2016–17 Basin-scale evaluation of Commonwealth environmental water – Ecosystem Diversity

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2016–17 Basin-scale evaluation of Commonwealth environmental water — Ecosystem Diversity

Report prepared for the Commonwealth Environmental Water Office by La Trobe University

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The La Trobe University offices are located on the land of the Latje Latje and Wiradjuri peoples. We undertake work throughout the Murray–Darling Basin and acknowledge the traditional owners of this land and water. We pay respect to Elders past, present and future.

Contents

List of tables

List of figures

Abbreviations

ANAE	Australian National Aquatic Ecosystem (classification)
CEWO	Commonwealth Environmental Water Office
GIS	geographical information system
ha	hectare
LTIM	Long Term Intervention Monitoring
MDBA	Murray–Darling Basin Authority

1 Preface

This evaluation of the contribution of Commonwealth environmental water to Ecosystem Diversity uses a revised ecosystem classification and new mapping and results herein should not be compared to those of previous LTIM Ecosystem Diversity reports (Brooks 2016, 2017b). The Australian National Aquatic Ecosystem (ANAE) classification of the Basin on which this report is based underwent a substantial revision in 2017 to improve the accuracy and comprehensiveness of ecosystem mapping in the Basin (Brooks 2017a). The update included new mapping that substantially changed the number and extent of mapped aquatic ecosystems in areas that receive Commonwealth environmental water. The most significant changes are to the extent of floodplain and riparian ecosystems; however, the use of new and improved data sources for the different ecosystem attributes (e.g. water regime, salinity and vegetation) also changed the ecosystem type classification of many lakes and wetlands.

A basin-scale comparison among years of the LTIM project was achieved by re-evaluating the contribution of Commonwealth environmental water delivered in each of the previous years against the revised ANAE classification. Therefore, the results presented below reflect the most current mapped aquatic ecosystems in the Basin and the results presented in previous reports (2014-2016) are not comparable. Further changes to the ANAE classification are expected in the near future as NSW updates mapping of vegetation over much of the western half of the state. The cumulative evaluation of Ecosystem Diversity outcomes across years will then be repeated in a future report.

2 Introduction

Biological diversity describes the variety of living organisms and ecosystems on Earth. The concept of biodiversity is often understood in terms of numbers of species of microbes, plants and animals but increasingly the definition is expanded to include other forms of natural variation such as genetic diversity, ecosystem diversity and diversity of ecosystem function (Figure 1). A focus on protecting and restoring ecosystems also preserve the communities and species within them in addition to critical ecosystem functions and services that ecosystems may provide to us (Cadotte *et al.* 2011; Pollock *et al.* 2017)

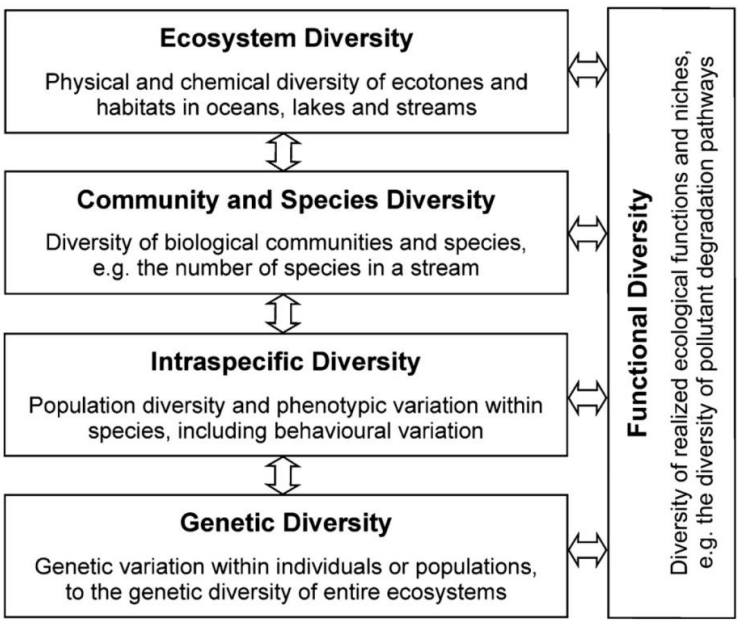

Figure 1. Hierarchical levels of biodiversity in aquatic ecosystems **(Geist 2011)**

There is increasing recognition globally that conserving biodiversity is critically important to maintain the functioning of natural ecosystems and for the sustainability of resources and ecosystem services on which human survival depends. Australia has joined 195 other countries as signatories to the United Nations Convention on Biological Diversity (1993, https://www.cbd.int) which provides guidance and impetus for conserving biodiversity and promoting sustainable development and sharing of genetic resources. The Basin Plan (Commonwealth of Australia 2012) is consistent with these objectives as it balances the need for sustainable water resource use with the environmental imperative to protect and restore biodiversity that is dependent on those same water resources.

Managed delivery of Commonwealth environmental water supports the maintenance of ecosystem diversity in the Basin via the provision of water to aquatic habitats which in turn supports a mosaic of water-dependent flora and fauna and provides the physical and chemical conditions that determine how ecosystems function (Junk *et al.* 1989; Poff 1997; Thorp *et al.* 2006). In theory, delivery of environmental water also has the potential to change physical landscape diversity through geomorphological processes (Figure 2). In practice, however, the frequency and volumes of Commonwealth environmental water that are delivered are constrained by storage volumes, infrastructure, and land use to volumes that complement natural hydrological regimes rather than creating wholesale hydrological regime change that has potential to restructure landscapes.

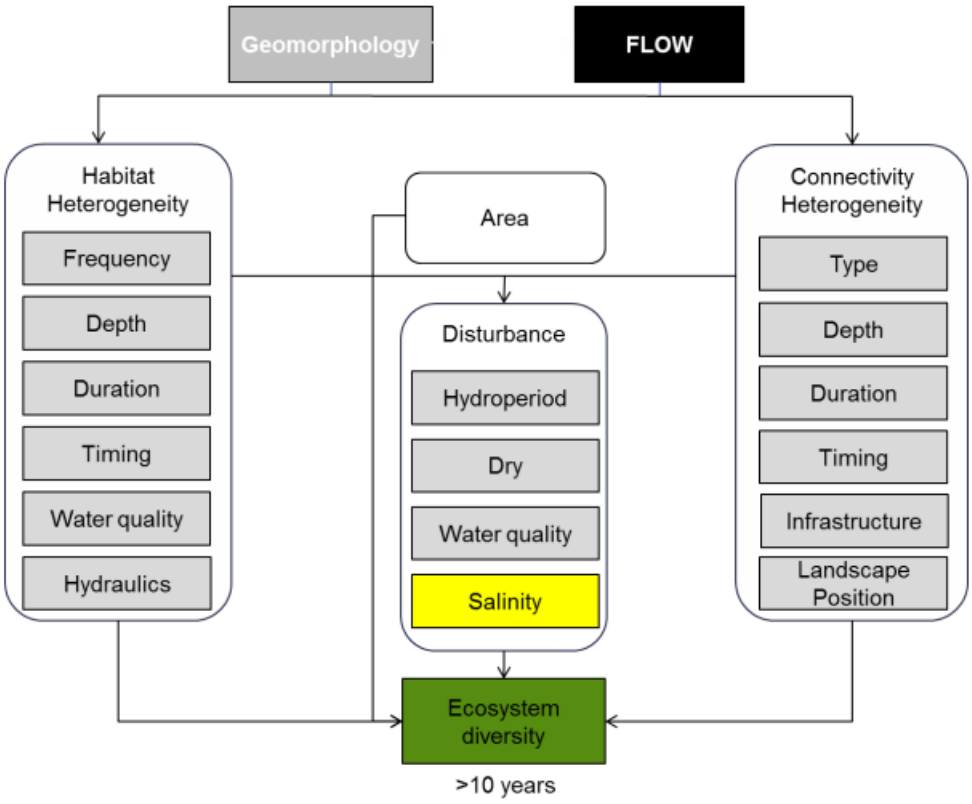

Figure 2. Cause-and-effect diagram depicting the influence of flow on landscape ecosystem diversity **(MDFRC 2013)**.

This evaluation catalogues the different ecosystem types that received Commonwealth environmental water during the 2016–17 water year. Evaluating the extent to which water-dependent ecosystem types have been supported by Commonwealth environmental water therefore contributes to assessing the contribution of Commonwealth environmental water to biodiversity in the Basin as outlined in the Commonwealth Environmental Water Outcomes Framework (CEWH 2013).

The output of the Ecosystem Diversity evaluation also provides a template that can be used to extrapolate observed outcomes at monitoring sites within the Basin (e.g. in LTIM Selected Areas) to similar ecosystem types in areas that are not monitored, thereby facilitating a Basin-scale evaluation of the impact of Commonwealth environmental water. The specific hydrological and ecological outcomes are the subject of other LTIM Basin matter and Selected Area reports (Gawne *et al.* 2014).

3 Method

Ecosystem diversity is quantified using the interim ANAE Classification Framework to define the distinct ecosystem types and their location in the Basin. The ANAE framework was prepared by the Australian Government Aquatic Ecosystems Task Group (AETG) to provide a consistent ecosystem type classification that can inform cross-jurisdictional adaptive management of aquatic ecosystems (Aquatic Ecosystems Task Group 2012). It uses three levels of attribute data to classify ecosystem types (

Figure 3).

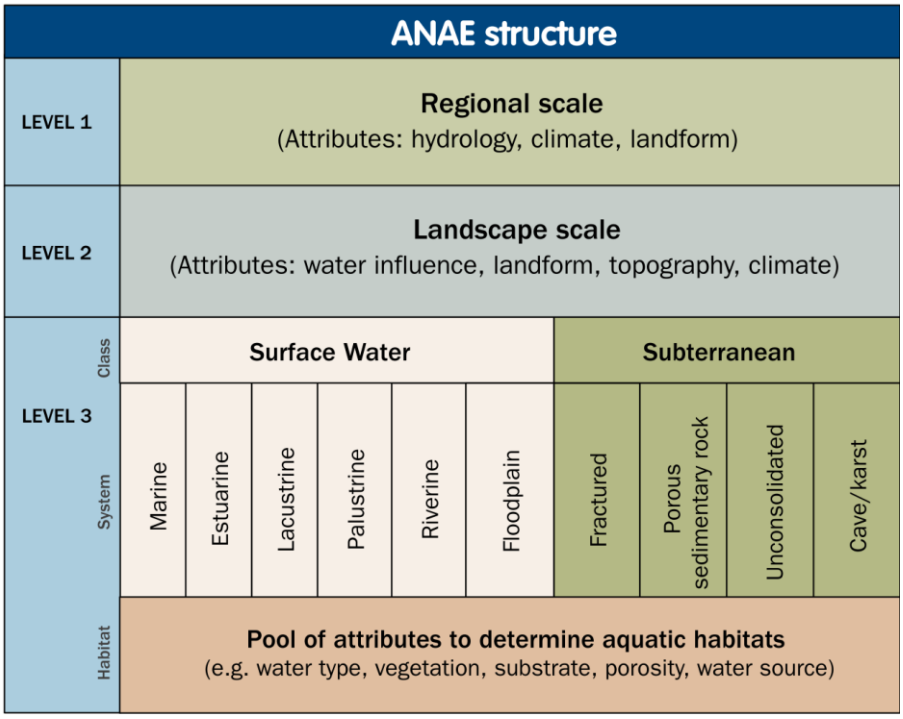

Figure 3. Structure and levels of the Interim Australian National Aquatic Ecosystem Classification Framework **(Aquatic Ecosystems Task Group 2012)**.

Level 1 attributes include national and regional data related to national climate, landform and hydrological patterns. Level 2 attributes are similar to Level 1 attributes but applied at sub-catchment scales. Level 3 attributes are applied to individual aquatic ecosystems. The ANAE classification was applied to the best available jurisdictional mapping for Basin wetlands, floodplains and rivers by Brooks *et al.* (2014) to produce the interim Murray-Darling Basin Aquatic Ecosystem Classification data set. This data set provides the LTIM project with a relevant and contemporary means for defining ecosystem diversity in the Basin.

Overlaying the ANAE ecosystem map with the distribution of Commonwealth environmental water that was delivered in the Basin can then identify which ecosystem types received Commonwealth

environmental water to answer the following short-term (1-year) and long-term (5-year) Basin-scale evaluation question:

1. What did Commonwealth environmental water contribute to ecosystem diversity?

3.1 Data

Data inputs to the evaluation of ecosystem diversity include:

The Murray-Darling Basin ANAE data set (Brooks *et al.* 2014; Brooks 2017a) (Figure 4). In 2017 the ANAE classification of the Basin underwent a substantial revision designed to improve the accuracy and currency of aquatic ecosystem mapping and to integrate all ecosystem types into a single aquatic ecosystem map for the Basin (Brooks 2017a). Additional changes were made in 2018 to further refine the classification of floodplains and to add new mapping for floodplains in QLD to improve consistency of mapping across state borders (Figure 5).

As a result of all the changes to the ecosystem mapping, the Ecosystem Diversity evaluation results presented in this report are not comparable to those presented in previous reports. To facilitate comparison among years, the inundation extents from previous years were re-evaluated against the revised ANAE and compared below.

