Attachment 1 **Unconfirmed minutes of the Sustainability Advisory Committee meeting held on 5 May 2005**

CITY OF JOONDALUP

Minutes of meeting of the **SUSTAINABILITY ADVISORY COMMITTEE** held in Conference Room 3, Joondalup Civic Centre, Boas Avenue, Joondalup on **THURSDAY 5 MAY 2005.**

ATTENDANCE

Committee Members:

Ms Marilynn Horgan	***Chairperson***
Mr Steve Magyar	***Deputy Chairperson***
Cmr Michael Anderson	
Mr Kieron D'Arcy	
Mr Martin Brueckner	
Cmr. Michael Anderson	
Prof Sherry Saggers	
Mr David Wake	
Mr Vincent Cusack	
Prof Adrianne Kinnear	

Officers:

Manager, Strategic and Sustainable Development	R HARDY
Team Leader, Sustainable Development	S EVANS
Sustainable Development Officer	B REAY

APOLOGIES

Mr Geoff Down
Ms Ute Goeft
Mr Will Carstairs

The Chairperson declared the meeting open at 1740 hrs.

DECLARATIONS OF FINANCIAL INTEREST/INTEREST THAT MAY AFFECT IMPARIALITY

Nil

CONFIRMATION OF MINUTES

MINUTES OF THE SUSTAINABILITY ADVISORY COMMITTEE MEETING HELD ON 10 FEBRUARY 2005

MOVED Mr Brueckner SECONDED Prof Saggers that the Minutes of the Sustainability Advisory Committee meeting held on 10 February 2005 be confirmed as a true and accurate record of proceedings.

The Motion was Put and CARRIED

MINUTES OF THE SUSTAINABILITY ADVISORY COMMITTEE MEETING HELD ON 24 MARCH 2005

MOVED Prof Saggers SECONDED Mr Brueckner that the Minutes of the Sustainability Advisory Committee meeting held on 24 March 2005 be confirmed as a true and accurate record of proceedings.

The Motion was Put and CARRIED

ONGOING BUSINESS ITEMS FROM PREVIOUS MEETINGS

Nil

ITEMS OF BUSINESS

ITEM 1 UPDATE ON THE IMPLEMENTATION OF THE SUSTAINABILITY ADVISORY COMMITTEE'S STRATEGIC WORK PLAN [00906]

WARD – All

PURPOSE

To provide an update to the Sustainability Advisory Committee on the implementation of the Strategic Work plan endorsed in October 2004.

EXECUTIVE SUMMARY

Following the appointment of seven new Committee members and the Sustainability Advisory Committee (SAC) meeting held on 18 December 2003, it was agreed that there was a need to develop a shared view of sustainability given the diverse wealth of knowledge and experience of its members. With the appointment of the new members, it was considered that the Committee was now well positioned to 'fully' address sustainability and there was a clear need to identify how this can be progressed via the Committee.

The Sustainability Advisory Committee decided to undertake a workshop process to

> **"…*develop a strategic direction for the Committee and also to clearly identify its role with regard to supporting sustainability principles within the City*".**

High priority objectives and strategies were identified and presented in a concise Strategic Work plan. The high priority actions are to be implemented within 12 – 36 months.

DETAILS

Several of the high priority actions identified in the Strategic Work plan have been implemented, whilst other actions remain in progress or remain pending. The high priority actions that have been progressed since endorsement of the Strategic Work plan in October 2004 include:

Action 3.1a Report to Council seeking State of Environment (SOE) reporting for the City of Joondalup.

The City is currently investigating draft SOE benchmarking documents from multiple sources and will provide a report to the Sustainability Advisory Committee at a future meeting.

Action 3.1b Investigate SOE reporting opportunities and report to Council.

This action will be progressed upon completion of Action 3.1 where appropriate.

Action 3.2a Assess current use of Sustainability considerations in Council reports at the City of Joondalup.

Report completed and presented to the Sustainability Advisory Committee in December 2004.

The City is currently trialling a Sustainability Reporting Matrix (SRM) to assist in the assessment of sustainability implications when reporting and to provide a consistent and streamlined approach to these implications. It is envisaged that following a six month trial, the information collected will allow the SRM to be tailored to individual business unit requirements and provide a significantly useful tool for officers at the City.

Action 3.2b Provide guidelines to assist staff in reporting against sustainability impacts/implications.

See Action 3.2a

Action 3.2c Include sustainability considerations in Council tendering and supply contracts.

Will be developed following outcomes of the current sustainability matrix trial.

Action 10.1a To gain an understanding on how Public Participation Policy is being actioned.

and

Action 10.1b To review the Public Participation Policy and provide comments for improvements/enhancements.

This action is pending the outcomes of the Policy Review Committee

The Public Participation Policy and Strategy has been presented to the Sustainability Advisory Committee for review and comment in October 2004. The strategy document is currently being drafted for Council at its meeting in May 2005.

Action 10.1c To investigate resource requirements for strategy implementation.

Will be progressed pending Council endorsement of the Strategy in May 2005.

Action 11.1a To develop desirable outcomes for a community education program.

A community education strategy has been drafted and is being reviewed internally.

Action 14.1a Review cultural, social and recreational policies to identify synergies across social sustainability issues.

The City administration will arrange for a presentation of the Community Development Plans at a future Sustainability Advisory Committee meeting in accordance with Council resolution dated 2 November 2004:

> *"NOTE that the request for the City's Community Development Plans (including the cultural, recreational and social plans) to be referred to the Sustainability Advisory Committee for review at the draft stage will be progressed administratively. City Administration will arrange for a presentation of the Community Development Plans at a future Sustainability Advisory Committee meeting"*

Action 16.1a Report to Council on research findings (community well being).

City officers are currently developing 'quality of life' indicators in conjunction with a customer monitor survey in mid 2005.

Action 17.1a Model on method of community engagement through a public seminar on Sustainability Advisory Committee.

Pending Council endorsement of the Public Participation Strategy in May 2005.

The following table provides an update of the implementation of the Sustainability Advisory Committee's Strategic Work plan:

	Objectives	Strategies	Estimated Timeframe	Actions	*Responsibilities*	KFA	Tasks	Progress
3	**To develop a methodology to measure the City's ecological foot print**	3.1 Develop a framework to report against the current state of the environment (SOE).	**24 – 36 months**	3.1a Report to Council seeking SOE reporting for the City of Joondalup.	**ADMINISTRATION**	**2**	To investigate and research SOE reporting (benchmarking).	Currently investigating draft SOE benchmarking documents from multiple sources.
							To produce an SOE report for the City of Joondalup.	
					SAC		To provide input and research information to be included in the administration report.	Pending administration input.
							To review current policies for the incorporation of SOE reporting.	
							To endorse the SOE report and make recommendations to Council on relevant policies.	

	Objectives	Strategies	Estimated Timeframe	Actions	*Responsibilities*	KFA	Tasks	Progress
					ADMINISTRATION		To develop an SOE implementation plan.	Pending administration input.
				3.1b Investigate State of Environment reporting opportunities and report to Council.	**ADMINISTRATION**	**2**	To develop milestones to progress State of Environment Reporting for Council.	
					SAC		To advise and comment on the milestones of State of Environment Reporting for Council upon completion.	
		3.2 Ensure environmental impacts are considered and reported in all decisions.	**12 months**	3.2a Assess current use of Sustainability considerations in Council reports at the City of Joondalup.	**ADMINISTRATION**	**2**	Investigate and report on the current use of Sustainability considerations in Council reports at the City of Joondalup	Report completed (December 2004)

	Objectives	Strategies	Estimated Timeframe	Actions	*Responsibilities*	KFA	Tasks	Progress
					SAC		To advise on the degree to which sustainability is being incorporated into Council documents.	
				3.2b Provide guidelines to assist staff in reporting against sustainability impacts/implications.	**ADMINISTRATION**	**2**	To prepare a report on the current sustainability reporting.	
							To develop guidelines for the reporting of sustainability implications.	Draft sustainability Matrix/reporting framework developed. Trial process in progress.

	Objectives	Strategies	Estimated Timeframe	Actions	*Responsibilities*	KFA	Tasks	Progress
					SAC		To review and make recommendations to Council on policy relevant to sustainability reporting.	Awaiting internal outcomes from the Policy Review Committee regarding statement of principle for policy review (SAC, October 2004)
				3.2c Include sustainability considerations in Council tendering and supply contracts.	**SAC**	**2**	To comment on how well sustainability considerations are included in the tendering process and supply contracts.	Will be developed following outcomes of the current Sustainability Matrix trial.

