# Acid Sulphate Soil Management Procedure

## 1. Purpose

The purpose of this Procedure is to provide a summary of tasks, responsibilities, tools and templates applicable to renewals programs delivered by the Project Delivery Group, relevant to the management of acid sulphate soils.

## 2. Scope

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|---|---|---|
| ☐ Planning | ☒ Delivery | ☐ Handover |
| ☐ Program Management | ☐ Procurement | ☐ Community & Stakeholder |
| ☐ Safety | ☒ Environment | ☐ Quality |

This Procedure steps through the processes for acid sulphate soil management on projects and programs delivered by TasWater. This procedure is a summary of the advice contained within the Tasmanian Acid Sulphate Soil Management Guidelines (the Guidelines) [Attachment A] and details the steps required to be followed for:

1. Undertaking Acid Sulphate Soil (ASS) Investigations
2. Developing ASS Management Plans
3. Unanticipated ASS Discovery

This Procedure should be read in conjunction with the following documents:

1. PDG Environmental Management Plan
2. Waste Management Procedure
3. Erosion and Sediment Control Procedure
4. Establishing and Managing Environmental No-Go Zones

Acid Sulphate Soils (ASS) are soils that contain sulphides which were formed from ancient bacterial activity in marine and freshwater sediments, which now form soils in coastal areas (where the ocean has receded) or in inland areas associated with floodplains and swamps. Undisturbed, these soils present no danger, but when excavated and exposed to oxygen, the sulphides in the soil begin to oxidise and produce sulfuric acid. This sulfuric acid can then mobilise in rains and cause serious damage to both the ecology of an area as well as to man-made infrastructure through corrosion.
The acronym **PASS** refers to “potential acid sulphate soils” and is referring to undisturbed soils that contain the potential for acid generation whereas the acronym **AASS** refers to “actual acid sulphate soils” which refers to soils that have started oxidising to produce sulfuric acid; collectively these are known as Acid Sulphate Soils or **ASS**.

## 3. Definitions

This Procedure should be read in conjunction with the Project Delivery Group Acronyms and Glossary document.

**This is not an exhaustive list. It provides step-by-step guidance. Please refer to the relevant management plan or tools for detailed information.**

## 4. ASS Investigations

The purpose of this procedure is to provide guidance on how to complete an ASS risk assessment for TasWater PDG projects.

| PROCEDURE | RESPONSIBILITY |
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| **STEP 1 COMPLETE A DESKTOP ASS PROBABILITY ASSESSMENT** | |
| ASS probability has been mapped in Tasmania as part of the Tasmanian Acid sulphate Soils Information' (TASSI) project and is based on various datasets and models developed in part by the CSIRO. The probability mapping is available on the online LISTmap service (https://maps.thelist.tas.gov.au/listmap/app/list/map) or through the TasWater GIS Portal (https://gishub.taswater.com.au/portal/home/) for internal users.<br>The layers are under the parent layer category *Geology and Soils* and then the sub-category *Soils*, with the following layers to be used for investigation:<br>• **Coastal Acid Sulphate Soils (0 – 20m AHD)** – This layer shows the predicted occurrence of ASS in the coastal region below 20m AHD (Australian Height Datum).<br>• **Inland Acid Sulphate Soils (>20m AHD)** – This layer shows the predicted occurrence of ASS in inland areas above 20m AHD, which are usually related to water courses and floodplains.<br>• **Marine Subaqueous/Intertidal Acid Sulphate Soil** – This layer shows the predicted occurrence of ASS in sediments in the seaward zone below the high-water mark extending into the sub-tidal zone.<br>• The above layers use the follow scale of probability of ASS occurrence:<br>– **High** with a probability of >70% of occurrence<br>– **Low** with a probability of 6-70% of occurrence<br>– **Extremely Low** with a probability of 1-5% of occurrence<br>• To check the predicted occurrence of ASS for a project, zoom to the extent of the project in LISTmap and turn all three of the above layers on and note the occurrence probability within your project extent.<br>• If there is no mapped probability of ASS occurrence, then the site is generally considered free of ASS and no further investigation is warranted.<br>• If there is ASS occurrence predicted with a "Low" or "High" probability and the project will result in the excavation of >100m$^3$ of soil or sediment or involves the dumping >500m$^3$ of soil to a depth >0.5m, then move to **Step 2** of this procedure. If not, then no further ASS consideration warranted.<br>• If there is ASS occurrence predicted with an "Extremely Low" probability, a desktop risk assessment is to be completed by the Project Manager and Environmental Advisor to determine if a screening assessment is required. | Environmental Advisor |
| **STEP 2 COMPLETE A PRELIMINARY SCREENING ASSESSMENT** | |
| • The preliminary screening assessment involves the collection of soil samples by a suitably experienced TasWater personnel, utilising a hand auger at intervals of 0.5m (or when the soil profile changes) to a maximum depth of 2 m per hole.<br>• Spatial distribution of the samples depends on the proposed project layout, but generally four (4) sample holes per hectare of disturbance is considered sufficient at this stage or for linear projects, one sample hole every 50-100 m. Sampling density is to be determined by the TasWater PDG Environment Team on a case by case basis.<br>• The collected samples are sent to the laboratory for initial screening analysis which involves a test known as the Field pH (pHf) and peroxide pH (pHfox) test ($pH_{field/fox}$). This test determines whether further laboratory analysis is warranted.<br>• In the event the results of the $pH_{field/fox}$ screening test indicate the potential presence of ASS, more in depth targeted analysis should be completed by the laboratory to determine the concentration of acid forming sulphur in the soil (this test is usually a chromium reducible sulphur test).<br>• In the event this preliminary screening assessment indicates ASS is present on the project site, a risk assessment should be completed by the Project Manager and the TasWater Environmental Advisor to determine the need for a full PASS/ASS assessment. This assessment should consider:<br>– The severity of ASS results | Project Manager<br>Environmental Advisor |

