guidelines and may be subject to EPA works approval and licensing.

Use of biosolids must be planned and managed so that the current and future beneficial uses of land are not sacrificed, regardless of the land's current land-use zoning. Consideration should also be given to how the requirements for ongoing monitoring and management can continue to be met even if there is a change in land ownership or land use.

Proponents should undertake a consultation process with the local community surrounding the proposed reuse site. The degree of public consultation required will depend on the size of the project and its proximity to sensitive and/or residential areas. Proponents should take into account any feedback from the community when developing an EIP for EPA approval (see Section 3.1.3).

The principles of sustainable reuse set out in Section 1.2 must also be met.

5.2 Permitted end uses

The background principles outlined in Sections 1.2 and 5.1 are aimed at ensuring other, more desirable beneficial uses, such as land application, are not overlooked.

When suppliers are undertaking an assessment of possible end uses, a Life Cycle Assessment and Triple Bottom Line Analysis should be undertaken to compare the net environmental gains, sustainability and economics associated with the following three alternatives:

- permitted end uses provided for by publication 943
- geotechnical reuse
- energy recovery.

The outcome of the assessment process should be reported in the EIP.

If assessed as suitable for geotechnical reuse, biosolids may be used in construction applications such as in roadways, roadway embankments or building pads. Construction of objects such as noise mounds or landscaping will generally not be considered as an acceptable end use, if no use of geotechnical properties can be demonstrated[2].

Geotechnical end uses where biosolids deposits remain exposed (uncapped) after development will not be permitted, due to the risk of leaching or run-off of biosolids material and possible risks associated with human contact with biosolids. Geotechnical end uses should be designed to ensure that the environment and human health are protected during and after construction and that biosolids deposits remain undisturbed after construction.

To be approved for geotechnical reuse in accordance with these Guidelines, a biosolids placement proposal must ensure the environmental risks are managed appropriately. In some cases, such management will involve permanently 'capped and lined' deposits, because biosolids can contain contaminant concentrations equivalent to Category C contaminated soils. However, no leachate collection system is required for a comprehensive EIP (see Section 8). By comparison, Category C contaminated soil reuse requires an EPA works approval and licence or exemption (and may require a leachate collection system).

[2] Reuse as landfill cover is not classified as geotechnical reuse and is not covered by these Guidelines. Refer to EPA publication 943 and scheduled premises requirements for landfills.

The less restrictive controls on biosolids reuse (compared to Category C contaminated soils) are appropriate because:

- biosolids have a known origin and history, whereas soils can be sourced from a variety of sites with different histories
- biosolids contaminant types and sources are generally well known and understood, whereas contaminants in reused soil may be unknown
- biosolids contaminant concentrations are typically at the lower end of Category C contaminated soil concentrations
- biosolids are a uniform material, whereas soil may be a mixture of fill material, natural soil and other wastes
- the organic matter content of biosolids binds contaminants, resulting in lower leaching potential than most soils.

PERMISSIBLE END USES

Objectives

To ensure appropriate control measures are implemented for specific end uses, so that the risk to the environment and human health is minimised.

Suggested measures to meet objective

- Ensure that geotechnical reuse is the most sustainable reuse option.
- Ensure biosolids quality meets contaminant and treatment grade requirements.
- Manage risks to human health and the environment from biosolids contaminants, nutrients, odour and pathogens during and after construction.
- Only use biosolids in geotechnical applications where there will be ongoing environmental protection measures in place (for example, 'capped and lined' deposits).
- Include ongoing monitoring and maintenance of biosolids deposits.

6 SITE SELECTION AND MANAGEMENT

Once the biosolids grade and feasible end uses have been determined, the suitability of potential end-use sites needs to be evaluated and appropriate management practices adopted.

6.1 Site selection

The initial phase of site selection and assessment should begin with a screening process. This activity may identify characteristics that will typically make a site unsuitable for placing biosolids as geotechnical fill, unless the characteristics can be addressed through detailed management controls. For example, geotechnical reuse of biosolids would not typically be permitted where:

- the site is classified as a sensitive land category (publication 943, Section 5.3)
- the site is subject to frequent waterlogging or flooding (within the 1-in-100-year flooding zone)
- minimum buffer distances cannot be met (Table 5)
- biosolids may be exposed to erosional processes (including use in unsealed roads)

or

- there is deemed to be an unacceptable risk to beneficial uses of surface water, groundwater or land.

For groundwater protection, biosolids deposits should always be placed two metres above the long-term average groundwater depth, with a liner below the deposit to avoid all contact with groundwater[3]. Biosolids deposits should not be established or extended into any area where an aquifer contains Segment A (A1 or A2) groundwater (as defined by the *SEPP: Groundwaters of Victoria*), unless the proponent satisfies EPA that sufficient design and management practices will be implemented.

As for all biosolids reuse, these Guidelines do not provide a complete list of site suitability factors. Any unique site features that may pose a potential human health or environmental risk should be identified and managed on a project-specific basis.

