ENGINEERING DESIGN GUIDELINES

SOIL AND WATER QUALITY MANAGEMENT

Planning Scheme Policy No. 15.07

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Contents

1 Scope and general

1.1 Scope

This section sets out the guidelines developed specifically for the design of erosion and sediment control and management of stormwater quality to minimise adverse environmental impact resulting from development.

Virtually all construction activity which requires the disturbance of the soil surface and the existing vegetation, naturally predisposes the construction site to erosion. This in turn leads to sediment loss in the resultant run-off water.

Since such soil disturbance is a necessary part of development, it is essential therefore to develop measures which reduce the erosion hazard of any particular construction activity. Having done that, it is necessary to control run-off water, which carries the sediment, in such a way as to reduce the amount of that sediment leaving the site to an acceptable level.

After construction is complete and the site fully rehabilitated, permanent water quality control structures and features commence their role. These include trash racks, gross pollutant traps, wet retention basins and the creation of, or increase in size of wetlands.

1.2 Objective

Minimise the amount of pollutants such as sediment, litter, nutrients and oil entering Mackay's waterways and stormwater drains.

Minimise and prevent environmental harm to Mackay's waterways and associated ecosystems.

Provide an effective stormwater management system that balances environmental, social and economic interests within the Mackay community and incorporates water quantity, quality and waterway corridor controls.

Minimise environmental nuisance or harm from land-disturbing activities.

1.3 Terminology

Acid Sulfate Soils – Acid Sulfate Soils are soils occurring naturally in low lying coastal areas predominantly below 5 m AHD. The term refers to both 'actual' and 'potential' acid sulfate soils as detailed below:

- Soil or sediment containing highly acidic soil horizons or layers affected by the oxidation of iron sulphides (actual acid sulfate soils); and/or
- Soil or sediment containing iron sulphides or other sulfacid material that has not been exposed to air and oxidised (potential acid sulfate soils)

Catchment Management Plans (CMP's) – These documents describe the catchment, waterways, environmental values, water quality objectives, hydrology, water quality and hydraulic issues associated with the catchment. The CMPs also include strategies and action plans to manage a wide range of waterway issues within the catchment, including social, environmental, financial and planning issues.

CMPs may be used by:-

- Council to identify and prioritise actions that need to be undertaken in the catchments;

- Community groups to guide community based activities in their catchment and increase their understanding of the waterway related issues facing their catchment and their waterways;
- Staff in Council who are developing Priority Infrastructure Plans (PIPs); and
- Developers or their Consultants who need specific information (eg on existing water quality, waterway health and key local issues) to support their development applications.

Creek Catchment – An area of land bounded by natural features such as hills, from which all runoff flows to a common low point (such as a creek, lake, river, bay etc).

ESC – Erosion and Sediment Control

- **ESC Management Plan -** A site plan, including brief explanatory notes (usually on the plan) that simply explains to regulators and site personnel how erosion is going to be minimised and sediment runoff controlled. This Plan is usually acceptable for low risk developments.
- **ESC Program** – A set of documents including ESC Management Plans, supporting documentation, specifications and construction details.
- **ESC Measures** – Practices and devices used to minimise erosion (eg retaining and/or establishing vegetation) and control sediment (eg installing a sediment fence or sediment basin).

Environmental Values (EVs) – Qualities or characteristics of a waterway that support healthy ecosystems and the communities livelihoods and lifestyle. Environmental Values are determined by community preference and reasonable judgement.

High Risk Development – A development (or development proposal) may be classified as 'high risk' if it falls within one of the following categories:

- Any development (or development proposal) adjoining areas of identified ecological status as indicated on Council planning scheme maps;
- Multi-unit dwellings with an impermeable surface area (not including roof area) in excess of 2500 m^2;
- Subdivisions where the ultimate developed area is greater than 2 ha;
- Industrial/Commercial activities that have uncovered storage/working space and car parking with a combined area greater than 1000 m^2; and/or
- Large scale land disturbance activities where the area of the disturbance is greater than 2 ha.

Land-Disturbing Development – Any carrying out of building work, plumbing or drainage work, land clearing, operational work (eg road building, placement of fill) or reconfiguring a lot (ie subdivision) where there is potential for accelerated erosion from wind or water and/or the discharge of sediment to drains or waterways.

