INFORMATION AND GUIDANCE SERIES

for

AUSTRALIAN NATURAL BURIAL GROUND PIONEERS

Guideline 3: Assessment Procedures for Proposed Natural Burial Ground Sites

Site Characteristics & Design Elements

Geo-Scientific Assessment Procedure

Geo-Scientific Assessment Checklist

Australian
Natural Burial
Project

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Registration number TBA

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Keywords: natural burial, earth burial, green burial, natural burial ground, site analysis, burial ground – guidelines, burial round – impacts - environmental, burial ground – literature review, NEB, development principles – natural burial.

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Assessment Procedures for Proposed Natural Burial Ground Sites

INTRODUCTION, PURPOSE AND USE OF THIS GUIDELINE

Introduction

Each Guideline in this series builds upon the information presented in the previous Guideline/s. In this way, a comprehensive understanding of the subject matter is developed gradually, and without repetition. If you have not read the Guideline/s that preceed this one, it is recommended that you do so.

The assessment of any site intended for the burial of human remains requires a detailed geoscientific evaluation to identify potential environmental risks. Primary among such risks is the possibility of decomposition products finding their way into (potable) ground or surface water supplies.

In the case of a site intended for use as a traditional cemetery, there are risks associated with enbalming chemicals and toxic glues and lacquers (used in coffin manufacture) that are buried with the body. In addition, the common practice of lining coffins with non-biodegradable, plastic sheeting effectively locates the body within a durable, water retaining 'tub' that invariably fills with surface (rain) water that enters readily through the disturbed soils of a grave. Though the effects are not fully understood, the long-term submersion of the body certainly impedes natural decomposition, and presents the possibility for long-term, local retention of liquids containing decomposition products.

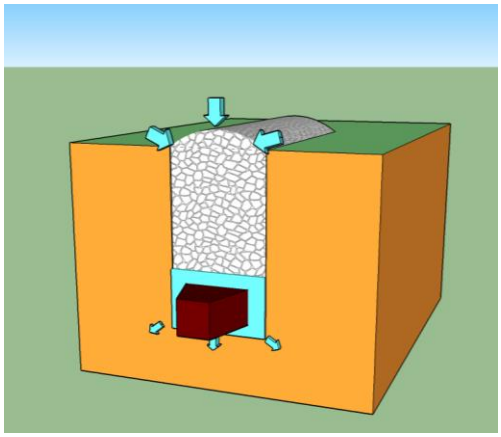


Figure 1. Illustrates the increased tendency of rain (and surface run-off) water to enter a grave through the loosened back-fill soil. Percolation of water into surrounding soils is usually slower, allowing for traditional coffins to fill with, and retain, water.

A site intended to be used exclusively for natural burial, also requires detailed and careful evaluation. However, embalming is not used in natural burial, biodegradable coffins, shrouds and liners are prescribed, and single interments occur in graves excavated to the minimum legal depth. Together these practices ensure that decomposition products arise primarily from the body itself, are organic in nature, and are dispersed into, and processed by, the surrounding soil as quickly and effectively as possible in the local conditions.

Best practice design and management principles for natural burial grounds (detailed later in this Guideline) include; low burial density (lowering the load of decomposition products on the site relative to traditional cemetery practice), and extensive use of trees and natural vegetation both within buffer zones around burial grounds, and on, and around, actual gravesites to stablise and absorb the natural products of decomposition. A properly conducted natural burial process conforms to the well established principles of permaculture, and will, of itself, result in an esentially neutral environmental impact.

Accordingly, site assessment criteria for natural burial grounds can, and should, differ in certain ways to those applicable to traditional cemeteries. Of course, the presence of flooding, high water tables or swampy land would make a proposed site unsuitable for either a traditional cemetery or a natural burial ground. However, the lower overall risk associated with natural burial and natural burial grounds (as well as the woodland aesthetic) may allow for a natural burial ground to be sited in locations not entirely suitable for a traditional cemetery.

