DEVELOPMENT DESIGN PLANNING SCHEME POLICY

21 June 2004

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TABLE OF CONTENTS

3 ROADS (CONT..

4 EARTHWORKS

10 LANDSCAPING INFRASTRUCTURE, PLANTING & STREET TREES

11 Waterfront Structures & Canals

12 Specifications and Construction

List of Tables

List of Figures

Appendices

List of Acronyms and Abbreviations

AADT	Annual Average Daily Traffic
AD	Average Day
ADAC	Asset Design and As Constructed
AHD	Australian Height Datum
ANZECC	Australia and New Zealand Environment and Conservation Council
ARI	Average Recurrence Intervals
ARQ	Australian Run-off Quality
ARR	Australian Rainfall and Runoff
ASS	Acid Sulfate Soils
BCC	Brisbane City Council
BOD	Biological Oxygen Demand
CBR	Californian Bearing Ratio
CCTV	Closed Circuit Television
CE-QUAL-WZ	a water quality model
CMB	Cement Modified Base
CPTED	Crime Prevention Through Environmental Design
CRCCH	Cooperative Research Centre for Catchment Hydrology
CTB	Cement Treated Base
CWITP	Civil Works Inspection and Testing Plan
DCDB	Digital Cadastral Data Base
DDPSP	Development Design Planning Scheme Policy
DICL	Ductile Iron Cement Lined
DLWC	NSW Department of Land and Water Conservation (now named Department of Infrastructure, Planning and Natural Resources)
DMR	Department of Main Roads
DNPLT	Design of New Pavements for Light Traffic
DNRM and E	Department of Natural Resources, Mines and Energy
DYRASEM-CADEM	a water quality model
EAR	Environmental Assessment Report
EERP	Environmental Emergency Response Plan
EMC	Event Mean Concentration
EMP	Environmental Management Plan
EMS	Environmental Management Systems
EPA	Environmental Protection Agency
ERP	Erosion Risk Potential
ESA	Equivalent Standard Axles
EV	Environmental Values
FBE	Fusion Bonded Epoxy
FRC	Fibre Reinforced Concrete Pipe
FSWMP	Flood and Stormwater Management Plan
GDA	Geocentric Datum of Australia
GIS	Geographical Information Systems
GPS	Global Positioning Systems
GPT	Gross Pollutant Trap
HAT	Highest Astronomical Tide
HGL	Hydraulic Grade Line
IDAS	Integrated Development Assessment System
IFD	Intensity/Frequency/Duration - Rational Method - AR & R
ILUA	Indigenous Land Use Agreement
IMEAQ	Institute Mechanical Engineers Association Queensland
IPWEA	Institute of Public Works Engineering Australia
LAT	Lowest Astronomical Tide
LATM	Local Area Traffic Management
MD	Maximum Day
MDMM	Mean Day Maximum Month

MH	Maximum Hour
MHWS	Mean High Water Springs
MIKE 21	a storm water model
MLWS	Mean Low Water Springs
MSL	Mean Sea Level
MUSIC	a water quality model
MUTCD	Manual of Uniform Traffic Control Devices
NATA	National Association of Testing Authorities
PASS	Possible Acid Sulfate Soils
PSM	Permanent Survey Mark
PUP	Public Utility Plant
QUDM	Queensland Urban Drainage Manual
QWQ	Queensland Water Quality
RCBC	Reinforced Concrete Box Culvert
RCP	Steel Reinforced Concrete Pipe
RHS	Rectangular Hollow Section
RMA 11 (2D)	a 2D model water quality simulation
RMA 11 (3D)	a 3D model water quality simulation
RP	Registered Property
RPDM	Road Planning and Design Manual
RPEQ	Registered Professional Engineer of Queensland
RRPM	Raised Retro Pavement Markers (also shown as Retro Reflective Markers)
RTA	Roads and Traffic Authority (NSW)
SQID	Stormwater Quality Improvement Device
SUNROC	Sunshine Coast Regional Organisation of Councils
SWL	Still Water Level
TMCP	Traffic Management Control Plan
TWCM	Total Water Cycle Management
UPVC	Unplasticised (i.e. rigid) Poly Vinyl Chloride
WQO	Water Quality Objectives
WSAA	Water Services Association of Australia
WSCA	Water Supply Code of Australia
WSUD	Water Sensitive Urban Design
XP-AQUALM	a water quality model

Contents of Section 1– Introduction

Section 1

Section 1

Section 1– Introduction

1.1 Purpose

(1) The purpose of the Policy is to ensure that Council's standard guidelines for development, construction and design of works which are undertaken as part of new development, achieve a consistent standard which reflects best practice in engineering, environmental management and natural resource planning, while addressing safety, accessibility and aesthetically appropriate considerations.

(2) When undertaking development, applicants should have regard to the standards contained within this Policy, which are the minimum acceptable to satisfy performance requirements.

(3) Developers may propose alternative solutions for Council approval to meet the objectives of this policy including safety, legal and environmental considerations.

1.2 Policy Structure Overview

(1) The Policy is divided into eleven sections as follows:

(a) Section 1– Introduction

This section provides an overview of the Policy and general information regarding the application of the Policy, consultant responsibilities, definition of terms, reference documents referred to in the Policy, and standard specifications.

(b) Section 2 – 11 – Development and Design Guidelines

These Sections of the Policy detail development and design guidelines for works undertaken as part of new developments which require Council approval. These sections also apply to all infrastructure assets developed and managed by Council.

(c) Section 12 – Construction

(i) This section details standard guidelines for "donated infrastructure" with regard to its construction, compliance and acceptance.

(ii) This section covers "As Constructed" submissions and Standard Civil Works Inspection and Testing Plans.

1.3 Application of Policy

(1) This Policy is to be read in conjunction with all Codes in which reference is made to the Development Design Planning Scheme Policy.

(2) Where a conflict occurs between the Planning Scheme and Planning Scheme Policies, the Planning Scheme prevails.

(3) This Policy applies to all assessable development including:
- (a) carrying out 'building work';
- (b) carrying out 'plumbing work' or 'drainage work';
- (c) carrying out 'operational work' (including engineering works);
- (d) 'reconfiguring a lot'; and
- (e) 'making a material change of use'.

(4) This policy is applicable to all Council capital works projects and other infrastructure construction and maintenance.

1.4 Consultant Responsibilities

(1) General

(a) All infrastructure which is to be transferred to Council ownership ("donated infrastructure") is to be designed and supervised by an engineer registered with the Board of Professional Engineers Queensland, or the National Professional Engineers' Register.

(b) The engineer is to ensure that infrastructure to be transferred to Council ownership has been designed and constructed in accordance with these guidelines and in accordance with sound engineering practice. Should the engineer propose a design which does not fall within the range of design alternatives permitted by the guidelines, the engineer should discuss the proposal with the relevant development assessment staff at an early stage to ascertain Council's attitude to the proposal.

(2) Design Drawings

(a) Council has adopted a range of standard drawings applicable to development and design of works which require approval. If other than these Standard drawings are to be used, the consultant engineer is to provide sufficient supporting information to justify the alternative proposed.

(b) Design drawings should be numbered, dated, signed and identify authorship. The print quality should be of a standard suitable for photocopying. All drafting should be in accordance with AS 1100: *Technical Drawing*.

(c) Drawings produced for Council works, should be on council drawing sheets with Council job numbers in the title block. Other development works drawings should have "Council's file number" shown on the border of the drawing.

(d) Drawings should be lodged on A1, and/or A3 sized sheets. Where designs are lodged on A1 sized sheets, at least one copy at A3 size should also be lodged. Design details may also be lodged on A4 sized sheets.

(e) Drawings lodged including reduced copies, should be at scales 1:1, 1:2, 1:2.5 and 1:5 and multiples of 10 of these scales.

(f) Text print size on drawings lodged should be not less than 3mm for uppercase text and 3.5mm for lowercase text. This allows for an A1 sheet to be reduced to A3 and still be legible.

(g) All levels should be reduced to Australian Height Datum. Azimuth should be to GDA (Zone 56). Survey should be on true GDA not based on DCDB co-ordinates. Drawings should detail PSMs adopted along with Eastings, Northings and levels. The Surveyor's name and contact details should be detailed on the drawings.

(h) Design revisions should be notated and dated on the drawings.

(i) The drawings to be lodged as part of a design are to include, but are not limited to, the following:
- ♦ Locality plan;
- ♦ Stormwater catchment plan and calculations;
- ♦ Road layout plan, incorporating allotments, contours (or levels), carriageways, chainages, stormwater drainage layout;
- ♦ Longitudinal sections (10:1 distortion), for roads and open channels,
- ♦ Drainage cross sections for rural culvert crossings, (with levels and offsets to ends);
- ♦ Details of culvert inlet and outlet structures and inlet and outlet works (i.e. drains to achieve outlets);

- Intersection, speed control device and cul-de-sac detail plans, (intersection plans shall have 100mm contours) (scales as detailed following section);
- Earthworks and erosion and sediment control plan;
- Road signage, furniture and line marking plan, where applicable;
- Traffic Management Plan for works on Trunk Collector Class Roads (Road classification defined in Table 1) and above;
- Construction details;
- Notation with Design speed and Class of the road (Road classification defined in Table 1);
- Landscaping and Electricity Reticulation/Street lighting Details;
- Services (existing and planned) and services conflicts shall be highlighted;
- For site development works, site layout plan with contours/levels, proposed levels, paved areas, stormwater layout and levels, car parking layout with line marking, landscaping design and other relevant details.

1.5 Terminology

The following terms are used throughout the Policy. Other terms used specifically in various sections and subsections are defined in those sections.

"as-constructed" – all documentation relating to an application, which has been constructed, required by Section 12
"DCDB" – Digital Cadastral Data Base
"GDA" – Geocentric Datum of Australia
"infrastructure assets" – long lived capital assets normally stationary in nature and preserved for a significant number of years. For example roads, bridges, dams, drainage, water or sewerage systems
"PSM" – permanent survey mark
"works" – the design and construction of infrastructure assets

1.6 Reference Documents

The documents referenced in this Policy refer to the current edition including all amendments. These documents include Australian Standards, legislation, Queensland Department of Main Roads Specifications, Queensland Aus-Spec Development Specifications, Standard Test Methods and Caloundra City Council approved Standard drawings.

The Applicant and Supervising Engineer are responsible for ensuring the current edition of reference documents is used.

All Caloundra City Council documents are available for perusal at Council's Customer Service Centre.

Refer also to City Plan codes and other planning scheme policies 11-8 and 11.10 - 11.20.

All forms (eg "as constructed certificates, CWITP, etc.) will be made available from Council in both hard copy and electronic forms.

Caloundra City has adopted the IPWEAQ Standard Drawings for Roads and Drainage (except where modified).

Contents of Section 2 – Environmental Guidelines

Tables in Section 2

Figures in Section 2

Section 2

Section 2

Section 2 – Environmental Guidelines

2.1 Purpose and Structure

(1) The purpose of this Section is to provide guidance on the standards required to address environmental impact management responsibilities for new development in order to:

(a) eliminate and/or mitigate construction and operational impacts through planned and programmed implementation of appropriate controls; and
(b) demonstrate to the community that management of the project will occur in an environmentally acceptable manner.

(2) This Section states Council's procedures for environmental assessment and environmental management. It does not attempt to identify all issues that might arise from an environmental investigation, but will assist in raising awareness of the environmental issues which may affect or be affected by new projects and the process of decision making and management regarding those issues.

(3) This Section is structured as follows:

(a) Subsections 2.1 to 2.4 which provide the framework of the guidelines; and
(b) Subsection 2.5 which constitutes the guidelines:
   (i) 2.5.1 which outlines the requirements relating to the assessment of environmental impact (both positive and negative) as part of the overall environmental planning process through the preparation of an Environmental Assessment Report (EAR);
   (ii) 2.5.2 which outlines the requirements for the development and implementation of an Environmental Management Plan (EMP) which is required for all environmental impacts assessed as "high" under an EAR; and
   (iii) 2.5.3 which outlines the requirements for development and implementation of an Environmental Emergency Response Plan (EERP).

2.2 Terminology

General terms used in this Section are included in Section 1.5. The following terms relate specifically to this section of the Policy:

"EAR" – Environmental Assessment Report – assesses environmental impacts (positive and negative) of the proposed activity and measures the level of significance (High, Medium, Low).
"EMP" – Environmental Management Plan – describes the actions and procedures to avoid or mitigate adverse environmental and social impacts
"EERP" **–** Environmental Emergency Response Plan

2.3 Related Standards/References

(1) Related Standards/References referred to in this Section are as follows:

(a) Department of Main Roads (DMR) publications:
   (i) Road Planning and Design Manual (applies to environmental requirements when planning and designing roads in Caloundra City).

   The following chapters are particularly relevant to the environmental requirements for Council roads:

Chapter 1 – Planning and Design Framework of the DMR Road Planning and Design Manual (addresses the interaction between siting and planning of roads and interaction between other Acts such as the 'Environmental Protection Act 1994', 'Integrated Planning Act 1997' and 'Environmental Protection and Biodiversity Conservation Act 1999');

Chapter 2 – Planning and Design Process of the DMR Road Planning and Design Manual (addresses issues such as environmental assessment, cultural heritage, native title, traffic volumes, geometry); and

Chapter 3 – Environmental considerations; and

(ii) Special Conditions of Contract – Environmental Management (construction); and

(b) Environmental Protection Agency publications:
   (i) Noise Measurement Manual; and
   (ii) Environmental Protection Regulation 1998; and

(c) Australian Standards:
   (i) AS 2436: *Guide to Noise Control on Construction, Maintenance and Demolition Sites*; and
   (ii) AS 4282: *Control of the Obtrusive Effects of Outdoor Lighting*.

(d) City Plan Planning Scheme Policies:
   (i) 11.17 Environmental Assessment and Management Planning Scheme Policy; and
   (ii) 11.17 Noise, Light and Odour Nuisance Planning Scheme Policy.

2.4 Process

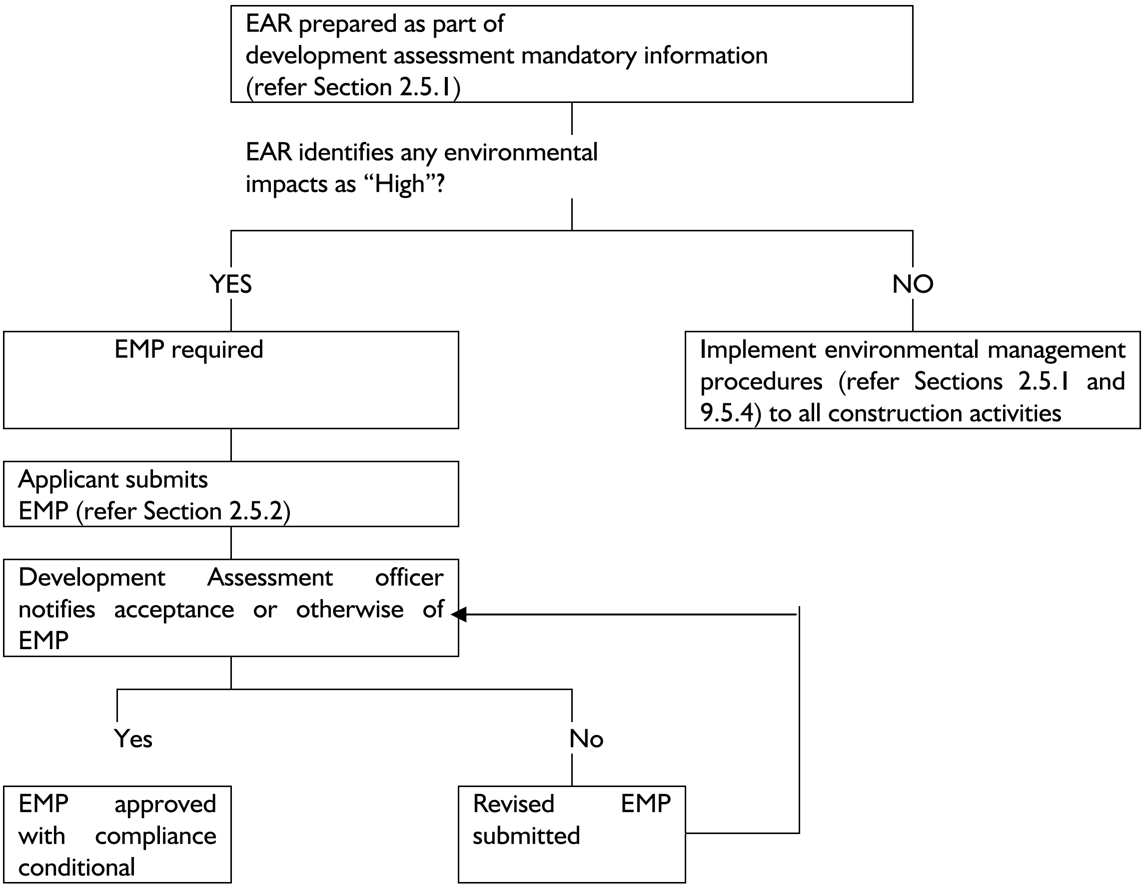


Figure 2.1 – Environmental Assessment Process

2.5 Guidelines

(1) The Environmental Assessment Report (EAR) and, where it is required, the Environmental Management Plan (EMP) is to be prepared by suitably qualified consultants.
(2) Refer also to 'Environmental Assessment and Management Planning Scheme Policy'.

2.5.1 Environmental Assessment Report (EAR)

(1) An Environmental Assessment Report (EAR) is required for all assessable development in order for Council to determine if environmental issues need to be managed through an Environmental Management Plan (EMP).
(2) A suggested EAR format (EAR checklist) is shown in Table 2.1. Following Table 2.1 there is a brief description (Subsection 2.5.1.1 – Guide to Completing EAR) of each of the elements referred to in preparing an EAR. These are intended as a guide only and are not an exhaustive list of issues to consider.
(3) If the EAR indicates that environmental impacts are likely to be **High** then an EMP must be prepared.

POTENTIAL IMPACTS	IMPACT LEVEL					REMARKS	APPROACH TO ADDRESS THE ISSUE			
	HIGH	MEDIUM	LOW	BENEFIT	**PHASE***		DESIGN	CONSTRUCTION METHODOLOGY	ON-GOING MAINTENANCE	FURTHER STUDY
NATURAL ENVIRONMENT										
Biodiversity										
Environmentally Significant Areas										
Water Supply Catchment										
Noise/Vibration										
Dust										
Lighting										
Soils										
Water Quality and Flooding										
Aquatic (Flora/Fauna)										
Vegetation Management										
Fauna										
Air Quality										
Groundwater										
Access										
Pest Management–(Flora/Fauna)										
Waste										
Stockpiles										
Contamination										
Dangerous Goods										

POTENTIAL IMPACTS	IMPACT LEVEL					REMARKS	APPROACH TO ADDRESS THE ISSUE			
	HIGH	MEDIUM	LOW	BENEFIT	**PHASE***		DESIGN	CONSTRUCTION METHODOLOGY	ON-GOING MAINTENANCE	FURTHER STUDY
SOCIAL ENVIRONMENT										
Visual Amenity										
Pedestrian Conflicts										
Access										
Resumptions										
Social Cohesion										
Passenger Transport										
Recreation										
Aboriginal Heritage										
Non-Aboriginal Heritage										
ECONOMIC ENVIRONMENT										
Economic Effects										
Property Values										
OTHERS										
Waste										
Stockpiles										
Contamination										
Dangerous Goods										

Table 2.1 – Environmental Assessment Report (EAR) Checklist

*C = Construction; O = Operation

2.5.1(1) Guide to Completing EAR

The following provides a brief description of each of the sections referred to in Table 2.1 and the standards to be met.

(1) Natural Environment

(a) *Biodiversity*

Applicants are advised to refer to any local or regional policies, plans, or strategies including maps and reports that identify and set management objectives for areas which are recognised for their significant biodiversity within and adjacent to the development site.

(b) *Environmentally Significant Areas*

Applicants are advised to refer to any local or regional policies, plans, or strategies including maps and reports that identify and set management objectives for areas which are identified as environmentally significant within and adjacent to the development.

(c) Council may, in its conditions of development approval, nominate all or part of the subject land as environmentally significant in order to preserve flora, fauna, habitat, geology or other environmental attributes. Appropriate details are to be included on the project design drawings and in the EMP if a "High" potential environmental impact is identified.

(d) *Water Supply Catchment*

Applicants are advised to plan for and take necessary precautions if works are proposed within any parts of Caloundra City's water supply catchments, including locating waterways which may be affected by runoff from the site. Contingency plans are recommended to prevent or respond to a spill or leakage into waterways.

(e) *Noise and Vibration*

The EAR process should determine if noise and vibration during the development phase could impact on the natural and social environment such as that generated by road traffic and construction equipment.

The objective is to reduce construction noise and vibration as far as practicable by appropriate management procedures, including using low-noise equipment, noise suppression on machinery, noise absorptive barriers, appropriate construction methods, programming of noise generating works to times of least sensitivity and liaison with stakeholders and community.

Noise readings are to be obtained from the nearest and/or most affected residential dwelling to construction site under development. Refer also to the 'Noise, Light and Odour Nuisance Planning Scheme Policy'.

The method of measurement and reporting of noise levels is to comply with the Environmental Protection Agency Noise Measurement Manual.

Critical to be met – noise and vibration.

- Effective silencing of equipment and other abatement techniques are to be employed to minimise construction site noise at all times. Table 2.2 lists typical noise limits (sound pressure levels) for construction plant as measured at seven metres. Further guidance can be obtained by referring to AS 2436: *Guide to Noise Control on Construction, Maintenance, and Demolition Sites*.

- Plant equipment and construction noise which exceeds the levels set out in Table 2.2 below will be recorded as non-compliance and actioned accordingly.

Item Description	**Sound Pressure Level (dBA) at 7m Distance**
Scraper	86
Bulldozer	85
Grader	84
Front-end Loader	86
Vibrating Roller	82
Backhoe	83
Excavator	80
Compressor	75
Concrete Vibrators	87
Concrete Pump	84
Dump Truck	83
Water Tanker	84
Compactor	85
Concrete Saw	93

Table 2.2 – Noise Limits of Construction Plant Items (L_{Amax}at 7m)

Source: DMR Special Conditions of Contract – Environmental Management (Construction)

- A builder or building contractor is not to carry out building work on a building site in a way that makes or causes audible noise to be made from the building work –

  (i) on a Sunday or public holiday, at any time; or
  (ii) on a Saturday or business day before 6.30am or after 6.30pm.

- Vibration from construction activities, when measured in the vertical or horizontal axes on a footing at a position closest to the dominant vibration is not to exceed the velocities outlined in DMR Special Conditions of Contract – Environmental Management (Construction). Any plant equipment and construction vibration which exceeds the levels set out above is to be recorded within the EMP.

(f) *Dust*

Dust suppression should be a normal procedure during construction especially if development activities are likely to occur near residential or ecological areas.

(g) *Lighting*

All internal and external lighting devices to be installed on the site are to be appropriately designed, sited, and installed in accordance with AS 4282: *Control of the Obtrusive Effects of Outdoor Lighting* to ensure that adjoining premises, traffic and wildlife are not adversely affected.

Landscape screening can only be considered an appropriate measure if the vegetation is in a mature state of growth and has width and density characteristics sufficient to provide light and noise control benefits. Until the vegetation is in a mature state, other measures should be considered to prevent a nuisance light issue.

(h) *Soils*

Potential for soil erosion, dispersive clays, acid sulfate soils, and instability arising from soil disturbance or placement are to be considered.

(i) Erosion and Sedimentation – Erosion and Sediment Control is to be addressed as part of the EMP. Any development is to be designed to manage erosion, sedimentation and stormwater quality in accordance with the requirements in Section 5 – Total Water Cycle Management, Section 6 – Stormwater and Drainage Management and Section 8.6.3 Erosion and Sediment Controls.

(ii) Contaminated Land – Where land to be developed may have been subject to contamination, investigation and/or clearance in accordance with the Environmental Protection Regulation 1998 is required.

The applicant is responsible for ensuring contaminated land is not used for inappropriate developments.

(iii) Acid Sulfate Soils – Soils that have the potential to develop acidic properties are to be managed in such a way that sulfate oxidation is minimised and/or prevented. In the event that acid is produced, such acid is to be neutralised to prevent or avoid any discharge of the acid from the site.

All development is to be designed to manage the potential effects of acid sulfate soil described above, in accordance with the requirements in Section 4 – Earthworks.

The presence of acid sulfate soils indicates a “High” potential environmental impact and is required to be addressed within an EMP.

(i) *Water Quality and Flooding*

Construction and development can change flooding characteristics, cause degradation of water quality and exacerbate flooding if works are implemented without considering possible impacts from stormwater runoff and the effects of development-related activities on waterways and structures.

All development is to be designed to manage these effects, in accordance with the requirements in Section 5 – Total Water Cycle Management and Section 6 – Stormwater and Drainage Management.

(i) Stormwater Quality Control – Stormwater Quality Control is to be addressed as part of an EMP if potential environmental impacts are assessed as “High”. Development is to be designed to manage stormwater quality in accordance with the requirements in Section 5 – Total Water Cycle Management, Section 6 – Stormwater and Drainage Management and Section 9.5.5 Soil Erosion and Sediment Controls.

(ii) Hydrology and Hydraulics (Flood Management) – Hydrology and hydraulic (flood management) aspects of the development are to be addressed as part of the EMP. Any development is to be designed to manage stormwater quantity in accordance with the requirements in Section 5 – Total Water Cycle Management, Section 6 – Stormwater and Drainage Management and Section 9.5.5 Soil Erosion and Sediment Controls.

(j) *Aquatic (Flora and Fauna)*

Effects of works such as bunding, roads and tracks, fluctuating water levels, generation of sediments, stormwater management in or adjacent to wetland, riparian, or estuarine areas are to be avoided or minimised. Spillages or leakages of hazardous substances may also adversely affect waterbodies and their storage, handling and use are to be in accordance with accepted standard practices.

(k) *Vegetation Management*

Areas disturbed during development may need to be rehabilitated. Therefore development should minimise or prevent impacts on existing vegetation. Applicants are to identify where vegetation can or should be retained, where it can be replaced, as well as identifying where significant areas need special management. There may be intrinsic values in how areas of vegetation provide continuous links to other habitats which need to be retained.

Depth and area of earthworks are to be minimised to retain the ground cover and its associated root structure and seed stock. In areas requiring more significant earthworks the topsoil should be stripped separately from the subsoil to an area where it can be recovered for later use.

In order to maintain existing natural drainage networks, and to ensure there is no adverse effect on stream bank vegetation, the limit of development is to be in accordance with the Natural Waterways and Wetlands Code for natural buffers to be maintained to waterways and wetlands and for water quality and water cycle management.

Development should be planned and managed to prevent the introduction of weed species during development and to minimise opportunities for weed infestation following completion.

(l) *Fauna*

Applicants are required to identify fauna species present on the site, and their status and habitat through a fauna survey.

As large an area of undisturbed habitat as possible needs to be preserved. It is also important to retain physical vegetation links to other habitats in order that fauna corridors can function as naturally as possible.

(m) *Air Quality*

Any relevant management actions relating to air quality pollutants including sulphur dioxide, carbon monoxide, nitrogen oxides, airborne lead, airborne particulates, organic pollutants, light, vibration, and vehicle emissions with a High potential environmental impact are to be incorporated into an EMP. The objectives should be:

(i) No significant decrease in air quality in accordance with EPA air quality indicators and goals for particulate matter (PM10); and

(ii) The minimisation of dust impact on nearby developments during construction using best practice techniques.

(2) Social Environment

(a) *Visual Amenity*

Opportunities for landscaping following completion of development are to be considered. Scenic quality and values of an area may be rated as "high", "medium", or "low" with various treatments ascribed as appropriate.

(b) *Pedestrian Conflicts*

Easy, safe and continuous access is to be maintained during development and following completion of the project.

(c) *Resumptions*

Resumption of land may be necessary as a part of the development approval process. If resumption is necessary then early discussions with Council development assessment officers is advised in order that affected parties may participate in a coordinated and timely consultation process.

(d) *Social cohesion*

Effects of the project on social cohesion and existing and future urban form both during development and post-development are to be considered. Refer to the Caloundra City Social Strategy.

(e) *Recreation*

Existing levels of service are to be maintained. Consideration is to be given to whether the development could add to existing recreation opportunities and if there are areas where the development could enhance access to recreation for the local community are to be considered. Refer to the Caloundra City Recreation Strategy.

(f) *Aboriginal Cultural Heritage*

Loss of, or damage to, items of cultural heritage or archaeological significance as a result of the development is to be minimised. Aboriginal cultural heritage is to be addressed as part of the EAR in accordance with the scale and potential impacts of the proposed development.

If Aboriginal cultural heritage rates "High" in the EAR a Cultural Heritage Management component is to be included in the EMP to address the following:

(i) a suitably qualified person is to be available during the initial development period prior to excavation to assess any cultural heritage material. This person is to have contacts with both the Queensland Museum and local traditional owners in the event that detailed assessment recording, collection, or monitoring is required;

(ii) production and distribution of a brief information sheet to development personnel covering Aboriginal and European cultural heritage issues, to inform them of the nature of material that may be encountered during construction;

(iii) A permit to excavate and collect under the Cultural Record (Landscapes Queensland and Queensland Estates) Act 1987, to enable the movement of cultural material from the site in the event of it being discovered; and

(iv) Specific procedures to be implemented for development activities, including Indigenous Land Use Agreements (ILUAs), cultural heritage management plans, and procedures for accidental discovery.

(g) Non-Aboriginal Heritage

Some areas may have historical significance due to the activities of European or other cultural groups. Applicants are advised to refer to the Cultural Heritage and Character Areas Code.

(3) Economic Environment

(a) *Economic Effects* – Whether the proposed development will provide opportunities for economic growth beyond the period of development or if the proposed development could enhance existing economic opportunities for the wider community are to be considered.

(b) *Property values* – Effects of the proposed development on property values are to be considered.

(4) Other

(a) *Waste*

(i) Development activities should minimise the potential for the generation of wastes;

(ii) Relevant authorities should be immediately notified if it is determined through monitoring of the quality of surrounding environmental indicators that current work or operating practices are having adverse impacts on flora, fauna, water quality or air quality; and

(iii) Actions should be taken to identify what is causing the non-conformance and to prevent or modify immediately any work or operating practices which are causing non-conformance.

(b) *Stockpiles*

(i) Stockpiles are to be minimised in area and volume and located away from watercourses; and

(i) Stockpiles are to be managed to prevent washing into waterways or drainage systems, and to prevent them from being a source of dust.

(c) *Contamination*

Existing or potential contamination on the site is to be managed to prevent movement of the contaminated material off site. Existing contaminated areas are to be left undisturbed, or, if necessary, moved off site and disposed of in an appropriate licensed facility.

(d) *Dangerous Goods*

(i) Dangerous goods are to be identified, including volumes and types of dangerous goods to be used/stored on site; and

(ii) The applicant is to ensure that storage and handling of dangerous goods does not cause pollution of the environment or harm to persons.

2.5.2 Environmental Management Plan (EMP)

(1) Purpose of EMP

(i) The purpose of an EMP is to detail the actions and procedures to be carried out during the implementation and operational phases of development in order to mitigate adverse environmental and social impacts.

(ii) The EAR identifies and establishes the potential environmental impacts of the project, with the recommended mitigation measures for these impacts to be addressed by the EMP.

(iii) The EMP is to address proposed safeguards and control measures and establish the management framework to ensure the mitigation measures identified in the EAR are implemented.

(iv) EMP becomes the key reference document in the construction and maintenance phase in that it converts the undertakings and recommendations of the EAR into a set of actions and commitments to be followed by the applicant.

(v) The EMP also makes provision for unforeseen events by outlining corrective actions which may be implemented or followed.

(vi) Each EMP should be written as a stand-alone document so that all pertinent information is included in a practical, useful and complete manner.

(2) Format and Structure of EMP

(i) All EMPs should be prepared taking into consideration the requirements of the contract specifications and environmental performance reported as part of the applicant's management and quality processes.

(ii) It is recommended that EMP is structured in the following format:

Executive Summary

1.0 Introduction

1.1 Background
1.2 Previous Studies
1.3 Purpose of the EMP
1.4 Structure of the EMP

2.0 Project Description

3.0 Environmental Responsibilities

4.0 Statutory and other Obligations

5.0 Environmental Management Procedures

6.0 Environmental Monitoring Program

7.0 Auditing

8.0 Training

9.0 Environmental Incident Reporting and Corrective Action

10.0 References

11.0 Appendices

Figure 2.2 – EMP Structure

Chapters 2, 3 and 4 of an EMP should describe the project, the overall environmental management structure and responsibilities and the statutory, legislative and policy obligations for the EMP.

Chapter 5 should identify the environmental factors and potential impacts and their associated design considerations and recommended management. For each environmental element the following points should be outlined:

(i) Issue of Significance – aspect of construction or operation with potential impact;
(ii) Potential Impacts – potential impacts which may occur as a result of the activity;
(iii) Performance Standard – establishment of agreed performance criteria and objectives for each element of the operation with potential impact in relation to appropriate policies, standards and guidelines; and
(iv) Control Measures – detailed prevention, minimisation, and mitigation measures for the potential impacts to achieve the performance standard.

The following environmental values should be considered when compiling an EMP. They are site specific and need to be addressed where relevant in the performance standards:

(i) Air quality
(ii) Acid sulfate soils
(iii) Cultural heritage
(iv) Erosion and sediment control
(v) Flora and fauna
(vi) Hazardous substance management
(vii) Light management
(viii) Mosquito and midge control
(ix) Noise control
(x) Site management
(xi) Stormwater management
(xii) Traffic management
(xiii) Waste management
(xiv) Water quality

Chapters 6, 7, 8 and 9 should detail the environmental monitoring, auditing, training and reporting programme and define the process for dealing with nonconformance.

For further details on these values, refer to Section 2.5.1.

2.5.3 Environmental Emergency Response Plan (EERP)

(1) It is recommended that the EERP is structured in the following format:

Part A: Introduction

- Purpose
- Legislation
- Reference
- Responsibilities
- Reporting

Part B: Environmental Contingency Procedures, determined by site/activity and associated environmental risks including:

- Spill Prevention and Management
- Fire Prevention and Management
- Flood Response Plan
- Dewatering
- Wildlife Rescue

Appendices:

- Contact Directory
- Environmental Incident Report Form
- Contingency Equipment List

Figure 2.3 – EERP Structure

2.6 Guidelines – Refuse Container Storage

The storage of refuse at high density residential, commercial and industrial premises is often a source of complaints and nuisance due to aesthetics (visual amenity, odours, flies, cockroaches etc) and has the potential to create both litter and stormwater pollution. The Environmental Protection (Interim Waste) Regulation 1996 provides Council with the power to require a suitable area for waste collection for all of the above uses.

This guideline provides the basic information to assess the minimum requirements of a refuse container storage area for a variety of uses. However, it is a guideline only which if followed will generally result in a refuse storage area that will be approved by Council's Environmental Health Officer.

The requirements for refuse container storage areas addressed by this guideline include definition of the developments where they are required, size, location, screening and enclosure, drainage, water supply and signage.

2.6.1 Developments Where Refuse Container Storage Areas are Required

The regulations provide Council with the power to require a storage area at practically all developments apart from a single unit private dwelling. It is generally not practical at many small scale developments to require a storage area as they may only have one or two wheely carts. The provision of a storage area is at the discretion of the Council's Environmental Health Officer but will generally be required for the following developments:-

- *Multiple Dwelling residential development of four (4) or more units*
- *Townhouse style residential development*
- *Commercial development (shops, offices, medical centres etc.)*
- *Accommodation buildings (motels, guesthouses, holiday resorts, flats etc)*
- *Industrial sheds and buildings*
- *Caravan parks, mobile home parks, camping grounds, cabins etc.*
- *Retirement villages, nursing homes, and the like.*
- *Tourist attractions, sporting facilities, places of public amusement or indoor/outdoor entertainment.*
- *Hospitals, schools, public facilities etc.*

Where a development does not easily fit into the above categories or is of such a scale that it is so large that it may require special refuse facilities or so small that a storage area may not be required, it is recommended that clarification of requirements be sought from the Environmental Health Officer, Growth Management Unit.

2.6.2 Size of Refuse Container Storage Areas

(1) Recycling Bins

Part of Council's implementation of the Waste Management Strategy is to supply all "commercial premises" with recycling bins (see note below). Developers/draftspersons/architects and building designers must be aware that the City's Waste Management Strategy has provision for the allocation of recycling bins to all properties, including commercial premises. This implementation will be a staged "role out" and whilst the majority of commercial sites do not presently have these recycling bins in place, provision should be made at the design stage of refuse container storage areas for commercial premises, to cater for recycling bins.

Section (a) – (e) below, discuss the areas required for refuse container storage areas for various types of developments. It is envisaged that these areas are large enough to cater for placement of recycling bins. However, a case by case determination may have to be made at the design stage which takes into account the nature of the proposed development. Designers of refuse container storage areas are encouraged to liaise with either Council's Environmental Health Officer (Growth Management) or Waste Management Officer in this instance.

Note: For the purposes of this section (section (a)), "commercial premises" also includes a residential site where they are more than three habitable dwellings located on the premises, i.e. A multiple dwelling containing 3 or more units, e.g. holiday units.

(2) Residential Development

Residential developments (e.g. high rise units, townhouses, retirement villages etc) generally utilise wheely carts although some have bulk bins. The size of the area required is dependant on the type of bin used. Where it is not known which bin system is preferred it is recommended that the criteria for wheely carts is applied as it will also cover the option of a bulk bin. Also note that the criteria are for external storage areas only. This Guideline does not apply where internal garbage chutes are utilised. Note: See also section (a) for provision of recycling bins.

(a) Wheely Carts

Minimum storage areas shall be 0.6m^2 per unit and be reasonably regular in shape. This will allow adequate space for the bins (up to one per unit), allow room for the movement of bins and allow easy access to all bins within the area.

(b) Bulk Bins

If it is certain that a bulk bin will be used then the following criteria can be applied.

NUMBER OF UNITS	MIN. DIMENSION OF STORAGE AREA
Up to 6 units	2.1m x 1.8m
7 to 12 units	2.5m x 2m
Over 12 units	*2.5m x 2m

Table 2.3 – Bulk Bins Criteria

* Must be confirmed by the Environmental Health Officer, Growth Management Unit as a larger area may be required.

At some forms of residential development it may be more desirable not to have a storage area. Detached unit style developments (e.g. The Groves, The Palms, small townhouses etc) usually prefer to have a bin stored at each unit and residents or managers place the bins at the kerbside for servicing. Generally a storage area will be required where it is a shared or common refuse service or where it is not possible or desirable to have a bin kept at each unit (e.g. high rise units, nursing homes etc).

Where it is a preferred option for single bins to be stored at each individual dwelling unit, it is still a requirement for a bin wash bay to be provided on the property that is drained in accordance with Section 4 of this Guideline. Furthermore, consideration must be given to the safe and accessible location of bins near the road frontage of the property to enable Council's Cleansing Contractor easy safe access to service the bins.

(3) Commercial Development

A great variety of uses fall under this category such as shops, offices, medical centres, motels, holiday resorts, caravan parks, guesthouses etc. Due to this variation the following minimum criteria may not always be accurate and larger or smaller areas may be required. Note: See also section (a) for provision of recycling bins.

(a) Shops, Offices, Medical Centres etc.

For up to six (6) units or tenancies a minimum area of 5m^2 is required with minimum dimensions of 2.5m x 2m. An additional 0.6m3 is required for every unit or tenancy over 6 for small to medium complexes. For larger shopping centres (e.g. Sunland, Franklins etc) garbage compactors may be required and the Environmental Health Officer's advice should be sought.

For premises where the intended use is for a medical centre or similar, and where clinical or related waste is generated (e.g. sharps, needles, blood products, human and animal waste, laboratory waste, radioactive waste etc), the refuse container storage area should be designed and constructed as a "secure" facility, such that the area is not accessible to persons or animals, other than those persons authorised by the operator of the premises to enter the area.

(b) Motels, Guesthouses, Cabins, Holiday Resorts (e.g. Oasis) etc.

A minimum area of 5m^2 with minimum dimensions of 2.5m x 2m. Where more than 15 units are proposed the area should be increased at the rate of 0.3m^2 per unit.

(c) Caravan Parks

A minimum area of 5m^2 with minimum dimensions of 2.5m x 2m. The size of the area is to be increased by 2m^3 for every 15 sites or part thereof where there are more than 40 sites.

(d) Service Stations

A minimum area of 5m^2 with minimum dimensions of 2.5m x 2m. Where a vehicle workshop, carwash or other ancillary use is also included with the service station a large storage area may be required.

(e) Hotels

A minimum area of 5m^2 with minimum dimensions of 2.5m x 2m. The size of the development may necessitate the provision of a larger area and the advice of the Council's Environmental Health Officer should be sought.

(f) Childcare Centres, Kindergartens

A minimum area of $3m^2$ with minimum dimensions of 2m x 1.5m.

(4) Industrial Development

There is significant variation between the size and types of bins used in industrial areas ranging from 120 litre wheely carts to 15m3 garbage compactors. At the building application stage it is rarely known what industrial use will occupy the building and these uses often change over a number of years. To cover most industrial premises a minimum area of $5m^2$ is required with minimum dimensions of 2.5m x 2m. For large industrial premises either multiple or larger storage areas may be required and the advice of the Council's Environmental Health Officer should be obtained. Note: See also section (a) for provision of recycling bins.

(5) Other developments where criteria not applicable

There are a wide range of uses where a refuse container storage area is required but no general size criteria can be applied. These include schools, hospitals, tourist attractions, sporting facilities, nursing homes, some accommodation uses etc. The size of the area required depends largely on the scale and anticipated patronage of the development. Storage areas for these uses will require individual assessment by the Council's Environmental Health Officer and a minimum area of $5m^2$ with minimum dimensions of 2.5m x 2m will generally be required. Note: See also section (a).

2.6.3 Location and Screening of Refuse Container Storage Areas

Generally storage areas must be located where they provide easy, unobstructed access for the cleansing contractor. They should be located as close as practicable to the street alignment (so long as the minimum frontage landscaping as required by the planning scheme is provided) and close to the vehicular access into a development. Often the contractor has to manoeuvre a large bulk bin on wheels into a suitable position for connecting it to the service vehicle. Any features that would make bin movement difficult, such as sloping areas, uneven surfaces, ledges, drains, bunds, stairs etc should be avoided around the storage area or where the bin has be manoeuvred to the service vehicle.

Storage areas should be kept as far away as possible from adjoining properties to minimise odour, fly and vermin problems.

Storage areas must be enclosed on at least three (3) sides to screen the bins from view from adjoining properties and the road. The enclosure should be at least 1.8 metres high and be comprised of materials that are compatible with buildings, fencing or landscaping on the site. Typical enclosures include paling fences, lattice work, brick or blockwork etc. Vegetated landscaping can also aid in screening the enclosure from view.

2.6.4 Drainage and Water Supply

An impervious floor surface is required in storage areas. Typical materials include concrete, bitumen and in some cases paving. Runoff from the floor of the area must not discharge directly to any neighbouring property, the road or to a point where the waste water could lead to a gully, gutter, drainage line or natural water way. Runoff should preferably run to a grassed area, garden bed or some other approved method of water quality improvement be employed before runoff enters the internal or external stormwater drainage system.

In addition, every storage area must be provided with a washdown pit connected to the sewerage system to the satisfaction of Council's Building & Plumbing Section (see attached). Preferably the washdown pit would be located centrally within the bin storage area. A hose cock must also be provided either in or adjacent to the storage area.

Note: In non-sewered areas of the City, it is not always practical to install a wash down pit because of the absence of a municipal sewer to connect the wash down pit to. In certain circumstances it will be possible to connect the wash down pit to the on-site waste water disposal system, i.e. the septic system or equivalent. Where this is not possible and/or practical, the wash down pit must be constructed such that waste water is entirely directed to a grassed or similarly vegetated area, e.g. landscaped gardens or some other approved method of water quality improvement, before the runoff enters the internal or external stormwater drainage system.

The following warning must be painted on the internal area of the washdown pit or in a conspicuous location adjacent to it, in letters of at least 50mm high and 30mm wide:-

<u>BIN WASHDOWN WASTE ONLY</u>
DISPOSAL OF ANY OTHER
LIQUID OR WASTE IS
PROHIBITED

Contents of Section 3 – Roads

Contents of Section 3 – Roads (cont…)

Tables in Section 3

Figures in Section 3

Section 3 – Roads

3.1 Purpose and Structure

(1) The purpose of this Section is to provide guidance on the standards required in relation to roadworks for new development in order to:

- (a) ensure road design and construction meets Council's requirements for planning and design, environmental and safety expectations and Council's Access and Equity Policy; and
- (b) ensure road assets which are transferred to Council meet Council's construction and maintenance requirements.

(2) This Section states Council's requirements in relation to all proposed dedicated roads and private roadways.

(3) This Section is structured as follows:

- (a) subsections 3.1 to 3.5 which provide the framework of the guidelines;
- (b) subsection 3.6 which constitute the guidelines:
  - (i) 3.6.1 which provides the principles for road planning;
  - (ii) 3.6.2 which provides the geometric and engineering design guidelines;
  - (iii) 3.6.3 which provides the guidelines for intersections and turning traffic;
  - (iv) 3.6.4 which provides pavement and surfacing design guidelines;
  - (v) 3.6.5 which provides the line marking, pavement markers and signage guidelines;
  - (vi) 3.6.6 which provides the guidelines for frontage works;
  - (vii) 3.6.7 which provides the street lighting guidelines;
  - (viii) 3.6.8 which provides the guidelines for utilities and service crossings;
  - (ix) 3.6.9 which provides the construction tolerances and testing guidelines;
  - (x) 3.6.10 which provides the drainage guidelines;
  - (xi) 3.6.11 which provides guidelines on other road issues.

3.2 Terminology

General terms used in this Section are included in Section 1.5. The following terms relate specifically to this Section of the Policy.

"AADT" – Annual Average Daily Traffic
"ARR" – Australian Rainfall and Runoff
"CCC" – Caloundra City Council
"***CMB"*** – Cement Modified Base
"CTB" – Cement Treated Base
"*DMR*" – Department of Main Roads Queensland
"ESA" – Equivalent Standard Axle
"IPWEA" – Institute of Public Works Engineering Australia
"MUTCD" – Manual of Uniform Traffic Control Devices (Main Roads Queensland edition)
"QUDM" – Queensland Urban Drainage Manual
"Road" – A road is a route in which the principal function is to carry traffic. Roads comprise those elements of Council's hierarchy of traffic collection and above.
"Road Lighting Tariff 1" – Lighting supplied, installed, owned and maintained by Energex
"Road Lighting Tariff 2" – Lighting owned and maintained by Energex
"Road Lighting Tariff 3" – Lighting supplied, installed, owned and maintained by Council or third party applicant contributed asset.
"RRPM" – Raised Retro-Reflective Pavement Markers
"RPDM" – Road Planning & Design Manual
"RTA" – Roads and Traffic Authority – NSW
"Street" – A street is a route in which fostering amenity is the principal objective. Streets comprise those elements of Council's hierarchy of collection and below.
"SUNROC" – Sunshine Coast Regional Organisation of Councils
"VPD" – Vehicles per day
"VC" – Vertical curve

3.3 Related Standards/References

(1) Related Standards/References referred to in this Section are as follows:

(a) Austroads Publications

(i) Rural Road Design Manual
(ii) Guide to Traffic Engineering Practice

Part 1	Traffic Flow
Part 2	Roadway Capacity
Part 3	Traffic Studies
Part 4	Road Crashes
Part 5	Intersections at Grade
Part 6	Roundabouts
Part 7	Traffic Signals
Part 8	Traffic Control Devices
Part 9	Arterial Road Traffic Management
Part 10	Local Area Traffic Management`
Part 11	Parking
Part 12	Roadway Lighting
Part 13	Pedestrians
Part 14	Bicycles
Part 15	Motorcycles

(iii) A Guide to Design of New Pavements for Light Traffic (DNPLT)
(iv) Road Safety Audit Guidelines

(b) Australian Rainfall and Runoff

(c) Australian Standards

(i) AS/NZS 1158.1.1: *Road Lighting Part 1.1: Vehicular Traffic (Category V) Lighting – Performance and Installation Design Requirements*
(ii) AS/NZS 1158.1.3: *Road Lighting Part 1.3: Vehicular Traffic (Category V) Lighting – Guide to Design, Installation, Operation and Maintenance*
(iii) AS/NZS 1158.3.1: *Road Lighting – Pedestrian Area (Category P) Lighting Code, Performance and Installation design requirements*
(iv) AS 1158.4: *SAA Public Lighting Code Part 4: Supplementary Lighting at Pedestrian Crossings*
(v) AS 1428.1: *Design for Access and Mobility, Part 1: General Requirements for Access*
(vi) AS/NZS 1428.4: *Design for Access and Mobility, Part 4: Tactile Ground Surface Indicators*
(vii) AS 2890.1: *Off Street Carparking*
(viii) AS 2890.2: *Commercial Vehicle Facilities*
(ix) AS 2890.3: *Bicycle Parking Facilities*
(x) AS 2890.4: *Bus Parking Facilities*
(xi) AS 2890.5: *On Street Parking*
(xii) AS 3600: *Concrete Structures*
(xiii) AS 1100: *Technical Drawing*

NOTE: The above list is not exhaustive and other relevant Australian Standards may be applicable depending on the works being designed and constructed. It is the responsibility of the user of this document to ensure that the relevant Australia Standards have been complied with.

The above standards shall be the latest published standards.

(d) Caloundra City Council Publications

(i) Caloundra City Road Hierarchy Study
(ii) Access and Equity Policy
(iii) Design Traffic Loading
(iv) CCC4 – Roadworks
(v) Recreational Links and Trails Strategy.

(e) Cement and Concrete Association Publications

(i) Concrete Pavement Design for Residential Streets
(ii) Road Note 62 – Skid Resistance of Decorative Paving
(iii) Interlocking Concrete Road Pavements – A Guide to Design and Construction
(iv) Concrete Segmental Pavements – Design Guide for Residential Accessways and Roads

(f) Queensland Urban Drainage Manual (QUDM)

(g) Queensland Department of Main Roads Publications

(i) Road Planning and Design Manual
(ii) Chapters 1, 2 and 3 which outline environmental requirements
(iii) Road Project Environmental Management Processes
(iv) Pavement Design Manual
(v) Pavement Rehabilitation Manual
(vi) Road Drainage Design Manual
(vii) Manual of Uniform Traffic Control Devices
(viii) Guide to Pavement Markings
(ix) Road Landscape Manual
(x) Standard Specifications Manual
(xi) Specification ES 126 – Road Signs

(xii)Cost sharing based on responsibilities within State Controlled roads.

(h) Queensland Streets

(i)Roads and Traffic Authority (RTA) publications

(i) Concrete Pavement Manual, Design and Construction
(ii) Concrete Round-a-bout pavements – A guide to their Design and Construction

(j)Institution of Engineers Australia (Queensland Division) Publication

(i) Soil Erosion and Sediment Control – Engineering Guidelines for Queensland Construction Sites (1996).

(j) Energex Design Guide – Design of Rate 2 Public Lighting Installations

(2) Document Precedence

Where there is any ambiguity between documents (or the required standards are not clarified in this Policy), the higher order document shall be that <u>first</u> mentioned in the following list:-
(a) Caloundra City Council Publications
(b) Queensland Streets
(c) Queensland Urban Drainage Manual
(d) Australian Rainfall and Runoff
(e) Queensland Department of Main Roads Publications
(f) Austroads Publications
(g) Australian Standards
(h) Cement and Concrete Association Publications
(i) RTA Publications
(j) Disability and Discrimination Act

Where a higher order document references a lower order document, the lower order document that is being referenced does not take preference over a higher order document. For example, if "Queensland Streets" referenced "Austroads Part 5", the requirements in "Part 5" would not take precedence over the Queensland Department of Main Roads Road Planning and Design Manual.

3.4 Standard Specifications

(1) All works are to be documented and constructed in accordance with either:
(a) Caloundra City Standard Specifications; or
(b) DMR Specifications + AS 2124: *General Conditions of Contract;* or
(c) SUNROC Auspec Construction Specifications (When issued).

(2) Ramps and pram ramps are to be constructed in accordance with AS 1428.4*: Design for Access and Mobility, Part 4: Tactile Indicators.*

(3) Tactile tiles are to be installed in accordance with AS 1428.1: Design for Access and Mobility, Part 1: General Requirements for Access – New Building Work.

(4) Refer to Section 1.4 (2) for the specifications for design drawings

(5) Refer to IPWEAQ standard drawings (except as modified).

3.5 Process

Road construction is:
required under a Code; or
required as a condition of development approval;
or
prepared by the applicant

EMP required under Section 2.5.2

YES

EMP process (refer Section 2.4)

NO

Road Design prepared taking into account:

(i) Access and Equity Policy - Section 3.6.11 (4).
(ii) Road Hierarchy classifications - Section 3.6.1 (1).
(iii) Pavement Design and Surfacing - Section 3.6.4.
(iv) Caloundra City Council adopted Standard Drawings.
(v) Water Sensitive Urban Design Principles - Section 6.11.
(vi) Landscaping provisions - Section 10.7.
(vii) Soil Erosion and Sediment Controls - Section 9.5.5.
(viii) Requirements of Section 3.6.2 (Geometric and Engineering Design).

Road(s) and/or Street(s) design certified by:
RPEQ or NPER3
Road Safety auditor {Section 3.6.11(1)}

Figure 3.1 – Road Design

3.6 Guidelines

(a) Consideration must be given to both the Road Planning and the full range of Engineering design requirements of this Section.
(b) It is important that the planning and design requirements are considered in the early and overall planning stage of a development proposed to ensure that road layouts are satisfactory. Alterations to the development layout may otherwise be necessary to accommodate planning and these requirements.
(c) Refer also to Section 9 – Site Development.

3.6.1 Road Planning

The position of a road in the hierarchy defines a number of principles that need to be embodied in the planning including:

(i) Design Speed Environment;
(ii) Capacity and Deficiency Volume;
(iii) Intersection and Turning Traffic Provisions;
(iv) Access Controls;
(v) Local Area Traffic Management;
(vi) Pedestrian and Bicycle Management;
(vii) Public Transport;
(viii) Kerbside Management – Parking and Public Transport;
(ix) Streetlighting; and
(x) Environmental Considerations.

3.6.1 (1) Road Hierarchy

(a) The classification of roads in Caloundra City is defined in the Caloundra City Road Hierarchy Study. Caloundra City has adopted the road hierarchy classification shown in table 3.1.

Road Hierarchy	Traffic Capacity per day	Definition / Function	Design Speed km/hr
Urban			
Freeway	+ 40,000	High speed - high volume route. Access to major arterial roads by grade separated interchanges.	80 to 100
Major Arterial Road	30,000 to 60,000	Major regional and inter-regional movement. Generally no intersection with residential streets	80 to 100
Arterial Road	20,000 to 30,000	Major regional and inter-regional movement. Limited intersection with residential streets. Possible frontage access to major development.	60 to 80
Sub-Arterial Road	< 15,000	Act as feeder roads between residential areas and arterial roads. No direct access to residential allotments. May provide access to mulit-unit developments, schools, or shopping centres.	60
Trunk Collector	< 10,000	No access Distributor Road providing connection between residential areas and arterial road system.	60
Collector Street	< 3,000	A "branch" which connects to a major street or road.	60
Access Street	<1,000 to 2,000	A "stem" from which two or more cul-de-sac street branch.	30
Access Place	<300	A single cul-de-sac street for local residential access.	30
Rural			
Freeway	+ 40000	High speed - high volume route. Access to major arterial roads by grade separated interchanges.	80 to 100
Major Arterial Road	30,000 to 60,000	Major regional and inter-regional movement. Generally no intersection with residential streets	80 to 100
Arterial Road	20,000 to 30,000	Major regional and inter-regional movement. Limited intersection with residential streets. Possible frontage access to major development.	60 to 80
Sub-Arterial Road	< 15,000	Act as feeder roads between residential areas and arterial roads. No direct access to residential allotments. May provide access to mulit-unit developments, schools, or shopping centres.	60
Collector Street	<3,500	A "branch" that connects to a major road. Highest category of rural street providing direct access to allotments.	60
Access Street	< 1,000	As for urban residential streets.	45
Industrial			
Industrial Collector Street	<12000	For circulation purposes connecting to a major road or street. Access to catchment of approximately 30 ha.	60
Industrial Access Street	<4000	Access to industrial dwellings, with a catchment of approximately 8 to 10 ha.	30 to 60

Table 3.1 – Road Hierarchy Classifications

(b) The relationship between Caloundra's road hierarchy and others in general use in documents referred in this policy is shown in Table 3.2.

Caloundra City Functional Road Hierarchy	Queensland Department of Main Roads	Queensland Streets	A.R.R.B.	AUSTROADS
Highway	State Strategic Road and National Highway	Freeway	Arterial	Freeway
Arterial	Regional Road	Major Arterial	Sub Arterial	Primary (other Arterial)
Sub-Arterial	District Road	Arterial	Distributor	Secondary Arterial
		Sub-Arterial		Distributor
Trunk Collector	Not Covered	Trunk Collector	Collector	Collector
Collector Street		Residential Collector	Local	Local
Access Street		Access Street		
Access Place				

Table 3.2 – Road Hierarchy Classification Terminology Comparison

3.6.1 (2) Design Speed Environment

(a) Design speed environment to be adopted for a particular class in the road hierarchy is defined in Table 3.3.

Road Classification	Likely Posted Speed	Minimum Design Speed (km/h)
Freeways	100 – 110	100
Major Arterial	70-100	80-100
Arterial	60-100	70-120
Sub-Arterial	60-100	100-110
Trunk Collector	40-60	40-70
Collector	40-50	40-60**
Access Street	50	30-50 #
Access Place	50	30-50 #
Rural Residential Collector	50-60	60*
Rural Residential Access Street	50-60	45*
Industrial Collector	50-60	60*
Industrial Access	50-60	40*

Table 3.3 – Design Speed Environment

* Recommended by Queensland Streets
** Lower design speed of 40km/h in school environments.
# Street alignment designed for 30km/h and sight distance designed for 50kph

(b) The design speed must be compatible with the desired operating and posted speed on the road.
(c) A different design speed is recommended for each frontage development and road classification to maintain an acceptable level of amenity, noise and pollution. Queensland Streets has been used as a guide where possible, in determining the appropriate design speeds shown in Table 3.3.
(d) It is further recommended, that reduced design speeds be used where the pedestrian activity is likely to be greater. This is likely to occur in the vicinity of retail, commercial and recreational

facilities, local schools and tertiary institutions, or where significant pedestrian crossing points exist.

(e) The design speeds are to be noted on "as constructed" drawings.

3.6.1 (3) Capacity and Deficiency Volumes

(a) The number of lanes to be provided in each direction of a road is a function of the predicted daily traffic volume (vpd) and maximum desirable operating daily lane capacity for a particular road class shown in Table 3.4. Indicative desirable operating daily lane capacities are also provided.

Road Class	Maximum Desirable Operating Capacity (veh/day/lane)	Deficiency Volume (vpd)
Arterial – 2 lane	10,000	20,000
Arterial – 4 lane	9,000	38,000
Arterial – 6 lane	9,000	54,000
Sub Arterial – 2 lane	9,000	18,000
Sub Arterial – 4 lane	8,750	35,000
Trunk Collector – 2 lane	8,000	16,000
Trunk Collector – 4 lane	7,500	30,000
Collector – 2 lane	Environmental Volume	3,000
Access Street – 2 lane	Environmental Volume	Maximum 2,000
Access Place – 2 lane	Environmental Volume	300
Rural Residential Collector – 2 lanes	Environmental Volume	3,500
Rural Residential Access Street – 2 lanes	Environmental Volume	Maximum 2,500
Industrial Collector – 2 lanes	6,000	12,000
Industrial Access Street – 2 lanes	3,000	Maximum 6,000

Table 3.4 – Road Capacity and Deficiency Volumes

(b) Traffic volume predictions for assessing capacity requirements will be based on existing 'base' traffic flows, predicted growth in base flows in addition to traffic from new development.

(c) Full details of how traffic volumes are predicted are to be submitted with the road design. These details are to include the source of traffic generation rates and vehicle classifications where appropriate.

(d) Council may be able to provide existing and/or historic traffic flows, but if no Council data are available, then an appropriate traffic count on a representative day is to be undertaken by a suitably qualified person and in accordance with AUSTROADS survey standards. The representative day is to be a normal day without any abnormal traffic flow characteristics.

3.6.1 (4) Intersections and Turning Traffic Provisions

(a) The preferred type and intersection control is related to a road's position in the hierarchy as shown in table 3.5.

Road Classification	Signal Co-ordination	Median ##	Spacing of Intersection	Provision for Turning Traffic
Freeways	n/a	yes	1.5 to 2.0km in urban areas and 5 to 8 km in rural areas	Signal or roundabout control of intersection at interchanges (i)
Major Arterial	yes (iii)	yes	1km to 2km	At major interchanges median breaks at average spacing of 500m to not more than 1km**
Arterial	yes (iii)	yes	500m to 1km	Protected right-turns in median breaks or from right-turn lanes (where safe). Median breaks at average spacing of 300 to 500m **
Sub-Arterial	yes (in business areas)	yes, desirable	100m minimum, average 300m (divided arterial) #	Protected right-turns in median. Provision of auxiliary lanes and channelisation (ii). Median breaks at average spacing of 150 to 300m**
Trunk Collector	yes	localised median	On same side of through road: 100m. On opposite side of through road: 60m*	Localised protected right turns. Localised provision of auxiliary lanes and channelisation where turn volumes are high or to prevent unsafe manoeuvres (ii)
Collector	Not desirable	no	On same side of through road: 60m. On opposite side of through road: 40m*	None
Access Street/ Place	n/a	no	On same side of through road: 60m. On opposite side of through road: 40m*	None
Rural Collector	n/a	no	No special provisions	Provision of auxiliary lanes and channelisation where turn volumes are high or to prevent unsafe manoeuvres
Rural Access Street	n/a	no	No special provisions	None
Industrial Collector	yes	no	On same side of road: 100m. On opposite side of road: 150m left-right stagger and 60m right-left stagger *	None
Industrial Access	n/a	no	On same side of road: 60m. On opposite side of road: 60m left-right stagger and 40m right-left stagger *	None

Table 3.5 – Intersection and Turning Traffic Controls

* Recommended by Queensland Streets
** Recommended by AMCORD
\# Average intersection spacing between intersections to major road categories (Queensland Streets – Section 6.5)
\## Median widths for Urban Freeways or Rural Arterial Roads are detailed in Austroads Part 9.
(i) Interchange types for Freeways per Austroads' Grade Separated Interchanges – A Design Guide and Queensland Transport's Urban Road Design Volume 1.
(ii) Consider the use of auxiliary lanes and channelisation in retail, commercial strip areas and multi-unit development where accessing (slowing/merging) is likely to significantly impede traffic flow. A traffic impact assessment is required.
(iii) Where intersection spacing $\leq$ 2km.

(b) Where an intersection is to be controlled on sub-arterial roads and above in the hierarchy to accommodate projected traffic volumes, there is a preference for four way intersections to be provided. On roads below sub-arterial, three way junctions are the preferred form of intersection treatment.

3.6.1 (5) Access Controls

(a) Access Controls to be adopted for a particular class in the road hierarchy are defined in Table 3.6.

Road Classification	Traffic Capacity (vpd)	Access Management
Freeways	+40,000	No property access.
Major Arterial	30,000 to 60,000	Limited access. No intersections with residential streets. Access provided from service roads.
Arterial (i)	20,000 to 30,000	No access to frontage development. Limited intersections with residential streets. Access to major developments only via service roads or signalised intersections that meet appropriate intersection spacing requirements.
Sub-Arterial (ii)	< 15,000	No direct individual access to residential property. May provide access to multi-unit residential development, schools or businesses.
Trunk Collector (ii)	< 10,000	No direct individual access to residential property. May provide access to multi-unit residential development, schools, or businesses.
Collector (iii)	< 3,000	Access permitted to individual developments (subject to safety considerations) and if other locational criteria are met.
Access Street	< 1,000 to 2,000	Access permitted to individual developments (if other locational criteria are met).
Access Place	< 300	Access permitted to individual developments (if other locational criteria are met).
Rural Residential Collector	< 3,500	Access permitted to individual developments (if other locational criteria are met).
Rural Residential Access Street	< 1,000	Access permitted to individual developments (if other locational criteria are met).
Industrial Collector	< 12,000	Access permitted to individual developments (if other locational criteria are met).
Industrial Access	< 4,000	Access permitted to individual developments (if other locational criteria are met).

Table 3.6 – Access Management

(i) An impact assessment report by a qualified Traffic Engineer is required as part of an application for access, including detailed intersection analysis, coordination/progression and preliminary design.
(ii) An impact assessment report by a qualified Traffic Engineer is required as part of an application for access.
(iii) Access to non-residential uses will require an impact assessment report by a qualified Traffic Engineer as part of an application for access.

(b) Access to a development will generally be required to be provided by way of a road connection into the development where:
(i) access is approved to a sub-arterial road and the development generates more than 1000 vehicles per day, a
(ii) access is approved to a trunk collector or collector street and the development generates more than 500 vehicles per day.

(c) Notwithstanding (a) above, driveway access will be considered in locations where pedestrian movements along footpaths adjacent to the development are to be encouraged through active street frontages, where traffic are less than those identified in (a) and adequate capacity exists to satisfy store turning traffic in the road adequately accommodating through traffic movements.

(d) Access to detached residential dwellings or developments containing less than 10 multi-unit dwellings will generally be provided by way of a driveway.

3.6.1 (6) Local Area Traffic Management

(a) Local Area Traffic Management should be planned in accordance with the requirement of Table 3.7.

Road Classification	LATM Controls
Freeways	Not appropriate.
Major Arterial	Not appropriate.
Arterial	Not appropriate.
Sub-Arterial	Not appropriate.
Trunk Collector	Speed restrictive techniques may be appropriate * (i)
Collector	Speed restrictive techniques appropriate. (i) Threshold treatment where appropriate.
Access Street / Place	Speed restrictive techniques and/or access control. (i) Treatments where required to protect street from through traffic or to restrict traffic speeds. (i)
Rural Collector	Speed control by alignment recommended rather than vertical devices. (ii)
Rural Access Street	Treatments where required to protect street from through traffic or to restrict traffic speeds. (i)
Industrial Collector	Not appropriate.
Industrial Access	Not appropriate.

Table 3.7 – Local Area Traffic Management

* Recommended by Queensland Streets.

(i) Appropriate speed restrictive techniques designed with reference to Queensland Streets, Austroads Part 10 – Local Area Traffic Management, and Council's guidelines.

(ii) Refer Queensland Streets for guidelines on appropriate street alignment.

(b) LATM is to be in accordance with the requirements of the Queensland Department of Main Roads Manual of Uniform Traffic Control Devices (MUTCD) and is to incorporate the methods outlined in Austroads Guidelines for Traffic Engineering Practice – Part 10: Local Area Traffic Management.

(c) Speed control through the use of speed humps is not to be used unless required on an existing road or for pedestrian safety.

(d) Where speed humps are to be used flat top humps in accordance with Figure 5, MUTCD – Part 13: "Local Area Traffic Management" with a 100mm high hump and 1:14 ramps, instantaneous grade where the ramps intersect with the pavement, are to be used. This allows for the optional line marking detailed in Figure 17, MUTCD – Part 13 to be applied at all intersections if required.

(e) Driveway links (Figure 2.13B of Queensland Streets) are not to be more than one allotment in length.

3.6.1 (7) Pedestrian and Bicycle Management

(a) Pedestrian and bicycle facilities are to be provided in accordance with Caloundra City Council's Bicycle and Pedestrian Strategy and Recreational Links and Trails Strategy.

(b) In the absence of a clear direction regarding pedestrian and bicycle facilities in (a) above, they will be provided in accordance with the requirement of Table 3.8.

Road Classification	Bicycle Access		Pedestrian Access	
	Along the Carriageway	at Crossing Points	Along the Carriageway	at Crossing Points
Freeways	Separate high speed parallel cycle-way appropriate.	Grade separated (underpass / overpass)	No provisions	At all underpasses and overpasses.
Major Arterial	High speed cycle-path (where limited access). Cycle-lanes (where frequent property accesses occur).	Grade separated (underpass / overpass) or at signalised intersections.	Separate pedestrian pathway along at least one side of the carriageway.	Grade separated (underpass / overpass) or at signalised intersections (staged crossing if necessary).
Arterial	High speed cycle-path (where limited access). Cycle-lanes (where frequent property accesses occur). Dual-use paths.* (i)	At signalised intersections.	Separate footpath on both sides of carriageway.	Signalised at grade crossings.
Sub-Arterial	Cycle-lanes (where road reserve supports). Else dual-use path (where conflicts may arise with public transport).* (i)	At signalised intersections or mid-block pedestrian crossings/refuges.	Shared pedestrian / cycle-path. Footpath on both sides of carriageway possibly shared with cycle-way.	Signalised at grade crossings and mid-block crossings.
Trunk Collector	Cycle-lanes (where road reserve supports). Dual-use paths* (where conflicts may otherwise arise with public transport and sufficient widths exist).	At signalised intersections or mid-block pedestrian refuges.	Dual-use path one or both sides. Footpath on one or both sides of carriageway (where part of a pedestrian route).	At signalised or unsignalised crossings (with refuge). At appropriate locations using refuges, 2m wide median, kerb build-outs, or raised pedestrian crossings. (iv)
Collector	Cycle-route (on-road bikeway)	At refuges.	Footpath on one side of carriageway (within verge). *	At appropriate devices such as refuges, kerb build-outs or raised pedestrian crossings (where heavy pedestrian demand).
Access Street / Place	No special provision required except where part of a cycle-route (e.g. associated with schools).	No special provisions.	Consider footpath on one side of carriageway. (v)	No special provisions.
Rural Collector	Cycle-route (on-road bike-way) (where supported in the carriageway). (ii) #	At refuges.	Provision of footpaths on one or both sides of carriageway	At refuges, kerb build-outs or raised pedestrian crossings.
Rural Access Street	No special provisions. #	No special provisions.	Provision of footpaths on one side of carriageway.	No special provisions.
Industrial Collector	Cycle-route or dual-use path on one side of carriageway where road reserve supports. (iii)	At refuges.	Along one or both sides of carriageway. Footpath along both sides for full frontage of lots.*	At refuges or kerb build-outs.
Industrial Access	No special provisions.	No special provisions.	Consider footpath on one side of carriageway. (v)	No special provisions.

Table 3.8 – Pedestrian and Bicycle Management

* Caloundra City Council Planning Scheme.
# Cycle-paths are not generally required in rural residential areas due to the longer distances to travel. Pony trails should be a consideration (refer Queensland Streets).
(i) On one or both sides of carriageway, dependent upon land use or destinations (e.g. schools, retail, sports and recreations, and public transport).
(ii) Additional verge width or sealed shoulders may be required to support cycle-routes in new subdivisions.
(iii) Provision for cyclists is important where connections can be made to other cycle-paths from an industrial area. Similarly, in new industrial developments, additional verge width should be made to accommodate this mode of travel.
(iv) Devices may be required based on pedestrian volumes, traffic volumes or adjacent land use (e.g. schools, shopping centres).
(v) Queensland Streets suggests no special provisions for pedestrians. The provision of a footpath on one side of the carriageway is recommended as part of a link to public transport, local or neighbourhood centres or schools.

3.6.1 (8) Kerbside Management – Parking and Public Transport

(a) Kerbside parking and public transport facilities are to be planned in accordance with the requirements of Table 3.9.

Road Classification	Parking	Public Transport
Freeways	Prohibited.	In separate right-of-way or mixed with Freeway traffic.
Major Arterial	Prohibited.	Bus priority measures most desirable.
Bus Lanes.	Indented bus bays at appropriate locations (where there is sufficient width).	
Arterial	Not preferred. (v)	Bus priority measures most desirable bus lanes. Indented bus bays at appropriate locations (where there is sufficient width).
Sub-Arterial	Design to discourage on-road parking. (v)	Bus priority measures desirable. Indented bus bays at appropriate locations (where there is sufficient width).* (i)
Trunk Collector	Consider possible in traffic lane or parking lane. Design to discourage on-road parking * Peak hour parking restrictions (iv).	Indented bus bays at appropriate locations (i)
Collector	On-street parking appropriate.	Bus stop in carriageway.
Access Street / Place	On-street parking appropriate (where supported in carriageway).	No special provisions.
Rural Collector	On-street parking appropriate. Sealed bus bays and acceleration / deceleration tapers near major arterials #	
Rural Access Street	On-street parking appropriate.	
	No special provisions.	
Industrial Collector	On-street parking appropriate. (ii)	Bus stop in parking lane.
Industrial Access	On-street parking appropriate. (iii)	No special provisions

Table 3.9 – Kerbside Management – Parking and Public Transport

* Recommended by Queensland Streets.
\# Source: Draft Landsborough & District LAP.
(i) Indented bus bays are suggested at appropriate locations where the adjacent land use includes schools, retail and commercial developments, major intersections and pedestrian / cycle routes. Where possible, these can be located in parking lanes for a Trunk Collector. They should be located reasonably close to pedestrian and cyclist crossings.
(ii) Parking lane on both sides of street except when adjacent to open spaces, very large industrial sites or at sharp bends (recommended by Queensland Streets).
(iii) Parking lane on both sides of streets (recommended by Queensland Streets).
(iv) Peak hour parking restrictions in vicinity of major intersections or where adjacent land use provides off-street parking areas.
(v) Where on-road parking exists for frontage development, consider parking restrictions in vicinity of major intersections and where conflicts are observed to occur. Reduce or remove on-road parking where existing developments provide parking on-site.

(b) Notwithstanding the requirement of Table 3.9, on-street parking in cul-de-sac and turning heads is to be provided at the rate of one space per lot.

(c) Bus routes are to be planned in accordance with Section 3.5 of Queensland Streets.
(d) Refer also to Queensland Transports' SafeST.

3.6.1 (9) Environmental Considerations

(a) Section 2 of this Development Design Planning Scheme Policy outlines requirements regarding environmental considerations relating to development generally.

(b) In addition to the requirements of Section 2, specific environmental considerations relating to road design and construction include, but are not limited to:

- (i) minimising impacts from road drainage into the receiving environment;
- (ii) minimising impacts of noise and vibration;
- (iii) design solutions for catchment drainage away from the road;
- (iv) drainage design to avoid obstruction to natural flows;
- (v) waterway crossing design to reduce environmental impact;
- (vi) general waterway design factors;
- (vii) fish passage design principles;
- (viii) management of stockpiles and waste storage sites;
- (ix) topsoil and vegetation management;
- (x) vehicle and machinery management;
- (xi) roadside vegetation management;
- (xii) weed control; and
- (xiii) fauna crossings over and under roadways.