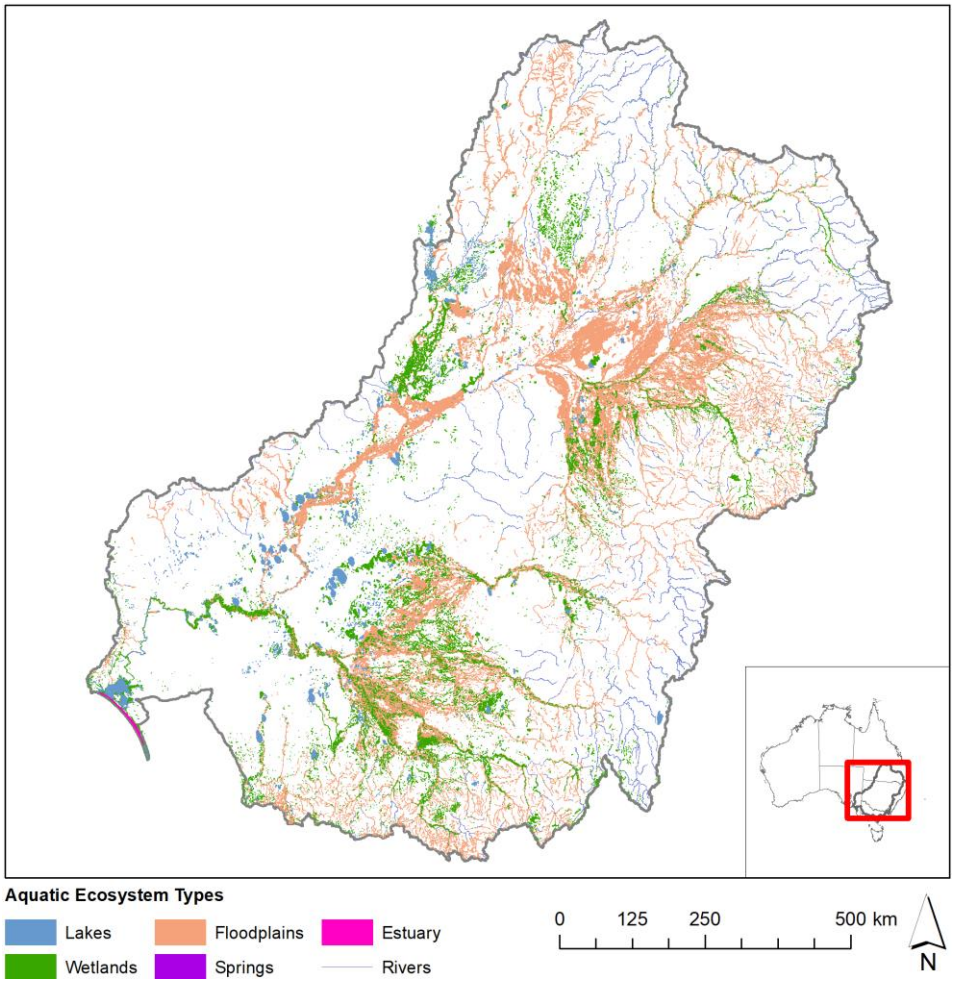

Figure 4. Aquatic ecosystems of the Murray-Darling basin (ANAE 2018 mapping).

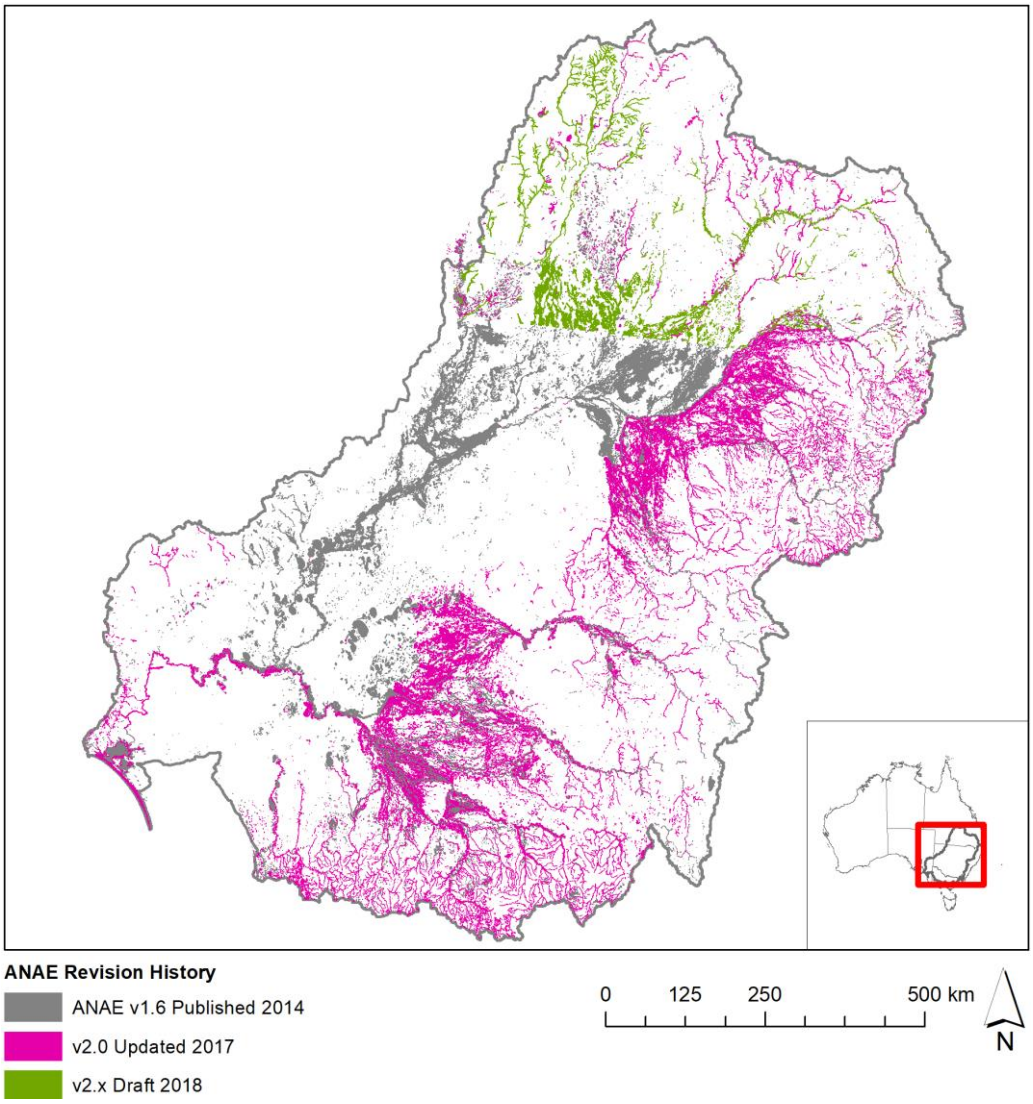

Figure 5. Revision history for the ANAE mapping in the Basin.

Commonwealth environmental water Inundation 2016–17 — a spatial representation of watering extent for Commonwealth environmental water delivered in the 2016–17 water year (Stewardson & Guarino 2018) (Figure 6). Improvements in the mapping of inundation extent this year led to the inclusion of the Coorong and Lakes Alexandria and Albert and the longitudinal extent of influence of Commonwealth environmental water in river channels. Commonwealth environmental water may include other environmental water (e.g. from State agencies) in a combined delivery and the extent mapped is the combined extent.

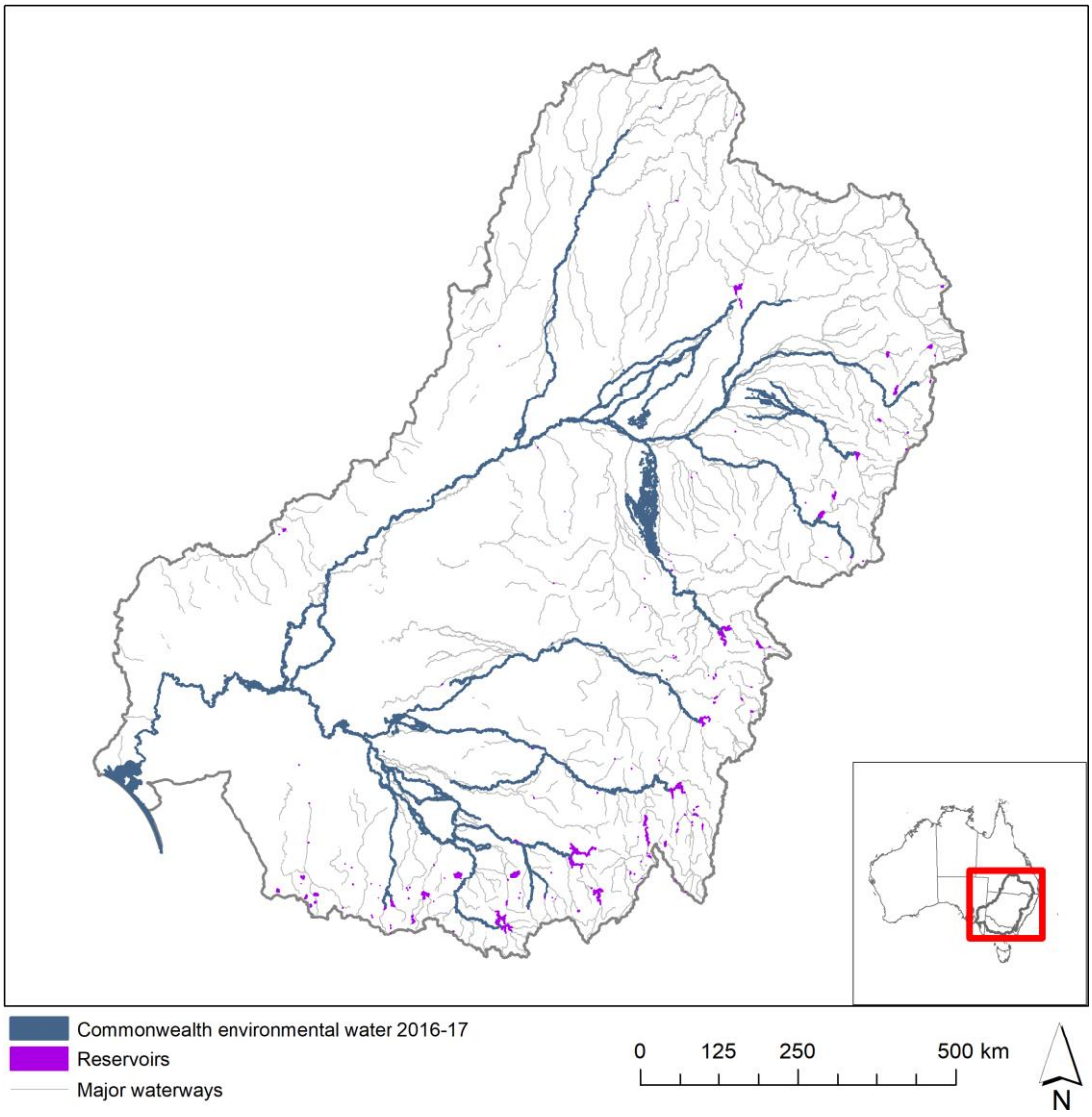

Figure 6. Commonwealth environmental water 2016–17.

LTIM valleys — a spatial layer developed for the LTIM project that subdivides the Basin into the major river valleys (Figure 7). These boundaries were derived from the Sustainable Rivers Audit (SRA) catchment boundaries with a modification to separate the Edward-Wakool Catchment from the Central Murray. The boundaries were adjusted slightly to improve the assignment of wetlands near valley boundaries to the watersheds in which managers and Commonwealth environmental water accounting allocate them. Mostly these changes affect the Central Murray area with a widening along the Murray River corridor to encompass fringing wetlands and the Gunbower and Barmah forests, and southern expansion of the Murrumbidgee valley to include Yanco Creek within the Murrumbidgee valley.

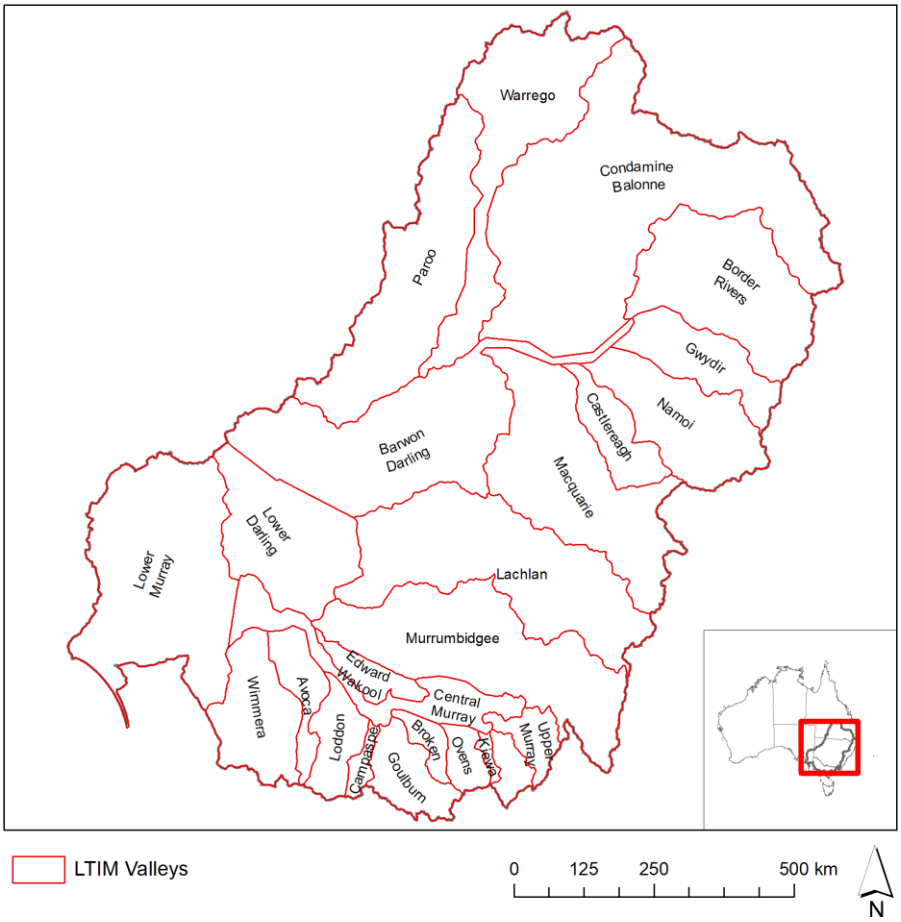

Figure 7. Valley boundaries within the Murray–Darling Basin used in this evaluation.