Purpose and use of this Guideline

This Guideline provides descriptions of ideal characteristics to assist in identifying potential natural burial ground sites, and a practical guide for the assessment of potential sites. It also includes an assessment criteria ‘checklist’ used to evaluate the findings of the site assessment procedure.

The materials and information contained herein are based upon the most current research, the experience of the Authors and advisors and professional best practice models. Nonetheless, they are designed to be used by competent lay persons to facilitate a reliable process of preliminary assessment that can then form a basis for critical early decision making. This Guideline contains three main sections as follow:

Site Characteristics and Design Elements

These provide an understanding of practical site constraints, and can assist the Natural Burial Ground Pioneer to identify the positive and negative qualities of a

proposed site. Key design principles are discussed to assist visualisation and, ultimately, development of a layout plan necessary for legal and administrative purposes.

Geo-scientific Assessment Procedure (the Assessment Procedure)

The Assessment Procedure provides a step by step guide to undertaking a thorough and systematic, preliminary site evaluation.

Geo-scientific Assessment Criteria Checklist (the Checklist)

The Checklist is the 'score card' for the site, and is completed using the findings of the Assessment Procedure. Once complete, the Checklist characterises the site as suitable, not suitable or requiring further professional assessment.

NOTE: This Guideline contains standards, recommendations and best-practice procedures derived collectively from the academic works referred to, and formally cited, in the Literature Review contained in Guideline 2. For ease of reading, in-text citations have not been included here, but the Authors fully acknowledge the invaluable contributions by Researchers and the origins of the collective knowledge.

SITE CHARACTERISTICS AND DESIGN ELEMENTS

Site Characteristics

Natural constraints

Floodplains, swamps, cliff lines, shallow soils (to some extent), landslip slopes, drainage areas to lakes or waterways and some filled areas - are not suitable burial sites.

Aquifers and water bodies

Ideally a minimum subsoil thickness depth of 1 metre should be present between the bottom of the grave and any impervious strata (i.e. the base of the grave must be at least 1 metres above solid rock). While an unsaturated zone of 1 metre or greater is ideal, some sites that do not meet this criterion, or meet it only in some areas, may still be suitable subject to soil analysis and/or a more detailed hydrogeological assessment.

The base of all graves must also be at least 1 metre above the highest fluctuations of natural water tables. Any seasonal variability in the water table levels should be taken into account.

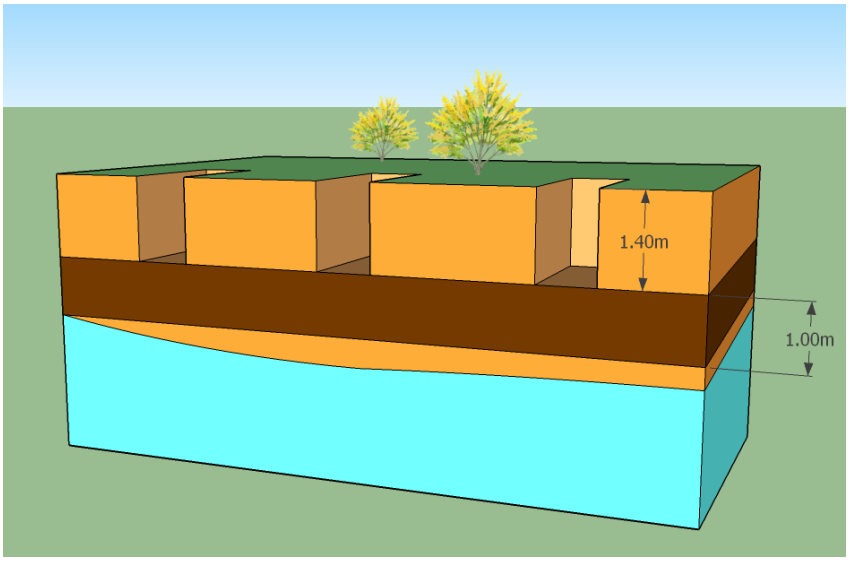


Figure 2. Illustrates the minimum acceptable 1m 'unstaurated zone' below the base of any grave excavation. In practice the unsaturated zone may be many metres in depth.