(c) Refer to the Department of Main Roads – Road Planning and Design Manual for environmental requirements when planning and designing roads in Caloundra City.

3.6.2 Geometric and Engineering Design

(a) Design criteria for roads are to be based on the document precedence outlined in Section 3.3 (2) with design provisions of Caloundra City Council documentation and Queensland Streets mandatory unless it can be shown that a relaxation of these requirements is acceptable and provides whole of life cycle benefit.

(b) The geometric design of all roadways shall be based on Queensland Streets, relevant sections of appropriate Department of Main Roads or AUSTROADS design manuals, except as specifically varied within this document:

- (i) Design Speed Environment
- (ii) Type Cross Section
- (iii) Horizontal Alignment
- (iv) Grades
- (v) Vertical Alignment
- (vi) Verges, Medians and Traffic Islands
- (vii) Auxiliary Lanes and Lane Widths
- (viii) Access and Driveways
- (ix) Pedestrians and Bicyclists

3.6.2 (1) Design Speeds

(a) Design speeds shall be as nominated in Table 3.3.

(b) Driveway links (Figure 2.13B of Queensland Streets) are not to be more than one allotment in length.

3.6.2 (2) Type Cross Section

(a) Road type cross sections are to be in accordance with Queensland Streets and Caloundra City Council's approved Standard Drawings except in the case of rural roads when (c) applies.

(b) In the case of rural roads, road cross sections are to be in accordance with the requirements set out in Table 3.10.

Caloundra City Functional Road Hierarchy Road Classifications	Number of Lots	General Maximum Grade (%)	Absolute Maximum Grade (%)	Formation Width (m)	Shoulder Material	Seal Width (m)
Access Street	0-20	16	20	6	Select Granular	4
Access Street	21-100	16	20	8	Gravel	6
Collector Street	101-400	12	16	10	Gravel	7
Sub-Arterial Road	Over 400	12	16	10	Sealed Gravel	10

Table 3.10 – Rural Road Design Criteria

(c) Minimum and maximum crossfalls for carriageways are to be in accordance with Queensland Streets.

(d) All 'through' road reserves and culs-de-sac corridors serving more than 10 lots in a Rural Residential settlement are to be not less than 20 metres in width.

(e) Base course is to be Type 2.1.

(f) Regardless of street classification, the average street reserve width shall be not less than 14 metres.

3.6.2 (3) Horizontal Alignment

(a) Horizontal alignments will generally comply with the requirements of Queensland Streets, Department of Main Roads and AUSTROADS design manuals except in the case of rural roads where:

   (i) Road design is to be in accordance with Queensland Department of Main Roads Road Planning & Design Manual and Austroads Rural Road Design Manual except as varied by this Policy. Relevant Australian Standards will apply where a design aspect is not adequately covered by the Austroads Rural Road Design Manual.

   (ii) The minimum cul-de-sac carriageway radius is to be 9.0 metres (Figure 2.12G Queensland Streets).

   (iii) Any temporary dead end road that provides the only effective access or servicing to any allotment is to be provided with a vehicle turning area, adequate to accommodate a 12.5m single unit truck, constructed with a minimum of 150mm compacted gravel, trimmed to drain to an appropriate point of discharge.

   (iv) Truck reversing in residential streets is limited to distances consistent with the turning areas of Figures 2.12M of Queensland Streets.

   (v) The average road reserve width shall not be less than 14 metres.

3.6.2 (4) Grades

(a) The minimum and maximum grades for roads will be in accordance with Queensland Streets, relevant sections of appropriate Department of Main Roads and AUSTROADS design manuals, except that the average grade over any 200 metres is not to exceed the general maximum grade. In the case of rural roads, the general and absolute maximum grades are shown in Table 3.10.

(b) The absolute maximum grade in commercial and industrial access streets is not to exceed 10%.

(c) Refer also 3.6.4 (2) (h) for surfacing on rural roads with a grade greater than 10%. The desirable maximum is 8%.

3.6.2 (5) Vertical Alignment

(a) The vertical alignment shall be designed in accordance with relevant Department of Main Roads and AUSTROADS design manuals.
(b) Where kerb and channel is provided, Sag VCs <u>at low points</u> (with changes in grade < & = 2%) are to be provided with VCs of radii as outlined in Table 3.11:

Design Speed	Radius
60	555
70	760
80	1000
100	1500

Table 3.11 – Sag Vertical Curves Radii

(c) Sag VCs <u>on grade</u> are to be in accordance with Queensland Streets (Sag VCs). Instantaneous changes of grade (i.e. No VC) will be considered where change of grade is less than 30/V% (where V = km/h).

3.6.2 (6) Verges, Medians and Traffic Islands

(a) Verges will be provided in accordance with Council's Standard Drawings.

(b) Medians and median openings will be provided in accordance with Table 3.5.

(c) Traffic islands shall be designed in accordance with Department of Main Roads or AUSTROADS design manuals.

(d) Residual medians are to be not less than 1.2 metres, unless expressly approved by Council.

(e) Traffic islands and medians of less than 2m width are to be hard surfaced in concrete with a pattered or broomed finish.

(f) Traffic islands and medians with natural vegetation are required to have subsoil drainage to the underground drainage system.

(g) Crossfall on verges and medians is to be not less than 1 in 6.

(h) The pavement crossfall at median openings shall not exceed 5%.

3.6.2 (7) Auxiliary Lanes and Lane Widths

(a) Auxiliary lanes are to be designed in accordance with AUSTROADS Design Manuals.

(b) Lane widths shall be provided in accordance with Council's Standard Drawings.

3.6.2 (8) Access and Driveways

(a) Access to a development site from a Sub-Arterial Road or a Trunk Collector Street will be permitted only where the development will generate a traffic volume more than 2000 vehicle trips per day or 500 vehicle trips per day respectively.

(b) The design of accesses to major developments and car parks is to conform to the design criteria outlined in Table 3.12.

Development	Minimum Access Strip Width (m)	Minimum Driveway Width (m)	Passing Bay Requirement	Maximum Grade (%)	Seal	Stormwater Drainage
Residential and Park Residential (1 Lot only)	6 (5)	3.0 Bitumen Seal 2.5 Concrete	Yes (5.0m) (No)	20 (20)	Yes (Yes)	**ARI 2 underground**
Commercial and Industrial	8	6.0	N/A	8	Yes (Concrete)	**ARI 10 underground**
Park Residential and Rural Residential	10	3.0 (5.0 formation)	Yes (5.5m on a 7.5m formation)	20	Yes*	**ARI 2 Culverts and Table Drains**
*A seal is required only where grades exceed 10% or the driveway would be otherwise subject of substantial erosion or it abuts a dwelling or a likely dwelling site.						

Table 3.12 – Access and Driveway Design Criteria

(c) Management of Access is to be provided in accordance with Table 3.6.

(d) Access strips to allotments (including open space areas) are to be wide enough to accommodate the required driveway, passing bays, pedestrian and service vehicle movement, driver and pedestrian facilities, service corridors, stormwater drainage, earthworks, retaining walls, landscaping, verges and clearances. Adjoining lots are to be truncated where necessary to provide safe and convenient access for users of the access strips. Basic design criteria are given in Table 3.12.

(e) Construction of accesses and driveways is required on lots with steep slopes to building sites, on lot frontages with visibility constraints and on access strips or access easements serving allotments.

(f) Design of access and driveways is to be in accordance with Caloundra City Council approved Standard Drawings for Residential Driveway Slab and Tracks and Rural Driveway Access onto Unsealed Roads and Austroads Part 5 – "Intersections at Grade".

(g) Unsealed gravel pavement may only be used in Rural Precincts for Access Street or Place carrying fewer than 100 vpd. Appropriate warning signage in accordance with MUTCD must be provided.

3.6.2 (9) Pedestrians and Cyclists

(a) Applicants are to introduce footpaths, pathways and bike lanes in accordance with the guidelines and maps within the Caloundra City Bicycle and Pedestrian Strategy and the standards in Table 3.13.

LINK DESCRIPTION	PURPOSE OF LINK	PERFORMANCE STANDARD	DESIGN STANDARD
Footpath	Connections with local facilities like schools, shops and community facilities	Width to provide for safe operation	Austroads Part 13 1.0 m absolute minimum 1.2 desirable minimum
		Alignment to satisfy likely travel speed	Austroads Part 13 Table 1.4 15km/h minimum design speed 30km/h desirable design speed
		Materials and construction standards to provide appropriate rideability and durability	Concrete likely for the majority of links
Pathway or widen existing footpath to pathway	Separation desirable to segregate bicycles and pedestrians from vehicles	Width to provide for safe operation	Austroads Part 14 Table 6-3 2.0m absolute minimum 2.5m desirable minimum 3.0m minimum for busy paths (3.0m minimum width clear of any obstructions such as footpath dining – path can be up to 6.0m to allow for obstructions or to achieve an appropriate level of service)
		Alignment to satisfy likely travel speed	Austroads Part 14 Table 6-2 20km/h minimum design speed 30km/h desirable design speed 50km/h design speed for commuters
		Materials and construction standards to provide appropriate rideability and durability	Asphalt preferred for higher design speeds Concrete likely for the majority of links Gravel suitable only for very low speeds and volumes Widening should be in same material as original, with care to ensure longitudinal joint is sound and intact
On-road exclusive bicycle lane (no parking)	The preferred on-road arrangement, particularly for commuter uses	Width to provide for safe operation	Austroads Part 14 Table 4-1 1.2m absolute minimum (60km/h) 1.5m desirable minimum(60km/h) 2.0m desirable minimum(80km/h) 2.5m desirable minimum(100km/h)
		Alignment to satisfy likely travel speed	Governed by road alignment and therefore likely to be suitable
		Materials and construction standards to provide appropriate rideability and durability	Governed by road construction and asphalt or seal likely to be provided. Concrete is unlikely and gravel is unsuitable for this application

Section 3

LINK DESCRIPTION	PURPOSE OF LINK	PERFORMANCE STANDARD	DESIGN STANDARD
On-road shared bicycle/parking lane	A suitable on-road arrangement where flows and speeds are moderate	Width to provide for safe operation	Austroads Part 14, Chapter 4 Tables 4-2 to 4-7 3.7m absolute minimum (40km/h) 4.0m desirable minimum(60km/h) 4.5m desirable minimum(80km/h)
		Alignment to satisfy likely travel speed	Governed by road alignment and therefore likely to be suitable
		Materials and construction standards to provide appropriate rideability and durability	Governed by road construction and asphalt or seal likely to be provided. Concrete is unlikely and gravel is unsuitable for this application
Recreational path	Paths which run along an esplanade or creek, through bushland, or adjacent to a beach	Width to provide for safe operation	3.0m absolute minimum 3.5m desirable minimum 4.0m desirable for busy shared paths
		Alignment to satisfy likely travel speed	Likely to be low speed environment, i.e. 20km/h design speed
		Materials and construction standards to provide appropriate rideability and durability	Hard paving necessary where traffic is high but cement-stabilised gravel suitable elsewhere, to reduce visual intrusion
Bridge Structures & Timber boardwalk	Link traverses waterways, mangroves, melaleuca swamp or other soft or difficult ground conditions	Width to provide for safe operation	Austroads Part 14, Chapter 7 2.5m absolute minimum for bike/ped use but greater than 3.0m width desirable between side rails, unless cycling is prohibited. Provide stopping/passing places at intervals on long sections. Where cycling is prohibited on path, an on-road bikelane of at least 1.2m must be provided.
		Alignment to satisfy likely travel speed	Adopt a 15km/h design speed
		Materials and construction standards to provide appropriate rideability and durability	Likely to be concrete or timber decking.

Table 3.13 - Bicycle and Pedestrian Strategy Standards

(b) Where practicable, provision is to be made within the existing road geometry for on-road cyclists on all roads and intersections.

(c) Notwithstanding the provisions of (a), provision is to be made in all Urban and Rural Residential roads for on-road cyclists by way of bicycle lanes, kerb ramps and safe crossings applicable to Table 3.8, even when an off-road bicycle facility is provided adjacent to the carriageway.

(d) Design of pedestrian and bicycle facilities is to be in accordance with:
   (i) AUSTROADS Part 13 Pedestrians;
   (ii) AUSTROADS Part 14 Bicycles;
   (iii) DMR Road Planning and Design Manual;
   (iv) DMR MUTCD;
   (v) DMR Guide to Pavement Marking; and
   (vi) Queensland Streets.

(e) Footpaths and bikeways are to have 2% maximum crossfall and be in accordance with IPWEA standard drawing, but with a nominal thickness of 100mm.

(f) Threshold splitter islands are to be 1.5m back from edge lines to allow space for cyclists to travel.

(g) Shoulders 1.5m minimum are to be provided to allow for cyclists. On slip lanes no additional width is required over the "W" requirement in Austroads Part 5, but a bike path/shoulder is to be marked to give the cyclists space through the intersection.

(h) Holding rails are to be provided with Class 1 reflective material where there is a possibility of being impacted by errant vehicles (i.e. installed on non-kerbed roads). Elsewhere (i.e. behind kerbs or mounted on islands) Class 2 reflective tape is acceptable.

(i) Where pedestrians are required to traverse islands, breaks are to be provided through the island for the passage and protection of pedestrians and the disabled. The break through the island is to be 2m wide with matching width kerb ramps at the kerb on either side of the road. The intention is that pedestrians will go <u>through</u> (or in front of) central islands and go <u>over</u> splitter islands at left turn slip lanes.

(j) Refer to Caloundra City Recreational Links and Trails Strategy.

3.6.3 Intersections and Turning Traffic

(a) Intersections on arterial, sub-arterial, trunk collector and industrial roads shall be designed in accordance with AUSTROADS design manual. Intersections on collector roads, access streets and places will be designed in accordance with Queensland Streets.

(b) Intersection spacings and controls are to be provided as outlined in Table 3.5.

3.6.3 (1) Geometric Standards

(a) All channelisation shall be designed to accommodate a design semi-trailer providing a clearance of not less than 0.6m between the wheel track and kerb, at all points, unless agreed otherwise by Council.

3.6.3 (2) Roundabouts

(a) The design of roundabouts shall be in accordance with MRD Road Planning and Design Manual and AUSTROADS design Manual.

(b) Where the centre island contains landscaping, a water source and perimeter sub-soil drainage shall be provided in accordance with Section 10.7 of these Guidelines.

(c) For any relaxation of the provisions of Section 10.7 of this policy, such as to use the Queensland Department of Main Roads Road Landscape Manual provisions, the applicant will need to demonstrate to Council's satisfaction that the alternative meets the principles outlined in Section 10.7.1(2) of this Policy.

(d) The minimum outside radius of a roundabout shall be 12.5 metres.

3.6.3 (3) Turning Traffic

(a) A turning area for service vehicles is to be provided at the end of each road carriageway to a standard consistent with the general road carriageway design.

(b) Turning areas referred to in (a) above are to be free draining and accommodate turning of vehicles reasonably expected to utilise the road to a minimum standard of the turning of a 12.5m single unit truck.

3.6.4 Pavement and Surfacing Design

3.6.4 (1) Pavement Design

(a) Figure 3.2 shows the schematic cross section for pavements.

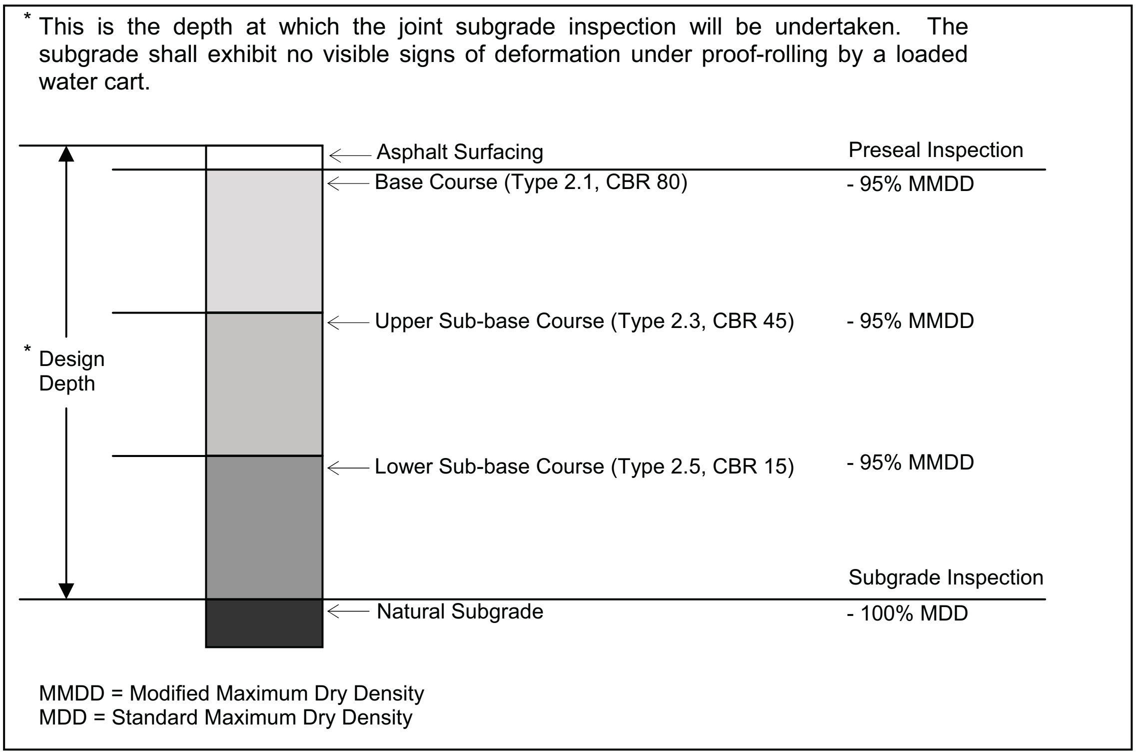


Figure 3.2 – Schematic Pavement Cross Section

Section 3

(b) Design of pavements is to be based on the provisions of the Austroads – "A Guide to the Design of New Pavements for Light Traffic" (APRG No 21) and the Department of Main Roads Pavement Design Manual using the Caloundra City Council Design Traffic Loadings identified in Table 3.14 – Design Traffic Loading/Pavement Thickness.

{PRIVATE }Road/Street Type	Traffic Max Volume or Lots in Catchment	Min. Design Traffic Loading (ESA'S)	Min. Pavement Thickness (Excluding surfacing)	Surfacing (1)	
				Asphalt* Min. Thickness	Bituminous Spray Seal – rural locations
FREEWAY	-	-	-	40	NP
MAJOR ARTERIAL	-	-	300	40	NP
ARTERIAL	-	1.5×10^7	300	40	NP
SUB ARTERIAL RD	12000 vpd	1×10^7	300	40	NP
Trunk Collector	1000 lots	2×10^6	250	25†	A
Collector Street	300 lots	3×10^5	250	25†	A
LOCAL					
Access Street	75 lots	5×10^4	200	25	A
Access Place	30 lots	5×10^4	200	25	A
Industrial Collector St	-	3.3×10^6	300	50	NP
Industrial Access Street	-	1.5×10^6	250	50	NP

Table 3.14 – Design Traffic Loading/Pavement Thickness

(1) Builtup areas or roads bounded by kerb and channel are to have asphalt surfacing with a thickness not less than shown in the table.
* All DG asphalt to be underlaid with a 7mm primer seal.
All Stone Mastic Asphalt (SMA) or Open Graded Asphalt (OGA) is to be underlaid with Prime at $1.0l/m^2$ + CL 170 at $1.4l/m^2$ + 10mm Aggregate at $150m^2/m^3$.
† At intersections and roundabouts minimum thickness to be increased to 50mm.
Roundabouts on trunk Collectors or above are to have Stone Mastic Asphalt or Polymer Modified Dense Graded Asphalt.
NP Not permitted
A Allowable standard treatment – Prime + 2 Coats 16/10

(c) For staged development where construction traffic associated with subsequent stages will use pavements constructed in preceding stages, the design traffic loading in Table 3.14 must be increased to take account of that construction traffic.

(d) The minimum design traffic loadings in Table 3.14 must be used, increased as required by the provisions of Clause 3.6.4 (1) (b).

(e) Pavement Design Parameters:

(i) The following design traffic parameters are to be used. For any relaxation of the requirements specified below, the applicant would need to establish to Council's satisfaction the structural integrity and full life cycle costs, including ongoing maintenance, of the proposed system to be used.

(ii) Pavement thicknesses are to be as determined using Fig. 13.8.2(A) Austroads – "A Guide to the Design of New Pavements for Light Traffic". For design traffic > 5×10^5, DMR charts are to be used.

(iii) Industrial and commercial developments

The design traffic loading is to be calculated by determining traffic generation from the proposed land uses within the development. Full details of these calculations are to be provided with the pavement design. These details are to include sources of traffic generation rates, allotment coverage and vehicle classification distributions. For any variance to this standard such as the traffic generation standards noted in Queensland Streets, the applicant will need to submit the appropriate calculations to Council for approval.

The minimum traffic loading is not to be less than the Design ESAs in Table 3.14.

(iv) Existing Streets/Roads

In addition to the determination of traffic generation for the new development it will be necessary to determine the existing traffic volumes and classifications. Council may be able to provide such data but if no Council data are available then a minimum of a 12 hour traffic count on one day is to be undertaken by a suitably qualified person and in accordance with Austroads survey standard. This day is to be a normal weekday without any abnormal traffic patterns.

(f) Pavement design shall generally conform with pavement layers identified in Figure 3.2.

(g) Subgrade inspections and preseal inspection are both “hold points” where joint inspection by the superintendent and Council’s inspector are required and are included in Figure 3.2.

(h) The area to be sealed is to comprise a gravel depth in accordance with the pavement design. Full pavement depth is to be used on road shoulders.

(i) Gravel pavement depth will be determined by subgrade testing and design is to be a minimum of 200mm except for unsealed pavement which is to be a minimum of 150mm. Shoulder depth is to be at least the minimum gravel pavement depth.

(j) Temporary turnarounds, such as at a development stage boundary, are to comprise a minimum 150mm deep compacted gravel.

(k) The design traffic loading is to be shown on the drawings represented by the design CBR (California Bearing Ratio) and design ESA’s (Equivalent Standard Axles). Pavement calculations and subgrade testing results are to be submitted for approval. Design life is to be 20 years for granular pavements.

(l) Where pavement is subject to testing during construction, the final pavement thickness is to be based on laboratory testing of the soaked CBR of the in situ material. The determined thickness is to be shown on the As–Constructed Drawings. All testing is to be in accordance with the Standard Civil Works Inspection and Testing Plan (CWITP) Section 3 – Construction Development and Design Standard (updated reference and included in Section 3.3).

(m) Pavement tapers to existing construction shall be designed in accordance with the current AUSTROADS design manuals based on the design speed. Detailing should include lengths, typical section(s), line marking and signage. Tapers shall be constructed to the same standards as the proposed full road pavements.

3.6.4 (2) Surfacing

(a) Surfacing in built up areas, roads bounded by kerb, and new subdivisions is to be asphalt, except for where other surfacing is permitted.

(b) Asphalt is to be of minimum thickness specified in Table 3.14. Asphalt 50mm thickness and greater may be considered as part of the design pavement thickness.

(c) Surfacing other than specified in (a) and (j) – (p) is to be sprayed bitumen seal.

(d) Sprayed bitumen seal is to comprise a prime seal plus two (2) coats consisting of CL170 bitumen and 16mm aggregate and a 10mm aggregate reseal.

(e) For any relaxation of the requirements specified below, the applicant must establish to Council's satisfaction the structural integrity and full life cycle costs, including ongoing maintenance, of the proposed system to be used.

(f) Urban roads and roads with kerb and channel are to consist of prime and asphalt (minimum standard) nominal design – prime at 1.01/m^2 and asphalt. Asphalt is to finish 5mm proud of the kerb and channel lip.

(g) In the case of access and driveways the surfacing identified in Table 3.12 is to be provided.

(h) All rural roads on grades greater than 10% are to be surfaced with AC or a two coat bitumen seal.

(i) For surfaces other than asphalt, the pattern of any surfacing (or pattern formed by the joints of any surfacing) should not cause confusion or be contradictory to the intended or allowable traffic flow.

(j) Pavers or paving tiles are to have a non-skid finish, colour and texture appropriate to their application. Only interlocking concrete pavers (minimum thickness 80mm) are to be used within Council road reserves unless the structural integrity and full life cycle costs, including ongoing maintenance, of the proposed paving system to be used are established to Council's satisfaction.

(k) Pavers are to be installed in accordance with the Cement and Concrete Association of Australia's "Concrete Segmental Pavements – Design Guide for Residential Accessways and Roads".

Clay pavers are permitted on private driveways not maintained by Council.

(l) A cement treated base (CTB) or concrete pavement is to be provided as a base to all pavers. Where a CTB is used the pavement is to be sealed with a bitumen prime sealant at 1.01/m^2. At low points the sand bedding layer for the pavers is to be drained back to the subsoil drain or the underground drainage system. Pavers are to be positioned such that the full height of the arris sits proud of the lip of kerb or edge restraint, but not more than 10mm. The pavement thickness under pavers is to be not less than that shown in Table 3.14 – Design Traffic Loading/Pavement Thickness.

(m) Concrete pavements are to have a non-skid finish, colour and texture appropriate to their purpose.

(n) White/light coloured cements that do not allow white pavement markings to be easily distinguished are not permitted. Concretes are to be coloured with oxides only. Carbon blacks and organic dyes are not permitted.

(o) Exposed aggregates are to have an appropriate skid resistance. Smooth rounded pebbles will not be permitted. Density and inherent properties of the stone are to be such that for the design traffic and speed, significant polishing of the stone will not occur over the design life of the surface. Skid resistance is to be in accordance with the Concrete Association's "Road Note 62 – Skid Resistance of Decorative Paving".

3.6.5 Line Marking, Pavement Markers and Signage

(a) Line marking is to be in accordance with the Queensland Department of Main Roads – Manual of Uniform Traffic Control Devices (MUTCD) and Queensland Department of Main Roads – Guide to Pavement Markings.

(b) Collector streets and higher order roads, and rural roads with daily volumes in excess of AAOT, are to be provided with centreline and edge line marking.

(c) Lines are to be marked in the following materials:

(i)	Edge Lines	Painted
(ii)	Continuity Lines, Bikelanes and Symbols	Painted
(iii)	Turn/Direction Arrows	Painted
(iv)	Diagonals/Chevrons	Painted (Type 2)
(v)	Zebra Crossings	Thermoplastic
(vi)	Stop Bars and Give Way Lines	Thermoplastic
(vii)	Holding & Exit Lines (Roundabouts)	Thermoplastic
(viii)	Turn Lines	Thermoplastic

(d) Paint types for lines or markings are to be:

(i) For AADT > 2000 – Type 1 Road marking paint is to be applied at 375 $\pm$ 25 microns (0.375 l/m^2) to achieve a dry thickness of 250-300 microns.

(ii) For AADT < 2000 – Type 2 Road marking paint is to be applied at 375 $\pm$ 25 microns (0.375 l/m^2) to achieve a dry thickness of 150-225 microns.

(e) Retro Reflective Pavement Markers (RRPMs) are to be applied in accordance with the MUTCD to augment line markings chevrons and islands.

(f) RRPMs are to be used to augment painted line markings in accordance with MUTCD.

(g) Where an on-road bicycle facility is identified in the Caloundra City Bicycle and Pedestrian Strategy strategic network maps, the design is to include full signage and pavement markings in accordance with (a), (c) and (j).

(h) Bikeway signs are to be generally size A, sized in accordance with the MUTCD.

(i) Where the on-road bicycle facility is NOT identified in the Caloundra City Bicycle and Pedestrian Strategy strategic network maps, the design is to make provision for the cyclists by offsetting, 1.5m from the edge line, any chevrons and RRPMs at locations likely to be ridden over by cyclists.

(j) All signs are to be in accordance with Queensland Department of Main Roads Manual of Uniform Traffic Control Devices.

(k) Retro reflective material is to be in accordance with Queensland Department of Main Roads Specifications ES 126 – Road Signs.

(l) Signs are to be kept clear of the lane line by a minimum of 2m, for example alignment markers around a curve.

(m) Temporary or construction signage and line marking shall be in accordance with the Department of Main Roads "Roadworks Signing Guide".

3.6.6 Frontage Works

(a) A concrete strip footpath must be provided as part of frontage works where identified in the Caloundra City Bicycle and Pedestrian Strategy.

Where the Caloundra City Bicycle and Pedestrian Strategy does not identify the requirement, but a path is to be produced as part of the development, it shall comply with IPWEAQ Standard Drawing R-0065 and Council's adopted Access and Equity Policy.

(b) Full width concrete footpaths or paving are required for the Caloundra CBD area and some commercial or shopping centre developments. This will be advised during development assessment.

(c) A kerb ramp will be required at the intersection of roads that front the site development and must comply with IPWEAQ Standard Drawing R-0084.

(d) Turfing either side of the footpath is required where it is possible to maintain the amenity of footpaths and adjacent areas, or where alternative means of preserving the amenity of adjacent areas are impracticable.

(e) Landscaping the road reserve is to be in accordance with the provisions of Section 10.7 Guidelines – Street Trees and Planting.

(f) For any relaxation of the provisions of Section 10.7 of this policy, such as to use the Queensland Department of Main Roads Road Landscape Manual provisions, the applicant will need to demonstrate to Council's satisfaction that the alternative meets the principles outlined in Section 10.7.1(2) of this Policy.

3.6.7 Street Lighting

(a) Street lighting (Route and Intersection Lighting) is to be designed in accordance with the requirements of Part 17 of the Department of Main Roads Road Planning and Design Manual and the warrants in Austroads Part 12 – Roadway Lighting.

(b) Intersection lighting is to be provided at intersections formed at all roads in accordance with Figure 17.1 of the Queensland Department of Main Roads Planning and Design Manual.

(c) All pedestrian crossings are to be lit in accordance with AS 1158.1 and AS 1158.4.

(d) Table 3.15 outlines the lighting categories required for the different Road Hierarchy Classifications according to the descriptions given in AS 1158**.**

(e) Lighting is to be provided on footpaths and bikeways through parkland including at the road entrances.

Road Classifications	Street Lighting Categories
URBAN	
Freeway	V3
Major Arterial Road	V3
Arterial Road	V3
Sub-Arterial Road	V5
Trunk Collector	V5
Collector Street	P3
Access Street	P4
Access Place	P5
RURAL	
Freeway	V3
Major Arterial Road	V3
Arterial Road	V3
Sub-Arterial Road	V5
Collector Street	P3
Access Street	P4
INDUSTRIAL	
Industrial Collector Street	V5
Access Street	P4
OTHER	
Footpaths and Bikeways	P1, P2, P3, P4 (Refer Australian Standard)
Parks and Gardens	P1, P2, P3, P4 (Refer Australian Standard)

Table 3.15 – Lighting Categories

(f) Street lighting is to be Tariff 2 with poles and luminaires selected from Energex's approved list.

(g) Applicant-installed Street Lighting Tariff 3 is not permitted.

(h) Aeroscreen Luminaires shall be provided for

- Lighting in areas surrounding airports to the requirements of the Civil Aviation Authority.
- Where properties abut or will abut Roads lit to Category V standard.
- To reduce Glare in areas where the background is intrinsically dark.

Refer Part 17 of the Road Planning and Design Manual for further details.

3.6.8 Utilities and Service Crossings

(a) Location of utility services is to be in accordance with Caloundra City Council approved Standard Drawings.

(b) Location of utility services on Council-owned infrastructure such as culverts, bridges, boardwalks and water towers or on land owned by or under Council control will not be permitted unless:
   (i) The relevant service authority has indemnified Council against future costs of relocation.
   (ii) Works are undertaken at no cost to Council.
   (iii) Where a 2nd party wishes to attach services to a Council owned bridge or culvert, Council's requirements regarding location, design and maintenance are to be met:
      - Ducting shall generally be galvanised steel tubing and mounted in brackets on the outside of the downstream deck / kerb unit.
      - Brackets shall be hot dip galvanised and fastened using stainless steel fasteners into the ferrules cast into the outside of the units.
      - Where ferrules do not exist, approval shall be sought from Council to use Stainless Steel Chemset (epoxy type) anchors. If is method is required care will be required not to damage the reinforcement of the structure when masonry drilling into the deck / kerb unit.
      - The Brackets used shall position the conduit to be clear of the waterway area, and shall not obstruct any transverse tensioning rods for the deck units.
      - All work shall be at no cost to Council, and the design for the proposed brackets and conduit system shall be forwarded to Council for approval.
      - Should the existing structure NOT have guardrail, the conduit shall be positioned so as to deflect away from both ends of the structure to allow for the future installation of guardrail.

(c) New development is required to underground power supplies, with the design provided in accordance with the requirements of the Energy Authority and the provisions of this section.

(d) Where existing pavements are disturbed for the installation of services, the road is to be reinstated to match the existing pavement and surfacing.

(e) Services are to be bored under any urban road or any road with existing AC or concrete paving. Other roads may be trenched and reinstated.

(f) Services trenches are to be backfilled from the top of the sand surround layer to the underside of pavement with Cement Modified Base (CBR 35, 1.5% Cement) compacted to 95% Standard in the lower layers and to 100% Standard in the top 300mm below subgrade. Alternatively trenches are to be backfilled with 7Mpa lean-mix concrete. (Higher strength is not permitted, to avoid problems when rehabilitating roads in the future).

3.6.9 Construction Tolerances and Testing

(a) All elements of roadwork construction within Caloundra City are to be in accordance with the tolerances detailed in Table 3.16 – Construction Tolerances for Roadworks. The construction tolerances will be implemented through joint responsibilities of the applicant's project superintendent and Council's audit and inspection role.

Element/ Course	Minimum Thickness	Minimum Density/ Strength	Horizontal Alignment Tolerance	Vertical Alignment Tolerance	Thickness Tolerance	Shape/Slope Tolerance
General Earthworks	N/A	95% standard compaction		± 100mm	N/A	Min. 1:100 general and over any 10m down contours. No ponding over 50mm deep.
Stormwater Pipes	N/A	N/A	±100mm	± 25mm	N/A	Uniform pipe grade and + 10% of design grade.
Manholes/ Pits	In situ 150mm	32MPa	Lateral ±100mm Along line ±300mm	± 50mm With K & C ±25mm	+ 100mm -0mm	Circular/Square/ Rectangular and Vertical +50
Subgrade	N/A	100% standard compaction	± 100mm Road width + 200mm – 50mm	+ 25mm – 50mm	N/A	No ponding Crossfall + 0.5%
Select Fill/ Subgrade Replacement	100mm	100% standard compaction Min. CBR15	± 100mm Road width +200mm -50mm	+ 25mm - 50mm	± 25mm	25mm in 3m max. and no ponding
Sub Soil Drains	Width 225mm	N/A	± 100mm	Min. 900mm below top of kerb	Width - 25mm +100mm	Uniform pipe grade 0.5% min
Kerb and Channel	Invert 125mm	20Mpa	± 100mm Road width +200mm -50mm	± 25mm	Concrete +20mm –10mm	15mm in 3m max. and +10% of design grade
Sub-Base	100mm	100% standard compaction	±100mm Road width +200mm -50mm	± 25mm	+50mm –20mm	25 mm in 3m max. and no ponding
Road Crossings -Conduits	Width 300mm	N/A	± 300mm	Min. 700mm & max. 1000mm below top of kerb	Width – 25mm	Uniform grade and straight
-Markers	N/A	N/A	±100 from conduit	N/A	N/A	N/A
Base	100mm	100% standard compaction	± 100mm Road width +200mm – 50mm	± 25mm	+ 25mm – 10mm	15mm in 3m max. Crossfall ± 0.5%
Surfacing (compacted)	25mm	N/A	± 100mm Road width +200mm -50mm	± 25mm +5mm - 0mm from lip of channel	+ 15mm – 0mm	7mm in 3m max. Crossfall ± 0.5%
Road Verges	N/A	N/A	N/A	± 25mm +25 – 0mm from top of kerb	N/A	± 10% of design crossfall
Topsoil and Grassing	75mm	N/A	N/A	± 100mm Road verges ± 25mm	- 25mm	As for General Earthworks
Water Supply Pipelines	N/A	N/A	± 50mm	+ 50mm -200 mm	N/A	To manufacturers' specification
Water Supply Fittings	N/A	N/A	± 250mm	± 25mm to FSL (surface fittings only)	N/A	N/A
Sewerage Pipelines	N/A	N/A	± 150mm	± 25mm	N/A	Max. 5mm in 8m and no ponding
Access Chambers	N/A	N/A	± 150 mm	finish lid 50mm above FSL	N/A	circular

Table 3.16 – Construction Tolerances for Roadworks

(b) Maximum particle size for Select Fill/Subgrade Replacement is to be 40mm.

(c) Construction outside tolerances will require re-design for checking and/or reconstruction.

(d) The equivalent modified compaction may be used for gravel materials.

(e) Council Soil Testing Laboratories (NATA Reg. No. 2783) may be requested to carry out Audit Testing where appropriate.

(f) All tests are to be arranged and supervised by a suitably qualified engineer. All compliance testing is to be carried out through laboratories registered with NATA and certified for the appropriate tests. Council Inspectors are to be notified well in advance so that traffic management arrangements can be approved by Council prior to undertaking the following activities on existing roads. On roads of Collector Street classification and above, Council's inspector may direct, at his or her own discretion, that a traffic control plan be required for testing activities.

(g) Bore holes or test pits under any road are to be backfilled with CMB Cement Modified Base (CBR 35, 1.5% Cement) and compacted to 95% Standard in the lower layers and to 100% Standard in the top 300mm below subgrade. Pavement and surfacing to match existing.

(h) Where testing is required on existing roads, wherever possible tests are to be undertaken at the interface of the traffic lane edge and the shoulder. If necessary to excavate within the lane, holes or pits are to be made between the wheel paths.

(i) Where existing pavements are disturbed for testing or soils investigation, the road is to be reinstated to match the existing pavement and surfacing.

3.6.10 Drainage

3.6.10 (1) Subsurface Drainage

(a) Provision of subsurface drainage on roads is to be in accordance with Caloundra City Council approved Standard Drawings.

(b) Cleaning points are to be provided at the end of each line and at each stormwater pit.

(c) Mitre drains are to be provided on roads with over 5% longitudinal grade, and at Cut to Fill transitions.

3.6.10 (2) Stormwater Drainage

(a) Stormwater drainage is to be designed in accordance with the Queensland Urban Drainage Manual, the "Road Drainage Design Manual" and ARR "Australian Rainfall and Runoff" and the requirements of Section 5 – Total Water Cycle Management and Section 6 – Stormwater and Drainage Management.

(b) Water Sensitive Urban Design principles are the preferred method of stormwater management and are described in Section 5 – Total Water Cycle Management (TWCM) and Section 6 – Stormwater and Drainage Management.

(c) Table drains are to be the general method of collection and discharge of stormwater where direct discharge from the road carriageway onto embankment or natural ground is not suitable.

(d) In cuttings or other particular locations, kerb and channel may be required. Catch drains will normally be required at the top of cut and fill batters.

(e) Table drains are to be diverted away from the road carriageway at close intervals wherever possible to minimise scour. Diversion drain spacing will generally be between 30 metres and 100 metres depending on grades, soil type and diversion opportunities. These table drain outlets are to be located clear of likely building sites and to be provided with energy dissipation and flow distribution devices before discharge of the stormwater into vegetated areas. On steep embankments and batters, concrete or stone pitched chutes should be provided at table drain and catch drain outlets.

(f) Erosion protection is to be provided in all table drains and catch drains liable to scour. On steep grades, protection may include concrete inverts.

3.6.11 Miscellaneous

3.6.11 (1) Road Safety Audit

(a) All developments submitted to Council are to be certified by a suitably qualified road safety auditor in accordance with the principles of Austroads – "Road Safety Audit Guidelines".

3.6.11 (2) Soil Erosion and Sediment Control

(a) Control of soil erosion and collection of sediment are to be in accordance with the provisions of Section 9.5.5 Erosion and Sediment Control.

3.6.11 (3) Traffic Management

(a) Traffic management is to be undertaken in accordance with the Main Roads (MUTCD) – Part 3 Works on Roads during any works on roads.

3.6.11 (4) Access and Equity

(a) Road design is to meet the principles set out in Council's Access and Equity Policy and take into account the needs of all users, including pedestrians, the disabled and cyclists as well as motorists;

(b) Ramps and Pram ramps are to be constructed in accordance with AS 1428.4: *Design for Access and Mobility, Part 4: Tactile Ground Surface Indicators*; and

(c) Tactile tiles are to be installed in accordance with AS 1428.1: *Design for Access and Mobility, Part 1: General Requirements for Access New Building Work*.

(d) General principles for the installation of tactile tiles can be found on the Caloundra City website (www.caloundra.qld.gov.au).

Contents of Section 4 – Earthworks

Figures in Section 4

Section 4

Section 4

Section 4 – Earthworks

4.1 Purpose and Structure

(1) The purpose of this Section is to provide guidance on standards required when undertaking earthworks for the approved use.

(2) This section is structured as follows:

(a) 4.1 to 4.4 provide the framework for the guidelines;
(b) 4.5 outlines the requirements relating to earthworks.

4.2 Terminology

The general terms used in this Section are included in Section 1.5. The following terms relate specifically to this Section of the Policy:

"ASS" – Acid Sulfate Soils
"*Grubbing*" – the removal of ground trees, roots, stumps, small rocks etc., to a depth of 300mm below the existing surface.
"Hollow-bearing trees" – trees that provide a habitat for fauna that require a hollow for shelter or nesting
"Small rocks" – volumes between 0.03 m^3 and 0.3 m^3.
"Spotter/catcher" – a Queensland Parks and Wildlife Services licensed spotter/catcher
"Three-cut method" – a method for lopping of trees that prevents bark from tearing
"*Topsoil*" – surface soil high in organic matter and contamination by residual grass seeds and grass roots.

4.3 Related Standards/References

(1) Related standards/references referred to in this Section are as follows:

(a) Queensland State Planning Policy 2/02 Guidelines: "Planning and Managing Development Involving Acid Sulfate Soils".

(b) Department of Natural Resources Mines and Energy "Guidelines for Sampling and Analysis Procedure for Lowland Acid Sulfate Soils (ASS) in Queensland" (1998).

(c) Planning Scheme Policy 11.6.3 Guidance Relevant to Acid Sulfate Soils Code.

(d) Australian Standard AS 3798: Guidelines on Earthworks for Commercial and Residential Developments.

(e) Workplace Health and Safety Act.

(f)AS2890: Parking facilities.

4.4 Process

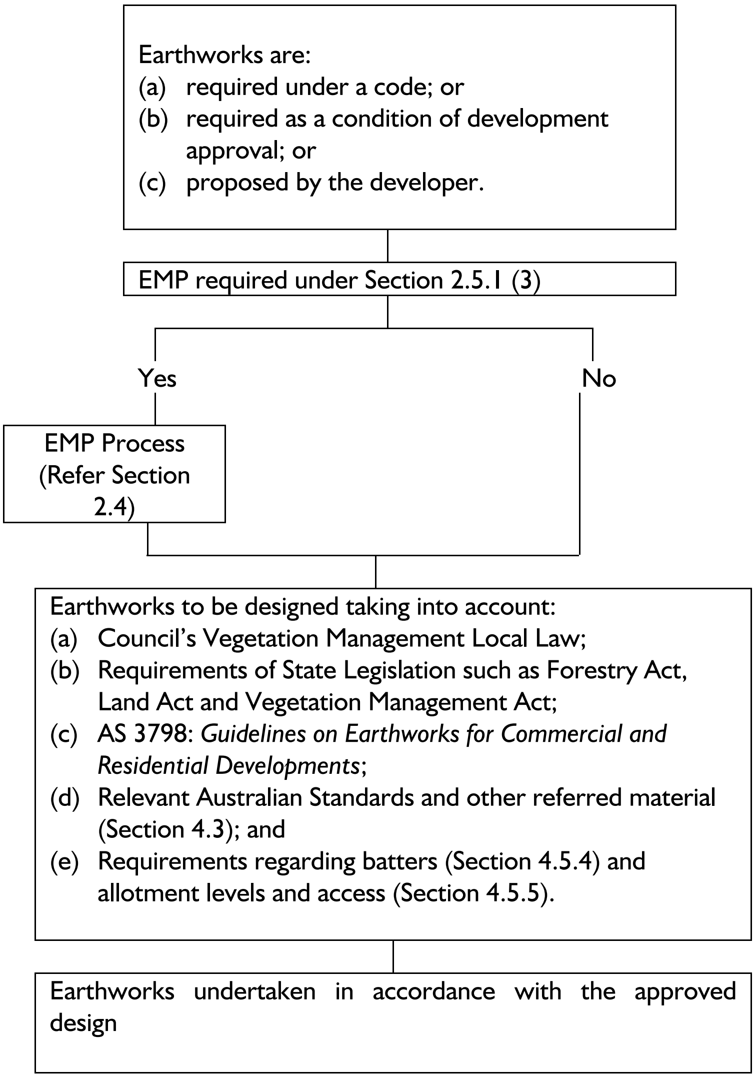


Figure 4.1 – Earthworks Process

4.5 Guidelines

(1) Refer also to Section 9 – Site Development.

4.5.1 Clearing

(1) Where an Environmental Management Plan (EMP) is required under Section 2 – Environmental Guidelines of this planning scheme policy, any clearing is to be in accordance with the approved EMP.

(2) In cases where an EMP is not required, any clearing of significant trees and vegetation is to be kept to a minimum in accordance with the following guidelines:

(a) Roadways clearing is to be confined to the limits of approved earthworks plus a sufficient lateral clearance to ensure that the works are not interfered with by trees or other vegetation.

(b) Allotment clearing is to be confined to the minimum areas required to safely construct services such as sewers and catchment drains, and the limits of approved earthworks to allotments plus a sufficient lateral clearance to ensure the works are not interfered with by trees or vegetation.

(c) No trees except as directed are to be damaged or removed from areas to be dedicated under the control of Council without prior written approval of Council.

(d) Dead, dying or dangerous trees or trees likely to be dangerous, are to be removed as directed by Council.

(e) Trees in existing road reserves are not to be damaged or removed without the approval of Council. All trees on existing roads affected by the works are to be shown and details given of proposed protection, relocation methods, or removal.

(f) The removal of any trees and vegetation from existing crown land, trust land, reserves, road reserves and freehold land may require approval under the Forestry Act, Land Act and the Vegetation Management Act.

(g) Other approvals may also be required from Council, under the provisions of the Management Local Law, Tree Protection Orders/Areas, covenants, drainage easements, and other Council regulatory controls.

(h) Where vegetation is removed, vegetation waste is to be disposed of in the following order of preference:

(i) milling;
(ii) chipping and mulching on site or at a landfill that accepts green wastes; or
(iii) another method approved of by Council.

(i) "Vegetation Protection Areas" are to be marked clearly in the field by way of temporary fencing consisting of star pickets and three strands of wire and appropriate signage (which is then checked by a Council Compliance Officer) prior to clearing operations commencing.

(j) Spotters/catchers should inspect the area prior to clearing to sight, capture and relocate wildlife, using appropriately qualified individuals accredited by the Environmental Protection Agency to conduct these programs.

(k) Identified hollow-bearing trees should be protected from development activities.

(l) Lopping of trees using three-cut method is preferred where possible rather than cutting down the entire tree.

(m) No disturbance to the beds or banks of any waterway or to the riparian vegetation thereof, is to be undertaken without prior written approval of the Queensland Department of Natural Resources, Mines and Energy.

(n) Grubbing shall be carried out for the full width of the cleared area.

(o) All topsoil can be removed and stockpiled for future spreading over the finished development.

4.5.2 Excavation

(1) *Acid Sulfate Soils*

(a) Where site development works require excavation, removal or filling of soil or sediment in an area to which the State Planning Policy 2/02 (as amended) applies, and nature and scale of site development works triggers the provisions of State Planning Policy 2/02, then an assessment of acid sulfate soils is required.

(b) Where the proposed site development works trigger the provisions of the State Planning Policy 2/02, then a field investigation and sampling analysis is to be undertaken in accordance with the most current version of the QASSIT Guidelines for sampling of lowland acid sulfate soils (ASS) in Queensland 1998 9as amended) or other acceptable guideline. A report, detailing the findings of the AASS/PASS investigation, should be prepared prior to the commencement of the site development earthworks design.

(c) Where the report, detailing the findings of the field investigation and sampling analysis, identifies that PASS/AASS management is required, then the management of PASS/AASS shall be undertaken in accordance with the most current version of the Instructions for the Treatment and Management of Acid Sulfate Soils, 2001 (EPA/DNRM/DPI) and generally in accordance with the approved Environmental Management Plan. The management plan should be assessed and endorsed by Council and the Department of Natural Resources & Mines prior to the completion of the detailed site development earthworks design.

(d) Field investigation and sampling analysis, and acid sulfate soils management plans are to be prepared by a suitably qualified person(s).

(e) Where the proposed site development works trigger relevant state government approval1 requirements, then the relevant approvals shall be obtained prior to the commencement of site development works.

[1]relevant approval may include, but is not limited to a licence and development permit to conduct a level 1 non-devolved Environmentally Relevant Activity "dredging".

(2) *Disposal of Surplus or Unsuitable Materials*

(a) Details of the surplus or unsuitable materials, as defined in AS3798, are to be included in the relevant development application submitted to Council.

(b) Where disposal is proposed on road reserves or parkland, or where the volume of material exceeds 2500 m^3 (loose), and transport over Council roads is required, Council's requirements are to be determined prior to lodgement of the relevant development application.

(c) Where the surplus material is generated from works within existing dedicated roads, Council may nominate that the spoil be placed on Council controlled land within 5 km of the site.

4.5.3 Embankments/Site Filling

(1) Filling is to meet the requirements of AS 3798: *Guidelines on Earthworks for Commercial and Residential Developments*.

(2) All materials proposed for use in filling and embankments, whether allotment, parkland or road, are to be suitable for the works – details to be supplied for approval.

(3) Where the volume of material to be imported to the site exceeds 1000 m^3 (loose), the proposed source, volume and transport route require Council approval.

(4) Where embankments require maintenance by conventional machinery, the maximum batter slope of the embankments is to be 1:4.

(5) No person shall be permitted to fill any land where in the opinion of Council, such filling will detrimentally affect the area available in any natural or artificial watercourse for either present or estimated future flood flows or storage, or will detrimentally reduce the volume within a flood plain available for the storage of flood waters.

4.5.4 Cut and Fill Batters

(1) Batter slopes are to be generally 1 on 4 for cut and fill batters for a height not exceeding 1.0 m.

(2) Where height exceeds 1.0m cut batters may be provided up to 1 on 1 and fill batters 1 on 2, subject to maintenance considerations.

(3) Cut batters in solid rock may be increased to 4 on 1. Lesser batter slopes will be required in unstable material.

(4) Batters are to be provided with scour protection measures, topsoiled and revegetated except for cut batters in non-erodable rock.

(5) Cut batters are to be benched when 1 on 1 batter exceeds 1.0m in height to retain topsoil for revegetation purposes.

(6) Cut batters steeper than 1 on 1 (in other than rock) or higher than 4m will only be accepted with a Geotechnical Report prepared by a Consulting Geotechnical Engineer.

(7) Property boundaries are to be at least 3 metres clear of cut and fill batters.

4.5.5 Allotment Levels and Access

(1) *Levels*

(a) The final allotment levels are to be determined by the applicant and approved by Council. The minimum development levels will include the standard freeboard requirements of the Queensland Development Code and the Caloundra City Planning Scheme and make allowance for the following:

(i) storm tides; and/or
(ii) river and stream flooding; and/or
(iii) local area flooding.

(b) The following grading of allotments is to apply:

(i) allotments should preferably drain to the road;

(ii) where allotment areas drain to rear or other adjoining allotments, then a rear allotment drainage system is to be provided; and
(iii) minimum falls in allotments are to be:
- residential – 1:100; or
- commercial, industrial – 1:300.

(2) *Access*

(a) Driveway grades should be limited for safety and amenity (refer AS 2890).

(b) In new sub divisional developments, construction of accesses and driveways will be required on lots with steep slopes to building sites, on lot frontages with visibility constraints, and on access strips or access easements serving allotments.

(c) Unless excluded in the development approval, accesses are to be provided to all rural residential lots. The access is to be provided to the boundary and be located to provide the required sight distance. Accesses with gradients greater than 1:10 are to be paved and sealed or concreted to the boundary, and it is to be demonstrated that practical access can be provided to a building envelope beyond the boundary.

(d) Driveways are to be constructed in accordance with Standard Drawing No. R-0050 CC Residential Driveway or R-0051/52 Commercial Driveways, Austroads Part 5 – Intersections at Grade, and AS 2890.

4.5.6 Topsoiling and Grassing

(1) Topsoil and any other organic material should be stripped from areas to be developed and stockpiled on site for subsequent respreading to areas that are to be landscaped or otherwise seeded, turfed, or revegetated.

(2) Imported soil should be clean and certified weed free.

(3) On the completion of the works, topsoil is to be re-spread to allotments, batters, fill areas, and other disturbed areas to a average depth of 75mm.

(4) All areas are to be seeded, turfed or otherwise revegetated and maintained to achieve 100% coverage within 6 months of the works being accepted on maintenance. Note that fertilisers should not be used adjacent to waterways and their use should be limited in areas of native re-vegetation. Consideration should be given to implementing an organic fertiliser program in sensitive areas.

(5) Refer to Section 9.5.5 Soil Erosion and Sediment Controls, Section 5 – Total Water Cycle Management, Section 6 – Stormwater and Drainage Management and Section 10 – Landscaping Infrastructure and Street Trees for more information.

4.5.7 Retaining Walls

(1) Retaining walls that have surcharge loads or are greater than 1m high will require a building permit.

(2) Retaining walls are to be fully located within the allotment not Council reserve area unless otherwise specifically approved by Council.

(3) Walls which are retaining road or parkland fill are to be located within the road or parkland reserve.

(4) Where walls are approved for construction on road reserves, the reserve is to be widened as necessary to provide a verge width suitable for pedestrians, infrastructure, maintenance requirements, services and clearances.

(5) Permanent fencing, having a minimum height of 1.2m and of a type approved by Council is to be provided for retaining walls located on future public land. Temporary fencing is to be provided for walls exceeding 1m in height located on private land.

(6) The maximum height of a retaining wall between adjacent allotments is to be 2m unless otherwise approved by Council.

(7) Retaining walls are to be masonry or rock only unless approved by Council.

4.5.8 Footpath / Verge Crossfalls

All footpath / verges shall fall from the frontage property boundary to the adjacent kerb and channel with acceptable crossfalls of between 3% and 6%.

4.5.9 Compaction

Compact of earthworks shall be in accordance with AS 3798: *Guidelines on Earthworks for Commercial and Residential Developments*.

Contaminated soils i.e. industrial sites, service stations etc – on site treatment.

Contents of Section 5 – Total Water Cycle Management

Figures in Section 5

Section 5

Section 5

Section 5 – Total Water Cycle Management

5.1 Purpose and Structure

The purpose of this Section is to explain the concept of Total Water Cycle Management (TWCM), and how the integration of the following elements achieves optimal water use and conservation. The elements to be integrated include:

(i) drinkable (reticulated) water supply;
(ii) sewage collection, treatment and effluent disposal;
(iii) stormwater collection, treatment and disposal; and
(iv) reclaimed (recycled) water collection, storage, treatment and re-use or disposal.

Integration of these elements through TWCM minimises the adverse impacts on water resources and the environment.

This section is structured as follows:

(i) 5.1 to 5.4 which provide the framework of the explanation; and
(ii) 5.5 to 5.8 provide guidance on principles of TWCM, their relationships and their application to development.

5.2 Terminology

"Total Water Cycle Management" – water management which includes all aspects of the hydrological cycle including water storage, use, reuse and disposal in a way that maintains or enhances water quality.

"Water Sensitive Urban Design" – is the integration of water cycle management into urban planning and design. Water cycle management includes:

- drinking water
- stormwater run-off
- waterway health
- waste water
- recycling

5.3 Related Standards

(1) Brisbane City Council Stormwater Quality Improvement Device (SQID) Design Guidelines

(2) Caloundra City Council Urban Stormwater Quality Management Plan (USQMP)

5.4 Process

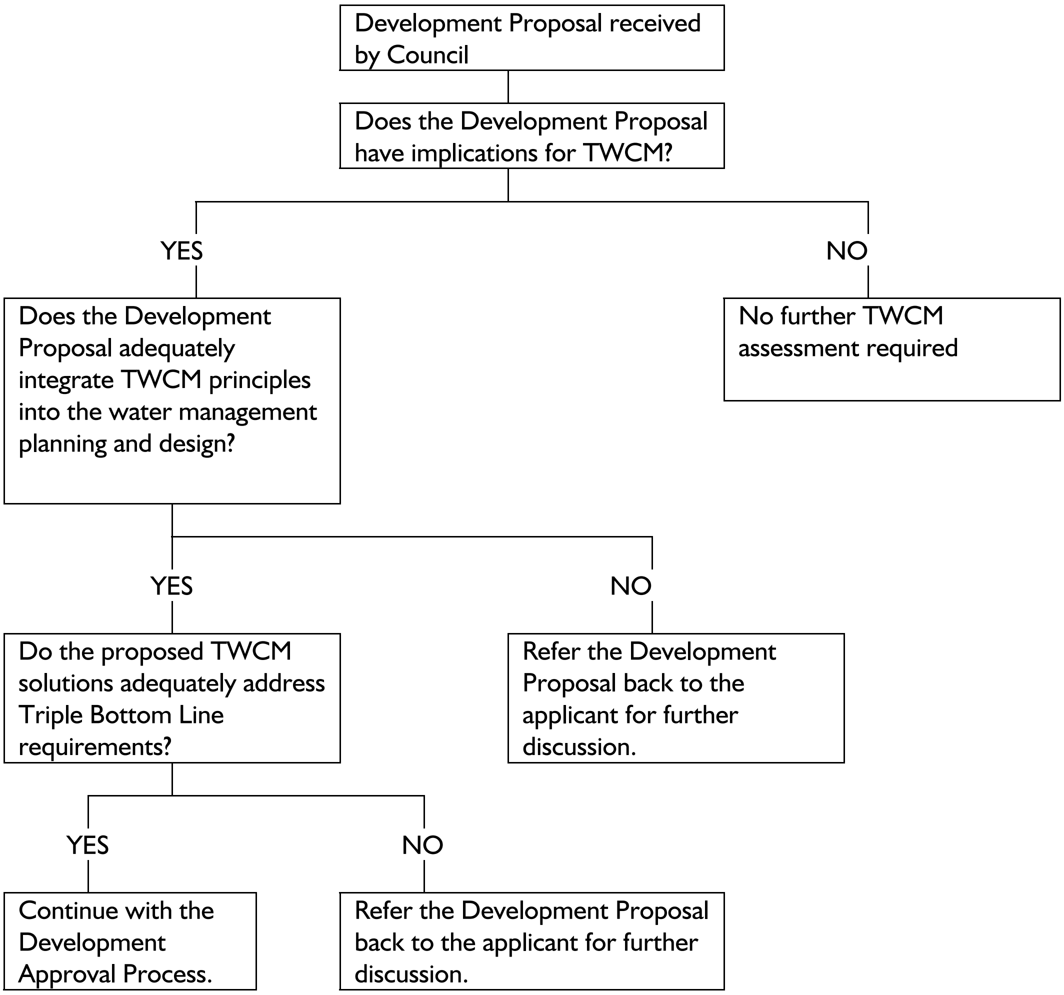


Figure 5.1 – Total Water Cycle Management

5.5 Guidelines - General

Total Water Cycle Management (TWCM) aims to integrate aspects of the water cycle to achieve sustainable outcomes in how we source, use, convey, and dispose of water.

The principal infrastructure components required to satisfy water cycle management objectives include:

- (a) drinkable (reticulated) water supply;
- (b) sewage collection, treatment and effluent disposal;
- (c) stormwater collection, treatment and disposal; and
- (d) reclaimed (recycled) water collection, storage, treatment and re-use or disposal.

5.6 Total Water Cycle Management Principles

(1) Total Water Cycle Management embodies the following principles:-

(a) Water Conservation and Reuse
- (i) Reducing potable water demand;
- (ii) Supply substitution;
- (iii) Alternative technologies for effluent disposal;
- (iv) Water demand management;
- (v) Water conservation principles;
- (vi) Safe (for public health and the environment) reuse of wastewater streams; and
- (vii) Stormwater harvesting and recycling.

(b) Environmental Management
- (i) Environmental flow requirements
- (ii) Preservation and enhancements of natural landforms and ecosystems;
- (iii) Promotion of use of natural waterways;
- (iv) Natural Channel Design; and
- (v) Appropriate sewage treatment and disposal where reuse is not an option.

(c) Stormwater Management
- (i) Stormwater Quality Management
- (ii) Stormwater Quantity Management
- (iii) Detention/retention requirements
- (iv) Minor and major stormwater system design
- (v) Flood immunity
- (vi) Public convenience
- (vii) Water Sensitive Urban Design
- (viii) Water Sensitive Road Design

(2) In Caloundra City, Total Water Cycle Management (TWCM) will aim to integrate stormwater management, water supply and sewerage management in the pursuit of sustainable water cycle outcomes.

Stormwater management should aim to maximise reuse, minimise the need for major gross pollutant traps, minimise impervious areas, and minimise maintenance, cleaning, and disposal costs. It should also attempt to minimise the impacts of high volumes and low quality of stormwater flowing into and along our natural waterways.

For example the use of rainwater tanks and high quality sewage effluent treatment (even though it will not be used for potable use) may decrease the amount of potable water consumption, improve security of supply, reduce the impacts of stormwater runoff, reduce stormwater and water supply infrastructure requirements, and reduce the potential for sewage overflows. High quality sewage treatment will decrease environmental impacts on receiving waters.

On a larger scale, purpose-designed regional detention ponds and wetlands will improve the quality of high volumes of stormwater prior to discharge. Regional solutions are generally more cost effective than individual localised solutions and should be pursued where possible.

Using this approach, a proportion of stormwater and waste water may be used to substitute for more conventional water supply in order to increase water reuse, decrease the potable demand, and decrease the amount of stormwater, waste water, and contaminants discharged to the environment.

Addressing stormwater management through an effectively managed TWCM approach may also achieve Triple Bottom Line objectives through integrating constructed water management solutions including detention ponds and vegetated swales with natural systems and processes such as waterways, wetlands, and lakes to achieve cost effective and socially acceptable sustainable water management outcomes.

The aims of TWCM in Caloundra City that can be achieved through this policy include:

(a) reduced stormwater discharges through storage and reuse;
(b) improved stormwater quality using non-structural solutions focussing on natural systems and processes for conveyance, storage, treatment, and release of stormwater;
(c) increased level of water reuse;
(d) reduced level of water extraction from supply catchments;
(e) reduced greenhouse gas emissions from pumping;
(f) reduced stormwater management costs and impacts;
(g) reduced capital costs of infrastructure;
(h) increased community involvement with improved social outcomes;
(i) reduced maintenance and operational overheads; and
(j) improved environmental outcomes.

Integrating activities such as water supply, sewerage, and stormwater management will achieve an improved level of water management which will require a change from 'conventional' methods of managing the quantities and quality of stormwater and waste water produced. Section 6 (Stormwater and Drainage) describes alternative methods of stormwater management in more detail.

5.7 Application of Total Water Cycle Management Principles

(1) Application of TWCM principles is encouraged for all development within Caloundra City. Water Sensitive Urban Design (WSUD) is an aspect of TWCM which incorporates sustainable management techniques into stormwater management, water supply and use, waste water treatment, reuse, and disposal.

(2) Implementation of a TWCM approach will assist in achieving the Specific Outcomes and preferable solutions within the relevant codes relating to water quantity, water quality, and water resources management:

(a) Civil Works Code;
(b) Habitat and Biodiversity Code;
(c) Natural Waterways and Wetlands Code;
(d) Reconfiguring a Lot Code; and
(e) Water Resource Catchment Code

(3) If assessable development does not address TWCM design requirements, the Specific Outcomes in the Codes may not be achieved which could result in refusal of the application.

(4) Accordingly, in designing the development, the designer is to focus primarily on the opportunities to implement TWCM and only resort to "conventional" engineering design in instances where it is not physically possible or practical to implement TWCM.

(5) Developments may consist of a mix of TWCM design and "conventional" design where it is practical to include only certain elements of TWCM.

(6) If "conventional" design is proposed for an element of the development then the applicant is required to clearly demonstrate that the corresponding TWCM principle cannot be achieved.

(7) Refer also to Caloundra City Council Urban Stormwater Quality Management Plan (USQMP).

5.8 How this Policy Addresses Total Water Cycle Management

The aspects of Total Water Cycle Management which are addressed in the context of this manual are Stormwater, Water Supply, and Sewerage. The following diagram shows how these are dealt with in this manual:

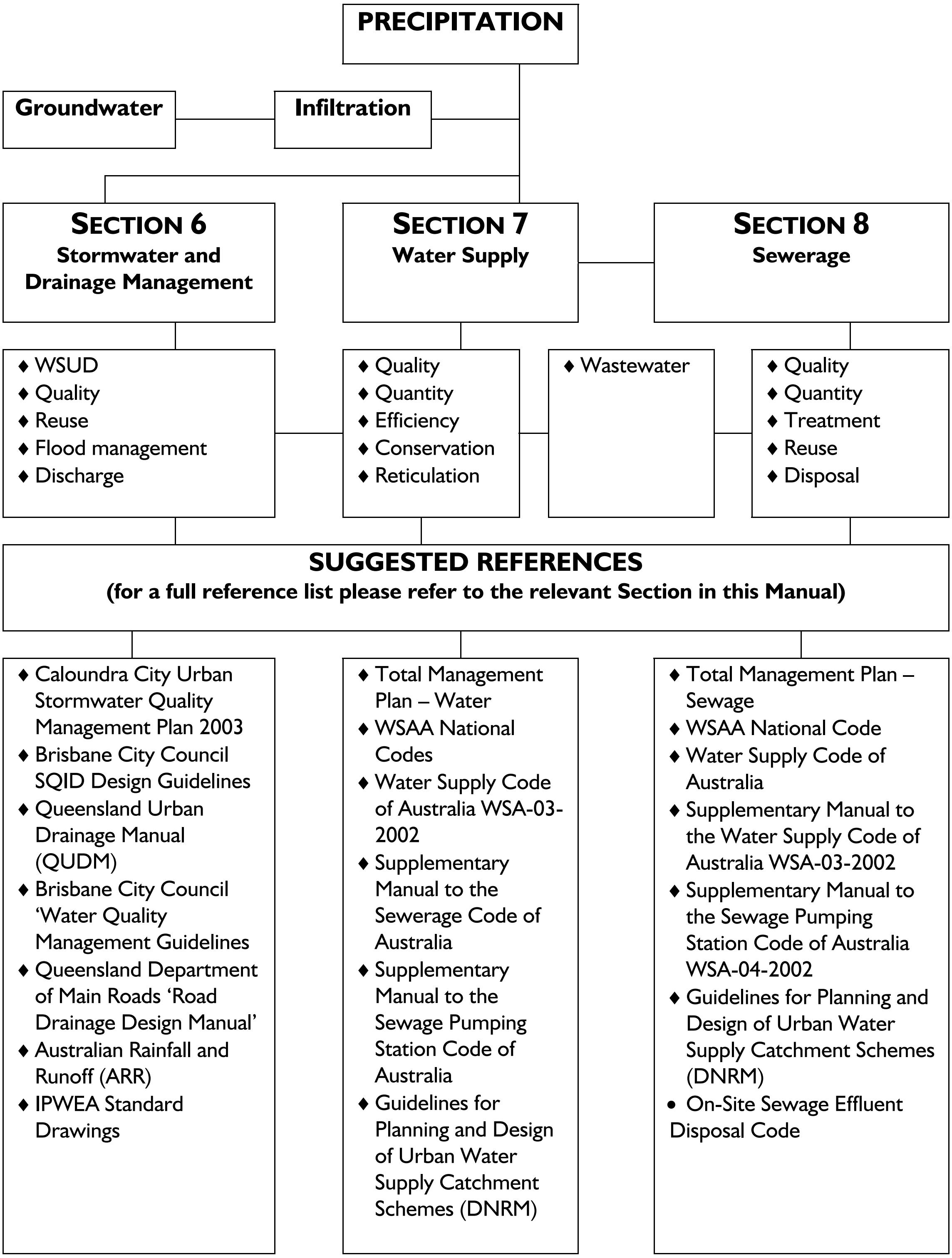


Figure 5.2 – Application of Total Water Cycle Management

Section 5

5.9 Examples of Water Sensitive Urban Design Measures

(source – 'Water Sensitive Urban Design Guidelines for the City of Knox', April 2003)

The following diagrams show how various Water Sensitive Urban Design measures can be incorporated into developments. Note these diagrams are indicative only and are only to be used for WSUD demonstration purposes.