6.2 Site management practices

Geotechnical reuse of biosolids requires 'cradle-to-grave' management of potential human health and environmental risks. This includes during:

- site preparation
- biosolids amendment
- biosolids transport and storage
- application at construction sites
- monitoring post application
- transfer of ownership or change of use.

For each site a proponent should assess how the use of biosolids in construction could potentially impact upon:

- beneficial uses of land (in accordance with the *SEPP Prevention and Management of Contamination of Land*)
- beneficial uses of surface water or groundwater (in accordance with the *SEPP Groundwaters of Victoria* and *SEPP Waters of Victoria*)
- amenity and odour (in accordance with the *SEPP: Air Quality Management*)
- human health (site workers and site users);

Management plans are required during construction to protect the environment. Up to two plans should be prepared and submitted with an EIP:

- A construction management plan (CMP) to manage biosolids handling during construction and prevent off-site discharges or odour.
- If lining and encapsulation is required for biosolids deposits, a construction quality assurance plan (CQAP) is needed to ensure that the construction works meet the design standards in Section 6.2. The CQAP must be assessed by an EPA-appointed auditor (Appendix A) to ensure that the construction works meet the design standards.

After construction is completed the potential for environmental or human health impacts would be largely mitigated by the construction design. However, ongoing monitoring and site-use controls should be included in the EIP to ensure biosolids deposits are not disturbed.

Generic buffer distances for the end use are required to manage potential off-site impacts of contaminants. Buffer distances appropriate to geotechnical reuse differ from those defined in publication 943, because:

- the nutrient content of the biosolids is not reused and can pose an additional environmental risk
- the nature of a construction project and end use may increase or decrease environmental or human health risks.

Buffer distances of at least 200 m from residential areas should usually be maintained, although biosolids reuse in freeways or roads (that may pass through residential areas) is permitted, provided that appropriate management controls are in place.

Biosolids reuse as a structural fill beneath building pads in commercial/industrial zones is permitted, provided that the buffer distances in Table 5 are met and that end-user construction safety specifications can be met.

[3] If fill is required to achieve two-metre separation from groundwater, then the proponent should use natural or imported fine-grade soil with a cation exchange capacity of about 10 mEq/100g (for contaminant attenuation).

Table 5: Recommended buffer distances (metres) for biosolids used as geotechnical fill

Land Uses	Buffer distance[1, 2] (m)	Additional requirements
Surface waters (excluding stormwater drains)	100	Not within the 1-in-10-year flood zone for rivers or streams
Drinking water bores	100	–
Other bores	25	–
Farm dams	25	–
Animal enclosures	10	–
Fence lines, lighting poles, power lines, traffic lights, signs, etc.[3]	5	Structures should not contact or pass through the biosolids deposit, cap or liner
Road intersections	5	Not within areas where frequent subsurface maintenance work may occur
Underground services (water, power etc)[3]	5	Services should not be located within or below the biosolids deposit, cap or liner
Stormwater drains, infiltration pits and grates[3]	5	No erosion/run-off of biosolids material is permitted
Sensitive areas (5.3)	50	–

1 Increased or decreased buffer distances may be appropriate, depending on gradient, location, geology and type of geotechnical application.

2 Assumes biosolids deposits are capped with compacted clay (infiltration less than 1 x 10^{-9} m/s), concrete, asphalt or a similar low- permeability material.

Buffer distances may not apply if biosolids deposits are located at least one metre vertically beneath the maximum depth of structure or service line.

6.2.1 Site preparation

Prior to biosolids use, suppliers and users must have received the necessary approvals from EPA and the relevant civil works and planning authorities. Storage areas must also be prepared to ensure compliance with these Guidelines and contract specifications.

Construction of any groundwater, surface water and stormwater pollution controls must also be undertaken as part of the site preparation and should be incorporated in to the construction management plan attached to the EIP.

6.2.2 Transport and storage

Transport

The transport of biosolids and any associated impacts should be considered when assessing alternative reuse options and any life cycle assessment and triple bottom line analysis conducted.

The transport of biosolids is not subject to EPA prescribed waste regulations. However, biosolids are considered a controlled waste under the *National Environment Protection Measure (Movement of controlled wastes between States and Territories)*. Therefore, the approval of the relevant regulator is required before interstate movement.

Where vehicular transport of biosolids is required, it should be managed to avoid spillage, odours or contamination of the product.

Suggested best-practice measures include:

- choosing transport routes and sites to minimise impacts on public amenity
- ensuring the quantity of biosolids supplied to the transporter is delivered to the user
- using fully enclosed or sealed tankers or trailers with locks and watertight tailgate seals
- waterproof covers for loads (particularly if biosolids are excessively wet or dry/dusty)
- ensuring vehicles used to transport biosolids are not contaminated with wastes (for example, residues of prescribed wastes) that will impact upon biosolids quality
- cleaning of truck tailgates and tyres prior to leaving production and application sites to avoid carryover or spills to roads
- preparation and implementation of an incident management plan to ensure rapid clean-up of transport spills (preferably by dry methods). Note: flushing of spilt biosolids down drains is prohibited and will result in enforcement action being taken by EPA.

