#### 

**Assessing Risks to Water Environment Associated with Burial Grounds**

June 2024

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## 1 Introduction

This document provides guidance on the protection of the water environment from burial grounds and cemeteries. It is intended for developers and local authorities developing or extending existing burial grounds.

The development of burial grounds is regulated via the planning regime. Authorisation from SEPA is not required.

**SEPA does not need to be consulted by developers, local authorities or planners if the criteria for low or moderate risk sites are met. SEPA are happy to provide pre-application advice to developers or local authorities in cases where they have carried out all the assessments required for higher risk sites, and they wish advice from SEPA on interpretation or mitigation.**

Developers and local authorities should manage the development and operation of the burial ground to ensure that the water environment is protected.

This document provides information regarding:

* When this guidance may apply;
* Factors influencing site suitability;
* Suggested approach for characterising local ground conditions (Annex 1);
* Suggested risk assessment approach;
* Potential mitigation measures (Annex 2).

Additionally, we have provided supporting information regarding ashes (Annex 3) and a checklist (Annex 4) outlining the information that is useful to supply in support of a planning submission for a burial ground.

### Terminology

In this guidance, the term ‘burial ground’ is used to refer to the whole site, which includes the burial areas plus associated areas such as access roads and car parking. The term ‘burial area’ is used to refer specifically to areas where burials are located (not including burial of ashes). The term ‘lair’ is used to refer to a burial plot. Note that more than one burial may take place within a single lair.

## 2 When does this guidance apply?

### 2.1 Overview

This guidance only applies to human burials.

This guidance applies to new burial grounds and to extensions to existing burial grounds. This guidance applies to both local authority and commercial sites.

For ashes, see Annex 3.

### 2.2 Green burials

This guidance applies to both traditional and ‘green’ burials.

If appropriately sited and designed, green burials may pose a lower risk to the water environment than traditional burials. This is largely because the density of burials within a green burial ground is typically lower than at a traditional burial ground. The applicant can take this into account during the risk assessment process.

Green burials may also offer other environmental benefits over traditional burials such as potential benefits for local biodiversity.

### 2.3 Private burials

There is no requirement for authorisation from SEPA for private burials. However, permission must be obtained from the local authority.

When selecting a site for a private burial, SEPA recommends aligning with the guidance for low-risk burial grounds.

### 2.4 Emergency burials

During emergency situations, such as a health epidemic or disaster, it is a priority to keep sources of drinking water safe from contamination.

Emergency planners should always try to use alternatives to burial for body disposal, such as cremation. Plans for using existing or new burial grounds must not affect the quality or safety of groundwater or any other water supplies.

Any temporary morgue or mortuary must be able to contain bodily fluids, microbes, substances and chemicals. This may involve sealing drains for safe collection of liquids for later removal by a specialist contractor.

## 3 Factors influencing site suitability

There are several factors that influence the likely risks to the water environment associated with burial grounds. High-level guidance is set out below regarding some of these potentially significant factors. Specialist advice may be required.

### 3.1 Potential receptors

Groundwater is an environmental receptor in its own right. This applies whether or not the groundwater is currently actively used. Groundwater can also be a pathway to other receptors.

Applicants must provide a detailed water features survey that identifies any nearby receptors of note that may be influenced via groundwater. The recommended search area is at least 250 metres from the boundary of the burial ground.

Groundwater dependent receptors include:

* Abstractions, particularly if supplying water for human consumption or food production;
* Surface waters, which may be influenced via groundwater baseflow;
* Wetlands, particularly groundwater dependent terrestrial ecosystems.

Applicants should take into account the location and sensitivity of the receptors when developing their conceptual site model and during the risk assessment process.

The recommended buffer distances for potential receptors may be modified if it can be demonstrated that the burial ground is unlikely to be in hydraulic connection with the receptor.

### 3.2 Ground conditions

Site-specific ground conditions are a key factor influencing the potential risks to the water environment. Of particular importance is the thickness and geology of the unsaturated zone, the soils or rock between the burials and the water table.

See Annex 1 for further information regarding characterising ground conditions through intrusive ground investigation and monitoring.

Applicants should normally assume that at least 1 metre of soil cover is required above burials unless otherwise agreed with the local authority.

### 3.2.1 Soil Type

Soil type is a key factor influencing the potential for natural attenuation of contaminants in the subsurface. In turn, this influences the potential risk to groundwater.

Coarse sands and gravels do not offer much potential for natural attenuation as infiltration rates are likely to be rapid and because coarser soils have a lower surface area for sorption or microbial activity.