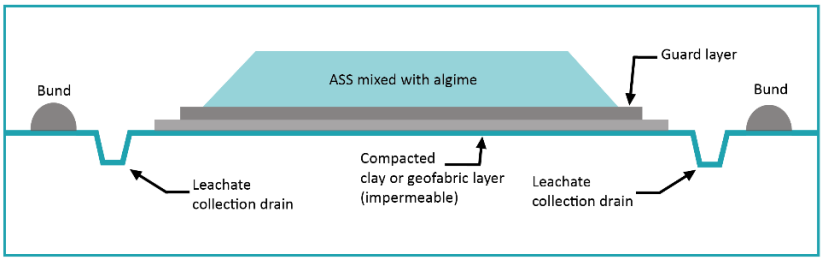
| PROCEDURE | RESPONSIBILITY |
|---|---|
| – The amount of material to be disturbed<br>– The complexity of soil management on site<br>– The depth of excavations required (i.e. greater than the 2 m limit of the preliminary assessment)<br>– The depth of groundwater beneath the site<br>– The risk to the environment and infrastructure from acidified run-off.<br>• If the outcome of the risk assessment is that a full PASS/ASS assessment is required, move to Step 3.<br>• If the outcome of the risk assessment is that the ASS on site is understood and manageable with the data already collected, then no further assessment is required, and the focus should move to the development of an ASS management plan, as outlined in **Section 1.2** of this procedure. | |
|   <br>***TasWater CDO staff taking ASS samples*** | |
| **STEP 3 COMPLETE A FULL PASS/ASS ASSESSMENT** | |
| • A complete PASS/ASS assessment should be undertaken using a qualified third-party consultant for quality assurance purposes. The TasWater Environmental Advisor should be contacted to request a list of current providers capable of completing the assessment.<br>• The proposed assessment should be undertaken in accordance with the advice contained within the Guidelines [Ref. 8]. It should be ensured that the consultant's proposal meets the specific minimum sampling requirement outlined in the guideline, including:<br>– Sampling spatial coverage<br>– Sampling depth (at least 1m below the depth of proposed disturbance or at least 2m below the land surface, whichever is greater)<br>– Sampling frequency (every 0.5m or change in soil type)<br>– Use of a NATA accredited laboratory for analysis.<br>Additional considerations are included in Appendix B of the Guidelines (*Soil sampling and analysis guidelines)* [Ref. 1]. | Project Manager<br>Environmental Advisor |

## 5. ASS Management Plan

The purpose of this procedure is to provide guidance to contractors on the development of ASS Management Plans.

