

DEVELOPING AND IMPLEMENTING A STATE ACID SULFATE SOILS STRATEGY, THE QUEENSLAND EXPERIENCE

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Abstract

There are an estimated 2.3 million hectares of acid sulfate soils located along the Queensland coastline. Pressures to develop land on coastal acid sulfate soils are substantial and go hand in hand with Queensland's high population growth. Disturbance can release sulfuric acid, leading to degraded aquatic ecosystems, infrastructure and impacts on human health. Acid sulfate soils have been identified as a significant State and national resource issue, leading to the development of a State strategy, which has provided useful guidance on direction and need. This strategy identified the following elements that needed to be addressed to successfully manage the issue: 1. Policy, regulation and lead agent; 2. Awareness, education and training; 3. Mapping and assessment of ASS; 4. Planning, management and environmental advice; 5. Research and development; and 6. Regional community participation.

Experience has shown that not addressing all the elements concurrently to some degree would have slowed effective progress, but with a sound stakeholder consultation process and a relatively small team of dedicated specialists, a substantial difference can be made. Elements that were not totally overlooked but should be more clearly enunciated in the strategy are Remediation and Monitoring and Evaluation.

Since it was formulated, the State of Queensland has addressed elements of the strategy progressively. This has been achieved by stakeholders having a clear idea of the challenges that lie ahead and by using a strongly consultative process. Lessons from implementing the elements of the strategy are discussed and recommended as applicable for addressing the various forms of natural resource degradation.

Additional Keywords: acid sulfate soil, natural resource strategy, policy

Introduction

Progress in Australia towards a culture of natural resource sustainability has been highly variable, despite the momentum provided by the Natural Heritage Trust (NHT), the Landcare movement and other initiatives over the past decade. Such initiatives have facilitated a variety of approaches including the highly successful Queensland Acid Sulfate Soils Management Strategy, which I believe has much to teach high level decision makers about the approaches to sustainable natural resource management that have worked and those that are unlikely to.

In the late 1980s repeated fish kills in tidal rivers of nearby northern New South Wales triggered widespread community concern about acid sulfate soils (ASS) (Powell and White, 2000). This led to Queenslanders also recognizing the connection between fish kills and ASS and the fact that the coastal lowland areas where these soils occur were coming under increasing pressure for agricultural and urban development.

Construction of canal estates, marinas, housing/industrial estates, roads, golf courses, aquaculture ponds, sand/gravel extraction and drainage for sugar cane are all activities that can disturb acid sulfate soils and risk the release of sulfuric acid; the acid may then drain into adjacent waterways with heavy rain leading to degraded aquatic ecosystems, infrastructure and human health. Overall costs to Queensland have been estimated to be in the order of \$189 million dollars annually (Sutherland and Powell, 2000). These activities and their associated costs occur on only a small proportion of some 2.3 million hectares of ASS located along the Queensland coastline. However the potential for damage in the future is substantial.

Since 1995 the State of Queensland has addressed ASS issues progressively. This has been achieved by stakeholders having a clear idea of the challenges that lie ahead, through a strongly consultative process leading to the development of a State strategy (Powell and Ahern, 1999). The strategy identified 6 essential elements for success and this paper describes the lessons learnt over the past 9 years in attempting to implement this strategy.

Materials and Methods

Support to develop a State wide approach to ASS was initiated in 1995 by a team of scientists within the newly formed Department of Natural Resources (DNR), who had successfully applied for funding from the NHT and the

sugar industry to undertake ASS risk mapping. The team, known as the Queensland Acid Sulfate Soils Investigation Team (QASSIT) has become an internationally recognised centre of excellence on ASS assessment and management. Because of the increasing recognition of ASS as an important natural resource management issue, the State Government in 1996 identified DNR as the lead agency for ASS matters.

In 1996, the DNR created an informal committee of stakeholders from industry, community, tertiary institutions and local and State government agencies to advise the Minister for Natural Resources on ASS matters. This was known as the Queensland Acid Sulfate Soils Management Advisory Committee (QASSMAC) and was modelled on a similar committee established in the adjacent State of New South Wales. Secretariat and technical support for QASSMAC operations and strategy implementation has been provided by QASSIT.

Developing a Queensland strategy

QASSMAC provided the mechanism for widespread stakeholder consultation and multi-agency collaboration on acid sulfate soil management issues and was responsible for development of the Queensland Acid Sulfate Soils Management Strategy (Powell and Ahern, 1999). The Strategy has formed the basis for action by the State Government and all stakeholders and is complementary to a National Strategy for the Management of Coastal Acid Sulfate Soils (National Working Party on Acid Sulfate Soils, 2000).