As in previous years, two different approaches were used to quantify the area of different ecosystem types that received Commonwealth environmental water:

1. Area inundated by Commonwealth environmental water = the sum of only the inundated areas of each wetland type, excluding the areas of wetlands that were not inundated.
2. Area influenced by Commonwealth environmental water = the sum of the all wetland areas that received water even if the inundation mapping showed that only a portion of the wetland was inundated.

The area *inundated* by Commonwealth environmental water is a 'literal' definition that represents the minimum contribution of Commonwealth environmental water in the landscape. The area

influenced by Commonwealth environmental water acknowledges that aquatic ecosystems are complex interconnected systems and delivering water to part of a wetland contributes benefits to the entire wetland system. For example, filling a wetland depression may raise local water tables and benefit fringing vegetation, or provide feeding habitat for waterbirds that roost elsewhere in the wetland vegetation that was not inundated.

For lakes and palustrine wetlands, the total area *influenced* by Commonwealth environmental water is the appropriate measure of the contribution of Commonwealth environmental water to ecosystem diversity because water entering one part of a wetland depression is likely to raise water levels or the local water table across the extent.

For floodplains, the area *inundated* by Commonwealth environmental water is used to measure the contribution of Commonwealth environmental water to ecosystem diversity. This more conservative measure is used for floodplains because floodplains occur as broad continuous expanses and the ecosystem response is generally limited to the wetted area. Depressional wetlands and channels that hold or convey water through floodplains are considered as separate entities.

GIS methodologies for calculating these areas are provided in Section 3.2.

The spatial representation of watering extent for Commonwealth environmental water delivered in 2016–17 includes all watering actions that resulted in inundation beyond the river channel (Stewardson & Guarino 2018). River reaches that received in-channel pulses, freshes and passing flows are also identified (Figure 6); however, the river channel inundation mapping is not of sufficient resolution to identify inundation of river banks and fringing habitats along the channels.

Commonwealth environmental water reaching the end of the system contributes to the maintenance of the Coorong, Lake Alexandrina, Lake Albert and the Murray Mouth ecosystems. Reliable inundation models for this area do not exist at this time so the extent of inundation is estimated from the mapped extent of the Coorong, Lake Alexandrina, Lake Albert and the Murray Mouth. This estimate is considered reliable because the lakes are managed for a relatively constant water level of 0.5 to 0.8m AHD by regulating outflows through the barrages. Below the barrages, water levels in the Murray Mouth and Coorong are maintained near sea level.

3.2 GIS Workflows

All spatial layers are based on the 1994 Geocentric Datum of Australia (GDA94). Areas in this report are in hectares and have been calculated in the Australia Albers Equal Area Conic projection to report accurate area measurements across the Basin.

The area of ecosystems inundated by Commonwealth environmental water is the fraction of the wetland area that intersects the Commonwealth environmental water inundation extent.

GIS Workflow:

1. Intersect:
    a. The Basin ANAE classification mapping;
    b. Commonwealth environmental water Inundation; and
    c. LTIM Valleys
2. Calculate polygon area in hectares using equal area GDA94 Australian Albers projection.
3. Sum the area of each ANAE wetland type per valley.

The area of ecosystems influenced by Commonwealth environmental water is defined as the sum of the areas of mapped features that are partially or fully overlapped by Commonwealth environmental water inundation extent.

GIS Workflow:

1. Select by location all ANAE wetland polygons that intersect the Commonwealth environmental water Inundation.
2. Intersect the selected wetlands with the catchment boundaries.
3. Calculate polygon area in hectares using equal area GDA94 Australian Albers projection.
4. Sum the area of each ANAE wetland type per valley.

Length of waterways influenced by Commonwealth environmental water

River length measurement is highly dependent on the resolution of the mapping with higher resolution mapping capturing more twists and turns in the river that increase the measured river length along the flow path between two points. The Basin ANAE waterway mapping compiles state data that varies in resolution from 1:25 000 to 1:100 000.

GIS Workflow:

1. Intersect:
    a. The Basin ANAE Waterways
    b. Commonwealth environmental water Inundation
    c. LTIM Valleys
2. Calculate the channel length inundated for each riverine ecosystem type in kilometres using equal area GDA94 Australian Albers projection.
3. Calculate summary statistics to sum the length of each river ecosystem type per valley.

4 Ecosystem Diversity Basin-scale evaluation

4.1 Highlights

In the 2016–17 water year:

- More than 77 500 ha of lakes and wetlands, 14 000 ha of floodplains and 21 000 km of rivers in the Basin upstream of the Lower Lakes were supported by Commonwealth environmental water.
- Commonwealth environmental water supported another 118 000 ha of Lake Alexandrina and Lake Albert and their fringing wetlands and 24 000 ha of estuarine habitat in the Coorong and Murray Mouth.
- Wetland and floodplains in five LTIM Selected Areas received Commonwealth environmental water with substantial areas also inundated in the Macquarie and Central Murray valleys.
- More than half (51%) of the different wetland ecosystem types and 83% of floodplain ecosystem types in the basin were represented in the area inundated by Commonwealth environmental water. Of the wetland areas receiving Commonwealth environmental water, 52% were meadows and marshes (41 000 ha) primarily in Gwydir and Macquarie valleys.
- Approximately 42% of the wetland areas that received Commonwealth environmental water were classed as temporary (intermittent) ecosystem types. These areas can be hot-spots for diversity if they support different suites of species in the dry and wet phases.
- As in previous years, Commonwealth environmental water contributed to all of the estuarine ecosystem types in the Basin during 2016–17 as environmental flows passed through to the Murray Mouth and Coorong.
- The rarest aquatic ecosystem types in the Basin, which include various types of paperback swamp and lakes with aquatic macrophyte beds, did not receive Commonwealth environmental water (and have not during the period of LTIM).

Comparing the three watering years 2014–15 to 2016–17:

- The broad pattern of watering across ecosystem types is similar across all the three years with 51% of wetland and lake ecosystem types receiving Commonwealth environmental

water in all three years and 38% of ecosystem types not receiving any Commonwealth environmental water in any year over the same period.

- The mix of ecosystem types and the proportions of those types that received Commonwealth environmental water in 2016–17 was very similar to 2014–15 with the two exceptions; permanent tall emergent marshes of the Great Cumbung Swamp at the end of the Lachlan River were not watered in 2016–17 and 12 500 ha of temporary lignum swamp within the Narran Lakes Ramsar Site received water in 2016–17 for the first time since LTIM commenced in 2013.
- The distribution of Commonwealth environmental water in 2015–16 was different to the other two years in that larger areas of the Lowbidgee, Barmah Forest and Lachlan river system were inundated supporting a greater proportion of temporary river red gum swamps, floodplain and riparian wetlands, temporary swamps and permanent saline wetlands compared to the years either side.

4.2 Basin-scale evaluation 2016–17

This evaluation does not consider the details of individual watering events and is ignorant of the specific timing and duration of Commonwealth environmental water in different areas of the landscape. The inundation map (Figure 6) collapses the maximum wetted extent of all watering actions during 2016–17 that included Commonwealth environmental water. The area inundated in each valley, and the length of river channels influenced by Commonwealth environmental water is presented in

Table **1**.

The contribution of Commonwealth environmental water to Ecosystem Diversity upstream of the Lower Lakes is presented under the broad system type categories: lakes and wetlands (Table 2), floodplains (Table 3), river channels (Table 4). The contribution of Commonwealth environmental water to Ecosystem Diversity in the Coorong and Lakes Alexandrina and Albert and the Murray Mouth are presented separately in (Table 5) for two main reasons. Firstly to prevent the large areas of Lakes Alexandrina and Albert from masking finer scale patterns of inundation of lakes in the rest of the Lower Murray valley. Secondly, the assumption of constant water levels inundating the same ecosystems each year may hinder evaluation of more variable inter-annual differences in the use of Commonwealth environmental water in other areas of the Basin.

Commonwealth environmental watering actions contributed to the inundation of a wide range of ecosystem types within the Basin that included approximately 51% of the different wetland types and 83% of the different floodplain types, and all (100%) of the river channel and estuarine ecosystem types.

A more detailed breakdown by valley is provided in Annex B (wetlands and estuarine ecosystems), Annex C (floodplains) and Annex D (river channels).

Table 1. Area of each LTIM catchment inundated by Commonwealth environmental water in 2016–17, including both floodplain and wetland ecosystem types.

Catchment name	LTIM Selected Area	Lakes and wetland area influenced (ha)	Floodplain area inundated (ha)	Length of waterways influenced (km)
Avoca		–	–	–
Barwon Darling		412	–	2611
Border Rivers		74	48	1630
Broken		–	–	177
Campaspe		–	–	–
Castlereagh		–	–	–
Central Murray		3372	209	2538
Condamine Balonne		17 341	34	2141
Edward–Wakool	Edward–Wakool river system	–	–	1033
Goulburn	Goulburn River	–	–	523
Gwydir	Gwydir river system	6730	1251	846
Kiewa		–	–	
Lachlan	Lachlan river system	144	2047	1506
Loddon		–	–	528
Lower Darling		32	11	1241
Lower Murray*	Lower Murray River*	6465*	1158	960
Lower Murray (Coorong Lakes Alexandrina and Albert and Murray Mouth)		Fresh: 118 148 Estuary: 23 850	66	–
Macquarie		36 842	6250	807
Mitta Mitta		–	–	–
Murrumbidgee	Murrumbidgee river system	6448	3211	2222
Namoi		–	–	1027
Ovens		–	–	483
Paroo		–	–	–
Upper Murray		–	–	–
Warrego	Junction of the Warrego and Darling rivers	17 734	186	1367
Wimmera		–	–	–
Total		**237 592**	**14 471**	**21 640**

* excludes the Coorong, Lakes Alexandrina and Albert and the Murray Mouth.

Table 2. Contribution of Commonwealth environmental water to ecosystem diversity of lakes and wetlands at the basin-scale. Ecosystem types are sorted by the area influenced by Commonwealth environmental water.

Australian National Aquatic Ecosystem (ANAE) wetland type	Total ex Coorong and Lower Lakes	Inundated*		Influenced*	
	area (ha)	Area (ha)	% of total	Area (ha)	% of total
Pt2.3.2: Freshwater meadow	125 128	3420	2.7	20 508	16.4
Pp4.2: Permanent wetland	77 300	11 132	14.4	20 095	26.0
Pt2.2.2: Temporary sedge/grass/forb marsh	135 475	3811	2.8	16 917	12.5
Pt1.7.2: Temporary lignum swamp	49 962	516	1.0	12 427	24.9
Pt1.1.2: Temporary river red gum swamp	74 721	1423	1.9	7517	10.1
Lp1.1: Permanent lake	127 660	1855	1.5	6840	5.4
Pt2.1.2: Temporary tall emergent marsh	68 622	2369	3.5	3116	4.5
Lt1.1: Temporary lake	459 347	808	0.2	2485	0.5
Pt1.8.2: Temporary shrub swamp	234 393	834	0.4	2122	0.9
Pt3.1.2: Clay pan	129 736	1299	1.0	1698	1.3
Pt4.1: Floodplain or riparian wetland	10 494	10	0.1	1008	9.6
Pt1.2.2: Temporary black box swamp	60 272	69	0.1	228	0.4
Pt1.6.2: Temporary woodland swamp	216 625	1	<0.1	186	0.1
Psp4: Permanent saline wetland	2114	156	7.4	172	8.1
Pt1: Temporary swamp	3767	110	2.9	132	3.5
Pp2.3.2: Permanent grass marsh	1507	50	3.3	96	6.4
Pp2.4.2: Permanent forb marsh	738	15	2.0	30	4.1
Pp2.2.2: Permanent sedge/grass/forb marsh	3590	15	0.4	15	0.4
Pst2.2: Temporary salt marsh	40 294	1	<0.1	1	<0.1
Lst1.1: Temporary saline lake	27 897	0	-	0	-
Pt4.2: Temporary wetland	26 892	0	-	0	-
Lsp1.1: Permanent saline lake	9229	0	-	0	-
Lt1.2: Temporary lake with aquatic bed	9052	0	-	0	-
Pp2.1.2: Permanent tall emergent marsh	7995	0	-	0	-
Pst4: Temporary saline wetland	6118	0	-	0	-
Pst1.1: Temporary saline swamp	5728	0	-	0	-
Pp3: Peat bog or fen marsh	4425	0	-	0	-
Pst3.2: Salt pan or salt flat	3201	0	-	0	-
Lst1.2: Temporary saline lake with aquatic bed	2238	0	-	0	-
Lp1.2: Permanent lake with aquatic bed	2067	0	-	0	-
Pu1: Unspecified wetland	1763	0	-	0	-
Pt1.5.2: Temporary paperbark swamp	412	0	-	0	-
Psp2.1: Permanent salt marsh	248	0	-	0	-
Lsp1.2: Permanent saline lake with aquatic bed	181	0	-	0	-
Psp1.1: Saline paperbark swamp	163	0	-	0	-
Pps5: Permanent spring	130	0	-	0	-
Pp1.1.2: Permanent paperbark swamp	1	0	-	0	-

* Area inundated/influenced by Commonwealth environmental water: see Section 3.2 for definitions.

Table 3. Contribution of Commonwealth environmental water to ecosystem diversity of floodplains at the Basin-scale, sorted by the area inundated.

Australian National Aquatic Ecosystem (ANAE) floodplain type	Total area (ha)	Inundated* area (ha)	% of total
F1.2: River red gum forest riparian zone or floodplain	639 022	6525	1.0
F2.4: Shrubland riparian zone or floodplain	407 981	2554	0.6
Lp1.1: Permanent lake	127 660	1855	1.5
F1.4: River red gum woodland riparian zone or floodplain	325 221	1237	0.4
F2.2: Lignum shrubland riparian zone or floodplain	143 852	1164	0.8
F1.10: Coolibah woodland and forest riparian zone or floodplain	427 507	949	0.2
F1.8: Black box woodland riparian zone or floodplain	779 636	844	0.1
F1.12: Woodland riparian zone or floodplain	318 572	136	<0.1
F1.6: Black box forest riparian zone or floodplain	131 442	118	0.1
F4: Unspecified riparian zone or floodplain	989 305	67	<0.1
F3.2: Sedge/forb/grassland riparian zone or floodplain	833 102	32	<0.1
F1.13: Paperpark riparian zone or floodplain	17	0	-

* Area inundated/influenced by Commonwealth environmental water: see Section 3.2 for definitions.