Storage

Biosolids should be stockpiled and stored in a manner that will avoid impacts on the beneficial uses of groundwater and surface waters, and avoid generation of offensive odours beyond the site boundary.

Medium to long-term biosolids storage should preferably occur at dedicated facilities at the generation or treatment site. Only short-term storage (fewer than 60 days and preferably fewer than 30 days) should typically occur at the end-use/application site, unless logistics require longer-term storage and environmental protection can be assured. If biosolids are stored at the application site:

- where practical, biosolids should be stored undercover or retained within a bunded storage area with an impermeable to low-permeability base and designed to capture the first flush of contaminated run-off
- water from bunded storage areas should be disposed of to sewer or used for dust suppression on-site (provided there are controls to protect against off-site discharge to surface water or stormwater)
- stockpile areas should be located on a slope of less than five per cent

- the buffer distances listed in Table 5 must be adopted
- to minimise off-site odour and dust generation stockpiles should not be turned or broken up on windy, dry days, (light watering of stockpiles can be undertaken to control dust generation)
- where bunding and an impermeable base is not practical at the application site: the stockpiles should be located on flat land, and the top surface sloped to reduce water penetration; stormwater flow into the storage site should be diverted; increased buffer distances to surface waters may be required; and the duration of storage should be minimised.

6.2.3 Design standards

Biosolids used as geotechnical fill should be deposited so as to avoid leaching or runoff due to contact with surface water or groundwater, and clearly identified as biosolids in case of future works. These requirements can be achieved by managing the risks as follows.

- Selection of biosolids that have been characterised by scientifically established and recognised indicators of geotechnical value, indicators of low risk of gas generation and indicators of chemical and biological compliance with classification criteria as set out in Section 4.
- Physical demarcation of biosolids by in-situ marker layers (as described below) to ensure that placed biosolids are not confused with natural earthen materials in future.
- Measures to avoid contaminant or nutrient leaching or run-off to surface water or groundwater. This may be demonstrated through a combination of low contaminant leachability fractions, insignificant nutrient levels, adequate buffer distances to surface water and groundwater, and capping (often via overlying road structure) that protects the deposits from water ingress. Where these do not provide adequate protection, a cap, liner and encapsulation will be required as outlined below.
- Systematic documentation of the biosolids used as a physical asset subject to asset management requirements, assuming that the management systems controlling this documentation and its use are subject to ongoing audit of the relevant EIP.

Further details of requirements for marker layers, caps, liners and encapsulation are set out below. However, alternatives to the design requirements described below may be approved, provided the EPA is satisfied that the alternative provides at least an equivalent environmental outcome.

Marker layer

A marker layer of geosynthetic mesh (or equivalent) should be placed on the compacted surface of the top layer of the biosolids (in the upper layer of cap), to provide a physical indication of the location of the biosolids. The material used for a marker layer should be:

- easily identifiable as a biosolids marker layer if unearthed at a later date
- of one type per construction project (or across multiple construction projects for the same site owner)
- described in the EIP.

Cap

The cap must be designed so that seepage through the cap is no more than 75 per cent of the anticipated seepage rate through the liner. Biosolids deposits should be capped using a low-permeability capping layer (such as clay) at least one metre deep, with a permeability no greater than $1x10^{-9}$ m/s. Concrete, asphalt or HDPE membranes are examples of materials that could be used in a composite cap, in addition to clay.

It will be important to demonstrate in the EIP how the cap can be monitored and maintained to prevent erosion, cracking, flooding or other processes from affecting the integrity of the cap.

Liner

Biosolids deposits should be lined beneath using a low-permeability layer (such as clay) at least one metre deep, with a permeability no greater than $1x10^{-9}$ m/s (or equivalent). In considering the nature of the liner required it is important to assess:

- depth to groundwater and ability of the liner to prevent biosolids or leachate from contacting groundwater
- elevation relative to the 1-in-100-year flood zone and ability of the liner to protect biosolids deposits from flood inundation.

A leachate collection system will generally not be required, as the biosolids deposits would only be open for a short period of time during construction and little water ingress would be expected.

Encapsulation

In cases requiring the use of a liner, the cap must join the liner at the base of the biosolids deposit to prevent water ingress. This construction method is known as *encapsulation*, where a 'dry tomb' is created for the biosolids.

Note that a marker layer should always be placed on both the top and sides of the biosolids deposit, to ensure that any excavation at a later date would encounter the marker before the biosolids layer is reached.

Further details on construction design standards for cap and liner systems are outlined in EPA publication 788, *Best practice environmental management for siting, design, operation and rehabilitation of landfills*.

6.2.4 Management controls during construction

Application of biosolids as geotechnical fill should be carried out under separate management and supervision from other works within or adjacent to construction areas. This will enable construction equipment used for biosolids to be kept separate from the equipment being used for other materials, ensuring that inadvertent cross-contamination will be avoided. The use of cement or water for moisture conditioning of the biosolids should also be separate from other construction operations.

Level 1 supervision (as defined in Australian Standard AS 3798) should be provided during application of biosolids for geotechnical fill.