	Objectives	Strategies	Estimated Timeframe	Actions	*Responsibilities*	KFA	Tasks	Progress
					ADMINISTRATION		To include sustainability considerations and advise from SAC into Council tendering process and supply contracts.	
10	**To undertake a proactive approach to community engagement, education, consultation (using community facilitators).**	10.1 Develop a 'public participation policy', guided by material etc. available from govt. – citizens & civics unit.	**6 – 12 months**	10.1 a To gain an understanding on how the Public Participation Policy is being actioned.	**ADMINISTRATION**	**3** **4**	To present the research findings from other local governments to the SAC. To present the Public Participation Policy 2.6.3 to the SAC To present the Public Participation Strategy development plan to the SAC.	Public Participation Policy and Strategy was presented to the Sustainability Advisory Committee for review and comment in October and December 2004. The Strategy

	Objectives	Strategies	Estimated Timeframe	Actions	*Responsibilities*	KFA	Tasks	Progress
				10.1 b To review the Public Participation Policy 2.6.3 and provide comments for improvements/enhancements.	**SAC**		To review the current Public Participation Policy 2.6.3 and comment.	document is currently drafted for Council meeting May 2005. Pending the outcomes of the policy review committee.
				10.1 c To investigate resource requirements for Strategy implementation.	**ADMINISTRATION**		To investigate and report to SAC on the required resources for Strategy implementation.	Will be progressed pending Council endorsement of the strategy I May 2005.
					SAC		To review and comment on the resource requirements of the Strategy Implementation.	

	Objectives	Strategies	Estimated Timeframe	Actions	*Responsibilities*	KFA	Tasks	Progress
11	**To rebuild trust with the Community and Council**	11.1 Develop a range of effective communication and consultation mechanisms with community groups.	**6 – 12 months**	11.1 a To develop desirable outcomes for a community education program.	**ADMINISTRATION**	**4**	To develop a workshop to determine the desirable outcomes from Community Education Program(s).	A community education strategy has been drafted and is being reviewed internally.
					SAC		To provide Administration with desirable outcomes of Community Education Program(s) through input into the workshop	
14	**To ensure that specific social sustainability indicators to the City link with the Cultural Plan**	14.1 Integrate social sustainability priorities across cultural, social and recreational plans.	**12 – 24 months**	14.1a Review cultural, social and recreational policies to identify synergies across social sustainability issues.	**SAC**	**1 4**	To review and make recommendations to Council on policies relevant to the cultural, social and recreational policies.	City Administration will arrange for a presentation of the Community Development Plans at a

	Objectives	Strategies	Estimated Timeframe	Actions	*Responsibilities*	KFA	Tasks	Progress
					ADMINISTRATION		To provide SAC with presentations on each plan's methodology to assist in raising awareness of the cultural, social and recreational plans.	future Sustainability Advisory Committee meeting.
16	**To contribute to community well being measures**	16.1 Investigate community well being measures that are simply and sophisticated.	**12 – 24 months**	16.1a Report to Council on research findings.	**SAC**	**1 4**	To review and comment on quality of life indicators developed by the City.	City officers are currently developing QOL indicators in conjunction with a customer monitor survey in mid 2005.
					ADMINISTRATION		To provide SAC with quality of life survey for review and comment.	
17	**Ensure increased community engagement.**	17.1 Develop a range of ways	**6 – 12 months**	17.1 a Model one method of community engagement	**SAC**	**4**	To participate in the development of the public seminar.	Pending Council endorsement of

	Objectives	Strategies	Estimated Timeframe	Actions	*Responsibilities*	KFA	Tasks	Progress
		to encourage community engagement.		through a public seminar on the Sustainability Advisory Committee.	**ADMINISTRATION**		To work with the SAC in the development of a seminar designed to demonstrate how community could work with Council in a constructive and significant manner.	the Public Participation Strategy in May 2005

ATTACHMENTS

Nil.

VOTING REQUIREMENTS

Simple Majority

OFFICERS RECOMMENDATION

That the Sustainability Advisory Committee NOTES the report on the implementation of the Strategic Workplan endorsed in October 2004.

Discussion ensued. The Committee was presented with the high priority actions and provided feedback and comment as follows:

Action 3.1a Report to Council seeking State of Environment (SOE) reporting for the City of Joondalup.

and

Action 3.1b Investigate SOE reporting opportunities and report to Council.

Discussion ensued on a template being developed by the Swan Catchment Council (SCC) for State of the Environment Reporting (SOE) for Local Government. The SOE template links with reporting requirements of the State Government and the Swan Natural Resource Management Strategy and there is an opportunity to have a presentation on this item from a SCC representative.

The Sustainability Advisory Committee agreed to seek a representative from the Swan Catchment Council to give a presentation on the draft State of the Environment template and that an invitation be extended to Conservation Advisory Committee members and relevant staff from across the organisation to attend the presentation.

Action 3.2a Assess the current use of Sustainability considerations in Council reports at the City of Joondalup.

and

Action 3.2b Provide guidelines to assist staff in reporting against sustainability impacts/implications.

and

Action 3.2c Include sustainability considerations in Council tendering and supply contracts.

Following a 6-month investigation on the Sustainability considerations in Council reports a reporting matrix was developed to streamline, coordinate and provide consistency to

sustainability reporting at the City. This Sustainability Reporting Matrix (SRM) is currently in trial to ascertain its effectiveness and usefulness to the City.

The Committee was provided with an update on the SRM developed to provide staff with a tool to make sustainability reporting to Council consistent and easy. Triggers are being developed to provide staff with customised prompts to assist considerations of sustainability when writing a report to Council.

In addition to the SRM, staff would benefit from guidance and education initiatives to further increase the awareness of sustainability issues. The Committee commented that sustainability education was a key driver for all initiatives and was required to ensure success in behaviour change within the City and the Community.

Action 10.1a To gain an understanding on how Public Participation Policy is being actioned.

and

Action 10.1b To review the Public Participation Policy and provide comments for improvements and enhancements.

and

Action 10.1c To investigate resource requirements for strategy implementation.

The Public Participation Policy was provided to the Committee for comment and review at it's meeting in October 2004. A strategy document is currently being drafted for the Council meeting scheduled in June 2005. The Committee queried if the Public Participation Strategy will be referred back to the Sustainability Advisory Committee for comment prior to going to Council. Advice was given that this may occur through the newly formed Policy Committee.

Action 11.1 a To develop desirable outcomes for a community education program.

The Committee was informed that a Community Education Strategy has been drafted and is being reviewed internally.

The Committee queried the content of the Community Education Strategy and was informed that the purpose of the current document was to set a mechanism for gaining internal support and resource capability for community education to be facilitated using the Learning City Concept and the City's Library Services as Community Education Centres. Once organisational capability is established and approved then the City would be in a position to engage with the community to develop the delivery of programs and products to community.

A model on the Jacksonville Community Council Inc was tabled to demonstrate effective Community Education and to assist the City in the development of the Community Education Strategy. Discussion ensued on the need to identify clear measures on the effectiveness of the Community Education Strategy and subsequent level of community involvement and the need to reflect individual groups needs for community education. The Committee requested comments on the Jacksonville report to discuss at a future Sustainability Advisory Committee meeting on the relevance and applicability to the City of Joondalup.

Reports from Jacksonville Community Council Inc can be accessed at http://www.jcci.org/hsc/

Action 14.1 Review cultural, social and recreational policies to identify synergies across social sustainability issues.

The Committee was informed that the Community Development Plans were still being developed and a presentation would be delivered to the Committee as soon as possible.

Action 16.1a Report to Council on research findings (community well being)

The Committee was advised that the quality of life (QOL) indicators are currently being developed in conjunction with a customer monitor survey. The Committee requested that the web link be included in the minutes.

The Customer Monitor Survey for 2005 has already been progressed and the City would not be looking at QOL measures until 2006. As this occurs the Sustainability Advisory Committee will be approached to give their advice on the development of these measures.

Action 17.1a Model a method of community engagement through a public seminar on Sustainability Advisory Committee.

This will be progressed pending endorsement of the Public Participation Strategy in June 2005.