Table 4. Contribution of Commonwealth environmental water to ecosystem diversity within river channels of the Basin sorted by the area influenced by Commonwealth environmental water.

Australian National Aquatic Ecosystem (ANAE) waterway type	Total	Inundated*	
	Length (km)	Length (km)	% of total
Rp1.4: Permanent lowland stream	40 783	15 558	38.1
Rt1.4: Temporary lowland stream	198 613	3894	2.0
Rp1.1: Permanent high energy upland stream	59 080	897	1.5
Rp1.2: Permanent transitional zone stream	17 920	766	4.3
Rp1.3: Permanent low energy upland stream	545	164	30.1
Rt1: Temporary stream	174	85	48.9
Rp1: Permanent stream	293	80	27.3
Rt1.1: Temporary high energy upland stream	167 220	69	<0.1
Rt1.2: Temporary transitional zone stream	116 557	55	<0.1
Rt1.3: Temporary low energy upland stream	2795	47	1.7
Rw1: Permanent river (landform unknown)	308	11	3.6
Ru1: Unspecified river (landform unknown)	256	8	3.1

* Area inundated/influenced by Commonwealth environmental water: see Section 3.2 for definitions.

Table 5. Ecosystem types in the Coorong, Lower Lakes and Murray Mouth that are influenced by Commonwealth environmental water. Ecosystem types are sorted by the area inundated by Commonwealth environmental water.

Australian National Aquatic Ecosystem (ANAE) wetland type	Total	Inundated*	
	area (ha)	Area (ha)	% of total
Lp1.1: Permanent lake	82 533	82 098	99.5
Ewd1.3.2: Coastal lagoon	18 912	18 657	98.7
Pt2.1.2: Temporary tall emergent marsh	7717	4702	60.9
Pt2.2.2: Temporary sedge/grass/forb marsh	7042	2405	34.2
Etd1.3.3: Tide dominated estuary	2240	2212	98.8
Pst1.1: Temporary saline swamp	2215	1493	67.4
Ewd1.2.4: Intertidal mudflat or sand bar	960	928	96.7
Pt3.1.2: Clay pan	8990	653	7.3
Lsp1.1: Permanent saline lake	2432	591	24.3
Etd1.2.2: Tide dominated mudflats and sandbar	629	590	93.8
Psp4: Permanent saline wetland	595	568	95.5
Ewd1.2.3: Intertidal saltmarsh	478	358	74.9
Pt4.2: Temporary wetland	4295	350	8.1
Pt4.1: Floodplain or riparian wetland	994	304	30.6
Ewd1.2.5: Intertidal rocky shoreline	284	274	96.5
Etd1.2.1: Tide dominated saltmarsh	321	259	80.7
Pst4: Temporary saline wetland	513	118	23.0
Pst2.2: Temporary salt marsh	412	109	26.5
Pst3.2: Salt pan or salt flat	169	70	41.4
F2.4: Shrubland riparian zone or floodplain	632	56	8.9
Pp4.2: Permanent wetland	107	46	43.0
Pt2.3.2: Freshwater meadow	64	27	42.2
Etd1.2.3: Tide dominated forest	19	16	84.2
Etd1.1.1: Tide dominated rocky shoreline	7	7	100.0
F2.2: Lignum shrubland riparian zone or floodplain	33	6	18.2
F1.12: Woodland riparian zone or floodplain	57	4	7.0
Pt1.8.2: Temporary shrub swamp	26	4	15.4
Lt1.1: Temporary lake	28	1	3.6
Pp2.1.2: Permanent tall emergent marsh	9	1	11.1
Pt1.7.2: Temporary lignum swamp	3	1	33.3
Pp2.4.2: Permanent forb marsh	2	1	50.0
Psp2.1: Permanent salt marsh	2	1	50.0
F1.8: Black box woodland riparian zone or floodplain	3	0	-

* Area inundated/influenced by Commonwealth environmental water: see Section 3.2 for definitions.

4.3 Cumulative Basin-scale evaluation (2014–17)

The cumulative evaluation compares the area of each floodplain ecosystem type that was inundated, and each wetland that was influenced by Commonwealth environmental water (i.e. the whole wetland area if part of the wetland was inundated) in each of the LTIM water years.

The inter-annual comparisons presented in Inundation of floodplain ecosystems has been similar across all years (Table 7) but the inundated extents are relatively small (often less than 1%). Inundation of floodplain ecosystems has been as high as 10% of total extent for “river cooba woodland riparian zone or floodplain” which is the second most restricted aquatic ecosystem type in the basin. The very restricted 17 ha of paperbark riparian zone or floodplain has not received Commonwealth environmental water during LTIM. Floodplain inundation is rarely an objective for Commonwealth environmental water because volumes are limited and delivery constraints imposed

by infrastructure and built assets often restrict watering actions to volumes that are contained within river channels and wetlands. Extensive floodplain inundation is not expected unless Commonwealth environmental water is delivered to augment natural floods.

Table 6 and Table 7 should be viewed as indicative only as there are some differences in the way inundation extents were mapped in each year. The 2014–15 inundation likely over-estimates the extent of Commonwealth environmental water in the Macquarie Marshes, Gwydir wetlands and Lower Murrumbidgee (Lowbidgee) due to poor discrimination of Commonwealth environmental water from other water in satellite imagery. Improvements to the data assembly process increased the accuracy and confidence in the inundation mapping from 2015–16 onwards. The LTIM hydrology Basin Matter is investigating ways of correcting the earlier estimates.

Commonwealth environmental water contributed to inundation of the Gwydir wetlands, Macquarie Marshes and Lowbidgee in all three years of LTIM 2014–17. The broad pattern of ecosystem types supported by Commonwealth environmental water reflects this similarity in the distribution of watering actions with 51% of wetland and lake ecosystem types in the Basin receiving Commonwealth environmental water in all 3 years and conversely 38% of ecosystem types have not received any Commonwealth environmental water during the same period (Inundation of floodplain ecosystems has been similar across all years (Table 7) but the inundated extents are relatively small (often less than 1%). Inundation of floodplain ecosystems has been as high as 10% of total extent for "river cooba woodland riparian zone or floodplain" which is the second most restricted aquatic ecosystem type in the basin. The very restricted 17 ha of paperbark riparian zone or floodplain has not received Commonwealth environmental water during LTIM. Floodplain inundation is rarely an objective for Commonwealth environmental water because volumes are limited and delivery constraints imposed by infrastructure and built assets often restrict watering actions to volumes that are contained within river channels and wetlands. Extensive floodplain inundation is not expected unless Commonwealth environmental water is delivered to augment natural floods.

Table 6). Some of the ecosystem types that have not been supported by Commonwealth environmental water since 2014 may be included in areas targeted for watering by state-based delivery partners but it is currently beyond the scope of the of LTIM to evaluate all environmental water delivered by other jurisdictions.

Water delivery infrastructure (river networks, storages, canals and regulators) constrains the area to which environmental water can be delivered. Some of the aquatic ecosystem types that are yet to receive Commonwealth environmental water will exist in locations that are outside the scope of environmental water delivery. Preliminary investigation has shown that during the three years of LTIM all Commonwealth environmental water (outside of river channels) has supported 332 000 ha of lakes and wetlands in the Basin. This is small proportion (0.3%) of the total Basin area, but represents a larger proportion (5%) of the area MDBA has mapped as "managed floodplain". Improving understanding of the ecosystems that are within scope for Commonwealth environmental water is an ongoing research activity for the LTIM project, and indeed for water managers in the Basin. Approximately 63 500 ha of the inundation by Commonwealth environmental water LTIM has measured over the first three years of LTIM lies outside of the area currently mapped as managed floodplain by MDBA. This may be further evidence that LTIM inundation extents for 2014–15 over-estimate the watering extent and that we still have a way to go before we can confidently delineate the population of ecosystem types that are within scope for Commonwealth environmental water.

The area and diversity of ecosystem types supported by Commonwealth environmental water in 2014–15 (year 1) and 2016–17 (year 3) were similar with the major differences being that 3 400 ha of permanent tall emergent marsh in the Great Cumbung Swamp was watered in year 1 and 2 but not in year 3 and 12 500 ha of temporary lignum swamp primarily around Narran Lakes received Commonwealth environmental water for the first time in year 3

The distribution of water delivery differed in 2015–16 (year 2), with Commonwealth environmental water reaching substantial areas of temporary river red gum swamps, floodplain and riparian wetlands, temporary black box swamp, temporary swamps with unknown vegetation and permanent saline wetlands in watering actions along the Murray River between Morgan and the S.A Border, Barmah Forest and the Lachlan River.

Over the duration of LTIM, Commonwealth environmental water has influenced more than 5% of the area of 13 different lake and wetland ecosystem types in at least one year (35% of the variety of these types present in the basin). Another 10 lake and wetland ecosystem types have had only small areas inundated by Commonwealth environmental water.

Inundation of floodplain ecosystems has been similar across all years (Table 7) but the inundated extents are relatively small (often less than 1%). Inundation of floodplain ecosystems has been as high as 10% of total extent for "river cooba woodland riparian zone or floodplain" which is the second most restricted aquatic ecosystem type in the basin. The very restricted 17 ha of paperbark riparian zone or floodplain has not received Commonwealth environmental water during LTIM. Floodplain inundation is rarely an objective for Commonwealth environmental water because volumes are limited and delivery constraints imposed by infrastructure and built assets often restrict watering actions to volumes that are contained within river channels and wetlands. Extensive floodplain inundation is not expected unless Commonwealth environmental water is delivered to augment natural floods.

Table 6. Comparison of the contribution of Commonwealth environmental water to ecosystem diversity of lakes and palustrine wetlands from 2014-17 (sorted by the magnitude of watering in the 2016-17 water year). Ecosystem types with more than 5% of their total Basin area inundated in any one year are shaded pale blue. Ecosystem types that have not received Commonwealth environmental water during the period of LTIM are shaded red. Large differences (>10%) among years are highlighted in dark blue.

Australian National Aquatic Ecosystem (ANAE) wetland type	Total area (ha)	% receiving Cew			Differences		
		Y1 14-15	Y2 15–16	Y3 16–17	Y2-Y1	Y3-Y2	Y3-Y1
Pp4.2: Permanent wetland	77 300	26.2	28.2	26.0	2.0	-2.2	-0.2
Pt1.7.2: Temporary lignum swamp	49 962	1.1	7.0	24.9	5.9	17.9	23.8
Pt2.3.2: Freshwater meadow	125 128	15.1	16.8	16.4	1.8	-0.4	1.3
Pt2.2.2: Temporary sedge/grass/forb marsh	135 475	12.1	15.1	12.5	3.0	-2.6	0.4
Pt1.1.2: Temporary river red gum swamp	74 721	13.3	56.1	10.1	42.8	-46.0	-3.2
Pt4.1: Floodplain or riparian wetland	10 494	8.3	21.0	9.6	12.7	-11.4	1.3
Psp4: Permanent saline wetland	2114	10.9	48.6	8.1	37.7	-40.4	-2.8
Pp2.3.2: Permanent grass marsh	1507	1.5	1.7	6.4	0.1	4.7	4.8
Lp1.1: Permanent lake	127 660	1.1	3.9	5.4	2.8	1.5	4.2
Pt2.1.2: Temporary tall emergent marsh	68 622	4.5	6.3	4.5	1.8	-1.8	0.0
Pp2.4.2: Permanent forb marsh	738	1.4	0.7	4.1	-0.7	3.4	2.7
Pt1: Temporary swamp	3767	7.4	18.5	3.5	11.1	-15.0	-3.9
Pt3.1.2: Clay pan	129 736	2.4	2.9	1.3	0.5	-1.6	-1.1
Pt1.8.2: Temporary shrub swamp	234 393	0.7	3.2	0.9	2.5	-2.2	0.2
Lt1.1: Temporary lake	459 347	0.6	1.7	0.5	1.1	-1.1	0.0
Pp2.2.2: Permanent sedge/grass/forb marsh	3590	0.4	0.5	0.4	0.1	-0.1	0.0
Pt1.2.2: Temporary black box swamp	60 272	1.8	10.4	0.4	8.7	-10.1	-1.4
Pst2.2: Temporary salt marsh	40 294	<0.1	1.6	<0.1	1.6	-1.6	-0.1
Pt1.6.2: Temporary woodland swamp	216 625	<0.1	0.3	<0.1	0.2	-0.2	-
Pp2.1.2: Permanent tall emergent marsh	7995	43.1	52.0	-	8.8	-52.0	-43.1
Pt4.2: Temporary wetland	26 892	<0.1	2.2	-	2.1	-2.2	-
Lst1.1: Temporary saline lake	27 897	-	0.5	-	0.5	-0.5	-
Pst1.1: Temporary saline swamp	5728	1.6	-	-	-1.6	-	-1.6
Lsp1.1: Permanent saline lake	9229	-	-	-	-	-	-
Lt1.2: Temporary lake with aquatic bed	9052	-	-	-	-	-	-
Pst4: Temporary saline wetland	6118	-	-	-	-	-	-
Pp3: Peat bog or fen marsh	4425	-	-	-	-	-	-

Australian National Aquatic Ecosystem (ANAE) wetland type	Total area (ha)	% receiving Cew			Differences		
		Y1 14-15	Y2 15–16	Y3 16–17	Y2-Y1	Y3-Y2	Y3-Y1
Pst3.2: Salt pan or salt flat	3201	-	-	-	-	-	-
Lst1.2: Temporary saline lake with aquatic bed	2238	-	-	-	-	-	-
Lp1.2: Permanent lake with aquatic bed	2067	-	-	-	-	-	-
Pu1: Unspecified wetland	1763	-	-	-	-	-	-
Pt1.5.2: Temporary paperbark swamp	412	-	-	-	-	-	-
Psp2.1: Permanent salt marsh	248	-	-	-	-	-	-
Lsp1.2: Permanent saline lake with aquatic bed	181	-	-	-	-	-	-
Psp1.1: Saline paperbark swamp	163	-	-	-	-	-	-
Pps5: Permanent spring	130	-	-	-	-	-	-
Pp1.1.2: Permanent paperbark swamp	1	-	-	-	-	-	-

Table 7. Comparison of the contribution of Commonwealth environmental water to ecosystem diversity of floodplains from 2014-17 (sorted by the magnitude of watering in the 2016-17 water year). Ecosystem types with more than 5% of their total Basin area inundated in any one year are shaded pale blue. Ecosystem types that have not received Commonwealth environmental water during the period of LTIM are shaded red. Large differences (>10%) among years are highlighted in dark blue.

