QASSMAC
ACID SULFATE SOILS MANAGEMENT STRATEGY FOR QUEENSLAND

An Initiative of the
Queensland Acid Sulfate Soils
Management Advisory Committee
(QASSMAC)

April 1999

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DNRQ990057

Published by QASSMAC and Queensland Department of Natural Resources, Natural Sciences Precinct, Indooroopilly, Queensland, Australia.

National Library of Australia Cataloguing in Publication Data
Title: **QASSMAC Acid Sulfate Soils Management Strategy for Queensland**

ISBN 0 7242 7475 8
DNRQ990057

April, 1999

Citation of this publication should take the form:

Powell B and Ahern CR (1999). *QASSMAC Acid Sulfate Soils Management Strategy for Queensland.* QASSMAC and Queensland Department of Natural Resources, Indooroopilly, Queensland.

Acknowledgements

The authors wish to acknowledge the major contribution made by members of QASSMAC (see Foreword for membership list) in developing the Queensland Strategy over a period of 2 years. We wish to also acknowledge the contribution of former QASSMAC members, in particular John Bennett (EPA), Milan Kupr (Australian Marine Conservation Society), John Beumer (DPI Fisheries), John Tadman (Queensland Landcare Council), Richard Reeve (Queensland Commercial Fishermens' Organisation), Mark Everson (Canegrowers) and Lionel Armistead (Sand Producers' Association).

We also thank the following organisations for providing comments on the Draft Strategy: Environmental Protection Agency; Department of Primary Industries; Department of Communication, Information, Local Government and Planning; Department of State Development; Department of Main Roads; Queensland Health; Local Government Association of Queensland; Queensland Commercial Fishermens' Association; Canegrowers; Urban Development Institute of Australia; Australian Marine Conservation Society; and Sunfish.

Valuable comments were provided by Kylie Hey, Phil Kohn, Geoff Edwards, John Mullins, Ross Berndt, Howard Briggs and the Regional Directors of DNR.

FOREWORD

Acid sulfate soils occur extensively along the Queensland coastline. However the dangers of disturbing these soils have only recently been recognised. Past government policies, the desire of many to enjoy a lifestyle with seaviews and the extensive development of agriculture along the coastal strip have all led, on occasions, to acid sulfate soils disturbance and the generation of sulfuric acid. Impacts such as fish kills, fish disease, habitat destruction, corrosion of engineering structures and potential health effects are all warnings that we should manage these soils with extreme care.

The Acid Sulfate Soils Management Strategy for Queensland proposes a State-wide coordinated approach between the State Government and its various agencies, local governments, industries and the community. It is an important step to ensure a cost effective and shared response to this emerging environmental problem.

The beneficiaries of the adoption of this Strategy will be the future generations of Queenslanders who will understand the nature of the problem, enjoy a high quality coastal environment and will not have to fund the high costs of acid sulfate soils remediation when inappropriate developments go wrong.

The challenge now is for stakeholders to support the strategy in its implementation.

QASSMAC

The Queensland Acid Sulfate Soils Management Advisory Committee (QASSMAC) was formed in late 1996 by DNR as a result of concerns by governments, industry and the community on the perceived approach being made in response to this issue. The role of QASSMAC is to facilitate a State-wide, whole-of-government approach to the responsible use and management of acid sulfate soils and to encourage coordination and collaboration between State and local government authorities, industry and the community.

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EXECUTIVE SUMMARY

Along 6,500 kilometres of Queensland coastline there are an estimated 2.3 million hectares of acid sulfate soils. When disturbed for agricultural or urban development these soils may generate large volumes of sulfuric acid that can leak into adjacent waterways, catastrophically damaging the environment, degrading local fisheries and corroding concrete and steel infrastructure. Over recent years, development pressures on areas with acid sulfate soils have increased significantly.

Acid sulfate soils are complex to manage and many government agencies are involved in decision-making about development associated with them. However, there is limited regional expertise in government departments, limited regional mapping, and only a low level of research into the nature and management of these soils.

Acid sulfate soils can be successfully managed by adopting best practices, but the consequences of not giving them adequate attention can be severe and on the most problematic sites development should be avoided.

Acid sulfate soils are a multi-dimensional issue involving many industries, local governments and coastal communities. It also crosses traditional State government departmental boundaries and a number of professional disciplines. In the absence of an existing structure to deal with this, the stakeholders identified the need for a coordinated State-wide strategy, involving whole of State Government, local governments, industry and community approach to address the acid sulfate soils issue. This Strategy proposes to build such an approach through six key elements:

1. Awareness, education and training
2. Mapping and assessment
3. Planning, management and environmental advice
4. Research and development
5. Policy, regulation and lead agency
6. Regional community participation.

