Richmond Valley Council

Acid Sulfate Soils

Guidance for Construction Activities

June 2007

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1. Introduction

Richmond Valley Council (RVC) is responsible for undertaking and managing works and approving developments which occur in areas containing acid sulfate soils (ASS). ASS are recognised as being a major environmental issue in the region and effective management is essential for the long-term sustainability of the land and water systems in the area.

The purpose of this guidance document is to provide guidance to Council works staff and contractors undertaking ground works within the RVC area, and allow for proper management of ASS. The guidance provides a step-by-step process for managing ASS in relation to undertaking ground works and directs the reader to the appropriate references for specific steps in the process.

Specific actions required include:

1. Understanding characteristics and implications of ASS;
2. Project planning relating to ASS;
3. Undertaking an ASS Preliminary Assessment of the works site; and,
4. Preparing an ASS Management Plan (ASSMP) for the works.

There are frequent references in this Management Plan to the following documents:

- Richmond River Local Environmental Plan 1992 and amendments. Specifically Clause 18A and associated Acid Sulfate Soils Planning Maps;
- Richmond River Shire Council Development Control Plan No. 5 – Acid Sulfate Soils;
- Acid Sulfate Soil Manual, NSW Acid Sulfate Soil Management Advisory Committee, August 1998;
- Queensland Acid Sulfate Soil Technical Manual Soil Management Guidelines, Queensland Department of Natural Resources and Mines, 2002;
- Acid Sulfate Soils Laboratory Methods Guidelines, Queensland Department of Natural Resources, Mines and Energy, 2004; and
- Acid Sulfate Soils Keys to Success, Acid Sulfate Soil Management Advisory Committee and NSW Agriculture, 2000.

This guidance should be reviewed as part of the planning for the works.

This Management Plan is set out in the following manner:

- Chapter 2 provides a brief description of the processes of ASS;
- Chapter 3 provides a description of the procedures by which ASS should be managed;
- Chapter 4 provides a summary of the requirements of a Preliminary Assessment and refers to specific field test and sampling procedures and protocols required; and,
- Chapter 5 provides a summary of the requirements of a site specific ASS Management
- The appendices provide background and supporting material including ASS risk maps, lime rate calculation procedures, reporting templates and works method statements.

2. Characteristics of Acid Sulfate Soils

Soils rich in pyrite (iron sulfide) or the products of pyrite oxidation are commonly known as ASS. The natural oxidation of these soils can occur when pyrite is exposed to oxygen during declines in relative sea level, prolonged drought, re-suspension of reduced sediments, and changes in tidal regimes. Human activities can, however, greatly accelerate pyrite oxidation through the lowering of coastal water tables, reduction of tidal flushing, alterations to surface drainage, dredging and excavation in coastal zones.

The generalised reaction for pyrite oxidation often documented in the literature shows that one mole of oxidised pyrite yields ferric hydroxide and two moles of dissolved sulfuric acid:

$$FeS_{2(s)} + \frac{15}{4} O_{2(g)} + \frac{7}{2} H_2O_{(aq)} \rightarrow Fe(OH)_{3(s)} + 2\ H_2SO_{4(aq)},$$

where $FeS_{2(s)}$ is pyrite (solid), $O_{2(g)}$ is atmospheric oxygen (gas), $H_2O_{(aq)}$ is water (aqueous), $Fe(OH)_{3(s)}$ is Ferric Hydroxide and $H_2SO_{4(aq)}$ is sulfuric acid (aqueous).

Several secondary reactions are also known to occur producing further acidity, which can significantly lower soil and water pH, often below pH 3. These low pH conditions readily mobilise toxic metals, such cadmium, arsenic, manganese and aluminium, held within the soil matrix, and can result in the formation of minerals, such as jarosite.

Pyrite typically forms under anaerobic conditions when there is a readily available supply of decomposable organic matter, reducing microbes, sulfate, usually from seawater, and a source of iron, usually derived from sediments. The majority of coastal pyrite was formed in estuarine lowlands and embayments, less than 5 m AHD, between 6000 to 10 000 years ago following the last major sea level rise. ASS are also known to occur in coastal plains where they are often overlain by alluvial deposits.

When left undisturbed, these soils are relatively benign and are indistinguishable from other reduced sedimentary deposits. The characteristics of PASS include:

- The presence of waterlogged soils - unripe muds (soft, buttery, blue grey or dark greenish grey) or estuarine silty sands or sands (mid to dark grey);
- Presence of reduced sulphur odours;
- Presence of shells; and
- Soil pH usually neutral but may be acidic.

Once these reduced soils are disturbed and exposed pyrite oxidises to produce enough acidity to exceed the soil's neutralising capacity these soils are termed Actual Acid Sulfate Soils (AASS). The characteristics of AASS include:

- Soil pH less than or equal to 4;
- Presence of shells;
- Jarosite horizons (pale yellow mineral deposit, product of the incomplete oxidation of pyrite) and/or substantial iron oxide mottling (orange to red secondary mineral deposit, formed from the oxidation and precipitation of mobilised iron).

Major effects of poorly managed AASS include impacts on aquatic ecosystems, disruption of plant physiological processes and health risks for animals and humans. These soils can also negatively impact concrete and steel components of structures, pipelines, and other engineering works.

The characteristics of water that has been affected by acid generated from AASS include:

- A pH of less than 5;
- Low alkalinity concentrations;
- Unusually clear or milky blue-green colour;
- Possible white precipitates (aluminium hydroxides) floating on the surface; and
- Extensive orange to red iron stains, flocculates or bacteria slicks.

3. ASS Management Process

The staged process described below is consistent with RVC's DCP No. 5 (RRSC, 1999) and the Acid Sulfate Soil Manual (ASSMAC, 1998) (ASSM).

3.1 Pre-construction Planning

3.1.1 Establish project roles and responsibilities

Project Managers, Supervisors and Contractors are responsible for complying with this Management Plan when undertaking site works. Responsible personnel should have a full understanding of the regulatory framework associated with ASS and the technical requirements for their management. Responsible personnel might employ suitably qualified consultants to provide particular planning or technical input where necessary. This delegation should be documented and relevant regulatory authorities informed.

3.1.2 Understanding the project

The physical nature of the works or construction processes should be clearly understood and documented. Particular emphasis needs to be placed on estimating the quantity of any excavation that this likely to occur. Also, consideration must be given to any activity that might cause a lowering of the groundwater for example drainage or pumping activities. This would include works undertaken in the construction phase and any residual issues post-construction. Typical examples of works Council and Contractors routinely undertake that might impact on ASS include:

- Water and sewer pipe repair or installation – temporary trench excavation;
- Drain maintenance and installation – permanent excavation and potential groundwater modification;
- Road construction – permanent excavation and/or fill; and
- Building/structure foundation preparation – permanent excavation and/or fill.

3.1.3 Richmond Valley Council LEP and DCP No. 5 and DNR ASS Risk Maps

Richmond Valley Councils' Local Environmental Plan 1992 (and amendments) (LEP) containing the Acid Sulfate Soil Planning Maps, and Development Control Plan No. 5 – Acid Sulfate Soils, 1999, should be consulted to determine the potential incidence of ASS in the locality of the proposed works. Clauses 7B, 7C and 18A of the LEP (1992 and amendments) are relevant for ASS areas and should be reviewed for application to the proposed works. Copies of the LEP, DCP No. 5 and the planning maps are available from Councils website (www.richmondvalley.nsw.gov.au) and are reproduced in Appendix A.

In addition to the Acid Sulfate Soil Planning Maps (LEP 1992), the Acid Sulfate Soils Risk Maps produced by the Department Natural Resources (formerly the Department of Land and Water Conservation (DLWC)) (1998) should be obtained and reviewed. For the specific site of interest, these maps describe the depth to acid sulfate materials, the environmental risk associated with disturbing the materials and examples of typical landform types. Additionally the Risk Maps indicate whether there would be a 'high probability of occurrence, 'low probability of occurrence' or 'no known occurrence' of ASS.

Given the anticipated excavation and groundwater conditions associated with the works and based on the LEP and DCP No. 5, a determination may be made on whether a Development Application (DA) is required.

For minor ground works, regardless of the ASS class of land (as per the ASS Planning Maps), disturbances of less than one tonne would not trigger the requirement for a DA. However, responsible assessment and management of minor works should include relevant techniques for assessment and management as described below.

Particular attention should be given to works occurring in the following 'priority' (as identified by the Evans Estuary Management Plan 2004) and 'hotspot' (as determined by NSW DLWC 1999) areas:

- Rocky Mouth Creek (hotspot);
- Sandy Creek – Bungawalbyn Creek (hotspot);
- Farmed land around Woodburn (priority area); and,
- Natural swamp areas in Brandy Arm Creek and Foggles Creek (priority area).

Once the ASS planning maps have been consulted, the general layout and design of the proposed works should be reviewed to determine whether there are opportunities for reducing the potential impact on ASS.

3.2 Preliminary Assessment (Site Investigation)

If the nature of the works and ASS site conditions trigger the DA process the proponent may either undertake a 'Preliminary Assessment' or proceed directly to an ASSMP. The full requirements of a Preliminary Assessment are found in the ASSM (ASSMAC, 1998). A summary is provided in Section 4. If the Preliminary Assessment confirms the presence of ASS, an ASSMP would be required. If the Preliminary Assessment found no incidence of ASS affecting the proposed works then the DA process would proceed without further ASS considerations.

These assessment techniques may be equally applied for site investigations undertaken outside the Preliminary Assessment process. This would occur for the purpose of providing general information on a particular site or waterway not the subject of development, or to a situation where less than 1 tonne of excavated material would be generated and not subjected to the requirements of the DA process.

3.3 ASS Management Plan

If the site is assumed to contain ASS or if the Preliminary Assessment confirms the presence of ASS then an ASSMP would be required. An ASSMP involves a detailed site investigation, including ASS testing, development of management strategies and implementation of a monitoring regime. Further information on the full requirements of a Management Plan are proved in Section 5, and detailed fully in the ASSM (ASSMAC, 1998).

4. Preliminary Assessment (Site Investigation)

The purpose of a Preliminary Assessment is to determine the likelihood of occurrence of AASS or PASS on the site. If the works are to be undertaken on a site know to contain AASS or PASS, then the Preliminary Assessment procedure is often skipped with an ASS Management Plan prepared from the outset.

4.1 Visual Identification

When assessing the site in the preconstruction phase the visual indicators listed below should be identified as potentially indicating the presence of AASS or PASS. The reference 'Keys to Success' (NSW Agriculture, 2000) provides a good summary of visual indicators and pictorial examples.

4.1.1 Vegetation

The following plants are acid tolerant and may indicate the presence of AASS and PASS:

- Tea Tree;
- Swamp Oak;
- Smart Weed;
- Water Couch, Swamp Couch and Buffalo Couch grasses;
- Water Lilies;
- Spike Rush, Umbrella Sedge and Phragmites emergent wetland plants; and,
- Maundia.

4.1.2 Water

The presence of sulfuric acid and associated mobilised iron and aluminium create a range of visual water indicators including:

- Crystal clear water which may indicate a pH range of 3 to 4, caused by the flocculation and sedimentation of particles to the bed of the waterway by mobilised aluminium;
- Blue-green water which can be caused by suspended aluminium flocs with a pH of 4 to 5;
- Milky-white precipitate which can be an indicator of another form of aluminium that occurs at a pH of 5 to 6;
- Yellow-brown water which could indicate dissolved and/or precipitated iron and a pH below 3.8; and,
- Suspended deep red-brown or brown-yellow colour precipitates throughout the water column or deposited on land after inundation which can be caused by iron flocculation at pHs below 4.

4.1.3 Soil

Soil indicators may be identified at the ground surface or down a depth profile at a borehole, drain or natural bank. Surface indicators include:

- Scalds, which may occur where the acidity (or salinity) of surface soil layers cause a dieback of vegetation. Scalds may be temporary or permanent features and may result in a change of vegetation to acid tolerant species;
- Salt crusts, may be related to the presence of AASS and PASS and should be considered for further investigation; and,
- Monosulfidic Black Ooze are muddy black sediments created in water saturated, low oxygen environments. They are usually associated with water inundated land, drains and waterways. When exposed to oxygen, the surface of monosulfidic black ooze becomes a red-brown colour due to the oxidation of iron.

The soils associated with ASS are estuarine sediments with a range of clay, silt and sand content. Soil profile indicators include:

- AASS with a pH below 4, usually has a red-orange mottling or a straw colour due to the presence of oxidised iron. These soils often have a distinctive hydrogen sulphide smell (similar to rotten egg). Jarosite mottles (yellow streaks and mottles around old root channels) are a positive indicator of ASS. Jarosite can form as an intermediate mineral during the chemical reaction which results in sulfuric acid. It forms when the soil is both acid and is in contact with oxygen (van Breeman 1982 in DLWC 1998). Not all AASS form jarosite, however, especially organic soils (DLWC 1998). Red-orange iron oxyhydroxide precipitates can also form during ASS oxidation, and result in the production of variable amounts of acidity; and,
- PASS with a pH above 4 are usually waterlogged with a grey, greeny or bluish grey colour. They may contain shell and other carbonates. PASS may exhibit Hydrogen sulfide odour.

4.2 Sampling Frequency

The soil sampling process is not prescriptive, however, suitably qualified ASS practitioners should be consulted for more extensive projects.

As a guide, Table 1 below (ASSMAC, 1998) provides areal frequencies for sampling and testing. These frequencies may be varied depending on factors such as sensitivity of surrounding environment, variability of ASS, high sulfide concentrations and amount (excavated volume, etc) of disturbance.

Table 1 Minimum number of sampling holes

Area of Site	Number of sample holes
Up to 1 ha	4 holes
1 to 2 ha	6 holes
2 to 3 ha	8 holes
3 to 4 ha	10 holes
Greater than 4 ha	2 holes per ha

For linear ASS disturbances (eg trenches, drains) a sampling frequency of every 50 to 100 metres would be appropriate with consideration given to potential ‘hot-spots’. As some linear projects can impact on

groundwater levels, consideration should also be given to sampling and testing in the area likely to be affected.

Testing of a soil profile at 0.25 m vertical intervals is recommended, however where sediments or profile demonstrates a high level of homogeneity, sampling intervals may be extended to 0.5 m intervals. Field testing should be undertaken within 0.25 m of visually identifiable soil horizons.

4.3 Field Tests

Field assessment of ASS for general information or as part of a Preliminary Assessment, requires some relatively inexpensive, quick and easy testing. The Keys to Success (NSW Agriculture 2000) provides a methodology for undertaking field testing of ASS. The ASSM (ASSMAC 1998) also provides a detailed methodology for undertaking a field test for a Preliminary Assessment and is included in Appendix B.

The general steps of the field testing are as follows:

1. Measure and record the pre-oxidation pH of a soil sample and water mixture;
2. Add an oxidising reagent (hydrogen peroxide), which artificially hastens the oxidising process, converting any PASS to AASS. The vigour of the reaction, involving the emission of gas (hydrogen sulphide) and potentially violent bubbling, should be observed and recorded; and
3. Measure and record the post-oxidation pH of the soil sample and added peroxide mixture after any reaction has ceased (up to 15 minutes).

WARNING: Hydrogen peroxide is a strong oxidising agent and should be handled carefully with appropriate eye and skin protection. The peroxide test should only be undertaken by trained operators.

4.3.1 Procedure

Field testing for pre-oxidation pH (pH_F) and post-oxidation (pH_{FOX}) mush be carried out in accordance with the methods described in the ASSM (ASSMAC 1998). Duplicate samples may be retained for analysis by a laboratory.

4.3.2 Indicative criteria

- If the post-oxidation pH_{FOX} value is at least one unit below the pre-oxidation pH_F, it may indicate PASS;
- If $pH_{FOX} < 3$ and a strong reaction to peroxide, there is a high level of certainty that sulfides are present;
- A pH_{FOX} of 3 to 4 is less positive and lab analysis is needed to confirm if sulfides are present. Sands particularly may give confusing field test results and must be confirmed by lab analysis;
- A pH_{FOX} of 4 to 5 could be positive OR negative. Sulfides may be present in small quantities, poorly reactive or neutralised by in-situ carbonate in the form of shell, or otherwise caused by organic acids. In this situation the Suspension Peroxide Oxidation Combined Acidity and Sulfate (SPOCAS) or Chromium Suite lab methods should be applied to check for the presence of oxidisable sulfides; and
- For $pH_{FOX} > 5$ and little or no change from the pH_F value, little net acid generating ability is indicated. However, the sulfur trial of the SPOCAS method should be applied to check some samples to confirm the absence of oxidisable sulfides.

Care must be taken in interpreting field tests as some soil minerals react vigorously with peroxide and do not show significant changes in pH.

4.4 Laboratory Testing

4.4.1 Analytical frequency

The field testing would provide an initial screen for determining the number of samples scheduled for laboratory testing. The criteria for scheduling laboratory tests should be pre-determined. Commonly, and for smaller works, the soil sample with the strongest indication of ASS or PASS determined from the field test would be duplicated and scheduled for laboratory testing. For more complicated works, numerous samples through the soil profile would be scheduled for laboratory analysis.