Australian National Aquatic Ecosystem (ANAE) wetland type	Total area (ha)	% receiving Cew			Differences		
		Y1 14-15	Y2 15–16	Y3 16–17	Y1-Y2	Y2-Y3	Y1-Y3
F1.11: River cooba woodland riparian zone or floodplain	11 541	9.8	10.9	6.7	1.0	-4.1	-3.1
F1.2: River red gum forest riparian zone or floodplain	639 022	3.8	5.2	1.0	1.3	-4.2	-2.8
F2.2: Lignum shrubland riparian zone or floodplain	143 852	3.8	1.7	0.8	-2.0	-0.9	-3.0
F2.4: Shrubland riparian zone or floodplain	407 981	0.3	1.8	0.6	1.5	-1.1	0.4
F1.4: River red gum woodland riparian zone or floodplain	325 221	1.1	0.6	0.4	-0.5	-0.2	-0.7
F1.10: Coolibah woodland and forest riparian zone or floodplain	427 507	0.8	0.4	0.2	-0.4	-0.2	-0.6
F1.8: Black box woodland riparian zone or floodplain	779 636	0.3	0.9	0.1	0.6	-0.8	-0.2
F4: Unspecified riparian zone or floodplain	989 305	<0.1	<0.1	<0.1	-	-	-
F1.12: Woodland riparian zone or floodplain	318 686	<0.1	<0.1	<0.1	-	-	-
F1.6: Black box forest riparian zone or floodplain	131 442	0.4	1.3	<0.1	0.9	-1.2	-0.3
F3.2: Sedge/forb/grassland riparian zone or floodplain	833 102	-	-	<0.1	-	-	-
F1.13: Paperpark riparian zone or floodplain	17	-	-	-	-	-	-

4.4 Adaptive management

There are a number of avenues by which the Ecosystem Diversity evaluation can foster improvements in Commonwealth environmental water management and evaluation. Namely:

1) Improving confidence in the evaluation of the contribution of Commonwealth environmental water to Ecosystem Diversity. This third year evaluation has benefited from improved knowledge and mapping of the spatial extent of Commonwealth environmental water in the Basin combined with the recent major update to parts of the Basin aquatic ecosystem mapping and ANAE classification. Completing the ANAE update for Western NSW will further improve the evaluation of the contribution of Commonwealth environmental water to Ecosystem Diversity in tributaries of the Darling river including the Junction of the Warrego and Darling rivers LTIM Selected Area.

2) Improving understanding of the landscape context at monitoring sites to inform extrapolation of observed outcomes to unmonitored sites. Understanding how biotic and functional responses vary among ecosystem types that are monitored within Selected Areas may permit extrapolation of Selected Area and Basin matter outcomes to watering events in the same ecosystem types located in other areas of the Basin.

3) Developing watering objectives and expected outcomes for different ecosystem types. Understanding how key ecosystem types influence Basin biodiversity, resilience, ecosystem function and ecosystem services paves the way towards delivering Commonwealth environmental water for ecosystem objectives that move beyond counting ecosystem watering targets. For example, shaping flow regimes to preserve patterns of spatio-temporal variability along a river, or delivering water at critical times to maintain life forms or processes *because* they characterise ecosystem types that are to be preserved or improved. Managing to prevent or promote ecosystem turnover to new types may require long-term management frameworks with institutional memory and conviction to stay the

course over decadal time scales. The CEWO currently does not have 1-year or 5-year expected outcomes for ecosystem diversity but it is hoped that within the LTIM project we can develop thinking towards an appropriate approach to draft ecosystem objectives. Current planning that links ecosystem types to water availability scenarios, e.g. directing water to maintain permanent water systems in dry years, and augmenting over-bank flows to the floodplain in wet years may be a good starting point.

4) Reducing the risks of implementing inappropriate watering regimes. Too much water, too frequently or consistently missing particular ecosystems types are all scenarios that are potentially deleterious to biodiversity in the Basin. Improving understanding of watering requirements at the aquatic ecosystem level should complement and enhance existing approaches that focus on the requirements of key species or communities. Through LTIM, we are assembling a library of Basin wide watering frequencies from Commonwealth environmental water. Ecosystems types (and locations) that are consistently not watered, or watered with too much regularity, can then be identified and an informed assessment of risks can then take place to determine if there is a need and capability to adjust management planning to ensure Basin Plan objectives are met.

5 Contribution to achievement of Basin Plan objectives

The Ecosystem Diversity component of the Basin evaluation contributes to the Basin Plan objective for Biodiversity under Section 8.05 of the Basin Plan and contributes indirectly to additional Basin Plan objectives by informing the evaluation of the Vegetation and Generic Diversity Basin Matters within the LTIM Project (Capon & Campbell 2016, 2017; Hale 2016, 2017).

The Commonwealth does not yet have 1-year or 5-year expected outcomes for ecosystem diversity (**Error! Reference source not found.**) and water is not currently delivered with direct understanding o f the contribution of Commonwealth environmental watering to ecosystem diversity at the Basin-scale. However, this evaluation provides a foundation from which expected outcomes for ecosystem diversity may be developed in the future as the spatial and temporal patterns of watering to different ecosystem types under current management regimes is better understood.

Table 8. Commonwealth Environmental Outcomes framework for ecosystem diversity.

Basin Plan objectives	Basin outcomes	5–year expected outcomes	1–year expected outcomes	Measured and predicted 1-year outcomes 2016–17	Measured and predicted 1–3 year outcomes 2014–17
Biodiversity (Basin Plan S. 8.05)	Ecosystem diversity	None identified	None identified	Over 252 000 hectares of mapped wetland and floodplain inundated 52% of the different aquatic ecosystem types inundated with Commonwealth environmental water	72% of the different aquatic ecosystem types inundated with Commonwealth environmental water.

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Annex A. Ongoing evolution of the Basin ANAE classification

Confidence in the accuracy of mapping and the Basin ANAE classification was examined in a previous LTIM ecosystem diversity evaluation (Brooks 2016a) and in the development of the ANAE classification (Brooks *et al.* 2014). In South Australia, ANAE types were manually ascribed to wetlands and riverine reaches along the full length of the Murray River to improve confidence and alignment of the classification to ecosystem types used by South Australian wetland managers. Some additional limitations of the ANAE classification in South Australia that influence the findings in this report are noted in Miles and Eckert (2013) and include: farm dams classified as natural wetland ecosystems, temporary wetlands to the south-east of the south lagoon of the Coorong being classified as permanent, and wetland boundaries adjacent to the Lake Alexandrina that encompass multiple ecosystem types. These errors are mainly associated with wetland types around Lake Alexandrina and the Coorong (M Miles, pers. comm., 2017) but similar examples can be found in all states in areas where fundamental hydrological data and vegetation mapping are limited. The recent update to the ANAE addressed some of these issues but a comprehensive evaluation against the issues raised by Miles and Eckert (2013) has not been conducted.

There was generally good agreement between the ecosystem types identified by the Basin ANAE classification when ground-truthed at Selected Area sampling sites (Brooks 2016). Most discrepancies were related to inaccuracies in the mapping of wetland boundaries rather than fundamental disagreement with the ANAE classification itself. The poorest representation of ecosystem types by the ANAE classification was in the Lachlan river system, Gwydir river system and Junction of the Warrego and Darling rivers Selected Areas (Brooks 2016). The Lachlan and Gwydir valleys were included in the 2017 major update to the ANAE classification which greatly improved the mapping for this and subsequent evaluations of the contribution of Commonwealth environmental water to Ecosystem Diversity in these Valleys (Brooks 2017a). Ecosystem mapping in the Central Murray Forests, the Macquarie Marshes, and Murrumbidgee were also improved in the revision.

A major component of the 2017 ANAE update relied on new NSW State vegetation mapping that is still incomplete for the NSW portion of the Basin (Figure 8). Further updates to the ANAE classification are being considered for when the draft NSW Western region vegetation mapping is finalised (expected July 2018). This is expected to greatly improve wetland and floodplain ecosystem mapping in the Junction of the Warrego and Darling rivers Selected Area and in southwestern NSW along the Darling and Murray River floodplains that have received Commonwealth environmental water already during the LTIM project. Updating the ANAE classification in these areas is therefore a high priority, with the understanding that there will be a need to re-evaluate the past contribution of Commonwealth environmental water to Ecosystem Diversity in the Lower Darling, Barwon Darling, Paroo, Warrego and Condamine Balonne valleys.

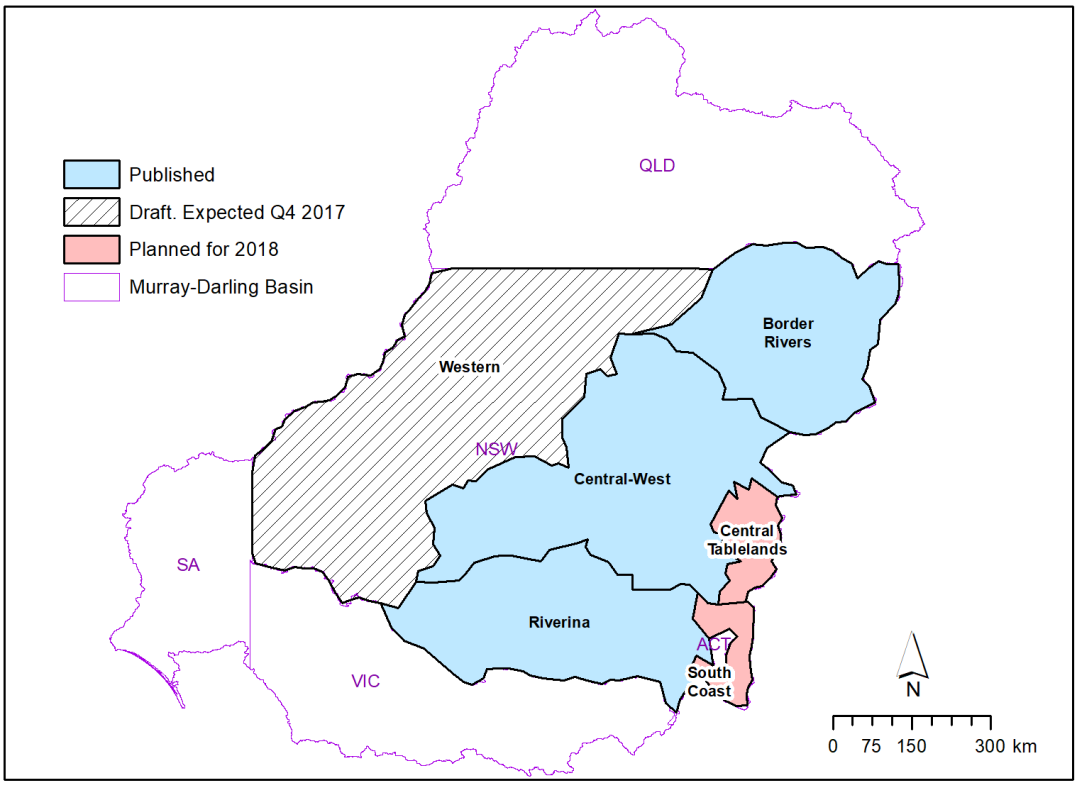

Figure 8: Extent and status of the new NSW state vegetation mapping. Published regions (blue) were used to update the ANAE classification in 2017. The Central Tablelands has recently been released as a draft and the Western region draft is expected to be finalised July 2018.

Annex B. ANAE wetland types influenced by Commonwealth environmental water by valley

Lake and wetland types influenced by Commonwealth environmental water are represented by the entire wetland when any portion of the wetland was recorded as having been inundated. The contribution of Commonwealth environmental water to supporting wetland ecosystem diversity within each valley is presented below in Table B1.

Table B1. Area of each lake and wetland ecosystem type and the contribution of Commonwealth environmental water to supporting wetland ecosystem diversity within each valley, sorted by the area influenced with inundation highlighted in blue (excludes in-channel flows presented in Annex D).

