Environmental Protection (Water and Wetland Biodiversity) Policy 2019

Condamine River Basin

Environmental Values and Water Quality Objectives

Part of Basin 422, including all surface waters of the Condamine River Basin

Queensland Government

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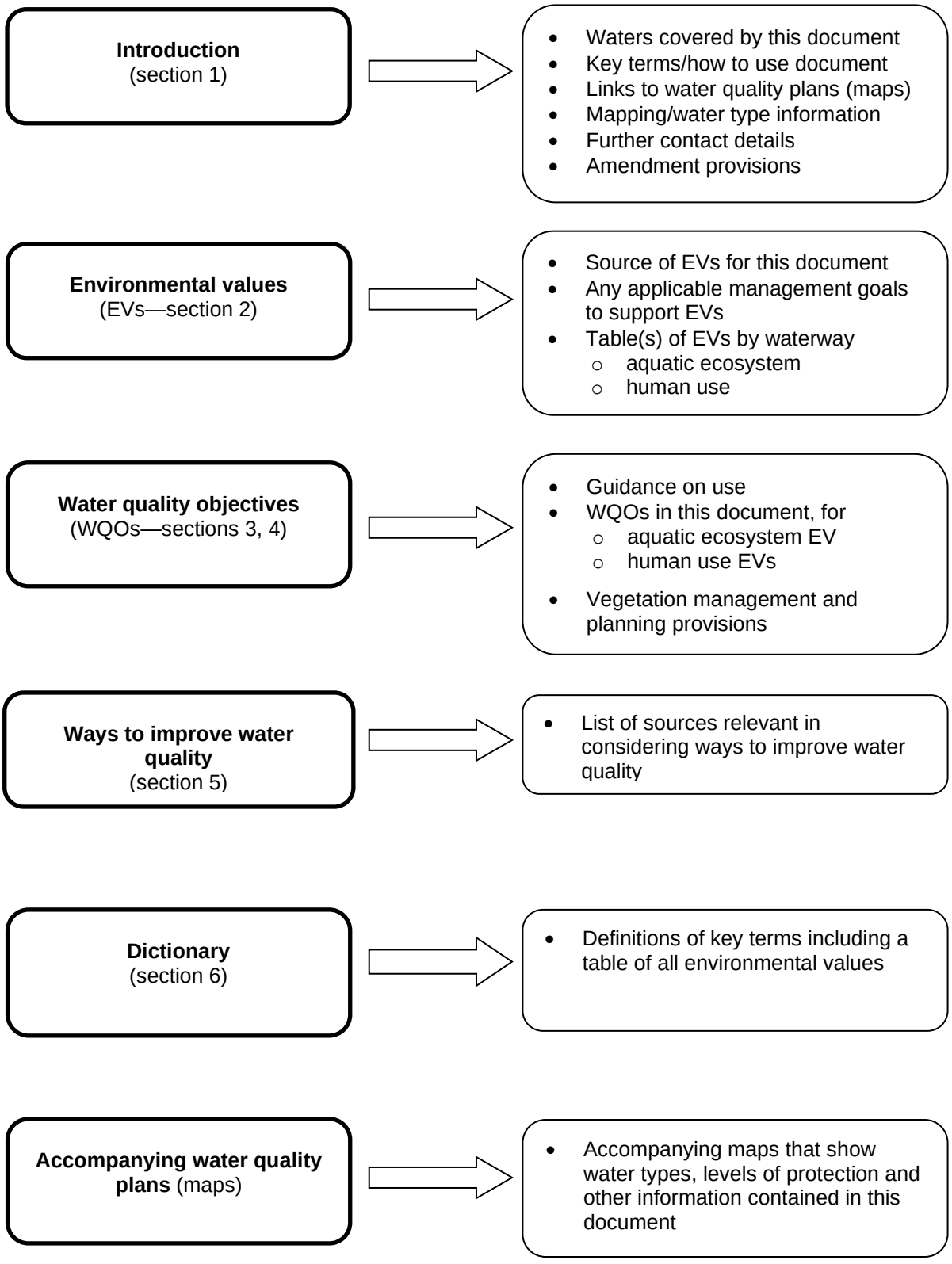
October 2020

Main parts of this document and what they contain



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1 Introduction

This document is made pursuant to the provisions of the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP [*Water and Wetland Biodiversity*]), which is subordinate legislation under the *Environmental Protection Act 1994*. The EPP (Water and Wetland Biodiversity) provides a framework for:

- identifying environmental values (EVs) for Queensland waters and wetlands
- identifying management goals for waters
- stating water quality objectives (WQOs) to protect or enhance EVs for waters (WQOs are long-term goals for receiving waters, not individual point source emission objectives.)
- including the identified EVs, management goals and WQOs for waters under Schedule 1 of the EPP (Water and Wetland Biodiversity).

This document contains EVs and WQOs for surface waters of the Condamine River Basin and is listed under schedule 1 of the EPP (Water and Wetland Biodiversity). For information on wetland EVs, refer to Section 7 of the EPP (Water and Wetland Biodiversity).

1.1 Purpose

The purpose of this document is to identify locally relevant environmental values (EVs) and water quality objectives (WQOs) for surface waters in the Condamine River Basin. EVs and WQOs are used to help set development conditions, influence local government planning schemes, and underpin report card grades for ecosystem health monitoring programs. Aquatic ecosystem water quality objectives have, where possible, been established using local data, and present a truer picture of the values and water quality of local waterways than national and state water quality guidelines. This ensures the values the community holds for its waterways can be maintained and improved, without imposing unrealistic standards from national guidelines that may be inappropriate for local conditions.

1.2 Queensland waters to which this document applies

This document applies to surface waters of the Condamine River Basin (part of basin 422[1]) as indicated in the accompanying plan (WQ4223—Condamine River Basin)[2].

Queensland waters covered by this document include:

- all Condamine River Basin surface waters, including the Condamine River and all tributaries
- wetlands, lakes and reservoirs

EVs and WQOs for groundwaters within this basin are contained in a separate EPP (Water and Wetland Biodiversity) schedule document: *Queensland Murray-Darling and Bulloo River Basins – Groundwater Environmental Values and Water Quality Objectives* published on the department's website.

1.3 Water Quality under the Basin Plan

The Basin Plan, prepared by the Murray-Darling Basin Authority under the Commonwealth *Water Act 2007*, was approved in November 2012. The Basin Plan provides a coordinated approach to water use across the State and Territory government areas that intersect the Murray-Darling Basin (specifically Queensland, New South Wales, Victoria, South Australia and the Australian Capital Territory).

In Queensland, Healthy Waters Management Plans (HWMPs) prepared under the EPP (Water and Wetland Biodiversity) contribute to meeting the requirements of a Water Quality Management Plan (WQM Plan) under Chapter 10, Part 7 of the Basin Plan. The HWMPs for the Queensland Murray-Darling Basin can be found on the

[1] Australia's River Basins 1997—Product User Guide. Published by Geoscience Australia. Canberra, ACT (3rd edition, 2004).

[2] This document and the accompanying plan are available from the department's website. The boundaries in the accompanying plan WQ4223 are indicative only. EVs, water types and aquatic ecosystem management intent (level of protection) depicted in the accompanying plans are stored in electronic form as part of the Queensland Environmental Values Schedule 1 Geodatabase, and held at the department's offices at 400 George Street Brisbane. Spatial (GIS) datasets can be downloaded free of charge from the Queensland Spatial Catalogue (QSpatial) at http://qldspatial.information.qld.gov.au/catalogue/custom/index.page. For further information, email the department at epa.ev@des.qld.gov.au.

department's website.

The EVs and WQOs stated in this document are based on the information included in the HWMP for the Condamine River Basin. Contents of this document have been updated where necessary to reflect the most up-to-date information. For example, aquaculture water quality objectives have been updated in collaboration with the Department of Agriculture and Fisheries to include objectives based on best available knowledge.

1.4 Guidance on using this document

1.4.1 Key terms (refer to dictionary for additional terms)

ADWG means the Australian Drinking Water Guidelines (2011, as amended), available on the National Health and Medical Research Council (NHMRC) website.

ANZG (Previously ANZECC) means the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018, as amended), available from the Australian Government's Water Quality Australia website.

Environmental values (EVs) for water means the EVs specified in EVs tables of this document for the corresponding water. EVs for water are the qualities of water that make it suitable for supporting aquatic ecosystems and human water uses. These EVs need to be protected from the effects of habitat alteration, waste releases, contaminated runoff and changed flows to ensure healthy aquatic ecosystems and waterways that are safe for community use. Particular waters may have different EVs. A range of EVs that can potentially apply to all surface waters are listed below, and further details are provided in the dictionary.

List of EVs

Environmental value (EV)
Protection of aquatic ecosystems (aquatic ecosystem EV) Protection or enhancement of aquatic ecosystem values, under four possible levels of ecosystem conditions: • high ecological value (effectively unmodified) waters • slightly disturbed waters • moderately disturbed waters • highly disturbed waters. (Suitability for wildlife habitat has also been specifically identified for some Queensland waters as a component of this EV).
EVs other than aquatic ecosystem EV (called human use EVs) Suitability for drinking water supplies Suitability for primary contact recreation (e.g. swimming) Suitability for secondary contact recreation (e.g. boating) Suitability for visual (no contact) recreation Suitability for human consumers of wild or stocked fish, shellfish or crustaceans (suitability for oystering has also been specifically identified for some Queensland waters) Protection of cultural and spiritual values, including Traditional Owner values of water Suitability for industrial use (including mining, minerals refining/processing) Suitability for aquaculture (e.g. red claw, barramundi) Suitability for crop irrigation Suitability for stock watering Suitability for farm supply/use

Level of protection for a water (aquatic ecosystem EV) means the level of aquatic ecosystem condition specified for waters in the Aquatic Ecosystem water quality objectives tables of this document that the corresponding WQOs for that water are intended to achieve (refer to management intent definition below for further information).

Management goal means the goal/s (if any) stated in this document to support the EVs for waters identified in the

EVs tables.

Management intent for a water (aquatic ecosystem EV) is defined in s.15 of the EPP (Water and Wetland Biodiversity). It is the management intent for the waters that the decision to release waste water or contaminant to waters must ensure that:

- for high ecological value (HEV) waters—the measures for the indicators are maintained;
- for slightly disturbed (SD) waters—the measures for the slightly modified physical or chemical indicators are progressively improved to achieve the water quality objectives for high ecological value water;
- for moderately disturbed (MD) waters:
  - if the measures for indicators of the EVs achieve the water quality objectives for the water—the measures for the indicators are maintained at levels that achieve the water quality objectives for the water, or
  - if the measures for indicators of the EVs do not achieve the water quality objectives for the water—the measures for indicators are improved to achieve the water quality objectives for the water;
- for highly disturbed (HD) waters—the measures for the indicators of all environmental values are progressively improved to achieve the water quality objectives for the water.

QWQG means the Queensland Water Quality Guidelines.

Water quality guidelines (defined in the EPP (Water and Wetland Biodiversity)) are numerical concentration levels or statements for indicators that protect a stated environmental value. Under the EVs setting process contained in the EPP (Water and Wetland Biodiversity), water quality guidelines are used as an input to the development of WQOs.

Water quality indicator (for an EV) means a property that is able to be measured or decided in a quantitative way. Examples of water quality indicators include physical indicators (e.g. temperature), chemical indicators (e.g. nitrogen, phosphorus, metals), and biological indicators (e.g. macroinvertebrates, seagrass, fish).

Water quality objectives (WQOs) means the WQOs specified in Table 3 and Table 4 of this document to support the corresponding EVs for waters identified in Table 2.

WQOs are long-term goals for water quality management. They are numerical concentration levels or narrative statements of indicators established for receiving waters to support and protect the designated EVs for those waters. Water quality objectives are not individual point source emission objectives, but the receiving water quality objectives.

They are based on scientific criteria or water quality guidelines but may be modified by other inputs (e.g. social, cultural, economic).

Examples of WQOs for the aquatic ecosystem EV include:

- total phosphorus concentration less than 70 micrograms per litre (µg/L)
- chlorophyll *a* concentration less than 9 µg/L
- dissolved oxygen between 60 per cent and 110 per cent saturation
- occurrence frequency of carp observed across the main river less than 0.65

Water type means groupings of waters with similar characteristics, as shown in the accompanying plans. Water types can include fresh waters, lakes/reservoirs, wetlands and groundwaters. WQOs applying to different water types are outlined in this document.

1.4.2 Use of this document

Section 2 lists the identified EVs for protection for particular waters. The aquatic ecosystem EV is a default applying to all Queensland waters. Reference to tables in sections 3–4 provides the corresponding WQOs to protect the aquatic ecosystem EV, and human use EVs.

Where more than one EV applies to a given water, the adoption of the most stringent WQO for the identified EVs applies to each water quality indicator in order to protect all identified EVs.

This document also refers to a number of guidelines, codes and other reference sources on water quality. In particular, the QWQG also provide more detailed information on water types, water quality indicators, derivation of local water quality guidelines, application during flood events, monitoring, and other matters.

1.5 Information about mapped areas and boundaries

The boundaries in the accompanying plan WQ4223 is indicative only. EVs, water types and aquatic ecosystem management intent (level of protection) depicted in the accompanying plan are stored in electronic form as part of the Queensland Environmental Values Schedule 1 Geodatabase, and held at the department's offices at 400 George Street Brisbane. Spatial (GIS) datasets can be downloaded free of charge from the Queensland Spatial Catalogue (QSpatial) at http://qldspatial.information.qld.gov.au/catalogue/custom/index.page. For further information, email the department at epa.ev@des.qld.gov.au.

1.6 Water types and basis for boundaries

1.6.1 Water types

The water types for the Condamine River Basin are displayed in plan WQ4223 and Table 1 below.

The following descriptions of water types in the Condamine River Basin are based on the Healthy Waters Management Plan for Condamine River Basin informed by expert opinion from the Water Quality Technical Panel.

Table 1 Description of water types for surface waters shown on plan WQ4223

Water type	Description
Central Condamine catchment waters	This water type includes the main agricultural areas of the Condamine floodplain from the eastern bank of the Condamine River (and between the River and the North Branch). The nature of the waterways and the anthropogenic impacts across this area are sufficiently similar to aggregate the land areas from Kings Creek to Cooranga Creek, with the exception of the Oakey Creek and Toowoomba area.
Dogwood Creek catchment waters	Dogwood Creek extends over the Maranoa-Balonne Rivers Basin and follows the Queensland Government sub-catchment boundary layer.
Emu Creek catchment waters	Emu Creek was separated from South-Eastern catchment waters due to a difference in ionic composition under low flow conditions.
Kumbarilla Ridge catchment waters	The boundaries of this water type are defined by the extent of the sandstone ridge. The differing geology and slope of this land area to adjacent land areas results in a different chemical signature of these waters.
Lake Leslie (Leslie dam) waters	The boundaries of this water type are defined by the extent of the dam's full supply level. The lentic ecosystem of a reservoir results in different physicochemical conditions of the water.
Lower Condamine Floodplain catchment waters (waterway only)	This includes all main channel water, and excludes the tributaries, which are unlikely to contain the same characteristics that are so heavily influenced by the upstream anthropogenic impacts. The Lower Condamine was split from the Middle Condamine due to differences in electrical conductivity between the two waters.
Lower Condamine River catchment waters (waterway only)	Floodplain waters off-stream of the Lower Balonne River have different water chemistry from the main river.
Middle Condamine River catchment waters (waterway only)	This includes all main channel water, and excludes the tributaries, which are unlikely to contain the same characteristics that are so heavily influenced by the upstream anthropogenic impacts. The Middle Condamine was split from the Lower Condamine due to differences in electrical conductivity between the two waters.
Murilla Creek catchment waters	Tributary systems have differing water chemistry to that of trunk streams. This water type includes similar landscapes to Bungil Creek, draining to the south, and Noona Creek draining to the west.