In contrast, low permeability soils such as clay may constrain the migration of both aqueous-phase contamination and gases. Low permeability soils are also more likely to be anaerobic, which may slow rates of biodegradation. The burial ground operator should manage any potential risks to health and safety associated with multiple burials in low permeability soils by adopting appropriate site management procedures.

### 3.2.2 Depth to bedrock

Shallow bedrock is a potential constraint on burial ground development. Typically, bedrock does not offer as much potential for natural attenuation of contaminants as soils, increasing the risks to groundwater. Shallow bedrock can also be a constraint with respect to ease of excavation of graves.

SEPA recommends, as far as possible, undertaking burials within soils or superficial deposits. However, SEPA recognises that this may not always be feasible, particularly for some remote and island communities.

### 3.2.3 Depth to groundwater

Depth to groundwater is a key factor influencing site suitability.

Burials must not cause pollution and therefore should not take place below the water table. Burials below the water table limit the capacity for attenuation and direct discharges of contaminants into groundwater is not usually acceptable.

SEPA recommends ensuring there is a minimum of 1 metre of unsaturated zone below the burials. This must allow for any seasonal variation in groundwater levels. Operators should take the potential influence of climate change into account where appropriate. This includes the potential influence of sea level rise for coastal sites.

### 3.3 Preferential pathways

Field drains, buried services including site drainage, and other subsurface structures may create preferential pathways for contaminant migration. SEPA recommends such subsurface features are diverted around the burial areas as far as is practicable.

Planners should take into account any subsurface pathways remaining within or immediately adjacent to the burial areas when developing the conceptual site model and during the risk assessment process.

### 3.4 Land contamination

Burial grounds can be developed on brownfield sites if they can be demonstrated to be suitable for use. Potential risks to human health and the environment posed by existing land contamination due to past activities should be managed as per the usual planning process for brownfield development.

SEPA recommends burial grounds are not developed on sites designated as Contaminated Land under Part IIA of the Environmental Protection Act unless it can be demonstrated that the presence of the burial ground will not significantly constrain future remediation of the site.

### 3.5 Mining

Burial grounds can be developed on previously mined sites if they can be demonstrated to be suitable for use. However, shallow mine workings and mine entries may create preferential pathways for contaminant migration through the subsurface. Developers must take this into account when developing the conceptual site model and during the risk assessment process.

The potential risks to health and safety posed by former mining should be managed as per the usual planning process for development in historically mined areas.

### 3.6 Flood risk

SEPA recommends developers avoid selecting areas at risk of flooding for future burial grounds.

During flood events, groundwater levels may rise due to increased infiltration of rainfall and surface water. The magnitude of the effects on groundwater levels will depend on both local ground conditions and on the frequency and duration of flooding. In the worst-case scenarios, groundwater levels may be at or near ground level at times. This makes it more difficult to ensure burials are located above the water table (see 3.2.3).

In addition to the environmental risks associated with flooding in burial grounds, there may also be other flooding-related factors that require consideration, including:

* Access constraints for staff and the public;
* Erosion risk;
* Risk of flotation;
* Risks to stability of gravestones.

Further information on development of sites at risk of flooding can be found on SEPA’s Planning web pages.

## 4 Risk assessment

### 4.1 Overview

The risks to groundwater and groundwater-dependent receptors should be assessed in accordance with WAT-PS-10.

The process for assessing new burial grounds takes into account the likely risks to the water environment. Sites may be subdivided into three categories: low, medium or higher risk (see Sections 4.2 to 4.4).

**SEPA does not require to be consulted on applications that satisfy the criteria for low or moderate risk sites.** Developers should ensure that their submissions to the planning authority make clear that they have followed this guidance and should clearly state what level of risk has been determined for the site.

If it is not possible to comply with the criteria for low or moderate risk burial grounds, then refer to the guidance for higher risk burial grounds (section 4.4). Development of a burial ground may still be possible, but more detailed site characterisation and risk assessment will be required to demonstrate the site is suitable.

Effective risk assessment is reliant on the development of a robust conceptual site model (CSM) based on site characterisation. The guidance in Annex 1 sets out the ground investigation and monitoring required to support each tier of risk assessment.

### 4.2 Low risk sites

Burial grounds are considered to be low risk if they meet the following criteria:

1. The average burial rate is <12 per annum.
2. The burial area is more than 250 metres of any spring, well or borehole used to supply water for human consumption or food production.
3. The burial area is more than 50 metres from any:
   1. Designated groundwater dependent terrestrial ecosystem;
   2. Designated bathing waters;
   3. Springs;
   4. Abstractions from wells or boreholes where water is not used for human consumption or food production.
4. The burial area is more than 10 metres from any:
   1. River, burn or loch;
   2. Field drain or ditch, including dry ditches;
   3. Wetland;
   4. Transitional water or coastal water, as measured from mean high water springs.
5. The burials are above the water table.

