Asset Management Plan

Flood Mitigation Drainage Structures

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1. EXECUTIVE SUMMARY

In the early 1970s a system of Flood Mitigation Drains, Levee Banks, Flood Gates and Bridges was constructed on the Shoalhaven River floodplain to assist in the control of flood waters and tidal inundation of the surrounding land. Council is committed to maintaining the flood mitigation system to a high standard and in a manner that protects the community, the environment, assets and productive agricultural land from inundation, this in partnership with landowners and relevant State Government Agencies.

For this reason, Council has recently engaged expert consultants to develop remediation plans of key prioritised assets. The remediation plan will seek to maintain or improve the services delivered by the assets whilst improving their environmental impacts. The remediation plans will inform the review of this AMP.

1.1. The Purpose of the Plan

The purpose of an Asset Management Plan (AMP) is to manage assets based on data research and investigation, which determines how assets are to be managed in a sustainable and effective method.

AMP is used to demonstrate how Council's assets are managed based on past and present information to create sustainable and reliable future planning. AMP will be the basic source for decisions of renewal, replacement or demolition of an asset.
It is also a plan to ensure that acquired assets support and meet the strategic and annual objectives of the organisation and that the cost of providing the service to the community does not outweigh the benefits.

AMP is fundamental to achieve key elements of asset management, the foundation of the Plan includes:

- Defining levels of service (LoS) – specifies services and the levels to be provided by Council for each asset type
- Condition assessment – specifies the technical tools used to assess the condition of each asset
- Life cycle management – how Council will manage its existing and future assets to provide the required services
- Financial summary – what funds are required to provide the required services
- Asset management practices – how the organisation will manage its assets and the tools used to accomplish this
- Monitoring – how the plan will be monitored to ensure it is meeting Council's objectives
- Asset Management Improvement Plan

The desirable situation is that the annual capital works and maintenance programs need to allocate sufficient resources to ensure these objectives are obtained.

1.2. Asset Description

Flood mitigation assets include:

- Flood mitigation drains
- Levee banks
- Flood gates
- Weirs
- Bridges over flood mitigation drains

1.3. Levels of Service

The preferred internal service provider, the Works and Services Section of the Assets and Works Group, will undertake all maintenance activities under the Service Agreement for Flood Mitigation Drainage Structures.

Service delivery under the Service Agreement will be monitored by unit cost of repairs, random audits of quality and achievement of specified annual repair quantity.

1.4. Future Demand

Factors affecting demand include, but are not limited to, population change, changes in demographics, seasonal factors, vehicle ownership, consumer preferences and expectations, economic factors, agricultural practices and environmental awareness.

1.5. Lifecycle Management Plan

Management of flood mitigation drainage structures relates particularly to the maintenance and renewal stages of asset life. After construction phase, it moves into what is known as the “Maintain” phase. Maintenance activities are required to minimise continued deterioration of an asset. As the asset components move towards the end of their life, activities are undertaken to restore the asset to a condition close to that of the original. This is referred to as the “Renewal” phase.

The importance of the time for intervention for renewal is paramount. If renewal activities are not undertaken in a timely manner, the condition of the asset will deteriorate rapidly to failure, and the cost of reconstruction may be many times that of renewal activities.

1.6. Financial Summary

The level of funding available is sufficient to continue with the existing maintenance regime. Work currently in progress to develop remediation plans for 19 key priorities sites, which will inform future capital works and maintenance programs.

1.7. Asset Management Practices

All flood mitigation assets are maintained in accordance with the Routine Maintenance Schedule 1, of Council's Service Agreement for Flood Mitigation Drainage Structures. Annual programmed maintenance schedules are prepared from routine condition/defect inspections of all assets. Defects are prioritised over a 1 to 5 year period and assigned an estimated cost of rectification. Emergency response works are also carried out under the service agreement.

An ideal Asset Management Practice should be reflective of strong governance and accountability; more sustainable decisions, enhanced customer service, effective risk management; and improved financial efficiency.

1.8. Monitoring and Improvement Programme

AMP are dynamic documents, reflecting and responding to changes over time and in accordance with the Improvement Programme available. Monitoring of an AMP is required to ensure compliance with the proposed improvement program milestone and to ensure compliance with adopted standards and procedures for condition and performance.

Ideally, full review of AMP should be undertaken every three to five years to document progress and set out proposals for the next ten to fifteen years.

It is anticipated that a full review of this AMP and associated Service Level Agreement will be undertaken by end of 2014 in order to reflect the outcomes of the work currently being undertaken by expert consultants.

2. INTRODUCTION

2.1. Background

This Asset Management Plan (AMP) is written to assist Council in meeting its goals and objectives in a way that best serves the community. It provides a framework for the future management of Flood Mitigation Drainage Structures within the Council area based on current and historical information.

Council has approximately thirty (30) Asset Management Plans which are divided based on individual asset types. An area, such as a sporting complex may consist of a few asset types. Therefore, each AMP interrelates with one another.

AMPs are positioned within Council's organisation chart to link with corporate and operational objectives as shown below:

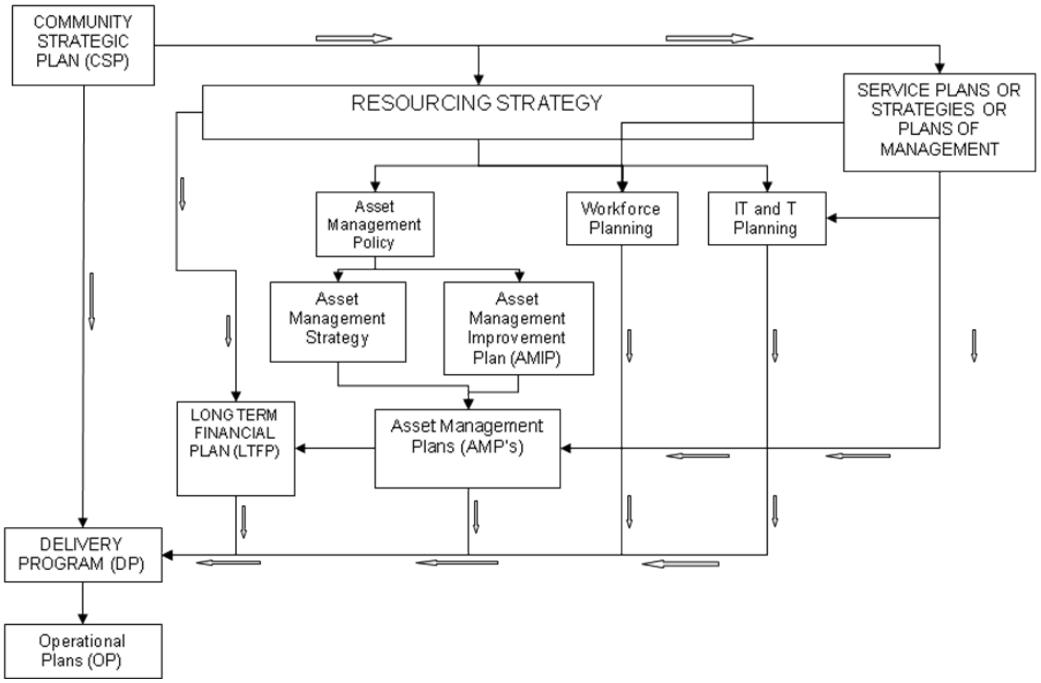


Diagram 1: SCC Organisational Operational Chart

2.2. Goals and Objectives of Asset Ownership

Council exists to provide services to its community. Some of these services are provided by infrastructure assets. Council acquires infrastructure assets by 'purchase', by contract, through its construction programsor by donation of assets constructed by developers and others to meet increased levels of service.

Our goal in managing infrastructure assets is to meet the defined level of service (as amended from time to time) in the most cost effective manner for present and future consumers. The key elements of infrastructure asset management are:

- Providing a defined Level of Service (LoS) and monitoring performance,
- Managing the impact of growth through demand management and infrastructure investment,
- Taking a lifecycle approach to developing cost-effective management strategies for the long-term that meet the defined LoS,
- Identifying, assessing and appropriately controlling risks, and
- Having a Long Term Financial Plan (LTFP) which identifies required, affordable expenditure and how it will be financed.

Council is committed to providing safe and efficient facilities, within realistic financial constraints, with the main objectives being as outlined in the strategy, specifically to:

- Improve safety
- Maintain flood mitigation drainage structures at a reasonable "level of service (LoS)"
- Plan for future development
- Develop strategies for the rationalisation of various flood mitigation drainage structures
- Plan for major work to facilities

Council is also committed to ensuring that the facilities provided are maintained to a standard to suit their purposeby ensuring available resources are effectively applied. It is recognised that it is neither reasonable nor practical to target zero defects.
However, the objective is to have an acceptable level of defects and none that affect customer health and safety or facilities' structural integrity. This is achieved through preventative maintenance.
The desirable situation is that the annual capital works and maintenance programs need to allocate sufficient resources to ensure these objectives are obtained.

Council's Vision

> We will work together in the Shoalhaven to foster a safe and attractive community for people to live, work, stay and play; where sustainable growth, development and environmental protection are managed to provide a unique and relaxed lifestyle.

(adopted by Council, 21 May 2013)

Council's Mission

> To enhance Shoalhaven's strong communities, natural, rural and built environments and appropriate economic activities through strategic leadership, effective management, community engagement and innovative use of resources.

(adopted by Council, 21 May 2013)

2.3. Plan Framework

The key elements that affect this AMP are:

Asset Management Policy

> The policy is used as a base of principles and requirements to create an AMP that is in accordance with the organisation's strategic plan (International Infrastructure Management Manual, 2011).

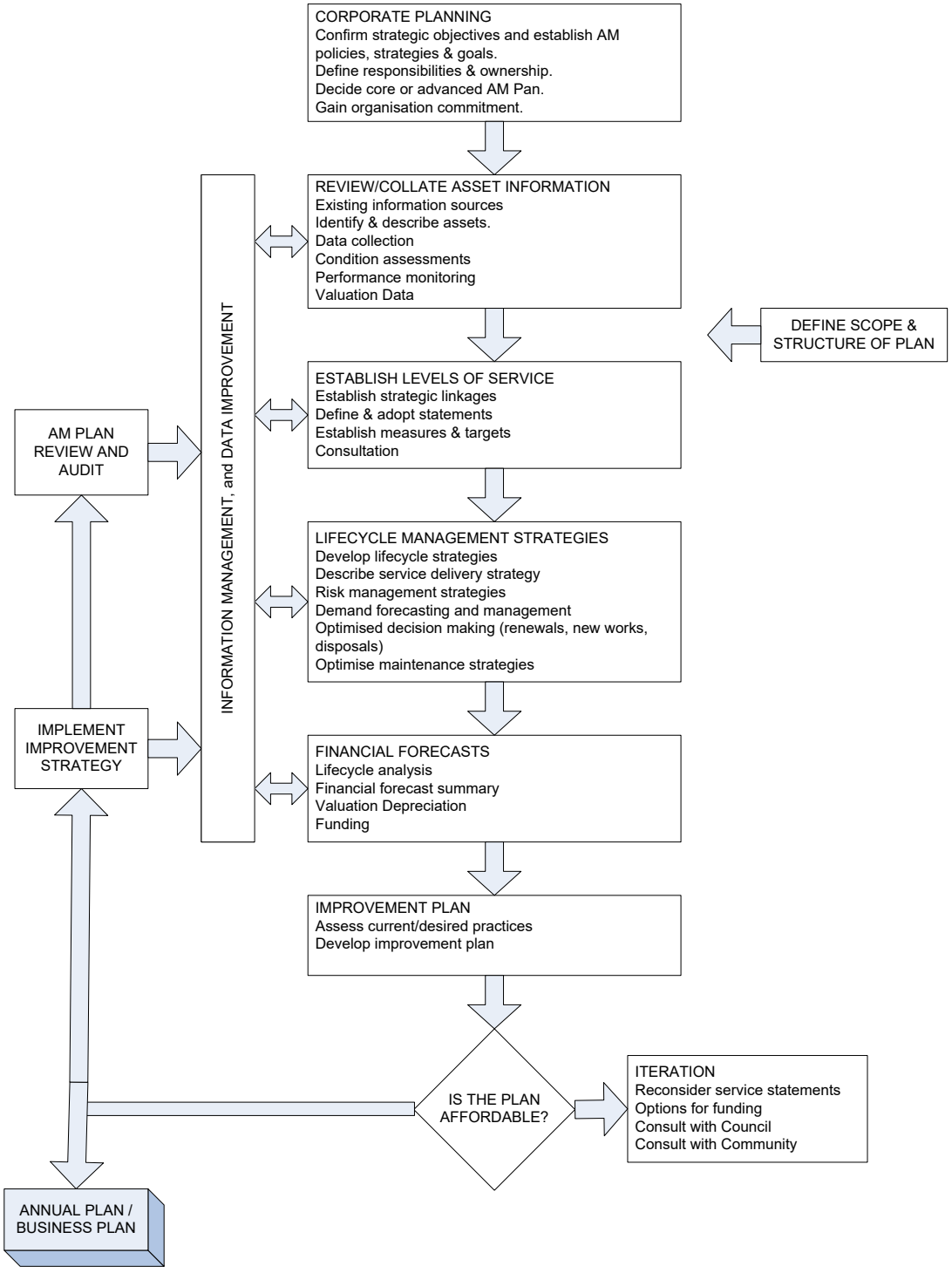
Asset Management Strategy

> A strategy for asset management covering development and implementation of plans and programs for asset creation, operation, maintenance, rehabilitation/replacement, disposal and performance monitoring to ensure a desired level of service and other operational objectives are achieved at optimum cost.

The basic key elements of the AMP consist of:

- Level of service (LoS) – specifying the services and levels of service to be provided by Council
- Future demand – how this will impact on future service delivery and how this is to be met
- Life cycle management – how Council will manage its existing and future assets to provide the required services
- Financial summary – what funds are required services
- Plan Improvement and Monitoring – how the plan will be monitored to ensure it is meeting Council's objectives

A road map for preparing an asset management plan is shown below:



Road Map for preparing an Asset Management Plan
Source: IPWEA, 2006, IIMM, Fig 1.5.1, p 1.11.

2.4. Core and Advanced AM

An Asset Management Plan is a document that will require ongoing evaluation. Currently, the level of this AMP is at the minimum level which contains basic information on assets and financial forecasts.

3. LEVELS OF SERVICE

3.1. Customer Research and Expectations

Most flood mitigation assets are located on private farm land. The property owners generally assist Council in monitoring the satisfactory operation of flood mitigation drains and gates and inform Council when urgent works are required. Consultation with the land owners also occurs during routine inspections and maintenance works.

3.2. Strategic and Corporate Goals

The AMP provides clear guidelines for the effective management of the assets owned and managed by Council. Local Authorities exist principally to supply core services that meet the needs of their communities.

Council's goal in managing assets is to meet the required level of service in a sustainable manner for present and future stakeholders. The key elements to strategic goals of asset management are:

- Demonstrating responsible stewardship;
- Taking a life cycle approach to asset ownership;
- Defining the infrastructure assets physically and financially;
- Providing a defined Level of Service and monitoring the performance against service levels and service expectations;
- Understanding and meeting the demands of growth through demand management and infrastructure investment;
- Managing risks associated with asset failure; and
- Support long term financial planning.