In cases requiring a liner and encapsulation, the end user must develop a construction quality assurance plan (CQAP) and submit it to EPA for approval with the EIP. The CQAP is designed to ensure that the encapsulation is constructed in accordance with its design specifications. An environmental auditor appointed under the *Environment Protection Act 1970* must prepare an environmental audit report that confirms that the biosolids deposit has been constructed in accordance with the approved CQAP (see Appendix A for auditor guidance).

Placement and compaction

The placement and compaction of biosolids will depend on the type of civil works, location and end-user requirements.

Biosolids should be applied in a systematic manner, consistent with engineering design standards. Control measures will be required to allow for the ongoing containment, monitoring and management of contaminants and should be included in the EIP.

Cleaning of machinery and other equipment used in the application of biosolids should be undertaken to avoid off-site contamination or cross-contamination with other construction materials.

Application timing and wind speed

Placement of biosolids as geotechnical fill should occur in the drier months, when conditions are conducive to undertaking earthworks. Application should not occur during rainfall events.

Construction activities involving biosolids should always be undertaken with good practice management measures to minimise dust and aerosol generation.

Application frequency

Once initial construction works are completed and commissioned, no additional biosolids should be used for geotechnical purposes at a site (including for any repair or maintenance work).

Stormwater and leachate management

The proponent must demonstrate that appropriate stormwater and sediment control measures are in place for the construction activity to control run-off. These controls are required for all construction activities, regardless of whether biosolids are used or not. Refer to EPA publication 275, *Construction techniques for sediment pollution control*.

Buffer distances for protection of stormwater are specified in Table 5. In addition, the biosolids require protection from infiltration and leaching of contaminants through:

- application of a low-permeability capping layer
- prohibiting subsurface maintenance or construction work that could affect the cap integrity after the cap is complete.

Signage and site access restrictions

Measures need to be taken to restrict access of the general public to the site until construction is complete. These measures will involve erection of prominent warning signs in compliance with AS 1319 – *Safety Signs for the Occupational Environment*. Other measures such as fencing would typically be employed for any large-scale construction project.

Withholding periods are generally not necessary for geotechnical reuse of biosolids, as the material is capped during construction.

Occupational health and safety precautions

As 'restricted-grade' biosolids may contain pathogens and chemical contaminants that require management, routine occupational health and safety (OH&S) precautions should be practised, including:

- education of on-site workers as to the risks associated with exposure to biosolids (ingestion or inhalation of biosolids dusts)
- worker immunisations where appropriate
- provision of washbasins and showering facilities
- no food or drink consumption while directly working with biosolids, and washing hands before meals or smoking
- adopting techniques that minimise the generation of mists and airborne dust; for example, using wet sweeping (but not flushing) techniques rather than dry sweeping, and avoiding use of high-pressure equipment such as water jet sprays or air pressure devices
- minimising worker access to the site during biosolids application, keeping workers upwind during application and using protective equipment; for example, eye protection and masks should be worn if dusts/aerosols are generated, and gloves should also be worn to minimise dermal contact.

Employers should make themselves aware of, and carry out, their OH&S responsibilities and duties under

the *Occupational Health and Safety Act 2004*. An OH&S plan should be prepared in consultation with Health and Safety Representatives and relevant employees, which includes integrating staff training and safe practices into day-to-day work procedures. WorkSafe Victoria has a number of booklets that assist in establishing a health and safety management program. These are available from WorkSafe Victoria offices.

OH&S requirements will also need to consider risks to maintenance workers (or other persons) that may encounter biosolids after construction.

6.3 Monitoring

The EIP should state who is responsible for ongoing monitoring and refer to the financial and contractual arrangements in place to ensure monitoring will be carried out. The end user or site owner will usually need to take responsibility for ensuring that ongoing monitoring is carried out.

Ongoing site and end use monitoring

The frequency and nature of monitoring inspections will vary between sites that have received biosolids as geotechnical fill.

As a minimum, site monitoring should occur annually for sites that pose a minimal ongoing environmental or human health risk. Sites with a greater risk of disturbance of biosolids deposits, or of damage to capping materials, may require more frequent monitoring.

Site monitoring should at least examine the following items:

- confirmation that site activities or natural processes (such as erosion, cracking, settlement or plant growth) have not in any way disturbed biosolids deposits or affected the integrity of the cap
- identification of site activities or natural processes that could affect the integrity of biosolids deposits or cap in future
- any potential environmental or human health risks posed by the biosolids deposit not previously identified
- confirmation that the end-use activity on the site remains appropriate.

The monitoring frequency may be reduced over time if monitoring results do not reveal any potential risks to the integrity of the biosolids deposit. EPA approval would be required prior to any reduction in monitoring frequency or scope.

If monitoring identifies damage or cracking of the capping materials (see Section 6.2), then the end user must take action immediately to repair the damage and prevent water ingress to the biosolids deposit.

6.3.1 Groundwater and surface water monitoring

Groundwater or surface water monitoring during construction may be required if there is an identified risk to beneficial uses of these resources, or where the buffer distances specified in Table 5 are reduced.