Valley name	Australian National Aquatic Ecosystem (ANAE) lake and wetland types	Total area (ha)	Cew Area (ha)	Percent
Avoca	Lst1.1: Temporary saline lake	19 829	0	-
Avoca	Pt3.1.2: Clay pan	18 587	0	-
Avoca	Pt1.2.2: Temporary black box swamp	4372	0	-
Avoca	Lt1.1: Temporary lake	4232	0	-
Avoca	Lst1.2: Temporary saline lake with aquatic bed	1820	0	-
Avoca	Pst1.1: Temporary saline swamp	1541	0	-
Avoca	Pst2.2: Temporary salt marsh	1174	0	-
Avoca	Pt1.6.2: Temporary woodland swamp	805	0	-
Avoca	Pt2.3.2: Freshwater meadow	723	0	-
Avoca	Pt1.7.2: Temporary lignum swamp	720	0	-
Avoca	Pst3.2: Salt pan or salt flat	309	0	-
Avoca	Psp2.1: Permanent salt marsh	209	0	-
Avoca	Pt4.2: Temporary wetland	208	0	-
Avoca	Pt1.1.2: Temporary river red gum swamp	145	0	-
Avoca	Lsp1.1: Permanent saline lake	137	0	-
Avoca	Lp1.1: Permanent lake	61	0	-
Avoca	Pt1.8.2: Temporary shrub swamp	51	0	-
Avoca	Pp4.2: Permanent wetland	50	0	-
Avoca	Pst4: Temporary saline wetland	50	0	-
Avoca	Pt4.1: Floodplain or riparian wetland	1	0	-
Barwon Darling	Pt2.3.2: Freshwater meadow	1225	412	33.6
Barwon Darling	Lt1.1: Temporary lake	56 914	0	-
Barwon Darling	Lp1.1: Permanent lake	31 477	0	-
Barwon Darling	Pt1.6.2: Temporary woodland swamp	16 269	0	-
Barwon Darling	Pt1.8.2: Temporary shrub swamp	10 914	0	-
Barwon Darling	Pt1.2.2: Temporary black box swamp	2956	0	-
Barwon Darling	Pp4.2: Permanent wetland	2566	0	-
Barwon Darling	Pt2.2.2: Temporary sedge/grass/forb marsh	1217	0	-
Barwon Darling	Pt1.1.2: Temporary river red gum swamp	378	0	-
Barwon Darling	Pt3.1.2: Clay pan	148	0	-
Barwon Darling	Pt4.2: Temporary wetland	63	0	-
Border Rivers	Lt1.1: Temporary lake	655	74	11.3
Border Rivers	Pt2.2.2: Temporary sedge/grass/forb marsh	8659	0	-
Border Rivers	Pt4.2: Temporary wetland	3495	0	-
Border Rivers	Pt1.6.2: Temporary woodland swamp	2486	0	-
Border Rivers	Pp2.2.2: Permanent sedge/grass/forb marsh	1405	0	-
Border Rivers	Pp4.2: Permanent wetland	1097	0	-
Border Rivers	Lp1.1: Permanent lake	938	0	-
Border Rivers	Pt1.1.2: Temporary river red gum swamp	718	0	-
Border Rivers	Pp3: Peat bog or fen marsh	633	0	-
Border Rivers	Pt2.3.2: Freshwater meadow	592	0	-
Border Rivers	Lp1.2: Permanent lake with aquatic bed	227	0	-

Valley name	Australian National Aquatic Ecosystem (ANAE) lake and wetland types	Total area (ha)	Cew Area (ha)	Percent
Border Rivers	Pt3.1.2: Clay pan	218	0	-
Border Rivers	Pt2.1.2: Temporary tall emergent marsh	96	0	-
Border Rivers	Pp2.3.2: Permanent grass marsh	26	0	-
Border Rivers	Pt1.2.2: Temporary black box swamp	13	0	-
Border Rivers	Lt1.2: Temporary lake with aquatic bed	12	0	-
Border Rivers	Pt1.8.2: Temporary shrub swamp	11	0	-
Border Rivers	Pst1.1: Temporary saline swamp	2	0	-
Broken	Lp1.1: Permanent lake	3305	0	-
Broken	Pt3.1.2: Clay pan	2998	0	-
Broken	Pt1.1.2: Temporary river red gum swamp	1911	0	-
Broken	Pt1.6.2: Temporary woodland swamp	427	0	-
Broken	Pt2.3.2: Freshwater meadow	268	0	-
Broken	Pt1.7.2: Temporary lignum swamp	192	0	-
Broken	Lt1.1: Temporary lake	104	0	-
Broken	Pt2.1.2: Temporary tall emergent marsh	98	0	-
Broken	Pt1.2.2: Temporary black box swamp	84	0	-
Broken	Pt2.2.2: Temporary sedge/grass/forb marsh	77	0	-
Broken	Pt4.1: Floodplain or riparian wetland	66	0	-
Broken	Pp4.2: Permanent wetland	43	0	-
Campaspe	Pt3.1.2: Clay pan	1887	0	-
Campaspe	Pt1.1.2: Temporary river red gum swamp	280	0	-
Campaspe	Pt1.6.2: Temporary woodland swamp	232	0	-
Campaspe	Lt1.1: Temporary lake	49	0	-
Campaspe	Pt2.1.2: Temporary tall emergent marsh	24	0	-
Campaspe	Lp1.1: Permanent lake	12	0	-
Campaspe	Pt2.3.2: Freshwater meadow	10	0	-
Campaspe	Pp4.2: Permanent wetland	4	0	-
Campaspe	Pps5: Permanent spring	1	0	-
Castlereagh	Pt2.2.2: Temporary sedge/grass/forb marsh	10 737	0	-
Castlereagh	Lt1.1: Temporary lake	456	0	-
Castlereagh	Pt1.8.2: Temporary shrub swamp	51	0	-
Castlereagh	Pt1.6.2: Temporary woodland swamp	35	0	-
Castlereagh	Pt3.1.2: Clay pan	30	0	-
Castlereagh	Pt1.2.2: Temporary black box swamp	26	0	-
Castlereagh	Pp4.2: Permanent wetland	18	0	-
Castlereagh	Pt2.1.2: Temporary tall emergent marsh	16	0	-
Castlereagh	Pp2.2.2: Permanent sedge/grass/forb marsh	8	0	-
Castlereagh	Lp1.1: Permanent lake	6	0	-
Castlereagh	Pps5: Permanent spring	1	0	-
Castlereagh	Pt1.1.2: Temporary river red gum swamp	1	0	-
Castlereagh	Pt2.3.2: Freshwater meadow	1	0	-
Central Murray	Lp1.1: Permanent lake	4518	1375	30.4
Central Murray	Lt1.1: Temporary lake	13 062	1243	9.5
Central Murray	Pp4.2: Permanent wetland	9222	496	5.4
Central Murray	Pt2.3.2: Freshwater meadow	5185	117	2.3
Central Murray	Pt1.1.2: Temporary river red gum swamp	38 447	76	0.2
Central Murray	Pt3.1.2: Clay pan	17 536	39	0.2
Central Murray	Pt1.8.2: Temporary shrub swamp	638	13	2.0
Central Murray	Pp2.4.2: Permanent forb marsh	133	7	5.3
Central Murray	Pt1.2.2: Temporary black box swamp	4137	6	0.1
Central Murray	Pt2.2.2: Temporary sedge/grass/forb marsh	2856	0	-
Central Murray	Pst2.2: Temporary salt marsh	2122	0	-
Central Murray	Pst4: Temporary saline wetland	2114	0	-
Central Murray	Pt1.7.2: Temporary lignum swamp	1602	0	-
Central Murray	Pt1.6.2: Temporary woodland swamp	1543	0	-
Central Murray	Pt2.1.2: Temporary tall emergent marsh	1475	0	-
Central Murray	Lst1.1: Temporary saline lake	1303	0	-

Valley name	Australian National Aquatic Ecosystem (ANAE) lake and wetland types	Total area (ha)	Cew Area (ha)	Percent
Central Murray	Pp2.1.2: Permanent tall emergent marsh	1169	0	-
Central Murray	Pst3.2: Salt pan or salt flat	732	0	-
Central Murray	Pt4.2: Temporary wetland	654	0	-
Central Murray	Psp4: Permanent saline wetland	642	0	-
Central Murray	Pt4.1: Floodplain or riparian wetland	462	0	-
Central Murray	Lsp1.1: Permanent saline lake	461	0	-
Central Murray	Pp2.3.2: Permanent grass marsh	80	0	-
Central Murray	Pp2.2.2: Permanent sedge/grass/forb marsh	45	0	-
Central Murray	Pst1.1: Temporary saline swamp	22	0	-
Condamine Balonne	Pt1.7.2: Temporary lignum swamp	11 804	11 695	99.1
Condamine Balonne	Lp1.1: Permanent lake	6454	5201	80.6
Condamine Balonne	Pp4.2: Permanent wetland	3754	445	11.9
Condamine Balonne	Pt2.1.2: Temporary tall emergent marsh	38 236	0	-
Condamine Balonne	Pt1.8.2: Temporary shrub swamp	29 303	0	-
Condamine Balonne	Pt1.6.2: Temporary woodland swamp	13 223	0	-
Condamine Balonne	Lt1.1: Temporary lake	11 526	0	-
Condamine Balonne	Pt4.2: Temporary wetland	8822	0	-
Condamine Balonne	Pt1.2.2: Temporary black box swamp	4684	0	-
Condamine Balonne	Pt2.2.2: Temporary sedge/grass/forb marsh	4248	0	-
Condamine Balonne	Pt2.3.2: Freshwater meadow	4102	0	-
Condamine Balonne	Pp2.1.2: Permanent tall emergent marsh	2522	0	-
Condamine Balonne	Pt3.1.2: Clay pan	1872	0	-
Condamine Balonne	Lp1.2: Permanent lake with aquatic bed	1648	0	-
Condamine Balonne	Lst1.1: Temporary saline lake	1624	0	-
Condamine Balonne	Pt1.1.2: Temporary river red gum swamp	1116	0	-
Condamine Balonne	Lt1.2: Temporary lake with aquatic bed	684	0	-
Condamine Balonne	Pt1.5.2: Temporary paperbark swamp	95	0	-
Condamine Balonne	Pp2.3.2: Permanent grass marsh	23	0	-
Condamine Balonne	Pps5: Permanent spring	6	0	-
Condamine Balonne	Lsp1.1: Permanent saline lake	3	0	-
Condamine Balonne	Pst4: Temporary saline wetland	1	0	-
Edward Wakool	Pt3.1.2: Clay pan	3581	0	-
Edward Wakool	Pt1.2.2: Temporary black box swamp	1663	0	-
Edward Wakool	Pt1.1.2: Temporary river red gum swamp	1318	0	-
Edward Wakool	Lt1.1: Temporary lake	886	0	-
Edward Wakool	Pp4.2: Permanent wetland	814	0	-
Edward Wakool	Pt2.3.2: Freshwater meadow	628	0	-
Edward Wakool	Pt1.6.2: Temporary woodland swamp	421	0	-
Edward Wakool	Pt1.8.2: Temporary shrub swamp	280	0	-
Edward Wakool	Pt2.2.2: Temporary sedge/grass/forb marsh	213	0	-
Edward Wakool	Pt1.7.2: Temporary lignum swamp	175	0	-
Edward Wakool	Lp1.1: Permanent lake	131	0	-
Edward Wakool	Pt2.1.2: Temporary tall emergent marsh	59	0	-
Edward Wakool	Pp2.3.2: Permanent grass marsh	19	0	-
Edward Wakool	Pp2.1.2: Permanent tall emergent marsh	7	0	-
Edward Wakool	Psp4: Permanent saline wetland	6	0	-
Edward Wakool	Pst1.1: Temporary saline swamp	5	0	-
Edward Wakool	Pp2.2.2: Permanent sedge/grass/forb marsh	1	0	-
Goulburn	Pt3.1.2: Clay pan	10 949	0	-
Goulburn	Pt1.1.2: Temporary river red gum swamp	5177	0	-
Goulburn	Lt1.1: Temporary lake	1598	0	-
Goulburn	Lp1.1: Permanent lake	1086	0	-
Goulburn	Pp4.2: Permanent wetland	1060	0	-
Goulburn	Pt1.6.2: Temporary woodland swamp	869	0	-
Goulburn	Pt2.1.2: Temporary tall emergent marsh	828	0	-
Goulburn	Pt2.3.2: Freshwater meadow	815	0	-
Goulburn	Pt1.7.2: Temporary lignum swamp	631	0	-

Valley name	Australian National Aquatic Ecosystem (ANAE) lake and wetland types	Total area (ha)	Cew Area (ha)	Percent
Goulburn	Pp2.4.2: Permanent forb marsh	571	0	-
Goulburn	Lst1.2: Temporary saline lake with aquatic bed	238	0	-
Goulburn	Pt2.2.2: Temporary sedge/grass/forb marsh	189	0	-
Goulburn	Pt4.1: Floodplain or riparian wetland	184	0	-
Goulburn	Pt1.2.2: Temporary black box swamp	118	0	-
Goulburn	Lsp1.1: Permanent saline lake	46	0	-
Goulburn	Lst1.1: Temporary saline lake	25	0	-
Goulburn	Pt4.2: Temporary wetland	19	0	-
Goulburn	Pp2.1.2: Permanent tall emergent marsh	4	0	-
Goulburn	Pst4: Temporary saline wetland	2	0	-
Goulburn	Pt1.8.2: Temporary shrub swamp	2	0	-
Gwydir	Pt2.2.2: Temporary sedge/grass/forb marsh	10 051	6218	61.9
Gwydir	Pt2.1.2: Temporary tall emergent marsh	373	373	10-
Gwydir	Lt1.1: Temporary lake	1142	69	6.0
Gwydir	Pt3.1.2: Clay pan	236	42	17.8
Gwydir	Lp1.1: Permanent lake	77	26	33.8
Gwydir	Pp4.2: Permanent wetland	354	1	0.3
Gwydir	Pp2.2.2: Permanent sedge/grass/forb marsh	1579	0	-
Gwydir	Pt4.2: Temporary wetland	374	0	-
Gwydir	Pp3: Peat bog or fen marsh	185	0	-
Gwydir	Pt1.6.2: Temporary woodland swamp	183	0	-
Gwydir	Pt1.8.2: Temporary shrub swamp	92	0	-
Gwydir	Pt1.1.2: Temporary river red gum swamp	13	0	-
Gwydir	Pt2.3.2: Freshwater meadow	6	0	-
Gwydir	Pt1.2.2: Temporary black box swamp	4	0	-
Gwydir	Pp1.1.2: Permanent paperbark swamp	1	0	-
Kiewa	Pp4.2: Permanent wetland	749	0	-
Kiewa	Pt3.1.2: Clay pan	323	0	-
Kiewa	Pt1.6.2: Temporary woodland swamp	39	0	-
Kiewa	Lp1.1: Permanent lake	37	0	-
Kiewa	Pt1.1.2: Temporary river red gum swamp	25	0	-
Kiewa	Pt2.2.2: Temporary sedge/grass/forb marsh	12	0	-
Kiewa	Pt2.1.2: Temporary tall emergent marsh	3	0	-
Lachlan	Pt1.8.2: Temporary shrub swamp	21 194	121	0.6
Lachlan	Pp4.2: Permanent wetland	2915	23	0.8
Lachlan	Lt1.1: Temporary lake	32 280	0	-
Lachlan	Pst2.2: Temporary salt marsh	30 311	0	-
Lachlan	Pt1.7.2: Temporary lignum swamp	22 220	0	-
Lachlan	Pt2.3.2: Freshwater meadow	21 013	0	-
Lachlan	Pt1.2.2: Temporary black box swamp	15 294	0	-
Lachlan	Pt3.1.2: Clay pan	14 938	0	-
Lachlan	Pt2.2.2: Temporary sedge/grass/forb marsh	13 535	0	-
Lachlan	Lp1.1: Permanent lake	7907	0	-
Lachlan	Pp2.1.2: Permanent tall emergent marsh	3450	0	-
Lachlan	Pt1.6.2: Temporary woodland swamp	3305	0	-
Lachlan	Pt1.1.2: Temporary river red gum swamp	2206	0	-
Lachlan	Pt2.1.2: Temporary tall emergent marsh	588	0	-
Lachlan	Pt4.2: Temporary wetland	348	0	-
Lachlan	Pp2.2.2: Permanent sedge/grass/forb marsh	63	0	-
Lachlan	Pp2.3.2: Permanent grass marsh	44	0	-
Lachlan	Pps5: Permanent spring	7	0	-
Loddon	Pt3.1.2: Clay pan	12 139	0	-
Loddon	Lp1.1: Permanent lake	5976	0	-
Loddon	Pt1.2.2: Temporary black box swamp	5762	0	-
Loddon	Pt1.7.2: Temporary lignum swamp	3995	0	-
Loddon	Pt2.3.2: Freshwater meadow	3483	0	-
Loddon	Lst1.1: Temporary saline lake	1478	0	-