'Low Risk' – For development subject to Council approval but not specified as 'high risk development' (see above). Note that for these types of development, water quality impacts need to be minimised by identifying and adopting best practice techniques.

Receiving Water – A water body that may receive runoff from the catchment under consideration, and has some environmental value of beneficial use. Natural wetlands are included in the definition of receiving waters, but constructed wetlands that have been built primarily for the purpose of stormwater (or wastewater) treatment, are not.

Riparian – The banks and associated areas that fringe waterways and are linked by physical and ecological processes to the waterway.

Sediment – Solids (typically sand, silt and mud) that are transported by water. Considered to be a 'contaminant' as defined in the *Environmental Protection Act 1994*.

Stormwater – Surface water runoff following a rain event (including piped flows).

Site Based Acid Sulfate Soil Management Plan (SBASSMP)
A SBASSMP shall identify potential on and off site impacts associated with the disturbance of ASS from a development. The Plan should also identify performance criteria and mitigation strategies together with relevant monitoring, reporting and corrective actions. Further details of the requirements for the Plans are contained in SPP Guideline 2/02. A SBASSMP may form part of the development's overall Environmental Management Plan.

Site Based Stormwater Management Plan (SBSMP)
A SBSMP shall identify potential on and off site (upstream, downstream and adjacent properties) impacts associated with stormwater for a proposed development. The SBSMP shall also identify a range of stormwater management strategies and action for water quality, water quantity and environmental issues (eg riparian vegetation within the waterways affected by the development). A SBSMP may form part of the development's overall Environmental Management Plan.

Stormwater Management Plan (SMP)
A plan that evaluates options for the management of stormwater quantity, quality and ecological values within the waterway corridor on a benefit-cost basis. The plan draws upon environmental assessments, as well as hydrologic, hydraulic and water quality modelling. The plan replaces the functions of, and builds upon, the old 'Master Drainage Plan'. The plan is usually developed for developing areas, for example, fringes or pockets of the City that are being urbanised.

Stormwater Quality Best Management Practices (SQBMPs)
A range of stormwater management measures which aim to reduce the amount of stormwater runoff and export of pollutants. These practices include:-

- *Source Controls* that aim to prevent the entry of pollutants into stormwater at the pollutant source. These are often non-structural controls that involve public education to modify community behaviour (eg drain and kerb labelling, public awareness campaigns).
- *Runoff Reduction Controls* which lower the volume and peak discharge of stormwater flows. These controls reduce the potential for pollutant wash off and downstream erosion (eg on-site detention systems, stormwater recycling systems, dry detention basins).
- *Infiltration Controls* that include stormwater treatment and/or disposal methods that allow filtration through a porous media (eg porous pavements, percolation trenches).
- *Pollution interception controls* (eg Stormwater Quality Improvement Devices – SQIDs) that physically intercept or retain stormwater pollutants for removal or further treatment (eg. filter strips gross pollutant traps, constructed wetlands, vegetated filter strips, grassed swales).

Stormwater Quality Improvement Devices (SQIDs) – Devices used to improve the health of our waterways. SQIDs work by reducing the amounts of pollutants that enter stormwater and waterways. Types of SQIDs include trash racks, gross pollutant traps, constructed wetlands, gully pit baskets.

Uncontaminated Runoff – Stormwater runoff that has not been contaminated by sediment from a work site, or has not been directly or indirectly contaminated as a result of actions associated with the work site.

Water Quality Indicators – A water quality indicator is an indicator for an environmental value, and is a property that can be measured in a quantitative way (eg. pH, temperature).

Water Quality Modelling – A technique used to make predictions about the quality of water in waterways. Water quality modelling encompasses pollutant export modelling via models such as MUSIC and AQUALM, which predicts the pollutant loads being discharged from a given area.

Water Quality Objectives (WQOs) – Measurable goals for the quality of receiving waters to ensure the Environmental Values are protected.

Water Sensitive Urban Design (WSUD) – WSUD is a relatively new concept in regional Queensland, dealing with the '*interactions between the urban built form (including urban landscapes) and the urban water cycle as defined by the three urban water streams being potable water, wastewater and stormwater'* (Engineers Australia 2003).

Waterway – Any element of a river, creek, stream, gully or drainage channel, including the bed and banks. This term includes waterways indicated on the Planning Scheme Maps.