To quote the strategy: “The purpose ... 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.”

To successfully manage the issue, the Queensland strategy identified 6 essential elements that needed to be addressed: 1. Policy, regulation and lead agent; 2. Awareness, education and training; 3. Mapping and assessment of ASS; 4. Planning, management and environmental advice; 5. Research and development; and 6. Regional community participation.

Strategy implementation

At the local level the initial emphasis was on awareness and management action. At the State level, the key roles have been coordination, development and implementation of policy, preparation of regulations, technical support for assessing development applications and production of maps and technical information for dissemination. Adequate funding for implementation continues to be an important challenge for all levels of government.

The roles and responsibilities for the various stakeholders are summarised in the strategy. It was proposed as a checklist of direct relevance to each of the stakeholders, to assist them in assessing their position and to determine priority actions. In many cases, collaborative actions between stakeholders were the appropriate means of providing the resources and support needed to achieve desired outcomes (Table 1).

Results and Discussion

Element by element the success or otherwise of this approach and its implementation are reviewed and factors leading to success or failure discussed.

Policy, regulation and lead agent

In terms of ensuring long term commitment to dealing with ASS in Queensland, this is the most critical element of the strategy. The early identification of DNR as the Queensland Government’s lead agency in 1996 was a very important and successful move for ASS management for several reasons. ASS like many NRM issues, are a multi-jurisdictional issue. Its’ causes and impacts spread across a number of State agencies with responsibilities for natural resources, environment, primary industries and fisheries, health, main roads, transport, State development, local government and planning. Without the early identification of a lead agency, a clear commitment to action by government would have been more difficult to achieve.

Table 1. Response to the Queensland ASS Strategy

Outcomes	Actions implemented	Summary of Progress
Having ASS maps and policies to assist State and local governments to (i) minimise disturbance of ASS, especially by avoiding 'hot spots'; (ii) promote proper planning and sustainable management of development sites on ASS; and (iii) rehabilitate degraded ASS sites	Mapping to identify areas of ASS risk and use of 5m AHD contour as a surrogate for the extent of ASS in the absence of mapping. Establishment of SPP2/02 and complementary links to other regulations and plans. Demonstration site using best practice	Mapping undertaken mainly for high pressure SE Qld. Some other key areas mapped and Mackay mapping still in progress. Big gaps remain in central and north Qld. A high profile ASS remediation project is being conducted at East Trinity, North Qld using lime assisted tidal flooding. Remediation of "hot spot" acidified areas remains a major challenge due to expense and technical and access difficulties.
Raised awareness and better knowledge by stakeholders leading to sustainable and more environmentally effective and economically efficient management of ASS.	Awareness, education and training programs and website. Industry codes of practice eg drain filling and laser levelling in sugarcane. Technical guidelines. Advice service.	Understanding has moved considerably from ignorance/denial to acceptance and increasing ownership. This is strongest in SE Qld but remains an issue in parts of central and north Qld.
Raised standards of environmental impact assessments and acid sulfate soil management plans. This includes a heightened awareness of ASS in the environmental impact assessment process.	SPP2/02 has attached guidelines for development assessment and refers to more detailed ASS management guidelines.	Publication of ASS Guidelines on sampling and assessment and on soil management.
Environmental codes of practice, including best management practices for ASS.	Individual industries have addressed ASS management issues.	The sugar industry and aquaculture industry have included ASS in their best management practice codes.
Raised standards of soil sampling and analysis procedures.	R&D of lab. tests. Technical guidelines	New, better methods now developed and guidelines released and being upgraded to Australian Standards.
Minimised future disturbance of ASS	Policy setting backed up by risk mapping.	ASS maps and SPP2/02 have provided a way forward that minimises ASS disturbances
Timely responses to development proposals.	Better-trained staff in government and industry.	More resources have been allocated by government agencies to ongoing training development assessment of ASS.
Skilled State and local government officers providing effective planning and environment advice on ASS.	Better trained staff in government and industry	Ongoing training has been undertaken More resources have been allocated by government agencies to development assessment of ASS.
(Depending on the outcomes of research) improved management of the public health aspects of acid sulfate soils disturbance.		No public health research undertaken to date.

