FRASER COAST WATERBODY MANAGEMENT STRATEGY

WATERBODY MANAGEMENT FRAMEWORK TECHNICAL REPORT

DesignFlow

Prepared for Fraser Coast Regional Council

November 2019

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1 INTRODUCTION

1.1 BACKGROUND AND CONTEXT

Fraser Coast Regional Council (FCRC) is responsible for the management of a significant number of urban waterbodies. These systems provide a range of social, environmental and economic values and/functions such as; aesthetics, amenity, park landscape, ecological habitat and flood management.

Urban waterbodies across the region are under considerable pressure due to increasing development and historical land uses. As a result, many waterbodies are in a degraded condition, or are at risk of deteriorating, with a range of issues including declining water quality and aesthetic values, fish kills, algal blooms, failure of hydraulic structures and infestations of noxious weeds.

In recognition of the values and potentially significant management costs associated with urban waterbodies, Council is seeking to proactively manage their urban waterbody assets, rather than in a reactive manner. This report presents the technical work which has informed the draft FCRC Waterbody Management Framework, which provides a systematic approach to identifying risks and prioritising management actions associated with Council's urban waterbodies.

FCRC is developing a Strategy document which will provide a concise overview of the strategic direction, key findings and prioritisation policy and directions of this work, and will be able to be referenced as the *FCRC Waterbody Management Strategy Summary Report*. The intention is that the Strategy document will be prepared following consultation on the draft FCRC Waterbody Management Framework.

1.2 OBJECTIVES

The aim of this technical report is to identify, characterise and prioritise Council's waterbody assets and use this information to develop a waterbody asset management framework. The framework and associated deliverables will be used to assess the operational efficiency of waterbodies across the Fraser Coast and assign relevant service levels (particularly in relation to high profile waterbodies).

1.3 REPORT STRUCTURE

The development of the Waterbody Management Framework includes the following sections as detailed in the *Waterbody Management Guideline* (Water by Design, 2013).

Waterbody Prioritisation (Section 2):

- Identify and review the number and key characteristics of urban waterbodies that Council are responsible for maintaining.
- Establish a 'Waterbody Class' to define levels of services for each waterbody based on its values and functions within the landscape.

- Develop a waterbody condition assessment rating system and then undertake field investigations to define the current 'Waterbody Condition' of each waterbody.
- Characterise and prioritise each waterbody based on the outcomes of the condition assessment and 'Waterbody Class' to determine an overall management priority.

Managing Waterbody Assets (Section 3):

- Provides a brief overview of the benefits and costs associated with the management of urban waterbodies from Council's perspective
- Identifies a number of recommended next steps to optimise the condition of waterbodies and better understand the cost of their management.

Developing Waterbody Management Plans (Section 4):

- Outline the steps for the development of a Waterbody Management Plan for individual waterbodies, including specific management options to better maintain and / or manage high priority waterbodies, based on existing legislation, policies and guidelines.
- Apply the Waterbody Management Plan Framework to two (2) high priority waterbody system:
    - Lowlands Lagoons (Anembo Lakes) in Torquay; and,
    - Ululah Lagoons, in Maryborough

1.4 SCOPE

The waterbody management framework focusses on constructed waterbodies (i.e. predominantly open water systems), located wholly or partially on land owned and managed by Council. Assets that are currently not the responsibility of Council were not included in the database. Natural waterways, and natural or constructed wetlands are not considered in this framework.

2 WATERBODY PRIORITY

2.1 OVERVIEW

Waterbody management issues across the Fraser Coast vary in type and magnitude considerably throughout the region depending on a range of factors such as profile in the landscape, water quality, weed issues, community expectations and environmental values. It is not possible for Council to closely manage all of the waterbodies it is responsible for, due to resource and budget constraints. Therefore, it is essential that these assets are prioritised to enable Council to focus existing resources and to plan for future implementation of waterbody management activities.

The prioritisation process involved the following tasks:

1. Waterbody Class – This classified each waterbody in terms of use and function in order to define an appropriate 'class' associated with each waterbody asset.
2. Waterbody Condition – This involved undertaking an intensive field condition assessment of all managed waterbodies across the FCRC region. Each waterbody was scored based on a range of criteria that reflect the range of issues and values associated with urban waterbodies.
3. Waterbody Management Priority - The 'Waterbody Class' and 'Waterbody Condition' scores were then combined to assign an overall management priority for each waterbody to inform future planning for Council's urban waterbodies.

The following sections describe the methodology and outcomes of the waterbody prioritisation process.

2.1.1 Waterbody Inventory

Council currently has management responsibility for 54 urban waterbodies which are being considered as part of the Waterbody Management Framework. An additional 105 waterbodies were excluded from the asset database due to being wholly within private ownership. Table 1 lists the 54 waterbodies included in this assessment, with their locations shown on Figure 1.

Table 1. FCRC waterbody inventory.

Asset ID	Asset Name	Suburb	Catchment	Area (ha)
NEWKM03	Charles Street, Pialba (Hervey Bay State High School)	Pialba	Charles St - School Dam	0.74
STDS00002	Boundary Rd, Wondunna (adj Aquatic Centre)	Wondunna	Bunya Creek 1.01	0.25
STDS00003	Doolong South Rd, Wondunna (Parklands Estate)	Wondunna	Bunya Creek 1.01	0.37
STDS00008A	Anembo Sth East - b/n Alexander St & Margaret St (Lowlands)	Torquay	Lowlands Lagoons 1.08	4.72
STDS00008B	Anembo Sth - b/n Ann St & Alexander St (Lowlands)	Torquay	Lowlands Lagoons 1.08	2.51
STDS00008C	Anembo West - west of Ann St (Lowlands)	Torquay	Lowlands Lagoons 1.08	8.39
STDS00008D	Anembo Nth - b/n Ann St & Alexander St (Lowlands)	Torquay	Lowlands Lagoons 1.08	6.20
STDS00008E	Anembo Nth East - b/n Alexander St & Margaret St (Lowlands)	Torquay	Lowlands Lagoons 1.08	5.97
STDS00011	Margaret St, Urangan (west of Botanic Gardens)	Urangan	Lowlands Lagoons 1.08	1.04
STDS00015	Elizabeth St, Urangan (Botanic Gardens)	Urangan	Lowlands Lagoons 1.08	0.85
STDS00016	O'Rourke St, Pialba (USC Campus)	Pialba	Tooan Tooan Creek 1.09	3.48
STDS00022	Hervey St, Scarness (b/n Zephyr St & East St)	Scarness	Tooan Tooan Creek 1.09	1.79
STDS00033	Pialba Burrum Heads Rd, Craignish (Petersen Park)	Craignish	O'Regans Creek 1.15	0.11
STDS00034	Pialba Burrum Heads Rd, Craignish (Petersen Park SW)	Craignish	O'Regans Creek 1.15	0.07
STDS00035	Panorama Dr, Dundowran Beach (Arkara Lagoons)	Dundowran Beach	Eli Creek 1.12	2.39
STDS00042	Richard St, Urangan (north of Botanic Gardens)	Urangan	Lowlands Lagoons 1.08	1.75
STDS00043	St Joseph's Dr - U/S, Urraween (Central Park Estate)	Urraween	Eli Creek 1.12	0.18
STDS00045	Parklands Bvd,, Wondunna (Parklands Estate)	Wondunna	Bunya Creek 1.01	0.17
STDS00047	Doolong Rd, Kawungan (east of Dundee Dr)	Kawungan	Bunya Creek 1.01	0.18
STDS00050	Fort St, Maryborough (Prickett Park)	Maryborough	Maryborough 2.17	0.41
STDS00051	Loretto Dr, Oakhurst (Woocoo Park)	Oakhurst	Saltwater Creek 1.2	0.72
STDS00052	Maryborough-Biggenden Rd, Oakhurst (Oakhurst Reserve)	Oakhurst	Saltwater Creek 1.2	0.07
STDS00053	Maryborough Showground , Maryborough West (Racecourse)	Maryborough West	Maryborough North 2.72	2.09
STDS00056	Maryborough Showground, Maryborough West (north of Entry)	Maryborough West	Maryborough North 2.72	3.53
STDS00057A	Alice St , Maryborough (Ululah north)	Maryborough	Maryborough 2.15	3.45
STDS00057B	Alice St , Maryborough (Ululah Lagoon - Anzac Park)	Maryborough	Maryborough 2.15	8.51
STDS00063	Endevour Way, Eli Waters (Mariners Cover Estate)	Eli Waters	Eli Creek 1.12	0.35

Asset ID	Asset Name	Suburb	Catchment	Area (ha)
STDS00065	Gunsynd Way, Point Vernon (Thoroughbred Park)	Point Vernon	Eli Creek 1.12	0.70
STDS00067	Genoa Ct, Point Vernon (Point Vernon Shores Estate)	Point Vernon	Dougan St 1.11	0.51
STDS00068	Dory Dr, Point Vernon (Point Vernon Shores Estate)	Point Vernon	Dougan St 1.11	0.48
STDS00070	Sunrise Cr , Burrum Heads (Cheelii Lagoon)	Burrum Heads	Burrum River 1.19	1.65
STDS00078	Barramundi Dr, Burrum Heads (On the Beach Estate)	Burrum Heads	Marsh Creek 1.17	3.97
STDS00079	Bentwood St, Burrum Heads (Burrum Waters Estate)	Burrum Heads	Marsh Creek 1.17	1.66
STDS00080	Beach Dr, Burrum Heads (Burrum Waters Estate)	Burrum Heads	Marsh Creek 1.17	3.08
STDS00081	Northshore Av , Toogoom (Fraser Waters Estate)	Toogoom	Beelbi Creek 1.16	10.59
STDS00082	O'Reagan Creek Rd , Toogoom (near Jeppesen Rd)	Toogoom	Beelbi Creek 1.16	0.64
STDS00090	Panorama Dr , Dundowran Beach (Panorama Estate)	Dundowran Beach	Eli Creek 1.12	0.24
STDS00106	Eagle Beach Pde, Dundowran Beach (Paradise Beach Estate)	Dundowran Beach	Eli Creek 1.12	0.53
STDS00108	Sempfs Rd, Dundowran Beach (Blue Lagoon Estate)	Dundowran Beach	Eli Creek 1.12	3.53
STDS00114	Yarilee Cct, Dundowran (Yarrilee Waters Estate)	Dundowran	Eli Creek 1.12	9.03
STDS00116	Pialba Burrum Heads Rd, Eli Waters (Condor Lakes Estate)	Eli Waters	Eli Creek 1.12	6.68
STDS00118	Lady Penrhyn Dr, Eli Waters (Mariners Cove Estate)	Eli Waters	Eli Creek 1.12	3.32
STDS00119	Lady Penrhyn Dr, Eli Waters (Mariners Cove Estate)	Eli Waters	Eli Creek 1.12	6.00
STDS00120	Lady Penrhyn Dr , Eli Waters (Mariners Cover Estate)	Eli Waters	Eli Creek 1.12	3.25
STDS00121	Endeavour Way, Eli Waters (adj Fantail Way)	Eli Waters	Eli Creek 1.12	6.51
STDS00122	Eli Creek Rd, Point Vernon (Thoroughbred Park)	Point Vernon	Eli Creek 1.12	0.74
STDS00125	Banksia St, Point Vernon (adj Spinnaker Dr)	Point Vernon	Dougan St 1.11	1.68
STDS00127	Charles St, Pialba (Hervey Bay Community Centre)	Pialba	Tooan Tooan Creek 1.09	1.49
STDS00144	Maryborough-Biggenden Rd, Oakhurst (Oakhurst Reserve)	Oakhurst	Saltwater Creek 1.2	0.36
STDS00148	Raward Rd, Wondunna (end Raward Rd)	Wondunna	Bunya Creek 1.01	0.52
STDS00149	Emerald Park Way, Urangan (Pulgul Creek Reserve)	Urangan	Pulgul Creek 1.05	0.29
STDS00150	Emerald Park Way, Urangan (Pulgul Creek Reserve)	Urangan	Pulgul Creek 1.05	0.29
STDS00154	Conservation Dr, Urraween (Kingfisher Lakes Estate)	Urraween	Eli Creek 1.12	3.36
STDS00155	Jennylee Ct, Urangan (adj Pulgul St)	Urangan	Moolyyir Creek 1.06	0.15

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LEGEND

- Waterbody
- Property Boundary

0 1.25 2.5 5 kms

Figure 1. Waterbody Locality Map

Fraser Coast WMS: Waterbody Management Framework Technical Report

SCALE: 1:150,000

DATE: 13 November 2019

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For:
FCRC

2.2 WATERBODY CLASS

2.2.1 Class assessment criteria

Urban waterbodies can provide a range of social, environmental and functional values. These values and uses vary considerably depending on the context within the surrounding landscape, with some waterbodies providing more benefits than others. As such, the level of service (and related maintenance effort) associated with each waterbody will also vary.

In recognition of variable attributes across Council's waterbodies, each waterbody has been grouped into a waterbody class (or hierarchy) system based on the individual values and functions provided. Table 2 presents the waterbody classes adopted with a summary of definitions for each and the associated expected level of service.

Table 2. Waterbody class and level of service definitions.

Waterbody Class	Typical values and functions	Indicative level of service
Very High	• Located in a very high profile area (e.g. regional park). • Provides high level of cultural/social/environmental opportunities. • Forms a key visual feature within the surrounding landscape • Very high community expectation for maintenance upkeep.	• Requires higher levels of maintenance to manage waterbody health, aesthetics and public health and safety risks. • Frequent inspection and maintenance (e.g. 12 visits per year).
High	• Highly visible, typically located in a medium-high profile area (e.g. district park). • Provides moderate cultural/social/environmental value. • High community expectation for maintenance upkeep.	• May require a high level of maintenance to manage environmental risks and public health and safety hazards. • Regular inspection and maintenance (e.g. 6 visits per year).
Medium	• Waterbody within low profile parkland (e.g. local park or drainage reserve) with informal pathways +/- park amenities. • Limited use due to surrounding land use • Provides function/values to local community	• Occasional inspection and maintenance (e.g. 4 visits per year).
Low	• Waterbody within low profile parkland (e.g. drainage reserve). • Limited public access or visibility (e.g. screened by dense vegetation. • May provide limited values to the community (e.g. flood function only) • Provides function/values to local residents only	• Infrequent inspection and maintenance (e.g. 2 visits per year).
Very Low	• No identified waterbody values or functions	• Consider decommissioning or reclassifying

'Waterbody Class' ratings were based on consideration of the classification categories that reflect the typical range of values provide by urban waterbodies. The five categories assessed included:

1. Environmental – This rating is due to the

2. Stormwater & Flood – This rating is due to the functional role provided by the waterbody in providing stormwater management and/or flood mitigation functions.
3. Park Profile & Amenity – This rating is due to the profile of the waterbody and surrounding parkland, visual and landscape amenity.
4. Community Benefit – This rating is due to the extent of facilities in the surrounding parkland such as pathways, viewing platforms, open space function and community/social benefit.
5. Cultural Heritage – This rating is due to the presence of cultural and aboriginal heritage significance.

Table 3 present the Waterbody Class assessment criteria scoring system.

Table 3. Waterbody Class assessment criteria.

Criteria	Score and description 3	2	1	0
Environmental	Within an area of ecological significance and providing connectivity or waterway/green corridor, or has high opportunity to provide *mapped MSES OM004 Biodiversity planning overlay (FC Planning Scheme)	Locally identified place with environmental value (e.g. local map layer or database) *mapped MSES OM004 Biodiversity planning overlay (FC Planning Scheme) but isolated or highly constrained	Some ecological value and isolated/no connectivity, limited wildlife use, OR high threats and risks to ecological value with limited opportunity to create or establish environmental value	low ecological value OR high threats and risks to ecological value with no opportunity to create or establish environmental value
Stormwater/ Flood	Performance of drainage function of high risk to protecting public life and property; 100yr flood extents exceed waterbody and/or drainage reserve banks and it is directly adjacent residential property	Performance of drainage function of moderate risk to protecting public life and property; 100yr flood extents exceed waterbody and/or drainage reserve banks and not directly adjacent to residential property	Performance of drainage function of low risk to protecting public life and property; 100yr flood extents contained within the waterbody and/or drainage reserve banks and it is directly adjacent residential property OR does not provide flood storage function (i.e. within drainage channel or without defined detention basin banks)	Very low to no risk to public life or property; 100yr flood extents contained within the waterbody and/or drainage reserve banks or does not provide flood storage function AND not directly adjacent residential property affected
Park Profile & Amenity	High - Waterbody within high profile parkland (e.g. regional) with dedicated pathways and amenities (such as viewing platforms, seating etc.). Close proximity to medium/high density urban areas	Medium - Waterbody within medium profile parkland (e.g. district park) with dedicated pathways and some facilities. Close to low density urban areas.	Low - Waterbody within low profile parkland (e.g. local park or drainage reserve) with informal pathways +/- park amenities. Limited use due to surrounding land use.	Very low - Waterbody within a low profile parkland (e.g. drainage reserve) with limited public access and no park amenities

Criteria	Score and description 3	2	1	0
Community Benefit	High - providing high level of service for informal active terrestrial recreation	Medium - open space is providing adequate level of service to users	Low - open space is providing limited open space function	Very low - no waterbody access and use of the surrounding area
Cultural Heritage	Within an area listed in the National Heritage List, Aboriginal Cultural Heritage Register, Qld Heritage Register, OR World Heritage Area	Within a locally identified place or contains a locally identified object with cultural significance OR is adjacent to an area listed in the National Heritage List, Aboriginal Cultural Heritage Register, Qld Heritage Register, OR World Heritage Area	Adjacent to a locally identified place or object with cultural significance	None known

2.2.1 Overall Waterbody Class

The Waterbody Class assessment rating system provided in Table 3 has been used to score each waterbody. The scoring was informed by discussion and input from relevant Council stakeholders, utilising their knowledge and experience in each of the classification areas. The outcomes of the waterbody values and classification scoring are provided in Table 4.