Water type	Description
North-Western Condamine catchment waters	This area includes Barakula and other state forest areas and the higher quality wetland areas of the Pelican Lagoons and the Gilgai wetlands of Charlies Creek. This area contains significant remnant areas with lower anthropogenic impacts and similar geology and chemistry.
Oakey Creek catchment waters	Trunk streams have differing water chemistry from that of tributaries and floodplains. These catchment waters are also heavily influenced by the adjacent land use (sewage treatment plant, urban)
Southern Condamine catchment waters	This area includes the granite and traprock landscapes of the upper Condamine. The boundary line has defined as between Clifton and Allora to account for the differences found in the landscapes between the two and the changing nature and intensification of the land use between these two sub-catchment areas.
South-Eastern catchment waters	Tributary systems have differing water chemistry from that of trunk streams.
Undulla Creek catchment waters	Tributary systems have differing water chemistry from that of trunk streams.
Upper Condamine River catchment waters (waterway only)	This includes all main channel water, and excludes the tributaries, which are unlikely to contain the same characteristics that are so heavily influenced by the upstream anthropogenic impacts. The Upper Condamine was split from the Middle Condamine due to differences in electrical conductivity between the two waters.

1.6.2 Water type boundaries

The boundaries of different water types have been mapped using a variety of attributes, including:

- geographic coordinates
- catchment or subcatchment boundaries
- surveyed terrestrial boundaries
- altitude
- boundaries based on technical investigations.

Boundaries are shown on the accompanying plan. The boundaries of water types may be confirmed or revised by site investigations.

1.7 Matters for amendment

Amendments of the following type may be made to this schedule 1 document (and accompanying plan) for the purposes of replacement under section 13(2)(b) of the EPP (Water and Wetland Biodiversity):

- changes to EVs
- changes to management goals
- changes to WQOs
- changes to management intent (level of protection) categories
- changes to waterway or water type boundaries/descriptions
- updates to information/data sources, websites and email contact details, agency/departmental names, other institutional names, references.

ENVIRONMENTAL VALUES
&
MANAGEMENT GOALS

2 Environmental values and management goals

2.1 Environmental values

Table 2 and the accompanying plan WQ4223 outline the EVs for waters in the Condamine River Basin.

The dictionary to this document provides further explanation of EVs (refer section 6)

Table 2 Environmental values: Condamine River Basin surface waters

Condamine River Basin	Environmental Values[1–5]											
	Aquatic ecosystems	Irrigation	Farm supply/use	Stock water	Aquaculture	Human consumer	Primary recreation	Secondary recreation	Visual recreation	Drinking water	Industrial use	Cultural, spiritual and ceremonial values
Water												
SURFACE FRESH WATERS (rivers, creeks, streams) (refer to plan WQ4223)												
Ashall Creek	✓	✓	✓	✓	✓				✓		✓	✓
Bowen Camp and Bogrambilla Creeks	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓
Braemar and Kogan Creeks	✓	✓	✓	✓					✓	✓	✓	✓
Central Condamine River	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Condamine River North Branch	✓	✓	✓						✓	✓	✓	✓
Condamine River North	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Condamine River South Branch	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓
Condamine River South	✓	✓	✓	✓		✓	✓		✓			✓
Cooby Creek Reservoir (Cooby Dam)	✓		✓			✓		✓	✓	✓	✓	✓
Dalrymple and Glengallan Creeks	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓

Condamine River Basin	Environmental Values[1–5]											
	Aquatic ecosystems	Irrigation	Farm supply/use	Stock water	Aquaculture	Human consumer	Primary recreation	Secondary recreation	Visual recreation	Drinking water	Industrial use	Cultural, spiritual and ceremonial values
Water												
Headwaters	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓
Hodgson Creek	✓	✓	✓	✓		✓			✓			✓
Jandowae and Upper Charleys Creeks	✓	✓	✓	✓		✓			✓	✓	✓	✓
Jimbour Creek	✓	✓	✓	✓					✓	✓		✓
Kings Creek	✓	✓	✓	✓		✓			✓	✓	✓	✓
Lake Broadwater	✓		✓				✓	✓	✓			✓
Lake Leslie (Leslie Dam)	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Lower Condamine River	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓
Murilla Creek	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Sandy Creek	✓	✓	✓	✓					✓			✓
Six Mile Creek and Thane Creek	✓	✓		✓		✓			✓	✓	✓	✓

Condamine River Basin	Environmental Values[1–5]											
	Aquatic ecosystems	Irrigation	Farm supply/use	Stock water	Aquaculture	Human consumer	Primary recreation	Secondary recreation	Visual recreation	Drinking water	Industrial use	Cultural, spiritual and ceremonial values
Water												
Undulla Creek	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓
Upper Myall Creek	✓	✓	✓	✓		✓			✓			✓
Upper Oakey	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wieambilla and Wambo Creeks	✓	✓	✓	✓	✓	✓			✓		✓	✓
Wilkie Creek	✓	✓	✓	✓					✓		✓	✓

Adapted from: DES 2019. Healthy Waters Management Plan: Condamine River Basin. Brisbane: Department of Environment and Science, Queensland Government.

Notes:

1. Refer to the accompanying plan WQ4223 for locations of EVs.
2. ✓ means the environmental value is selected for protection. Blank indicates that the environmental value is not selected for protection.
3. Refer to dictionary for further explanation of EVs.
4. Refer to Sections 3 and 4 for WQOs applying to the EVs in this table.
5. The selection of human use EVs for waters does not mean that these waters are free of dangerous aquatic organisms. Direct contact with dangerous aquatic organisms should be avoided. Access restrictions may apply in certain locations (e.g. defence, Traditional Owner lands), or at certain times of the year. Restrictions on certain activities (e.g. fishing, camping) may also apply in particular areas. Check with relevant authorities.
6. The selection of EVs for waters does not mean that these waters are currently free of toxicants (including bio accumulative toxicants). Information about contaminated land can be accessed by searching the Environmental Management and Contaminated Land Registers. For information on per and poly-fluoroalkyl substances (PFAS), including alert areas and links to further health advice on water use in such areas, refer to PFAS in Queensland.

2.2 Management intent for waters

It is the management intent for Queensland waters that the decision to release wastewater or contaminant to waters must ensure the following:

- for high ecological value (HEV) waters—the measures for the indicators are maintained
- for slightly disturbed (SD) waters—the measures for the slightly modified physical or chemical indicators are progressively improved to achieve the water quality objectives for high ecological value water
- for moderately disturbed (MD) waters:
    - if the measures for indicators of the EVs achieve the water quality objectives for the water—the measures for the indicators are maintained at levels that achieve the water quality objectives for the water, or
    - if the measures for indicators of the EVs do not achieve the water quality objectives for the water—the measures for indicators are improved to achieve the water quality objectives for the water
- for highly disturbed (HD) waters—the measures for the indicators of all environmental values are progressively improved to achieve the water quality objectives for the water.

Note 1 — refer to accompanying plan for locations of waters and level of protection/management intent

Note 2 — see the Environmental Protection Regulation 2019, section 35.

Note 3 — see the EPP (Water and Wetland Biodiversity), section 15.

2.3 Management goals for Murray-Darling Basin water resources (whole system)

The following goals apply to the Condamine River Basin waters due to their connectivity with the Murray-Darling Basin system.

2.3.1 Management goals to contribute to the achievement of the Murray-Darling Basin Plan

The relevant goals for water quality are:

a) to give effect to relevant international agreements through the integrated management of Basin water resources
b) to establish a sustainable and long-term adaptive management framework for Basin water resources, that takes into account the broader management of natural resources in the Murray-Darling Basin
c) to optimise social, economic and environmental outcomes arising from the use of water resources.

(Reflects Basin Plan Section 5.02, 1a-c)

The outcome for the Basin Plan as a whole is a healthy and working Murray-Darling Basin that includes:

a) communities with sufficient and reliable water supplies that are fit for a range of intended purposes, including domestic, recreational and cultural use; and
b) productive and resilient water-dependent industries, and communities with confidence in their long-term future; and
c) healthy and resilient ecosystems with rivers and creeks regularly connected to their floodplains and ultimately, the ocean.

(Reflects Basin Plan Section 5.02, 2a-c)

2.3.2 Management goals in relation to environmental outcomes

The goals in relation to environmental outcomes are, within the context of a working Murray-Darling Basin:

a) to maintain or improve water-dependent ecosystems of the Murray-Darling Basin; and
b) to maintain or improve the ecosystem functions of water-dependent ecosystems; and
c) to ensure that water-dependent ecosystems are resilient to climate change and other risks and threats.

(Reflects Basin Plan Section 5.03, 1a-c)

The outcome in relation to objectives (a) to (c) is the restoration and protection of water-dependent ecosystems and ecosystem functions in the Murray-Darling Basin with strengthened resilience to a changing climate.

(Reflects Basin Plan Section 5.03, 2)

2.3.3 Management goals in relation to water quality and salinity

In the Condamine River Basin:

1. To maintain or improve the water quality objectives for the waters, including salinity levels, for environmental, social, cultural, and economic activity.
2. That water resources remain fit for purpose. (Reflects Basin Plan Section 5.04, 1-2)
3. If the value of a water quality indicator (for example, salinity, nutrients, pesticides, pH, turbidity) is at a level that is better than its water quality objective for a water type, the management goal is to maintain that level.
4. The management goal in relation to managing water flows for dissolved oxygen is to maintain dissolved oxygen at a target value of at least 60% saturation.

2.4 Management goals for the Condamine River Basin

The following goals apply to the Condamine River Basin.

2.4.1 Aquatic Ecosystem Environmental Value

Water Quality Objectives to support the management goals are located in Table 3 to Table 8.

2.4.1.1 Management goals for freshwater macroinvertebrates

The management goal for freshwater macroinvertebrates is to maintain or improve the freshwater macroinvertebrates salinity index, taxa richness, stream invertebrate grade number average level (SIGNAL) index and percentage of tolerant taxa within the current ranges.

2.4.1.2 Management goal for freshwater fish

The management goals for freshwater fish are to:

1. maintain or improve occurrence frequency of native species; and
2. maintain or decrease occurrence frequency of non-native species.

WQOs to support these management goals are located in Table 6 to Table 8.

2.4.1.3 Water quality for declared Ramsar wetlands

The Condamine River Basin does not contain any Ramsar wetlands at time of print.

In Ramsar wetlands of international significance, the management goal is that the quality of water is sufficient to maintain the ecological character of the wetlands.

(Reflects Basin Plan Section 9.04, 1)

2.4.1.4 Wetlands other than declared Ramsar wetlands

The management goal is that the quality of water is sufficient:

a) to maintain or improve the ecosystems; and
b) to maintain or improve the ecosystem functions of the ecosystems; and
c) to ensure that the ecosystems are resilient to climate change and other risks and threats.

(Reflects Basin Plan Section 9.04, 2a-c)

2.4.1.5 Management goal for wetland extent

The management goal for wetland extent is no reduction in the extent of natural wetlands (palustrine, lacustrine and riverine) from 2013 baseline levels. Management Goals for Human Use Environmental Values.

WQOs to support the following management goals are located in Table 10.

2.4.1.6 Management goals for ground cover

a) No net increase in seasonally adjusted bare ground across each WQ type zone.
b) No net increase in seasonally adjusted bare ground across each WQ type zone in areas of greater than 1% slope (where no soil conservation plans in place).
c) For cropping lands with greater than 1% slope there is increased area of coordinated runoff/soil

conservation plans.

d) No net increase in seasonally adjusted bare ground across each WQ type zone in areas proximate to watercourses.

2.4.1.7 Management goal for riparian canopy cover

The management goal is that there be no decrease in canopy cover in riparian zones for each water quality type zone. Measures to be established using FPC measures at progressive times within a common riparian buffered spatial area for each water quality type zone.

2.4.2 Management Goals for Human Use Environmental Values

WQOs to support the following management goals are located in Table 10.

2.4.2.1 Irrigation water quality

The management goal for irrigation water is that the quality of water, when used in accordance with the best irrigation and crop management practices and principles of ecologically sustainable development, does not result in crop yield loss or soil degradation. Soil degradation means reduced permeability and soil structure breakdown caused by the level of sodium in the irrigation water, and is assessed using the sodium adsorption ratio[3]. Refer to ANZG, 2018 for guidance on how to assess the interactions of irrigation water salinity, sodicity and soil properties to prevent soil degradation. WQOs to support this management goal are provided in Table 15 and Table 16.

(Reflects Basin Plan Section 9.06)

2.4.2.2 Farm Supply Use

The management goal for farm supply use is that the quality of water provided for farm use is suitable for produce preparation and for domestic household uses other than drinking.

2.4.2.3 Stock water quality

The management goal for stock watering is that the quality of water provided to stock watering does not cause deterioration in stock health or condition (noting that water quality requirements may differ by stock type). WQOs to support this management goal are provided in Table 17 and Table 18.

2.4.2.4 Aquaculture

The management goal for aquaculture is that the quality of water provided to aquaculture does not cause deterioration in stocked fish, shellfish or crustacean health or condition and human health when consumed (noting that water quality requirements may differ between species). WQOs to support this management goal are provided in Table 12 to Table 14.

2.4.2.5 Human Consumer

The management goal for human consumers is that the quality of water produces aquatic food that is fit for human consumption and does not cause deterioration in human health. WQOs to support this management goal are located in Table 10.

2.4.2.6 Recreational Water Quality

The objective for recreational water quality is to achieve a low risk to human health from water quality threats posed by exposure through ingestion, inhalation or contact during recreational use of water resources in the basins. WQOs to support this management goal are also located in Table 19.

(Reflects Basin Plan Section 9.07)

2.4.2.7 Raw water for drinking water consumption

The management goals are to:

- minimise the risk that the quality of raw water taken for treatment for human consumption results in adverse human health effects
- maintain the palatability rating of water taken for treatment for human consumption at the level of ‘good’ as set out in the ADWG

[3] See Chapter 11 – Salinity Management Handbook (DERM, 2011); ANZG, 2018.

- minimise the risk that the quality of raw water taken for treatment for human consumption results in the odour of drinking water being offensive to consumers.

WQOs to support this management goal are provided in Table 11.

(Reflects Basin Plan Section 9.05, a-c)

2.4.2.8 Industrial Use

The management goal for industrial use is that the quality of water provided to industry is suitable for use, with an appropriate level of treatment. Industries usually treat water supplies to meet their specific needs. Accordingly, no WQOs are specified in this schedule document for industrial use.

2.4.2.9 Cultural and spiritual values and uses of water

The management goal is that Queensland Murray-Darling Basin water resources remain fit for purpose in relation to cultural, spiritual and ceremonial values and uses of water.