### 4.3 Moderate risk sites

Burial grounds are considered to be moderate risk if they meet the following criteria:

1. The average burial rate is <120 per annum.
2. The burial area is more than 250 metres from any spring, well or borehole used to supply water for human consumption or food production.
3. The burial area is more than 50 metres from any:
   1. Designated groundwater dependent terrestrial ecosystem;
   2. Designated bathing waters;
   3. Springs;
   4. Abstractions from wells or boreholes where water is not used for human consumption or food production;
   5. Any river, burn or loch.
4. The burial area is more than 10 metres from any:
   1. Field drain or ditch, including dry ditches;
   2. Wetland;
   3. Transitional water or coastal water, as measured from mean high water springs.
5. The burials are not within coarse sand or gravel or bedrock.
6. The burials are above the water table. There should be at least 1 metre of unsaturated zone below the burials.

With respect to point 5, ‘coarse sand or gravel’ refers to the principal soil type as described in BS5930:2015+A1:2020. It is acceptable for there to be a small proportion of coarse-grained clasts present, e.g., granular soils with less than 20% of particles larger than 0.6mm diameter.

### 4.4 Higher risk sites

If the criteria for low or moderate risk burial grounds cannot be met, then a site-specific hydrogeological risk assessment will be required to demonstrate that the proposed burial ground will not pose a significant adverse risk to the water environment.

The minimum distances between burial areas and receptors given for moderate risk sites should be maintained as far as possible. Lesser distances will only be acceptable if the risk assessment has demonstrated that the risk to the receptor is low.

Burials must be above the water table, with at least 1 metre of unsaturated zone beneath the burials, unless there is an appropriate hydraulic barrier between the burials and groundwater.

The hydrogeological risk assessment should be undertaken in accordance with WAT-PS-10. The degree of rigour required for the risk assessment will depend on the sensitivity of the site and its surroundings. The hydrogeological risk assessment will usually need to be supported by detailed quantitative risk assessment (DQRA) modelling.

The exact requirements of the hydrogeological risk assessment are complex and site-specific, and thus cannot be prescribed in detail in this guidance. However, the following pointers are provided as a starting point for undertaking DQRA:

* The modelling approach, input parameters, and associated assumptions must be documented and justified.
* The key contaminant of concern expected to be considered during the quantitative risk assessment is ammoniacal nitrogen.
  + The potential for conversion of ammoniacal nitrogen into nitrate should also be taken into account.
  + Although other contaminants may be present, quantitative risk assessment of these is not usually required unless sensitive receptors are very close.
* A typical 70 kg body contains approximately 1,800 g of nitrogen.
* The majority of decomposition will occur within the first 10 years for a traditional burial.
* The source term may be characterised by averaging the potential contaminant loading across the burial area, taking into account the proposed density and rate of burials. Any proposed zoning of the burial ground may be taken into consideration.
* The contaminant loading will also depend on the infiltration rate. Infiltration rates may be estimated from the average annual rainfall, taking into account the proposed land surface type (e.g. gravel, grass or woodland) and potential evapotranspiration.
* Natural attenuation within the unsaturated zone and saturated zone may be taken into account. It is acceptable to use literature values for sorption and degradation rates, if the selected values can be demonstrated to be reasonably representative for the site-specific conditions.
* Sensitivity analysis is recommended to address any areas of significant uncertainty.

Where proposed sites are extensions to existing burial grounds, monitoring the existing site may provide analogue data to aid the risk assessment process. The use of analogue data is acceptable supporting evidence as long as the ground conditions on both sites are similar.

## Annex 1 – Characterisation of local ground conditions

### A1.1 Overview

Site-specific assessment of ground conditions will require intrusive ground investigation.

The ground investigation should be undertaken in accordance with BS 5930:2015+A1:2020 Code of practice for ground investigations.

If possible, intrusive ground investigations should be undertaken in winter or early spring (November to March) when groundwater levels are likely to be at their seasonal maximum.

Exploratory holes should be surveyed to National Grid and Ordnance Datum.

The recommendations presented below regarding exploratory hole coverage are a starting point. Additional exploratory holes may be required if ground conditions are expected to vary significantly across the site, particularly in areas where historical land contamination may be present. Additional exploratory holes may also be required if there are sensitive receptors close to the site. The applicant should justify the adequacy of the coverage of exploratory holes as part of the planning submission.