Council's objective is to ensure financial strategies underpin its asset management policies and strategies. Its goal is to have long term vision for sustainability. In order to do so, Council prepares and reviews its short and medium term financial plans for Risk Management; Plant & Equipment, Information Technology, Section 94; Asset Management Plans and case reverses.

Acting as a leader in the delivery of social, financial, environmental, and operational objectives, Council needs to ensure it demonstrates good governance and administrative support for the community.

Council's other goals are to plan, manage and fund its public assets to meet community expectations and defined levels of service. Furthermore, the safety of the community is paramount and is acknowledged and supported through proactive policies, programs and strategies.

3.3. Legislative Requirements

Table 2: Lists of legislation requirements

Legislation	Requirement
National Asset Management Framework Legislation 2010	Focuses on long term financial sustainability and provides a mandate to have a long term strategy, financial statements and annual reporting mechanisms.
DLG Integrated Planning NSW	Key requirement is to integrated community plans with operational and delivery plans
Local Government Act 1993	Sets out role, purpose, responsibilities and powers of local governments including the preparation of a long term financial plan supported by asset management plans for sustainable service delivery
Work Health and Safety Act 2011	Aims to secure the health, safety and welfare of people at work. It lays down general requirements which must be met at places of work in New South Wales. The provisions of the Act cover every place of work in New South Wales. The Act covers self employed people as well as employees, employers, students, contractors and other visitors.
Occupational Health and Safety Regulation 2001	Regulations on the control and management or risk in the work place
The Protection of the Environment Operations Act 1997 (POEO Act)	Is the key piece of environment protection legislation administered by Department of the Environment and Climate Change (DECC). The POEO Act enables the Government to set out explicit protection of the environment policies (PEPs) and adopt more innovative approaches to reducing pollution.
Disability Discrimination Act	Sets out responsibilities of Council and staff in dealing with access and use of public infrastructure
Australian Accounting Standards	Sets out the financial reporting standards relating to infrastructure assets. Standards of particular relevane to Infrastructure Assets include:
	AASB116 Property, Plant & Equipment - prescribes requirement for recognition and depreciation of property, plant and equipment assets
	AASB136 Impairment of Assets - aims to ensure that assets are carried at amounts that are not in excess of their recoverable amounts
	AASB1021 Depreciation of Non-Current Assets - specifies how depreciation is to be calculated
	AAS1001 Accounting Policies - specifies the policies that Council is to have for recognition of assets and depreciation
	AASB1041 Accounting for the reduction of Non-Current Assets - specifies the frequency and basis of calculation depreciation and revaluation basis used for assets
	AAS1015 Accounting for acquistion of assets - method of allocating the value to new assets on acquistion
Crown Lands Act 1989	Defined principles for the use and management of Crown land which may be under Trust to Council, they may prescribe:
	Lease & licences of Crown Lands (Part 4, Division 3 & 4); and
	Plans of Management for Crown Lands (Part 5, Division 6)
AS 3600-2001 Concrete Structures	Proposes a set of standard for achieving a design life of 40-60 years for concrete structures.

3.4. Current Level of Service

Community Levels of Service - relate to how the community receives or derives benefit from the service of each asset in terms of safety, quality, quantity, reliability and responsiveness.
Supporting the community levels of service are operational or technical measures of service developed to ensure that the minimum community levels of service are met. These technical levels of service may relate to cost/efficiency and legislative compliance.

Community levels of service measures used in the asset management plan are:

Quality	How good is the service?
Function	Does it meet users' needs?
Capacity/Utilisation	Is the service over or under used?

Technical Levels of Service - Supporting the community service levels are operational or technical measures of performance. These technical measures relate to the allocation of resources to service activities that the organisation undertakes to best achieve the desired community outcomes and demonstrate effective organisational performance.

Technical service measures are linked to annual budgets covering:

- Operations – the regular activities to provide services such as opening hours, cleansing frequency, mowing frequency, etc.
- Maintenance – the activities necessary to retain an assets as near as practicable to an appropriate service condition (eg road patching, unsealed road grading, building and structure repairs),
- Renewal – the activities that return the service capability of an asset up to that which it had originally (eg frequency and cost of road resurfacing and pavement reconstruction, pipeline replacement and building component replacement),
- Upgrade – the activities to provide a higher level of service (eg widening a road, sealing an unsealed road, replacing a pipeline with a larger size) or a new service that did not exist previously (eg a new library).

3.5. Desired Level of Service

At present, indications of meeting or understanding the desired Levels of Service are gathered from various sources including meetings and consultations with Management Committees.
The main framework of desired Level of Service is stated as follows:

- Service attributes : Aspects or characteristic of a service which includes accessibility, cost, efficiency, quality, quantity, reliability, responsiveness and safety
- Levels of Service : What Council intends to deliver that is based on the community's point of view
- Community performance measure : How the community receives or reacts to the service
- Technical Performance Measure : What Council does to deliver the service, which includes operation and maintenance

(IPWEA, International Infrastructure Management Manual, 2011)

The action that has been undertaken is a survey to the community and data research to determine desired level of service. The data collected are synchronized with the performance measure to achieve a reliable performance based on concrete information.

4. FUTURE DEMANDS

4.1. Demand Drivers

A program of retrofitting some flood gates with automatic opening and closing mechanisms (Smart Gates), activated by telemetric data from upstream water level recorders, has been a recent enhancement of the flood mitigation system. The program is a new initiative, seen to be at the cutting edge of technology, and is a joint effort of the Wollongong University and the Shoalhaven City Council with funding support coming from the New South Wales state government under a program of reducing acid sulphate contamination of soils in the Shoalhaven floodplain.

The current program and has not been funded from Council's budget and it is expected that any future enhancement programs will be funded from external sources.

4.2. Demand Forecasts

Any enhancements of the existing facilities would need to be justified in relation to upgrading existing facilities which would provide an increase in the "level of service" rather than a maintenance activity which would prolong useful life of the facilities.

Factors affecting demand for flood mitigation drainage structures include population growth and density; changes in demographics; seasonal factors; social and economic factors; environmental awareness and technological changes.

4.3. Demand Impacts on Assets

Demands are usually impacted by a number of components which includes:

- Population or demographic changes
- Changes in community's expectation
- Changes in usage pattern
- Seasonal variation
- Cyclical variations
- Random variations which cannot be attributed to specific causes

Effective asset utilisation seeks to provide the maximum return on funds invested in assets. Over-utilisation can cause failure to achieve levels of service due to asset 'capacity failure'. Under-utilisation of an asset is also a 'capacity failure' and represents a lack of demand for the service the asset provides causing a less than cost effective level of utilisation. (International Infrastructure Management Manual, 2011)

4.4. Demand Management Plan

Strategies for ensuring that assets are well utilised include:

- Effective demand forecasting before creating new assets, to ensure asset capacity and demand requirements are matched
- Maximising the asset utilisation by providing other assets to meet the demand or operational asset solutions to improve overall asset capacity and hydraulic performance
- Management of customer demand, to reduce demand for over-utilised assets or vice versa

(International Infrastructure Management Manual, 2011)

Demand for new and enhanced services will be managed through a combination of managing existing assets, upgrading existing assets and providing new assets to meet demand and demand management. Demand management practice including non-asset solutions, insuring against risks and managing failures.

The planning for infrastructure due to demand is a constant process of review and assessment of existing infrastructure and its ability to cope with increasing demand, versus the need to augment with new infrastructure.

Demand on infrastructure is created through increased utilisation generated from a growing population and changing patterns of behaviour, ranging from social demographics to transport options and solutions. Often this increasing demand will stem from urban or residential growth increasing the utilisation of a range of community infrastructure.

Council develops strategies for demand management on single or groups of affected assets and continues to manage the relationship between existing and new asset requirements in the context of asset management. This demand management also includes asset rationalisation as discussed in this plan.

4.5. Asset Programmes to Meet Demand

There are no asset programmes to meet demand for this asset.

5. LIFECYCLE MANAGEMENT PLAN

5.1. Background Data

5.1.1. Physical Parameters

As at 30th June 2005 the flood mitigation system consisted of; 50 Flood mitigation drains (total length of 48.5km), 9 Levee banks (total length of 23.5km), 60 Flood gates, 3 Weirs and 14 Bridges. A list of flood mitigation assets is included in the Service Agreement at Attachment 1.

5.1.2. Asset Capacity / Performance

The flood mitigation drainage structures can be broadly categorised under two types based on the services they deliver and the risk they would pose to the community if they were to fail.

Category 1 - critical flood mitigation structures. These structures provide **public** flood risk mitigation benefits – These structures comprise the flood levees, floodgates and drains located at Terara, Riverview Road and Scenic Drive.

Category 2 - less significant flood mitigation drainage structures. These structures mainly provide agricultural benefits.

5.1.3. Asset Condition

The following tables indicate the overall condition of each type of flood mitigation asset:

Table 3. Condition of overall flood mitigation drainage structure 2013

FLOOD MITIGATION DRAINS	NUMBER	%
1. As New Condition		0
2. Good (Minor Deterioration)	46	85.19%
3. Fair Condition	8	14.81%
4. Poor Condition		0
5. Failed (Due for Replacement)		0

LEVEE BANKS	NUMBER	%
1. As New Condition		0
2. Good (Minor Deterioration)		0
3. Fair Condition	8	80%
4. Poor Condition	2	20%
5. Failed (Due for Replacement)		0

FLOOD GATES	NUMBER	%
1. As New Condition	7	11.30%
2. Good (Minor Deterioration)	35	56.45%
3. Fair Condition	12	19.35%
4. Poor Condition	5	8.06%
5. Failed (Due for Replacement)	3	4.84%

WEIRS	NUMBER	%
1. As New Condition		0
2. Good (Minor Deterioration)		0
3. Fair Condition	3	100%
4. Poor Condition		0
5. Failed (Due for Replacement)		0

FLOOD MITIGATION BRIDGES	NUMBER	%
1. As New Condition		0
2. Good (Minor Deterioration)		0
3. Fair Condition	14	100%

4. Poor Condition		0
5. Failed (Due for Replacement)		0

Condition/defect inspections of all flood mitigation assets are carried out annually in accordance with Council's Service Agreement for Flood Mitigation Drainage Structures, Section 9, to ensure that the assets are operating satisfactorily. A copy of the Service Agreement is included at Attachment A.

As a result of major maintenance works carried out in the last few years 79% of overall flood mitigation assets are rated as 'Good' or better condition.

5.1.4. Asset Valuations

The New South Wales Local Government Asset Accounting Manual indicates that useful lives of flood control structures, drains and levee banks are around one hundred (100) years and around eighty (80) years for bridges. Allowing for satisfactory continuation of Council's annual maintenance programmes including major maintenance of levee banks and refurbishment of structural and mechanical components of bridges, gates and weirs, replacement of these assets should not be required until around 2050.

5.1.5. Historical Data

Table 4. Year created of Flood Mitigation Drainage Structures

Asset Description	Location	Asset ID	Year Created
Bridge-P1D1cB1-Flood Mitigation-Worrigee	Worrigee Swamp	48997	31/12/1973
Bridge-P1D1B1-Flood Mitigation-Worrigee	Worrigee Swamp	48998	31/12/1973
Bridge-P2D1B1-Flood Mitigation-Terara	Terara Swamp	48999	31/12/1973
Bridge-P2D2B1-Flood Mitigation-Terara	Terara Swamp	49000	31/12/1973
Bridge-P3D7B1-Flood Mitigation-Jorams Creek	Jorams Creek Drainage	49001	31/12/1973
Bridge-P3D8B1-Flood Mitigation-Jorams Creek	Jorams Creek Drainage	49002	31/12/1973
Bridge-P4D1B1-Flood Mitigation-Bolong	Bolong Area	49003	31/12/1973
Bridge-P4D1B2-Flood Mitigation-Bolong	Bolong Area	49004	31/12/1973
Bridge-P5D1B1-Flood Mitigation-Numbaa	Numbaa Area	49006	31/12/1973
Bridge-P5D2B1-Flood Mitigation-Numbaa	Numbaa Area	49007	31/12/1973
Bridge-P6D1B1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	49014	31/12/1973
Bridge-P6D2B1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	49010	31/12/1973
Bridge-P6D8aB1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	49011	31/12/1973
Bridge-P9D1B1-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	49015	31/12/1973

Asset Description	Location	Asset ID	Year Created
Drain P1D1a-Flood Mitigation-Worrigee	Worrigee Swamp	43353	31/12/1973
Drain P1D1b-Flood Mitigation-Worrigee	Worrigee Swamp	43354	31/12/1973
Drain P1D1c-Flood Mitigation-Worrigee	Worrigee Swamp	48991	31/12/1973
Drain P1D1-Flood Mitigation-Worrigee	Worrigee Swamp	43330	31/12/1973
Drain P2D1-Flood Mitigation-Terara	Terara Swamp	43309	31/12/1973
Drain P2D2-Flood Mitigation-Terara	Terara Swamp	43367	31/12/1973
Drain P2D3-Flood Mitigation-Terara	Terara Swamp	43368	31/12/1973
Drain P3D1a-Flood Mitigation-Jorams Creek	Jorams Creek	43369	31/12/1973
Drain P3D1b-Flood Mitigation-Jorams Creek	Jorams Creek	43356	31/12/1973
Drain P3D9a-Flood Mitigation-Jorams Creek	Jorams Creek	43357	31/12/1973
Drain P3D2-Flood Mitigation-Jorams Creek	Jorams Creek	43311	31/12/1973
Drain P3D3-Flood Mitigation-Jorams Creek	Jorams Creek	43312	31/12/1973
Drain P3D4-Flood Mitigation-Jorams Creek	Jorams Creek	43313	31/12/1973
Drain P3D8-Flood Mitigation-Jorams Creek	Jorams Creek	43314	31/12/1973
Drain P3D9-Flood Mitigation-Jorams Creek	Jorams Creek	43315	31/12/1973
Drain P3D10-Flood Mitigation-Jorams Creek	Jorams Creek	43316	31/12/1973
Drain P3D1-Flood Mitigation-Jorams Creek	Jorams Creek	43334	31/12/1973
Drain P3D5-Flood Mitigation-Jorams Creek	Jorams Creek	43335	31/12/1973
Drain P3D6-Flood Mitigation-Jorams Creek	Jorams Creek	43336	31/12/1973
Drain P3D7-Flood Mitigation-Jorams Creek	Jorams Creek	43337	31/12/1973
Drain P4D1-Flood Mitigation-Bolong	Bolong Area	43338	31/12/1973
Drain P4D2-Flood Mitigation-Bolong	Bolong Area	43339	31/12/1973
Drain P4D3-Flood Mitigation-Bolong	Bolong Area	43340	31/12/1973
Drain P4D3a-Flood Mitigation-Bolong	Bolong Area	43370	31/12/1973
Drain P4D4-Flood Mitigation-Bolong	Bolong Area	43371	31/12/1973
Drain P5D3-Flood Mitigation-Numbaa	Numbaa Area	43372	31/12/1973