Figure 5.3	Typical Single Detached Residential Development
Figure 5.4	New Subdivision with standard lot sizes (450m^2 – 750m^2)sizes
Figure 5.5	Typical Detached Unit or Integrated Housing Development (Lot size between 350m^2 and 450m^2).
Figure 5.6	Typical Unit Development (Lot size between 250m^2 and 300 m^2)
Figure 5.7	Typical Urban Park Retrofit
Figure 5.8	Roadway Installation

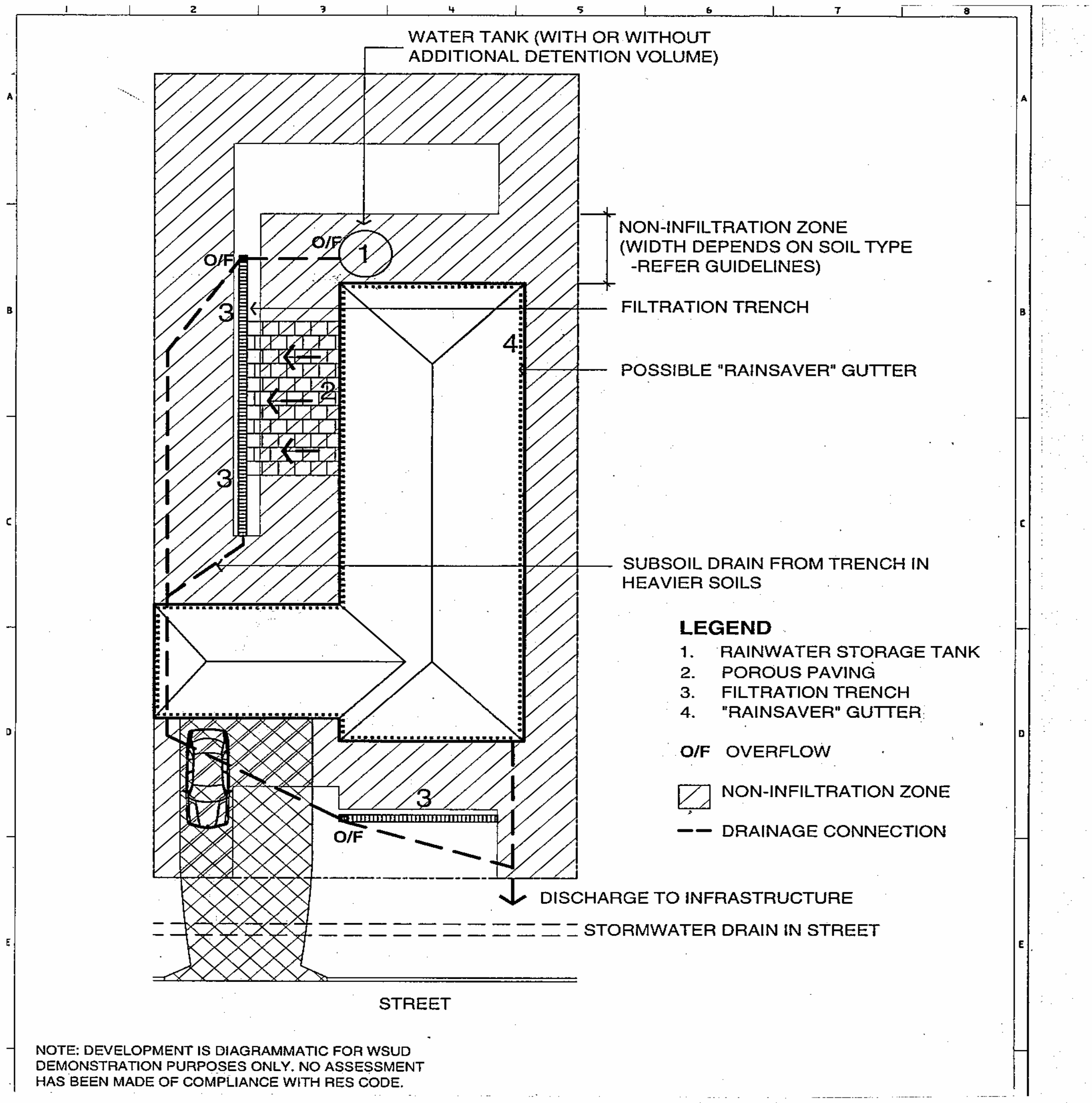


Figure 5.3 – Typical Single Detached Residential Development

Section 5

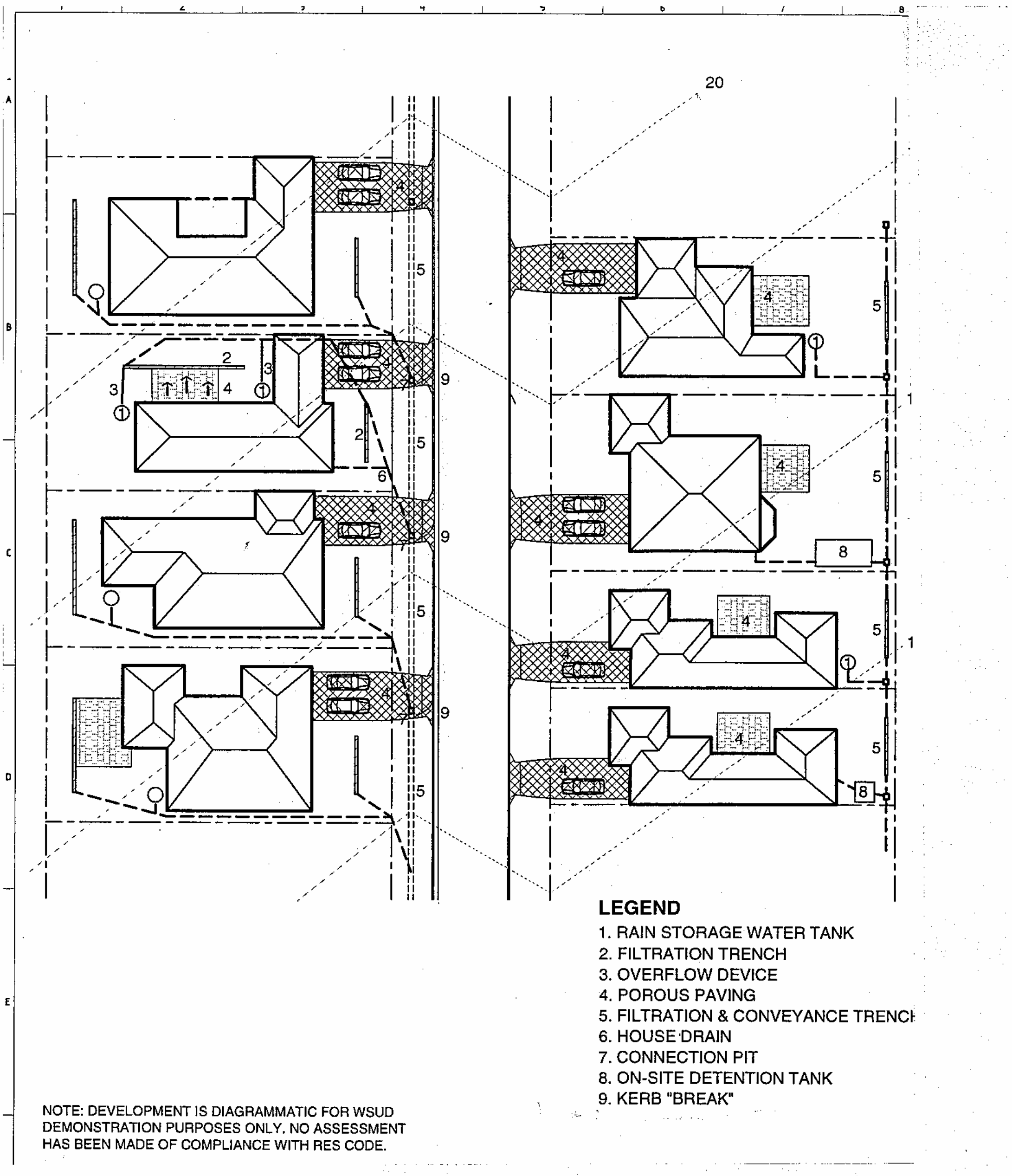


Figure 5.4 – New Subdivision with standard lot sizes (450m² – 750m²)

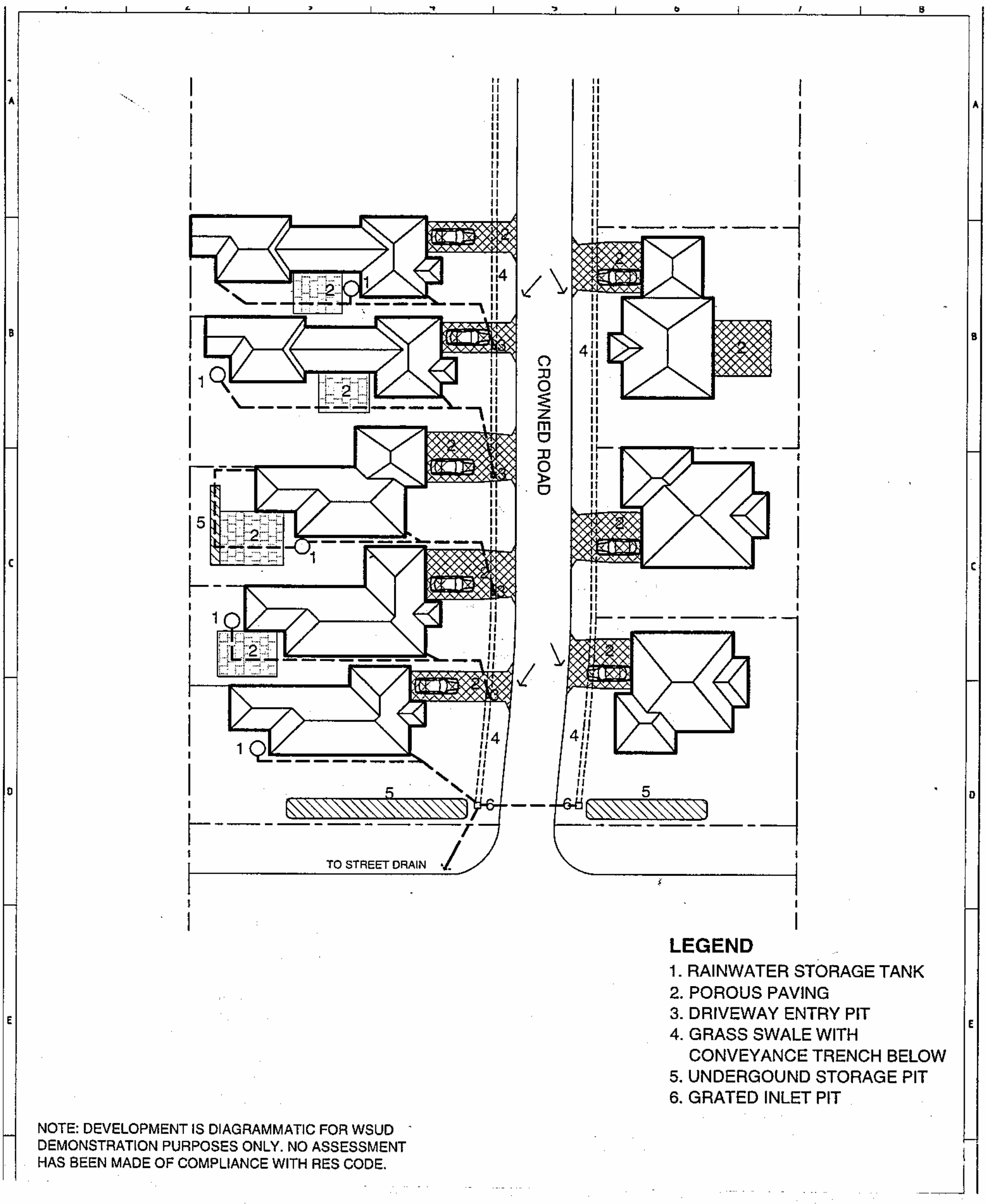


Figure 5.5 – Typical Detached Unit or Integrated Housing Development (Lot size between 350m² and 450m²).

Section 5

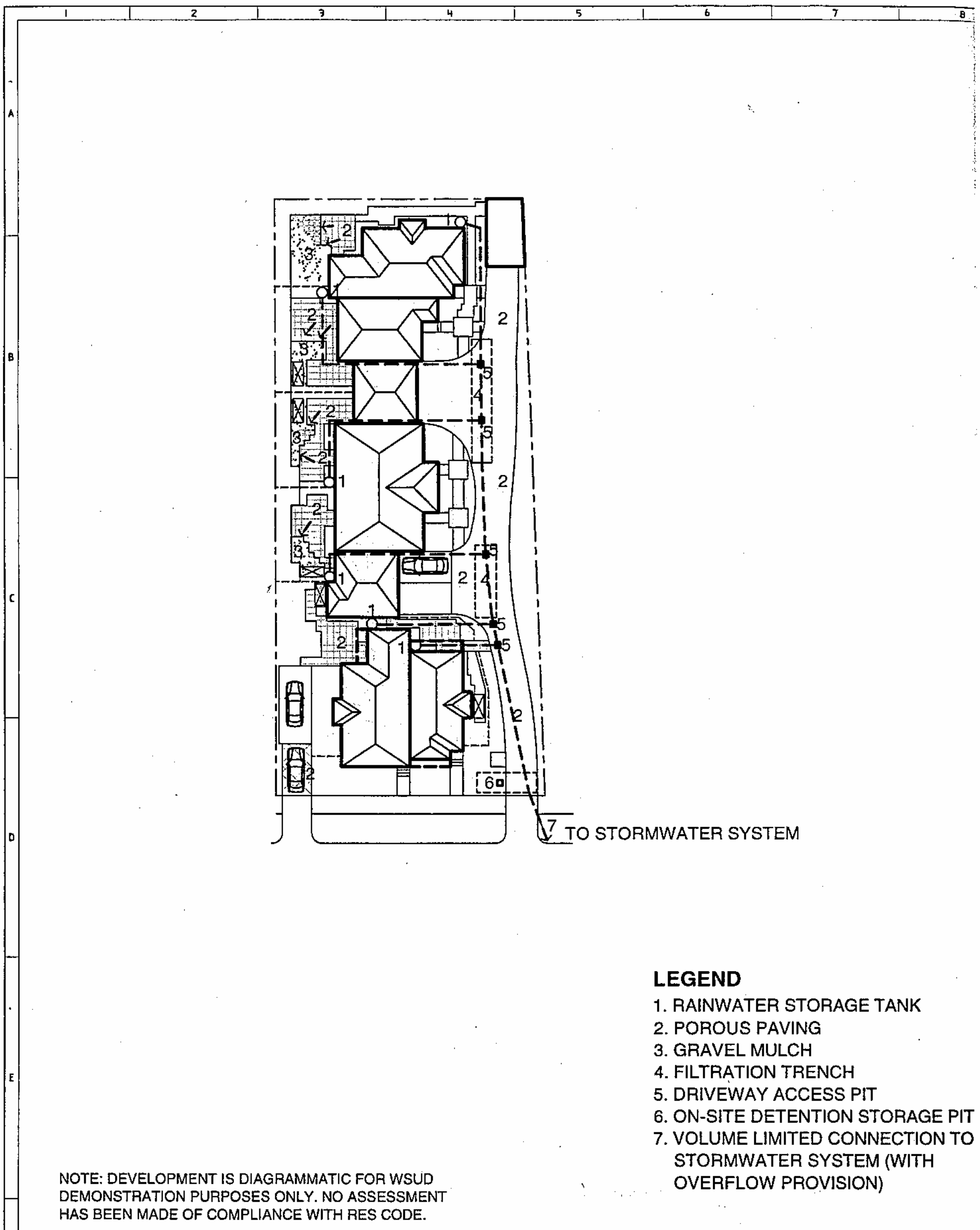


Figure 5.6 – Typical Unit Development (Lot size between 250m^2 and 300 m^2)

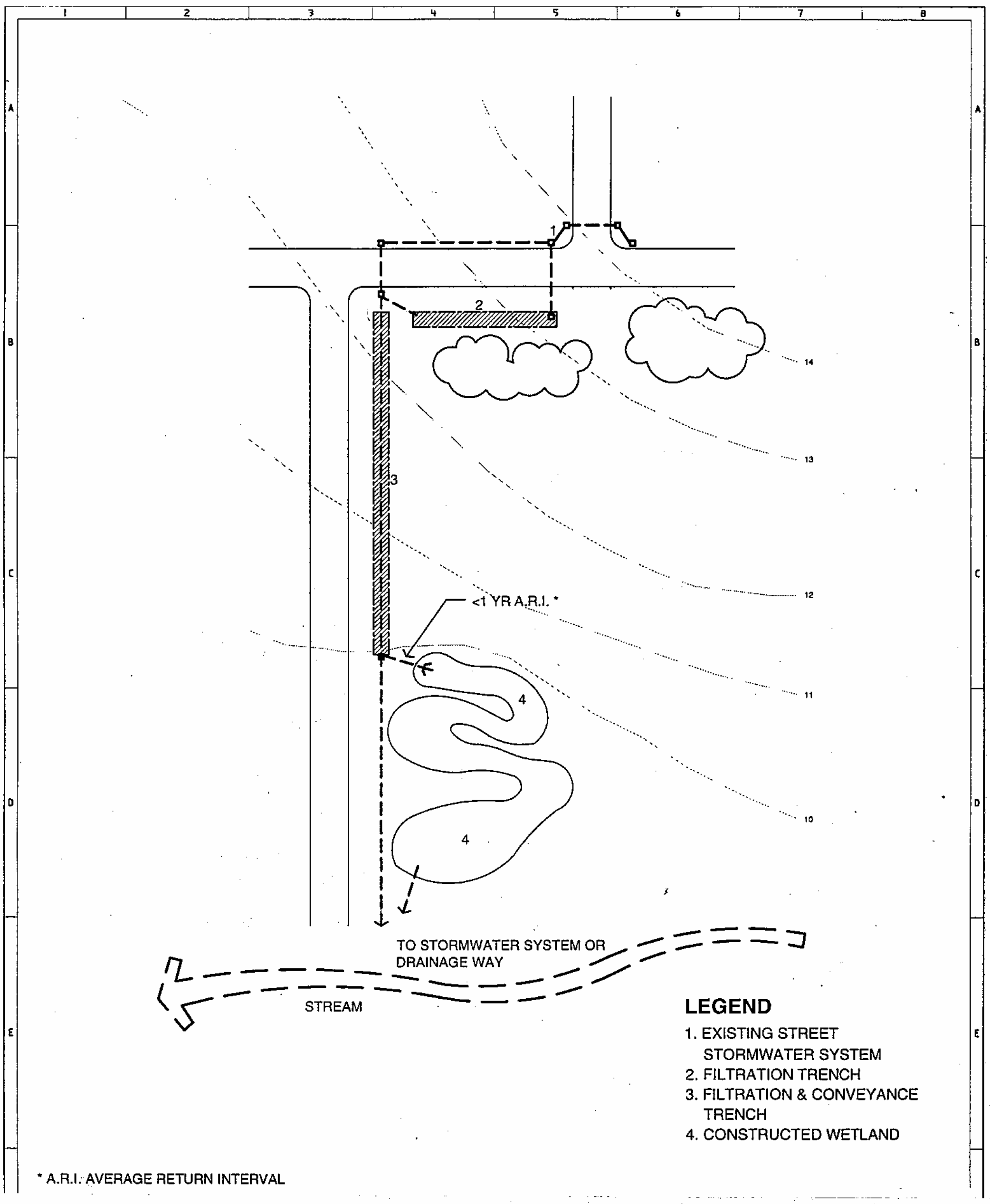


Figure 5.7 – Typical Urban Park Retrofit

Section 5

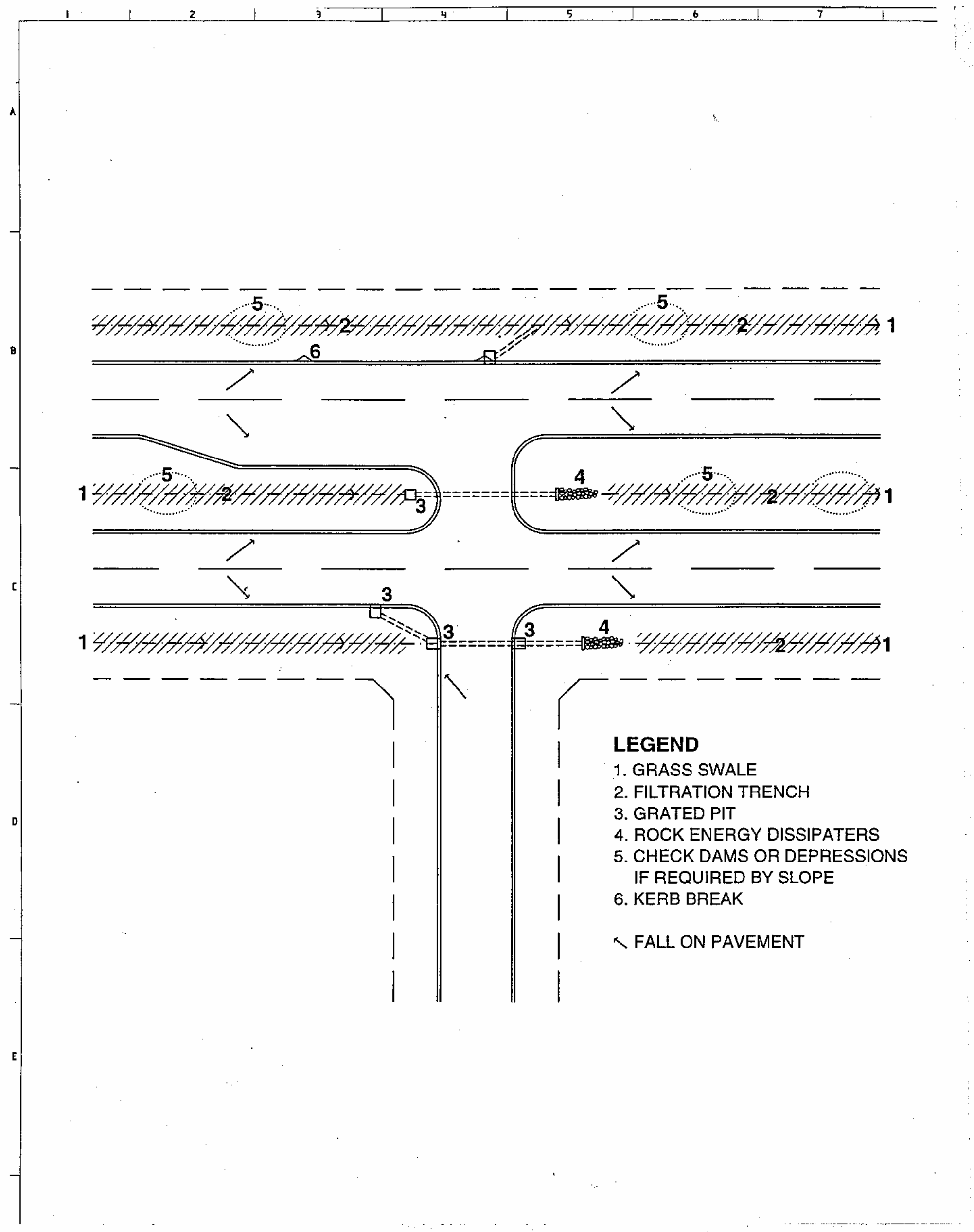


Figure 5.8 – Roadway Installation

Section 5

Contents of Section 6 – Stormwater and Drainage Management

Tables in Section 6

Figures in Section 6

Appendix Section 6

Section 6 – Stormwater Management

6.1 Purpose and Structure

(1) The purpose of this Section is to provide guidance on Water Sensitive Urban Design (WSUD) for development to address:

(a) stormwater quality management;
(b) protecting and enhancing environmental values of receiving water bodies;
(c) protecting and enhancing natural streams and gullies and ecological corridors; and
(d) preventing or minimising the potential adverse effects of stormwater runoff.

(2) This section is structured as follows:

(a) 6.1 to 6.4 which provide the framework for the guidelines;
(b) 6.5 which provides guidance on general requirements relating to stormwater management;
(c) 6.6 and 6.7 which provide common design principles and parameters applying to both WSUD and "conventional" engineering design;
(d) 6.8 which provides the requirements relating to Flood and Stormwater Management Plans;
(e) 6.9 which provides guidelines for construction using WSUD principles; and
(f) 6.10 which provides the requirements relating to stormwater management where application of WSUD principles is not physically possible and "conventional" engineering design is proposed.

6.2 Terminology

"Add value while minimising development costs" – minimise the drainage infrastructure cost of the development.
"Bio-retention Swale" – a series of stormwater filtration "cells" located along the invert or base of an open channel system or swale system.
"Constructed Wetland" – a designed and constructed complex of saturated substrates, emergent and submergent vegetation, animal life, and water that simulates natural wetlands for human use and benefits, often used to improve stormwater quality.
"Conventional Engineering Design" – engineering solutions to stormwater management which rely on traditional "pipe and convey" methods that have not included water quality nor flow reduction techniques.
"Filtration and Conveyance Trench" – a sub-surface drainage system comprised of perforated pipes combined with a gravel trench.
"Filtration Trench" – a sub-surface water filtration system (typically a shallow, excavated pit, filled with sand, gravel and/or rock) capable of holding stormwater runoff to allow it to infiltrate the ground and/or be temporarily detailed to achieve some water quality improvement.
"Floor Levels" – habitable floor levels are to be located at the required minimum height above the 100 yr ARI Local Area Flood Level, Regional Flood Level, or Storm Tide Level. The potential effects of climate change are to be taken into account when measuring floor levels. Refer also to the Flood Management Code.
"Grass Buffer" – a broad sloped area of grass or other dense vegetation capable of withstanding shallow sheet flow stormwater runoff.
"Grass Swale" – a grassed lined channel for conveying runoff from roads and other areas.
"Gross Pollutant Trap" – a constructed device used to remove solids greater than 5mm in diameter from the stormwater system.
"Gully pit gross pollutant trap" – a device that is installed at the inlet to the enclosed stormwater drain system.
"Integrate stormwater treatment into the landscape" – use stormwater in the landscape by incorporating multiple use corridors that maximise the visual and recreational amenity of developments.

"Lake" – A natural or constructed permanent body of water which provides amenity, habitat, and recreational value and which may also be used to manage quantity and quality of stormwater runoff.

"Lawful Point of Discharge" – refer to QUDM Section 3.02.

"Local Area Flood Level" – flood levels generated by rainfall within a local area catchment e.g. flood levels in the road reserves, overland flow paths and dry gullies etc. from rainfall within the proposed development. Typically flood levels from storm durations less than 6 hours, commonly known as flash flooding.

"MUSIC" - Model for Urban Stormwater Improvement Conceptualisation

"Oil and Grit Separator" – a device designed and constructed to separate oils and grit from stormwater runoff and remove coarse sediment and hydrocarbons.

"Overland flow paths" – are defined as:

- where a piped drainage system exists, the path where floodwaters exceeding the capacity of the underground drainage system would flow; and
- where no piped drainage system or other form of defined watercourse exists, the path taken by surface runoff from higher parts of the catchment. This does not include a watercourse or gully with well defined banks.

"Porous Pavement" – pavement that allows runoff to drain through pavement and subsequently infiltrate into the underlying soil.

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

(a) assessable development on land identified on a Planning Area Overlay Map as being subject to the :
  (i) Acid Sulfate Soils Code; or
  (ii) Natural Waterways and Wetlands Code; or
  (iii) Habitat and Biodiversity Code; or
  (iv) Flood Management Code; or
  (v) Steep land/Slope Stability Code; or
(b) any proposal on land listed in the Environmental Management Register or the Contaminated Land Register; or
(c) any proposal involving a new impermeable surface area (not including roofing area) in excess of 1,000 m^2; or
(d) Reconfiguring a lot to create 5 or more lots where new driveways/roadways are to be provided or new roads are to be opened; or
(e) industrial development that is impact assessable or that exceeds 1,000 m^2 in uncovered storage or working space; or
(f) a service station; or
(g) an uncovered carpark with at least 50 spaces; or
(h) a wholesale garden centre.

In addition, any development which will discharge stormwater or wastewater to an area deemed by Council to have significant environmental value may also be classified as 'primary risk' (e.g. Lake Baroon Catchment or Pumicestone Passage).

"Protect natural systems" – protect and enhance natural water systems within urban developments.

"Protect water quality" – maintain or improve the quality of water draining from urban developments into receiving environment.

"Rainwater Storage Tank" – a sealed tank designed to collect and utilise roof water.

"Reduce Runoff and Peak flows" – reduce peak flows from urban development by local detention measures and minimising impervious areas.

"Regional Flood Level" – *f*lood levels generated by rainfall within the regional catchment. e.g. river flood levels which may rise into the proposed development. Typically flood levels from storm durations greater than 6 hours.

"Secondary Risk Development" – development other than "Primary Risk Development".

"Sediment Basin" – a constructed depression in the ground where run-off water is collected and stored to allow suspended solids to settle out.

"Storm Tide Levels" – refer Section 11.5 Climate Change and Tidal Influences.

"Stormwater Harvesting" – *t*he approach of maximising the re-use of stormwater that is generated on a development site to supplement the supply of water to the urban (and rural) water cycle.

"Stormwater Quality Improvement Device" (SQID) – various structures that are installed along waterways and within stormwater infrastructure to filter pollutants and improve the quality of stormwater with the aim of protecting downstream water quality. Examples of SQIDs are Gross Pollutant Traps (GPTs), silt traps, retention basins, sediment basins and constructed wetlands.

"Total Water Cycle Management" – water management which includes all aspects of the hydrological cycle including water storage, use, reuse and disposal in a way that maintains or enhances water quality.

"Trash Rack" – a device which intercepts litter, trash and debris that flows through the drainage line and consists of a series of bars that act as a physical barrier. It can be located on-line or off-line to the main flow channel.

"Underground Storage Tank" – a below ground storage device that retains stormwater runoff.

"Vegetated Swale" – an open vegetated channel that can be used as an alternative stormwater conveyance system to conventional kerb and channel along roads and associated underground stormwater pipe.

"Water Sensitive Urban Design" – is the integration of water cycle management into urban planning and design. Water cycle management includes:

- drinking water
- stormwater run-off
- waterway health
- waste water
- recycling

"Wetland" – A constructed or naturally occurring impoundment or storage area which supports habitat, plants, and animal species adapted to permanently or intermittently wet environments, and which slows the movement of stormwater through a catchment while improving the quality of discharge.

6.3 Related Standards

(1) Brisbane City Council Stormwater Quality Improvement Device (SQID) Design Guidelines

(2) Caloundra City Council Urban Stormwater Quality Management Plan (USQMP)

(3) Queensland Urban Drainage Manual (QUDM)

(4) Brisbane City Council "Water Quality Management Guidelines"

(5) AS 2865: *Safe Working in Confined Spaces*

(6) Queensland Department of Main Roads "Road Drainage Design Manual"

(7) Australian Rainfall and Run-off (ARR)

(8) Institute of Public Works Engineering Australia (IPWEA) Standard Drawings

(9) Brisbane City Council Natural Channel Design Guidelines

(10) Brisbane City Council Roadside Swale and Bio-Retention Systems Design

(11) Stormwater Industry Association web site www.stormwater.asn.com.au

(12) Australian Water Association – products and services guide

(13) Draft Australian Runoff Quality Guideline (ARQ)

(14) Brisbane City Council Stormwater Outlets in Parks and Waterways

(15) DLWC Constructed Wetland Manual

(16) Standard Specification CCC2 – Stormwater Drainage

(17) Cost sharing based on responsibilities with State-controlled roads.

6.4 Process

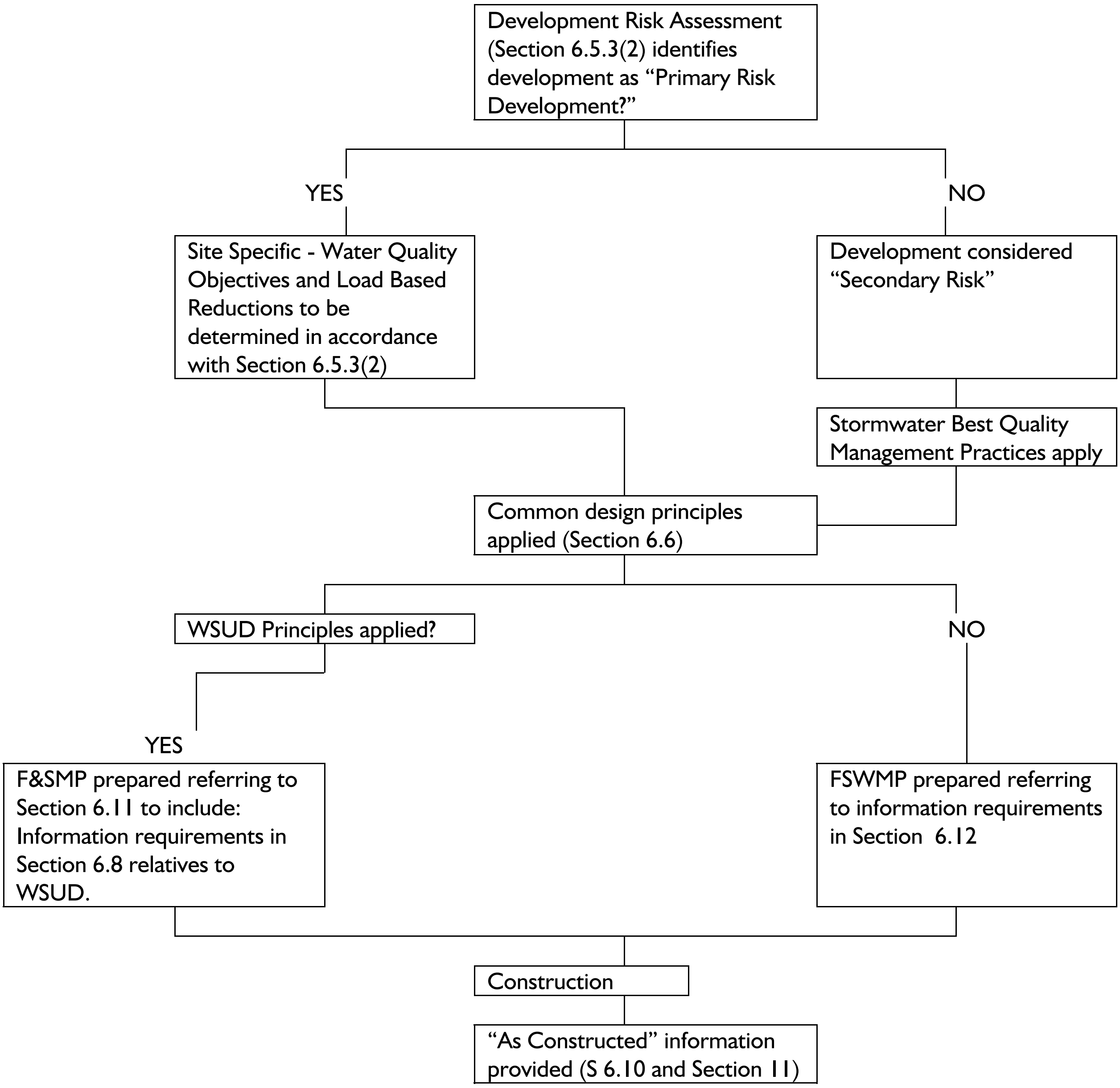


Figure 6.1 –Stormwater Management

6.5 Guidelines - General

6.5.1 Adjacent Properties and Lawful Point of Discharge

(1) A lawful point of discharge is to be provided to accommodate all roof and land water runoff:

- (a) originating from and flowing through the development site; and
- (b) originating from the external up-slope catchment flowing through the development site or diverted by the development.

(2) An applicant proposing to discharge stormwater runoff from a proposed development site, in an altered or concentrated form, onto any adjoining and/or downstream property, must provide Council with written consent from all property owners through which this runoff may flow and easements across the affected properties in accordance with Section 6.5.2 Reserves and Easements.

(3) Where stormwater runoff from adjacent or upstream properties enters the proposed development site, a drainage system is to be provided within the new works to accommodate such flows. The drainage system must ensure that no stormwater ponding occurs on any adjacent or upstream properties, and is to be designed in accordance with Section 6.7.4 Hydraulic Requirements.

(4) The drainage system is to be designed to accommodate a fully developed upstream catchment. The drainage system must also be designed so that it can be constructed up to the development site's boundaries and extended in the future to accommodate future development, without disturbing existing (or recently proposed) development.

(5) The tests and principles of QUDM Section 3.02 will be applied in determining if a lawful point of discharge has been achieved. If no lawful point of discharge or if no discharge approval agreement has been obtained, then the design cannot be accepted or approved.

6.5.2 Reserves and Easements

(1) *General Requirements*

- (a) Drainage reserve, or where appropriate park or road reserve, will generally be required over all stormwater flow paths and their verges unless specially approved otherwise in the following circumstances:
  - (i) Development of rural size lots;
  - (ii) Development of rural residential size lots where:
    - ♦ the catchment is smaller than 5 hectares;
    - ♦ the flow path does not adjoin a park area;
    - ♦ blockage of the flow path will not cause flooding of adjoining lots; and
  - (iii) Development of urban land where:
    - ♦ Council-controlled land does not drain into the flow path;
    - ♦ the catchment is smaller than one hectare; and
    - ♦ blockage of the flow path will not cause flooding of adjoining lots.

- (b) Drainage reserve, or where appropriate park or road reserve, will be required over all areas containing detention basins, gross pollutant traps, wetlands and other stormwater quality improvement devices and verges required to adequately serve or maintain these devices. The reserve will not be less than 5 metres wide.

- (c) Easements are required over all drainage systems which traverse private property. Additional information is provided in QUDM Section 3.04. All costs associated with the provision of an easement are to be borne by the applicant.

(2) *Vestment*

(a) Easements are to be vested in favour of Council for all drainage systems, structures and/or facilities which are, or will be, the responsibility of Council to preserve and maintain.

(b) Roofwater and inter-allotment drainage systems are considered as private drains and future maintenance responsibility will vest with the property owners. An easement in favour of all upstream property owners will be required over these drainage systems.

(3) *Easement Dimensions*

(a) Easements to be registered in favour of Council are to comply with QUDM Section 3.04(h) and have a minimum width of 4.0 metres.

(b) Easements over roofwater or inter-allotment drainage systems are to be minimum width of 1.5 metres for pipes up to 300mm in diameter. All pipes 300mm in diameter or larger are to be covered by easements in accordance with QUDM Section 3.04(h) Clause i.

(4) *Extinguishment of Easements*

(a) Existing easements in favour of Council will only be extinguished where the need for the drainage system through the land, not in Council control, is determined to be no longer warranted. All costs associated with the surrendering of an easement are to be borne by the applicant. In some cases, Council may require compensation for the loss of the rights under the easement.

(5) *Underground Drainage Easements*

(a) This type of easement is required for all enclosed drainage systems which require Council maintenance or for future construction works.

(b) The building of structures over or upon easements is not generally in the interest of the party that is vested in the easement. Accordingly, development applications that involve a proposal to build over or upon easements are required to demonstrate that:
(i) The proposal does not conflict with the terms of the easement agreement;
(ii) The proposed structure or the construction of the proposed structure does not increase loadings on the underground infrastructure assets;
(iii) The drainage system through the easement does not include an overland flowpath or an open channel;
(iv) The proposed structure does not restrict (or prevent) access of maintenance staff and plant;
(v) Fencing allows free passage of flow.

(6) *Overland Flow Easements*

(a) This type of easement allows for the passage of stormwater runoff or redirection of flow across the natural land surface. These easements prohibit any activities or works which may obstruct or impede the flow of stormwater runoff, unless prior approval is provided. Designs of overland flowpath must take into account future fencing that may be constructed across the easement.

(b) Any fences to be constructed across easements or along the easement boundary are to provide sufficient access for Council's maintenance or future construction, by either the provision of gates or removable sections that are wide enough to allow access.

(c) Fencing is to allow free passage of flow.

(d) Survey levels provided on the design plans will form the basis of the levels required for this overland flow. Survey levels are acceptable on RP survey plans.

(7) *Open Cut Drainage Easements*

(a) This type of easement caters for maintenance and for future construction of a design open drain or channel, which is used solely for the passage of stormwater runoff. Freeboard requirements and access and safety beams are to be associated within the designated easement as required under Section 6.12.2(g) and (h) Guidelines – “Conventional” Engineering Design.

(8) *Access Easements*

(a) Access easements permit Council to have access from the nearest surveyed road to any drainage easement(s), in order to carry out maintenance and/or construction activities or works. This will normally be a requirement of all other drainage-related easements in favour of Council.

(b) In order for stormwater management facilities to function at their designated level of service, most will require some level of periodic inspection, maintenance works, cleaning or repairs. Therefore, consideration is to be given to the maintenance of the stormwater drainage system and stormwater quality management facility(s) during the design process.

(c) Reasonable access for both personnel and equipment is one of the most critical design considerations of both the enclosed and open drainage systems. Any proposed landscaping should be designed in conjunction with access requirements.

(d) Maintenance (including costs) of all stormwater quality management facilities is an important consideration and a detailed management plan or maintenance strategy is to be produced for each facility and submitted to Council for review prior to development approval for operational works.

(9) *Combination of Easements*

(a) In many cases, combinations of different types of drainage easements will be required. These are to be provided within the same easement documents.

(10) *Maintenance of Drainage Reserves and Easements*

(a) Drainage easements will be covered by a binding agreement between Council and the landholder.

(b) Trees should not be planted on drainage easements/reserves without the prior written consent of Council.

(c) Native vegetation is to be retained on the easement/reserve.

(d) Declared and environmental weeds must be removed from any easement.

(e) No structures, excavation, filling, or drainage works are to be commenced on an easement or reserve without the prior written consent of Council.

6.5.3 Water Quality Design and Assessment Process

(1) *General*

(a) Water Quality Objectives (WQO) for the site are to be determined in accordance with this sub-section regardless of whether WSUD principles or "conventional" engineering design principles are applied to the subject site and proposed development.

(b) The Water Quality Objectives (Appendix 6.1) are intended as an interim protective measure, and will be superseded by site-specific WQOs based on community nominated Environmental Values or Council endorsed studies as they become available.

(c) Refer to the Section 6.7.8 Stormwater Runoff Quality and Caloundra City Council Urban Stormwater Quality Management Plan (USQMP).

(d) The following is a generic summary of the water quality design and assessment process:

Step	Type of Action	Action
Step 1	Planning	Determine Risk of Development
Step 2	Planning	Determine the Environmental Values and Water Quality Objectives that apply to the proposed development.
Step 3	Modelling	Determination of Water Quality Discharge for the Site (Unmitigated Development Form)
Step 4	Design Planning	Selection of individual SQIDs to form the "Treatment Train"
Step 5	Modelling	Determination of the Mitigation Effect of the "Treatment Train" on the Water Quality Discharge for the Site
Step 6	Specification	Determination of the Treatment Specifications for the Various SQIDs
Step 7	Site Layout	Determine Development Site Design to Incorporate the Various SQIDs
Step 8	Detailed Design	Detailed Design of Stormwater System in accordance with the DDPSP and the Treatment Specifications for the Various SQIDs
Step 9	Construction-Implementation	Construct and Implement the Various SQIDs.

Table 6.1 – Generic Water Quality Design Process

(e) For Secondary Risk Development, please refer to Section 6.5.4 Secondary Risk Development Approach.

(2) *Step 1 – Development Risk Assessment*

(a) Development is classified as either of "Primary Risk Development" or "Secondary Risk Development" as defined in Section 6.2.

(b) Generally, there will be no latitude given to allow a development to downgrade the risk where it is identified to be discharging to an area with significant environmental value.

(c) For "Primary Risk Developments", a set of Water Quality Objectives and Load Based Reductions Objectives is to be identified and it is then required to demonstrate to Council how the measures outlined in the FSWMP will ensure that these objectives will be satisfied. Pollutant export modelling will normally be required. Results should be presented in a tabular form detailing the concentrations and load output for the 'Development Unmitigated' and 'Development Mitigated' scenarios.

(d) The specific Water Quality Objectives and Load Based Reduction Objectives are contained in Appendix 6.1 (Water Quality Objectives for Caloundra City) and Appendix 6.10 (Load Based

Reduction Objectives – Operational Phase) respectively. A development will be required to demonstrate compliance with the construction stage Best Practice Discharge Guidelines as outlined in Appendix 6.8 (Best Practice Discharge Guidelines {Construction Stage}).

(e) Site Constraints
   (i) it is acknowledged that some 'primary risk' developments will be constrained due to either:
      - the nature of the site (e.g. available area for stormwater quality management measures); and/or
      - the limited ability for applicants to control the design of buildings on subdivided land.
   (ii) such constraints may result in difficulty meeting WQOs and Load Based Reductions for most key contaminants. In such circumstances, the development approval process will determine whether or not the development should be refused on water quality grounds.

(f) For "Secondary Risk Developments", refer to Section 6.5.4.

(g) For both "Primary Risk Development" and "Secondary Risk Development", water quality impacts need to be minimised by identifying and adopting best practice techniques as identified in Section 4 of BCC Water Quality Management Guidelines.

(3) *Step 2 – Site-Specific Water Quality Objectives*

(a) Determine the level of risk of proposed development in accordance with Section 6.5.3(2)

(b) For proposed Constructed Waterbodies refer to Section 6.5.3(5).

(c) Once the level of risk (R) of the development phase (construction or operation) has been established, Table 6.2 and Appendices 6.1 to 6.7 are to be used to determine the Water Quality Objectives.

(d) If the applicant considers the Water Quality Objectives established under 6.5.3(3)(c) to be unattainable, then the FSWMP is required to address the justification of use of alternative Water Quality Objectives through:
   (i) division of the catchment area into separate reaches/waterbodies with relatively homogenous characteristics;
   (ii) consultation with the community regarding the range of environmental values which each reach/waterbody should support; and
   (iii) translation of the community-nominated environmental values through the following process:
      - if primary or secondary contact recreation is nominated, refer to Chapter 5 of ANZECC Guideline 2000 Vol 1.
      - if protection of drinking water is nominated, refer to Chapter 6 of ANZECC Guideline 2000 Vol 1.
      - if irrigation, livestock watering or aquaculture is nominated, refer to Chapter 4 of ANZECC Guideline 2000 Vol 1.
      - if protection of aquatic ecosystems is nominated, refer to the Queensland Draft Water Quality Guidelines (March 2001).
      - heritage nominations should be considered on a site-by-site basis. However, if WQO's include protection of aquatic ecosystems, heritage provisions are likely to be adequately covered.
   (iv) Council is responsible for defining the waterbody category reach limits for all waterways under its jurisdiction. Council is also responsible for categorising every enclosed or semi-enclosed waterbody under its jurisdiction. This information will be made freely available on a GIS base. (refer to Appendices 6.2, 6.3 and 6.4)
   (v) if Table 6.2 recommends the standard application of prescribed WQOs:
      - the applicant is to determine the category of receiving waters through referral to CCC map products/GIS; and
      - the applicant may then elect to adopt the WQOs prescribed for the receiving waterbody category in question (Refer to Appendix 6.1).

(vi) if the prescribed WQOs are considered unattainable, the applicant may request that Council consider alternative objectives. A detailed scientific/engineering report must be provided:
- substantiating the viewpoint that the rates of contaminant reduction prescribed in the Guideline are unattainable; and
- justifying the applicant's proposed rates of contaminant reduction on scientific grounds.

RISK	**WATER QUALITY OBJECTIVES DURING CONSTRUCTION PHASE**	**WATER QUALITY OBJECTIVES DURING OPERATIONAL PHASE**
Primary	Mandatory application of prescribed WQO's ** (concentration based) Applicant to demonstrate to Council's satisfaction how these will be attained prior to development approval.	Mandatory application of prescribed WQO's ** and Load Based Reduction (Refer Appendix 6.10). Applicant to demonstrate to Council's satisfaction how these will be attained prior to development approval
Secondary	Standard application of best practice discharge guidelines (Appendix 6.8) If discharge guidelines are considered unattainable, a detailed scientific/engineering report must be provided substantiating this viewpoint and justifying the proposed discharge limits.	Applicant to nominate either 1. Application of prescribed WQOs ** If WQOs are considered unattainable, a detailed scientific/engineering report must be provided substantiating this viewpoint and justifying the proposed objectives or discharge limits. or 2. Application of Best Practice Impact Reduction Guidelines (Load based) (Appendices 6.11and 6.12). (Based on % reduction of coarse sed, fine sed, N and P). Reduction in Prescribed Rates negotiable, subject to justification.

Table 6.2 – Correlation of Water Quality Objectives with Levels of Risk

** Refer to Appendix 6.1 (Water Quality Objectives for Caloundra City)

(4) *Step 3 – Modelling - General*

(a) The codes have defined that a particular development needs to assess if that development has had an impact upon Environmental Values and Water Quality Objectives of the receiving waterbody's.

(b) In Section 6.5.3 the Environmental Values and Water Quality Objectives have been determined for the proposed development. As part of this process, a risk assessment has been undertaken, and the development has been assigned as a primary or secondary risk development.

(c) The purpose of this section is to define the process of designing a development to achieve the Environmental Values and Water Quality Objectives that have been applied to the development site, and how Council will assess the development in this regard.

(d) For the purposes of this section, WQO will represent the Water Quality Objectives that are described in Appendix 6.1 .

(5) *Step 3 continued - Commonly Used Models and Alternative Models*

(a) Examples of commonly used models are provided in the following discussion. It must be noted that this not an exhaustive list and other models may be accepted by Council where it has been demonstrated that for the situation in which that it is being applied:
   (i) the modelling package is appropriate;
   (ii) the basic model assumptions are valid for the situation; and
   (iii) there is adequate supporting information provided with the model (i.e. copies of manuals, technical support contacts etc.).

(b) Council requires that all models utilised be:
   (i) publicly documented. Typically a user's manual that describes computer data requirements. The model theory and numerical procedures used is also to be stated.
   (ii) technically supported by the supplier or software developer, so that users and Council can obtain answers and/or solutions to issues or problems that may arise through the modelling exercise and the development assessment based upon the model.

(c) Council prefers that models that applied in the development design be widely used by others than just the software developer.

(6) *Step 3 continued - Pollutant Export Models*

(a) The purpose of pollutant export models is to represent the generation of pollutants within a catchment due to its development form and activities that would be expected to occur. These models can represent the discharge concentration (i.e. Event Mean Concentration EMC) or a load (i.e. Pollutant Load as mass/unit of time).

(b) The approach is to model median events which will represent what will occur over wet, dry and average years, and will accordingly be able to be related to the WQOs.

(c) Pollutant export models relate to the discharge from the catchment, and provide input data for hydrodynamic-based water quality models that represent what occurs in the receiving waterbody.

(7) *Step 3 continued - Hand Calculations*

(a) Hand calculations should be undertaken based on Average Annual Pollutant Loads provided in the latest version of the Brisbane City Council *Guidelines for Pollutant Export Modelling in Brisbane*. Preference should be given to a Caloundra City Council document once available.

(b) Hand calculations are suitable only for "Secondary Risk Developments". The use of hand calculations for other development applications will result in additional information requests and may result in the refusal of a development application for not demonstrating that it has achieved the relevant Specific Outcome in the Codes.

(c) The procedure for undertaking hand calculations is straight forward and best illustrated through the following formulae:
   (i) $P_N = L_N \times A$
      - Where: "P_N" is the Natural Catchment Pollutant Load (kg/yr), "L_N" is the Natural Catchment Average Annual Pollutant Load Rate (kg/ha/yr) and "A" is the Catchment Area (ha)
   (ii) $P_U = L_U \times A$
      - Where: "P_U" is the Urbanised Catchment Pollutant Load (kg/yr), "L_U" is the Urbanised Catchment Average Annual Pollutant Load Rate (kg/ha/yr) and "A" is the Catchment Area (ha)
   (iii) $P_T = P_U \times (100\% - T\%)$

- Where: "P_U" is the Urbanised Catchment Pollutant Load (kg/yr), "P_T" is the Treated Catchment Pollutant Load (kg/yr) and "T%" is the Overall Treatment Efficiency of the "Treatment Train"
- Where: $T\% = 100\% - \Pi_{i=1\ldots n}(100\% - t_i)$
- Where: "Π" is the product function, "n" is the number of SQID devices in series and "t_i" is the individual treatment efficiency of a SQID expressed as a percentage.

(8) *Step 3 continued - Time-Step Computer Models*

(a) While hand calculations are appropriate for low risk proposals, computer-based models are more appropriate for medium and high risk proposals, where there may be a number of land uses, treatment trains and discharge points involved.

(b) The selection of the model and the time-step has to be undertaken in consideration of the situation that is being modelled. For most SQIDs, daily time-step models may not effectively represent the physical, biological or chemical processes that occur in the SQIDs treatment of stormwater. Accordingly, determination of time-step will be critical in the appropriate representation of treatment measures.

(c) Assessments are to be based on the results of a long time period (10 years minimum) continuous simulation, with the results from the "warm-up" period (usually the first year) excluded from the analysis set.

(d) MUSIC is a pollutant export model developed by the CRC for Catchment Hydrology that can be run with time-steps from 6 minutes up to 24 hours. MUSIC has the added advantage of estimating device performance based on the physical characteristics/dimensions of SQID devices. This software therefore has the ability to incorporate preliminary sizing/conceptual design of treatment devices with the treatment train analysis. A six minute time-step is to be used when modelling.

(e) When modelling using the MUSIC program, the land use parameters are to be altered to reflect those specified in Brisbane City Council's *Guidelines for Pollutant Export Modelling in Brisbane*".

(f) Any deviation from the parameters listed in these guidelines must be clearly stated and justified through reference to appropriate scientific publications.

(9) *Step 3 continued - Waterbody Water Quality Models*

(a) Waterbody water quality models are required to assess the impact of the catchment loads and concentrations upon the water quality within the receiving waterbody. Accordingly, hydrodynamic, hydrological, biological and chemical processes need to be considered in addition to the waterbody's dimensions (i.e. cross-sections, depth, volume, area, length etc.).

(b) Developments proposing or impacting upon constructed or natural waterbodies are required to undertake detailed modelling to demonstrate that the waterbody will function effectively and the relevant Environmental Values and Water Quality Objectives will be met. The choice of model will depend on the dominant physical and biological processes likely to occur in the waterbody. A discussion of appropriate models based on the key processes is provided below for a number of typical scenarios

   (i) Large Freshwater Lake With Overflow Weir Outlet - potential for vertical stratification (salinity or temperature gradients) and associated nutrient cycling, freshwater systems (no tidal exchange), possibly horizontally well-mixed. Examples of models that may be appropriate include DYRASEM-CADEM;

   (ii) River or Canal that is Shallow and Well-Flushed through Tidal Action – limited stratification potential, tidal exchange, narrow channel or linear flow (laterally well-mixed). Examples of models that may be appropriate include MIKE 11;

(iii) River or Canal that is Deep and Poorly-Flushed Through Tidal Action – potential for vertical stratification, narrow channel or linear flow (laterally well-mixed). Examples of models that may be appropriate include CE-QUAL-W2;

(iv) Large Shallow Lake with Tidal Exchange – limited potential for vertical stratification, tidal exchange system, and potential for 2-D horizontal effects. Examples of models that may be appropriate include MIKE21, RMA 11 (2-D);

(v) Large Deep Lake with Tidal Exchange – potential for vertical stratification, tidal exchange system, potential for 2-D horizontal effects. Examples of models that may be appropriate include RMA 11 (3-D).

(c) Typical applications would include the above hydrodynamic-water quality models linked to a catchment pollutant-export model such as XP-AQUALM or MUSIC. The pollutant export models create the water quality input for the hydrodynamic water quality model.

(d) Where modelling is undertaken on already constructed/existing waterbodies then appropriate hydrodynamic and water quality data must be sourced or measured to enable calibration and verification of the model.

(e) Certain hydraulic modelling packages also have water quality modules as add-ons. The use of "add-on" water quality modules may be acceptable, depending on the application of the water quality module and satisfaction of the conditions within Section 6.5.4 (2).

(10) *Step 3 continued - Determination of Water Quality Discharge for the Site (Unmitigated Development Form)*

(a) The purpose of this step is to determine the water quality discharge that would be expected for the developed site, if there were **no** treatment measures implemented or constructed. This will assist in the determination of the level of treatment that would be required to achieve the WQOs.

(b) By comparing the water quality discharge from the unmitigated development form to the WQOs, the developer will be able to determine the target efficiency reduction that the treatment process will need to achieve.

$WQ_{UM} - WQO = WQ_T$
$T\% = WQ_T / WQ_{UM} \times 100\%$

Where for a particular parameter: "WQ_{UM}" is the water quality discharge from unmitigated development form, "WQO" is the Water Quality Objective for the proposed development, "WQ_T" is the required reduction in the particular parameter and "T%" is the target efficiency of the "treatment train".

(c) For primary risk developments, a time-step based pollutant export model is required to determine the water quality discharge for the unmitigated development form of the site.

(11) *Step 4 -Selection of individual SQIDs to form the "Treatment Train"*

(a) By comparing the water quality discharge from Step 3 (6.5.4 (7) (a)) the developer will be able to determine the magnitude of treatment that is required. From this, select the individual SQIDs that will best achieve the efficiencies that will be required to achieve the WQOs.

(b) If for a particular parameter, the unmitigated development form achieves the WQOs then no treatment may be acceptable. If it is proposed that no treatment be implemented for the parameter for the development site, Council will require full justification in the form of a written report by a suitably qualified professional as well as demonstration that the proposed development achieves the Specific Outcomes of the Codes. It should be noted that such a proposal may not achieve the Specific Outcomes of the Codes, and may be refused. For the remaining parameters that do not achieve the

WQO in an unmitigated form, then treatment measures (such as SQIDs) need to be selected, assessed, designed and implemented.

(c) Only on rare occasions would no treatment be acceptable for all parameters to achieve the WQO. If it is proposed that no treatment be implemented for the development site, Council will require full justification as well as demonstration that the proposed development achieves the Specific Outcomes of the Codes. It should be noted that such a proposal may not achieve the Specific Outcomes of the Codes, and may be refused.

(d) Pollution Reduction Efficiency
The pollution reduction (or treatment) efficiencies of the various individual SQIDs are to be selected in accordance with Section 6.11.14 (g).

(e) Iterative Process
The effective selection of a treatment train will involve an iterative process of choosing individual SQIDs and assessing the mitigation effect through Section 6.5.4 (10 a-e). It is essential to the design process that a realistic and practical selection of SQIDs is undertaken, and that innovative solutions are considered to achieve the WQOs and the objectives of Total Water Cycle Management.

(12) *Step 5 - Determination of the Mitigation Effect of the "Treatment Train" on the Water Quality Discharge for the Site*

(a) The basis of the WQOs applied to the development is that this is the discharge from the site within the catchment to ensure that the receiving waterbody will achieve its Environmental Values and Water Quality Objectives.

(b) If the actual water quality in the receiving waterbody is not achieving its Environmental Values and Water Quality Objectives, then by achieving the WQOs for the site, the development will be undertaking all that is reasonable to enhance the receiving waterbody water quality.

(c) If the actual water quality in the receiving waterbody is achieving its Environmental Values and Water Quality Objectives, then by achieving the WQOs for the site, the development will be undertaking all that is reasonable to protect the receiving waterbody water quality.

(d) As mentioned in Section 6.11, the selection of the individual SQIDs to form the treatment and determining the mitigation effect is an iterative process. The test is if the modelled water quality discharge from mitigated developed site is within the WQO, then the proposed treatment train arrangement is appropriate. If the modelled water quality discharge from mitigated developed site is not within the WQO, then treatment train arrangement will have to be re-selected.

(e) Primary Risk Developments:
As the application of WQO to High Risk developments is mandatory, there is no scope to apply a Best-Fit Treatment Train approach. Accordingly, the developer is required to design the treatment train is required to achieve the WQOs for all parameters.

It is recommended that the developer seeks Council's in-principle acceptance of the treatment train proposed to achieve the WQOs for all parameters prior to proceeding to the next stage. Whilst this is not mandatory, it will assist in achieving Council's final approval.

(13) *Step 6 - Determination of the Treatment Specifications for the Various SQIDs*

(a) From the results of Step 6 (Section 6.5.4 (7) (a)), the individual SQIDs will have been assessed based upon a Best, Average and Worst Case Scenario of pollutant removal efficiency for the relevant target parameters. The purpose of this step is to specify for each individual SQID what the design pollutant removal efficiency and what SQID design event will need to be achieved. In this manner, the designer can arrange the individual SQIDs within the treatment train for the development to achieve the WQOs. Refer also Section 6.11.4.

(b) Once all individual SQID have been specified, the model is to be updated to confirm that the specifications will achieve the required WQOs.

(c) The specified design pollutant removal efficiency and SQID design event will have to be achieved in the design of the individual SQID.

(d) Primary Risk Developments:
As the application of WQO to high risk developments is mandatory, there is no scope to apply a Best-Fit Treatment Train approach. Accordingly, the developer is required to ensure that the specification of the individual SQIDs forms a treatment train that achieves the WQOs for all parameters.

(14) *Step 7 - Determine Development Site Design to Incorporate the Various SQIDs*

(a) The core principles of the approach to site layout are discussed in Section 6.6 about Site Design and Allotment Layout Requirements.

(b) With the specifications for each individual SQID, an appropriate sizing can be determined. From the specifications, and the site constraints, each individual SQID can be located within the development site. The location of some SQIDs will be restricted due to various reasons, such as size, drainage, drainage impacts and position within the treatment train series arrangement (i.e. the trash rack will have to be located upstream of the wetland). Typical site constraints that will need to be considered are:
(i) Natural channels and drainage lines;
(ii) Soil types;
(iii) Ecological linkages, native vegetation and areas to preserved;
(iv) Impacts upon flooding;
(v) Topography (including slope);
(vi) Size of the site.

This process may involve various revisions as the individual SQIDs and development elements are located and adjusted within the site constraints.

(15) *Step 8 - Detailed Design of Stormwater System in Accordance with the DDPSP and the Treatment Specifications for the Various Individual SQIDs*

For the design requirements of the various individual SQIDs, please refer to the relevant section within the DDPSP. The developer is required to design the SQIDs so that it achieves its respective specified design pollutant removal efficiency for the SQID design event.

(16) *Step 9 - Construct and Implement the Various SQIDs*

The developer is required to ensure that all proposed SQIDs be constructed to the Council-approved engineering designs. The developer is required to submit as-constructed information in accordance with Section 6.10.

6.5.4 Secondary Risk Development Approach

(a) A simplified approach will be applied for secondary risk development. This will allow the implementation of simplified Best Management Practice approach to the implementation of total water cycle management. It will generally be sufficient to identify Stormwater Quality Best Management Practices, in keeping with the land use and size of the development, rather than having to demonstrate to Council how the stormwater management system will protect water quality in receiving waters.

(b) Hand calculations (refer Section 6.5.4 (4)) will be considered for the assessment of low risk development applications. The efficiencies of the proposed treatment options are to be based upon Section 6.11.4 (1) (g).

(c) The simplified concentration WQO approach is as follows:
   (i) calculate developed case water quality discharge;
   (ii) determine what individual actions can be implemented on the site as a treatment train;
   (iii) calculate efficiency of treatment train;
   (iv) calculate developed case with treatment train water quality discharge; and
   (v) compare results of Step (iv) to WQOs.

(d) If WQOs are not able to be achieved with the current treatment train arrangement, some reiteration of Step 3 to 5 will be required to refine the treatment train. If it is considered that the WQO are unattainable, then:

   (i) the developer can submit a report in accordance with Section 6.5.3; and
   (ii) the development is to include a treatment train that best fits the site and maximises treatment potential and efficiency.

(e) If the developer has elected to apply the Best Practice Impact Reduction, then:
   (i) No Net Increase Approach:
      - calculate undeveloped case water quality discharge;
      - calculate developed case (with treatment train) water quality discharge;
      - compare water quality discharge from Step 1 to water quality discharge from Step 2, then:
         - if no net increase, then treatment train is sufficient;
         - if there is a net increase, then treatment train is insufficient and will have to be reconsidered, and then recalculated so that the "no net increase" condition is achieved.
   (ii) Target Reduction Approach:
   Determine a treatment train that achieves the reduction targets specified in Appendix 6.8, Appendix 6.9 and Appendix 6.10.

(f) Overall
   (i) The onus is on the developer to demonstrate that they have applied best practice management in the selection of treatment measures that will be implemented to achieve the WQOs for the proposed development.
   (ii) For the design requirements of the various individual SQIDs, please refer to Section 6.11. The applicant is required to design the SQIDs so that they achieve its respective specified design pollutant removal efficiency for the SQID design event.

6.5.5 Demonstrating Compliance with Water Quality Objectives

(a) The WQOs for Caloundra City (Appendix 6.1) are concentration-based to facilitate easy compliance monitoring. The Objectives define the maximum allowable median concentrations of pollutants in runoff leaving the subject site. In special cases (e.g. canal development) Council may require that the Objectives apply to a defined range of upstream and downstream receiving waters potentially impacted by the development.

(b) To achieve compliance with WQOs, the applicant is required to demonstrate that the median value for each water quality parameter (for the entire period of monitoring) does not exceed the trigger value or lie outside the range specified for the Objective in question.

(c) The applicant may elect to adopt load based WQOs for the operational stage of a Secondary Risk Development (refer Appendix 6.10). These are based on a % reduction of existing contaminant export rates. However, concentration based Objectives are preferred by Council, as it is difficult to establish compliance with a load based objective through water quality monitoring alone.

(d) An appropriate program of compliance monitoring is required to be established and agreed through negotiation with Council prior to the granting of development consent. During the construction stage of a development (depending on the type of development) monitoring might typically take place on a weekly basis for the duration of construction (refer Appendix 6.8). During the operational stage, monitoring intervals could typically be extended to monthly.

(e) In cases where responsibility for maintenance of a development and its water treatment infrastructure will eventually be delegated to Council, the applicant will be required to demonstrate ongoing compliance with WQOs for a minimum period of two years during the operational phase before handover to Council (refer Appendix 6.9 and Appendix 6.10).

(f) All water quality analysis is required to be carried out by a NATA accredited laboratory. The applicant may be required by Council to demonstrate the veracity of any results tendered to demonstrate compliance with WQOs.

6.5.6 Setting Water Quality Objectives for Constructed Waterbodies

(a) Refer to Section 11.6.4 – Constructed Wetlands.

(b) Constructed waterbodies are built to fulfil clearly defined functions (e.g. primary or secondary contact recreation, irrigation, livestock, drinking water and the like). The intended use(s) of the waterbody defines the Environmental Values (EVs) which will apply. These EVs must be established through a program of community consultation, and be clearly articulated and ratified by Council prior to the formal lodgement of a development application.

(c) The process of community consultation followed to arrive at the nominated EVs is to be fully documented and provided to Council in the form of a report demonstrating that the consultation was:
- (i) in accordance with the Environmental Protection Act processes;
- (ii) open and transparent; and
- (iii) publicly advertised in the local media, allowing sufficient notice for stakeholders to contribute at community meetings and by written submission.

(c) Once the agreed EVs for the waterbody have been established, they are to be translated into WQOs by adopting the following process:
- (i) if primary or secondary contact recreation is nominated refer to Chapter 5 of ANZECC Guideline 2000 Vol 1.
- (ii) if protection of drinking water is nominated, refer to Chapter 6 of ANZECC Guideline 2000 Vol 1.
- (iii) if irrigation, livestock watering or aquacultures are nominated refer to Chapter 4 of ANZECC Guideline 2000 Vol 1.
- (iv) if protection of aquatic ecosystems is nominated as a value, WQOs are required to be set on the basis of reference site data (This approach is recommended in ANZECC 2000). A reference site is to be selected which:

  - displays as similar characteristics to the waterbody in question as possible; and
  - supports a healthy, functioning ecosystem. Monitoring of this waterbody should take place over several years (preferably including wet, dry and normal years) to establish baseline medians which can be adopted as WQOs.
- (v) If no relevant data are available, the applicant may elect to adopt Queensland Water Quality Guidelines WQOs for protection of aquatic ecosystems in lower catchment waterways.

6.6 Common Design Principles

6.6.1 General

(1) This section deals with design principles for stormwater management that are common to both Water Sensitive Urban Design (WSUD) and "conventional" engineering design (commonly referred to as "drainage"). It is unacceptable to design stormwater management systems that do not address all aspects of the Specific Outcomes in the various relevant codes. For example, it is not appropriate to design a development and stormwater management system that fully treats the water quality, but does not provide the required immunities to the development. Or the converse example, it is not appropriate to design a conventional drainage system that does not consider any measures or practices to improve stormwater quality.

(2) Accordingly, there are certain principles that are common for WSUD and "conventional" engineering design that are to be implemented in the design and construction of any development's stormwater management system.

(3) Climate Change and Tidal Influences

(a) Refer to Section 11 - Waterfront Structures and Canals.

(b) Effect of climate change and tidal influences on sea level rise is generally accounted for in the Council flood models. Accordingly, where the drainage system is designed to the flood model levels as the tailwater levels, then there is no additional requirement for sea level rise. If the proposed drainage system flows to the Pacific Ocean or Pumicestone Passage, refer to the Caloundra City Storm Tide Study, August 2003. In other circumstances, adopt the tailwater condition applied in the Council flood model.

6.6.2 Site Development Requirements – General

(1) Refer to Section 9 - Site Development for further information.

(2) The various elements of total water cycle management are required to be incorporated into the design and layout of the development. The central principle is that sufficient space must be allocated within the development site for appropriate WSUD infrastructure.

(3) As the early stages of the development process are critical for the size, location and form of the development, it is important that the various elements of WSUD are incorporated at these early stages. Details of such elements are further developed in following development stages. These various elements of WSUD are to be sized and located so that their desired function is achieved.

(4) Stormwater management infrastructure assets such as Stormwater Quality Improvement Devices (SQIDs), natural channels and overland flowpaths are such elements of WSUD. Accordingly, they are to be appropriately sized and located within the site.

(5) Planning for Water Sensitive Urban Design is to be undertaken in conjunction with the initial planning phases for the development site. Consideration should be given to Water Sensitive Urban Design, Stormwater Quality Improvement Devices, stormwater reuse/harvesting, rainwater tanks, on-site detention and other water recycling opportunities outlined in Section 6.11:

(a) the level of stormwater treatment required;

(b) the area of land required to treat stormwater or for other Water Sensitive Urban Design infrastructure assets;

(c) site constraints and opportunities;

(d) required protection of drainage lines, overland flowpaths, natural channels, waterway corridors and wetlands;

(e) the siting and location of stormwater treatment measures or other total water cycle management infrastructure assets; and

(f) the cost and timing of works.

(6) Discussions are to be held with the relevant Council Officers prior to:

(a) detailed development planning;

(b) hydrological, hydraulic or water quality modelling;

(c) detailed design of stormwater management and treatment measures (including Water Sensitive Urban design, SQIDs, Natural Channel Design, or conventional design);

(d) detailed design of water recycling infrastructure (including stormwater harvesting); and

(e) detailed design of other infrastructure.

(7) Preference will be given to innovative development solutions that incorporate Water Sensitive Urban Design principles and assets into the desired land use and development form.

(8) The design of urban stormwater drainage systems is to be in accordance with these Guidelines, "Queensland Urban Drainage Manual (QUDM)" and "Australian Rainfall and Runoff (ARR)", with this order defining the precedence of any one document over another.

(9) The design of rural stormwater drainage system is to be in accordance with these Guidelines, "Main Roads – Road Drainage Design Manual" and "Australian Rainfall and Runoff (ARR)", with this order defining the precedence of any one document over another.

(10) The interpretation of "urban" and "rural" environments is to be made by reference to the precinct within which the land is included in the Caloundra City Plan. Drainage structures are to be in accordance with the Institute of Public Works Engineering Australia (IPWEA) Standard Drawings.

(11) Roofwater drainage systems and inter-allotment drainage sections will be classed as private drains and future maintenance responsibility will vest with the property owners. An easement in favour of all upstream property owners (for inter-allotment drains) will be required (minimum width 1.5 metres). Refer to Section 6.5.2 - Reserves and Easements for further details.

(12) Inter-allotment drainage systems or roofwater drainage systems that take more than one allotment are not to discharge to the kerb and channel of the road. The inter-allotment drainage systems or roofwater drainage systems are to be connected to a Council gully pit, field inlet, or manhole to the satisfaction of Council. A connection point at the lowest point is to be provided for each property. This connection point is to be a minimum of 100mm in diameter for Urban Residential-Low Density, 150mm for Urban Residential High Density, 225mm for commercial or industrial development.

(13) All rear of allotment (roofwater) drainage systems must discharge to a Council gully, field inlet or the like and not to the kerb and channel. Inspection pits or field inlets (constructed at the low point of each allotment) are to be provided at regular intervals along the roofwater drainage system and must be in

accordance with IMEAQ Standard Drawing D-0110.

(14) For Soil Erosion and Sediment Control, refer to Section 9 - Soil Erosion and Sediment Controls Development and Design Guidelines.

(15) For site landscaping requirements, refer to Section 10 - Landscaping Infrastructure Development and Design Guidelines.

(a) The landscaping is to be designed to allow for maintenance of and access to the stormwater asset and the landscaping in a safe and cost effective manner.

(16) Where there is a requirement for the stormwater management system to connect to an existing Council asset, the connection is to:

(a) Not cause structural damage to or failure of the existing asset;

(b) Be appropriately sealed; and

(c) Not interfere with or reduce the intended purpose of the existing asset.

(17) For connecting pipes into enclosed drainage systems, connections are to be made only to gully pits, manholes and field inlets. The connection is to be core-drilled and sealed with a two-part epoxy sealant.

6.6.3 Site Development Requirements – Residential

(1) Residential Use Class developments as defined in Part 3.2 of the Caloundra City Plan are to be considered as the following for the purposes of QUDM Tables 5.0.4.1 and 5.0.6.1:

(a) "Urban Residential High Density" for developments which result in greater than 20 dwellings per hectare or for multiple dwellings; or

(b) "Urban Residential Low Density" for developments which result in greater than 5 dwellings per hectare but are less than 20 dwellings per hectare.

(2) Land in the Low Density Residential Precinct or the Township Residential Precinct is to be considered as "Urban Residential-Low Density" and as such, the appropriate minor storm design event (QUDM Table 5.06.1) and runoff Co-efficient (QUDM Table 3.10.3), apply.

(3) Land in the Mixed Use Residential Precinct or the Multi-Unit Residential Precinct is to be considered as "Urban Residential-High Density" for the purposes of QUDM Tables 5.0.4.1 and 5.0.6.1.

(4) Allotments which do not fall at least 1 in 200 towards the road reserve must be provided with a rear of allotment roofwater drainage system in accordance with QUDM Section 5.18. Level II is required for "Urban Residential – Low Density" lots, while Level III will be required for all other classes of residential development (except rural and rural residential). This roofwater drain will be required regardless of the downhill property type.

(5) For allotments which do fall towards the road reserve, two kerb adaptors are to be provided and are to conform to IPWEA Standard Drawing R-0081. One should be located at the centre of the block and the other 500mm from the common boundary on the low side. Where a concrete footpath is to be constructed, a 90mm diameter UPVC pipe is to extend from the adaptor to the property boundary in accordance with Caloundra City Council adopted Standard Drawings.

(6) At least one connection point, generally at the lowest point, is to be provided for each property. This connection point is to be a minimum of 100mm in diameter for "Urban Residential – Low Density" and 150mm for "Urban Residential – High Density".

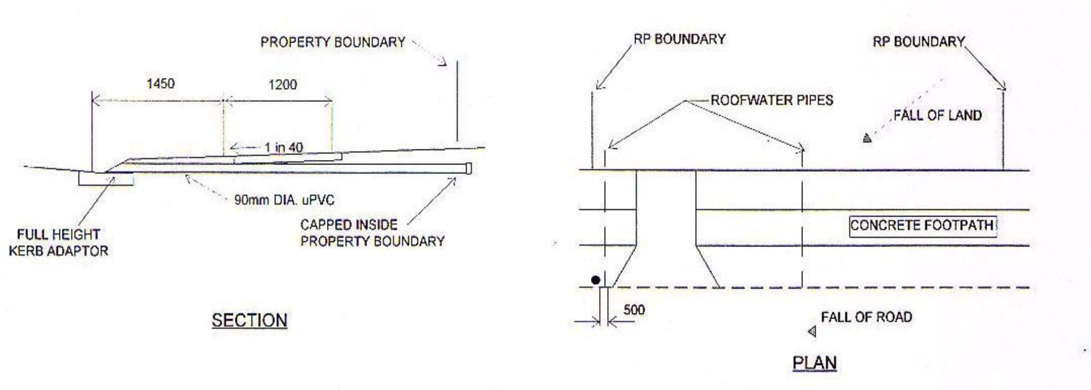


Figure 6.2 – Residential Outfalls towards the Road

6.6.4 Site Development Requirements – Rural and Rural Residential

(1) Rural and Rural Residential Use developments offer an opportunity to promote Water Sensitive Urban Design and all aspects of stormwater harvesting and water reuse are to be considered.

(2) Rural Use Class developments as defined in Part 3.4 of the Caloundra City Plan and development in the Rural Residential Settlement Precinct as described in Part 5 of the Caloundra City Plan are to be considered as "Rural Residential" for the purpose of QUDM Tables 5.0.6.1 and 5.0.4.1.

(3) For land in the Rural Precinct or Rural Residential Settlement Precinct, stormwater runoff from the road reserve may be discharged directly onto the subject subdivision should it be impossible to drain directly to a watercourse. A drainage reserve or easement will be required over the drainage outlet from the road reserve–refer to Section 6.5.2 (1) (a). A property note informing property owners that stormwater discharges will occur during rainfall and that the amenity of their allotment may be reduced may be applied.

(4) Allotments which are less than 2000 m^2 in area and have on-site effluent disposal require inter-allotment drainage. This should be designed as per "Urban Residential – Low Density".

6.6.5 Site Development Requirements – Industrial and Commercial

(1) Business and Commercial Use developments as defined in part 3.2 of the Caloundra City Plan are to be considered as:

(a) "Commercial and Industrial" for the purposes of QUDM Table 5.0.4.1; and

(b) "Central Business and Commercial" for the purposes of QUDM Table 5.0.6.1.

(2) Industrial Use developments as defined in Part 3.3 of the Caloundra City Plan are to be considered as:

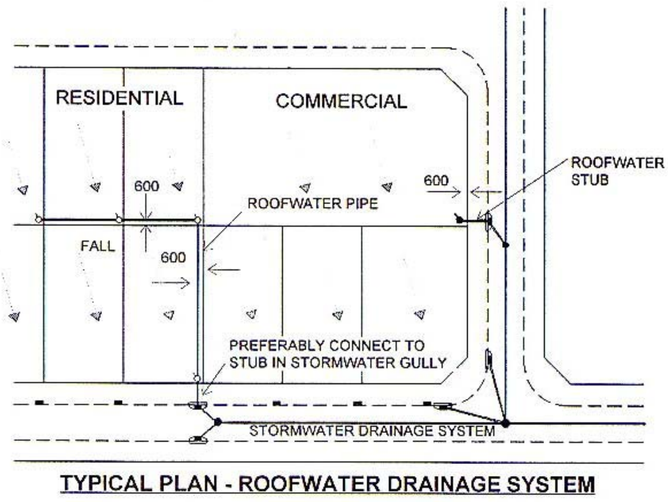
(a) "Commercial and Industrial" for the purposes of QUDM Table 5.0.4.1; and

(b) "Industrial" for the purposes of QUDM Table 5.0.6.1.

(3) Should the land fall away from the road reserve, roofwater drainage must be provided in accordance with QUDM Section 5.18 (levels, III, IV and V).

(4) For land which falls towards the road reserve, the roofwater system is to be piped and connected to the trunk drainage system at a manhole or gully. A stub is to be provided in new drainage systems for this purpose, located 600mm within the front property boundary. This must also be within 1.2 metres from the common boundary on the low side (refer Caloundra City Council adopted Standard Drawings). Where a site is being redeveloped, the lot must be reconfigured to ensure that these requirements are met.