1.4 Reference and Source Documents

(a) Council Guidelines & Specifications

D5 Stormwater Drainage Design
D20 Drawings and documentation Guidelines
C211 Control of Erosion and Sedimentation
C273 Landscaping
Stormwater Quality Management Plan for Mackay, 2006

(b) QLD State Legislation

Environmental Protection Act 1994
Environmental Protection Regulation 1998

Environmental Protection (Water) Policy 1997

Integrated Planning Act 1997

State Planning Policy 2/02 Planning and Managing Development involving Acid Sulfate Soils

Coastal Protection and Management Act 1995

Coastal Protection and Management Regulation 2003

Fisheries Act 1994

Water Act 2000

Soil Conservation Act 1986

Vegetation Management Act 1999

Local Government Act 1993

(c) QLD State Authorities

Queensland Department of Natural Resources and Mines
Dam Safety Management Guidelines, 2002
Soil Management Guidelines in *Queensland Acid Sulfate Soil* Technical Manual 2002
Queensland Department of Main Roads
Road Drainage Design Manual, Chapter 5: Erosion and Sediment Control, 2002

(d) Other

ANZECC
Australian Water Quality Guideline for Fresh and Marine Waters 2000
Argue, J.R. (Ed)
Water Sensitive Urban Design: Basic Procedures and Marine Waters 2000

AustRoads
Waterway Design (A Guide to the Hydraulic Design of Bridges, Culverts & Floodways), 1994
Brisbane City Council (BCC)
Sediment Basin Design Guidelines 2001
Stormwater Outlets in Parks and Waterways, Guidelines, 2002
Natural Channel Design Guidelines, 2000
Guidelines for Pollutant Export Modelling in Brisbane, Version 7 – Draft 2003
Water Quality Management Guidelines, 2000
Water Sensitive Urban Design Engineering Guidelines: Stormwater
Engineers Australia
Australian Runoff Quality (Draft) 2003.
Gold Coast City Council
MUSIC Modelling Guidelines 2006
Healthy Waterways
Water Sensitive Urban Design Technical Design Guidelines for South East Queensland.
Institution of Engineers Australia, Queensland Division (IEAQ)
Soil Erosion and Sediment Control – Engineering Guidelines for Queensland Construction Sites, 1996
Melbourne Water
WSUD Engineering Procedures, 2005
Morse McVey & Associates (NSW Department of Housing)
Soil land Water Management for Urban Development
NSW Department of Housing 1998
Managing Urban Stormwater (Soils and construction)
Townsville City Council 2002
Erosion and Sediment Control Planning for North Queensland – Course Notes
Witheridge, G
Erosion and Sediment Control - Course Notes, 2004

1.5 Planning and Concept Design

The Designer is to consider the site characteristics, constraints and opportunities relating to stormwater management at the initial planning phases of the development. This is to ensure that sufficient area is allocated within the development site for appropriate stormwater management infrastructure.

For all IDAS applications, a Site Based Stormwater Management Plan (Concept) shall be submitted with the development application to Council for all developments. This will assist in assessing the impact of the development on the site.

For all IDAS applications where State Planning Policy 2/02 – Planning and Managing Development involving Acid Sulfate Soils applies, a Site Based Acid Sulfate Soils Management Plan (Concept) is to be submitted with the development application.

A Site Based Stormwater Management Plan (Concept) for all Council projects shall be prepared by the Designer, or Consultant, and submitted to Council for approval. The approved concept design shall be included in the Drawings for the project.

A Site Based Acid Sulfate Soil Management Plan (Concept) for Council projects shall be prepared where SPP2/02 would apply to the works if it was a development assessed under IDAS. This Plan shall be submitted for approval by Council and the Department of Natural Resources and Mines.

1.6 Detailed Design

The following documents shall be submitted to Council as part of the detailed engineering design documentation following approval of the concepts from Council and other relevant Government Departments:

- Site Based Stormwater Management Plan (SBSMP);
- Site Based Acid Sulfate Soils Management Plan (SBASSMP) where applicable; and
- Erosion and Sediment Control Program (ESC Program).

The documents are to be site specific and not a generalisation of erosion and sediment control, stormwater quality and acid sulfate soil management philosophies. The documents may also form part of the contract specifications for a contractor to comply with during construction.

For Council projects, the organisation responsible for the preparation of the detailed design of the SBSMP, SBASSMP (where applicable) and ESC Program will depend on whether the Works are to be constructed by Council's staff or by Contract.