Asset Description	Location	Asset ID	Year Created
Drain P5D1-Flood Mitigation-Numbaa	Numbaa Area	43317	31/12/1973
Drain P5D2-Flood Mitigation-Numbaa	Numbaa Area	43318	31/12/1973
Drain P5D3a-Flood Mitigation-Numbaa	Numbaa Area	43360	31/12/1973
Drain P6D8a-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43361	31/12/1973
Drain P6D5a-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	48994	31/12/1973
Drain P6D9-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	49171	31/12/1973
Drain P6D1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43319	31/12/1973
Drain P6D5-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43320	31/12/1973
Drain P6D6-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43321	31/12/1973
Drain P6D7-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43322	31/12/1973
Drain P6D2-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43341	31/12/1973
Drain P6D3-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43342	31/12/1973
Drain P6D4-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43343	31/12/1973
Drain P6D8-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43344	31/12/1973
Drain P7D1-Flood Mitigation-Brundee	Brundee Swamp	43325	31/12/1973
Drain P8D2a-Flood Mitigation-Pyree	Pyree Area	43323	31/12/1973
Drain P8D3-Flood Mitigation-Pyree	Pyree Area	43324	31/12/1973
Drain P8D1-Flood Mitigation-Pyree	Pyree Area	43345	31/12/1973
Drain P8D2-Flood Mitigation-Pyree	Pyree Area	43346	31/12/1973
Drain P9D2a-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	43374	31/12/1973
Drain P9D2-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	43308	31/12/1973
Drain P9D1-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	43331	31/12/1973
Drain P10D1 (Creek)-Flood Mitigation-Saltwater Creek	Saltwater Creek	43348	31/12/1973
Drain P12D1-Flood Mitigation-Nowra	Nowra, Scenic Drive	48298	31/12/1973

Asset Description	Location	Asset ID	Year Created
Flood Gate P1D1G1-Flood Mitigation-Worrigee	Worrigee Swamp	43278	31/12/1973
Flood Gate P2D1G1-Flood Mitigation-Terara	Terara Swamp	43279	31/12/1973
Flood Gate P2G2-Flood Mitigation-Terara	Terara Swamp	43363	31/12/1973
Flood Gate P2D2G1-Flood Mitigation-Terara	Terara Swamp	43280	31/12/1973
Flood Gate P2D3G1-Flood Mitigation-Terara	Terara Swamp	43281	31/12/1973
Flood Gate P2G1-Flood Mitigation-Terara	Terara Swamp	43282	31/12/1973
Flood Gate P3D9G1-Flood Mitigation-Jorams Creek	Jorams Creek	48992	31/12/1973
Flood Gate P3D4G1-Flood Mitigation-Jorams Creek	Jorams Creek	43284	31/12/1973
Flood Gate P3D5G1-Flood Mitigation-Jorams Creek	Jorams Creek	43285	31/12/1973
Flood Gate P3D6G1-Flood Mitigation-Jorams Creek	Jorams Creek	43286	31/12/1973
Flood Gate P3D7G1-Flood Mitigation-Jorams Creek (Smart Gate)	Jorams Creek	43287	31/12/1973
Flood Gate P3D10G1-Flood Mitigation-Jorams Creek	Jorams Creek	43288	31/12/1973
Flood Gate P4D2G1-Flood Mitigation-Bolong	Bolong Area	43290	31/12/1973
Flood Gate P4D3G1-Flood Mitigation-Bolong	Bolong Area	43291	31/12/1973
Flood Gate P4D4G1-Flood Mitigation-Bolong	Bolong Area	48987	31/12/1973
Flood Gate P4D1G1-Flood Mitigation-Jorams Creek	Jorams Creek	43283	31/12/1973
Flood Gate P5D1G1-Flood Mitigation-Numbaa	Numbaa Area	43292	31/12/1973
Flood Gate P5D3G1-Flood Mitigation-Numbaa	Numbaa Area	43293	31/12/1973
Flood Gate P6D1G1-Flood Mitigation-Berry/Far Meadow (Smart Gate)	Berry/Far Meadow	43294	31/12/1973
Flood Gate P6D2G1-Flood Mitigation-Berry/Far Meadow (Smart Gate)	Berry/Far Meadow	43295	31/12/1973
Flood Gate P6D3G1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43296	31/12/1973
Flood Gate P6D4G1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43297	31/12/1973
Flood Gate P6D5G1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43298	31/12/1973
Flood Gate P6D6G1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43299	31/12/1973
Flood Gate P6D7G1-Flood Mitigation-Berry/Far Meadow (Smart Gate)	Berry/Far Meadow	43300	31/12/1973

Asset Description	Location	Asset ID	Year Created
Flood Gate P6D8G1-Flood Mitigation-Berry/Far Meadow (Smart Gate)	Berry/Far Meadow	43301	31/12/1973
Flood Gate P6G2-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	164457	31/12/1973
Flood Gate P6D2G2-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	48995	31/12/1973
Flood Gate P6G1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	48996	31/12/1973
Flood Gate P6D9G1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	49172	31/12/1973
Flood Gate P7D1G1-Flood Mitigation-Brundee	Brundee Swamp	43347	31/12/1973
Flood Gate P8G4-Flood Mitigation-Eelwine Creek-Pyree	Eelwine Creek	43305	31/12/1973
Flood Gate P8G2-Flood Mitigation-Pyree	Pyree Area	43326	31/12/1973
Flood Gate P8G3-Flood Mitigation-Pyree	Pyree Area	43327	31/12/1973
Flood Gate P8D3G1-Flood Mitigation-Pyree	Pyree Area	43328	31/12/1973
Flood Gate P8G1-Flood Mitigation-Pyree	Pyree Area	43302	31/12/1973
Flood Gate P8D1G1-Flood Mitigation-Pyree	Pyree Area	43303	31/12/1973
Flood Gate P8D2G1-Flood Mitigation-Pyree	Pyree Area	43304	31/12/1973
Flood Gate P9G2-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	48986	31/12/1973
Flood Gate P9G1-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	43329	31/12/1973
Flood Gate P9D1G1-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	43307	31/12/1973
Flood Gate P9D2aG1-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	43373	31/12/1973
Flood Gate P10G1-Flood Mitigation-Saltwater Creek	Saltwater Creek	43306	31/12/1973
Flood Gate P12G1-Flood Mitigation-Nowra	Nowra, Scenic drive	48297	31/12/1973
Flood Gate P13G1-Flood Mitigation-Additional Flood Structures	Terara	49173	Unknown
Flood Gate P13G2-Flood Mitigation-Additional Flood Structures	Terara	49174	Unknown
Flood Gate P13G3-Flood Mitigation-Additional Flood Structures	Terara	49175	Unknown
Flood Gate P13G4-Flood Mitigation-Additional Flood Structures	Greenwell Point	49176	Unknown
Flood Gate P13G5-Flood Mitigation-Additional Flood Structures	Greenwell Point	49177	Unknown
Flood Gate P13G7-Flood Mitigation-Additional Flood Structures	North Nowra	49179	Unknown
Flood Gate P13G8-Flood Mitigation-Additional Flood Structures	Mayfield	49180	Unknown
Flood Gate P13G9-Flood Mitigation-Additional Flood Structures	Mayfield	49181	Unknown

Asset Description	Location	Asset ID	Year Create
Flood Gate P13G10-Flood Mitigation-Additional Flood Structures	Shoalhaven Heads	49182	Unknown
Flood Gate P13G11-Flood Mitigation-Additional Flood Structures	Nowra	49183	Unknown
Flood Gate P13G13-Flood Mitigation-Additional Flood Structures	Nowra	49184	Unknown
Flood Gate P13G14-Flood Mitigation-Additional Flood Structures	Nowra	49185	Unknown
Flood Gate P13G15-Flood Mitigation-Additional Flood Structures	Nowra	49186	Unknown
Flood Gate P13G16-Flood Mitigation-Additional Flood Structures	Nowra	49187	Unknown
Flood Gate P13G12-Flood Mitigation-Additional Flood Structures	Nowra	49188	Unknown
Weir P13W2-Flood Mitigation-Additional Flood Structures	Berry/Far Meadow	49190	31/12/2001
Weir P13W4-Flood Mitigation-Additional Flood Structures	Berry/Far Meadow	49192	31/12/2001
Weir P13W5-Flood Mitigation-Additional Flood Structures (Under Construction 23/12/05)	Berry/Far Meadow	164476	23/12/2005

5.2. Infrastructure Risk Management Plan

Risk inspections are normally carried out as part of the annual routine condition/defect inspections and are targeted towards identifying hazards which may endanger life or property. Additional inspections are carried out in response to requests or complaints received from the public, employees or through the Customer Request System (MERIT).

Risk/hazard information is recorded on Council's MERIT system and forwarded to the relevant maintenance manager for corrective action. The severity of the risk needs to be evaluated by the inspector to ensure appropriate response time for corrective actions but the normal maximum response time for items most likely to endanger life or property is four (4) hours.

In the case of identification of potentially longer term risk/hazards these items are to be recorded as defects on Council's Asset Condition Survey Form and forwarded to the City Services Asset Management Unit for inclusion in the Asset Defects Registers for inclusion in the annual programmed maintenance list.

There are two (2) main risks that Council is facing as follows:

- **Strategic Risk** – Risk managed through Council's annual Risk Management Plan due to the potential affect a failure in this area can have on Council's operations
- **Operational Risk** – Risks that relate to the day-to-day operations of Council. Operational risk arises from inadequate internal controls, inadequate or no documentation, poor planning and implementation, or inadequate supervision.

The 'Defect and Risk Management Inspection Procedure' specifies the following inspection frequencies for flood mitigation drainage structures:

- Defect Inspections - Every two (2) years and,
- Hazard Inspections – by the community with some monitoring and auditing by Council staff.

Any hazards identified will be prioritised and undertaken as either “Urgent Maintenance” or listed and undertaken as “Programmed Maintenance” in accordance with the timeframes adopted by Council for the defect priority.

This risk management section of the asset management plan concentrates on identification of practical risks at the asset level. An assessment of the risks associated with the service delivery of building assets has identified some critical risks to Council. The risk assessment process:

- Identifies credible risks;
- The likelihood of the risk event occurring;
- The consequences should the event occur;
- Develops a risk rating; and
- Evaluates the risk and develops a risk treatment plan for non-acceptable risks.

5.3. Routine Operations and Maintenance Plan

5.3.1. Operations and Maintenance Plan

Maintenance includes proactive, reactive and cyclic maintenance work activities. Reactive maintenance is unplanned repair work carried out in response to service requests and management / supervisory directions. Community and customers directly affected by the asset generally make these requests. To provide the highest level of service, Council's objective in relation to maintenance requests is to inspect and prioritise the work requests as quickly as possible.

General maintenance strategies have been developed to have an annual asset inspection to identify any defects which have developed since the time of the previous inspection. A reasonable base condition of the facilities has been established and documents in the Asset Audit Reports for each of the drainages.

When the defect is identified, it is recorded in the conquest database with a condition assessment and priority for action. The data in the data base forms the basis of the annual programmed maintenance program. Any defects which show up and considered a risk or hazard are rectified from the maintenance budget.

Below is the total expenditure per annum for operating and maintaining flood mitigation

Year	Actual Expenditure
2011/12	$76,972
2010/11	$103,293
2009/10	$107,032
2008/09	$91,714
2007/08	$91,141
2006/07	$159,066
Average	**$104,870**

5.3.2. Operations and Maintenance Strategies

The organisation will operate and maintain assets to provide the defined level of service to approved budgets in the most cost-efficient manner. The operation and maintenance activities include:

- Scheduling operations activities to deliver the defined level of service in the most efficient manner,
- Undertaking maintenance activities through a planned maintenance system to reduce maintenance costs and improve maintenance outcomes. Undertake cost-benefit analysis to determine the most cost-effective split between planned and unplanned maintenance activities (50 – 70% planned desirable as measured by cost),
- Maintain a current infrastructure risk register for assets and present service risks associated with providing services from infrastructure assets and reporting Very High and High risks and residual risks after treatment to management and Council/Board,
- Review current and required skills base and implement workforce training and development to meet required operations and maintenance needs,

- Review asset utilisation to identify underutilised assets and appropriate remedies, and over utilised assets and customer demand management options,
- Maintain a current hierarchy of critical assets and required operations and maintenance activities,
- Develop and regularly review appropriate emergency response capability,
- Review management of operations and maintenance activities to ensure Council is obtaining best value for resources used.

5.3.3. Summary of Future Costs

Based on the average expenditure from the last six (6) years, the estimated future cost to continue similar operation and maintenance of Flood Mitigation Drainage Structures is listed below

Year	Estimated
2012/13	$108,540.11
2013/14	$112,339.01
2014/15	$116,270.87
2015/16	$120,340.35
2016/17	$124,552.27
2017/18	$128,911.60
2018/19	$133,423.50
2019/20	$138,093.32
2020/21	$142,926.59
2021/22	$147,929.02
2022/23	$153,106.54
2023/24	$158,465.27

5.4. Renewal / Replacement Plan

Renewal expenditure is major work which does not increase the asset's design capacity but restores, rehabilitates, replaces or renews an existing asset to its original service potential. Work over and above restoring an asset to original service potential is upgrade/expansion or new works expenditure.

5.4.1. Renewal Plan

Renewing or Replacing flood mitigation is a reactive maintenance process, which means that major work will only occur in accordance with condition of the assets. Therefore for the next ten (10) years there is no flood mitigation drainage structure that requires renewal/ replacement.

5.4.2. Renewal Strategies

Renewal expenditure is major work which does not increase the asset's design capacity but restores, rehabilitates, replaces or renews an existing asset to its original service potential. Work over and above restoring an asset to original service potential is upgrade/expansion or new works expenditure.

5.4.3. Summary of Future Costs

Council has recently engaged experts to holistically review the flood mitigation drainage structures located in the Shoalhaven/Crookhaven and Broughton Creek systems.
This work will develop remediation plans for 19 identified priority sites.The costs associated with the implementation of the remediation plans will be well beyond Council's existing funding capacity and will need to rely on grants and in-kind participation from land owners.

5.5. Creation / Acquisition / Augmentation Plan

5.5.1. Selection Criteria

Currently there is no plan for any new flood mitigation drainage structures.

5.5.2. Capital Investment Strategies

Capital Investment Strategies for creating a new facility requires considering the whole life cost of the new asset. This includes the initial capital cost, operating cost and selling or disposing of the asset. A more expensive way to construct that produces an asset that is cheaper to operate and maintain may be a better option than the alternative.
The organisation will plan capital upgrade and new projects to meet level of service objectives by:

- Planning and scheduling capital upgrade and new projects to deliver the defined level of service in the most efficient manner,
- Undertake project scoping for all capital upgrade/new projects to identify:
    - the service delivery 'deficiency', present risk and required timeline for delivery of the upgrade/new asset,
    - the project objectives to rectify the deficiency including value management for major projects,
    - the range of options, estimated capital and life cycle costs for each options that could address the service deficiency,
    - management of risks associated with alternative options,
    - and evaluate the options against evaluation criteria adopted by Council/Board, and
    - select the best option to be included in capital upgrade/new programs,
- Review current and required skills base and implement training and development to meet required construction and project management needs,

Review management of capital project management activities to ensure Council is obtaining best value for resources used..

5.5.3. Summary of Future Costs

The future summary cost to construct a new flood mitigation drainage structure is nil.

5.6. Disposal Plan

The opportunity to dispose of any flood mitigation asset (remove and not replace) is minimal as they are all an integral part of the overall flood mitigation system. However if a total upgrading of the system was ever carried out and some assets were identified as no longer being required at their present location, they could be removed and not replaced. Careful consideration, including consultation with property owners of the land on which flood mitigation infrastructure is located, and Council's Natural Resources & Floodplain Unit would be required prior to any asset being removed.