Groundwater or surface water monitoring would not normally be required after construction is complete for biosolids deposits that are capped, although demonstration of a low leaching potential is necessary (see Table 1).

6.4 Subsequent works or changes in end use

It is possible that in the future a structure that has used biosolids as a geotechnical fill may require works for modification or upgrade, or to allow a change in land use (for example, widening or realignment of a freeway).

If works are required that could affect biosolids deposits (including the cap or liner) the end user must contact EPA prior to any works commencing and obtain EPA approval for:

- any changes or modifications to the cap and liner system surrounding the biosolids
- transport and reuse of biosolids material if it is to be moved off-site.

The buffer distances in Table 5 should prevent most minor works from disturbing biosolids deposits. However, utility services could potentially install new service lines (for example, stormwater or lighting) that could affect the integrity of biosolids deposits.

The proponent must be able to demonstrate that such works can be managed. This may require giving copies of maps and other documentation showing the location of biosolids deposits to utility service providers.

The proponent must demonstrate in the EIP that there are record-keeping and monitoring controls in place to ensure works can be handled appropriately, as described above.

6.5 Auditing

As detailed in Section 6.2, if encapsulation is required an auditor appointed under the *Environment Protection Act 1970 must sign off that construction has occurred in accordance with the approved CQAP*.

*Further to this, b*iosolids schemes and EIPs should have a broader audit program. The scope, frequency and whether an EPA-appointed auditor is used for this auditing depends on the size of the scheme and level of risks associated.

SITE SELECTION AND MANAGEMENT

Objective

To ensure that only sustainable end-use sites are selected, that appropriate design principles are applied and that any associated potential risks are effectively managed and monitored.

Suggested measures to meet objective

- Biosolids are not used on unsuitable sites, unless there is detailed assessment and mitigating controls can be implemented.
- Transport of biosolids involves appropriately sealed vehicles, low-impact road routes, vehicle cleaning and incident (spill response) management plans.
- If biosolids storage at a site is needed, appropriate management practices are implemented.
- At suitable sites, biosolids are applied in accordance with guidance on methods, timing and frequency.
- During development a construction management plan is used to ensure there is no off-site movement of micro-organisms, nutrients, chemicals or offensive odours.
- Biosolids are placed in appropriately capped and (where required) lined deposits in accordance with a construction quality assurance plan. An EPA-appointed auditor must assess compliance with the CQAP during construction.
- Implement occupational health and safety responsibilities and duties under the *Occupational Health and Safety Act* 2004 (see Section 6.2.3).
- Biosolids deposits are protected from disturbance after development.
- Undertake ongoing monitoring of site usage and the integrity of capped and lined biosolids deposits.

7 RECORD KEEPING AND INFORMATION TRANSFER

Information transfer and record keeping are both essential components of a management framework for ensuring sustainable biosolids use. In this Section, the requirements for information transfer and record keeping are discussed with regard to:

- generators, who need to supply information to users and reprocessors and also retain records relating to the quality, quantity and destinations of biosolids produced
- reprocessors, who need to maintain records regarding the quality and quantity of biosolids inputs and outputs
- users and site owners, who need to maintain records relating to biosolids quality, construction design and location, management controls and ongoing monitoring controls.

This Section also describes the requirements for supply of information to organisations such as EPA, and for reporting of non-compliance.

7.1 Producer requirements

7.1.1 Record keeping

Producers of restricted-grade biosolids for geotechnical reuse should record:

- contaminant concentrations and leachable fractions, and batch grade
- historic trends of contaminant levels
- treatment process, microbiological testing, stabilisation method and resultant treatment grade
- concentrations of nitrogen, phosphorus and other relevant nutrients in biosolids
- details of incidents and the corrective action taken
- inspection and maintenance reports
- details of any materials (such as clay) that are inadvertently mixed with biosolids during the drying process
- methods to minimise inadvertent mixing in future (if this will allow land application of biosolids)
- the date on which the biosolids stockpile was completed
- details of any intentional biosolids amendment, including type and quantity of materials (for example, lime or cement) added to each biosolids batch
- evidence that biosolids contain useful geotechnical properties (refer to Appendix B)
- the biosolids' destination, volume and end use (cross-referenced to the relevant approved EIP)
- a copy of the end-user information described in Section 7.3.

For regional EIPs, the details of site-specific assessments and EPA approvals should also be recorded (refer to Section 8.2).

7.1.2 Information transfer

The producer should provide adequate information with the biosolids to inform reprocessors and users of the quality of the biosolids and relevant management controls. Information supplied should include general guidance for the protection of human health when handling biosolids and a warning that the dumping or discharge of biosolids to surface water or stormwater is prohibited. Information about geotechnical specifications may also need to be provided under construction contracts.

7.2 Reprocessor requirements

Reprocessors may undertake additional treatment or drying of the biosolids, or amend biosolids to improve geotechnical properties. Record keeping requirements are the same as those for producers (see Section 7.1). Additional record-keeping requirements for reprocessors include:

- address of the producer
- volume of biosolids and the date received from the producer
- volume and type of amendment materials added to the biosolids
- biosolids destination, volume and end use; cross-reference the approved EIP.