The Strategy identifies roles and responsibilities for stakeholders and proposes that resourcing be shared across most of these groups. The Strategy is designed to put in place the elements which can facilitate and support the minimisation of further disturbance of acid sulfate soils and promote the management and rehabilitation of acid sulfate soils.

BACKGROUND

An estimated 2.3 million ha of acid sulfate[1] soils occur naturally in low-lying areas of coastal Queensland, less than 5m above sea level. Figure 1 shows those areas with potential acid sulfate soils. When disturbed and exposed to air, these soils derived from wetlands have the potential to produce sulfuric acid (battery acid), which drains into adjacent waterways with rain. Construction of canal estates, roads, golf courses and aquaculture ponds, extraction of sand/gravel, drainage of sugar cane lands and construction of ponded pastures can disturb acid sulfate soils and release sulfuric acid.

Impacts on the environmental values include the acidification of coastal waterways and the destruction of aquatic habitat and marine vegetation. Dramatic and newsworthy impacts include the infection or death of fish and other aquatic animals such as oysters and crabs. Recent fish kills directly attributable to disturbance of acid sulfate soils have been observed in environmentally sensitive areas in both north and south Queensland. Commercial and recreational fisheries, aquaculture and tourism are major industries that may be adversely affected by the disturbance of acid sulfate soils. Acidified waters also have an economic consequence by corroding concrete and steel infrastructure such as culverts, pipes and bridges.

Acid sulfate soils (ASS) have been recognised only recently as one of the most important environmental issues affecting land use on the coastal lowlands of Queensland. Since 1995, proponents of developments collectively worth billions of dollars have needed to consider the environmental and economic impact of disturbing acid sulfate soils. The majority of these have been in south-east and northern Queensland where development pressure is most acute.

Comparisons with New South Wales are valuable. Their coastal areas also experience significant problems with acid sulfate soils, resulting in long-running public disputes between the sugar cane and fisheries industries. The annual loss of fish catch in New South Wales as a result of disturbed acid sulfate soils is estimated to be $1 million, and a similar figure is estimated for the oyster industry. The Tweed Shire Council recently spent $4 million replacing infrastructure damaged by acidic run off. In 1997/98 NSW Agriculture was allocated $750,000 in its budget to tackle acid sulfate soils with $2.1 million over the next 3 years.

In ASS areas, any overuse of groundwater leading to the lowering of the watertable results in degradation of groundwater quality with reduced pH and increased levels of soluble metals through the oxidisation of acid sulfate soil. In irrigation areas, such as Moore Park near Bundaberg, oxidisation of previously saturated acid sulfate soils has resulted in acid leakage into drains, followed in some cases by seawater intrusion and iron pan precipitation, resulting in the irreversible loss of agricultural resources.

The public health implications of disturbing acid sulfate soils are not fully understood and require research to determine their significance. Acidic dust from construction activities and ploughing can cause eye irritation and dermatitis. There is also potential for contamination of ground waters and farm dams by acid sulfate soil leachate containing aluminium and in some cases heavy metals.

[1] By interstate convention, the international spelling of sul**f**ate with "f" rather than sul**ph**ate with "ph" has been adopted.

Figure 1. Indicative distribution of acid sulfate soils in Queensland

Some species of mosquito which transmit arboviruses such as Ross River Fever may be tolerant of acidic waters and build up their numbers in the absence of less tolerant predators. The high incidence of the toxic blue green algae, *Lyngbya majuscula* in Deception Bay is possibly linked to local iron-rich surface water run off and disturbance of ASS. Local fisherman who have come in contact with the *Lyngbya* have experienced skin rashes and asthma-like reactions. *Lyngbya* is also associated with fouling of nets, loss of seagrass and reduced fish catches.

In 1995 the Queensland Acid Sulfate Soils Investigation Team was established at the Resource Sciences Centre of the Department of Natural Resources to map and research acid sulfate soils. In the past two years, the Queensland Acid Sulfate Soils Investigation Team has secured a national reputation as specialists in acid sulfate soils mapping, chemistry and environmental impact assessment. Inquiries on State acid sulfate soils problems have been received from Cairns to Coolangatta. There have also been increasing requests for advice from interstate, including the Northern Territory and Western Australia. The Queensland Acid Sulfate Soils Investigation Team is represented on the National Working Party on acid sulfate soils, which has prepared a draft National Acid Sulfate Soils Management Strategy, and on the acid sulfate soils Technical Committee based in NSW.

