

**Attachment 5**  
**Acid Sulfate Soils**

# Guidelines for Acid Sulfate Soils

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## *Preliminary note*

This guide provides a brief outline to assist applicants in the preparation of reports for the investigation and management of acid sulfate soils. Information within this guide has been taken from the document titled *Acid Sulfate Soils Manual*, prepared by the Acid Sulfate Soil Management Advisory Committee, and published on 26 August 1998. This guide does not replace the *Acid Sulfate Soils Manual*. A preliminary assessment and an acid sulfate soils management plan must be prepared in the manner set out in the *Acid Sulfate Soils Manual*.

## *What are acid sulfate soils?*

Acid sulfate soils are sediments and soils containing iron sulfates that are usually found in low-lying parts of coastal floodplains, rivers and creeks. When these soils and sediments remain underwater they are stable and the sulfates do not cause problems. However, if sulfates are exposed to oxygen by disturbance of the soil or by the lowering of groundwater levels, sulfuric acid is generated. Soil acidification can result in severe on-site and off-site environmental impacts. Unless managed properly impacts can include:

- ▶ damage and destruction of vegetation
- ▶ reduction in soil fertility and increased salinity
- ▶ failed soil structure with consequent erosion problems
- ▶ pollution of local ground water and surface water bodies
- ▶ death or disease of fish and destruction of aquatic ecosystems
- ▶ corrosion of structures, particularly concrete, ferroconcrete, iron, steel and aluminium [this is particularly a problem with pipes, drains, cables, in-ground pools, foundations, and basement car parks.]

Acid sulfate soils include *actual acid sulfate soils* and *potential acid sulfate soils*. *Actual acid sulfate soils* are soils containing iron sulfates, which have been exposed to oxygen. *Potential acid sulfate soils* are soils that contain iron sulfates, which have not been exposed to oxygen.

## *Identifying potential acid sulfate soils in Woollahra*

Land that may contain potential acid sulfate soils on the Acid Sulfate Soils Map (map) in Woollahra Local Environmental Plan 2014 (Woollahra LEP 2014). The map establishes 5 classes of land based on the probability of acid sulfate soils being present (Class 1 being the most likely and Class 5 being the least likely).

Due to the topography of the Woollahra local government area (LGA) only limited areas of Class 1 and 2 land exist, with these areas being located near the harbour foreshore and along creek systems. Much of the LGA falls within the Class 5 classification.

The map does not describe the severity of acid sulfate soils in an area or on a particular site. They provide an initial indication that acid sulfate soils could be present on land.

Associated with the map is the following table that sets out for each class of land those types of work that, if carried out, are likely to present an environmental risk.

Class of Land (as shown on acid sulfate soils planning map)	Works
1	Any works
2	Works below the natural ground surface. Works by which the watertable is likely to be lowered.
3	Works more than 1 metre below the natural ground surface. Works by which the watertable is likely to be lowered more than 1 metre below the natural ground surface.
4	Works more than 2 metres below the natural ground surface. Works by which the watertable is likely to be lowered more than 2 metres below the natural ground surface.
5	Works within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below 5 metres Australian Height Datum and by which the watertable is likely to be lowered below 1 metre Australian Height Datum on adjacent Class 1, 2, 3 or 4 land.

**Note:** Lowering of the watertable can occur through processes and actions including: extraction of groundwater; excavation to or below the watertable; dewatering of construction sites; construction of deep drains; growing of trees on previously cleared land.

### *Legislative framework*

The legal framework for acid sulfate soil management in the Woollahra Municipality is found in clause 6.1 of Woollahra LEP 2014. Clause 6.1 sets out:

- ▶ Circumstances where development consent is or is not required for works relating to potential acid sulfate soils land
- ▶ Considerations that the Council must carry out when assessing a development application
- ▶ Requirements for an acid sulfate soils management plan
- ▶ The role of a preliminary assessment.

## *Managing potential acid sulfate soils*

Investigation and management of acid sulfate soils can be carried out in one or two stages:

- ▶ A preliminary assessment
- ▶ An acid sulfate soils management plan.

### *Preliminary assessment*

#### **What is a preliminary assessment?**

A preliminary assessment involves investigations, analysis and reporting that:

- ▶ Identifies the characteristics of the proposed works, particularly in regard to excavation and groundwater disturbance
- ▶ Establishes whether acid sulfate soils are present on a site and if so whether the proposed works are likely to disturb those soils
- ▶ Establishes whether an acid sulfate soils management plan should be prepared
- ▶ Provides information to assist with the design of a soil and water assessment program
- ▶ Provides information to assist in decision making.

#### **What should a preliminary assessment report contain?**

The *Acid Sulfate Soils Manual* sets out steps for preparing a preliminary assessment. Subject to the nature of works proposed, the location of the site and the findings from investigations, certain steps within the assessment may not be required. Therefore, a preliminary assessment report may need to contain all or part of the following information:

- ▶ The general characteristics of earthworks associated with the proposal, including:
  - a full description of the proposed earthworks together with the method and equipment to be used for the works
  - the volume of soil to be disturbed
  - the depth of disturbance of soil due to construction and operational works in AHD
  - whether the disturbance is short term or permanent
  - whether the disturbance is to be or can be staged to minimise exposure of disturbed soil to the air
  - information on how the disturbed area and excavated soils are to be managed in the short and long term
  - whether the landscape and soil characteristics make mitigation easy or difficult
  - information on whether mitigation can be undertaken on site
  - whether leachate can be easily contained and neutralised
  - the acid sulfate soils condition on adjoining land and in the immediate area.
- ▶ Details about groundwater conditions, including the level in AHD. Depending on the type of works proposed and their location in mapped areas, a preliminary hydrology study may be required.
- ▶ The classification of land on which the works are proposed (refer to the Acid Sulfate Soils Map in Woollahra LEP 2014).
- ▶ A check against geomorphic or site criteria to establish the likely presence of acid sulfate soils [refer to the Acid Sulfate Soils Manual - Assessment Guidelines, section 2.2].
- ▶ The findings from soil and water (surface and sub-surface) analysis.