For larger projects a suitably qualified ASS practitioner should design the sampling and analysis procedures.

4.4.2 Laboratory analysis selection

There are numerous analytical methods available for quantifying ASS. The main determining factor in selecting the analytical method is whether the sample is 'wet or dry'.

Wet samples would be those taken from drains, ponds, lakes, estuaries etc and which contain sludges or ooze (referred to as monosulfidic ooze). Wet samples may contain a component of acid volatile sulfur which needs specific sampling and analysis prior to analysis by dry sample methods. Dry samples would be all other samples and comprise those taken form test pits, boreholes, embankments, etc.

The analytical methods include:

- Acidity methods (the 'acid trail'), using Titratable Actual Acidity (TAA), Titratable Peroxide Acidity (TPA) or Titratable Sulfur Acidity (TSA) reported as moles H^+ per tonne ($molH^+/t$);
- Sulfur (and associated cation) methods (the 'sulfur trail) using the Total Sulfur (S_T), Peroxide Sulfur (S_P) or Chromium Reducible Sulfur (S_{CR}), reported as percent oxidisable sulphur (%S); and,
- Combined (SPOCAS) method utilising analytical components of both the acid and sulfur trails.

Specific laboratory analysis will however, be dependent on the soil types and sediment origin. Analysis selection should be based on discussions with the Project Manager or Councils Planning Department, with reference to the methods contained in the ASSM (ASSMAC 1998) or ASSLMG (QASSIT, 2004). The choice of laboratory analysis will depend in part on the nature of the materials being tested. The acid trail should not be relied upon unless there is sufficient evidence to show that the shell is fine ground and evenly distributed through the sediment being tested. Full SPOCAS or a combination of Chromium Reducible Sulfur (method 22b) with TAA, is recommended.

4.4.3 Action criteria

Action Criteria are based on the percentage of oxidisable sulfur (%S) or equivalent acidity, for a broad range of soils. Coarse soils are the most sensitive, due to their high permeability to air and water, hence higher potential of rapid oxidisation and leachate generation. Where laboratory results exceed these action criteria, special management will be required to prevent the generation and migration of acid leachates.

Table 2 Action Criteria for Treatment of ASS and PASS

Soil Texture	Clay Content %	< 1000 Tonnes Disturbed		> 1000 Tonnes Disturbed	
		Sulfur Content %	Acid mol/tonne	Sulfur Content %	Acid mol/tonne
Coarse (sands-gravels)	≤ 5	0.03	18	0.03	18
Medium (sandy loam-light clay)	5 - 40	0.06	36		
Fine (medium to heavy clays, silty clays)	≥ 40	0.10	62		

Source: Ahern et al., 1998.

4.5 Reporting

If the site investigation and field tests are undertaken as part of a Preliminary Assessment for a DA process, the results of the assessment will need to be documented and presented to Council. A Preliminary Assessment report template (NSW Department of Primary Industries) is included in Appendix C.

5. ASS Management Plan

A site specific or works ASSMP for the works may be initiated directly by the Applicant or as a result of the Preliminary Assessment. As part of the Management Plan a detailed ASS site investigation is undertaken, including mapping, to determine surface water features, groundwater characteristics (depth quality), depth (and concentration) of AASS and PASS and sensitivity of surrounding environment.

The strategies presented in this chapter have been summarised from the ASSM (ASSMAC, 1998).

5.1 Site Specific Management Plan Format

A typical site specific ASSMP should include the following topics:

1. Introduction – This section would detail the site characteristics and proposed works;
2. Summary of Preliminary Assessment/Procedures for Site Investigations – This section would summarise the results of the Preliminary Assessment if undertaken previously or if not then the details of the proposed site investigation including sampling and analysis procedures;
3. Potential Impacts and Issues – This section would discuss the hazards and risks of the proposed works and ASS;
4. Management Strategies – This section would nominate the various proposed management strategies to manage the risks of ASS;
5. Calculation of Liming Rates – This section would utilise the results of the site investigations and adopted management strategies to calculate the lime requirements for the site if necessary;
6. Monitoring – This section would nominate the proposed monitoring strategy over the short and long term depending on the nature of the works and ASS management;
7. Contingency Planning – This section would include emergency measures and OH&S planning.

Example of Works Method Statements which should be produced and applied during the planning and works stages of the proposal are contained in Appendix F.

5.2 Mitigation and Management Strategies

A simple from of ASS management is to minimise the disturbance altogether. This would include minimising exposure of PASS to oxygen by either excavation or groundwater lowering.

The ASSM (ASSMAC, 1998) provides an outline of the most common mitigation approaches:

- Avoidance
  - Avoid disturbing ASS by not undertaking works on land where they are located;
- Prevention of Oxidation
  - If ASS are present on the land, avoid disturbing them by not digging up the soil or lowering the watertable;
  - Burial below the permanent water table;
- Neutralise Acid Generation

- If ASS are to be disturbed, manage the acid generation potential, neutralise any acid produced, prevent any acid water leaving the site and use acid resistant construction materials;
- If ASS have previously been disturbed, undertake works which will manage any acid already being produced, will minimise further production and will remediate any degradation in the long term;
- Avoid using ASS for land formation. If ASS are to be used, manage the acid generation potential before the material leaves the site where it originates; and

» Separate and Treat ASS component

- If material is very sandy, separation of pyrite by sluicing and subsequent treatment of ASS component. This method is particularly suited to dredging operations.

5.3 Avoidance

5.3.1 Shallow soil disturbance

Detailed soil investigations and mapping would be required to provide confidence that the proposed works would not disturb ASS. The design of the proposed works should consider ASS depth.

5.3.2 Rehabilitating existing drainage

Conduct hydrological and hydraulic investigations to determine acceptability of providing alternative drainage systems. These would include 'ASS friendly' systems like laser levelling (to promote sheet flow and reduce drain frequency and gullying) and wide shallow drains (as opposed to typical narrow and deep drains).

5.3.3 Groundwater modifications

Works which cause lowering or fluctuations in groundwater levels should be avoided. These would include:

» deep drains;

» drains without drop boards;

» operations causing fluctuating drain water level;

» superficial groundwater abstraction;

» dewatering operations during construction – Wet construction or construction methods in ASS should be used;

» increasing plant transpiration rates through substitution of native vegetation with higher water demand crops like sugar cane; and,

» construction of on-farm water storages or sediment/nutrient ponds.

5.3.4 Import clean fill

Where ASS occur close to the ground surface, importing clean fill may provide an acceptable formation for construction requirements, eg foundations. This avoidance strategy should be carefully considered as most ASS will be subject to some level of subsidence. In some instances the underlying ASS might undergo horizontal and vertical displacement, with material being pushed upwards outside the loaded

area with corresponding potential for oxidation. Depending on the level of the proposed loads on the ASS, hydrogeotechnical investigation might be required to fully understand the processes at place.

5.3.5 Set-aside ASS areas

Where ASS areas are variable, it may be possible to develop on areas free of ASS and leave ASS areas undisturbed. Correspondingly, if it is not feasible to avoid ASS disturbance, it is preferable to disturb areas with relatively lower ASS levels and set-aside higher ASS areas.

5.4 Prevention of Oxidation

This strategy requires the imposition of anaerobic (no oxygen) conditions on the ASS material. This condition prevents the oxidation of the ASS to sulfuric acid. When existing acidity from previously oxidised material is present, the addition of a neutralising agent is also required due to the ability of oxidised intermediaries contributing to further acid generation.

5.4.1 Stage projects to limit oxidation

On occasions where disturbance (excavation) of soils is required, the planning of the works should be staged so that the period of exposure is kept to a minimum. Once the works are completed, the ASS material would be replaced in its original location with a suitable amount of lime added to neutralise any acid that had or would be generated as a result of the exposure.

For sandy soils, due to their reduced buffering capacity and free draining nature (high permeability) a period of hours to one day is a typical acceptable exposure range. For clays, around two days would be a maximum exposure period before replacement in its original location.

The replacement of the ASS material should be supplemented by lime addition at a rate determined by laboratory analysis and including a safety factor (of 2). When material is placed immediately in its original location, the safety factor may not need to be applied.

5.4.2 Place sulfidic material under water

This management method necessarily requires the availability of a water-body to provide the anaerobic environment required to prevent oxidation. This may either occur as an over excavation below groundwater level and removal of non-ASS, or the construction of an artificial water body (eg artificial wetland). The former would require prior understanding of the sites hydrogeology and cut/fill balance of each ASS and non-ASS layer, while the later an understanding of the sites water balance and occurrence of ASS.

5.4.3 Raise the water table

This strategy applies to ASS areas that have been previously subject to groundwater level modification and is only practical when sufficient water is available to maintain these levels during seasonal variations including drought conditions. Additional measures would be required to neutralise acid already generated and to manage potential mosquito habitats. Options available to raise the water table include:

» Construction of control structures like levees, drop-gate or floodgate, to raise the water level upstream of the control: This option would have ecological and water flow and quality implications and would

need to be developed in coordination with NSW Fisheries, the Department of Natural Resources. Northern Rivers Catchment Management Authority and others;

- Application of irrigation to ASS areas: This option would normally require guaranteed access to an irrigation water source like an industrial effluent or sewage treatment plant effluent. Detailed studies of the proposed source water and target ASS would be required for this strategy to be employed; and,
- Modify the drainage or tidal management system to permanently inundate the ASS areas: This management technique will require specific soil and water investigations before and after the inundation and possibly application of a neutralising agent (lime) to manage potential acid generation. This management strategy would need to be developed in coordination with NSW Fisheries and Department of Natural Resources.

5.4.4 Cap the ASS

Capping involves the construction of an impermeable layer of clay or plastic (eg polyethylene) to prevent the ingress of oxygen and rainfall and runoff into the encapsulated ASS material. Capping should only be adopted as an interim measure before treatment or re-burial to prevent oxidation and rainfall leaching. Careful consideration should be given to the performance of the cap should this be adopted as solution.

5.5 Neutralising Acid Generation

This strategy involves the addition of a neutralising agent to disturbed ASS to neutralise the acid generated. The neutralising agents include:

- Agricultural lime;
- Estuarine/sea water; and,
- Vertical mixing using adjacent non-ASS layers.

The ability of a particular neutralising agent to neutralise acid generated is dependant on the quantity of oxidisable sulfur present in the ASS and the neutralising capacity of the neutralising material.

5.5.1 Lime addition

Agricultural lime is the most common variety of neutralising agent used with ASS. It is relatively inexpensive, widely available and safest to use with a pH of around 8.2. Numerous other varieties of lime are available including dolomite, mixed limes, hydrated lime and other neutralising agents. The determination of the lime addition rates should be undertaken by a suitably qualified ASS practitioner.

When calculating lime application rates, a factor of 1.5 to 2 should be applied. The safety factor allows for inefficient mixing and low reactivity.

Lime application may be carried out by a number of means:

Opportunistic application

Common in agricultural situations, this technique involves applying lime to an area of ASS on an ad hoc basis commonly by spreading and/or ploughing operations. Due to the insoluble nature of commercial lime, surface spreading has limited effectiveness in neutralising subsurface acid generation.

Full lime treatment and gradual oxidation

Full lime treatment requires soil analysis and lime application rates to be determined by a suitably qualified ASS practitioner. The liming rate determined from the soil analysis and consequent liming calculations should be increased by a factor of safety of 1.5 to 2. The ASSM (ASSMAC,1998) provides methods for determining the level of ASS and PASS and the calculation of lime application rates. Table 6.2 of the ASSM (ASSMAC,1998) (included in Appendix D) provides a quick estimate of the amount of lime likely required based on the level of oxidisable sulfur (as determined by laboratory analysis).

It is important to note that liming rates are highly dependent on the characteristics of the lime as indicated on the labelling of the product. Additionally, the mechanical means by which the lime is mixed with the soils requires experienced consideration due to the variability of neutralisation rates with soil type and treatment method.

Stockpiles

Stockpiling of ASS may be required as part of the neutralisation strategy or as a component of another strategy. ASS stockpiles will require design to manage surface water run-on into the stockpile, generation of leachate and run-off from the pile and application rates of neutralising agents (including guard layers of lime at the base of the stockpile).

Monitoring

Monitoring of neutralisation performance should be undertaken. This would include monitoring of leachate generation, and soil analysis.

Hastened Oxidation

This treatment mechanism is not recommended, however in some circumstance it may be the only strategy available. It involves the separation of AASS and PASS soils to a containment site able to collect and treat acid leachate prior to discharge. This method requires continuous treatment to aerate the target soils and promote acid leachate generation through rainfall or irrigation. The process would require appropriate design and monitoring by suitably qualified AASS practitioners as there are potentially significant issues related to flooding, acid leachate treatment and residual acid and heavy metal concentrations.

5.5.2 Neutralisation using the buffering capacity of estuarine/sea water

This method is currently regarded as experimental by ASSMAC and not recommended as a management strategy

5.5.3 Vertical mixing using non-ASS layers

This method is currently regarded as experimental by ASSMAC. It involves utilising the naturally occurring neutralising capacity of non-ASS layers through vertical mixing of the various soil profiles. This management technique would require soil investigation, lime application, and monitoring by suitably qualified ASS practitioners.

5.6 Complex and Large Scale Management

In some circumstances works may occur in areas identified as high risk which would include ‘high probability of occurrence’ zones on the DNR ASS Risk Maps (DNR,1998), Class 1 or 2 zones on

Councils ASS Planning Maps (RRSC, 1992), or 'priority' areas (WBM, 2002) or 'hotspot' areas (NSW DLWC 1999) or may involve a significant level of disturbance or remediation. In such circumstances detailed investigation, management system design and monitoring will likely be required. For further details of such requirements, the ASSM (ASSMAC, 1998) and suitably qualified and experienced practitioners should be consulted.

6. References

1. Acid Sulfate Soil Manual, Acid Sulfate Soil Management Advisory Committee, NSW Agriculture, 1998.
2. Queensland Acid Sulfate Soil Technical Manual, Queensland Department of Natural Resources and Mines, 2002.
3. Guidelines for the Use of Acid Sulfate Soil Risk Maps, New South Wales Department of Land and Water Conservation, 1998.
4. Development Control Plan No. 5 – Acid Sulfate Soils, Richmond Valley Council, 1999.
5. Richmond River Local Environmental Plan 1992 (Amendment No. 5) – Acid Sulfate Soils Planning Map, Richmond River Shire Council 1999.
6. Evans River, Estuary Management Study and Plan, WBM, 2002.
7. Acid Sulfate Soil Management Priority Areas in the Lower Richmond Floodplain, M. Tulau, Department of Land and Water Conservation, 1999.
8. Acid Sulfate Soils Keys to Success, Woodhead A., Jenkins A., Wood M. Acid Sulfate Soil Management Advisory Committee, NSW Agriculture, 2000.

Appendix A

Richmond River Shire Council Planning Instruments

Richmond River Shire Council Local Environmental Plan (as amended) 1992, consolidated 2002, Clauses 7B Exempt Development, 7C Complying Development and 18A Development on Land Containing Acid Sulfate Soils

Richmond River Shire Council, Development Control Plan No. 5 – Acid Sulfate Soils

Acid Sulfate Soils Planning Maps 1 to 12 and Header Map, Richmond River Local Environmental Plan 1992 (Amendment No. 22)

"TRANSFER STATION" means a building or place used for the temporary storage and disposal of waste products awaiting transportation to a waste disposal facility;

[def. insert Amendment No. 2 - 2/5/97]

"WASTE DISPOSAL FACILITY" means a building or place used for the storage, disposal or treatment of waste products and may include the recycling of recoverable materials;

[def. insert Amendment No. 2 - 2/5/97]

"WORKS THAT MAY ALTER GROUNDWATER LEVELS" means drainage works, ground water bores, wells, ground dewatering, or the like on or adjacent to land containing acid sulfate soils which may lower the groundwater level in the general area.

[def. insert Amendment No. 5 – 16/7/99]

(2) In this plan -

(a) a reference to a building or place used for a purpose includes a reference to a building or place intended to be used for the purpose;

(b) a reference to a map is a reference to a map deposited in the office of the Council; and

(c) a reference to land within a zone specified in clause 8 is a reference to land shown on the map in the manner indicated in that clause as the means of identifying land of the zone so specified.

6. Adoption of Model Provisions

6. The Environmental Planning and Assessment Model Provisions 1980, except for:

(a) the definitions of 'advertisement', 'advertising structure', "airline terminal", "dwelling", "gross floor area", "home occupation", "map", "motor showroom", "professional consulting rooms", "residential flat building" and "transport terminal" in clause 4(1);

(b) clauses 5(1) - (4), 8(7), 13 - 17, 19 - 23, 26, 29, and 32 - 34,; and

(c) clause 35 and items 2 and 11 of Schedule 1, only where development consent is required pursuant to clause 18A of this plan.

are adopted for the purpose of this plan.