Table 4. Waterbody Class and associated values and functions

Asset ID	Asset Location	Environmental	Stormwater &Flood	Park Profile & Amenity	Community Benefit	Cultural Heritage	Total Class Score	Waterbody Class Rating
STDS00057B	Alice St , Maryborough (Ululah Lagoon – Anzac Park)	3	2	2	2	3	12	Very high
STDS00127	Charles St, Pialba (Hervey Bay Community Centre)	3	2	3	3	0	11	Very high
STDS00121	Endeavour Way, Eli Waters (adj Fantail Way)	2	3	3	3	0	11	Very high
STDS00016	O'Rourke St, Pialba (USC Campus)	3	2	3	2	0	10	Very high
STDS00035	Panorama Dr, Dundowran Beach (Arkara Lagoons)	3	1	3	3	0	10	Very high
STDS00042	Richard St, Urangan (north of Botanic Gardens)	3	3	2	2	0	10	Very high
STDS00051	Loretto Dr, Oakhurst (Woocoo Park)	3	2	2	3	0	10	Very high
STDS00078	Barramundi Dr, Burrum Heads (On the Beach Estate)	3	1	3	3	0	10	Very high
STDS00011	Margaret St, Urangan (west of Botanic Gardens)	3	2	2	2	0	9	High
NEWKM03	Charles Street, Pialba (Hervey Bay State High School)	3	2	2	1	0	8	High
STDS00154	Conservation Dr, Urraween (Kingfisher Lakes Estate)	1	3	2	2	0	8	High
STDS00057A	Alice St , Maryborough (Ululah north)	3	3	1	1	0	8	High
STDS00008B	Anembo Sth - b/n Ann St & Alexander St (Lowlands)	3	3	1	1	0	8	High

Asset ID	Asset Location	Environmental	Stormwater &Flood	Park Profile & Amenity	Community Benefit	Cultural Heritage	Total Class Score	Waterbody Class Rating
STDS00008A	Anembo Sth East - b/n Alexander St & Margaret St (Lowlands)	3	1	2	2	0	8	High
STDS00079	Bentwood St, Burrum Heads (Burrum Waters Estate)	1	3	2	2	0	8	High
STDS00070	Sunrise Cr , Burrum Heads (Cheelii Lagoon)	2	3	1	2	0	8	High
STDS00022	Hervey St, Scarness (b/n Zephyr St & East St)	3	1	2	1	0	7	High
STDS00008D	Anembo Nth - b/n Ann St & Alexander St (Lowlands)	3	1	1	2	0	7	High
STDS00015	Elizabeth St, Urangan (Botanic Gardens)	3	0	2	2	0	7	High
STDS00114	Yarilee Cct, Dundowran (Yarrilee Waters Estate)	2	3	1	1	0	7	High
STDS00008E	Anembo Nth East - b/n Alexander St & Margaret St (Lowlands)	3	1	2	1	0	7	High
STDS00116	Pialba Burrum Heads Rd, Eli Waters (Condor Lakes Estate)	2	3	1	1	0	7	High
STDS00081	Northshore Av , Toogoom (Fraser Waters Estate)	2	1	2	2	0	7	High
STDS00063	Endevour Way, Eli Waters (Mariners Cover Estate)	3	2	1	1	0	7	High
STDS00067	Genoa Ct, Point Vernon (Point Vernon Shores Estate)	2	3	1	1	0	7	High
STDS00045	Parklands Bvd,, Wondunna (Parklands Estate)	1	1	2	2	0	6	Medium
STDS00122	Eli Creek Rd, Point Vernon (Thoroughbred Park)	2	1	2	1	0	6	Medium
STDS00090	Panorama Dr , Dundowran Beach (Panorama Estate)	3	1	1	1	0	6	Medium
STDS00068	Dory Dr, Point Vernon (Point Vernon Shores Estate)	2	1	1	2	0	6	Medium
STDS00108	Sempfs Rd, Dundowran Beach (Blue Lagoon Estate)	2	1	1	2	0	6	Medium
STDS00150	Emerald Park Way, Urangan (Pulgul Creek Reserve)	2	1	1	1	1	6	Medium
STDS00008C	Anembo West - west of Ann St (Lowlands)	3	1	1	1	0	6	Medium
STDS00125	Banksia St, Point Vernon (adj Spinnaker Dr)	3	1	1	1	0	6	Medium
STDS00149	Emerald Park Way, Urangan (Pulgul Creek Reserve)	2	1	1	1	1	6	Medium
STDS00118	Lady Penrhyn Dr, Eli Waters (Mariners Cove Estate)	2	1	1	2	0	6	Medium
STDS00047	Doolong Rd, Kawungan (east of Dundee Dr)	1	2	1	1	0	5	Medium
STDS00119	Lady Penrhyn Dr, Eli Waters (Mariners Cove Estate)	0	1	2	2	0	5	Medium
STDS00065	Gunsynd Way, Point Vernon (Thoroughbred Park)	2	1	1	1	0	5	Medium
STDS00080	Beach Dr, Burrum Heads (Burrum Waters Estate)	1	3	1	0	0	5	Medium
STDS00120	Lady Penrhyn Dr , Eli Waters (Mariners Cover Estate)	2	1	1	1	0	5	Medium
STDS00056	Maryborough Showground, Maryborough West (north of Entry)	3	0	1	0	0	4	Medium
STDS00155	Jennylee Ct, Urangan (adj Pulgul St)	2	1	0	0	0	3	Low

Asset ID	Asset Location	Environmental	Stormwater &Flood	Park Profile & Amenity	Community Benefit	Cultural Heritage	Total Class Score	Waterbody Class Rating
STDS00043	St Joseph's Dr - U/S, Urraween (Central Park Estate)	2	1	0	0	0	3	Low
STDS00050	Fort St, Maryborough (Prickett Park)	0	0	2	1	0	3	Low
STDS00082	O'Reagan Creek Rd , Toogoom (near Jeppesen Rd)	2	1	0	0	0	3	Low
STDS00106	Eagle Beach Pde, Dundowran Beach (Paradise Beach Estate)	0	1	0	2	0	3	Low
STDS00034	Pialba Burrum Heads Rd, Craignish (Petersen Park SW)	0	0	2	0	0	2	Low
STDS00003	Doolong South Rd, Wondunna (Parklands Estate)	1	1	0	0	0	2	Low
STDS00002	Boundary Rd, Wondunna (adj Aquatic Centre)	0	0	0	2	0	2	Low
STDS00053	Maryborough Showground , Maryborough West (Racecourse)	0	0	1	1	0	2	Low
STDS00144	Maryborough-Biggenden Rd, Oakhurst (Oakhurst Reserve)	2	0	0	0	0	2	Low
STDS00052	Maryborough-Biggenden Rd, Oakhurst (Oakhurst Reserve)	2	0	0	0	0	2	Low
STDS00033	Pialba Burrum Heads Rd, Craignish (Petersen Park)	1	0	0	0	0	1	Very low
STDS00148	Raward Rd, Wondunna (end Raward Rd)	0	0	0	0	0	0	Very low

Table 5 summarises the number of waterbodies within each Waterbody Class.

Table 5. Summary of FCRC waterbodies within each Waterbody Class.

Combined Class Score	Class Rating	Number of waterbodies with class rating (%)
>9	Very High	8 (15%)
7-9	High	17 (31%)
4-6	Medium	16 (30%)
2-3	Low	11 (20%)
0-1	Very Low	2 (4%)

An additional 105 waterbodies were excluded from the asset database due to being wholly within private ownership.

2.3 WATERBODY CONDITION ASSESSMENT

2.3.1 Condition assessment criteria

Figure 2 presents an overview of the specific condition assessment criteria that were established based on the range of waterbody management issues and values associated with Council's waterbodies. For each of these criteria a 'performance standard' was defined to enable the waterbodies' condition to be assessed and scored based on the scoring system presented in Table 6. Full descriptions of each condition assessment criteria and associated scoring definitions are presented in the following sections.

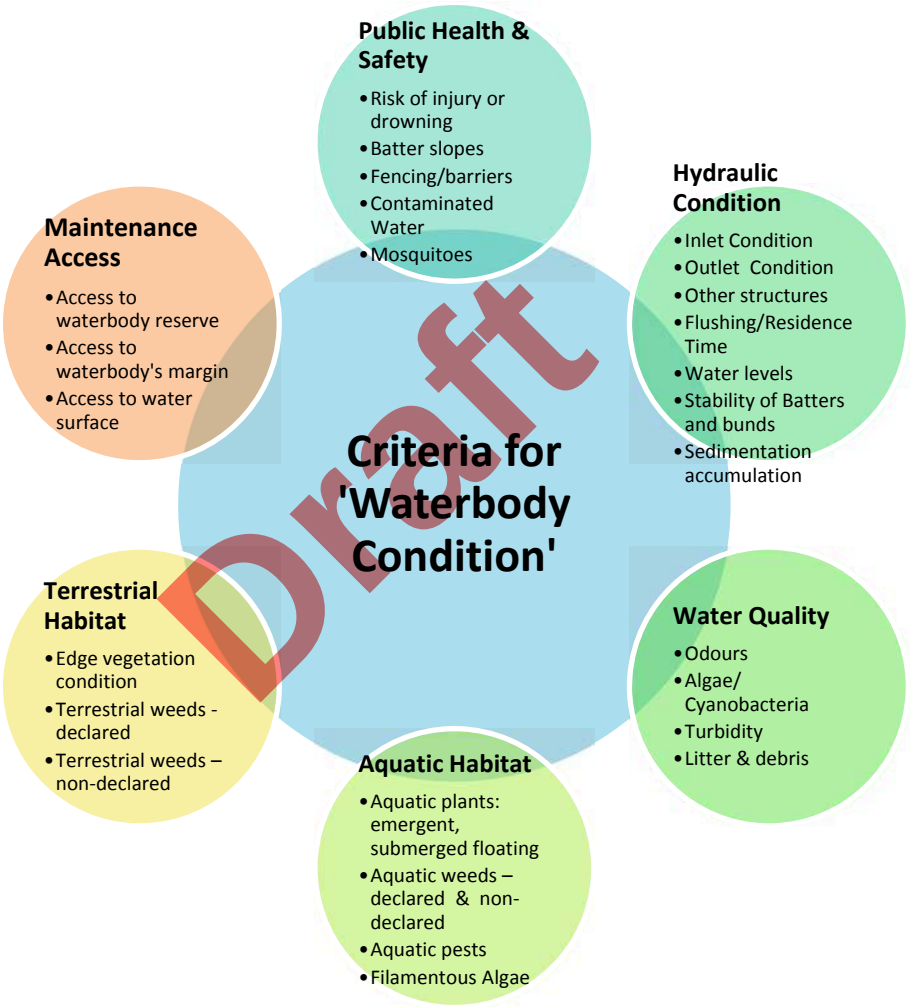

Figure 2 Condition assessment categories used to prioritise waterbodies.

Table 6. Condition assessment scoring criteria

Score	Description
1	Good (Performance indicator exceeded)
2	Adequate (Performance indicator met)
3	Poor (Performance indicator not met, Management required)
4	Very Poor (Performance indicator failed, Further investigation required)

2.3.2 Public Health & Safety

Table 7. Condition assessment criteria for 'Public Health and Safety'.

Item	Component	Performance indicator (PI)	Score 1	2	3	4
1.1	**Risk of injury or drowning**	Open space areas adjacent to water minimise risk of drowning	Low risk – open space areas adjacent to waterbody edge, shallow waterbody profile along waterbody edges (i.e. depth <0.3m, 1m from edge)	Moderate risk – waterbody edges obscured from open spaces, shallow waterbody profile along waterbody edge with minor vertical drop (i.e. waterbody depth <0.5m, 1m from edge, <0.25m vertical drop)	High risk – deep water adjacent to waterbody edge, +/- vertical drop (i.e. waterbody depth >0.5m, 1m from edge, +/- >0.25m vertical drop)	Extreme - deep water adjacent to waterbody edge, +/- vertical drop (i.e. waterbody depth >0.5m, 1m from edge, +/- >0.5m vertical drop)
1.2	**Batter slopes**	Slope ideally 1:6 or flatter adjacent to open water zones. Batter slope above and below water level is no steeper than 1 in 4.	Batter slope >1:6	Batter slope between 1:3-1:6	Batter slope between 1:2-1:3	Batter slope <1:2
1.3	**Fencing/ barriers**	Fencing / barriers present in unsafe areas (walls greater than 1m high anywhere or walls/steep batters of any height into permanent water). Appropriate fencing or vegetation barriers in place where batter slope is steep or adjacent to deep water	No barriers required	Appropriate barriers present (i.e. formal fencing or vegetation buffer)	Barriers present in some areas, unsafe access present.	Unrestricted access to deep water
1.4	**Contaminated Water**	No obvious contamination of water. E.g. due to chemical contamination, faecal matter (e.g. large bird population, sewer leaks etc.)	No visible contamination present	No obvious contamination present. Suspected contamination due to odours or water discoloration.	Minor contamination present due to due to odours or water discoloration	Major contamination present. Immediate intervention required
1.5	**Mosquitoes**	Low mosquito populations, no isolated depressions creating mosquito habitat, no larvae observed.	No mosquitos observed	Isolated mosquito individuals observed	Noticeable mosquito population present (more than 10 individuals observed).	Major mosquito population present. Obvious, large mosquito population present.

2.3.3 Hydraulic Condition

Table 8. Condition assessment criteria for 'Hydraulic Condition'.

Item	Component	Performance indicator (PI)	Score 1	2	3	4
2.1	**Inlet Condition - e.g. pipes, channels**	No blockage, erosion or structural damage	Inlet functional - no blockage, erosion or structural damage	Inlet functional with minor impairment due to blockage, erosion or structural damage	Inlet function impaired due to blockage, erosion or structural damage	Inlet function severely impaired due to blockage, erosion or structural damage
2.2	**Outlet Condition - Including bund, pipes, pits, grates, outlet weirs, scour protection**	No blockage or damage. No erosion, scour tunnelling or structural damage. The waterbody bund is not overtopped regularly	Outlet and associated infrastructure functional - no blockage, erosion or structural damage	Outlet functional with minor impairment due to blockage, erosion or structural damage.	Outlet function impaired due to blockage, erosion or structural damage.	Outlet function severely impaired due to blockage, erosion or structural damage.
2.3	**Other structures**	No erosion and damage to other structures, e.g. pits, pipes, ramps and walls.	No erosion or damage present	Minor erosion or damage present, not impacting function	Erosion impacting function, minor modification required	Major erosion present, major modification required
2.4	**Flushing/ Residence Time**	The system is well flushed with no dead pockets/backwatered areas	Well flushed. No dead pockets. No islands.	Minor (<10%) stagnant or backwater areas present	Larger areas (10-50%) stagnant or backwater areas present	Stagnant. Dead pockets. Islands and dead pockets.
2.5	**Water levels**	Water level close to normal operating level.	0-200mm below outlet level	200-400mm below outlet level	400-600mm below outlet level	>600mm below outlet level
2.6	**Stability of Batters and bunds**	Minor and localised erosion only. No scour or exposed earth on batters.	Batters stabile	Minor erosion present, low risk to batter stability	Major erosion present, high risk to batter stability	Catastrophic erosion, batters unstable and actively eroding
2.7	**Sedimentation accumulation**	No visible coarse sediment accumulation within waterbody.	No sediment accumulation present	Minor sediment accumulation present (i.e. minor mounding near inlets)	Notable sediment accumulation (i.e. notable mounding on waterbody bed)	Major sediment accumulation, impacting on flow through the waterbody system

2.3.4 Water Quality

Table 9. Condition assessment criteria for 'Water Quality'.

Item	Component	Performance indicator (PI)	Score 1	2	3	4
3.1	**Odours**	No odours detected	No odours present	Minor odours present, related to natural processes (i.e. decomposing organic matter)	Notable odours present, related to poor water quality, animal faeces or significant decomposition of organic matter	Highly pungent odours present, related to major issue requiring immediate action
3.2	**Algae / Cyano-bacteria**	No obvious sign of planktonic algae in water column	No algal biomass visible in the water column	Slight discoloration of the water column (i.e. transparent green colour)	Notable discoloration of the water column (i.e. obvious green colour, high turbidity)	Surface scums present and major discoloration of the water column
3.3	**Turbidity**	Water column clear and visibility >1m. Turbidity ranges between 1-20 NTU	Water column clear and visibility >1m	Water column clear and visibility <1m	Water column turbid and visibility <0.5m	Water column highly turbid and visibility <0.1m
3.4	**Litter/ Debris**	No grass clippings. No floating litter. Bins are provided and are adequately maintained and routinely empty.	No litter or debris present within the waterbody	Minor litter or debris present within the waterbody (i.e. isolated litter/debris)	Notable litter or debris present within the waterbody (i.e. aggregated litter/debris impacting visual amenity)	Excessive litter or debris accumulation present within the waterbody (i.e. major impact on visual amenity and waterbody users)

2.3.5 Aquatic Habitat

Table 10. Condition assessment criteria for 'Aquatic Habitat'.