(Reflects Basin Plan Section 10.52, 1a-b)

WATER QUALITY OBJECTIVES TO PROTECT AQUATIC ECOSYSTEM ENVIRONMENTAL VALUE

3 Water quality objectives to protect aquatic ecosystem environmental values

Water quality objectives (WQOs) are long-term goals for water quality management. They are numerical concentration levels or narrative statements of indicators established for receiving waters to support and protect the designated EVs for those waters. Water quality objectives are not individual point source emission objectives, but the receiving water quality objectives.

Where more than one EV applies to a given water (for example aquatic ecosystem and recreational use), the most stringent WQO for each water quality indicator applies, which will then protect all identified EVs. Refer to the following example on selection of most stringent WQOs.

Example: (Note that this is an example only and should not be directly adopted for use)

For freshwater streams with aquatic ecosystem and drinking water EVs, the respective Sulfate WQOs are:

- aquatic ecosystem freshwater stream: less than 25 mg/L
- drinking water: less than 250 mg/L.

In this case the aquatic ecosystem WQO for Sulfate (less than 25 mg/L) is the more stringent, and its adoption therefore supports both the aquatic ecosystem and drinking water EVs.

3.1 Aquatic ecosystem water quality objectives

This section provides physical, chemical and where available, biological water quality objectives (WQOs) to support and protect the aquatic ecosystem EV. (Human use EVs, including recreation, stock watering etc., are addressed in section 4).

The aquatic ecosystem EV is a default applying to all Queensland waters, and therefore the WQOs for aquatic ecosystems form the minimum WQOs for all waters. Where no human use EVs are identified, the WQOs identified for aquatic ecosystem protection remain applicable.

WQOs for specified indicators are listed in the following tables by basin, water type/catchment, management intent, and flow regime/season where indicated.

- Table 3: Condamine River Basin Surface Waters Water Quality Objectives: Physicochemical (nutrients, algal, water clarity)
- Table 4: Condamine River Basin Water Quality Objectives: Additional indicators

Details on management intent are included in the tables and notes supporting tables. Links to wetland, riparian and State Planning Policy (state interest – water quality) mechanisms are provided in and after the tables. Sources used in deriving WQOs are provided in and after the tables. WQOs for metals and other toxicants, where not stated in this document, are referred to in the ANZG guidelines (2018, as amended).

3.1.1 Comparison of test data with water quality objectives

The following protocols are recommended when comparing fresh, estuarine or coastal/marine water quality (at a 'test' site) with the corresponding aquatic ecosystem water quality objective (WQO). For concentration-based indicators (e.g. nutrients) and turbidity (NTU), the intent is for test site water quality value to be equal to or less than the corresponding WQO. For WQO indicators where a range is specified (e.g. pH, DO), the intent is that the test site water quality median value falls within the specified WQO range. For Secchi measurements (typically used in estuarine, coastal and marine waters), the intent is for the test site water quality value to be equal to or greater than the stated WQO. Further detail is provided in the QWQG.

For HEV and SD waters:

- Where the WQO is expressed as a 20^{th}–50^{th}–80^{th} percentile range of values (e.g. Total N: 65–100–125 μg/L), the 20^{th}–50^{th}–80^{th} percentile distributions of the test data should meet the specified range of values. The sample number is a minimum of 24 test values over the relevant period (12 months if a continuous activity or alternatively a shorter period for activities where discharge occurs for only part of the year).
- For DO and pH, the median value of preferably five or more independent samples at a monitoring (test) site are compared against, and should fall within, the specified percentile range.
- Where a single WQO value is provided, the median value of preferably five or more independent samples at a monitoring (test) site should be compared against the corresponding aquatic ecosystem WQO.

For MD and HD waters:

- The median value (e.g. concentration) of preferably five or more independent samples at a monitoring (test) site should be compared against the corresponding aquatic ecosystem WQO (WQOs in these waters are typically expressed as a single figure).
- For DO and pH, the median value of preferably five or more independent samples at a monitoring (test) site are compared against, and should fall within, the specified percentile range.

For toxicants in water: unless otherwise stated, WQOs for toxicants are derived from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) default guideline values for the corresponding level of species protection. The ANZG (2018) recommends that the 95th percentile of test data is compared against the default guideline value. As the proportion of test values that is required to be less than the default guideline value is high, the ANZG indicates that a single observation greater than the default guideline value is considered an exceedance.

For comparisons of toxicants in sediments, refer to ANZG (2018).

Further information: Refer to the QWQG, the Queensland Monitoring and Sampling Manual (2018), and the ANZG (2018) for more details.

AQUATIC ECOSYSTEM WATER QUALITY OBJECTIVES

CONDAMINE RIVER BASIN

Table 3 Aquatic ecosystem water quality objectives - Condamine River Basin

Water type	Management intent / Level of protection	Amm N (µg/L)	Oxid N (µg/L)	Total N (µg/L)	FRP (µg/L)	Total P (µg/L)	Chl-a (µg/L)	DO (% sat)	Turb (NTU)	SS (mg/L)	pH	Conductivity (µS/cm)	Sulfate (mg/L)	Alkalinity (mg/L as $CaCO_3$)
CONDAMINE RIVER BASIN SURFACE WATERS **Aquatic ecosystem water quality objectives (Also refer to WQOs contained in Table 4 - Table *8*)** **Note:** WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. <15). For single value WQOs, medians of test data are compared against the WQO (refer to section 3 for more details). HEV–high ecological value; SD–slightly disturbed; MD–moderately disturbed, ID-Insufficient Data Sources: S1: Local datasets/reporting; S2: Murray-Darling Basin Plan 2012, Schedule 11 (A2, B1, B2, C2). Unless otherwise indicated, attribute the source for all values to S1.													
CONDAMINE RIVER BASIN CATCHMENTS (REFER PLAN WQ4223)														
HEV and SD Waters	**HEV & SD**	The WQOs for HEV waters are to maintain/achieve effectively unmodified water quality (20th, 50th and 80th percentiles), habitat, biota, flow and riparian areas. Further sampling in HEV waters is required to confirm the water quality objectives listed for this level of protection. Refer to QWQG for details on how to establish a minimum water quality data set for deriving local 20th, 50th and 80th percentiles.												
CENTRAL CONDAMINE (s1)	**MD**	**LOW FLOW <0.2m³/s (cumecs) at gauge 422352A – Hodgson Creek at Balgownie and <0.3m³/s (cumecs) at gauge 422334A – Kings Creek at Aides Bridge**												
		4	4	860	20	170	9	60–110% (s2)	25	25	7.4–8.3	890	5	350
		HIGH FLOW ≥0.2m³/s (cumecs) at gauge 422352A – Hodgson Creek at Balgownie and ≥0.3m³/s (cumecs) at gauge 422334A – Kings Creek at Aides Bridge												
		ID	480	2200	500	950	4	60–110% (s2)	220	130	7.0–7.6	290	4	100
	HEV	**LOW FLOW <0.2m³/s (cumecs) at gauge 422352A – Hodgson Creek at Balgownie and <0.3m³/s (cumecs) at gauge 422334A – Kings Creek at Aides Bridge**												
		1–4–7	2–4–40	600–860–1600	13–20–60	90–170–490	4–9–30	60–110% (s2)	13–25–60	13–25–40	7.4–8.0–8.3	430–890–1500	3–5–7	230–350–430
		HIGH FLOW ≥0.2m³/s (cumecs) at gauge 422352A – Hodgson Creek at Balgownie and ≥0.3m³/s (cumecs) at gauge 422334A – Kings Creek at Aides Bridge												
		ID	230–480–750	1700–2200–3500	350–500–500	630–950–1400	3–4–7	60–110% (s2)	90–220–610	45–130–1400	7.0–7.3–7.6	220–290–440	2–4–6	75–100–150

Water type	Management intent / Level of protection	CONDAMINE RIVER BASIN SURFACE WATERS Aquatic ecosystem water quality objectives (Also refer to WQOs contained in Table 4 - Table *8*)												
		Note: WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. <15). For single value WQOs, medians of test data are compared against the WQO (refer to section 3 for more details). HEV–high ecological value; SD–slightly disturbed; MD–moderately disturbed, ID-Insufficient Data Sources: S1: Local datasets/reporting; S2: Murray-Darling Basin Plan 2012, Schedule 11 (A2, B1, B2, C2). Unless otherwise indicated, attribute the source for all values to S1.												
		Amm N (µg/L)	**Oxid N** (µg/L)	**Total N** (µg/L)	**FRP** (µg/L)	**Total P** (µg/L)	**Chl-a** (µg/L)	**DO** (% sat)	**Turb** (NTU)	**SS** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L)	**Alkalinity** (mg/L as $CaCO_3$)
DOGWOOD CREEK (s1)	**MD**	**LOW FLOW <1.1m³/s (cumecs) at gauge 422202B – Gilweir**												
		30	8	1300	7	130	8	60–110% (s2)	110	35	6.5–7.5	110	2	20
		HIGH FLOW ≥1.1m³/s (cumecs) at gauge 422202B – Gilweir												
		ID	ID	1400	ID	170	ID	60–110% (s2)	190	70	6.2–7.2	80	3	14
	HEV	**LOW FLOW <1.1m³/s (cumecs) at gauge 422202B – Gilweir**												
		15–30–45	4–8–95	1200–1300–1600	6–7–25	100–130–170	4–8–25	60–110% (s2)	70–110–170	20–35–80	6.5–7.0–7.5	95–110–130	2–2–4	16–20–30
		HIGH FLOW ≥1.1m³/s (cumecs) at gauge 422202B – Gilweir												
		ID	ID	1300–1400–1800	ID	120–170–230	ID	60–110% (s2)	150–190–540	25–70–460	6.2–6.5–7.2	65–80–100	2–3–6	12–14–19
EMU CREEK (s1)	**MD**	**LOW FLOW <0.6m³/s (cumecs) at gauge 422313B – Emu Creek at Emu Vale**												
		5	35	370	25	65	ID	60–110% (s2)	5	9	7.6–8.2	470	5	140
		HIGH FLOW ≥0.6m³/s (cumecs) at gauge 422313B – Emu Creek at Emu Vale												
		ID	ID	380	ID	140	ID	60–110% (s2)	10	10	7.5–8.0	180	2	60

Water type	Management intent / Level of protection	CONDAMINE RIVER BASIN SURFACE WATERS Aquatic ecosystem water quality objectives (Also refer to WQOs contained in Table 4 - Table *8*)												
		Note: WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. <15). For single value WQOs, medians of test data are compared against the WQO (refer to section 3 for more details). HEV–high ecological value; SD–slightly disturbed; MD–moderately disturbed, ID-Insufficient Data Sources: S1: Local datasets/reporting; S2: Murray-Darling Basin Plan 2012, Schedule 11 (A2, B1, B2, C2). Unless otherwise indicated, attribute the source for all values to S1.												
		Amm N (µg/L)	**Oxid N** (µg/L)	**Total N** (µg/L)	**FRP** (µg/L)	**Total P** (µg/L)	**Chl-a** (µg/L)	**DO** (% sat)	**Turb** (NTU)	**SS** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L)	**Alkalinity** (mg/L as $CaCO_3$)
		LOW FLOW <0.6m³/s (cumecs) at gauge 422313B – Emu Creek at Emu Vale												
	HEV	2–5–12	3–35–160	270–370–490	15–25–55	55–65–100	ID	60–110% (s2)	2–5–7	5–9–12	7.6–7.9–8.2	320–470–750	3–5–10	110–140–170
		HIGH FLOW ≥0.6m³/s (cumecs) at gauge 422313B – Emu Creek at Emu Vale												
		ID	ID	330–380–620	ID	130–140–160	ID	60–110% (s2)	6–10–17	8–10–35	7.5–7.7–8.0	140–180–250	2–2–3	50–60–75
KUMBARILLA RIDGE (s1)	**MD**	**LOW FLOW <12.8m³/s (cumecs) at gauge 422336A – Condamine River at Brigalow**												
		4	4	860	20	170	9	60–110% (s2)	110	ID	6.8–7.6	170	3	35
		HIGH FLOW ≥12.8m³/s (cumecs) at gauge 422336A – Condamine River at Brigalow												
		ID	ID	2000 (s2)	ID	450 (s2)	ID	60–110% (s2)	270 (s2)	ID	7.0–8.5 (s2)	ID	ID	ID
	HEV	**LOW FLOW <12.8m³/s (cumecs) at gauge 422336A – Condamine River at Brigalow**												
		1–4–7	2–4–40	600–860–1600	13–20–60	90–170–490	4–9–30	60–110% (s2)	55–110–260	ID	6.8–7.2–7.6	130–170–290	2–3–4	15–35–45
		HIGH FLOW ≥12.8m³/s (cumecs) at gauge 422336A – Condamine River at Brigalow												
		ID	ID	ID	ID	ID	ID	60–110% (s2)	ID	ID	ID	ID	ID	ID

Water type	Management intent / Level of protection	CONDAMINE RIVER BASIN SURFACE WATERS Aquatic ecosystem water quality objectives (Also refer to WQOs contained in Table 4 - Table *8*)												
		Note: WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. <15). For single value WQOs, medians of test data are compared against the WQO (refer to section 3 for more details). HEV–high ecological value; SD–slightly disturbed; MD–moderately disturbed, ID-Insufficient Data Sources: S1: Local datasets/reporting; S2: Murray-Darling Basin Plan 2012, Schedule 11 (A2, B1, B2, C2). Unless otherwise indicated, attribute the source for all values to S1.												
		Amm N (µg/L)	**Oxid N** (µg/L)	**Total N** (µg/L)	**FRP** (µg/L)	**Total P** (µg/L)	**Chl-a** (µg/L)	**DO** (% sat)	**Turb** (NTU)	**SS** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L)	**Alkalinity** (mg/L as $CaCO_3$)
LOWER CONDAMINE RIVER (waterway only) (s1)	**MD**	**LOW FLOW <10.2m³/s (cumecs) at gauge 422333A – Condamine River at Loudoun Bridge**												
		8	4	890	80	210	14	60–110% (s2)	35	25	7.4–8.1	360	5	100
		HIGH FLOW ≥10.2m³/s (cumecs) at gauge 422333A – Condamine River at Loudoun Bridge												
		25	370	1700	210	640	6	60–110% (s2)	390	390	7.1–7.6	180	3	70
	HEV	**LOW FLOW <10.2m³/s (cumecs) at gauge 422333A – Condamine River at Loudoun Bridge**												
		3–8–30	2–4–120	670–890–1300	25–80–140	130–210–370	7–14–25	60–110% (s2)	16–35–130	13–25–85	7.4–7.8–8.1	250–360–560	3–5–9	80–100–140
		HIGH FLOW ≥10.2m³/s (cumecs) at gauge 422333A – Condamine River at Loudoun Bridge												
		13–25–210	120–370–780	1270–1700–2200	110–210–320	520–640–870	2–6–15	60–110% (s2)	270–390–930	55–390–890	7.1–7.3–7.6	140–180–240	2–3–5	55–70–90
LOWER CONDAMINE FLOODPLAIN (waterway only) (s1)	**MD**	**LOW FLOW <21.8m³/s (cumecs) at gauge 422325A – Cotswold**												
		11	20	1100	55	270	6	60–110% (s2)	130	40	7.2–7.9	220	4	70
		HIGH FLOW ≥21.8m³/s (cumecs) at gauge 422325A – Cotswold												
		ID	ID	2000 (s2)	ID	450 (s2)	ID	60–110% (s2)	270 (s2)	ID	6.9–7.4	160	ID	ID