Sites with clean, coarse, sandy or gravelly soils require specific assessment to determine appropriate depth of water tables.

The influences of perched and ephemeral (short-lived or seasonal) water tables and springs need to be taken into account.

In general terms, no burial should be closer than 200 metres horizontally from any drinking water well; however, alternate safe distances may vary from site to site as determined by detailed hydro-geological investigation.

Soils

The best soils for burial sites are well drained clayey-sand or sandy-clay soils. These favour decomposition, and the local retention and attenuation of decomposition products.

Soil profiles considered to be of high permeability, e.g. sands underlain by impermeable layers, are generally not suitable for burial.

In Australia the minimum depth of burial is prescribed under individual State law. It is normally expressed as the depth of soil 'above the breastbone' or 'lid of a coffin', and ranges between 700 and 1000mm (depending on the State). The minimum legal depth is used for natural burial to foster decomposition, and maximise the unsaturated zone. As an aside, this explains the practical limitations of the novel idea of vertical burial, often cited as a solution to limited space in metropolitan cemeteries. Even where mechanical augers might be available to dig a 'posthole grave' the depth of the body length + 1000mm, locating sites with an adequate soil depth would be challenging.

Natural burial ground design elements

Buffer zones

No burials should lie at the boundary of the burial ground - buffer zones are needed; 5 -10 metres in clay soils, 20 metres or more in sandy soils.

Plan to preserve and plant deep-rooting, locally adapted, native trees and shrubs - particularly in buffer zones. While some Australian plants are sensitive to high levels of nutrients, in most cases low density interment, considered timing of near grave planting and avoidance of known sensitive varieties should address most concerns. The advice of a local ecologist should be sort to clarify and assist in the selection of locally adapted native species.

Interment site dimensions, layout and site capacity

The higher the density of graves the greater the local environmental load. Consideration needs to be given to overall capacity of the site, and its ultimate life span. An area of approximately 6 - 9 square metres per burial is recommended (3 to 4 times the space allocation of a traditional cemetery), as is non-sequential grave use with longer term vegetative infilling (planting on, and around, actual interments).

Surface water

Water cycling should be controlled by draining precipitation water from sealed surfaces through an efficient drainage system, either out of the burial ground or to densely planted buffer zones.

On hillsides, excavation and road and track design should, as far as feasible, be along the contour to maximise local absorption of surface water, or otherwise controlled by careful consideration of surface flows and directions. A local surveyor will be of considerable assistance in considering these issues.

PRELIMINARY SITE ASSESSMENT PROCEDURE

The ability to undertake a thorough, systematic and low cost assessment (just the time investment and perhaps the cost of test pit excavations) can allow individuals and community groups to eliminate a poor site, or establish the suitability of an ideal one. In the case of a promising site where some minor issues have been identified, the initial assessment can provide sufficient data to discuss the site's potential with professional consultants, and, if desirable, seek their advice and assistance.

Step One – The Statutory Context

In almost all circumstances in Australia, consent of (usually) Local Government will be required for the establishment of a natural burial ground. However, there is a great deal that can be done to determine the suitability of a proposed site before engaging in official applications.

That being said, before doing anything at all, check with local government authorities (LGA's), either directly or by accessing Local Environment Plans (LEPs) and other local government Development Plans (usually available on line), to determine whether the zoning of the area where the proposed site is located is suitable. Also check whether the site has been ear-marked for some future development, for example a railway line extension or a housing tract. If zoning or future use is an issue, look for another site now rather than taking on an up-hill battle for non-compliant development permission or legislative or regulatory changes. Ensure the site lies above any 1 in 100 year flood levels determined for the location.