- ▶ Based on the investigations, conclusions on whether or not an acid sulfate soils management plan is required.

### **When is a preliminary assessment required?**

A preliminary assessment is required for those development applications seeking consent for works described and proposed to be located on land classified in the table to clause 6.1 of Woollahra LEP 2014 and its associated map. Depending on the nature of the proposed development and its location (relative to the acid sulfate land classification), investigations and reporting could proceed directly to the preparation of an acid sulfate soils management plan.

### *Acid sulfate soils management plan*

#### **What is an acid sulfate soils management plan?**

An acid sulfate soils management plan, is a plan, prepared in the manner set out in the *Acid Sulfate Soils Manual*. The plan identifies the extent and nature of acid sulfate soils on a particular site, assesses the likely impacts of any proposed activity upon those acid sulfate soils (including the consequence of no action), and details the prescriptive measures to be taken to minimise environmental impacts resulting from interaction between the acid sulfate soils and the proposed activity or inaction.

#### **What should an acid sulfate soils management plan contain?**

An acid sulfate soils management plan should contain, as a minimum, the following information:

- ▶ An overview of environmental attributes of the site and its surrounds. This will include groundwater conditions.
- ▶ An overview of the proposed works, particularly the proposed excavation works and works that may lower groundwater levels. For details relating to excavation works, refer to the list for a preliminary assessment. Lowering of the watertable can occur through processes and actions including: extraction of groundwater; excavation to or below the watertable; dewatering of construction sites; construction of deep drains; growing of trees on previously cleared land.
- ▶ A description of the acid sulfate soils mitigation strategies incorporating a schedule of construction and operational phases to minimise impacts from:
  - the disturbance (including excavation or changes in surface or subsurface water systems)
  - any excavated soils (including storage, treatment or use)
  - any acid leachate produced (including storage, treatment, discharge or use).
- ▶ A monitoring program for soils and the surface and subsurface water quality outlining:
  - ▶ the parameters to be monitored
    - monitoring locations
    - monitoring frequency
    - analyses to be conducted
    - laboratory analyses to be conducted
    - procedures to be undertaken if monitoring indicates that thresholds are being exceeded
    - reporting procedures to relevant authorities and neighbouring property owners, where necessary

- ▶ A description of the pilot project or field trial, if new mitigation strategies are being used or a pilot project is required by the Council. The pilot project or field trial will:
  - prove the effectiveness and feasibility of new technology, or selected management procedures to deal with the acid sulfate soils and other environmental impacts
  - demonstrate that the developer has the capability to implement those management procedures effectively
  - demonstrate the ability to comply with agreed standards and performance targets
- ▶ A description of the contingency procedures to be implemented at the site to deal with unexpected events or failure of management procedures, including a remedial action and restoration action plan related to:
  - any failure to implement any proposed acid sulfate soil management strategies
  - any mitigation strategies being ineffective so that the project fails to meet agreed standards or performance levels.

The amount of detail within an acid sulfate soils management plan will depend on:

- ▶ the size and complexity of the development proposal
- ▶ the level of risk from acid sulfate soil conditions due to the proposed works
- ▶ the level of certainty associated with the proposed mitigation strategy
- ▶ the sensitivity of the environment likely to be affected.

*Note: The above material has been taken from section 6 of the Acid Sulfate Soils Assessment Guideline, August 1998, which forms part of the Acid Sulfate Soils Manual.*

#### **When is an acid sulfate soils management plan required?**

An acid sulfate soil management plan must be prepared in all circumstances when it has been determined that works in the site's soils will result in the action criteria listed in Table 4.4 of the *Acid Sulfate Soils Assessment Guideline* being exceeded (see below). Information to reach this conclusion may be obtained by undertaking the investigations and analysis set out in a preliminary assessment.

**Table 4.4** Action criteria based on ASS soil analysis for three broad texture categories

Type of material		Action criteria 1-1000 tonnes disturbed		Action criteria if more than 1000 tonnes disturbed	
Texture range McDonald et al (1990)	Approx. clay content (%<0.002mm)	Sulfur trail  %S oxidisable  (oven-dry basis) e.g. S <sub>TOS</sub> or S <sub>POS</sub>	Acid trail  mol H <sup>+</sup> /tonne  (oven-dry basis) e.g. TPA or TSA	Sulfur trail  %S oxidisable  (oven-dry basis)  e.g. S <sub>TOS</sub> or S <sub>POS</sub>	Acid trail  mol H <sup>+</sup> /tonne  (oven-dry basis) e.g. TPA or TSA
Course texture  Sands to loamy sands	≤5	0.03	18	0.03	18
Medium texture  Sandy loams to light clays	5 - 40	0.06	36	0.03	18
Fine texture  Medium to heavy clays and silty clays	≥40	0.1	62	0.03	18

Source: Acid Sulfate Soils Assessment Guideline, August 1998