Water type	Management intent / Level of protection	CONDAMINE RIVER BASIN SURFACE WATERS Aquatic ecosystem water quality objectives (Also refer to WQOs contained in Table 4 - Table *8*)												
		Note: WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. <15). For single value WQOs, medians of test data are compared against the WQO (refer to section 3 for more details). HEV–high ecological value; SD–slightly disturbed; MD–moderately disturbed, ID-Insufficient Data Sources: S1: Local datasets/reporting; S2: Murray-Darling Basin Plan 2012, Schedule 11 (A2, B1, B2, C2). Unless otherwise indicated, attribute the source for all values to S1.												
		Amm N (µg/L)	**Oxid N** (µg/L)	**Total N** (µg/L)	**FRP** (µg/L)	**Total P** (µg/L)	**Chl-a** (µg/L)	**DO** (% sat)	**Turb** (NTU)	**SS** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L)	**Alkalinity** (mg/L as $CaCO_3$)
	HEV	**LOW FLOW <21.8m³/s (cumecs) at gauge 422325A – Cotswold**												
		8–11–20	3–20–220	900–1100–1500	40–55–120	160–270–320	3–6–30	60–110% (s2)	40–130–260	15–40–90	7.2–7.5–7.9	170–220–330	3–4–5	55–70–100
		HIGH FLOW ≥21.8m³/s (cumecs) at gauge 422325A – Cotswold												
		ID	ID	ID	ID	ID	ID	60–110% (s2)	ID	ID	6.9–7.3–7.4	110–160–220	ID	ID
MIDDLE CONDAMINE RIVER (waterway only) (s1)	**MD**	**LOW FLOW <7.9m³/s (cumecs) at gauge 422316A – Condamine River at Cecil Plains Weir and <10.2m³/s (cumecs) at gauge 422333A – Condamine River at Loudoun Bridge**												
		6	3	740	50	140	10	60–110% (s2)	25	20	7.5–8.1	320	4	95
		HIGH FLOW ≥7.9m³/s (cumecs) at gauge 422316A – Condamine River at Cecil Plains Weir and ≥10.2m³/s (cumecs) at gauge 422333A – Condamine River at Loudoun Bridge												
		20	120	1200	180	470	7	60–110% (s2)	160	140	7.2–7.8	240	3	75
	HEV	**LOW FLOW <7.9m³/s (cumecs) at gauge 422316A – Condamine River at Cecil Plains Weir and <10.2m³/s (cumecs) at gauge 422333A – Condamine River at Loudoun Bridge**												
		3–6–15	2–3–70	530–740–1200	25–50–110	80–140–260	6–10–21	60–110% (s2)	11–25–75	10–20–60	7.5–7.8–8.1	270–320–430	3–4–5	85–95–130
		HIGH FLOW ≥7.9m³/s (cumecs) at gauge 422316A – Condamine River at Cecil Plains Weir and ≥10.2m³/s (cumecs) at gauge 422333A – Condamine River at Loudoun Bridge												
		12–20–75	18–120–250	960–1200–1700	110–180–230	290–470–750	4–7–11	60–110% (s2)	65–160–290	50–140–310	7.2–7.5–7.8	200–240–290	3–3–5	60–75–100

Water type	Management intent / Level of protection	CONDAMINE RIVER BASIN SURFACE WATERS Aquatic ecosystem water quality objectives (Also refer to WQOs contained in Table 4 - Table *8*)												
		Note: WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. <15). For single value WQOs, medians of test data are compared against the WQO (refer to section 3 for more details). HEV–high ecological value; SD–slightly disturbed; MD–moderately disturbed, ID-Insufficient Data Sources: S1: Local datasets/reporting; S2: Murray-Darling Basin Plan 2012, Schedule 11 (A2, B1, B2, C2). Unless otherwise indicated, attribute the source for all values to S1.												
		Amm N (µg/L)	**Oxid N** (µg/L)	**Total N** (µg/L)	**FRP** (µg/L)	**Total P** (µg/L)	**Chl-a** (µg/L)	**DO** (% sat)	**Turb** (NTU)	**SS** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L)	**Alkalinity** (mg/L as $CaCO_3$)
MURILLA CREEK (s1)	**MD**	**LOW FLOW <0.1m³/s (cumecs) at gauge 422210A – Tabers**												
		5	9	1100	30	200	ID	60–110% (s2)	45	20	7.3–8.1	250	14	140
		HIGH FLOW ≥0.1m³/s (cumecs) at gauge 422210A – Tabers												
		12	110	1400	95	330	ID	60–110% (s2)	270	220	6.6–7.7	120	2	50
	HEV	**LOW FLOW <0.1m³/s (cumecs) at gauge 422210A – Tabers**												
		2–5–18	2–9–130	660–1100–1900	13–30–60	65–200–420	ID	60–110% (s2)	25–45–140	10–20–70	7.3–7.8–8.1	170–250–690	5–14–110	75–140–290
		HIGH FLOW ≥0.1m³/s (cumecs) at gauge 422210A – Tabers												
		8–12–25	40–110–260	1100–1400–2100	70–95–100	280–330–550	ID	60–110% (s2)	110–270–500	130–220–690	6.6–7.2–7.7	95–120–180	2–2–5	35–50–65
NORTH WESTERN CONDAMINE (s1)	**MD**	**LOW FLOW <13.5m³/s (cumecs) at gauge 422308C – Condamine River at Chinchilla and <1.1m³/s (cumecs) at gauge 422343A – Charley's Creek at Chinchilla**												
		9	2	1200	20	140	17	60–110% (s2)	80	30	7.0–7.4	120	2	35
		HIGH FLOW ≥13.5m³/s (cumecs) at gauge 422308C – Condamine River at Chinchilla and ≥1.1m³/s (cumecs) at gauge 422343A – Charley's Creek at Chinchilla												
		ID	ID	ID	ID	130	ID	60–110% (s2)	140	ID	7.0–8.5 (s2)	75	ID	ID

Water type	Management intent / Level of protection	CONDAMINE RIVER BASIN SURFACE WATERS Aquatic ecosystem water quality objectives (Also refer to WQOs contained in Table 4 - Table *8*) **Note:** WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. <15). For single value WQOs, medians of test data are compared against the WQO (refer to section 3 for more details). HEV–high ecological value; SD–slightly disturbed; MD–moderately disturbed, ID-Insufficient Data Sources: S1: Local datasets/reporting; S2: Murray-Darling Basin Plan 2012, Schedule 11 (A2, B1, B2, C2). Unless otherwise indicated, attribute the source for all values to S1.												
		Amm N (µg/L)	**Oxid N** (µg/L)	**Total N** (µg/L)	**FRP** (µg/L)	**Total P** (µg/L)	**Chl-a** (µg/L)	**DO** (% sat)	**Turb** (NTU)	**SS** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L)	**Alkalinity** (mg/L as $CaCO_3$)
		LOW FLOW <13.5m³/s (cumecs) at gauge 422308C – Condamine River at Chinchilla and <1.1m³/s (cumecs) at gauge 422343A – Charley's Creek at Chinchilla												
	HEV	7–9–22	1–2–10	1100–1200–1400	4–20–25	100–140–180	8–17–35	60–110% (s2)	60–80–130	25–30–35	7.0–7.2–7.4	90–120–140	1–2–2	25–35–60
		HIGH FLOW ≥13.5m³/s (cumecs) at gauge 422308C – Condamine River at Chinchilla and ≥1.1m³/s (cumecs) at gauge 422343A – Charley's Creek at Chinchilla												
		ID	ID	ID	ID	110–130–210	ID	60–110% (s2)	60–140–330	ID	ID	55–75–140	ID	ID
OAKEY CREEK (s1)	**MD**	**LOW FLOW <0.9m³/s (cumecs) at gauge 422350A – Oakey Creek at Fairview**												
		10	5	1000	45	110	5	60–110% (s2)	13	14	7.7–8.3	510	7	130
		HIGH FLOW ≥0.9m³/s (cumecs) at gauge 422350A – Oakey Creek at Fairview												
		ID	ID	1300	90	340	ID	60–110% (s2)	55	65	7.4–8.1	380	7	85
	HEV	**LOW FLOW <0.9m³/s (cumecs) at gauge 422350A – Oakey Creek at Fairview**												
		6–10–30	3–5–80	720–1000–1600	25–45–135	70–110–280	1–5–24	60–110% (s2)	4–13–30	6–14–30	7.7–8.0–8.3	400–510–880	5–7–19	110–130–180
		HIGH FLOW ≥0.9m³/s (cumecs) at gauge 422350A – Oakey Creek at Fairview												
		ID	ID	820–1300–1700	45–90–210	140–340–500	ID	60–110% (s2)	25–55–160	20–65–210	7.4–7.7–8.1	240–380–670	4–7–15	70–85–140

Water type	Management intent / Level of protection	CONDAMINE RIVER BASIN SURFACE WATERS Aquatic ecosystem water quality objectives (Also refer to WQOs contained in Table 4 - Table *8*)												
		Note: WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. <15). For single value WQOs, medians of test data are compared against the WQO (refer to section 3 for more details). HEV–high ecological value; SD–slightly disturbed; MD–moderately disturbed, ID-Insufficient Data Sources: S1: Local datasets/reporting; S2: Murray-Darling Basin Plan 2012, Schedule 11 (A2, B1, B2, C2). Unless otherwise indicated, attribute the source for all values to S1.												
		Amm N (µg/L)	**Oxid N** (µg/L)	**Total N** (µg/L)	**FRP** (µg/L)	**Total P** (µg/L)	**Chl-a** (µg/L)	**DO** (% sat)	**Turb** (NTU)	**SS** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L)	**Alkalinity** (mg/L as $CaCO_3$)
SOUTH-EASTERN CONDAMINE (s1)	**MD**	**LOW FLOW <0.3m³/s (cumecs) at gauge 422306A – Swan Creek at Swanfels**												
		4	4	270	50	110	5	60–110% (s2)	8	10	7.7–8.3	440	2	190
		HIGH FLOW ≥0.3m³/s (cumecs) at gauge 422306A – Swan Creek at Swanfels												
		13	80	460	90	200	ID	60–110% (s2)	25	18	7.5–8.1	190	2	70
	HEV	**LOW FLOW <0.3m³/s (cumecs) at gauge 422306A – Swan Creek at Swanfels**												
		2–4–9	2–4–12	200–270–450	35–50–80	80–110–150	2–5–16	60–110% (s2)	4–8–20	6–10–25	7.7–8.0–8.3	330–440–650	2–2–5	140–190–250
		HIGH FLOW ≥0.3m³/s (cumecs) at gauge 422306A – Swan Creek at Swanfels												
		6–13–40	35–80–270	340–460–1500	75–90–130	120–200–560	ID	60–110%	8–25–90	9–18–110	7.5–7.8–8.1	145–190–330	1–2–3	50–70–140
SOUTHERN CONDAMINE (s1)	**MD**	**LOW FLOW <0.1m³/s (cumecs) at gauge 422338A – Canal Creek at Leyburn and <0.3m³/s (cumecs) at gauge 422357A –Iron Pot Creek at Sheep Yard (CLOSED)**												
		6	3	590	15	45	5	60–110% (s2)	9	8	7.2–7.9	170	3	45
		HIGH FLOW ≥0.1m³/s (cumecs) at gauge 422338A – Canal Creek at Leyburn and ≥0.3m³/s (cumecs) at gauge 422357A –Iron Pot Creek at Sheep Yard (CLOSED)												
		ID	ID	830	20	60	ID	60–110% (s2)	25	17	7.0–7.6	160	2	35

Water type	Management intent / Level of protection	CONDAMINE RIVER BASIN SURFACE WATERS Aquatic ecosystem water quality objectives (Also refer to WQOs contained in Table 4 - Table *8*)												
		Note: WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. <15). For single value WQOs, medians of test data are compared against the WQO (refer to section 3 for more details). HEV–high ecological value; SD–slightly disturbed; MD–moderately disturbed, ID-Insufficient Data Sources: S1: Local datasets/reporting; S2: Murray-Darling Basin Plan 2012, Schedule 11 (A2, B1, B2, C2). Unless otherwise indicated, attribute the source for all values to S1.												
		Amm N (µg/L)	**Oxid N** (µg/L)	**Total N** (µg/L)	**FRP** (µg/L)	**Total P** (µg/L)	**Chl-a** (µg/L)	**DO** (% sat)	**Turb** (NTU)	**SS** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L)	**Alkalinity** (mg/L as $CaCO_3$)
	HEV	**LOW FLOW <0.1m³/s (cumecs) at gauge 422338A – Canal Creek at Leyburn and <0.3m³/s (cumecs) at gauge 422357A –Iron Pot Creek at Sheep Yard (CLOSED)**												
		4–6–18	2–3–30	420–590–1200	6–15–30	25–45–80	2–5–17	60–110% (s2)	4–9–20	5–8–15	7.2–7.6–7.9	130–170–350	2–3–5	40–45–70
		HIGH FLOW ≥0.1m³/s (cumecs) at gauge 422338A – Canal Creek at Leyburn and ≥0.3m³/s (cumecs) at gauge 422357A –Iron Pot Creek at Sheep Yard (CLOSED)												
		ID	ID	700–830–1300	12–20–35	40–60–95	ID	60–110% (s2)	13–25–60	10–17–65	7.0–7.4–7.6	120–160–250	2–2–5	25–35–50
LAKE LESLIE (LESLIE DAM) (s1)	**MD**	**No Flow Separations Applied**												
		20	120	590	7	40	6	60–110% (s2)	4	8	7.3–8.1	320	5	50
UNDULLA CREEK (s1)	**MD**	**LOW FLOW <21.8m³/s (cumecs) at gauge 422325A – Cotswold**												
		30	8	1300	7	130	8	60–110 (s2)	110	35	6.5–7.5	110	2	20
		HIGH FLOW ≥21.8m³/s (cumecs) at gauge 422325A – Cotswold												
		ID	ID	1400	ID	170	ID	60–110 (s2)	190	70	6.2–7.2	80	3	14

Water type	Management intent / Level of protection	CONDAMINE RIVER BASIN SURFACE WATERS Aquatic ecosystem water quality objectives (Also refer to WQOs contained in Table 4 - Table *8*)												
		Note: WQOs for indicators are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved (e.g. 3–4–5), lower and upper limits (e.g. pH: 7.2–8.2), or as a single value (e.g. <15). For single value WQOs, medians of test data are compared against the WQO (refer to section 3 for more details). HEV–high ecological value; SD–slightly disturbed; MD–moderately disturbed, ID-Insufficient Data Sources: S1: Local datasets/reporting; S2: Murray-Darling Basin Plan 2012, Schedule 11 (A2, B1, B2, C2). Unless otherwise indicated, attribute the source for all values to S1.												
		Amm N (µg/L)	**Oxid N** (µg/L)	**Total N** (µg/L)	**FRP** (µg/L)	**Total P** (µg/L)	**Chl-a** (µg/L)	**DO** (% sat)	**Turb** (NTU)	**SS** (mg/L)	**pH**	**Conductivity** (µS/cm)	**Sulfate** (mg/L)	**Alkalinity** (mg/L as $CaCO_3$)
	HEV	**LOW FLOW <21.8m³/s (cumecs) at gauge 422325A – Cotswold**												
		15–30–45	4–8–95	1190–1300–1600	6–7–25	100–130–170	4–8–25	60–110% (s2)	70–110–170	20–35–80	6.5–7.0–7.5	95–110–130	2–2–4	16–20–28
		HIGH FLOW ≥21.8m³/s (cumecs) at gauge 422325A – Cotswold												
		ID	ID	1300–1400–1800	ID	120–170–230	ID	60–110% (s2)	150–190–540	25–70–460	6.2–6.5–7.2	65–80–100	2–3–6	12–14–19
UPPER CONDAMINE RIVER (waterway only) (s1)	**MD**	**LOW FLOW <3.9m³/s (cumecs) at gauge 422310C – Condamine River at Warwick**												
		8	18	400	35	75	6	60–110% (s2)	7	10	7.5–8.0	280	3	75
		HIGH FLOW ≥3.9m³/s (cumecs) at gauge 422310C – Condamine River at Warwick												
		16	140	1000	80	210	5	60–110% (s2)	50	50	7.1–7.7	170	3	50
	HEV	**LOW FLOW <3.9m³/s (cumecs) at gauge 422310C – Condamine River at Warwick**												
		6–8–15	5–18–80	295–400–560	20–35–55	50–75–120	4–6–14	60–110% (s2)	5–7–17	7–10–20	7.5–7.7–8.0	230–280–360	2–3–4	65–75–90
		HIGH FLOW ≥3.9m³/s (cumecs) at gauge 422310C – Condamine River at Warwick												
		9–16–40	75–140–275	640–1000–1900	60–80–120	140–210–370	4–5–15	60–110% (s2)	20–50–90	15–50–130	7.1–7.4–7.7	150–170–210	3–3–4	35–50–60

Indicators: Amm N – ammonium nitrogen; Oxid N – oxidised nitrogen; Total N – Total Nitrogen; FRP – filterable reactive phosphorus; Total P – Total Phosphorous; Chl-a – chlorophyll-a; DO – dissolved oxygen; Turb – Turbidity; SS – total suspended solids.