If the site is suitably zoned and not in a flood area, obtain the legal description of the site: the Folio and Lot Number that describe the property. These are normally included on land deeds and legal documents, but can be generally be accessed via Government land title websites and data bases using the common street address.

Use these details to obtain on-line maps of the site, and to obtain any GIS (geographic information system) data and mapping that exists. At this point in time, the amount of GIS data for any particular site varies greatly. There may be a great deal, or none at all. Where available, this information can provide detail of the geological and hydrogeological character of the site. NearMap and Google Earth are also becoming excellent resources site orientation purposes.

What is the total available area? Areas of less than 2 Ha (about 5 acres) may not be worth the effort of establishment. This comes back to your purpose.

Windscreen survey

It is likely that you will already have made several visits to the proposed site by the time you decide to move the project forward. If for some reason you have not before visited the site, first do a casual 'windscreen survey', getting an overall feel for the landscape, the neighbours, the local transport, agriculture, fuel, shopping and other systems, and if possible viewing the property from a higher, somewhat distant vantage point, then walk the land if open to you. Take photos to refer to later.

While most of the basic information required is readily available on line, input from local landholders, local government planners, catchment authority officers and local wildlife rangers can save a lot of time and misunderstanding. While its probably not advisable to rush in proclaiming your unusual intentions, it is well worth having informal 'conversations around the shops', and eventually meeting and developing cordial and open relationships with community gatekeepers.

Preparing for a more formal inspection

Check websites for water catchment authorities, primary industries, environment and heritage and mining departments for data and maps that show roads and buildings ('ortho-cadastral' maps), vegetation, catchment boundaries, watercourses and other water bodies, 100-year flood levels, drains, aquifers and wells. Mark these on your map(s) for ground truthing on site.

Prepare an aerial photograph or topographical map at a scale that is useful to visualise single buildings, and broken into sections if the property is very large. Also prepare a larger scale map that encompasses the whole property.

Have your maps as large as feasible (eg A3), and consider either laminating them (and making notes with marker pens) or fixing them to a plastic-sheeted clip board (to avoid wind and rain). Also take a notepad and pens of 2-3 colours. You should now be prepared for an Initial On-Site Inspection

Step Two - Initial On-site Inspection

Consider the following aspects:

Context

Note the position of the site relative to other development including roads, houses, other buildings, fences, access points, tracks, bores, powerlines and public facilities.

Consider ease of visitor access, the nature of the roads used to travel to the site and public transport connections.

Where and who are the immediate neighbours? The consent of all adjoining neighbours is ideal, and, in most circumstances, the consent of the greater majority of them will be necessary to proceed. This is all about creating a valuable, and valued, community asset, so the process should be harmonious.

Terrain and aspect

Note the general lay of the land in terms of overall slope, direction of the Sun, low-lying areas, rocks, cliffs. Are there rocky outcrops that might suggest shallow soil depth?

Evidence of soil type(s), and what is where if variable.

Flora and fauna

The presence, or otherwise, of existing vegetation and vegetation type, eg., is there natural scrub or planted crops, woodlots, or evidence of fire?

Presence/evidence of animals: exotic, native fauna, feral.

Water

Presence, or not, of creeks, streams, dams, bores, beaches and storm water drains.

Potential for flooding.

Can you see any floodlines, high water marks or vegetation changes that may indicate underground water, wet spots (often indicated by a change in plant or grass types or presence of reeds)?

Consider your observations in respect of the Site Characteristics above. Are there any aspects about which you feel uneasy?

If the initial on-site inspection does not suggest any obvious barriers, proceed to a Desktop Assessment.

Step Three - Desktop Assessment.

This is essentially the gathering of all available, existing data about the site, without necessarily going back to the site.

At least some of the following will likely need to be considered for most proposed sites: Environmental Protection Plans, State and Aboriginal Heritage protections, bushfire and earthquake risk zoning, natural and planned wildlife corridors and locally endangered species conservation plans.