[Cl.6 Amended Amendment No.2 - 2/5/97] [Cl.6 Amended Amendment No. 4 – 12/3/99]

[Cl.6 Amended Amendment No.5 – 16/7/99]

7. Consent authority

7. The Council shall be the consent authority for the purpose of this plan.

7A. Notes

7A. Notes in this plan are explanatory notes and do not form part of this plan.

[Cl.7A Insert Amendment No.15 – 4/2/00]

7B. Exempt development

7B. (1) Exempt development is development listed in Schedule 1.0 to *Richmond River Shire Council Development Control Plan No. 6 – Exempt and Complying Development* (as adopted by the Council on 21 September 1999), or specified in this plan, subject to subclauses (2) and (3).

(2) Development is exempt development only if it satisfies all of the following requirements:

(a) it does not cause interference with the amenity of the neighbourhood because of the emission of noise, vibration, smell, fumes, smoke, vapour, steam, soot, ash, dust, wastewater, waste products, grit or oil or otherwise; and

(b) it complies with any deemed-to-satisfy provisions of the *Building Code of Australia* relevant to the development; and

(c) it complies with:

(i) relevant standards and requirements of this plan; and

(ii) relevant standards and requirements specified for that development in Schedule 1.0 of *Richmond River Shire Council Development Control Plan No. 6 – Exempt and Complying Development* (as adopted by the Council on 21 September 1999); and

(iii) any other relevant standards and requirements in any other environmental planning instrument applying to the land on which it is proposed to be carried out; and

(d) it does not contravene any condition of a development consent applying to the land; and

(e) it does not obstruct drainage of the site on which it is carried out or that of any adjoining land; and

(f) it does not restrict any vehicular or pedestrian access to or from the site or that of any adjoining land; and

(g) it will not involve excavation of soil more than 300 mm below the natural ground surface or in excess of 1 tonne on land identified as Class 1, 2, 3 or 4 on the map titled "Richmond River Local Environmental Plan 1992 (Amendment No. 5) Acid Sulfate Soils Planning Map", a copy of which is available for inspection at the offices of the Council.

(3) Development is not exempt development if it is carried out on land that:

(a) is the site of a heritage item pursuant to this plan, or a heritage item pursuant to the *North Coast Regional Environmental Plan*, or that is subject to an interim heritage order under the *Heritage Act 1977* or that is listed on the State Heritage Register under that Act; or

(b) is declared to be an Aboriginal place under the *National Parks and Wildlife Act 1974* or is an Aboriginal relic, or is dedicated or reserved under the *National Parks and Wildlife Act 1974*; or

(c) is within an environmental protection zone; or

(d) is reserved or dedicated under the *Crown Lands Act 1989* for the preservation of flora, fauna or geological formations or for other environmental protection purposes; or

(e) is land to which *State Environmental Planning Policy No. 14 – Coastal Wetlands* applies; or

(f) is land to which *State Environmental Planning Policy No. 26 – Littoral Rainforests* applies; or

(g) is an aquatic reserve declared under the *Fisheries Management Act 1994*.

Note: *Under Section 76(3)(a) of the EP&A Act, exempt development cannot be carried out on land that:*
(a) is critical habitat (within the meaning of the Threatened Species Conservation Act 1995 or Part 7A of the Fisheries Management Act 1994), or
(b) is, or is part of, a wilderness area (within the meaning of the Wilderness Act 1987).

[Cl.7B Insert Amendment No.15 – 4/2/00]

7C. Complying development

7C. (1) Complying development is development listed in Schedule 2.0 to *Richmond River Shire Council Development Control Plan No. 6 – Exempt and Complying Development* (as adopted by the Council on 21 September 1999), if:

(a) it is local development of a kind that can be carried out only with consent on the land on which it is proposed to be carried out; and

(b) it is not an existing use, as defined in section 106 of the Act;

subject to subclauses (2) and (3).

(2) Development is complying development only if it satisfies all of the following requirements:

(a) it complies with any deemed-to-satisfy provisions of the *Building Code of Australia* relevant to the development; and

(b) it complies with:

(i) the development standards specified for the development in Schedule 2.0 of *Richmond River Shire Council Development Control Plan No. 6 – Exempt and Complying Development* (as adopted by the Council on 21 September 1999); and

(ii) any other development standards specified for the development in any other environmental planning instrument applying to the land on which it is proposed to be carried out; and

(c) the development will not involve excavation of soil, on land identified as Class 1, 2, 3 or 4 on the map titled "Acid Sulfate Soils Planning Map for Richmond River Shire", a copy of which is available for inspection at the offices of the Council:

(i) to more than 300mm below the natural ground surface, or by which the watertable is likely to be lowered on land identified as Class 2; or

(ii) to beyond 1 metre below the natural ground surface, or by which the watertable is likely to be lowered to any point beyond 1 metre below the natural ground surface on land identified as Class 3; or

(iii) beyond 2 metres below the natural ground surface, or by which the watertable is likely to be lowered to any point beyond 2 metres below the natural ground surface on land identified as Class 4;

unless the excavation will result in less than 1 tonne of acid sulfate soil material being disturbed or the Council has issued a written advice to the person proposing to carry out the works, pursuant to clause 18A(4), confirming that results of the preliminary assessment indicate the proposed works need not be carried out pursuant to an acid sulfate soils management plan; and

(d) it is consistent with any plan of management approved under *State Environmental Planning Policy No. 44 – Koala Habitat*, and with any recovery plan or threat abatement plan in force under the *Threatened Species Conservation Act 1995* that apply to the land; and

(e) it does not contravene any condition of a development consent applying to the land; and

(f) a certificate of compliance has been obtained for the development, if required, from the Council as the local water supply and sewer authority.

Note: *Under Section 76A (6) of the EP&A Act, the following development cannot be complying development:*
(a) State significant development,
(b) designated development,
(c) development for which development consent cannot be granted except with the concurrence of a person, other than:
(i) the consent authority, or
(ii) the Director-General of National Parks and Wildlife as referred to in section 79B(3) of the Act.

(3) Development is not complying development if it is carried out on land that:

(a) is a site that has previously been used:

(i) as a service station; or

(ii) as a cattle tick dip site; or

(iii) for intensive agriculture; or

(iv) for mining or an extractive industry; or

(v) for waste storage or waste treatment; or

(vi) for the manufacture of chemicals, asbestos or asbestos products; or

(vii) in any other manner that could have caused contamination of the land;

and a notice of completion of remediation work for the proposed use has not been given to Council in accordance with *State Environmental Planning Policy No. 55 – Remediation of Land*; or

(b) is within an environmental protection zone, or is land that a public authority may be required to acquire under clause 33; or

(c) is reserved or dedicated under the *Crown Lands Act 1989* for the preservation of flora, fauna or geological formations or for other environmental protection purposes; or

(d) is land to which *State Environmental Planning Policy No. 14 – Coastal Wetlands* applies; or

(e) is land to which *State Environmental Planning Policy No. 26 – Littoral Rainforests* applies; or

(f) is an aquatic reserve declared under the *Fisheries Management Act 1994*; or

(g) is declared to be an Aboriginal place under the *National Parks and Wildlife Act 1974* or is an Aboriginal relic, or is dedicated or reserved under the *National Parks and Wildlife Act 1974*; or

(h) is State protected land within the meaning of the *Native Vegetation Conservation Act 1997*.

Note: *Under Section 76A (6) of the EP&A Act, complying development cannot be carried out on land that:*

(a) is critical habitat (within the meaning of the Threatened Species Conservation Act 1995 or Part 7A of the Fisheries Management Act 1994), or

(b) is, or is part of, a wilderness area (within the meaning of the Wilderness Act 1987), or

(c) comprises, or on which there is, an item of the environmental heritage:

(i) that is subject to an interim heritage order under the Heritage Act 1977, or that is listed on the State Heritage Register under that Act, or

(ii) that is identified as such an item in an environmental planning instrument, or

(d) is identified as an environmentally sensitive area in the environmental planning instrument that makes provision for the complying development.

(4) A complying development certificate issued for any such development is to be subject to the conditions for the development specified in Schedule 3.0 of *Richmond River Shire Council Development Control Plan No. 6 – Exempt and Complying Development*, (as adopted by the Council on 21 September 1999), as in force when the certificate is issued.

[Cl.7C Insert Amendment No.15 – 4/2/00]

18A. Development on land containing acid sulfate soils

18A. (1) Objectives

The objective of this clause is to require special assessment of certain development on land identified as being subject to acid sulfate soils.

(2) Consent usually required

A person must not, without the consent of Council, carry out works described in the following table on land of the class or classes specified for those works in that table and shown on the Acid Sulfate Soils Planning Map, except as provided by subclause (4).

TABLE

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 beyond 1 metre below the natural ground surface; Works by which the watertable is likely to be lowered to any point beyond 1 metre below the natural ground surface.
4	Works beyond 2 metres below the natural ground surface; Works by which the watertable is likely to be lowered to any point beyond 2 metres below the natural ground surface.
5	Works which are likely to lower the watertable in adjacent Class 1, 2, 3 or 4 land to any point below 1 metre AHD.

(3) For the purposes of subclause (2), **"works"** includes:

(a) any disturbance of more than one tonne of soil (such as occurs in carrying out agriculture, agricultural-related works, the construction or maintenance of drains, engineering works, extractive industries, dredging, the construction of artificial waterbodies (including canals, dams and detention basins) or foundations, or flood mitigation works); or

(b) any other works that are likely to lower the watertable.

(4) **Exception following preliminary assessment**

This clause does not require consent for the carrying out of works if:

(a) a copy of a preliminary assessment of the proposed works undertaken in accordance with the *Acid Sulfate Soils Assessment Guidelines* has been given to the Council; and

(b) the Council has provided written advice to the person proposing to carry out the works confirming that results of the preliminary assessment indicate the proposed works need not be carried out pursuant to an acid sulfate soils management plan prepared in accordance with the *Acid Sulfate Soils Assessment Guidelines*.

(5) **Considerations for consent authority**

Council must not grant a consent required by this clause unless it has considered:

(a) the adequacy of an acid sulfate soils management plan prepared for the proposed development in accordance with the *Acid Sulfate Soils Assessment Guidelines*;

(b) the likelihood of the proposed development resulting in the discharge of acid water;

(c) any comments received from the Department of Land and Water Conservation within 21 days of the Council having sent that Department a copy of the development application and the related acid sulfate soils management plan; and

(d) whether the application was made in accordance with *Richmond River Development Control Plan No. 5 – Acid Sulfate Soils*.

(6) **Public authorities**

This clause requires consent for development to be carried out by Richmond River Shire Council, other councils, county councils or drainage unions despite:

(a) Clause 35 and items 2 and 11 of Schedule 1 to the *Environmental Planning and Assessment Model Provisions 1980*, as adopted by this plan; and

(b) Clause 10 of *State Environmental Planning Policy No. 4 – Development Without Consent.*

(7) **Special provisions for Council and county councils**

Notwithstanding the provisions of subclause (6), the following types of development may be carried out without consent by the Council or a county council:

(a) development consisting of emergency work;

(b) development consisting of routine maintenance; and

(c) development consisting of minor work,

and development ancillary to that development, such as the carrying out of excavation work, the construction of accessways and the provision of power supplies.

(8) Despite subclause (7), development consisting of routine maintenance or minor work may be carried out only with consent if the development is on a site listed as a heritage item in Schedule 1.

(9) Where the Council or a county council carries out development described in subclause (7) and encounters, or is reasonably likely to encounter, actual acid sulfate soils, the Council or county council shall properly deal with those soils in accordance with the *Acid Sulfate Soils Management Guidelines* so as to minimise the actual or potential impact to the environment arising from disturbance of the soils.

(10) In this clause:

"COUNCIL'S WORKS" means such works as are owned or controlled by the Council.

"COUNTY COUNCIL" has the meaning as in the Local Government Act 1993.

"EMERGENCY WORK" means the repair or replacement of any part of the Council's works or the works of a county council:

(a) because it has been (or is being) damaged by a natural disaster, an accident, an act of vandalism or a like occurrence, or

(b) because it has ceased to function or suddenly ceased to function adequately,

and includes work reasonably necessary to prevent or limit any further damage or malfunction.

"ENGINEERING WORKS" means works carried out under the supervision of a suitably qualified engineer and using equipment or plant. Such works may consist of or include any of the following:

- construction of roads, bridges, buildings, levees, dams, railways or drains;

- laying of pipes, cables or conduits;
- levelling of the ground;
- extractive industries or mining;
- dewatering;
- flood mitigation works;

or the like, and may consist of or include an agricultural-related work.

"MINOR WORK" means new work affected by the Council or a county council, but not drainage work, which has a value not greater than $20,000.

"ROUTINE MAINTENANCE" means the periodic inspection, cleaning, repair and replacement of the Council's works or the works of a county council, but does not include work that would result in an increase in the design capacity of any part of those works or necessitate the deepening of an existing works capacity, except where one tonne, or less, of soil is disturbed.

"WORKS OF A COUNTY COUNCIL" means such works as are owned or controlled by a county council.

[Cl18A. Insert Amendment No.5 – 16/7/99]

DIVISION 3 - URBAN DEVELOPMENT

19. Residential development standards

19. (1) This clause applies to land within Zone No. 2(v).

(2) The Council may approve a development control plan in respect of land to which this clause applies to control development for the purpose of residential flat buildings:

(a) by restricting the carrying out of that development to a specific area within the zone; and

(b) by fixing standards or specifying requirements in respect of any aspect of that development.

19A. Dual occupancy development

19A (1) This clause applies to land within Zone No. 2(v).

(2) In this clause, "dual occupancy" means 2 dwellings (whether attached or detached) on:

(a) a single allotment of land; or

(b) 2 allotments of land created in accordance with this clause.

(3) The Council must not grant consent to development for the purpose of a dual occupancy unless:

(a) the site area is not less than:

(i) where the dwellings will be attached – 400 square metres; or

(ii) where the dwellings will not be attached – 600 square metres; or

(b) the floor space ratio of the dual occupancy will be not greater than:

(i) where the dual occupancy is to be erected – 0.5:1;

(ii) where an existing building is to be altered to create the dwellings and the floor space ratio before the building is altered exceeds 0.5:1 – the floor space ratio before the building is altered; or

(iii) where an existing building is to be altered (or added to) to create the dwellings and the floor space ratio before the building is altered or added to does not exceed 0.5:1 – 0.5:1; and

Richmond River Shire Council

Development Control Plan No. 5 - Acid Sulfate Soils

21 September 1999

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This document was produced by the Environmental Development Services Division of Richmond River Shire Council.

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Development Control Plan adopted by Richmond River Shire Council on 21 September 1999.

Development Control Plan becomes effective from 5 October 1999.

1.0 PRELIMINARY

1.1. Citation

This Plan may be cited as Development Control Plan No. 5 – Acid Sulfate Soils.

1.2. Aims & Objectives

The aims of this Plan are to:

(a) ensure effective management of areas affected by *acid sulfate soils*;

(b) provide guidance to landowners, consultants and the general community on the procedures involved in the management of areas affected by *acid sulfate soils*;

(c) to ensure that activities located within an area of *acid sulfate soils* risk are identified;

(d) to require a preliminary acid sulfate soil assessment be undertaken to clarify the extent of risk;

(e) to require, where necessary, an acid sulfate *soil management plan* to be prepared where the nature of development poses an acid sulfate soil risk;

(f) provide exceptions to the provisions for Council and county councils for emergency works, routine maintenance and minor works.

1.3. Land to which this Plan applies

This Plan applies to land identified as Classes 1, 2, 3, 4 and 5 in the sheets of the *Acid Sulfate Soils Map* marked "Richmond River Local Environmental Plan 1992 (Amendment No. 5) – Acid Sulfate Soils Planning Map".

NOTE: Land-use tables contained within Richmond River Local Environmental Plan 1992 still apply. Although development consent may not be required within the land-use tables, consent may be required for other purposes as provided by clause 18A of the Richmond River Local Environmental Plan 1992. Applicants are advised to contact Council's Environmental Development Services prior to commencing works.

1.4. Relationship with other Planning Controls

This Plan was prepared in accordance with Section 72 of the *Environmental Planning & Assessment Act* 1979. The operation of this Plan is subject to the statutory provisions of Richmond River Local Environmental Plan 1992, particularly clause 18A.

1.5. Definitions

"ACID SULFATE SOILS" means actual acid sulfate soils or potential acid sulfate soils.

"ACID SULFATE SOILS ASSESSMENT GUIDELINES" means the *Acid Sulfate Soils Assessment Guidelines* as published from time to time by the NSW Acid Sulfate Soils Management Advisory Committee (ASSMAC) and adopted by the Director.

"ACID SULFATE SOIL MANUAL" is document produced by the Acid Sulfate Soil Management Advisory Committee (August 1998) and contains planning guidelines, assessment guidelines, management guidelines, laboratory methods guidelines, drainage guidelines, groundwater guidelines, management plan guidelines and industry guidelines.