(5) At least one connection point, generally at the lowest point, is to be provided for each property. This connection point is to be minimum of 225mm for commercial or industrial development.



NOTES:
1. Minimum cover to roofwater pipes to be 450mm.
2. Roofwater drainage systems shall discharge into gully or stormwater manhole.

Roofwater Inspection Manhole with 150mm dia. Stub and end cap.

U.P.V.C. 'Y' Junction with 150mm stub and endcap.

Kerb Adaptors.

Figure 6.3 – Inter–allotment Drainage Locations

6.6.6 Site Development Requirements – Parks and Other Open Space

(1) The natural drainage corridor should be retained in land designated for public open space, i.e. park, drainage, or road reserve.

(2) Pipe drainage systems will generally be required through parks designated for active use. Care should be taken over the design of surcharge pits and inlet structures, so as to ensure that safety and amenity criteria are satisfied.

(3) The planning for dual use e.g. drainage and park must be integrated within the whole planning process to ensure that the final design provides for amenity, health and safety, and stormwater management functions of the development.

(4) For public safety purposes, all public facilities such as play equipment and BBQs are to be located clear of 100 yr ARI flood levels and clear of 100 yr ARI overland flow paths.

(5) Drainage standards to be applied to a dual use area must be considered in terms of the mix of functional uses such as:

(a) General open space areas with a low to high need for access by pedestrians and cyclists;

(b) Passive areas with a low to high visitation;

(c) Active areas in low to high tourist significant areas; and

(d) Natural watercourses with low to high ecological significance.

(6) Appropriate drainage standards for particular areas will be required by Council having regard to the following:

(a) Major flood capacity;
(b) Convenience flood capacity – minor event in terms of interval event and the time to drain ponded sites;

(c) Maintenance costs (e.g. batter slopes between 1 in 4 and 1 in 6);

(d) Safety (e.g. maximum D x V of 0.4 m^2/sec);

(e) Stability factors such as resistance to scour, slip; and

(f) Ecological considerations such as preserving valuable areas, appropriate planting in waterway areas, and minimum impact on existing riparian/aquatic ecosystems.

6.6.7 Site Development Requirements – Refurbishment of Buildings

(1) In the design of refurbishment of buildings, consideration is to be given to the feasibility of the inclusion of stormwater harvesting techniques such as rainwater tanks, rain gardens or roof-top gardens as identified in Section 6.11 to maximise opportunities to reduce demand on the potable water supply.

(2) The requirements outlined in (1) above do not override any requirements relating to Plumbing Regulations.

(3) Regarding any hydrological or hydraulic design requirements for stormwater management, a refurbishment of building is to be considered in context of the building's Use type.

6.6.8 Overland Flows and Flowpaths

(1) Overland flow paths shall be shaped so that the overland flow component of the 100 year storm flow is fully contained within the flow path, reserve or easement, with a minimum 100mm freeboard to adjoining lots.

Flow paths shall also fully contain the 100 year storm flow as overland flow to cater for the incidence of a fully blocked underground drainage system.

Where an overland flow path is used also for public access, the depth by velocity product for the overland flow component of the 100 year storm flow shall not exceed 0.4m2/sec.

(2) Any proposed development is to take account of existing or created overland flow paths and make due provision in the design. Design maximum overland flow should not exceed 2m/sec, with depth of flow not exceeding 0.3m and Depth by Velocity product not exceeding 0.4m2/sec.

(3) Where a proposed site development requires filling, dry gullies and waterways are not to be filled or altered below the 100 yr ARI flood contour for either the local area or regional storm event.

(4) Overland flow paths should be located in road reserves, parks, pathways or other Council controlled land. Overland flowpaths should not traverse private property, but may be permitted through non Council controlled land with the appropriate easements (refer Section 6.5.2 Reserves and Easements).

(5) Overland flow paths and proposed drainage reserves and easements are to be clearly indicated on the engineering drawings.

(6) In site developments such as apartment buildings or townhouses where the sites are filled to provide suitable falls to the roadway, particular attention is to be paid to the preservation of existing overland flow paths, the obstruction of which may cause flooding or ponding of stormwater on adjoining properties.

(7) Overland flow paths not in designated channels are required to have a velocity depth product of no greater than 0.4 m^2/s and a maximum depth of 0.3 m (applicable to vehicular accommodation and access areas) for the Q100 event. Where these values are exceeded, alternative layout or upgrade to the pipe drainage system may be required.

(8) Where there is no alternative layout (especially in built up areas) or where the overland flow path is completely blocked (e.g. by filling, building or retaining walls), underground drainage to Q100 capacity will be required. The inlet capacity is to be designed to allow for an additional 50% blockage factor.

(9) Details and calculations are required for all overland flow paths. Calculations are to demonstrate that overland flow will not enter lots during a Q100 flow and that freeboard is achieved during this event. Drainage calculations, cross sections and plan layouts, are to be provided for any proposed overland flow path. The applicant is required to ensure that the "as-constructed" levels are consistent with those shown on the approved engineering drawings.

(10) The localised overland flow and site drainage in smaller allotment subdivisions or where 'built to the boundary' building envelopes apply will also require the applicant to carefully design the stormwater system. Additional pipe drainage, easements and concrete lined drains may be required along the rear boundary of lots including the boundary of the development.

6.7 Flood and Stormwater Management Plans (FSWMP)

(1) This sections sets out the information requirements for Council to assess the development application in the context of this section of the DDPSP and in reference to the Planning Scheme Codes. Hydraulic and flooding issues that affect a development site are considered to be a constraint for the site, and consequently the submission of a report addressing concerns of flooding needs to be submitted in response to the Codes at the Reconfiguration and/or material Change of Use stage. These requirements will not be left to be addressed at an Operational Works stage, and may form the basis for refusal if it is not properly addressed.

(2) Flood and Stormwater Management Plans (FSWMP) are required to document how the development will achieve the Specific Outcomes of the Codes. The core principle in preparing a FSWMP is to provide all the necessary information for Council to be able to make a decision. The detail required with a FSWMP may differ for the various types of development applications.

(3) Stormwater management plans may be rejected by Council, if they incorporate open drains that will demand considerable maintenance, will be difficult to maintain, or utilise specialised equipment, if other alternatives are physically possible.

   (a) Background information is provided in QUDM Section 9. Design approach is provided in QUDM Section 9.02.7. This section is only concerned with stormwater quality for the developed stage. Soil erosion and sediment controls during (and post) the construction phase are detailed in Section 7 - Soil Erosion and Sediment Control (QUDM).

(b) Stormwater runoff water quality controls and Best Management Practices are to consider "whole of life" costs prior to adoption. A management plan or proposed maintenance schedule is to be supplied to Council for these facilities.

(4) The Water Quality Objectives are to be determined prior to preparation of a FSWMP in accordance with Section 6.5.3 and are to form the basis of the FSWMP.

(5) The Common Design Principles set out in Section 6.6 are to apply in all cases.

(6) *Information Requirements*

Where a Flood and Stormwater Management Plan (FSWMP) is required for a development the following information must be included:

(a) a plan or plans at a scale of 1:200, 1:500 or 1:1000 showing:
 (i) site location;
 (ii) existing contours at sufficient intervals to adequately define general drainage paths, catchment boundaries and estimated Q100 flood contours for local area and regional flood plans;
 (iii) physical improvements on the site;
 (iv) location, dimensions, elevations and details of stormwater drainage system and any stormwater quality management devices;
 (v) location of proposed stormwater discharge point(s) from the site, both during construction and following completion of the development;
 (vi) location and size of any proposed land disturbance works in relation to existing drainage corridors, or proposed stormwater drainage system or facility;
 (vii) any proposed natural channel designs, including incorporation of existing natural vegetation;
 (viii) any proposed easements or reserves internal or external to the site;
 (ix) details, including location and sizing, of any proposed detention/retention storages, including on-site detention schemes; and
 (x) details of proposed stormwater and/or wastewater recycling scheme, including water balance calculations.

(b) Supporting information including:
 (i) description of how stormwater runoff is to be managed for the entire site, whether or not a staged development is proposed. This may include a flood study on any relevant watercourse;
 (ii) description of the topographic, vegetative and soil conditions for the site;
 (iii) description of the adjacent properties (in particular, the upstream catchment and the downstream receiving properties) and any existing structures, buildings, stormwater drainage infrastructure or improvements located on these properties;
 (iv) a letter of approval from the adjacent (or downstream) property owner(s) accepting that the development proposes to discharge an altered or concentrated flow of stormwater runoff onto their property. Failing this, stormwater flows must be kept to pre-developed runoff peak rates and overall catchment response, or else the development will not be permitted to proceed;
 (v) description of the method used in selection of soil erosion and sediment control measures for the development and commencement and completion dates of any stages;
 (vi) evidence of applications of TWCM principles outlined in Section 5.2 or details on the justification of applying conventional design principles for stormwater management; and
 (vii) sufficient engineering detail to demonstrate that the proposed infrastructure meets the requirements of this Section.

(7) *Additional Information*

Depending on the nature of the development application, the following additional information to that described in (a) above may be required:

(a) Plans to include:
   (i) the enclosed drainage system shown on plan, long section, watershed and details, similar to the design drawings in QUDM, Volume 2, Appendix 6 – Example Design Drawings;
   (ii) construction and design details for structural controls. These should generally be in accordance with information provided by the IPWEA Standard Drawings – Drainage Section;
   (iii) detailed modelling on the determination of detention/retention requirements for the site; and
   (iv) longitudinal and cross sections of the open drainage system including natural watercourses are to be provided.

(b) The following additional supporting information:

   (i) commentary on stormwater runoff quality with reference to the Water Quality Objectives described in Appendix 6.1, including detail of how stormwater quality will be managed to minimise adverse effects on receiving waters and to achieve the desired water quality objectives;
   (ii) all calculations needed to design the system and associated structures, including pre and post development velocities and peak rates of discharge of stormwater runoff at all existing and proposed points of discharge from the site;
   (iii) inflow and outflow hydrographs for all stormwater retarding facilities;
   (iv) the expected timing of flood peaks through the downstream drainage system to be assessed when planning the use of retarding facilities;
   (v) in determining downstream effects from the stormwater drainage system and stormwater quality management facilities of the development, hydrological-hydraulic engineering studies are to extend downstream to a point where the proposed development represents less than ten (10) percent of the total catchment;
   (vi) if the stormwater management plan and/or design report indicates that there may be a drainage or flooding problem at the exit from the proposed development or at any location between the exit point and the point downstream where the development represents less than 10% of the total catchment, Council may require:
      - water surface profiles plotted for the conditions of pre- and post-development for the minor system design event;
      - water surface profiles plotted for the conditions of pre- and post-development for the major system design event;
      - elevations of all structures potentially damaged by the minor and/or major system design event flows; and
      - Roughness factors (n) used for the main channel and overbank areas of the drainage system including natural waterways is to be shown on the longitudinal and cross sections. Photographic reference is also to be provided to assist the maintenance of the vegetation to ensure the roughness factor is maintained to prevent flooding from overgrown drainage systems and natural waterways.
   (vii) analysis of all stormwater management facilities and all major portions of the conveyance system through the proposed development (that is, channels, culverts and the like), using the minor and major system design events and for design conditions and operating conditions which can reasonably be expected during the life of the facility. This should be reproduced on a drawing sheet in a format similar to those provided in QUDM, Volume 2, Appendix 5 - Example Calculation Sheets.
   (viii) a landscaping plan in accordance with the Landscaping Code (City Plan) and Section 10 – Landscaping Infrastructure, Planting and Street Trees including:
      - tree saving and planting plan;
      - types of vegetation that will be used for stream bank stabilisation, erosion control, sediment control, aesthetics and water quality improvements;
      - access for maintenance;
      - any special requirements related to the landscaping of the drainage system and efforts necessary to preserve the natural aspects of the drainage system;

- description of site conditions around points of all surface water discharge, including vegetation and method of flow conveyance from the land disturbing activity;
- roughness factors (n) used for the main channel and overbank areas of the drainage system, including natural waterways, is to be shown on the longitudinal and cross sections; and
- photographic reference is also to be provided to assist in the maintenance of the vegetation to ensure the roughness factor is maintained to prevent flooding from overgrown drainage systems and natural waterways.

(ix) designation of all easements needed for inspection and maintenance of the drainage system and stormwater management facilities;

(x) hydraulics calculations supporting the design of culverts, channels, drop structures, overland flowpaths or an other methods used for stormwater runoff conveyance (refer Section 6.5.3(2) and 6.5.3(3);

(xi) hydrological and/or hydraulic calculations for the design of water quality treatment facilities, including inlets, outlets and high level outlets (refer Section 6.5.3(2) and 6.5.3(3);

(xii) proposed management strategy or plan for water quality treatment facilities;

(xiii) evidence that upstream and/or adjacent flood levels will not be aggravated;

(xiv) evidence that the existing downstream drainage system will adequately cater for the altered stormwater runoff conditions (if any);

(xv) geotechnical advice on the stability of any basin or dam wall and any soft-lined batters steeper than 1(v) in 2.5(h) and greater than 2.0 metres deep;

(xvi) the estimated Q100 flood contours for all flows on natural drainage corridors, designed channels or overland flowpaths;

(xvii) details, including hydrological, hydraulic and structural, of any interim drainage requirements for staged subdivisions or developments;

(xviii) justify the efficacy (pollutant retention relationships) of the treatment measures factored into the model. The efficacy of the treatment structures should be supported by empirical data/studies and design parameters of the treatment measure utilised;

(xix) if Event Mean Concentrations (EMC's) are used in the modelling, provide justification and a reference for their selection; and

(xx) all model files are to be submitted electronically accompanying the written report.

(8) *Water Quality Monitoring*

(a) Water quality monitoring is an integral step in ensuring compliance with the approved FSWMP and providing the link between on-site activities and required corrective actions. Regular visual inspections/monitoring of all sites are required during the construction and on-maintenance phase.

(b) Additional quantitative water quality monitoring is required in the following circumstances:

(i) for developments involving constructed water bodies, monitoring is required for the duration of construction activities and for the agreed on-maintenance period prior to hand-over of the asset; and

(ii) additional monitoring will generally not be required for the operational phase of developments where the stormwater treatment devices included have recognised performance and maintenance levels.

(c) Information required for inclusion in the submitted monitoring program includes:

(i) agreed performance criteria;

(ii) monitoring and reporting frequency;

(iii) monitoring locations; and

(iv) monitoring parameters.

(d) Laboratory analysis of water samples is to be carried out by a NATA certified laboratory information in the analysis report is to include:

(i) water sampling points are to be identified by their GPS readings;

(ii) the day, date, and time of water sampling;

(iii) the weather at the time of water sampling;
(iv) field observations noted of the on-site water bodies; and
(v) data is to be provided in electronic (Excel) and hard copy format.

(e) The sampling methodology is to be reported in accordance with methods prescribed in the Department of Environment and Heritage Water Quality Sampling Manual, 3rd Edition, December 1999, or more recent additions or supplements to that document as such become available.

(f) Records of water quality monitoring results should be kept on site at all times. Regular monitoring reports should be submitted to Council within one month of the sample collection date unless otherwise agreed.

(g) Physical results (measured in-situ) are to be faxed to Council within 24 hours of the sample date should the results indicate a breach of the performance criteria.

(h) Detailed assessment reports, which compile all monitoring results, are required to be submitted prior to 'on-maintenance' and prior to 'off-maintenance'. Water quality monitoring reports to Council should have the following format and information:
(i) Standard reporting:
- Name, address and real property description for the development site;
- Council file reference number if known;
- Plan indicating monitoring locations;
- List of agreed performance criteria;
- List of results for each site as outlined in 6.8 Water Quality Monitoring (6) (d) (i – v) above identifying any breaches of performance criteria; and
- Discussion of results including description of stage of works, any reasons for breaches and corrective actions taken.

(ii) Assessment Reports – Including detailed analysis of all monitoring data as well as relevant Council or EPA data and assessment against the agreed performance criteria/ provisions of the approved Stormwater or Water Quality documentation.

6.8 Common Design Parameters

6.8.1 Natural Waterways, Open Channels and Wetlands

(1) The development design and site layout is required to consider the natural waterways and drainage paths to achieve the requirements of the Natural Waterways and Wetlands Code.

(2) Council's preferred approach is for watercourses to remain in their natural state. Some selective clearing and maintenance may be carried out with approval.

(3) The natural waterway is to be analyised for Q100 flows and the assessed flood contour line(s) provided on all relevant plans. Land filling will not be permitted below these levels, unless it can be demonstrated that there will be no detrimental effects to other properties along the watercourse and there is no net filling below these levels. The watercourse's natural state may, in some cases, control the type, volume and placement of fill allowable in a development application.

(4) For natural waterways or channels, the development is to be planned and designed so that the 100 yr ARI flood event is contained within public open space.

(5) Conventional hard edge open channels are to be designed to cater for the 100yr ARI flood event and the freeboard provisions are to be in accordance with QUDM 8.02.

(6) Open channels are to be designed to cater for the major design storm and are to include freeboard provisions in accordance with QUDM Table 8.02. Open channels through parkland or open space areas may be designed to cater for Q10 flows. The associated overbank flow areas, which cater for the difference between Q100 and Q10 flows are to be designed to ensure low velocities occur during flood, while enhancing amenity values during non flood periods.

(7) A minimum 3 metres wide verge is to be provided for maintenance vehicle access.

(8) Drainage lines and watercourses offer excellent opportunities for planting to riparian zones along rivers, creeks and streams. Appropriate natural vegetation to these areas can greatly improve the environmental benefits in relation to fauna movement and habitat in these areas. The following planting guidelines apply to drainage lines and watercourses:

(a) retain existing native vegetation;
(b) remove inappropriate or environmental weed species;
(c) promote use of local endemic species, planted without the application of fertilizers.

(9) All landscaping is to be accordance with Section 10 – Landscaping Infrastructure, Planting & Street Trees and the Biodiversity Code.

6.8.2 Hydrological Requirements

(1) Design flows are to be determined assuming the catchment is fully developed. Catchment development is to be in accordance with the appropriate Local Area Plan, Flood and Stormwater Management Plan or Catchment Management Plan in the first instance or in areas where these do not exist, the Caloundra City Council Planning Scheme.

(2) Caloundra City specific information is to be used to determine catchment responses.

(3) For major/minor drainage system requirements refer to QUDM Table 5.06.1. A street in Caloundra City is defined as one with < 3000 AADT while a road is defined as having > 3000 AADT.

(4) QUDM 5.06 presents the concept of major system and minor system design. Within this section QUDM also notes that a local authority may vary the design ARI's to suit local conditions.

(5) Water Sensitive Urban Design and "conventional" major/minor system design are to be designed and constructed in accordance with the requirements within QUDM Tables 5.06.1 and 5.06.2.

(6) The boundaries of catchments and subcatchments are to be determined in accordance with QUDM Section 5.03. Council has additional information within its GIS system to assist in the determination of catchment and subcatchment areas. Boundaries should be verified by site inspection and certified as correct.

(7) For urban catchments, the coefficient of runoff will be determined in accordance with Appendix 6.6.

(8) For developments that include rural or bushland catchment areas the Queensland Department of Main Roads Drainage Design manual clause 3.5.7 is to be used in determining the coefficient of runoff.

(9) Refer to Appendix 6.3 for Caloundra's Catchment Areas, the Intensity Frequency Duration (IFD) table for a catchment in Appendix 6.5, and the Catchment Management Standards in Appendix 6.12.

(10) *Time of Concentration – Urban*

(a) Time of concentration is to be calculated in accordance with QUDM 5.05.

(b) Where inlets are applied, the standard inlet times (QUDM Section 5.05.4) will be applied for urban areas, except where approval is given to utilise other methods. The average slopes referred to are the slopes along the predominant flow paths for the catchment in its developed state.

(c) The kinematic wave and the Bransby-Williams equations are not to be used. The time of concentration must take due account of partial area effects in accordance with QUDM Section 5.02.2, particularly where there is open space within a residential area or for developments with significant directly connected impervious areas.

(11) *Time of Concentration – Rural*

(a) Time of concentration is to be calculated in accordance with the Queensland Department of Main Roads Road Drainage Design Manual.

6.8.3 Hydrological Modelling

(1) The catchment is to be modelled using a hydrological modelling package. The applicant will be required to justify to Council the advantages of any particular model chosen for the analysis. The applicant will need to demonstrate to Council's satisfaction that the chosen software is suitable to model all open channel components within the catchment. (Council also requires the choice of model to be an off-the-shelf item, standard software, such that Council can access the model data in future through the purchase of its own software).

(2) The model network should include all major drainage and waterways in the catchment and is to take into account the physical characteristics of the catchment and waterways for all cases assessed. The sub-catchment areas need to be confirmed to best represent flow estimates at critical locations.

(3) Comparison of the computed peak flows (hydrological model) against the Rational Method is required. Availability of recorded flood level information for calibration purposes is to be determined and is the responsibility of the applicant. Where no recorded flood level information is available, a Rational Method check will be used to confirm estimated discharges at key locations throughout the catchment.

(4) Determination and assessment of the peak discharges for the 2, 5, 10, 20, 50 and 100 years ARI events under existing and defined development conditions is required. Council may relax the required ARI year events to be modelled dependent on the scale and type of development. These peak flows should be calculated at all critical locations to allow assessment on the impact of future developments.

(5) The applicant must ensure the hydrological model is detailed enough for use in conjunction with the Rational formula method to calculate the design peak discharge for the assessment of minor or local piped drainage system.

(6) The applicant is required to state all assumptions and justify the adoption of all parameters used in the modelling process as part of the detailed design component of the development application phase.

6.8.4 Hydraulic Requirements

(1) Backwater analysis is to be performed on all drainage systems, whether they are enclosed, open or natural systems. A detailed Hydraulic Grade Line (HGL) is required for the analysis of the enclosed and open drainage system (refer to QUDM Section 5.20 and 5.21). The applicant must demonstrate that there is no change in hydraulic grade outside of the proposed development's property boundary.

(2) The proposed drainage system must not increase local or regional flood levels or the area of inundation either upstream or downstream of the development. If Council has any reason to believe that flood levels or the area of inundation will increase, Council may seek additional information from the applicant (refer Section 6.8 – Flood and Stormwater Management Plan) to demonstrate that flood levels or the extent of inundation are not increased.

(3) Where proposed drainage networks, both closed and open, have adjacent future or existing drainage networks, the applicant is to provide information in accordance with Section 6.12 for the whole network, either future or existing, from head of line to final outlet.

(4) Drainage networks, both open and closed, servicing catchments having sub-catchments with varying ARI's (for example, a drainage network servicing a roadway with 10yr ARI with an abutting residential subdivision with a 2 yr ARI) are to comply with the following:

(a) The whole network is to be analysed for each ARI within the catchment. In the above example this means that the 2yr ARI sub-catchment would have a 10 yr ARI rainfall intensity applied to it so that the HGL can be proved for the 10 yr ARI area and the 10 yr ARI sub-catchment would have a 2yr ARI rainfall intensity applied to it;

(b) Surcharge bypass from the lower ARI sub-network during the greater ARI analysis is to be taken into consideration;

(c) Separate catchment calculation tables are to be provided for each of the ARI's;

(d) Hydraulic grades lines and tailwater levels are to be shown for each ARI on the long sections; and

(e) Hydraulic grades levels are to be shown for each ARI on the cross sections of open drainage networks.

(5) *Hydraulic Considerations*

(a) All hydrologic and hydraulic calculations for major watercourses or creeks for the purpose of determining ultimate flood levels and development and flood levels are based on:
(i) Q_{100} flows for a fully developed catchment. The effects of lesser flows must also be investigated.
(ii) A fully vegetated waterway corridor using a Manning's n of 0.15, unless the scope of full vegetation is not possible due to an unacceptable increase in flood levels. The restricted vegetation areas are usually identified in available Council studies such as Stormwater Management Plans, Waterway Management Plans and Flood studies. In general, the planting of trees and shrubs impedes the passage of flow, thereby leading to increased flood levels. The high vegetal roughness coefficient allows for generally unrestricted planting of vegetation.

(b) The proposed development must not cause any adverse flooding, nor make matters worse with respect to flooding of developed or developable areas, erosion potential, or the general amenity of the area. The Developer must not assume that the downstream drainage will be upgraded at a future date thereby allowing its proposal to be a lower standard. Developers cannot rely on future maintenance by Council to support a proposal.

6.8.5 Hydraulic Modelling

(1) The purpose of the hydraulic model is to assess existing drainage systems, determine flood levels, and design mitigation options to minimise the impact of future developments on flooding and the environment.

(2) The hydraulic modelling is to include analysis of the complete piped system and all open drainage components. The applicant will be required to justify the advantages of any particular model chosen for

the analysis. The applicant will need to develop a methodology and convince Council that the chose software is suitable.

(Council also requires the choice of model to be an off-the-shelf item, such that Council can access the model data in future through the purchase of its own software).

(3) The model should incorporate all relevant hydraulic structures and physical constraints including culverts and bridges.

(4) A sensitivity analysis should be undertaken to verify the adopted flood level parameters of the model when historical flood levels have not been recorded, or are unavailable, for the catchment.

(5) Determination and assessment of flood levels along the main waterways for the 2, 5, 10, 20, 50 and 100 year ARI design events under existing and defined development conditions is required. Council may relax the required ARI year events to be modelled, dependent on the scale and type of development.

(6) Depending on development location the hydrological and hydraulic models are to produce comparable peak discharges with similar timing for the same event at all locations, so that the information from the hydrological model can be utilised for Council flood warning systems in the future.

(7) An hydraulic analysis of the complete piped stormwater drainage system should be undertaken. A review of the performance of all existing drainage is required so the piped drainage assessment must include all associated infrastructure.

(8) The applicant is required to state all assumptions and justify the adoption of all parameters used in the modelling process as part of the detailed design component of the development application phase. (Council will provide suitable tailwater conditions for the above design events specified where applicable).

(9) Council's minimum landscaping requirements for open channels dictates a minimum Manning's 'n' of 0.08 although greater values may be directed by Council where deemed appropriate. A sensitivity analysis should always be undertaken for a Manning's 'n' of 0.15 to ensure the freeboard is not exceeded in a design.

Table 6.3 provides a semi-quantitative approach towards the evaluation of various Manning's roughness coefficients. Source reference: *Natural Channel Design Guidelines* (Brisbane City Council, 2000).

Manning's 'n'	Description
0.03	Short grass with the water depth >> grass height.
0.04	Short grass with the water depth >> grass height on a slightly irregular earth surface. Trees at 10m spacing and areas are easy to mow.
0.05	Long grass on an irregular (bumpy) surface with few trees and irregular ground could make grass cutting difficult. Alternatively, trees at 8m spacing on an even, well grassed surface, no shrubs, no low branches.
0.06	Long grass, trees at 6m spacing, few shrubs. Easy to walk through vegetation. Area not mowed, but regular maintenance is required to removed weeds and debris.
0.07	Trees at 5m spacing, no low branches, few shrubs, walking may be difficult in some areas.
0.08	Trees at 4m spacing, some low branches, few shrubs, few restrictions to walking.
0.09	Trees at 3m spacing, weeds and long grasses may exist in some locations. Walking becomes difficult due to fallen branches and woody debris.
0.10	Trees at 2m space, low branches, regular shrubs, no vines. canopy cover possible shades weeds and it is difficult to walk through.
0.12	Trees at 1.5m spacing with some low branches, a few shrubs. Slow to walk through.
0.15	Trees and shrubs at 1m spacing, some vines, low branches, fallen trees, difficult and slow to walk through. Alternatively, a continuous coverage of woody weeds with sparse leaves and no vines.
0.20	Trees and shrubs at 1m spacing plus thick vine cover at flood level and fallen trees, very difficult to walk through. Alternatively, a continuous coverage of healthy shrubs and woody weeds from ground level to above flood level

Table 6.3 – Floodplain Revegetation Density Guidelines for Various Manning's Roughness Values

6.8.6 Water Quality Modelling

(1) The following general information is to be submitted to Council for any development requiring water quality modelling.

(a) Justify the model selected by demonstrating that the basic model assumptions and limitations accurately reflect the dominant physical processes occurring. Detail any calibration undertaken and include an analysis of errors.

(b) Detail the meteorological input data (such as rainfall and pan evaporation data) used within the model. If the data used has not been obtained from the nearest Bureau of Meteorology Station, then provide justification for the data utilised.

(c) Detail all relevant model parameters adopted including rainfall runoff parameters and pollutant export rates. Provide a concise justification for the relationships used such as a study based on empirical evidence/studies or other relevant pollutant export/stormwater modelling. Detail any manipulation or adjustment to data to model defaults. Brisbane City Council SQID Design Guidelines should be referred to when proposing solutions involving SQIDs.

(d) Provide a figure depicting how the site has been modelled and a justification of such.

(e) Confirm that a "warm up" model run was undertaken prior to the final model run and that the "warm up" has been excluded from the extracted results. If the model was unstable after the "warm up", it may result in the refusal of a development application for not demonstrating that it has achieved the relevant Specific Outcome in the Codes. The "warm up" period is defined as the period after which the assumed initial model conditions have no significant effect on the model results.

(f) Justify the size and designation of the land use areas factored into the model for both the base case (undeveloped) and developed case.

(g) Justify the catchment boundaries utilised in the model.

6.8.7 Flood Levels and Tailwater Levels

(1) The requirements specified in Table 6.4 applies to Residential A, B, C, Tourist and Special Residential, Business and Industry Precincts, and for Child Care Centres, Nursing Homes, Hospitals etc.

(2) Each Park Residential and Rural Residential allotment is to contain a rectangle 0.5metres above the 100yr ARI dimensioned at a minimum of 30x40m and 40x50m respectively.

(3) As well as 10yr ARI immunity, the 100yr ARI flooding of carparking areas must not exceed a depth of inundation of 0.3m, a depth x velocity ratio of 0.4m^2/s and velocity of 2.0m/s.

(4) Basement carparks can be constructed to below the specified levels provided that suitably waterproofed perimeter walls, air vents, and entry/exit ramps at the carpark entrance are above at least 0.5 metres above the 100 ARI year flood levels for all flooding sources.

Minimum Design levels (mAHD)			
Flooding Type	**Allotment Fill (note 1 & 2)**	**Floor Levels**	**Carparking (note 3 & 4)**
River, Creek, Waterway, Overland Flow, Open Channel or Storm Surge	100y ARI + 0.5m	100y ARI + 0.8m	10y ARI

Table 6.4 - Minimum Flood Immunity Levels for Developments

(5) For calculations of tailwater conditions the following references are to be used for the general scenario categories listed below (refer to Table 6.5)**:**

(a) Storm surge — Reference for major storms
(b) River systems — Flood studies
(c) Tidal — MHWS (minor)
(d) Lakes — Response time of lakes to rainfall events

(6) The design capacity of the minor stormwater system could be reduced if the water level exceeds the design tailwater level. This reduction in the capacity of the minor stormwater system is to be taken into account when determining the design capacity for the major design storm (QUDM Section 7). In general, design tailwater levels are to be Mean High Water Springs (MHWS) for the minor storm, whilst for the major storm, tailwater levels are to be MHWS and any additional elevation due to a storm surge.

Information Available	Responsible Party
Where a flood study endorsed by Caloundra City Council exists	Delegated Caloundra City Council business unit with 'appropriately' qualified officers in hydrology
Developments which have taken place after the completion of a flood study endorsed by Caloundra City Council	Caloundra City Council business unit responsible for development applications
Flood Studies submitted with development applications	Caloundra City Council business unit responsible for development applications
In the absence of any flood studies	The applicant will be responsible. The applicant in this instance refers to applicants under IDAS and building applications.

Table 6.5 – Responsible Party for Provision of Flood and Storm Tide Level Information

6.8.8 Stormwater Runoff Quantity

(1) All stormwater quantity discharges are to be calculated in accordance with Section 5.18 of the Queensland Urban Drainage Manual (QUDM), unless approved otherwise.

(2) Drainage of roofwater and site surface stormwater runoff is to be piped drainage and must comply with AS 3500.3 and QUDM Section 5.18, levels III, IV & V.

(3) No out-of-catchment runoff is to be directed into the Council's stormwater drainage system.

(4) Stormwater runoff discharges in excess of 50 Litre/s for the Q20 storm event must be piped to a Council stormwater drainage system (i.e. gully (catchpit), access chamber, etc.) and not to the kerb and channel.

(5) Council will only approve the use of a pumped stormwater drainage system if:

   (a) letters of refusal are received from all property owners through which a gravity system could have been taken. These letters should acknowledge that significant overland flow may occur in heavy rainfall in the event of power failure or mechanical breakdown; or
   (b) no other option is available.

(6) Should any internally collected stormwater runoff be designed to bypass its pre-developed point of discharge into the Council's stormwater drainage system, the Council's gully which would receive this additional runoff, must be analysed to ensure its functionality. This also includes the gully's connection to the trunk drainage system.

(7) Should an adjacent property (or properties), by virtue of topography and / or existing development, require current or future gravity fed stormwater discharge through the subject site, an easement in favour of that property(s) must be provided. This easement will extend from the road reserve to the RP boundary(s) adjoining these properties and be a minimum of 1.2 metres in width. A drain or connection (minimum of 225mm diameter) is to be constructed in this easement, so as to reduce future impacts to residents of the subject site.

(8) Existing overland flow paths are to be preserved. where, in residential developments, the difference in levels of the dwelling adjacent to the overland flowpath is minimal, calculations will have to be provided to demonstrate that habitable floor levels are 300mm above Q100 flood level.

6.8.9 Stormwater Runoff Quality

(1) Best Management Practice stormwater quality management facilities may include both structural and non-structural elements. Natural swales and other natural runoff conduits should be retained where practicable.

(2) Where stormwater quality management facilities are required to satisfy the minimum control requirements, the following measures may be used:

(a) stormwater detention structures (dry basins);

(b) stormwater retention structures (wet ponds);

(c) facilities designed to encourage overland flow, reduce flow velocities and direct flow through buffer zones; and

(d) infiltration practices.

(3) Where detention and retention structures are implemented, designs should consolidate these facilities into a limited number of large structures, rather than designs which utilise a large number of small structures.

(4) Stormwater management plans may be rejected, if they incorporate structures and facilities that will demand considerable maintenance, will be difficult to maintain, or utilise numerous small structures if other alternatives are physically possible.

(5) Ponds and basins may be incorporated into a development to reduce peak discharges downstream or to reduce flow velocities and pollutant removal. Care must be taken in the design of basins so that they perform their primary role. That is, if a basin is designed for flood control, it should be designed for this case. Any water quality improvements must be considered an added benefit only.

(6) The design of significant embankments is to be carried out by an appropriately qualified Geotechnical Engineer, to ensure stability and reduce erosion potential. The constructed works will require certification prior to the works being accepted "on maintenance". Refer to Section 4 - Earthworks.

(7) When selecting a method of estimation of potential runoff loads for a particular site, it is preferable to determine pollutant loads by land use. Total loadings can then be obtained from event mean concentrations (EMC) of pollutants and runoff volumes. EMC's have been found not to vary significantly for similar land uses from site to site for the same constituent, and also not to vary with storm runoff volume. What this implies is that the total volume of pollution (as opposed to the concentration) will be proportional to the volume of runoff.

(8) Unless locally specific information is available, the BCC interim data or QUDM Table 9.1 should be used as a guide to concentrations of pollutants in urban stormwater runoff (refer to the "Guideline for Pollutant Export Modelling in Brisbane", Brisbane City Council).

6.8.10 Public Safety

(1) The enclosed stormwater system (including manholes, GPTs, gully manholes and other enclosed structures) is to be designed in accordance with AS 2865: *Safe Working in Confined Spaces* and particular attention is required in regard to Section 7 of AS 2865.

(2) Wetlands constructed for the purpose of stormwater retention/detention and treatments are to be designed in accordance with relevant public safety standards.

(3) Ponded water bodies in public open space present a clear risk to public safety if steps are not taken during the design, commissioning and maintenance of the device to address safety issues. Key elements incorporating safety into design include providing suitable side slopes, plantings which discourage/restrict public access, and fencing where other options are unachievable.

(4) Detailed safety requirements for all ponded water bodies proposed for areas of Public Open Space are:

(a) Side slopes are to be no steeper than 1:6 (H:V), with recommended slopes of 1:8 (H:V);

(b) Water's edge are to be offset at least 15m from allotment boundaries or roadways except where safety fencing is provided;

(c) Interim fencing is required between the construction and establishment of vegetation within the water body (typically during the on-maintenance period) where any part of the water body is deeper than 350mm; and

(d) Areas are to be fenced and gated in any areas where the above safety requirements are not met (for example in maintenance access areas).

6.9 Maintenance Plans and Estimated Costs Schedules

(1) For all contributed assets (excluding conventional enclosed drainage systems), a Maintenance Plan that documents all maintenance requirements and responsibilities is to be developed in parallel with the asset design. The Maintenance Plan is to be submitted to, and approved by Council prior to Council assuming responsibility for the assets.

(2) The Maintenance Plan is required to set out how the asset should be maintained, and is required to address the following issues:

(a) inspection procedures and frequency, detailing what the maintenance personnel are to check and document when they inspect the contributed asset;

(b) maintenance frequency, particularly for assets that require clean-out of collected material (i.e. gross pollutants), weed control, pest control or replanting of vegetation;

(c) appropriate waste disposal requirements;

(d) appropriate environmental management requirements;

(e) access for plant and staff;

(f) consumables (including vegetation for replanting);

(g) staff training;

(h) plant and equipment needs;

(i) public safety and occupational health and safety requirements;

(j) asset design details and supplier contacts (in case modifications to the design need to be made in future);

(k) public consultation or notification requirements;

(l) data collection requirements (if any); and

(m) estimated annual maintenance costs.

(3) Council staff with practical experience with maintenance can be consulted through the Development Assessment Manager for their expertise in asset maintenance. For proprietary designs, model Maintenance Plans should be readily available and require only minor, if any modification.

6.10 As-Constructed Information

(1) As-constructed information for all contributed assets is to provide an accurate capture of the condition and construction of the asset.

(2) As-constructed information is to be provided to Council in accordance with Section 12 of this Policy. The following information is to be supplied:

(a) the as-constructed survey of the final location and levels to AHD of all elements of the:
(i) stormwater management system(s);
(ii) drainage system(s);
(iii) inter-allotment drainage system(s);
(iv) water recycling system(s) (i.e. grey water reuse system);
(v) water harvesting system(s); and
(vi) rehabilitated or constructed natural channel(s).

(b) any changes that were made to the design during the construction process (i.e. size of facilities, materials used, additions to or elimination of facilities); and
(c) any variation between the original plans and specifications and the final installed facilities.

6.11 Guidelines – Total Water Cycle Management (TWCM) and Water Sensitive Urban Design

6.11.1 General

(1) The following sections outline a range of best practice design solutions to achieve water sensitive urban design. The solutions are not exhaustive and the applicant may propose other alternatives which meet the principles of Section 5 -Total Water Cycle Management and Water Sensitive Urban Design.

(2) A WSUD approach may be adopted as part of an integrated water quality management strategy at a development site aim economically achieving the required discharge water quality requirements from the site.

(3) The applicant proposing WSUD in place of conventional pipes and roadway flow should advise Council of this intention prior to or at the time of lodging the Reconfiguring a Lot application (or Material Change of Use Application) if no further applications are required.

(4) If total water cycle management infrastructure consists of hard infrastructure items such as pipes, slotted pipes, or field inlets please also refer to Section 6.12 Guidelines "Conventional Engineering Design" for structural design requirements.

(5) Refer also to Caloundra City Council Urban Stormwater Quality Management Plan (USQMP).

6.11.2 Water Sensitive Road Design

(1) Water sensitive road drainage systems aim to pass "every day" rainfall runoff events through slower flowing surface (and near surface) drainage systems such as swales and bio-retention systems. It is more beneficial to allow these more frequent flows to be collected and conveyed within swales and bio-retention systems to allow for some attenuation of the flow and to facilitate the retention of contaminants prior to these flows discharging to receiving waterways.

(2) Grassed swales and bio-retention systems can also be included in "non-road" elements of the development design or within developments that do not include any road works.

(3) Where the natural topography has grades less than 4% (1 in 25) the majority of roads should be aligned perpendicular to the contours. This allows lots on either side of the road reserve to drain to the road drainage system thus avoiding "low-side" lots that require inter-allotment or roofwater drainage.

(4) Where the natural topography has grades between 4% (1 in 25) and 7% (1in 15) the majority of roads should be aligned at an angle across the contours to ensure the longitudinal grade of the roads does not exceed 4%. Natural topography steeper than 7% will generally not be suitable for implementing WSUD drainage systems within road reserves unless road grades are kept to less than 4% and retaining walls are provided along "high-side" lots.

(5) Conventional pipe drainage systems would normally be provided along roads with longitudinal grades steeper than 4% unless additional flow control features such as check dams are used to promote uniform flow conditions.

(6) Where practicable, dual carriageway roads should be provided along trunk drainage routes to allow use of centre medians for WSUD drainage systems.

(7) Single carriageway roads should be designed to provide for implementation of WSUD drainage systems such as swales and bio-retention systems within the "high-side" verge. Where the road is running perpendicular to the contours and there is no discernible "high-side" then either verge can be used for WSUD drainage systems.

6.11.3 Natural Channel Design

(1) The design, implementation and/or construction of any natural channel or natural channel rehabilitation works is to be in accordance with the Brisbane City Council Natural Channel Design Guidelines.

(2) In addition to the requirements within the BCC Natural Channel Design Guidelines, Caloundra's local topography, geology and geomorphology are to be considered in the design of natural channel works or natural channel rehabilitation works. A sensitivity analysis must be conducted using a Manning's 'n' of 0.15 to ensure that channel freeboard is not exceeded.

(3) An extended maintenance period may be required until the channel has sufficiently stabilised and vegetative cover is well established. The desired style of drainage channel can vary from a grass lined overland flow path for very small catchments, to a fully established river channel for large catchments. Desirable bed conditions in a reconstructed watercourse usually depend on the following factors:

(a) catchment areas;

(b) catchment soil type (infiltration capacity) and erodibility; and

(c) canopy cover.

(4) Any works within receiving waters, including natural channel design, shall not be included as a "treatment device" in any stormwater treatment train models.

6.11.4 Stormwater Quality Improvement Devices

(1) Stormwater Quality Improvement Devices (SQID)

(a) The installation of SQIDs as part of the development is generally required to mitigate the impact of the development to achieve the Site Discharge Objectives as defined in Section 6.5.3 and to assist in achieving the receiving water body's Environment Values and Water Quality Objectives.

(b) The design event for the component SQIDs that make up the "treatment train" is to be considered on a development case-by-case basis. Alternatively, the default design event for all SQIDs is the 2 year ARI event, and should not be confused with the minor stormwater system design event as discussed in Section 6.7.2.

(c) Brisbane City Council SQID Design Guidelines should be referred to when proposing solutions involving SQIDs. These guidelines will assist in considering matters such as life cycle costing, operational maintenance, and maintenance plans.

(d) Detailed hydraulic calculations are required to establish the hydraulic response of the stormwater system (major and minor) downstream and upstream of the Stormwater Quality Improvement Devices as outlined in Table 6.6.

Situation	Requirement
New Stormwater Systems – Stormwater Quality Improvement Devices to be installed as part of development.	Where a SQID is to be installed on a new stormwater system, the full hydraulic losses through the SQID are to be assessed and the stormwater system and SQID sized accordingly to prevent surcharging from the minor stormwater system upstream of the SQID during the relevant minor event.
New Stormwater Systems – Stormwater Quality Improvement Devices to be retrofitted at some future date.	Hydraulic loss through SQID equal to 1.5 times the velocity head at the potential site for a SQID, or at the outlet of the system for the relevant minor event.
Existing Stormwater Systems – Retrofit a SQID on an existing stormwater drainage system.	Where it is proposed to retrofit a SQID on an existing stormwater drainage system, the hydraulic assessment will need to consider: • Potential surcharge flows. • Potential overland flowpaths. • Upsizing of SQID to reduce hydraulic losses. • Impacts on road, reserves and private lands upstream and downstream of the SQID.

Table 6.6 – SQIDs – Hydraulic Response Requirements

Design ARI	1 month	2 month	3 month	4 month	6 month	9 month
Proportion of 1 year ARI	0.25	0.40	0.50	0.60	0.75	0.9

Table 6.7 – SQIDs – Proportions for Determination of Rainfall for ARIs less than 1 in 1 year.

(e) At specifically defined locations it may be necessary to design SQIDs to treat flows from a recurrence interval greater than the three month ARI event.

(f) *High Flow Bypass*

For most SQIDs, it is preferable that the flood events greater than the SQID design event bypass the SQID.

This prevents:

- the SQID from being unnecessarily scoured in the larger flood events; and
- captured contaminants from being re-entrained.

(i) Generally, for the flood events greater than the SQID design event, the SQID is simply unable to treat the volume of water that flows for the event within the duration of the event.

(ii) Examples of high flow bypasses are:

- grassed open channel bypassing a stormwater treatment wetland via a controlled weir; and
- surcharge pit upstream of a gross pollutant trap flowing to the waterway via an overland flow path.

(iii) The high flow bypass is to be designed:

- in accordance with the design principles for the form of the high flow bypass (i.e. an open channel is to be designed in accordance with the open channel section of these guidelines (refer Section 6.7.1);
- to accommodate the 100 yr ARI flood event and the bypass flows greater than SQID design event;
- to accommodate overflow events in the circumstance when the SQID is fully blocked by debris, litter or pollutants; and
- to ensure that public safety is maintained and protected.

(iv) In circumstances where a collapsible weir is proposed, the applicant is to clearly demonstrate that when the weir collapses it does not create a public hazard through (but not limited to):

- a flood wave (or surge);
- the action of collapsing; or
- increasing flood levels (in addition to the general requirements in regard to impacts on flood levels).

(v) In addition, collapsible weirs are required to be:

- accessible for maintenance operations;
- maintainable;
- consisting of parts or components that would be common for Council (i.e. no unusual parts or components); and
- structurally sound and able to withstand debris loads.

(g) Table 6.8 is the general range of efficiencies that would reasonably occur for certain types of SQIDs, if well maintained and designed for the SQID design event (generally 3 month ARI). These are intended only as a broad guide, and do not replace the requirement to design systems to achieve the required efficiency for a particular parameter.

In applying these removal rates, consideration should be given to the practical constraints of the device selected such as head loss, space requirements, tailwater conditions (i.e. tidal) etc. The selected device must be 'fit-for-purpose' as well as meeting the requirements on paper.

In undertaking modelling or hand-calculations, these efficiencies are to be applied as:

(i) best case scenario (the top of the efficiency range);
(ii) average case scenario (half-way between the top and bottom of the efficiency range); and
(iii) worst case scenario (the bottom of the efficiency range).

Source controls such as education, street sweeping and rubbish bins are not included. Education relates to engendering a social and cultural shift in the attitudes and practices of the community. It is important to note that these source controls are critical to improving stormwater quality, but they can not be simply related to "efficiency".

If alternative efficiencies are proposed to be used instead of the range presented in the following table, the developer is required to provide a justification, efficiency research results and published peer-reviewed literature to support the proposed departure. Council may not accept the proposed alternative efficiency. It must be noted that if a higher efficiency than expected is being relied upon, then the onus will be on the developer to design the system to achieve the efficiency and prove that the SQID will achieve the efficiency.

Cleanout or maintenance will need to utilise plant and equipment currently in use by Council. The contributed assets are to be designed and constructed so that they can be maintained and operated without specialized equipment that is not currently available to Council's maintenance operations.

SQIDs are to be designed so that maintenance can be achieved with no manual handling of trapped pollutants.

This table is based upon Table C4.3 in Chapter 4 of Part C of the BCC Subdivision and Development Guidelines.

Stormwater Quality Improvement Device		Gross Pollutants (Litter)	Coarse Sediment	Fine Sediment (Suspended Solid)	Nutrients (NandP)[1]	Oxygen Demanding Substances	Hydro-carbons[2]	Pathogens	Heavy Metals[3]
Gully Pit GPTs	Litter Baskets	L-M	-	-	-	L	-	-	-
Gully Pit GPTs	Proprietary Traps	L-M	L	-	-	L	-	-	-
Oil and Grease Separator		L	L-M	L	-	L	L-M	L	L
Trash Rack	Nets	H	-	-	-	-	-	-	-
Trash Rack	Trash Racks	M	L	-	-	L	-	-	-
Trash Rack	Downwardly Inclined Screens	H	-	-	-	-	-	-	-
Trash Rack	Floating Litter Booms	L	-	-	-	-	-	-	-
Trash Rack	Hydraulically Operated Trash Racks	H	L-M	-	-	-	-	-	-
Gross Pollutant Traps	In-Ground GPTs	H-VH	H	L	L	L-M	L	-	L
Gross Pollutant Traps	In-Ground Separators	M	L-M	-	-	-	-	-	-
Gross Pollutant Traps	Open GPTs	M-H	H	L	L	L	L	L	L
Sediment Basins	Extended Detention Basins	-	M-H	L-M	L	L	L	M	L
Sediment Basins	Sediment Basins	L	H	L	L	L	L	L	L
Swales	Filter Strips	M	H	M	L-M	L	L(S)	M(S)	L
Swales	Swales	L-M	M-H	M	L-M	L	L	M(S)	M
Extended Detention Wetlands		M-VH	H	M	M	L	M	M(S)	H
Water Quality Ponds		M-VH	H	L-M	L-M	L	L	L	L-M

Table 6.8 – Efficiencies for Various SQIDs

Stormwater Quality Improvement Device		Gross Pollutants (Litter)	Coarse Sediment	Fine Sediment (Suspended Solid)	Nutrients (NandP)[1]	Oxygen Demanding Substances	Hydro-carbons[2]	Pathogens	Heavy Metals[3]
Bio-Retention Systems	Sand Filters (apply also to Bio-Retention Swales)	-	M-H	M-H	M	M	M	M	M
	Infiltration Trench/Basins (apply also to Bio-Retention Systems)	-	M-H	M	M	M	M	M	M-H
Other	Grates and Entrance Screens	L	-	-	-	-	-	-	-
	Baffle Pits	L	L-M	L	-	L	-	-	L
	Catch Pits	L	L-M	L	-	L	-	-	L
	Porous Pavements	-	H	M-H	M	M	M	H	M-H

Table 6.8 (Cont...) – Efficiencies for Various SQIDs

Symbol	-	L	M	H	VH	S
Meaning	Negligible Benefit	**Low** 10-30% Pollutant Reduction Efficiency	**Medium** 30-50% Pollutant Reduction Efficiency	**High** 50-75% Pollutant Reduction Efficiency	**Very High** 75-100% Pollutant Reduction Efficiency	Secondary Benefits

1. May be dissolved or attached to the particle. The efficiency for Nitrogen will be different from the efficiency for Phosphorus, and professional judgement will also need to be considered in regards to nutrients.
2. Within the compounds classed as hydrocarbons, there is significant variation of density, solubility and ease of treatment. Some hydrocarbons float, others will settle or attach to particles and others will enter the soluble portion of the water column.

In certain circumstances (i.e. catchment, pH levels etc.), heavy metals will be soluble in the water column. Soluble heavy metals may have greater impact on the environment.

(h) *Swales*

(i) Swales are a series of vegetated open channels designed specifically to treat and attenuate runoff for a specified water quality volume. They function by filtering stormwater through vegetation in the channel, filtering through a subsoil matrix, and infiltration into underlying soil.

(ii) Grassed swales are primarily linear systems and are often used adjacent to roads and in residential areas.

(iii) Grassed swales are not to be used:
- as the sole treatment measure for large drainage areas; and
- stormwater "hot spots", areas with the potential to generate highly contaminated runoff, such as gas stations (where infiltration can be a threat to groundwater).

(iv) Design**:**
- Grassed swales are required to achieve the following minimum design objectives:
    - hydraulic residence time of nine minutes (and not less than five minutes) for the minor design event (as defined by QUDM);
    - ensure uniform flow distribution to maximise the potential for pollutant removal;
    - shaped to minimise the scour potential with no “sharp” corners (i.e. trapezoidal, parabolic – wide, flat or slightly “dished” channels – avoid “triangular” shaped channels);
    - design flow velocity of approximately 0.25m/s or less during minor event, but no greater than 0.5 m/s and maximum velocity of 1.0 m/sec for the 100 yr ARI event;
    - maximum depth of flow during minor event equal to 1/3 of grass height in infrequently mowed swales and equal to ½ the grass height in regularly mowed swales (to maximum of 75mm);
    - ensure that the swale is effectively integrated into the landscape design and character of the development; and
    - selection and planting of vegetation is to maximise the effective vegetative filter area under design flows.

- The acceptable hydrological and hydraulic calculation methods are contained within QUDM.
- Further design considerations that should be addressed as part of the engineering design include:
    - cross sectional shape should be trapezoidal to avoid concentration of flow and scouring in the base of the swale;
    - side slopes should be no steeper than 1V:4H to allow mowing by motorised equipment, or retained;
    - check dams should be installed if longitudinal slopes exceed 4% (depending on velocity calculations) and underdrain (subsoil drainage) installed if slopes are less than 2% (refer to Section 2.14);
    - swale base widths exceeding 2.5m will require flow distribution devices at regular intervals in order to ensure uniform flow across the cross section;
    - the recommended Manning’s n value is 0.2 for flow conditions where the depth of flow is below the height of the vegetation and 0.03 for 100yr ARI event; and
    - the selected vegetative lining of the swale is required to be able to cater for the expected flow velocities without erosion or scour.
    - In urban areas, when providing access across the footpath to a residential lot, the swale shall be shaped to suit a driveway for travel by a standard car with the necessary clearances. Pipe crossings will not be approved in the swale.

- Swales must be designed to ensure that the depth-velocity limit of $0.4m^2/s$ is not exceeded for all flows up to the major flow event (or in the case of inter-allotment drainage, the design event as defined above).

- Alongside roadway pavements, the swales must be sized so that the water level in the swale during the 2 year ARI event is below the base of the roadway pavement (typically in the order of 300mm below the roadway surface). Alternative systems (involving, say, impermeable membranes separating the swale from the pavement) may be considered if it can be demonstrated that these flows will be prevented from seeping into the pavement.

- Also, for roadside application, the swale shall be shaped to suit a driveway profile for travel by a standard car with clearances. Pipe crossings for driveways will not be permitted.

- The Brisbane City Council's *Roadside Swale and Bio-Retention Systems Design Spreadsheet* can be utilised for the sizing of appropriate swales and bio-retention systems.

(i) Bio-retention Swales

(i) Refer to Section 6.11.4(6) – Bio retention.
(ii) The length of each filtration "cell" is generally defined by practical site constraints. As a minimum, the cell length is nominally defined by the spacing between driveway cross-overs. The segmentation of bio-retention systems into cells also allows points for maintenance access or water quality sampling. Accordingly, the cell partitions are also to be designed to allow future maintenance with:
(iii) Access for a draincam or a root-cutter to be inserted into the slotted pipe (if large enough); and
(iv) Cell partition so the "old" and clogged filtration media can be removed for disposal or treatment.
(iv) The width of the filtration "cell" is to be determined to ensure the design flow to be infiltrated into the filtration media (typically the 2 year ARI peak discharge) can do so without prolonged surfacing ponding.
(v) The depth of the filtration "cell" is set by site conditions and construction practicalities with the greater the depth the better the water quality improvement. The minimum depth of 0.6m is recommended. A slotted (agricultural) pipe is typically located along the base of each filtration"cell" to facilitate recovery of the stormwater that has percolated through the filtration media. The size of the slotted pipe is to be determined with respect to the desired retention time of the particular cell, desired retention time of the entire bio-retention system and the proposed outlet design.
(vi) The Brisbane City Council's Roadside Swale and Bio-Retention Systems Design Spreadsheet can be utilised for the sizing of appropriate swales and bio-retention systems. The latest copy of the spreadsheet is available from BCC.

(j) Buffer Strips

(i) Grass buffers can:
  - provide sediment and some pollutant removal from runoff prior to entering a drainage system;
  - provide some reduction in run-off volume through infiltration; and
  - slightly reduce peak volumes through delay in runoff.

(ii) Key issues involved with the implementation of grass buffers include:
  - land must be graded accurately to ensure maintenance of sheet flow and avoid concentration that may cause erosion or scouring;
  - delivery of stormwater runoff to the buffer area must be from area graded to ensure sheet flow;
  - grass buffers are only to be included in a stormwater treatment train immediately downstream of an impervious source. Hence, this should be reflected in modelling and private property is not to be considered as a buffer strip in any circumstances; and
  - grades to be between 2% and 4% across the direction of fall.

(iii) Maintenance requirements for grass buffers are:
  - regular mowing to maintain grass (preferably higher than 75mm); and
  - maintenance to retain continuity of grass sward (eg. reseeding).

(k) *Gross Pollutant Traps (GPT)*

(a) Gross Pollutant Traps (GPTs) are devices that are installed within or towards the outlet of enclosed stormwater drain systems. Generally, they function to trap gross pollutants (i.e. litter, general garden waste etc.) and coarse sediments (approximately greater than 2mm diameter), within or at the outlet of the stormwater system.
(b) GPT's are used as part of the pre-treatment within the overall treatment system in areas where enclosed minor stormwater systems (i.e. piped drainage systems) are installed. GPTs can also be used in existing enclosed minor stormwater systems, where there is sufficient hydraulic capacity for the installation.
(c) Gross Pollutant Traps are not to be used for the removal of:
  - ♦ pollutants/fine sediments that are less than 2 mm;
  - ♦ colloidal material;
  - ♦ dissolved chemical pollutants;
  - ♦ nutrients; or
  - ♦ hydrocarbons (including oil and grease).

(d) GPTs are not to be used in retrofit situations where the existing hydraulic capacity of the stormwater system is not to current standards, unless the developer upgrades the existing stormwater system to current standards, with sufficient hydraulic capacity for the inclusion of a GPT. Such an upgrade is required as part of the development, and is to be undertaken in accordance with the Development Design Planning Scheme Policy.
(e) Gross Pollutant Traps (GPTs) are to be designed and constructed so that:
  - ♦ the GPT captures a minimum of 90 percent of solid type pollutants 2mm and larger at the SQID design event;
  - ♦ the GPT captures a minimum of 75 percent of floatable pollutants having dimensions of 25mm in length, 10mm in width and 10mm in depth at the SQID design event;
  - ♦ the GPT is located in an accessible location (and not in swampy areas, at the bottom of embankments or other inaccessible locations);
  - ♦ the GPT is not located near electrical equipment or where a voltaic cell can occur;
  - ♦ the GPT is to be fitted with a suitably designed lockable access cover approved by Council that prevent entry of unauthorised persons;
  - ♦ re-suspension of captured pollutants during flows in excess of the SQID design event is prevented;
  - ♦ a minimum of 90 percent of pollutants re-suspended by back flushing is recaptured;
  - ♦ grill/mesh have a self cleansing mechanism to prevent blockage;
  - ♦ the GPT does not increase the hydraulic gradeline in an existing stormwater drainage system at the first pit/manhole upstream of the device by more than 150mm at a flow equal to the minor storm event for the minor stormwater system for that flow from the catchment;
  - ♦ the GPT does not create surcharge at the pit/manhole immediate by upstream of the GPT, unless there is an acceptable overland flowpath or high flow bypass;
  - ♦ the GPT is suitably located in public road, park or drainage reserve;
  - ♦ the GPT can be hydraulically isolated during cleanout;
  - ♦ when located in areas where tidal backflow is present, the downstream drain includes provision of a tide gate to prevent tidal inflow; and
  - ♦ any proprietary products are to be designed and installed in accordance with the manufacturer's guidelines.

(f) It is also preferred that GPTs are located adjacent to a sewer access point, so that any water that collects in the GPT can be pumped directly to the sewer as trade waste.

(l) *Gully Pit Gross Pollutant Traps*

(i) gully pit GPTs are used as part of the pre-treatment within the overall treatment system in areas where enclosed minor stormwater systems (that is, piped drainage systems) are installed. Gully pit

GPTs can also be used in existing enclosed minor stormwater systems, where there is sufficient hydraulic capacity for the installation.

(ii) the gully pit GPT should not be used in retrofit situations where the existing system's inlet capacity is insufficient for the major stormwater system to take the events greater than the minor enclosed stormwater system (i.e., if there is no overland flowpath from a trapped sag gully).

(iii) gully pit GPTs are to be designed and constructed so that:
- gross pollutants for the SQID design event are captured prior to entry to the minor stormwater system;
- sufficient overflow capacity is provided so that the minor storm event enters the minor stormwater system when the gully pit GPT is fully blocked. In certain circumstances, this will mean that additional gully pits will need to be installed;
- any proprietary products are designed and installed in accordance with the manufacturer's guidelines;
- the pollutant collection chamber is free draining to prevent anaerobic decomposition of collected matter. Anaerobic decomposition may be a source of odour and polluted leachate;
- the grates of the gully pit GPT are to be lockable such that a member of the public cannot access the pollutant collection chamber, but so that Council maintenance crews can;
- it can be cleaned easily utilising a vacuum truck or a vacuum street cleaner; and
- for health and safety reasons, manual lifting or cleaning of gully pit GPTs is to be minimised through appropriate design and development.

(m) *Oil, Grease and Grit Separators*

(i) Oil and grit separators are intended to remove the bulk of hydrocarbons and grit flushed from commercial areas, industrial areas, carparks and other land uses where oil spills occur or where hydrocarbons and sediment can accumulate.

(ii) Key issues involved with the implementation of oil, grease and grit separators include:
- limited removal of fine sediments or soluble pollutants;
- potential re-suspension of sediments and/or entrainment of floating oil with turbulence;
- trapped debris is likely to have high concentrations of pollutants, possibly toxicants;
- potential safety hazard to maintenance personnel;
- require frequent maintenance to provide continued performance;
- potential release of nutrients and heavy metals from sediments;
- total suspended solids minimum 85% removal efficiency @ 150μm;
- oil removal based on specific gravity of 0.82 – 0.87: >95%;
- installation of units is to be performed in strict accordance with the manufacturer recommendations and specifications;
- the installation of the device must account for prevailing soil pressures and must be designed to prevent hydrostatic uplift when the water table is at or close to the ground surface; and
- the installation must be designed to prevent damage by vandals.

(iii) A range of devices are commercially available for installation in appropriate situations a list of these devices can be supplied on request.

(iv) Maintenance requirements for oil and grit separators are regular cleaning out and removal to appropriate disposal points.

(v) Council requires that discharges from these traps including overflows are diverted to wastewater treatment facilities under a trade waste permit or to a hold tank.

(vi) Oil and grease separators are not suitable for the removal of dissolved or emulsified oils and pollutants such as coolants, soluble lubricants, glycols and alcohols. There is significant risk of re-suspension of accumulated sediments during heavy storm events. Accordingly, Council requires that oil and grease separator units be installed off line with a high flow by-pass.

(vii) Oil and grease from urban catchments may be better treated by grass swales, bio-retentions systems and wetlands.

(viii) Groundwater seepage into underground or basement car parks may not be discharged to sewer. Any discharge to stormwater may occur only after suitable treatment has reduced or removed the potential for acid sulfate soil and/or hydrocarbon contamination.

(n) *Trash Racks*

(i) Council does not promote the use of trash racks in situations where gross pollutant traps or gully pit gross pollutant traps can be implemented. Trash racks are only to be proposed in situations in which gross pollutant traps cannot be effectively installed.
(ii) Trash racks are not to be used when the system requires effective and efficient capture of coarse and fine sediments, oils and hydrocarbons, nutrients or dissolved pollutants.
(iii) Trash racks are to be designed and constructed so that:
  - the trash rack captures litter and debris for the SQID design event;
  - bar spacing is to be capable of retaining a 375mL metal drink container (standard aluminium drink can), with a maximum clear spacing of 40mm between bars;
  - the materials will structurally withstand:
    - the debris load of a fully blocked rack for the 100 year ARI event;
    - impact by a large floating object (i.e. log); and/or
    - when overtopped for the 100 year ARI event.
  - they are sized to operate effectively whilst passing the SQID design event flow without overtopping and with 50% blockage (i.e. the height of the trash rack is to be greater than the flood level of the SQID design event with 50% blockage of the rack);
  - a concrete pad of 1.5m width upstream of the rack allows easy access for clearing the collected material from the rack;
  - maintenance access is provided to the trash rack;
  - the individual panels of the rack are sized so that a backhoe can easily lift the panel (i.e. weight to be less than 300kg), to suit commercially available materials (i.e. steel) and the structural provisions outlined above;
  - the adverse impacts of a fully blocked trash rack are minimised by the incorporation of mechanisms or high flow bypass; and
  - landscape screening and safety fencing are incorporated in accordance with Section 10 of this Policy.

(o) *Other SQID Devices*

(i) Council will consider alternative SQID devices. The applicant will be required to demonstrate that the alternative SQID does achieve the required treatment objectives and is a maintainable asset.
(ii) The applicant is required to submit to Council sufficient information to assess:
  - The performance, efficiency and suitability of the alternative SQID device; and
  - The potential cost of maintenance of the alternative SQID device.
(iii) Detailed calculations and test results (laboratory and field) are to be submitted to provide verification of the claims being made as to performance, efficiency, suitability and maintenance costs for the device proposed.
(iv) Submissions to Council are required to include:
  - Catchment plan together with hydrological and hydraulic calculations. Calculations should generally commence at the outlet of the drainage system to a waterway under the control of Council or other location nominated.
  - Drawings of the proposed alternative SQID device.
  - Facts detailing the performance of the alternative SQID device.
  - Details of the verification procedure to be applied by Council to confirm that the alternative SQID device is performing as stated by the designers.
  - Copies of reports on the performance of the device from laboratory and/or field trials.
  - Details of locations where similar alternative SQID device have been constructed, including name of authority and contact telephone number of person who can provide verification as to the performance of the alternative SQID device in service.
  - Details of cleanout/maintenance and anticipated costs of procedures to be adopted. Cleanout/ maintenance will need to utilise plant and equipment currently in use by Council. A requirement for use of specialised equipment not currently available to Council's maintenance operations may preclude the use of the alternative SQID device.
  - Structural calculations showing the device, the roofs and access covers are designed for a W7 traffic load. Council prefers access covers to be of checker plate or similar construction.

Access covers are to be large enough to enable vertical removal of components where required.
- Details of guarantees as to the long term performance of the device.

(v) Inspection/maintenance access lids are to be provided to alternative SQID devices. The lids are to be 900mm x 600mm in size and have recessed hinges and padlocks. Inspection access lids are required to all chambers and chamber areas where separated by dividing walls or weirs.

(vi) Maintenance drop boards are required to isolate the alternative SQID device from upstream and downstream flows. The drop boards must stay with the device and be designed to be lowered in position within Workplace Health and Safety lifting requirements.

(vii) No confined space entry is permitted for regular maintenance cleanouts.

(4) *Stormwater Harvesting*

(a) General

(i) The primary aim of stormwater harvesting is to assist in reducing demand on municipal potable water supplies.

(ii) A secondary aim of stormwater harvesting is to reduce the impacts development and urbanisation has on the storm hydrograph. Urbanisation tends to reduce the time of concentration, which can result in higher peak flows during a storm event, and a reduction in natural attenuation effects. Accordingly, the loss of natural attenuation effects is compensated through the development of detention and/or retention areas within the developed catchment.

(iii) As similar infrastructure or assets can achieve both the stormwater harvesting aim and detention/retention aims, these guidelines address both aims for the infrastructure or assets.

(b) Underground Storage Tanks

(i) Discharge control pits:
- provide onsite detention thereby reducing peak flows; and
- provide potential for stormwater re-use for non-potable uses (such as irrigation, wash down water etc.).

(ii) Underground storage tanks also provide a minor water quality improvement function by allowing sediment to settle.

(iii) Key issues involved with the implementation of underground storage tanks include:
- sized to achieve predevelopment flows in stormwater discharge;
- if device has a stormwater reuse function then only roof water should be connected, otherwise, pavement and roofwater may be combined;
- pre-treatment required for remove gross pollutants prior to entry if collecting from paved surfaces;
- pre-treatment for sediment removal is advisable for both roof and pavement collection sources;
- locate access points away from heavily trafficked areas so as to minimise disincentives to maintenance; and
- use light duty access covers to minimise disincentives to maintenance.

(iv) A number of preconstructed pits and storage devices are available commercially. A list can be supplied on request.

(v) Maintenance requirements are:
- annual flushing out of tank; and
- regular maintenance of first flush device.

(c) Rainwater Storage Tanks

(i) Storage tanks can:
- allow the reuse of collected rainwater as a substitute for mains water supply, either inside or outside the building (including toilet flushing, hot water, laundry use or garden watering); and
- when designed with additional capacity above the overflow volume, provide an onsite detention role, thereby reducing the peak flow of a storm event.

(ii) Key issues involved with the implementation of rain water storage tanks include:
- must be installed by a licensed plumber;

- must be fitted with a “first flush” device to ensure pollutants and sediments are diverted before reaching the tank;
- must be sealed at the inlet to avoid insect ingress and mosquito breeding;
- rainwater that may be used inside the home should only be collected from roofs. Roofs coated with lead or bitumen based paints or asbestos cement roofs must not be used;
- should be sized to provide storage for a minimum of one week’s use of the intended water application rate. Generally, capacities between 3kL and 10kL provide maximum water savings and stormwater management benefits;
- must be sited to the side or rear of the house and not be visible from the street;
- a planning permit or building permit may be required for tanks of a certain size;
- tanks must not be located within 0.5m of a boundary.
- if to be used for potable water inside the house, only roof water can be collected and will require professional installation and Council approval. Stormwater drainage designs are not to incorporate any provision for rainwater tanks or detention value of rainwater tanks.

(iii) There are to be no physical interconnections with the mains water system: a dual water pipe system for mains and tank water is required;

(iv) There is to be a provision for switching over to mains water to enable continued use of any internal fixtures (i.e. during periods of low rainfall);

(v) The back-up supply of water to the rainwater tank is to be a mains trickle-feed water supply to the tank (separated from the maximum tank water level by an air-gap to prevent backflow). The air gap is required to comply with Australian Standards AS/NZ 3500.1.2 and 2845. Alternative solutions will be considered but are not to involve physical interconnections with the mains water system;

(vi) Within declared water supply areas, at least one separate mains connection is required to be provided for outdoor uses; and

(vii) Water quality in the mains water system is to be protected through the appropriate design and use of rainwater tank systems that ensure continued circulation of mains water within mains water systems.

(viii) All rainwater tanks should be designed, fabricated, constructed and installed in accordance with the practical guidelines provided in the Guidance on Use of Rainwater Tanks (National Environmental Health Forum).

(ix) A major consideration with implementing rainwater tanks is the effective maintenance of these assets by the responsible asset owner. Generally, rainwater tanks will be implemented at the allotment or site level. As the property owner, and not Council, is the asset owner of rainwater tanks it will be the responsibility of the owner to maintain and operate rainwater tanks according to Council requirements.

(x) Design of the roof water system will depend on a number of factors including:
- the proposed uses of the roof water (toilet flushing, hot water, laundry, outdoor use);
- the objective of the roof water system (stormwater management, mains water demand management or other objectives);
- whether the storage is above or below ground; and
- whether the roof water system will form part of a dual water supply scheme (mains water and roof water) or will the roof water system be independent of the mains water supply.

(xi) Maintenance requirements for rainwater storage tanks are:
- annual flushing out of tank;
- regular inspection to ensure appropriate sealing;
- regular maintenance of first flush device;
- gas monitoring; and
- pump maintenance (if non-gravity system e.g. below ground).

(xii) Another product that operates on a similar principle to rainwater collection, is the use of enlarged roof guttering. Particular assessment must be made of the structural engineering requirements of the system in relation to the load it imparts on roof structures if this product is proposed.

(d) Regional Retention Requirements

(i) Developments that create large urban areas are required to determine the volume of retention or detention required to reduce the impact of urbanisation and to ensure that the required retention/detention volume is provided in the development design. The objective is to ameliorate the impact of urbanisation as much as possible, and to replicate natural hydrological conditions as best as physically practical. The required retention volume for the development is to be calculated through the hydrological routing methods. Using such hydrological routing methods, the retention volume for a subcatchment can be determined across the development site thus allowing the developer to assign retention requirements between separate basins and/or on-site detention requirements.

(ii) Retention/detention may be required to mitigate an existing downstream flooding problem or to allow a reduction of the size or form of downstream infrastructure (either natural or constructed). The volume of retention to have this mitigating effect is to be considered in addition to the volume of retention required to ameliorate the impact of urbanisation.

(iii) For all retention/detention schemes, the impact on scouring of downstream waterways is also to be considered. There are three possible scour scenarios:

- Scour due to an unmitigated peak flow for developed situations;
- Scour due to prolonged discharge from retention/detention discharge storages; or
- Scour due to increased frequency of the critical scour velocities.

(iv) Accordingly, retention/detention storage requirements and the outlet design is to be considered in parallel to the natural channel design requirements and the natural hydrograph. Channel erosion can occur in natural streams, but in an urban environment this may be undesirable due to lot alignment, sediment load and receiving waterbody Environmental Values.

(v) To achieve these objectives, the development will be required to implement a Regional Retention/Detention Basin (Section 2.13.5.3) or an On-Site Detention Scheme (Section 2.13.5.4), or both in parallel.

(e) Regional Retention/Detention Basins

(i) In some cases, the provision of a regional detention/retention basin will be more cost effective and appropriate than the installation of on-site detention devices. The design and construction of a regional detention/retention device does not preclude the development of on-site detention facilities or rainwater tanks on the allotment scale of the development.

(ii) The hydraulic design of detention (dry) and retention (wet) basins is outlined in QUDM Section 6 and further information is provided in various publications.

(iii) Basins are to be analysed for the entire range of design storms (Q1-Q100) Design procedures are provided in QUDM Section 6.03 and 6.04.

(iv) The recommended maximum batter for grassed slopes is to be 1v in 6h, however the absolute maximum is to be 1v to 4h. This can be reduced to 1v in 2.5h for the portion of the embankment below water level in a wet basin. Landscaped batters which improve the overall aesthetics of the basin may be steeper, provided that safety, maintenance and outlet blockage issues are addressed.

(v) The maximum depth of water in a wet basin, lake or dam less than 0.5ha in area, is to be 1.2 metres during dry weather flows.

(vi) Detention or Dry Basins

- The maximum depth of water in the basin is to be 1.2 metres at Q20 flows.
- Subsoil drainage may be required, however, designs which assist the recharge of groundwater are encouraged, provided that the surface does not remain water-logged for more than a few days.
- The relevant site soil conditions will determine if this is possible or necessary.
- Low Flow provisions are to be catered for. This is to be a minimum of Q1 and should be piped between the inlet and outlet structure. The basin floor is to have a minimum grade of 1v in 150h.