6. FINANCIAL SUMMARY

The current (2012/13) total budget is $117,841. According to the estimated future expenditure operations and capital work, this budget is satisfactory to continue the existing maintenance regime. No allowance for new flood mitigation assets or other enhancement works is currently funded.

6.1. Financial Statements and Projections

There are two key indicators for financial sustainability that have been considered in the analysis of the services provided by this asset category:

- Long term lifecycle costs, to 2036
- Medium-term costs over the 10 year period of Council's financial Plan.

The ratio of lifecycle costs to lifecycle expenditure gives an indicator of sustainability of service provision. Lifecycle expenditure includes maintenance plus renewal expenditure. Lifecycle expenditure will vary depending on the timing of asset renewals.
The disparity between lifecycle costs and lifecycle expenditure gives an indication as to whether Council is over-servicing or under-servicing the community. Where lifecycle costs exceed expenditure, i.e. where there is a negative disparity or 'shortfall', then asset consumption is outpacing asset renewal. In the reverse case (expenditure greater than costs and appositive disparity or 'surplus' exists), consumers are receiving a higher level of service. The absence of a disparity (cost equal expenditure) indicates that the community is paying their share of the assets they consume each year.

6.2. Funding Strategy

The identified budget/ funding for flood mitigation drainage structures is satisfactory.

6.3. Valuation Forecasts

According to Australian Accounting Standard (AASB) 116, asset classes only need to be revalued if there have been material change otherwise it is every five (5) years. The due date of revaluation to each asset class is shown below:

Table 5: Fair Valuation – Infrastructure, property, plan and equipment

Asset Class	Due
Water & Sewer	30-Jun-17
Property, plant and equipment, operational land, buildings	30-Jun-13
Roads, bridges, footpaths, drainage, bulk earth works	30-Jun-15
Community land, other assets, land improvement	30-Jun-16

6.4. Key Assumptions Made in Financial Forecasts

Key assumption made in presenting the information in this AMP and in preparing forecast of required operating and capital expenditure and asset values, depreciation expenses and carrying amount estimates are detailed below. They are presented to enable readers to gain an understanding of the levels of confidence in the data behind the financial forecast.

Key assumption:

- Average useful lives and average remaining lives of the asset classes are based on current local knowledge and experience, historical trends and accepted industry practice. These need to be reviewed and the accuracy improved, based on regular re-assessment of asset deterioration.
- Reviews of the effective useful lives of assets and population/demographic changes have the potential for greatest variance in future cost predictions.
- Changes in development needs associated with the rate and location of growth and changes in the desired level of service and service standards from those identified in the Asset Management Plan, will both impact on future funding.

Specific annual maintenance and renewal cost trends are detailed for each asset category in the relevant Sections.

6.5. Forecast Reliability and Confidence

The Long Term Financial Plan has been developed using the Conquest Asset Register, TRIM Records Management and FIS Financial System. These softwares provide historical information, coupled with valuations, capital and operations budget analysis, using the combined information held in the financial system. Asset renewal analysis has also been completed on a lifecycle management basis based on information provided by Conquest asset register, MERIT requesting system and MMS Maintenance system.

The finance system is the responsibility of the Finance section and the asset register (Conquest) is maintained by Infrastructure Group. The requesting system (MERIT) is maintained by Information Technology section. The Maintenance Management System (MMS) is maintained by Works and Services section.

7. PLAN IMPROVEMENT AND MONITORING

This section of the asset management plan outlines any asset management practices and improvements that have arisen during the process of documenting this first plan and can be incorporated into the organisation's methodology for further enhancement to the asset management practice as the second tier asset management plan is undertaken.

7.1. Status of AM Practices

An ideal Asset Management Practice should be reflective of strong governance and accountability; more sustainable decisions, enhanced customer service, effective risk management; and improved financial efficiency.

This section identifies the strategies, practices and guidelines supporting Asset Management at Shoalhaven City Council. These activities provide the tools and functions required to support the management, maintenance, renewal, creation and disposal of assets. It includes system planning and monitoring; system record management; and asset management planning and policy.

7.1.1. Accounting/ Financial Systems

Financial transactions are recorded in Council's corporate SunSystems Financial Software and are viewable through the Financial Information System (FIS). Finance staffs are responsible for operating the finance system especially the general ledger and budget accounts receivable. A systems Accountant assists in providing technical support for the systems operation and maintenance.

Continued analysis of the Financial Model, capital expenditure, asset renewal, maintenance and operations requirements, and the interrelationships between service levels and expenditure is expected to be part of the Asset Management Improvement Programme (AMIP). The Local Government Act 1993 requires that Council prepare and maintain all accounting records, accounts and financial statements in accordance with all relevant Australian Accounting Standards. The following accounting standards and guidelines must be complied with:

- AASB 116 Property, Plant & Equipment – prescribes requirements for recognition and depreciation of property, plant and equipment assets
- AASB 136 Impairment of Assets – aims to ensure that assets are carried at amounts that are not in excess of their recoverable amounts
- AASB 1021 Depreciation of Non-Current Assets – specifies how depreciation is to be calculated
- AAS 1001 Accounting Policies – specifies the policies that Council is to have for recognition of assets and depreciation
- AASB 1041 Accounting for the reduction of Non-Current Assets – specifies the frequency and basis of calculating depreciation and revaluation basis used for assets
- AAS 1015 Accounting for acquisition of assets – method of allocating the value to new assets on acquisition
- AAS 27 Financial reporting by Local Government

- AAS 1010 Recoverable Amounts of Non-Current Asset – specifies requirement to test the reasonableness of valuations

The objective of the above Accounting Policies is to provide guidance around identifying, classifying, valuing, recording and disposing of non-current physical assets. This will provide for greater understanding and accuracy of Council's capital requirements and depreciation expenses in the context of financial sustainability and intergenerational equity as well as ensuring that Council is meeting its statutory reporting obligations.

7.1.2. Asset Management Systems

Physical Asset data is recorded in Council's Conquest Asset Register. Customer enquiries are managed via Council's MERIT system, with document management undertaken using the TRIM system.

Responsibilities for administering asset management systems generally sit with the Infrastructure Systems and Support team. Data entry on a job by job basis is handled via several staff across Council, with significant data entry by Council's City Works and Infrastructure Divisions.

7.2. Improvement Programme

There is an increasing need to align stormwater quantity projects with stormwater quality projects. Accordingly, it is recommended that regular liaison meetings be established between natural resource & floodplain staff and maintenance staff as well as landowners.

One of the improvement programme identified is to have a further detailed investigation for the Long Term Financial Planning to be analysed more in the next Asset Management Plan.

System Integration is also significant for AMP improvement. This includes linking the Asset Register (Conquest) to Strategic Planning Systems (Maloney Modelling Tool), Works Management Systems (MMS), Asset Costing Systems (Knowledge Base), Customer Request Systems (Merit), Plans & Records Management (Drawing Catalog), Electronic Data Management System (EDMS/TRIM), Financial Information System (SUN/FIS) and Spatial Mapping Systems (ESRI/GIS).

7.3. Monitoring and Review Procedures

Regular monitoring and review of this asset management plan is essential in order to ensure the document is able to continue to provide strategic guidance in the sustainable management of Council's open space and recreational assets. This is the second version of the AMP and it will be reviewed and further developed over the next few years with further detailed information for an advanced AMP.

7.4. Performance Measures

The following Key Performance Indicators will be used to gauge satisfactory outcomes from this Asset Management Plan and shall be measured as at 30th June each year –

- Number of requests for emergency repairs and programmed maintenance works
- % of total number of flood mitigation assets in Condition 2 "Good" or better as at 30th June each year, and
- satisfactory performance during flood events.

8. REFERENCES

IPWEA, 2006, 'International Infrastructure Management Manual', Institute of Public Works Engineering Australia, Sydney, www.ipwea.org.au/IIMM

IPWEA, 2008, 'NAMS.PLUS Asset Management', Institute of Public Works Engineering Australia, Sydney, www.ipwea.org.au/namsplus

IPWEA, 2009, 'Australian Infrastructure Financial Management Guidelines', Institute of Public Works Engineering Australia, Sydney, www.ipwea.org.au/AIFMG.

IPWEA, 2011, 'International Infrastructure Management Manual', Institute of Public Works Engineering Australia, Sydney, www.ipwea.org.au/IIMM

9. APPENDICES

9.1. Glossary (sourced from IIMM 2011)

Age
The current date less year when asset was constructed

AMP
Asset Management Plan

Annual service cost (ASC)
1) Reporting actual cost
   The annual (accrual) cost of providing a service including operations, maintenance, depreciation, finance/opportunity and disposal costs less revenue.
2) For investment analysis and budgeting
   An estimate of the cost that would be tendered, per annum, if tenders were called for the supply of a service to a performance specification for a fixed term. The Annual Service Cost includes operations, maintenance, depreciation, finance/ opportunity and disposal costs, less revenue.

Asset condition assessment
The process of continuous or periodic inspection, assessment, measurement and interpretation of the resultant data to indicate the condition of a specific asset so as to determine the need for some preventative or remedial action.

Asset management
A systematic process to guide the planning, acquisition, operation and maintenance, renewal and disposal of asset based on the combination of management, financial, economic, engineering and other practices applied to physical assets with the objective of providing the required level of service in the most cost effective manner.

Asset
A resource controlled by an entity as a result of past events and from which future economic benefits are expected to flow to the entity. Infrastructure assets are a sub-class of property, plant and equipment which are non-current assets with a life greater than 12 months and enable services to be provided.

Asset category
Sub-group of assets within a class hierarchy for financial reporting and management purposes.

Asset class
A group of assets having a similar nature or function in the operations of an entity, and which, for purposes of disclosure, is shown as a single item without supplementary disclosure.

Asset condition assessment
The process of continuous or periodic inspection, assessment, measurement and interpretation of the resultant data to indicate the condition of a specific asset so as to determine the need for some preventative or remedial action.

Asset Register
A record of asset information including condition, construction, financial, historical, inventory and technical details

Asset renewal funding ratio
The ratio of the net present value of asset renewal funding accommodated over a 10 year period in a long term financial plan relative to the net present value of projected capital renewal expenditures identified in an asset management plan for the same period [AIFMG Financial Sustainability Indicator No 8].

Average annual asset consumption (AAAC)*
The amount of an organisation's asset base consumed during a reporting period (generally a year). This may be calculated by dividing the depreciable amount by the useful life (or total future economic benefits/service potential) and totalled for each and every asset OR by dividing the carrying amount (depreciated replacement cost) by the remaining useful life (or remaining future economic benefits/service potential) and totalled for each and every asset in an asset category or class.

Borrowings
A borrowing or loan is a contractual obligation of the borrowing entity to deliver cash or another financial asset to the lending entity over a specified period of time or at a specified point in time, to cover both the initial capital provided and the cost of the interest incurred for providing this capital. A borrowing or loan provides the means for the borrowing entity to finance outlays (typically physical assets) when it has insufficient funds of its own to do so, and for the lending entity to make a financial return, normally in the form of interest revenue, on the funding provided**.**

Capital expansion expenditure
Expenditure that extends an existing asset, at the same standard as is currently enjoyed by residents, to a new group of users. It is discretional expenditure, which increases future operating, and maintenance costs, because it increases council's asset base, but may be associated with additional revenue from the new user group, eg. extending a drainage or road network, the provision of an oval or park in a new suburb for new residents.

Capital expenditure
Relatively large (material) expenditure, which has benefits, expected to last for more than 12 months. Capital expenditure includes renewal, expansion and upgrade. Where capital projects involve a combination of renewal, expansion and/or upgrade expenditures, the total project cost needs to be allocated accordingly.

Capital expenditure - expansion
Expenditure that extends the capacity of an existing asset to provide benefits, at the same standard as is currently enjoyed by existing beneficiaries, to a new group of users. It is discretionary expenditure, which increases future operations and maintenance costs, because it increases the organisation's asset base, but may be associated with additional revenue from the new user group, eg. extending a drainage or road network, the provision of an oval or park in a new suburb for new residents.

Capital expenditure - new
Expenditure which creates a new asset providing a new service/output that did not exist beforehand. As it increases service potential it may impact revenue and will increase future operations and maintenance expenditure.

Capital expenditure - renewal
Expenditure on an existing asset or on replacing an existing asset, which returns the service capability of the asset up to that which it had originally. It is periodically required expenditure, relatively large (material) in value compared with the value of the components or sub-components of the asset being renewed. As it reinstates existing service potential, it generally has no impact on revenue, but may reduce future operations and maintenance expenditure if completed at the optimum time, eg. resurfacing or resheeting a material part of a road network, replacing a material section of a drainage network with pipes of the same capacity, resurfacing an oval.

Capital expenditure - upgrade
Expenditure, which enhances an existing asset to provide a higher level of service or expenditure that will increase the life of the asset beyond that which it had originally. Upgrade expenditure is discretionary and often does not result in additional revenue unless direct user charges apply. It will increase operations and maintenance expenditure in the future because of the increase in the organisation's asset base, eg. widening the sealed area of an existing road, replacing drainage pipes with pipes of a greater capacity, enlarging a grandstand at a sporting facility.

Capital funding
Funding to pay for capital expenditure.

Capital grants
Monies received generally tied to the specific projects for which they are granted, which are often upgrade and/or expansion or new investment proposals.

Capital investment expenditure
See capital expenditure definition

Capitalisation threshold
The value of expenditure on non-current assets above which the expenditure is recognised as capital expenditure and below which the expenditure is charged as an expense in the year of acquisition.

Carrying amount
The amount at which an asset is recognised after deducting any accumulated depreciation/ amortisation and accumulated impairment losses thereon.

Capital new expenditure
Expenditure which creates a new asset providing a new service to the community that did not exist beforehand. As it increases service potential it may impact revenue and will increase future operating and maintenance expenditure.

Capital renewal expenditure
Expenditure on an existing asset, which returns the service potential or the life of the asset up to that which it had originally. It is periodically required expenditure, relatively large (material) in value compared with the value of the components or subcomponents of the asset being renewed. As it reinstates existing service potential, it has no impact on revenue, but may reduce future operating and maintenance expenditure if completed at the optimum time, eg. resurfacing or resheeting a material part of a road network, replacing a material section of a drainage network with pipes of the same capacity, resurfacing an oval. Where capital projects involve a combination of renewal, expansion and/or upgrade expenditures, the total project cost needs to be allocated accordingly.

Capital upgrade expenditure
Expenditure, which enhances an existing asset to provide a higher level of service or expenditure that will increase the life of the asset beyond that which it had originally. Upgrade expenditure is discretional and often does not result in additional revenue unless direct user charges apply. It will increase operating and maintenance expenditure in the future because of the increase in the council's asset base, eg. widening the sealed area of an existing road, replacing drainage pipes with pipes of a greater capacity, enlarging a grandstand at a sporting facility. Where capital projects involve a combination of renewal, expansion and/or upgrade expenditures, the total project cost needs to be allocated accordingly.

Capital Works
The creation of new assets or an increase in the capacity of existing assets beyond their original design capacity or service potential

Carrying amount
The amount at which an asset is recognised after deducting any accumulated depreciation / amortisation and accumulated impairment losses thereon.

Component
An individual part of an asset which contributes to the composition of the whole and can be separated from or attached to an asset or a system.