Units: % saturation – percent saturation; µg/L – micrograms per litre; NTU – nephelometric turbidity units; m – metres; mg/L – milligrams per litre; µS/cm – microsiemens per centimetre

Resources:
Queensland Water Quality Guidelines, 2009

Water Act 2007 – Basin Plan 2012

ANZG 2018, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, available from the Australian Government's Water Quality Australia website

DES 2019. Healthy Waters Management Plan: Condamine River Basin. Brisbane: Department of Environment and Science, Queensland Government.

Table 4 Condamine River Basin Water Quality Objectives: Additional indicators for aquatic ecosystem environmental value

Water type	Management intent /Level of protection	CONDAMINE RIVER BASIN SURFACE WATERS Aquatic ecosystem water quality objectives
		Sources: S1: Local datasets/reporting; S2: Murray-Darling Basin Plan 2012, Schedule 11 (A2, B2, C2), S3: ANZG, 2018
TOXICANTS (INCLUDING PESTICIDES, HERBICIDES)		
All basins - HEV, SD fresh waters: **Toxicants (s3)**	**HEV/SD**	• Toxicants (including metals, biocides) in water: refer to 99% of species protection values contained in: o ANZG (2018) 'toxicant default guideline values for water quality in aquatic ecosystems', as amended o The following sources, where their guideline values post-date the specified ANZG guideline value, or where there is no ANZG value specified for a toxicant (Note: the ANZG specifies the date of guideline development for each toxicant): ▪ Biocides: King et al (2017, as amended) (vol 1 and 2) *Proposed aquatic ecosystem protection guideline values for pesticides commonly used in the Great Barrier Reef catchment area* (available from Queensland Government publications) • Toxicants in sediments: refer to ANZG 'toxicant default guideline values for sediment quality' Anti-fouling: Comply with *Anti-fouling and in-water cleaning guidelines* (2015, as amended)
All basins – fresh waters not mapped as HEV,SD: **Toxicants (s3)**	**MD**	• Toxicants (including metals, biocides) in water: o Waters outside developed reaches (low level of disturbance): refer to 99% of species protection values contained in sources below o Waters within developed reaches: refer to 95% of species protection values (or 99% of species protection values for those toxicants identified in ANZG as having bioaccumulation potential) contained in sources below ▪ ANZG (2018) 'toxicant default guideline values for water quality in aquatic ecosystems', as amended ▪ The following sources, where their guideline values post-date the specified ANZG guideline value, or where there is no ANZG value specified for a toxicant (Note: the ANZG specifies the date of guideline development for each toxicant) - Biocides: King et al (2017, as amended) (vol 1 and 2) *Proposed aquatic ecosystem protection guideline values for pesticides commonly used in the Great Barrier Reef catchment area* (available from Queensland Government publications) • Toxicants in sediments: refer to ANZG 'toxicant default guideline values for sediment quality' Anti-fouling: Comply with *Anti-fouling and in-water cleaning guidelines* (2015, as amended)

Water type	Management intent /Level of protection	CONDAMINE RIVER BASIN SURFACE WATERS Aquatic ecosystem water quality objectives
		Sources: S1: Local datasets/reporting; S2: Murray-Darling Basin Plan 2012, Schedule 11 (A2, B2, C2), S3: ANZG, 2018
TEMPERATURE		
All basins - fresh waters	**All**	Temperature varies daily and seasonally, is depth-dependent and highly site specific. Refer to QWQG for details on how to establish a range (20^{th} – 80^{th} %iles) for temperature. From an ecological effects perspective, daily maximum temperature and daily variation in temperature are key indicators, and seasonal variations also need to be identified.
Southern Condamine - fresh waters	**All**	In waters with the following stenotherm species: Northern River Blackfish (*Gadopsis marmoratus*), Lamington Crayfish (*Euastacus sulcatus*) and Mountain Galaxias (*Galaxias olidus*); present, temperatures should not exceed 27°C to avoid acute health impacts/death and should not exceed 23°C for extended periods to avoid chronic impacts.
SALINITY		
All basins - fresh waters	**All**	Refer to Table 5.
MACROINVERTEBRATES		
All basins - fresh waters	**All**	It is recommended that targeted macroinvertebrate sampling is conducted for the Condamine River basin to allow the development of locally relevant macroinvertebrate guidelines.
FISH		
All basins - fresh waters	**All**	Refer to Section 3.3, Table 6 – Table 8
WETLANDS		
Ramsar wetlands		The Condamine River Basin does not contain any Ramsar wetlands at time of print. In Ramsar wetlands of international significance, the management goal is that the quality of water is sufficient to maintain the ecological character of the wetlands.

Water type	Management intent /Level of protection	CONDAMINE RIVER BASIN SURFACE WATERS Aquatic ecosystem water quality objectives
		Sources: S1: Local datasets/reporting; S2: Murray-Darling Basin Plan 2012, Schedule 11 (A2, B2, C2), S3: ANZG, 2018
Wetlands other than Ramsar wetlands	**All**	To protect the aquatic ecosystem values of lakes, they should be protected against threats of secondary salinity and sedimentation. Refer to Section 5 for ways to prevent sedimentation and to Table 5 for End-of-Basin Salinity Targets. As additional data becomes available, it is recommended that water quality objectives are developed for wetlands. Refer to QWQG for details on how to establish a minimum water quality data set for deriving local 20th, 50th and 80th percentiles.
Wetlands extent	**All**	Refer to section 3.4
STATE PLANNING POLICY		
State Planning Policy	**All**	Refer to section 3.4
GROUNDWATERS		
Groundwaters (s2)	**HEV**	Refer to the separate schedule document under the EPP (Water and Wetland Biodiversity), Queensland Murray-Darling and Bulloo basins Groundwater. Where groundwaters interact with surface waters, groundwater quality should not compromise identified EVs and WQOs for those waters. *'Protection of groundwater quality is imperative to ensure the protection of healthy ecosystems and maintenance of environmental values as well as for future economic and population growth' (Australian Government, 2013)*

Sources:

Water quality objectives for macroinvertebrates indexes are adapted from the *Queensland draft macroinvertebrate guidelines: Murray-Darling and Bulloo catchments*, (Negus, P., Steward, A., & Blessing, J., 2013), available on the department's website. Noted as local data (s1) in this table.

Water Act 2007 – Basin Plan 2012

Australian Government (2013) Guidelines for groundwater quality protection in Australia: National Water Quality Management Strategy, Department of Agriculture and Water Resources, Canberra, March. CC BY 3.0. Further information available from the Water Quality Australia website.

Management intent: Waters for which all physico–chemical WQOs (e.g. nutrients, toxicants) have been set corresponding to HEV management intent are identified in columns 1 and 2 of Table 3 and Table 4. Each of these waters is given a specific label in the table (e.g. 'HEV12345') which links to mapping data of the accompanying plan. Slightly disturbed (SD) waters are similarly identified.

The management intent (level of protection) for most waters other than HEV or SD is to achieve a 'moderately disturbed' (MD) condition, for which corresponding WQOs have been derived. Where local WQOs are derived for MD areas these are also identified with specific labels (e.g. 'MD12345'). For some indicators and water types, WQOs correspond with a 'slightly to moderately disturbed' (SMD) level of protection, based on management intent categories specified in source technical guidelines, in particular the Australian water quality guidelines (ANZG, 2018). For ease of interpretation, this document and accompanying mapping include these within the MD level of protection. For some MD waters a higher level of protection may be provided for toxicants (e.g. pesticides).

3.2 Salinity Water Quality Objectives for the purposes of long-term salinity planning and management

Table 5: Queensland Basin Salinity Management Strategy End-of-Valley Salinity Targets

WATER QUALITY TARGET VALUES FOR LONG-TERM SALINITY PLANNING AND MANAGEMENT									
Valley	Baseline as at 1 Jan 2000			End-of-Valley targets (as absolute value)			Valley reporting site	AWRC Site Number	Map EoV Site ID
	Salinity (EC µS/cm)		Salt Load (t/yr)	Salinity (EC µS/cm)		Salt Load (t/yr)			
	Median (50%ile)	Peak (80%ile)	Mean	Median (50%ile)	Peak (80%ile)	Mean			
Queensland									
Condamine-Balonne	170	210	4,200	170	210	4,200	Ballandool R @ Hebel-Bollon Rd	422207A	83
	170	210	5,000	170	210	5,000	Bokhara R @ Hebel	422209A	82
	150	280	6,500	150	280	6,500	Briarie Ck @ Wollerbilla-Hebel Rd	422211A	84
	170	210	29,000	170	210	29,000	Culgoa R @ Brenda[1]	422015[1]	85
	160	210	10,000	160	210	10,000	Narran R @ New Angledool[1]	422030[1]	81

Notes:

1. These monitoring sites are operated by New South Wales on behalf of Queensland.

Source: Appendix 1 of Schedule B to the Murray-Darling Basin Agreement (Schedule 1 of the Water Act 2007). Version 15 June 2010, and as amended.

3.3 Fish

Table 6: Fish Frequency for the Condamine River Basin (Southern Section)

Derived frequency of fish capture (proportion of multiple surveys across multiple sites) by electrofishing combined with fyke netting in the Condamine River from Murray Bridge (just upstream of Warwick) to the headwaters upstream of Killarney, shown as the section between the headwaters of the Condamine and point A on plan WQ4223. This includes tributaries that join this section of the river. Tributary stream frequencies are for electrofishing only. No floodplain lagoons were sampled in this region.

Interpretation: in the Southern Section, on average there is a 11%▪ chance of sampling a Murray cod (*Maccullochella peelii*) within the main river, with an expected 3.33▪ different species to be present in total.

Management goal 1: **Maintain or improve occurrence frequency**		
Species	Derived frequency of occurrence	
	Main river (electrofishing and fykes)	Tributary (electrofishing only)
Murray cod (*Maccullochella peelii*)	0.11▪	0
Spangled perch (*Leiopotherapon unicolor*)	0.11	0
Freshwater catfish (*Tandanus tandanus*)	0.67	0
Carp gudgeon spp. (*Hypseleotris* spp.)	1.00	0.06
Purple spotted gudgeon (*Mogurnda adspersa*)	0	0.06
Murray-Darling rainbow (*Melanotaenia fluviatilis*)	0.11	0
Australian smelt (*Retropinna semoni*)	0.67	0
Mountain galaxias (*Galaxias olidus*)	1.00	0.59
River blackfish (*Gadopsis marmoratus*)	0.11	0.59
Mean native species richness	**3.33▪**	**1.22**
Management goal 2: Maintain or decrease occurrence frequency		
Goldfish (*Carassius auratus*)	0.67	0
Mosquitofish (*Gambusia holbrooki*)	0	0.06
Rainbow trout (*Oncorhynchus mykiss*)	0	0.12
Mean non-native species richness	**0.67**	**0.17**

Source: Water quality objectives for fish are adapted from Hutchison, M (2014*), Fish assemblages as indicators of ecosystem health in the Condamine-Balonne River system – A guide prepared for the Department of Science, Information Technology, Innovation and the Arts*, Department of Agriculture, Fisheries and Forestry, Queensland.

Table 7: Fish Frequency for the Condamine River Basin (Mid-Section)

Derived frequency of fish capture by electrofishing combined with fyke netting in the Condamine River between the Cecil Plains bifurcation and Murray Bridge, just upstream of Warwick and shown as the section between point A and point B on plan WQ4223. This includes tributaries that join this section of river.

Interpretation: in the Mid-Section, on average there is a 67%▪ chance of sampling a Golden Perch (*Macquaria ambigua*) within the main river, with an expected 7.67▪ different species to be present in total.

Management goal 1: **Maintain or improve occurrence frequency**		
Species	Derived frequency of occurrence	
	Main river	Tributary
Golden perch (*Macquaria ambigua*)	0.67▪	0.38
Murray cod (*Maccullochella peelii*)	0.33	0.13*
Silver perch (*Bidyanus bidyanus*)	0.08*	0
Spangled perch (*Leiopotherapon unicolor*)	0.54	0.38
Bony bream (*Nematalosa erebi*)	1.00	0.75
Freshwater catfish (*Tandanus tandanus*)	0.15*	0.50
Hyrtl's tandan (*Neosilurus hyrtlii*)	0.33	0
Carp gudgeon spp. (*Hypseleotris* spp.)	1.00	0.63
Dwarf flathead gudgeon (*Philypnodon macrostomus*)	0.08*	0.13*
Purple spotted gudgeon (*Mogurnda adspersa*)	0	0.25*
Unspecked hardyhead (*Craterocephalus stercusmuscarum fulvus*)	0.38	0.38
Murray-Darling rainbowfish (*Melanotaenia fluviatilis*)	0.54	0.50
Australian smelt (*Retropinna semoni*)	0.38	0.75
Olive perchlet (*Ambassis agassizii*)	0.33	0.38
Mountain galaxias (*Galaxias olidus*)	0	0.13*
Mean native species richness	**7.67▪**	**6.88**
Management goal 2: Maintain or decrease occurrence frequency		
Carp (*Cyprinus carpio*)	0.33	0.75
Goldfish (*Carassius auratus*)	0.67	0.63
Mosquitofish (*Gambusia holbrooki*)	0.33	0.50

Management goal 1: **Maintain or improve occurrence frequency**		
Species	Derived frequency of occurrence	
	Main river	Tributary
Pearl cichlid (*Geophagus brasiliensis*)	0.08	0
Mean non-native species richness	**2.07**	**1.62**

Source: Water quality objectives for fish are adapted from Water quality objectives for fish are adapted from Hutchison, M (2014*), Fish assemblages as indicators of ecosystem health in the Condamine-Balonne River system – A guide prepared for the Department of Science, Information Technology, Innovation and the Arts*, Department of Agriculture, Fisheries and Forestry, Queensland.