Depending on the site’s history, additional appropriate soil and groundwater characterisation may be required to aid assessment of any potential land contamination that may be present. Refer to BS10175:2011 + A2:2017 *Investigation of potentially contaminated sites*.

### A1.2 Low risk sites

At least 3 exploratory holes that extend at least 1 metre deeper than proposed maximum lair depth.

### A1.3 Moderate risk sites

At least 6 exploratory holes per hectare. This may be reduced to 4 exploratory holes per hectare for larger sites exceeding 5 hectares. The exploratory holes should extend at least 1 metre deeper than proposed maximum lair depth.

Analysis of representative soil samples is recommended to confirm the soil composition beneath the lairs. It is recommended that the analysis includes particle size distribution (PSD) and organic matter content.

### A1.4 Higher risk sites

The investigation for higher risk sites should follow the moderate risk site requirements, plus the following additional requirements:

1. At least three boreholes installed as groundwater monitoring wells. Larger sites exceeding 5 hectares should have at least one additional monitoring well per 5 hectares. The boreholes can be counted towards the exploratory hole coverage requirements.
   1. The siting and design of the groundwater monitoring wells should enable characterisation of groundwater levels and the groundwater flow direction.
   2. The boreholes are recommended to extend at least 3 metres deeper than the proposed maximum lair depth. It is recommended to ensure the boreholes are deep enough to allow year-round monitoring of groundwater levels.
   3. The siting of the monitoring wells should also take into account the locations of any sensitive receptors in the vicinity of the burial ground.
   4. The monitoring well headworks must be designed to avoid ingress of surface waters.
   5. The borehole logs must include drilling details, geological information, monitoring installation construction details, and the elevation of the monitoring datum (usually top of casing) in metres above Ordnance Datum.
2. Sufficient groundwater level monitoring to allow characterisation of any seasonal trends.
   1. Monthly groundwater level monitoring over at least 12 months is suggested as a minimum. Consideration may be given to accepting more frequent monitoring over a shorter period, provided there are at least 12 data points and the monitoring covers the period November to March.
   2. The use of groundwater level loggers is beneficial, particularly at sites where groundwater levels are likely to fluctuate significantly or rapidly.
   3. Surface water level monitoring may also be beneficial at some sites to help characterise the hydrogeological regime.
3. Baseline groundwater quality monitoring, particularly for ammoniacal nitrogen and nitrate, is recommended. Background water quality may be taken into account in the risk assessment.
4. Baseline water quality monitoring is also recommended in nearby groundwater-dependent receptors, such as watercourses, abstractions, or groundwater dependent terrestrial ecosystems.
5. SEPA recommends collecting supporting data that will aid any detailed quantitative risk assessment. For example, this could include characterisation of redox conditions and dissolved oxygen concentrations to aid assessment of likely rates of ammoniacal nitrogen degradation, or site-specific measurements of hydraulic conductivity to aid characterisation of the flow regime.

For extension sites, developers or burial authorities could also consider undertaking water quality monitoring at the existing burial ground. This will enable the impacts of the existing site on the water environment to be characterised. These findings may be used as an analogue to inform the risk assessment for the extension area, provided ground conditions are similar in both areas.

## Annex 2 - Mitigation measures

Where the burial ground does not meet the requirements specified above the developer could consider modifying the design to meet these requirements. This section provides guidance on possible modifications that could be undertaken to address some of these issues.

### A2.1 Site zoning

Many sites suffer from constraints related to topography, ground conditions or groundwater levels. The entire site need not necessarily be rejected if a portion of the site is not suitable for burials.

Internal zoning of the site according to site conditions may be an appropriate solution. This may include zoning lair depths across the site. Some areas may only be suitable for single burials. Other areas may be able to accommodate two or more burials.

### A2.2 Land raising

Earthworks may be required at some sites to help ensure that burials are above the water table.

If it is not possible to achieve a cut and fill balance within the site, then materials may be required to be imported onto site to achieve the desired fill levels. Appropriate assessment should be undertaken to confirm the materials are suitable for use.

If a suitable greenfield source site(s) can be identified, SEPA recommends the applicant takes note of the advice set out in SEPA’s guidance document ‘Promoting the sustainable reuse of greenfield soils in construction’.

If consideration is being given to importing other materials for use in the land raising, it is recommended that SEPA is consulted again prior to the materials arriving on site. Note that the use of waste materials is likely to require authorisation under the relevant waste regulations.

The implications or land raising on flood risks must be considered and managed as per the usual planning process for development sites, in accordance with national planning policy.