Reprocessors should supply to end users similar information to that described for producers to supply to end users (see Section 7.1.2).

7.3 End-user requirements

End users of restricted grade biosolids for geotechnical reuse should record:

- source of biosolids, batch identification and date received
- biosolids classification information from producer
- date of works and details of placement, clearly defining the location of the biosolids, including plans, volumes used, map coordinates and depth (as a reduced-level datum) of deposits
- occupier and site owner, including title details
- checklist of compliance with buffer distances (see Table 5)
- use as geotechnical fill (demonstrating use is not as general fill - see Appendix B), including details of amendment, type of end use and quality assurance/quality controls (including supervision reporting)
- the construction management plan and construction quality assurance plan
- groundwater quality and depth below biosolids deposits

- monitoring requirements during and after development
- notification procedures in the event of works/change in end use and transfer of records to utilities (see Section 6.4)
- cross-reference with the EIP and associated management controls
- details of site-specific assessments and EPA approvals for regional EIPs (see Section 8.2).

The end user, if not the site owner of the land on which biosolids have been applied, must provide all records, as described above, to the owner of the land at completion of the construction project. If there is a change of ownership of the site, all records are to be transferred in full to the new owner (see Section 7.5).

7.4 Transfer of information and reporting

Producers (and reprocessors, if relevant) and end users must notify EPA of any significant changes to the scheme such as changes in roles and responsibilities (for example, change of site ownership) or changes to the biosolids deposit.

Records should be made available to the EPA on request and kept for the lifetime of the structure that has been built. For construction projects this may also be required under the *Public Records Act 1973*.

At the completion of a construction project, end users should provide EPA with a statement of compliance with the EIP and any approved construction management plan. If an auditor is required, a copy of the auditor report for the construction quality assurance plan should also be provided to EPA at the completion of the works (see Appendix A).

The results of any ongoing monitoring program undertaken by the end user/owner should be provided to EPA annually, or as required.

7.5 Transfer of ownership

The capacity of the owner of the land to effectively maintain long-term records will need to be demonstrated and documented in the scheme EIP. This includes a requirement to transfer information and management responsibilities to a new owner in the event of a change of land ownership.

A covenant attached to the land title, pursuant to Section 88 (Notification of restrictive covenants) of the *Transfer of Land Act 1958,* is one method to ensure information can be transferred to a new site owner.

A site owner must consult with EPA and demonstrate the appropriate transfer of management responsibilities prior to any sale of the land.

7.6 Reporting emergencies and non-compliance

The EIP must document the circumstances under which reporting of incidents and non-compliance events should occur. It should also document who is responsible for the reporting because, depending on the incident, this may be the supplier or the end user. Examples of incidents include biosolids spills and contamination of surface or groundwater. Examples of non-compliance events may include handling or placement of biosolids in a manner inconsistent with the EIP, incorrect classification of biosolids, damage to the capping system, or failures in adequate record keeping.

The appropriate regional office of EPA should be notified of any event or emergency that significantly increases the risk to the environment (for example, spills of biosolids onto roads, or into or immediately adjacent to waterways).

The Department of Human Services should be notified in the case of an emergency or an incident that significantly increases the risk to public health.

The Department of Sustainability and Environment should be notified in the event of an emergency or event that presents a risk to native flora or fauna, National Parks, conservation reserves or other sensitive areas.

RECORD KEEPING & INFORMATION TRANSFER

Objectives

To ensure that appropriate ('cradle-to-grave') biosolids management records are maintained and effective information transfer occurs.

Suggested measures to meet objective

Records

- Producers of biosolids should maintain records and supply these to EPA, the reprocessor or subsequent user, as relevant.
- Reprocessors should maintain records and supply these to EPA or the subsequent user as relevant.
- Biosolids users and suppliers should retain appropriate records of all details of the location and construction of biosolids deposits.
- In the event of a change in land ownership, EPA must be notified and measures taken to ensure responsibilities for ongoing monitoring and management of biosolids deposits are transferred to a new owner.

Emergency Incidents

- Significant incidents (involving environmental or public health) associated with biosolids use must be promptly reported to the relevant regulatory body.

8 ENVIRONMENT IMPROVEMENT PLANS

The development of an EIP is a key component of sustainable biosolids use. An EIP should bring together all the roles and responsibilities, management and monitoring practices that are necessary to ensure a safe, sustainable and compliant (and therefore successful) biosolids end-use scheme.

For geotechnical reuse, an EIP will be required for all schemes. Biosolids suppliers must ensure that restricted-grade biosolids are only supplied to schemes that have an approved EIP.

8.1 Preparing an EIP

A documented EIP should be based on the specifics of the end-use scheme and environmental risks posed, and should draw on the objectives, concepts and suggested measures and practices described throughout Sections 2 to 7 of these Guidelines.