Limited funds are being made available for acid sulfate soils investigation in Queensland through the State Government, the Natural Heritage Trust (NHT), the sugar cane industry and two local governments. However there are major constraints through lack of resources for:

- formulation of policy, codes and guidelines;
- coordination of effort between governments, industry and the various levels of community;
- technical training and awareness;
- mapping of acid sulfate soils for purposes of planning by local government and industry;
- monitoring of water quality; and
- research and development to establish the appropriate environmental standards and management practices.

Many acid sulfate soils situations can be successfully managed by adopting best practices and following guidelines, but to be readily accepted and adopted by industry these practices need additional promotion and effective demonstration.

EXISTING SITUATION: ACTIVITIES OF THE QUEENSLAND GOVERNMENT

Government departments with a direct interest in the management of acid sulfate soils include:

- Primary Industries (fisheries protection, sugar cane development);
- Environment and Heritage (environmental management);
- Natural Resources (resource management);
- Communication and Information, Local Government and Planning (statutory planning and development assessment);
- State Development (development); and
- Transport (dredging, road and rail).

Other state authorities with less direct interest include the Departments of Mines and Energy (gravel, sand and lime resources) and Tourism, Sport and Racing (coastal amenity and resort development). The Department of Natural Resources currently provides guidelines and other technical advice on assessment and management of acid sulfate soils.

Natural Resources also releases coastal State land (by lease or sale) which may need assessment and management of acid sulfate soils before it can be safely developed. The Department of State Development has an interest in improving the approval processes relating to development on these soils and the Department of Transport is establishing procedures to deal with them for road, rail and dredging activities.

With the assistance of external funding, Department of Natural Resources through the Queensland Acid Sulfate Soils Investigation Team has taken the initiative to establish several acid sulfate soils investigatory projects in south-east Queensland. These include risk mapping, research into acid drainage of sugar lands, monitoring of water quality and development of laboratory methods. The Team has regular contact with local governments, industry and community groups, universities, CSIRO and the Australian Geological Survey Organisation.

On a State-wide basis there is an inadequate level of regional expertise, limited regional inventory and assessment activities, and only a low level of research into the nature, impact and management of these soils. Major regional State government projects such as the Sugar Industry Infrastructure Package and coastal infrastructure for State Water Projects and Regional Infrastructure Development have received criticism from local communities over disturbance and perceived poor management of acid sulfate soils. In response, project managers have requested the Queensland Acid Sulfate Soils Investigation Team to provide/supervise mapping and technical guidance. Implications for water-based development include the need to:

- incorporate acid sulfate soils within the consideration of land suitability for irrigation of potential irrigation areas (eg. Elliot Main Channel area of the Burdekin Irrigation Scheme);
- check existing irrigation areas for evidence of acid sulfate soils;
- examine the potential risk for damage to concrete, pumps and pipelines from acid water; and
- ensure Departmental engineers are aware of current technical guidelines for dealing with acid sulfate soils.

The demand for knowledge, skills and technical support far outstrips the resources currently allocated. Present workloads on the Queensland Acid Sulfate Soils Investigation Team are unsustainable. Development pressures on acid sulfate soils are increasing rapidly and the Queensland Acid Sulfate Soils Investigation Team has since 1996 reviewed many applications for multi-million dollar (>$2,000,000,000) development affected by acid sulfate soils.

The development industry has a major interest in the issue of acid sulfate soils. There are usually large costs involved in detailed soil sampling, analysis and impact assessment. This information is required in much greater detail (1:5,000 scale minimum) than that provided by the Department of Natural Resource's regional maps. This sampling is 25 to 100 times more detailed than any Department of Natural Resources proposed mapping.

With high costs of investigation and potentially even higher costs for managing disturbed acid sulfate soils, industry and providers of public infrastructure require better mapping to avoid the high risk areas. Mapping also indicates the likely depths and levels of potential acidity, and hence helps industry to make more informed investment decisions.

Developers need greater certainty, and the provision of foundation mapping, technical training and advice would improve the quality of acid sulfate soils management plans and therefore the quality and timeliness of development approvals.