Where Council's staff are utilised, the detailed design shall be prepared by Council, or its consultant.

For Works by Contract, the Contractor is responsible for preparing and submitting for approval, the SBSMP and SBASSMP and ESC Program.

These detailed Plans and Program shall be referred to the Designer for a concurrence report in both cases and subsequent consideration for approval by Council's Environmental Engineer.

Documentation required for SBSMPs, ESC Programs and SBASSMPs are detailed in Section 1.16 to 1.19.

Where available, examples of proposed developments detailing locations of water quality structures, sediment and erosion control devices may be obtained from Council and used as a guide when preparing SBSMPs and ESC Programs.

1.7 Construction

No site works shall commence prior to approval of the detailed design documents submitted to Council. All works are to be undertaken in accordance with the approved SBSMP, SBASSMP and ESC Program, ESC Management Plans, local laws, development conditions and environmental regulations.

Implementation of the approved works during construction must be supervised by personnel with appropriate qualifications in soil and water quality management.

The developer (or representative) shall constantly monitor, review and modify soil and water management practices to correct any deficiencies.

Amendments required to the approved documents during construction are to be discussed and approved by Council Officers prior to implementing amended practices.

Random audits may be performed by Council Officers throughout the construction phase of the project to review compliance with approved documentation. Where inconsistencies are noted, written advice will be sent to the developer (or representative) requiring appropriate action within 24 hours.

Where Council Officers notifications are not complied with, the works may be undertaken by Council without further reference to the developer. All costs incurred by Council in carrying out the works will be recovered from the maintenance bond.

1.8 Maintenance

Maintenance plans are to be provided for SQIDs that are to be handed over to Council. The responsibilities for maintenance of SQIDs are to be detailed in the SBSMP. The maintenance plans are to be written for use by Council's maintenance and asset

personnel. Examples of SQIDs that require maintenance plans include trash racks, gross pollutant traps, constructed wetlands and ponds. The maintenance plans are to include:

- Design details
- Manufacturer and supplier contact details (where relevant)
- Inspection frequency
- Maintenance frequency
- Data collection requirements; and
- Clean-out procedures that address, at a minimum, public safety, maintenance techniques, equipment requirements, environmental management considerations, and occupational health and safety and disposal requirements.

A hand-over meeting must occur between the developer (or representative), previously responsible maintenance personnel, Council's Maintenance Co-ordinator and Environmental Engineer.

In the event that the SQID is not complying with approved conditions, Council is under no obligation to accept responsibility of the asset.

2 STORMWATER QUALITY MANAGEMENT

2.1 Stormwater Quality Management

Mackay City Council is committed to improving stormwater quality. This is demonstrated in Council's Stormwater Quality Management Plan (SWQMP), which has been prepared for Mackay's urban areas.

The SWQMP establishes the framework "*to manage stormwater quality in urban waterways in a way that maintains or enhances the state of balance among environmental, social and economic interests within the community*". The goal is consistent with Council's corporate objective for ecological sustainability as described in the Corporate Plan.

Stormwater inlet structures such as gully pits and field inlet pits are to be stencilled or embedded with an environmental awareness message aimed to improve the quality of water entering waterways. Appropriate messages include:

- The Drain is Just for Rain
- Dump - No Waste – Flows to Creek; and
- Protect our Waterways – Flows to the Ocean.
- Refer to Council's standard drawings for details.

Implementation of on the ground improvements for stormwater quality is to be achieved through catchment-based management strategies, initially focusing on 'at risk' catchments. The SWQMP identifies and prioritises urban catchments within Mackay City.

Catchment Management Plans (CMPs) for these catchments together with Stormwater Management Plans (SMPs) and Waterway Management Plans (WMPs) are progressively being prepared with outcomes form these projects including the definition of Environmental Values (EVs) and Water Quality Objectives (WQOs) in Mackay's waterways.

The Environmental Protection Policy for Water (EPP Water (1997)) provides the legislative basis for water quality management in Queensland. It identifies the need to establish Environmental Values (EVs) and related Water Quality Objectives (WQOs) for waters.

EVs and WQOs need to be identified to ensure that the quality of affected receiving waters are maintained or enhanced. WQOs includes all measurable water quality goals that have been derived to protect corresponding environmental values.