Access on-line water authority data bases (different in each state, may involve departments of mining) and retrieve all available information about bores and wells within a 2 km radius of the site. A census of all nearby bores helps to establish an understanding of the nature of water tables in the area. Take note of whether water from nearby bores has been identified as suitable for human consumption (potable), or is considered suitable for domestic (watering gardens or flushing toilets) and/or stock use only or highly saline.

Check with local authorities to access flood level records, and/or 1 in 100 year flood assessments.

Use on-line government sites to determine if the site is in a high bushfire or earthquake risk zone.

Are there any geological survey records that might indicate soil type and depth, or previous excavation work by council or other agencies? Are there any signs of soil instability – this relates to the safe, workable excavation of grave sites? As well as formal sources check with landholders, local earth movers and agricultural consultants -all may have valuable, practical knowledge.

Access Bureau of Meteorology sites to obtain records of average annual precipitation. Review all available records from local and nearby weather stations. Local landholders can generally indicate variations in weather patterns e.g. rain-shadow zones.

Using available maps of the site or aerial photographs, sketch up a general layout working with the unique features of the site, and keeping in mind the **Site Characteristics** criteria. Draw in buffer zones, and be conservative. At this stage of the investigation it is always better to allow extra distance from boundaries and water courses. It can be adjusted later, when other factors have been properly considered or on-site experience has been acquired.

Mark in actual or potential access roads and paths, areas that need immediate re-vegetation and planting, include existing vegetation and any areas that might be used for facilities or car-parking. Once this is done, re-assess the area available for burials. Calculate the remaining available area in sq metres (government on-line mapping sites often have calculator features), and divide by 9 (sq metres per burial) to determine the capacity of the site.

Is the capacity sufficient to warrant the effort of establishment?

If the Desktop Assessment does not indicate any obvious barriers, proceed to a Shallow Soil Assessment.

Step Four – Shallow Soil Assessment.

This involves going back on site with an excavator and digging a series of grave-like inspection pits.

Using the rough site plan you have developed, consider the location of the inspection pits. In general terms two to four pits per Ha spaced out evenly should be sufficient to develop an understanding of the local soil profiles. If you suspect there are areas of shallow soil, or areas with possible high water tables, locate extra pits in these locations.

Mark the location of the pits on the map, and give them all an identifying number. Physically peg the location of each pit – this saves time on the day of the dig.

Arrange a digging day with a local earth moving contractor. Have the contractor dig each pit location as deeply as possible, down to bedrock if it is present or at least 2.5 metres.

Have a thick tape-measure or surveying staff available to put down and measure the depth of each pit. Have a camera to take photos of each pit showing the depth. Prepare a set of 3 clip-lock plastic bags for each pit, marked with the pit number and the words top, bottom and middle. Use these to collect soil samples from the top, bottom and middle depths of each pit. Collect about 1 kg of soil in each bag. Arrange with the earth moving contractor to pause digging to allow safe collection of soil samples. In most cases professional soil analysis will not be required, but it's little effort to collect soil samples now in case they are required in the future.

Take notes about each pit. Is there rock, and if so, at what depths?. Is there any evidence of ground water, and if so, which way is it flowing? Take photos showing depth and any other details. Have the contractor move onto the next site while you are assessing the first. That way she/he can keep digging, and then begin backfilling the first pits as you are finishing off the inspection of the last ones.

Consider what you have found, and how the site compares against the **Site Characteristics** criteria. Is there adequate soil depth, and does the soil dig easily while holding its shape without the walls falling in? Is there evidence of ground water? How much rain has there been in the past few months? Is most of the site suitable, but one part has shallow soil depth?

The ideal site.

According to a leading Australian hydrogeologist,

> "an ideal cemetery situation is one where the site is only gently sloping, and hosts a deep, acid soil with an intermediate range of properties such as clayey sand or sandy clay, with a regional water table which is always at least 1.0 m below the invert level of any grave and which will not be flooded. These soils would be quite workable and would

encourage the decomposition of the interred remains and artefacts, with a reduced likelihood of bacteria or virus migration off-site"

With this in mind, the next step is to bring together all the findings and information from each stage of the **Assessment Procedure**, to see how the proposed site rates against standards designed to protect the environment.