Notes:

* Indicates a rare species for that part of the catchment.

Table 8: Fish Frequency for the Condamine River Basin (Northern Section)

Derived frequency of fish capture by electrofishing combined with fyke netting in the Condamine River between the Cecil Plains bifurcation and the Dogwood Creek-Condamine River confluence (start of the Balonne River) and shown as the section between the point B and the end of the Schedule area on plan WQ4223. This includes tributaries that join this section of the Condamine River (including Dogwood Creek) and floodplain lagoons.

Interpretation: in the Northern Section, on average there is a 91%■ chance of sampling a Golden Perch (*Macquaria ambigua*) within the main river, with an expected 6.65■ different species to be present in total.

Management goal: **Maintain or improve occurrence frequency**			
Species	Derived frequency of occurrence		
	Main river	Tributary	Lagoon
Golden perch (*Macquaria ambigua*)	0.91■	0.60	0.54
Murray cod (*Maccullochella peelii*)	0.29*	0.27*	0.08*
Silver perch (*Bidyanus bidyanus*)	0.03*	0.03*	0
Spangled perch (*Leiopotherapon unicolor*)	0.82	0.85	0.92
Bony bream (*Nematalosa erebi*)	1.00	0.78	0.92
Freshwater catfish (*Tandanus tandanus*)	0.15*	0.40	0.23*
Hyrtl's tandan (*Neosilurus hyrtlii*)	0.28*	0.53	0.38
Rendahl's tandan (*Porochilus rendahli*)	0	0.05*	0.15*
Carp gudgeon spp. (*Hypseleotris* spp.)	1.00	0.95	0.92
Dwarf flathead gudgeon (*Philypnodon macrostomus*)	0.58	0	0.08*
Purple spotted gudgeon (*Mogurnda adspersa*)	0	0.03*	0

Management goal: **Maintain or improve occurrence frequency**			
Species	Derived frequency of occurrence		
	Main river	Tributary	Lagoon
Unspecked hardyhead (*Craterocephalus stercusmuscarum fulvus*)	0.15*	0.55	0.23*
Murray-Darling rainbowfish (*Melanotaenia fluviatilis*)	0.56	0.82	0.15*
Australian smelt (*Retropinna semoni*)	0.74	0.60	0.23*
Olive perchlet (*Ambassis agassizii*)	0.26*	0.52	0.46
Mean native species richness	**6.65▪**	**6.78**	**5.31**
Management goal 2: Maintain or decrease occurrence frequency			
Carp (*Cyprinus carpio*)	0.65	0.70	0.53
Goldfish (*Carassius auratus*)	0.68	0.75	0.84
Mosquitofish (*Gambusia holbrooki*)	0.94	0.93	0.77
Mean non-native species richness	**2.26**	**2.38**	**1.90**

Source: Water quality objectives for fish are adapted from Water quality objectives for fish are adapted from Hutchison, M (2014*), Fish assemblages as indicators of ecosystem health in the Condamine-Balonne River system – A guide prepared for the Department of Science, Information Technology, Innovation and the Arts*, Department of Agriculture, Fisheries and Forestry, Queensland.

Notes:

* Indicates a rare species for that part of the catchment.

3.4 Vegetation management and planning provisions

This following is provided for information on habitat management and planning matters. While it is current at time of publication, readers should refer to relevant Queensland websites and legislation to ensure they are referring to current materials.

3.4.1 Riparian vegetation

The clearing of native vegetation in Queensland is regulated by the *Vegetation Management Act 1999*, the *Planning Act 2016* and associated policies and codes. This includes the regulation of clearing within a defined distance of watercourses and drainage features.

For vegetation management relating to waterways, reference should be made to:

- State Development Assessment Provisions (SDAP) State code 16: Native vegetation clearing (DSDMIP, 2019, as amended). This code requires clearing of native vegetation to meet performance outcomes relating to the protection of wetlands, watercourses and drainage features. The code outlines buffer areas where clearing cannot occur within a specified distance of watercourses or drainage features. If clearing within these buffers cannot be reasonably avoided, an offset must be provided to counterbalance any significant residual impact to a wetland, watercourse or drainage feature. For more information on SDAP State code 16, refer to the 'Queensland's Planning System' website https://planning.dsdmip.qld.gov.au/planning/better-development/the-development-assessment-process/the-states-role/state-development-assessment-provisions
- The relevant Accepted Development Vegetation Clearing Codes (ADVCC) under the *Vegetation Management Act 1999*. These codes allow self-assessable clearing for certain purposes in particular land tenures and regional ecosystems. It is a requirement across all codes for landholders to use best practice methods when clearing vegetation to prevent soil erosion and instability and to prevent increased sediment run-off entering a

wetland, watercourse or drainage feature. The codes also contain riparian protection zones to prevent clearing within a defined distance of a wetland, a stream ordered watercourse or a drainage feature. Where a code permits clearing within these areas, there are additional requirements to rehabilitate the area or (for clearing of regulated regrowth vegetation) to legally secure an exchange area to counterbalance the impact. For more information on the ADVCCs and guidance material, refer to the Department of Natural Resources, Mines and Energy website https://www.dnrme.qld.gov.au/.

Clearing of native vegetation in a watercourse may also require a riverine protection permit under the *Water Act 2000*. Further information is available at www.business.qld.gov.au.

Local Government Planning schemes under the *Planning Act 2016* may also specify riparian buffers (for example under catchment protection or waterway codes). Refer to the Department of State Development, Manufacturing, Infrastructure and Planning website and relevant local government websites for further information about planning schemes.

For more information on riparian vegetation targets specific to this basin, refer to the Condamine River Basin Healthy Waters Management Plan.

3.4.2 Wetlands Extent

The Environmental Protection (Water and Wetland Biodiversity) Policy 2019 defines environmental values for wetlands.

Table 9: Wetland area by system (2013): Condamine River Basin

System	Area (km^2)	Wetlands area (%)	Percentage of total catchment area (%)
Artificial and highly modified	158.0	48.08%	0.52%
Lacustrine	7.0	2.13%	0.02%
Palustrine	41.1	12.51%	0.14%
Riverine	122.4	37.25%	0.40%
Total	**328.6**	**100%**	**1.08%**

Note: All statistics are approximate and generated based on data transformed to a customised Albers equal-area projection, thus allowing wetland extent change for different regions of Queensland to be comparable. Areas may change over time as mapping approaches improve. Totals may not match the sum of individually displayed figures due to the rounding of displayed figures.

Sources: Condamine River drainage sub-basin — facts and maps, WetlandInfo, Department of Environment and Science, Queensland, viewed 1 June 2020 <https://wetlandinfo.des.qld.gov.au/wetlands/facts-maps/sub-basin-condamine-river/>.

3.4.3 Waterways providing for fish passage

Waterway barrier works may inhibit the free movement of fish along waterways and onto floodplains, injure fish or affect fish health and habitat. Many native fish need to access a range of habitats for food, breeding and refuge and move or migrate to complete their lifecycle.

Adequate fish passage must be provided at any proposed waterway barrier. Operational work that is to construct or raise a waterway barrier is assessable development for which a development approval is required under the *Planning Act 2016,* or is accepted development under the *Fisheries (General) Regulation 2019.* Work types that are described as accepted development must comply with the relevant Accepted Development Requirements in all respects. If all requirements are not met, then the development is assessable and must be applied for. The State assesses development applications that may have impacts to fish passage using the State Development Assessment Provisions (SDAP) State code 18: Constructing or raising waterway barrier works in fish habitats. For more information on SDAP State codes, refer to the 'Queensland's Planning System' website https://planning.dsdmip.qld.gov.au/planning/better-development/the-development-assessment-process/the-states-role/state-development-assessment-provisions.)

Performance outcomes for all development include (but are not limited to):

- development does not increase the risk of mortality, disease or injury, or compromise the health, productivity, marketability or suitability for human consumption of fisheries resources, having regard to (but not limited to)
    - biotic and abiotic conditions, such as water and sediment quality
    - substances that are toxic to plants or toxic to or cumulative within fish
- sufficient water exchange and flow is maintained and provided to sustain and where necessary restore, water quality and the health and condition of fisheries resources, ecological functions and fish passage
- development likely to cause drainage or disturbance to acid sulfate soils, prevents the release of contaminants and impacts on fisheries resources and fish habitats.

A waterway providing for fish passage is a matter of state environmental significance under the *Environmental Offsets Act 2014* and an environmental offset may be required for any significant residual impact that is approved.

The Department of Agriculture and Fisheries website contains further information on approvals, accepted development requirements and other aspects relating to waterway barrier works and fish passage. Refer to the link below for more details. https://www.daf.qld.gov.au/fisheries/habitats/fisheries-development/approvals-required

3.4.4 State planning policy – (state interest – water quality)

The State Planning Policy (SPP) defines the Queensland Government's policies about matters of state interest in land use planning and development (a state interest is defined under the *Planning Act 2016*).

Water quality is a state interest. The SPP (state interest – water quality) seeks to ensure that 'the environmental values and quality of Queensland waters are protected and enhanced'. It includes provisions relating to receiving waters, acid sulfate soils and water supply buffer areas.

The provisions of the SPP are applied through their 'integration' into local government planning schemes. Planning schemes adopt measures prescribed in the SPP that ensure development is planned, designed, constructed and operated to manage stormwater and wastewater in ways that support the protection of environmental values and meet the water quality objectives identified in the Environmental Protection (Water and Wetland Biodiversity) Policy 2019. This is achieved by:

- ensuring land zoned for urban purposes is located and constructed to avoid adverse impact on water quality; and
- development meeting stormwater management design objectives during construction and post construction phase.

Stormwater management design objectives for construction include developments using measures to manage the velocity of stormwater flows and prevent erosion, sediment, litter and other contaminates entering waterways while construction is occurring. Post construction stormwater management design objectives generally apply to lots over 2500m^2 that results in six or more dwellings or lots. The objectives seek to limit the amount of nutrients and litter, including nitrogen, phosphorus and suspended sediments, entering waterways from the operation of the development.

The SPP (state interest – water quality) is supported by the State Planning Policy—state interest guidance material – Water quality. The SPP (including SPP code) and guideline are available from the Department of State Development, Manufacturing, Infrastructure and Planning website https://planning.dsdmip.qld.gov.au/planning/better-planning/state-planning/state-planning-policy-spp

WATER QUALITY OBJECTIVES
for
HUMAN USE ENVIRONMENTAL VALUES

4 Human use EVs water quality objectives

This section outlines water quality objectives (WQOs) to protect human use environmental values (EVs), which comprise those EVs (e.g. recreation, stock watering, aquaculture and crop irrigation) other than the aquatic ecosystem EV. The tables in section 2 of this document outline the EVs that have been identified for different waters. Where a human use EV has been identified, the following tables can be used to identify the WQOs to support that EV. Where more than one EV applies to a given water (for example aquatic ecosystem and recreational use), the adoption of the most stringent WQO for each water quality indicator will then protect all identified EVs.

WQOs in this section are, unless otherwise specified, based on relevant national water quality guidelines including ANZG (2018, as amended) and the Australian Drinking Water Guidelines (ADWG). Where national guidelines or other codes remain the primary source for WQOs, reference to those national guidelines or codes is necessary to obtain comprehensive listings of all indicators and corresponding WQOs.

The following table summarises WQOs for human use EVs. More details are provided in subsequent sections by human use EV.

Table 10 Human use EVs water quality objectives

Environmental value	Water quality objectives to protect EV (refer to specified codes and guidelines for full details)
Suitability for drinking water supply	The Australian Drinking Water Guidelines (NHMRC, 2011, as amended) provides a framework for catchment management and source water protection for drinking water supplies. Quality of raw water (prior to treatment) should consider the requirements of water supply operators, and their capacity to treat the water to make it safe for human consumption. Also refer to Table 11. Note: For water quality after treatment or at point of use refer to legislation and guidelines, including: • *Public Health Act 2005* and Regulation • *Water Supply (Safety and Reliability) Act 2008*, including any approved drinking water quality management plan under the Act • *Water Fluoridation Act 2008* and Regulation • *Australian Drinking Water Guidelines* (ADWG, 2011, as amended). • Safe Water on Rural Properties guideline (Queensland Health, 2015) Whether water is drawn from surface catchments or underground sources, it is important that the local catchment or aquifer is understood, and that the activities that could lead to water contamination are identified and managed. Effective catchment management and source water protection include development of a catchment management plan, with the commitment of land use planning authorities to prevent inappropriate development and to enforce relevant planning regulations.
Protection of the human consumer	As per ANZG and Australia New Zealand Food Standards Code, Food Standards Australia New Zealand, as amended.
Protection of cultural and spiritual values	Protect or restore indigenous and non-indigenous cultural heritage consistent with relevant policies and plans.
Suitability for industrial use	None provided. Water quality requirements for industry vary within and between industries. The ANZG do not provide guidelines to protect industries, and indicate that industrial water quality requirements need to be considered on a case-by-case basis. This EV is usually protected by other values, such as the aquatic ecosystem EV.
Suitability for aquaculture	As per: • Tables 12–14 • ANZG and Australia New Zealand Food Standards Code, Food Standards Australia New Zealand, as amended
Suitability for irrigation	Pathogens and metal WQOs are provided in Tables 15 and 16 (based on ANZG). For all other indicators, such as salinity, sodicity, sodium adsorption ratio (SAR), and herbicides, refer ANZG.
Suitability for stock watering	As per ANZG, including median faecal coliforms <100 organisms per 100 mL. For total dissolved solids and metals, refer Tables 17 and 18, based on ANZG.