Existing Statutory Framework for Dealing with Acid Sulfate Soils

The Environmental Protection Agency is the lead agent for environmental protection. The *Environmental Protection Act 1994* provides that all Queenslanders have a general environmental duty to take all reasonable and practical measures to prevent or minimise environmental harm. The Act also provides that in deciding what measures are appropriate, a person must have regard to the nature of the harm, the sensitivity of the receiving environment, the current state of technology and the economic implications of different measures which might be applied to avoid or minimise environmental harm.

Under the *Integrated Planning Act 1997*, State and local government interests are to be integrated into planning schemes. For acid sulfate soils this can be achieved by defining areas of acid sulfate soils risk, or by including 'desired environmental outcomes', performance indicators, policies and codes against which development applications can be assessed. Development applications require either code or impact assessment or both depending upon the types of development. Assessment is carried out by assessment manager and any referral agencies, usually State departments and is coordinated by the assessment manager. Where the referral agency is a concurrence agency, ie. a State department with a legislative responsibility, it can impose conditions or require the development application to be refused on matters that fall within its jurisdiction. In most cases the local government will be the assessment manager, and it has the ability to impose reasonable and relevant conditions on development approvals.

The process of designated developments and areas under the *Local Government (Planning & Environment) Act 1990* to require an environment impact statement and, if required, sets the terms of reference for the study, is continuing for a limited period under the *Integrated Planning Act 1997*. This process is called Referral Coordination and sets Information Request Guidelines for the designated developments. Where appropriate, the assessment of acid sulfate soils impacts can be included in the information request guidelines by referral agencies. Under Integrated Development Assessment System (IDAS) local governments can call for additional information about acid sulfate soils when assessing a development application even if an environment impact statement is not triggered under the *Integrated Planning Act 1997*.

The Queensland *Fisheries Act 1994*, under Section 125 enables the Department of Primary Industries to issue a Notice to Restore Fisheries habitat etc. This section of the Act can be applied if it appears to the Chief Executive, that the polluting matter such as soil, noxious substance or other matter is on land, in waters, on marine plants or in a fish habitat and that the polluting matter has had, or may have an adverse effect on the quality or integrity of a fish habitat, fish stocks or fishery.

Under the *Local Government Act 1993,* local government has the power to make local laws for the management of acid sulfate soils. The Gold Coast City Council recently became the first local government in Queensland to establish a policy for the management of acid sulfate soils. The Councils of Maroochy, Caloundra and Caboolture have now adopted policies on acid sulfate soils.

STAKEHOLDERS

In late 1996, the Department of Natural Resources through its Resource Sciences Centre established the Queensland Acid Sulfate Soils Management Advisory Committee. It is similar to a successful committee established in NSW by the Minister for Agriculture. The Queensland Acid Sulfate Soils Management Advisory Committee includes representatives of major stakeholders affected by the need to responsibly manage acid sulfate soils in Queensland, as follows:

Community

- Landcare and Catchment Management Council;
- Australian Marine Conservation Society representing the Queensland Conservation Council; and
- Sunfish.

Industry organisations

- Canegrowers;
- Queensland Commercial Fisherman's Organisation;
- Urban Development Institute of Australia; and
- the consultancy industry.

Local governments

- Local Government Association of Queensland; and
- councils (by Maroochy Shire City Council).

State Government

- Environmental Protection Agency;
- Department of Primary Industries;
- Department of Natural Resources;
- Department of Communication and Information, Local Government and Planning; and
- Department of State Development.

Tertiary institutions

- Griffith University.

The role of the Queensland Acid Sulfate Soils Management Advisory Committee is to facilitate a State-wide, whole-of-government approach to the responsible use and management of acid sulfate soils and to encourage coordination and collaboration between State and local government authorities, industry and the community.

Other stakeholders with an interest in acid sulfate soils include residents and businesses of coastal communities, the conservation movement, the grazing industry, the aquaculture industry, the oyster industry, railways/main roads, harbours, recreational fishermen, tourism interests and port authorities. Officers from the Department of Mines and Energy have also expressed interest because of the similarities of acid sulfate soils issues with acid mine drainage issues. The Department of Health has expressed interest in the public health consequences of disturbing acid sulfate soils.

An important stakeholder is the Commonwealth Government. Through the Natural Heritage Trust the Commonwealth has provided catalytic funding for acid sulfate soils mapping. A Working Party under the Sustainable Land and Water Resources Management Committee recently prepared a draft National Acid Sulfate Soils Management Strategy for consideration by the Standing Committee for Agriculture and Resource Management.