SEPA recommends the planning application for the burial ground is supported by drawings showing the extent (lateral and vertical) of any proposed earthworks. SEPA recommends developers include cross-section drawings showing the existing and proposed ground levels, relative to the inferred water table elevation and proposed lairs (all in metres above Ordnance Datum).

### A2.3 Drainage

The depth to the water table may be locally increased by installing subsurface drainage. This may help ensure that burials are above the water table. Only passive drainage solutions are considered appropriate.

Subsurface drainage may act as a preferential pathway for contaminant migration. For the duration of cemetery use it is considered good practice for cemetery managers to maintain a discharge quality monitoring programme, to ensure that no consequential pollution of the environment occurs.

Maintenance arrangements and associated financial provision, including contingency for any future treatment if required, should be agreed with the burial authority.

### A2.4 Burial chambers

Where ground conditions are unsuitable for traditional burials, the use of burial chambers built of durable and impermeable materials may be considered. In these instances, there is no need to demonstrate the potential for natural attenuation within the materials below the burial chamber. Where the type of burial chamber proposed comprises fully sealed units, the potential for contamination of the water environment would no longer be a consideration at planning.

Maintenance arrangements and associated financial provision should be agreed with the burial authority.

### A2.5 Ongoing monitoring

For the duration of burial ground operations, it is considered good practice to maintain a groundwater level and groundwater quality monitoring programme. Such monitoring helps confirm that the site is not having a detrimental impact on the water environment. Ongoing monitoring is particularly beneficial for sites close to sensitive receptors. Such a monitoring programme is however not a compulsory planning requirement and will not be requested by SEPA. The results of any ongoing monitoring do not need to be submitted to SEPA unless requested.

## Annex 3 - Ashes

The following guidance applies to ashes from cremations as well as the solid residue from alkaline hydrolysis.

Permission from SEPA is not required to scatter or inter ashes from a single individual on your own land. You should seek permission from the landowner if you want to scatter or inter ashes on someone else’s land, but authorisation from SEPA is not required.

If landowners wish to allocate any areas specifically for the repeated scattering of ashes and/or multiple ash interments, SEPA recommends such areas be selected in accordance with the guidelines for low-risk burial grounds.

Ash interments must be above the water table. A suggested maximum density of ash interments is approximately 0.5 metre spacing.

SEPA recommends that urns, if used, are composed of inert (e.g. ceramic or stone) or biodegradable (e.g. wood) materials.

If you scatter ashes across surface waters, wetlands or other sensitive habitats, you should:

* seek permission from the landowner;
* make sure the effect on the environment and wildlife is minimal and will not affect other users;
* not include wreaths or other memorabilia as they may harm the environment and wildlife.

## Annex 4 - Checklist for supporting documentation

SEPA recommends including the following documentation in support of planning applications for burial grounds.

1. Water features survey with a suggested search radius of at least 250 metres from the site boundary:
   1. Details of the location, construction and usage of any spring, well or borehole;
   2. Designated groundwater dependent terrestrial ecosystems;
   3. Designated bathing waters;
   4. Surface water features;
   5. Any other receptors of potential note.
2. Ground investigation factual and interpretative data:
   1. Justification of approach including adequacy of exploratory hole coverage;
   2. Exploratory hole logs;
   3. Soil characterisation testing data (if applicable);
   4. Groundwater level monitoring data in metres above Ordnance Datum;
   5. Water quality monitoring data (if applicable) including associated field records and laboratory certificates;
   6. Interpretation of local ground conditions.
3. Hydrogeological risk assessment:
   1. Conceptual site model, including source-pathway-receptor linkages;
   2. Justification of risk assessment approach and any assumptions;
   3. Modelling input parameters and results (if applicable);
   4. Identification of any areas of uncertainty and any associated sensitivity analysis;
   5. Interpretation of risk assessment results.
4. Drawings:
   1. Site location map;
   2. Site layout plan;
   3. Plan showing locations of receptors identified by the water features survey;
   4. Plan(s) showing locations of any other features of note, such as former mining or areas of existing land contamination;
   5. Plan showing exploratory hole locations;
   6. Plan showing groundwater level contours in metres above Ordnance Datum;
   7. Plan showing proposed lair depths across site (including any zoning if applicable) in metres above Ordnance Datum;
   8. Cross-sections showing existing ground level (and proposed ground level if applicable), proposed lair depths, and inferred water table elevation in metres above Ordnance Datum;
   9. Plan showing proposed site drainage systems;
   10. Drawings of any proposed mitigation measures (if applicable).

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