As the values and objectives are being determined, Council will maintain a set of recommended environmental values and water quality objectives for all of the City's waterways. These will be provided to developers for guidance on the performance objectives that their development is to be designed to achieve for receiving water quality. These are documented in Council's Stormwater Quality Management Plan.

These water quality objectives have been developed based on expert advice and the best information available. However, where a developer wishes to invest in local water quality studies to better define applicable site-specific environmental values and water quality objectives, this may be done in consultation with regulatory authorities, and the resulting site-specific water quality objectives may override Council's recommended water quality objectives.

Council is to be contacted regarding the status of the various CMPs, SMPs and WMPs.

2.2 Stormwater Quality Risk Classification

Small, 'low risk' developments in Mackay do not have to identify EVs and WQOs for receiving waters. Proposals for these developments need to demonstrate achievement of best management practices for the type of pollutants that are likely to be generated.

Developments in Mackay considered a 'high risk' in relation to impacts on stormwater quality require the identification of EVs and WQOs for receiving waters within and/or downstream of the development. Proposals for these developments need to demonstrate that stormwater draining from the site will not threaten the relevant environmental values and their corresponding water quality objectives, in affected receiving waters through the use of appropriate SQBMPs.

2.3 Stormwater Quality Best Management Practices(SQBMP)

Stormwater Quality Best Management Practices is a term given to a collection of practices and devices that improve stormwater quality through the prevention, minimisation and/or trapping of pollutants. They include non-structural and structural controls as described below:

(a) **Non Structural Source Controls**

Community awareness (education) programs
Enforcement on littering and ESC on construction sites
Incentives for adopting innovation in SQBMP
Street cleaning
Rehabilitating, expanding and protecting buffer zones
Environmental awareness message on stormwater inlet structures

(b) **Structural Source controls (or Stormwater Quality Improvement Devices, SQIDs)**

(i) ***Primary practices/devices*** **–** remove gross pollutants and coarse sediment

In-ground GPT
Oil/grit Separators
Sediment Traps
Litter and trash racks
Downwardly inclined screens
Floating litter booms
End of pipe litter nets
Litter baskets
Side entry traps or gully pit gross pollutant traps

(ii) ***Secondary practices/devices*** – remove sediments, with partial removal of heavy metals and bacteria.

Filter strips
Grass swales
Sand/Bioretention Filters
Infiltration trench/basin
Porous pavements
Detention Basins (Dry)

(III) ***Tertiary practices/devices*** – remove nutrients, bacteria, fine sediments and heavy metals.

Water Quality Ponds (with pre-treatment***)***
Constructed Wetlands

The design of structural source controls or SQIDs should be prepared in accordance with the reference and source documents contained in 1.4.

2.4 Process for Identification of EVs and WQOs

General

This section explains how applicants can identify and apply relevant environmental values (EVs) and water quality objectives (WQOs) in receiving waters within or outside their proposed development in order to comply with Council's Stormwater Quality Management Plan for Mackay Urban Areas and the EPP Water (1997).

The hierarchy of WQOs to be used as performance objectives for proposed developments can be summarised as:

(a) Objectives derived from Schedule 1 of the Environmental Protection (Water) Policy 1997 (highest status);

(b) Objectives derived from site specific scientific investigations, ie. as part of the development's environmental impact assessment process;

(c) Objectives derived from regional water quality studies, Catchment Management Plans, Stormwater Management Plans and Waterways Management Plans;

(d) Council's water quality objectives for the city's waterways as identified in the Stormwater Quality Management Plan; and

(e) Plans and Waterways Management Plans; Objectives derived from using the current Australian National Water Quality Guidelines to convert environmental values into numerical objectives, where values have been determined from a limited consultation exercise (lowest status).

Identifying and Receiving Waters and Catchment

Identify the receiving waters immediately outside or within the proposed development. This may be a creek, river, lake, wetland, estuary, or other waterway. Where the immediate receiving environment consists of an overland flow path or constructed drainage networks, the receiving water is to be taken as the nearest affected waterway, eg. creek or river.

The receiving waters can include groundwaters. If groundwater is used in the area, and could be contaminated by the proposed development, the Department of Natural Resources and Mines should be consulted to identify relevant environmental values and water quality objectives.