Furthermore, a workshop is planned for 23 May 2005 which will invite all members of all Council's advisory committees to come together to provide input into how Council can provided a statement time during Council meetings. This will provide a model from which the Sustainability Advisory Committee can evaluate.

RECOMMENDATION

MOVED Mr Brueckner SECONDED Mr Wake that the Sustainability Advisory Committee:

1. **NOTES the report on the status of implementation of the Strategic Work plan endorsed in October 2004; and**

2. **SEEKS a representative from the Swan Catchment Council to give a presentation on the draft State of the Environment template and that an invitation be extended to Conservation Advisory Committee members and relevant staff from across the organisation to attend the presentation.**

The Motion was Put and CARRIED

ITEM 2 ACID SULPHATE SOILS INTERIM REPORT 2 [00906]

WARD – All

PURPOSE

To provide the Sustainability Advisory Committee an opportunity to comment and review the Acid Sulphate Soils (ASS) Interim Report 2.

EXECUTIVE SUMMARY

In light of growing community concern and at the directive of the Chief Executive Officer, the City's administration has been requested to research appropriate and best practice processes for assessment of ASS for developments in the City of Joondalup.

ASS are naturally occurring soils that contain iron sulfide minerals, predominantly as the mineral pyrite. ASS are generally found in a layer of water logged soil or sediment and are benign in their natural state below the surface.

A draft interim report 2 has been prepared for Council (as shown at attachment 1) for review and comment by the Sustainability Advisory Committee.

ATTACHMENTS

Attachment 1: Acid Sulphate Soils Interim Report 2.
Attachment 2: Identification and Investigation of ASS – October 2004

VOTING REQUIREMENTS

Simple Majority

OFFICERS RECOMMENDATION

That the Sustainability Advisory Committee

1. NOTES the Acid Sulphate Soils Interim Report 2.

2. REVIEWS and COMMENTS on the Acid Sulphate Soils Interim Report 2.

The Committee discussed this item of business at length to ensure that issues of concern, particularly with planning and the impacts of development on acid sulphate soils are contained within recommendations made to Council.

The Committee was particularly positive with the prompt manner the Chief Executive Officer dealt with the issues related to the acid sulphate soils. The Committee also felt that the report was a solid and professional approach but could be strengthened to

ensure future issues are managed. The Committee considered planning and future developments particularly important and it was agreed that Council must ensure, wherever possible, that sufficient planning processes are in place. The Committee agreed that the Acid Sulphate Soil Interim report 2 (shown at attachment 1) could consider strengthening recommendations to ensure that future title deed transferrals require disclosure of the acid sulphate soil risk. The Committee noted the low cost testing procedure.

Minor errors were discussed in the Acid Sulphate Soil Interim report 2, in particular it was highlighted by a Committee member that the following statement is incorrect:

> *"The applicant carried out site investigations into the groundwater levels below the site which enabled them to address the requirements of the Planning Bulletin." (Acid Sulphate soils Interim Report 2, pp 4.)*

RECOMMENDATION

1. **MOVED Mr Cusack SECONDED Prof Saggers that the Sustainability Advisory Committee NOTES the Acid Sulphate Soils Interim Report 2 and congratulates the Chief Executive Officer's rapid response on this matter and the project team for its ongoing research.**

The Motion was Put and CARRIED

2. **MOVED Prof Kinnear SECONDED Mr Brueckner that the Sustainability Advisory Committee REQUESTS Council to consider the following items with view of having them included in the final Acid Sulphate Soils report:**

    a. **A reference to the large potential economic costs incurred by all stakeholders from the generation of acid soils and water; and**

    b. **An explanation of the relative ease and small costs involved in carrying out the specific test for determining the presence of acid sulphate soils (reference appended for Councils' information at Attachment 2).**

The Motion was Put and CARRIED

3. **MOVED Mr Wake SECONDED Cmr Anderson that the Sustainability Advisory Committee REQUESTS Council to REQUEST the Chief Executive Officer to ENSURE the correct technical staff avail of the opportunity to participate directly in the acid sulphate soils test for both the Hocking Road and Woodlake Retreat sites with the aim of gaining experience to inform its intended local planning policy for acid sulphate soils;**

The Motion was Put and CARRIED

4. **MOVED Prof Saggers SECONDED Prof Kinnear that the Sustainability Advisory Committee REQUESTS Council to make the following amendments to recommendation 2 in interim report 2 (shown at attachment 1):**

"That the City of Joondalup work with the Department of Environment to develop a local planning policy that includes the requirement for all developments in areas considered at risk by the City, to undertake a rigorous soil assessment process, to advise Council and potential buyers/users of current and future risks."

The Motion was Put and CARRIED

5. **MOVED Mr Brueckner SECONDED Prof Kinnear that the Sustainability Advisory Committee REQUESTS that Council REQUEST the Chief Executive Officer to ENSURE that all future reports being referred to the Sustainability Advisory Committee be accompanied by the author or appropriate technical person.**

The Motion was Put and CARRIED

GENERAL BUSINESS

The Committee discussed minor issues including:

1 Environmental Officer at Edith Cowan University (ECU)

The Committee was advised that ECU has agreed to appoint a full time environmental officer the Joondalup Campus. The Committee discussed the opportunity for the City to apply for the delivery of services required of this position. This arrangement could provide for a mutually beneficial partnership for both organisations.

Mr Brueckner leaves the meeting at 1915 hrs.

2 Sustainable Cities Inquiry

The Committee was advised of the Sustainable Cities Inquiry being undertaken on the House of Representatives Standing Committee on Environment and Heritage. The inquiry examines ways to make Australia's cities more sustainable by 2025. It was noted that Ms Horgan (Perth Area Consultative Committee) and Mr Wake (Conservation Council of WA) appeared before the committee during hearings in Perth on March 31 2005.

Federal Member for Moore Dr Mal Washer MP chairs the committee. The report of the inquiry is being prepared and can be provided to the Sustainability Advisory Committee upon request.

The Committee requested that Dr Mal Washer be invited to a Sustainability Advisory Committee meeting to meet Committee members and provide a briefing on the Sustainable Cities Inquiry.

RECOMMENDATION

MOVED Mr Wake SECONDED Mr Cusack that the Sustainability Advisory Committee REQUESTS an invitation is extended to Hon. Dr Mal Washer to attend a Sustainability Advisory Committee meeting and provide a briefing on the Sustainable Cities 2025 enquiry.

The Motion was Put and CARRIED

3 Sustainable Energy Development Office (SEDO) Funding

The Committee was advised that funding is available for sustainable projects via SEDO. Officers advised the Committee that the City has successfully secured funding from SEDO in the past and will continue to seek funding for suitable projects.

4 Oil dependence

The Committee was advised that a report on peaking of oil production would be presented at the next meeting of the Sustainability Advisory Committee.

5 Other sustainability committees

Advice was sought on other local governments that have a Sustainability Advisory Committee. Other Local Governments were discussed and the Eastern Metropolitan Regional Council was identified as a key source of further information.

DATE OF NEXT MEETING

The next meeting of the Sustainability Advisory Committee will be held in Conference Room 3, Joondalup Civic Centre, Boas Avenue, Joondalup on Thursday 16 June 2005 at 1730 hrs.

CLOSURE

There being no further business, the Chairperson declared the meeting closed at 1925 hrs.

CITY OF JOONDALUP - REPORT FOR 05 April 2005

ACID SULFATE SOILS - INTERIM REPORT 2

WARD - All

PURPOSE

To provide Council with interim advice and recommendations regarding investigations into Acid Sulfate Soils, as a response to concerns raised by the Sustainability Advisory Committee at the Council Meeting of 22 February 2005.

EXECUTIVE SUMMARY

In light of growing community concern and at the directive of the Chief Executive Officer, the City's administration has been requested to research appropriate and best practice processes for assessment of Acid Sulfate Soils for developments in the City of Joondalup.

Acid Sulfate Soils are naturally occurring soils that contain iron sulfide minerals, predominantly as the mineral pyrite. ASS are generally found in a layer of water logged soil or sediment and are benign in their natural state below the surface.

ASS do not pose a significant risk to human health or the environment when undisturbed. However, disturbance of these soils and oxidation of pyrite by drainage, dewatering or soil excavation can cause:

- significant environmental and economic impacts including fish kills,
- damage to estuarine fisheries and loss of biodiversity in wetlands and waterways,
- contamination of surface water and groundwater resources by acids, arsenic, heavy metals and other contaminants,
- loss of agricultural productivity; and
- corrosion of concrete and steel infrastructure by acidic soil and water.