The prime objectives of an EIP should be to:

- demonstrate that the performance objectives of these Guidelines can be achieved by detailing the procedures and practices that will be followed
- address all aspects of the scheme that pose a risk to the environment, amenity (odour), or human or stock health
- provide a framework for assessing the long-term performance of the biosolids scheme.

An EIP for geotechnical reuse of biosolids should at least address or refer to the relevant document that addresses the following:

- roles and responsibilities, outlining clear accountability for each stage of the scheme and how this will be achieved
- biosolids transport, storage and distribution systems
- biosolids quantity and classification in terms of treatment and contaminants
- site assessment, including buffer distances (see Table 5) and identification of site-specific risks to groundwater, surface water, land and health
- details of the end use, demonstrating reuse of the biosolids geotechnical properties
- assessment of alternative end uses such as land application, including:
  - justification for why geotechnical reuse is preferred
  - options for improving biosolids quality in future, to allow other reuse options to be investigated
  - date stockpiles were completed
- details of any amendment process and risk assessment (as required for classification)
- details of the reuse scheme, including the proposed location of biosolids deposits, management controls, buffer distances, capping and marker layers
- construction management plan, for protection of the environment and human health, including, odour prevention, land, surface water and groundwater protection
- construction quality assurance plan, for achieving design standards for biosolids deposits
- monitoring and inspection process, including requirements for ongoing monitoring and contractual arrangements to ensure monitoring will occur
- an independent inspection or audit program to assess risks to the environment and ensure compliance with the EIP
- record keeping and reporting, including arrangements for the transfer of information from the producer to the end user and, ultimately, to the owner of the land and EPA
- management procedures in the event of changes in ownership or land use (for example, including information on the land title)
- details of community engagement and public consultation undertaken, and of a complaints register
- training programs
- contingency planning.

8.2 Regional EIPs

A regional EIP may be appropriate where there are a number of potential receiving sites with the same end use and construction design, and one site owner/operator. For instance, biosolids used as geotechnical fill for public roads may be used in a number of locations but will have one long-term end use and one owner/operator (VicRoads).

Regional EIPs will need to demonstrate a sound process to undertake site-specific assessments, and robust management requirements in the case of changes in land ownership or end use, and EIP compliance from individual site owners. Regional EIPs would be expected to contain comprehensive management, monitoring, auditing and reporting procedures, to ensure compliance with these Guidelines. An approved regional EIP would either approve a generic process for site assessments or would require reporting of site-specific assessments, design types, management (CMP and CQAP) and monitoring controls to EPA for approval, prior to commencing site works.

8.3 Submission of EIP to EPA

A copy of the EIP must be approved by EPA prior to the commencement of a scheme.

The EIP can be subject to an audit program, with the scope and frequency of the audit depending on the size of the scheme and the level of any identified risks. For larger, more complex schemes, the audit program should involve an independent, experienced auditor

such as a person appointed under the *Environment Protection Act 1970*. This may need to be discussed with EPA prior to tendering processes for the construction works.

The EIP should form part of an overall quality assurance system for the end-use scheme. If premises or an industry (such as road construction) have adopted a quality assurance (QA) system, the EIP should be integrated into the QA system.

From time to time, EPA produces updated information bulletins and guidelines relating to EIPs. Proponents preparing EIPs should also consider the additional guidance provided by such supplementary publications.

While EPA does not have any statutory timelines in which to assess an EIP, we commit to providing timely assessment of reuse EIPs and can provide early advice on the understanding that project timelines can be restrictive between tender processes and construction.

ENVIRONMENT IMPROVEMENT PLANS

Objectives

To prepare an EIP that ensures a safe, sustainable and compliant biosolids end-use scheme.

To ensure that schemes using biosolids for geotechnical fill have approved EIPs.

Suggested measures to meet objectives

- EIPs should be prepared for use of restricted-grade biosolids and approved by EPA.
- The EIP document should be prepared in appropriate detail relevant to the scale of the specific end-use scheme, the risks posed, and drawing on the objectives and suggested measures described throughout Sections 2 to 7 (refer to list of items in Section 8.1).
- Regional EIPs describing generic management controls can be developed by biosolids suppliers, but only if they relate to one end user/site owner and one proposed construction type (for example, roads). Site-specific assessments and audits would still be required.
- Biosolids use should be undertaken in accordance with the EIP to ensure compliance with these Guidelines.

9 GUIDELINES REVIEW AND RESEARCH NEEDS

These Guidelines will be reviewed over time to examine issues such as:

- any identified deficiencies in these Guidelines
- contaminants not listed in Table 1
- any available data on leachability fractions and lower limits for nutrients that might allow an unrestricted grade
- new options for biosolids reuse.

APPENDIX A: GEOTECHNICAL ASSESSMENT OF BIOSOLIDS

The following information provides guidance on geotechnical assessment methods that may be required by the end user to determine whether biosolids are suitable for geotechnical reuse.

It should be noted that biosolids in both 'as-sampled' and amended form have some properties that make them different from conventional materials used in construction projects. The proponent should always seek advice from a suitably qualified geotechnical practitioner when considering the use of clay-rich biosolids as geotechnical fill.