Identify Environmental Values and Water Quality Objectives

In order to identify the environmental values and water quality objectives for the receiving waters, reference should firstly be made to:

- Mackay Urban Stormwater Quality Management Plan or, if prepared, the relevant Catchment Management Plan, Stormwater Management Plan or Waterway Management Plan.
- Schedule 1 of the Environmental Protection (Water) Policy 1997. This schedule should be checked to ensure that there are no 'higher' objectives set for the receiving water.
- Site-specific water quality and ecological studies can be undertaken by the applicant to derive local receiving water quality objectives. If this option is chosen, the applicant is required to construct a scientifically rigorous case which demonstrates why the proposed objectives are superior to those already identified. The applicant may be required to consult with relevant regulatory authorities and key stakeholders in order to identify appropriate environmental values for the receiving waters.

Process for Determining Site Specific Discharge Limits

Once receiving water quality objectives have been identified for the proposed development, there are several options to derive discharge limits for the quality of stormwater leaving the site:

(a) Use the receiving waterbody's water quality objectives as discharge limits for the stormwater leaving the site, eg. if the receiving waters must have a pH above 6.5 and below 8.5, so must the stormwater flowing from the site. Special consideration is allowed for the quality of stormwater leaving the site in association with a major storm event as water quality objectives are usually defined as an upper limit (or range) that a water quality data set's median value must fall below (or within).

(b) If existing stormwater systems discharge into the development, the water quality objectives need to be amended to consider the effects of upstream water quality on water quality discharging from the site.

(c) Council may allow the discharge limit for the quality of stormwater leaving the site to exceed the receiving waterbody's water quality objectives, if the applicant can demonstrate with the assistance of ambient water quality monitoring, environmental assessments, pollutant export modelling and/or receiving water modelling that water quality objectives in the nearest affected receiving water will be met.

If the prescribed WQOs are considered unattainable, the designer may request that Council consider alternative objectives. The request will only be considered if a scientifically rigorous case is submitted outlining:

- Details of why the WQOs are unattainable
- Details of the proposed rates of pollutant reduction, and
- Justification of the proposed rates of pollutant reduction

Selection of Key Performance Indicators

Key stormwater performance indicators need to be identified for differing types of development as:

(a) different types of development have differing waterborne pollutants which may be exported from a site; and

(b) the environmental value of a waterway may also be sensitive to particular waterborne pollutants.

Table 7-1 outlines the minimum key performance indicators that need to be included in the water quality objectives for particular development types. If the aquatic environment of the receiving waters is considered to be sensitive to other water quality parameters, additional key indicators may need to be considered when developing the water quality objectives.

Table 7-1 Minimum key indicators to be evaluated for particular development types

Development Type	Minimum key performance indicators
Subdivision	Suspended solids (sediment)
	Nutrients (Total Nitrogen & Total Phosphorus)
	Litter
	Hydrocarbons (during construction)
Residential Development	Nutrients (Total Nitrogen & Total Phosphorus)
Townhouse Development	Nutrients (Total Nitrogen & Total Phosphorus)
	Surfactants
Industrial & Commercial Development *	Suspended solids (sediment)
	Nutrients (Total Nitrogen & Total Phosphorus)
	Litter
Service Stations	Hydrocarbons (including oil and grease)
	Metals
	Litter
Carparks	Suspended Solids (Sediment)
	Metals
	Hydrocarbons (including oil and grease)
	Litter
Acid sulfate soil related activities Eg. development in areas known to host acid sulfate soils	pH levels Metals

***** Other indicators that may need to be included, depending on the Industrial & Commercial development type include:

- Heavy Metals
- Pathogens/Faecal Coliforms
- Thermal Pollution (heat)
- pH
- Organochlorines and organophosphates
- Surfactants
- Oxygen demanding substances (organic and chemical matter)

3 EROSION AND SEDIMENT CONTROL

3.1 Erosion and Sediment Control Principles

The principles for effective erosion and sediment control are:

(a) Minimise the extent and duration of soil disturbance

(b) Control the location and velocity of drainage flow during the construction phase.

(c) Minimise soil erosion initiated by wind, rain or concentrated flow.

(d) Minimise sediment runoff from the site.

(e) Promptly revegetate or stabilise all exposed and or unstable soil surfaces.

(f) Adequately install, operate and maintain all ESC measures.

(g) Develop an Erosion and Sediment Control Program (ESC Program) and amend the program to minimise environmental harm.