Environmental value	Water quality objectives to protect EV (refer to specified codes and guidelines for full details)
	For other indicators, such as cyanobacteria and pathogens, see ANZG.
Suitability for farm supply/use	As per ANZG.
Suitability for primary contact recreation	Note: at time of publication the NHMRC guidelines for recreational water quality were under review, and updates may supersede the following. Refer to NHMRC website for latest information and updated guidelines. As per NHMRC (2008 – refer NHMRC website) including: • water free of physical (floating and submerged) hazards. Where permanent hazards exist (e.g. rips and sandbars), appropriate warning signs should be clearly displayed. • temperature range: 16–34°C • pH range: 6.5–8.5 • DO: >80% • faecal contamination: designated recreational waters are protected against direct contamination with fresh faecal material, particularly of human or domesticated animal origin. Two principal components are required for assessing faecal contamination: - assessment of evidence for the likely influence of faecal material - counts of suitable faecal indicator bacteria (usually *enterococci*) These two components are combined to produce an overall microbial classification of the recreational water body. • direct contact with venomous or dangerous aquatic organisms should be avoided. Recreational water bodies should be reasonably free of, or protected from, venomous organisms (e.g. box jellyfish and bluebottles) • waters contaminated with chemicals that are either toxic or irritating to the skin or mucous membranes are unsuitable for recreational purposes.
Suitability for primary contact recreation	Note: at time of publication the NHMRC guidelines for recreational water quality were under review, and updates may supersede the following. Refer to NHMRC website for latest information and updated guidelines. • cyanobacteria/algae: Recreational water bodies should not contain: - level 1[1]: ≥ 10 µg/L total microcystins; or ≥ 50 000 cells/mL toxic *Microcystis aeruginosa*; or biovolume equivalent of ≥ 4 mm^3/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume or - level 2[1]: ≥ 10 mm^3/L for total biovolume of all cyanobacterial material where known toxins are not present - where *Cylindrospermopsis caciborskii* is the dominant species present, advice should be sought for an appropriate guideline for cylindrospermopsin or - cyanobacterial scums consistently present. Further details are contained in NHMRC (2008) and Table 19.
Suitability for secondary contact recreation	As per NHMRC (2008), including: • intestinal enterococci: refer primary recreation above • cyanobacteria/algae—refer primary recreation, NHMRC (2008) and Table 19.
Suitability for visual recreation	As per NHMRC (2008), including: • recreational water bodies should be aesthetically acceptable to recreational users. The water should be free from visible materials that may settle to form objectionable deposits; floating debris, oil, scum and other matter; substances producing objectionable colour, odour, taste or turbidity; and substances and conditions that produce undesirable aquatic life. • cyanobacteria/algae—see, NHMRC (2008) and Table 19.

Notes:

1. Level 1 recognises the probability of adverse health effects from ingestion of known toxins, in this case based on the toxicity of microcystins. Level 2 covers circumstances in which there are very high cell densities of cyanobacterial material, irrespective of the presence of toxicity or known toxins. Increased cyanobacterial densities increase the likelihood of non-specific adverse health outcomes, principally respiratory, irritation and allergy symptoms. (NHMRC, 2008; 8).

Sources:

The WQOs were determined from a combination of sources, including:

- Australian Drinking Water Guidelines (NHMRC, 2011 as updated 2016), available from NHMRC website
- Australia New Zealand Food Standards Code (Australian Government: Food Standards Australia New Zealand), available from Food Standards Australia New Zealand website
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018, as amended)
- Guidelines for Managing Risks in Recreational Water (NHMRC, 2008), available from NHMRC website. At time of publication the NHMRC guidelines were under review. Refer to NHMRC website for latest information and updated guidelines.
- Safe Water on Rural Properties Guideline (Queensland Health, 2015)
- Technical review and advice from Queensland Health and Department of Natural Resources Mines and Energy (2020)

4.1 Drinking water EV water quality objectives

Table 11 Drinking water EV: Priority water quality objectives for drinking water supply in the vicinity of off-takes, before treatment

Indicator	Water quality objective [1]
Giardia	No guideline value set (ADWG) If *Giardia* is detected in drinking water then the Water Supply Regulator, DNRME and Queensland Health should be notified immediately and an investigation of the likely source of contamination undertaken.
Cryptosporidium	No guideline value set (ADWG) If *Cryptosporidium* is detected in treated drinking water then the Water Supply Regulator, DNRME and Queensland Health should be notified immediately and an investigation of the likely source of contamination undertaken.
E. coli	Well designed treatment plants with effective treatment barriers and disinfection are designed to address faecal contamination. *E. coli* or thermotolerant coliforms should not be present in any 100 mL sample of (treated) drinking water (ADWG). <1 cfu/100ml (Public Health Regulation 2018) and upstream sewage effluent discharges need to be known (catchment management).
Algal toxin	<1.3 µg/L Microcystin (ADWG)
pH	6.5–8.5 (ADWG)
Total dissolved solids (TDS)	<600mg/L The concentration of total dissolved solids in treated drinking water should not exceed 600 mg/L (ADWG, based on taste considerations).
Sodium	General [2]: The concentration of sodium in reticulated drinking water supplies should not exceed 180 mg/L (ADWG, based on threshold at which taste becomes appreciable). At-risk groups (medical) [2]: The concentration of sodium in water supplies for at-risk groups should not exceed 20 mg/L (ADWG).
Sulfate	The concentration of sulfate in drinking water should not exceed 250 mg/L (ADWG 2011, based on taste/aesthetic considerations). ADWG 2011 health guideline: <500mg/L
Dissolved oxygen	>85% saturation (ADWG)
Pesticides	Raw supplies: Below detectable limits. Treated drinking water: Refer to ADWG.
Other indicators (including physico-chemical indicators) e.g. turbidity	Refer to ADWG. <1 NTU is the target to facilitate for effective disinfection of drinking water (as turbidity of ≥ 1 NTU inhibits the performance of chlorination (ADWG))

Notes:

1. This table outlines WQOs for water **before treatment**, unless otherwise stated (e.g. ADWG). For water quality after treatment or at the point of use, refer to relevant legislation and guidelines, including *Public Health Act 2005* and Regulation, *Water Supply (Safety and Reliability) Act 2008 and Regulation*, including any approved drinking water management plan under the Act, *Water Fluoridation Act 2008*, the Australian Drinking Water Guidelines (ADWG, 2011 updated December 2013), and the Safe Water on Rural Properties guideline (Queensland Health, 2015).
2. The ADWG notes that 50 mg/L is a '*typical value*' in reticulated supplies. The ADWG value for sodium is 180 mg/L (based on level at which taste become appreciable) however '*sodium salts cannot be easily removed from drinking water*' and '*any steps to reduce sodium concentrations are encouraged'*. It further notes that '*medical practitioners treating people with severe hypertension or congestive heart failure should be aware if the sodium concentration in the patient's drinking water exceeds 20 mg/L*' (ADWG; sodium factsheet).

Source: Australian Drinking Water Guidelines (NHMRC, 2011 as updated 2018). Technical review and advice from Queensland Health and Department of Natural Resources Mines and Energy (2020).

4.2 Aquaculture EV water quality objectives

The following table outlines WQOs for aquaculture, depending on species.

Table 12 Aquaculture EV: Water quality objectives for optimal growth of particular freshwater species

WATER QUALITY OBJECTIVES VALUES FOR AQUACULTURE						
Water parameter	**Barramundi**	**Eel**	**Silver perch**	**Jade perch**	**Sleepy cod**	**Redclaw**
Dissolved oxygen	4–9 mg/L	>3 mg/L	>4 mg/L	>3 mg/L	>4.0 mg/L	>4.0 mg/L
Temperature	26–32˚C	23–28˚C	23–28˚C	23–28˚C	22–31˚C	23–31˚C
pH	7.5–8.5	7.0–8.5	6.5–8.5	6.5–8.5	7.0–8.5	7.0–8.5
Ammonia (TAN, Total ammonia–nitrogen)	ID	<1.0 mg/L	ID	ID	<1.0 mg/L	<1.0 mg/L
Ammonia (NH_3, un–ionised form)	<0.46 mg/L	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L
Nitrate (NO_3)	ID	ID	<100 mg/L	ID	ID	ID
Nitrite (NO_2)	<1.5 mg/L	<1.0 mg/L	<0.1 mg/L	ID	<1.0 mg/L	<1.0 mg/L
Salinity (extended periods)	0–35 psu	ID	<5 psu	<5 psu	ID	<4 psu
Salinity bath (short term treatment)	0–35 psu	ID	5–10 psu for 1 hour	ID	max. 20 psu for 1 hour	ID
Hardness ($CaCO_3$)	50-100 mg/L	ID	>50 mg/L	>50 mg/L	>40 mg/L	>40 mg/L
Alkalinity	>50 mg/L	ID	100–400 mg/L	100–400mg/L	>40 mg/L	>40 mg/L
Chlorine	<0.04 mg/L	ID	ID	ID	<0.04 mg/L	ID
Hydrogen sulphide	<0.3 mg/L	ID	ID	ID	<0.3 mg/L	ID
Iron	<0.1 mg/L	ID	<0.5 mg/L	<0.5 mg/L	<0.1 mg/L	<0.1 mg/L
Spawning temperature	marine	ID	23–28	23–28	>24 for more than 3 days	ID

Indicator: psu – practical salinity unit, ID – Insufficient data

Note: The table provides indicative water requirements for a range of aquaculture species (fresh and/or marine), recognising that not all listed species will occur in a given area, and that potential exists for changes in species under culture.

Source: Department of Primary Industries and Fisheries—Water Quality in Aquaculture—DPI Notes April 2004 (as amended) and DAF 2019-2020 technical review and advice.

Table 13 Aquaculture EV: General WQOs for a range of tropical freshwater aquaculture species

Water parameter	Recommended range		Water parameter	Recommended range
	Fresh water	Marine		General aquatic
Dissolved oxygen	>4 mg/L	>4 mg/L	**Arsenic**	<0.05 mg/L
Temperature	21–32˚C	24–33˚C	**Cadmium**	<0.003 mg/L
pH	6.8–9.5	7–9.0	**Calcium/Magnesium**	10–160 mg/L
Ammonia (TAN, total ammonia-nitrogen)	<1.0 mg/L	<1.0 mg/L	**Chromium**	<0.1 mg/L
Ammonia (NH_3, un-ionised form)	<0.1 mg/L	<0.1 mg/L	**Copper**	<0.006 mg/L in soft water
Nitrate (NO_3)	1–100 mg/L	1–100 mg/L	**Cyanide**	<0.005 mg/L
Nitrite (NO_2)	<0.1 mg/L	<1.0 mg/L	**Iron**	<0.5 mg/L
Salinity	0–5 psu	15–35 psu	**Lead**	<0.03 mg/L
Hardness	20–450 mg/L	ID	**Manganese**	<0.01 mg/L
Alkalinity	20–400 mg/L	>100 mg/L	**Mercury**	<0.00005 mg/L
Turbidity	<80 NTU	ID	**Nickel**	<0.01 mg/L in soft water <0.04 mg/L in hard water
Chlorine	<0.003 mg/L	ID	**Tin**	<0.001 mg/L
Hydrogen sulphide	<0.002 mg/L	ID	**Zinc**	0.03–0.06 mg/L in soft water 1–2 mg/L in hard water

Indicator: psu – practical salinity unit, NTU - nephelometric turbidity units, ID – Insufficient data

Note: The table provides indicative water requirements for a range of aquaculture species (fresh and/or marine), recognising that not all listed species will occur in a given area, and that potential exists for changes in species under culture.

Source: Department of Primary Industries and Fisheries—Water Quality in Aquaculture—DPI Notes April 2004 (as amended) and DAF 2019-2020 technical review and advice.

Table 14 Aquaculture EV: Water quality objectives for optimal growth of particular marine species

Water parameter	Barramundi		Giant Tiger prawn (*Penaeus monodon*)	
	Hatchery	**Grow out**	**Hatchery**	**Grow out**
Dissolved oxygen	saturation	>4 mg/L	>4 mg/L	>3.5 mg/L
Temperature	28–30˚C optimum 25–31˚C range	28–30˚C optimum	28-30˚C	26–32˚C
pH	approx. 8	approx. 8	7.8-8.2	7.5–8.5
Ammonia (TAN, total ammonia-nitrogen)	ID	0.1–0.5 mg/L	ID	<3 mg/L
Ammonia (NH_3, un-ionised form)	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L
Nitrate (NO_3)	<1.0 mg/L	<1.0 mg/L	<1.0 mg/L	<1.0 mg/L
Nitrite (NO_2)	<0.2 mg/L	<1.0 mg/L	<0.2 mg/L	<0.2 mg/L
Salinity	28–31psu	0–35psu	30-35psu	10–25 psu optimum
Alkalinity	ID	105–125 mg/L $CaCO_3$	ID	>80 mg/L
Clarity	ID	<10mg/L	ID	30–40cm secchi disk
Hydrogen sulphide	ID	<0.3 mg/L	<0.1 mg/L	<0.1 mg/L
Iron	ID	<0.02 mg/L	<1 mg/L	<1.0 mg/L
Spawning temperature	ID	28–32˚C	ID	27–32˚C

Indicator: psu – practical salinity unit, ID – Insufficient data

Note: The table provides indicative water requirements for a range of aquaculture species (fresh and/or marine), recognising that not all listed species will occur in a given area, and that potential exists for changes in species under culture.

Source: Department of Primary Industries and Fisheries—Water Quality in Aquaculture—DPI Notes April 2004 (as amended) and DAF 2019-2020 technical review and advice.

4.3 Irrigation EV water quality objectives

The following tables outline WQOs for irrigation, based on relevant national guidelines.

Table 15 Irrigation EV: Water quality objectives for thermotolerant (faecal) coliforms in irrigation waters used for food and non-food crops[1]

Intended use	Median values of thermotolerant coliforms (colony forming units—cfu)[2]
Raw human food crops in direct contact with irrigation water (e.g. via sprays, irrigation of salad vegetables)	<10 cfu/100 mL
Raw human food crops not in direct contact with irrigation water (edible product separated from contact with water, e.g. by peel, use of trickle irrigation); or crops sold to consumers cooked or processed	<1000 cfu/100 mL
Pasture and fodder for dairy animals (without withholding period)	<100 cfu/100 mL
Pasture and fodder for dairy animals (with withholding period of five days)	<1000 cfu/100 mL
Pasture and fodder (for grazing animals except pigs and dairy animals, such as cattle, sheep and goats)	<1000 cfu/100 mL
Silviculture, turf, cotton, etc. (restricted public access)	<10 000 cfu/100 mL

Notes:

1. Adapted from ARMCANZ, ANZECC and NHMRC (1999).
2. Refer to AWQG, Volume 1, Section 4.2.3.3 for advice on testing protocols. Source: AWQG, Volume 1, Section 4.2.3.3, Table 4.2.2.

Table 16 Irrigation EV: Water quality objectives for heavy metals and metalloids in agricultural irrigation water— soil cumulative contamination loading limit (CCL), long-term trigger value (LTV) and short-term trigger value (STV)[1]

Element	Soil cumulative contaminant loading limit (CCL)[2] (kg/ha)	Long-term trigger value (LTV) in irrigation water (up to 100 years) (mg/L)	Short-term trigger value (STV) in irrigation water (up to 20 years) (mg/L)
Aluminium	ND[2]	5	20
Arsenic	20	0.1	2.0
Beryllium	ND	0.1	0.5
Boron	ND	0.5	Refer to AWQG, Vol 3, Table 9.2.18
Cadmium	2	0.01	0.05
Chromium	ND	0.1	1
Cobalt	ND	0.05	0.1
Copper	140	0.2	5
Fluoride	ND	1	2
Iron	ND	0.2	10
Lead	260	2	5
Lithium	ND	2.5 (0.075 for citrus crops)	2.5 (0.075 for citrus crops)
Manganese	ND	0.2	10
Mercury	2	0.002	0.002
Molybdenum	ND	0.01	0.05
Nickel	85	0.2	2
Selenium	10	0.02	0.05
Uranium	ND	0.01	0.1
Vanadium	ND	0.1	0.5
Zinc	300	2	5

Notes:

1. Concentrations in irrigation water should be less than the trigger values. Trigger values should only be used in conjunction with information on each individual element and the potential for off-site transport of contaminants (refer AWQG, Volume 3, Section 9.2.5).

2. ND = Not determined; insufficient background data to calculate CCL.

Source: AWQG, Volume 1, Section 4.2.6, Table 4.2.10.