"ACID SULFATE SOILS PLANNING MAP" means the series of sheets of the map marked "Richmond River Local Environmental Plan 1992 (Amendment No. 5) – Acid Sulfate Soils Planning Map", kept in the office of the Council.

"ACTUAL ACID SULFATE SOILS" are soils containing highly acidic soil horizons or layers resulting from the aeration of soil materials that are rich in iron sulfides, primarily sulfide. This oxidation produces hydrogen ions in excess of the sediment's capacity to neutralise the acidity resulting in soils of pH of 4 or less when measured in dry season conditions.

"AGRICULTURAL-RELATED WORKS" means any farming or land management activities which will materially alter the shape or natural form of the land or which are likely to alter groundwater levels. They include the following:

- drainage works;
- construction and maintenance of open drains;
- excavation works ;
- extractive industries or mining;
- construction of dams, stock water holes, aquaculture ponds and the like;
- site levelling;
- flood mitigation works, including construction of levees (artificial waterbodies);
- topsoil removal and turf farming;
- laying of pipes, cables, conduits and the like;
- dewatering of wetlands, dams and the like.

NOTE: This definition does not include ploughing, scarifying, tilling or deep ripping less than 30cm below natural ground level.

"COUNTY COUNCIL" has the meaning as in the Local Government Act 1993.

"COUNCIL WORKS" means such works as are owned or controlled by Council.

"DRAIN" means a depression, ditch or channel deeper than 300mm and that is not naturally occurring, used to convey water from one area to another.

"DRAINAGE MANAGEMENT PLAN" means a document that contains a full description of the management procedures to be applied to a site regarding *existing drains* and proposed *drains*. The Drainage Management Plan must comply with the requirements of the *Acid Sulfate Soil Manual*.

"ENGINEERING WORKS", for the purposes of clause 18A of the Richmond River Local Environmental Plan 1992 and this Development Control Plan, means works carried out under the supervision of a suitably qualified engineer and using equipment or plant. Such works may include any of the following:

- construction of roads, bridges, buildings, levees, dams, railways, drains
- laying of pipes, cables or conduits
- levelling of the ground
- extractive industries and mines
- dewatering of the ground
- flood mitigation works

or the like, and may include an agricultural-related work.

"EMERGENCY WORK" means the repair or replacement of any part of Council works or the works of a county council:

(a) because it has been (or is being) damaged by a natural disaster, an accident, an act of vandalism or a like occurrence, or

(b) because it has ceased to function or suddenly ceased to function adequately,

and includes work reasonably necessary to prevent or limit any further damage or malfunction.

"EXISTING DRAINS" means a drain lawfully constructed prior to 20 June 1998 (being the first date during the public exhibition of the draft of Richmond River Local Environmental Plan 1992 (Amendment No. 5).

"FLOOD MITIGATION WORKS" means structural measures intended to reduce flood damage by either reducing flood levels or the lateral extent of flooding and includes any of the following:

- levees;
- flood mitigation drains;
- retarding or detention basins;
- bypass floodways;
- flood gates on drains;
- channel improvement.

"MAINTENANCE OF EXISTING DRAINS" refers to any works that will disturb or remove soil within existing drains.

"MINOR WORK" means new work affected by Council or a county council, but not drainage work, which has a value not greater than twenty thousand dollars ($20,000) or such larger amount as the Council might fix by resolution from time to time.

"pH" refers to the scale of measurement for acidity or alkalinity. A *pH* of 7.0 denotes neutrality, higher values indicate increasing alkalinity, and lower values indicate increasing acidity.

"POTENTIAL ACID SULFATE SOILS" are soils which contain iron sulfides or sulfidic material which have not been exposed to air. They will become severely acid when exposed to air and oxidised. The field pH of these soils in their undisturbed state is pH 4 or more and may be neutral or slightly alkaline.

"PRELIMINARY SOILS ASSESSMENT" means a soil survey involving soil sampling and laboratory methods outlined in the *Acid Sulfate Soil Manual*.

"ROUTINE MAINTENANCE" means the periodic inspection, cleaning, repair and replacement of Council works or the works of a county council, but does not include work that would result in an increase in the design capacity of any part of those works or necessitate the deepening of an existing works capacity, except where one (1) tonne, or less, of soil is disturbed.

"SOIL MANAGEMENT PLAN" means a full description of the management procedures to be applied to a site. The Management Plan must comply with the requirements of the *Acid Sulfate Soil Manual*.

"THE PLAN" means the Richmond River Local Environmental Plan 1992.

"WORKS OF A COUNTY COUNCIL" means such works as are owned or controlled by a county council.

"WORKS THAT MAY ALTER GROUNDWATER LEVELS" means drainage works, ground water bores, wells, ground dewatering, or the like on or adjacent to land containing acid sulfate soils which may lower the groundwater level in the general area.

2.0 ASSESSMENT

2.1. Acid Sulfate Soil Planning Map

A series of maps identified as *Richmond River Local Environmental Plan 1992 (Amendment No. 5) – Acid Sulfate Soils Planning Map* (February 1999) have been produced by Council's GIS staff based on the Department of Land and Water Conservation's *Acid Sulfate Soil Planning Map* (December 1997). Clause 18A of Richmond River Local Environmental Plan 1992, (clause inserted by Amendment No. 5), requires proponents to seek development consent for specific works in five principal land classes. The table below indicates where development consent will be required for each of the classes of land.

Table 1 - Development Control Requirements

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 beyond 1 metre below the natural ground surface; Works by which the watertable is likely to be lowered to any point beyond 1 metre below natural ground surface.
4	Works beyond 2 metres below the natural ground surface; Works by which the watertable is likely to be lowered to any point beyond 2 metres below natural ground surface.
5	Works which are likely to lower the watertable in adjacent Class 1, 2, 3 or 4 land to any point below 1 metre AHD.

In Table 1, **"works"** is defined in Richmond River Local Environmental Plan 1992 and includes:

(a) any disturbance of more than one tonne of soil (such as occurs in carrying out agriculture, agricultural related works, the construction or maintenance of drains, engineering works, extractive industries, dredging, the construction of artificial waterbodies (including canals, dams and detention basins) or foundations, or flood mitigation works), or

(b) any other works that are likely to lower the watertable.

The onus is on the landowner, contractor and proponent proposing to undertake any works to check which class their land falls within and whether a Development Application is required under these or any other environmental planning instrument provisions. Land not classified on the *Acid Sulfate Soil Planning Map* (land shown white (or uncoloured) and not numbered on the *Acid Sulfate Soils Planning Map*) may still require development consent for the work in accordance with another provision of the local environmental plan or another environmental planning instrument. Applicants are advised to check with Council's Environmental Development Services Planning Staff to determine whether a development application is required prior to commencing works.

2.2. What types of Development require Council's consent?

The following activities, works, development and the like are subject to the need to obtain development consent if the land falls within classes 1-5, inclusive, and the relevant criteria are met:

- *agricultural-related works*
- *agriculture*
- *flood mitigation works*
- *foundations*
- *works that may alter groundwater levels*
- construction or maintenance of *existing drains*
- buildings and structures
- construction of roads
- aquaculture ponds
- sand and gravel extraction
- dewatering of dams, wetlands, or quarries
- land forming works
- *engineering works*
- construction of artificial waterbodies (including canals, dams and detention basins)

2.3. Exception From Development Consent Following Preliminary Assessment

Subclause (4) provides that clause 18A. does not require development consent for the carrying out of works if:

(a) a copy of a preliminary assessment of the proposed works undertaken in accordance with the *Acid Sulfate Soils Assessment Guidelines* has been given to the Council; and

(b) the Council has provided written advice to the person proposing to carry out the works confirming that results of the preliminary assessment indicate the proposed works need not be carried out pursuant to an acid sulfate soils management plan prepared in accordance with the *Acid Sulfate Soils Assessment Guidelines*.

The result of this subclause is that where work would normally require consent as a result of clause 18A. this work may be carried out without consent if the preliminary assessment determines that no acid sulfate soil material will be encountered or disturbed.

Example, a farmer wishes to construct a drain 0.5 metre deep through land within class No. 2. Normally a development application would be required to undertake any excavation within this zone, however, if a preliminary assessment along the proposed path of the drain shows that there is no acid sulfate soil material, to a point beyond the depth of the proposed drain, then this drain may be constructed following submission of the preliminary assessment to Council and receipt of written advice from Council stating that no development consent will be required.

To assist Council with processing preliminary assessments they should be accompanied by a letter requesting Council advice, identification of the proposed works, property identifiers (lot and Deposited Plan Numbers), a map identifying the property, location of sample points and propose works.

2.4. Public Authorities

Generally, public authorities are exempt from requiring development consent for certain works under the provisions of Clause 35 of the *Environmental Planning and Assessment Model Provisions* 1980. Due to the environmental significance of Acid Sulfate Soils some of these provisions have been revoked in subclause (6), for the purposes of Clause 18A of the Richmond River Local Environmental Plan 1992. Therefore, public authorities relying upon items 2 and 11 of Schedule 1 to the 1980 Model Provisions will now require consent for earth works where that consent is required by clause 18A of the Plan.

Notwithstanding subclause (6), subclause (7) of the Richmond River Local Environmental Plan 1992 provides that the development may be carried out without consent by Council or a county council in relation to:

(a) development consisting of emergency works;

(b) development consisting of routine maintenance; and

(c) development consisting of minor works,

and development ancillary to that development, such as the carrying out of excavation work, the construction of accessways and the provision of power supplies.

To spite these works not requiring consent under Part 4 of the *Environmental Planning and Assessment Act* 1979, such activities may require assessment under Part 5 of the Act. In addition, subclause (10) of the Richmond River Local Environmental Plan 1992 requires that where a Council or county council encounters acid sulfate soils the Council or the county council shall properly deal with those soils in accordance with the *Acid Sulfate Soils Management Guidelines* so as to minimise the actual or potential impact to the environment arising from disturbance to the soils.

2.5. Development Application Procedure

Table 2 provides a flow-diagram outlining the general procedure landowners, applicants and proponents will need to follow when proposing to undertake certain works within lands classed 1-5 inclusive on the *Acid Sulfate Soil Planning Map*.

During the preparation of a soil assessment or management plan, applicants are advised to liaise with the local offices of the:

- Department of Land & Water Conservation
- Environment Protection Authority
- NSW Fisheries
- NSW Department of Agriculture

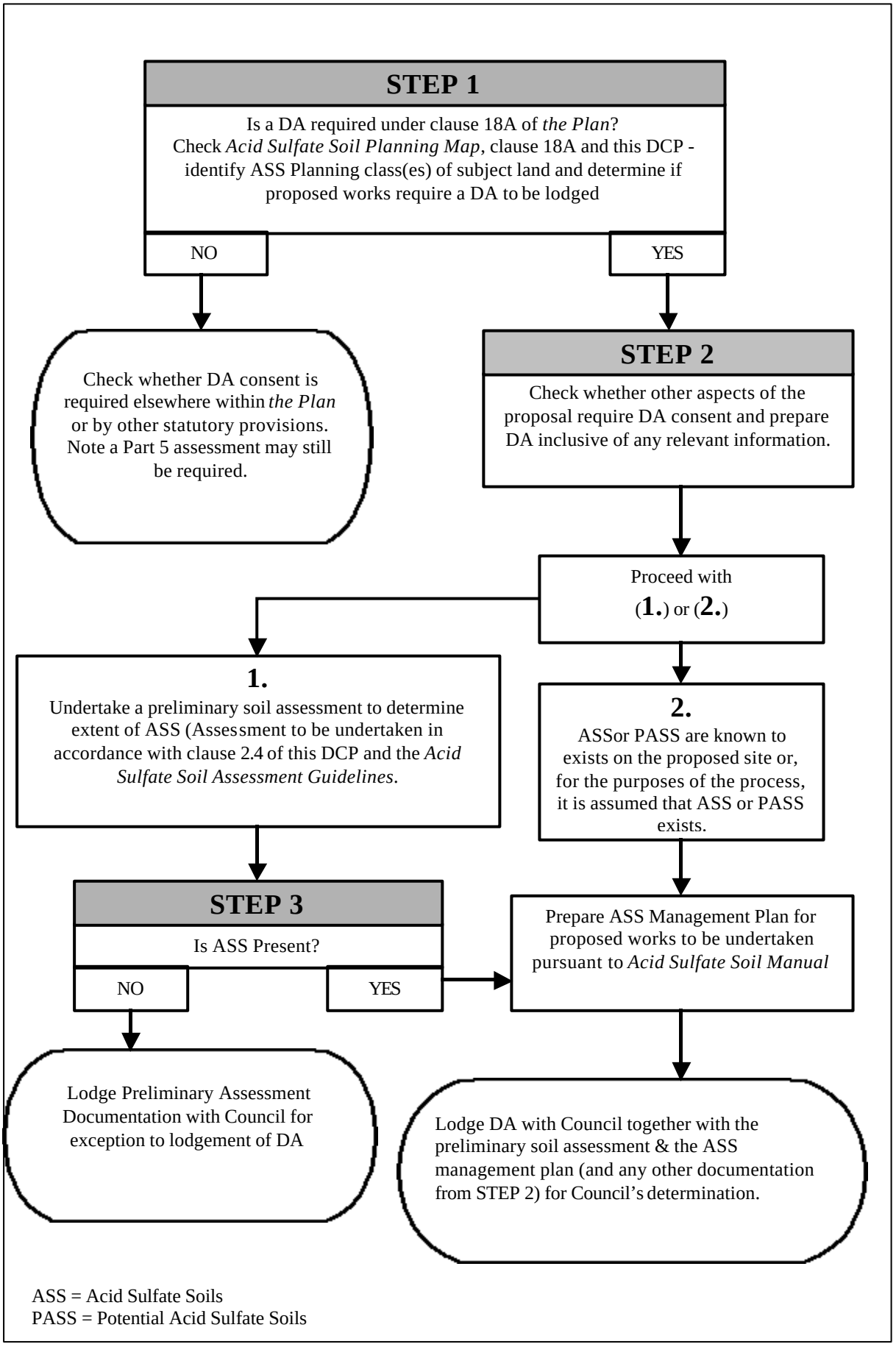
Applications accompanied by copies of correspondence from the above agencies, which provide comments on the Soil Assessment or Management Plan, will be determined by Council more expeditiously than those applications not providing this information. Applications, not accompanied by relevant advise, will be referred to the relevant Departments for comment prior to consideration by Council.

2.6. Soils Assessment and/or Soil Management Plan

Where it is proposed to carry out any works requiring development consent under clause 18A of *the Plan*, the application must be lodged with a *preliminary soils assessment* and/or *soil management plan*.

A *preliminary soils assessment* must be prepared by a suitably qualified person. The assessment must include the matters outlined in the Acid Sulfate Soil Manual prepared by the NSW Acid Sulfate Soil Management Advisory Committee August 1998. As illustrated in Table 2 all applicants have the opportunity to assume that the proposed development site contains Acid Sulfate Soil and by-pass the need to undertake a *preliminary soils assessment*. However, this will still necessitate a *soil management plan* to be undertaken.

Table 2 – Development Application Process for Proposed Works Within ASS & PASS Areas



2.7. Joint Applications

Where a development involves, or may impact upon, a number of properties in the one locality, Council encourages the proponents to prepare and lodge a joint development application for the proposed works and ongoing management. Examples where joint development applications would prove advantageous would be where a development may involve maintenance of new and/or *existing drains* that traverses two or more properties or where proposed *flood mitigation works* may impact upon a specific area.

2.8. Drainage Management Plans

Where a property contains a series of *drains* or works that would require development consent for each individual section, the owner is encouraged to submit a *drainage management plan* for the whole property. This plan would form part of the development application. Such a management plan would cover all the *drains* on that specific property, including their maintenance and rehabilitation details, as needed.

Council encourages this approach by landowners as it promotes better overall management and provides Council with a more complete overview of the location, ongoing maintenance and interaction of such *drains*.

A property owner who has prepared a *drainage management plan* may also enter into a joint application, however, the applicant should be aware that in the case of a joint development consent any amendment to the *drainage management plan* would require the written support of each landowner involved in the consent.

2.9. Determination by Council

In the case of a joint application or a *drainage management plan* Council will determine the application in accordance with the provisions of *the Plan* and this DCP. Where development consent is given, no further development application will be required for those works provided any ongoing maintenance and management is carried out in accordance with the terms and conditions of the consent. For example: if an approved drain is to be deepened, widened, extended, etc and the original consent did not allow for that work, then further development consent would be required. Likewise, if the applicant continued maintaining the drain in accordance with the consent, then no further application would be required.

An applicant working under a joint development consent or *drainage management plan* is encouraged to contact Council's Environmental Development Services if there is any question as to the terms and conditions of consent. New owners of land should also contact Council's Environmental Development Services regarding the terms and conditions of any development consent issued by Council and applying to the property. When a property is bought or sold the consent stays with the property. The new owner must comply with the consent or where an amendment is sought, have support, in writing, of all the joint applicants.