Investigation into the issue of Acid Sulphate Soils has revealed bigger challenges faced not only by the City of Joondalup but other Western Australian Local Government Authorities in relation to Acid Sulphate Soils, further to the applicant self assessment process which was the original focus of the required investigation.

Acid Sulfate Soils (ASS) is a multi-dimensional issue involving many stakeholders. It crosses traditional State government departmental boundaries and a number of technical disciplines. The management of ASS here in WA is currently made even more complicated by the lack of an endorsed state management framework.

This report serves to advise on the preliminary recommendations identified as a result of this investigation with the various stakeholders (Department of Planning & Infrastructure, Department of Environment, Western Australian Local Government Association, other Local Government Authorities and the Swan Catchment Council) consulted as a result of the council resolution. These preliminary recommendations are identified as follows:

(i) That the City raise the issue with WALGA to lobby for the endorsement of 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.

(ii) That, given the ASS risk maps do not provide with certainty the location of ASS, until detailed soil mapping has been undertaken the DoE and a comprehensive policy response to acid sulfate soils is prepared and released by the WAPC, the COJ work with the DoE to develop a local planning policy. This policy will ensure that development on land suspected to contain ASS is planned and managed to avoid potential adverse effects on the natural and built environment. This policy will include a more rigorous self assessment tool, and will include the need for development involving excavation in areas deemed at risk by the City to undertake a soil assessment process.

(iii) That the City engage partners City of Wanneroo, Department of Conservation and Land Management, Yellagonga Catchment Group, and Friends of Yellagonga Regional Park to lobby the DoE to determine the extent to which wetlands on Gnangara mound are underlain by ASS and the depth at which pyrite occurs as a matter of urgency and the Environmental Water Provisions for the wetlands adjusted to protect the environmental values of the wetlands within the region.

(iv) That the City lobby the State government to develop guidelines for managing the location and use of domestic garden bores in areas potentially underlain by ASS to prevent groundwater acidification and contamination.

(v) That the City of Joondalup work in conjunction with the DoE in developing education material for the public about the risks of using untreated groundwater and to promote the regular testing of privately owned bores for acidity, arsenic and heavy metals.

(vi) That the City engage the DoE to provide ongoing professional development training to officers of the City of Joondalup in the identification, assessment and best practice management of ASS.

It needs to be noted that any outcome formed as a result of the investigations undertaken needs to add value to the process and not create an expectation that the City of Joondalup can solve the issue.

As a result of the shared concerns with the community, the issue has been raised with the Western Australian Local Government Association, who have confirmed that the issue of ASS, and the self assessment process, has ramifications for other local government authorities. The City of Joondalup is seeking support from the WALGA State Council to confirm Acid Sulphate Soils as a priority for their Environment Portfolio.

Although development pressure across the state is increasing in low-lying swampy areas due to increasing land values, the City of Joondalup has a significantly smaller problem than other local government authorities on the Swan Coastal Plain. The only areas identified in the preliminary Acid Sulfate Soil risk mapping as having high risk of Actual Acid Sulfate and less than 3 metres from the surface, are within the boundaries of the Yellagonga Regional Park. Further, development potential within this area is low as the majority of the land is already developed or not suitable for further development.

Of greater concern however is the possible acidification of the groundwater dependent wetlands within the Yellagonga Regional Park due to water table decline in the Gnangara mound following a long period of below average rainfall and increasing groundwater abstraction. Groundwater abstraction near wetlands needs to carefully managed so the watertable remains above pyrite layers in the soil. This will involve significant collaboration with the DoE to ensure the protection and sustainability of the wetlands within the region.

BACKGROUND

The Council recently considered an application for development on a site which is adjacent to the Yellagonga Regional Park. The site originally contained land depicted in the map attached to Planning Bulletin No 64 as having high risk Acid Sulfate Soils. Land near the North West Corner of the site is mapped as having high risk of Actual Acid Sulfate and Potential acid sulfate soil less than 3 m from the surface. This low lying portion of the site was subsequently excised from the original parent lot and no longer forms part of the site.

Planning Bulletin 64–Acid Sulfate Soils, which provide planning guidelines for local governments in relation to the assessment of applications for planning approval where there is evidence of a ‘significant’ risk of disturbing acid sulfate soils, provide a four-step test for determining whether an acid sulfate soil investigation is required in any particular instance. This four step test is called ‘The Acid Test’ and is an applicant self assessment form. The onus is on the applicant to provide this information with any application on land where there is evidence of a significant risk of disturbing acid sulfate soils. Step 1 of this test is in determining if there is evidence of a significant risk of disturbing ASS in the proposed development location.

The applicant, carried out site investigations into the groundwater levels below the site which enabled them to address the requirements of the Planning Bulletin.

Based on the self-assessment form, the proposal was deemed not to require any further investigation in regard to ASS, nor referral to the Department of Environment for assessment as the development lot was outside the area mapped as having risk in relation to Acid Sulfate Soils and therefore deemed as having no evidence of a significant risk of disturbing ASS.

It is this process in relation to the self assessment form, contained within Step One of the Acid Test, that has raised community concern as to the perceived rigor and appropriateness in this process. The City's Sustainability Advisory Committee at its meeting of the 10 February 2005 discussed this issue and deemed that a transparent and independent process was necessary.
The minutes of this meeting were considered by Council at it's meeting of the 22 February 2005. It was resolved at this meeting that Council:

2. *REQUESTS the CEO to submit a further report to the ordinary meeting of the Council held on the 15 March 2005 addressing the concerns raised by the Sustainability Advisory Committee pertaining to acid sulfate soils; and*
3. *INITIATES appropriate research into the matter of Acid Sulfate Soils considering the issues raised by the SAC and seeks input from the Western Australian Local Government Association, Department of Planning and Infrastructure and other relevant state government agencies*

In light of community concern and in response to this Council resolution, the CEO commenced investigation into the matter. A project team has been responsible for seeking advice from the relevant State government agencies on the management of Acid Sulphate Soils, taking issue on the appropriateness of the self assessment process with the relevant agencies, clarifying roles and responsibilities in relation to Acid Sulphate Soils and benchmark best practice service provision in relation to assessment of developments in potential or high risk Acid Sulphate Soils areas.

DETAILS

Investigation into the issue of Acid Sulphate Soils has revealed bigger challenges faced not only by the City of Joondalup but other Western Australian Local Government Authorities in relation to Acid Sulphate Soils, further to the applicant self assessment process which was the focus of the required investigation.

This report serves to advise on the prelimary recommendations formed as a result of investigation into ASS with the various stakeholders consulted as a result of the council resolution. These preliminary recommendations are detailed to follow.

1. Institutional Arrangements
Currently there is no whole of government approach to management of ASS.

The potential impacts of disturbance of ASS on the State's environment, health care system and economy are significant. A state-wide coordinated approach

between the State government and its various agencies, local government, industries and the community is imperative to ensure a responsible, cost effective and shared response to this emerging problem.

A Proposed Framework for Managing Acid Sulfate Soils was released for comment in 2004. The Framework proposes five key objectives and 15 recommendations to mitigate potential impacts on the State's environment and economy and provide a coordinated framework to manage the issue in a consistent manner. This document is yet to be endorsed by the State Government, and makes Western Australia the only state without a state management strategy for managing ASS.

Due to the broad threat ASS and acidic drainage represent, there is currently over 15 stakeholders (State and Local government) with which are affected by these threats. A lead agency is required to ensure there is a coordinated approach by state government agencies. The DoE have recommended in the Proposed Framework that it has a lead role in coordinating the management of ASS in WA. Further to this, the establishment of a steering committee (Western Australian Acid Sulphate Soil Advisory Committee) is recommended to advise on the implementation of a state framework, reporting directly to the Minister of the Environment. This is needed as a matter of priority.

Local Government is considerably exposed without the support of this State framework. It is imperative that this Committee is established and that the proposed Framework be adopted by the relevant agencies so as to ensure effective management of the ASS issue in WA. This issue has been raised with WALGA to lobby relevant agencies to expedite the adoption of framework and subsequent establishment of the Committee.

Preliminary Recommendation 1:
Elevate issue to WALGA to lobby for the endorsement of 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.