Item	Component	Performance indicator (PI)	Score 1	2	3	4
4.1	**Aquatic vegetation - emergent**	Native emergent macrophytes present around the shallow margins (<0.35m depth) of the waterbody. Plants healthy and free from disease. (includes native water lilies)	Shallow margins with high (>50%) emergent macrophyte cover	Shallow margins with medium (10-50%) emergent macrophyte cover	Shallow margins with low (<10%) emergent macrophyte cover	Shallow margins with no emergent macrophyte cover
4.2	**Aquatic vegetation - submerged**	Native submerged macrophytes present (0.35-1.5 m depth). Includes all submerged genera (Ceratophyllum, Potamogeton, Myriophyllum)	High (>25%) submerged macrophyte cover	Medium (>5-25%) submerged macrophyte cover	Low (<5%) submerged macrophyte cover	No submerged macrophyte cover
4.3	**Aquatic vegetation – free-floating**	Less than 5% of the waterbody surface covered by native floating macrophytes (i.e. Azolla, Water lilies).	< 5% waterbody surface cover	5-10% waterbody surface cover	10-50% waterbody surface cover	>50% waterbody surface cover
4.4	**Aquatic weeds – declared**	Declared weeds controlled.	No declared aquatic weeds present	Declared aquatic weeds present but controlled	Declared aquatic weeds present, <5% waterbody area impacted, control works required	Declared weeds present, >5% waterbody area impacted, immediate control works required
4.5	**Aquatic weeds – non-declared**	Less than 20% of the waterbody surface area covered in non-declared weeds	No non-declared aquatic weeds present	<20% of the waterbody surface area covered in non-declared weeds	20-50% of the waterbody surface area covered in non-declared weeds	>50% of the waterbody surface area covered in non-declared weeds
4.6	**Aquatic fauna pests**	No damage by pests (e.g. Tilapia digging). No pests present (e.g. no Tilapia observed, no large bird populations)	None observed	Minor evidence. Pests suspected.	Moderate impacts. Pests observed.	Significant infestation
4.7	**Filamentous algae**	Less than 10% of the water surface covered with filamentous algae. No algal blooms.	No filamentous algae present	Minor filamentous algae cover present around waterbody edges (<10% cover)	Filamentous algae present throughout the waterbody (10-20% cover), free-floating clumps or growing on macrophytes	Filamentous algae present throughout the waterbody (>20% cover), floating clumps or growing on macrophytes

2.3.6 Terrestrial Habitat

Table 11. Condition assessment criteria for 'Terrestrial Habitat'.

Item	Component	Performance indicator (PI)	Score 1	2	3	4
5.1	**Edge vegetation condition**	A minimum vegetation width of 1m along the lower waterbody batter. Greater than 90% vegetation cover. Plants healthy and free from disease.	>2m vegetation width along the waterbody batters, and >90 % vegetation cover	1-2m vegetation width along the waterbody batters, and >90 % vegetation cover	<1m vegetation width along the waterbody batters, and >50 % vegetation cover, or >1m vegetation width along the waterbody batters, and <90 % vegetation cover	<1m vegetation width along the waterbody batters, and <50 % vegetation cover
5.2	**Terrestrial weeds - declared**	Declared weeds controlled.	No declared weeds present	Declared weeds present but controlled	Declared weeds present, <5% waterbody edge impacted, control works required	Declared weeds present, >5% waterbody edge impacted, immediate control works required
5.3	**Terrestrial weeds – non-declared**	Less than 10% of the batters covered in non-declared weeds	No non-declared weeds present	<10% of the waterbody edge covered in non-declared weeds	10-50% of the waterbody edge covered in non-declared weeds	>50% of the waterbody edge covered in non-declared weeds

2.3.7 Maintenance Access

Access to the waterbody and its surrounds is an important requirement when undertaking maintenance activities. Maintenance condition criteria have been defined based on access to waterbody reserve, the waterbody margins and also on to the water surface.

Table 12. Condition assessment criteria for 'Maintenance Access'.

Item	Component	Performance indicator (PI)	Score 1	2	3	4
6.1	**Access to waterbody reserve**	Formal access provided into the waterbody reserve.	Formal access provided to waterbody reserve (i.e. gated maintenance track).	Informal access possible (i.e. access via adjacent road)	Access difficult (+/- pedestrian access only)	No access possible
6.2	**Access to waterbody's margin**	Adequate access to waterbody edge provided for weed management	Full access to all waterbody edges	>50% waterbody edge accessible	25-50% waterbody edge accessible	<25% waterbody edge accessible
6.3	**Access to water surface**	An appropriate access is available for harvesting aquatic weeds (weed harvester or boat)	Formal access to water surface provided (i.e. ramp).	Informal access to water surface (i.e. access via bank)	Assisted access to water surface possible	No water access possible

2.3.8 Overall Waterbody Condition

Each of Council's waterbodies were inspected in December 2018 by DesignFlow staff and scored against the condition assessment criteria. The scores for each waterbody were combined and ranked from highest to lowest priority. These results are summarised in Table 13. Refer to the Waterbody Condition database, which accompanies this report for further detail of condition scores and management issues for each waterbody.

To establish the overall condition rating for each waterbody individual condition assessment scores within each category were averaged to give an overall score and performance rating from 1-4 for each condition category item. The combined score for each category were then summed to give an overall condition score.

Table 13. Condition Assessment Scores and Overall Waterbody Condition Rating

Asset ID	Asset Location	Public Health & Safety	Hydraulic Condition	Water Quality	Aquatic Habitat	Terrestrial Habitat	Maintenance Access	Overall condition score	Overall condition rating
STDS00016	O'Rourke St, Pialba (USC Campus)	3.4	3.0	3.5	2.1	2.3	2.0	16.4	Very poor
STDS00022	Hervey St, Scarness (b/n Zephyr St & East St)	2.8	2.9	2.3	1.7	3.0	2.0	14.6	Very poor
STDS00008D	Anembo Nth - b/n Ann St & Alexander St (Lowlands)	2.6	2.0	2.5	2.1	3.0	2.3	14.6	Very poor
STDS00047	Doolong Rd, Kawungan (east of Dundee Dr)	2.0	3.1	2.0	1.9	3.0	2.3	14.3	Very poor
STDS00035	Panorama Dr, Dundowran Beach (Arkara Lagoons)	2.4	2.1	2.5	2.0	2.7	2.3	14.0	Very poor
STDS00015	Elizabeth St, Urangan (Botanic Gardens)	3.0	2.1	2.0	2.1	2.7	2.0	14.0	Poor
STDS00114	Yarilee Cct, Dundowran (Yarrilee Waters Estate)	2.0	2.2	2.3	1.5	3.0	3.0	13.9	Poor
NEWKM03	Charles Street, Pialba (Hervey Bay State High School)	2.0	2.1	2.5	2.4	2.7	2.0	13.7	Poor
STDS00057B	Alice St , Maryborough (Ululah Lagoon – Anzac Park)	2.2	2.3	2.3	1.9	2.7	2.3	13.6	Poor
STDS00148	Raward Rd, Wondunna (end Raward Rd)	2.0	2.3	2.3	1.0	4.0	2.0	13.6	Poor
STDS00155	Jennylee Ct, Urangan (adj Pulgul St)	2.4	2.0	1.8	1.3	2.0	4.0	13.5	Poor
STDS00011	Margaret St, Urangan (west of Botanic Gardens)	2.8	2.1	1.8	1.6	2.7	2.3	13.3	Poor
STDS00033	Pialba Burrum Heads Rd, Craignish (Petersen Park)	2.0	2.3	1.3	1.6	2.7	3.3	13.1	Poor
STDS00043	St Joseph's Dr - U/S, Urraween (Central Park Estate)	2.2	2.3	1.8	1.6	2.3	2.7	12.8	Poor
STDS00122	Eli Creek Rd, Point Vernon (Thoroughbred Park)	1.6	2.4	2.3	2.0	2.3	2.0	12.6	Poor
STDS00154	Conservation Dr, Urraween (Kingfisher Lakes Estate)	2.0	2.0	1.8	1.9	2.3	2.7	12.6	Poor
STDS00119	Lady Penrhyn Dr, Eli Waters (Mariners Cove Estate)	2.4	2.4	1.8	1.0	2.0	3.0	12.6	Poor
STDS00008E	Anembo Nth East - b/n Alexander St & Margaret St (Lowlands)	2.8	1.5	2.8	1.4	2.0	2.0	12.5	Poor
STDS00090	Panorama Dr , Dundowran Beach (Panorama Estate)	2.0	2.6	1.3	2.0	2.3	2.0	12.2	Poor
STDS00056	Maryborough Showground, Maryborough West (north of Entry)	1.6	2.0	1.3	2.6	1.7	3.0	12.1	Poor
STDS00068	Dory Dr, Point Vernon (Point Vernon Shores Estate)	2.0	2.3	2.0	1.4	2.3	2.0	12.0	Poor
STDS00116	Pialba Burrum Heads Rd, Eli Waters (Condor Lakes Estate)	1.0	2.0	1.5	1.9	2.7	3.0	12.0	Poor

Asset ID	Asset Location	Public Health & Safety	Hydraulic Condition	Water Quality	Aquatic Habitat	Terrestrial Habitat	Maintenance Access	Overall condition score	Overall condition rating
STDS00034	Pialba Burrum Heads Rd, Craignish (Petersen Park SW)	1.4	1.3	1.5	2.4	3.0	2.3	12.0	Adequate
STDS00042	Richard St, Urangan (north of Botanic Gardens)	2.6	2.3	1.8	1.3	2.0	2.0	11.9	Adequate
STDS00045	Parklands Bvd,, Wondunna (Parklands Estate)	2.0	2.3	1.8	1.9	2.0	2.0	11.9	Adequate
STDS00057A	Alice St , Maryborough (Ululah north)	1.0	2.0	1.5	2.7	2.3	2.3	11.9	Adequate
STDS00127	Charles St, Pialba (Hervey Bay Community Centre)	2.2	1.8	2.0	1.3	2.3	2.0	11.7	Adequate
STDS00008B	Anembo Sth - b/n Ann St & Alexander St (Lowlands)	2.6	1.7	1.0	1.6	2.7	2.0	11.6	Adequate
STDS00108	Sempfs Rd, Dundowran Beach (Blue Lagoon Estate)	2.0	1.6	2.0	1.9	2.0	2.0	11.4	Adequate
STDS00050	Fort St, Maryborough (Prickett Park)	1.4	2.1	1.0	2.6	2.0	2.0	11.1	Adequate
STDS00008A	Anembo Sth East - b/n Alexander St & Margaret St (Lowlands)	2.6	1.6	1.5	1.3	2.7	1.3	11.0	Adequate
STDS00003	Doolong South Rd, Wondunna (Parklands Estate)	1.4	2.1	2.0	1.0	1.3	3.0	10.9	Adequate
STDS00002	Boundary Rd, Wondunna (adj Aquatic Centre)	1.6	2.1	1.8	1.3	2.0	2.0	10.8	Adequate
STDS00150	Emerald Park Way, Urangan (Pulgul Creek Reserve)	2.0	1.0	1.3	1.1	2.7	2.7	10.7	Adequate
STDS00008C	Anembo West - west of Ann St (Lowlands)	1.6	1.8	1.0	2.1	2.7	1.3	10.6	Adequate
STDS00125	Banksia St, Point Vernon (adj Spinnaker Dr)	1.4	1.7	1.3	1.3	2.7	2.0	10.3	Adequate
STDS00149	Emerald Park Way, Urangan (Pulgul Creek Reserve)	1.2	1.0	1.3	1.1	2.7	2.7	9.9	Good
STDS00065	Gunsynd Way, Point Vernon (Thoroughbred Park)	1.8	1.8	1.5	1.0	1.3	2.3	9.8	Good
STDS00081	Northshore Av , Toogoom (Fraser Waters Estate)	2.4	1.3	1.3	1.1	1.7	2.0	9.7	Good
STDS00063	Endevour Way, Eli Waters (Mariners Cover Estate)	1.2	1.0	1.8	1.0	2.0	2.7	9.6	Good
STDS00053	Maryborough Showground , Maryborough West (Racecourse)	1.0	1.4	1.0	2.1	2.3	1.7	9.6	Good
STDS00082	O'Reagan Creek Rd , Toogoom (near Jeppesen Rd)	1.8	1.2	1.3	1.1	1.0	3.0	9.4	Good
STDS00079	Bentwood St, Burrum Heads (Burrum Waters Estate)	1.6	1.1	1.3	1.0	1.3	3.0	9.3	Good
STDS00121	Endeavour Way, Eli Waters (adj Fantail Way)	2.0	2.0	1.3	1.0	1.0	2.0	9.3	Good
STDS00070	Sunrise Cr , Burrum Heads (Cheelii Lagoon)	1.0	1.0	1.5	1.3	2.0	2.3	9.1	Good
STDS00144	Maryborough-Biggenden Rd, Oakhurst (Oakhurst Reserve)	1.0	1.3	1.0	1.7	2.3	1.7	9.0	Good
STDS00080	Beach Dr, Burrum Heads (Burrum Waters Estate)	1.2	1.3	1.0	1.0	1.7	2.3	8.5	Good
STDS00052	Maryborough-Biggenden Rd, Oakhurst (Oakhurst Reserve)	1.0	1.4	1.0	1.4	1.7	2.0	8.5	Good
STDS00051	Loretto Dr, Oakhurst (Woocoo Park)	1.0	2.3	1.0	1.6	1.3	1.3	8.5	Good
STDS00067	Genoa Ct, Point Vernon (Point Vernon Shores Estate)	1.4	1.2	1.0	1.3	2.0	1.7	8.5	Good
STDS00106	Eagle Beach Pde, Dundowran Beach (Paradise Beach Estate)	1.0	1.3	1.0	1.3	1.3	2.0	8.0	Very good
STDS00078	Barramundi Dr, Burrum Heads (On the Beach Estate)	1.2	1.2	1.0	1.3	1.0	1.7	7.4	Very good
STDS00118	Lady Penrhyn Dr, Eli Waters (Mariners Cove Estate)	1.0	1.3	1.3	1.0	1.0	1.7	7.3	Very good
STDS00120	Lady Penrhyn Dr , Eli Waters (Mariners Cover Estate)	1.0	1.3	1.3	1.0	1.0	1.3	6.9	Very good

Table 14 summarises the number of waterbodies within each Waterbody Condition.

Table 14. Summary of FCRC waterbodies within each Waterbody Condition

Combined Condition Score	Condition Rating	Number of waterbodies with condition rating (%)
>14	Very Poor	5 (9%)
12-14	Poor	17 (31%)
10-12	Adequate	14 (26%)
8-10	Good	14 (26%)
<8	Very Good	4 (7%)

2.4 MANAGEMENT PRIORITY

2.4.1 Management Priority Ranking

Management Priority was defined based on the 'Waterbody Class' and 'Waterbody Condition' ratings for each waterbody based on the matrix presented in Table 15. The approach adopted is similar to a risk management framework, where management priority is weighted towards higher class waterbodies in poorer condition.

Table 15. Waterbody Management priority matrix.

WATERBODY CLASS	CONDITION WEIGHTING				
	Very Poor	Poor	Adequate	Good	Very Good
Very High	Very High	Very High	Very High	High	High
High	Very High	High	High	Medium	Medium
Medium	High	Medium	Medium	Low	Low
Low	Medium	Medium	Low	Very Low	Very Low
Very Low	Low	Low	Very Low	Very Low	Very Low

The Overall Waterbody Management Priority list is presented in Table 16.