3.2 Erosion and Sediment Control Measures

The following list contains control measures that can minimise drainage, erosion and sediment control issues. When these measures are implemented appropriately, the effects of soil erosion and sediment dispersion may be significantly decreased when compared to development without these control measures.

(a) **Drainage Control Techniques**
Water diversion channels/structures
Temporary and permanent waterway crossings
Energy dissipators and outlet protection
Check dams
Chutes and drop pipes
Grassed channels
Level spreaders
Reinforced grassed channels
Rock and concrete lined channels and protection\Sediment basin spillways
Sediment basin spillways
Vegetative cover

(b) **Erosion Control Techniques**
Ground covers
Mulching and seeding
Erosion control blankets/mats
Surface roughening
Vegetation/revegetation
Chemical surface stabilisers
Soil-cement treatment
Geosynthetic lined channels
Control of wind erosion
Turfing
Vegetation logs and mats

(c) **Sediment Control Techniques**

Entry/exit pads
Grass filter strips and buffer zones
Stockpile protection
Grass swales
Dewatering Activities
Sand filters
Infiltration trench/basin
Water quality ponds and Constructed wetlands
Control of wind erosion
Sediment fences
Rock filter dams
Sediment basins, ponds and weirs
Gross pollutant traps

The designer is encouraged to refer to the Reference and Source Documents listed in sub-clause 1.4(d) for assistance in the design of ESC measure listed above.

4 ACID SULFATE SOILS

4.1 Acid Sulfate Soils Management

Acid Sulfate Soils (ASS) can have major environmental, economic, engineering, and health impacts that may provide constraints to activities in coastal areas. Acid sulfate soils, if oxidised (through exposure of the pyrite to air), produce sulfuric acid that can result in soil and groundwater/surface waters becoming acidic. Exposure to ASS can occur naturally, through soil disturbance or from lowering of the water table.

If managed inappropriately the acid generated can corrode steel and concrete and release toxic levels of aluminium, iron, and heavy metals from the breakdown of clays and silts. Toxic levels of these metals combined with acid conditions, pose a significant risk to vegetation, concrete and steel infrastructure, and aquatic organisms.

In coastal situations, proposals that involve earthworks or disturbances to hydrology/drainage patterns must consider ASS. Any development that alters the existing conditions of ASS can trigger the oxidation of iron sulfides. The potential risk to the environment must be quantified, and management techniques proposed to mitigate the environmental impacts associated with the proposed activity both on and off the site.

Where disturbances of ASS is unavoidable, preferred management strategies are:

- Minimisation of disturbance;
- Neutralisation;
- Hydraulic separation of sulfides, either on its own or in conjunction with dredging;
- Strategic re-burial (reinterment); and
- Other management measures may be considered, but may pose increasingly higher or even unacceptably high risks.

A detailed assessment of the site is an essential prerequisite before deciding on a management approach. There are many options for managing, handling and treating actual and potential acid sulfate soils. The Soil Management Guidelines (NRM, 2002) in the *Queensland Acid Sulfate Soil Technical Manual* documents risk based management procedures for ASS and provides guidance on how to achieve best practice environmental management (BPEM).

5 DOCUMENTATION

5.1 Site Based Stormwater Management Plan

A Site Based Stormwater Management Plan (SBSMP) identifies stormwater management strategies and actions to address:

(a) Water quality;

(b) Water quantity; and

(c) Waterway corridor issues.

The contents of the SBSMP are dependent on the stage of development (concept or detailed design) and the level of risk for the proposed development ('low' or 'high').

The SBSMP should contain sufficient detail to determine whether the stormwater controls are acceptable. An example of the contents of a SBSMP is described below.

All drawings and documentation to be submitted to Council for approval shall conform to the requirements of Council's Guideline D20 - *Drawings and Documentation*. A copy of these Guidelines will be made available on request.

Failure to comply with Council's *Drawings and Documentation Guidelines* may result in the drawings and/or documentation being returned to the designer without consideration by Council.