2. Identifying the distribution of ASS in WA

At this point in time, there is no mapping that provides advice on **actual** distribution of ASS in WA.

The DoE has compiled preliminary ASS risk maps for the Swan Coastal Plain. These maps has been compiled using existing geological information and is only provides some preliminary guidance for identifying areas where there is likely to be ASS. There is little or no soil chemistry data to test the validity of the map or the map boundaries. The DoE general guidance note for ASS state that the ASS risk maps will not replace the need to undertake a detailed soil identification and on-ground soil assessment process in areas considered high risk.

The State Government as allocated $650 000 over the 03/04 and 04/05 financial years for the DoE to undertake soil sampling to ensure more accurate mapping of

ASS areas. The DoE advise that soil mapping of the Perth metropolitan area should be completed by December 2005.

Preliminary Recommendation 2:
The COJ to work with the DoE to develop a local planning policy that includes the requirement for developments involving excavation in areas considered at risk by the City, to undertake a rigorous soil assessment process.

3. Avoiding the disturbance of ASS

There is currently very little known about the extent to which wetlands on the Jandakot and Gnangara mounds are underlain by ASS and the depth at which pyrite occurs.

Pyrite-rich peaty sediments often underlie groundwater–dependent wetlands on the Swan Coastal Plain. These wetlands are susceptible to acidification if the watertable falls below the pyretic material, and this can cause major changes in the ecology of the wetlands, particularly for macro-invertebrate communities. (Sommer and Horwitz, 2001). The DoE advise that the water table on both the Gnangara and Jandakot mounds has been progressively declining due to a long period of below average rainfall and groundwater abstraction, and there is a risk of our groundwater dependent wetlands (e.g. Lake Joondalup, Wallaburnup swamps & Lake Goollelal) becoming acidic. Groundwater abstraction near wetlands needs to managed so the watertable remains above pyrite layers in the soil.

Preliminary Recommendation 3:
Engage partners City of Wanneroo, CALM, YCG, Friends of YRP to lobby DoE to determine the extent to which wetlands on Gnangara mound are underlain by ASS and the depth at which pyrite occurs as a matter of urgency and the Environmental Water Provisions for the wetlands adjusted to protect the environmental values of the wetlands within the region.

4. Public Health Implications

- High concentrations of arsenic in groundwater pose a health risk for garden bore users.
- No mechanism to manage garden bore users in areas underlain by ASS.
- Acidification of surface water bodies commonly increases mosquito breeding, leading to possible outbreaks of mosquito borne disease.

If ASS are disturbed either through drainage or excavation, it will become extremely acidic due to exposure of pyrite to air. A number of oxidation products are formed, including sulphuric acid. Sulphuric acid not only acidifies soil and groundwater, but also mobilises metals e.g. aluminium, iron and manganese as well as heavy metals (arsenic, lead) from the soil into groundwater.

High concentrations of arsenic in groundwater pose a health risk for garden bore users. The Department of Health advise not to drink water from garden bores however there are other routes of exposure including ingesting home grown fruits and vegetables irrigated with contaminated groundwater, filling swimming pools, and children playing under sprinklers.
(DoE, 2004)

The current use and installation of garden bores in the Perth Metropolitan region is largely unregulated. DoE regulates groundwater abstraction from large irrigation bores and dewatering operations, however there is no mechanism to manage garden bore users in areas underlain by ASS. These areas are susceptible to groundwater acidification and arsenic contamination from excessive groundwater abstraction, particularly during periods of below average rainfall.

Further, the acidification of surface water bodies commonly increases mosquito breeding , as mosquito larvae are generally more resistant to acidic conditions than their predators. This is turn could lead to increases in mosquito borne diseases such as Ross River Virus. (DoE, 2004)

Preliminary Recommendation 4:
Lobby State government to develop guidelines for managing the location and use of domestic garden bores in areas underlain by ASS to prevent groundwater acidification and contamination.

Preliminary Recommendation 5:
Work in conjunction with the DoE to develop education material for the public about the risks of using untreated groundwater and to promote the regular testing of privately owned bores for acidity, arsenic and heavy metals.

5. Training, Management & Environmental Advice
In most cases Local Government Authorities have limited funds and expertise dealing with ASS issues however they play a critical role in planning and managing the disturbance of ASS, as well as managing local wetland areas, and in ensuring the protection of human health from heavy metal contaminated groundwater.

There is currently a need to increase the competency of local government authorities to identify triggers or indicators of ASS, and in the assessment and management of problems caused by the disturbance of ASS. Local Government needs access to appropriate information which will provide the ability to make objective decisions regarding ASS, and to enable competent management of ASS in a manner consistent with principles of Ecologically Sustainable Development and Best Practice Environmental Management.

Preliminary Recommendation 6:
Engage DoE to provide ongoing professional development training to Officers of the City of Joondalup in the identification, assessment and best practice management of ASS.

Local Governments access to appropriate information providing the ability to make objective decisions is somewhat limited until such a time as detailed soil mapping as been undertaken by the DoE. Advice obtained from DoE stated that soil mapping of the Perth metropolitan area should be completed by December 2005.

The planning guidelines contained within Bulletin 64 have been adopted by WAPC until such a time as this detailed mapping of ASS areas is available and a comprehensive policy response of acid sulfate soils is prepared.

Concerns raised by the Council's SAC in relation to the ASS self-assessment form, specifically step one, have been raised with the Department of Planning & Infrastructure (DPI). Advice from DPI states that the planning bulletin and self assessment form is currently under review and noted that the City's concerns will be taken into consideration as part of the review. These concerns will be formally submitted to the DPI in writing shortly.

The DPI advised that the current planning bulletin allows the decision maker to override the results of the self assessment form if site characteristics and local knowledge lead to decision maker to form the view that there is a significant risk of disturbing ASS at that location. However this is not made clear in the planning bulletin. A further issue that arises as a result of this advice is that many Local Government Officers do not have the knowledge to override the contents of the form without appropriate training for identifying ASS.

DPI further advised that the Planning Bulletin is a guideline document only. The 'Statement of Planning Policy No 2: Environment and Natural Resources Policy', provides the head of power to justify environmental conditions placed in planning applications, and can be used as the legislative base for developing Local Planning Policies in relation to Environment and Natural Resources provided that a local policy aligns with the objectives of the State Planning Policy.

In regard to planning processes within the City of Joondalup it is recommended that where there is the possibility for ASS to be disturbed that the project/development be subject to an appropriately rigorous risk assessment. Identifying the location of ASS is crucial to planning and managing development.

Preliminary recommendation 7:
Given the ASS risk maps do not provide with certainty the location of ASS, until detailed soil mapping as been undertaken the DoE and a comprehensive policy response of acid sulfate soils is prepared and released by the WAPC, the COJ will work with the DoE to develop a local planning policy to ensure that development on land containing ASS is planned and managed to avoid potential adverse effects on the natural and built environment. This policy will include a more rigorous self assessment tool.

Statutory Provision:

Western Australian Planning Commission – Planning Bulletin 64 – Acid Sulphate Soils
Town Planning & Development Act 1928
Environmental Protection Act 1986
Health Act 1911

Policy Implications:

Nil

Financial Implications:

The resource implications of the issue are as yet unknown.

Strategic Implications:

Aligns with the City's Key Focus Areas of Community Well-being and Caring for the Environment

Sustainability Implications:

Ensures that the development of land containing acid sulphate soils is planned and managed to avoid potential adverse effects on the natural and built environment.

Community Consultation:
A proposed method of community engagement for new local government policy on Acid Sulphate Soils needs to be developed and will be the subject of a subsequent report to SAC.

COMMENT

It is intended for this report to be forwarded to appropriate stakeholders within the City, including the Sustainability Advisory Committee, for comment.

Relevant comments will be incorporated into a final report to Council at the earliest available meeting date after comments have been received, containing the final recommendations of the City in regard to Acid Sulfate Soils as a result of the issues raised by SAC, and of the broader ramifications in regard to management of Acid Sulfate Soils within the City of Joondalup.

ATTACHMENTS
Nil

VOTING REQUIREMENTS

RECOMMENDATION
That Council:
1. NOTES the contents of this interim report
2. NOTES a final report will be presented to Council following comment from the appropriate stakeholders within the City of Joondalup, including the Sustainability Advisory Committee, concluding the final recommendations and findings of the City's investigation into Acid Sulfate Soils.