2.10. Consultation

As stipulated in 2.1, proponents, applicants and developers are advised to consult with the following government agencies when preparing a soil assessments or *soil management plan*.

When considering a development application, Council shall consult with:

1. the Department of Land and Water Conservation – where no management plan is submitted unless written advice from the Department of Land and Water Conservation is submitted with the application; or
2. the Department of Land and Water Conservation and the Environment Protection Authority – where a management plan is submitted.
3. the NSW Department of Agriculture – where the development specifically relates to agricultural purposes which involves enhancing and/or maintaining agricultural production.

The matters on which the Departments shall be consulted are the adequacy of the soil assessment and/or management plan, the conclusions of those assessments and in the case of the NSW Department of Agriculture, its likely impact on the agricultural production.

Council shall give Government agencies 28 days to respond to the consultation. If no response is forthcoming within that period Council may proceed to finalise assessment of the application. It should be noted that major applications may take longer than 28 days for a response from Government agencies. If this is the case, the applicant will be notified either verbally or in writing. Minor applications may, at Council's discretion, be dealt with without consultation.

In deciding whether to grant consent to the application, Council shall take into consideration the likelihood of the development resulting in the oxidation of *acid sulfate soils* and the adequacy of any management plan having regard to any government department's comments.

3.0 BIBLIOGRAPHY

- Acid Sulfate Soil Management Advisory Committee, (August 1998). *Acid Sulfate Soil Manual*.
- Hasting Shire Council, (27 June 1997), *Hastings Local Environmental Plan 1987 (Amendment No. 63).* NSW Government Gazette, Sydney.
- Hastings Shire Council, (June 1997). *Development Control Plan No. 34 – Acid Sulfate Soils.* Hastings Shire Council, Port Macquarie.

4.0 Extract from Richmond River Local Environmental Plan 1992 – Clause 18A

Development on land containing acid sulfate soils

18A. (1) **Objectives**

The objective of this clause is to require special assessment of certain development on land identified as being subject to acid sulfate soils.

(2) **Consent usually required**

A person must not, without the consent of Council, carry out works described in the following table on land of the class or classes specified for those works in that table and shown on the Acid Sulfate Soils Planning Map, except as provided by subclause (4).

TABLE

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 beyond 1 metre below the natural ground surface; Works by which the watertable is likely to be lowered to any point beyond 1 metre below the natural ground surface.
4	Works beyond 2 metres below the natural ground surface; Works by which the watertable is likely to be lowered to any point beyond 2 metres below the natural ground surface.
5	Works which are likely to lower the watertable in adjacent Class 1, 2, 3 or 4 land to any point below 1 metre AHD.

(3) For the purposes of subclause (2), **"works"** includes:

(a) any disturbance of more than one tonne of soil (such as occurs in carrying out agriculture, agricultural-related works, the construction or maintenance of drains, engineering works, extractive industries, dredging, the construction of artificial waterbodies (including canals, dams and detention basins) or foundations, or flood mitigation works); or

(b) any other works that are likely to lower the watertable.

(4) **Exception following preliminary assessment**

This clause does not require consent for the carrying out of works if:

(a) a copy of a preliminary assessment of the proposed works undertaken in accordance with the *Acid Sulfate Soils Assessment Guidelines* has been given to the Council; and

(b) the Council has provided written advice to the person proposing to carry out the works confirming that results of the preliminary assessment indicate the proposed works need not be carried out pursuant to an acid sulfate soils management plan prepared in accordance with the *Acid Sulfate Soils Assessment Guidelines*.

(5) **Considerations for consent authority**

Council must not grant a consent required by this clause unless it has considered:

(a) the adequacy of an acid sulfate soils management plan prepared for the proposed development in accordance with the *Acid Sulfate Soils Assessment Guidelines*;

(b) the likelihood of the proposed development resulting in the discharge of acid water;

(c) any comments received from the Department of Land and Water Conservation within 21 days of the Council having sent that Department a copy of the development application and the related acid sulfate soils management plan; and

(d) whether the application was made in accordance with *Richmond River Development Control Plan No. 5 – Acid Sulfate Soils*.

(6) **Public authorities**

This clause requires consent for development to be carried out by Richmond River Shire Council, other councils, county councils or drainage unions despite:

(a) Clause 35 and items 2 and 11 of Schedule 1 to the *Environmental Planning and Assessment Model Provisions 1980*, as adopted by this plan; and

(b) Clause 10 of *State Environmental Planning Policy No. 4 – Development Without Consent.*

(7) **Special provisions for Council and county councils**

Notwithstanding the provisions of subclause (6), the following types of development may be carried out without consent by the Council or a county council:

(a) development consisting of emergency work;

(b) development consisting of routine maintenance; and

(c) development consisting of minor work,

and development ancillary to that development, such as the carrying out of excavation work, the construction of accessways and the provision of power supplies.

(8) Despite subclause (7), development consisting of routine maintenance or minor work may be carried out only with consent if the development is on a site listed as a heritage item in Schedule 1.

(9) Where the Council or a county council carries out development described in subclause (7) and encounters, or is reasonably likely to encounter, actual acid sulfate soils, the Council or county council shall properly deal with those soils in accordance with the *Acid Sulfate Soils Management Guidelines* so as to minimise the actual or potential impact to the environment arising from disturbance of the soils.

(10) In this clause:

"COUNCIL'S WORKS" means such works as are owned or controlled by the Council.

"COUNTY COUNCIL" has the meaning as in the Local Government Act 1993.

"EMERGENCY WORK" means the repair or replacement of any part of the Council's works or the works of a county council:

(a) because it has been (or is being) damaged by a natural disaster, an accident, an act of vandalism or a like occurrence, or

(b) because it has ceased to function or suddenly ceased to function adequately,

and includes work reasonably necessary to prevent or limit any further damage or malfunction.

"ENGINEERING WORKS" means works carried out under the supervision of a suitably qualified engineer and using equipment or plant. Such works may consist of or include any of the following:

- construction of roads, bridges, buildings, levees, dams, railways or drains;
- laying of pipes, cables or conduits;
- levelling of the ground;
- extractive industries or mining;
- dewatering;
- flood mitigation works;

or the like, and may consist of or include an agricultural-related work.

"MINOR WORK" means new work affected by the Council or a county council, but not drainage work, which has a value not greater than $20,000.

"ROUTINE MAINTENANCE" means the periodic inspection, cleaning, repair and replacement of the Council's works or the works of a county council, but does not include work that would result in an increase in the design capacity of any part of those works or necessitate the deepening of an existing works capacity, except where one tonne, or less, of soil is disturbed.

"WORKS OF A COUNTY COUNCIL" means such works as are owned or controlled by a county council.

RICHMOND RIVER
LOCAL ENVIRONMENTAL PLAN 1992
(AMENDMENT NO. 22)

ACID SULFATE SOILS PLANNING MAP

0 5 10
kilometres

Kyogle Council

Lismore City Council

Ballina Shire Council

Casino Council

Bruxner Hwy

Bruxner Hwy

Summerland Way

Coraki

Broadwater

Woodburn

Evans Head

Rappville

Copmanhurst Council

Pacific Hwy

Pacific Ocean

Maclean Council

1 2 3 4 5 6 7 8 9 10 11 12

WORKS FOR WHICH PLANNING INSTRUMENT APPLIES

1	Any Works
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3	Works beyond 1 metre below the natural ground surface ; Works by which the watertable is likely to be lowered to any point beyond 1 metre below natural surface.
4	Works beyond 2 metres below the natural ground surface ; Works by which the watertable is likely to be lowered to any point beyond 2 metres below natural surface.
5	Works which are likely to lower the watertable in adjacent class 1,2,3 or 4 land to any point below 1 metre AHD.

MAJOR DRAINS — LGA BOUNDARY

PREPARED BY RICHMOND VALLEY COUNCIL, APRIL 2004.

Government Gazette No. 131 of 6/8/2004.

MORANS RD

Sandy Creek

MOTHERSOLES RD

REYNOLDS RD

LAGOON RD

CORAKI - ELLANGOWAN RD

CORAKI ELLANGOWAN RD

MYALL CREEK

SPRINGVILLE RD

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MAJOR DRAINS

STATEMENT OF RELATIONSHIP WITH OTHER PLANS

AMENDS RICHMOND RIVER L.E.P. 1992

Scale 1 : 25 000

0 0.5 1 2

Kilometres

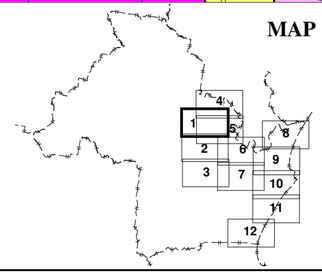
Maps prepared by L. Neall, Richmond Valley Council, April 2004.
CADASTRAL Data supplied by L.I.C., Bathurst.
ACID SULFATE SOILS Data supplied by D.L.W.C. Grafton.

ENVIRONMENTAL PLANNING & ASSESSMENT ACT, 1979.

RICHMOND RIVER LOCAL ENVIRONMENTAL PLAN 1992

(Amendment No. 22)

ACID SULFATE SOILS PLANNING MAP



MAP 1 of 12

Planning officer - J. Hession

Council File No. - 20/4/63

Dept. File No. - G96/00219

Certificate issued under Sec.65 EPA Act, 26th June 2002.

Certified in accordance with the Environmental Planning & Assessment Act 1979 and Regulations.

General Manager

5.4.04
Date

Government Gazette No. 131 of 6/8/2004.

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MAJOR DRAINS

CORAKI - EL

SPRINGVILLE RD

MYALL CR

MOFFITS LN

BORA CODRINGTON RD

MYALL CREEK RD

HAUGHWOOD RD

BENAULDS RD

MYALL CREEK RD

BOGGY CREEK R

STATEMENT OF RELATIONSHIP WITH OTHER PLANS

AMENDS RICHMOND RIVER L.E.P. 1992

Scale 1 : 25 000

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Kilometres

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RICHMOND RIVER
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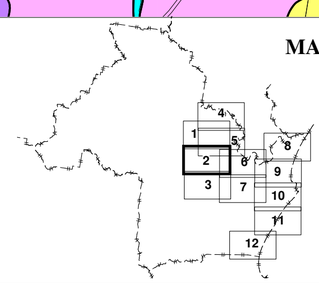

MAP 2 of 12

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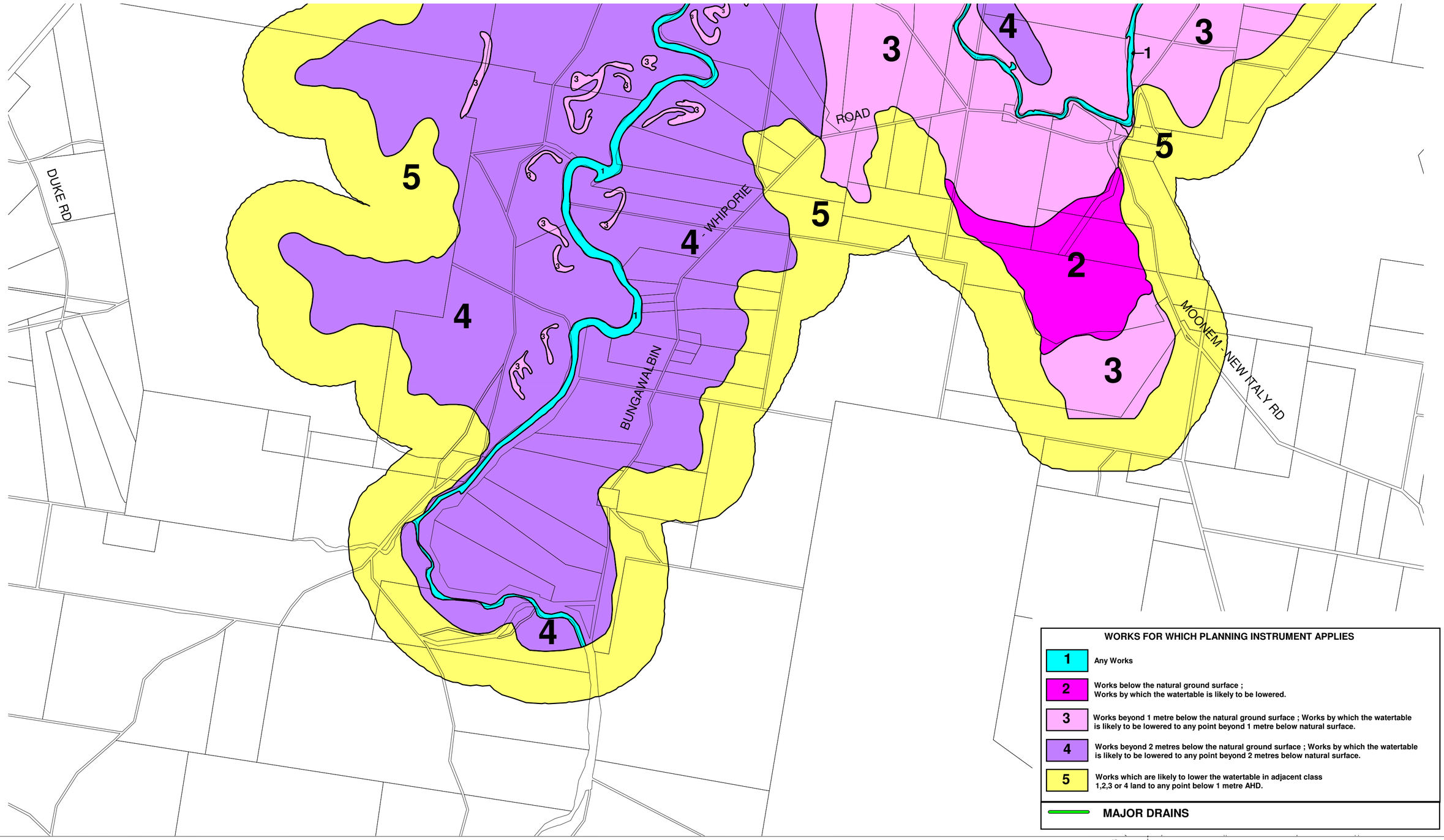

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	MAJOR DRAINS

STATEMENT OF RELATIONSHIP WITH OTHER PLANS

AMENDS RICHMOND RIVER L.E.P. 1992

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Kilometres

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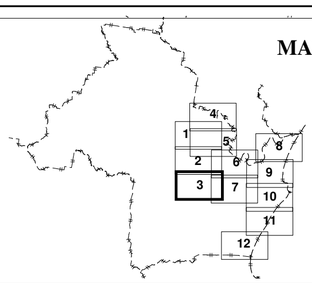

MAP 3 of 12

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General Manager

5.4.04
Date

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Lismore City Council

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MAJOR DRAINS — Shire Boundary

Tatham
EES LN
TOMKI TATHAM RD
CASINO - CORAKI RD
SMITHS RD
Richmond
River
CASINO - CORAKI RD
CODRINGTON LN
NEWMANS RD
REYNOLDS RD
CASINO - CORAKI RD
SPRINGHILL RD
LAGOON RD
Sandy
Creek

STATEMENT OF RELATIONSHIP WITH OTHER PLANS

AMENDS RICHMOND RIVER L.E.P. 1992

Scale 1 : 25 000

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Kilometres

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ENVIRONMENTAL PLANNING & ASSESSMENT ACT, 1979.

RICHMOND RIVER LOCAL ENVIRONMENTAL PLAN 1992

(Amendment No. 22)

ACID SULFATE SOILS PLANNING MAP

MAP 4 of 12

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Government Gazette No. 131 of 6/8/2004.

LAGOON RD
CORAKI
HENDERSON ST
CORAKI ELLANGOWAN RD
CORAKI - ELLANGOWAN RD
SPRINGVILLE RD
BORA CODRINGTON RD
MYALL CREEK RD
Richmond River

Lismore City Council

WORKS FOR WHICH PLANNING INSTRUMENT APPLIES

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MAJOR DRAINS — Shire Boundary

STATEMENT OF RELATIONSHIP WITH OTHER PLANS

AMENDS RICHMOND RIVER L.E.P. 1992

Scale 1 : 25 000

0 0.5 1 2

Kilometres

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ENVIRONMENTAL PLANNING & ASSESSMENT ACT, 1979.

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ACID SULFATE SOILS PLANNING MAP

MAP 5 of 12

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MAJOR DRAINS — Shire Boundary

STATEMENT OF RELATIONSHIP WITH OTHER PLANS

AMENDS RICHMOND RIVER L.E.P. 1992

Scale 1 : 25 000

0 0.5 1 2

Kilometres

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ENVIRONMENTAL PLANNING & ASSESSMENT ACT, 1979.