Table of Contents (General)		Low Risk	High Risk
1.0	**Introduction**		
	Proposed Development	✓	✓
	Risk Assessment	✓	✓
	Study Team	✓	✓
2.0	**Site Description**		
	Location	✓	✓
	Land Use (existing and proposed on-site and surrounding landuses	✓	✓
	Topography and Drainage	✓	✓
	Soils	✓	✓
	Watercourses	✓	✓
	Flora and Fauna	✓	✓
3.0	**Data**		
	Existing stormwater infrastructure	✓	✓
	Related studies/plans such as Catchment Management Plans, Waterway Management Plans, Stormwater Management Plans	✓	✓
	Hydrologic and Hydraulic needs/wants	x	✓
	Water Quality/Stream Health Data	x	✓
4.0	**Opportunities and Constraints**		
	Key site characteristics	✓	✓
	Previous Studies/Plans	✓	✓
	Key Stakeholder's needs/wants	x	✓
	Parkland contributions (if required)	✓	✓
5.0	**Stormwater Quantity (Hydrology & Hydraulics)**		
	Existing conditions	✓	✓
	Methodology	✓	✓
	Model Analysis	x	✓
	Comparison of existing and proposed hydrology and hydraulics eg. catchments, flows and flood levels	✓	✓
	Designs Drawings	✓	✓
	Proposed Mitigation Measures	✓	✓
6.0	**Stormwater Quality**		
	Pollutants of Concern	✓	✓
	Receiving Waters	✓	✓
	Identification of Environmental Values and Water Quality Objectives	x	✓
	Methodology	✓	✓
	Model Analysis	x	✓
	Impact of Development	✓ qualitative	✓
	Proposed Management Strategies	✓	✓
7.0	**Stormwater Management Options**		
	Selection and Assessment of Stormwater Quantity Controls	✓	✓
	Selection and Assessment of Stormwater Quality Controls	✓	✓
	Integration with Waterway Corridor	✓	✓
	Stormwater Management Strategy including Actions, Responsibilities and Program	✓	✓
8.0	**Cost Assessment**		
	Capital Cost of Proposed Strategy	✓	✓
	Maintenance Cost of proposed Strategy'	✓	✓
	Asset Life of Proposed Strategy	✓	✓
	Lifecycle Cost of Proposed Strategy	✓	✓
9.0	**Water Quality Monitoring Program**		
	Proposed Program	x	✓
10.0	**Maintenance Plans**		
	Responsibilities for Maintenance of structural controls	x	✓
11.0	**Asset Handover**		
	Process and timing for Asset Handover to Council	x	✓
12.0	**References**	x	✓

5.2 Erosion and Sediment Control Program

An erosion and Sediment Control Program (ESC Program) is a set of documents including:

- Erosion and Sediment Control Plans (ESC Management Plan);
- Supporting documentation; and
- Specification and construction details.

The supporting documentation for an ESC Program may include:

- Design standards used for ESC Measures;
- Calculations for the sizing of various ESC measures, particularly sediment basins;
- Proposed construction staging;
- Proposed ESC installation sequence.

It is envisaged that a brief description of the site and major site issues and concerns would be highlighted in the SBSMP.

ESC specifications typically cover:

(a) Materials used in construction of ESC measures
(b) Construction or installation procedures
(c) Operational requirements
(d) Inspection and maintenance requirements
(e) Procedures for removal of ESC measures and site rehabilitation.

5.3 Erosion and Sediment Control Management Plans

Erosion and Sediment Control Management Plans shall be scaled drawings (no larger than 1:1000) with detailed specifications/diagrams which can be readily understood and applied on site by supervisory staff. All Drawings shall be in accordance with the minimum drafting requirements in D20 – Drawing and Documentation Guidelines.

Items to be included on the ESC Management Plan but not limited to, shall be:

- Limits of disturbance such as proposed vegetated buffer strips, vegetation, retention and "no access" areas
- Location of critical areas (vegetated buffer strips, drainage lines and structures, water bodies, unstable slopes, flood plains and seasonally wet areas)
- Location and description of existing vegetation
- Soil types
- Location of access haulage tracks and borrow pits
- Location of temporary drainage, erosion and sediment control measures
- Construction details for erosion and sediment control measures
- Notes relating to:
  - Site preparation
  - ESC measures
  - Procedures for maintenance of ESC measures
  - Details for staging of works
  - Revegetation requirements

5.4 Site Based Acid Sulfate Soils Management Plan

A Site Based Acid Sulfate Soils Management Plan (SBASSMP) is to be prepared to address the management of ASS where required by SPP 2/02. The information to be included in the SBASSMP is outlined in Appendix 4 of SPP Guideline 2/02.