Table 16. Overall Waterbody Management Priority

Asset Id	Location	Waterbody Class Rating	Overall condition priority rating	Management Priority
STDS00016	O'Rourke St, Pialba (USC Campus)	Very High	Very Poor	VERY HIGH
STDS00057B	Alice St , Maryborough (Ululah Lagoon - Anzac Park)	Very High	Poor	VERY HIGH
STDS00035	Panorama Dr, Dundowran Beach (Arkara Lagoons)	Very High	Very Poor	VERY HIGH
STDS00127	Charles St, Pialba (Hervey Bay Community Centre)	Very High	Adequate	VERY HIGH
STDS00042	Richard St, Urangan (north of Botanic Gardens)	Very High	Adequate	VERY HIGH
STDS00022	Hervey St, Scarness (b/n Zephyr St & East St)	High	Very Poor	VERY HIGH
STDS00008D	Anembo Nth - b/n Ann St & Alexander St (Lowlands)	High	Very Poor	VERY HIGH
STDS00011	Margaret St, Urangan (west of Botanic Gardens)	High	Poor	HIGH
NEWKM03	Charles Street, Pialba (Hervey Bay State High School)	High	Poor	HIGH
STDS00015	Elizabeth St, Urangan (Botanic Gardens)	High	Poor	HIGH
STDS00114	Yarilee Cct, Dundowran (Yarrilee Waters Estate)	High	Poor	HIGH
STDS00154	Conservation Dr, Urraween (Kingfisher Lakes Estate)	High	Poor	HIGH
STDS00121	Endeavour Way, Eli Waters (adj Fantail Way)	Very High	Good	HIGH
STDS00057A	Alice St , Maryborough (Ululah north)	High	Adequate	HIGH
STDS00008B	Anembo Sth - b/n Ann St & Alexander St (Lowlands)	High	Adequate	HIGH
STDS00008E	Anembo Nth East - b/n Alexander St & Margaret St (Lowlands)	High	Poor	HIGH
STDS00047	Doolong Rd, Kawungan (east of Dundee Dr)	Medium	Very Poor	HIGH
STDS00116	Pialba Burrum Heads Rd, Eli Waters (Condor Lakes Estate)	High	Poor	HIGH
STDS00008A	Anembo Sth East - b/n Alexander St & Margaret St (Lowlands)	High	Adequate	HIGH
STDS00051	Loretto Dr, Oakhurst (Woocoo Park)	Very High	Good	HIGH
STDS00078	Barramundi Dr, Burrum Heads (On the Beach Estate)	Very High	Very Good	HIGH
STDS00122	Eli Creek Rd, Point Vernon (Thoroughbred Park)	Medium	Poor	MEDIUM
STDS00090	Panorama Dr , Dundowran Beach (Panorama Estate)	Medium	Poor	MEDIUM
STDS00068	Dory Dr, Point Vernon (Point Vernon Shores Estate)	Medium	Poor	MEDIUM
STDS00045	Parklands Bvd,, Wondunna (Parklands Estate)	Medium	Adequate	MEDIUM
STDS00119	Lady Penrhyn Dr, Eli Waters (Mariners Cove Estate)	Medium	Poor	MEDIUM
STDS00108	Sempfs Rd, Dundowran Beach (Blue Lagoon Estate)	Medium	Adequate	MEDIUM
STDS00079	Bentwood St, Burrum Heads (Burrum Waters Estate)	High	Good	MEDIUM
STDS00070	Sunrise Cr , Burrum Heads (Cheelii Lagoon)	High	Good	MEDIUM
STDS00081	Northshore Av , Toogoom (Fraser Waters Estate)	High	Good	MEDIUM
STDS00150	Emerald Park Way, Urangan (Pulgul Creek Reserve)	Medium	Adequate	MEDIUM
STDS00063	Endevour Way, Eli Waters (Mariners Cover Estate)	High	Good	MEDIUM
STDS00008C	Anembo West - west of Ann St (Lowlands)	Medium	Adequate	MEDIUM
STDS00155	Jennylee Ct, Urangan (adj Pulgul St)	Low	Poor	MEDIUM
STDS00125	Banksia St, Point Vernon (adj Spinnaker Dr)	Medium	Adequate	MEDIUM
STDS00056	Maryborough Showground, Maryborough West (north of Entry)	Medium	Poor	MEDIUM
STDS00043	St Joseph's Dr - U/S, Urraween (Central Park Estate)	Low	Poor	MEDIUM
STDS00067	Genoa Ct, Point Vernon (Point Vernon Shores Estate)	High	Good	MEDIUM
STDS00149	Emerald Park Way, Urangan (Pulgul Creek Reserve)	Medium	Good	LOW
STDS00065	Gunsynd Way, Point Vernon (Thoroughbred Park)	Medium	Good	LOW
STDS00050	Fort St, Maryborough (Prickett Park)	Low	Adequate	LOW
STDS00033	Pialba Burrum Heads Rd, Craignish (Petersen Park)	Very low	Poor	LOW
STDS00034	Pialba Burrum Heads Rd, Craignish (Petersen Park SW)	Low	Adequate	LOW
STDS00148	Raward Rd, Wondunna (end Raward Rd)	Very low	Poor	LOW
STDS00080	Beach Dr, Burrum Heads (Burrum Waters Estate)	Medium	Good	LOW
STDS00118	Lady Penrhyn Dr, Eli Waters (Mariners Cove Estate)	Medium	Very good	LOW
STDS00003	Doolong South Rd, Wondunna (Parklands Estate)	Low	Adequate	LOW
STDS00002	Boundary Rd, Wondunna (adj Aquatic Centre)	Low	Adequate	LOW
STDS00120	Lady Penrhyn Dr , Eli Waters (Mariners Cover Estate)	Medium	Very good	LOW
STDS00082	O'Reagan Creek Rd , Toogoom (near Jeppesen Rd)	Low	Good	VERY LOW
STDS00053	Maryborough Showground , Maryborough West (Racecourse)	Low	Good	VERY LOW
STDS00144	Maryborough-Biggenden Rd, Oakhurst (Oakhurst Reserve)	Low	Good	VERY LOW
STDS00106	Eagle Beach Pde, Dundowran Beach (Paradise Beach Estate)	Low	Very good	VERY LOW
STDS00052	Maryborough-Biggenden Rd, Oakhurst (Oakhurst Reserve)	Low	Good	VERY LOW

A summary of the number of waterbodies in each management priority are provided in Table 17 and shown graphical in the Figure 3.

Table 17. Summary of overall waterbody management priority

Management Priority Categories	Number of waterbodies within each Management Rating category (%)
Very High	7 (13%)
High	14 (26%)
Medium	17 (31%)
Low	11 (20%)
Very Low	5 (9%)

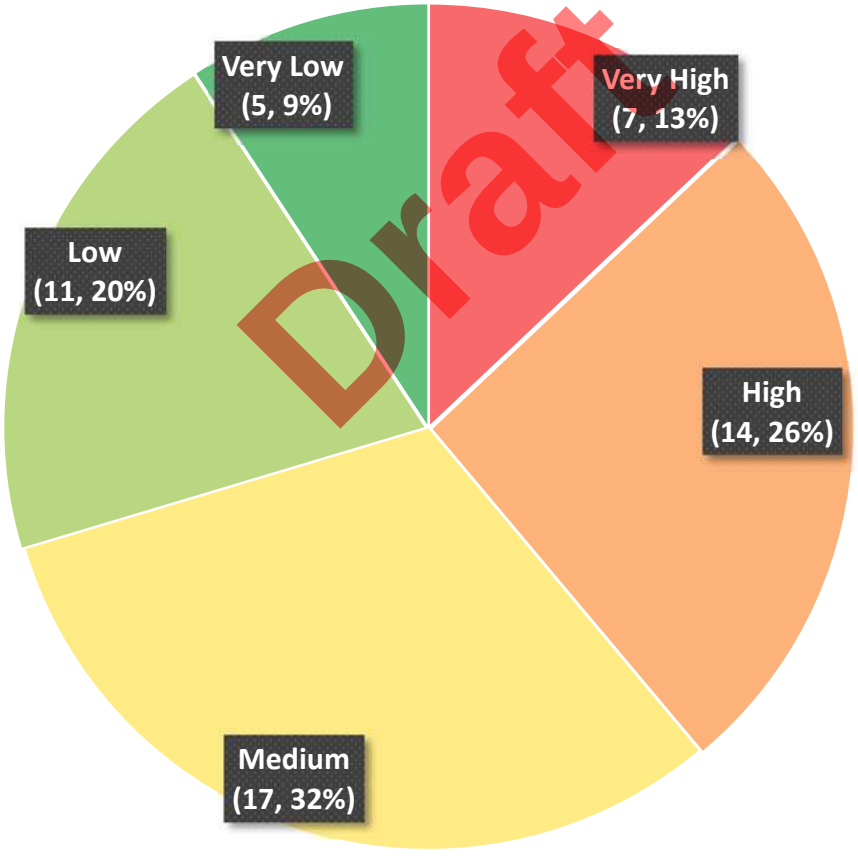

Figure 3. Chart of waterbody management priorities.

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Management Priority Legend

- Very High
- High
- Medium
- Low
- Very Low

(Image source: Nearmap, 2019)

Figure 4. Waterbody Priority Rating (Maryborough Area)

Fraser Coast WMS: Waterbody Management Framework Technical Report

SCALE: 1:25,000	DATE: 15 November 2019

DesignFlow
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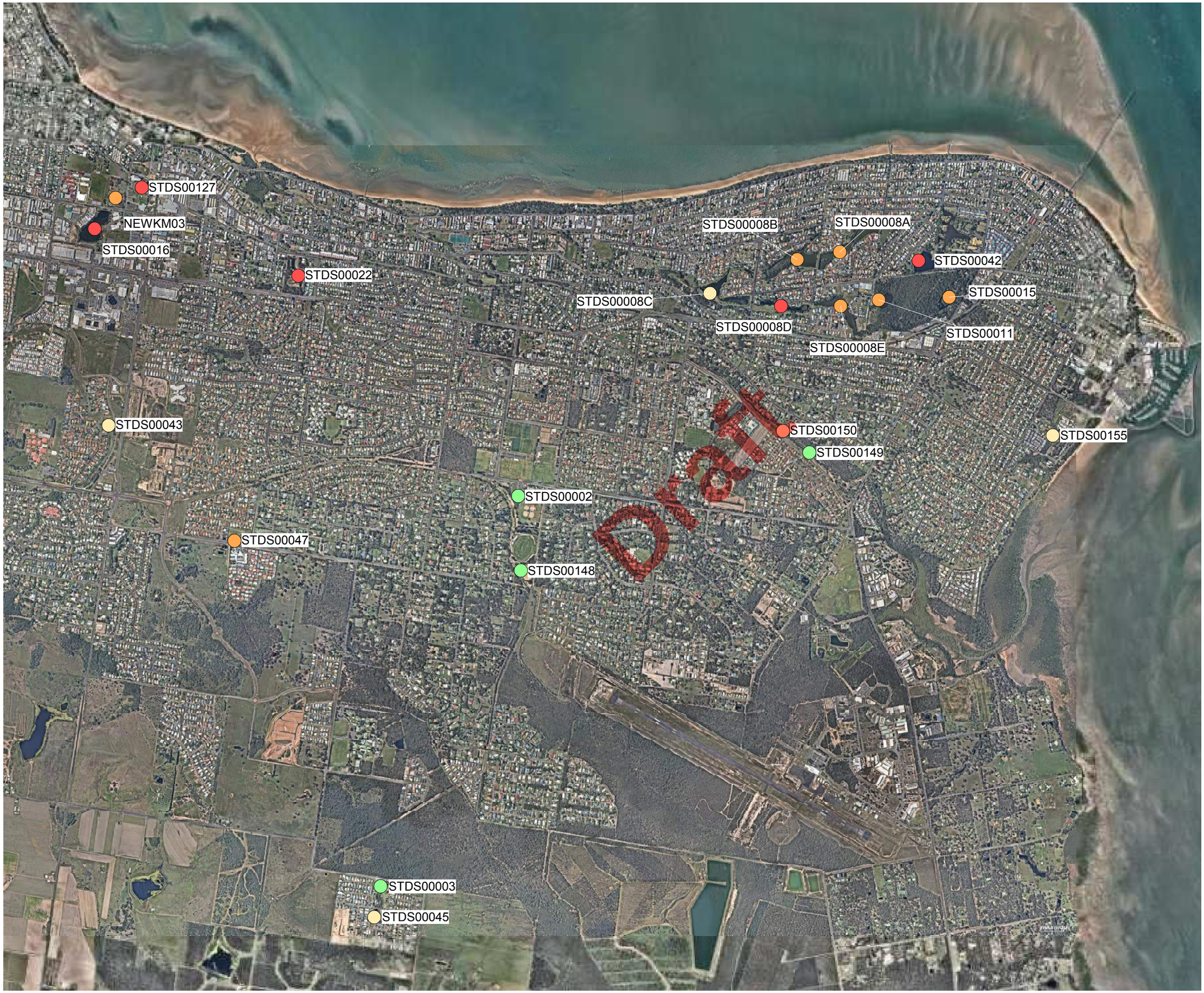
For:
FCRC



DesignFlow

Management Priority Legend

- Very High
- High
- Medium
- Low
- Very Low

(Image source: Nearmap, 2019)

Figure 5. Waterbody Priority Rating (Torquay area)

Fraser Coast WMS: Waterbody Management Framework Technical Report

SCALE: 1:25,000

DATE: 15 November 2019

DesignFlow
PO Box 1250, Southport BC
7 Bauer St, Southport QLD 4215

For:
FCRC

DesignFlow

Management Priority Legend

- Very High
- High
- Medium
- Low
- Very Low

(Image source: Nearmap, 2019)

Figure 6. Waterbody Priority Rating Dundowran area)

Fraser Coast WMS: Waterbody Management Framework Technical Report

SCALE: 1:25,000

DATE: 15 November 2019

DesignFlow
PO Box 1250, Southport BC
7 Bauer St, Southport QLD 4215

For:
FCRC

DesignFlow

Management Priority Legend

- Very High
- High
- Medium
- Low
- Very Low

(Image source: Nearmap, 2019)

Figure 7. Waterbody Priority Rating (Burrum Heads area)

Fraser Coast WMS: Waterbody Management Framework Technical Report

SCALE: 1:50,000

DATE: 15 November 2019

DesignFlow
PO Box 1250, Southport BC
7 Bauer St, Southport QLD 4215

For:
FCRC

3 MANAGING WATERBODY ASSETS

3.1 VALUE OF WATERBODIES TO THE FRASER COAST (BENEFIT)

People are inherently attracted to water or the aesthetic value that water provides. This has meant we have brought water closer to where we live in the form of urban waterbodies. Many of the waterbodies managed by FCRC are considered to add significant value to the community through increased amenity and landscape diversity. Twenty-five (25) of FCRC waterbodies have been classed as ranking either 'Very High' or 'High' scores for 'Waterbody Class' (refer Table 5).

Waterbodies in the urban environment provide a range of benefits to the community (refer Section 2.2). The majority of these benefits are non-market benefits and estimations of their economic worth are limited. Most benefits occur over a long temporal scale, albeit with some immediate benefits, like improved amenity and land value of an urban development. Table 18 lists the potential benefits associated with urban waterbodies, the more significant benefits are:

- Premium on property values
- Community benefits
- Amenity and aesthetics
- Ecological diversity
- Council and political image

Table 18. Typical benefits of urban waterbodies

Item	Description of potential benefit	Value estimates that are potentially relevant to the application of waterbodies (both directly and indirectly)	Data source (where available)
Indirect financial			
Premium on property values	Waterbodies add significant community benefit and visual amenity to urban environments. Research and development based evidence confirms that people are willing to pay more to be close to waterways and waterbodies thus increased property values within the vicinity of waterways and waterbodies.	The premium on land close to urban green space (e.g. in Ipswich) is around 10% for properties within 500 m of open space. Premium on land adjacent to water, in particular open water, can be as high as 100%.	Marsden Jacobs Associates (2007)
		Research in Western Australia indicates property values increase by 7% when located adjacent to natural wetlands that are preserved, or newly created stormwater treatment wetlands.	Tapsuwan *et al.* (2007)
		Research undertaken by CSIRO found that the Maroochy River underpins property value in the region to the value of $951 million. This represents 8–10% of the total value of property within the region of the river.	CSIRO (2008)
		A review of six studies that attempted to measure the effect of water quality on the value of nearby properties in Washington found the premium associated with improvements in water quality typically ranges from 1%–20%. Similar studies have been completed in Maine and Mississippi and found similar waterbodies add significant value to properties. These studies have been used to underpin waterbody management funding.	Washington Department of Ecology (2003) www.epa.gov/owow/lakes
		There was a drop in property values for water frontage lots around Lake Boga (Victoria) after major algal blooms in the summers of 1993–94 and 1994–95. Property valuations in late 1995 indicated on average, lakeside properties were worth 20%–25% less than before the blooms.	Read Sturgess and Associates (2001)
		The value of properties adjacent to waterbodies could be between 15% and 40% higher than for those located 100-300m away.	Hagare *et al.* (2015)

Item	Description of potential benefit	Value estimates that are potentially relevant to the application of waterbodies (both directly and indirectly)	Data source (where available)
Flood management	Many waterbodies play an important role in reducing flood flows. This reduces the risk of properties downstream becoming inundated during floods.	The cost of flooding to urban zones is well understood and relatively easily quantified. The benefit of a particular lake, in terms of flood management, is site specific and not provided here.	
Non-market			
Aesthetics, amenity and liveability	Waterbodies enhance amenity of urban areas. The high aesthetic value that waterbodies provide mean that waterbodies are often considered the central part of parkland areas in urban zones.	Refer to 'Premium on property values'	
Waterway health	Non-market values associated with improvement of waterway health.	Blackwell estimated the value of waterbodies and rivers in Australia to be $1,528,078 ($2005) per km^2.	Blackwell, Dr Boyd Dirk, (2005)
Education and awareness	Provision of a research or educational asset. The presence of waterbodies in urban areas often means residents understand the linkage with pollutant of stormwater more closely.	Data are unavailable.	
Ecological 'existence' values	Healthy waterbodies systems introduce a new and diverse ecology to urban areas that would otherwise not exist. The impact on the ecological health of affected local or regional ecosystems ('existence' values).	It is estimated that residents of the (former) Maroochy Shire were willing to pay up to $2 million per annum for non-use values associated with Moreton Bay and its environs.	Taylor (2005)
Ecological 'option' values	The impact of the value of having healthy aquatic and riparian ecosystems for potential use in the future (i.e. 'option' values).	A New Zealand study found that the 'option price' (i.e. the sum of use, preservation and option values) to be $17.05 (in 2004 NZ dollars, expressed as a mean willingness to pay per household per year) for users and non-users of the river	Taylor (2005)
Ecological 'bequest' values	The impact of the value of providing healthy aquatic and riparian ecosystems for future generations (i.e. 'bequest' values).	The Rakaia River study by Kerr et al. (2004) found the present value of preservation values of the river to be approximately $19 million (in 2004 NZ dollars).	Taylor (2005)

3.2 THE COST OF MANAGING URBAN WATER BODIES

Fish kills (e.g. at Lowlands Lagoons, Ululah Lagoons and Charles Street Basin) and the widespread occurrence of algal blooms and declared aquatic weeds across many waterbodies has highlighted the risk that waterbodies pose to Council. These problems come at a significant financial, environmental, social and political cost. Unless these waterbodies are managed properly with appropriate resources and funds it is considered that the frequency of waterbody 'failures' will escalate in coming years.