4.4 Stock watering EV water quality objectives

The following tables outline WQOs for stock watering, according to stock type (cattle, sheep etc.).

Table 17 Stock watering EV: Water quality objectives for tolerances of livestock to salinity, as total dissolved solids, in drinking water[1]

Livestock	Total dissolved solids (TDS) (mg/L)		
	No adverse effects on animals expected.	Animals may have initial reluctance to drink or there may be some scouring, but stock should adapt without loss of production	Loss of production and decline in animal condition and health would be expected. Stock may tolerate these levels for short periods if introduced gradually
Beef cattle	0–4000	4000–5000	5000–10 000
Dairy cattle	0–2500	2500–4000	4000–7000
Sheep	0–5000	5000–10 000	10 000–13 000[2]
Horses	0–4000	4000–6000	6000–7000
Pigs	0–4000	4000–6000	6000–8000
Poultry	0–2000	2000–3000	3000–4000

Notes:

1. From ANZECC (1992), adapted to incorporate more recent information.

2. Sheep on lush green feed may tolerate up to 13 000 mg/L TDS without loss of condition or production.

Source: ANZECC, ARMCANZ (2000), Volume 1, Section 4.3.3.5, Table 4.3.1. Note that a review of stock watering tolerances under the ANZG (2018) may lead to revised values from those in this table. Refer to ANZG (2018) for further details.

Table 18 Stock watering EV: Water quality objectives (low risk trigger values) for heavy metals and metalloids in livestock drinking water

Metal or metalloid	Trigger value (low risk)[1,2] (mg/L)
Aluminium	5
Arsenic	0.5 (up to 5[3])
Beryllium	ND
Boron	5
Cadmium	0.01
Chromium	1
Cobalt	1
Copper	0.4 (sheep), 1 (cattle), 5 (pigs), 5 (poultry)
Fluoride	2
Iron	not sufficiently toxic
Lead	0.1
Manganese	not sufficiently toxic
Mercury	0.002
Molybdenum	0.15
Nickel	1
Selenium	0.02
Uranium	0.2
Vanadium	ND
Zinc	20

Notes:

1. Higher concentrations may be tolerated in some situations (further details provided in ANZECC, ARMCANZ (2000), Volume 3, Section 9.3.5).

2. ND = not determined, insufficient background data to calculate.

3. May be tolerated if not provided as a food additive and natural levels in the diet are low.

Source: ANZECC, ARMCANZ (2000), Volume 1, Section 4.3.4, Table 4.3.2. Note that a review of stock watering tolerances under the ANZG (2018) may lead to revised values from those in this table. Refer to ANZG (2018) for further details.

4.5 Recreation EV water quality objectives - cyanobacteria

When cyanobacteria are present in large numbers, they can present a significant hazard, particularly to primary contact users of waters. Water quality guidelines for cyanobacteria in recreational waters are provided below. Monitoring and action requirements relative to cyanobacteria 'alert' levels are summarised below and are explained more fully in the Guidelines for Managing Risks in Recreational Water (NHMRC, 2008). Further details on the process to determine suitability of waters for recreation, relative to historical cyanobacterial levels and susceptibility to cyanobacterial contamination, are contained in sections 6 and 7 of the NHMRC guidelines.

Note: at time of publication the NHMRC guidelines for recreational water quality were under review, and updates may supersede the following. Refer to NHMRC website for latest information and updated guidelines.

Table 19 Recreational waters: Alert levels and corresponding actions for management of cyanobacteria

Green level surveillance mode[1]	Amber level alert mode[1]	Red level action mode[1]
Fresh waters		
≥ 500 to <5000 cells/mL *M. aeruginosa* or biovolume equivalent of >0.04 to <0.4 mm^3/L for the combined total of all cyanobacteria.	≥ 5000 to <50 000 cells/mL *M. aeruginosa* or biovolume equivalent of ≥ 0.4 to <4 mm^3/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume[2]. or[3] ≥ 0.4 to <10 mm^3/L for the combined total of all cyanobacteria where known toxin producers are not present.	Level 1 guideline[4]: ≥ 10 µg/L total microcystins or ≥ 50 000 cells/mL toxic *M. aeruginosa* or biovolume equivalent of ≥ 4 mm^3/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume. or[3] Level 2 guideline[4]: ≥ 10 mm^3/L for total biovolume of all cyanobacterial material where known toxins are not present. or cyanobacterial scums are consistently present[5].

Notes:

1. Recommended actions at different alert levels are outlined below (based on NHMRC, 2008, Table 6.6—fresh waters. Similar actions are outlined for coastal/estuarine waters in NHMRC Table 7.6):
   a. **Green**: Regular monitoring. Weekly sampling and cell counts at representative locations in the water body where known toxigenic species are present (i.e. *Microcystis aeruginosa, Anabaena circinalis, Cylindrospermopsis raciborskii, Aphanizomenon ovalisporum, Nodularia spumigena*); or fortnightly for other types including regular visual inspection of water surface for scums.
   b. **Amber**: Notify agencies as appropriate. Increase sampling frequency to twice weekly at representative locations in the water body where toxigenic species (above) are dominant within the alert level definition (i.e. total biovolume) to establish population growth and spatial variability in the water body. Monitor weekly or fortnightly where other types are dominant. Make regular visual inspections of water surface for scums. Decide on requirement for toxicity assessment or toxin monitoring.
   c. **Red**: Continue monitoring as for (amber) alert mode. Immediately notify health authorities for advice on health risk. ('In action mode the local authority and health authorities warn the public of the existence of potential health risks; for example, through the media and the erection of signs by the local authority.' NHMRC, 2008; 114). Make toxicity assessment or toxin measurement of water if this has not already been done. Health authorities warn of risk to public health (i.e. the authorities make a health risk assessment considering toxin monitoring data, sample type and variability).
2. The definition of 'dominant' is where the known toxin producer comprises 75 per cent or more of the total biovolume of cyanobacteria in a representative sample.
3. This applies where high cell densities or scums of 'non toxic' cyanobacteria are present i.e. where the cyanobacterial population has been tested and shown not to contain known toxins (mycrocystins, nodularian, cylindrospermopsin or saxitoxin).
4. Health risks and levels: Level 1 is developed to protect against short-term health effects of exposure to cyanobacterial toxins ingested during recreational activity, whereas the Level 2 applies to the circumstance where there is a probability of increased likelihood of non-specific adverse health outcomes, principally respiratory, irritation and allergy symptoms, from exposure to very high cell densities of cyanobacterial material irrespective of the presence of toxicity or known toxins (NHMRC, 2008;114).
5. This refers to the situation where scums occur at the recreation site each day when conditions are calm, particularly in the morning. Note that it is not likely that scums are always present and visible when there is a high population as the cells may mix down with wind and turbulence and then reform later when conditions become stable.

Source: Based on NHMRC (2008) Guideline for Managing Risks in Recreational Water (tables 6.2, 6.6, 7.3).

5 Ways to improve water quality

The following sources are relevant in considering ways to improve water quality. The list below is additional to the plans, guidelines and other sources referred to in previous sections, **and is provided for information only.**

Local plans, studies

- Council planning scheme and supporting codes, policies, available from DSDMIP website and council websites

State plans, policies, guidelines, agreements

- Healthy Waters Management Plan: Condamine River Basin, available from DES website.
- State Planning Policy (state interest – water quality), including SPP code – water quality, and supporting SPP guidelines, available from the DSDMIP website
- *Water Act 2000* – Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017
- *Water Act 2000* – Water Plan (Condamine and Balonne) 2019

Federal plans, policies, guidelines, agreements

- Basin Salinity Management 2030 (BSM2030) - Licensed from the Murray–Darling Basin Authority under a Creative Commons Attribution 3.0 Australia Licence
- *Water Act 2007* – Basin Plan 2012
- *Water Act 2007* – Intergovernmental Agreement on Implementing Water Reform in the Murray Darling Basin

Water quality guidelines

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018)*
- Monitoring and Sampling Manual, available from the department's website
- Queensland Water Quality Guidelines (QWQG), available from the department's website

Other supporting technical information – riparian management

- Fisheries Guidelines for Fish Habitat Buffer Zones, FHG003, available from the Department of Agriculture and Fisheries
- Healthy Waterways Incorporated – Water by Design: resources and information available on the Water by Design website
- Information on PFAS in Queensland, including access to PFAS national environmental management plan
- Queensland Murray–Darling Basin Ground Cover Report, 2015
- Riparian vegetation levels in the Queensland Murray–Darling Basin and Bulloo catchments for 2013, Department of Science, Information Technology and Innovation, 2015
- Salinity Management Handbook – available on the Queensland Government Publications website
  - Chapter 10 – Waters
  - Chapter 11 – Water Quality
- Soil conservation guidelines for Queensland – available on the Queensland Government Publications website
  - Chapter 10 – Land management on flood plains
  - Chapter 11 – Stream stability
  - Chapter 13 – Gully Erosion
- Water Connections: Aboriginal People's water needs in the Queensland Murray-Darling Basin, A guide to the water plans in the Condamine and Balonne, Border Rivers and Moonie catchments, February 2019, available from Murray-Darling Basin Authority website.
- Northern Basin Toolkit Projects Investment Recommendations for Queensland
- Riparian fencing and improved management of stock and feral species in riparian areas under the Basin Plan 2012

6 Dictionary

ANZECC means the Australian and New Zealand Environment and Conservation Council.

ANZECC Guidelines mean the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (recently updated to become ANZG, 2018), prepared by the Australian and New Zealand Environment and Conservation Council (ANZECC) and the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ).

Aquatic ecosystem (defined in the ANZG) any watery environment from small to large, from pond to ocean, in which plants and animals interact with the chemical and physical features of the environment.

Aquatic ecosystem (defined in the EPP (Water and Wetland Biodiversity)) means a community of organisms living within or adjacent to water, including riparian or foreshore areas.

Basin means the basin name and number provided by Geoscience Australia, Canberra (3rd edition, 2004).

Basin Plan means the *Basin Plan 2012*, prepared under the Commonwealth *Water Act 2007*.

Biological Integrity (defined in the EPP (Water and Wetland Biodiversity)) for water or a wetland, means the ability of the water or wetland to support and maintain a balanced, integrative, adaptive community of organisms having a species composition, diversity and functional organisation comparable to that of the natural habitat of the locality in which the water or wetland is situated.

Catchment means the total area draining into a river, creek, reservoir or other body of water. The limits of a given catchment are the heights of land (such as hills or mountains) separating it from neighbouring catchments. Catchments can be made up of smaller sub-catchments.

Ecological integrity (health) (defined in the ANZG) means the ‘health’ or ‘condition’ of an ecosystem. The ability of an ecosystem to support and maintain key ecological processes and organisms so that their species compositions, diversity and functional organisations are as comparable as possible to those occurring in natural habitats within a region.

Environmental value (EV) means:

(a) a quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or

(b) another quality of the environment identified and declared to be an environmental value under an Environmental Protection Policy or Regulation (e.g. water suitable for swimming in or drinking).

The EVs for water that can be identified for protection are outlined in the accompanying table.

Queensland waters (as defined in *Acts Interpretation Act 1954*): means all waters that are a) within the limits of the state; or b) coastal waters of the state.

Sub-basin means part of a basin.

Sub-catchment means part of a catchment.

Toxicant (defined in the ANZG): means a substance capable of producing an adverse response (effect) in a biological system, which may seriously injure structure or function or produce death at sufficiently high concentration.

Table 20 Environmental values that can be identified for protection

Environmental values and definitions	ICON (as shown on plans)
Aquatic ecosystem 'A community of organisms living within or adjacent to water, including riparian or foreshore area.' (EPP (Water and Wetland Biodiversity), schedule 2 - Dictionary) The intrinsic value of aquatic ecosystems, habitat and wildlife in waterways and riparian areas, for example, biodiversity, ecological interactions, plants, animals, key species (such as turtles, platypus, seagrass and dugongs) and their habitat, food and drinking water. Waterways include perennial and intermittent surface waters, groundwaters, tidal and non-tidal waters, lakes, storages, reservoirs, dams, wetlands, swamps, marshes, lagoons, canals, natural and artificial channels and the bed and banks of waterways. (This EV incorporates the 'wildlife habitat' EV used in the South East Queensland Regional Water Quality Management Strategy). See below for more details on aquatic ecosystems, based on the EPP (Water and Wetland Biodiversity).	
High ecological/conservation value waters 'Waters in which the biological integrity of the water is effectively unmodified or highly valued.' (EPP (Water and Wetland Biodiversity), schedule 2).	None
Slightly disturbed waters 'Waters that have the biological integrity of high ecological value waters with slightly modified physical or chemical indicators but effectively unmodified biological indicators.' (EPP (Water and Wetland Biodiversity), schedule 2).	None
Moderately disturbed waters 'Waters in which the biological integrity of the water is adversely affected by human activity to a relatively small but measurable degree.' (EPP (Water and Wetland Biodiversity), schedule 2).	None
Highly disturbed waters 'Waters that are significantly degraded by human activity and have lower ecological value than high ecological value waters or slightly or moderately disturbed waters.' (EPP (Water and Wetland Biodiversity), schedule 2).	None

Environmental values and definitions	ICON (as shown on plans)
Irrigation Suitability of water supply for irrigation, for example, irrigation of crops, pastures, parks, gardens and recreational areas.	
Farm water supply/use Suitability of domestic farm water supply, other than drinking water. For example, water used for laundry and produce preparation.	
Stock watering Suitability of water supply for production of healthy livestock.	
Aquaculture Health of aquaculture species and humans consuming aquatic foods (such as fish, molluscs and crustaceans) from commercial ventures.	
Human consumers of aquatic foods The suitability of the water for producing aquatic foods for human consumption such as fish, crustaceans and shellfish from natural waterways.	
Primary recreation Means a use that involves the following types of contact with the water—full body contact, frequent immersion by the face and trunk, frequent contact with spray by the face where it is likely some water will be swallowed or inhaled, or come into contact with ears, nasal passages, mucous membranes or cuts in the skin. Examples–diving, swimming, surfing (EPP (Water and Wetland Biodiversity), section 6).	
Secondary recreation Means a use that involves the following types of contact with the water—contact in which only the limbs are regularly wet, and other contact, including the swallowing of water, is unusual (examples—boating, fishing, wading) or occasional inadvertent immersion resulting from slipping or being swept into the water by a wave. (EPP (Water and Wetland Biodiversity), section 6).	
Visual recreation Means a use that does not ordinarily involve any contact with the water—for example angling from the shore, sunbathing near water (EPP (Water and Wetland Biodiversity), section 6).	
Drinking water supply Suitability of the water for supply as drinking water having regard to the level of treatment of the water.	
Industrial use Suitability of water supply for industrial purposes, for example, food, beverage, paper, petroleum and power industries, mining and minerals refining/processing. Industries usually treat water supplies to meet their needs.	

Environmental values and definitions	ICON (as shown on plans)
Cultural and spiritual values Means scientific, social or other significance to the present generation or past or future generations, including Aboriginal people or Torres Strait Islanders (EPP (Water and Wetland Biodiversity)), section 6), for example: • custodial, spiritual, cultural and traditional heritage, hunting, gathering and ritual responsibilities • symbols, landmarks and icons (such as waterways, turtles and frogs) • lifestyles (such as agriculture and fishing).