Judgements about the overall suitability of the location of the site, concerns about existing flora and fauna, natural and Aboriginal heritage issues, access and neighbour consent will need to considered on their merits and determined on a site by site basis. The key geo-scientific criteria, however, apply to every site and these can be evaluated using the **Checklist** below.

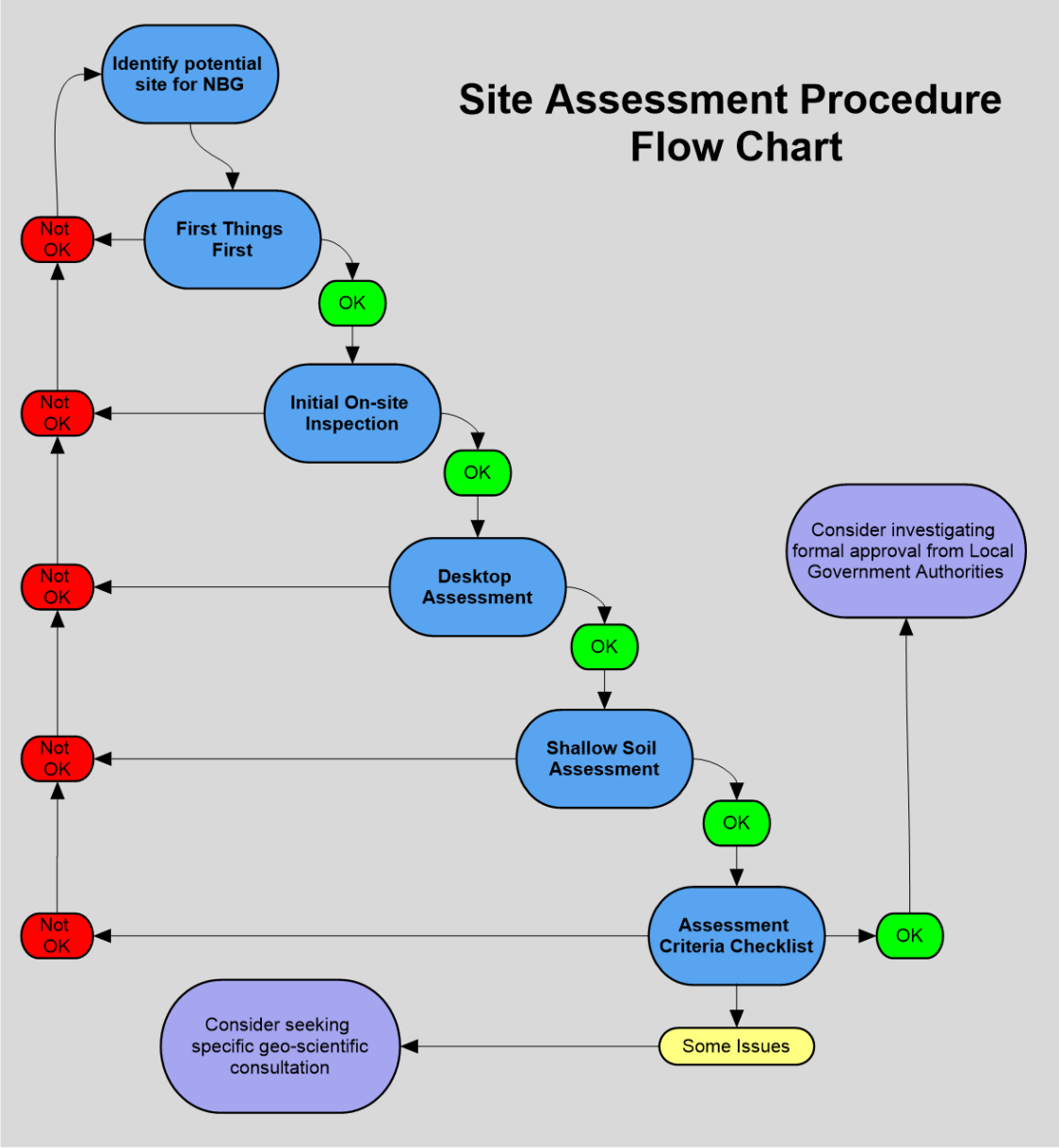
GEO-SCIENTIFIC SITE ASSESSMENT CRITERIA CHECKLIST