1. Perform organic content tests

The organic content of the biosolids should be tested at the frequency required by standards specified for the end use. Sampling methods, locations and depths would be governed by construction design standards that apply to the construction project.

If the organic content of 'as-sampled' clay-rich biosolids is considered to be within acceptable limits, then the geotechnical properties of the biosolids can be assessed.

2. Perform geotechnical testing

The following parameters are likely to require testing to assess the geotechnical properties of the biosolids for use as construction fill:

- moisture content
- Atterberg limits
- particle size distribution
- maximum dry density (MDD)
- optimum moisture content (OMC)
- soaked CBR (California bearing ratio)
- CBR swell
- consolidation parameters.

Assessment of strength parameters may also be required, depending on the proposed application. The testing frequency should be as required by standards specified for the end use.

If the biosolids exhibit less than adequate geotechnical properties, then:

- the biosolids may be treated with an appropriate additive to improve their geotechnical properties and retested

or

- the biosolids should be rejected as construction fill.

The geotechnical properties of the biosolids should be used to assess the settlement behaviour and batter stability of the earthworks concerned.

3. EPA approval

EPA requires a statement from the end user describing the geotechnical testing that has been done and confirming that the biosolids are acceptable for use as a geotechnical fill. This statement should be included in the EIP to confirm that the biosolids are to be used as geotechnical fill, not general fill.

APPENDIX B: AUDITOR GUIDANCE

This Appendix provides guidance for auditors appointed under the *Environment Protection Act 1970* who have been engaged by a proponent (biosolids producer and/or end user) to assess compliance with the construction design requirements of these Guidelines.

Scope of auditor assessment

The EIP for geotechnical reuse of biosolids must contain two plans, namely:

- the construction management plan (CMP) for managing biosolids handling during construction
- the construction quality assurance plan (CQAP) for ensuring the construction design meets the requirements of these Guidelines (see Section 6.2.3).

The proponent should engage an auditor to assess compliance with the CQAP. The proponent is not obliged to engage an auditor to assess compliance with the overall EIP or the CMP.

Assessment requirements

Prior to the commencement of construction of any structure using biosolids as geotechnical fill, the proponent must engage an environmental auditor to prepare an environmental audit report pursuant to Section 53V of the *Environment Protection Act 1970*.

The environmental audit report must confirm that the biosolids have been used in the construction in accordance with the CQAP submitted to the EPA with the EIP. The EIP (including the CMP and CQAP) must be approved by EPA prior to any works commencing on the site that involve the use of biosolids.

In preparing the environmental audit report, the environmental auditor must:

- review the approved CQAP
- review all reports, measurements and other data provided in the context of the construction quality assurance plan and EIP
- review all other records and/or management systems relevant to the construction of the biosolids deposit
- collect and review all other data or information which the environmental auditor considers relevant
- undertake one or more inspections of the site
- assess the risk of any possible harm or detriment to the groundwater or surface water environment caused by the manner in which the biosolids deposit has been constructed.

The auditor must notify EPA and the proponent immediately if any design defects are identified during construction that would compromise the objectives of the CQAP, or would pose an unacceptable risk of harm to the groundwater environment. The proponent must then undertake works to rectify the defect as far as practicable, at the direction of the auditor.

Steps for auditor engagement and assessment

1. Proponent to prepare EIP, CMP and CQAP.
2. Proponent to engage auditor.
3. Proponent to submit EIP, CMP and CQAP to EPA for approval.
4. Commence construction once EPA has approved EIP.
5. On completion, Auditor to prepare audit report and submit to EPA.

SELECTED REFERENCES

Key references in addition to those listed in publication 943, include the following:

- Australian Standard 4439.2 – 1997, *Wastes, sediments and contaminated soils*. Part 2: Preparation of leachates – Zero headspace procedure.
- Australian Standard 4439.3 – 1997, *Wastes, sediments and contaminated soils*. Part 3: Preparation of leachates – Bottle leaching procedure.
- Australian Standard 4482.1 – 2005, *Guide to sampling and investigation of potentially contaminated soil*. Part 1: Non-volatile and semi-volatile compounds.
- Australian Standard (2007) AS 3798: *Guidelines on earthworks for commercial and residential developments*. Standards Australia, Sydney.
- den Berg et al. (1998) *Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife*. Environmental Health Perspectives 106(12): 775-792.
- EPA (1991). *Construction techniques for sediment pollution control*. EPA publication 275.
- EPA (2009). *Sampling and analysis of waters, wastewaters, soils and wastes*. EPA publication IWRG701.
- NEPC (1999). *National Environment Protection (Assessment of Site Contamination) Measure* (NEPM). National Environment Protection Council, Adelaide.
- US EPA (2003) Control of Pathogens and Vector Attraction in Sewage Sludge. Environmental Regulations and Technology, EPA/625/R-92/013. United States Environmental Projection Agency.
- VicRoads (2008) *Standard Specifications for Roadworks and Bridgeworks*. Sections S204, S304, S306 and S307. Prepared by VicRoads, Melbourne, Victoria July 2006.