ALISON EDMUNDS
Principal Environmental Health Officer
Officer

GARRY HUNT
Chief Executive

Report Completion Date: 5 April 2005
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Department of Environment

Acid Sulfate Soils Guideline Series

Identification and investigation of acid sulfate soils

1.0 Introduction

The early identification of acid sulfate soils can provide a useful platform for developing and adopting effective measures to reduce the generation of acidic soils and water. Acid Sulfate Soils (ASS) are soils that contain iron sulfides which, when drained or disturbed and exposed to oxygen, produce sulfuric acid and result in the release of soluble iron, sulfate, aluminium and other toxic metals. These soils commonly have a pH of between 4 and 6.

Proponents proposing to carry out developments that involve the disturbance of soil or the change of groundwater levels in areas susceptible to ASS, should conduct a preliminary site investigation to determine whether or not ASS are present. Inappropriate management of ASS by landowners or developers can result in environmental harm and regulatory action by the Department of Environment.

2.0 Purpose of the Guideline

The purpose of this guideline is to provide information on the level of investigation required to:

- identify the presence or the absence of ASS in areas to be disturbed by a proposed development; and if present,
- define the location of ASS and the maximum amount of existing and potential acidity in order to determine appropriate management measures.

This document provides information on the identification and investigation of ASS. Guidance on management measures can be obtained from the document entitled *Treatment and management of disturbed acid sulfate soils.*

3.0 Investigations

A two-step investigation process will usually be required:

Step 1: Desktop assessment and preliminary site investigation involving collection of samples; and
Step 2: Sample selection and laboratory analysis (supported by Step 1).

3.1 Step 1: Desktop assessment and preliminary site investigation

Step 1 involves a desktop assessment and a site visit to identify indicators of ASS followed by soil sampling.

3.1.1 Desktop assessment

The desktop assessment is a preliminary appraisal of ASS risk within the property/landholding. This involves gathering information from ASS risk maps, generic soil maps, environmental geological maps, topographic maps, aerial photographs and other local investigations or environmental impact reports to assess the possibility of ASS occurrence.

The ASS risk map provided by the DoE is based on existing geomorphological and hydrological properties of the relevant soil formation. It is a broad scale assessment for planning purposes and provides an indication where acid sulfate soils may exist. Copies of the ASS risk maps are available under http://www.wapc.wa.gov.au/publications/policies/bulletins/PB64/64Nov03.html. Local variance in soil conditions will greatly influence the on-ground validation of key map units. The ASS risk map will not replace the need to undertake a detailed soil identification and on-ground assessment.

The following geomorphic or site description criteria should be used to determine if ASS are likely to be present:

- land with elevation less than 5 metres AHD;
- soil and sediment of recent geological age (Holocene);
- marine or estuarine sediments and tidal lakes;
- low-lying coastal wetlands or back swamp areas, waterlogged or scalded areas, stranded beach ridges and adjacent swales, interdune swales or coastal sand dunes;
- coastal alluvial valleys;
- areas where the dominant vegetation is tolerant of salt, acid and/or waterlogging conditions e.g. mangroves, saltcouch, swamp-tolerant reeds, rushes, paperbarks (*Melaleuca spp.*) and swamp oak (*Casuarina spp.*); and
- areas identified in geological descriptions or in maps as:
    - bearing sulfide minerals;
    - coal deposits or marine shales/sediments (geological maps and accompanying descriptions may need to be checked); and
    - deep older estuarine sediments below ground surface of either Holocene or pre-Holocene age.

3.1.2 Preliminary site investigation

Soil sampling locations should be guided by the desktop assessment and site characteristics. Relevant characteristics to consider include:

- nature of the disturbance (excavation, filling or groundwater extraction);
- specific location or locations of disturbance;
- total area of the site (m^2 or hectares) to be disturbed; and
- volume of material to be disturbed; and maximum depth of disturbance with reference to metres AHD (including any underground service pipes such as sewerage or drains).

Care should be taken to ensure representative samples are collected especially on sites with more than one type of geomorphological unit, or clearly different land surface elevations, so that sampling is representative of the area.

Appendix 1 provides a list of soil and water indicators that can be used (as a result of either site investigation or field soil tests) to identify if ASS are present. The preliminary site inspection should include investigations for the presence of both **actual** and **potential** ASS. Also note that it is common to have an actual ASS that also contains some un-oxidised iron sulfides or potential acidity.

3.1.2.1 Soil sampling

A staged approach is usually the most efficient for collecting data and locating any follow-up boreholes if required. Soil sampling involves drilling or augering investigative boreholes to at least 3 metres depth, or at least 1 metre below the maximum depth of disturbance (whichever is the greater), describing and undertaking field soil tests on the soil profiles retrieved and collecting and storing samples for laboratory analysis. The information gathered from this step will be required to assist in selecting appropriate samples for laboratory analysis and enable both the proponent and the Department of Environment (DoE) to review and assess the results. Considerations should be made on the time taken to undertake the Preliminary Site Investigation to ensure that the investigation is completed appropriately ahead of when earth works are due to commence.

The following information should be provided as part of the soil sampling procedure:

- the full grid reference of each borehole using Australian Metric Grid;
- the exact location of each borehole shown on an appropriately scaled map;
- an exact description of the vertical dimensions of the borehole relative to existing surface height AHD;
- a brief description of the equipment and/or methods used to retrieve the samples;
- a field description for each soil profile including soil texture, colour (using Munsell colour book), mottling, organic matter and other diagnostic features (e.g. jarosite, shell); and
- results from field soil tests [field pH (pH_F), pH after oxidation with hydrogen peroxide (pH_{FOX}) and reaction with peroxide] at 0.25 metre vertical intervals to the base of the soil profile (see Appendix 2 for notes on how to interpret these tests).

The number of boreholes required is dependant on the volume of ASS disturbance, or for disturbances greater than 1000 m^3, the area (m^2 or hectares) to be disturbed. Table 1 summarises the minimum number of boreholes to be drilled, described, field tested and sampled for non-linear and linear disturbances.

Table 1 – Minimum number of boreholes required for ASS investigation in high risk areas

Extent of site project	Number of boreholes
1. Area project	
< 1 ha	4
1 – 2 ha	6
2 – 3 ha	8
3 – 4 ha	10
> 4 ha	2 for every hectare
2. Volume of disturbance (m^3)	
≤ 250	2
251 – 1000	3
> 1000	1 for every 500m^3
3. Linear project	
Minor width and volume and low S(%)	@ 100 m intervals
Major width and volume	@ 50 m intervals

Note: The borehole density relates to the pre-development stage, as opposed to sampling requirements after disturbance. For large projects sampling density may vary based on the geomorphic and geologic evidence submitted to the DoE for consideration. For larger projects it may be possible that the investigations be conducted in stages to reduce the upfront costs.

Once boreholes have been dug, the profiles described and soil field tests conducted, soil samples must be collected from each profile at a vertical maximum of 0.5 metre intervals. In deciding the appropriate sampling intervals, the field operator should refer to the field description notes and identify any significant

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Once boreholes have been dug, the profiles described and soil field tests conducted, soil samples must be collected from each profile at a vertical maximum of 0.5 metre intervals. In deciding the appropriate sampling intervals, the field operator should refer to the field description notes and identify any significant

sampling increment of 0.25m is preferred. Different horizons must not be mixed and sample intervals should be kept within a horizon.

(iv). Ideally, soil samples should constitute up to 0.5 kg each to allow sufficient sample for physical and chemical analysis. Check with the chosen analytical laboratory for soil sample quantity. Sample analysis may be requested as part of the approval, development assessment, or an audit process, or for other unforeseen uses.

(v). Quantitative laboratory tests need to be conducted on every 0.5 m depth interval, unless strong justification is provided. Laboratory analysis confirming the absence of sulfides is often just as important as determining the actual sulfide content on a positive sample. Where there is strong field evidence morphologically and with field pH_F and pH_{FOX} results suggesting no ASS present, then the number of samples analysed per profile may initially be reduced, to around 30% of the samples collected in that profile. The supporting profile data must be presented and commented on.