Conquest
An asset management software package that includes Council's Asset Register and Asset Maintenance System

Core asset management
Asset management which relies primarily on the use of an asset register, maintenance management systems, job resource management, inventory control, condition assessment, simple risk assessment and defined levels of service, in order to establish alternative treatment options and long-term cashflow predictions. Priorities are usually established on the basis of financial return gained by carrying out the work (rather than detailed risk analysis and optimised decision- making).

Cost of an asset
The amount of cash or cash equivalents paid or the fair value of the consideration given to acquire an asset at the time of its acquisition or construction, plus any costs necessary to place the asset into service. This includes one-off design and project management costs.

Council
Shoalhaven City Council

Critical assets
Assets for which the financial, business or service level consequences of failure are sufficiently severe to justify proactive inspection and rehabilitation. Critical assets have a lower threshold for action than noncritical assets.

Current replacement cost (CRC)
The cost the entity would incur to acquire the asset on the reporting date. The cost is measured by reference to the lowest cost at which the gross future economic benefits could be obtained in the normal course of business or the minimum it would cost, to replace the existing asset with a technologically modern equivalent new asset (not a second hand one) with the same economic benefits (gross service potential) allowing for any differences in the quantity and quality of output and in operating costs.

Current replacement cost "As New" (CRC)
The current cost of replacing the original service potential of an existing asset, with a similar modern equivalent asset, i.e. the total cost of replacing an existing asset with an as NEW or similar asset expressed in current dollar values.

Depreciable amount
The cost of an asset, or other amount substituted for its cost, less its residual value.

Depreciated replacement cost (DRC)
The current replacement cost (CRC) of an asset less, where applicable, accumulated depreciation calculated on the basis of such cost to reflect the already consumed or expired future economic benefits of the asset

Depreciation / amortisation
The wearing out, consumption or other loss of value of an asset whether arising from use, passing of time or obsolescence through technological and market changes. It is accounted by the allocation of the cost (or revalued amount) of the asset less its residual value over its useful life.

Disposal
Activities necessary to dispose of decommissioned assets

DLG
NSW Division of Local Government, Department of Premier and Cabinet

Expenditure
The spending of money on goods and services. Expenditure includes recurrent and capital.

Facility
A complex comprising many assets which represent a single management unit for financial, operational, maintenance and other purposes

Fair value
The amount for which an asset could be exchanged, or a liability settled, between knowledgeable, willing parties, in an arms length transaction.

Financing gap
A financing gap exists whenever an entity has insufficient capacity to finance asset renewal and other expenditure necessary to be able to appropriately maintain the range and level of services its existing asset stock was originally designed and intended to deliver. The service capability of the existing asset stock should be determined assuming no additional operating revenue, productivity improvements, or net financial liabilities above levels currently planned or projected. A current financing gap means service levels have already or are currently falling. A projected financing gap if not addressed will result in a future diminution of existing service levels**.**

GIS
Geographical Information System, mapping and spatial location technology systems which show location and relationship to key geographical datum points

Heritage asset
An asset with historic, artistic, scientific, technological, geographical or environmental qualities that is held and maintained principally for its contribution to knowledge and culture and this purpose is central to the objectives of the entity holding it.

Impairment Loss
The amount by which the carrying amount of an asset exceeds its recoverable amount.

Infrastructure assets
Physical assets of the entity or of another entity that contribute to meeting the public's need for access to major economic and social facilities and services, eg. roads, drainage, footpaths and cycleways. These are typically large, interconnected networks or portfolios of composite assets. The components of these assets may be separately maintained, renewed or replaced individually so that the required level and standard of service from the network of assets is continuously sustained. Generally the components and hence the assets have long lives. They are fixed in place and are often have no market value.

Investment property
Property held to earn rentals or for capital appreciation or both, rather than for:
(a) use in the production or supply of goods or services or for administrative purposes; or
(b) sale in the ordinary course of business (AASB 140.5)

Level of service
The defined service quality for a particular service against which service performance may be measured. Service levels usually relate to quality, quantity, reliability, responsiveness, environmental, acceptability and cost).

Life Cycle Cost *
1. **Total LCC** The total cost of an asset throughout its life including planning, design, construction, acquisition, operation, maintenance, rehabilitation and disposal costs.
2. **Average LCC** The life cycle cost (LCC) is average cost to provide the service over the longest asset life cycle. It comprises average operations, maintenance expenditure plus asset consumption expense, represented by depreciation expense projected over 10 years. The Life Cycle Cost does not indicate the funds required to provide the service in a particular year.

Life Cycle Expenditure
The Life Cycle Expenditure (LCE) is the actual or planned annual maintenance and capital renewal expenditure incurred in providing the service in a particular year. Life Cycle Expenditure may be compared to Life Cycle Expenditure to give an initial indicator of life cycle sustainability.

Loans / borrowings
Loans result in funds being received which are then repaid over a period of time with interest (an additional cost). Their primary benefit is in 'spreading the burden' of capital expenditure over time. Although loans enable works to be completed sooner, they are only ultimately cost effective where the capital works funded (generally renewals) result in operating and maintenance cost savings, which are greater than the cost of the loan (interest and charges).

Maintenance
All actions necessary for retaining an asset as near as practicable to an appropriate service condition, including regular ongoing day-to-day work necessary to keep assets operating, eg road patching but excluding rehabilitation or renewal. It is operating expenditure required to ensure that the asset reaches its expected useful life.

- **Planned maintenance**
  Repair work that is identified and managed through a maintenance management system (MMS). MMS activities include inspection, assessing the condition against failure/breakdown criteria/experience, prioritising scheduling, actioning the work and reporting what was done to develop a maintenance history and improve maintenance and service delivery performance.
- **Reactive maintenance**
  Unplanned repair work that is carried out in response to service requests and management/ supervisory directions.
- **Specific maintenance**
  Maintenance work to repair components or replace sub-components that needs to be identified as a specific maintenance item in the maintenance budget.
- **Unplanned maintenance**
  Corrective work required in the short-term to restore an asset to working condition so it can continue to deliver the required service or to maintain its level of security and integrity.

Maintenance and renewal sustainability index
Ratio of estimated budget to projected expenditure for maintenance and renewal of assets over a defined time (eg 5, 10 and 15 years).

Maintenance expenditure
Recurrent expenditure, which is periodically or regularly required as part of the anticipated schedule of works required to ensure that the asset achieves its useful life and provides the required level of service. It is expenditure, which was anticipated in determining the asset's useful life.

Materiality
An item is material is its omission or misstatement could influence the economic decisions of users taken on the basis of the financial report. Materiality depends on the size and nature of the omission or misstatement judged in the surrounding circumstances.

Modern equivalent asset
Assets that replicate what is in existence with the most cost-effective asset performing the same level of service. It is the most cost efficient, currently available asset which will provide the same stream of services as the existing asset is capable of producing. It allows for technology changes and, improvements and efficiencies in production and installation techniques

Net present value (NPV)
The value to the organisation of the cash flows associated with an asset, liability, activity or event calculated using a discount rate to reflect the time value of money. It is the net amount of discounted total cash inflows after deducting the value of the discounted total cash outflows arising from eg the continued use and subsequent disposal of the asset after deducting the value of the discounted total cash outflows.

New Works
New work expenditure is Capital Works expenditure, i.e. money spent on new works (development costs) and upgrades to an existing asset or on creating a new asset

Non-revenue generating investments
Investments for the provision of goods and services to sustain or improve services to the community that are not expected to generate any savings or revenue to the Council, eg. parks and playgrounds, footpaths, roads and bridges, libraries, etc.

Operations
Regular activities to provide services such as public health, safety and amenity, eg street sweeping, grass mowing and street lighting.

Operating expenditure
Recurrent expenditure, which is continuously required excluding maintenance and depreciation, eg power, fuel, staff, plant equipment, on-costs and overheads.

Operational Plan
Generally comprise detailed implementation plans and information with a 1-3 year outlook (short-term). The plans detail structure, authority, responsibilities, defined levels of service and emergency responses

Rate of annual asset consumption *
The ratio of annual asset consumption relative to the depreciable amount of the assets. It measures the amount of the consumable parts of assets that are consumed in a period (depreciation) expressed as a percentage of the depreciable amount.

Rate of annual asset renewal *
The ratio of asset renewal and replacement expenditure relative to depreciable amount for a period. It measures whether assets are being replaced at the rate they are wearing out with capital renewal expenditure expressed as a percentage of depreciable amount (capital renewal expenditure/DA).

Rate of annual asset upgrade/new *
A measure of the rate at which assets are being upgraded and expanded per annum with capital upgrade/new expenditure expressed as a percentage of depreciable amount (capital upgrade/expansion expenditure/DA).

Reactive maintenance
Unplanned repair work that carried out in response to service requests and management/ supervisory directions.

Recoverable amount
The higher of an asset's fair value, less costs to sell and its value in use.

Recurrent expenditure
Relatively small (immaterial) expenditure or that which has benefits expected to last less than 12 months. Recurrent expenditure includes operating and maintenance expenditure.

Recurrent funding
Funding to pay for recurrent expenditure.

Rehabilitation
See capital renewal expenditure definition above.

Remaining Useful life
Remaining useful life is determined for each individual asset from the condition rating. It is the time that the asset provides future economic benefit, from acquisition to expected replacement, renewal in full or replacement / disposal

Renewal
Works or actions to upgrade, refurbish or replace components of an asset to restore it to near new and required functional condition, extending its current remaining life

Residual value
The net amount which an entity expects to obtain for an asset at the end of its useful life after deducting the expected costs of disposal.

Revenue generating investments
Investments for the provision of goods and services to sustain or improve services to the community that are expected to generate some savings or revenue to offset operating costs, eg public halls and theatres, childcare centres, sporting and recreation facilities, tourist information centres, etc.

Risk management
The application of a formal process to the range of possible values relating to key factors associated with a risk in order to determine the resultant ranges of outcomes and their probability of occurrence.

Section or segment
A self-contained part or piece of an infrastructure asset.

Service
A benefit gained from utilising or accessing an asset and the associated work done by Council staff or others associated with the Council

Service expectation
The description of Level of Service available to users of an asset and any associated services, as described in consultation for developing and reviewing the Community Strategic Plan

Specific Maintenance
Replacement of higher value components/sub-components of assets that is undertaken on a regular cycle including repainting, replacement of air conditioning equipment, etc. This work generally falls below the capital/ maintenance threshold and needs to be identified in a specific maintenance budget allocation.

Strategic Longer-Term Plan
A plan covering the term of office of councillors (4 years minimum) reflecting the needs of the community for the foreseeable future. It brings together the detailed requirements in the Council's longer-term plans such as the asset management plan and the long-term financial plan. The plan is prepared in consultation with the community and details where the Council is at that point in time, where it wants to go, how it is going to get there, mechanisms for monitoring the achievement of the outcomes and how the plan will be resourced.

Stakeholder
A person; group; company or government department representing an interest in an asset; project or service utilising an asset

Sub-component
Smaller individual parts that make up a component part.

Useful life
Either:
(a) the period over which an asset is expected to be available for use by an entity, or
(b) the number of production or similar units expected to be obtained from the asset by the entity.
It is estimated or expected time between placing the asset into service and removing it from service, or the estimated period of time over which the future economic benefits embodied in a depreciable asset, are expected to be consumed by the council. It is the same as the economic life.

Value in Use
The present value of estimated future cash flows expected to arise from the continuing use of an asset and from its disposal at the end of its useful life. It is deemed to be depreciated replacement cost (DRC) for those assets whose future economic benefits are not primarily dependent on the asset's ability to generate new cash flows, where if deprived of the asset its future economic benefits would be replaced.

10. REVIEW

The Asset Management Plan shall be reviewed every five years.

Attachment 1 - Service Agreement for Management and Maintenance of Flood Mitigation Drainage Structures

SERVICE AGREEMENT

for

Management and Maintenance of Flood Mitigation Drainage Structures

CONTENTS

INTRODUCTION

The purpose of this agreement is to set out the way in which the Provider (*Works & Services Section, City Services Group)* and the Client (*Infrastructure & Asset Management Section, City Services Group)* intend to work together to achieve outcomes that are in the best interest of Council and its customers.

The budget for maintenance will be allocated annually according to funding availability. While no guarantees can be given, there is a long-term commitment by the client towards providing sufficient funding for maintenance.

It is recognised that during the term of this agreement, changes brought about by the extension or introduction of new specifications for maintenance work may require a review of the entire document. This ongoing formal review process will aim to improve the format and content of the Service agreement.

OBJECTIVE

Shoalhaven City Council is committed to providing an adequate flood mitigation drainage scheme to protect its community, assets and productive agricultural land from inundation. To achieve this, efficient floodgate and drain maintenance is important. Flood mitigation assets (under this agreement) include but are not limited to Flood Mitigation Drains, Flood Mitigation Gates, Flood Mitigation Bridges and Flood Mitigation Levee Banks.

Maintenance is to be ongoing throughout the year however there will be peak demand during wet periods, after floods or during weed outbreaks. The major emphasis of work is to be as follows:

- Preventative (regular routine work)
- Corrective (needs a quick fix)
- Reactive (during emergencies).

PARTIES

Works & Services Section, City Services Group	⇨	**W&S (Provider)**
Infrastructure & Asset Management Section, City Services Group	⇨	**IAM (Client)**

LOCALITY OF WORK

The Service Agreement covers the management and maintenance of all flood mitigation assets as listed in Schedule 1 within the City area as well as Coastal Lakes and the Lower Shoalhaven River drainage structures. (Please note that no grant money is to be spent on drains not included in the original drainage scheme as shown on the City of Shoalhaven Flood Mitigation Key map). Work at additional locations and/or of a different nature may be requested by the Client and is to be funded from within the existing budget.

5. EXTENT OF WORK

The Provider will need to provide sufficient skilled resources to carry out the required activities, which include the following activities as outlined in Schedule 1 and in the Service Agreement Matrix in Appendix 1:

- Capital Works
- Maintenance
- Investigations and Audits
- Customer Service
- Data Collection
- Emergency Response

6. SPECIFIC SERVICE EXPECTATIONS

The intent of the Service Agreement is for the provision of a total management service rather than only undertaking defined maintenance activities. It is a performance-based specification aimed at providing an effective, efficient and well-maintained flood mitigation scheme for the Shoalhaven. The information in Appendixes 2 to 6 may be used as a guide to recommended practices.

To achieve the above goal, scheduled works on drains (see also Schedule 1 & Appendix 1) shall include but are not limited to:

- regular inspection of drains as set out in schedule 1; (selected drains may require priority treatment during weed outbreaks)
- keeping culverts operational and free of obstruction
- inspecting tide flaps and repair if required
- keeping of water surface of particular drains to set level as required
- emergency response

Other works on drains may include:

- clearing
- removal and spraying of weeds
- replacement of wattles and willows along drains with small natives or reeds
- excavation of drains to design level (need REF for effects of acid sulphate soils)
- inspection and control of aquatic weeds
- recording of weed locations in drains with GPS system to produce a yearly weed-map together with details of spraying efforts done
- drain liming
- salt water flushing

Works on floodgates shall include but are not limited to:

- regular scheduled inspections as specified in schedule 1
- inspections in case of flood warning as well as after flood events
- regular training of staff in manual opening of gates
- emergency response

Other works on floodgates may include:

- sandblasting and metallising
- repairs
- leak detection

Works on bridges shall include but are not limited to:

- regular inspections as specified in schedule 1
- emergency response

Other works on bridges may include:

- repairs
- keeping approaches and exits free of vegetation

Works on levees shall include but are not limited to:

- checking for burrowing animals' damage and repair if required
- checking for cracks and other damage
- emergency response

Other works on levees may include:

- maintaining the set level of the top of embankments
- checking and repairing of bank erosion
- removing trees and weeds

Major repairs to bridges, gates, levees and drains as well as to ancillary items shall be agreed to by both parties and undertaken under the annual Programmed Maintenance Works List.