RICHMOND RIVER
LOCAL ENVIRONMENTAL PLAN 1992
(Amendment No. 22)

ACID SULFATE SOILS PLANNING MAP

MAP 6 of 12

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General Manager — Date 5.4.04

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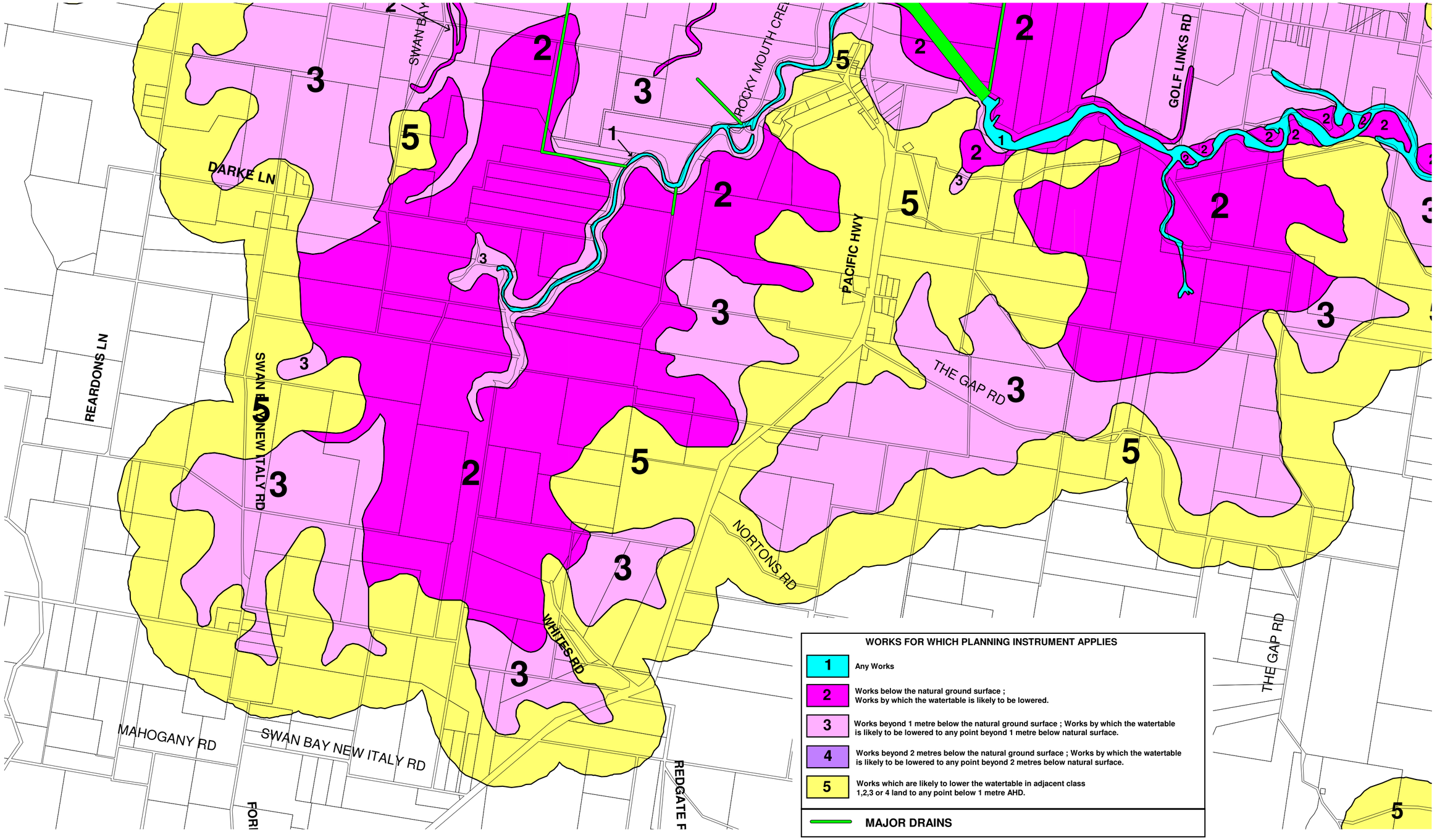

STATEMENT OF RELATIONSHIP WITH OTHER PLANS

AMENDS RICHMOND RIVER L.E.P. 1992

Scale 1 : 25 000

0 0.5 1 2

Kilometres

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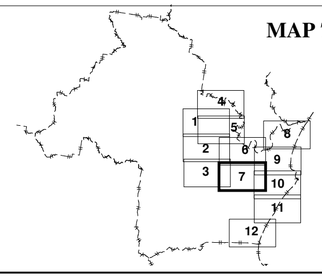
ACID SULFATE SOILS PLANNING MAP



MAP 7 of 12

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5.4.04
Date

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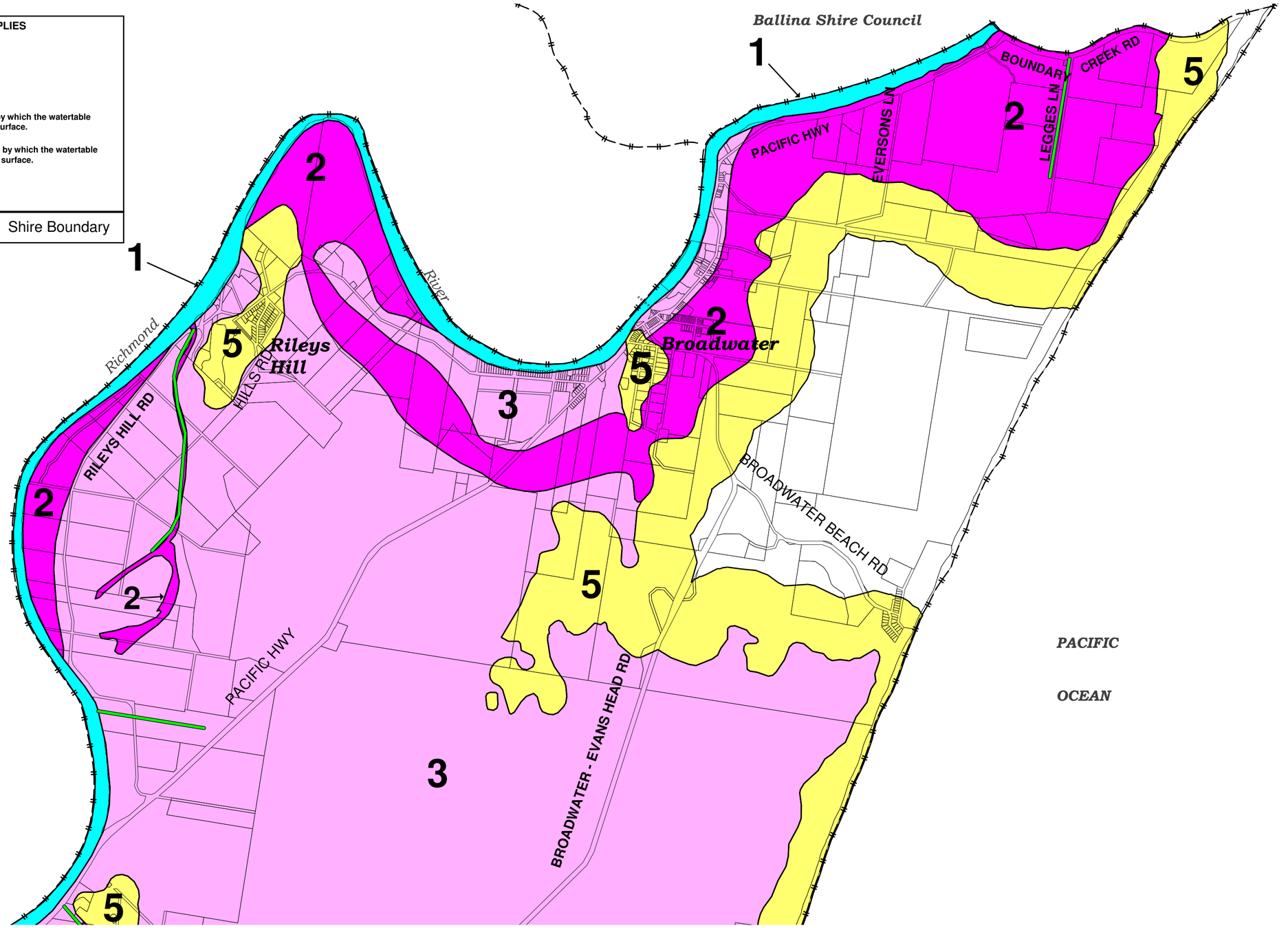
5	Works which are likely to lower the watertable in adjacent class 1,2,3 or 4 land to any point below 1 metre AHD.

MAJOR DRAINS — Shire Boundary



STATEMENT OF RELATIONSHIP WITH OTHER PLANS

AMENDS RICHMOND RIVER L.E.P. 1992

Scale 1 : 25 000

0 0.5 1 2

Kilometres

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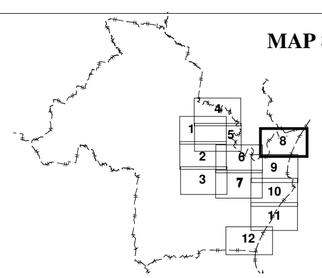
RICHMOND RIVER LOCAL ENVIRONMENTAL PLAN 1992

(Amendment No. 22)

ACID SULFATE SOILS PLANNING MAP



MAP 8 of 12

Planning officer - J. Hession
Council File No. - 20/4/63
Dept. File No. - G96/00219

Certificate issued under Sec.65 EPA Act, 26th June 2002.

Certified in accordance with the Environmental Planning & Assessment Act 1979 and Regulations.

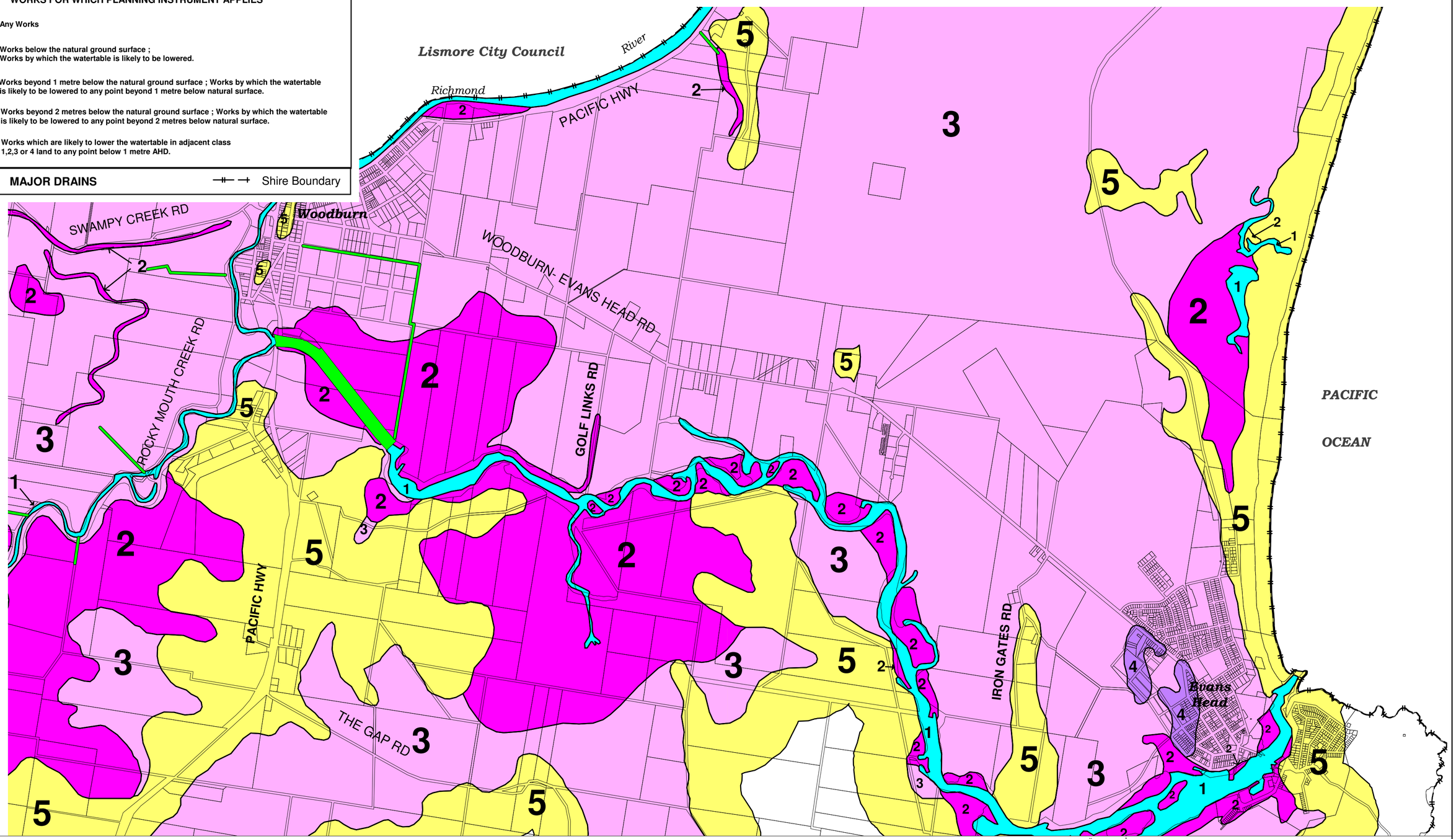
General Manager — Date 5.4.04

Government Gazette No. 131 of 6/8/2004.

WORKS FOR WHICH PLANNING INSTRUMENT APPLIES

1	Any Works
2	Works below the natural ground surface ; Works by which the watertable is likely to be lowered.
3	Works beyond 1 metre below the natural ground surface ; Works by which the watertable is likely to be lowered to any point beyond 1 metre below natural surface.
4	Works beyond 2 metres below the natural ground surface ; Works by which the watertable is likely to be lowered to any point beyond 2 metres below natural surface.
5	Works which are likely to lower the watertable in adjacent class 1,2,3 or 4 land to any point below 1 metre AHD.

MAJOR DRAINS — Shire Boundary



STATEMENT OF RELATIONSHIP WITH OTHER PLANS

AMENDS RICHMOND RIVER L.E.P. 1992

Scale 1 : 25 000

0 0.5 1 2

Kilometres

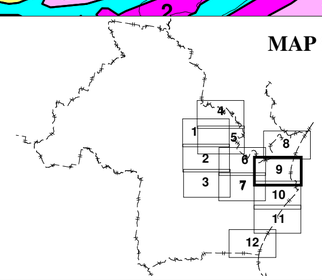
Maps prepared by L. Neall, Richmond River Shire Council, April 2004.
CADASTRAL Data supplied by L.I.C., Bathurst.
ACID SULFATE SOILS Data supplied by D.L.W.C. Grafton.

ENVIRONMENTAL PLANNING & ASSESSMENT ACT, 1979.