The lead agency DNR (now Department of Natural Resources, Mines and Energy or NRM&E), using QASSMAC as its prime mechanism for public consultation identified the potential for a State Planning Policy to help regulate development of ASS. Sponsored by NRM&E, the 'State Planning Policy 2/02: Planning and Managing Development Involving Acid Sulfate Soils' identifies the State's interest in acid sulfate soils (Department of Local

Government and Planning and Department of Natural Resources and Mines, 2002). As part of its lead agency role, NRM&E over time has gradually increased its resource allocation to QASSIT, the planning policy area and to regional implementation of the policy. These activities are unlikely to have happened while there was bureaucratic uncertainty as to who should take the lead for ASS matters.

SPP2/02 is the core plank that has underpinned the success of the strategy. It provides a clear description of the State interests in ASS management and demonstrates that the government has a strong and ongoing commitment to the responsible management of ASS. SPP2/02 is cross-referenced in State Coastal Management Plan and Regional Coastal Management Plans being developed under the *Coastal Protection and Management Act 1995* and more recently to the Reef Water Quality Protection Plan (The State of Queensland and Commonwealth of Australia, 2003). The *Environmental Protection Act 1994*, applies generally but also specifically to acid sulfate soils via the *Environmental Protection Policy (Water) 1997*. ASS disturbance is also a major consideration for fisheries habitat protected under the *Fisheries Act 1994* and is an important criterion in the issuing of clearing permits under the *Vegetation Management Act 1999*.

The primary means of implementation of SPP2/02 is through local governments, where many development assessment officers deal with development applications potentially involving ASS disturbance.

The development industry has welcomed the open consultative approach taken and supported the SPP2/02 as a means of providing greater certainty in respect to development condition in areas that might contain ASS. Conservation and fisheries interests have valued the recognition that the SPP2/02 has given to ASS as an important environmental and fisheries habitat issue that the government needs to deal with.

Awareness, education and training

The lead agency (NRM&E) took prime responsibility for this activity, using the technical expertise of QASSIT as the basis of support. This was a big challenge as initially understanding of ASS issues was not widespread in government, industry or the general community. There were many individuals in denial that it was even an issue. When ASS was first recognized in Queensland in the early 1990s as an NRM issue, there was no tradition and history of tertiary training and government and community response, when compared to soil erosion, pest invasion, landscape salinity and loss of biodiversity. This has now changed around to the degree where there is increasing acceptance and ownership by all key stakeholder groups. Targeted activities have been very effective, but the technical complexity of the issue makes this element an important ongoing activity.

Success has been greatest in southeast Queensland where population growth and coastal development pressure is greatest and there has been more ready access to the Brisbane based QASSIT. However there are still significant challenges ahead in other regional coastal areas. For instance, although there appears to be substantial local grass roots and relevant industry and local government awareness, the newly formed Natural Resource Management regional groups formed under the NHT umbrella have yet to clearly demonstrate that they have identified ASS as an NRM priority. Similarly State and Federal Government senior decision makers are responding to the message unevenly, given the “policy noise” of the many NRM issues competing for their attention and funds. Where awareness is greatest, there is more grass roots and policy support.

Mapping and assessment

Driving this activity has been the major responsibility of QASSIT and is an important way of putting the ASS issue into perspective. It was the mapping and assessment program that unambiguously identified the presence of ASS in Queensland and gave some assessment of the extent of the problem. Using indicators of geology and coastal alignment, QASSIT estimated that Queensland had 2.3 million hectares of ASS (Powell *et al.*, 1996).

Investigations of Queensland development sites soon identified ASS as a serious potential source of acidification.

Regional ASS mapping has revealed about 70 000ha from the New South Wales border to Noosa. Limited key area mapping has also been undertaken further north from Maryborough to Mackay. The mapping combined with awareness, education and training activities are substantial factors in the greater recognition being accorded ASS in these areas. Where mapping is unavailable, recognition and ownership of the ASS issue is weakest.

Planning, management and environmental advice

In the early days of ASS recognition, the demand for management advice accelerated rapidly. This demand there led to the establishment of a technical information service by QASSIT. Today people can access the most current advice from QASSIT through a website (www.nrm.qld.gov.au/land/ass/), email and a telephone service. A wide range of information sheets and technical documents are available and continue to be developed.