Other repairs/actions shall be undertaken at cost to the limit of the Provisional Sum.

7. RESPONSIBILITIES OF CLIENT AND PROVIDER

The responsibilities of each party are outlined in the Service Agreement Matrix in Appendix 1.

The parties shall meet monthly to review performance under the Agreement and to refine the content of the Agreement.

8. PROGRAMS OF WORKS

The Provider shall submit a monthly report to inform the Client of all completed and planned works for each period.

The Client shall advise, prior to the commencement of the period, any required deletions, additions or amendments to the list of proposed works.

9. INSPECTION AUDITS

Asset condition assessment inspection shall be undertaken of all flood mitigation structures (refer Schedule 1 for frequencies) by November to enable the determination and prioritisation of programmed repair works (defects audit) and to collect information for updating, as required, the component conditions in the Asset Register. Hard copies of the Audit forms shall be provided to the Client for updating of the Defects Register.

The inspections should be undertaken during dry periods and as close to low tide as possible and may include diving to assess some structural elements such as bridge foundations.

The drains, gates, bridges and levees are to be inspected as specified in Schedule 1; at these times an audit is to be undertaken to identify any defects at the structures. Additional inspections are to occur along drains with a history of aquatic weed infestation. Inspections are to be undertaken at least every 3 weeks in summer and as required at other times to ensure the weeds are under control. Records are to be kept for every defect inspection regardless of its outcome. Any identified defect shall be made safe or repaired. Major identified works (>$2,500) are to be referred to the Client for determination of future action. City Services Division will provide a format for the collection of defect data.

The Client shall be responsible to maintain an Asset Register and database of required repair works (defects) for each asset.

10. EMERGENCY RESPONSE

At times of expected flood flows in the Shoalhaven River, W&S is to closely work together with IAM to provide the field component of emergency response procedures. This includes maintaining a two-way radio network, providing assistance for an incident management & operations control centre and communicating with the SES.

Specific tasks to be undertaken include but are not limited to the following:

- Floodgate inspections;
- Keeping drains, culverts and bridges free of obstructions where possible;
- Patrolling of levees to check for overtopping and for sand boils on the town side of the levee (SES will keep an adequate stock of sand bags to respond to potential over flow spots);
- Assisting SES in sandbagging of overflow points.

Emergency response work qualifies for after hour callouts and may be done without prior approval from IAM, however has to be reported as soon as practicable after the event.

11. SHOALHAVEN HEADS AND LAKE OPENINGS

Shoalhaven Heads and several lakes in the Shoalhaven Area may require opening in times of flooding or as specified in Council Procedures. W&S is to provide labour and equipment to respond to the need for openings as per the different Opening

Procedures. Specific instructions will be issued by IAM for any opening after the necessary approvals have been attained.

12. REPORTING

Reports are to be provided as per schedule 3.

13. KEY PERFORMANCE INDICATORS

Key performance indicators are specified in schedule 4 and will be monitored by IAM.

14. TYPE OF CONTRACT

This contract shall be a part “Lump Sum” and part “Provisional Sum” contract for all specified services. The agreed budgets for activities to be performed under this agreement are shown in Schedule 2.

The Provider (W&S) shall provide all necessary labour, plant, materials, equipment and overheads for carrying out the specified services.

Variations larger than +2% of the overall maintenance program require approval of the IAM Manager. In an emergency, this variation limit may be too restrictive and appropriate action should be taken first and then reported to the Client as soon as possible.

15. QUALITY OF SERVICE

The quality of any services and/or work under the Agreement shall comply with relevant Standards, the Industry’s best practice principles and in particular with:

- All relevant Australian Standards and Codes of Practice;
- all Federal, State and Local laws;
- the Local Government Act 1993; and
- the Occupational Health and Safety Act.

All customer requests shall be attended to within the timeframes as determined for each priority code.

The Provider shall prepare for approval an Operational Plan detailing the methods, resources and management organisation to be provided to enable the requirements under the Agreement to be attained.

16. COOPERATION AND COMMUNICATION

Each party agrees to co-operate and liaise fully with the other to ensure:

- This agreement is implemented effectively
- Council’s statutory and legal obligations are met
- Unacceptable risk is reduced

- Co-operative planning takes place so that routine operation and maintenance issues are completed within the current financial year
- Consultation takes place to produce a mutually agreed program so that capital works can be completed where practical within the established time period
- Regular reviews of the operation of the agreement are carried out
- The CAMS system is used to its full capacity and accurate technical information is linked to asset recording systems to enable cost effective management of Council's assets
- Each party give to the other prompt notice whenever it wishes to initiate any change or becomes aware of any change or pending change which effects Council's rights and obligations under any law.

Schedule 1

Routine Maintenance

The following 7 pages detail the routine maintenance schedules for:

- Flood Mitigation Bridges
- Flood Mitigation Drains
- Flood Gates and Weirs
- Levee Banks

Flood Mitigation Bridges - Routine Maintenance Schedule

Asset Description	Location	Asset ID	Length (m)	Width (m)	Inspection	Weed Control
Bridge-P1D1cB1-Flood Mitigation-Worrigee	Worrigee Swamp	48997	11.00	2.70	Every 5 years	Inspect in Sept/Oct & prioritise
Bridge-P1D1B1-Flood Mitigation-Worrigee	Worrigee Swamp	48998	18.30	3.70	Every 5 years	Inspect in Sept/Oct & prioritise
Bridge-P2D1B1-Flood Mitigation-Terara	Terara Swamp	48999	24.50	4.30	Every 5 years	Inspect in Sept/Oct & prioritise
Bridge-P2D2B1-Flood Mitigation-Terara	Terara Swamp	49000	14.00	4.30	Every 5 years	Inspect in Sept/Oct & prioritise
Bridge-P3D7B1-Flood Mitigation-Jorams Creek	Jorams Creek Drainage	49001	9.50	4.30	Every 5 years	Inspect in Sept/Oct & prioritise
Bridge-P3D8B1-Flood Mitigation-Jorams Creek	Jorams Creek Drainage	49002	9.50	4.30	Every 5 years	Inspect in Sept/Oct & prioritise
Bridge-P4D1B1-Flood Mitigation-Bolong	Bolong Area	49003	18.10	3.70	Every 5 years	Inspect in Sept/Oct & prioritise
Bridge-P4D1B2-Flood Mitigation-Bolong	Bolong Area	49004	12.40	3.65	Every 5 years	Inspect in Sept/Oct & prioritise
Bridge-P5D1B1-Flood Mitigation-Numbaa	Numbaa Area	49006	17.20	4.30	Every 5 years	Inspect in Sept/Oct & prioritise
Bridge-P5D2B1-Flood Mitigation-Numbaa	Numbaa Area	49007	14.00	4.30	Every 5 years	Inspect in Sept/Oct & prioritise
Bridge-P6D1B1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	49014	8.50		Every 5 years	Inspect in Sept/Oct & prioritise
Bridge-P6D2B1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	49010	8.70	3.55	Every 2 years (Timber bridge)	Inspect in Sept/Oct & prioritise
Bridge-P6D8aB1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	49011	10.00	3.50	Every 2 years (Timber bridge)	Inspect in Sept/Oct & prioritise
Bridge-P9D1B1-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	49015	11.00	3.35	Every 5 years	Inspect in Sept/Oct & prioritise

Flood Mitigation Drains - Routine Maintenance Schedule

Asset Description	Location	Asset ID	Length (m)	Inspection	Excavation to design level	Weed Control	Mowing
Drain P1D1a-Flood Mitigation-Worrigee	Worrigee Swamp	43353	160	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P1D1b-Flood Mitigation-Worrigee	Worrigee Swamp	43354	40	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P1D1c-Flood Mitigation-Worrigee	Worrigee Swamp	48991	230	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P1D1-Flood Mitigation-Worrigee	Worrigee Swamp	43330	2760	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P2D1-Flood Mitigation-Terara	Terara Swamp	43309	3160	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P2D2-Flood Mitigation-Terara	Terara Swamp	43367	3760	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P2D3-Flood Mitigation-Terara	Terara Swamp	43368	1000	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P3D1a-Flood Mitigation-Jorams Creek	Jorams Creek	43369	230	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P3D1b-Flood Mitigation-Jorams Creek	Jorams Creek	43356	230	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P3D9a-Flood Mitigation-Jorams Creek	Jorams Creek	43357	280	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P3D2-Flood Mitigation-Jorams Creek	Jorams Creek	43311	1150	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P3D3-Flood Mitigation-Jorams Creek	Jorams Creek	43312	400	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P3D4-Flood Mitigation-Jorams Creek	Jorams Creek	43313	690	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P3D8-Flood Mitigation-Jorams Creek	Jorams Creek	43314	1120	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P3D9-Flood Mitigation-Jorams Creek	Jorams Creek	43315	450	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P3D10-Flood Mitigation-Jorams Creek	Jorams Creek	43316	95	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P3D1-Flood Mitigation-Jorams Creek	Jorams Creek	43334	2300	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required

Asset Description	Location	Asset ID	Length (m)	Inspection	Excavation to design level	Weed Control	Mowing
Drain P3D5-Flood Mitigation-Jorams Creek	Jorams Creek	43335	265	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P3D6-Flood Mitigation-Jorams Creek	Jorams Creek	43336	2000	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P3D7-Flood Mitigation-Jorams Creek	Jorams Creek	43337	1530	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P4D1-Flood Mitigation-Bolong	Bolong Area	43338	755	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P4D2-Flood Mitigation-Bolong	Bolong Area	43339	2700	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P4D3-Flood Mitigation-Bolong	Bolong Area	43340	250	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P4D3a-Flood Mitigation-Bolong	Bolong Area	43370	380	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P4D4-Flood Mitigation-Bolong	Bolong Area	43371	170	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P5D3-Flood Mitigation-Numbaa	Numbaa Area	43372	1035	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P5D1-Flood Mitigation-Numbaa	Numbaa Area	43317	3400	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P5D2-Flood Mitigation-Numbaa	Numbaa Area	43318	1500	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P5D3a-Flood Mitigation-Numbaa	Numbaa Area	43360	655	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P6D8a-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43361	480	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P6D5a-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	48994	300	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P6D9-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	49171	100	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P6D1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43319	635	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P6D5-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43320	690	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P6D6-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43321	150	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required

Asset Description	Location	Asset ID	Length (m)	Inspection	Excavation to design level	Weed Control	Mowing
Drain P6D7-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43322	290	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P6D2-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43341	520	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P6D3-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43342	1035	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P6D4-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43343	730	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P6D8-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43344	770	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P7D1-Flood Mitigation-Brundee	Brundee Swamp	43325	2600	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P8D2a-Flood Mitigation-Pyree	Pyree Area	43323	370	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P8D3-Flood Mitigation-Pyree	Pyree Area	43324	370	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P8D1-Flood Mitigation-Pyree	Pyree Area	43345	100	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P8D2-Flood Mitigation-Pyree	Pyree Area	43346	1220	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P9D2a-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	43374	120	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P9D2-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	43308	620	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P9D1-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	43331	1800	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P10D1 (Creek)-Flood Mitigation-Saltwater Creek	Saltwater Creek	43348	2900	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required
Drain P12D1-Flood Mitigation-Nowra	Nowra, Scenic Drive	48298	15	Annually & on request	As required	Inspect in Sept/Oct & prioritise	As Required

Flood Mitigation Gates & Weirs - Routine Maintenance Schedule

Asset Description	Location	Asset ID	Width (m)	Height (m)	Number of Gates	Inspection	Clearing	Training of Manual Operation
Flood Gate P1D1G1-Flood Mitigation-Worrigee	Worrigee Swamp	43278	7.90	4.00	3	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P2D1G1-Flood Mitigation-Terara	Terara Swamp	43279	10.00	4.00	4	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P2G2-Flood Mitigation-Terara	Terara Swamp	43363				Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P2D2G1-Flood Mitigation-Terara	Terara Swamp	43280			5	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P2D3G1-Flood Mitigation-Terara	Terara Swamp	43281			1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P2G1-Flood Mitigation-Terara	Terara Swamp	43282	7.70	2.60	4	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P3D9G1-Flood Mitigation-Jorams Creek	Jorams Creek	48992			1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P3D4G1-Flood Mitigation-Jorams Creek	Jorams Creek	43284	6.10	3.00	3	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P3D5G1-Flood Mitigation-Jorams Creek	Jorams Creek	43285	6.10	3.00	3	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P3D6G1-Flood Mitigation-Jorams Creek	Jorams Creek	43286	6.10	3.00	3	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P3D7G1-Flood Mitigation-Jorams Creek (Smart Gate)	Jorams Creek	43287	6.10	3.00	3	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P3D10G1-Flood Mitigation-Jorams Creek	Jorams Creek	43288			1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P4D2G1-Flood Mitigation-Bolong	Bolong Area	43290	5.00	4.00	2	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P4D3G1-Flood Mitigation-Bolong	Bolong Area	43291	5.00	2.00	2	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P4D4G1-Flood Mitigation-Bolong	Bolong Area	48987			1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P4D1G1-Flood Mitigation-Jorams Creek	Jorams Creek	43283	10.40	4.00	4	Annually & before & after flood events	Annually & on request	Bi-annually

Asset Description	Location	Asset ID	Width (m)	Height (m)	Number of Gates	Inspection	Clearing	Training of Manual Operation
Flood Gate P5D1G1-Flood Mitigation-Numbaa	Numbaa Area	43292	12.00	3.00	4	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P5D3G1-Flood Mitigation-Numbaa	Numbaa Area	43293	6.10	3.00	3	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P6D1G1-Flood Mitigation-Berry/Far Meadow (Smart Gate)	Berry/Far Meadow	43294	4.50	3.00	2	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P6D2G1-Flood Mitigation-Berry/Far Meadow (Smart Gate)	Berry/Far Meadow	43295	6.00	2.10	2	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P6D3G1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43296	4.20	3.00	2	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P6D4G1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43297	6.00	3.00	2	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P6D5G1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43298	12.00	3.00	2	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P6D6G1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	43299			1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P6D7G1-Flood Mitigation-Berry/Far Meadow (Smart Gate)	Berry/Far Meadow	43300	4.50	2.00	2	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P6D8G1-Flood Mitigation-Berry/Far Meadow (Smart Gate)	Berry/Far Meadow	43301	4.50	2.00	2	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P6G2-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	164457			1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P6D2G2-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	48995				Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P6G1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	48996				Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P6D9G1-Flood Mitigation-Berry/Far Meadow	Berry/Far Meadow	49172		750mm dia	1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P7D1G1-Flood Mitigation-Brundee	Brundee Swamp	43347	2.00	3.00	4	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P8G4-Flood Mitigation-Eelwine Creek-Pyree	Eelwine Creek	43305				Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P8G2-Flood Mitigation-Pyree	Pyree Area	43326			1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P8G3-Flood Mitigation-Pyree	Pyree Area	43327			1	Annually & before & after flood events	Annually & on request	Bi-annually