Valley name	Australian National Aquatic Ecosystem (ANAE) lake and wetland types	Total area (ha)	Cew Area (ha)	Percent
Loddon	Pt1.6.2: Temporary woodland swamp	1404	0	-
Loddon	Pst1.1: Temporary saline swamp	1379	0	-
Loddon	Pt1.1.2: Temporary river red gum swamp	1256	0	-
Loddon	Lsp1.1: Permanent saline lake	1252	0	-
Loddon	Lt1.1: Temporary lake	417	0	-
Loddon	Pp4.2: Permanent wetland	314	0	-
Loddon	Lsp1.2: Permanent saline lake with aquatic bed	181	0	-
Loddon	Pst3.2: Salt pan or salt flat	109	0	-
Loddon	Pt1.8.2: Temporary shrub swamp	109	0	-
Loddon	Lt1.2: Temporary lake with aquatic bed	55	0	-
Loddon	Pst4: Temporary saline wetland	55	0	-
Loddon	Pt2.1.2: Temporary tall emergent marsh	54	0	-
Loddon	Psp2.1: Permanent salt marsh	37	0	-
Loddon	Pst2.2: Temporary salt marsh	28	0	-
Loddon	Pps5: Permanent spring	4	0	-
Lower Darling	Pp4.2: Permanent wetland	1221	30	2.5
Lower Darling	Pt1.1.2: Temporary river red gum swamp	879	2	0.2
Lower Darling	Lt1.1: Temporary lake	187 338	0	-
Lower Darling	Pt1.8.2: Temporary shrub swamp	103 569	0	-
Lower Darling	Lp1.1: Permanent lake	9685	0	-
Lower Darling	Pt2.3.2: Freshwater meadow	8082	0	-
Lower Darling	Pt1.6.2: Temporary woodland swamp	4422	0	-
Lower Darling	Pt1.2.2: Temporary black box swamp	1921	0	-
Lower Darling	Pt3.1.2: Clay pan	1470	0	-
Lower Darling	Lst1.1: Temporary saline lake	509	0	-
Lower Darling	Pt4.2: Temporary wetland	53	0	-
Lower Darling	Pp2.3.2: Permanent grass marsh	26	0	-
Lower Darling	Pst2.2: Temporary salt marsh	4	0	-
Lower Murray	Pt2.3.2: Freshwater meadow	8938	2150	24.1
Lower Murray	Pt4.1: Floodplain or riparian wetland	9646	1008	10.4
Lower Murray	Lt1.1: Temporary lake	30 729	825	2.7
Lower Murray	Pt1.7.2: Temporary lignum swamp	2651	733	27.6
Lower Murray	Pp4.2: Permanent wetland	4362	651	14.9
Lower Murray	Pt3.1.2: Clay pan	8717	251	2.9
Lower Murray	Psp4: Permanent saline wetland	1450	172	11.9
Lower Murray	Pt1.8.2: Temporary shrub swamp	2987	154	5.2
Lower Murray	Pt1: Temporary swamp	3767	132	3.5
Lower Murray	Pt1.1.2: Temporary river red gum swamp	503	121	24.1
Lower Murray	Pp2.3.2: Permanent grass marsh	109	95	87.2
Lower Murray	Lp1.1: Permanent lake	21 652	64	0.3
Lower Murray	Pt2.1.2: Temporary tall emergent marsh	3787	51	1.3
Lower Murray	Pt1.2.2: Temporary black box swamp	412	33	8.0
Lower Murray	Pp2.4.2: Permanent forb marsh	34	24	70.6
Lower Murray	Pu1: Unspecified wetland	1763	0	-
Lower Murray	Lst1.1: Temporary saline lake	1529	0	-
Lower Murray	Pt1.6.2: Temporary woodland swamp	862	0	-
Lower Murray	Pt4.2: Temporary wetland	687	0	-
Lower Murray	Pst1.1: Temporary saline swamp	545	0	-
Lower Murray	Pst3.2: Salt pan or salt flat	417	0	-
Lower Murray	Lsp1.1: Permanent saline lake	242	0	-
Lower Murray	Psp1.1: Saline paperbark swamp	132	0	-
Lower Murray	Pt1.5.2: Temporary paperbark swamp	132	0	-
Lower Murray	Pst4: Temporary saline wetland	125	0	-
Lower Murray	Pt2.2.2: Temporary sedge/grass/forb marsh	41	0	-
Lower Murray	Pst2.2: Temporary salt marsh	26	0	-
Lower Murray	Pp2.1.2: Permanent tall emergent marsh	2	0	-
Lower Murray	Pps5: Permanent spring	2	0	-

Valley name	Australian National Aquatic Ecosystem (ANAE) lake and wetland types	Total area (ha)	Cew Area (ha)	Percent
Lower Murray	Psp2.1: Permanent salt marsh	1	0	-
Macquarie	Pp4.2: Permanent wetland	18 998	18 032	94.9
Macquarie	Pt2.2.2: Temporary sedge/grass/forb marsh	41 785	9 866	23.6
Macquarie	Pt1.1.2: Temporary river red gum swamp	5783	5 156	89.2
Macquarie	Pt2.1.2: Temporary tall emergent marsh	3014	2 454	81.4
Macquarie	Pt1.8.2: Temporary shrub swamp	1704	781	45.8
Macquarie	Lt1.1: Temporary lake	9214	249	2.7
Macquarie	Pt1.6.2: Temporary woodland swamp	2636	186	7.1
Macquarie	Pt1.2.2: Temporary black box swamp	1919	55	2.9
Macquarie	Lp1.1: Permanent lake	814	33	4.1
Macquarie	Pt3.1.2: Clay pan	1895	16	0.8
Macquarie	Pp2.2.2: Permanent sedge/grass/forb marsh	46	15	32.6
Macquarie	Pt2.3.2: Freshwater meadow	2348	0	-
Macquarie	Pt4.2: Temporary wetland	1442	0	-
Macquarie	Pps5: Permanent spring	15	0	-
Macquarie	Pp3: Peat bog or fen marsh	9	0	-
Mitta Mitta	Pp4.2: Permanent wetland	984	0	-
Mitta Mitta	Pt2.3.2: Freshwater meadow	626	0	-
Mitta Mitta	Pt3.1.2: Clay pan	594	0	-
Mitta Mitta	Pt1.6.2: Temporary woodland swamp	562	0	-
Mitta Mitta	Pt1.8.2: Temporary shrub swamp	449	0	-
Mitta Mitta	Lp1.1: Permanent lake	86	0	-
Mitta Mitta	Pt4.2: Temporary wetland	57	0	-
Mitta Mitta	Pt1.1.2: Temporary river red gum swamp	3	0	-
Murrumbidgee	Pt1.1.2: Temporary river red gum swamp	7371	2161	29.3
Murrumbidgee	Pt3.1.2: Clay pan	17 188	1350	7.9
Murrumbidgee	Pt1.8.2: Temporary shrub swamp	22 695	1054	4.6
Murrumbidgee	Pt2.2.2: Temporary sedge/grass/forb marsh	30 863	833	2.7
Murrumbidgee	Pp4.2: Permanent wetland	8910	417	4.7
Murrumbidgee	Pt2.1.2: Temporary tall emergent marsh	855	239	28.0
Murrumbidgee	Lp1.1: Permanent lake	1484	140	9.4
Murrumbidgee	Pt1.2.2: Temporary black box swamp	4795	134	2.8
Murrumbidgee	Pt2.3.2: Freshwater meadow	35 225	95	0.3
Murrumbidgee	Lt1.1: Temporary lake	30 616	24	0.1
Murrumbidgee	Pst2.2: Temporary salt marsh	1739	1	0.1
Murrumbidgee	Pp3: Peat bog or fen marsh	1784	0	-
Murrumbidgee	Pt1.6.2: Temporary woodland swamp	1611	0	-
Murrumbidgee	Pt4.2: Temporary wetland	1475	0	-
Murrumbidgee	Pt1.7.2: Temporary lignum swamp	1464	0	-
Murrumbidgee	Pp2.1.2: Permanent tall emergent marsh	186	0	-
Murrumbidgee	Pp2.3.2: Permanent grass marsh	36	0	-
Murrumbidgee	Pp2.2.2: Permanent sedge/grass/forb marsh	31	0	-
Murrumbidgee	Pps5: Permanent spring	19	0	-
Namoi	Pp4.2: Permanent wetland	11 298	0	-
Namoi	Pt3.1.2: Clay pan	5331	0	-
Namoi	Pt2.2.2: Temporary sedge/grass/forb marsh	5183	0	-
Namoi	Lp1.1: Permanent lake	5123	0	-
Namoi	Pt4.2: Temporary wetland	3510	0	-
Namoi	Pt1.6.2: Temporary woodland swamp	3427	0	-
Namoi	Lt1.1: Temporary lake	2604	0	-
Namoi	Pt1.2.2: Temporary black box swamp	1771	0	-
Namoi	Pt1.1.2: Temporary river red gum swamp	1618	0	-
Namoi	Pt2.3.2: Freshwater meadow	622	0	-
Namoi	Pt1.8.2: Temporary shrub swamp	567	0	-
Namoi	Pp2.2.2: Permanent sedge/grass/forb marsh	392	0	-
Namoi	Pp3: Peat bog or fen marsh	17	0	-
Namoi	Pt1.7.2: Temporary lignum swamp	16	0	-

Valley name	Australian National Aquatic Ecosystem (ANAE) lake and wetland types	Total area (ha)	Cew Area (ha)	Percent
Namoi	Pps5: Permanent spring	1	0	-
Ovens	Pt3.1.2: Clay pan	2015	0	-
Ovens	Pt2.3.2: Freshwater meadow	915	0	-
Ovens	Pt1.6.2: Temporary woodland swamp	818	0	-
Ovens	Pt1.1.2: Temporary river red gum swamp	441	0	-
Ovens	Pp4.2: Permanent wetland	213	0	-
Ovens	Pt4.2: Temporary wetland	106	0	-
Ovens	Lp1.1: Permanent lake	80	0	-
Ovens	Pt2.1.2: Temporary tall emergent marsh	47	0	-
Ovens	Pt2.2.2: Temporary sedge/grass/forb marsh	45	0	-
Ovens	Pp2.1.2: Permanent tall emergent marsh	30	0	-
Ovens	Pt4.1: Floodplain or riparian wetland	23	0	-
Ovens	Lt1.1: Temporary lake	4	0	-
Paroo	Pt1.6.2: Temporary woodland swamp	152 703	0	-
Paroo	Lt1.1: Temporary lake	44 652	0	-
Paroo	Pt1.8.2: Temporary shrub swamp	29 765	0	-
Paroo	Lp1.1: Permanent lake	18 283	0	-
Paroo	Pt2.1.2: Temporary tall emergent marsh	12 485	0	-
Paroo	Pt1.2.2: Temporary black box swamp	8427	0	-
Paroo	Pt2.3.2: Freshwater meadow	7398	0	-
Paroo	Lsp1.1: Permanent saline lake	5868	0	-
Paroo	Pp4.2: Permanent wetland	4470	0	-
Paroo	Pt2.2.2: Temporary sedge/grass/forb marsh	4165	0	-
Paroo	Pt1.7.2: Temporary lignum swamp	3471	0	-
Paroo	Pt4.2: Temporary wetland	1949	0	-
Paroo	Pst2.2: Temporary salt marsh	1449	0	-
Paroo	Pp2.1.2: Permanent tall emergent marsh	586	0	-
Paroo	Lst1.1: Temporary saline lake	371	0	-
Paroo	Pt1.1.2: Temporary river red gum swamp	111	0	-
Paroo	Pst4: Temporary saline wetland	77	0	-
Paroo	Pt3.1.2: Clay pan	31	0	-
Paroo	Pps5: Permanent spring	9	0	-
Upper Murray	Pp3: Peat bog or fen marsh	1611	0	-
Upper Murray	Pt3.1.2: Clay pan	1457	0	-
Upper Murray	Pp2.3.2: Permanent grass marsh	1144	0	-
Upper Murray	Pt2.2.2: Temporary sedge/grass/forb marsh	725	0	-
Upper Murray	Pp4.2: Permanent wetland	408	0	-
Upper Murray	Pt1.1.2: Temporary river red gum swamp	290	0	-
Upper Murray	Pt1.6.2: Temporary woodland swamp	137	0	-
Upper Murray	Lp1.1: Permanent lake	94	0	-
Upper Murray	Pps5: Permanent spring	63	0	-
Upper Murray	Lt1.1: Temporary lake	50	0	-
Upper Murray	Pt4.2: Temporary wetland	50	0	-
Upper Murray	Pt2.3.2: Freshwater meadow	24	0	-
Upper Murray	Pp2.1.2: Permanent tall emergent marsh	16	0	-
Upper Murray	Pt2.1.2: Temporary tall emergent marsh	3	0	-
Upper Murray	Pp2.2.2: Permanent sedge/grass/forb marsh	1	0	-
Warrego	Pt2.3.2: Freshwater meadow	19 130	17 734	92.7
Warrego	Pt1.6.2: Temporary woodland swamp	4611	0	-
Warrego	Pt2.1.2: Temporary tall emergent marsh	4389	0	-
Warrego	Pt1.8.2: Temporary shrub swamp	3691	0	-
Warrego	Lp1.1: Permanent lake	3277	0	-
Warrego	Pp4.2: Permanent wetland	3227	0	-
Warrego	Lt1.1: Temporary lake	2330	0	-
Warrego	Pt4.2: Temporary wetland	1573	0	-
Warrego	Pt2.2.2: Temporary sedge/grass/forb marsh	875	0	-
Warrego	Pt3.1.2: Clay pan	653	0	-