PURPOSE AND VISION

The purpose of the Queensland Acid Sulfate Soils Management Strategy (the Strategy) is to ensure that acid sulfate soils are not contributing to unsustainable degradation of soil, water and biological resources and to achieve ecologically sustainable production and development. This will be achieved by developing and encouraging the use of best practice for land and water management in areas of acid sulfate soils, by establishing mechanisms to:

- minimise future disturbance of acid sulfate soils;
- promote the sustainable management of acid sulfate soils disturbed by development; and
- promote the rehabilitation of previously disturbed acid sulfate soils to minimise environmental effects.

THE STRATEGY

The key elements of the Strategy are:

- awareness, education and training;
- mapping and assessment of acid sulfate soils;
- planning, management and environmental advice;
- research and development;
- policy, regulation and lead agent; and
- regional community participation.

Awareness, Education and Training

The sustainable use and management of acid sulfate soils depends on stakeholders having a sound understanding of acid sulfate soils assessment techniques, the principles of development of acid sulfate soils, and the responsible use and management of acid sulfate soils.

Priority actions include:

1. Develop and implement a State-wide program to raise awareness of acid sulfate soils with local governments in coastal regions, State departments, industries and communities.
2. Develop and distribute material relating to training/information/education such as:
   - packages on acid sulfate soils; and
   - Internet products.
3. Train key State and local government officers particularly in coastal regions, and environmental consultants on recognition, assessment, and the responsible use and management of acid sulfate soils.
4. Provide specialist technical advice to stakeholders on the use and management of acid sulfate soils and seek support for applied research.
5. Promote self reliance by industry and local government.

Mapping and Assessment of Acid Sulfate Soils

A map at a coarse scale (1:5,000,000) has been prepared (see Figure 1 *or back cover for colour version*) showing indicative areas of acid sulfate soils in Queensland. The map is based on a geological map that identifies unconsolidated Quaternary marine sediments along the coast. Advice from the Australian Geological Survey Organisation is that the majority of this geological unit is of Holocene age and therefore quite likely to have the potential for generation of acid sulfate soils. This map however identifies only the broad areas with potential for acid sulfate soils, areas where care should be taken with any development. Within these areas, most local governments are able to use only crude criteria such as elevation above sea level and geology to identify areas at risk of acid sulfate soils.

The best basis for planning the management of areas with acid sulfate soils is through comprehensive soils mapping with assessment of the soil profile in some cases to a depth of 5m. Developments such as canal estates, marinas and quarries commonly excavate to this depth.

Previous soil surveys in Queensland assessed the soil profile to a depth of only 1.2m. As has already been undertaken in New South Wales, acid sulfate soil risk maps can be incorporated into planning schemes and acid sulfate soil policies. Current maps are used in this way by the Gold Coast City Council. However, mapping of many coastal areas is constrained by unavailability of 1:25,000 topographic maps and associated aerial photos.

Established coastal primary industries such as sugar cane, grazing and sunrise industries like aquaculture and tea-tree oil also urgently require acid sulfate soil maps. Such maps will assist these industries in managing existing areas of acid sulfate soils, planning future expansion and avoiding high-risk sites.

There is a general requirement to map and assess soils in those areas where urban and more intensive rural developments have occurred or are proposed in the future. At a minimum, mapping is required to a scale of 1:50,000 and 1:25,000 is better. Experience has shown that mapping at this scale provides a better basis for planning in areas under intense pressure for development and also allows for more certain and timely advice on development applications. Most proponents of developmental projects are required to map and assess (at their expense) acid sulfate soils at 1:5,000 scale or finer (see page 5).

Priority for mapping and assessment at a minimum of 1:50,000 scale is urgently required in selected areas of south-east Queensland, the Wet Tropics, Mackay, Townsville and Gladstone. Some mapping at 1:100,000 scale is required for coastal grazing lands where ponded pastures may disturb acid sulfate soils. Requests for such mapping have been received for the coastal strip from Mackay to Gladstone. Resources will limit the ability to map all these areas at this scale and regions will need to prioritise the particular areas to be mapped. More detailed mapping may be required in certain areas.

Priority actions include:

1. Prepare a State-wide program to undertake mapping and assessment of acid sulfate soils.
2. Undertake the State-wide mapping and assessment program, including dedicated laboratory support.
3. Prepare and publish guidelines for soil sampling and investigation.
4. Prepare interim guidelines for assessing and managing the construction and maintenance of major drains eg. for Sugar Industry Infrastructure Package, State Water Projects (water storages).
5. Establish and maintain an acid sulfate soils site database for access by all stakeholders.