Asset Description	Location	Asset ID	Width (m)	Height (m)	Number of Gates	Inspection	Clearing	Training of Manual Operation
Flood Gate P8D3G1-Flood Mitigation-Pyree	Pyree Area	43328			1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P8G1-Flood Mitigation-Pyree	Pyree Area	43302			1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P8D1G1-Flood Mitigation-Pyree	Pyree Area	43303			1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P8D2G1-Flood Mitigation-Pyree	Pyree Area	43304	4.50	2.00	2	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P9G2-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	48986			2	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P9G1-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	43329			1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P9D1G1-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	43307	12.00	3.00	4	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P9D2aG1-Flood Mitigation-Coolangatta	Coomonderry/Coolangatta	43373			1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P10G1-Flood Mitigation-Saltwater Creek	Saltwater Creek	43306	6.10	4.00	3	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P12G1-Flood Mitigation-Nowra	Nowra, Scenic drive	48297	4.00	2.00	2	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P13G1-Flood Mitigation-Additional Flood Structures	Terara	49173		750mm dia	1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P13G2-Flood Mitigation-Additional Flood Structures	Terara	49174		375mm dia	1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P13G3-Flood Mitigation-Additional Flood Structures	Terara	49175		600mm dia	1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P13G4-Flood Mitigation-Additional Flood Structures	Greenwell Point	49176		750mm dia	1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P13G5-Flood Mitigation-Additional Flood Structures	Greenwell Point	49177		900mm dia	1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P13G7-Flood Mitigation-Additional Flood Structures	North Nowra	49179		900mm dia	2	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P13G8-Flood Mitigation-Additional Flood Structures	Mayfield	49180		1200x600mm	1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P13G9-Flood Mitigation-Additional Flood Structures	Mayfield	49181		375mm dia	1	Annually & before & after flood events	Annually & on request	Bi-annually

Asset Description	Location	Asset ID	Width (m)	Height (m)	Number of Gates	Inspection	Clearing	Training of Manual Operation
Flood Gate P13G10-Flood Mitigation-Additional Flood Structures	Shoalhaven Heads	49182		750mm dia	2	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P13G11-Flood Mitigation-Additional Flood Structures	Nowra	49183		300mm dia	1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P13G13-Flood Mitigation-Additional Flood Structures	Nowra	49184		375mm dia	1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P13G14-Flood Mitigation-Additional Flood Structures	Nowra	49185		375mm dia	1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P13G15-Flood Mitigation-Additional Flood Structures	Nowra	49186		525mm dia	1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P13G16-Flood Mitigation-Additional Flood Structures	Nowra	49187		375mm dia	1	Annually & before & after flood events	Annually & on request	Bi-annually
Flood Gate P13G12-Flood Mitigation-Additional Flood Structures	Nowra	49188		375mm dia	1	Annually & before & after flood events	Annually & on request	Bi-annually
Weir P13W2-Flood Mitigation-Additional Flood Structures	Berry/Far Meadow	49190				Annually & before & after flood events	Annually & on request	Bi-annually
Weir P13W4-Flood Mitigation-Additional Flood Structures	Berry/Far Meadow	49192				Annually & before & after flood events	Annually & on request	Bi-annually
Weir P13W5-Flood Mitigation-Additional Flood Structures (Under Construction 23/12/05)	Berry/Far Meadow	164476				Annually & before & after flood events	Annually & on request	Bi-annually

Schedule 2

Budget Details

1. Lump sum to undertake investigation and response to all customer action requests (including written)

   $5,000 per annum

2. Lump sum to undertake annual detailed asset condition and defects assessment and supply completed forms as per Section 9.

   $10,000 per annum

3. Lump sum for reporting requirements.

   $2,000 per annum

4. Provisional Sum for undertaking of agreed annual programmed maintenance and improvement activities, including preventative and corrective work.

   $56,341

5. Provisional Sum for undertaking emergency response works.

   $15,000

6. Provisional Sum for weed control works.

   $6,000

7. Provisional Sum for undertaking lake openings.

   $10,000

8. Provisional Sum for undertaking (at cost) works identified from customer requests of inspections or requested by Client.

   $10,000

9. Provisional Sum for inspections and testing of Smart Gate control systems. (6 monthly inspections by ETS)

   $3,500

TOTAL $ 117,841

Schedule 3

Reporting Requirements

The following reports shall be prepared by the Provider:

A. Monthly & cumulative expenditure figures for “Provisional Sum” and “Lump Sum” activities;

B. Monthly Progress Reports for programmed maintenance program/projects including any actual or foreseen major variations to Provisional and/or Lump Sum budget target allowances and any suggestions for system improvements as they arise;

C. Monthly details of any insurance claims and action to remove defect;

D. Annual (November) report on defects and condition;

E. Annual report on acid sulphate soil problems;

F. W&S to keep records of customer service requests in MERIT up to date;

G. Supporting argument where expenditure exceeds allocation by + 2% of overall program;

H. W&S to report any Health and Safety problems and make suggestions on how to improve the situation;

I. W&S to report environmental incidences to CSD and to the relevant departments and authorities as well as make suggestions on solutions to the problems encountered;

Schedule 4

Key Performance Indicators

Item	Required Performance
Completion of agreed annual programmed maintenance projects.	95% compliance
The MERIT database shall be queried by the Client on an overall basis to determine compliance with corporate completion timeframes.	95% compliance
Weed elimination	Decreasing weed control requirements
Completion of annual defect / condition audit by November	Completed on time

Appendix 1

Service Agreement Responsibility Matrix

The following 4 pages detail the service agreement responsibility matrix for:

- Infrastructure Maintenance
- Service Locations
- Financial
- Specification
- Customer Service
- Health & Safety
- Environmental
- Service Standard
- Emergency Management

Appendix 1

Service Agreement Responsibility Matrix

CSD Role	W&S Role	Reporting Required	Service Standard
Infrastructure Maintenance			
Capital Works Planning for provision of a flood mitigation drainage system.	Undertaking of maintenance and minor improvement works to the extent of agreed budget for each activity.	IAM to write Council reports, W&S to provide supporting information.	As a minimum to maintain the drainage system condition to the standard achieved in the last financial year.
Determination of annual operating budgets and Capital Works Program.	Carry out the day-to-day operation of the flood mitigation system, including provision for after hours service and on-site face-to-face contact with customers.	Monthly Progress Reports for programmed maintenance program/projects.	To meet the community's expectation of friendly 24 hour per day, 365 day per year services.
Determination of annual maintenance budget for each work activity.	Preparation of a draft annual maintenance program.		
Data entry and keeping of asset database.	Annual asset condition assessments and provision of collected data in hard copy.	Annual (November) report on defects and condition.	To IAM's asset condition assessment guidelines.
Data entry and keeping of asset database.	Regular asset hazard identification audits.	Hazard reports.	To Council guidelines.
Prioritising of capital projects.	Assistance in prioritising (to available budget) maintenance and/or minor improvement works.		
Gaining of all required approvals such as development consent and organising of reports such as REF's, which are required before any work can be undertaken.	Provision of supporting information.	REF, approval documents.	To Council guidelines.
	Maintain stocks of replacement parts, materials, signs & barricades to meet acceptable response times.	Up to date Inventory.	

Service Agreement Responsibility Matrix

CSD Role	W&S Role	Reporting Required	Service Standard
Service Locations			
Provision of location maps of all specified assets under the Agreement.	Provision of details for a map with access routes to each flood mitigation asset together with contact details of property owner where required/possible.	GIS system.	6 monthly update of all asset registers and Council's GIS system.
Take on risks associated with providing plans that may contain incorrect locations.	Provision of corrections for maps where necessary after field surveys.	Report of any abnormalities encountered.	6 monthly update of all asset registers and Council's GIS system.
	Locating of weeds with GPS system.	Weed Map and details of spraying efforts.	Yearly report.
Financial			
Provision of sufficient funds for annual Maintenance budget under this service agreement.	Keep detailed record of expenditure per project or maintenance activity.	Monthly & cumulative expenditure figures for "Provisional Sum" and "Lump Sum" activities C and details of any actual or foreseen major variations to Provisional and/or Lump Sum budget target allowances.	
Payment of any licence fees, electricity & water accounts.	To supply quotes to carry out customer requests that are beyond the scope of this agreement and available resources.	Cost Reports	With 30 days of receiving request.
Dealing with Insurance Claims including court appearances if required.	Investigation and formal reporting on public liability claims including court appearances if required.	Monthly details of any insurance claims and action to remove hazard.	

Service Agreement Responsibility Matrix

CSD Role	W&S Role	Reporting Required	Service Standard
Specification			
Development of relevant Council policies.	Provision of supporting information.	IAM to advise of new policies.	To Council's standards.
Customer Service			
Investigation of customer requests requiring capital works.	Investigating and providing verbal and/or written responses to all customer enquiries.	MERIT	Within 24 hours if urgent. Within 7 days if medium urgency. Within 30 days if low urgency.
Supporting ACMD in case of disputes with property owners.	Telling property owners/occupiers of need and duration of entry to property if required.		In police and efficient manner.
Health & Safety			
To maintain a safe & healthy work environment and develop new work procedures and policies where required.	To maintain a safe & healthy work environment, fix operational problems and audit work practices.	Reporting of all safety hazards and providing any suggestions for system improvements as they arise.	Occupational Health & Safety Regulations.
Environmental			
To undertake environmental studies	To minimise environmental impact and participate in incident management.	Reporting of all environmental incidents and hazards to IAM and to the relevant departments and authorities as well as make suggestions on solutions to the problems encountered.	To relevant legislation.
To develop environmental policies.	To assist with research projects, such as acid sulphate soils studies.	Annual report on acid sulphate soil problems	To best practice principles.
	Acquisition of EPA licence for activities such as weed spraying.		To EPA standard requirements.

Service Agreement Responsibility Matrix

CSD Role	W&S Role	Reporting Required	Service Standard
Service Standard			
Monitoring of quality of services provided under the Agreement.	Comply with relevant Standards and the Industry's best practice principles.	Reporting of all non-compliances and irregularities.	To relevant Standards, Policies and Industry guidelines.
Emergency Management			
Provision of procedures for the opening of Shoalhaven Heads and specific lakes.	Provision of labour and equipment to undertake the openings.		To Council procedures.
Development of incident management and emergency response plans.	Provision of the field component of the management and emergency response plans.	Incident reports.	To Industry guidelines and best knowledge at the time.
Communication with SES staff.	Communication with SES staff.	Provide all necessary information to relevant staff and authorities.	
Provision of sufficient expert staff to run emergency control centre.	Provision of sufficient trained staff to undertake emergency response.	Up to date Roster	Backup staff are required in case rostered staff are affected by emergency and thus unavailable.
Provision of emergency control centre with access to all required resources.	Provision of required equipment for emergency response.		

Appendix 2

Guidelines for Maintenance Procedures

Appendixes 2 to 6 have been reproduced and adapted to SCC local conditions from Robert J Smith & Associates and Clarence River County Council's Drain and Floodgate Maintenance Procedures 20 October 1999

Purpose

These Procedures are designed to assist all staff who in the course of their work handle inquiries, undertake field work or supervise other staff and contractors involved in drain and floodgate maintenance. The Procedures are also designed to assist in demonstrating to landholders, industry organisations and regulatory agencies that those responsible for drain and floodgate maintenance procedures are striving to achieve the highest possible management standards.

There is also a need for councils to curtail activities that cause environmental harm, especially the disturbance or drainage of acid sulfate soils, which predominate in many backswamps which were originally semi-permanently inundated. Acid drainage impacts on water quality, fauna and flora and can cause severe economic impacts.

There is increasing need for Councils and landholders to meet their obligations under planning and environmental statutes to ***jjustify maintenance*** activities involving mechanical and chemical weed control. Landholder requests need to be accompanied by substantiated evidence that there is a drainage problem and that the proposed method is justified. Where siltation, blocks and weed growth are the result of poor landholder management, a low priority to cleaning drains needs to be considered. In some instances ongoing educational material needs to be provided to landowners encouraging them to better manage drains.

DLWC has identified ***'Hot Spots'*** in low-lying parts of floodplains where further drain cleaning is questionable given that the 'hot spots' generally require remediation strategies. It may be appropriate to defer where possible all works in backswamps pending the development of Floodgate and Drain Management Agreements. However, funding is necessary to facilitate the development of agreements.

Appendices 3 to 6 include information additional to the Drain and Floodgate Maintenance Procedures. Please note that their inclusion is based on recommendations for Clarence River County Council only, and therefore may not be applicable in any other circumstances.

Some of the recommended procedures will require further local investigation and trials in order to develop the most effective implementation details. Such procedures may include use of the field peroxide test for calculating lime requirements, trialling of alternative lime application techniques and equipment, operating floodgates to control weeds with saline water, and trialling of silt curtains to prevent drain discharge after mechanical cleaning.

The interpretation of other procedures may require a certain level of knowledge or prior action. For example, salt water flushing of drains to control some weeds requires previous installation of a suitable floodgate lifting device or mini-sluice gate; an experienced plant operator will know to determine the drain depth to invert by the water mark on the excavator arm. The development of local expertise through action and network support is endorsed by CRCC.

Recommended Maintenance Procedures

ITEM	RECOMMENDED PROCEDURE	EXPLANATION
Timing of Works	• Drain cleaning works should not be carried out during runoff events • Drain cleaning in the lower estuary should be scheduled for late winter /early spring period • Fit in with sensitive cropping activities eg. Preparation for cane planting	• There is a high risk of discharges of acid products and silt when drains are flowing • Cooler months (July-September) are when flowering/fruiting cycle of marine plants is least and there is minimal fish migration
Excavator Operators	• Must be provided with a copy of current Drain and Floodgate Maintenance Procedures and Floodgate and Drain Management Agreement specifying the site features and safeguards required • Must have received approved training in recognising and handling ASS material	• Written instructions are an important means of risk management as well as assisting in improving operators' understanding of the issues
Deepening or Widening Drains	• Original drain profiles should not be enlarged • Where drain design is inadequate, seek an engineering assessment prior to cleaning • Maintain drains no deeper than the invert level • Encourage installation of dish drains in laser levelled fields	• An REF may be required before any work is undertaken • Deep drainage lowers groundwater levels and increases the export of acid products • Some drains which are in need of redesign may require Development Approval • Laser levelling removes the need for the maintenance of deep drainage
Weed Removal	• Where practical salt water flushing should have been practised prior to chemical or mechanical weed removal • Reed bucket should be used wherever possible in preference to silt bucket • Plant material should be placed as far away from the drain as possible	• Weed control with salt water is less environmentally damaging • Reed bucket removes minimal sediments from drain • Vegetation from nutrient rich drains will release phosphate and nitrogen which is best absorbed in the paddock, rather than running back into the drain to promote further weed growth
Sediment Testing	• Sediment to be removed must be sampled, analysed and limed in accordance with the ASS Manual • Cost saving field tests (eg. Field peroxide test) must be backed up by laboratory testing to verify reliability	• Drain sediments can become very acidic when disturbed and can pollute waterways • Sampling and testing methods can result in highly variable estimates of liming requirements