(vii) Inlet/Outlet

- Inlet and outlet weirs are to have depth velocity products in line with QUDM. In some cases, a number of smaller outlets may be required, instead of one large outlet. The use of multiple outlets will also reduce the likelihood of system blockage. Multiple outlets may also be necessary when limiting outflow to pre-developed rates.
- Appropriate landscaping should be employed so as to improve the amenity of the area by screening of inlets and outlet(s). Care must be taken to ensure trees or shrubs used do not effect the hydraulics of the structure or increase the risk of blocking by vegetative matter (i.e. small leafed type vegetation is preferred to broad leafed type).

(viii) Safety

- Signs must be placed at relevant locations warning of the possible hazards such as water depth, piped inlet suction, major spillway effects.
- Downstream effects of spillway usage need to be considered during design.

(ix) Water Act

- Regional detention/retention basins are also required to comply with the requirements under the Water Act (2000).

(x) Water Reuse

- Water reuse systems are required to be included as part of the retention/detention basin design. The reticulation system is required to be marked as recycled stormwater and is only to be reticulated to outdoor, laundry and toilet uses, and not to the hot water system. The water reuse reticulation system can include a regional temporary storage and pump stations. All infrastructure elements of the water reuse reticulation system are required to comply with the Water Supply Section of the DDPSP.

(xi) Lakes and Dams

- Section 5.10 of the Local Government (Planning and Environment) Act 1990 is applicable, should a lake be incorporated into a subdivision.
- An EIS is required under the Local Government (Planning and Environment) Act 1990. For lakes in excess of 0.5 ha in area, Section 8.2 of this Act is relevant.
- A licence may also be required from the Water Resources Commission if the lake or dam is considered “referable”. QUDM Table 6.03 provides information on referable dams and the entire Section 6 supplies additional information on the hydraulic design of lakes and dams.
- All pipe drainage entering the lake must incorporate some method of trash, litter and sediment capture and removal. It is Council’s preference for a small number of large outlets, rather than a large number of smaller outlets.
- Maintenance (including costs of the lake or dam is an important consideration and a detailed management plan is to be produced.

(f) On-Site Detention

(i) On-site Stormwater Detention (OSD) involves the temporary storage and controlled release of stormwater generated within a site. Typically, it is focused upon reducing the impact of urbanisation on the storm hydrograph and possibly mitigating existing downstream flooding problems. But, by its nature, it is also an opportunity to maximise stormwater reuse.

(ii) Accordingly, provision is to be made to redirect the outflow from the OSD device to top up the rainwater tank and to supply the allotment scale water reuse system.

(iii) For development sites that are less than 5 hectares, the OSD requirement is to be based upon the procedures presented in Section 5 and 6 of the *On-Site Stormwater Detention Handbook* (1999 Upper Parramatta River Catchment Trust). Section 5.1.1 of the OSD Handbook (1999, UPRCT) defines:

- Preliminary Storage Requirement (PSR) as 470m3/ha; and
- Preliminary Permissible Site Discharge (PSD) as 80l/s/ha.

(iv) For Caloundra City, these figures do not apply and the development is to apply PSR and PSD from the following hierarchy of sources:

- PSR and PSD determined for the particular catchment by Stormwater Management Plan or Catchment Management Plan as prepared by Council;
- PSR and PSD determined for a similar catchment by Stormwater Management Plan or Catchment Management Plan as prepared by Council, in consultation with Council;
- PSR and PSD based upon retention storages of other developments greater than 5 hectares within Caloundra, in consultation with Council; or
- PSR and PSD based upon consultation with Council.

(v) For development sites that are greater than 5 hectares, the retention volume is to be calculated and apportioned as discussed above in Section 2.13.5.2. The design principles and procedures is to be based upon the procedures presented in Section 5 and 6 of the On-Site Stormwater Detention Handbook (1999 Upper Parramatta River Catchment Trust). But the PSR and PSD requirements are to be based upon the hydrological routing and retention storage as discussed in Section 2.13.5.2 above.

(vi) OSD devices are not contributable assets, and Council will not accept ownership of OSD devices. The ownership and maintenance responsibility will be vested in the property owner.

(5) *Bio-retention*

(a) General

(i) Bio-retention systems involve the infiltration of stormwater into a permeable (draining) filtration medium. The biofilms (growing on the surfaces of the filtration medium) assist in the water quality improvement function by:
- Adsorption of fine particulates; and
- Biochemical processing of soluble contaminants.

(ii) Bio-retention systems may drain to groundwater stores, drain to surface water or both.

(iii) Bio-retention systems are used primarily for fine sediments and nutrients and also assist in the removal of hydrocarbons and heavy metals. To be effective, pre-treatment for gross pollutants and coarse sediments is required.

(iv) Bio-retention systems can be incorporated into the landscape design of developments and roads. They can also be constructed within existing developments.

(v) Bio-retention systems can be prone to clogging by coarser sediments. Accordingly, a coarse sediment trap of some form is required upstream of the bio-retention system.

(vi) Consideration of the in situ geology and locations of aquifers is required. If the bio-retention system is recharging the aquifer through infiltration, a careful assessment will need to be undertaken to consider if there is any water quality impact on the groundwater.

(vii) Bio-retention systems are not to be used for the removal of:
- gross pollutants (i.e. litter, large green waste);
- coarse pollutants or coarse sediments; or
- highly hazardous or toxic pollutant loads.

(b) Design

(i) The main cause of failure in bio-retention systems is clogging of the media by organic material or coarse sediment. Pre-treatment of stormwater inflows and effective siting of bio-retention systems is therefore essential. Buffer strips and/or grassed swales located upstream of the infiltration device are a pre-treatment option which can be effectively integrated with the infiltration system design.

(ii) The length of each filtration "cell" is generally defined by practical site constraints. The segmentation of bio-retention systems into cells also allows points for maintenance access or water quality sampling. Accordingly, the cell partitions are also to be designed to allow future maintenance with:
- access for a draincam or a root-cutter to be inserted into the slotted pipe (if big enough);
- cell partition so that “old” and clogged filtration media can be removed for disposal or treatment.

(iii) The effectiveness of stormwater detention and retention systems for any particular runoff event is dependent on antecedent storage conditions. Continuous simulation of the hydrological behaviour of bio-retention systems and the proposed outlet design is therefore the preferred method of design, and developments proposing to incorporate these devices are required to size them in this way. Simulations of bio-retention systems are to be based upon:
- in-situ soil properties (i.e. infiltration rates) based on site-specific investigations (refer to AS/NZS 1547:2000 for methods for determining infiltration rates);
- infiltration rates through the permeable filtration media;
- dimensions (width, length and depth) of the bio-retention cells that make up the bio-retention system;
- effective storage available within the bio-retention cells that make up the bio-retention system;
- sub-soil perforated pipe sizing and location; and
- outlet design and hydraulic rating.

(iv) In addition to the above sizing requirements, the following requirements are to be followed in regard to detailed design and construction of a bio-retention system:

- geotextile fabric should be provided at the base and sides of the bio-retention system to minimise migration of surrounding soils;
- geotextile fabric can be extended to cover the surface of the bio-retention system if topsoil and vegetation are provided;
- for bio-retention systems that are to facilitate infiltration, compaction of the base of the trench and surrounding soils is to be avoided;
- during construction sediment runoff should be directed away from the bio-retention area;
- adequate overland flow paths are to be provided for events exceeding the capacity of the bio-retention area;
- if the velocities of the storm events greater than the SQID design event to the major design event create scour conditions along the bio-retention system or could cause the re-entrainment of collected pollutants, a high-flow bypass is required;
- adequate sub-surface drainage is required through a perforated pipe network (agri pipe) along the length of the device, discharging to the outlet or into the infiltration system.
- methods used for design and sizing should be in accordance with ARQ.

(v) Permeable Filtration Media Design

- the permeable filtration medium is a critical component of the design of bio-retention systems. At this stage there are no specific design guidelines for all bio-retention situations. The design of the permeable filtration media needs to consider:
  - desired retention time;
  - design infiltration rate;
  - media sizing and grading;
  - vertical layers of media types;
  - cell sizing and locations;
  - sizing and grading of aggregate material;
  - mulch and top-soil requirements for the proposed vegetation;
- The applicant is required to detail the basis of the permeable filtration media design proposed for the bio-retention system.

(vi) Vegetation

- The design concept is that planting a bio-retention area with vegetation will assist by:
  - breaking down pollutants;
  - consuming some nutrients;
  - providing micro-drainage paths along the live and dead roots; and
  - take-up of some of the collected water.

  Native plants that are able to survive extensive wetting and drying as well as prolonged inundation are to be used. Species are to be selected in accordance with Appendix 6.11. The use of vegetation will also greatly improve the aesthetic appeal and public acceptance of a bio-retention system.

(vii) Outlet Design

- The outlet design for the bio-retention system is essential in the determination of retention time and water quality treatment efficiency. The following are examples of outlet designs to be considered:
  - free flowing;
  - dropboard weir within a manhole;
  - set orifice;
  - siphon;
  - staged riser;
  - set riser; or
  - infiltration system to groundwater.
- Hydraulic design of the outlet (excluding infiltration outlet) should be undertaken in accordance with the methods specified by QUDM and DLWC Constructed Wetland Manual (Section 21.7) in order to achieve the required detention time.
- The hydraulic design of the infiltration system will require comprehensive soil testing, permeability testing and aquifer investigations. The aquifer investigations are required to determine the location, depth and water quality of the aquifer, and if the system is phyletic or confined.

(6) *Sediment Basins*

(a) Sediment basins (sometimes known as sediment traps) are primarily designed to trap coarse sediment. The basin can take the form of a formal 'tank' or less formal pond. Sedimentation is typically encouraged by enlarging the channel so that water velocities are reduced to the point where settling may occur.

(b) Sediment basins can be used in isolation in the stormwater system or as a pre-treatment upstream of other SQIDs. Sediment basins can also form an integral part of a construction site's erosion and sediment control strategy.

(c) Sediment basins are not to be used for the removal of:
- (i) gross pollutants (i.e. litter, large green waste);
- (ii) fine pollutants or fine sediments;
- (iii) colloidal material;
- (iv) dissolved chemical pollutants;
- (v) nutrients; or
- (vi) hydrocarbons (including oil and grease).

(d) A GPT or trash rack is to be located upstream of the sediment basin.

(e) Sediment basins are to be sized based on the sedimentation function using Stokes Law, based on the following requirements:
- (i) the sediment basin should be sized to trap a target particle size of 125μm during the SQID design event;
- (ii) the sediment basin is to have a minimum settling zone depth of 0.6m to prevent re-suspension/scour of trapped particles; and
- (iii) adequate sediment storage depth should be provided below the settling zone depth to provide for five years' worth of sediment or 100% of the settling zone volume.

(f) Sediment basins (excluding construction phase sediment basins) are required to have a high-flow bypass.

(g) Sediment basins as part of the construction phase erosion and sediment control are to be designed in accordance with Brisbane City Council Sediment Basin Design Construction and Maintenance Guidelines (2001).

(7) Constructed Wetlands

(a) Natural wetlands are not to be used to treat stormwater runoff from subdivisions or other types of development.

(b) Wetlands are dominated by macrophyte areas, are much shallower than ponds, and rely on enhanced sedimentation and biological uptake through contact with the vegetation to achieve pollutant removal. Fluctuating hydrological conditions (water levels) are an essential feature of extended detention wetlands and are necessary for maintaining a diverse vegetation community and for aeration of sediments (which progressively makes settled phosphorus less bio-available). A small volume of permanent water (relative to the ephemeral storage volume) is often provided to increase detention times while not compromising macrophyte diversity.

(c) Wetlands are used primarily for fine sediments and to some extent nutrients, heavy metals and organic matter. To be effective, pre-treatment for gross pollutants and coarse sediments is required. Accordingly, for constructed wetlands in Caloundra, pre-treatment in the following forms are required as part of a wetland's design and construction:
- (i) gross Pollutant Trap (GPT) or trash rack for gross pollutants; and
- (ii) an inlet zone that acts as a coarse sediment trap.

(d) Wetlands as SQIDs should not be confused with ecological wetlands or with amenity wetlands. The SQID wetland will also have aesthetic and ecological features, but its main function and design is for the improvement of water quality.

(e) The three basic components of a constructed wetland are the inlet zone, the macrophyte zone and the outlet structure. Each zone is sized and designed to individual parameters and is discussed separately below. Other key components of a wetland system include:
   (i) a GPT or trash rack upstream of the inlet zone;
   (ii) a sediment basin upstream of the inlet zone;
   (iii) a flow distribution device between the inlet zone and the macrophyte zone to ensure that even lateral distribution of flow occurs into the macrophyte zone; and
   (iv) a high flow bypass (secondary outlet) to protect the macrophyte zone during large runoff events.

(f) All ponded areas located within Public Open Space require pre-treatment for litter removal.

(g) Public safety is a paramount issue in the design of extended detention wetlands. Accordingly, please refer to Section 6.7.9.

(h) Sizing the Inlet Zone
   (i) The inlet zone performs the function of flow attenuation and distribution to the macrophyte zone, acts as a sedimentation basin and can incorporate a secondary outlet discharging to the high-flow bypass channel. It is Council's preference that the high flow bypass be incorporated upstream of the GPT or trash rack.
   (ii) The inlet zone may be sized based on the sedimentation function using Stokes Law, based on the following requirements:
      - the inlet zone should be sized to trap a target particle size of 125μm during the SQID design event;
      - the inlet zone is required to have a minimum settling zone depth of 0.6m to prevent re-suspension/scour of trapped particles;
      - adequate sediment storage depth should be provided below the settling zone depth to provide for five years worth of sediment or 100% of the settling zone volume.

(i) Sizing the Macrophyte Zone
   (i) There are many methods used for sizing the macrophyte zone, however Council recommends the method described within the Draft Australian Runoff Quality Guideline.
   (ii) Sizing of macrophyte zone using this method is based on the use of hydrological effectiveness curves that relate the required storage volume to the mean annual runoff. The volume calculated can then be used to derive an appropriate surface area. It is recommended that sizing calculations are based upon an 80% hydrological effectiveness, with a minimum 72 hours detention period. When designing the macrophyte zone and outlet system, the velocities within the wetland is to be restricted to a maximum of 0.05m/sec, however a velocity of 0.02m/sec is desirable. Hydraulic efficiency involves the proper control of flow patterns within the wetland. Both uniform flow conditions and effective volume utilisation are necessary to promote good hydraulic efficiency. The hydraulic efficiency of a wetland should ideally be >0.7, however >0.6 is acceptable.
   (iii) Once sizing using the above method has been completed, it should be modelled using a continuous simulation pollutant export model (such as MUSIC) that takes account of the physical dimension of the wetland when estimating pollutant removal efficiency, and has a short enough time-step to adequately model ephemeral storages.
   (iv) It should be noted that sizing wetlands using the wetland module of AQUALM will not be accepted. This is due to the module basing pollutant removal on detention-time relationships, which tend to favour the design of deep ponded water bodies over ephemeral wetlands when used in conjunction with a daily model time-step.

(j) Detailed Design

(i) Flow Regulation: As discussed above, a high flow bypass is required to protect the macrophyte zone during high-flow events. A flow distribution device (such as a rubble weir) is required between the inlet zone and the macrophyte zone to ensure even distribution of the attenuated flow across the cross-section of the macrophyte zone.

(ii) Primary Outlet Design: The outlet design for a wetland system is also essential in the determination of retention time and water quality treatment efficiency. The following are examples of outlet designs to be considered:

- set orifice;
- siphon;
- staged riser;
- set riser; and
- dropboard weir within a manhole.

In selecting the primary outlet structure preference is to be given to risers, due to the ability to achieve near-constant detention time over the full depth range. The holes located along the vertical axis of the riser should be positioned to achieve maximum detention for the minor runoff events as well as for larger events.

Hydraulic design of the primary outlet should be undertaken in accordance with the methods specified by QUDM and DLWC Constructed Wetland Manual (Section 21.7) in order to achieve the required detention time and the depth-inundation characteristics of the macrophyte zone as described below.

(iii) Configuration of Macrophyte Areas: The macrophyte zone should be configured to achieve the following outcomes:

- permanent pool of 10-15% of total storage (permanent plus ephemeral);
- length: width ratio at least 3:1. Storms should be routed through the basin using a hydraulic modelling package in order to check these velocities and determine an appropriate L:W ratio in accordance with the methods specified by QUDM;
- vegetation should be provided in bands of uniform cross-section perpendicular to the direction of flow. The bands are to be arranged in the order of ephemeral – shallow marsh – deep marsh – open water – deep marsh – shallow marsh – ephemeral so the wetland can drain down to a sustainable deep marsh area during periods of extended dry weather. The final band before the primary outlet is required to be open water. The relative areas required for each vegetation type and the elevation of each band relative to the invert of the outlet structure is provided below:

Vegetation Band	Percentage of Total Macrophyte Zone Area	Elevation of Planting Zones (above the invert of the primary outlet)	Percentage of Time Planting Zone Inundated (long term)
Ephemeral marsh	10%	0.6 to 1.0m	15%
Shallow marsh	35%	0.2 to 0.6m	28%
Deep marsh	30%	-0.2 to 0.2m	57%
Open water	25%	-1.2 to 0.0m	100%

Table 6.9 – Relative areas and evaluation of vegetation bands

Water balance modelling for an extended time period (10 years) is required to be undertaken in conjunction with the design of the primary outlet demonstrating that the above depth-inundation requirements for the macrophyte zone are achievable. The above depth-inundation profile may need to be adjusted depending on the selected extended storage depth (1m assumed in above table), though similar inundation periods for each planting zone should be achieved.

- adequate longitudinal slopes are required to be provided on planting shelves (at least 1:10 H:V) to prevent stagnation and isolation of small pockets of water which will provide mosquito breeding potential.
- drainage is required to be provided between planting shelves where the shelf is at a greater elevation than the invert of the primary outlet. This is to be by small diameter pipe or geotextile wrapped aggregate drain.

(iv) Determine Planting Plan for Macrophyte Areas

- Appendix 6.11 provides a species list of wetland plants suitable for south-east Queensland. Each species is identified as belonging to one or more of the vegetation banks identified above. The planting plan should identify proposed species, densities, locations, substrate (topsoil) provision and proposed methods of water level control in the wetland during the establishment phase of the vegetation.
- At least 150mm of topsoil containing a minimum of 5% organic content is required to be provided throughout the macrophyte planting areas.
- A wetland vegetation and weed management plan is required to be submitted in conjunction with the planting plan, detailing activities to be undertaken to maintain healthy and diverse vegetation communities prior to the wetland being accepted off-maintenance.
- Planting should be conducted at approximately eight stock per m^2.

(v) Detailed Structural and Hydraulic Design of Wetland Components

- All detailed hydraulic modelling of primary and secondary outlet structures, specifications for embankments and freeboards should be as per the requirements of QUDM.

(vi) Water Pollution Control Ponds

- Ponds are dominated by open water areas and rely primarily on free settling of particles and attached pollutants for achieving pollutant removal. Ponds generally have little variation in water levels and have low diversity of macrophytes. Maintaining aerobic conditions in the sediments is essential for preventing anoxic conditions adjacent to the bed and remobilisation of nutrients from the sediments to the water column. Open water areas are essential in these systems to maintain areas for wind mixing (aeration of sediments) and the pond must be sufficiently large to be able to cope with the BOD loadings from catchment runoff.
- Ponds are typically used for amenity and aesthetic purposes. They can be utilised as coarse sediment basins.
- In practice, ponds within the Caloundra City generally suffer from aquatic weed growth throughout the surface area. In addition water quality and odour issues regularly occur. The use of ponds will generally be discouraged in favour of extended detention wetlands.
- Ponds are not to be used for the removal of:
  - gross pollutants (i.e. litter, large green waste);
  - fine pollutants or fine sediments;
  - colloidal material;
  - dissolved chemical pollutants;
  - nutrients; or
  - hydrocarbons (including oil and grease);

(k) Design

(i) All ponded areas located within Public Open Space require pre-treatment for litter removal.

(ii) Developments proposing to incorporate ponds will need to demonstrate that adequate water quality will be maintained within the pond, as demonstrated by the absence of algal blooms during long-term assessments (10 years). A process model is available for assessment of the pollutant removal performance and in-pond water quality of stormwater treatment ponds, as described in Lawrence and Breen (1998) and available from the CRC for Freshwater Ecology website. The model attempts to account for the key physical, chemical and biological processes occurring within stormwater treatment ponds, and conceptual design parameters (depth, area, L:W and % macrophyte cover) can be obtained as a result of the modelling and will be required to be reported in the submission of the design.

(iii) Further issues which should be addressed in the detailed design of stormwater treatment ponds include:
- wetland planting is required to be provided around the perimeter of the pond to address safety issues and enhance water quality treatment. Species are to be selected in accordance with Appendix 6.11. A planting and vegetation management plan and detailed design of hydraulic components are required; and
- proposed methods to maintain open water areas in the pond and any on-going associated costs are required to be documented.

(iv) Reference should be made to Lawrence and Breen (1998) for a detailed discussion of the above issues.

(7) Porous Pavement

(a) Porous pavements may be located above a deep gravel layer or reservoir, which in turn, is bedded on a sand filter layer. Runoff percolates through the porous pavement into the gravel reservoir and into the sand layer below.

(b) Porous Pavements:
(i) provide for a reduction of dissolved pollutants including hydrocarbons;
(ii) provide for onsite retention of stormwater runoff, therefore reducing peak flows;
(iii) reduce the overall volume of stormwater runoff from a site;
(iv) minimise the export of sediments and pollutants off the site; and
(v) can be designed to become temporary storage areas for higher rainfall events.

(c) Key issues involved with the implementation of porous pavements include:
(i) generally the pavement area to be set at a maximum grade of 1% or less, and none constructed on grades greater than 5%;
(ii) runoff directed to porous pavements should, where possible, be pre-treated to remove sediment;
(iii) porous pavement areas to be fully protected from sediment contamination during construction;
(iv) should be graded such that the area can drain to another source control device or the street drainage system in an overflow event;
(v) suitable for areas that have relatively low vehicle use, carparks and paving in residential and appropriate commercial developments;
(vi) if used as storage for on-site retention, should be designed to criteria appropriate for Sediment Basins – Detention/Retention. (Refer Caloundra City Council adopted Standard Drawings).
(vii) appropriate products include:
- modular concrete blocks;
- no-fines concrete;
- open graded asphalt; and
- “reinforced grass” products.

(d) Other key issues include:
(i) moderate soil infiltration rates are required (low rates will result in long exfiltration periods, while high rates may cause groundwater contamination);
(ii) pavement surface clogging may reduce effectiveness;
(iii) must be capable of supporting the traffic loading and volume (possible pavement deflection);
(iv) generally can not be located on steep slopes, loose or unstable areas; and
(v) have the potential for metal accumulation in the fill.

(e) Maintenance Requirements for porous pavements are:
  (i) wash down with high pressure hose annually;
  (ii) vacuum sweeping three monthly in higher sediment environments; and
  (iii) asphalt porous paving (like other asphalt pavements) require occasional resurfacing.

6.12 Guidelines – "Conventional" Engineering Design

(1) *General*

(a) "Conventional" engineering design is not encouraged and Total Water Cycle Management (TWCM) is the preferred approach to stormwater management.

(b) Section 5 refers to the circumstances when Council may accept "conventional" engineering design.

(c) Attention is drawn to Appendices 6.1 – 6.7 regarding water quality objectives, environmental values and water body categories in Caloundra City.

(2) *Open Channel Design*

(a) Open channels are to be designed in accordance with QUDM Section 8, with particular attention to the structural design requirements.

(b) If the open channel is to be a grassed channel (that is, not a natural channel design and not a hard edged design) then the longitudinal grade is to be no flatter than 0.5%. If it is flatter than 0.5%, then low flow pipe, concrete "vee" drain or a subsoil drainage system (such as a bio-retention system) is required to be included in the design to prevent prolonged pondage of water.

(c) Open channels that are grass lined (including the low flow of large channels) are to include an aggregate-filled seepage drain along the full length of the invert. This seepage drain is to be a minimum 600mm wide by 300mm deep and be fully encased by a suitable geotextile barrier. A 100mm thick permeable topsoil layer is to be constructed above this seepage drain.

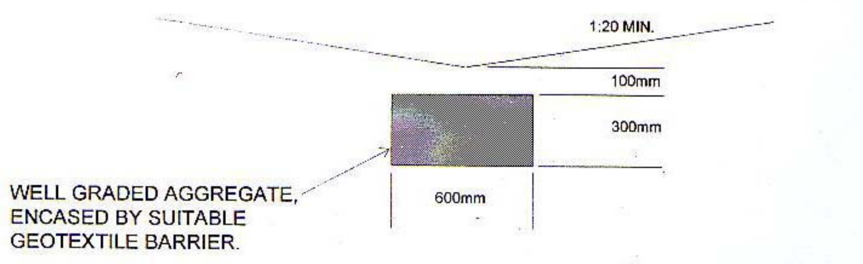


Figure 6.4 – Seepage Drains for Unlined Open Channels

(d) Hard lined channels are to be designed in accordance with QUDM Section 8.09 and must include regular entry ramps suitably graded and at an adequate width to permit the access of a skid-steer loader.

(e) Soft lined channel side slopes are to be designed in accordance with QUDM Section 8.10 (d). Slope stability analysis may be required for channels which are greater than 2.0 metres deep, subject to satisfactory scour protection and provision for convenient maintenance. For channels that are less than 1 metre in total depth, side slopes may be as steep as 1v on 1h. Soft lined open drains or channels must be designed in a manner that permits maintenance activities such as: grass and brush cutting, debris removal, relining, structural repairs etc.

(f) Side slopes steeper than 1:4 require special treatment for stability and minimal maintenance.

(g) In addition to the construction of step irons as required by QUDM Section 8.09 (c), a safety fence is required for all open channels greater than 2.0 metres deep and with batters steeper than 1v on 2h. The fencing of the open channel is to be to accepted pool fencing standards with the following minimum specifications:
   (i) 1.2m high powder coated galvanised steel 'Monowills' or similar approved handrail with 12mm diameter vertical rods at 100mm centre-to-centre to infill.

(h) Designed open channels are to have as minimum, a 1.5 metre safety berm on each side. A 4.5 metre maintenance berm is also required on one side or both sides, if more than 15 metres between top of banks. This maintenance berm may be located within the open channel above the minor storm flow level, or alternatively, it may also include the safety berm, provided that the maintenance berm is above the major storm flow level and associated freeboard.

(i) The top of bank should be a minimum of 3.0 metres from any private property.

(j) Drop structures, including chutes and flumes, are not to be constructed of rock filled mattress. However, large boulders grouted together (artificial rapids) may be used to improve the aesthetics of the structure, while reducing downstream velocities.

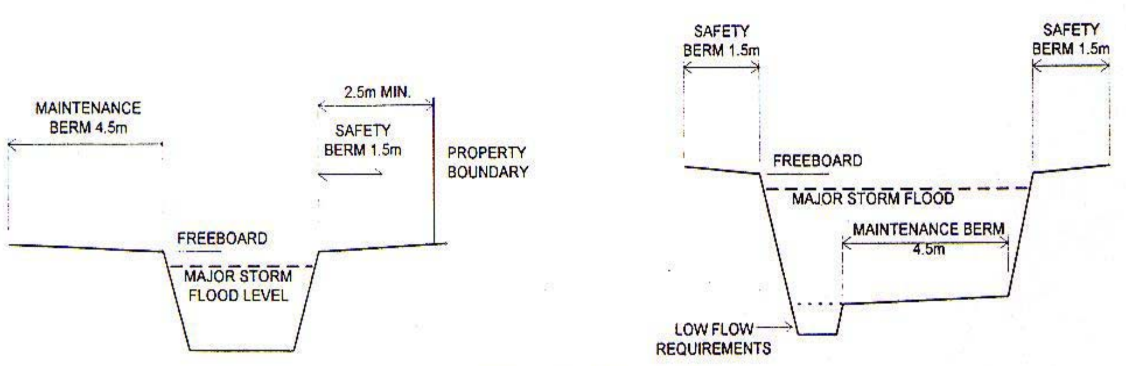


Figure 6.5 – Berms

(k) Rock-filled mattress and gabions may be used as up and down-stream protection.

(l) It is important to note that large vertical drops without a plunge pool create a safety hazard. In turn, plunge pools create a health concern. Designers should be aware of the safety, maintenance and natural environments on which the drop structure will impact.

(m) Designers should be wary of using a "standard" drop structure design for a purpose for which it was not intended, or for a condition in which it has not been tested (Witheridge 1993).

(n) Refer to BCC Stormwater Outlets in Parks and Waterways for design of drop structures and stormwater outlets.

(o) Concrete low flow channels or pipes are to be constructed for catchment areas in excess of 25 hectares. Low flow channels should be designed based on a minimum of $0.01m^3/s$ per hectare of contributing catchment.

(p) The development design may be rejected if it incorporates structures and facilities that:
   (i) require considerable maintenance;
   (ii) are difficult, cumbersome or troublesome to maintain;

(iii) require specialist maintenance services that are not common to Council's maintenance services; or
(iv) are small and numerous, when there is a viable alternative.

(q) The stormwater system will not be accepted off-maintenance or connected to an existing downstream canal or waterway until there has been compliance with all aspects of the approved Stormwater Management Plan including Water Quality Objectives and performance criteria.

(3) *Drainage System Layout*

(a) The drainage system layout is to be generally in accordance with QUDM Section 5.12, however, pipework within the verge is generally not permitted.

(b) Alignments may vary, depending on the location of sewer mains and pits, but should generally be located as follows:
(i) rear boundary within 2.5 metres;
(ii) side boundary within 1.2 metres.

(c) Manholes will not be permitted in road carriageways.

(d) Gully to gully drain lines are acceptable for pipes 600 mm diameter or less provided that the design complies with all the following:
(i) gullies are consistent with Council's adopted standard drawings;
(ii) acute angles in connecting pipes are avoided to minimise head losses;
(iii) potential interference with other utility services on the footpath is avoided;
(iv) The major drainage line (spine) of the gully to gully system is constructed on one side of the road only. Any gullies on the opposite side of the road are to be connected directly across the road. Under no circumstances are spines of gully to gully systems permitted on both sides of the road; and
(v) The gully pit is appropriately benched.

(e) Gully manholes are not considered to be appropriate and are not a preferred solution. However, there are rare instances that gully manholes are necessary. Accordingly, gully manholes may be approved provided that compliance with all of the following is achieved:
(i) the inlet and manhole is at the same point e.g. at the sag of the road;
(ii) it is the only alternative to a multi-grated inlet;
(iii) written advice from the responsible utility authority is submitted, stating that the existing services will preclude the construction of the conventional herringbone drainage pattern without substantial utility service relocation costs;
(iv) Council's standard components such as lintels and grates are to be used wherever possible;
(v) hydraulic analysis and structural testing data are to accompany the design if it is proposed to use alternative components;
(vi) the gully manholes are not to pose a public safety risk; and
(vii) the gully manhole complies with the requirements as detailed in Section 6.12 (6) - Manholes.

(4) *Pipes*

(a) Council will only accept the future ownership and maintenance responsibility of pipes 300mm in diameter or greater.

(b) While Council will approve the use of any structurally sound pipe, prior approval must be sought for the use of any pipe other than steel reinforced (RCP) or fibre reinforced (FRC) concrete pipes. It is Council's preference that FRC pipes be used in locations where the drainage system may be subject to tidal waters.

(c) Rubber ring joint pipes are to be used for all pipes up to and including 600mm diameter and for all pipes in areas of high water table and/or sandy soils.

(d) Service and construction loadings are to be calculated in accordance with AS 3725: *Loads on Buried Concrete Pipes*. In many cases, construction loading will be the critical load case for selection of pipe class. AS 4058: *Precast Concrete Pipes (Pressure and Non-Pressure)* will apply for testing requirements or where standard steel reinforced concrete pipes may be exposed to aggressive conditions.

(e) To counteract premature pipe cracking, the following are required:
   (i) the design and selection of the pipe type and class is to consider construction loading (based upon the calculations described above), which is usually the critical load case for pipes <900 mm diameter;
   (ii) drainage plans issued for construction are required to indicate, for each drain line, the following:
   - pipe type and class.
   - installation type.
   - construction method (layer thickness, compaction plant).

   (iii) design aids available from concrete pipe manufacturers may be used and are recommended. These include software for calculation of loads on pipes to AS 3725, tables and charts. It is recommended that charts showing the relationship between compaction equipment and pipe class are also included with the engineering drawings.
   (iv) no more than two weeks before the on-maintenance inspection and prior to the formal acceptance of on-maintenance, closed circuit television camera (CCTV) inspection is required to demonstrate that the standard of the stormwater system is acceptable to Council. CCTV inspections can be arranged through suitably qualified service providers. Any defects identified by the inspection are to be repaired or replaced or as directed by Council. A follow up camera survey is required to demonstrate that the remediation measures are satisfactory. The CCTV pipe surveys are required to conform to Council's standard inspection and reporting protocols.
   (v) Cracked pipes shall be rejected. Hairline or crazing cracks associated with concrete shrinkage are permitted.

(5) Culverts

(a) Box culverts may be used where low vertical clearances exist or as approved; however, circular sections should be used in urban enclosed drainage systems.

(b) Box sections are to be constructed from precast reinforced concrete box culvert sections.

(c) The minimum dimension of a box culvert is to be 300mm.

(6) Manholes

(a) Manholes are to be designed and constructed in accordance with IPWEA Standard Drawings D-0010 to D-0016 inclusive. Any manholes required outside these standards, must be structurally certified by a Registered Professional Engineer Qld (RPEQ).

(b) Benching is not recommended, however, deflection devices may be used if improved hydraulic efficiency is required. Hydraulic design can be improved if the five principles (a-e) outlined in QUDM Section 5.11.1 are observed. Principles "d" and "e" should be utilised for non-circular or box type access chambers.

(c) Precast manholes are acceptable, as is the use of prefabricated pipe directional changes (mitre bends), provided this overall directional change is not more than 45°.

(d) The spacing of manholes is to be in accordance with QUDM Table 5.11.1.

(e) Where drainage manholes are located in flood-prone areas or where the design hydraulic grade line is above the top of the manhole, bolt down manhole tops are required.

(7) Gully Pits and Catch Pits

(a) Council will permit the following types of gullies or catchpits (or alternative brands that meet the same specifications):
   (i) IPWEA Gully with Cast Iron bicycle-safe Grate Roadway Type, Lip in Line; (Refer IPWEA Standard Drawing D-0063D,Rev D = C.C.C. Revision)
   (ii) Inlets are to be provided with Max Q bicycle-safe grates only fluted grates and concrete filled covers will not be permitted.

(b) Inlet capacity charts for IPWEA are available in QUDM. Designers should use these charts and the appropriate provisions for blockage as set out in QUDM Table 5.10.1.

(c) All gullies or catchpits are to be designed so as to be Lip-in-line (Refer IPWEA Standard Drawings D-0063 and D-0067), except for "anti-ponding" gullies. The minimum outlet pipe for gullies or catchpits is to be 300mm nominal diameter, except for "anti-ponding" gullies where a 300mm diameter pipe may be used.

(d) Allowable flow widths and capacity are as follows:
   (i) multilane roads (with more than one lane travelling in one direction): refer to Section 5.4 of the Queensland Department of Main Roads - Road Drainage Design Manual;
   (ii) sub-arterial roads, trunk collector roads, collector streets and access streets, as defined in Queensland Streets;
   (iii) Intersections on State controlled roads and side streets connecting to State controlled roads (up to the end of the auxiliary lanes or tapers leading onto the state-controlled road) – refer to Section 5.4 of the Queensland Department of Main Roads - Road Drainage Design Manual;
   (iv) other intersections - refer to Clause 5.09 of QUDM.

(e) None of the requirements outlined in (iv) above reduces the depth requirements stipulated elsewhere in these guides.

(f) On rural roads the design flows or ponding in the table drain is not to encroach upon the shoulder for the longitudinal or cross drainage.

(g) For gully pit capture charts refer to Caloundra City Council adopted Standard Drawings.

(8) *Field Inlets and Pipe Outlets*

(a) General Design
   (i) For inlets within, or outlets to, an overland flowpath, the design should generally be in accordance with IPWEA Standard Drawing D-0080. Maintenance and amenity factors should also be considered.

(b) Field Inlets
   (i) Council will permit the following types of field inlets (or alternative brands that meet the same specifications):
      - IPWEA Field Inlet and Overflow Gully;
      - Roadway Type, Lip in Line;
      - (Refer IPWEA Standard Drawing D-0063D;
      - Rev D = C.C.C. Revision).
   (ii) Field inlets (and surcharge pits) are to be designed and constructed in accordance with IPWEA Standard Drawing D-0050. A 50% blockage factor is to be applied during design calculations. When debris is expected, a raised grated inlet is required with a locking device. Further design information is provided in Section 5.10.5 of QUDM;
   (iii) All inlets require a safety grille;
   (iv) The grille should comprise bars or plates on a 1:2 slope with the minimum necessary cross members and shall be hot dipped galvanised;

(v) All inlets and outlets 750mm or larger in diameter (or equivalent section) require a surrounding pool type fence or similar.

(c) Pipe Outlets

(i) Energy dissipaters will generally be required at all outlets to reduce velocity to acceptable levels. Refer to QUDM Table 8.03 for permissible velocities;
Drowned outlets are not to be used without prior approval, except where enclosed drains outlet to a canal;
(ii) For inlet headwalls where the pipe invert is located below the natural channel invert such that a standard field inlet is not warranted (eg the drop is less than the pipe diameter), a masonry "inverted curtain wall" shall be constructed across the headwall apron in preference to stone pitching outside the headwall.
(iii) Refer to BCC Stormwater Outlets in Parks and Waterways for design of drop structures and stormwater outlets.

(9) *Structural Design*

(a) Designers are referred to Section 5.14 of QUDM for the structural design of the enclosed drainage system. Further information on pipe, RCBC bedding and backfilling can be gained from IPWEA Standard Drawings D-0030 and D-0031.

APPENDIX

	WATERBODY CATEGORY								
WATER QUALITY OBJECTIVE	**F1 FRESHWATER UPPER CATCHMENT**	**F2 FRESHWATER MID - LOWER CATCHMENT**	**F3 FRESHWATER MID - LOWER CATCHMENT (Lakes)**	**S1 UPPER ESTUARINE**	**S2 MID-ESTUARINE**	**S3 ENCLOSED COASTAL / LOWER ESTUARY**	**S4 OCEAN / OPEN COASTAL**	**S5 ENCLOSED COASTAL / LOWER ESTUARY**	**S6*** ENCLOSED COASTAL / LOWER ESTUARY (Pumicestone Passage)**
Physical-Chemical Indicators									
Temperature Degrees Celsius ° C	14.2 – 23.0	18.9-23.2	18.9-23.2	18.6-27.5	19.6-27.2	18.7 – 26.0	Ocean 20.0-24.6 Open Coastal 22.7-28.5	18.7 – 26.0	18.7 – 26.0
pH	7.43-8.22	7.26-8.08 7.45-8.37	7.26-8.08 7.45-8.37	7.60-8.07	8.06-8.44	8.13-8.38	Ocean 8.21-8.46 Open Coastal 8.17-8.51	8.13-8.38	8.13-8.38
Conductivity (mS/cm)	0.078 – 0.112	Mary R (244.1km) 0.240-0.388 Mary R (91.0 km) 0.348-0.646	Mary R (244.1km) 0.240-0.388 Mary R (91.0 km) 0.348-0.646	10.28-24.96	37.40-52.70	48.62-55.23	Ocean 53.65-54.45 Open Coastal 53.95-54.73	48.62-55.23	48.62-55.23
Dissolved Oxygen DO* (% saturation)	98-108	84-104 82-102	84-104 82-102	89 - 98	85 - 96	88-95	Ocean 92-98 Open Coastal 93-98	88-95	88-95
Turbidity* (NTU)	1.0-4.0	6.0-18.0	6.0-18.0	5.0-20.0	3.0-5.0	2.0-8.0	Ocean 0-1.0 Open Coastal 0 -3.0	2.0-8.0	2.0-8.0
Secchi Depth* (m)	0.2-0.3	1.0-2.0 0.3-0.8	1.0-2.0 0.3-0.8	0.4	0.4-0.9	0.9-2.0	Ocean 5.0-11.0 Open Coastal 1.2-5.0	0.9-2.0	0.9-2.0
Suspended Solids* (mg/L)	1.0-3.0	1.0-6.0	1.0-6.0	5.0-32.0	4.0-13.0	5.0-17.0	Ocean 1.0-10.0 Open Coastal 4.0-7.0	5.0-17.0	5.0-17.0
Anthropogenic Pollutants (eg man made litter)	No Anthropogenic (man made) material greater than 5mm in any dimension	No Anthropogenic (man made) material greater than 5mm in any dimension	No Anthropogenic (man made) material greater than 5mm in any dimension	No Anthropogenic (man made) material greater than 5mm in any dimension	No Anthropogenic (man made) material greater than 5mm in any dimension	No Anthropogenic (man made) material greater than 5mm in any dimension	No Anthropogenic (man made) material greater than 5mm in any dimension	No Anthropogenic (man made) material greater than 5mm in any dimension	No Anthropogenic (man made) material greater than 5mm in any dimension

Appendix 6.1 – Water Quality Objectives for Caloundra City

	WATERBODY CATEGORY								
WATER QUALITY OBJECTIVE	**F1 FRESHWATER UPPER CATCHMENT**	**F2 FRESHWATER MID - LOWER CATCHMENT**	**F3 FRESHWATER MID - LOWER CATCHMENT (Lakes)**	**S1 UPPER ESTUARINE**	**S2 MID-ESTUARINE**	**S3 ENCLOSED COASTAL / LOWER ESTUARY**	**S4 OCEAN / OPEN COASTAL**	**S5 ENCLOSED COASTAL / LOWER ESTUARY**	**S6*** ENCLOSED COASTAL / LOWER ESTUARY (Pumicestone Passage)**
Nutrients									
Organic Nitrogen OrgN*(ug/NL)	50.0-200.0	280.0-500.0	280.0-500.0	100.0-380.0	50.0-240.0	100.0-200.0	Ocean 50.0-100.0 Open Coastal 50.0-100.0	100.0-200.0	100.0-200.0
Ammonia* NH^4 (ug/NL)	3.0-6.0	6.0-10.0	6.0-10.0	10.0-42.0	10.0-27.0	6.0-13.0	Ocean 8.0-15.0 Open Coastal 6.0-15.0	6.0-13.0	6.0-13.0
Oxidised Nitrogen NOx* (nitrate / nitrite) (ug/NL)	3.0-20.0	1.0-130.0	1.0-130.0	1.0-25.0	2.0-10.0	2.0-4.0	Ocean 1.0-8.0 Open Coastal 1.0-4.0	2.0-4.0	2.0-4.0
Total Nitrogen N* (ug/L)	*320*	*500*	*750*	*470*	*300*	*250*	*120*	*400*	*220*
Dissolved Reactive Phosphorus DRP* (ug/PL)	13.0-22.0	8.0-34.0	8.0-34.0	10.0-21.0	2.0-6.0	5.0-12.0	Ocean 4.0-8.0 Open Coastal 2.0-6.0	5.0-12.0	5.0-12.0
Total Phosphorus TP* (ug/PL)	15.0-35.0	25.0-69.0	25.0-69.0	27.0-60.0	10.0-20.0	18.0-32.0	Ocean 9.0-30.0 Open Coastal 8.0-20.0	18.0-32.0	18.0-32.0

Appendix 6.1 (Cont…) – Water Quality Objectives for Caloundra City

	WATERBODY CATEGORY								
WATER QUALITY OBJECTIVE	**F1 FRESHWATER UPPER CATCHMENT**	**F2 FRESHWATER MID - LOWER CATCHMENT**	**F3 FRESHWATER MID - LOWER CATCHMENT (Lakes)**	**S1 UPPER ESTUARINE**	**S2 MID-ESTUARINE**	**S3 ENCLOSED COASTAL / LOWER ESTUARY**	**S4 OCEAN / OPEN COASTAL**	**S5 ENCLOSED COASTAL / LOWER ESTUARY**	**S6*** ENCLOSED COASTAL / LOWER ESTUARY (Pumicestone Passage)**
Biological Indicators									
Chl - a* (ug/L)	0.6-1.7	2.8-9.0	2.8-9.0	1.0-5.7	0.7-2.9	1.1-2.9	Ocean 0.3-1.3 Open Coastal 0.3-1.0	1.1-2.9	1.1-2.9
Microbiological (organisms / 100mL)	Median <150 faecal coliforms or <35 enterococci	Median < 150 faecal coliforms or <35 enterococci	Median <150 faecal coliforms or <35 enterococci	Median < 150 faecal coliforms or <35 enterococci	Median <150 faecal coliforms or <35 enterococci	Median <150 faecal coliforms or <35 enterococci	Median <150 faecal coliforms or <35 enterococci	Median <150 faecal coliforms or <35 enterococci	Most probable number (MPN) of Coliforms < 14/100mL. No more than 10% of samples > 43MPN/100mL=
Delta 15 Nitrogen** (parts per thousand) Data to be added from Currimundi and Mooloolah River reports								N/A	<4
Nuisance organisms	Algae <20,000 cells/mL. No excessive macrophyte growth	No excessive macrophyte growth	Algae <20,000 cells/mL. No excessive macrophyte growth	No excessive macrophyte growth	Algae <20,000 cells/mL. No excessive macrophyte growth	Algae <20,000 cells/Ml. No excessive macrophyte growth	Algae <20,000 cells/mL. No excessive macrophyte growth	Algae <20,000 cells/mL. No excessive macrophyte growth	Algae <20,000 cells/mL. No excessive macrophyte growth
Visual Indicators									
Colour	<10 points change on Munsell scale	< 10 points change on Munsell scale	<10 points change on Munsell scale	< 10 points change on Munsell scale	<10 points change on Munsell scale	<10 points change on Munsell scale	<10 points change on Munsell scale	<10 points change on Munsell scale	<10 points change on Munsell scale
Surface films	Oils and petrochemicals not visible nor detectable by odour	Oils and petrochemicals not visible nor detectable by odour	Oils and petrochemicals not visible nor detectable by odour	Oils and petrochemicals not visible nor detectable by odour	Oils and petrochemicals not visible nor detectable by odour	Oils and petrochemicals not visible nor detectable by odour	Oils and petrochemicals not visible nor detectable by odour	Oils and petrochemicals not visible nor detectable by odour	Oils and petrochemicals not visible nor detectable by odour

Appendix 6.1 (Cont….) – Water Quality Objectives for Caloundra City

WATER QUALITY OBJECTIVE	WATERBODY CATEGORY								
	F1 FRESHWATER UPPER CATCHMENT	**F2 FRESHWATER MID - LOWER CATCHMENT**	**F3 FRESHWATER MID - LOWER CATCHMENT (Lakes)**	**S1 UPPER ESTUARINE**	**S2 MID-ESTUARINE**	**S3 ENCLOSED COASTAL / LOWER ESTUARY**	**S4 OCEAN / OPEN COASTAL**	**S5 ENCLOSED COASTAL / LOWER ESTUARY**	**S6*** ENCLOSED COASTAL / LOWER ESTUARY (Pumicestone Passage)**
Metal Toxicants in Sediments									
Aluminium Al %									
Arsenic As mg/kg									
B mg/kg									
Calcium Ca mg/kg									
Cadmium Cd mg/kg	0.5-1.5	0.5-1.5	0.5-1.5	0.5-1.5	0.5-1.5	0.5-5.0	0.5-5.0	0.5-5.0	0.5-5.0
Chromium Cr mg/kg	15.0-240.0	15.0-240.0	15.0-240.0	30.0-95.0	30.0-95.0	60.0-100.0	60.0-100.0	60.0-100.0	60.0-100.0
Copper Cu %	10.0-64.0	10.64.0	10.0-64.0	5.0-23.0	5.0-23.0	16.0-23.0	16.0-23.0	16.0-23.0	16.0-23.0
Iron Fe mg/kg									
Mercury Hg mg/kg									
Potassium K mg/kg									
Manganese Mg mg/kg									
Molinium Mo mg/kg									
Na mg/kg									
Nickel Ni mg/kg	5.0-40.0	5.0-40.0	5.0-40.0	5.0-23.0	5.0-23.0	15.0-20.0	15.0-20.0	15.0-20.0	15.0-20.0
Phosphorus P mg/kg									

Appendix 6.1 (Cont…) – Water Quality Objectives for Caloundra City

	WATERBODY CATEGORY								
WATER QUALITY OBJECTIVE	**F1 FRESHWATER UPPER CATCHMENT**	**F2 FRESHWATER MID - LOWER CATCHMENT**	**F3 FRESHWATER MID - LOWER CATCHMENT (Lakes)**	**S1 UPPER ESTUARINE**	**S2 MID-ESTUARINE**	**S3 ENCLOSED COASTAL / LOWER ESTUARY**	**S4 OCEAN / OPEN COASTAL**	**S5 ENCLOSED COASTAL / LOWER ESTUARY**	**S6*** ENCLOSED COASTAL / LOWER ESTUARY (Pumicestone Passage)**
Metal Toxicants in Sediments									
Lead Pb mg/kg	5.0-20.0	5.0-20.0	5.0-20.0	5.0-13.0	5.0-13.0	5.0	5.0	5.0	5.0
Selenium Se mg/kg									
Zinc Zn mg/kg	30.0-120.0	30.0-120.0	30.0-120.0	37.0-110.0	37.0-110.0	50.0-100.0	50.0-100.0	50.0-100.0	50.0-100.0

Appendix 6.1 (Cont...) – Water Quality Objectives for Caloundra City

WATER QUALITY OBJECTIVE	WATERBODY CATEGORY								
	F1 FRESHWATER UPPER CATCHMENT	**F2 FRESHWATER MID - LOWER CATCHMENT**	**F3 FRESHWATER MID - LOWER CATCHMENT (Lakes)**	**S1 UPPER ESTUARINE**	**S2 MID-ESTUARINE**	**S3 ENCLOSED COASTAL / LOWER ESTUARY**	**S4 OCEAN / OPEN COASTAL**	**S5 ENCLOSED COASTAL / LOWER ESTUARY**	**S6*** ENCLOSED COASTAL / LOWER ESTUARY (Pumicestone Passage)**
Metal Toxicants in Biota									
Aluminium Al %				Hairy Mussel Sydney Rock Oyster	29.0-52.0 (Median = 37.0)				
Antimony ug/L									
Arsenic As mg/kg				Hairy Mussel Sydney Rock Oyster	14.0-25.0 (Median = 19.0)				
B mg/kg									
Calcium Ca mg/kg									
Cadmium Cd mg/kg				Hairy Mussel Sydney Rock Oyster	730.0-1570.0 (Median = 1020.0)				
Chromium Cr mg/kg				Hairy Mussel	1.7-16.4 (Median = 3)				
Cobalt				Hairy Mussel	780-1710 (Median = 1040.0)				
Copper Cu %				Hairy Mussel	6.6-9.0 (Median = 7.7)				
Iron Fe mg/kg				Hairy Mussel	270.0-680.0 (Median = 400)				
Mercury Hg ug/L				Hairy Mussel	22.0-36.0 (Median =29)				
Potassium K mg/kg									
Manganese Mg mg/kg				Hairy Mussel	13.0-20.0 (Median = 16.0)				
Molybdenum Mo ug/L				Hairy Mussel	700.0-1910.0 (Median = 1080.0)				
Na mg/kg									
Nickel Ni mg/kg				Hairy Mussel	3.6-11.3 (Median = 6.6)				
Phosphorus P mg/kg									

Appendix 6.1 (Cont…) – Water Quality Objectives for Caloundra City

WATER QUALITY OBJECTIVE	F1 FRESHWATER UPPER CATCHMENT	F2 FRESHWATER MID - LOWER CATCHMENT	F3 FRESHWATER MID - LOWER CATCHMENT (Lakes)	S1 UPPER ESTUARINE	S2 MID-ESTUARINE	S3 ENCLOSED COASTAL / LOWER ESTUARY	S4 OCEAN / OPEN COASTAL	S5 ENCLOSED COASTAL / LOWER ESTUARY	S6*** ENCLOSED COASTAL / LOWER ESTUARY (Pumicestone Passage)
Metal Toxicants in Biota (Hairy Mussel - Trichomya hirsutus)									
Lead Pb ug/L				280.0-620.0 (Median = 430)				5.0	5.0
Selenium Se mg/kg				4.4-6.3 (Median = 5.2)					
Titanium mg/L				3.1-8.3 (Median = 5.5)					
Vanadium mg/L				2.4-7.7 (Median= 3.7)					
Zinc Zn mg/kg				80-120 (Median = 100.0)				50.0-100.0	50.0-100.0
Hydrocarbons									

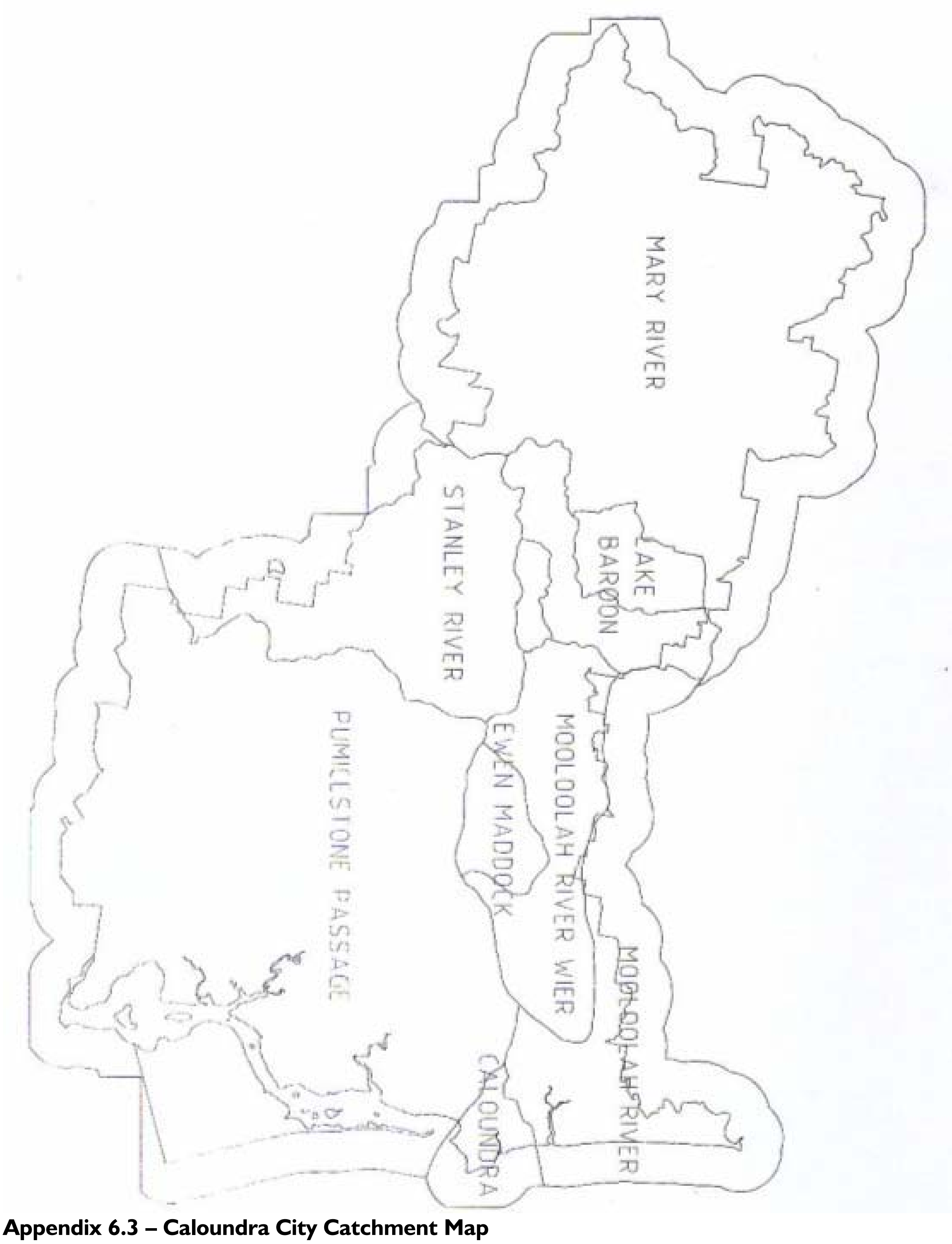
Appendix 6.1 (Cont…) – Water Quality Objectives for Caloundra City

*For these parameters, compliance will be determined by comparing the median value of monthly samples over a running six month period.
** Delta 15 nitrogen is an indicator of the presence of sewage nitrogen, which is a significant contributor to the overall nitrogen load in Moreton Bay.
*** S6 WQOs have been obtained from the SEQ regional Water Quality Management Strategy, and are interim only. The range of WQO parameters will be expanded as more research is carried out.
= This WQO is intended to protect the consumers of aquatic food obtained from the Passage.

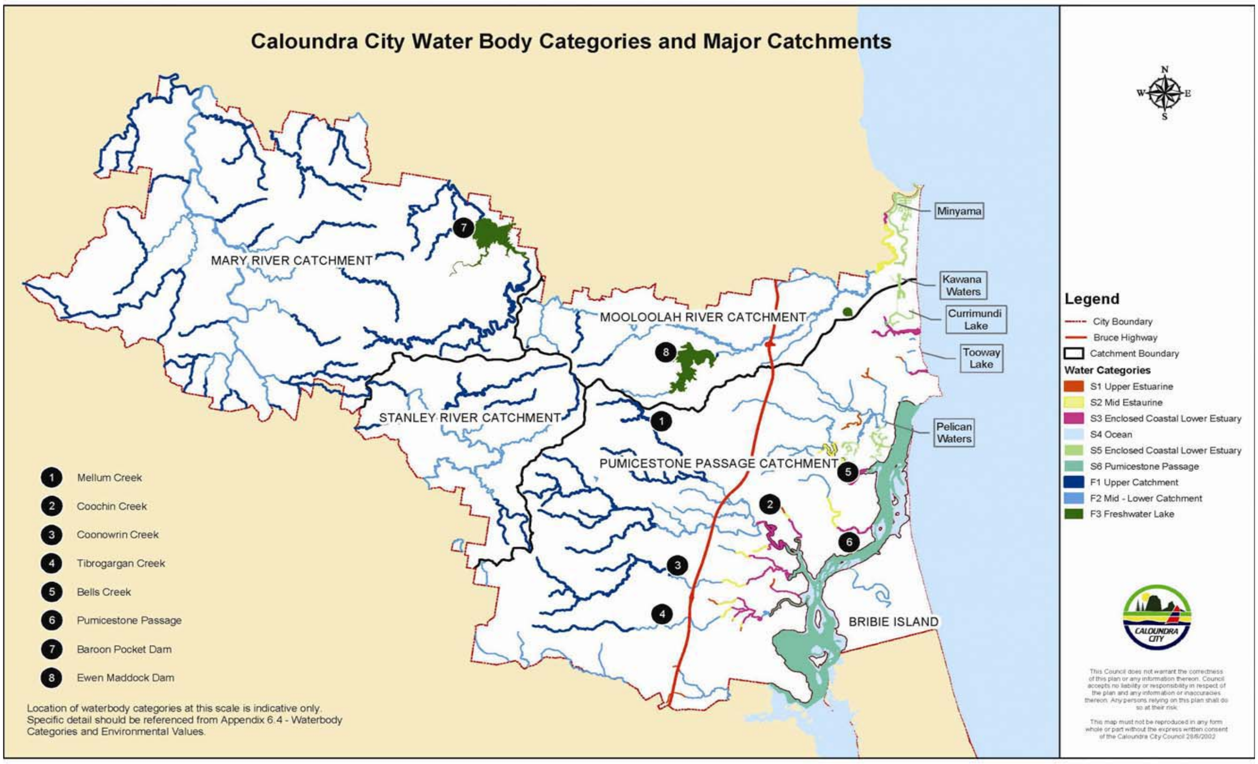
This table is based upon the range of reference values between the 20th and 80th percentiles of key reference sites in south-east Queensland catchments and waterways. The variability highlights changes in the natural and unmodified ecosystems. More modified and urbanised catchments and waterways will typically fall outside of these reference values.

F1 Freshwater Upper Catchment Use Coomera River (72 km)	**S1 Upper Estuarine** Use Noosa River (26 km)	**S4 Marine/Open Coastal** Use Southern Broadwater Use Cleveland Bay
F2 Freshwater Mid to Lower Catchment Use Mary River (244 km) Use Mary River (91 km)	**S2 Mid-Estuarine** Use Noosa River (5.3 km)	**S5 Constructed Coastal Waterways and Lakes** Use S3 Reference Values
F3 Freshwater Lakes Use F2 Reference Values	**S3 Enclosed and Partially Enclosed Marine** Use Noosa River (2.3 km) Use Pumicestone Passage	**S6 Pumicestone Passage** Use Pumicestone Passage

Appendix 6.2 - Key to Waterbody Category and QWQ Reference Values:



Appendix 6.3 – Caloundra City Catchment Map



Appendix 6.4 – Caloundra City Waterbody Categories and Major Catchments

RAINFALL INTENSITY FOR CALOUNDRA							
DURATION	AVERAGE RECURRANCE INTERVAL						
(MINS)	1 Yr m m/hr	2 Yr m m/hr	5 Yr m m/hr	10 Yr m m/hr	20 Yr m m/hr	50 Yr m m/hr	100 Yr m m/hr
5.0	129	163	201	221	250	287	316
5.5	125	158	195	214	242	278	306
6.0	121	153	189	207	235	270	297
6.5	117	149	184	201	228	263	289
7.0	114	145	179	196	222	256	281
7.5	111	141	175	191	216	250	274
8.0	109	138	170	187	211	244	268
8.5	106	134	166	182	206	238	262
9.0	104	131	162	178	202	233	256
9.5	101	128	159	174	198	228	251
10.0	99	126	156	171	194	224	246
10.5	97	123	153	168	190	219	241
11.0	95	121	150	165	187	215	237
11.5	93	119	147	162	182	211	233
12.0	92	117	144	159	178	208	229
12.5	90	115	141	156	176	204	225
13.0	89	113	139	153	174	201	221
13.5	87	111	137	151	171	197	217
14.0	86	109	135	149	168	194	214
14.5	84	107	133	146	165	191	211
15.0	83	106	131	144	163	189	208
15.5	82	104	129	142	161	186	205
16.0	81	103	127	140	159	184	202
16.5	80	101	125	138	156	181	199
17.0	79	100	124	136	154	178	197
17.5	77	98	122	134	152	176	194
18.0	76	97	120	133	151	174	192
18.5	75	95	118	131	149	172	189
19.0	74	94	117	129	147	170	187
19.5	73	93	116	127	145	168	185
20.0	73	92	115	126	143	166	183
21.0	71	90	112	123	140	162	179
22.0	69	88	109	120	137	158	175
23.0	68	86	107	117	134	155	171
24.0	66	84	105	115	131	152	167
25.0	65	83	103	113	128	149	164
26.0	64	81	101	111	126	146	161
27.0	63	79	99	109	124	143	158
28.0	61	77	97	107	122	140	155
29.0	60	76	95	105	120	138	152
30	59	75	94	104	118	136	150
35	55	69	87	96	109	126	139
40	51	65	81	89	101	118	130
45	47.7	61	76	84	95	111	122
50	45.0	57	72	79	90	105	115
55	42.6	54	68	75	86	99	110
60	40.6	52	65	72	82	95	105
75	35.1	44.5	56	62	71	83	92
90	31.2	39.8	50	56	64	74	82
120	25.7	32.9	41.6	46.3	53	62	69
3 hr	19.6	25.1	31.9	35.6	40.9	47.8	53.1
4 hr	16.1	20.7	26.4	29.6	34.0	39.9	44.4
5 hr	13.9	17.8	22.8	25.6	29.5	34.6	38.6
6 hr	12.3	15.8	20.3	22.7	26.2	30.8	34.4
8 hr	10.1	13.0	16.8	18.9	21.8	25.7	28.7
10 hr	8.69	11.2	14.5	16.4	18.9	22.3	25.0
12 hr	7.69	9.94	12.9	14.6	16.8	19.9	22.3
16 hr	6.54	8.48	11.1	12.6	14.7	17.4	19.6
20 hr	5.76	7.49	9.90	11.3	13.1	15.7	17.7
24 hr	5.19	6.77	8.99	10.3	12.0	14.4	16.3
36 hr	4.09	5.36	7.23	8.33	9.81	11.8	13.4
48 hr	3.43	4.51	6.15	7.12	8.43	10.2	11.6
72 hr	2.62	3.47	4.81	5.63	6.71	8.20	9.39

RAINFALL INTENSITY FOR GLASS HOUSE MOUNTAINS							
DURATION	AVERAGE RECURRANCE INTERVAL						
(MINS)	1 Yr m m/hr	2 Yr m m/hr	5 Yr m m/hr	10 Yr m m/hr	20 Yr m m/hr	50 Yr m m/hr	100 Yr m m/hr
5.0	124	157	194	214	243	281	310
5.5	120	152	188	207	235	272	301
6.0	116	147	182	201	228	264	292
6.5	113	143	177	195	222	257	284
7.0	110	139	172	190	216	250	276
7.5	107	135	168	185	211	244	269
8.0	104	132	164	181	206	238	263
8.5	101	129	160	177	201	233	257
9.0	99	126	157	173	197	228	252
9.5	97	123	153	169	192	223	247
10.0	95	121	150	166	188	219	242
10.5	93	118	147	162	184	214	237
11.0	91	116	144	159	181	210	233
11.5	89	114	141	156	178	206	228
12.0	88	112	139	154	175	203	224
12.5	86	110	136	151	172	199	220
13.0	85	108	134	148	169	196	217
13.5	83	106	132	146	166	193	213
14.0	82	105	130	144	164	190	210
14.5	81	103	128	141	161	187	207
15.0	80	101	126	139	159	184	204
15.5	78	99	124	137	156	181	201
16.0	77	98	123	135	154	179	198
16.5	76	97	121	133	152	176	195
17.0	75	96	119	132	150	174	193
17.5	74	94	117	130	148	172	190
18.0	73	93	116	128	146	170	188
18.5	72	92	114	126	144	168	185
19.0	71	91	113	124	142	166	183
19.5	70	90	111	123	140	164	181
20.0	70	89	110	122	139	162	179
21.0	68	87	107	119	136	158	175
22.0	66	85	105	116	133	155	171
23.0	64	83	103	113	130	152	167
24.0	63	81	101	111	128	149	164
25.0	62	79	99	109	125	146	161
26.0	61	77	97	107	122	143	158
27.0	60	75	95	105	120	140	155
28.0	59	74	93	103	118	137	152
29.0	58	73	91	101	116	135	149
30	57	72	90	100	114	133	147
35	52	67	83	93	106	123	137
40	48.6	62	78	86	99	115	127
45	45.6	58	73	81	93	108	120
50	43.0	55	69	77	88	102	113
55	40.7	52	65	73	83	97	108
60	38.8	49.6	62	69	79	93	103
75	33.6	43.1	55	61	70	82	91
90	29.9	38.4	48.9	55	63	74	83
120	24.7	31.9	41.0	46.1	53	63	71
3 hr	18.9	24.5	31.9	36.2	42.1	50	56
4 hr	15.6	20.3	26.7	30.4	35.6	42.5	48.0
5 hr	13.4	17.5	23.4	26.6	31.2	37.5	42.4
6 hr	11.9	15.5	20.8	23.8	28.0	33.8	38.3
8 hr	9.81	12.9	17.4	20.1	23.7	28.7	32.6
10 hr	8.46	11.1	15.1	17.5	20.8	25.3	28.8
12 hr	7.49	9.89	13.5	15.7	18.7	22.8	26.1
16 hr	6.40	8.44	11.5	13.4	15.9	19.4	22.2
20 hr	5.66	7.46	10.2	11.8	14.0	17.1	19.5
24 hr	5.11	6.74	9.18	10.7	12.6	15.4	17.6
36 hr	4.06	5.34	7.26	8.41	9.97	12.1	13.8
48 hr	3.42	4.49	6.09	7.06	8.36	10.2	11.6
72 hr	2.63	3.46	4.68	5.41	6.40	7.76	8.84

RAINFALL INTENSITY FOR MALENY							
DURA TION	AVERAGE RECURRANCE INTERVAL						
(MINS)	1 Yr m m/hr	2 Yr m m/hr	5 Yr m m/hr	10 Yr m m/hr	20 Yr m m/hr	50 Yr m m/hr	100 Yr m m/hr
5.0	121	154	191	211	240	278	308
5.5	117	149	185	204	232	269	297
6.0	114	145	179	198	225	261	288
6.5	110	141	174	192	219	254	280
7.0	107	137	170	187	213	247	273
7.5	104	133	165	182	208	241	266
8.0	102	130	161	178	203	235	260
8.5	99	127	157	174	198	230	254
9.0	97	124	154	170	194	225	249
9.5	95	121	151	166	190	220	243
10.0	93	119	148	163	186	215	238
10.5	91	116	145	160	182	211	233
11.0	90	114	142	157	179	207	229
11.5	88	112	139	154	175	203	225
12.0	86	110	137	151	172	200	221
12.5	84	108	134	148	169	196	217
13.0	83	106	132	146	166	193	214
13.5	82	104	130	143	163	190	210
14.0	81	103	128	141	161	187	207
14.5	79	101	126	139	158	184	204
15.0	78	99	124	137	156	181	201
15.5	77	98	122	135	154	178	198
16.0	76	97	120	133	152	176	195
16.5	75	95	118	131	150	173	192
17.0	74	94	117	129	148	171	190
17.5	73	92	115	127	146	169	187
18.0	72	91	114	126	144	167	185
18.5	71	90	112	124	142	165	182
19.0	70	89	111	123	140	163	180
19.5	69	88	109	121	138	161	178
20.0	68	87	108	120	137	159	174
21.0	66	85	105	117	134	155	172
22.0	65	83	103	114	131	152	168
23.0	63	81	101	112	128	149	164
24.0	62	79	99	110	125	146	161
25.0	61	78	97	108	123	143	158
26.0	60	76	95	106	120	140	155
27.0	59	75	93	104	118	137	152
28.0	58	73	91	102	116	134	149
29.0	57	72	90	100	114	132	146
30	56	71	89	98	112	130	144
35	51	65	82	91	103	120	133
40	47.7	61	76	84	96	112	124
45	44.7	57	71	79	90	105	116
50	42.2	54	67	75	85	99	110
55	40.0	51	61	68	77	94	105
60	38.1	48.6	61	68	77	90	100
75	33.7	43.1	54	61	70	81	91
90	30.5	39.1	49.7	56	64	75	83
120	25.9	33.4	42.9	48.2	56	66	73
3 hr	20.6	26.7	34.7	39.3	45.7	54	61
4 hr	17.5	22.7	29.9	34.1	39.8	47.5	54
5 hr	15.4	20.1	26.6	30.4	35.7	42.8	48.4
6 hr	13.9	18.1	24.2	27.8	32.7	39.3	44.6
8 hr	11.8	15.5	20.9	24.1	28.4	34.4	39.1
10 hr	10.4	13.7	18.6	21.5	25.5	31.0	35.4
12 hr	9.37	12.4	16.9	19.7	23.4	28.5	32.6
16 hr	7.94	10.5	14.5	16.9	20.2	24.7	28.3
20 hr	6.98	9.25	12.8	15.0	18.0	22.0	25.3
24 hr	6.27	8.33	11.6	13.6	16.3	20.1	23.1
36 hr	4.92	6.56	9.23	10.9	13.1	16.2	18.8
48 hr	4.10	5.49	7.78	9.23	11.2	13.9	16.1
72 hr	3.12	4.20	60.2	7.19	8.74	10.9	12.7

Appendix 6.5 – Intensity Frequency Duration (IFD) for Caloundra, Glass House Mountains and Maleny

DEVELOPMENT CATEGORY	C_{10}	f_i
Central Business	0.90	1.00
Commercial and Industrial	0.88	0.90
Significant Paved Areas e.g. Roads and Carparks	0.88	0.90
Urban Residential - High Density	0.88	0.90
Urban Residential - Low Density (Including Roads) Average Lot < 650 m^2 ≥ 650 m^2	 0.82 0.76	 0.60 0.30
Urban Residential - Low Density (Excluding Roads) Average Lot < 650 m^2 ≥ 650 m^2	 0.81 0.75	 0.55 0.25
Rural or Rural Residential	0.74	0.20
Open Space & Parks, etc.	0.70	0.00

Appendix 6.6 - C_{10} vs Development Category

Waterbody Category		Description	Interim Environmental Values
Saline:			
S1	***Upper Estuarine***	Applies to the most upstream extent of an estuary where there is very limited natural flushing during dry weather. Except for larger waterways these reaches are usually dead ends in dry conditions and consequently exhibit poorer water quality than the better flushed downstream estuarine reaches.	▪ Protection of aquatic ecosystems ▪ Secondary contact recreation
S2	***Mid-Estuarine***	Middle estuarine waters which include freshwater tidal zones. Located between upper estuarine reaches which display very little natural flushing and downstream estuarine reaches which exchange with marine waters on every tide.	▪ Protection of aquatic ecosystems ▪ Primary contact recreation
S3	***Enclosed Coastal/Lower Estuary) Enclosed and Partially Enclosed Marine***	Coastal waters with reduced influence and / or exchange with ocean waters. Category includes the following zones: ▪ the most downstream reaches of estuaries (the estuarine zone which exchanges with coastal waters on every tide) ▪ naturally occurring saline lakes with limited flushing / exchange and marine based ecosystems – e.g. Lakes Tooway and Currimundi.	▪ Protection of aquatic ecosystems ▪ Primary contact recreation
S4	***Ocean/Open Coastal (Marine / Open Coastal)***	Coastal waters that are strongly influenced by and have large exchange with oceanic waters.	▪ Protection of aquatic ecosystems ▪ Primary contact recreation
S5	***Enclosed Coastal/Lower Estuary (Constructed Coastal Waterways and Lakes)***	Constructed or highly modified coastal waterbodies with reduced tidal exchange. Are often situated in urban areas and may display residential / commercial frontage. Examples include Pelican Waters, Kawana Waters and Birtinya Lake.	▪ Protection of receiving waters ▪ Primary contact recreation
S6	***Pumicestone Passage***	Special category which recognises the regional significance of Pumicestone Passage. (defined as the body of water located between Bribie Island and the coast proper).	▪ Protection of aquatic ecosystems ▪ Primary contact recreation
Freshwater:			
F1	***Upper Catchment***	Streams in upper catchment areas with extensive riffles and a predominantly stony or sandy substrate. Usually display heavily incised channels with a relatively steep grade and few meanders.	▪ Protection of aquatic ecosystems ▪ Primary contact recreation
F2	***Mid to Lower Catchment***	Streams with reduced riffles, larger pools and significant areas of muddy substrate. Usually located on a flood plain or just upstream of a flood plain, displaying relatively broad meandering channels with moderate grade. This category also includes smaller streams of shorter length located near coastal reaches.	▪ Protection of aquatic ecosystems ▪ Secondary contact recreation
F3	***Freshwater Lakes***	Enclosed waterbodies (both natural and constructed) displaying freshwater conditions with limited water exchange / flushing.	▪ Protection of aquatic ecosystems ▪ Primary contact recreation

Appendix 6.7– Description of Waterbody Categories and Related Environmental Values

Sediment - On sites > 1ha, sediment basins are to be designed in accordance with Brisbane City Council's *Sediment Basin Design, Construction and Maintenance Guidelines*. For all storms within the design range of the sediment basin, an upper discharge limit of 50mg/L total suspended solids is to be maintained.
Gross Pollutants - 100% capture of all gross pollutants >5mm for storm events <Q 3month ARI.
pH - pH must be maintained between 6.5 and 8.5 at all times.