As a general rule, urban waterbodies tend to decline in condition over time, meaning the priority for management will increase and so will the associated management costs (e.g. increased reactionary management). Furthermore, it is likely that a number of new waterbodies will be handed over to Council from new development in the next few years further increasing the management burden.

It is considered that the risk of more waterbodies failing, at a higher frequency, is inevitable. The increase in cost to Council for clean-up and the other indirect costs is expected to be significant. The reactionary approach to waterbody management will result in an ever increasing costs to Council. Proactive management of waterbodies is therefore required.

3.3 RECOMMENDED ACTIONS

It is recommended that Council undertake an evaluation of the following items to inform how it can most effectively and sustainably manage its waterbody assets, including:

1. Gap analysis of council systems and processes (future assessment)
2. Development of a Business Case on current and an ideal management approach for waterbodies (future assessment)
3. Develop individual Waterbody Management Plans for Very High and High priority lakes (refer Section 4).

Gap analysis

A gap analysis would involve assessing Council's current organisation process in relation to waterbody management and would involve the following:

- Review Council's existing structure and allocation of resources for managing waterbodies.
- Identify preliminary resource requirements for managing waterbodies (people and equipment).
- Identify gaps and overlaps in Council's asset management system for waterbodies and provide recommendations for changes/actions (e.g. concerns with current issues, processes, resources, funding and needs).
- Identify what information is required by decision makers in Council who will influence the allocation of budgets and resources.

Business Case for Managing Waterbodies

Council has traditionally managed waterbody issues as they arise (i.e. reactionary), rather than planning for waterbody management activities in a structured and co-ordinated manner (i.e. proactive). This reactive management approach may result in additional long term cost to Council. As such it is recommended that a business case be developed that compares 'business as usual' versus and 'proactive' (or ideal) management approach for urban lakes.

A business case for managing waterbodies in Fraser Coast Regional Council needs to consider:

- Establishing the qualitative benefit or value of waterbodies;
- Outlining the current waterbody management approaches (i.e. reactionary) and associated costs and risks to Council;
- Defining the resource requirements and cost of managing waterbodies in a proactive manner; and
- Communicating the importance of providing sufficient funding and resources for long term management of waterbody assets.

4 DEVELOPING WATERBODY MANAGEMENT PLANS

This section of the report outlines the process to develop individual Waterbody Management Plans for higher priority lakes. The intent of system specific management plans is to establish proactive management actions, broad implementation timeframes and costs for individual waterbodies.

The framework described below includes the required information, instructions and tools in order to make decisions around waterbody management and complete additional investigations when required. Application of the framework will deliver a concise management plan tailored for a specific waterbody made up of a plan of the waterbody and a schedule of work.

An overview of the main steps in developing a Waterbody Management Plan is provided in Figure 8. The following sub-sections describe the methods for completing each step of the framework.

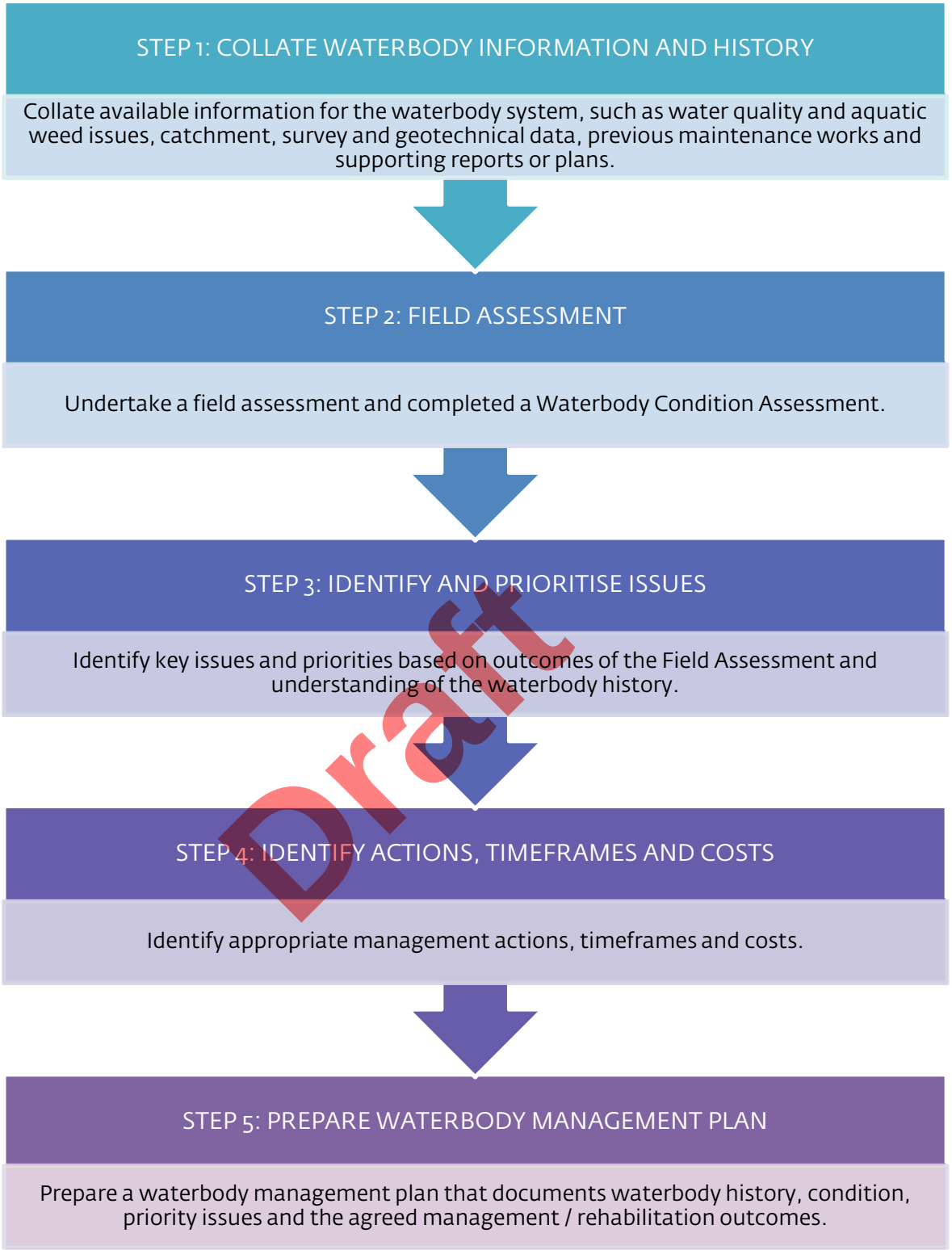


Figure 8. Overview of the Waterbody Management Plan Framework

4.1 STEP 1 - COLLATE WATERBODY INFORMATION AND HISTORY

To inform the waterbody management an understanding of the following is required as a minimum:

- Catchment (size and pressures)
- Waterbody depth/bathymetry
- Whether the waterbody is tidal or not
- Current and historical weed issues
- Current and historical water quality issues
- Location and suitability of hydraulic controls

Other information such as geotechnical surveys, soils, parkland planning, health and safety will also inform the waterbody assessment but the items listed above are critical.

The first step is to collate all the available information for the waterbody system and meet with Council officers to discuss the history of the waterbody and management issues. Data that may be available to assist with the waterbody assessment include:

- GIS information for the parkland and catchment
- Topographical survey include above and below water levels, water levels, pipes, pits, pathways, services and vegetation
- Geotechnical and groundwater information
- Water quality information
- Hydraulic assessments
- Previous waterbody management ideas or works
- Tide levels (where relevant)
- Waterbody or park planning that may have occurred for the site

A meeting with relevant Council officers from Engineering, Asset Management and Environmental Health should occur to discuss waterbody management issues and history including:

- Water quality issues and causes
- Algae bloom occurrence and frequency
- Fish kills
- Weed management issues (species and management approach)
- Litter issues
- Bird issues
- Tidal inundation
- Sedimentation issues
- Health and safety concern
- Hydraulic function and problems
- Maintenance issues (i.e. lack of access)

The range of issues should be documented and mapped for the waterbody in question and circulated to the Council officers for confirmation.

4.2 STEP 2 - FIELD ASSESSMENT

The second step is to undertake a rapid field assessment to assess the current condition of each waterbody, in relation to Council's key waterbody management condition assessment criteria, namely:

1. Public Health and Safety
2. Hydraulic Condition
3. Water Quality
4. Aquatic Habitat
5. Terrestrial Habitat
6. Maintenance Access

These categories are the same as those in the waterbody priority and condition assessment (refer to Section 2 for details of condition assessment scoring criteria.

The field assessment should occur using Council's Field Condition Assessment field sheet (Appendix A). This field sheet enables data to be entered directly in the waterbody management database record. The field sheet allows the rating of waterbody issues against performance indicators (1=Good, 2 = Adequate, 3 = Poor, 4 = Very Poor) to quickly identify particular issues with the waterbody and provide an overall condition rating for each category.

As part of completing the inspection, in accordance with the Field Condition Assessment, the following should occur:

- Performance indicator ratings provided as well as a description of each of the categories assessed, particularly those rated as 3 = Poor and 4 = Very Poor, to assist officers to identify waterbody specific issues and priorities.
- Physical water quality profiling from surface to bed of waterbody at a number of locations with a focus on dissolved oxygen, redox, electrical conductivity, turbidity, temperature and pH.
- Measurement of waterbody bathymetry with a depth sounder or measuring stick if existing survey is not available. If the waterbody will be significantly modified then a formal survey of the waterbody bed will be required.
- Grab sampling of waterbody sediments at a number of locations and visual inspection (with option for laboratory testing).

A table summarising the outcomes of the Field Condition Assessment should be generated. Table 19 provides an example of a completed summary table taken from the Lowlands Lagoon WMP. The table provides a summary of the performance ratings and describes main issues with the waterbody.

Step 1 and 2 of the framework aim to provide the necessary information to make decisions on waterbody management.

Table 19 Example summary of outcomes of the Field Condition Assessment from waterbody STDSoooo8A

(1=Good, 2 = Adequate. 3 = Poor, 4 = Very Poor)

	Performance Indicator	Rating Score	Comments
Public Health & Safety	Risk of injury or drowning Batter slopes Fencing/barriers Contaminated Water Mosquitoes **Overall condition score** **Overall condition rating**	3 3 3 2 2 **2.6** **Poor**	• Many areas of the waterbody are obscured and do not have adjacent open space areas. • The majority of the waterbody edges have steep drop-offs into the water, often with undercutting. • Mown edges often with greater than 1:3 batter slope. • No fencing present around the waterbody. • Unrestricted access to open water areas.
Hydraulic Function	Inlet condition Outlet condition Other structures Flushing/Residence Time Water Levels Stability of batters and bunds Sediment accumulation **Overall condition score** **Overall condition rating**	2 1 1 2 1 1 3 **1.6** **Adequate**	• Submerged inlet pipes. • Major inlet area – accumulated sediment with weed cover. • Submerged connection to Waterbody B. • Outlet channel stable • Waterbody residence time unknown, dependent upon inflows from local catchments. • Batter slopes extremely steep tending to vertical in some areas. • Waterbody edges well vegetated and stable.
Water Quality	Odours Algae/Cyanobacteria Turbidity Litter/debris **Overall condition score** **Overall condition rating**	1 1 2 2 **1.5** **Good**	• Moderate turbidity. • Planktonic algal biomass low. • Floating litter observed within the waterbody.
Aquatic habitat	Aquatic vegetation - emergent Aquatic vegetation - submerged Aquatic vegetation - floating Aquatic weeds - declared Aquatic weeds – non-declared Aquatic fauna and pests Filamentous algae **Overall condition score** **Overall condition rating**	1 3 1 1 1 1 1 **1.2** **Good**	• Extensive emergent macrophyte cover around the edges of the waterbody. Generally confined to low profile species growing out from edges including: *Alternanthera denticulata, Persicaria attenuata, Leersia hexandra* and *Typha orientalis*. • No submerged macrophytes observed. • Minor floating macrophyte cover present – Spirodela sp. • No declared or non-declared aquatic weeds observed.
Terrestrial habitat	Edge vegetation condition Terrestrial weeds – declared Terrestrial weeds – non-declared **Overall condition score** **Overall condition rating**	2 3 3 **2.7** **Poor**	• Edge vegetation highly variable, ranging from grass cover to overhanging trees. South-east waterbody edges dominated by Sporobolus *virginicus*. Southern edge mix of mown turf and native species including: *Bacopa monnieri, Fimbristylis* sp. and *Restio* sp. Northern edge vegetation dominated by overhanging trees including Broadleaved pepper tree. North-west

	Performance Indicator	Rating Score	Comments
			corner of waterbody with extensive grass cover extending into waterbody, comprising of *Leersia hexandra* and *Paspalum vaginatum*. • Waterbody edges dominated by Broad-leaved pepper tree and Cassia in several locations. • Introduced grasses and broad-leaved weeds present along waterbody edges.
Maintenance Access	Access to waterbody reserve Access to waterbodies margin Access to water surface **Overall condition score** **Overall condition rating**	2 1 1 **1.3** **Good**	• Access to the waterbody mainly foot access, some areas along northern edge accessible by vehicle. • Majority of the waterbody edges accessible, access to north-east corner (mainly overhanging vegetation) limited. • Access to water edge available at waterbody inlet (SE corner) or via Margaret Street.

4.3 STEP 3 - IDENTIFY AND PRIORITISE ISSUES

Following the rapid field assessment the main issues are to be confirmed and prioritised for each waterbody in consultation with Council. This occurs using the findings of the Field Condition Assessment ratings and the Waterbody Management Issues and Actions Table (**Appendix C**). This table lists the main waterbody management issues that need to be considered in this process, which relate directly to the categories provided in the Field Condition Assessment and the summary table (refer Table 19 for example).

Each waterbody issue must be prioritised as either:

- High – Issue is currently management risk to Council, health and safety or environment that requires addressing.
- Medium - Issue is a minor management risk to Council, health and safety or environment but has the potential to become a High priority in future if not managed.
- Low – Not currently and management risk to Council and unlikely to become issue in near future.

Generally the following will apply when consider the findings of the Field Condition Assessment:

- Good Condition Rating = Low priority
- Adequate Condition Rating = Medium priority
- Poor or Very Poor Condition Rating = High priority

However, this is not always the case and requires judgment on behalf of the person completing the assessment and discussion with Council.

4.4 STEP 4 - IDENTIFY ACTIONS, TIMEFRAMES AND COSTS

For waterbody management issues identified as Low priority, no actions are required, apart from ensuring that these issues are incorporated into regular, scheduled inspections. If all the issues for a waterbody have low priority, then the findings of Steps 1-3 should be documented and the waterbody should be inspected regularly (e.g. every 12 months) to confirm that there has been no deterioration in the waterbody or relevant issue. If any follow up inspections identify any Very High, High or Medium Condition/Risks, then the completion of Steps 4-5 will then be required.

For waterbody management issues identified as Medium or High priority, waterbody management actions must be identified from the information provided in Appendix C. A decision needs to be made whether to proactively manage or do nothing. The decision will require consideration of the following as a minimum:

- The scale of the risk to Council and ongoing cost to Council if proactive management is not implemented.
- The community desires for the waterbody
- The environmental/conservation values of the waterbody and surrounds
- Underwater (bathymetric) survey information. This will show what is possible and provide a basis for all future actions.
- The ability to manage a number of risks through a single actions (i.e. converting the waterbody to a wetland will manage water quality, aquatic weeks and many hydraulic issues).

A preliminary suite of actions, timeframes and costs should be established and documented in tabular and schematic form for discussion with Council. Table 20 provides the basis for the tabular information and should be completed prior to discussion with Council stakeholders. The 'rating' column refers to the rating applied in the Field Condition Assessment spreadsheet for each relevant issue. The 'related issues' column refers to the Management Issues and Actions table (Appendix C), which can be used to assist with determining the appropriate combination of management actions.

A Council stakeholder workshop should occur to discuss the preliminary actions and to agree on the appropriate management actions for each of the High and Medium priority issues and to identify the broad implementation timeframes and costs. This should include representatives from a range of departments and disciplines.

Following the stakeholder workshop, Table 20 should be finalised and concept plans developed, identifying the location and priority of management actions for each waterbody.

Table 20. List of management actions, timeframes and costs (for Very High, High and Medium risk issues)

Related issue (from issues table)	Issue	Comments / Notes	Rating (from condition assessment)	Priority for Management (H, M, L)	Likely Rating following implementing management actions	Responsible departments	Maintenance / Management Schedule
A1	Risk of injury or drowning						
A2	Health risks due to human contact with contaminated water						
A3	Chemical contamination.						
A4	Faecal and/or nutrient contamination.						
A5	Human health risk due to excessive Mosquito Populations						
B1	Inlet/outlet erosion or instability						
B2	Outlet blockage Water level is consistently too high above normal water level						
B3	Poor flushing or dead pockets						
B4	Water level is consistently too low						
B6	Flooding of adjacent land, parkland or property or regular overtopping of waterbody bund						
B5	Scour of batters						
B7	Coarse sediment accumulation						
B8	Fine sediment or organic matter accumulation						
C1	Odours						
C2	Algal or cyanobacterial blooms						
C3	Persistent high turbidity levels.						
C4	Stratification and low dissolved oxygen						
C5	Variable salinity						
C6	Litter						
D1	Aquatic weeds						
D2	Presence of aquatic pests (e.g. exotic fish species)						
E1	Terrestrial weeds						
F1	Access for maintenance						

4.5 STEP 5 - WATERBODY MANAGEMENT PLAN

The findings of the waterbody assessment are to be documented in a waterbody specific Waterbody Management Plan. The plan is intended to be simple and practical set of tables and drawings which enable each department with waterbody management responsibilities to plan for and schedule works to fit in with their own programs. The Plan can be referred to by operational staff while in the field to ensure that the appropriate action is undertaken at the correct locations and frequencies. The Plan should be concise and incorporate:

1. A completed 'Site Overview' table
2. An A3 colour Concept Plan/s
3. Management schedule table/s

The information required to be included in the 'Site Overview' is provided in Table 21. The completed table will provide a brief summary of the site and associated issues / values and constraints that can be referred to when required.