RICHMOND RIVER LOCAL ENVIRONMENTAL PLAN 1992

(Amendment No. 22)

ACID SULFATE SOILS PLANNING MAP



MAP 9 of 12

Planning officer - J. Hession
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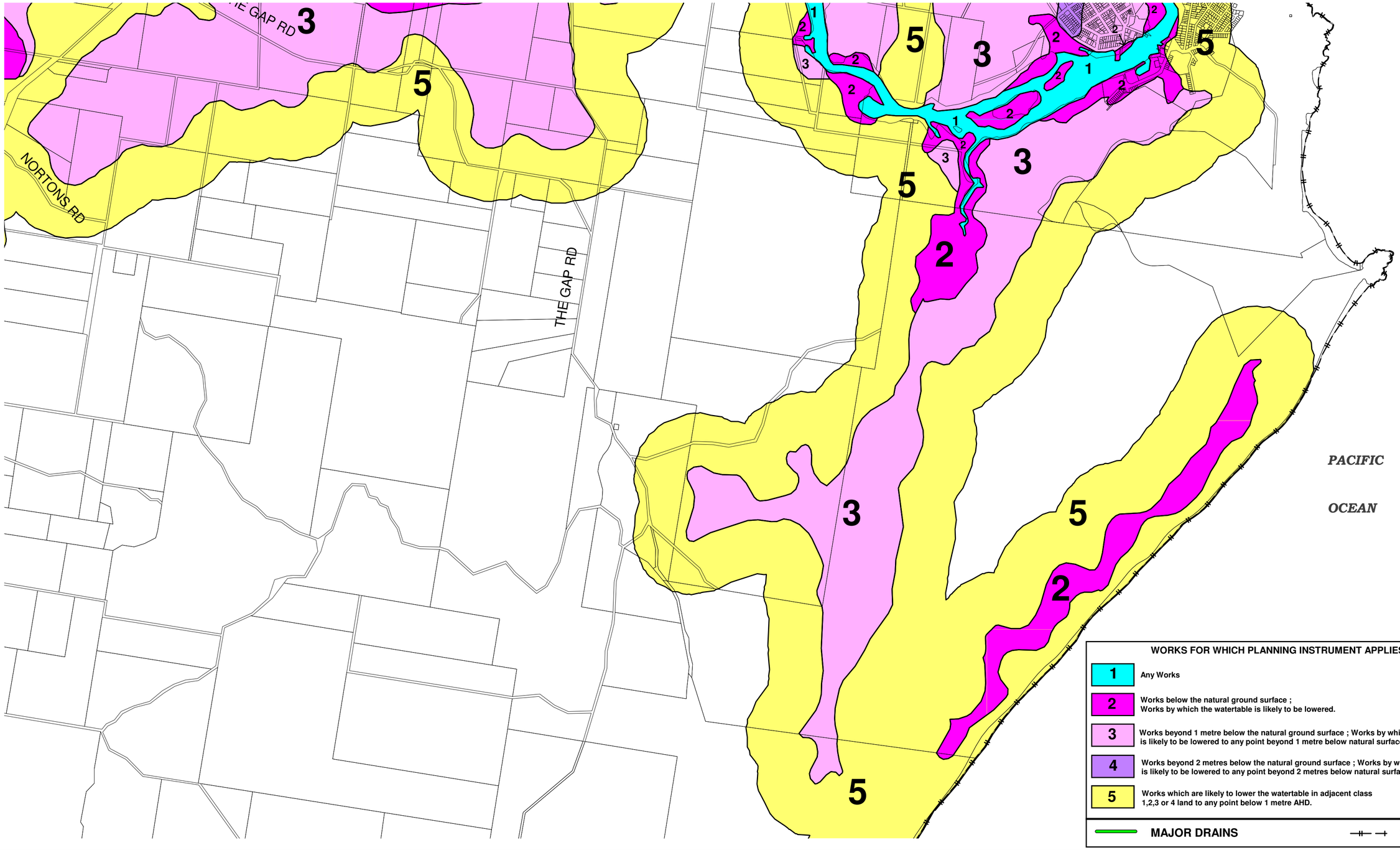

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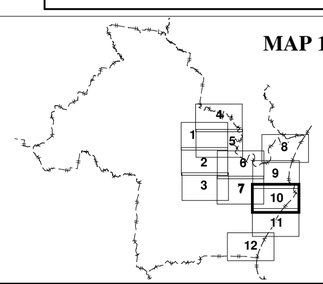

MAP 10 of 12

Planning officer - J. Hession

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5.4.04
Date

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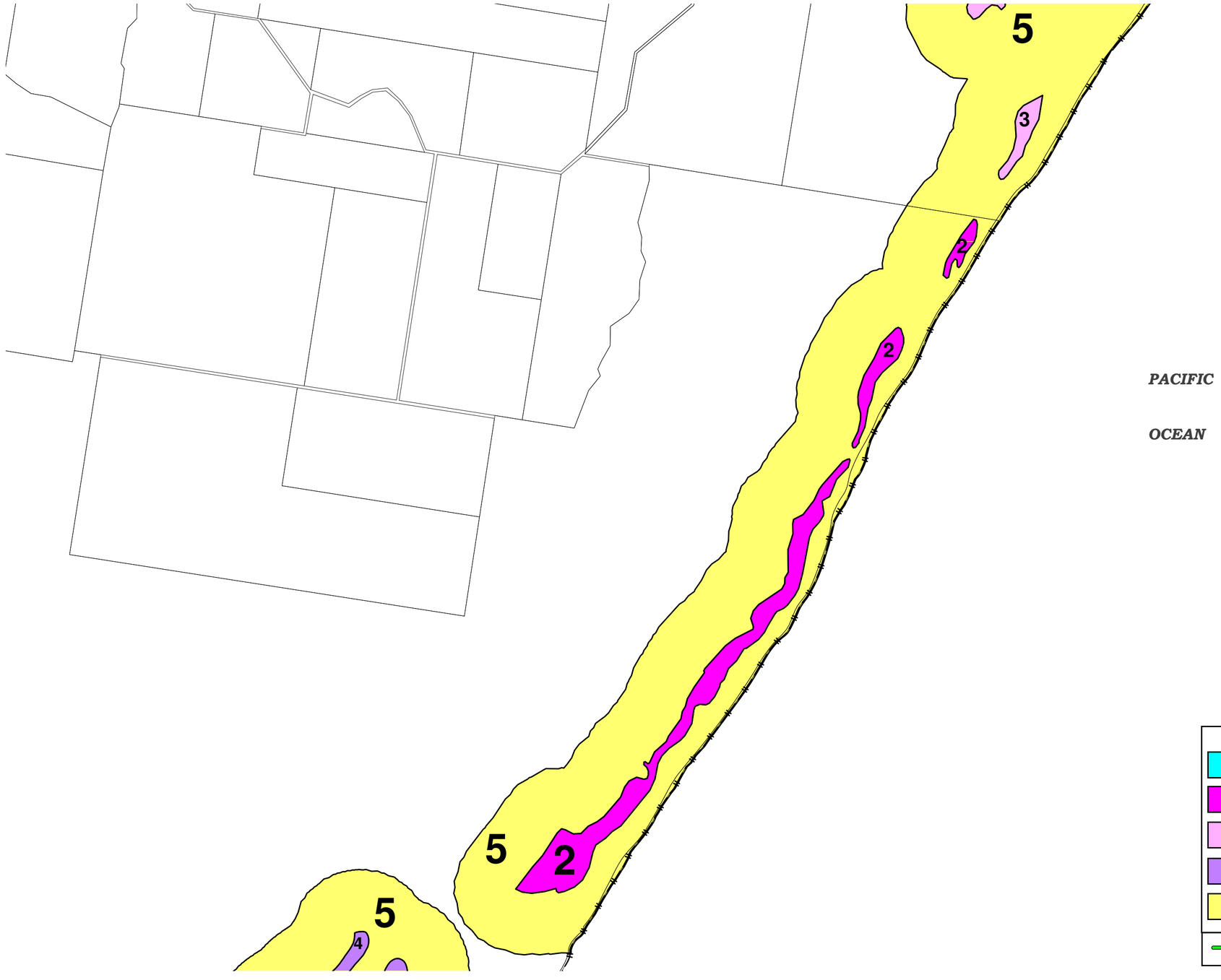

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MAJOR DRAINS — Shire Boundary

STATEMENT OF RELATIONSHIP WITH OTHER PLANS

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Scale 1 : 25 000

0 0.5 1 2

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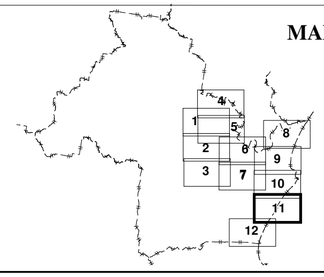
(Amendment No. 22)

ACID SULFATE SOILS PLANNING MAP



MAP 11 of 12

Planning officer - J. Hession

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General Manager

5.4.04
Date

Government Gazette No. 131 of 6/8/2004.

PACIFIC

OCEAN

Maclean Council

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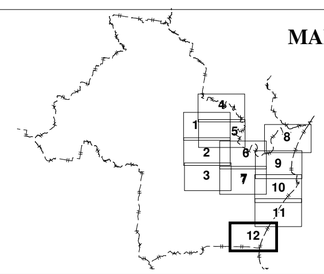

MAP 12 of 12

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General Manager — Date 5.4.04

Government Gazette No. 131 of 6/8/2004.

Appendix B

Field pH and the Peroxide Test

Acid Sulfate Soils Manual, (Acid Sulfate Soils Management Advisory Committee, 1998)

2. Field Peroxide pH Test

To test for the presence of unoxidised sulfides and therefore potential acid sulfate soils, the oxidation of the soil with 30% (100 volume) hydrogen peroxide can be performed in the field. The most common method is:

- a small sample of soil is placed in a small glass container (eg short clear centrifuge tubes or clear tissue culture clusters) and a small volume of peroxide is dropped onto the soil.

Note: Allow the digested solution to cool after the reaction.
A pH probe will only measure to 60°C.

The reaction should be observed and rated. In some cases, the reaction may be instantaneous; in others, it may take 10 minutes or more. Heating over hot water or in the sun may be necessary to start the reaction on cool days, particularly if the peroxide is cold.

Potentially positive reactions includes one or more of the following:

- change in colour of the soil from grey tones to brown tones
- effervescence
- the release of sulfurous odours
- a substantial depression in pH below pH_F
- pH < 3

The strength of the reaction is a useful indicator. The peroxide test is most useful and reliable with clays and loams containing low levels of organic matter. It is least useful on coffee rock, sands or gravels, particularly dredged sands with low levels of sulfidic material (eg <0.05 % S). With soils containing high organic matter (such as surface soils, peats, mangrove/estuarine muds and marine clays), care must be exercised when interpreting the reaction as high levels of organic matter and other soil constituents particularly manganese oxides can also cause a reaction.

Note of caution with the use of peroxide

30 % hydrogen peroxide is a strong oxidising agent and should be handled carefully with appropriate eye and skin protection. This test should be only undertaken by trained operators.

The pH of analytical grade peroxide may be as low as 3 as manufacturers stabilise technical grade peroxide with acid, The peroxide pH should be checked on every new container and regularly before taking to the field and adjusted to 4.5 - 5.5 with a few drops of 0.1M NaOH if necessary. False field pH_{FOX} readings could result if this step is not undertaken.

3. pH after oxidation

The measurement of the change in the pH_{FOX} following oxidation can give a useful indication of the presence of sulfidic material and can give an early indication of the distribution of sulfide down a core/ profile or across the site. The pH after oxidation test is not a substitute for analytical test results.

If the pH_{FOX} value is at least one unit below field pH_F, it may indicate potential acid sulfate soils. The greater the difference between the two measurements, the more indicative the value is of a potential acid sulfate soils. The lower the final pH_{FOX} value is, the better the indication of a positive result.

- If the $pH_{FOX} < 3$ and there was a strong reaction to the peroxide, there is a high level of certainty of a potential acid sulfate soils. The more the pH_{FOX} drops below 3, the more positive the presence of sulfides.
- A pH_{FOX} 3-4 is less positive and laboratory analyses are needed to confirm if sulfides are present. Sands particularly may give confusing field test results and must be confirmed by laboratory analysis.
- For pH_{FOX} 4-5 the test is neither positive nor negative. Sulfides may be present either in small quantities and be poorly reactive under quick test field conditions. In some cases, the sample may contain shell/carbonate that neutralises some or all acid produced by oxidation. In other cases, the pH_{FOX} value may be due to the production of organic acids and there may be no sulfides present. In these cases, analysis for sulfur using the POCAS method would be the best to check for the presence of oxidisable sulfides.
- For $pH_{FOX} > 5$ and little or no drop in pH from the field value, little net acid generating ability is indicated. Again, the sulfur trail of the POCAS method should be used to check some samples to confirm the absence of oxidisable sulfides.

Care is needed with interpretation of the result on highly reactive soils. Some soil minerals other than pyrite react vigorously with peroxide, particularly manganese but may only show small pH changes. When selecting soil for testing it is advisable to avoid material high in organic matter as the oxidation of organic matter can lead to the generation of acid. However, pH of soils containing organic matter and no pyrite do not generally stay below 4 on extended oxidation. In general, positive tests on 'apparently well drained' surface soils should always be treated with caution and followed up with laboratory confirmation.

The field peroxide tests can be made more consistent if a fixed volume of soil (using a small scoop) is used, a consistent volume of peroxide is added and left to react for an hour, and the sample is made up to a fixed volume with deionised water before reading. However, such procedures take time in the field and are more suited to a 'field shed' situation. When effervescence (sometimes violent) has ceased, a few additional mL of peroxide should be added until the reaction appears complete. If the reaction is violent, it is recommended that deionised water be added to cool and dilute the reaction. The test may have to be repeated with a small amount of water added to the soil prior to peroxide addition. The
pH^{FOX} of the resultant mixture is then measured.

4. Reporting the results

All pH_F and pH_{FOX} results along with the strength of reaction should be tabulated by site and depth and reported in the ASS report. An example of a recording sheet is attached.

Table A1.1 Field pH and peroxide results

Proj/Experiment: **OFFICER:** **Date Collected:** **Profile ID:**

Oven No. Date In Oven: Date Out: Date In Freezer: Description:.....

											Laboratory Analysis required	
Lab No.mm	**SAMPLE NO**	**Core SAMPLE DEPTH**	**SAMPLED** (Must Tick)	**DEPTH pH**	**pH_F**	**pH_{FOX}** Duplicate	**Eff.** Reaction	**EC_F**	**Segr/Frag** SS = shell J = Jarosite R= roots	**COMMENTS**	**POCAS**	**S TOS**
		0-0.1		**0.1**								
		0.2-0.3		**0.3**								
		0.5-0.6		**0.6**								
		0.8-1.0		**1.0**								
		1.3-1.5		**1.5**								
		1.8-2.0		**2.0**								
		2.3-2.5		**2.5**								
		2.8-3.0		**3.0**								
		3.3-3.5		**3.5**								
		3.8-4.0		**4.0**								
		4.3-4.5		**4.5**								
		4.8-5.0		**5.0**								

Final Water Height:
Water EC (dS/m=mS/cm):
(1000uS/cm= 0.1dS/m)

Appendix C

Preliminary Assessment Reporting Template

NSW Department of Primary Industries

* CITY COUNCIL

ACID SULFATE SOIL PRELIMINARY ASSESSMENT

Details of the location of the site on which works are proposed:

- ☐ Applicant / Property owner
- ☐ Property address
- ☐ Locality.....Parish.....
- ☐ Lot / Portion / DP number.....
- ☐ Describe the location of the works: .....
  .....
  .....
- ☐ Show the location of the works on a map or sketch map
- ☐ Map grid reference.....E.....N
- ☐ Attach a photograph of the site if available

Site Characteristics

- ☐ Elevation of the soil surface (AHD)
- ☐ Vegetation species present: .....
  .....
  .....

Description of the proposed works

- ☐ Describe the proposed works:.....
  .....
  .....
  .....
  .....
- ☐ What is the time frame over which the works will be undertaken?
- ☐ What is the depth of disturbance of the soil?
- ☐ How many tonnes of soil will be disturbed? <1 1 – 5 >5 (how many)?
- ☐ Will soil material be removed from the site or stockpiled?
- ☐ What is the likelihood of the works disturbing acid sulfate soils?
- ☐ What ASS treatment is proposed.....
  .....
  .....

Site Indicators Indicate if Present or Not Present at or near the site

- ☐ Water of pH <4.0
- ☐ Clear or milky green water
- ☐ Rust coloured iron stains on drain or pond or rust stained water
- ☐ Sulfurous (rotten egg gas) smell
- ☐ Scalded bare soil
- ☐ Corrosion of concrete and/or steel

Soil Profile Description

Complete the following table for each different soil layer thicker than 10cm.
Choose options from the list below

Layer Depth (cm)	Colour (1)	Texture (2)	Mottle Colour (3)	Stones or Shells (4)	Water table (5)	pH (6)	Peroxide Reaction (7)

(1) Black, Dark Brown, Light Brown, Dark Grey, Light Grey, Orange, Red, Yellow, Pale
(2) Peat, Sand, Loam, Clay, Clay Loam, Silty Clay
(3) Rusty, Brown, Red, Pale Yellow, Orange, Black
(4) Present / Absent, Size?, Amount?
(5) Measure depth to free water in the soil.
(6) Record soil pH
(7) Record peroxide reaction class (0 – 3) (Optional)

- ☐ The extent of works and the location of soil test holes should be clearly marked on a scaled map

Declaration

I declare that the information provided is true and correct to the best of my knowledge:

Signed.....

Name.....

Council Assessment

- ☐ LEP Zone
- ☐ ASS Planning Map Class (1-5)
- ☐ ASS Risk Map Class (eg: Ap1)
- ☐ Surveyed elevation?
- ☐ DLWC Soil Landscape Map Class
- ☐ Depth of soil disturbance
- ☐ Depth of Actual ASS
- ☐ Depth of Potential ASS

Delete which ever does not apply:

- ☐ Acid sulfate soils will not be impacted by the proposed works.
- ☐ The proposed works do not require development consent *see note below
- ☐ Acid sulfate soils may be impacted by the proposed works
- ☐ The proposed works require development consent
- ☐ The proposed works do not otherwise require development consent under LEP 95.

Assessment on behalf of Greater Taree City Council by: .....
Signature ..... Date.....
* Note: This determination applies only to the works described above and should not be taken to apply to any other circumstances.

Appendix D

Lime Treatment Requirements

Table 6.2 Acid Sulfate Soils Manual, (Acid Sulfate Soils Management Advisory Committee, 1998)

Table 6.2 Treatment categories and lime required to treat a weight of disturbed acid sulfate soils – based on soil analysis

L	**Low treatment level**: <0.1 t lime
M	**Medium treatment level:** >0.1 to 1 t lime
H	**High treatment level**: >1 to 5 t lime
VH	**Very High treatment:** >5 tonne lime

The tonnes (t) of pure fine lime required to fully treat the total weight/volume of acid sulfate soil can be read from the table at the intersection of the weight of disturbed soil (row) with the soil sulfur analysis (column). Where the exact weight or soil analysis figure does not appear in the heading of the row or column, use the next highest value (or calculate values exactly). Lime rates are for pure fine $CaCO_3$ using a safety factor of 1.5. A factor that accounts for Effective Neutralising Value is needed for commercial grade lime. An approximate volume (cubic m) can be obtained by dividing weight (tonne) by bulk density (t/m^3).