Criteria		Yes	No
Ground water	**No. 1**: The highest fluctuations of natural water tables are at least 1 m below the anticipated base of graves. Seasonal variability of water table levels has been taken into account. **Supporting Materials**: Census of all bores within a 2 km radius: Bureau of Meteorology records:		
	No. 2: Able to confirm there is no presence of rock shelves, perched water tables, springs or ephemeral water flows **Supporting Materials**: Records of Shallow Soil investigation:		
	No. 3: Able to confirm there are no drinking water wells within 200 metres of the site **Supporting Materials**: Census of all bores within a 2 km radius:		
Surface Water	**No. 4**: The site is above 1 in 100 year flood levels **Supporting Materials**: Existing data or survey information:		
	No. 5: There is space within the site for buffer zones around the burial area to ensure adequate distances from creeks, streams, dams, bores, beaches and storm water drains. **Supporting Materials**: Site maps, plans and/or survey information:		
	No. 6: If necessary, provision can be made to ensure that precipitation water can be directed away from burial sites and/or into buffer zones **Supporting Materials**: Site maps, plans and/or survey information:		
Soils	**No. 7**: Able to confirm suitability of soils. i.e. not course gravelly, high permability soils **Supporting Materials**: Existing information or description of local soil characterisitics: Soil test results		
	No. 8: Soil is of an adequate dept to ensure a mimimum of 1m of unsaturated soil lies beneath the bottom of any grave **Supporting Materials**: Records of Shallow Soil investigation:		
	No. 9: Soil is workable in terms of digging of graves and stability of grave walls **Supporting Materials**: Records of Shallow Soil investigation:		

If **'yes'** applies to all 9 criteria the geo-scientific characteristics of the site this is a strong indication that the site is suitable for the establishment of a natural burial ground.

If **'no'** applies to any criterion (other than criteria 2, 3 and 8) the site is not suitable. Every site has its own unique geo-scientific characterisitics, and this creates a reasonable degree of variability with regard to criteria 2, 3 and 8. If you, or your group, wish to proceed than a professional assessment should be undertaken to determine if these criteria rule the site out of contention.

SITE ASSESSMENT PROCEDURE FLOW CHART



MOVING FROM A PROMISING SITE TO A NATURAL BURIAL GROUND

If the proposed site is looking promising at this stage, it's probably time to re-confirm the level of local and community support, and, looking into the future, start thinking about who will be responsible for the long-term management and operation of the natural burial ground.

A planned Guideline in this series – **Establishment, Management & Operation of a Natural Burial Ground** – will step the natural burial ground Pioneer through the legal and practical requirements.

A further planned Guideline in this series – **Planning Your Natural Burial Ground Landscape** – will describe the basic elements you, your site planner or landscape architect will need to address in producing the working landscape plan you will need for devlopment, ongoing administration and legally required recording of burials.

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The Authors gratefully acknowledge the generous contributions of Dr Boyd Dent. Dr Dent's extensive research concerning the hydrogeological context of cemeteries is internationally recognised, and his personal advice and critical review of these Guidelines has been invaluable. Thank you Boyd.

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The authors are not aware of any conflict of interest in their contributions to this document. They have no current involvement in the commercial funeral industry, but do declare their involvement with the active promotion of natural burial grounds and sustainable funeral practices within private and public spheres.

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