Planning, Management and Environmental Advice

The provision of planning, management and environmental advice on acid sulfate soils at a satisfactory standard requires a high level of technical competence and experience in the management of acid sulfate soils. It has been claimed that past delays in approvals for major developments because of acid sulfate soil management issues have cost developers up to $100,000 a week. Examples of affected major developments in recent times include Earl Hill at Cairns, Port Hinchinbrook, Cairns Port, Dungeness at Port Lucinda, Oyster Cove at Coomera, Pacific Harbour at Bribie Island and developments at Robina and Mudgeeraba.

Assessments are therefore needed at two levels, strategically (eg. for planning schemes) and at a property-specific or project level (for individual developments). All local governments will be preparing planning schemes within the next five years. This adds urgency to the task of mapping acid sulfate soils and making these data available to local governments. At the project level, many developments are of a politically sensitive nature and the highest quality advice should be provided on acid sulfate soils and the associated environmental impact assessment.

Under IDAS, specific time frames for responses are required for the provision of advice. Significant decisions are often required in a short time frame and often involve senior officers. Departmental officers have to be very sure of the scientific basis of their advice, as there is a strong possibility of court challenges if advice is doubtful. With rare exceptions, regional Queensland does not currently have the people with the skills required or resources available to provide this level of advice. The Department of Natural Resources has been providing most of the advice on major developments from Brisbane. The timely and efficient provision of this advice has implications for the provision and training of Departmental staff.

Priority actions include:

1. Develop a high quality acid sulfate soils advisory and information service to help prepare:
   - planning schemes and to disseminate advice about methods of dealing with acid sulfate soils through planning schemes to coastal local governments;
   - industry environmental codes of practice; and
   - environmental management plans for areas of acid sulfate soils including provision for ongoing monitoring.
2. Technical guidelines on management of acid sulfate soils.
3. Develop a program of training and support for planners and advisers on acid sulfate soil matters.
4. Organise a joint conference of New South Wales and Queensland practitioners to evaluate the range of planning mechanisms potentially available for acid sulfate soils.
5. Develop a process and the technical guidelines for information requests, code assessment and environmental impact assessment through the Integrated Development Assessment System. This aims to ensure that 'Desired Environmental Outcomes' are achieved in respect of acid sulfate soils management.

Research and Development

Our understanding of acid sulfate soils in Queensland is in its infancy. Similar problems have been encountered with acid sulfate soils in coastal New South Wales, Asia and Florida. It is proposed that research should be cooperatively based and includes Queensland and New South Wales State Government departments, Commonwealth Government, universities, industry and instrumentalities such as CSIRO.

An immediate requirement is a literature review with a research focus, together with workshops to help prioritise impacts in the following fields:

- economics (eg. cane, fishing, shell fish, aquaculture, development, infrastructure);
- social science (eg. health, amenity, nuisance, recreational, lifestyle);
- management techniques (eg. liming, sea water neutralisation, capping, sluicing);
- resource science (eg. soils physics, hydrology, soil and water chemistry, sulfur cycle); and
- environmental science (eg. habitat, biodiversity, extent, population, toxicology).

Priority actions already identified include the investigation of:

1. Timing of liming and other treatments to neutralise the acid produced.
2. Alternative methods of treatment: biological methods, sluicing, re-use of pyritic fines.
3. Understanding of oxidation rates of acid sulfate soils and measuring of acid export rates.
4. *In situ* hydrology, particularly for reformed profiles to predict the effects of disturbing acid sulfate soils.
5. Improved water quality criteria and water quality monitoring techniques.
6. Use of seawater for acid neutralisation and its impact on estuarine fish and other biota.
7. Methods of risk assessment which provide a consistent scientific model to determine whether development of a site represents a significant environmental risk.
8. Low cost techniques for managing groundwater levels to reduce formation and export of acid.
9. Tolerance of mosquitoes and their natural predators to acidic waters.
10. The relationship between disturbance of acid sulfate soils and outbreaks of blue green algae.

Policy, Regulation and Lead Agency

A State-wide collaborative approach requires the identification of a lead agent to coordinate policy and its implementation as well as development of a sound mechanism for consulting major stakeholders. There is also a need for consultation with regions by either sponsoring events in regional centres or funding regional representatives to attend meetings in Brisbane.