Appendix 6.8 – Best Practice Discharge Guidelines (Construction Stage)

1. No net increase in the annual pollutant loads of key pollutants when the load from the existing (pre-development) land use is compared with the proposed (post-development) land use.
OR
2. Where the existing land use and / or proposed land use is more disturbed / intense than rural residential, then the following load reduction targets must be achieved for the annual pollutant loads from the proposed land use of the developed site. (i) 80% reduction in coarse sediment (< 0.5mm); (ii) 50% reduction in fine sediment (TSS) (<0.1mm); (iii) 50% reduction in total nitrogen; (iv) 50% reduction in total phosphorus; (v) 100% reduction in gross pollutants sized 5mm or larger for storm events <Q 3month ARI.

Appendix 6.9 – Best Practice Impact Reduction Guidelines (Operational Stage)

The following Load Based Reduction targets must be achieved for the annual pollutant loads when comparing the developed site (unmitigated) to the developed site (mitigated). ♦ TSS – 70% ♦ TN – 50% ♦ TP – 50%

Appendix 6.10 – Load Based Reduction (Operational Phase)

(Note this is a guide only and each case will require site-specific assessment to determine suitable species type and quantity)

Scientific Name	Common Name	Salt tolerance	Zone
Trees			
Callistemon viminalis	Weeping bottlebrush	Unknown	Terrestrial
Casuarina glauca	Swamp oak	Moderate	Terrestrial
Eucalyptus robusta	Swamp mahogany	Unknown	Terrestrial
Glochidion ferdinandii	Cheese tree	Unknown	Terrestrial
Hibiscus diversifolius	Swamp hibiscus	Unknown	Terrestrial
Hibiscus tiliaceus	Cotton tree	Moderate	Terrestrial
Lophostemon suaveolens	Swamp box	Unknown	Terrestrial
Melaleuca bracteata	River tea-tree	Unknown	Terrestrial
Melaleuca linariifolia	Flaxleaf paperbark	Unknown	Terrestrial/ Ephemeral marsh
Melaleuca nodosa	Prickly-leaved paperbark	Unknown	Terrestrial
Melaleuca quinquenervia	Broad-leaved paperbark	Moderate	Terrestrial/ Ephemeral marsh
Shrubs			
Austromyrtus dulcis	Midyim	Unknown	Terrestrial
Babingtonia similis	Baeckea	Unknown	Terrestrial
Baeckea frutescens	Weeping baeckea	Unknown	Terrestrial
Banksia aemula	Wallum banksia	Unknown	Terrestrial
Banksia integrifolia	Coastal banksia	Unknown	Terrestrial
Banksia oblongifolia	Dwarf wallum banksia	Unknown	Terrestrial
Banksia robur	Broad-leaved banksia	Unknown	Terrestrial
Boronia falcifolia	Wallum boronia	Unknown	Terrestrial
Boronia parviflora	Swamp boronia	Unknown	Terrestrial
Callistemon pachyphyllus	Wallum bottlebrush	Unknown	Terrestrial
Leptospermum juniperinum	A tea-tree	Unknown	Terrestrial
Leptospermum liversidgei	A tea-tree	Unknown	Terrestrial
Leptospermum polygalifolium	A tea-tree	Unknown	Terrestrial
Leptospermum semibaccatum	A tea-tree	Unknown	Terrestrial
Leptospermum trinervium	A tea-tree	Unknown	Terrestrial
Leptospermum whitei	A tea-tree	Unknown	Terrestrial
Melaleuca alternifolia	Paperbark tea-tree	Unknown	Terrestrial
Melaleuca thymifolia	Thyme-leaved paperbark	Unknown	Terrestrial
Melastoma affine	Blue tongue	Unknown	Terrestrial

Appendix 6.11 – Plants Suitable for Constructed Wetlands in Caloundra City

Scientific Name	Common Name	Salt tolerance	Zone
Ferns			
Acrostichum speciosum	Mangrove fern	Moderate	Terrestrial/ Ephemeral marsh
Blechnum indicum	Swamp water fern	Unknown	Terrestrial/ Ephemeral marsh
Todea Barbara	Southern king fern	Unknown	Terrestrial/ Ephemeral marsh
Sedges, Rushes, Grasses, Herbs and Lilies			
Bacopa monnieri	Bacopa	Unknown	Terrestrial
Crinum pedunculatum	Swamp lily	Moderate	Terrestrial/ Ephemeral marsh
Cyperus exaltatus	Tall flat sedge	Moderate	Terrestrial/ Ephemeral marsh/ Shallow marsh
Cyperus haspan		Unknown	Terrestrial/ Ephemeral marsh
Cyperus lucidus		Unknown	Terrestrial/ Ephemeral marsh
Cyperus pilosus		Unknown	Terrestrial/ Ephemeral marsh
Cyperus procerus		Unknown	Terrestrial/ Ephemeral marsh
Cyperus trinervis		Unknown	Terrestrial/ Ephemeral marsh
Diplachne fusca	Brown beetle grass	Moderate	Terrestrial/ Ephemeral marsh/ Shallow marsh
Echinochloa inundata	Marsh millet	Unknown	Terrestrial/ Ephemeral marsh
Eleocharis cylindrostachys		Unknown	Terrestrial/ Ephemeral marsh/ Shallow marsh
Eriocaulon scariosum		Unknown	Terrestrial/ Ephemeral marsh
Gahnia sieberiana	Red-fruited sawsedge	Moderate	Terrestrial/ Ephemeral marsh
Juncus continuus		Unknown	Terrestrial/ Ephemeral marsh
Juncus polyanthemus		Low	Terrestrial/ Ephemeral marsh
Juncus prismatocarpus	Branching rush	Unknown	Terrestrial/ Ephemeral marsh
Juncus usitatus	Common rush	Low	Terrestrial/ Ephemeral marsh
Lepidosperma longitudinale	Pithy sword sedge	Low	Terrestrial/ Ephemeral marsh
Ludwigia octovalvis	Willow primrose	Unknown	Terrestrial
Lomandra hystrix	Stream matrush	Unknown	Terrestrial
Lomandra longifolia	Long-leaved matrush	Unknown	Terrestrial
Sporobolus virginicus	Salt couch	High	Terrestrial/ Ephemeral marsh

Appendix 6.11 (Cont…) – Plants Suitable for Constructed Wetlands in Caloundra City

Scientific Name	Common Name	Salt tolerance	Zone
Emergents, submerged and floating aquatics			
Baumea articulata	Jointed twigrush	Low	Shallow marsh/ Deep marsh
Baumea rubiginosa	Soft twigrush	Moderate	Ephemeral marsh
Baumea teretifolia		Unknown	Ephemeral marsh/ Shallow marsh
Bolboschoenus fluviatilis	March clubrush	Moderate	Shallow marsh/ Deep marsh
Carex fascicularis	Tassel sedge	Low	Ephemeral marsh
Cyperus difformis	Rice sedge	Unknown	Ephemeral marsh/ Shallow marsh
Cyperus platystylis		Unknown	Ephemeral marsh
Cyperus polystachyos	Bunchy sedge	Unknown	Ephemeral marsh
Cyperus unioloides		Unknown	Shallow marsh
Eleocharis dulcis	Chinese water chestnut	Low	Shallow marsh
Eleocharis equisetina		Low	Shallow marsh
Eleocharis sphacelata	Tall spikerush	Low	Shallow marsh/ Deep marsh
Eleocharis plana	Ribbed spikerush	Unknown	Ephemeral marsh/ Shallow marsh
Fimbristylis dichotoma	Common fringerush	Unknown	Ephemeral marsh
Isolepis inundata	Swamp club rush	Unknown	Ephemeral marsh
Juncus kraussii	Sea rush	High	Terrestrial/ Ephemeral marsh
Leersia hexandra	Swamp ricegrass	Unknown	Ephemeral marsh/ Shallow marsh/ Deep marsh
Lepironia articulata	Grey reed	Low	Shallow marsh/ Deep marsh
Ludwigia peploides subsp. montevidensis	Water primrose	Low	Ephemeral marsh/ Shallow marsh
Marsilea mutica	Nardoo	Low	Ephemeral marsh/ Shallow marsh
Monochoria cyanea	Monochoria	Unknown	Shallow marsh
Nymphaea gigantea	Giant waterlily	Unknown	Shallow marsh/ Deep marsh
Nymphoides crenata	Wavy marshwort	Unknown	Shallow marsh/ Deep marsh

Appendix 6.11 (Cont…) – Plants Suitable for Constructed Wetlands in Caloundra City

Scientific Name	Common Name	Salt tolerance	Zone
Nymphoides indica	Water snowflake	Unknown	Shallow marsh/ Deep marsh
Ottelia ovalifolia	Swamp lily	Unknown	Shallow marsh
Persicaria attenuata	a smart weed	Unknown	Shallow marsh
Persicaria decipiens	Slender knotweed	High	Shallow marsh
Persicaria hydropiper	Water pepper	Unknown	Shallow marsh
Persicaria prostrata	Creeping knotweed	Unknown	Shallow marsh
Philydrum lanuginosum	Frogsmouth	Unknown	Ephemeral marsh/ Shallow marsh/
Ranunculus inundatus	River buttercup	Unknown	Ephemeral marsh
Schoenoplectus litoralis		Moderate	Ephemeral marsh/ Shallow marsh/ Deep marsh
Schoenoplectus mucronatus		Low	Ephemeral marsh/ Shallow marsh/ Deep marsh
Schoenoplectus validus	River club rush	Moderate	Ephemeral marsh/ Shallow marsh/ Deep marsh
Villarsia exaltata		Unknown	Shallow marsh/ Deep marsh

Appendix 6.11 (Cont...) – Plants Suitable for Constructed Wetlands in Caloundra City

Source: Gold Coast City Council

Catchment	Rainfall Chart
Caloundra	Caloundra
Ewen Maddock	Glass House Mountains
Lake Baroon	Maleny
Mary River	Maleny
Mooloolah River	Caloundra
Mooloolah River Weir	Glass House Mountains
Pumicestone Passage	Glass House Mountains
Stanley River	Maleny

Appendix 6.12 – Catchment Management Standards

Contents of Section 7 – Water Supply

Tables in Section 7

Figures in Section 7

Section 7

Section 7 - Water Supply

7.1 Purpose and Structure

(1) The purpose of this Section is to provide guidance on standards applying where Council requires that town water be provided for development.

Council supports the Water Services Association of Australia (WSAA) National Codes initiative to develop national codes for water supply, sewerage and sewage pumping stations. Benefits of the national codes include the development of best practices, the encouragement of innovation and minimisation of capital costs through standardisation of components used in water supply and sewage collection systems.

(2) This section is structured as follows:

(a) 7.1 to 7.5 which provide the framework for the guidelines;
(b) 7.6 which outlines the requirements relating to:

(i) construction of internal reticulation mains;
(ii) construction of external delivery mains; and
(iii) installation of water services to properties.

7.2 Terminology

General terms used in this Section are included in Section 1.5. The following terms relate specifically to this Section of the Policy:

"Designer" – the designer is to be a Registered Professional Engineer of Queensland (RPEQ) and is responsible for ensuring that the design complies with the requirements set out in the Water Supply Code of Australia and these supplementary guidelines. The RPEQ is to ensure that the Water Agency's endorsement is obtained for any variations from these requirements. Any change in nominated RPEQ is to be accompanied with a transfer of responsibilities for the work including works completed prior to the change of RPEQ.

"Water Agency" – the owner and administrator of water and sewerage assets.

"Level of Service Impact Assessment Specification" - The framework by which the Water Agency may require information to assess development applications, due diligence requests or other information that may impact upon the Water Agency's ability to achieve the desired standard of service (DSS) for customers as defined in

the Water Agency's current water supply and sewerage growth management strategies. The specification sets out information requirements essential to assess the existing and future effects on the performance and capacity of water assets including the identification of infrastructure needs, costs, and timings associated with deviation from population assumptions/sequencing underpinning the Water Agency's current long term infrastructure planning.

7.3 Standard Drawings

(i) The following lists the acceptability or otherwise of Water Supply Code of Australia (WSCA) Standard Drawings.

WSAA Drawing Numbers		Remarks
All		The Water supply Code of Australia WSA 03 drawings detail a number of infrastructure options and arrangements. A number of these options are not compatible with current Council practice. The acceptance, modification or deletion of the WSAA drawings are set out below.
WAT-1100	Not adopted	Use SCW 385 - drawing under development
WAT-1101	Not adopted	Use SCW 380 - drawing under development
WAT-1102	Adopted	Valve to be directly off tee
WAT-1103	Adopted	Valve to be directly off tee
WAT-1104	Adopted	1.) 63 OD PE water mains in cul de sac heads only. 2.) 63 OD PE water mains to be looped using entire head of cul de sac.
WAT-1105	Adopted	
WAT-1106	Not adopted	Use SCW 350, SCW 355 and SCW 360.
WAT-1107	Not adopted	Use SCW 355
WAT-1108	Not adopted	Use SCW 360
WAT-1109	Not Adopted	Use SCW 350
WAT-1200	Adopted	
WAT 1201	Adopted	
WAT-1202	Adopted	
WAT-1203	Adopted	
WAT-1204	Adopted	
WAT-1205	Adopted	
WAT-1206	Not Adopted	
WAT-1207	Adopted	Hydrant tees are to be restrained in accordance

Section 7

WSAA Drawing Numbers		Remarks
		with socketed valve restraints
WAT-1208	Adopted	
WAT-1209	Adopted	
WAT-1210	Adopted	
WAT-1211	Adopted	
WAT-1212	Adopted	
WAT-1213	Adopted	
WAT-1214	Adopted	
WAT-1300	Not adopted	Use SCW 365
WAT-1301	Not adopted	Use SCW 320
WAT-1302	Not adopted	Use SCW 320 & SCW 325
WAT-1303	Not adopted	Use SCW 320 & SCW 325
AT-1304	Not adopted	Use SCW 320 & SCW 325
WAT-1305	Not adopted	Use SCW 320 & SCW 325
WAT-1306	Not adopted	Use SCW 320 & SCW 325
WAT-1307	Adopted	
WAT-1308	Not adopted	
WAT-1309	Not adopted	Use SCW 330
WAT-1310	Adopted	
WAT-1311	Adopted	
WAT-1312	Adopted	
WAT-1313	Adopted	
WAT-1400	Adopted	
WAT-1401	Adopted	
WAT-1402	Adopted	
WAT-1403	Adopted	
WAT-1404	Adopted	
WAT-1405	Adopted	
WAT-1406	Adopted	
WAT-1407	Adopted	
WAT-1408	Adopted	
WAT-1409	Not adopted	

Public Utilities		Remarks
SEQ R-100		Public Utilities – Typical Service Corridors and Alignments
SEQ R-101		Public Utilities – Typical Service Conduit Sections

Table 7.1 – Standard Drawings – Water Supply

7.4 Related Standards/References

(1) Water Services Association of Australia Publications

(a) . The following guidelines (Section 7.6) shall be read in conjunction with, and take precedence over, the WSAA Water Supply Code of Australia – WSA 03-2002 to define the technical requirements of Council and the Water Agency in relation to the planning, design and construction of water supply systems.

(b) Whilst Caloundra City Council endeavours to ensure the accuracy of the information contained in this document, Council will not be liable for any loss or damage that may occur as a result of using information contained herein.

(2) Queensland Department of Natural Resources and Mines "Guidelines for Planning and Design of Urban Water Supply Catchment Schemes" (1997).

7.5 Process

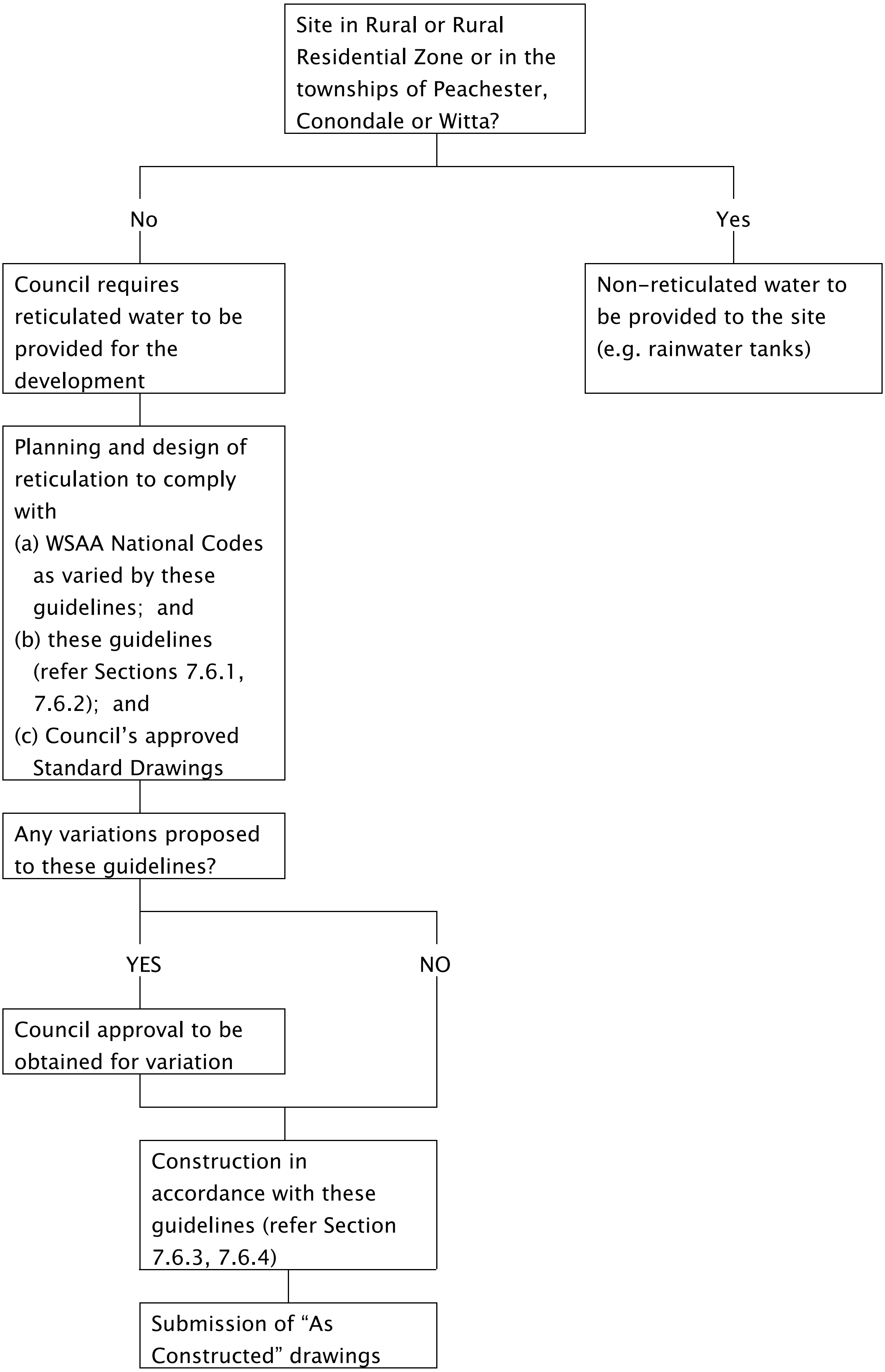


Figure 7.1 – Water Supply

7.6 Guidelines

7.6.1 General

(1) All connections or alterations to Council water reticulation mains are to be made by Council staff at the applicant's expense.

(2) Water Meters

(a) Water meters are installed at the time of subdivision. All new unit type developments whether single or multi-storey shall be provided with individual water meters. The cost of the installation of the water meters will be borne by the developer and the water meters will be supplied by Council. Primary water meters should be located within the immediate title boundary. Council may request that in multi-storey strata title unit developments of three (3) storeys or more, individual meters shall be connected with remote reading counters located at the ground floor level or for two storey unit developments, all individual meters shall be located at the ground level above ground.

(3) Refer also to 'Water Supply and Sewerage Headworks Planning Scheme Policy'.

7.6.2 Planning and Design

The following provisions relate to variations to the National Codes.

(1) **Water Agency (Pt 1, Section 1.5.2).**

Add to WSAA requirement:

(a) For development proposals, the Water Agency may request that a water supply network analysis be undertaken to determine (a), (b) and (c).

(2) **System Planning Process (Part 1, Section 2.1)**

Add to WSAA requirement:

(a) The designer shall liaise with the Water Agency prior to commencement of the design.

(3) **Demands (Part 1, Section 2.2)**

Replace WSAA requirement with:

(a) Water demands shall be determined in accordance with the Council's Level of Service Impact Assessment Specification.

(4) **Peak Demands (Part 1, Section 2.2.3)**

Replace WSAA requirement with:

(a) The designer shall liaise with the Water Agency to obtain the peak demand factors.

(5) **System Configuration (Part 1, 2.3) (a) and (b)**

Add to WSAA requirement:

(a) Where deemed necessary by the Water Agency, existing asbestos cement water mains shall be replaced along the full frontage of any proposed development site or where affected by any development works.

(b) Replacement of existing water mains will be required in commercial, industrial and high density residential precincts where existing mains fronting any proposed development are less than 150mm diameter. Mains shall be replaced along the full frontage of the proposed development site prior to the placement of any site sheds or construction materials over or adjacent to the water main.

(6) **Network Analysis (Part 1, Section 2.4.2)**

Add to WSAA requirement:

(a) The Water Agency will undertake, at the designer's expense an assessment, and establish any adverse impacts, of the proposed developments on the existing system using the Water Agency's hydraulic model. The designer shall provide details of the proposed system development and demands to allow completion of this assessment. Alternatively, the Water Agency may require the designer to carry out this assessment. Network analyses are to include all pipes in the network model and comply with Council's Level of Service Impact Assessment Specification.

(7) **Operating Pressures (Part 1, Section 2.4.3)**

Add to WSAA requirement:

(a) The minimum desirable service pressure shall be 220kPa at the water meter. The maximum service pressure shall be 800kPA.

(8) **Minimum Pipe Sizes (Part 1, Section 3.2.2)**

Add to WSAA requirement:

(a) Pipe sizes shall not be less than DN150mm diameter for high density residential, commercial, industrial and rural residential precincts.

(9) **Fire Flows (Part 1, Section 3.2.4)**

Replace WSAA requirement with:

(a) Fire flows shall comply with the requirements specified in 'Guidelines for Planning and Design of Urban Water Supply Schemes' Chapter 21A, 1997, Dept of Natural Resources and Mines. The water supply scheme shall be capable of supplying the following fire flow demands above maximum hour demand: Commercial and Industrial Precincts – 30 litres per second at 12 metres residual pressure. Residential Precincts – 15 litres per second at 12 metres residual pressure.

(10) **Minimum Pressure Class (Part 1, Section 3.7.2)**

Replace WSAA requirement with:

(a) The minimum pipe and fitting pressure class for reticulation mains shall be Class 16.

(11) **Design Tolerances (Part 1, Section 4.1.1)**

Add to WSAA requirement:

(a) Horizontal alignment shall be referenced to GDA mapping co-ordinates.

(12) **Location of Water Mains (Part 1, Section 4.3)**

Add to WSAA requirement:

(a) Reticulation water mains shall generally be located within the road reserve on a 1.5 metre alignment from the property boundary.
(b) In general, water mains are not to be constructed on private property, however, in instances where this is unavoidable it will be necessary to provide an easement of minimum 3.0 metres width registered for the benefit of the Council on the title of the land. The main is to be constructed centrally within the easement. A wider easement may be necessary in some instances, as determined by the Water Agency, to ensure adequate access for maintenance purposes.

(13) **Water Mains in Road Reserves (Part 1, Section 4.3.2)**

Add to WSAA requirement:

(a) Mains shall be located to provide a minimum 0.5 metres from existing or proposed footpaths. Landscape planting within 1.0 metre of Council water infrastructure or within a water easement shall be low growing when mature and be suitable approved varieties.
(b) Consideration shall be given at land reconfiguration stage to ensure road reserves are of adequate width to provide required clearances between all services and improvements.

(14) Shared Trenching (Part 1, Section 4.4)

Replace WSAA requirement:
(a) Water mains shall not be co-located with other services.

(15) Duplicate Mains (Part 1, Section 4.5)

Add to WSAA requirement:
(a) Water mains are to be provided on both sides of the road in the case of divided carriage ways, commercial, industrial and high density residential precincts.

(16) Connection of New Mains to Existing Mains (Part 1, Section 4.7)

Add to WSAA requirement:
(a) All works on the existing reticulation system shall be considered 'live works' and will be constructed by the Water Agency at the contractors cost. These works shall be clearly delineated on the drawings and shown in sufficient detail such that the works can be readily constructed. The connection point to the existing system shall be located to minimise disruption of supply to customers and be subject to Water Agency approval.

(17) Temporary Ends of Water Mains (Part 1, Section 4.8.3)

Add to WSAA requirement:
(a) Water mains shall be constructed across the full frontage of any property being developed.

(18) Property Services (Part 1, Section 4.9)

(a) Replace WSAA Standard Drawings WAT - 1106, WAT - 1107 and WAT - 1109 with Council Standard Drawings SCW 350, SCW 355 and SCW 360.
(b) Add to WSAA requirement: Ductile iron pre-tapped fittings and service pipework shall be installed by the developer at the time of lot reconfiguration in accordance with Council Standard Drawing SCW 360. Conventional tapping bands may be utilized for pipe diameters where pre-tapped fittings are not available. Property service connections shall only be installed on reticulation mains with a diameter less than or equal to 300 mm. Property connections shall be installed in accordance with Council's standard drawings. Water service pipework shall be provided for the full length of access strips and access easements serving Lots(25mm NB min).
(c) Add to WSAA requirement: Conduits shall be provided under all roads to carry water services to properties on the opposite side to the main.

Conduits shall be installed in accordance with Council standard drawings and at an alternate position to power and/or telecommunication services. Kerb markers shall be placed in accordance with Council standard drawings. If, as may occur at corner properties, electrical pillar boxes are located on both side boundaries, the property service connection shall be placed at the RP boundary truncation point. Community title schemes shall be provided with a single service to the boundary of the property. All internal works will be privately owned and the responsibility of the body corporate.

(d) Add to WSAA requirement: Water meters shall be installed by the developer prior to survey plan release. The Water Agency will advise the type and supplier of the approved water meters. Meters shall be installed in accordance with standard drawings SCW-350, SCW-355, SCW-360.

(19) **Clearance from Structures (Part 1, Section 4.10.4)**

Replace WSAA requirement with:

(a) Other structures deemed satisfactory to be constructed over or adjacent to Council's water supply shall be designed and constructed to protect the infrastructure from physical damage and to allow Council access when necessary.

(20) **Pipe Cover (Part 1, Section 5.4.2)**

Add to WSAA requirement:

(a) Where site works either reduce the depth of cover below the minimum, or increase the depth of cover to invert above 1.5 metres, the water main shall be re-laid to maintain the required depth.

(21) **Geotechnical Considerations (Part 1, Section 5.5.1)**

General

Add to WSAA requirement:

(a) Considerations to include the existence of acid sulphate soils (ASS) and possible acid sulphate soils (PASS).

(22) **Installation (Part 1, Section 6.1.4)**

(a) Replace WSAA Standard Drawings WAT- 1301, WAT - 1304 and WAT - 1309 with Council Standard Drawings SCW 320, SCW 365 and SCW 330.

(23) **Stop Valves - General (Part 1, Section 6.2.1.1)**

Replace first paragraph of WSAA requirement:

(a) When extending an existing water main, a stop valve may only be installed at the junction of the existing and new water mains if approved by the Water Agency.

(24) **Stop Valves for Reticulation Mains (Part 1, Section 6.2.3)**

Add to WSAA requirement:

(a) Stop valves are required on each side of all mains crossing railway reserves, major roads and on mains traversing easements.

(b) Valves shall be resilient seated, coated, o-ring stem sealed, anticlockwise closing class 16 conforming to AS2638. The wedge shall be totally encapsulated in an approved synthetic rubber conforming to AS1646. The body shall be internally and externally coated with fusion bonded epoxy (FBE) or a thermoplastic polyamide such as Rilson Nylon 11. Valves to be installed in accordance with SCW 320 and WAT 1207.

(25) **Stop Valves – Location and Arrangements – General (Part 1, Section 6.2.5 1)**

Add to WSAA requirement:

(a) Stop valve locations shall be in accordance with Arrangement 1.

(b) Zone valves shall be in accordance with Arrangement 3(b).

(26) **Pressure Reducing Valves (Part 1, Section 6.3.2)**

(PRVs)

Add to WSAA requirement:

(a) PRVs shall be designed in accordance with Standard Drawing SCW 330.

(27) **Air Valves – Installation Design Criteria (Part 1, Section 6.4.1)**

(a) Replace WSAA Standard Drawing WAT- 1302 with SCW Standard Drawings SCW 320 and SCW 325

(28) **Swabbing Points (Part 1, Section 6.7)**

Add to WSAA requirement:

(a) Swabbing points will generally only be required on large diameter or lengthy transfer mains. The Water Agency will advise any requirements on a case by case basis.

(29) **Hydrants (Part 1, Section 6.8)**

Add to WSAA requirement

Hydrants shall be installed as follows:

(a) Location – opposite common boundaries, generally installed at crests or sags and end of mains.
(b) Spacing – maximum 80 metres
(c) Orientation – spring hydrants shall be oriented with bolts parallel to the water main.
(d) Hydrants shall comply with AS3952-1991 for DN80 spring hydrants and shall be fusion bonded epoxy (FBE) or thermoplastic polyamide (Rilsan Nylon 11) coated. All fasteners are to be 316 stainless steel.

(30) **Hydrant Locations (Part 1, Section 6.8.8)**

(a) Replace WSAA Standard Drawings WAT -1300 with Council Standard Drawing SCW 365
(b) Replace WSAA Standard Drawing WAT 1301 with Council Standard Drawing 320.
(c) Replace WSAA Standard Drawing WAT 1302 with Council Standard Drawings SCW 320, SCW 325.

(31) **Composition of Design Drawings (Part 1, Section 7.2.2)**

(a) Longitudinal sections are to be prepared for water mains 250mm diameter or larger.

Add to WSAA:
(b) Ensure all revision amendments are clouded

7.6.3 Products and Materials

(1) **Products and Materials (Part 2, Section 3.1.2.4)**

(2) **Product Standards and Specifications (Part 2, Section 8.4)**

Add to WSAA requirement:
(a) The following materials are approved for use in the construction of water reticulation and trunk main systems.

Table 7.2 Approved Pipe Materials

Diameter		Function	Material				
Material Description		Copper	PVC-O	PE	DICL	MSCL	PVC-M
WSAA Purchase Specification		AS3500	PS-210	PS-207	PS-234	PS-203	PS-209
DN-20 - DN50	Water Service	Approved	N/A	PE100B PN16	N/A	N/A	N/A

DN50 – DN100	Water Service	Approved	N/A	N/A	N/A	N/A	N/A
DN63	Water Main Cul de sac only	N/A	N/A	PE100B PN16	N/A	N/A	N/A
DN100 – DN150	Water Main	N/A	PN16 SN10	N/A	PN35	N/A	PN16 SN10
DN200 – DN300	Water Main	N/A	N/A	N/A	PN35	N/A	N/A
DN375 – DN750	Water Main	N/A	N/A	N/A	PN35	Note 1	N/A

7.6.4 Construction

3.1.2.5 Part 3: Construction

(1) **Personnel Qualifications (Part 3, Section 10.2)**

Add to WSAA

(a) Pipe layers shall be accredited by the pipe manufacturer.

(2) **Traffic Management (Part 3, Section 11.5.4.2)**

Replace WSAA requirement with:

(a) A traffic management plan shall be prepared for all projects.

(3) **Laying (Part 3, Section 15.1.4)**

(a) Replace WSAA Standard Drawing WAT -1101 with Council Standard Drawing SCW380.

(4) **Bending Pipe (Part 3, Section 15.2.3)**

(a) Replace WSAA requirement with:

(b) Cold bending of PE pipe to manufactures specifications is permitted. Cold bending of all other pipes is not permissible.

(5) **Thrust and Anchor Blocks and Restrained Joints (Part 3, Section – 15.5)**

(a) Delete WSAA Standard Drawing WAT- 1206. Add Council's Standard Drawing SCW 310

Add to WSAA

(b) Hydrant tees are to be restrained in accordance with socketed valve restraint standard. Refer WAT – 1207

(6) **Property Services and Water Meters (Part3, Section 15.6)**

(a) Replace WSAA Standard Drawings WAT–1106 to WAT – 1109 inclusive with Council Standard Drawings SCW 350, SCW 355 and SCW 360.

(7) **Installation (Part 3, Section 15.11.1)**

(a) Replace WSAA Standard Drawings WAT– 1301 to WAT – 1306 with Council Standard Drawings SCW 320 and SCW 325.

(8) **Valve Chambers for Large Diameter Mains (Part 3, Section 15.11.2)**

(a) Replace WSAA Standard Drawing WAT – 1308 and WAT – 1309 with Council Standard Drawing SCW 330.

(9) **Location Markers (Part 3, Section 15.16)**

(a) Replace WSAA Standard Drawing WAT – 1300 with Council Standard Drawing SCW 365.

(10) **Connections to Existing Water Mains (Part 3, Section 22)**

Replace WSAA requirement with:

(a) All works that may involve connection to or modifications of the existing water supply system shall be undertaken by the Water Agency at the applicant's expense. Water mains are considered to be live once accepted 'on maintenance' by the Water Agency.

(b) No person, other than authorised Water Agency employees, shall operate any existing valve or draw water from any existing main without the authority of the Water Agency.

Contents of Section 8 – Sewerage

Tables in Section 8

Figures in Section 8

Section 8 – Sewerage

8.1 Purpose and Structure

(1) The purpose of this Section is to provide guidance on standards applying where Council requires sewerage to be provided for development and requirements in non-sewered areas.

Council supports the Water Services Association of Australia (WSAA) National Codes initiative to develop national codes for water supply, sewerage and sewage pumping stations. Benefits of the national codes include the development of best practices, the encouragement of innovation and minimisation of capital costs through standardisation of components used in water supply and sewage collection systems.

(2) This section is structured as follows:

(a) 8.1 to 8.5 which provide the framework for the guidelines;
(b) 8.6 which outlines the requirements relating to:

(i) installation of house connections within the boundary of each allotment;
(ii) construction of internal reticulation sewers and manholes; and
(iii) construction of pump stations, rising mains and extension of external sewers.

8.2 Terminology

General terms used in this Section are included in Section 1.5. The following terms relate specifically to this Section of the Policy:

"Designer" – the designer is to be a Registered Professional Engineer of Queensland (RPEQ) and is responsible for ensuring that the design complies with the requirements set out in the Sewerage Code of Australia and Sewage Pumping Station Code of Australia and these guidelines. The RPEQ is to ensure that the Water Agency's endorsement is obtained for any variations from these requirements. Any change in nominated RPEQ is to be accompanied with a transfer of responsibilities for the work including works completed prior to the change to RPEQ.

"Water Agency" – the owner and administrator of water and sewerage assets.

"*Level of Service Impact Assessment Specification"* – The framework by which the Water Agency may require information to assess development applications, due diligence requests or other information that may impact upon the Water Agency's ability to achieve the desired standard of service (DSS) for customers as defined in the Water Agency's current water supply and sewerage growth management strategies. The specification sets out information requirements essential to assess the existing and future effects on the performance and capacity of water assets including the identification of infrastructure needs, costs, and timings associated with deviation from population assumptions/sequencing underpinning the Water Agency's current long term infrastructure planning

8.3 Standard Drawings

(1) The following lists the acceptability or otherwise of Sewerage Code of Australia WSAA Standard Drawings.

WSAA Drawing Numbers		Remarks
		The Sewerage Code of Australia WSA Standard Drawings details various infrastructure options and arrangements. A number of these options are not compatible with current Council practice. The acceptance, modification or deletion of the WSA drawings is set out below.
SEW-1100	Not Adopted	Drawing under development
SEW-1101	Adopted	
SEW-1102	Not Adopted	
SEW-1103	Not Adopted	
SEW-1104	Not Adopted	Use SCW 125
SEW-1105	Not Adopted	Use SCW 160 – Drawing under development

SEW-1106	Not Adopted	Use SCW 125, SCW 130
SEW-1107	Not Adopted	Use SCW 125, SCW 130
SEW-1108	Not Adopted	Use SCW 125
SEW-1109	Not Adopted	Use SCW 125 and SCW 130
SEW-1200	Adopted	
SEW-1201	Adopted	
SEW-1202	Adopted	
SEW-1203	Adopted	
SEW-1204	Adopted	
SEW-1205	Adopted	
SEW-1206	Adopted	
SEW-1207	Adopted	
SEW-1208	Adopted	
SEW-1300	Adopted	
SEW-1301	Adopted	
SEW-1302	Adopted	
SEW-1303	Adopted	
SEW-1304	Adopted	
SEW-1305	Adopted	
SEW-1306	Adopted	
SEW-1307	Not Adopted	

SEW-1308	Adopted	
SEW-1309	Adopted	
SEW-1310	Adopted	
SEW-1311	Adopted	
SEW-1312	Adopted	
SEW-1313	Adopted	
SEW-1314	Adopted	
SEW-1315	Not Adopted	
SEW-1316	Adopted	
SEW-1317	Adopted	
SEW-1400	Not Adopted	
SEW-1401	Adopted	
SEW-1402	Adopted	
SEW-1403	Adopted	
SEW-1404	Adopted	
SEW-1405	Adopted	
SEW-1406	Adopted with Modification	Excluding Option 2
SEW-1407	Adopted	
SEW-1408	Adopted	

SEW-1409	Not Adopted	
SEW-1410	Not Adopted	
SEW-1411	Not Adopted	
SEW-1412	Not Adopted	Use SCW 135
SEW-1500	Adopted	
SEW-1501	Adopted	
SEW-1502	Not Adopted	

Table 8.1– Standard Drawings – Sewerage

(2) The following lists the acceptability or otherwise of Sewage Pumping Station Code of Australia (WSAA) Standard Drawings.

Table of Standard Drawings		Remarks
SPS-1100	Adopted	
SPS-1101	Not Adopted	Use SCW 501 & 506
SPS-1102	Not Adopted	Use SCW 501 & 506
SPS-1103	Not Adopted	Use SCW 503 & 512
SPS-1104	Adopted	
SPS-1200	Not Adopted	Use SCW 501 & 506
SPS-1201	Not Adopted	Use SCW 501 & 506
SPS-1202	Not Adopted	Use SCW 501 & 506
SPS-1203	Not Adopted	Use SCW 501 & 506
SPS-1204	Not Adopted	Use SCW 501 & 506

SPS-1205	Adopted	
SPS-1300	Not Adopted	Use SCW 503, 508 & 509
SPS-1301	Not Adopted	Use SCW 502
SPS-1302	Not Adopted	Use SCW 502, 503, 507, 508 & 509
SPS-1303	Not Adopted	
SPS-1304	Not Adopted	Use SCW 503, 508 & 509
SPS-1305	Not Adopted	Use SCW 503, 512 & 515
SPS-1306	Not Adopted	Use SCW 502, 503, 505, 508 & 514
SPS-1307	Not Adopted	Use SCW 502 & 507
SPS-1308	Not Adopted	Use SCW 516 & 519
SPS-1309	Not Adopted	Use SCW 502 & 507
SPS-1310	Adopted	
SPS-1400	Adopted	
SPS-1401	Adopted	
SPS-1402	Adopted	
SPS-1403	Adopted	
SPS-1404	Not Adopted	Use SCW 135
SPS-1405	Adopted	
SPS-1500	Adopted	
SPS-1501	Adopted	
SPS-1502	Adopted	
SPS-1503	Adopted	

SPS-1504	Adopted	
SPS-1505	Not Adopted	Use SCW 505 & 511
SPS-1506	Adopted	
SPS-1507	Adopted	
SPS-1508	Adopted	
SPS-1600	Adopted	
SPS-1601	Adopted	
SPS-1602	Adopted	
SPS-1603	Adopted	
SPS-1604	Adopted	
SPS-1605	Adopted	
SPS-1606	Adopted	

Table 8.2 – Standard Drawings – Sewerage Pump Stations

8.4 Related Standards/References

The following guidelines (Section 8.6) shall be read in conjunction with, and take precedence over, the WSAA Sewerage Code of Australia WSA 02-2002 and WSAA Sewage Pumping Station Code of Australia (WSA 04 – 2005) to define the technical requirements of Council and the Water Agency in relation to the planning, design and construction of reticulated sewerage systems and sewage pumping systems.

Whilst Council endeavours to ensure the accuracy of the information contained in this document, Council will not be liable for any loss or damage that may occur as a result of using information contained herein.

8.5 Process

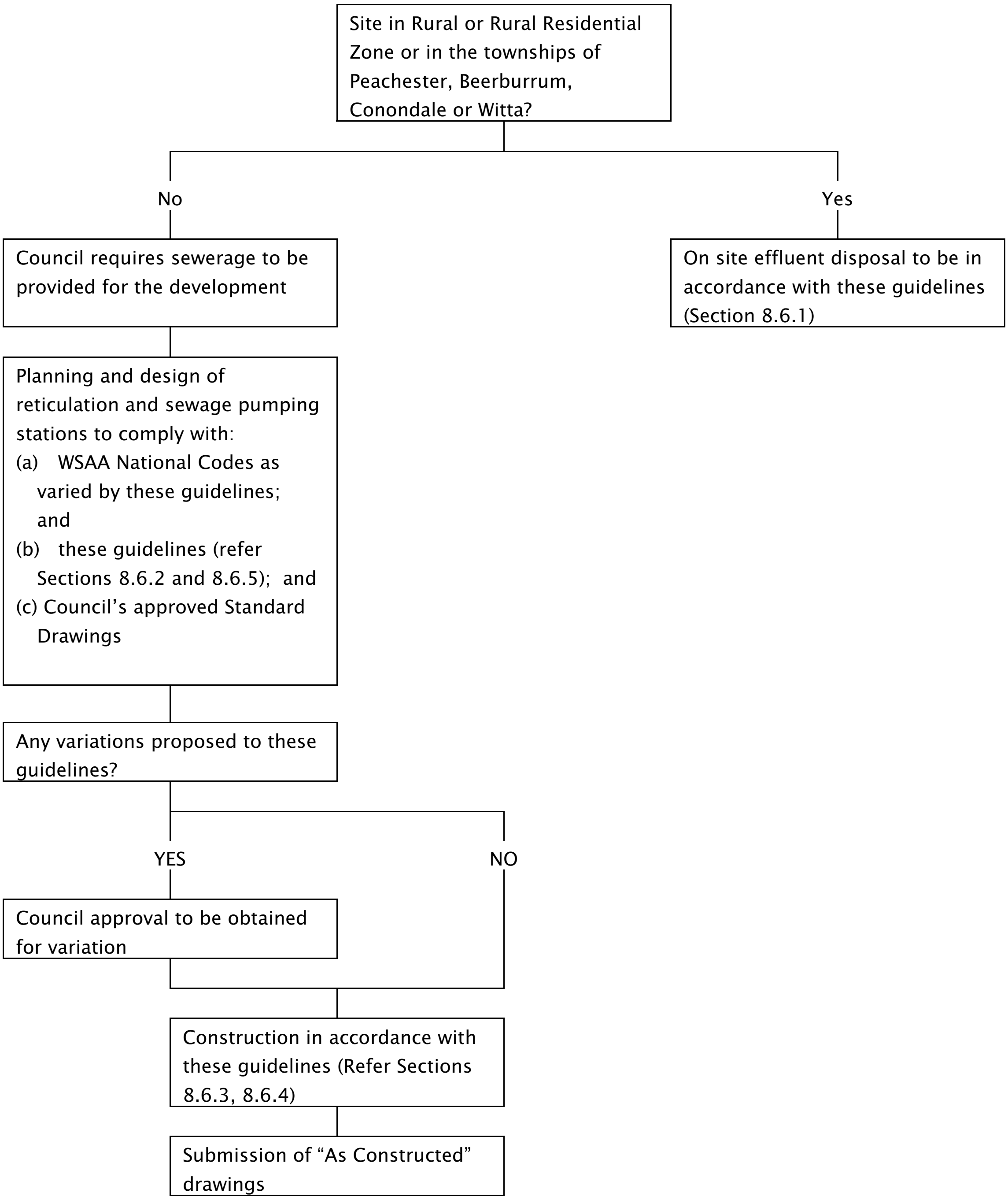


Figure 8.1 – Sewerage

8.6 Guidelines

(1) All connections or alterations to Council sewer mains are to be made by Council staff at the applicant's expense.

(2) The following provisions relate to variations in the WSAA National Codes.

(3) Refer also to ' Infrastructure Contributions for Water Supply and Sewerage Infrastructure' Planning Scheme Policy

8.6.1 Non-Sewered Areas

(1) All on-site sewerage systems require relevant approval from the Water Agency. All applications are to comply with the Plumbing and Drainage Act (2002), Standard Plumbing and Drainage Regulation (2003), Australian New Zealand Standard-on-site domestic-wastewater management (AS/NZS 1547:2000), and Queensland Plumbing and Wastewater Code (Department of Infrastructure and Planning).

(2) Where the Council allows disposal of sewage to a communal holding tank then such disposal will be at the cost of the applicant subject to the following:

(a) the applicant is to be responsible for:

(i) the full cost of installation of the holding tanks;
(ii) the full direct cost of the disposal;
(iii) an administration charge of 10%; and
(iv) the full cost of connection to the new sewer including conversion or demolition of the holding tank, backfilling and restoration.

(b) each property in the subdivision is to be levied standard sewerage charges;
(c) the applicant's liability under (a)(ii) is to be reduced by the net amount of sewerage charges levied as in (b); and
(d) the applicant is required to meet the obligation by either:

(i) payment of an agreed lump sum to cover the expected liability for the period until sewerage is connected; or
(ii) provide security by way of an unconditional bank guarantee of an amount sufficient to meet the likely liability to be incurred for the period until sewerage is connected.

(3) On all land where sewerage is not available for connection, a detailed report, addressing the suitability and long-term sustainability of the land for on-site effluent disposal, must be provided with any application lodged. Environmental

modelling is to be conducted by a suitably qualified consultant to determine what effect, in terms of additional nutrient loads, the proposed unsewered development has on the receiving catchment. The report shall include detail of calculations used in quantifying nitrogen and phosphorus loads as well as management options used to mitigate any increase in loads calculated due to on-site effluent disposal systems. In determining loads, a failure rate of 10-20% should be incorporated into the calculations. The increase in loads that are calculated in modelling should be incorporated within the Stormwater Management Plan. Increased loads should be subsequently reflected in stormwater quality modelling (i.e. MUSIC) to demonstrate how additional loads are mitigated.

8.6.2 Planning and Design – Reticulation

a) Part 1, Section 1.4.2 Objectives of the Sewerage System

Add to WSAA requirement:
Sewerage system provisions to include:

- Extension of sewers to upstream property boundaries of development sites.
- Sewage pumping stations will not be approved where a reticulated gravity system could be provided.

b) Part 1, Section 2.3 – Planning Parameters

Replace WSAA loading rates with:
Average daily loading shall be in accordance with Council's Level of Service Impact Assessment Specification.

c) Part 1, Section 3.2.2 – Traditional design Flow
Estimation Method

Replace WSAA requirement with:
Design flows shall be determined in accordance with Council's Level of Service Impact Assessment Specification.

d) Part 1, Section 4 – Detail Design

Add to WSAA requirement:
The minimum pipe size for sewer reticulation shall be 150mm diameter.

e) Part 1, Section 4.2.3 – Sewer Layout

Add to the WSAA requirement:
Where practicable all sewers are to be located as shown in the following table:

Table 8.3 – Preferred Sewer Alignments

Location	Alignment
Roadway	On application
Footpath	On application
Private Properties (side boundaries)	1.0 metre
Private Properties (rear and front boundaries)	1.5 metres

<u>Alignment</u>

Sewers in Lots with zero lot boundaries shall be located in the front of lots where possible. Sewers in industrial precincts are to be located at the front of lots where possible. Sewers in commercial precincts should be located within the road reserve, where possible. Sewers are to be constructed to serve the entire area of each lot within the development site and are to be extended to the boundaries of the site to serve existing lots and potential development sites upstream at the developer's full cost.

Wherever possible, sewerage manholes shall be located on the high side of allotments.

In flat areas, sewers must be designed to serve properties on both sides of the sewer.

Where sewers are located in road reserves, they shall be located on the opposite side to watermains, electricity and communications cables.

Sewers shall be constructed to serve the entire area of the allotment using a fall of 1:60 for the internal allotment drains allowing 300mm cover to top of pipe at head of drain.

Sewers must be designed to follow the natural grade of the land.

f) Part 1, Section 4.2.5 – Easements

Add to WSAA requirement:

All sewers located within private property shall be contained within a minimum 3.0 metre wide easement. Sewers in excess of 3.0 metres deep shall be contained within a minimum 4.0 metre wide easement. Unless otherwise agreed with the Water Agency, sewers shall be located centrally in the easement.

g) Part 1, Section 4.3.4 – Public and Private Property

Add to WSAA requirement:

- Maintenance structures on private property shall generally be 1.0 metre from side boundaries and 1.5 metres from front and rear boundaries and must be a minimum of 0.5 metres clear of the property boundary.
- Landscape planting within 1.5 metres of a Council sewer or within a sewer easement must be low growing when mature and be suitable approved varieties.

h) Part 1, Section 4.3.5 – Changes in Direction Using a Maintenance Hole

Replace WSAA requirement with:
The maximum change in direction at a maintenance hole shall be 90 degrees unless otherwise approved by the Water Agency.

i) Part 1, Section 4.3.7 – Horizontal Curves in Sewers

Replace WSAA requirement with:
Horizontal curves in sewers are not permitted.

j) Part 1, Section 4.3.8 – End of Lines (NEW)

Replace WSAA requirement with:
Sewers are to be designed to terminate at a MH or TMH, except for branch lines less than 15 metres in length that serve no more than one lot.

k) Part 1, Section 4.4.4 – Clearance from Structures

Replace WSAA requirement with:

- Buildings must provide at least 1.5 metres from the outermost projection of the structure to the nearest edge of any existing or proposed infrastructure.
- Other structures deemed satisfactory to be constructed over or adjacent to Council's sewerage infrastructure must be designed and installed to protect the infrastructure from physical damage and to allow Council access when necessary.
- Proposals to construct within 1.5 metres of infrastructure – 150mm diameter or less:

The Water Agency's consent is required to construct within 1.5 metres of water supply or sewerage infrastructure and will only be considered where it is demonstrated that clauses 1 or 2 below cannot be achieved:

1. The building or other structure is redesigned, or relocated to provide a minimum 1.5 metres horizontal clearance from the existing infrastructure to the outermost projection of the proposed structure.

Or

2. Existing infrastructure is relocated, with the approval of the Water Agency, to provide a minimum 1.5 metres horizontal clearance from the outermost projection of the proposed building or other structure.

Where it is demonstrated that clauses 1 and 2 cannot be achieved, the Water Agency may consider giving consent to construct within 1.5 metres of the infrastructure subject to any or all of the following requirements:

- Submission of a structural footing design prepared and certified by a registered professional engineer, demonstrating that the building or other structure does not impose any load on the infrastructure.
- Any footings of the building or structure which are within the zone of influence of the infrastructure are to extend below Line B (refer Figure 8.2) either with piers or a continuous footing located a minimum horizontal distance of 1.0 metre clear of the pipe.
- Replacement of the existing pipe work with DICL or an approved PVC-U pipe material to ensure a future life in excess of 50 years.
- Design of the building or structure to permit its easy removal for access to the Water Agency's infrastructure if required.
- A pre and post construction video inspection of the affected sewerage infrastructure.
- Lodgement of a security bond, as determined by Council under bonding requirements, to cover potential damage to the infrastructure as a result of the proposed building works.
- Construction of a maintenance hole immediately upstream and/or downstream of the structure.
- Completion of a Deed of Indemnity, by the property owner/s, legally indemnifying Council against any future structural failure, repair or reinstatement works.
- Payment of the prescribed application fee.

Proposals to construct within 1.5 metres of infrastructure larger than 150mm diameter: For infrastructure larger than 150mm diameter, building within 1.5 metres of infrastructure is not permitted. The infrastructure is to be relocated or the building designed to provide a minimum 1.5 metres horizontal clearance from the outermost projection of the structure to the nearest edge of the pipe.

Proposals to construct 1.5 metres or greater from infrastructure: The foundations of any structure, located 1.5 metres or a greater horizontal distance from water supply or sewerage infrastructure, but within Zone B (refer Figure 8.2) are to extend below Line B either with piers or a continuous footing.

There are no requirements for structures outside the zone of influence.

The following structures do not require consent from the Water Agency, however the design considerations of this code still apply:

- Any structure located 1.5 metres, or greater horizontal distance, from water supply or sewerage infrastructure
- Any demountable fence
- Masonry fences up to 1.8 metres high, located on boundaries and constructed parallel to the sewer with a minimum horizontal distance from the fence foundation of 1.0 metre clear of the pipe
- Retaining walls less than 1.0m high
- A single demountable lightweight garden shed with wall lengths of less than 3.0 metres, lightweight roof and concrete floor no greater than 100mm thick. The shed must be easily removable from the concrete pad

Other Considerations:

Where masonry fences greater than 1.0 metre high cross a sewer the fence must be self supporting for a minimum of 1.0 metre either side of the sewer main.

No excavation or filling shall be undertaken over or adjacent to water supply or sewerage infrastructure without the consent of the Water Agency. Where consent is obtained, any affected maintenance holes or fittings shall be adjusted as required.

Council generally does not support the construction of buildings over sewers.

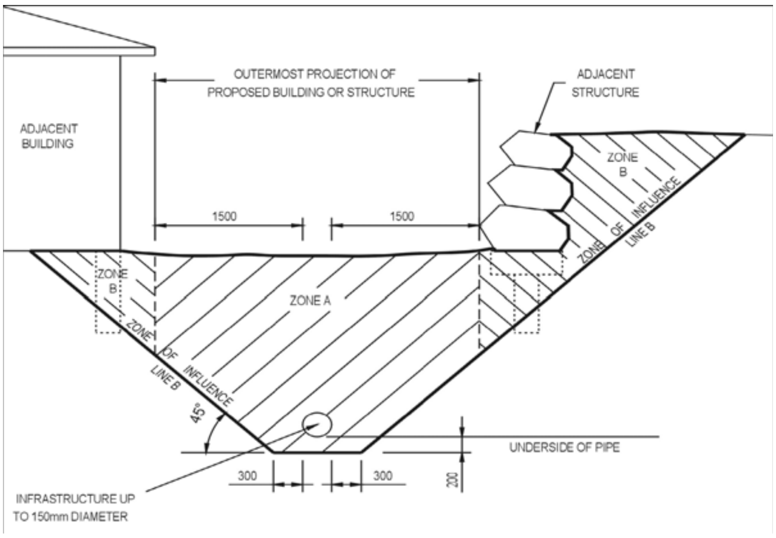


Figure 8.2 Building Work Adjacent to Services

Section 8

Ground surface levels must not be altered in a way causing ponding of water over any maintenance hole.

A sewer connection point must have:
- A clear area of at least 2.0m x 2.0m maintained around the sewer connection;
- A minimum horizontal clearance of 1.0 metre from any building;
- A minimum unobstructed vertical clearance of 2.4 metres.

Unrestricted access must be maintained to water supply and sewerage infrastructure at all times.

l) Part 1, Section 4.4.5 – Underground Structures and Services

Add to WSAA requirement:
- Sewerage mains crossing stormwater culverts or pipes in excess of 225mm diameter are to be laid or replaced with PVC-U class 12 pipe for the full extent of the crossing plus 1.5 metres either side. Spigot ends of the class 12 pipe are to be chamfered to provide a smooth transition of flows.
- A minimum horizontal separation of 1.0 metre must be maintained between stormwater pipes greater than 225mm diameter, and any sewerage and water pipes.
- Stormwater infiltration and filtration devices, and soakage trenches, must be located to provide a minimum 1.5 metres horizontal clearance to any sewerage infrastructure.

m) Part 1, Section 4.5.3 – Minimum Air Space for Ventilation

Replace WSAA requirement with:
Minimum air space in sewer mains shall be in accordance with Council's Level of Service Impact Assessment Specification

n) Part 1, Section 4.5.7 – Minimum Grades for Self Cleansing

Replace WSAA table 4.6 with:
Minimum grades for reticulation sewers shall be as shown in the following table:

Table 8.4 – Minimum Grade for Reticulation Sewers

Diameter	Minimum Grade
150mm (up to 2 lots)	1 in 80
150mm (3 – 5 lots)	1 in 100
150mm general (6 or more lots)	1 in 150
225mm	See WSA02 Table 4.6
300mm	See WSA02 Table 4.6

Sewers shall not be upsized to take advantage of flatter grades.

o) Part 1, Section 4.5.8 – Minimum Grades for Slime Control

Add to WSAA requirement:
Unless otherwise agreed with the Water Agency, the minimum grade of sewerage mains of 300 mm diameter and greater shall ensure that a slime stripping velocity is achieved.

p) Part 1, Section 4.6.1 – Vertical Alignment of Sewers
– General

Add to WSAA requirement:
• Sewers shall not be in excess of 5.0 metres deep.

• Junctions in excess 3.0 metres in depth must be 'Sugden' type.

q) Part 1, Section 4.6.2 – Long Section Design Plan

Replace first paragraph of WSAA requirement with:
Vertical alignments of sewers shall be shown on the longitudinal section of the design drawings.

r) Part 1, Section 4.6.3 – Minimum Cover over Sewers

Add to WSAA requirement:
Additional sewer depth may be required in lots and footpaths where future access driveways could be constructed. In exceptional circumstances, a minimum 0.6 metres pipe cover may be approved in road reserves subject to construction in DICL or PVC-U Class 18 pipe from maintenance hole to maintenance hole.

s) Part 1, Section 4.6.4 – Lot Servicing Requirements

Add to WSAA requirement:
- Where development is proposed on allotments currently serviced by combined house drainage systems, the applicant will be responsible to upgrade the system to current sewerage standards. This responsibility may extend to any affected adjacent properties.
- The use of private sewage pump stations is not acceptable for any reconfiguration of a lot proposal within Council's sewerage headworks areas.

t) Part 1, Section 4.6.5.4 –Depth of Connection Point

Replace part (b) and (d) of WSAA requirement with:
Sewer connections shall not be in excess of 1.5 metres deep. Replace WSAA Standard Drawing SEW– 1109 with Council Standard Drawings SCW 125 and SCW 130.

u) Part 1, Section 4.6.7 – Vertical Curves

Replace WSAA requirement with:
Vertical curves are not permitted.

v) Part 1, Section 4.6.8 – Compound Curves

Replace WSAA requirement with:
Compound curves are not permitted.

w) Part 1, Section 5.2 – Limitations of Connection to Sewers

WSAA Standard Drawings SEW – 1409 to SEW – 1411 inclusive are not adopted by Council.

x) Part 1, Section 5.3.1 – Methods of Property Connection – General

Replace WSAA requirement with:
House drainage connections shall comply with Council standard drawings and approved WSAA Standard Drawing.

Replace WSAA Standard Drawing SEW– 1107 with Council Standard Drawings SCW 125 and SCW 130.

y) Part 1, Section 5.6 – Location of Connection Points

Add to WSAA requirement:

- Connection points shall be located clear of driveways and a minimum of 1.0 metre inside the property boundary and otherwise in compliance with WSA02 Section 5.6.
- For battleaxe allotments, where the sewer house connection lies within the access strip, sanitary house drainage is to be extended from the provided inspection opening. along the access strip, at a minimum grade of 1 in 60, to a point 1.0 metre inside the main body of the lot prior to construction of the driveway.

z) Part 1, Section 5.7 – Y – Property Connections

Replace WSAA requirement with:
Property connections must be in accordance with Council's Standard Drawing SCW 125.

aa) Part 1, Section 5.8 – Length of Property Connection Sewers

Replace WSAA requirement with:
The maximum length of a house connection, measured from the reticulation sewer to the boundary of the property to be served, shall be 5.0 metres

ab) Part 1, Section 6.1 – Types of Maintenance Structures
WSAA Standard Drawings SEW – 1307 and SEW – 1315 are not adopted by Council.

Part 1, Section 6.3.2

Replace WSAA requirement with:
For reticulation sewers, the maximum distance between any two consecutive maintenance structures shall be 90 metres, subject to the provisions of Clause 6.3.1. Plastic maintenance structures must not be used at junctions of mains.

ac) Part 1, Section 6.5 – Special Considerations for Connection of New Sewers to Existing Sewers

WSAA standard Drawing SEW – 1502 is not adopted by Council.

Where pressure sewers discharge to a gravity system, the receiving structure must be a plastic maintenance hole or approved alternative. Connection to the Council sewer system must be by gravity only to a maintenance hole with an approved H2S gas inhibiting product. The two maintenance holes immediately downstream and one immediately upstream must also be treated with an approved H2S gas inhibiting product.

ad) Part 1, Section 6.6.2 – Types of MH Construction

WSAA Standard Drawing SEW – 1307 is not adopted by Council.

ae) Part 1, Section 6.6.8 – Ladders, Step Irons and Landings

Replace WSAA requirement with:
Fixed internal access arrangements are not permitted in maintenance holes servicing sewers. Stainless steel safety bars and landings shall be provided in maintenance holes servicing sewers of 400mm diameter and greater.

af) Part 1, Section 6.6.9 – MH Covers

Add to WSAA requirement:
Bolt down metal access covers (water tight type) shall be specified on MH's located:

- On all MH covers below the 1: 100 ARI flood level;
- On all MH covers on sewers of 450mm diameter or greater;
- On all MH covers within roadways;
- On all MH covers designated by the Water Agency.

ag) Part 1, Section 7.2 – Boundary Traps

Replace WSAA requirement with:
Boundary traps are not required.

ah) Part 1, Section 7.3 – Gas Check Manholes

Replace WSAA requirement with:
Gas check manholes are not required.

ai) Part 1, Section 7.9.2 Design Parameters for Emergency relief Structures (ERS).

Replace WSAA Standard Drawing SEW -1412 with Council Standard Drawing SCW 135.

aj) Part 1, Section 8 Structural Design

Add to WSAA requirement:
Concrete encasement of sewerage mains is not permitted.

ak) Part 1, Section 9.2.1 General

Add to WSAA Requirement:
Design Drawings are to include:
Signed checking certification from a RPEQ.

al) Part 1, Section 9.2.3 Sewers (Plans)

Add to WSAA Requirement:

Design Drawings are to include:

- Clouding of revision amendments
- Clearly defined stage boundaries
- Kerb and channel location
- Proposed sewerage easements drawn
- Where removal of trees is contemplated these must be shown on plans
- Size and location of other services located within 1.5 metres of sewerage infrastructure. Dimensioned clearances of services to the sewer main to be included.
- Finished surface level contours at intervals not greater than 0.5m
- Existing surface spot levels at corners of proposed allotments
- Finished surface spot levels at corners of proposed allotments
- Sewer line and maintenance hole numbers
- Details of allotments with zero or reduced building setback alignments

am) Part 1, Section 9.2.4 Structures

Add to WSAA:

Design Drawings are to include:

Structures are to be referenced to GDA mapping co-ordinates

an) Part 1, Section 9.2.5 Longitudinal Sections

Add to WSAA:

- Ensure all revision amendments are clouded
- Cut and fill are notated
- Natural surface and proposed finished surface levels
- Bedding and sewer foundation details
- Pipe size, class and material
- Existing and proposed services crossing the sewer main. Size, material and levels of these services must be included
- Levels and references to AHD
- Chainages and invert levels of all proposed house connections
- Sewer line and maintenance hole numbers
- Pipe bedding type
- Depths to pipe invert
- Depth and location of other services including stormwater

ao) Part 1, Section 9.2.6 Title Block Notation and Standard Notes

Add to WSAA:

- Estate name (if known)
- Council Development Application number (if available)

- Drawing number and revision number

ap) Part 1, Section 9.3 Drafting Standards

Add to WSAA:
Drawings are to be prepared in accordance with this policy.

8.6.3 Products and Materials – Reticulation

3.2.3.2 Part 2 Products and Materials

a) Pt 2 – 10.4.1 Product Standards

Add to WSAA requirement:
The following materials are approved for use in the construction of sewerage systems.

Diameter Function		Material							
Material Description		PVC-U	VC	GRP	CONCRETE PVC lined	ABS	PP	PE (note 6)	DICL (Note 6, 8)
WSAA Purchase Specification (note 9)		PS-230	PS-231	PS-232	-	PS-238	-	PS-207	PS-234
Applicable Notes		1, 2,3,4	1,4	1,4,5	1,4	1,4,5	1,4	1,5	1, 4,6,7
DN 100	House connection	SN 6	CS 34	N/A	N/A	N/A	N/A	N/A	N/A
DN 150	House connection	SN8	CS 34	N/A	N/A	SN 8	N/A	SN 8	PN 35
DN 150	Sewer	SN8	CS 34	N/A	N/A	SN 8	N/A	SN 8	PN 35
DN 225	Sewer	SN8	MCN 160	N/A	N/A	SN 8	N/A	SN 8	PN 35
DN 300	Sewer	Min Class 12	MCN 120	SN 10	N/A	SN 8	SN 10	SN 8	PN 35
DN 375 - DN450	Sewer	N/A	MCN 95	SN 10	N/A	SN 8	SN 10	SN 8	PN 35
DN 525	Sewer	N/A	MCN 95	SN 10	N/A	SN 8	SN 10	SN 8	PN 35
DN 600	Sewer	N/A	MCN 95	SN 10	CLASS 3	SN 8	SN 10	SN 8	PN 35

Table 8.5 – Approved Pipe Materials

Notes:

1. Pipe classes specified are minima only. The designer shall confirm pipe class suitability by structural analysis.
2. Class SN 8 is acceptable for sewers up to max. 3.0m depth. Sewers in excess of 3.0m deep to be constructed from PVC-U class12 series 1 pipework.
3. Pipe to be solid wall type, maximum 3.0m lengths.
4. Rubber ring seal only.
5. Suitable for specific uses only, as approved by the Water Agency.
6. Allowable in sewerage pressure pipeline systems.
7. Sewerage pressure pipeline fittings shall be fusion bonded polymer encapsulated ductile iron cement lined.
8. DICL pipes shall be protected against chemical attack by an approved method such as Calcium aluminate cement mortar lining
9. WSSA Product Purchase Specifications are available to down load at www.wsaa.asn.au

8.6.4 Construction – Reticulation

a) Part 3, Section 12.2 Personnel Qualifications

Add to WSAA:
Pipe layers shall be accredited by the appropriate pipe manufacturer

b) Part 3, Section 13.5.4.2 – Traffic Management

Replace WSAA requirement with:
A traffic management plan shall be prepared for all projects.

c) Part 3, Section 17.1.4 Laying

WSAA reference to SEW – 1103 is not adopted by Council.

d) Part 3, Section 17.7 Property Connection Sewers

Replace WSAA Standard Drawing SEW 1109 with Council Standard Drawings SCW 125 and SCW 130.

e) Part 3, Section 17.8 – Dead Ends

Replace WSAA Standard Drawing SEW – 1109 with Council Standard Drawings SCW 125 and SCW 130.

f) Part 3, Section 17.9 – Marking of Property Connection Sewers and Dead Ends

Replace WSAA Standard Drawings with Council standard Drawings SCW 125 and SCW 130.

g) Part 3, Section 17.12 – Bored Pipes under Roads, driveways and elsewhere

h) Part 3,Section 18.1 – Maintenance Holes (MHs) – General

WSAA Standard Drawing SEW 1307 is not adopted by Council.

WSAA Standard Drawing SEW – 1400 is not adopted by Council.

i) Part 3, Section 19.1 – Maintenance Shafts (MS and TMS) and Inspection Openings (IO) – General. Replace WSAA referenced standard drawings SEW 1105, 1106 and 1109 with SCW 160, SCW 125, SCW 130, and WSAA SEW – 1314, SEW – 1316 and SEW – 1317

j) Part 3, Section 19.2 – Sealing Caps

Replace WSAA Standard Drawing SEW – 1106 with Council Standard Drawing SCW 125 and SCW 130.

k) Part 3, Section 19.3 – Covers

Replace WSAA Standard Drawings SEW – 1106 and SEW – 1109 with Council Standard Drawings SCW 125 and SCW 130.

l) Part 3, Section 20.6 – Concrete Embedment and Encasement

WSAA reference to the Standard Drawing SEW – 1400 is not adopted by Council.

m) Part 3, Section 22.4 – Air Pressure and Vacuum Testing of Sewers

Add to WSAA requirement:
Vacuum testing shall be undertaken on all sewers and maintenance holes.

n) Part 3, Section 22.6 – Deflection (Ovality) Testing of Flexible Sewers

Add to WSAA requirement:
Deflection testing shall be undertaken on all flexible sewers.

o) Part 3, Section 22.6.3 – Flexible Sewers

Replace with 22.6.4

p) Part 3, Section 22.7 – CCTV Inspection

Add to WSAA requirement:
CCTV inspection shall be undertaken on all sewers prior to 'on' and 'off' maintenance inspections

q) Part 3, Section 24 – Connection to Existing Sewers

Replace WSAA requirement with:
All works that may involve connection to or modification of the existing sewerage system are known as 'live sewer works'.

Typical works include:
- new connections to existing maintenance holes, and sewers;
- connection of a new maintenance hole over an existing sewer or dead end;
- extension or relaying existing sewers;
- replacement of sewers;
- raising or lowering of existing maintenance holes;

- other works on existing sewers and maintenance holes.

'Live sewer works' shall be clearly identified on the drawings. All 'live sewer works' shall be undertaken by the Water Agency at the applicant's expense. Sewer mains are considered to be live once accepted 'on maintenance' by the Water Agency.

r) Part 3, Section 27 – Excavation or Filling over Existing Sewers
Where Water Agency approval is granted to alter the existing ground surface level over an existing sewer:

- house connections on the sewer are to be altered to the minimum depth capable of draining the entire property;
- maintenance holes affected by the works are to be altered as required.

3.2.3.4 Specifications

All relevant details are applied under Water Services Association of Australia (WSAA) National Code.

8.6.5 Planning and Design – Sewage Pumping Stations

Usage

This policy shall be read in conjunction with, and take precedence over, the WSAA Sewerage Pumping Station Code of Australia – WSA 04-2005 to define the technical requirements of Council and the Water Agency in relation to the planning, design and construction of sewage pumping stations.

This policy shall be read in conjunction with Council's Standard Specification "Supply and Installation of Electrical Equipment for Pumping Stations". Where discrepancies exist the Council specification shall have precedence.

Refer to Tables of Standard Drawings for relevant adopted drawings.

Part 1: Planning and Design

a) Pt 1, Section 5.2.6 Landscaping

Add to WSAA requirements:
Landscaping works require an Operational Works approval

b) Part 1, Section 5.3.2 Inlet MH design

Replace WSAA requirement with:
House overflow monitoring/telemetry equipment not required

c) Part 1, Section 5.4.2 Sizing

Replace WSAA requirement with:
The wet-well diameter shall be a minimum of 2.4m

d) Part 1, Section 6.6.5 Junction Boxes

Junction Boxes are not permitted

e) Part 1, Section 6.8.1 Pump Starters and Variable Speed Drives

Autotransformers are not permitted

f) Part 1, Section 7.3.1 Power and Control Cubicle

Aluminium/zinc coated steel sheet is not permitted

g) Part 1, Section 7.3.2.4 Degree of Protection

The switching mechanism component shall be rated at a degree of protection of IP42.

h) Part 1, Section 8.3.1 Pumping Control

Interlock control is not required.

i) Part 1, Section 8.3.5 Pump Starts and Interlocks

Interlock control is not required.

j) Part 1, Section 10.11.2 Discharge MHs

Add to WSAA:
Where pressure sewers discharge to a gravity system, the receiving structure must be a plastic maintenance hole or approved alternative. Connection to the Council sewer system must be by gravity only to a maintenance hole with an approved H2S gas inhibiting product. The two maintenance holes immediately downstream and one immediately upstream must also be treated with an approved H2S gas inhibiting product.

k) Part 3, Section 21.4.6 Mains Requirements

Item (a) is not required.

l) Part 3, Section 21.4.8.1 Underground Cable Installation

Method (b) is the required method.

m) Part 3, Section 21.7.2 Control Circuit Wiring

Replace WSAA conductor requirement with:

- Use flexible PVC coated tinned 30/0.65 copper conductors of minimum size 1.5mm^2 with 250 V grade insulation.
- Extra low voltage devices are coloured orange.

n) Part 3, Section 21.8.2 Conduits

Hot dip galvanised saddles are not permitted.

o) Part 3, Section 36.4.2.2 Low pressure air testing

Replace WSAA requirement with:
Vacuum testing is required for gravity sewers

Contents of Section 9 – Site Development

Tables in Section 9

Figures in Section 9

Section 9 – Site Development

9.1 Purpose and Structure

(1) The purpose of this Section is to provide guidance on standards required during the development of the site for the approved use.

(2) This section is structured as follows:

(a) 9.1 to 9.4 which provide the framework for the guidelines;

(b) 9.5 which outlines the requirements relating to development of the site for approved use in terms of vehicular access traffic management during construction, public utility plant, construction activities and practice, and soil erosion and sediment controls.