| PROCEDURE | RESPONSIBILITY |
|---|---|
| **STEP 1 REVIEW THE MANAGEMENT PRINCIPLES TO BE APPLIED TO THE PROJECT** | |
| • The Guidelines [Ref. 1] outline the management principles that should be applied to ASS on a construction site, and are summarised as follows:<br>– Avoiding the disturbance of ASS should be considered foremost when considering how to manage ASS at a site. Project designs should be reassessed if possible, to consider alternative construction methods that avoid ASS disturbance.<br>– Where disturbance is unavoidable, the preferential management strategies are disturbance minimisation, ASS neutralisation, and strategic reburial.<br>– Receiving waters must not be used to dilute acid runoff.<br>– Excavated ASS soil must be treated and not simply stockpiled<br>– When developing the management plan, consideration should be given to the sensitivity of the receiving environment, linkages to surface and groundwaters, the properties of the soil and any local or state government management strategies in the area. | Contractor |
| **STEP 2 DEVELOP ASS MANAGEMENT PLAN** | |
| • The ASS management plan should be developed in consideration of the guiding principles outlined in Step 1 above and the Guidelines [Ref. 1].<br>• The first management principle to consider is the possible avoidance of the ASS areas within the project site outside of the direct project footprint (which is assumed to have been finalised at this point and unable to be changed). This could mean realigning haul roads, moving laydown areas, or reconsidering borrow pit locations. Areas of ASS within the project site should be shown on a map within the management plan.<br>• Where it is unavoidable to excavate ASS, one option to be considered is the treatment either onsite or offsite of the ASS with a neutralising agent. The most used agent is fine powdered aglime, which when mixed with the ASS acts to neutralise the sulphuric acid generated, resulting in the generation of a harmless salt.<br>• To determine the dosing rate of the aglime, the laboratory results of the site assessments are used. Most laboratory results provide a suggested liming rate in **kg $CaCO_3$/t**. This should be used as a base rate and then a minimum safety factor of 1.5x applied to the rate. This can be acquired from the TasWater CDO PEMR who will have the laboratory results on file.<br>  <br>***Aglime delivered to a site for ASS treatment***<br>• Lime should be mixed with the ASS material by an excavator on a dedicated treatment pad within the construction facility. This pad should be developed in accordance with the Guidelines [Ref. 1] and should contain an impermeable compact clay or geofabric layer, | Contractor |

leachate collection drains with a holding pond, and sufficient bunds to prevent water getting in or out of the system (see image below). Aglime can be mixed with sand within the base of the drainage system to further neutralise any collected run-off.




***Schematic of basic ASS pad design***

- The runoff from the neutralised material should be monitored regularly to ensure the efficacy of lime treatment. Once neutralised, this material can then essentially be considered clean fill and used elsewhere on site or taken to a landfill facility. This should be determined in consultation with the TasWater Environmental Advisor and Project Manager.

***ASS leachate drain development***

- Another option for the management of ASS material is its reburial in the same or another location once the required project phase is completed (e.g. installing a pipeline leaving an open trench to be backfilled). If this method is chosen, several factors should be taken into consideration including potential impacts to the groundwater table, potential use of neutralising agents, potential impacts to infrastructure, and suitable layering of the material. Advice should be sought from an ASS consultant when using this methodology of disposal.
- The ASS management plan should outline as a minimum:
  - The areas of ASS on the site predicted or known to occur
  - Areas to avoid for vehicles and machinery
  - Any ASS stockpile locations
  - Any drainage features associated with ASS
  - The storage locations of any neutralising materials (e.g. aglime)
  - A method to calculate the rate of addition of neutralising material and how to sufficiently mix the material.
  - The locations and agreements with any landfill facilities that may be accepting the ASS or neutralised material.
  - The contact details of any consultants for additional advice
  - Any monitoring that should be undertaken of ASS areas, including any aquatic receiving environments.
- The format of the management plan is at the discretion of the contractor but must contain georeferenced map(s) of the site with the abovementioned features included where suitable.

## 6. Unanticipated ASS Discovery

The purpose of this procedure is to provide guidance to site personnel on the process to follow should unanticipated discovery of PASS/ASS occur.

| PROCEDURE | RESPONSIBILITY |
|---|---|
| **POTENTIAL ASS DISCOVERED DURING CONSTRUCTION** | |
| • Discovery of the following may indicate the presence of PASS/ASS within the project site:<br>– Soil typically includes orange material with prominent yellow mottles<br>– Soil is typically fine-grained silt or clay<br>– Testing of water or soil typically has a pH below 4<br>– Freshly exposed soils may have a rotten egg gas smell (caused by sulphides)<br>  <br>***Exposed ASS typically has a yellow or orange colour***<br>• Should any combination of the above characteristics be identified during construction, works in that area are to cease and the Environmental Advisor and Project Manager are to be notified. | Contractor |

## 7. References

*Tasmanian Acid* sulphate *Soil Management Guidelines, DPIPWE, 2015*

PDG Environmental Management Plan

Waste Management Procedure

Erosion and Sediment Control Procedure

Establishing and Managing Environmental No-Go Zones