Priority actions include:

1. Continue the Queensland Acid Sulfate Soils Management Advisory Committee, which is representative of major stakeholders. Queensland Acid Sulfate Soils Management Advisory Committee is currently chaired by the Department of Natural Resources.
2. In particular, prepare a State Planning Policy. The *Integrated Planning Act 1997* utilises the state planning policy mechanism to express the State's interest in planning matters. The State's interest in the management of acid sulfate soils is centred around the creation of conditions in which coastal development, including agricultural land use and other activities that promote prosperity are undertaken with minimal impact on public health, the environment and fisheries.
3. Develop policies, codes and guidelines, particularly those that can be given effect through local laws, planning schemes and coastal management plans.

4. Appoint a lead agent to coordinate acid sulfate soil strategies, particularly with the aims of providing consistent advice to Government and preparation of submissions for funding.
5. Assist in the preparation of action plans for the management of acid sulfate soils.
6. Consider which department if any, should become a concurrence agency for acid sulfate soils under the *Integrated Planning Act 1997*. Collate aspects of current local, State and federal legislation relevant to acid sulfate soils and make it publicly available.
7. Ensure that governments, industry and development organisations incorporate acid sulfate soil considerations into environmental codes of practice.

Regional Community Participation

In regional coastal areas, many community groups are concerned about the effects of acid sulfate soils and would be willing to support a range of activities. Regional, State and local government officers should become increasingly involved in local collaboration on acid sulfate soils activities with these groups.

The priority activities include:

1. Encourage local networks of people with an interest in acid sulfate soils to become well informed.
2. Encourage local committees to monitor water quality and development activities.
3. Support local communities and agencies to obtain funding/technical support for projects associated with monitoring, mapping and awareness raising.
4. Support schools and Environmental Education Centres through presentations, displays, materials and field trips.
5. Fund some meetings and seminars in regional centres to raise the profile of acid sulfate soils.

IMPLEMENTATION OF THE STRATEGY

At the local level the initial emphasis will be on awareness and management action. At the State level, the key roles are coordination, development and implementation of policy, preparation of regulations, technical support for assessing development applications and production of maps and technical information for dissemination. Funding is an important challenge for all levels of government.
The roles and responsibilities for the various stakeholders are summarised below. They are proposed as a checklist of direct relevance to each of the stakeholders, to assist them to assess their position and determine priority actions. In many cases, collaborative actions between stakeholders will be the appropriate means of providing the resources and support needed to achieve desired outcomes.

Commonwealth Government

- in consultation with the States, Territories and local governments, develop national policy guidelines for acid sulfate soils; provide assistance to local governments to address acid sulfate soils at the local level;
- share in funding projects that promote awareness/education of acid sulfate soils, identify the extent of the problem (mapping), improve management and reduce adverse impacts; and
- through funding programs such as the Natural Heritage Trust, provide support to community groups for rehabilitation and monitoring projects addressing significant acid sulfate soils problems.

Queensland Government

The State's interest in the management of acid sulfate soils is centred around the creation of conditions in which coastal urban development, agricultural land use and other activities that promote prosperity are ecologically sustainable

and undertaken with minimal impact on the environment and fisheries. Further, that services are provided within a framework which promotes self-regulation and self-reliance by industry but with effective development control, mainly through local governments and (over State land) through conditions of land tenure. The Government's role is to facilitate responsible and sustainable development of the coastal zone and protect sensitive coastal and aquatic environments through the following measures:

- support for continued operation of the Queensland Acid Sulfate Soils Management Advisory Committee as the consultative committee in coordinating government, industry and community response using and managing acid sulfate soils. Departmental members of the Committee will periodically evaluate progress, recommend changes as required and report their assessments to their relevant Ministers;
- endorse the Department of Natural Resources as the lead agent to coordinate activity by various State entities;
- include acid sulfate soils considerations in formulating environmental, land, coastal and water resource policies and programs and support planning and regulatory controls associated with the use and management of acid sulfate soils. This includes the development of a State Planning Policy which is supported by a code of practice and is complementary to the licensing provisions of the *Environmental Protection Act 1994*;
- apply the provisions of the *Fisheries Act 1994* for the restoration of fisheries habitats and also those habitats that support fisheries resources; and
- apply the provisions of the *Coastal Protection and Management Act 1995*.

In a budgetary context, the following actions will require State Government funding in addition to existing resources:

- provide assistance to local governments in the implementation of this Strategy;
- initiate incentive schemes for land owners to avoid disturbing acid sulfate soils or to remediate disturbances of acid sulfate soils which directly affect environmental values such as fish habitat and sensitive wetlands; and
- provide support for the role of lead agency. This includes funding for the activities listed elsewhere in this Strategy: ASS training/information services, technical support (including advice and guidelines), broad scale risk mapping, extension and research into the nature and cost of the problem, and establishment of environmental standards. This will lead to agreement between governments, industry and community on management measures for the treatment for ASS. In many cases, funding may be matched by external sources, eg. Commonwealth NHT funding, university scholarships.