9.2 Terminology

General terms used in this Section are included in Section 1.5. The following terms relate specifically to this Section of the Policy:

"Affected Public Utility" – any Public Utility Plant which the Contract identifies and requires to be relocated due to the execution of the work under the Contract.
"ARI" – Average Recurrence Interval
***"Completed Public Utility Plant Relocation"* –** a relocation of Public Utility Plant (PUP) that has been completed and approved by the responsible Public Utility Authority for reconnection to the PUP network.
"Public Utility Authority" – any Commonwealth, State or local Government department, council, body, instrumentality or corporation or any other corporation, authority or body (statutory or otherwise) which owns, operates or has jurisdiction or authority over any Public Utility Plant.
***"Public Utility Plant"* –** any railway, viaduct, aqueduct, conduit, water channel, pipeline (water, stormwater, oil, gas, sewerage or otherwise), fixed mechanical conveyor, tower, pole, cable, electrical installation or telecommunications plant (including cameras) that is on, in, over or under the site.
"Public Utility Plant Relocation Work" – the work of relocating an Affected Public Utility.

9.3 Related Standards/References

(1) Related standards/references referred to in this Section are as follows:

(a) Institution of Engineers Australia (Queensland Division) "Soil Erosion and Sediment Control, Engineering Guidelines for Queensland Construction Sites (1996)"

(b) Brisbane City Council "Environmental Best Management Practice for Erosion and Sediment Control (1996)"

(c) Brisbane City Council "Stormwater Quality Improvement Device Design Guidelines"

9.4 Process

Site development proposed and development approval obtained where relevant
Aspects of site development to be designed taking into account: (a) Vehicular access design (Section 9.5.1) (b) Earthworks (Section 4)
Site development not to commence unless the following plans (where required) have been submitted and approved: (a) Traffic Management Control Plan (Section 9.5.2) (b) Erosion Control Plan (Section 9.5.5) (c) Public Utility Plan Relocation Management Plan (Section 9.5.3) (d) EMP (Section 2.5.2)
Site development not to commence unless the permits (where required) outlined in Section 9.5.4 (1) have been obtained.
Site development undertaken in accordance with: (a) Approved plans and permits (b) Construction activities and practices identified in Section 9.5.4

Figure 9.1 – Site Development

9.5 Guidelines

9.5.1 Vehicular Access

(1) Engineering design plans must indicate the location, type, size and finish of driveways.

(2) For site development on all land other than Residential "A", a commercial driveway must be constructed. This driveway is to comply with Caloundra City Council approved Standard Drawings.

(3) Generally, a Type A driveway(s) will suffice for most development. Council will indicate through approval conditions if a Type B driveway(s) is required with the relevant dimensions.

(4) Driveways are to be a minimum of 3.0 metres wide at the R.P. alignment and must not cross the footpath or verge in front of adjoining properties, unless otherwise approved.

(5) A grated drain is required on the inside of the R.P. alignment on ascending driveways and may be piped directly to the kerb and channel (a kerb adaptor should be used where practical, refer IPWEAQ Standard Drawing), unless stormwater runoff from the area discharging to the grated drain is required to be treated to remove pollutants before discharging to Council's drainage system.

(6) Grated drains are to be bolted down to diminish noise. The piping across the footpath to the kerb and channel must be constructed of hot dip galvanised rectangular hollow sections (RHS) with a maximum height of 100mm and a minimum width of 75mm. The RHS is to be placed at 45° to the frontage kerb and must not encroach upon the verge fronting any adjoining land.

(7) Driveway surfaces must have a non-slip finish, while stamped concrete must not include edges or lips that compromise pedestrian safety.

(8) Saw cuts must be used at existing footpath, kerb and channel and road pavements when constructing a driveway.

(9) All existing vehicular crossings that will be redundant are to be closed and the footpath reinstated. Kerb and channeling is to be in accordance with Caloundra City Council approved Standard Drawings.

9.5.2 Traffic Management during Construction

(1) A Traffic Management Control Plan (TMCP) is to be prepared to provide for the safe and orderly passage of vehicular, pedestrian and bicycle traffic through and around the site during construction of works, and for management of environmental impacts of traffic.

(2) The TMCP is to be prepared by a suitably qualified person and is to:

(a) describe traffic arrangements which provide for the construction of the work while minimising disruption to local traffic from adjacent communities, emergency vehicles, pedestrians and cyclists;

(b) provide details of all traffic management changes;

(c) describe how the construction work zone is to be physically isolated from traffic and pedestrians;

(d) provide details of how local access to communities and adjacent businesses will be maintained;

(e) provide advance notification to the Superintendent, Police and Emergency Services of proposed significant changes to traffic arrangements on the major network roads;

(f) describe measures to effectively minimise any dust which may occur during construction activity including transport of material to and from the site which may affect the safety and general comfort of the public, employees and/or occupants of adjacent buildings;

(g) describe measures to ensure access for emergency vehicles to the construction site;

(h) describe measures to provide adequate information to ensure the community, including local businesses, are informed of changes to traffic movements as a result of construction; and

(i) describe where police officers are to be employed to assist with control of traffic, provide evidence of approval of necessary arrangements with Queensland Police Service.

(3) *Temporary Closures*

(a) Short duration closures of an entire carriageway may be approved, but are subject to the issue of a permit from the relevant Council Unit. For a carriageway closure to be approved, it must be demonstrated that partial lane closures are impractical because of:

(i) an unacceptable hazard to motorists or workers; and/or
(ii) the extent of delays to motorists or rework occasioned by partial closures over a more extended period.

(b) The duration of any closure is to be the minimum required to affect the critical works.

9.5.3 Public Utility Plant

(1) Provision is to be made for the relocation of any Public Utility Plant within the site during the construction of works through:

(a) Preparation, submission, monitoring and updating of a Public Utility Plant Relocation Management Plan;

(b) Management and co-ordination of public utility plant relocations; and

(c) Liaison and negotiation with relevant Public Utility Authorities.

(2) The applicant will be responsible for the management of all outstanding work associated with relocation of affected utilities and to ensure that the specific relocation and/or replacement requirements of each responsible Public Utility Authority are met.

(3) The applicant will be responsible for any damage to any Public Utility Plant (including any completed Public Utility Plant Relocation) caused by the execution of work. The applicant is to make arrangements directly with the relevant Public Utility Authority for any such repair work.

(4) the applicant is to ensure that disruption in disconnecting and reconnecting Public Utility Plant to individual land owners and/or occupiers is kept to a minimum. The applicant is to consult with the relevant Public Utility Authority regarding special requirements regarding continuity of supply of any Public Utility Plant and take all measures necessary to satisfy such requirements.

(5) The applicant is to notify affected landowners and/or occupiers at least 24 hours prior to planned works commencing.

(6) The applicant is to provide as constructed drawings to the standard specified in Section 12, as soon as practicable after the responsible Public Utility Authority has approved the Completed Public Utility.

9.5.4 Construction Activities and Practices

(1) *General*

(a) All works are to be constructed in accordance with approved plans.

(b) The following permits (if applicable) are to be sought from the relevant Council Unit prior to construction activity:

(i) permit to cross footpath (construction vehicular access to site);
(ii) permit to open road (for works on footpath or roadway);
(iii) permit to connect to Council's stormwater drainage system;
(iv) permit to occupy footpath (construction of stages or erection of scaffolding); and
(v) permit to close footpath (storing materials on the footpath)

(c) Whether or not an Environmental Management Plan is required under Section 2 - Environmental Guidelines the provisions of this Section apply to all site development works.

(2) *Construction Debris and Waste*

(a) Construction works are to be undertaken in such a manner so as to minimise the entry of pollutants into the stormwater system.

(b) No wastes are to be disposed to the stormwater drainage system, Council's sewer system, landfill or other facility except in accordance with Table 91.

Disposal to:	Allowable During Construction	Allowable Post Construction
Stormwater Drainage System	• Only discharges that meet the Water Quality Objectives in Section 6 may be discharged to the Stormwater Drainage System	• Only discharges that meet the Water Quality Objectives in Section 6 may be discharged to the Stormwater Drainage System
Council Sewer System	• Any material or liquids permitted under the Water Act 2000. • Internal wash or cleaning waters.	• Any material or liquids permitted under the Water Act 2000. • Saline water from evaporative air conditioners. • Backwash waters from swimming pools. • Washwater from refuse bin wash area.
Landfill - Rubbish Tip	• Residue or sediment from filtered cleaning water, dewatering activity, collected sediment in erosion and sediment control traps or devices. • Solid wastes from brick, tile cutting, etc, plastering, concreting or general construction activity. • General building site solid wastes.	Not applicable.
Hazardous Waste Facility	• All designated toxic, corrosive, hazardous materials which are no longer required. • Radioactive substances or wastes.	Not applicable.
Other	• Cleaning water-based paints: following settling, residue to landfill, water to sewer or to a vegetated area, avoiding ponding. • Cleaning oil based paints: following settling residue to a waste treatment facility such as a landfill. • Colouring dyes for concrete to be contained and recycled.	Not applicable.

Table 9.1 – Disposal of Wastes from Construction Sites

Note: Reusable and recyclable wastes such as timber, skids, pallets, drums, and scrap metal, waste oils, lubricants, and fuels etc should be salvaged where practicable.

(c) Provision is to be made on site for the orderly collection and temporary storage of all site debris and waste.

(d) The storage area or areas for site debris and waste are to be kept covered and located away from drainage paths to prevent litter and debris entering the stormwater drainage system.

(e) Catch drains are to be installed upslope from stockpiles to divert water around stockpiles.

(f) Spoil stockpiles kept on site for more than 14 days are to be stabilised with vegetation. All spoil heaps are to be surrounded by a silt fence at the toe of the stockpile and not in a stormwater flow path.

(g) Hazardous or Pollutive Spills, Clean Up Procedures
    (i) An Environmental Emergency Response Plan as outlined in Section 2.5.3 is required for any activity which contains the use of hazardous and/or potentially polluting material.
    (ii) A copy of the Material Safety Data Sheets is to be provided by the applicant and made readily available for all hazardous and/or potentially polluting material and any spill must be cleaned up in accordance with these sheets and the Emergency Response Plan.

(h) De-watering
    (i) All ground water overflows from de-watering activity are to be filtered, before being discharged into the stormwater drainage system. Generally, if this (and some other building site runoff wastes) undergo some method of sediment control or filtration, the filtered liquid may be suitable to be discharged into the stormwater drainage system.
    (ii) There are a number of methods available to filter out sediment and solid wastes, such as existing areas of vegetation, filter dams and sediment weirs and sand filters. Further details on the design, construction and maintenance of these devices are provided in reference texts. These activities are not to be carried out on public roads, footpaths or reserves.

(g) Plastering
    (i) All residues and wastes from plastering activities are to be allowed to dry within a designated contained area on site.

(h) Painting
    (i) Water based paint cleaning waters are to be diverted into a contained area on the site for soakage then/or disposed to an authorised waste depot.
    (ii) Oil based cleanup material is to be filtered for reuse of the solvent, or taken to an authorised waste depot.

(i) Concrete Works
    (i) All residues and wastes generated by the carrying out of the concrete works are to be prevented from entering the stormwater system. Where this is not possible (such as concrete pavement cutting works), the amount of waste that may enter the stormwater drainage system is to be minimised, by use of absorption socks and the like.
    (ii) Site mixing of concrete, either by hand or mechanical means, is to be carried out in a designated area of the site which minimises the chance of wastewaters entering the stormwater system.
    (iii) Concrete mix trucks, pumps and equipment must not be washed down in roadways, footpaths or reserves but this should be conducted at wash-down bays, either on-site or at the applicant's depot.

(j) Exposed Aggregate or Coloured Concrete
    (i) All slurry from exposed aggregate concrete finishes is to be directed to a contained area on site so that the sediments can be filtered out. Where this is not possible, a filter sock

can be placed in the kerb and channel downstream so as to minimise the amount of pollution entering the stormwater drainage system.
- (ii) If colouring is added following the placement of concrete, care is to be taken to reduce the waste which may be blown or washed into the stormwater drainage system.

(k) Brick works and paver cutting
- (i) Mortar is not to be mixed in locations which drain directly to the stormwater drainage system.
- (ii) All wastewater from brick, paver and tile cutting activities is to be prevented from directly entering the stormwater drainage system. This could be carried out in the same designated area as where concrete mixing, cleaning and the like are undertaken.

(l) Cleaning
- (i) All general building cleaning wastes with the exception of lead/caustic paint scrapings are to be discharged either into a contained area on site for soakage then/or disposed to an authorised waste depot.

(m) Other
- (i) Evaporative air conditioners are to be installed in such a manner that the saline water from the cooler dump valve system is directed to sewer. For other domestic non-dump valve systems, overflows should be directed to a suitable landscaped area.
- (ii) Any spray treatments are to be applied in such a manner as to minimise the potential for pollution of the stormwater system.

(3) *Acid Sulfate Soils*

(a) Refer to Section 4.5.2 (1) – Earthworks for details relating to managing acid sulfate soils.

(4) *Pesticides, Herbicides and Insecticides*

(a) *Best Management Practices*

The following points provide guidance when using/mixing/disposing of pesticides:
- (i) Pre-emergence insecticides are preferred over adult treatment in that they prevent the development of breeding stock.
- (ii) Spraying should not occur during windy conditions, as this leads to wastage, higher application costs and the wind may transport the spray to non-target species and the stormwater drainage system.
- (iii) Wanding or painting onto leaves or, for woody weeds, cutting and painting or injecting of chemical agents should be used in preference to sprays.
- (iv) All chemical applications used should be coloured to indicate where they have been used, hence reducing excessive use and additional cost.
- (v) All applications should be carried out in accordance with the manufacturers' instructions.
- (vi) Empty containers should be "triple washed" and then disposed to landfill.
- (vii) Very few pesticides are registered for use in watercourses and should the application of chemical agents be required, this would need to be done in consultation with the Environmental Protection Agency.
- (viii) All pest management works should be carried out by an appropriately qualified and experienced pest control operator.

9.5.5 Soil Erosion and Sediment Control

(1) *General*

(a) An Erosion Control Plan is required to be submitted as part of the detailed Engineering Plans for Reconfiguring a Lot application and in accordance with the scale and potential impacts of other proposed developments.

(b) In the case of a Reconfiguring a Lot application, the Erosion Control Plan may be combined with the details provided in the Flood and Stormwater Management Plan required under Section 5 of this Policy.

(c) Site issues such as soil type and topography combined with identified environmental factors determine the level of erosion risk and, hence, the standard of soil erosion and sediment control techniques required.

(d) A description of the factors which contribute to and aid in the prevention of, soil erosion is found in Section B of the Institution of Engineers Australia (Queensland Division) "Soil Erosion and Sediment Control Guidelines".

(e) Erosion Risk Potential of each site is to be determined using the following formula:

ERP = Sr x Cr x Er x Tr

Where:

Soil Erodibility Factor (Sr)

Design Values are to be obtained from Table 9.2. However, should analysis of the soil indicate that the soil is non-dispersive, a Soil Erodibility Factor of 1.2 may be adopted.

Climatic Condition Factor (Cr)

Design Values are to be obtained from Table 9.3.

Environmental Factor (Er)

Design Values are to be obtained from Table 9.4. Should discharge be to an enclosed drain, then the Receiving Water to be adopted is that of which occurs at the outlet to the enclosed drain.

Topography Factor (Tr)

Design Values are to be obtained from Table 9.5.

(f) The ERP value is then to be converted into the site's level of erosion risk by use of Table 9.6.

(g) Once the level of erosion risk has been determined, the types, quantity and quality of controls necessary can be established using the information contained in Table 9.7.

Texture Type	Erodibility	Texture Type	Erodibility
Sand	1.0	Clay Loam	1.7
Loamy Sand	1.2	Clay	1.8
Sandy Loam	1.4	Silty Clay	1.8
Sandy Clay Loam	1.4	Silty Clay Loam	1.9
Sandy Clay	1.5	Silt Loam	1.9
Loam	1.6	Silt	2.0

Table 9.2 – Soil Erodibility Factor (Sr)

Month	Effect	Month	Effect
January	2.5	July	1.0
February	2.5	August	1.0
March	2.5	September	1.0
April	2.0	October	1.5
May	1.5	November	1.5
June	1.5	December	2.0

Table 9.3 – Climatic Condition Factor (Cr)

Receiving Water	Standard	Receiving Water	Standard
Open Drain	1.0	River (nat. Clear)	1.4
Sediment Trap	1.1	Creek (nat. Clear)	1.4
River (nat. Turbid)	1.2	Water Supply Dam	1.5
Creek (nat. Turbid)	1.3	Pumicestone Passage	1.5

Table 9.4 – Environmental Factor (Er)

Slope Gradient		Slope Length (m)							
Ratio	%	10	20	30	40	50	60	80	100
1 in 100	1	0.12	0.14	0.14	0.15	0.16	0.16	0.17	0.17
1 in 50	2	0.20	0.24	0.26	0.28	0.30	0.31	0.34	0.36
1 in 33	3	0.28	0.34	0.39	0.43	0.46	0.48	0.53	0.57
1 in 25	4	0.35	0.44	0.52	0.57	0.62	0.66	0.73	0.80
1 in 20	5	0.41	0.55	0.64	0.72	0.79	0.85	0.95	1.04
1 in 16.7	6	0.48	0.65	0.77	0.87	0.96	1.04	1.18	1.30
1 in 12.5	8	0.61	0.85	1.03	1.18	1.32	1.44	1.65	1.84
1 in 10	10	0.77	1.11	1.37	1.59	1.78	1.96	2.27	2.55
1 in 8.3	12	0.97	1.42	1.77	2.07	2.33	2.58	3.02	3.41
1 in 7.1	14	1.16	1.72	2.16	2.55	2.89	3.21	3.77	4.28
1 in 6.3	16	1.34	2.02	2.56	3.03	3.45	3.84	4.54	5.18
1 in 5.5	18	1.52	2.31	2.94	3.50	4.00	4.47	5.31	6.07
1 in 5	20	1.70	2.59	3.33	3.97	4.56	5.10	6.08	6.97
1 in 4	25	2.11	3.29	4.26	5.12	5.90	6.63	7.97	9.20
1 in 3.3	30	2.49	3.94	5.14	6.21	7.19	8.11	9.80	11.35
1 in 2.5	40	3.17	5.09	6.72	8.18	9.52	10.79	13.13	15.30
1 in 2	50	3.72	6.04	8.03	9.82	11.48	13.04	15.92	18.65

Source: NSW Dept. of Housing (1993)

Table 9.5 – Topography Factor (Tr)

Erosion Risk Potential	ERP Value
Low	<1
Moderate	1 - 5
High	5 - 20
Extreme	>20

Table 9.6 – Level of Erosion Risk

EROSION RISK POTENTIAL	STRUCTURAL CONTROLS	DRAINAGE CONTROLS	EROSION CONTROLS	SEDIMENT CONTROLS
LOW	All structural controls are to be designed for a 1 year ARI event.	1. Divert upslope stormwater runoff around the disturbed area or work site. Refer to IE Aust Guidelines, Section A5-A1, A5-A4 and A5-A7. 2. Provide chutes, flumes, drop pipes etc. for transportation of concentrated flows down embankments. Refer to IE Aust Guidelines, Sections A5-A3 and A5-A5. 3. Provide stabilised drainage outlets as required. This may include stabilised grassed areas or constructed energy dissipator outlets similar to that used on down pipes. Refer IE Aust Guidelines, Section A5-A5. 4. Provide temporary watercourse crossings as required. Refer to IE Aust Guidelines, Section A5-A12.	1. All exposed land following works is to be revegetated; this may be as simple as seeding and fertilising. Refer to IE Aust Guidelines, Section A5-B4. 2. For slopes steeper than 18%, surface roughening should be carried out prior to revegetation. Refer to IE Aust Guidelines, Section A5-B6.	1. A sediment basin or pond is to be constructed at the location of all stormwater discharges from the site that includes land disturbance within their catchment. Refer to IE Aust Guidelines, Section A5-C9, C11. For very small catchments (< 0.5ha), a rock filter dam or straw bales may be adopted. Refer to IE Aust Guidelines, Section A5-C7, C13. 2. Any sediment barriers or inlet protection as necessary. Refer to IE Aust Guidelines, Section A5. 3. All proposed entry/exit locations from the site are to be controlled in a manner so as to reduce the export of sediment from the work site. Refer to IE Aust Guidelines, Section A5-C3.
MODERATE	All structural controls are to be designed for a 2 year ARI event.	1 Divert upslope stormwater runoff around the disturbed area or work site. Refer to IE Aust Guidelines, Section A5-A1, A5-A4 and A5-A7. 2 Provide chutes, flumes, drop pipes etc. for transportation of concentrated flows down embankments. Refer to IE Aust Guidelines, Sections A5-A3 and A5-A5. 3 Provide stabilised drainage outlets as required. This may include stabilised grassed areas or constructed energy dissipator outlets similar to that used on down pipes. Refer IE Aust Guidelines, Section A5-A5. 4 Provide temporary watercourse crossings as required. Refer to IE Aust Guidelines, Section A5-A12.	1. All exposed land following works is to be revegetated, generally with some type of surface stabiliser. Refer to IE Aust Guidelines, Section A5-B1, B2, B3. 2. For slopes steeper than 18%, surface roughening should be carried out prior to revegetation. Refer to IE Aust Guidelines, Section A5-B6.	1. A sediment basin or pond is to be constructed at the location of all stormwater discharges from the site that includes land disturbance within their catchment. Refer to IE Aust Guidelines, Section A5-C9, C11. For very small catchments (<0.5ha), a rock filter dam or straw bales may be adopted. Refer to IE Aust Guidelines, Section A5-C7, C13. 2. Any sediment barriers or inlet protection as necessary. Refer to IE Aust Guidelines, Section A5. 3. All proposed entry/exit locations from the site are to be controlled in a manner so as to reduce the export of sediment from the work site. Refer to IE Aust Guidelines, Section A5-C3.
HIGH	All structural controls are to be designed for a 5 year ARI event.	1. Divert upslope stormwater runoff around the disturbed area or work site. Refer to IE Aust Guidelines, Section A5-A1, A5-A4 and A5-A7. 2. Provide chutes, flumes, drop pipes etc. for transportation of concentrated flows down embankments. Refer to IE Aust Guidelines, Sections A5-A3 and A5-A5. 3. Provide stabilised drainage outlets as required. This may include stabilised grassed areas or constructed energy dissipator outlets similar to that used on down pipes. Refer IE Aust Guidelines, Section A5-A5. 4. Provide temporary watercourse crossings as required. Refer to IE Aust Guidelines, Section A5-A12.	1. All exposed land following works is to be revegetated and should be mulched and/or covered with erosion control mats or similar. Refer to IE Aust Guidelines, Section A5-B2, B3. 2. For slopes steeper than 20%, or longer than 40m and steeper than 10%, which will be left exposed for longer than 7 days, turf or erosion control mats are required as temporary stabilisation.	1. A sediment basin or pond is to be constructed at the location of all stormwater discharges from the site that includes land disturbance within their catchment. Refer to IE Aust Guidelines, Section A5-C9, and C11. For very small catchments (<0.5ha), a rock filter dam or straw bales may be adopted. Refer to IE Aust Guidelines, Section A5-C7, and C13. 2. Sediment barriers or inlet protection are required for all points of surface water into a receiving stormwater drainage system as necessary. Refer to IE Aust Guidelines, Section A5. 3. All proposed entry/exit locations from the site are to be controlled in a manner so as to reduce the export of sediment from the work site. Refer to IE Aust Guidelines, Section A5-C3.
EXTREME	All structural controls are to be designed for a 10 year ARI event.	1. Divert upslope stormwater runoff around the disturbed area or work site. Refer to IE Aust Guidelines, Section A5-A1, A5-A4 and A5-A7. 2. Provide chutes, flumes, drop pipes etc. for transportation of concentrated flows down embankments. Refer to IE Aust Guidelines, Sections A5-A3 and A5-A5. 3. Provide stabilised drainage outlets as required. This may include stabilised grassed areas or constructed energy dissipator outlets similar to that used on down pipes. Refer IE Aust Guidelines, Section A5-A5. 4. Provide temporary watercourse crossings as required. Refer to IE Aust Guidelines, Section A5-A12.	1. All exposed land following works is to be revegetated by turfing and/or mulching and landscaping. Refer to IE Aust Guidelines, Section A5-B2, and B3. 2. For slopes steeper than 20%, or longer than 40m and steeper than 10%, which will be left exposed for longer than 7 days, turf or erosion control mats are required as temporary stabilisation. Refer to IE Aust Guidelines, Section A5-B2.	1. A Sediment basin or pond is to be constructed at the location of all stormwater discharges from the site that includes land disturbance within their catchment. Refer to IE Aust Guidelines, Section A5-C9, and C11. For very small catchments (<0.5ha), a rock filter dam or straw bales may be adopted. Refer to IE Aust Guidelines, Section A5-C7, and C13. 2. Sediment barriers or inlet protection are required for all points of surface water into a receiving stormwater drainage system as necessary. Refer to IE Aust Guidelines, Section A5. 3. All proposed entry/exit locations from the site are to be controlled in a manner so as to reduce the export of sediment from the work site. Refer to IE Aust Guidelines, Section A5-C3.
SITE DEVELOPMENT	All structural controls are to be designed for 2 year ARI event	1. Divert upslope stormwater runoff around the disturbed area or work site. Refer to IE Aust Guidelines, Section A5-A1, A5-A4 and A5-A7. 2. Provide chutes, flumes, drop pipes etc. for transportation of concentrated flows down embankments. Refer to IE Aust Guidelines, Sections A5-A3 and A5-A5. 3. Provide stabilised drainage outlets as required. This may include stabilised grassed areas or constructed energy dissipator outlets similar to that used on down pipes. Refer IE Aust Guidelines, Section A5-A5. 4. Provide temporary watercourse crossings as required. Refer to IE Aust Guidelines, Section A5-A12.	1. All exposed land following works is to be revegetated by turfing and/or mulching and landscaping. Refer to IE Aust Guidelines, Section A5-B2, and B3. 2. For slopes steeper than 20%, or longer than 40m and steeper than 10%, which will be left exposed for longer than 7 days, turf or erosion control mats are required as temporary stabilisation. Refer to IE Aust Guidelines, Section A5-B2.	1. A sediment basin or pond is to be constructed at the location of all stormwater discharges from the site that includes land disturbance within their catchment. Refer to IE Aust Guidelines, Section A5-C9, and C11. For very small catchments (<0.5ha), a rock filter dam or straw bales may be adopted. Refer to IE Aust Guidelines, Section A5-C7, and C13. 2. Any sediment barriers or inlet protection as necessary. Refer to IE Aust Guidelines, Section A5. 3. All proposed entry/exit locations from the site are to be controlled in a manner so as to reduce the export of sediment from the work site. Refer to IE Aust Guidelines, Section A5-C3.

Table 9.7 – Site Details – Drainage, Erosion and Sediment Control

9.5.6 Drainage, Erosion and Sediment Control Plan (DESCP)

(1) *General*

(a) The Erosion Control Plan is to provide information on actions proposed to be taken to address the following:
   (i) minimise disturbance;
   (ii) drainage control;
   (iii) erosion control;
   (iv) sediment control;
   (v) site rehabilitation; and
   (vi) maintenance and monitoring.

(2) *Information to be provided*

(a) The Erosion Control Plan is to be at a scale of either 1:200 or 1:500 and contain the following general information:

   (i) Overall site plan with the determined Erosion Risk Potential for the site (or segmented areas of the site) in accordance with the provisions of Table 9.7;
   (ii) Overall site plan with existing contours at sufficient intervals to adequately define general drainage paths and estimated Q100 flood contours for all flows in excess of 10 m^3/s;
   (iii) A site plan indicating the location and size of any proposed land disturbance works and the proposed direction and quantity of overland flow from these areas;
   (iv) The location of proposed soil erosion and sediment control(s) for the site, both during construction and for the maintenance period of the development;
   (v) Areas of existing vegetation, highlighting protection of vegetation, limits of clearing, re-establishment of stabilising vegetation and proposed timings; and
   (vi) Location of site storage and stockpile areas, site access points, areas of potential mass movement.

(b) In addition to the information provided in (a) above, the Erosion Control Plan is also to include the following specific and supporting information:

   (i) Drainage Controls
   - information is to be provided for erosion control designed waterways such as catch drains, in accordance with Section 5 - Total Water Cycle Management and Section 6 - Stormwater and Drainage Management.

   (ii) Erosion Controls
   - location, including dimensions, volumes and the like, of mulching, turfing, or revegetation required;
   - areas to be covered by erosion control mats; and
   - areas steeper than 10% and the length of critical slope

   (iii) Sediment Controls
   - design details of sediment basins, ponds and the like, including maintenance requirements and frequency;
   - location and requirements of all other structural control devices;
   - location of all vegetative sediment control devices; and
   - information on protection of existing (including current development works) drainage facilities from damage.

   (iv) Supporting Information
   - overall description of existing site conditions including soil, climatic and vegetation information;
   - proposed maintenance program and disposal method(s) of sediments and other pollutants;
   - description of neighbouring areas, including the location of the nearest downstream natural waterway, and other environmentally relevant areas;
   - description of on-site dust control measures; and

- description of the proposed construction program (including staging) and the revegetation or stabilisation of exposed land.

(v) Additional Supporting Information

The following information may also be required:

- hydrology/hydraulics and geotechnical reports;
- specifications and construction details for drainage, erosion and sediment control techniques where applicable; and
- details of any on or off-site monitoring requirements.

(c) The Erosion Control Plan is to demonstrate compliance with the following:

(i) Minimise Disturbance

- exposure of stripped areas to be minimised;
- haul roads and access tracks to be clearly indicated and confined to proposed permanent road locations;
- effective control of the generation of dust, litter and debris within the site through the use of storage facilities, rubbish bins, hoppers, and the like; and
- limitation of site access to nominated and controlled areas.

(ii) Drainage Control

- stormwater runoff from potentially polluted surfaces shall be discharged on or in to suitable treatment system prior to entering the stormwater drainage system. The use of sedimentation traps and oil/water separators are required for industrial and commercial developments. Sedimentation traps are to be designed to hold the first 20mm of run-off from the paved areas (not including roofs) of the site;
- all refuse container storage areas located on the site are to be drained in accordance with Section 2.6 – Refuse Container Storage;
- Washwater from washdown areas must not be discharged into the stormwater drainage systems, and must be lawfully discharged to sewer. On commercial and industrial developments, it will generally be required that washdown areas be directed to a pre-treatment system and then to sewer. On residential type developments, wash down waters are to be directed to sewer via an appropriately installed bucket filter trap. Alternative means of treating washdown waters are to be approved by Council;
- cut-off and/or diversion drains are to be installed prior to significant land disturbance and around stockpile sites to divert run-off from undisturbed areas into stable drainage lines at non-erosive velocities;
- the amount of stormwater leaving the site is to be minimised through on-site storage and reuse such as through dust suppression and revegetation;
- excess water is not to be discharged into stormwater drains, local drainage lines or streams until discharges meet the stated water quality objectives. temporary structures or retention basins are to be designed on site to cater for the physical treatment of excess or contaminated waters; and
- all borrow pit areas on site are to be constructed with cutoff drains.

(iii) Erosion Control

- all temporary erosion and sediment control devices are to be designed to ensure non-erosive channel or sheet flow for the 2-year ARI event and for the hydraulic capacity of channels or other control structures 10-year ARI, time of concentration event;
- erosion and sediment controls are to be installed prior to any site disturbance, vegetation clearance or services installation. areas of high erosivity are to be managed according to best practice methods to reduce or prevent erosion and/or loss of sediments offsite;
- erosion control measures such as chemical surface stabilisation, mulching, soil-cement treatment, control mats and surface roughening are to be applied on exposed areas;
- erosive potential of runoff on disturbed areas is to be reduced through use of check dams, bunds and/or cutoff drains across the contour. This will reduce the distance of overland flow and convey water to stable drainage lines at a non-erosive velocity.

- progressive stripping of topsoil is to be undertaken prior to drainage works where possible; and
- continual maintenance of erosion control and sediment collection devices.

(iv) Sediment Control

- all construction fill and stored materials are to be situated in approved storage areas. These areas are to have cutoff and diversion drains to divert runoff and are to be located on flat land, bunded and away from drainage lines and flood plains. When not in use, stockpiles to be covered and protected from wind and rain;
- chutes and flumes are to be progressively lengthened as fill batters are constructed. Water flowing from these is to be dissipated and directed to stable areas for sediment treatment.

(v) Site Rehabilitation

- uncontaminated sediment removed from all sediment control devices is to be incorporated in landscaping, fill batters, or mounds or as otherwise approved by council. Contaminated sediment is to be disposed of to an approved spoil or stockpile area or to a spoil dump.

(vi) Maintenance and Monitoring

- a rehabilitation plan is to be developed that allows progressive revegetation so that each area is given a protective ground cover as soon as work is completed for that area. The rehabilitation plan is to describe how maintenance and monitoring of disturbed and rehabilitation sites is to be undertaken.

(vii) Staging of Works

- works for each stage should minimise the exposure of land, to assist in erosion control.

(d) Reference Information
   (i) The Institution of Engineers Australia (Queensland Division) "Soil Erosion and Sediment Control, Engineering Guidelines for Queensland Construction Sites" (1996) provides design guidance on the following erosion and sediment control measures:
      - buffer zones;
      - controlled access points;
      - minimising detrimental effects of haul routes;
      - topsoiling, stripping and stockpiling;
      - Stockpiles;
      - designed watercourses;
      - Sediment traps;
      - dust controls.
   (ii) Brisbane City Council "Stormwater Quality Improvement Device Design Guidelines" provides design guidance on stormwater quality improvement devices.

Contents of Section 10 – Landscaping Infrastructure, Planting & Street Trees

Figures in Section 10

Section 10

Section 10

Section 10 - Landscaping Infrastructure and Street Trees

10.1 Purpose and Structure

The purpose of this Section is to provide guidance on the standards required to meet the performance criteria nominated in the development codes in relation to landscape infrastructure and street tree planting.

Compliance with the guidelines contained in this Section will assist to achieve coherency and maintain local distinctiveness throughout the city while also meeting Council's maintenance requirements.

These guidelines relate to landscape infrastructure, planting and street trees to be provided on land which is or is intended to be in the public domain. Additional guidelines for private and public land for are contained in City Plan Part 9 – Landscaping Code.

This Section is structured as follows:

10.1 to 10.4 provide the framework of the guidelines;

10.5 and 10.6 provide guidance on the appropriate standards to meet Council's requirements regarding landscape infrastructure; and

10.7 provides guidance on the appropriate species and planting for street trees.

10.2 Terminology

General terms used in this Section are included in Section 1.5. The following terms relate specifically to this Section of the Policy:

"Landscaping infrastructure" – any externally built asset which has an inherent value to Caloundra City residents. The core value of such infrastructure can be deemed to provide public amenity and functionality to both public and private spaces, improve or provide the basis for the visual amenity of these spaces as well as improving and protecting both the community lifestyle and ecological value of Caloundra City.

10.3 Related Standards/References

(1) Related Standards/References referred to in this Section are as follows:

- (a) AS 1158: *Public lighting (public walkways);*
- (b) AS 4282: *Control of obtrusive effects of outdoor lighting;*
- (c) AS 4373: *Pruning of amenity trees*
- (d) AS/NZS 1428: *Design for access and mobility;*
- (e) Caloundra City Council Amenities Guidelines;
- (f) Playground Australian Standards;
- (g) Queensland Workplace Health and Safety Act and Queensland Government Department of Industrial Relations Workplace Health & Safety Guide for Building and Construction Industry;
- (h) Environmental Protection Act;
- (i) Institution of Engineers Australian (Queensland Division) "Soil Erosion and Sediment Control Guidelines;
- (j) Department of Main Roads "Road Planning and Design Manual;
- (k) Caloundra City Council's Access and Equity Policy; and
- (l) Caloundra City Art Works – Caloundra Public Strategy and Procedures Manual.
- (m) Planning Scheme Policies 11.2, 11.3, 11.4, 11.5, 11.7, 11.10, 11.15 which take precedence over this Section.

10.4 Process

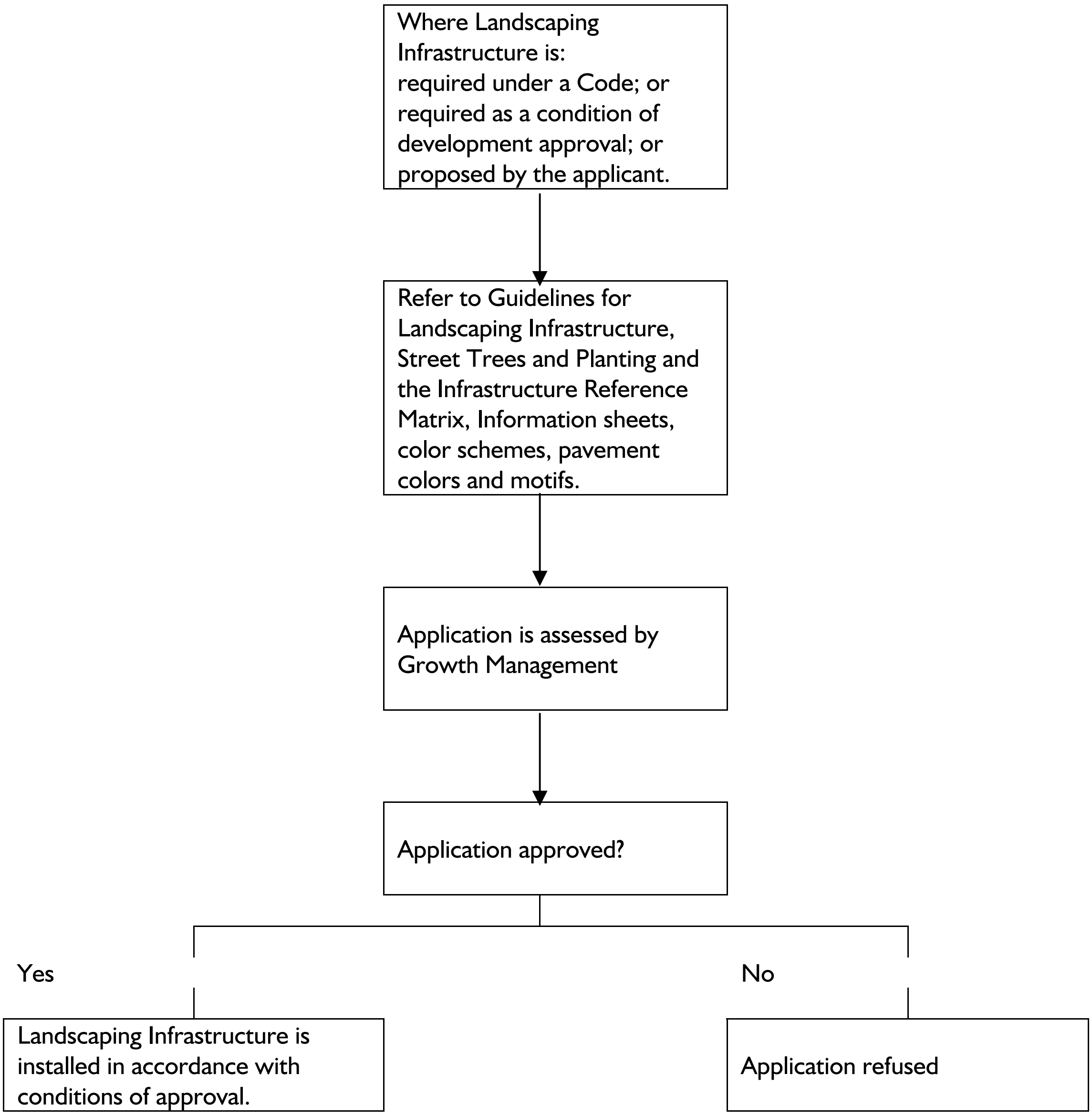


Figure 10.1 – Landscaping Infrastructure

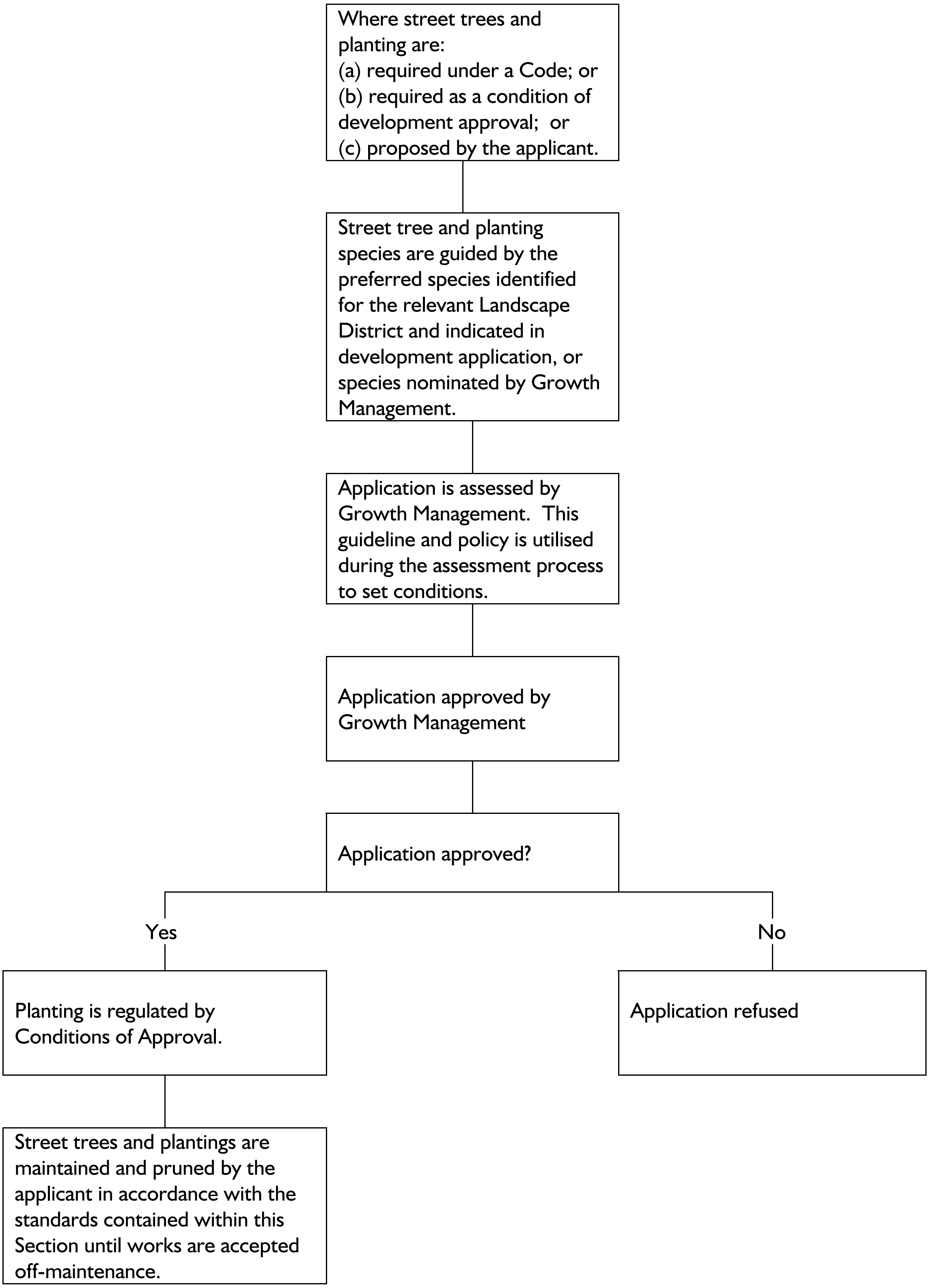


Figure 10.2 – Street Trees

10.5 Landscaping Infrastructure

Refer to Landscaping Code.

10.5.1 Introduction

Caloundra City contains a variety of landscape and urban settlement types, ranging from coastal urban, coastal village, hinterland village, rural areas, and dramatic scenic landscapes to significant environmental reserves. The selection of appropriate landscape infrastructure elements in these guidelines seeks to:

- provide robust landscape infrastructure elements;
- reinforce the diverse character within coastal and hinterland regions; and
- reinforce the individual identity of the particular planning areas and suburbs/localities within those areas.

These guidelines have been developed in order to ensure ecological, recreational and amenity values are protected and enhanced throughout Caloundra City by promoting high quality and cohesive landscape infrastructure. The guidelines identify the preferred landscape infrastructure to be installed within the City's parks, reserves, open space areas, streetscapes and urban spaces.

Landscape infrastructure included in the guidelines has been selected on the basis that it is responsive to the local landscape character, robust, sensitive to the environment and vandal resistant.

10.5.2 Relationship to the Planning Scheme

The Landscape Infrastructure Development and Design Guidelines are intended to provide "probable solutions" to meet the "specific outcomes" specified in the planning scheme codes, in relation to landscape infrastructure.

If any doubt exists in respect of the interpretation of any part of these guidelines, the most appropriate interpretation is that which is most consistent with the stated purpose of the relevant code(s).

The relevant codes in a particular case are the relevant Planning Area Code and the Use Code or other Codes applicable to the proposed development. These are listed below.

10.5.3 Planning Area Codes

These guidelines should be read in conjunction with the relevant Planning Area Code. These codes are as follows:

- Central Caloundra Planning Area Code
- Kawana Waters Planning Area Code
- Caloundra South Planning Area Code
- Caloundra West Planning Area Code
- Caloundra Eastern Beaches Planning Area Code
- Beerwah Township Planning Area Code
- Maleny Township Planning Area Code
- Landsborough Township Planning Area Code
- Mooloolah Township Planning Area Code
- Glass House Mountains Township Planning Area Code
- Beerburrum Township Planning Area Code
- Pumicestone Planning Area Code
- Mary River - Conondale Planning Area Code
- Stanley River - Peachester Planning Area Code
- Maleny Plateau Planning Area Code
- Mooloolah Valley Planning Area Code

10.5.4 Other Planning Scheme Codes

These guidelines should be read in conjunction with the Use Code or Other Code which is relevant to the proposed development including, but not limited to, the following:

- Landscaping Code
- Civil Works Code
- Multi Unit and Mixed Use Residential Code
- Business Centre, Shopping and Commercial Development Code
- Industrial Development and Design Code
- Advertising Devices Code
- Noise, Light and Odour Nuisance Code
- Design for Safety Code
- Reconfiguring a Lot Code
- Stormwater Quality Management Code

10.5.5 Using the Guidelines

The guidelines provide information on the selection of landscape infrastructure. Information sheets for the current range of approved landscape infrastructure are outlined in the sections listed below:

- Landscape Infrastructure Reference Matrix (10.6.1);
- Landscape Infrastructure Information Sheets (10.6.2);
- Colour schemes (10.6.3);
- Pavement colour selection table (10.6.4) and
- Motifs (10.6.5).

Guidelines for landscape infrastructure elements not contained in the landscape infrastructure reference matrix and information sheets are outlined in the sections listed below. These include:

- Playgrounds (10.6.6); and
- Public Art (10.6.7).

Use of other landscape infrastructure elements not contained on the information sheets will require Council approval.

10.5.6 Landscape Character and Design Context

(1) *Introduction*

Caloundra City contains a variety of landscape and urban settlement types, ranging from coastal urban, coastal village, hinterland village, rural areas, and dramatic scenic landscapes to significant environmental reserves. The selection of appropriate landscape infrastructure elements in these guidelines seeks to:

- provide robust landscape infrastructure elements;
- reinforce the diverse character within coastal and hinterland regions; and
- reinforce the individual identity of the particular planning areas and suburbs/localities within those areas.

(2) *Coastal/Urban Context*

The majority of Caloundra's urban areas are located along the coastline. The coastal planning areas identified in the planning scheme include:

- Central Caloundra
- Kawana Waters

- Caloundra South
- Caloundra West
- Caloundra Eastern Beaches
- Pumicestone (eastern part)

These coastal areas are characterised by seaside elements such as ocean views and vegetation, and have a 'beachside style'. The colours chosen for use within these areas identify with the local character and beachside style.

The microclimate of these coastal areas presents harsh and corrosive conditions. Therefore the materials identified in these guidelines for landscape infrastructure items located within these coastal areas are robust and durable.

(3) *Hinterland/Rural Context*

The hinterland of Caloundra City includes a number of township planning areas and rural planning areas, namely:

- Beerwah Township
- Maleny Township
- Landsborough Township
- Mooloolah Township
- Glass House Mountains Township
- Beerburrum Township
- Remainder of Pumicestone Planning Area
- Mary River – Conondale Township
- Stanley River – Peachester Township
- Maleny Plateau Township
- Mooloolah Valley Township

The hinterland is characterised by large tracts of rural lands, significant vegetation and diverse topography. The mountainous backdrop and strong rural identity reinforce the character of the areas. The materials and colours identified in these guidelines for landscape infrastructure items located within the hinterland/rural context are intended to maintain and enhance the rural identity and landscape character of these areas.

(4) *Planning Area Design Context*

The landscape infrastructure identified in these guidelines has been selected to reflect the landscape character of the various planning areas identified in the planning scheme; and (in some planning areas) the intended character for individual locations.

To aid legibility and continuity, the landscape infrastructure reference matrix is structured around these planning areas and particularly suburbs/localities.

In this regard, landscape infrastructure elements have been themed according to each suburb/locality to assist in reinforcing their identity. Such theming will also play a role in creating a sense of place for the residents who use these public open space areas.

A brief overview of the dominant landscape character of each of these planning areas (as applied in the Caloundra City Plan) is provided below, as general design context.

(5) *Central Caloundra Planning Area*

The Central Caloundra Planning Area comprises a central business district that has developed over time around a traditional 'main street'. Its surrounding neighbourhoods include Bulcock Beach and Kings Beach.

The character of parts of the central planning area is predominantly urban with a more relaxed landscaped edge closer to the beaches.

The suburbs/localities within this planning area include:
- Caloundra
- Kings Beach
- Bulcock Beach

(6) *Kawana Waters Planning Area*

The Kawana Waters Planning Area encompasses part of the Mooloolah River Catchment. Its seaside, water oriented location is reflected in the 'beachside' landscape character, including foreshore, dune and coastal plain areas. Its suburbs/localities comprise of traditional and contemporary suburban and town centre developments including:
- Buddina
- Minyama
- Warana
- Bokarina
- Wurtulla
- Parrearra
- Birtinya
- Currimundi
- Meridan Plains
- Palmview

(7) *Caloundra South Planning Area*

Caloundra South covers coastal urban areas that adjoin rural lands and large tracts of State Forest, enhancing the ecological importance of this area.

The coastal urban neighbourhoods maintain a 'seaside village' character. The suburbs/localities in this planning area include:
- Golden Beach
- Pelican Waters
- Bells Creek
- Little Mountain
- Aroona
- Bells Creek
- Caloundra
- Caloundra West
- Coochin Creek
- Glenview
- Landsborough
- Meridan Plains

(8) *Caloundra West Planning Area*

The Caloundra West Planning Area comprises a variety of topographical forms. Whilst there are a number of established neighbourhoods, this area represents one of the largest areas of 'emerging community' residential development.

The suburbs/localities within this planning area include:

- Caloundra West
- Aroona
- Battery Hill
- Caloundra
- Currimundi
- Little Mountain
- Meridan Plains
- Wurtulla

(9) *Caloundra Eastern Beaches Planning Area*

The Caloundra Eastern Beaches Planning Area consists of diverse neighbourhood identities, whilst maintaining a common element of the 'seaside village' character. The coastal urban suburbs/localities include:

- Moffat Beach
- Shelly Beach
- Currimundi
- Dicky Beach
- Battery Hill
- Aroona
- Caloundra
- Caloundra West
- Kings Beach
- Wurtulla

(10) *Beerwah Township Planning Area*

The Beerwah Township Planning Area is centred on the traditional Railway Township of Beerwah. The Planning Area includes Beerwah town centre, surrounding urban areas and rural lands.

The landscape is lush, sub-tropical and rural in character, with the Glass House Mountains providing a dramatic backdrop to the area.

The suburbs/localities within this planning area include:

- Beerwah
- Glass House Mountains

(11) *Maleny Township Planning Area*

Maleny Township Planning Area has a strong identity and vibrant character within the coastal hinterland. Located on the Maleny Plateau, its landscape comprises undulating topography and lush sub-tropical vegetation. Maleny Township represents an important traditional rural village with high heritage and scenic quality values.

The suburbs/localities within this planning area include:

- Maleny
- North Maleny

(12) *Landsborough Township Planning Area*

Landsborough Township Planning Area is well known in the City as the hinterland's 'historic' township. This traditional 'rural' area contains built form and open spaces of high cultural value.

The suburbs/localities within this planning area include:

- Landsborough

(13) *Mooloolah Township Planning Area (refer also to Mooloolah Valley Planning Area)*

The Mooloolah Township Planning Area contains a traditional village and the rural lands surrounding it, with high scenic qualities. These qualities contribute to its rural character.

The suburbs/localities within this planning area include:

- Mooloolah

(14) *Glass House Mountains Township Planning Area*

Glass House Mountains Township is a traditional railway town with a rural character and identity. The area also contains significant remnant vegetation and high quality scenic values.

The suburbs/localities within this planning area include:

- Glass House Mountains

(15) *Beerburrum Township Planning Area*

Beerburrum Township Planning Area comprises the traditional rural town of Beerburrum and its surrounding rural lands, including a significant area of State Forest. The township was developed around the railway and has a strong rural identity. It contains places of cultural significance in the town centre. It has significant vegetation and scenic qualities, including the Anzac Avenue Memorial Trees.

The suburbs/localities within this planning area include:

- Beerburrum

(16) *Pumicestone Planning Area*

Pumicestone Planning Area comprises the Pumicestone Passage catchment area and the coastal lowlands that support threatened flora and fauna species. This area contains diverse landscape types and has high quality scenic values.

The Pumicestone Planning Area also includes the rural/residential areas adjoining the Glass House Mountains, Beerwah and Landsborough townships.

The suburbs/localities within this planning area include:

- Bald Knob
- Beerburrum
- Beerwah
- Bells Creek
- Bribie Island North
- Coochin Creek
- Glass House Mountains
- Glenview
- Landsborough
- Meridan Plains
- Mount Mellum
- Peachester
- Pelican Waters

(17) *Mary River - Conondale Planning Area*

The Mary River - Conondale Planning Area consists of the Mary River catchment area rural lands and, the villages of Conondale and Crystal Waters. Its rich rural character is combined with the diverse landscape including the Mary River floor, steep hillsides of the Conondale Range and the Maleny Escarpment.

The suburbs/localities within this planning area include:
- Booroobin
- Cambroon
- Conondale
- Curramore
- Elaman Creek
- Harper Creek
- Kidaman Creek
- Reesville
- Witta
- Wootha

(18) *Stanley River - Peachester Planning Area*

This area comprises the headwaters of Stanley River, rural lands and the rural residential settlement of Peachester. It is typically 'rural' in character and includes areas of significant vegetation and native forest.

The suburbs/localities within this planning area include:
- Bald Knob
- Beerwah
- Booroobin
- Crohamhurst
- Glass House Mountains
- Landsborough
- Maleny
- Mount Mellum
- Peachester
- Wootha

(19) *Maleny Plateau Planning Area*

The Maleny Plateau Planning Area includes predominantly rural lands with small rural residential settlements including the settlement of Witta and a large water storage area, Lake Baroon.

The basaltic tableland with its undulating hills and steep plateau margins produces a different microclimate from other parts of the region. Due to its topography and vegetation, the area is subject to bush fires. It also includes significant remnant vegetation that supports threatened flora and fauna species and has high quality scenic values.

The suburbs/localities within this planning area include:
- Bald Knob
- Balmoral Ridge
- Booroobin
- Crohamhurst
- Curramore
- Elaman Creek
- Kidaman Creek
- Maleny

- North Maleny
- Reesville
- Witta
- Wootha

(20) *Mooloolah Valley Planning Area (refer also to Mooloolah Township Planning Area)*

The Mooloolah Valley Planning Area comprises a major floodplain area, rural lands and rural residential settlement

The suburbs/localities within this planning area include:
- Bald Knob
- Balmoral Ridge
- Diamond Valley
- Glenview
- Landsborough
- Little Mountain
- Meridan Plains
- Mooloolah Valley
- Palmview

10.6 Guidelines - Landscaping Infrastructure

The landscape infrastructure items contained in these guidelines were selected to reflect the varying character and conditions of Caloundra City, from the urban coastal areas to the rural hinterland. Existing landscape infrastructure elements and Master Plan information were also considered.

10.6.1 Landscape Infrastructure Reference Matrix

The matrix, which is available on the Caloundra City website, has been developed to align with the Planning Areas of Caloundra City Council and is to provide reference to appropriate landscape infrastructure elements for the City's Streetscapes, Class 'A' Parks and Class 'B' Parks. These categories have been defined as follows:

- **Streetscape**: For the purpose of this Section a streetscape is defined as a street or road that comprises specifically designed landscape infrastructure elements and planting design. The street can represent a 'main street' e.g. Bulcock Street in Central Caloundra, an entry to an estate development (residential, commercial or industrial) or a significant street within a neighbourhood in terms of its position in the road 'hierarchy' and/or function (i.e. adjacent to a park, community centre, shopping strip etc). The designed elements of the streetscape should reflect the local landscape character.

- **Class 'A' Park**: A park that has high usage by both local residents and tourists and has generally been designed by specialist consultants to provide high quality amenity and facilities to the local community and broader region it serves. The landscape infrastructure elements are contemporary and durable and have been coordinated through a design process to ensure cohesive design that reflects the local landscape character, promoting passive and active recreational opportunities. These parks would generally include seating, shelters, barbecues, pathways and lighting, toilet facilities, playground and landscaping promoting native plant selection. A Class 'A' Park can be a local, district or regional park (for definitions of park types refer to Caloundra City Council's Open Space Plan).

- **Class 'B' Park:** A park that has medium level local usage and is best described as an open space that provides the standard landscape infrastructure elements set out in this Section. The elements would generally comprise park seating, basic shelters, access pathways, lighting and some amenity to promote social equity for all users. A Class 'B' Park can be a local or district park (for definitions of park types refer to Caloundra City Council's Open Space Plan).

The Landscape Infrastructure reference matrix is divided into two parts:

- ♦ Table A for Streetscapes and Class 'A' parks;
- ♦ Table B for Class 'B' parks.

10.6.1 (1) *How to use the Matrix*

When specifying landscape infrastructure for your area of interest, visit the site to assess the character/themes and either:

(a) match the existing infrastructure/themes (only if suitable); or
(b) select a suitable landscape infrastructure according to the matrix for the relevant locality/suburb.

To select the appropriate landscape infrastructure items using the landscape infrastructure reference matrix on the Caloundra City Council website (www.caloundra.qld.gov.au), users should:

(a) First select whether your area of interest is in Table A or Table B and then go to the relevant table.
(b) Select the appropriate locality/suburb in the matrix (e.g. Kings Beach). If you are unsure, refer to CalMap for boundaries. If a locality/suburb boundary is shown in the middle of a street, select the most appropriate landscape infrastructure from either locality/suburb list. Please note: for ease of reference, the planning area that relates to each locality/suburb has also been identified in the matrix. Some localities/suburbs may overlap into more than one planning area.
(c) Select the item identified in the matrix heading code (e.g. Bins).
(d) Select the code that identifies the appropriate information sheet(s) (e.g. BN1).

10.6.2 Landscape Infrastructure Information Sheets

Landscape infrastructure information sheets (available on the website) relate to the landscape infrastructure reference matrix (as detailed above) and include, but are not limited to:

- ♦ Barbecues
- ♦ Bicycle Racks
- ♦ Bins
- ♦ Boardwalks & Viewing Decks
- ♦ Bollards
- ♦ Bridges
- ♦ Drinking Fountains
- ♦ Edging
- ♦ Gates & Fences
- ♦ Lights
- ♦ Picnic Tables & Chairs
- ♦ Planter Boxes
- ♦ Seats
- ♦ Shelters
- ♦ Signage
- ♦ Sporting – half Basketball Court & half Cricket Pitch
- ♦ Stairs
- ♦ Taps & Showers
- ♦ Toilet Blocks
- ♦ Tracks & Paving
- ♦ Tree Grates & Guards
- ♦ Walls

Refer to the website (www.caloundra.qld.gov.au) for current Landscape Infrastructure Information Sheets.

10.6.3 Colour Schemes

The colour schemes are provided in order to promote cohesive design and local landscape character and identity in the two broader regions of Caloundra, being the coastal/urban region and the hinterland/rural region. They are to be utilised unless otherwise required in a specific Planning Area Planning Scheme Policy. The current Coastal and Hinterland colour schemes are available on the website.

Note: Dulux paint colours have been specified, but other brands of equal colour and quality may be used.

Refer to the website (www.caloundra.qld.gov.au) for current colour scheme information.

10.6.4 Pavement Product Selection

The pavement product selection table provides guidance on the different concrete colours, aggregate selection and paver types and colours to be used within the Coastal areas and Hinterland areas, unless otherwise required in a specific Planning Area Planning Scheme Policy. These products reflect the overall landscape character of the coastal and hinterland areas, and have been selected to work with the colour schemes outlined in the previous section.

The colours have been put into a dark and light category to assist with contrast combinations for paved header courses and infill pavers/concrete colour. Any number of combinations can be used (see landscape infrastructure information sheets relating to tracks and paving for further details). All products specified can be replaced with a product of equal quality.

Refer to the website (www.caloundra.qld.gov.au) for current pavement product selection.

10.6.5 Motifs

Motifs have been developed to enhance local landscape character and identity for parks and open space. These motifs can be incorporated with the landscape infrastructure items and include, but are not limited to:

- Park Motif
- Environmental Reserve Motif

Refer to the website (www.caloundra.qld.gov.au) for current motif designs.

10.6.6 Playgrounds

Landscape infrastructure associated with playgrounds is vast and varied, due to different age group and usage requirements. Playgrounds must be designed and developed in accordance with current Australian Standards and the relevant planning scheme code.

Playground design is to respond to the local landscape character, demands and identity, through the choice of infrastructure and colour schemes. Playgrounds are safe, fun, interesting and should be inclusive to all users. Appropriate shade structures and/or mature shade trees are to be incorporated in the design.

It is intended that a number of exercise stations will be provided throughout Caloundra City parks and open spaces. Exercise stations consist of designated equipment for users to undertake exercise and will be designed in accordance with Playground Standards.

Refer to the website (www.caloundra.qld.gov.au) for current playground information.

10.6.7 Public Art

Caloundra City Council embraces public art and its inclusion in the city's streetscapes, open spaces and parks. Local distinctiveness is embodied in the diverse character of the region and promotes a strong awareness of identity and a 'sense of place'. Caloundra City Council aims to develop and foster closer relationships between people and places through projects such as public art. These initiatives can be incorporated into landscape infrastructure elements through collaboration with Council and the design/development consultants on various projects throughout the region (refer to Council's "Art Works – Caloundra Public Strategy and Procedures Manual").

10.7 Guidelines – Street Trees and General Planting

10.7.1 Introduction

(1) These guidelines outline requirements for the selection and planting of street trees, general plantings, turfing and irrigation in public places throughout the City.

(2) The principles to be considered in order to effectively integrate new development into existing streetscapes are:

(a) species selection to enhance local township and neighbourhood identity;

(b) protection of existing infrastructure and services;

(c) consideration of public health and safety; and

(d) minimisation of ongoing maintenance.

(3) Street trees and planting in public spaces can profoundly influence the attractiveness and appeal of a place.

The opportunity exists to establish a distinctive landscape identity for Caloundra through the strategic use of street trees. The carefully planned implementation of street trees within Caloundra can improve both the legibility and the image of the City and its thoroughfares, whilst drawing upon and enhancing the special and diverse place-making features of the City.

Street trees and planting not only identifies the City of Caloundra as a desirable place to live, but reflect local history and character and reinforce the development of distinctive precincts within this rapidly expanding city.

(4) The benefits within the urban environment and the value of street trees and associated planting are widely recognised. These benefits encompass environmental, social, and economic issues, including:

(a) Environmental Benefits

- Reduced air pollution - Street trees and planting reduce the air pollution impacts from motor vehicles and adjacent land uses, by absorbing pollutants, intercepting particulate matter such as dust, pollen and smoke; and releasing oxygen through photosynthesis.
- Reduced wind speed - Street trees and planting have a calming effect upon strong wind flows by providing a natural buffer in the path of strong or turbulent winds.
- Reduced glare and reflection - Plants ameliorate glare and reflection as their foliage captures and effectively dampens the path of direct and reflected light.
- Reduced noise pollution - Although a wide and dense planting buffer is required to significantly reduce noise pollution, the perception of noise pollution is reduced by trees and planting.

- Shade and comfort - Street trees and planting reduce the predominance of heat absorbing surfaces in our streets; by providing shade and evapotranspiration (cooling of air). Shading also contributes to sun safety, which is an issue high on the public agenda.
- Improved water quality - Plants filter and absorb runoff in our catchments and make an important contribution to catchment management.
- Wildlife habitat - Plants attract and protect native wildlife in our urban areas by providing food and shelter.

(b) Social Benefits:

- Psychological well-being - Plants contribute to psychological well being particularly in urban environments by creating a connection to nature and to all of its positive connotations.
- Recreation opportunities - Plants create important settings for recreation.
- Improved civic pride - The aesthetic contribution of plants has been shown to improve a community's pride in its surroundings, and this has positive social behavioral impacts i.e. reduced vandalism.
- Aesthetic value - Trees and plants contribute to a more pleasant work and living environment. Street trees and landscaping can screen obtrusive or unattractive land uses and can create more useable and interesting outdoor spaces.
- Human scale - Trees and plants create a human scale to streets, reducing the impact of large buildings and roads, and providing visual relief from manufactured surfaces and finishes.
- Crime Prevention Through Environmental Design (CPTED) - Street tree planting and landscaping are an integral part of the fundamental principles of CPTED. CPTED aims to prevent or minimise vandalism of community property, by utilising good environmental design, to create appropriate places for the people that use them, that will engender a sense of ownership and pride. Community ownership can also lead to natural surveillance of community spaces.
- Street tree planting and landscaping can also assist access control.

(c) Economic Benefits:

- Reduced maintenance - The installation of street trees with thoughtful location and species selection can reduce maintenance requirements e.g. damage to paved surfaces, pruning away from power lines etc.
- Commercial activity and tourism - Trees contribute to the development of attractive places for visitors and thus contributes to commercial and tourism success.

(5) The species inventory and planting guidelines contained in this sub-section have been developed to meet the above principles. If any doubt exists in respect of interpretation of any part of this Section, the most appropriate interpretation will be that which is most consistent with the stated purpose of the relevant Code(s).

10.7.2 Using the Guidelines

The guidelines provide information on the selection of street trees meeting the performance criteria in the relevant Planning Scheme Codes. Information for the current range of preferred street trees are outlined in the sections listed below:

- Street Tree Reference Matrix (refer 10.7.3)
- Street Tree Supply and Procurement (refer 10.7.4)
- Street Tree Locations (refer 10.7.5)

Additional guidelines for general planting (including street trees) are outlined in the sections listed below:

- Planting and Turf Guidelines (refer 10.7.6)
- Planting Locations (near services) (refer 10.7.7)
- Planting Bed Design to Reduce Maintenance (refer 10.7.8)
- Planting Density to Planting Beds (refer 10.7.9)
- Irrigation (refer 10.7.10)

Use of other street trees or general planting specifications not contained in the guidelines will require Council Approval.

10.7.3 Street Tree Reference Matrix

The Matrix, which is available on the Caloundra City website, has been developed to align with the Planning Areas of Caloundra City Council and is to provide reference to appropriate street trees for use in the Caloundra City.

10.7.3 (1) *How to use the Matrix*

When specifying street trees for a particular street, visit the site to assess the physical characteristics such as microclimate, soils and drainage, spatial parameters, services, etc and either;

(a) Match the existing species (if considered suitable)
(b) Select a suitable tree according to the characteristics outlined in the Matrix for the relevant locality/suburb.

To select the appropriate street tree using the Street Tree Reference Matrix on the Caloundra City Council website (www.caloundra.qld.gov.au), users should:

(a) select the appropriate locality/suburb in the matrix (eg. Kings Beach). Please note for ease of reference, the Planning Scheme Area that relates to each locality/suburb has also been identified in the matrix. Some localities/suburbs may overlap into more that one planning area. If you are unsure of the locality/suburb refer Caloundra City Council CALMAP for boundary maps. If a locality/suburb boundary is shown in the middle of a street select the most appropriate street tree for either suburb or locality list.
(b) Any of the street trees listed can be used, but ensure they are suitable for your area of interest by using the table of characteristics as a guide (eg. Landscape zones, features, soil suitability, etc).

10.7.4 Street Tree Supply and Procurement

Installing healthy, robust plants is essential to the success of street tree and planting strategies. By starting with healthy stock, many problems of maintenance and replacement can be avoided.

The following guidelines should be used by Council to guide both their procurement of trees for future planting and for recognising suitable stock supplied by external nurseries.

These guidelines are based upon the advanced tree stock specifications recommended by Natspec, the 'Australian Building Industry National Specifications'. It should be noted that these guidelines represent the ideal specification of tree stock, a standard that is not commonly met by commercial nurseries. If Council encounters this issue, it is recommended that any compromise consider the application of the trees, timing and possible future availability. The following items: form, root system, health, vigour, freedom from pests, disease, and weeds, stem taper, balance of crown, uniformity of growth, pruning history, tree sizes and shrub sizes outline expectations for tree health.

(1) General
Trees are to have a strong central leader, be of good form with well-developed branching structure that does not contain branches with acute angles.

(2) Form
Trees are to have a strong central leader with an evenly spaced and regular branch structure.

(3) Root System
Ensure trees have large healthy root systems, with no evidence of root curl, restriction or damage.

(4) Health
Ensure trees supplied have foliage size, texture and colour consistent with that shown in healthy specimens of the species.

(5) Vigour
Ensure trees are supplied with extension growth consistent with that shown in vigorous specimens of the species.

Trees should be hardened off for wind conditions, not soft or forced, and suitable for planting in the natural climatic conditions prevailing at the site.

(6) *Freedom from pests, disease and weeds*
Trees should be supplied free of pests, disease and weeds. Previous pest or disease damage is to be restricted to 10% of the foliage and be in a condition that does not hinder future performance of the tree (e.g. no damage to central leaders). Certification should be provided stating the plants are pest or disease free and state the treatment regime used.

(7) Balance of crown
Maximum variation in crown bulk on opposite sides of stem axis should be less than 20%.

(8) Uniformity of growth
The maximum internode acceptable is 1.2 x shortest internode.

(9) Stem taper
Trees are to be self supporting unstaked.

(10) Pruning history
General: Comply with the recommendations of AS 4373. Fresh pruning wounds are to be less than 25% of the clean stem height. Wound diameters are to be less than 50% of stem diameter immediately above point of pruning. Branches are to be cut at branch collar. No damage above 10% of the trunk area will be acceptable.

(11) Tree Sizes
Street trees should be installed at a minimum of 45 litre bags. Larger sizes may be required in urban areas or when risk of damage by vehicles or vandalism is an issue. 25 litre bags or smaller may be considered in certain situations depending upon location or species and must be approved by Council.

- 25 litre: shall be in a minimum 25L size (plastic bags 300mm x 350mm diameter);

- 45 litre: shall be in a minimum 45 litre (plastic bags 420mm diameter x 450mm or equal) and shall have a well-developed straight stem and a minimum calliper of 25mm and be a minimum height generally of 1800mm;
- 100 litre: shall be a minimum 100 litre bag size (bag size 700 x 700 x 500mm or grow rings to the same size) and shall have a well-developed stem. Minimum height generally of 2500mm.

10.7.5 Street Tree Locations

Well considered location of street trees, to avoid conflicts with Urban Infrastructure, is essential for the successful integration of street trees into the City of Caloundra.

Site selection with regard to the placement of street tree plantings should be determined through a thorough above and below ground site inspection. This inspection should include consideration of:

- street lights, bus stops and signage;
- underground services;
- pathways and driveways,
- street corners;
- tree and planting arrangement - formal plantings at regular spacings or informal groves of trees and shrubs;
- current and future pedestrian crossings;
- the location of overhead powerlines and poles; and
- any other object that may conflict with the siting of trees.

The following guidelines should be considered when determining the location of street trees:

- trees should only be installed where the footpath or median is 4 metres or more in width;
- trees should be installed 1 metre from the face of kerb;
- trees should not be planted within three metres of a footpath crossover, driveway, bikeway or pathway;
- trees should be spaced at approximately 8 - 10 metres in most residential streets. This spacing may be adjusted to suit special situations i.e. a spacing of up to 20 metres is suitable for major city and rural township approaches.
- trees should not be planted within 15 metres of either side of a current or future pedestrian crossing;
- trees should not be planted within 2.5 metres of electricity or telephone poles, pillars or fire hydrants;
- trees should not be planted within four metres of street lights;
- locate trees in a manner that does not obstruct access to any services or signage;
- plant trees eight metres from the extension of property boundaries on side streets;
- planting should be undertaken no less than 20 metres from the approach and 5 metres from the departure side of a bus stop, as a minimum guide. The type of service e.g. hail and ride bus service, should also be considered; and
- trees should not be planted under over-hanging canopies of existing trees growing on adjacent property.