Disturbed soil	**Soil Analysis - Oxidisable Sulfur (S %)** or equivalent TPA/TAA													
(tonnes)	***0.03***	***0.06***	***0.1***	***0.2***	***0.4***	***0.6***	***0.8***	***1***	***1.5***	***2***	***2.5***	***3***	***4***	***5***
1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.1	0.1	0.1	0.2	0.2
5	0.05	0.05	0.05	0.05	0.1	0.1	0.2	0.2	0.4	0.5	0.6	0.7	0.9	1.2
10	0.05	0.05	0.05	0.1	0.2	0.3	0.4	0.5	0.7	0.9	1.2	1.4	1.9	2.3
15	0.05	0.05	0.1	0.1	0.3	0.4	0.6	0.7	1.1	1.4	1.8	2.1	2.8	3.5
20	0.05	0.1	0.1	0.2	0.4	0.6	0.7	0.9	1.4	1.9	2.3	2.8	3.7	4.7
25	0.05	0.1	0.1	0.2	0.5	0.7	0.9	1.2	1.8	2.3	2.9	3.5	4.7	5.9
35	0.05	0.1	0.2	0.3	0.7	1.0	1.3	1.6	2.5	3.3	4.1	4.9	6.6	8.2
50	0.1	0.1	0.2	0.5	0.9	1.4	1.9	2.3	3.5	4.7	5.9	7.0	9.4	11.7
75	0.1	0.2	0.4	0.7	1.4	2.1	2.8	3.5	5.3	7.0	8.8	10.5	14.0	17.6
100	0.1	0.3	0.5	0.9	1.9	2.8	3.7	4.7	7.0	9.4	11.7	14.0	18.7	23.4
200	0.3	0.6	0.9	1.9	3.7	5.6	7.5	9.4	14.0	18.7	23.4	28.1	37.5	46.8
500	0.7	1.4	2.3	4.7	9.4	14.0	18.7	23.4	35.1	46.8	58.5	70.2	93.6	117.1
750	1.1	2.1	3.5	7.0	14.0	21.1	28.1	35.1	52.7	70.2	87.8	105.3	140.5	175.6
1,000	1.4	2.8	4.7	9.4	18.7	28.1	37.5	46.8	70.2	93.6	117.1	140.5	187.3	234.1
2,000	2.8	5.6	9.4	18.7	37.5	56.2	74.9	93.6	140.5	187.3	234.1	280.9	374.6	468.2
5,000	7.0	14.0	23.4	46.8	93.6	140.5	187.3	234.1	351.2	468.2	585.3	702.3	936.4	1170.5
10,000	14.0	28.1	46.8	93.6	187.3	280.9	374.6	468.2	702.3	936.4	1170.5	1404.6	1872.8	2341.0

Appendix E

Lime Application Rate Calculation

Calculation of Base Limiting Rates for ASS

The value S_{cr}% denotes the amount of sulfur that could potentially react to form sulfuric acid. The value is dimensionless because the units are mass of sulfur per mass of soil.

The following calculations are based on the methodology provided in the ASSM (ASSMAC, 1998).

Calculations and Key Assumptions

Step 1 – What is the maximum amount of sulfuric acid that could be theoretically produced

For the purposes of calculating the quantity of lime, it is assumed that all of the sulfur occurs as sulfide and that the following reaction proceeds to completion:

$$FeS_2 + 15/4\ O_2 + 7/4H_2) \rightarrow Fe(OH)_3 + 2H_2SO_4$$

With this assumption, a soil containing 1% potentially reactive sulfur (S_{cr} = 1%) could produce a maximum of 30.59 kg sulfuric acid per tonne of soil. This assumes total reaction of the sulfide and no soil buffering capacity, and so is the most conservative figure.

1 tonne of 1% S_{POS} soil can produce 30.59 kg of sulfuric acid.

Step 2 – How much pure lime would need to be added to neutralise the theoretical maximum amount of sulfuric acid

This amount of acid would require 31.21 kg of pure lime (ie. pure $CaCO_3$) per tonne of soil to fully neutralise the acid. This application rate assumes that all of the lime reacts completely with all of the acid. That is, this assumes the lime has a neutralising value (NV) of 100.

31.21 kg of pure lime (NV = 100) is required to neutralise 30.59 kg of sulfuric acid.

Step 3 – What are the typical characteristics of commercial lime

Commercial lime is not pure lime (ie. pure $CaCO_3$) and therefore the actual neutralising value (NV) is typically less than 100, and is usually supplied with the product label.

For the purposes of these calculations the following assumptions are made about the characteristics of commercial lime:

Assume neutralising value (NV) of 95

Assume 95% of particles <0.3 mm

Assume moisture content of 5%

Step 4 – What is the effective neutralising value (ENV) of commercial lime

The effective neutralising value (ENV) of commercial lime is typically less than 100 as it is influenced by the starting neutralising value (NV), particle size distribution and moisture content.

Based on the assumptions made in Step 3 the effective neutralising value (ENV) is calculated as follows:

Size Fraction	Proportion	Utilisation Factor	% Value
<0.3 mm	95%	1.0	95
>0.3 mm	5%	0.1	0.5
	100%		95.5
NV	= 95		
ENV	= NV x 95.5% = 90.7		
Moisture corrected ENV	= 90.7 x (100-5)% = 86.2		

Therefore the effective neutralising value (ENV) of this commercial lime (based on the assumptions in Step 3) is 86.2. This means that 1.16 parts (100/86.2) of this commercial lime is required to be equivalent to 1 part of pure fine lime.

The effective neutralising value of this commercial lime is 86.2

Therefore 1.16 parts of this commercial lime are equivalent to 1 part pf pure fine lime.

Step 5 – What is the required safety factor for application of commercial lime

Further to application of the correction factor calculated in Step 4, a safety factor must also be added. This safety factor is added to allow for slow reactivity and non-homogenous mixing of the commercial lime in to the soil.

The safety factor used is usually between 1.5 and 2, depending on the level of hazard. A safety factor of 2 would be used in highly sensitive environments.

A safety factor of 2 will be adopted.

Step 6 – Calculating the combined factor for this commercial lime.

The combined factor is based on the combination of the adopted safety factor (Step 5) and the ENV (Step 4).

The final combined factor to use is:

Combined factor = 100/ENV x safety factor = 1.16 x 2 = 2.32

The combined factor for this commercial lime is 2.32.

Step 7 – Calculating the required application rate of this commercial lime.

The required rate of application of this commercial lime is determined based on the combined factor (Step 6) and the amount of pure lime required (Step 2).

Required application rate = required pure lime rate x combined factor = 31.21 kg x 2.32 = 72 kg

Therefore 72 kg of this commercial lime is required to neutralise 1 tonne of acid sulfate soil with S_{cr} = 1%. This lime must be of the type specified in Step 3.

Appendix F

Example Works Method Statements

ASS Works Method Statement 1

Acid Sulfate Soil (ASS) /Potential Acid Sulfate Soil (PASS) Identification and Excavation Management

Objective	• To identify ASS/PASS site soils to enable effective management to be undertaken. • Manage excavations to minimise the potential for oxidation of PASS
Performance Indicators/Target	All personnel trained in identification of site soils (PASS/ASS), and suitable management techniques associated with the site operations. Oxidation of PASS and acid leachate generation minimised on the site.
Responsible Personnel	*Manager* *Foreman* *Plant Operators*
Monitoring/Reporting	• The brown tan fill material containing shells and gravels/cobbles overlying much of the site (representative of excavated spoil), is non ASS/PASS and suitable for excavation and does not require neutralisation. All other underlying natural soils, including grey sands and clays, black organic material and marine muds to be excavated, must be neutralised with lime at the required rate, managed on site and reinstated back to its former horizon or as close as possible. • Excavation of PASS/ASS material not to occur unless directed by the *Foreman* and the designated stockpiling area and resources are available to lime and stockpile the soil prior to the completion of the days work. • The production of acid leachate from PASS will not occur if saturated materials are maintained in a saturated state. • All excavation faces to be lime dusted regularly and at the completion of the daily excavation works. • Covering of PASS excavations with a 300mm cover layer where possible after lime dusting. • Minimising the area under excavation at one time will facilitate management of smaller quantities of material and minimise any potential oxidation of soil exposed to the atmosphere. • Monitoring of groundwater and seepage prior to any discharge/dewatering occurring. • Water from dewatering to be used to recharge the groundwater in the vicinity of the excavation through the sand fill material. • Testing and possible neutralisation of any potential leachate from the excavation after each rainfall event. • All excavation faces to be lime dusted prior to backfilling. • Where there is a potential for seepage/groundwater migration off site from an open excavation, downstream bund to be constructed for collection of any potential leachate and to allow sampling prior to any discharges occurring. • Up-gradient diversion bunds to be constructed to minimise overland flow into the excavation.
Corrective Action	• If objectives not met, examine excavation method/design and modify process as required. • If pH outside limits, undertake further analysis and undertake neutralisation as required, under direction of suitably qualified acid sulfate soils practitioners. • If poor groundwater quality persists, seek specialist advice and prepare Environmental Management Program.

ASS Works Method Statement 2

Monitoring-
Stormwater and Site

Objective	• To maintain effective sediment and erosion controls measures. • Minimise release of sediment and contaminants to the environment. • Identify potential impacts / indicators of ASS to enable prompt remediation measures to be undertaken. • To meet the Acid Sulfate Soil Manual (ASSMAC 1998) guidelines
Performance Indicators/Target	• All site discharges within acceptable limits prescribed in the EMP and as per QASSIT guidelines. • No adverse environmental impacts to occur. • Site staff undertaken training associated with the site and ASS.
Responsible Personnel	• Business Hours: Notify *Contractor Foreman* / *Council Ph:* • After Hours: *Contractor pH* Note the corrective actions taken on inspection log when completed.
Monitoring / Reporting	• Establishment of a base line study of surface and groundwater where required from designated sampling locations prior to any disturbance of ASS/PASS soils is undertaken. • Daily appraisal of Site for stormwater controls, monitoring and any ASS indicators observed - to be recorded in inspection log and filed. **General** – Ensure stormwater controls, drains, overland flow paths are operational and stable. – All materials stockpiled in their allocated positions and sediment runoff is adequately contained. – Spilt materials are removed via dry cleaning methods. – Sediment controls on site entry and exits are fully functional. – Sources of sediment runoff are investigated and appropriate control measures taken. – Emergency supplies of repair material such as hay bales, sediment fences, agricultural lime, spill equipment are available. – Site facilities are suitably maintained. – Ensure no potential effects from ASS are present on the site or the receiving environment. **ASS Monitoring** – Undertake pH monitoring daily when PASS/ASS disturbance undertaken, and weekly and after rainfall events at nominated sampling locations, unless otherwise directed. – Notify *Foreman* if monitoring results outside acceptable limits (pH 6.5-pH 8.5) and/or further monitoring to be undertaken at and downgradient of the area.. – Waters to be discharged off the site into local water body, must meet the following acceptable parameters, – pH 6.5-pH 8.5, maximum iron (Fe) levels of 500 µg/L and Aluminium (Al) levels of 100 µg/LEC <1500 S – Monitoring to be performed for one month after cessation of construction activities at each identified ASS site. – If material is encountered that is not representative of soils previously sampled for ASS, or additional earthworks is required in an area not previously assessed, further sampling and analysis to be undertaken using the POCAS method. • **Excavation Monitoring** – Prior to any natural material being excavated, and before the re-

	commencement of daily excavation, pH monitoring of any groundwater/seepage to be undertaken. – Dewatering only to be undertaken daily, on pH values meeting the acceptance criteria and under the direction of the *Foreman.* • Routine testing and monitoring results to be forwarded to the superintendent as soon as available. • Record monitoring results and observations and notify foreman of non-compliance or where remedial action is required.
Corrective Action	• *Foreman* to be contacted immediately where potential or actual ASS impacts are identified to enable prompt assessment and remedial action/management. • If return levels from monitoring lie outside prescribed limits, *Manager* to take immediate action to modify existing methods to ensure that acceptable discharge limits are attained and modify remediation procedures. • Responsible personnel to allocate necessary resources or assistance if required • Implement corrective action if appropriate, otherwise instigate more detailed investigation. • Notify Council and EPA of any environmental incidents. • Prepare Environmental Management Program (if necessary).

ASS Works Method Statement 3

Liming and Stockpile Management

Objective	To minimise adverse environmental impact from liming and storage of PASS and ASS stockpiles and ensure effective neutralisation of stockpiles.
Performance Indicators/Target	• ASS and PASS soils identified, are well mixed and stabilised with lime (applied at the nominated rate of *x* kg/tonne). • Stormwater to be diverted from stockpiled area and potential leachate to be contained, monitored and treated if required prior to discharge from the area. • All soil to be limed prior to stockpiling and overnight storage. • No overflows or leaks from stockpiled areas. • No leachate/runoff from storage area.
Responsible Person	*Site Foreman* (*name and contact*)
Monitoring/Reporting	• Stockpiles to be placed on hardstand in designated area and limed immediately at the nominated rate, by placing soil in *x* mm layers and liming, with mixing undertaken by grader blade. • PASS and ASS material excavated must be stockpiled and limed within the same day in a bunded enclosure. • Perimeter bunds to contain potential leachate, to be constructed from clay materials and on decommissioning to be dusted with lime prior to backfilling. • The surface profile within the bunds to be graded to a low point where possible and a collection pit/sump constructed. • Stockpiles to be established on designated hardstand and perimeter bunded with upgradient stormwater diversion. • Lime to be appropriately stored and dust control measures implemented associated with lime neutralisation. • Daily inspection of stockpiled areas to be undertaken. • Minimising the area under excavation at one time will facilitate management of smaller quantities of material and minimise any potential oxidation of soil exposed to the atmosphere. • Test potential leachate for pH after every rainfall event and as part of routine monitoring of Site. • Excavated material to be reinstated to its former location and horizon where possible. • A detailed record of all PASS and ASS soil excavated and limed to be kept, including source, volume, time, monitoring and reinstatement on-site to be kept by the *Contractor*.
Corrective Action	• Where poorly stabilised soil is evident, re-lime and improve operation of lime spreading and mixing. • If surface runoff or leachate from storage areas does not meet acceptance requirements for discharge, contact *Foreman* for suitable remedial action. • Where further ASS or PASS soils cannot be effectively limed and stockpiled on site, notify *Foreman* to halt further excavation works. • Sweep up small ASS/PASS spills from area and place in bunded area.

ASS Works Method Statement 4

Acid Sulphate Soil Management Strategy

Objective	• Outline procedures for the undertaking of ASS investigations at any areas identified within the site where excavations are to occur, or where works may alter the surface and/or groundwater existing on the site. • Control any acidity generated by the disturbance of any PASS/ASS on the site. • Minimise the levels of potential acidity from soils disturbed on the site to an acceptable level (Acid Sulfate Soil Manual, ASSMAC 1998), and minimise any potential on and off site environmental impacts. • To perform site works and undertake ASS procedures in a manner which minimises environmental risk. • The Contractors *Foreman* and staff are made aware of site specific conditions associated with any ASS/PASS on the site.
Performance Indicators/Target	• No adverse environmental impacts on and off site. • PASS and ASS effectively managed on site. • There is an awareness of site conditions and requirements for effective management of ASS/PASS. • Modification of construction procedures if required to improve ASS management on the site.
Responsible Personnel	*Manager*
Monitoring/Reporting	• Notify appropriate staff areas where ASS/PASS soils may be encountered and the lateral and vertical extent of the materials prior to any disturbance occurring. • Develop a program of works for areas where disturbance to PASS/ASS is to occur, outlining construction sequence, soil neutralisation, containment measures and monitoring of excavation and action plans for occurrence of leachate. • The *Foreman* shall report to the *Managerand Council* weekly on: – the effectiveness of the operating procedures on the site; – Any problems in implementing ASS management; – Compliance with testing requirements; – Any environmental incidences or excellences of acceptance criteria for discharge of water from the site; and, – Effectiveness of any corrective measures that have been adopted. • All reporting pertaining to ASS/PASS and environmental issues should be formally documented.
Corrective Action	Implement the measures necessary to ensure Acid Sulfate Soil management is effective on the site and no adverse environmental impacts occur.

ASS Works Method Statement 5

Chemicals Handling - General Storage

Objective	• To store chemicals in accordance with government regulations. • Provide appropriate Haz-Chem signage throughout the system.
Performance Indicators/Target	No spills to enter stormwater.
Responsible Personnel	*Foreman*
Monitoring/Reporting	• Reporting of incidents to *Safety Officer* and documenting in site log book.
Corrective Action	• Maintain chemical storage areas in a clean and safe manner. • Upgrade chemical storage facilities. 1. Replace/Install signs, emergency equipment. 2. Designate separate areas for incompatible chemical types ie. Flammables, corrosives, oxidisers. 3. Add Bunding to storage facilities, where required. 4. Build/design new facilities.

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