Note: Acceptance of this Strategy does not bind the State to provide funds. All proposals for funding should be considered in the context of State budgets.

Local Governments (coastal only)

While it is acknowledged that local governments have limited funds and expertise in dealing with acid sulfate soils issues, they have a critical role in planning and managing the disturbance of acid sulfate soils in Queensland. Therefore it is advantageous for local governments to:

- assist with detailed mapping and assessment of acid sulfate soils in priority areas;
- prepare and implement local planning instruments which incorporate acid sulfate soils considerations into land use planning, environmental assessment processes and development controls;
- assist with coordination of community activities;

- investigate the need for, and if necessary undertake, water quality monitoring of risk areas, development of local management plans and modification of infrastructure works known to impound acid water;
- cooperate with local industry and community groups to rehabilitate problem sites;
- ensure that staff are adequately trained on acid sulfate soil issues and their management;
- consider incentive schemes for land owners to avoid development on high risk acid sulfate soil sites and to improve land use practices which directly improve the quality of drainage water; and
- work with State agencies to develop a uniform fish kill response and reporting strategy including mechanisms for rapid response to acid sulfate soil 'emergencies', such as potential or actual fish kills.

Industry Organisations

- consult with local and State governments on mapping priorities, land use planning, assessment and management plans and assist with detailed mapping and assessment of acid sulfate soils in priority areas;
- adopt best management practices and acid sulfate soil land use guidelines;
- support training and promotion activities to ensure that members are knowledgeable about the risks and appropriate avoidance and/or management actions for dealing with acid sulfate soils; and
- identify research and development priorities and recognise the need to contribute funding in collaboration with research entities for treatment, assessment and rehabilitation of acid sulfate soils.

Community Organisations and Groups

- sponsor the formation of local action groups to resolve management issues and facilitate and support local education and awareness programs;
- encourage and endorse funding submissions for local research, mapping, monitoring and rehabilitation projects;
- participate in the development of planning controls at the local level; and
- monitor water quality in local waterways.

Individual Landholders

- participate in education and training programs to improve knowledge of the cause/effect relationships which apply to the management of acid sulfate soils on their properties;
- become actively involved in local community groups and adopt and promote best management practices for acid sulfate soils;
- observe social and environmental values as well as economic considerations in managing acid sulfate soils on their land; and
- support and cooperate in relevant land use planning activities and participate in local research, monitoring and rehabilitation.

OUTCOMES OF THE STRATEGY

Adoption of the strategy will result in significantly improved management of acid sulfate soils through:

- raised awareness and better knowledge by stakeholders leading to sustainable and more environmentally effective and economically efficient management of acid sulfate soils;
- having acid sulfate soils maps and policies to assist State and local governments to (i) minimise disturbance of acid sulfate soils, especially by avoiding 'hot spots'; (ii) promote proper planning and sustainable management of development sites on acid sulfate soils; and (iii) rehabilitate degraded acid sulfate soils sites;
- raised standards of environmental impact assessments and acid sulfate soil management plans. This includes a heightened awareness of acid sulfate soils in the environmental impact assessment process;
- environmental codes of practice, including best management practices for acid sulfate soils;
- raised standards of soil sampling and analysis procedures;
- minimised future disturbance of acid sulfate soils;
- timely responses to development proposals;
- skilled State and local government officers providing effective planning and environment advice on acid sulfate soils; and
- (depending on the outcomes of research) improved management of the public health aspects of acid sulfate soils disturbance.

The collaborative and educational approach encouraged by the Strategy will engender confidence among stakeholders that acid sulfate soils are being responsibly managed in an environment in which development needs and environmental values coexist for maximum community benefit.

State-wide, responsible acid sulfate soils management would be guided by the enunciation of clear policies by the State Government. This, together with supporting administrative and technical guidelines, will reduce uncertainty and confusion by industry and the community, raise planning and environmental standards, and lead to ecologically sustainable development.

ACTION PLAN

To implement the Strategy, a five-year Action Plan is being proposed. It covers all six elements of the Strategy and will outline actions to initiate, continue, monitor and review the accepted actions. The Strategy and its actions will be subject to annual monitoring and review by the multisector Queensland Acid Sulfate Soils Management Advisory Committee.

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