ITEM	RECOMMENDED PROCEDURE	EXPLANATION
Handling Iron Monosulfides	• Spread drain sludge as a thin layer in cultivation paddocks, immediately lime at recommended rates and cultivate into the topsoil when dry enough • In pasture areas, ensure that drain sludge is placed so as not to be flushed back into drains	• Concentrated iron monosulfides in drain sediments need to be handled very carefully as they can begin to oxidise and generate acidic products within minutes of exposure to air • Drain sludge is easily washed back into drains
Drain Liming	• Apply required lime to the drain before use of the reed bucket on a trial basis and monitor the effects • All exposed surfaces (batters) be limed to ensure neutral drain water after cleaning	• Liming drains prior to cleaning assists in mixing lime and sludge giving better neutralisation and stabilisation of acid products • Intercepts and neutralises acid seepage from drain sides
Controlling Discharge of Polluted Water	• On a trial basis, clean drains in stages beginning furthest from the floodgates to minimise the risk of sediment transport to the estuary where invert level and design gradient can be determined ***or*** • On a trial basis, install where necessary a temporary weir or silt curtain in drains to contain water/sediment prior to commencing works • Do not lift floodgates for a minimum of 2 weeks after drain cleaning or spraying and until pH stabilises at about pH 6 • Treat drain with a lime slurry to achieve pH 6	• Drain cleaning can disturb toxic sediments (monosulfides) which can impact adversely on the estuary • Herbicides and decaying OM can pollute water • pH of discharge water should be within 1 pH unit of the receiving waters • reliance on sea water to buffer acid caused by drain cleaning strips the water of carbonate which is deleterious to aquatic life
Liming Spoil	• Split lime applications below and on top of spoil heaps at time of cleaning • Mix the top lime into spoil as soon as the material is dry enough to be cultivated • Where spoil heaps have not naturally revegetated within 12 months, rehabilitation (cultivation, liming, seeding) to be carried out	• Split applications ensure that acid leachate and runoff pass through lime and hopefully is neutralised • Thorough mixing of lime is required to ensure efficient neutralisation • Bare spoil heaps can continue to leach acid products as well as being a source of erodable material
Shaping Spoil Heaps	• Where possible, shape spoil heaps to improve farm access during wet weather	• Overdrainage is often brought on by farmers' need to access wet paddocks by vehicle
Monitoring	• Undertake spot sampling to monitor drain water discharges after cleaning to meet ASSMAC Guidelines • Review procedures based on results	• Guidelines suggest pH > 6, dissolved oxygen >60% saturation, turbidity < 25 NTU

ITEM	RECOMMENDED PROCEDURE	EXPLANATION
Spraying Aquatic Weeds	• Ensure that the proposed use of a pesticide is fully compliant with EPA licence to spray aquatic weeds as well as complying with label directions • Apply herbicides only in dry periods to avoid adverse impacts from both the pesticide and the export of decaying organic material • Timely spot spraying is preferred to blanket spraying of drains • Only spray the bottom of the drains, not the batters	• Pesticide use in aquatic situations is strictly controlled because of the risk of environmental damage • Pesticide use can lead to low dissolved oxygen levels through vegetation rotting in drains • Spot spraying can effectively control invasive water weeds • Erosion of batters is minimised if they are well vegetated • Spraying has adverse environmental impacts
Salt Water Flushing	• Repair minor leaking floodgates only if they are causing damage to agricultural production or are in danger of structural failure • Encourage landholders to accept minor leakage or partial opening of floodgates as an alternative method of weed control • Introduce salt water gradually to drains • Assess whether floodgates could be seasonally opened • Assess whether floodgate redesign (e.g. mini-sluicegate, sluicegate) is required • Approvals are required to significantly alter the function of floodgates affecting SEPP 14 Wetlands • Repair of long term leaky gates requires Fisheries approval	• Leaking floodgates can have environmental benefits by flushing drains thus improving water quality, controlling water weeds, maintaining elevated groundwater and allowing fish passage • Gradual opening avoids fish kills, rapid death of plants and deoxygenation of water and rapid sediment removal by tidal flushing • Gradual opening allows the extent of salt water intrusion to be gauged • Salt damage to crops and pasture can occur from surface inundation and through lateral intrusion in sandy soils • Expert advice will be necessary to assess these risks in some situations
Metalising Floodgates	• Use of copper slag to sand blast floodgates for metallising requires compliance with EPA guidelines	• Metallic compounds used in rust protection can be environmentally damaging
Treating of sandboils in levees during flooding	• Spread Geotextile over the area concerned and cover with fill. • Build sandbag enclosure around sandboil like container.	• Quick remedy if stockpiles and geotextile are readily available. • Enclosure fills up inside until head of water that is driving the boil is equalised.

ITEM	RECOMMENDED PROCEDURE	EXPLANATION
Native Vegetation	• DLWC approval is required to trim, lop or destroy any native vegetation on protected lands including slopes over 18 degrees and riverbanks • Removal of marine vegetation requires written authority from NSW Fisheries • Encourage permanent vegetation on at least one drain batter which may be alternated in different parts of the drain • Place spoil on previously disturbed areas rather than in areas of native vegetation.	• Vegetation growing on drain banks helps prevent soil erosion • Continuous vegetation provides important sheltered habitat for juvenile migrating fish • Shade is also important in maintaining high dissolved oxygen levels in drains • Only one side of drains can be allowed to revegetate due to need for machinery access
Aquatic Fauna	• Where eels etc are observed in drain spoil, defer spreading of spoil heaps for 24 hours • Vegetation and drain clearing to allow for floodgate operation and maintenance in front of floodgates should be limited to a radius no more than the width of the floodgate headworks structure • additional vegetation clearing should be limited to one side of the drain as it passes into the estuary, by agreement with NSW Fisheries as required	• Drain cleaning can result in substantial number of eels being placed on land. The fate of these eels is not known but it is likely that they will find their way back into the drain if they are in good physical condition
Record Keeping	• Council should maintain a comprehensive data base and filing system on drains including site features, hazards, maintenance records, management trials, complaints, requests, completed works, drainage redesign requirements and landowner views • Staff to report any concerns about floodgate and drain maintenance procedures that may be impacting on the environment, including actions by others	• Reviews of floodgate and drain design, operation and maintenance will be greatly assisted by record keeping • Records are important in documenting improvements in drain and floodgate management • Managers have a responsibility to exercise “due care” in drain and floodgate maintenance
Review	• Drain and Floodgate Maintenance Procedures should be reviewed and revised, preferably annually	• Changes in maintenance procedures will be required as new information becomes available

Appendix 3

Classification of Drains

ASS Risk Category
ASS_H = High
ASS_M = Medium
ASS_L = Low

Area of ASS Drained
A_L = Large
A_M = Medium
A_S = Small

Ecological Importance
E_H = High

E_M = Moderate
E_L = Low

Sensitivity of Receiving Waters
W_H = High

W_M = Moderate
W_L = Low

Land Use
C = Cane

T = Tea Tree

G = Grazing

Importance of Removing Floodwaters Rapidly
F_1 = Essential for floodwater removal (through levee-toe)

F_2 = Desirable for floodwater removal (edge of backswamp)

F_3 = *Marginal for floodwater removal (backswamp)*

Example: **Imesons Swamp = ASS_H, A_L, E_H, W_M, G, F_3**

Imesons Swamp, north of Sportsmans Creek is a high risk acid sulfate area ASS_H with a large wetland habit (A_L) of high ecological significance (E_H) draining into the mid Clarence estuary which is of moderate significance (W_M) used for grazing(G), where rapid removal of floodwaters is not critical (F_3).

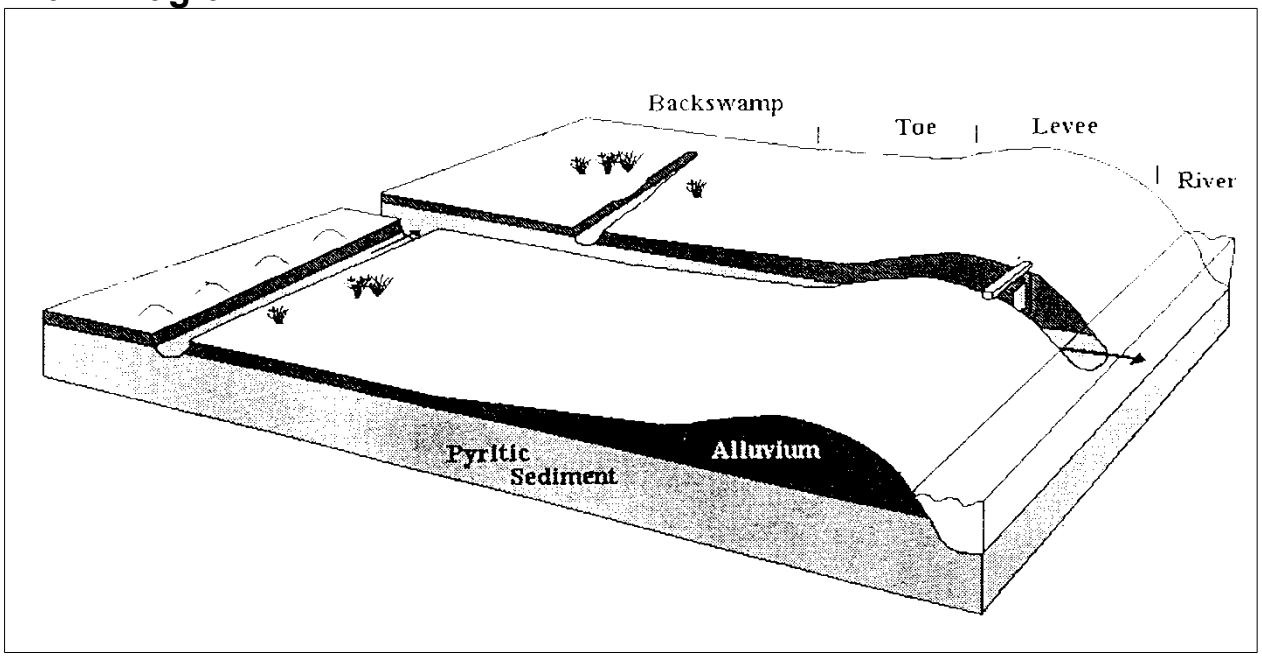
Appendix 4

Assessment of Weed Infestation in Drains

1. **Tick which part of drain is weed infested and the type of weed** (see drain diagram below)

	Backswamp Drain	***Toe Drain***	***Levee Drain***
no weeds is	☐	☐	☐
sub-surface weeds	☐	☐	☐
low emerging weeds 0-0.25m above surface	☐	☐	☐
medium emergent weeds 0.25-0.5m above surface	☐	☐	☐
tall emergent weeds >0.5m above water surface	☐	☐	☐
Drain length requiring cleaning (m)	☐	☐	☐

Drain Diagram



2. Circle the names of the main water weeds present:

common rush	cumbungi	Dirty Dora
para grass	soft rush	tall spike rush
umbrella sedge	water couch	other

Attach photographs with captions of the sections of the drain to be cleaned

Appendix 5 Rapid Appraisal of Need for Drain Cleaning

The following information is required to prioritise drain cleaning and floodgate maintenance. It is important to read ***Drain and Floodgate Maintenance Procedures*** before completing this form.

Drain No…… Drain Name …… Requested by…….…….. Phone……..…

QUESTION	***ANSWER***
NATURE OF DRAINAGE PROBLEM	
Weeds are blocking drain (see Aquatic Weed Guide) - *which weeds?*	
Sediment has partially filled the drain – *localised or extensive?*	
Local blockages caused by logs etc - *describe*	
What type of land is being drained eg. cane, pasture, backswamp etc	
Does the drain dry out during the dry season – *yes/no?*	
Can floodgates be lifted to allow tidal flushing – *yes/no?*	
Is drain design adequate – *if not suggest improvements*	
Is drain cleaning proposed in an area that has been laser levelled – *yes/no?*	
DRAIN CLEANING REQUEST	
Total length of drain to be cleaned - *metres*	
Type of machine required - *dragline or excavator?*	
Type of bucket required - *reed bucket, desilting bucket?*	
Time since last cleaning - *years*	
Last method used	
Estimate of the time required to clean the drain - *days*	
WEED SPRAYING REQUEST	
What herbicide is proposed - *Amitrol, Diuron, Glyphosate, other?*	
Has registration or permit been checked – *yes/no?*	
Is spot spraying possible? – *yes/no?*	
HAZARDS	
Is drain cleaning proposed in mapped DLWC 'hot spot' backswamps – *yes/no?*	
Does the drain discharge into a commercial/recreational fishing area or oyster lease – *yes/no?*	
Are there eels or fish in the drains – *yes/no?*	
Is there adequate land available for treatment of spoil – *yes/no?*	
What other adverse impacts are anticipated – *provide detail*	
Is drain cleaning/spraying impeded by native vegetation – *yes/no?*	
Is it necessary to trim, lop or destroy any native vegetation – *yes/no?*	
Is removal of marine vegetation required – *yes/no?*	
ALTERNATIVE METHODS	
Has salt water been used to control weed growth – *yes/no?*	
What prevents controlled salt water exchange being used to control weeds – *provide detail*	
ADEQUACY OF FLOODGATE AND DRAIN DESIGN	
Is floodgate or drain redesign required - *mini-sluicegate, penstock, dish drain, deep drain*	
URGENCY	
Can works be held over until dry season – *yes/no?*	
Can works be deferred until the Management Agreement is signed – *yes/no?*	
LANDHOLDER AGREEMENT	
Has a Management Agreement been developed – *yes/no?*	
Is a signed agreement of all affected landholders attached – *yes/no?*	
OTHER ISSUES	
Provide detail	

WORKS RECOMMENDED - yes/no? *CHECK AGAIN IN 6 / 12 / 18 months?*
WORKS COMPLETED …./ …/ … *BY (operator)…… USING (plant)……..……...*

Site maps showing sections of drain cleaned is attached yes /no?

Appendix 6

'Look- Up Table for Estimating Liming Requirements'

This look-up table is for use with the field peroxide test as detailed in the NSW ASS Manual 1998. It has been developed by the authors for use specifically to *predict* the amount of lime required to neutralise drain sediment.

At time of writing (Nov 1999) this technique was still in the trial stages. It is imperative that back-up laboratory testing of samples be conducted to monitor the accuracy of the field peroxide test and results interpretation when used in this way (suggested for 10% of samples, at least).

Other methods for obtaining neutralising lime requirements are being developed, in particular involving the chromium-reducible sulfur method.

Lime Requirement (kg/m^3)			
Oxidised Field pH	**Fine Soil**	**Medium Soil**	**Course Soil**
1.30	107	77	25
1.50	77	54	17
1.70	58	39	12
1.90	45	29	9
2.10	35	22	6
2.30	29	18	5
2.50	24	14	4
2.70	20	12	3
2.90	17	10	2
3.10	15	8	2
3.30	13	7	2
3.50	11	6	1
3.70	10	5	1
3.90	9	5	1
4.10	8	4	1
4.30	7	4	1
4.50	6	3	1

Predicted kg Lime Required / m^3 for ASS Affected Drain Spoil relating to different soil texture classes

From G.E. Rayment, T. Balakrishnan, P. Nielson and M. Raymond.
And acknowledging the assistance of the Cooperative Research Centre for Sustainable Sugar Production

Notes:

- Lime rates are for drains / drain spoil rather than the entire paddock, particularly in agricultural areas.
- The lime rates cover both actual and potential acidity with an ASSMAC-recommended safety factor of 1.5.
- Amendments other than lime can be used if due allowance is made for their effective neutralisation capacity.

Approval for use of document.

Martin Upitis
Infrastructure & Asset Management Manager

Bill Paterson
Director City Services

R Pigg
General Manager

Attachment 2 - Map