The Concept Plan/s should be prepared based on the outcomes of Steps 1-4 of the Management Framework and reference the actions, timeframes and responsible departments listed in Table 20.

Draft Waterbody Management Plans have been developed for the Lowlands Lagoons (Anembo Lakes) system and the Ululah Lagoons system to illustrate the level of content required for the plans.

Table 21. Site overview template

Name:	Waterbody name		
Description:			
Priority:			
Management Goal:			
Council ID:		Surface Area:	
Catchment:			
Function / Purpose			
Issues / Values			
Constraints			
Conservation designations			
Existing / proposed management actions			
Supporting information			

5 SUMMARY AND RECOMMENDATIONS

This Waterbody Management Framework was developed to set out the steps for effectively and efficiently managing the complex dynamics of urban waterbodies in the local government context.

5.1 WATERBODY PRIORITY

Council currently manages 54 waterbodies. Each waterbody has been rated according to 'Waterbody Class' (based on a range of social and environmental values provided) and 'Waterbody Condition' (based on the current waterbody function and health) and based on these ratings a 'Management Priority' was assigned. The outcome of the prioritisation process ensures that waterbodies that are higher class and/or poorer condition are prioritised for management over lower class and/or better condition.

The results of the final prioritisation identified 7 waterbody systems as Very High Priority, 14 as High Priority, 17 as Medium Priority and 16 as Low or Very Low Priority. The list of Very High and then High Priority waterbodies will be the focus of management in the coming years.

5.2 MANAGING WATERBODY ASSETS

It is recommended that Council undertake an evaluation of the following items to inform how it can most effectively and sustainably manage its waterbody assets, including:

- Gap analysis: It is recommend that Council's organisational structure is reviewed to identify gaps in the current management approach to urban waterbodies to identify potential inefficiencies or where additional resources may be required.
- Business Case (Cost analysis including funding and resourcing): It is recommended that Council developed a business case for proactive waterbody management and compare the costs against the current management approach.

5.3 WATERBODY MANAGEMENT PLANS

A stepped process for completing a Waterbody Management Plan was developed in order to establish management and rectification actions, broad implementation timeframes and costs for individual waterbodies. This process involves a number of steps applying a number of tools to complete the investigations. The intent of system specific management plans is to deliver a concise management plan made up of a plan of the waterbody management issues, management actions, and schedule of works and costs for individual waterbodies on an as-need basis.

Draft Waterbody Management Plans for Lowlands Lagoons (Anembo Lakes) system and the Ululah Lagoons system were completed to assist with development and application of the framework.

It is recommended that these Plans inform management principles and actions that can be rolled out to address similar issues for other urban waterbodies where detailed individual waterbody management plans may not be required.

5.4 CONCLUSIONS

It is recommended that Council starts to pro-actively management waterbody assets through the following actions:

- **Business Case** – undertake an assessment of cost associated with managing waterbody assets including funding and resourcing;
- **Gap analysis** – undertake an assessment of waterbody management roles, responsibilities and procedures
- **Strategy** – Prepare a strategy document which provides a concise overview of the strategic direction, key findings and prioritisation policy and directions of the Framework.
- **Implementation –** Begin a process of systematically implementing the framework on Very High and High Priority waterbody systems across the region. This may require the development of support tools (such as field kits and training sessions) to facilitate implementation of the Framework;
- **Development control –** Council doesn't accept new lakes, especially not existing farm dams. If council does by exception consider accepting a new waterbody through development then appropriate development controls must be implemented to ensure that the system is designed and constructed to strictly adhere to best practice, is handed over to Council correctly and developers provide a long-term financial contribution to Council for management.

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APPENDIX A FIELD CONDITION ASSESSMENT FORM

Asset Name:	Asset ID:	Location:	Date:		
Category	**Item**	**Component**	**Performance indicator (PI)**	**Category Score***	**Comment**
Public Health & Safety	1.1	Risk of injury or drowning	Open space areas adjacent to water minimise risk of drowning		
	1.2	Batter slopes	Slope ideally 1:6 or flatter adjacent to open water zones. Batter slope above and below water level is no steeper than 1 in 4.		
	1.3	Fencing/ barriers	Fencing / barriers present in unsafe areas (walls greater than 1m high anywhere or walls/steep batters of any height into permanent water). Appropriate fencing or vegetation barriers in place where batter slope is steep or adjacent to deep water		
	1.4	Contaminated Water	No obvious contamination of water. E.g. due to chemical contamination, faecal matter (e.g. large bird population, sewer leaks etc.)		
	1.5	Mosquitoes	Low mosquito populations, no isolated depressions creating mosquito habitat, no larvae observed.		
Hydraulic Condition	2.1	Inlet Condition - e.g. pipes, channels	No blockage, erosion or structural damage		
	2.2	Outlet Condition - Including bund, pipes, pits, grates, outlet weirs, scour protection	No blockage or damage. No erosion, scour tunnelling or structural damage. The waterbody bund is not overtopped regularly		
	2.3	Other structures	No erosion and damage to other structures, e.g. pits, pipes, ramps and walls.		
	2.4	Flushing/ Residence Time	The system is well flushed with no dead pockets/backwatered areas		
	2.5	Water levels	Water level close to normal operating level.		
	2.6	Stability of Batters and bunds	Minor and localised erosion only. No scour or exposed earth on batters.		
	2.7	Sedimentation accumulation	No visible coarse sediment accumulation within waterbody.		
Water Quality	3.1	Odours	No odours detected		
	3.2	Algae / Cyano-bacteria	No obvious sign of planktonic algae in water column		
	3.3	Turbidity	Water column clear and visibility >1m. Turbidity ranges between 1-20 NTU		
	3.4	Litter/ Debris	No grass clippings. No floating litter. Bins are provided and are adequately maintained and routinely empty.		

Asset Name:	Asset ID:	Location:	Date:		
Category	**Item**	**Component**	**Performance indicator (PI)**	**Category Score***	**Comment**
Aquatic habitat	4.1	Aquatic vegetation - emergent	Native emergent macrophytes present around the shallow margins (<0.35m depth) of the waterbody. Plants healthy and free from disease (includes native water lilies).		
	4.2	Aquatic vegetation - submerged	Native submerged macrophytes present (0.35-1.5 m depth). Includes all submerged genera (Ceratophyllum, Potamogeton, Myriophyllum)		
	4.3	Aquatic vegetation – free-floating	Less than 5% of the waterbody surface covered by native floating macrophytes (i.e. Azolla, Water lilies).		
	4.4	Aquatic weeds – declared	Declared weeds controlled.		
	4.5	Aquatic weeds – non-declared	Less than 20% of the waterbody surface area covered in non-declared weeds		
	4.6	Aquatic fauna pests	No damage by pests (e.g. Tilapia digging). No pests present (e.g. no Tilapia observed, no large bird populations)		
	4.7	Filamentous algae	Less than 10% of the water surface covered with filamentous algae.		
Terrestrial Habitat	5.1	Edge vegetation condition	A minimum vegetation width of 1m along the lower waterbody batter. Greater than 90% vegetation cover. Plants healthy and free from disease.		
	5.2	Terrestrial weeds - declared	Declared weeds controlled.		
	5.3	Terrestrial weeds – non-declared	Less than 10% of the batters covered in non-declared weeds		
Access for Maintenance	6.1	Access to waterbody reserve	Formal access provided into the waterbody reserve.		
	6.2	Access to waterbodies margin	Adequate access to waterbody edge provided for weed management		
	6.3	Access to water surface	An appropriate access is available for harvesting aquatic weeds (weed harvester or boat)		

*Scoring: 1 = Good (PI exceeded), 2 = Adequate (PI met), 3 = Poo (PI not met), 4 = Very Poor (PI failed)

APPENDIX B WATERBODY ISSUES AND ACTIONS TABLE

Issue	Description	Investigations / monitoring	Minor or Immediate Response Management Actions[1]	Proactive Management Actions[2]	Relevant policy, legislation and supporting information
A. Public Health and Safety					
A1 **Risk of injury or drowning**	Potential safety issues (i.e. drowning) may be due to: • Steep batters • Lack of access control • Lack of perimeter vegetation	Discuss with asset owner to identify and document any issues. Undertake desk-top review and initial site inspection.	If risk is deemed unacceptable the following actions should be considered: • Install temporary protection (temporary fencing) to exclude public entry; and/or • Erect signage to highlight risk to public and that a response is being identified.	Proactive management actions will depend on the scale, type and degree of risk. Actions may include: • Planting waterbody batters with dense vegetation to restrict access. • Installing access control using barriers such as permanent fencing where risk of access is high. • Modifying the waterbody edge to provide safe batters above and below the water level (a maximum slope of 1:4 is recommended as a minimum). • Reducing the depth of the waterbody, particularly around the edges. • Where the waterbody is located near high children use area (i.e. children's playground), consider moving the use to another part of the parkland. Refer to *Rectifying WSUD Assets* – Appendix B (Water by Design) for additional guidance.	Water by Design (2011) *Rectifying WSUD Assets.*
A2 **Health risks due to human contact with contaminated water**	Potential health risks may exist where public have direct access to water contaminated with chemicals, faecal matter or cyanobacteria Certain types of cyanobacteria (blue–green algae) can release toxins that affect the liver or nervous system when they die, which can be a major public health issue. In addition, all Cyanobacteria contain toxins within their cell walls that can cause skin irritations and allergic responses in human skin tissue from direct contact with the cells.	Discuss waterbody contamination history with asset owner, engineering and environmental health departments to identify and document any issues. Undertake desk-top review and site inspection. Detailed investigations will depend on the nature of the contamination. Refer to issue A-3 for chemical contamination, A-4 for faecal contamination and C-2 for algal and cyanobacterial blooms	Where contamination is reported, the relevant state government department (environmental health) should be notified and monitoring/management completed in accordance with DERM (2009), ANZECC (2018) and NH&MRC (2008). Management actions will be guided by monitoring outcomes but may include: • Installation of temporary protection (temporary fencing) to exclude public entry; • Erecting signage to highlight risk to public and that a response is being identified. • Community consultation • clean-up/treatment or adaptive management as required For ongoing management actions refer to issue A-3 for chemical contamination, A-4 for faecal contamination and C-2 for algal and cyanobacterial blooms	Refer to issue A-3 for chemical contamination, A-4 for faecal contamination and C-2 for algal and cyanobacterial blooms	DSDIP (2017) *State Planning Policy.* ANZECC (2018) *The Australian and New Zealand Guidelines for Fresh and Marine Water Quality – 2018 edition.* NH&MRC (2008) *Guidelines for managing risk in recreational waters.* DERM (2010a) *Environmental Protection (Water) Policy 2009 Burrum, Gregory, Isis, Cherwell and Elliott Rivers environmental values and water quality objectives Basin No. 137 (July 2010)* DERM (2010b) *Environmental Protection (Water) Policy 2009 - Mary River environmental values and water quality objectives. Basin No. 138, including all tributaries of the Mary River (July 2010)* Chorus and Bartram (1999). *Toxic cyanobacteria in water: A guide to their public health consequences, monitoring and management.*

[1] Actions that can be completed immediately, rapidly or cost effectively in response to the issue. The focus of management actions is investigation and easily implemented responses. May require ongoing management/investigations.

[2] Actions that require planning, design and budgeting to implement. Generally involves responses/actions which are more onerous and take time to consider.

Issue	Description	Investigations / monitoring	Minor or Immediate Response Management Actions[1]	Proactive Management Actions[2]	Relevant policy, legislation and supporting information
A3 **Chemical contamination.**	The presence of chemical contamination may be indicated by: • Obvious discoloration of the waterbody water (i.e., orange, red, grey). • Chemical residues floating on the surface of the waterbody (e.g. oily scums). • Fish kills	Discuss with asset owner, engineering and environmental health departments to identify and document any historical issues. Undertake desk-top review of potential contamination sources (e.g. proximity to ERAs) and site inspection.	Suspected contamination by toxic chemicals should be reported immediately to DERM. If toxic chemicals are found at levels which exceed the relevant WQOs (DERM 2010a, DERM 2010b) an adaptive management program should be implemented in accordance with the risk assessment framework set out in NH&MRC (2008). Management actions may include: • Installation of temporary protection (temporary fencing) to exclude public entry; • Erecting signage to highlight risk to public and that a response is being identified. • Community consultation • treatment or adaptive management as required	Clean-up of spills should be conducted with advice from DERM and an appropriate specialist as required, in accordance with the NH&MRC (2008) risk assessment framework. Management actions will be resolved as part of the waterbody investigations. Potential management responses to may include : • Installation of stormwater treatment systems in the upstream catchment to remove pollutants prior to entering the waterbody. • Resetting the waterbody system as a wetland.	NH&MRC (2008) *Guidelines for managing risk in recreational waters.* DERM (2010a) *Environmental Protection (Water) Policy 2009 Burrum, Gregory, Isis, Cherwell and Elliott Rivers environmental values and water quality objectives Basin No. 137 (July 2010)* DERM (2010b) *Environmental Protection (Water) Policy 2009 - Mary River environmental values and water quality objectives. Basin No. 138, including all tributaries of the Mary River (July 2010)*
A4 **Faecal and/or nutrient contamination.**	Contamination of the waterbody by faecal bacteria and nutrients may be due to: • Large bird populations on or adjacent to the waterbody. • Untreated sewage entering waterbody via stormwater inflows. • Leakage of septic systems into ground, surface or stormwater. • Diffuse runoff from surrounding land uses, particularly areas with high concentrations of domestic animals (e.g. dogs, cats, cattle, sheep, pigs, poultry etc.). • Internal (nutrient) loading from the sediments) The presence of faecal contamination is often difficult to detect, however may be indicated by: • Obvious discolouration of the waterbody water (e.g. grey, blue-grey). • Unusual foaming on the surface of the waterbody, especially at inflow sites • Unusual water odours (e.g. effluent).	Discuss with asset owner, engineering and environmental health departments to identify and document any current or historical issues. Undertake desk-top review and initial site inspection. Depending on the outcomes of the risk assessment, the asset owner may wish to undertake additional site surveys and /or Implement a water quality monitoring program in accordance with NH&MRC (2008).	If faecal contamination is found at levels which exceed the relevant WQOs (DERM 2010a, DERM 2010b) an adaptive management program should be implemented in accordance with the risk assessment framework set out in NH&MRC (2008). Management actions may include: • Installation of temporary protection (temporary fencing) to exclude public entry; • Erecting signage to highlight risk to public and that a response is being identified. • Community consultation • Routine inspections and maintenance of existing dog waste bins • treatment or adaptive management as required	If the risk is deemed unacceptable, management actions may include:: • Removing or culling waterfowl from the waterbody system. • Treating contamination sources from the catchment, including illegal sewer connections to drainage system, STP overflows, stormwater etc. • Treatment or containment of drainage from intensive agriculture / industry • Signage and public education programs. • Installation of dog/domestic animal waste bins	NH&MRC (2008) *Guidelines for managing risk in recreational waters.* DERM (2010a) *Environmental Protection (Water) Policy 2009 Burrum, Gregory, Isis, Cherwell and Elliott Rivers environmental values and water quality objectives Basin No. 137 (July 2010)* DERM (2010b) *Environmental Protection (Water) Policy 2009 - Mary River environmental values and water quality objectives. Basin No. 138, including all tributaries of the Mary River (July 2010)*

Issue	Description	Investigations / monitoring	Minor or Immediate Response Management Actions[1]	Proactive Management Actions[2]	Relevant policy, legislation and supporting information
A5 **Human health risk due to excessive Mosquito Populations**	The presence of large mosquito populations represents both a potential human health risk (as mosquitoes are vectors for many pathogens including protozoa, nematodes and viruses) and a nuisance to local residents.	Discuss safety with asset owner and environmental health stakeholders to identify and document any issues. Undertake site inspection to check for evidence of mosquito breeding sites around the margins of the waterbody and also in any isolated shallow pools in the near vicinity. Check for evidence of litter which may support mosquito breeding. Record whether or not: • The mosquito problem is associated with the waterbody (or the surrounding ecosystems). • Simple management actions can be implemented to reduce populations. • A mosquito control plan should be prepared and management actions implemented. Where a mosquito control plan is required then an audit of the mosquito species and population density both within the waterbody and adjacent habitats is required.	Simple management actions may include: • Implementing a regular litter removal program • Regular Spraying with larvicides (seek advice from environmental health experts within Council if the use of chemical control agents are deemed necessary.)	Where further management is required, a mosquito control plan should be prepared in accordance with the *Mosquito Management Code of Practice for Queensland* (Local Government Association of Queensland Inc. 2002). Rectification options may include: • Draining isolated pockets of pooled water. • Filling in uneven areas where stagnant water accumulates • Increasing depth in open water areas to >60cm to limit mosquito breeding • Improving waterbody circulation and flushing • Introducing mosquito predators (native fish).	Local Government Association of Queensland (2002) *Mosquito Management Code of Practice.* Diseases Control Services, Communicable Diseases Unit, Queensland Health (2002) *Guidelines to minimise mosquito and midge biting problems in new development areas.* Water by Design (2011) *Rectifying WSUD Assets.* Water by Design (2011) *Maintaining WSUD Assets.*
B. Hydraulic condition					
B1 **Inlet/outlet erosion or instability**	Instability or erosion of inlet or outlet structures may be hazardous due to structural failure of hydraulic controls, blockages, creation of deep pools/unsafe batters, etc. Instability of the inlet/outlet may result from: • High discharges due to storm inflows. • Lateral surface flows entering the waterbody via drainage lines. • Localised high velocities (e.g. shape of waterbody, around inlet). • Failure of aging infrastructure	Inlet/outlet scour/instability issues with inlets and outlets with asset owners to identify and document any issues. Complete a site inspection to check for evidence of failure of hydraulic controls at inlets/outlets and assess the scale of the problem and reason for erosion/instability. Following the investigation tasks listed above a decision needs to be made regarding the following whether the issues require management or not. This decision will be dictated by the amount of erosion/instability, risk of further failure and the public safety risk (**A1**). Where management is required, in most cases this will not require detailed assessment but rather will involve design of a replacement structure / scour protection measures.	Where erosion/instability exists and has stabilized or is not considered a risk to Council, then no management action required. Monitor the issue zones via regular visual inspection.	Management of significant erosion/instability will be dictated by the investigations and may require specialist input from a soil scientist and /or stormwater engineer. Management responses may include: • Re-enforcing the eroded areas with rock protection. • Directing inflows to rock-lined channels that feed down the batters to the waterbody. • Replacing topsoil in scoured zones and re-establishing the vegetation. • Modifying hydraulic control structures (i.e. inlet and outlet pipes and weirs). If the soil is problematic, seek advice from the soil laboratory for management options to meet the specifications. In some cases, in-situ management may be possible. However, if not, remove and replace the soil.	