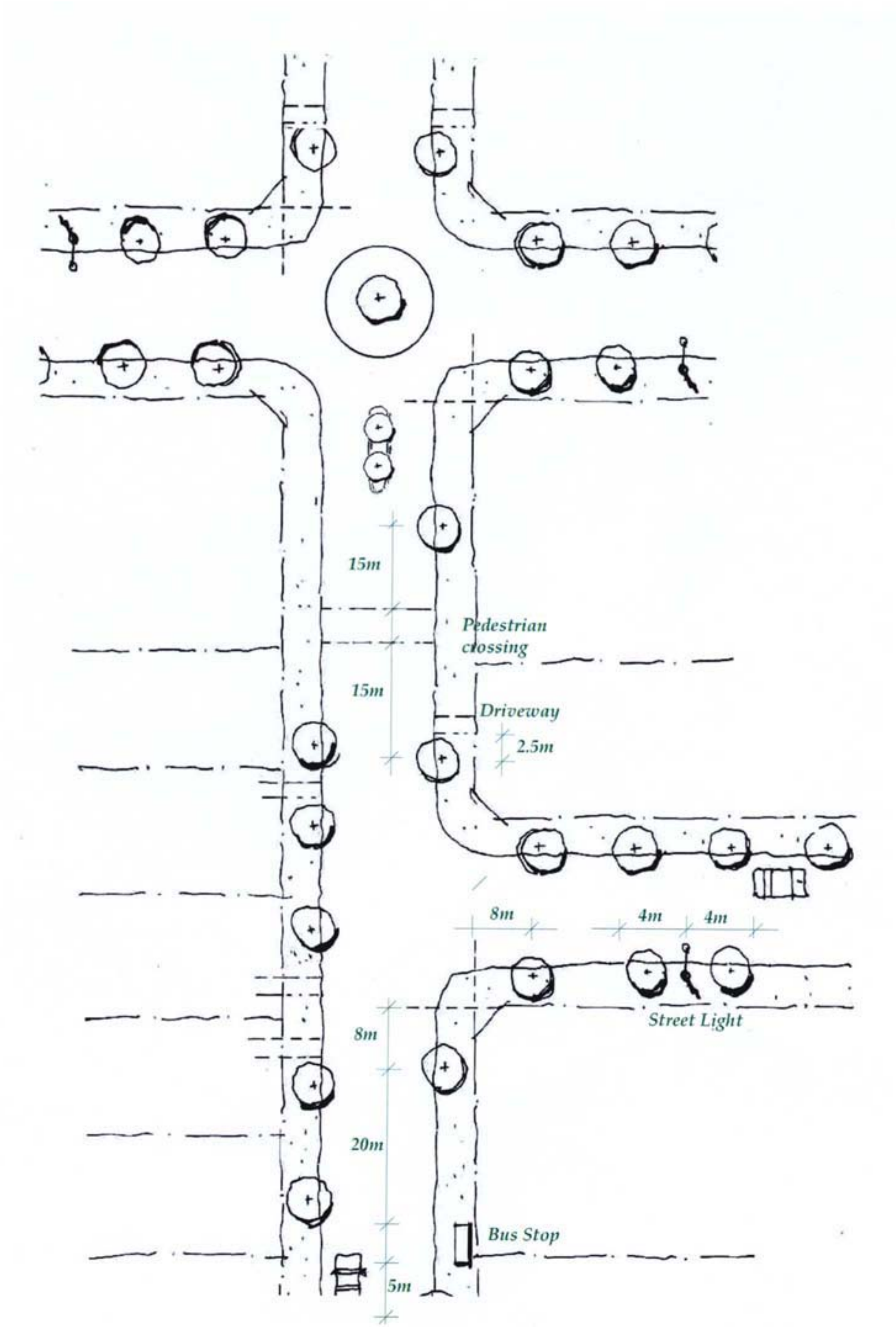


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Figure 10.3 – Typical Street Tree Alignments

(1) Planting in Roundabouts

Planting in roundabouts can play an important role in the character of an area and should be encouraged. Planting needs to avoid interference with sight lines. Sight lines vary according to roundabout size and road speed environment. Austroads guidelines should be consulted prior to the preparation of any planting design.

Generally the use of turf should be avoided. If planting is not possible, then Hardscape works should be used in preference.

10.7.6 Planting and Turf Guidelines

Caloundra City Council has both strong environmental and landscape amenity beliefs. The planting and turf guidelines (refer to the Caloundra City Council website (www.caloundra.qld.gov.au) for more information) are pertinent to a broad range of applications, including but not limited to the following:

- Urban and Rural Parks;
- Road Reserves;
- Urban and Rural Streetscapes;
- Unit/Townhouse and Resort Developments;
- Residential Subdivision Developments;
- Golf Courses;
- Commercial/Industrial Precincts;
- Technology Parks;
- Private Dwellings;
- Sporting Clubs/Precincts;
- Easement Developments (e.g. drainage, access easements)

IDAS development applications that include Landscape Plans are impact, self and code assessable and must achieve the specific requirements of Council's Growth Management Unit.

10.7.7 Planting Locations (near services)

(1) Planting under Powerlines

In general:

Ideally street trees should be 4 –5 metres in height at maturity. A larger tree may be used if it can be formatively pruned during growth to reduce encroachment on power lines.

The street tree reference matrix contains trees considered suitable for planting beneath powerlines.

Any planting beneath power lines must conform to the guidelines established by the relevant electrical authority in relation to the required clearance below electrical lines. This includes the requirement that no branches or foliages of street trees be within three metres of powerlines. In addition in situations where existing trees conflict with existing or proposed powerlines then negotiation with power supply authorities is to be undertaken, particularly in rural areas.

In older areas bundling of power lines should be considered where conflicts with existing trees occur. In urban areas undergoing streetscape improvements the relocation of electrical services underground should be considered.

(2) Planting near Services

In general within residential areas street tree planting should avoid services. However in urban areas and in areas where shrub and groundcover planting is required the following guidelines in relation to services should be observed:

(a) all underground services including telephone and digital communications cables, electricity, sewer, water, and gas service lines should be located prior to planting;

(b) hand digging within one metre above, beside or below cable location;

(c) root barrier should be used where concerns exist about future impact of trees on services;

(d) contact service providers for accurate location of cabling;

(e) in urban areas services may be bridged to avoid disturbance and to disperse vertical loads into a horizontal plane. This typically involves providing a concrete beam around service lines to disperse tree loading.

(3) Roadside Corridor Planting

Roadside planting is an important contributor to the character of rural areas of Caloundra. Roadsides perform a number of functions including: framing views to rural areas; buffering unsightly commercial or industrial development; providing a visual break between urban areas; habitat for flora and fauna; and visual enhancement of entrances to the City reflective of a natural character.

The following guidelines should be followed for roadsides:

(a) Existing native vegetation should be retained and protected.

(b) Future road upgrade programs should limit damage to roadside vegetation and where possible contribute to its enhancement through the removal of inappropriate or environmental weed species, and through planting of additional local endemic native vegetation in all disturbed areas as part of works.

10.7.8 Planting Bed Design to Reduce Maintenance

Planting areas can significantly improve the visual appearance of areas such as entries, roundabout and nodal points. In addition they offer practical solutions for batters greater than 1:4. It is important that planting beds be designed to limit maintenance required.

Actions to achieve this are:

(a) include trees in planting beds to reduce the need for intensive mowing between planting beds and the trees in grass;

(b) ensure a mowing strip constructed flush with lawn areas is installed. Unless otherwise stated this should be a 100mm x 100mm concrete mowing strip integrally coloured black.

(c) provide 300mm minimum of good quality soil and 100mm minimum of mulch;

(d) provide adequate density (refer planting density section below);

(e) in low lying areas mound planting beds to improve drainage.

10.7.9 Planting Density to Planting Beds

It is important to consider the long term effects of any planting design. Whilst overall density will vary between species, it is critical that the design results in garden beds that are covered once all the plants have grown. An even coverage is more desirable than sparsely planted beds. Sparse plant growth increases the likelihood of weed invasion. General densities for planting beds are:

(a) trees: 5 metre centres;

(b) medium to large shrubs: 1.5 - 2.5 metre centres;

(c) shrubs: 1.0 metre centres;

(d) groundcovers: 0.5- 0.8 metre centres.

10.7.10 Irrigation

Irrigation installed to establish landscaping will be approved for the 12 months maintenance period. Council may require the removal of irrigation prior to hand-over for off-maintenance.

Council requires non-irrigated landscaping and promotes the use of local native plant species that are drought resistant, as irrigation systems will be subject to water restrictions during drought periods.

Generally irrigation systems in parks and open spaces are considered to be a permanent fixture in the landscape and are intended to be handed over to Council for its continued operation. Irrigation design and installation must conform to current relevant Australian Standards and to Caloundra City Council approval. Irrigation systems are to consider water conservation and minimal equipment maintenance, whilst providing sufficient water for sustainable plant growth.

Refer to the website (www.caloundra.qld.gov.au) for current Irrigation Guidelines.

Contents of Section 11 – Waterfront Structures & Canals

Tables in Section 11

Figures in Section 11

Section 11

Section 11 - Waterfront Structures and Constructed Waterbodies

11.1 Purpose and Structure

(1) The purpose of this Section is to provide guidance on the design and construction of:

(a) various types of private, commercial and Council operated and maintained waterfront structures and waterbodies located within tidal lands or waters;
(b) constructed waterbodies.

(2) This Section is structured as follows:

(a) 11.1 to 11.5 which provide the framework for the guidelines;
(b) 11.6 which outlines the requirements relating to design and construction of waterfront structures and constructed waterbodies.

11.2 Terminology

The general terms used in this Section are included in Section 1.5. The following terms relate specifically to this Section of the Policy:

"1.5kPa loading" – unit of loading used in engineering calculations, kilopascals or kilonewtons per square metre (kN/m^2) and approximately equivalent to 150 kilograms of force per unit square metre of area. Density of fill material can vary significantly depending on type of fill (eg. sand, clay, rock) and level of compaction. Typical densities of general purpose fill (including compaction) can vary from 1100 to 1600 kg/m^3. Fill for engineering purposes can be as high as 2000 kg/m^3. The height of fill material and its density (measured as compacted, in place) is multiplied together to arrive at the resultant loading. For example, 1.0m height of fill with a density of 1500 kg/m^3 is approximately equivalent to 1.5 kPa.
"AHD" – Australian Height Datum
"Bishop's Modified Method" – Council's adopted method of embankment analysis to determine the stability (slip circle failure surfaces) of slopes and excavations.
"Fender pile" – vertical structural member that protects part of a structure from impact, damage or abrasion.
"H.A.T. (Highest Astronomical Tide) & L.A.T. (Lowest Astronomical Tide)" – These are the highest and lowest tide levels which can be predicted to occur under average meteorological conditions and any combination of astronomical conditions. These levels will not be reached every year, and are not the extreme levels which can be reached, as storm surges may cause considerably higher or lower levels to occur.
"M.H.W.S. (Mean High Water Springs) & M.L.W.S. (Mean Low Water Springs)" – These are the long term average of the heights of two successive high/low waters during those periods of 24 hours (approximately once a fortnight) when the range of tide is greatest, at full and new moon. The approximate positions and heights of M.H.W.S. and M.L.W.S. may be obtained by observations at the site.
"Revetment wall" – a wall erected against an earth bank or rock face to protect it against erosion, or a structural retaining wall at the waterfront edge.
"RPEQ" – Registered Professional Engineer of Queensland. In these guidelines it is expected that a RPEQ would be experienced in the design of waterfront structures and this may also include a specialist geotechnical engineer experienced in waterfront development.
"Setback" – means the shortest distance measured horizontally from the outermost projection of the building or other structure concerned to the vertical projection of the boundary of the allotment. Note that setback from a revetment wall is from the landside of the revetment wall.
"Still Water Level (SWL)" – tide level plus the Storm Surge level.

"Storm Surge" – the increase in sea level due to the effects of atmospheric pressure and onshore wind associated with cyclonic and non-cyclonic storm events.

"Storm Tide" – the total water level, incorporating tide, surge and wave setup.

"Tide" – the normal oscillation of sea levels, generally due to the gravitational effects of the sun and moon.

"Water Allocation Area" – The area of a waterway in which a waterfront property owner could construct tidal works (subject to obtaining the required approvals), which would not interfere with the rights of adjoining waterfront property owners or impede navigable access in the waterway.

"Waterfront structures" – includes jetties, pontoons, boat ramps, decks and piling associated with a residential use. The term does not include marinas, slipways or other structures associated with commercial or industrial use.

"Wave Runup" – the vertical distance above the still water level reached by waves breaking on the shoreline.

"Wave Setup" – the increase in water level resulting from increased wave activity on the shoreline.

11.3 Related Standards/References

(1) Environmental Protection Agency

  (a) "Guidelines for the Construction of Works on Tidal Lands or Waters for Private Use"

(2) Building Code of Australia

  (a) BCA Vol 2 Part 3.1.2.0 – Drainage (AS 3500.3.2)
  (b) BCA Vol 2 Part 3.1.2.2 (d) – Excavation and Piling near Sewers and Drains
  (c) BCA Vol 2 Part 3.1.1 – Earthworks

(3) Australian Standards

  (a) AS 664.1: *Aluminium Structures Code*
  (b) AS 170.1 and 1170.2: *Loading Codes*
  (c) AS 720*: Timber Structures Code*
  (d) AS 2159*: Piling Code*
  (e) AS 3500*: Part 3.2, Stormwater Drainage – Acceptable Solutions*
  (f) AS 3600*: Concrete Structures Code*
  (g) AS 3700: *Masonry Structures Code*
  (h) AS 3962: *Guidelines for Design of Marinas Code*
  (i) AS 4110: *Steel Structures Code*

(4) Coastal Protection and Management Act (1995 as amended)

(5) Section 86 of the Harbours Act

(6) Caloundra City Council Storm Surge Study – Development Report

(7) Coastal and Engineering Manual

(8) Shore Protection Manual (Harbours and Marine – Moreton Bay Navigational Chart)

11.4 Process

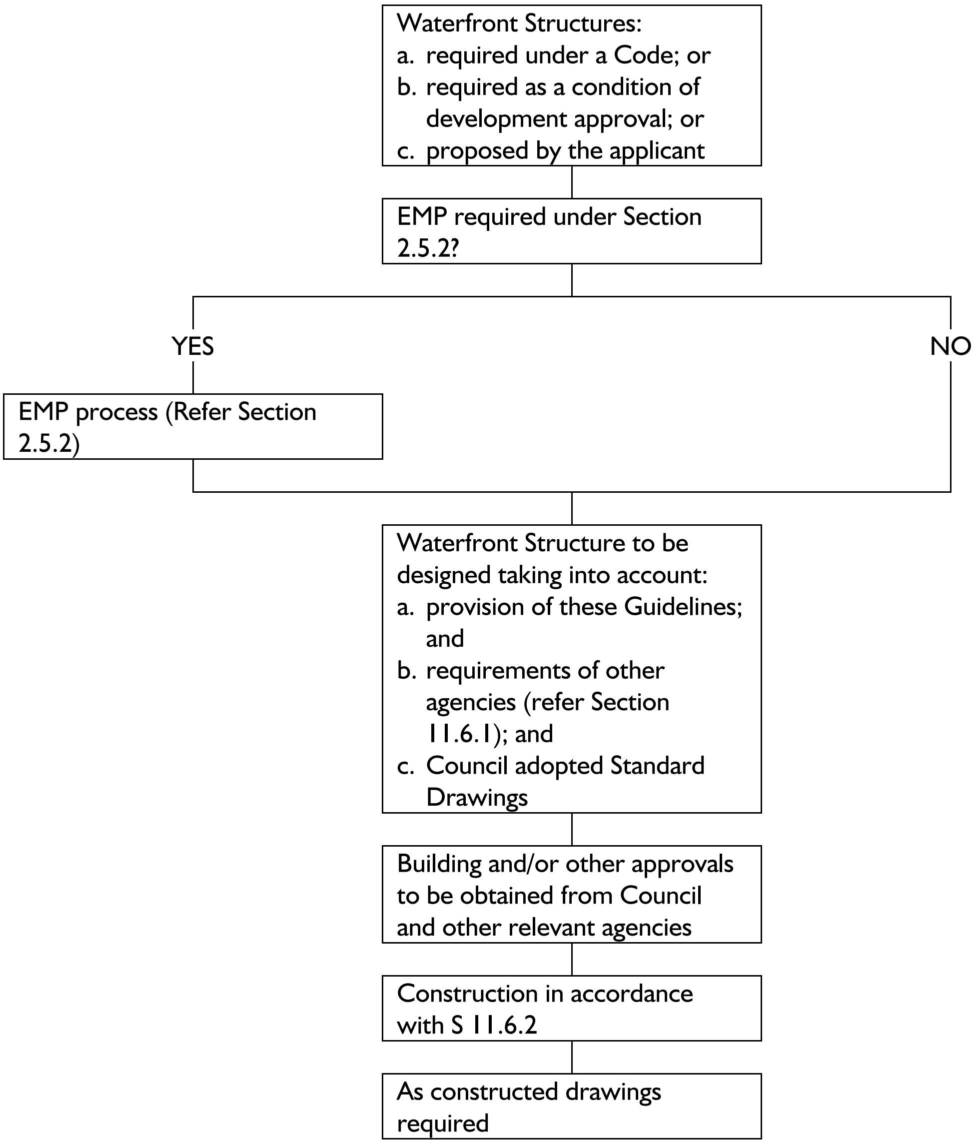

Figure 11.1 – Waterfront Structures

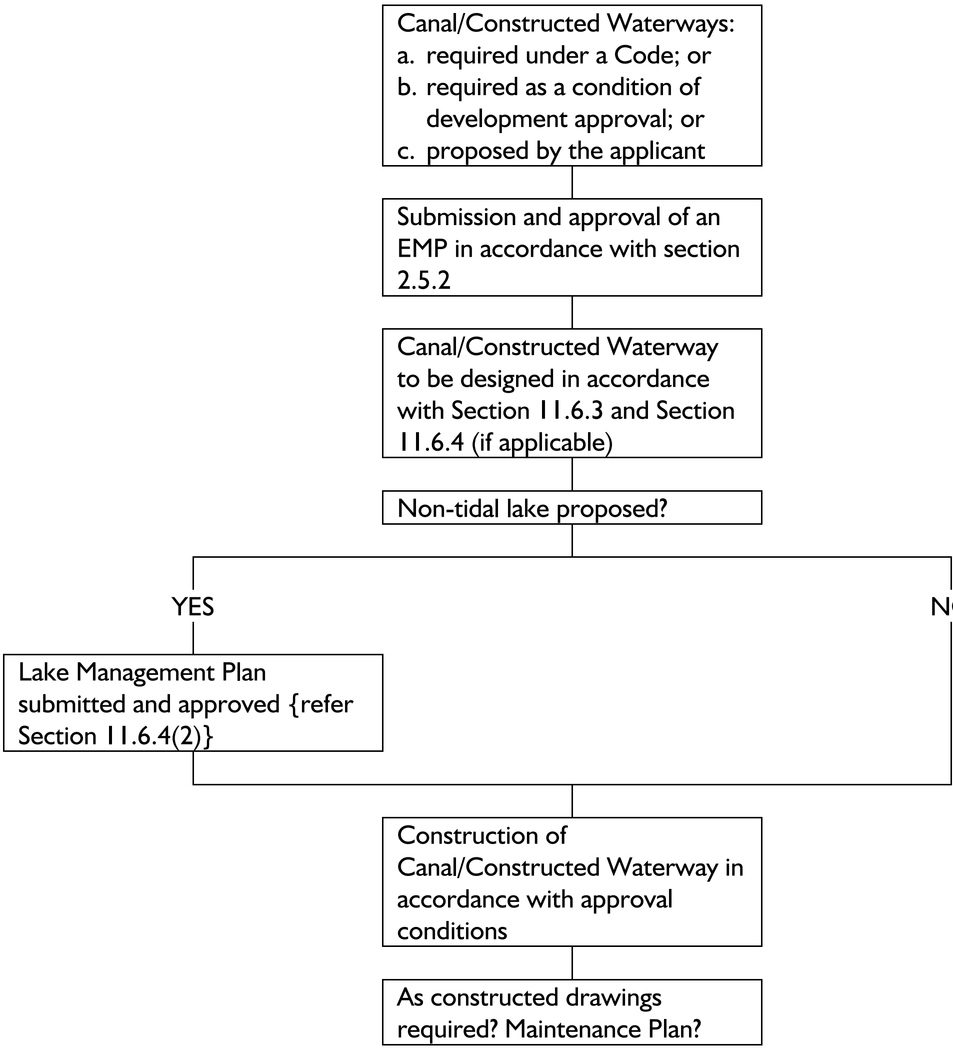

Figure 11.2 –Constructed Waterways/Canals

11.5 Climate Change and Tidal Influences

(1) The impact of climate change is a consideration in design of waterfront structures.

(2) The Caloundra City Storm Tide Study concluded that:

(i) There is no evidence that cyclone intensity is significantly worsened under enhanced greenhouse conditions. The implications are that the statistical study undertaken for the Storm Tide Study is valid for projections into the future. Therefore no adjustment to the cyclonic statistical analysis is required to account for climate change; and

(ii) Latest predictions of sea level rise over the next 50 years are 0.2m. This figure was recommended to Council, and has been adopted for use.

11.6 Guidelines

11.6.1 General

(1) These guidelines are to be read in conjunction with the Environmental Protection Agency "Guidelines for the Construction of Works on Tidal Lands or Waters for Private Use" and the provisions of the Coastal Protection and Management Act.

(2) These guidelines apply to the design and construction of Waterfront Structures, and Waterbodies located within tidal lands or waters, natural waterways and constructed waterbodies.

(3) Some structures might be of such a nature that they are required to be designed in accordance with standards that are higher than those given in these guidelines. It is advisable to check with the following agencies, in addition to Council, to ascertain the requirements of loadings, dimensions, construction materials, navigation effects, aquatic vegetation protection, and environmental effects in any particular case:

(a) Environmental Protection Agency;

(b) Department of Transport;

(c) Department of Primary Industries – Fisheries; and

(d) Department of Natural Resources and Mines.

(4) The presence of Acid Sulfate Soils requires the preparation of an Environmental Management Plan (EMP) under Section 2 - Environmental Guidelines. Refer also to Section 4.5.2(1) of this Policy and 7.2 Acid Sulfate Soils Code for further information regarding Acid Sulfate Soils.

11.6.2 Waterfront Structures

11.6.2(1) Application

(1) These guidelines apply to the design and construction of jetties, pontoons, boat ramps, boat lifts, decks and revetments for private or commercial use in, on, over, through or across canals and/or within tidal lands or waters and loadings within 6m of a revetment wall.

(2) It is intended that:

(a) Development occurring next to a waterbody has regard to the structural stability requirements of the development, the waterway, embankment and/or revetment wall; and

(b) The existing or intended uses of the waterway are not adversely impacted upon.

(3) These guidelines incorporate a number of key design considerations to ensure that waterfront structures:

(a) remain structurally sound throughout a 40 year design life;

(b) do not interfere with the structural stability of the waterway;

(c) do not restrict the maintenance, hydraulic and flood carrying capacity of the waterway;

(d) waterfront structures and/or moored vessels do not interfere with public access or usage of the waterway or intertidal zone;

(e) allow for navigation where necessary along the waterbody;

(f) remain within the waterbody associated with the adjoining property;

(g) contribute positively to the waterfront environment;

(h) avoid or minimise environmental harm; and

(i) are designed and constructed with regard to the environmental considerations in Section 2.5.1 (1).

11.6.2(2) Responsibility of Owners

(1) The owner or occupier of the property associated with the approved waterfront structure is required to maintain the works in a sound state of repair in accordance with the approved plans.

(2) Covenants and approval conditions specific to canal/artificial waterway estates and provisions that are required to be adhered to are available to owners on application.

11.6.2(3) Legislation and Associated Requirements

(1) Works covered/addressed by these guidelines may require approval from other Agencies. The main approval for works covered by these guidelines is a Section 86 Permit under the Harbours Act 1955. This is required for works below M.H.W.S.

(2) Other legislation and standards which apply to waterfront structures and constructed waterbodies include the following:

(a) BCA Vol 2 Part 3.1.2.0 – Drainage (AS 3500.3.2)
(b) BCA Vol 2 Part 3.1.2.2 (d) – Excavation and Piling Near Sewers and Drains
(c) BCA Vol 2 Part 3.1.1 – Earthworks
(d) AS 1664.1: *Aluminum Structures Code*
(e) AS 1170.1 and 1170.2: *Loading Codes*
(f) AS 1720: *Timber Structures Code*
(g) AS 2159: *Piling Code*
(h) AS 3500: *Part 3.2, Stormwater Drainage – Acceptable Solutions*
(i) AS 3600: *Concrete Structures Code*
(j) AS 3700: *Masonry Structures Code*
(k) AS 3962: *Guidelines for Design of Marinas Code*
(l) AS 4110: *Steel Structures Code*
(m) Coastal Protection and Management Act
(n) Section 86 of the Harbours Act
(o) Caloundra City Council Storm Surge Study – Development Report
(p) Coastal and Engineering Manual
(q) Shore Protection Manual (Harbours and Marine – Moreton Bay Navigational Chart

11.6.2(4) General Requirements

(1) The following general requirements apply to the construction of any waterfront structure:

(a) Access is to be available for future remedial, repair or maintenance works on canal and revetment walls;
(b) It should be demonstrated to Council's satisfaction that the proposed waterfront structure will be designed so as not to cause any geotechnical instability to the embankment, environmental harm, erosion, and bed scour or revetment wall collapse.
(c) Building works or structures within 6m of a revetment wall are not to place a loading greater than 1.5kPa between the building line and the revetment wall unless satisfactory details and

certification from a RPEQ has been accepted by Council demonstrating that the proposed works do not exceed design loads for the site. This includes:

(i) swimming pools;
(ii) retaining walls;
(iii) filling of an allotment;
(iv) patio, decks, footings, other structures and the like; and
(v) permanent planter boxes and significant landscaping works.

(d) All excessive loadings within the setback require an assessment of the stability of the canal embankment and revetment wall using the Bishop's Modified Method. The design is to demonstrate a minimum factor of safety against overturning and sliding of 1.5.
(e) Generally, setbacks of any waterfront structure are to be a minimum of 1.5m from the outermost projection of the structure to the landside of the revetment wall. This includes footings, piers, piles, and any supports. However, larger setbacks may be required such as Building Regulation setbacks, setbacks to swimming pool waterline and the like. Some canal estates may not allow structures or the alteration of the level of land within specified setbacks, except in certain circumstances as set out in the approval.
(f) All stormwater generated from the roofs of houses and ancillary buildings, patios, and the like located within the curtilage of the dwelling is to be drained to the road stormwater drainage system. Refer to Section 5 – Total Water Cycle Management and Section 6 – Stormwater and Drainage Management for water sensitive urban design stormwater solutions.
(g) Swimming pool backwash is to be discharged to the sewer.
(h) No roofed or other structure is permitted on any pontoon, boat ramp, deck, jetty or the like.
(i) All building works are to be in accordance with Standard Building Regulations, Building Code of Australia and associated Australian Standards.
(j) Unless approval has been granted by the appropriate Agency, no riparian vegetation is to be removed or damaged during the construction of works. Legislation restricts disturbance to marine animals/organisms that may arise from construction activity.
(k) Vegetation is not to be planted within 1.5m from the landside of any revetment wall. Shrubs, preferably endemic species, and/or small trees less than 2.0m in height and with a non-invasive root system may be permitted to be planted between 1.5 and 4.5m from the landside of the revetment walls.

11.6.2(5) Sea Walls

(1) The design of sea walls is to be such as providing immunity of Peak Seawater Level.

(2) Peak Seawater Level in relation to any site is determined by:

(a) identification as to whether the site is in an Extreme Water Level Location as identified in Table 11.1;
(b) prediction of wave heights in combination with extreme water level predictions using critical design criteria set out in Tables 11.2, 11.3 and 11.4; and
(c) topographical constraints of the site.

(3) Prediction of wave heights and design of sea walls is to be carried out by a qualified and experienced Marine or Coastal Engineer and referencing the following documents:

(a) Caloundra City Council Storm Surge Study – Development Report;
(b) Coastal and Engineering Manual; and
(c) Shore Protection Manual (Harbours and Marine – Moreton Bay Navigational Chart).

Location
Coochin Creek
Between Coochin Creek and Halls Creek
Halls Creek
Bells Creek
Golden Beach
Kings Beach
Dicky Beach
Currimundi
Bokarina
Kawana SLSC, Buddina
Minyama – Sunshine Motorway
Minyama – Mooloolah Drive

Table 11.1 – Extreme Water Level Locations

	Average Recurrence Interval (years)		
Location	**20**	**50**	**110**
Coochin Creek	1.60	1.88	2.15
Between Coochin and Halls Creeks	1.48	1.73	1.95
Halls Creek	1.17	1.33	1.49
Bells Creek	1.20	1.37	1.54
Golden Beach	1.15	1.28	1.41
Kings Beach	1.11	1.20	1.31
Dicky Beach	1.11	1.20	1.30
Currimundi	1.11	1.19	1.29
Bokarina	1.11	1.18	1.28
Kawana SLSC, Buddina	1.09	1.16	1.26
Minyama – Sunshine Motorway	1.05	1.29	1.45
Minyama – Mooloolah Drive	1.12	1.25	1.35

Note: Potential rise in MSL caused by climate change not included

Table 11.2 – Still Water Level Recurrence Intervals (Cyclonic) – m AHD (Excluding Wave Setup)

	Average Recurrence Interval (years)		
Location	20	50	110
Bells Beach	1.54	1.59	1.62
Golden Beach	1.57	1.62	1.65
Kings Beach	1.55	1.60	1.63
Dicky Beach	1.50	1.53	1.56
Currimundi	1.53	1.58	1.61
Bokarina	1.53	1.57	1.60
Kawana SLSC, Buddina	1.53	1.58	1.61
Minyama – Sunshine Motorway	1.50	1.53	1.56
Minyama – Mooloolah Drive	1.50	1.54	1.58

Note: Potential change in MSL caused by climate change not included.

Table 11.3 – Still Water Level Recurrence Intervals (Non-Cyclonic) – m AHD East Coast Lows (Excluding Wave Setup)

	Average Recurrence Interval (years)		
Location	20	50	110
Coochin Creek	0.2	0.2	0.3
Between Coochin and Halls Creeks	0.2	0.2	0.3
Halls Creek	0.2	0.2	0.3
Bells Creek	0.2	0.2	0.3
Golden Beach	0.2	0.2	0.3
Kings Beach	0.3	0.3	0.3
Dicky Beach	0.3	0.3	0.3
Currimundi	0.3	0.3	0.3
Bokarina	0.4	0.4	0.4
Kawana SLSC, Buddina	0.4	0.4	0.4
Minyama – Sunshine Motorway	0.3	0.3	0.3
Minyama – Mooloolah Drive	0.3	0.3	0.3

Table 11.4 – Recommended Wave Setup for Joint Occurrence with Peak Cyclone Surge

11.6.2(6) Jetties

(1) Jetties and their associated mooring systems are to be designed and constructed to sustain all relevant loadings including earth and hydraulic pressure, berthing impact, dead load of the structure, wind, tidal and flood flows (including debris), and other loadings relevant to the structure as assessed by a RPEQ.

(2) Jetties and their associated shore abutments are to be designed and constructed so as not to impact adversely on the structural stability of the waterway and be structurally independent of the revetment wall, unless the revetment wall is certified by an RPEQ as structurally adequate to withstand all loadings imposed by the structure. A new certificate is required to be dated along with each new proposed structure that may impose additional loadings to existing revetment walls.

Certification from a RPEQ is still required even if the jetty and its associated shore abutment do not place additional loads on the existing revetment walls.

(3) The deck level of the jetty is not to be less than 300mm above M.H.W.S.

(4) Low level landings below M.H.W.S. may be incorporated into the structure design but fender piles or other markers must indicate their presence when under water.

(5) The width of the jetty is to be generally not less than 900mm not greater than 3m on any part of the deck area. Handrails are to be provided along at least one side of the jetty stem, but preferably both sides.

(6) For larger vessels moored at jetties, mooring piles may be required to secure the moored vessel.

(7) Jetties are to be designed not to interfere with stormwater infrastructure or impose any adverse loads on stormwater drains, and generally should be located free of Council stormwater outlets into the waterbody.

(8) Jetties are to be designed not to interfere with navigation, the water allocation area of adjoining properties, or the public usage of the waterway, and are not to protrude beyond the quay line of the waterbody. Vessels moored to the jetty are not to interfere with navigation, encroach on the water allocation area of adjoining properties, or the public usage of the waterway.

(9) The head of the jetty is to enable access/egress to the moored vessel and may also be used for the storage of small vessels such as jet skis and dinghies. The maximum head size is restricted to 65% of the water allocation area frontage at the quay line for all waterways.

(10) The head of the jetty is to be located along the approved quay line. For location where there is no quay line determined, then an impact assessment is to demonstrate the sustainability of the quay line position proposed. An impact assessment is also to be completed for proposals to locate jetties at locations other than the approved quay line.

(11) Where piling for jetties is required to be installed through the rock revetment, the rocks are to be removed and a neat cut/penetration made to the geotextile fabric under the rock revetment prior to installation of driven or screw piling, and the geotextile fabric and rock facing protection reinstated around the piles.

(12) A bond is to be submitted to Council, as required in the development approval, which will be held by Council until an inspection immediately after completed works, and following a further inspection 12 months after works have been completed, determines that no damage to canal infrastructure has occurred as a result of the works.

(13) Jetties are not to be designed and constructed with roofed structures.

11.6.2(7) Pontoons

(1) Pontoons are to be designed and constructed to sustain all relevant loadings including earth and hydraulic pressure, berthing impact, dead load of the structure, wind, tidal and flood flows (including debris), and other loadings relevant to the structure as assessed by a RPEQ.

(2) Shore abutments for access walkways or gangways to pontoons are to be a minimum of 300mm above M.H.W.S. and designed to be structurally independent of the revetment wall, unless the revetment wall is certified by a RPEQ as structurally adequate to withstand all loadings imposed by the structure. A new certificate is required to be dated along with each new proposed structure that may impose additional loadings to existing revetment walls.

Certification from a RPEQ is still required even if the gangway does not place additional loads on the existing revetment walls.

(3) Pontoons are to be designed such that they can accommodate the rise in water level associated with the highest recorded flood and still safely moor any vessel.

(4) Pontoons are to be designed such that they can sit on the canal bed during low tides or when there is a change in canal bed profile without experiencing structural failure or damage to themselves or support piles.

(5) Pontoons are to be designed to provide a mooring system with provision for positive fixing of the flotation unit in plan position as follows:

(a) Mooring systems are to be attached to the flotation unit and to concrete anchors positioned in the banks behind the structurally independent revetment walls and beyond the slip zone.

(b) In rivers, creeks and canals which carry flood runoff, mooring systems may be required to be designed and constructed with driven or screw piling.

(c) For larger vessels, mooring piles may be required to secure the vessel.

(6)

(a) Pontoons are to be constructed of materials suitable for the purpose with a minimum standard of workmanship as outlined in Section 4 of the EPA guidelines.

(b) Thin walled steel oil drums are not permitted for pontoon floats. Pontoons are to be protected against corrosion, attack by marine organisms and deterioration of the materials by abrasion or immersion in sea water.

(7) Gangways are to be designed with a minimum distance of 500mm from the edge of the pontoon.

(8) Gangways are to be constructed with a permanent non-slip surface and handrails along at least one side of the access walkway, but preferably both sides.

(9) Pontoons and their gangways are to be designed so as not to interfere with navigation, the water allocation area of adjoining properties, or the public usage of the waterway, and are not to protrude beyond the quay line of the waterbody. Vessels moored to pontoons are not to interfere with navigation, the water allocation area of adjoining properties, or the public usage of the waterway.

(10) The head of the pontoon is to enable access/egress to the moored vessel and may also be used for storage of small vessels such as jet skis and dinghies. The maximum head size is restricted to 65% of the water allocation area frontage at the quay line for all waterways.

(11) The head of the pontoon is to be located along the approved quay line. For locations where there is no quay line determined then an impact assessment is to demonstrate the sustainability of the

quay line position proposed. An impact assessment is also to be completed for proposals to locate pontoons at locations other than the approved quay line.

(12) Where piling for pontoons is required to be installed through the rock revetment, the rocks are to be removed and a neat cut/penetration made to the geotextile fabric under the rock revetment prior to installation of driven or screw piling, and the geotextile fabric and rock facing protection reinstated around the piles.

(13) A bond is to be submitted to Council, as required in the development approval, which will be held by Council until an inspection immediately after completed works, and following a further inspection 12 months after works have been completed, determines that no damage to canal infrastructure has occurred as a result of the works**.**

(14) Pontoons are not to be designed and constructed with roofed structures.

11.6.2(8) Decks

(1) Decks are to be designed and constructed to sustain all relevant loadings as assessed by a RPEQ.

(2) The design and construction of the deck is to be such that it allows remedial work to the bank, foreshore, revetment wall, retaining wall or other structures to be undertaken.

(3) Access hatches of minimum size 200mm x 200mm are to be installed in a deck 300mm seaward of the revetment wall and located approximately every 4m and/or 2m from either side of the deck. These access hatches will be used for sand replenishment of the waterway.

(4) Decks are to have a height not more than 500mm from the top of the revetment wall to the top of the finished deck surface with a minimum clearance of 50mm between the top of the revetment wall and any part of the deck.

(5) All footings, piers, piles and the like associated with the deck are to be located no closer than 1.5m from the landside of the revetment wall and not be connected to or supported by the revetment wall.

(6) Decks are not to be designed and constructed with roofed structures.

(7) Decks are to be designed not to interfere with stormwater infrastructure or impose any adverse loads on stormwater drains.

(8) Decks are to be designed not to interfere with navigation, the water allocation area of adjoining properties, or the public usage of the waterway.

(9) Decks are not to extend more than 3m from the real property boundary into the waterway in canal developments.

(10) Decks are not to extend 500mm beyond the toe of the rock revetment wall for properties outside of canal estates.

(11) Decks are to be a minimum distance of 3m from all common side property boundaries and their projections, and from any defined water way boundary of adjoining properties.

Notwithstanding the above, a proposed deck abutting a property which has an embayment (such as a canal cul-de-sac) on its waterfront boundary will be considered on its merits, but may be granted preliminary approval if the adjacent properties are not significantly affected.

(12) Where there is public access/usage in the intertidal zone to adjoining properties, a proposed deck is not to unduly constrain the continuation of practical access to these areas.

(13) Where piling for decks is required to be installed through the rock revetment, the rocks are to be removed and a neat cut/penetration made to the geotextile fabric under the rock revetment, prior to installation of driven or screw piling and the geotextile fabric and rock facing protection reinstated around the piles.

(14) A bond is to be submitted to Council, as required in the development approval, which will be held by Council until an inspection immediately after completed works, and following a further inspection 12 months after works have been completed, determines that no damage to canal infrastructure has occurred as a result of the works.

11.6.2(9) Revetment Walls

(1) Walls must be located along the revetment regulation line. Where no regulation line exists for a particular location, then an impact assessment is required that demonstrates the sustainability of a particular proposed revetment regulation line location. Impact assessment is also required to support proposals to locate revetment walls in a manner other than that suggested by Council guidelines.

(2) All buildings, additions or major structures to be erected on lots with frontages along a waterway are to be protected by an existing or new revetment wall certified as adequate by a RPEQ, according to the site conditions. Soft engineering solutions may be more appropriate in some instances.

(3) Maintenance of walls is the responsibility of the owner and a minimum of 1 metre wide setback area behind the wall must be provided to allow maintenance to be performed. Within this area no structure is to be built that would strict maintenance activities. This area should preferably be grassed, gravelled or loose-paved etc. to allow monitoring of problems as they develop. If other surfacing is installed then it must be easily removable should any maintenance be necessary.

(4) Any structure built within the approved waterfront setback area is not to impose further loading on the revetment wall unless a new structural certification has been produced that specifically states that the revetment wall will continue to remain structurally sound with the additional loading for the remainder of its 40 year lifespan.

11.6.2 (10) Boat Ramps

(1) The applicant and Council shall be indemnified under a policy(s) of insurance against all loss or damage to property and all loss or damages resulting from personal injury including illness and death, which may arise during construction of the works.

   (a) A bond is to be submitted to council, as required in the development approval, which h will be held by Council until an inspection immediately after completed works, and following a further inspection 12 months after works have been completed, determines that no damage to canal infrastructure has occurred as a result of the works.

   (b) The building applicant shall secure and maintain as described herein for an amount not less than five million dollars ($5,000,000.00) a Public Liability policy with Caloundra City Council being noted as an “Interested party”. Proof of this current public liability insurance in the form of a Certificate of Insurance shall be submitted to Council prior to work commencing on revetment walls to construct a boat ramp.

(2) Boat ramps shall be designed and constructed to sustain all relevant loadings as assessed by a RPEQ.

(3) Boat ramps shall have a minimum width of 3.6m for vehicular access.

(4) Boat ramps shall have a minimum side boundary clearance of 1.5m.

(5) Side and edge walls for boat ramps shall extend around the boat ramp to a minimum depth of 600mm below natural ground level to prevent damage from scour.

(6) Boat ramps should be designed and constructed with a gradient generally not steeper than 1(V):8(H). Ramps with slopes as steep as 1:6 are acceptable provided the surface is appropriate. Steeper slopes will require operation by a winch. Proposals to construct ramps steeper than 1:8 shall be supported by an impact assessment study that demonstrates the sustainability of the proposal.

(7) The surface of boat ramps shall be:

   (a) finished and maintained so as to inhibit the formation of a slippery surface; and

   (b) within 200mm of the natural surface levels wherever possible. For constructed canals, the natural surface is considered to be the original design profile of the beach.

(8) Boat ramps shall be designed not to interfere with stormwater infrastructure or impose any adverse loads on stormwater drains.

(9) Boat ramps shall be designed not to interfere with navigation, the water allocation area of adjoining properties, or the public usage of the waterway.

11.6.2(11) Boat Lifts

(1) Boatlifts are to be designed and constructed to sustain all loadings including hydraulic pressure, berthing impact and dead load of the structures as assessed by a RPEQ.

(2) Gangways, pontoons or jetties required for access/egress are to be in accordance with the provisions of Sections 11.6.2(6) and 11.6.2(7).

(3) Boatlifts are to be designed to raise a vessel a maximum of 300mm above H.A.T.

(4) Boatlifts are to be fully contained shoreward of the approved quay line.

(5) The maximum size of a vessel using a boatlift is to be determined by:

   (a) ensuring that the vessel does not impact upon the adjacent allotment's waterway area allocation. Maneuvering details may be required to support the application; and
   (b) where applications are made for boatlifts in canals to service a vessel over eight metres, the application is to be referred to Council for consideration.

(6) Operation of the boatlift should not cause nuisance noise.

(7) Adequate lighting should be provided for safe pedestrian access to the berths, security of vessels and shore facilities, and safe navigation in the vicinity of the structure. All lighting should be designed and located to minimise glare for vessels navigating in the vicinity and to neighbouring properties. Refer to AS 3962-2001: *Guidelines for Design of Marinas*.

11.6.2(12) Swimming Pools

(1) Swimming pools are to be designed and constructed to be structurally independent of the revetment wall, and not impose any net additional load on the revetment wall, unless the revetment wall is certified by a RPEQ as structurally adequate to withstand all loadings imposed by

the swimming pool. A new certificate is required to be dated along with each new proposed structure that may impose additional loadings to existing revetment walls.

(2) Certification from a RPEQ is still required even if the swimming pool and any associated structures do not place additional loads on the existing revetment walls.

11.6.3 Canals

(1) All canals, revetment walls and associated facilities required in a canal subdivision are to be designed and constructed in accordance with the Coastal Protection and Management Act 1995 as amended, and in accordance with the canal layouts approved by Council at the time of consideration of the preliminary approval. The design and construction are to meet the requirements set out in clauses (2) to (12) below.

(2) The canal access from the adjacent channel is to be constructed to the approved depth and include appropriate structures to prevent infilling and siltation;

(3) The beach profile is to be constructed for long term stability with due consideration to tides, boat wash, wind induced waves, and stormwater discharges;

(4) The outside face of revetments (reinforced concrete wall or rock wall) is to align with the allotment Registered Property (RP) Boundary. Reinforced concrete walls should be designed with a minimum design life of 40 years. The footings of the wall are to be located 300mm below L.A.T. for the site;

(5) The location of revetments/walls is to be such to ensure:

(a) The waterway provides a suitable navigation channel;
(b) Reasonable provision for boat storage on pontoons or jetties for each waterfront property;
(c) Maintenance of the water quality within the waterway during normal tidal flows;
(d) Midge populations can be controlled by minimising intertidal sand/mud flats;
(e) Mosquito populations can be controlled by minimising ponded water areas behind sand banks or structures; and
(f) Flood conveyance and flood storage requirements are maintained during flood flows;

(6) Certification of the revetment wall design/construction by a RPEQ is to be provided. Anchor rods should not be located within the allotment;

(7) All allotments should fall to the road frontage for drainage purposes. The embankment slope to the canal is to be minimised. Subsequent building development drainage should discharge to the road drainage system;

(8) Suitable access is to be provided to the canal to enable maintenance activities to be undertaken. A typical access way would consist of a maintenance boat ramp constructed within a waterfront parkland as part of each canal subdivision area;

(9) Due consideration is to be given to the layout of the ends of the canals to ensure adequate allocation to waterway area, for each allotment, by using the prolongation of side boundaries;

(10) The land abutting the revetment wall is to be not greater than 1 in 6 slope;

(11) Canal design should ensure sufficient flushing or water exchange rate throughout the entire canal, especially dead-end areas. Stormwater outlets placed in dead-end areas to assist flushing are encouraged; and

(12) Dead-end areas or canal lengths with long runs and no continuous connection to the canal system should be minimised.

11.6.4 Constructed Waterways

(1) All lakes require approval in accordance with Section 8.2 of the Local Government (Planning and Development) Act (which is currently called up under the Integrated Planning Act 1997) and are to be generally designed in accordance with the requirements of:

(a) Section C2 of the Institution of Engineers Australia (Queensland Division) Soil Erosion and Sediment Guidelines; and
(b) Section 11.6.3 of these Guidelines.

(2) A Lake Management Plan is required for all non-tidal lakes.

(3) Design, construction and maintenance of constructed waterways should protect and improve their ecosystem health. Refer to Section 6.5.3 – Water Quality Objectives for Caloundra City.

(4) Natural design concepts should be a primary consideration in constructed lakes. Refer to Section C2 of the Institution of Engineers Australia (Queensland Division) Soil Erosion and Sediment Guidelines.

11.6.5 Natural Waterways

(1) For any development fronting natural waterways, a suitable revetment wall may be required by Council to protect the site from erosion. If a revetment is required it is to be constructed to the requirements of Section 11.6.2.

(2) Natural waterways should be retained in as natural a state as possible. Works should be carried out along natural waterways in such a way that ecosystem health is protected and improved.

(3) Factors to be considered in natural waterway assessment are design, location, and options for erosion control such as soft or hard engineering methods.

(4) Where development activities are proposed in tidal areas, the provisions of the Coastal Protection Management Act apply.

(5) For sites fronting an ocean beach, special regulations are applicable:

(a) If the site is in the Open Coast Erosion Prone Areas as defined in the Environment Protection Authority Beach Protection Map; or
(b) If the site is in the Coastal Management Control District as defined by the Environment Protection Authority.

Applicants are advised to contact the Environment Protection Authority regarding any requirements of the Authority.

(6) Development is to comply with the requirements of 7.11 Natural Waterways and Wetlands Code.

Contents of Section 12 – Specifications and Construction

Tables in Section 12

Figures in Section 12

Section 12

Section 12 – Specifications and Construction

12.1 Purpose and Structure

(1) The purpose of this Section is to outline Council's specification and construction guidelines for work which requires Council approval with regard to its construction, compliance and acceptance.

(2) This Section is structured as follows:

(a) 12.1 to 12.4 which provide the framework of the guidelines;
(b) 12.5 which outlines the standard specifications to form part of contract documentation for works;
(c) 12.6 which outlines the inspection and testing standards which apply during construction and up to the completion of works;
(d) 12.7 which outlines the requirements to be met before works will be accepted on-maintenance, including "as-constructed" documentation.

12.2 Terminology

General terms used in this Section are included in Section 1.5. The following terms relate specifically to this Section of the Policy.

"as-constructed documentation" – all documentation relating to an application, which has been constructed, required by this Section.
"as-constructed submission" – all documentation relating to an application, which has been constructed, required by this Section.
"donated infrastructure" – items of infrastructure provided by a developer and handed over to Council ownership.
"on maintenance" – period during which the developer will be responsible for rectification of any defective works or defective materials incorporated into the works.
"Superintendent" – either:
(a) the consulting engineer engaged by the developer to administer and supervise the contracts; or
(b) Council's engineer nominated in the contract documents where the contract is between the Council and an applicant.

12.3 Related Standards/References

(1) Related Standards/References referred to in this Section are as follows:

Department of Natural Resources Mines and Energy Specification

12.4 Process

Development approval for construction works

Contract documentation prepared for works incorporating:

a. specific development approval conditions;
b. standard specifications (refer Section 12.5.2); &
c. Standard Civil Works Inspection and Testing Plan (CWITP) (refer Section 12.6)

Construction commenced

Inspection and Testing Verification and Records Forms submitted (refer Section 12.6) in accordance with the CWITP

Construction completed

As-constructed documentation submitted, checked and approved by Council (refer Section 12.7). Maintenance bond lodged.

Acceptance of development works “on-maintenance”

Acceptance of development works “off-maintenance”, and release of maintenance bond held by Council.

Figure 12.1 – Specifications and Construction

12.5 Standard Specifications

12.5.1 General

(1) The aim of adopting Standard Specifications is:

(a) To detail all acceptable materials for the construction of works within Caloundra City;
(b) To detail the quality compliance requirements for all acceptable materials to assure the standard and quality of the infrastructure being transferred to Caloundra City Council;
(c) To detail the requirements for construction activities within Caloundra City; and
(d) To ensure that the standards for construction of works comply with Australian Standards, Statutory Authority Standards and sound engineering practice.

(2) The standard specifications are written to form part of contract documents between private developers or between Caloundra City Council and applicants. The specifications are also intended for works carried out by the Council's own workforce.

(3) For contracts between a developer and an applicant the Council's role is detailed in this Policy and the Standard Civil Works Inspection and Testing Plan (CWITP) referred to in Section 12.6.

12.5.2 Standard Specifications Framework

(1) The Standard Specifications framework adopted by Caloundra City Council includes:

(a) Caloundra City Council Standard Specifications, listed in Table 12.1;
(b) Queensland Aus-Spec (SUNROC version), Development Specification Series (Construction), listed in Table 12.2; and
(c) Queensland Department of Main Roads (DMR), Standard Specifications for Roadworks including earthworks, pavement drainage and protective treatment, pavement bituminous surfacing/spray seals or asphalt, road furniture, line-marking and street lighting – as listed in Table 12.3

(2) Generally, the Queensland Department of Main Roads Specifications are to be utilised for the following works:

(a) Stormwater Drainage Works including kerbs and channel, road culverts, underground stormwater drainage, major and minor open drainage and overland flowpaths. Refer to Standard Specifications Caloundra City Council (CCC 2 – Stormwater Drainage).
(b) Roadworks including earthworks, pavement drainage and protective treatments, pavement, bituminous surfacing (spray seals or asphalt), road furniture, line markings and street lighting. Refer to Standard Specifications Caloundra City Council (CCC 4-Roadworks).

Specification	Description
CCC 1	Allotment Earthworks
CCC 2	Stormwater Drainage
CCC 3	Erosion, Sedimentation and Water Quality Controls
CCC 4	Roadworks

Table 12.1 – Caloundra City Council Standard Specifications

Section 12

Specification No.	Specification Title
CQS	Quality System Requirements
CQC	Quality Control Requirements
C101	General
C201	Control of Traffic
C211	Control of Erosion and Sedimentation
C212	Clearing and Grubbing
C213	Earthworks
C220	Stormwater Drainage – General
C221	Pipe Drainage
C222	Precast Box Culverts
C223	Drainage Structures
C224	Open Drains including Kerb & Gutter (Channel)
C230	Subsurface Drainage – General
C231	Subsoil and Foundation Drains
C232	Pavement Drains
C233	Drainage Mats
C241	Stabilisation
C242	Flexible Pavements
C244	Sprayed Bituminous Surfacing
C245	Asphaltic Concrete
C247	Mass Concrete Subbase
C248	Plain or Reinforced Concrete Base
C254	Segmental Paving
C255	Bituminous Microsurfacing
C261	Pavement Markings
C262	Signposting
C263	Guide Posts
C264	Non-Rigid Road Safety Barrier Systems (Public Domain)
C265	Boundary Fencing
C271	Minor Concrete Works
C273	Landscaping
C501	Bushfire Protection (Perimeter Tracks)
DQS	Quality Assurance Requirements for Design
D1	Geometric Road Design (Urban and Rural)
D2	Pavement Design
D3	Structures/Bridge Design
D4	Subsurface Drainage Design
D5	Stormwater Drainage Design
D6	Site Regrading
D7	Erosion Control and Stormwater Management
D8	Waterfront Development
D9	Cycleway and Pathway Design
D10	Bushfire Protection

Table 12.2 – Queensland Aus-Spec Development Specifications

Identification Number	Title	Version	Interim Version
MRS11.01	Introduction to Standard Specifications	12/93	11/98
MRS11.02	Control of Vehicular Traffic at Roadworks	12/93	
MRS11.03	Drainage, Retaining Structures and Protective Treatments	12/93	9/97
SET-MRS11.04	General Earthworks	12/93	9/97
MRS11.05	Unbound Pavements	12/93	9/98
MRS11.06	Reinforced Soil Structures	12/93	5/99
MRS11.07	In Situ Stabilised Pavements	12/93	
MRS11.08	Plant-Mixed Stabilised Pavements	12/93	11/98
MRS11.11	Sprayed Bituminous Surfacing (Excluding Emulsions)	12/93	8/97
MRS11.12	Sprayed Bitumen Emulsion Surfacing	12/93	
MRS11.13	Bituminous Slurry Surfacing	12/93	
MRS11.14	Road Furniture	12/93	12/97
MRS11.15	Noise Barriers		
PM-MRS11.16	Landscaping	12/93	
MRS11.19	Bitumen Cutter Cutback Bitumen	12/93	
MRS11.20	Medium Curing Cutback Bitumen	12/93	
MRS11.21	Bitumen Emulsion	12/93	
MRS11.23	Supply and Delivery of Quicklime and Hydrated Lime for Road Stabilisation	12/93	
MRS11.24	Manufacture of Precast Concrete Culverts	12/93	
MRS11.25	Manufacture of Precast Concrete Pipes	12/93	8/97
MRS11.27	Manufacture of Fibre Reinforced Concrete	12/93	
MRS11.28	Applicant's Site Facilities and Camp	12/93	8/97
MRS11.30	Dense Graded Asphalt Pavements	12/93	9/97
MRS11.31	Low Rut Dense Graded Asphalt Pavements		
MRS11.33	Stone Mastic Asphalt Pavements		8/97
MRS11.34	Open Graded Asphalt Pavements	12/93	
MRS11.39	Lean Mix Concrete Sub-base for Pavement		9/98
MRS11.40	Concrete Pavements		9/98
MRS11.41	Specification for Performed Joint Fillers for Concrete Road Pavements and Structures		4/98
MRS11.45	Pavement Marking		8/97
MRS11.50	Specific Quality System Requirements	12/93	8/97
MRS11.51	Environmental Management		
MRS11.55	Use of Explosives in Roadworks		
MRS11.63	Cast-In-Place Piles	12/93	
MRS11.65	Precast Prestressed Concrete Piles	12/93	
MRS11.66	Driven Steel Piles	12/93	
MRS11.67	Bitumen Slip Layer On Piles	12/93	
MRS11.70	Concrete	12/93	8/97
MRS11.71	Reinforcing Steel	12/93	8/97
MRS11.73	Manufacture of Prestressed Concrete Members and Stressing Bars	12/93	
MRS11.74	Supply and Erection of Prestressed Concrete Girders and Kerb Units	12/93	
MRS11.75	Supply and Erection of Prestressed Concrete Girders and Reinforced Concrete Deck	12/93	
MRS11.77	Supply and Erection of Steel Girders and Reinforced Concrete Deck	12/93	
MRS11.78	Fabrication of Structural Steelwork	12/93	3/98
MRS11.79	Fabrication of Aluminium Bridge Barriers	12/93	
MRS11.80	Supply and Erection of Bridge Barrier	12/93	
MRS11.82	Bearings, Joints, Fillers and Built-In Items for Bridges	12/93	
MRS11.83	Anti-Graffiti Protection	12/93	
MRS11.84	Painting of Steel Bridges		
MRS11.86	Preparation for Bridge Widening	12/93	

Identification Number	Title	Version	Interim Version
MRS11.91	Ducts and Pits	12/93	8/87
MRS11.92	Traffic Signal and Road Lighting Footings	12/93	11/97
MRS11.93	Traffic Signals		1/98
MRS11.94	Road Lighting Installation		9/97
MRS11.95	Switchboards and Cables		8/97
SS-SET-53.99	Supplementary Specifications	12/99	12/99
MRS11.15	Line Marking		
MRS11.22	Supply of Cover Aggregate		
Annexure MRS11.14.1	Road Furniture		
Annexure MRS 11.22.1	Supply of Cover Aggregate		
Annexure MRS 11.30.1	Dense Graded Asphalt Pavements		

Table 12.3 – Queensland Department Main Roads (DMR) Standard Specifications

(3) *Roadworks – DMR Standard Specifications*

(a) Where the DMR standard specifications reference an associated annexure, a Caloundra City Council annexure in a compatible format is available in both hard copy and electronic form for inclusion in contract documentation.

(b) the relevant annexures are:
- (i) CCC Annexure MRS 11.03.1 – Drainage, Retaining Structures and Protective Treatments
- (ii) CCC Annexure MRS 11.04.1 – General Earthworks
- (iii) CCC Annexure MRS 11.50.1 – Specific Quality System Requirements

(4) *Specific Amendments to DMR Specifications*

(a) General Earthworks MRS 11.04
- (i) Subgrade Vertical Tolerance {Clause 5.3.1(b)}: + 15mm, -35mm
- (ii) Subgrade Compaction (Clauses 8.3.1 and 10.3.1): In addition to density requirements, the sub-grade is to be proof rolled with a single drive axle truck with an axle load of 8.2t. The proof rolling is to cover all lanes (traffic and parking). No discernible movement should be observed for acceptance.

(b) Unbound Pavements MRS 11.05
   (i) Alternative Material Properties as shown in Table 11.4

A.S. Sieve Size (mm)	Percentage Passing By Mass				
	Subtype				
	2.1	2.2	2.3	2.4	2.5
37.5	100	100	100	100	100
19.0	85-100	75-100	75-100	75-100	
9.6	55-90	58-90	58-90	58-90	
4.75	40-70	45-70	45-70	45-70	
2.36	30-55	36-55	36-55	36-55	35-80
0.425	14-30	18-30	18-30	18-30	18-50
0.075	7-15	8-17	8-17	8-17	10-25
% passing 0.075/ % passing 0.425	0.35-0.55	0.35-0.65	0.35-0.65	0.35-0.65	0.35-0.65
Liquid Limit (max)	25	28	28	28	35
Linear Shrinkage x % passing AS 0.425 sieve (max)	85	85	110	135	
California Bearing Ratio (soaked)	80	60	45	35	20

Table 12.4 – Alternative Material Properties – Type 2 Materials

   (ii) Minimum Limits for Plasticity Index or Linear Shrinkage as shown in Table 11.5 (Clauses 6.2.3 and 6.3.3).

Material Subtype	2.1	2.2	2.3	2.4	2.5
Minimum Linear Shrinkage	1.5	1.5	2.0	2.5	2.5

Table 12.5 – Minimum Limits for Plasticity Index or Linear Shrinkage

   (iii) Compaction Standards (Clause 8.2.1): Proof rolling as detailed in 2.1 is required for the base layer.
   (iv) Geometrics, Vertical Tolerances (Clause 8.2.5.1)

	Kerb and Channel	No Kerb and Channel
Sub base	+10mm,-20mm	+15mm,-35mm
Base	± 15mm	± 25mm

Table 12.6 – Geometrics, Vertical Tolerances

   (v) Surface Evenness (Clause 8.2.5.2(c)): No testing of surface evenness is required.

(c) Road Furniture MRS 11.14

(i) Reference Marking (Clause 8.4.7): The Caloundra City Council corporate logo of size 100mm high is required on the back of all signs except for double sided signs. Major sign manufacturers have the required details.

(d) Supply of Cover Aggregate MRS 11.22
   (i) Precoating (Clause 5.4): All cover aggregates are to be pre-coated. The type and rate of precoating is to be given to the Engineer for approval prior to any precoating being undertaken.

(e) Specific Quality System Requirements
   (i) Mandatory Hold Points (Clause 8.1)
      - Where the works are part of a development within Caloundra City, Council has mandatory hold points to allow inspection of the works. These inspections include joint inspection with superintendent and Council's inspector and random audit inspections by Council.
      - Refer Section 12.6 – Inspection and Testing Standards

12.6 Inspection and Testing Standards

12.6.1 Standard Civil Works Inspection and Testing Plan (CWITP)

(a) The Caloundra City Council Standard Civil Works Inspection and Testing Plan (CWITP) for roadworks, stormwater drainage and allotment works and for water supply and sewerage reticulation is to form part of contract documents relating to those works between private developers and between Caloundra City Council and applicants. The CWITP is available from Caloundra City Council in both hard copy and electronic forms.

(b) For contracts between a developer and an Applicant, the Council's audit role is outlined in the Standard Civil Works Inspection and Testing Plan.

(c) The CWITP is available from Council in both hard copy and electronic form for inclusion in contract documentation.

(d) Council's Standard forms for inspection testing verification and records are to be submitted for all relevant works:
   (i) Inspection and Testing Verification and Records – Roadworks
   (ii) Inspection and Testing Verification and Records – Stormwater Drainage
   (iii) Inspection and Testing Verification and Records – Water Reticulation
   (iv) Inspection and Testing Verification and Records – Sewerage

(e) During construction and up to the completion of works Council will conduct random audit and inspections if considered necessary with or without prior notification.

(f) The major inspections and their coverage are listed in the Standard Civil Works Inspection and Testing Plan (CWITP). The listings are not intended to be exhaustive and Council may require inspection and testing of other items.

(g) The applicant is to confirm adoption of Council's Standard Civil Works Inspection and Testing Plan, with written confirmation.

(h) The applicant must follow the plan, unless variations are approved and submit certification that the plan has been followed in accordance with the "as-constructed" submission documentation.

(i) Should any of the test results fail to meet specification, the consultant is to include in the submission, details of retesting/rectification carried out.

(j) The documentation is to be presented in a logically assembled and bound document including a table of contents confirming completeness.

12.7 "As-Constructed" Documentation

12.7.1 General

(a) Development works will not be accepted "on-maintenance" until such time as all "as-constructed" drawings have been received, checked and approved.

(b) The purpose of "as-constructed" documentation is to:
  (i) enable a quantitative check of the works against the approved design to ensure design philosophies and criteria have been achieved (the "checking" function); and
  (ii) provide an accurate record of the locations of underground services (the "recording" function).

(c) Information required for "checking" function must be presented in a form which allows ready comparison between design and 'as-constructed' data by engineering staff.

(d) Data is to be presented in hard copy for record purposes and electronic format for direct transfer to Council's Geographic Information System (G.I.S.).

(e) Where the consultant is unable to comply with (c) and (d) above, a charge will be applied for conversion of any "as-constructed" data not supplied in line with the standards given in the following sections.

(f) "As-constructed" documentation is to include Council's Standard Forms – "As-Constructed Drawings – Submission and Compliance Report" and, where applicable "As-Constructed Drawings – Non-Compliance Report".

12.7.2 Certification

(a) The Caloundra City Council Standard "As-Constructed Drawings – Submission and Compliance Report" which is available from Council in both hard copy and electronic form is to be completed by the consultant and approved by Council prior to the acceptance of works "on-maintenance".

(b) In addition to (a) above, the consultant is to identify the nature and number of items of "as-constructed" data that do not comply with the approved design using the standard Non-Compliance Report form and either:
  (i) certify that the completed works do not in any way compromise the design intent; or
  (ii) give details of proposed rectification works and time for completion.

(c) Engineering Certification of the drawings is required as follows:

"This drawing is an accurate representation of the works as-constructed and the information is suitable for use by Council and others. As-constructed levels have been provided by a person, Registered under the Surveyors Act 1977. We hereby accept responsibility for the as-constructed information shown on this drawing.

Certified By ……………………………………………………………………………………"

(d) As "as-constructed" drawings become public property through their lodgment with Council, copyright on these drawings is to be removed.

12.7.3 Data Format

(a) "As-constructed" drawings and documentation are to be submitted using the appropriate forms and to comprise the following:

   (i) As-constructed drawings
   - Hard Copy – every drawing included in the approved design, including stormwater calculation sheets, catchment plans and landscaping plans, is to be submitted in certified "as-constructed" form as full size drawings.
   - Electronic submission is to use the current version of ADAC routines. The drawings are to indicate the version of the ADAC utility that was used to create drawing, to allow Council to run the appropriate script on the data for that version of the software. For example, drawing CO1.dwg would be renamed to c01_adac030918.dwg where "030918" are the last six digits of the ADAC software version number.

   (ii) As-Constructed Drawings – Submission and Compliance Report (FORM No. 1.1).
   (iii) As-Constructed Drawings – Non Compliance Report (FORM No. 1.2).
   (iv) Inspection and Testing Verification and Records (FORM 1.3).
   (v) Other Documentation as requested.
   (vi) Submission of a single set of prints is satisfactory for checking, until approved. Once approved, copies of all drawings are to be submitted in both hard copy and electronic form.

(b) Digital data is to be in Autocad.DWG format and is to include at least two relatively well spaced permanent survey marks with AMG co-ordinates and AHD levels to fourth order standard as defined by the Department of Natural Resources Specifications.

(c) As Council will be checking only a sample of the "as-constructed" information for accuracy and completeness, any departure from these requirements will be grounds for rejection of the submission and resubmission will be necessary after amendment.

(d) All "As-constructed" drawings are to have linework and lettering of suitable thickness and clarity to be legible, typically 2.5mm black lettering minimum.

(e) Numerical amendments are to be denoted as a diagonal line through the design value with the "as-constructed" value adjacent in brackets. Other amendments are to be denoted by encircling with a notated cloud.

(f) Construction cost data (as currently required by existing Guidelines).

12.7.4 Tolerances

(a) alignment tolerance is 0.1 metre

(b) level tolerance is 0.005 metre

12.7.5 Specific Information

(a) Subdivision Plan
   (i) The subdivision layout plan is to be based on the final plan of survey intended for lodging with the Lands Title Office.
   (ii) Approved road names and Final Plan of Survey – Lot Numbers are to be shown on this and other related drawings.
   (iii) A copy of the Final Plan of Survey is to be provided.

(b) Earthworks – refer to Section 4 – Earthworks and Section 9 – Site Development.

(i) Where the existing ground profile has remained unaltered during the course of construction, natural surface contours are to be provided at 0.5 metre intervals over that part of the site.
(ii) Areas affected by cut and fill operations, other than roads and drains, are to be recorded by spot heights at regular intervals to adequately represent the change in surface profile (Tolerance ± 100mm).

(c) Roadworks – refer to Section 3 – Roads.
(i) Nominal face of kerb line, edge of bitumen, crown of road and the like are to be shown. Certification that the works have been constructed in accordance with the design plans is sufficient provided that level information on change of grade is given on the plan.
(ii) Constructed Road Surfacing type, pavement thickness and composition including subgrade C.B.R. values are to be noted for each individual road segment.

(d) Road Furniture – refer to Section 3 – Roads.
(i) Location of permanent signs, street light conduits, guide posts, guardrails, pathways, and the like are to be shown on the plan. Provided certification is given that such appurtenances have been placed in accordance with the approved plans, detailed survey is not required.

(e) Stormwater Drainage – refer Section 5 – Total Water Cycle Management and Section 6 – Stormwater and Drainage Management.
(i) All drainage lines, structures, open channels and the like are to be shown on plan. Certification of the design plan will be acceptable providing the following tolerances have not be exceeded:
- surface levels and invert levels ± 50mm;
- structure locations ± 1000mm of design;
- pipe size and class – no variation.

Where these tolerances have been exceeded, "as-constructed" data will be acceptable provided that the Consultant can demonstrate that the design intent is not compromised. This will require written certification of the design by the Consultant.
(ii) Where drainage systems (that may be extended by future development), have been constructed out of tolerance, including but not limited to incorrect pipe sizes and major out of tolerance construction, the Consultant is to amend the design calculation sheets to reflect the "as-constructed" performance of the system.
(iii) Notwithstanding the above criteria, the information detailed in Table 12.7 is to be provided.

Manholes and Pits	
Use	Pit Manhole
Construction	Precast Insitu
Chamber Size	Circular Rectangular Diameter Length Width
Inlet Structure	Pit Number Surface Level Depth Invert Level Inlet Type Lid Type
Configuration	Left Centre Right
Outlet	Outlet Type Fire Retardant Device
End Structures	
Structure Number	
Insert End Cap	
Structure Level	
End Wall	End Wall Type
Construction	Precast Insitu
Wing Wall	Wing Wall Type
Construction	Precast Insitu
Apron	Apron Type
Construction	Precast Insitu
Grated	Grate Type
Tide Gate	Tide Gate Type
Predominant Material	
Outlet Protection Type	
Pipe/Culvert Description	
S.Q.I.D. Type	
Pipes	
Upstream Structure	U/S Pit No U/S Surface Level U/S IL
Downstream Structure	D/S Pit No D/S Surface Level D/S IL
Grade (%)	
Coordinates	Length Coordinates U/S Coordinates D/S

Type	Pipe Box Size Multi Cell
Concrete Cover Type	Standard Saltwater
Material	
Class	
Joint	
Surface Drainage	
Type	
Shape	
Lining Material	
Lined Width	
Upstream Details	U/S Point ID U/S IL
Downstream Details	D/S Point ID D/S IL
Average Grade	
Drain Length	

Table 12.7 – Stormwater Drainage As-Constructed Information

(f) Water Supply
  (i) Certification of the design plan will be acceptable provided the tolerances in accordance with WSA 03-2002 Section 21 (Water Supply Code of Australia) have not been exceeded.
  (ii) Where these tolerances have been exceeded the services are to be surveyed for "as-constructed" location and approval in writing granted from the Development Engineer for acceptance of deviation from the approved plans.

(g) Sewerage Reticulation
  (i) All works relating to sewerage reticulation construction will require detailed survey of "as-constructed" services. Certification that the works have been constructed in accordance with design will be accepted providing tolerances in accordance with WSA 02-2002, Section 23 (Sewerage Code of Australia) have not been exceeded.

Maintenance Holes		
Use		An attribute that differentiates the use of the subject item.
Chamber Size	Circular	General shape of chamber
	Rectangular	General shape of chamber
	Diameter	The diameter of the pit (Internal Dimensions)
	Length	The rectangular dimensions of the pit (Internal Dimensions)
	Width	The rectangular dimensions of the pit (Internal Dimensions)
Inlet Structure	Surface Level	The height of the top surface of the lid, hatch, rim or roof (m).
	Invert Level	The height of the top surface of interior floor/bottom (m)
	Material Type	The material composition of the maintenance hole
	Lining	The lining material of the maintenance hole
	Lid Type	The type of lid of the maintenance hole
	Drop Type	The drop type
	Catchment P/S	The catchment identifier
	Line Number	The sewerage line identifier
	M/H Number	The maintenance hole identifying number
	Offset	
	Tie	
	Chainage	
Pipes 1 (Non Pressure)		
Upstream Structure	U/S Pit No	Upstream pit number
	U/S Surface Level	Upstream surface level
	U/S IL	Upstream invert level
Downstream Structure	D/S Pit No	Downstream pit number
	D/S Surface Level	Downstream surface level
	D/S IL	Downstream invert level
Grade (%)		Grade of pipe in percentage
Length		Length of pipe in metres
Coordinates	Coordinates U/S	GDA X & Y values
	Coordinates D/S	GDA X & Y values
Use		This value differentiates similar entities by use or type.
Alignment		Offset from cadastre boundary to the main
Size		The manufacturer's designated size, or nominal diameter.
Material		The material composition of the subject item
Class		The pipe class as specified by the manufacture
Wrapping		The protective wrapping material used during construction
Average Depth		Nominal depth to the top of the pipe.
Embedment		Embedment listing from WSAA Sewerage Code
Joint Type		
Rock Excavated		
Pipes 2 (Pressure)		
Use		This value differentiates similar entities by use or type.
Alignment		Offset from cadastre boundary to the main
Size		The manufacturer's designated size, or nominal diameter

Maintenance Holes		
Material		The material composition of the subject item.
Class		The pipe class as specified by the manufacture
Average Depth		Nominal depth to the top of the pipe.
Protection		The protective wrapping material used during construction
Embedment		Embedment listing from WSAA Sewerage Code
Joint Type		
Rock Excavated		
Coordinates	Check Pipe Length	To check length of pipe in metres
	Coordinates U/S	GDA X & Y values
	Coordinates D/S	GDA X & Y values
Valves		
Use		This value differentiates similar entities by use or type.
Type		The particular kind, class, or group of valve.
Size		The manufacturer's nominal size designation
Protection		External corrosive protection
Manufacturer		Manufacturers name/details
Fittings		
Type		
Material		
Body Size		
Branch Size		
House Connections		
Coordinates	Coordinates U/S	GDA X & Y values
	Coordinates D/S	GDA X & Y values
Levels	Surface Level	The height of the top surface of the lid, hatch, rim or roof (m).
	Invert Level	The height of the top surface of interior floor/bottom (m)
Use		This value differentiates similar entities by use or type.
Size		The manufacturer's designated size, or nominal diameter.
Material		The material composition of the subject item.
Material Class		The material class.
Type		The Council's standard type name (i.e. Stub, Y, P, A etc)
Chainage		The distance from the centre of the downstream manhole to the offset of the point of connection.
Offset Length		The distance measured square from the centre of the pipe to the end of the point of connection.

Table 12.8 – Sewerage As-Constructed Information

(h) Pump Stations
  - (i) All work relating to sewerage pump station construction requires "as-constructed" survey.
  - (ii) Information detailed in Table 12.9 is to be shown on the plan.

COMPONENT	ATTRIBUTES
Wet Well	Dimensions (Diameter) Sewer I.L. Alarm Level Standby Start Level Duty Start Level Stop Level Floor Level Surface Level (Top of Lid)
Valves, R.P.Z.D.'s & Other Fittings	Type Material / Class Protection
Pumpsets	Manufacturer / Type / Model Number Serial Number Design Duty Motor Rating (k.W.) Superimposed Characteristic Curves Including: System Resistance Curve Pump Output Curve Pump Efficiency Curve Overall Unit Efficiency Curve
Electrical Equipment	Schematic Arrangement Manufacturer / Type / Model Number of components Serial number of major components (e.g. vent fans, level controls and variable speed drives)
Vent	Dimensions (Dia. & Ht.) Material
Overflow	Invert Level E.P.A. Licence No. and Conditions
Underground Power Supply	Location Cover

Table 12.9 – Pump Station Construction

12.8 Maintenance Period

(1) Development works which include "donated infrastructure" will be subject to a minimum of 12 months and a maximum of 3 years (on developments considered significant) maintenance period during which the developer will be responsible for maintaining the approved standard of open spaces and rectification of any defective works or defective materials incorporated into the works.

(2) Prior to acceptance of the development works "on-maintenance", the developer must have lodged with Council:

(a) all required "as-constructed" documentation;

(b) inspection and testing documentation and certifications; and

(c) a maintenance bond (either cash or unconditional bank guarantee) equal to 5% of the cost of the "donated infrastructure" to guarantee that the developer will promptly undertake any required rectification works during the maintenance period (otherwise Council may undertake the works and deduct the cost from the bond).

(3) At the end of the maintenance period, the works will be accepted "off-maintenance" and the maintenance bond returned to the applicant.

Index

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