Those seeking more detailed technical information can now also access the 'Soil Management Guidelines' (Dear *et al.*, 2002). Sponsored by QASSMAC and the NHT, this is the first of a series of chapters being developed for the 'Queensland Acid Sulfate Soil Technical Manual'. In kind stakeholder contributions were essential to the success widespread acceptance of these guidelines, which have imposed higher standards of management on industry. Other chapters are being developed.

Research and development

This element is more suited to a collaborative national approach because the benefits of research and development investment tend to have national implications. However the Queensland strategy has been useful in identifying priorities for R&D as they apply to Queensland.

Initially Queensland relied on R&D that had been undertaken elsewhere, mainly through New South Wales based researchers. Scientists readily offered encouragement and support across the border. Consequently substantial collaborative world class ASS research has now been conducted in Queensland on soil chemistry, hydrology, acid generation and export and testing the remediation effectiveness of lime assisted tidal reflooding. Another piece of related research has been collaborative work between QASSIT, the University of Queensland, Queensland University of Technology and University of New South Wales that looked at possible links between land sources of iron, organics and phosphorus and the incidence of nuisance blooms of marine blue green algae (*Lyngbya majuscula*) in Moreton Bay (Watkinson *et al.*, 2000). Disturbed ASS are a major potential source of iron.

Regional community participation

The major mechanism of consultation and development of stakeholder ownership has been through the State based group QASSMAC. Despite being informal and voluntary, non-government QASSMAC representatives have remained supportive and committed over an 8-year period. Some groups and State agencies have chosen not to continue but other more enthusiastic stakeholders have replaced them and a core group has remained in place. Consequently there has been relatively little controversy surrounding ASS compared to New South Wales, where on many occasions, the sugar industry and urban developers were in heavy conflict with fisheries industries and conservationists.

Local regional groups have shown highly variable responses to ASS issues and their interest and involvement depends on many factors. Regional community participation is now mainly formally facilitated through the Regional Management Groups (RMG) being established under the Commonwealth-State, NHT sponsored, healthy regions initiative. To date links to QASSMAC and RMG's has been very uneven and not very effective. RMG's are being funded to establish regional level natural resources management and will receive discretionary public funding under certain conditions. It remains to be seen whether this approach will assist in achieving some of the objectives of the Queensland ASS strategy.

Gaps

Elements that were not totally overlooked but should have been more clearly enunciated in the strategy are Remediation and Monitoring and Evaluation. A substantial remediation effort has been undertaken with a Government owned site at East Trinity near Cairns, and some major developments along the coast have undertaken containment, rather than remediation strategies.

Monitoring of progress has been in the form of the number of development assessments requiring ASS management conditions under SPP2/02. This number has steadily risen over time, indicating better identification and action with new developments. Monitoring of water quality in coastal receiving waters by EPA and community based "Waterwatch Groups" has been of a general nature and not targeted ASS discharge. Similarly little analysis of these trends have been undertaken.

Conclusions

The Queensland Government's early identification of a lead agency and its policy settings have set the scene Statewide. This together with a collaborative industry and community response has led to effective outcomes, particularly where mapping, awareness and training activities have gone hand in hand. Some local governments also have strongly worded policy-planning positions on ASS. Where mapping has not been conducted there is no informed basis for raising the issue locally, except at controversial sites where ASS problems are either suspected or found. Regular contact and greater availability of technical support in the form of QASSIT has greatly benefited southeast Queensland but has been of less accessible to more remote, resource strapped regions. This has been partially overcome by the development of a website, telephone and email communications and a wide array of technical information products. However there is no substitute for face-to-face communication and onsite discussion on an ASS problem area, as experience has shown that no two situations are ever alike. Strong research and development is essential for addressing complex resource issues like ASS and progress to date has been supported by good communication of the latest science.

Experience has shown that not addressing these issues concurrently to some degree will slow effective progress. It is a long haul – it took until 1999 for a 12 month temporary State Planning Policy to be established. This was superseded in 2002 by the permanent policy (SPP2/02), and like all natural resource management issues, ASS policy development is an ongoing process.

To sum up it is concluded that the Queensland Strategy has successfully put ASS on the map! Addressing the elements of the strategy concurrently has assisted enormously in maintaining momentum despite cyclic downturns in funding support. The strategy structure is simple to follow and has provided a clear blue print to address aspects of natural resource management that need to be addressed. The success of the approach would suggest it is a useful model for other resource management issues, some of which have been identified for more than a century, but are yet to be effectively addressed.

Acknowledgements

I wish to thank Col Ahern and Geoff Edwards for providing useful comments on the paper.

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