Issue	Description	Investigations / monitoring	Minor or Immediate Response Management Actions[1]	Proactive Management Actions[2]	Relevant policy, legislation and supporting information
B2 **Outlet blockage - Water level is consistently too high above normal water level**	Persistent high water levels (minor flood conditions) within the waterbody causing issues adjacent to waterbody (e.g. death of vegetation, waterlogging of parkland area, tidal backwatering etc.).	Discuss elevated water levels issue with asset owner and engineering services to identify and document any issues. • Complete site inspection following rainfall and during dry conditions to assess elevated water levels and identify potential causes: This will include checking for blockage of the outlet pipe or weir. • Incorrect design or construction of the outlet pipe or weir. • Blockage or siltation of downstream drainage system causing backwatering up the pipe. • Increased catchment inflows due to changes in catchment land use or drainage. Where the risk of elevated water levels is high or very high and the solution is not straight forward then further technical assessment may be required. Seek advice from an engineer if the outlet is regularly blocked or undersized. Review catchment land use to determine if there has been a significant increase in catchment imperviousness. Catchment modelling may be required to determine waterbody inflows. Assess the capacity of the waterbody outlet to cope with increased flows. Installation of a water level gauge may assist with technical assessment.	Management options for elevated water level may include: • Undertaking regular inspection and maintenance of waterbody outlet. • Cleanout of downstream waterways to ensure free drainage of waterbody • Erecting signs to inform the community about the water level issue in the waterbody.	If the risk is deemed unacceptable, management actions may include: • Decrease future risk of blockage (i.e. submerged outlets, inclined grates, large conveyance opening to allow for accumulation of litter) • Provide increased capacity (i.e. new pit or pipes). • Provide easy inspection and maintenance access (4.8) • Allow adaptive management of the waterbody water levels (e.g. install valve or stage outlet to allow water levels to be lowered or raised easily).	Healthy Waterways (2010) *WSUD Technical Design Guidelines.*
B3 **Poor flushing or dead pockets**	Poor flushing or dead pockets are demonstrated by patches of still, stagnant water, sometimes accompanied by an odour and / or algal growth. This is caused locally by areas of open water that are rarely flushed (isolated 'dead pockets') or more broadly waterbodies that have relatively small or infrequent inflows.	Discuss coarse poor flushing and dead pockets with asset owner and engineering services to identify and document any issues. Complete site inspection around the full perimeter of the waterbody to identify potential to dead pockets indicated by: • Small backwaters which do not receive flowing water. • Poor water quality and algae	Where poor flushing exists but it is not leading to poor water quality, then no management action required. Monitor the poorly flushed zones via regular visual inspection.	Where poor flushing is resulting in poor water quality outcomes (i.e. algae blooms), then management should occur. Options include: • Recirculation • Removal of islands • Retrofitting of inlets/outlets to maximize flushing • Redirecting flows through the waterbody to ensure flow pass through dead pockets. • Re-shaping base of the waterbody to remove or fill in dead pockets. • Converting dead pockets to wetland zones.	

Issue	Description	Investigations / monitoring	Minor or Immediate Response Management Actions[1]	Proactive Management Actions[2]	Relevant policy, legislation and supporting information
B4 **Water level is consistently too low**	The waterbody water level drops following rainfall to expose the bed of the waterbody system.	Discuss low water levels with asset owner and engineering services to identify and document any issues. Complete site inspection following rainfall and during dry conditions to assess elevated water levels and identify potential causes. This will include checking for: • Incorrect outlet structure. • Leaking outlet structure. • The waterbody catchment is small (i.e. not enough inflow to sustain water level) • The base or bund of the waterbody is not properly sealed. • Depth of waterbody has reduced due to siltation. • Inflows are bypassing the waterbody. Where the risk of low water levels is high or very high and the solution is not straight forward then further technical assessment may be required. Seek advice from an waterbody specialist (internal or external to Council) to confirm the reason for the water level reduction: • Obtain design information for the waterbody in particular catchment area, inflow points, earthworks/bathymetry and outlet structure. • Obtain certification and construction information for the waterbody. • Where required collect survey data to confirm the design levels are achieved. • Review the catchment area to ensure the catchment is suitably large enough to sustain water in the waterbody (i.e. waterbodies which are greater than 5% of the catchment in the Fraser Coast region may experience significant water level variation). • Review the depth of the system to confirm whether siltation has occurred (may require survey). • Complete boreholes in the base of the waterbody to confirm the presence of a clay liner (or otherwise).	Management options for low water levels may include: • Erecting signs to inform the community about the water level issue in the waterbody.	If the risk is deemed unacceptable, management actions may include: • Installing a new outlet structure. • Fixing any leaks in the outlet structure. • For a waterbody with a small catchment, reduce the size of the waterbody or decommission. • Diverting more catchment into the waterbody. • Use proprietary product which flocculates fine sediment to the base of the waterbody to create a thick impermeable liner. Apply following a number of rainfall events where suspended solids are elevated to maximize sediment capture on base. • Draining and sealing the base or bund of the waterbody properly • Converting a waterbody which has a 'leaky' base to an ephemeral wetland. Where the waterbody has been constructed recently and certified by geotechnical engineer or civil engineer, consider taking action for compensation to cover costs of management works.	
B5 **Flooding of adjacent land, parkland or property or regular overtopping of waterbody bund**	Drainage into or out of the waterbody has the potential to flood adjacent land, park or property due to poor hydraulic controls (i.e. uncontrolled flow out of waterbody).	Discuss flooding issues with asset owner and engineering services to identify and document any issues. Complete site inspection following rainfall to assess flow behaviour through the waterbody system with a focus on inflows and outflows from the waterbody and any recorded flood prone areas. Further assessment may be required if risk is identified as high. This may include undertaking a detailed desktop catchment investigation (areas, land use incl. changes, flood/stormwater management reports, flow calculations and/or modelling, complaints register)	Management actions may include:: • Undertaking regular inspection and maintenance of waterbody outlet. • Regular cleanout of downstream waterways to ensure free drainage of waterbody.	If the risk is deemed unacceptable, management actions may include: • Modifying outlet structures to control flooding (i.e. lower water levels, increase capacity, staged outlet) • Installing or increasing the size of the high flow weir outlet from the waterbody. • Increasing the capacity of downstream waterways • Stabilising flood inflow and outflow locations. • Diverting upstream catchment into or around waterbody.	Department of Natural Resources and Water (2016) *Queensland Urban Drainage Manual Fourth Edition.*

Issue	Description	Investigations / monitoring	Minor or Immediate Response Management Actions[1]	Proactive Management Actions[2]	Relevant policy, legislation and supporting information
B6 **Scour of batters**	Scoured batters may be hazardous due to the instability of the waterbody edges and presence of under-cut edges. Scour of the batters may result from: • High discharges due to storm inflows. • Lateral surface flows entering the waterbody via drainage lines. • Localised high velocities (e.g. shape of waterbody, around inlet). • Lapping of water against exposed turf edges. • Use of inappropriate soils around the edge of the waterbody (dispersive soils and the associated tunnel erosion).	Discuss scour of waterbody batters with asset owner and environmental health stakeholders to identify and document any issues. Complete a site inspection to check for evidence of scour around the margins of the waterbody and assess the scale of the problem and reason for scour. Following the investigation tasks listed above a decision needs to be made regarding the following whether the scour issues require management or not. This decision will be dictated by the amount of scour, risk of further scour and the public safety risk (1.1). Where management is required, in most cases this will not require detailed assessment but rather will involve design of a new waterbody batter which stable.	Where scour exists and has stabilized or is not considered a risk to Council, then no management action required. Monitor the scour zones via regular visual inspection.	Management of significant scour will be dictated by the investigations and may require specialist input from a soil scientist and /or stormwater engineer. Management responses may include: • Re-enforcing the eroded areas with rock protection and benching. • Directing inflows to rock-lined channels that feed down the batters to the waterbody. • Replacing topsoil in scoured zones and re-establishing the vegetation. • Modifying hydraulic control structures (i.e. inlet and outlet pipes and weirs). If the soil is problematic, seek advice from the soil laboratory for management options to meet the specifications. In some cases, in-situ management may be possible. However, if not, remove and replace the soil.	
B7 **Coarse sediment accumulation**	Coarse sediment is the largest component of urban stormwater pollutants in term of quantity. Therefore, coarse sediment deposition in the inlet zones to waterbodies will eventually be an issue for management. Excessive sediment accumulation within the waterbody may result in the blockage of preferred flow path and the development of multiple flow paths. The growth of emergent macrophyte vegetation upon silted areas may also influence the hydraulic behaviour of a waterbody system	Discuss coarse sediment accumulation with asset owner and engineering services to identify and document any issues. Complete site inspection to each of the inflow points into the waterbody to assess coarse sediment accumulation: • Visible sediment accumulation above or below the normal water level. Sediment accumulation is often most evident near the waterbody inlet zone/s. • Growth of emergent macrophytes within the waterbody. • Collection of sediment cores using a simple grab sampler/corer. Where coarse sediment has accumulated the cause should be identified e.g.: • Untreated catchment runoff • Catchment land use or activities • Failure of WSUD systems (GPTs or sediment basins) within the catchment to adequately capture coarse sediments • Erosion of upstream waterways.	Management actions for coarse sediment manage can be undertaken provided access to the inlet zone is possible and include: • Desilting the inlet area with machinery or dredges • Desilting sediment basins of GPTs located upstream of the waterbody.	If the risk is deemed unacceptable and cannot be treated by management actions alone, management actions may include: • De-watering the waterbody and mechanically removing the sediments. • Managing the coarse sediment at its source (e.g. stabilizing upstream waterway). • Installing GPT or sediment basins at the inflow point to the waterbody • Creating maintenance access to the inflow zones or sediment capture systems. • Creating dewatering areas Note: An analysis of the sediment quality should be undertaken prior to removing sediments in order to determine the contamination level.	
B8 **Fine sediment or organic matter accumulation**	Fine or organic sediment accumulation on the bed of the waterbody system has a significant influence on waterbody function. Fine or organic sediment carries a large quantity of particulate nutrients. At the bed of the waterbody the sediment becomes anaerobic and these nutrients may be released in soluble form into the waterbody water column. Therefore, the fine organic sediment that accumulates on the base of waterbody can become a limitless source of nutrients to support algae blooms and weed growth.	It can be generally assumed that most waterbodies will have fine sediment accumulation. The question is how much accumulation. Discuss fine sediment accumulation with asset owner and engineering services to identify and document any issues. Complete site inspection to the waterbody to assess fine sediment accumulation. This will require collection of sediment cores using a simple grab sampler/corer and visual inspection. Sample testing may be considered but in most cases the accumulation of fine sediment will be obvious. The sediment assessment should be combined with water quality profiling for dissolved oxygen and redox to assess the state of the sediment (i.e. anoxic). Where fine sediment has accumulated the cause should be identified e.g.: • Untreated catchment runoff • Catchment land use or activities • Failure of WSUD systems within the catchment to adequately fine coarse sediments • Erosion of upstream waterways.	Where fine sediment accumulation is minor (say < 5cm) and the waterbody water quality is in relatively good condition, monitor waterbody water quality and health. No need to remove sediment.	Where fine sediment accumulation is significant (say > 5cm), anoxic and is the likely cause of poor water quality in the waterbody the management is required. Management options include: • Converting the waterbody to a wetland (if shallow enough) • Filling in the waterbody • Dewatering the waterbody, allowing to dry out and removing sediment. • Dredging or desilting the waterbody in wet conditions. • Sealing the fine sediments under a layer of flocculated layer of sediment (i.e. flocculent added to waterbody)	

Issue	Description	Investigations / monitoring	Minor or Immediate Response Management Actions[1]	Proactive Management Actions[2]	Relevant policy, legislation and supporting information
C. Water Quality					
C1 **Odours**	Odours that detract from public open space or are a nuisance for local residents. There are a number of reasons why odours may develop in waterbody systems (also refer to Issues A2 - A4 and C2 - C5 in this table).	Discuss with asset owner, engineering and environmental health departments to identify and document any current or historical issues. Undertake desk-top review and initial site inspection. Site inspections should be undertaken during early morning or low wind conditions to confirm presence of odour. Check the waterbody for possible sources of odour. This will include checking for: • Decomposing organic matter • Evidence of algal blooms (e.g. surface scums). • Anoxic sediments (surface bubbling, sulphur-based odours when the sediment is disturbed). • Chemical residues upon the water surface • Large populations of water birds • Chemical spillage (via the stormwater drainage system). • Cross-connections from the sewerage system, or cross-contamination from septic systems in rural areas. As indicated by the possible causes above, the presence of odour is almost always associated with other waterbody management issues. In most cases the presence of odour will be temporary and not a significant issue.	Where the odour issue is believed to be temporary or low-medium risk then no action is required. Where odour is believed to be permanent and high to very high risk then management will be required. In the interim the odour issues could be managed by: • Notifying residents of the issue • Erecting signage notifying people of the issue.	If the risk is deemed unacceptable, management actions may include: • Installation of mixers or aerators into the waterbody to increase dissolved oxygen levels (C7 and B3) • Removing organic matter and fine sediment (B8) • Removal or treatment of chemical contamination (A3) • Managing bird populations (A4) • Identifying and sealing sewerage cross connection (A4) • Rectifying the source of algal blooms (C2)	
C2 **Algal or cyanobacterial blooms**	Algal and / or Cyanobacterial blooms are indicators of poor water quality and aquatic health within a waterbody system. While most species of algae (e.g. green algae, flagellates and diatoms) are not dangerous to humans or animals, some may reduce aesthetic values through changes in water colour, odours and surface scums. The presence of persistent cyanobacterial / algal biomass may be due to a range of factors, including: • Untreated stormwater inflows. • Nutrient released from the sediments. • Excessive waterbody residence times • High internal carbon (organic) loading (i.e. resulting from decay of aquatic weeds such as Salvinia). • Low submerged or emergent macrophyte cover. • Excessive waterbird population. • Rapid variations in salinity	Discuss algal and cyanobacterial issues with asset owner, engineering and environmental health departments to identify and document any historical issues. Undertake desk-top review and site inspection. Further assessment is only required if persistent blooms are recorded and if the asset owner considers it necessary to obtain a more detailed understanding of waterbody processes to inform rectification. This may include: Monitoring for the following parameters:: • Chlorophyll-a, total phosphorous, soluble phosphorous, total nitrogen and nitrate-N. • Temperature, redox, salinity and DO depth profiles at a number of locations • Cyanobacterial identification and counts • Cyanobacterial toxin concentrations (i.e. where counts exceed the Red Alert level).	If cyanobacteria / algal risks are deemed unacceptable, a specialist should be consulted to develop a monitoring program and implement an adaptive management framework in accordance with DERM (2009), ANZECC (2018) and NH&MRC (2008). Management actions will be guided by monitoring outcomes but may include: • Installation of temporary protection (temporary fencing) to exclude public entry; • Erecting signage to highlight risk to public and that a response is being identified. • Community consultation • Treatment or adaptive management as required Immediate actions are not generally required for managing harmless algal blooms. However, long term management actions may be necessary to improve aesthetic values and aquatic habitat condition (refer to management actions).	The management actions will be resolved as part of the waterbody investigations. Potential management responses • the waterbody system as a wetland. • Installing recirculation systems for waterbody waters (wetland, sand filter, UV) to deplete algal biomass and nutrient loading within the waterbody. If cyanobacterial toxin concentrations exceed the primary contact recreation WQOs Powdered activated carbon (PAC) dosing may be required (note that specialist advice should be sought before this action is undertaken).	DERM (2009) *Queensland Water Quality Guidelines.* ANZECC (2018) *The Australian and New Zealand Guidelines for Fresh and Marine Water Quality – 2018 edition.* NH&MRC (2008) *Guidelines for managing risk in recreational waters.* DERM (2010a) *Environmental Protection (Water) Policy 2009 Burrum, Gregory, Isis, Cherwell and Elliott Rivers environmental values and water quality objectives Basin No. 137 (July 2010)* DERM (2010b) *Environmental Protection (Water) Policy 2009 - Mary River environmental values and water quality objectives. Basin No. 138, including all tributaries of the Mary River (July 2010)* Chorus and Bartram (1999). *Toxic cyanobacteria in water: A guide to their public health consequences, monitoring and management.*