3.2.3 Dredging Projects

Sampling of material to be dredged from coastal rivers, lakes, dams, drains, canals and wetlands should be undertaken according to the major transect spacing (Table 1). Samples should be collected to at least 1 metre below the maximum depth of expected material extraction, ensuring that samples from all sedimentary layers are included. Careful attention must be paid in collecting underwater sediment samples to ensure that all sediment particle sizes are collected. The fine silt and clay fraction of the dredged material may contain high concentrations of sulfide but this material can easily drain/disperse from the sample during collection. In some wet dredging operations, acid sulfate material (usually silt and clay) can separate from the bulk material (sand) during stockpiling. Assessment of such dredged material may require that the constituent fractions of the resource be separated and tested accordingly. Interpretation of soil analysis on the dredge material may be complicated due to the neutralising influences of shell or seawater in the sample.

3.2.4 Laboratory analysis selection

Once the appropriate samples have been selected, the samples should be submitted to a laboratory which is NATA accredited for the analysis required as described in the *Acid Sulfate Soil Laboratory Methods Guidelines, 2004*. The existing acidity and potential acidity of the soil should be analysed. Potential acidity can be determined by using at least one or two recommended standard analytical suites for ASS analysis:

- Suspension Peroxide Oxidation Combined Acidity and Sulfate (SPOCAS) method is a self-contained acid base accounting test. It provides a measurement of the maximum oxidisable sulphur, Titratable Actual Acidity (TAA) and Titratable Peroxide Acidity (TPA) present in the soil sample. The TPA result of SPOCAS represents a measure of the net acidity, effectively equivalent to the sum of the soil's potential sulfidic acidity and actual acidity. The calculated Titratable Sulfidic Acidity (TSA) is the difference between TPA and TAA. The S_{POS} (sulphur trail) of SPOCAS result can be compared to the TSA (acid trail) result provided the two quantities are expressed in equivalent units. For example, the S_{POS} can be multiplied by 623.71 to convert it to "equivalent" mol H^+/t. Conversely, to convert mol H^+/t to %S divide by 623.7.
- Chromium Reducible Sulfur (S_{CR}) is the preferred method for estimating reduced inorganic sulphur in ASS and is not subject to significant interferences from the sulphur, either in organic matter or sulfate minerals (eg gypsum). The reduced inorganic sulphur compounds measured by this method include pyrite and other iron disulfides, acid volatile sulfides, etc.
- Total Sulfur (S_T) and Total Oxidisable Sulfur (S_{TOS}) are appropriate only as screening methods and should not be used as a substitute for SPOCAS and S_{CR}. Soils with jarosite or other similar insoluble compounds have a less available existing acidity and will require more detailed analysis.

A combination of analyses may be required if a more detailed knowledge of the soil chemistry is necessary e.g. to determine the most appropriate neutralising agent or management technique, or if the proponent wants to minimise the amount of neutralising agent used (often economical for larger scale disturbances).

A full Acid Base Accounting (ABA) calculation is expected when using the Chromium or SPOCAS suites as provided in the *Acid Sulfate Soils Laboratory Guidelines–2004* available at www.environment.wa.gov.au. The ABA is used to predict net acidity from sulfide oxidation of ASS in the following equation:

Net acidity = Potential sulfidic acidity + Existing acidity – Acid Neutralising Capacity

3.3 Conclusion

A preliminary site investigation will not provide sufficient information on the appropriate management of disturbed acid sulfate soils and groundwater including the requirement for the preparation of an ASS Management Plan. Projects involving the disturbance of ASS must assess the risk of both on and off-site impacts based on DoE guidance on *Treatment and Management of Disturbed Acid Sulfate Soils DoE 2004, Guidance for Groundwater Management in Urban Areas on Acid Sulfate Soils - 2004* and the *Queensland Soil Management Guidelines – Acid Sulfate Soil Technical Manual 2002.* Appendix 4 provides a flow chart of the DoE acid sulfate soils assessment process.

4.0 Further information

It is recommended that reference be made to guidelines and manuals developed by the New South Wales and Queensland State governments, in particular;

- *Queensland Acid Sulfate Soil Technical Manual 2002, Soils Management Guidelines* Queensland Acid Sulfate Soils Management Advisory Committee;
- *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998*, Queensland Acid Sulfate Soils Investigation Team;
- *NSW Acid Sulfate Soil Manual 1998*, Acid Sulfate Soil Advisory Committee; and
- *Acid Sulfate Soils – Laboratory Methods Guidelines May 2004,* Department of Natural Resources, Mines and Energy, Indooroopilly, Queensland Australia.

5.0 Acknowledgements

The Land & Water Quality Branch would like to acknowledge the guidelines and manuals produced by the following committees and organisations which were used in the development of this guideline:

- Queensland Acid Sulfate Soils Investigation Team;
- Queensland Acid Sulfate Soil Management Advisory Committee;
- NSW Acid Sulfate Soils Management Advisory Committee;
- National Committee for Acid Sulfate Soils; and
- Southern Cross University.

6.0 References

Ahern CR, Ahern MR and Powell B (1998). *Guidelines for sampling and analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.* Department of Natural Resources, Indooroopilly, Queensland, Australia. DNRQ980124.

Ahern CR and McElnea AE (1999). Reactions of Acid Sulfate Soils. In *Acid Sulfate Soils and their Management in Coastal Queensland: Forum and Technical Papers*. Hey KM, Ahern CR, Eldershaw VJ, Anorov JM and Watling KM (eds), Brisbane 21—23 April, 1999. Department of Natural Resources, Mines and Energy, Indooroopilly, Queensland, Australia. ISBN 0 7242 7476 6 DNRQ990058.

Ahern CR, Sullivan LA, and Mclnea AE (2004). Laboratory Methods Guidelines 2004 – Acid Sulfate Soils. In *Queensland Acid Sulfate Soils Manual Technical Manual.* Department of Natural Resources, Indooroopilly, Queensland, Australia.

Ahern CR, Hey KM, Watling KM and Eldershaw VJ (eds), (June, 2000), Department of Natural Resources, Indooroopilly, Queensland, Australia. *A Handbook of Australian Soils.* Rellim Technical Publications, Glenside, South Australia.

Australian Standard, *Guide to the sampling and investigation of potentially contaminated soil, Part 1: non-volatile and semi-volatile compounds, AS 4482.1 – 1997*

Australian Standard, *Guidance on sampling of bottom sediments, AS/NZS 5667.12 – 1999*

Bush RT and Sullivan LA (1998). Acid Volatile Sulfur. S_{AV} – Method 22A. In: *Acid Sulfate Soils Laboratory Methods Guidelines*. Ahern CR, Blunden B and Stone Y (eds). Acid Sulfate Soils Management Advisory Committee, Wollongbar, NSW.

Environmental Protection Agency (2001), *Instructions for the Treatment and Management of Acid Sulfate Soils.* Environmental Protection Agency, Brisbane.

Hey KM, Ahern CR, and Watling, KM (2000). Using chemical field tests to identify acid sulfate soils likelihood. In: *Acid Sulfate Soils: Environmental Issues, Assessment and Management, TechnicalPapers.* Ahern CR, Hey KM, Watling KM and Eldershaw VJ (eds), Brisbane, 20—22 June, 2000. Department of Natural Resources, Indooroopilly, Queensland, Australia.

Hey KM and Ahern CR (2000). Preliminary methods for recognition of acid sulfate soils: Desktop assessment and use of on-site indicators. In: *Acid Sulfate Soils: Environmental Issues, Assessment and Management, Technical Papers*. Ahern CR, Hey KM, Watling KM and Eldershaw VJ (eds), Brisbane, 20–22 June, 2000. Department of Natural Resources, Indooroopilly, Queensland, Australia.

McDonald R, Isbell RF, Speight JG, Walker J and Hopkins MS (1990). *Australian Soil and Land Survey Field Handbook* (2nd edition), Inkata Press, Melbourne.

McElnea AE, Ahern CR and Menzies NW (2002a). Improvement to peroxide oxidation methods for analysing sulfur in acid sulfate soils. *Australian Journal of Soil Research* 40(7).

McElnea AE, Ahern CR and Menzies NW (2002b). The measurement of actual acidity in acid sulfate soils and the determination of sulfidic acidity in suspension after peroxide oxidation. *Australian Journal of Soil Research* 40(7).

Mulvey PJ (1993). Pollution prevention and management of sulfidic clays and sands. In: *Proceedings of the National Conference on Acid Sulfate on Acid Sulfate Soils,* Cooloongatta, June 1993. (Ed) R Bush, NSW Department of Agriculture. Wollongbar, NSW. pp 116-129.