Issue	Description	Investigations / monitoring	Minor or Immediate Response Management Actions[1]	Proactive Management Actions[2]	Relevant policy, legislation and supporting information
C3 **Persistent high turbidity levels.**	Excessive turbidity, total suspended solids (TSS) or total dissolved solids (TDS) can smother aquatic habitats and reduce sunlight infiltration, which may provide conditions favourable to increased algal production and invasive species (e.g. carp, tilapia etc) that are more tolerant to a range of water quality conditions.	Discuss with asset owner and engineering department to identify and document any current or historical issues. Undertake desk-top review and site inspection. Record turbidity levels in-situ using a water quality probe. Further monitoring during both wet and dry weather may be required if potential sediment sources are identified. If turbidity levels within the waterbody consistently exceed the relevant WQOs (1-20 NTU), for the protection of moderately disturbed freshwaters) in DERM 2010a or b, then further investigation may be required to determine the source/s of the high turbidity (e.g. development sites, stormwater inflows, sediment re-suspension etc) and to consider other catchment management solutions.	Treatment of persistent high turbidity levels will not normally require any ongoing management actions – refer to rectification	Management actions will be dictated by the field investigations and whether or not the risk is identified by the asset owner as acceptable. Management actions may include: • Establish and maintain healthy submerged and emergent macrophytes within the waterbody. • Establish and maintain healthy riparian vegetation on waterbody margins. • Repair areas of bank erosion (e.g. lining with geofabric) and revegetating using endemic species • Stormwater treatment within the upstream catchment. (e.g. providing additional sediment capture upstream of waterbody such as sediment basins). • Managing runoff from construction sites in accordance with State Planning Policy for Healthy Waters (DERM 2010c) and IECA Australasia (2008). • Replacing topsoil used within the waterbody (refer AS4419 2003). • Repairing areas of the waterbody where the clay liner has been exposed.	DERM (2010a) *Environmental Protection (Water) Policy 2009 Burrum, Gregory, Isis, Cherwell and Elliott Rivers environmental values and water quality objectives Basin No. 137 (July 2010)* DERM (2010b) *Environmental Protection (Water) Policy 2009 - Mary River environmental values and water quality objectives. Basin No. 138, including all tributaries of the Mary River (July 2010)* AS4419 (2003). *Soils for landscaping and garden use* DSDIP (2017) *State Planning Policy.* IECA Australasia (2008). *Best Practice Erosion and Sediment Control. November 2008.*
C4 **Stratification and low dissolved oxygen**	Water column stratification may be present due to a range of factors, including: • Excessive water depth (>2.5 m) – although stratification can occur in highly eutrophic waterbodies less than 1m deep. • High surface water temperatures. • Elevated salinity in freshwater waterbody systems. • Fresh water inflows to saline waterbodies. • Elevated organic carbon, nutrient and sediment loading. • Long detention times or lack of wind mixing. • Low or absent cover of submerged or emergent aquatic macrophytes. • Unsuitable waterbody configuration / orientation • The presence of inappropriate or multiple flow paths One of the major concerns associated with stratification is dissolved oxygen depletion. This may result in the release of dissolved (bioavailable) nutrients from the waterbody sediment which encourages algae and floating weed growth. Low dissolved oxygen concentrations are also a major cause of fish kills and sediment odour problems.	Discuss with asset owner, engineering and environmental health departments to identify and document any current or historical issues. Undertake desk-top review and initial site inspection. The asset owner may wish to undertake additional monitoring to determine the spatial extent and duration of stratification. This will involve regularly monitoring electrical conductivity, water temperature dissolved oxygen and Redox potential through the full water column at several locations throughout the waterbody system. (Note: as dissolved oxygen concentrations vary considerably throughout the day due to the processes of respiration and photosynthesis it is recommended that monitoring is undertaken at different times during the day.)	Persistent stratification will not normally require any ongoing management actions – refer to rectification	If the risk of persistent stratification is deemed unacceptable, management actions may include: • Installation of mixing systems (including aerators and water pumps). • Modification of waterbody bathymetry to increase hydraulic efficiency and wind forced mixing (e.g. infilling backwaters, moving inlet/outlet structures, targeting planting, removal of clumped vegetation to promote longer flow paths, removal of islands, dredging etc). • Installation of waterbody re-circulation systems to improve internal waterbody mixing. • Establishment and maintenance of healthy submerged and emergent macrophytes within the waterbody to facilitate nutrient uptake, reduce turbidity levels and reduce sediment oxygen consumption. • Establishment and management of healthy riparian vegetation on waterbody margins to improve shading and reduce sources of diffuse runoff. • Removal and / or treatment (e.g. Phoslock®) of the waterbody sediments (refer to 'Siltation' in this table). • Installation of stormwater treatment systems in the upstream catchment to remove pollutants before they enter the waterbody.	

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C5 **Variable salinity**	Brackish waterbodies and waterbodies which experience large variations in salinity should be avoided. For freshwater and saline waterbody systems, large fluctuations in salinity levels may provide conditions that are unfavourable for submerged macrophytes and favour undesirable vegetation (riparian or aquatic) and algae (particularly blue-green algae). Increased salinity within freshwater waterbodies may be due to: • Tidal intrusion of saline water into waterbody. • Ingress of saline groundwater to the waterbody. • Contamination from upstream land uses (e.g. industrial, agricultural etc.) via stormwater inflows or diffuse runoff For saline waterbodies (tidally flushed), decreased salinity may be due to: • Stormwater inflows or diffuse runoff to the waterbody. • Ingress of freshwater groundwater to the waterbody. • Often the inflow of freshwater into saline waterbodies is accompanied by increased nutrient loads.	Discuss with asset owner and engineering department to identify and document any current or historical issues. Undertake desk-top review and initial site inspection. Refer to Appendix G of the *Queensland Water Quality Guidelines* (DERM 2009) to determine acceptable variations in salinity. The asset owner may wish to undertake additional site surveys and /or Implement a monitoring program including monitoring electrical conductivity both after rain and during long dry periods to observe changes in salinity. For freshwater waterbodies, electrical conductivity levels of >1500 µS/cm pose an immediate risk to aquatic plants. For saline waterbodies, the risk of cyanobacterial blooms increases where electrical conductivity is <10 000 µS/cm Refer to DesignFlow 2010 for guidance on additional investigations to determine the source of the saline / freshwater intrusion.	Variable salinity will not normally require any ongoing management actions – refer to rectification	If the risk of variable salinity levels is deemed unacceptable, management actions may include: <u>Freshwater waterbodies</u> If observations during large tide events and salinity monitoring confirm tidal backwatering into the waterbody, consider: • Raising the water level within the waterbody so that saline water cannot enter through the waterbody outlet. This will require modifying the configuration of the outlet structure. • Installing a flap gate on the outlet pipe to the downstream saline environment. • Raising bund levels to prevent tidal backwatering If saline groundwater intrusion is evident within the waterbody and impacts on vegetation health are obvious, it may be necessary to replace or repair the waterbody liner. Alternative options include • Trenching along the waterbody batter and placing a clay or bentonite barrier across the groundwater intrusion site. • Replanting the waterbody with saline or brackish tolerant plant species. (Note: there is an increased risk of mosquitoes in saline / brackish waters which will need to be monitored). Refer to mosquitoes in this table. If other catchment sources are suspected, contact DERM to investigate potential sources of contamination. <u>Saline (tidal) waterbodies</u> If observations during rainfall events and salinity monitoring confirm freshwater inflows and lack of tidal flushing is occurring, consider: • Diverting stormwater flows around waterbody • Converting to a freshwater waterbody • Increasing tidal flushing or removing any blockages • Groundwater management as per above	DERM (2009). *Queensland Water Quality Guidelines: Appendix G: Salinity guidelines (expressed in conductivity units) for Queensland freshwaters.* ANZECC (2018) *The Australian and New Zealand Guidelines for Fresh and Marine Water Quality – 2018 edition.* DesignFlow (2010). *Townsville Constructed Lakes Guideline.*
C6 **Litter**	The presence of excessive amounts of litter reduces the amenity of the waterbody and can increase public health risk by harbouring mosquitoes.	Discuss with asset owner, engineering and environmental health departments to identify and document any current or historical issues. Undertake desk-top review and initial site inspection. Check for possible sources of litter. This will include checking for: • Catchment runoff from commercial or industrial zones • Failure of a gross pollutant traps • Direct dumping of litter in adjacent parkland areas • Overflowing or un-managed bins	Where risk is medium then litter removal should occur on a scheduled or reactive basis. If gross pollutant traps or trash racks exists then commence maintenance on this system as required.	If the risk is deemed unacceptable management actions may include: • Retrofitting the upstream drainage system with litter controls, e.g. a gross pollutant trap or a trash rack • Incorporating a trash rack with easy access to the inlet zone of the waterbody • Providing litter disposal bins in the adjacent public open space • Creating access to the zones in the waterbody where litter tends to accumulate for litter collection. This will typically be at the downwind of the waterbody along the line of prevailing winds. • Undertaking an education campaign within the catchment on litter and its impact on downstream ecosystems.	

Issue	Description	Investigations / monitoring	Minor or Immediate Response Management Actions[1]	Proactive Management Actions[2]	Relevant policy, legislation and supporting information
D. Aquatic Habitat					
D1 **Aquatic weeds**	The persistence of aquatic weeds within the waterbody may be due to: • Uncontrolled weed infestations in the upstream catchment. • Excess sediment accumulation within waterbody. • High nutrient concentrations present within the waterbody • Vegetation failure allowing weeds to colonise. • Accidental or illegal introduction (e.g. ornamental pond or aquarium species, such as Salvinia) • Presence of vectors, e.g. birds. • Lack of maintenance.	Discuss aquatic weed issues with asset owner, engineering and environmental health departments to identify and document any issues. Complete a site inspection to determine presence of / proportion, species etc. Seek advice from a weed specialist for long term weed removal or control strategies. This will require: • Confirming the weed species present • Identifying the cause/s of the weed infestation • Considering the biological characteristics of the weed species • Determining long term weed management options	The control of declared weeds is mandated under the *Land Protection (Pest & Stock Route Management) Act 2002*. Therefore, these weeds must be dealt with as part of the regular maintenance schedule. Refer to *Maintaining WSUD Assets* for general advice about managing weeds. Management actions may include • Regular harvesting using aquatic weed harvester • Chemical control (Note: Seek advice from weed specialist if chemical control is being considered. The potential impacts of chemical herbicides on the waterbody ecosystem should be considered. • Biological control agents, such as the Salvinia weevil (*Cyrtobagous salviniae*) and water hyacinth weevil (*Necochetina eichorniae*) (Note: specialist advice should be sought *from the CSIRO divisio*n of entomology).	If the risk is deemed unacceptable and the aquatic weed infestation cannot be controlled by management alone, management actions include: • Completely removing the weed species using control methods listed in *Maintaining WSUD Assets*. • Draining and drying out the waterbody in order to desiccate the weed species. Obtain specialist advice about the required drying out period. • Preventing the future ingress of weeds by planting the edges of the waterbody with plant species that provide dense cover and shade. • Establishment and maintenance of healthy submerged and emergent macrophytes within the waterbody. • Establishment and management of healthy riparian vegetation on waterbody margins to improve shading and reduce sources of diffuse runoff. Generally a combination of the above actions is required to manage and / or eradicate infestations.	*Land Protection (Pest & Stock Route Management) Act 2002*. Water by Design (2011) *Maintaining WSUD Assets*. Refer to Biosecurity Queensland: DPI website (http://www.dpi.qld.gov.au), including: • *Guideline for the management of Salvinia* • *Guideline for the management of water lettuce* • *Guideline for the management of water hyacinth* Refer to weeds of national significance (WONS) http://www.weeds.gov.au/weeds/lists/wons.html FCRC (2017) *Fraser Coast Regional Council Biosecurity Surveillance Program for Prohibited and Restricted matter 2017 - 2021*
D2 **Presence of aquatic pests (e.g. exotic fish species)**	Exotic fish species (e.g. European carp, tilapia, mosquitofish, goldfish etc.) are generally able to tolerate a wide range of water quality and environmental conditions, and so have a competitive advantage over native fish species. Exotic fish can also contribute to the further deterioration of water quality through sediment re-suspension (bottom feeders), habitat destruction/fragmentation and increased internal loading of nutrients.	Discuss with asset owner, engineering and environmental health departments to identify and document any current or historical issues. Undertake desk-top review and initial site inspection. The asset owner may wish to undertake a fish survey to determine the proportion of native and exotic fish species, biomass and size distribution present. (Note: The capture, removal or destruction of fish is governed by strict ethical considerations and should only be undertaken by qualified staff, in accordance NH&MRC (2004) and with relevant permits obtained from the Queensland Department of Primary Industries and Fisheries).	The presence of exotic fish species will not normally require any ongoing management actions – refer to rectification	If the risk is deemed unacceptable management actions to reduce/eliminate the invasion of exotic fish species may include: • Trapping and removal of pest species in accordance with NH&MRC (2004). • Improving aquatic habitat conditions to encourage recruitment and breeding of native species. This may include the establishment and maintenance of healthy submerged and emergent macrophytes, installation of artificial habitat structures, introducing large woody debris (LWD/re-snagging) etc. • Establishing and maintaining healthy riparian vegetation. • Implementing a native fish stocking program. • Improving hydraulic connectivity of on-river waterbodies (where possible) by modifying/replacing existing inlet/outlet structures to provide for suitable upstream passage of native fish and other aquatic organisms. • Improving water quality conditions.	Refer to DAF Website: https://www.daf.qld.gov.au/business-priorities/fisheries/habitats FCRC (2017) *Fraser Coast Regional Council Biosecurity Surveillance Program for Prohibited and Restricted matter 2017 - 2021*

Issue	Description	Investigations / monitoring	Minor or Immediate Response Management Actions[1]	Proactive Management Actions[2]	Relevant policy, legislation and supporting information
E. Terrestrial Habitat					
E1 **Terrestrial weeds**	The persistence of terrestrial along waterbody edges or adjacent to the waterbody may be due to: • Uncontrolled weed infestations in the upstream catchment. • Discontinuous or fragmented perimeter vegetation • Vegetation failure allowing weeds to colonise. • Accidental or illegal introduction • Presence of vectors, e.g. birds. • Lack of maintenance. • Contaminated fill and mulch (on batters)	Discuss terrestrial weed issues with asset owner, engineering and environmental health departments to identify and document any issues. Complete a site inspection to determine presence of / proportion, species etc. Seek advice from a weed specialist for long term weed removal or control strategies. This will require: • Confirming the weed species present • Identifying the cause/s of the weed infestation • Considering the biological characteristics of the weed species • Determining long term weed management options	The control of declared weeds is mandated under the *Land Protection (Pest & Stock Route Management) Act 2002*. Therefore, these weeds must be dealt with as part of the regular maintenance schedule. Refer to *Maintaining WSUD Assets* for general advice about managing weeds. Management actions include: • Chemical control (Note: Seek advice from weed specialist if chemical control is being considered. The potential impacts of chemical herbicides on the waterbody ecosystem should be considered). • Regular inspection and application of clean mulch around waterbody perimeters	If the risk is deemed unacceptable and the aquatic weed infestation cannot be controlled by management alone, management actions include: • Completely removing the weed species using control methods listed in *Maintaining WSUD Assets*. • Establishment and management of healthy riparian vegetation on waterbody margins Generally a combination of the above actions is required to manage and / or eradicate infestations	*Land Protection (Pest & Stock Route Management) Act 2002.* Water by Design (2011) *Maintaining WSUD Assets.* Refer to weeds of national significance (WONS) http://www.weeds.gov.au/weeds/lists/wons.html FCRC (2017) *Fraser Coast Regional Council Biosecurity Surveillance Program for Prohibited and Restricted matter 2017 - 2021*
F. Maintenance					
F1 **Access for maintenance**	Poor access for maintenance of hydraulic structures, removal of sediment from inlet areas and pump infrastructure can result in deterioration of the system Ideally maintenance access should be following locations: • Stormwater inflows to waterbody for sediment desilting. • Edge of waterbody for weed harvesting or to launch boat. • Hydraulic controls • Around the broad perimeter of the waterbody of riparian weed management.	Discuss maintenance access allowance with asset owner, maintenance and engineering services to identify and document any issues. Complete site inspection to identify existing maintenance allowance and obvious access problems.	Provided the maintenance access is constructed from suitable materials (i.e. gravel, concrete or reinforced vegetation), then maintenance will be minimal and based on inspections. Maintenance may involve weeding and filling of wheel ruts.	Where maintenance access is deficient installation of access will be required. The nature of access for different maintenance activities should be discussed with the asset owner. Management actions may include: • Provision of maintenance access for vehicles, boats and weed harvesters (e.g. ramps for sediment removal, tracks for access to structures etc) • Provision of work areas for sediment drying, maintenance of hydraulic structures and erosion/scour • Installation of access tracks • Provision of Sediment drying area/s	*Maintaining WSUD Assets* (Water by Design, 2012)