Queensland Acid Sulfate Soils Investigation Team (QASSIT), Department of Natural Resources, Queensland Acid Sulfate Soil Technical Manual (2002) – *Soil Management Guidelines.*

Queensland Government (2002). *State Planning Policy: Planning and Managing Dvelopment Involving Acid Sulfate Soils*. Department of Local Government and Planning, Brisbane, Queensland.

Stone Y, Ahern CR and Blunden B (1998). *Acid Sulfate Soils Manual 1998*. Acid Sulfate Soils Management Advisory Committee, Wollongbar, NSW..

McDonald R, Isbell RF, Speight JG, Walker J and Hopkins MS (1990). *Australian Soil and Land Survey Field Handbook* (2nd edition), Inkata Press, Melbourne.

McElnea AE, Ahern CR and Menzies NW (2002a). Improvement to peroxide oxidation methods for analysing sulfur in acid sulfate soils. *Australian Journal of Soil Research* 40(7).

McElnea AE, Ahern CR and Menzies NW (2002b). The measurement of actual acidity in acid sulfate soils and the determination of sulfidic acidity in suspension after peroxide oxidation. *Australian Journal of Soil Research* 40(7).

Mulvey PJ (1993). Pollution prevention and management of sulfidic clays and sands. In: *Proceedings of the National Conference on Acid Sulfate on Acid Sulfate Soils,* Cooloongatta, June 1993. (Ed) R Bush, NSW Department of Agriculture. Wollongbar, NSW. pp 116-129.

Queensland Acid Sulfate Soils Investigation Team (QASSIT), Department of Natural Resources, Queensland Acid Sulfate Soil Technical Manual (2002) – *Soil Management Guidelines.*

Queensland Government (2002). *State Planning Policy: Planning and Managing Dvelopment Involving Acid Sulfate Soils*. Department of Local Government and Planning, Brisbane, Queensland.

Stone Y, Ahern CR and Blunden B (1998). *Acid Sulfate Soils Manual 1998*. Acid Sulfate Soils Management Advisory Committee, Wollongbar, NSW..

Appendix 2: Interpreting soil field pH tests

It is important to note that whilst a useful exploratory tool, soil field pH tests are indicative only and cannot be used as a substitute for laboratory analysis to determine the presence of ASS. Laboratory analysis is needed to quantify the amount of existing plus potential acidity. This appendix provides information on how to interpret the results from soil field pH tests. For further information on how to conduct and interpret these tests, consult the latest version of the *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.*

Field pH tests should be conducted on the soil profile at regular intervals (0.25 metres) using a field pH meter calibrated according to the manufacturer's instructions. All results (pH_F and pH_{FOX} values, peroxide reaction) should be tabulated and reported.

Other semi-field tests such as examination under a microscope for pyrite and its reaction with peroxide on the slide may be useful tools to identify pyrite presence, but they require experience and training.

1. Field pH test (pH_F) i.e. pH of soil and water paste

The pH_F test measures the existing acidity of a 'soil:water' paste, and is therefore used to help identify if ASS are present. If the measured pH of the soil paste is $pH_F \leq 4$, oxidation of sulfides has probably occurred in the past, indicating the presence of AASS. Highly organic soils or heavily fertilised soils may also return a pH_F close to 4. A $pH_F > 4$ but ≤ 5 indicates an acid soil, but the cause of the acidity will need to be further investigated by laboratory analysis. The pH_F test does not detect any unoxidised sulfides (i.e. PASS). For this reason, this test must be used in conjunction with the pH_{FOX} test.

2. Field pH peroxide test (pH_{FOX}) i.e. pH of soil and peroxide mix and reaction with peroxide

The pH_{FOX} test is used to indicate the presence of iron sulfides or PASS. This test involves adding 30% hydrogen peroxide (pH adjusted to 4.5–5.5) to a sample of soil. If sulfides are present a reaction will occur. The reaction can be influenced by the amount of sulfides present in the sample, the presence of organic matter or the presence of manganese. Once the reaction has occurred, the pH is measured.

A combination of three factors is considered in arriving at a 'positive field sulfide identification':

A reaction with hydrogen peroxide. The strength of the reaction with peroxide is a useful indicator but cannot be used alone. Organic matter, coffee rock and other soil constituents such as manganese oxides can also cause a reaction. Care should be exercised in interpreting a reaction on surface soils and high organic matter soils such as peats and coffee rock, and some mangrove/estuarine muds and marine clays. This reaction should be rated, e.g. L = Low reaction, M = Medium reaction, H = High reaction, X = Extreme reaction.

The actual value of pH_{FOX}. If the $pH_{FOX} < 3$, and a significant reaction occurred, then it strongly indicates a PASS. The more the pH_{FOX} drops below 3 the more positive the presence of inorganic sulfides.

A much lower pH_{FOX} than field pH_F. The lower the final pH_{FOX} value and the greater the difference between the pH_{FOX} compared to the pH_F, the more indicative the presence of PASS. This difference may not be as great if starting with an already very acid pH_F (close to 4), but if the starting pH is neutral or alkaline then a larger change in pH should be expected. Where fine shell, coral or carbonate, is present the change in pH may not be as large due to buffering. The 'fizz test' (effervescence with 1 M HCl) should be used to test for carbonates and shell.

NOTE: *Field techniques are useful exploratory tools, but are indicative only and definitely not quantitative. They are not a replacement for quantitative laboratory analyses. Although it is commonly assumed that a low %S value means a low risk, the situation is more complex: [%S] x [volume disturbed] = risk assessment. Lowering of groundwater is another level of complication that needs to be addressed.*

Field and laboratory tests, sampling intensity and action levels (based on oxidisable sulfur results) relevant to the investigation of ASS are outlined in the Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils in Queensland 1998. These guidelines, also available at www.environ.wa.gov.au, should be used to guide Western Australian investigations in combination with the Draft DoE and EPA Guidance on Acid Sulfate Soils (2002).

APPENDIX 3: Texture-based ASS "Action Criteria"

The *Action Criteria* are based on the sum of existing plus potential acidity, calculated as equivalent sulfur (e.g. s-TAA + S_{CR} in %S units) or equivalent acidity (e.g. TAA + a- S_{CR} in mol H+/tonne). The highest laboratory result(s) is always used to assess against the action criteria. For further information refer to *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.*

As clay content tends to influence a soil's natural pH buffering capacity, the action criteria are grouped by three broad texture categories – coarse, medium and fine. The criteria are used to define when ASS disturbed at a site will need to be treated and managed.

For projects that disturb ≥1000 tonnes of ASS with ≥0.03 %S or ≥18 mol H+/tonne equivalent acidity, a detailed management plan and development consent will be required.

Texture-based acid sulfate soils 'action criteria'

Type of material		**Action Criteria if 1-1000 tonnes of materials is disturbed Existing + Potential Acidity**		**Action Criteria if >1000 tonnes of materials is disturbed Existing + Potential Acidity**	
Texture range McDonald et al. (1990)	**Approx. clay content (%)**	**Equivalent sulfur (%S) (oven-dry basis)**	**Equivalent Acidity (mol H+/tonne) (oven-dry basis)**	**Equivalent sulfur (%S) (oven-dry basis)**	**Equivalent Acidity (mol H+/ tonne) (oven-dry basis)**
Coarse Texture Sands to Loamy sands	**≤ 5**	**0.03**	**18**	**0.03**	**18**
Medium Texture Sandy loams to light clays	**5 – 40**	**0.06**	**36**	**0.03**	**18**
Fine Texture Medium to Heavy clays and silty clays	**≥ 40**	**0.1**	**62**	**0.03**	**18**

The action criteria refer to existing and potential acidity for given volume of ASS. The highest result(s) should always be used to assess if the relevant action criteria level has been made or exceeded; using the average or mean of a range of results is no longer considered appropriate.

Total actual acidity (TAA) is determined by titration of a 1M KCl salt solution to pH 5.5 using NaOH. This is a measurement of the soil's existing acidity prior to oxidation of sulfidic material.

Total potential acidity (TPA) is determined by peroxide double oxidation. This is estimated by titration to pH 5.5 of total acidity after oxidation of the soil with 30% hydrogen peroxide.

When determining lime requirements, subtracting TAA from Total Potential Acidity (TPA) to get Total Sulfidic Acidity (TSA) is acceptable.

Appendix 4 : Flowchart for ASS investigation process