Valley name	Australian National Aquatic Ecosystem (ANAE) lake and wetland types	Total area (ha)	Cew Area (ha)	Percent
Warrego	Pp2.1.2: Permanent tall emergent marsh	23	0	-
Warrego	Pt1.1.2: Temporary river red gum swamp	12	0	-
Warrego	Pps5: Permanent spring	2	0	-
Warrego	Pst1.1: Temporary saline swamp	2	0	-
Wimmera	Lt1.1: Temporary lake	25 070	0	-
Wimmera	Lt1.2: Temporary lake with aquatic bed	8300	0	-
Wimmera	Pt1.8.2: Temporary shrub swamp	5885	0	-
Wimmera	Pt3.1.2: Clay pan	4918	0	-
Wimmera	Pt1.1.2: Temporary river red gum swamp	4712	0	-
Wimmera	Pt2.3.2: Freshwater meadow	3729	0	-
Wimmera	Pst4: Temporary saline wetland	3311	0	-
Wimmera	Pt1.6.2: Temporary woodland swamp	3222	0	-
Wimmera	Pst1.1: Temporary saline swamp	2232	0	-
Wimmera	Pt1.2.2: Temporary black box swamp	1912	0	-
Wimmera	Pst3.2: Salt pan or salt flat	1633	0	-
Wimmera	Lp1.1: Permanent lake	1541	0	-
Wimmera	Lst1.1: Temporary saline lake	1132	0	-
Wimmera	Pt4.2: Temporary wetland	559	0	-
Wimmera	Pst2.2: Temporary salt marsh	404	0	-
Wimmera	Lp1.2: Permanent lake with aquatic bed	192	0	-
Wimmera	Pt1.5.2: Temporary paperbark swamp	185	0	-
Wimmera	Lst1.2: Temporary saline lake with aquatic bed	180	0	-
Wimmera	Pt1.7.2: Temporary lignum swamp	174	0	-
Wimmera	Pp4.2: Permanent wetland	145	0	-
Wimmera	Pt2.1.2: Temporary tall emergent marsh	127	0	-
Wimmera	Pt4.1: Floodplain or riparian wetland	111	0	-
Wimmera	Psp1.1: Saline paperbark swamp	31	0	-
Wimmera	Lsp1.1: Permanent saline lake	24	0	-
Wimmera	Psp4: Permanent saline wetland	16	0	-

Annex C. ANAE floodplain types inundated by Commonwealth environmental water by valley

For floodplains, the area inundated by out-of-channel delivery of Commonwealth environmental water is presented in Table C1.

Table C1. Area of each floodplain ecosystem type and the contribution of Commonwealth environmental water to supporting floodplain ecosystem diversity within each valley, sorted by the area inundated with inundation highlighted in blue.

Valley name	Australian National Aquatic Ecosystem (ANAE) floodplain type	Total Length (km)	Cew Length (km)	Percent
Avoca	F1.4: River red gum woodland riparian zone or floodplain	3128	0	-
Avoca	F1.8: Black box woodland riparian zone or floodplain	2988	0	-
Avoca	F1.6: Black box forest riparian zone or floodplain	977	0	-
Avoca	F1.12: Woodland riparian zone or floodplain	891	0	-
Avoca	F2.2: Lignum shrubland riparian zone or floodplain	80	0	-
Avoca	F2.4: Shrubland riparian zone or floodplain	4	0	-
Avoca	F1.2: River red gum forest riparian zone or floodplain	1	0	-
Barwon Darling	F3.2: Sedge/forb/grassland riparian zone or floodplain	238 708	0	-
Barwon Darling	F1.8: Black box woodland riparian zone or floodplain	74 613	0	-
Barwon Darling	F4: Unspecified riparian zone or floodplain	69 185	0	-
Barwon Darling	F2.4: Shrubland riparian zone or floodplain	38 445	0	-
Barwon Darling	F1.6: Black box forest riparian zone or floodplain	26 262	0	-
Barwon Darling	F1.10: Coolibah woodland and forest riparian zone or floodplain	14 516	0	-
Barwon Darling	F1.12: Woodland riparian zone or floodplain	4544	0	-
Barwon Darling	F1.2: River red gum forest riparian zone or floodplain	3997	0	-
Barwon Darling	F2.2: Lignum shrubland riparian zone or floodplain	1049	0	-
Barwon Darling	F1.4: River red gum woodland riparian zone or floodplain	346	0	-
Barwon Darling	F1.11: River cooba woodland riparian zone or floodplain	17	0	-
Border Rivers	F1.4: River red gum woodland riparian zone or floodplain	666	30	4.5
Border Rivers	F1.2: River red gum forest riparian zone or floodplain	27 172	15	0.1
Border Rivers	F1.12: Woodland riparian zone or floodplain	24 909	3	<0.1
Border Rivers	F1.10: Coolibah woodland and forest riparian zone or floodplain	71 383	0	-
Border Rivers	F3.2: Sedge/forb/grassland riparian zone or floodplain	14 098	0	-
Border Rivers	F4: Unspecified riparian zone or floodplain	5657	0	-
Border Rivers	F1.8: Black box woodland riparian zone or floodplain	3196	0	-
Border Rivers	F2.2: Lignum shrubland riparian zone or floodplain	2488	0	-
Border Rivers	F1.11: River cooba woodland riparian zone or floodplain	2322	0	-
Border Rivers	F1.6: Black box forest riparian zone or floodplain	1104	0	-
Border Rivers	F2.4: Shrubland riparian zone or floodplain	371	0	-
Broken	F1.4: River red gum woodland riparian zone or floodplain	4503	0	-
Broken	F1.12: Woodland riparian zone or floodplain	1355	0	-
Broken	F1.8: Black box woodland riparian zone or floodplain	61	0	-
Broken	F1.2: River red gum forest riparian zone or floodplain	20	0	-
Broken	F2.2: Lignum shrubland riparian zone or floodplain	6	0	-
Campaspe	F1.4: River red gum woodland riparian zone or floodplain	2961	0	-
Campaspe	F1.12: Woodland riparian zone or floodplain	1966	0	-
Campaspe	F1.2: River red gum forest riparian zone or floodplain	17	0	-
Campaspe	F2.2: Lignum shrubland riparian zone or floodplain	1	0	-
Castlereagh	F1.10: Coolibah woodland and forest riparian zone or floodplain	41 417	0	-
Castlereagh	F1.8: Black box woodland riparian zone or floodplain	31 874	0	-
Castlereagh	F1.2: River red gum forest riparian zone or floodplain	11 973	0	-

Valley name	Australian National Aquatic Ecosystem (ANAE) floodplain type	Total Length (km)	Cew Length (km)	Percent
Castlereagh	F1.6: Black box forest riparian zone or floodplain	4553	0	-
Castlereagh	F1.12: Woodland riparian zone or floodplain	4156	0	-
Castlereagh	F2.4: Shrubland riparian zone or floodplain	1725	0	-
Castlereagh	F1.4: River red gum woodland riparian zone or floodplain	214	0	-
Castlereagh	F2.2: Lignum shrubland riparian zone or floodplain	102	0	-
Castlereagh	F1.11: River cooba woodland riparian zone or floodplain	61	0	-
Central Murray	F1.2: River red gum forest riparian zone or floodplain	161 186	125	0.1
Central Murray	F1.8: Black box woodland riparian zone or floodplain	48 212	42	0.1
Central Murray	F1.4: River red gum woodland riparian zone or floodplain	23 554	40	0.2
Central Murray	F2.4: Shrubland riparian zone or floodplain	1245	2	0.2
Central Murray	F4: Unspecified riparian zone or floodplain	671	1	0.1
Central Murray	F2.2: Lignum shrubland riparian zone or floodplain	7212	0	-
Central Murray	F1.12: Woodland riparian zone or floodplain	6760	0	-
Central Murray	F1.6: Black box forest riparian zone or floodplain	4414	0	-
Condamine Balonne	F3.2: Sedge/forb/grassland riparian zone or floodplain	290 499	32	<0.1
Condamine Balonne	F2.2: Lignum shrubland riparian zone or floodplain	3474	2	0.1
Condamine Balonne	F4: Unspecified riparian zone or floodplain	501 081	0	-
Condamine Balonne	F1.12: Woodland riparian zone or floodplain	68 315	0	-
Condamine Balonne	F1.8: Black box woodland riparian zone or floodplain	30 578	0	-
Condamine Balonne	F1.2: River red gum forest riparian zone or floodplain	18 032	0	-
Condamine Balonne	F1.4: River red gum woodland riparian zone or floodplain	13 901	0	-
Condamine Balonne	F2.4: Shrubland riparian zone or floodplain	9419	0	-
Edward Wakool	F1.8: Black box woodland riparian zone or floodplain	77 935	0	-
Edward Wakool	F1.2: River red gum forest riparian zone or floodplain	58 568	0	-
Edward Wakool	F1.4: River red gum woodland riparian zone or floodplain	7710	0	-
Edward Wakool	F1.6: Black box forest riparian zone or floodplain	4196	0	-
Edward Wakool	F2.4: Shrubland riparian zone or floodplain	2484	0	-
Edward Wakool	F2.2: Lignum shrubland riparian zone or floodplain	1858	0	-
Goulburn	F1.12: Woodland riparian zone or floodplain	26 248	0	-
Goulburn	F1.4: River red gum woodland riparian zone or floodplain	18 088	0	-
Goulburn	F1.2: River red gum forest riparian zone or floodplain	5721	0	-
Goulburn	F1.8: Black box woodland riparian zone or floodplain	130	0	-
Goulburn	F2.4: Shrubland riparian zone or floodplain	35	0	-
Goulburn	F2.2: Lignum shrubland riparian zone or floodplain	27	0	-
Gwydir	F1.10: Coolibah woodland and forest riparian zone or floodplain	161 514	611	0.4
Gwydir	F1.11: River cooba woodland riparian zone or floodplain	4501	584	13.0
Gwydir	F1.2: River red gum forest riparian zone or floodplain	15 550	56	0.4
Gwydir	F1.12: Woodland riparian zone or floodplain	15 189	0	-
Gwydir	F1.6: Black box forest riparian zone or floodplain	12 186	0	-
Gwydir	F1.8: Black box woodland riparian zone or floodplain	5679	0	-
Gwydir	F1.4: River red gum woodland riparian zone or floodplain	859	0	-
Gwydir	F2.2: Lignum shrubland riparian zone or floodplain	656	0	-
Gwydir	F2.4: Shrubland riparian zone or floodplain	87	0	-
Kiewa	F1.12: Woodland riparian zone or floodplain	2713	0	-
Kiewa	F1.4: River red gum woodland riparian zone or floodplain	1436	0	-
Lachlan	F2.4: Shrubland riparian zone or floodplain	222 840	1784	0.8
Lachlan	F1.8: Black box woodland riparian zone or floodplain	100 711	260	0.3
Lachlan	F1.2: River red gum forest riparian zone or floodplain	96 919	2	-
Lachlan	F1.6: Black box forest riparian zone or floodplain	22 898	0	-
Lachlan	F2.2: Lignum shrubland riparian zone or floodplain	9694	0	-
Lachlan	F1.4: River red gum woodland riparian zone or floodplain	4123	0	-
Lachlan	F1.12: Woodland riparian zone or floodplain	2260	0	-
Lachlan	F1.11: River cooba woodland riparian zone or floodplain	3	0	-
Lachlan	F3.2: Sedge/forb/grassland riparian zone or floodplain	1	0	-
Loddon	F1.4: River red gum woodland riparian zone or floodplain	8031	0	-
Loddon	F1.8: Black box woodland riparian zone or floodplain	7835	0	-

Valley name	Australian National Aquatic Ecosystem (ANAE) floodplain type	Total Length (km)	Cew Length (km)	Percent
Loddon	F2.2: Lignum shrubland riparian zone or floodplain	6600	0	-
Loddon	F1.12: Woodland riparian zone or floodplain	2524	0	-
Loddon	F2.4: Shrubland riparian zone or floodplain	104	0	-
Loddon	F1.2: River red gum forest riparian zone or floodplain	100	0	-
Loddon	F1.6: Black box forest riparian zone or floodplain	33	0	-
Lower Darling	F1.2: River red gum forest riparian zone or floodplain	13 158	11	0.1
Lower Darling	F1.8: Black box woodland riparian zone or floodplain	71 157	0	-
Lower Darling	F1.6: Black box forest riparian zone or floodplain	20 532	0	-
Lower Darling	F2.4: Shrubland riparian zone or floodplain	11 441	0	-
Lower Darling	F1.12: Woodland riparian zone or floodplain	1270	0	-
Lower Darling	F4: Unspecified riparian zone or floodplain	279	0	-
Lower Darling	F3.2: Sedge/forb/grassland riparian zone or floodplain	106	0	-
Lower Darling	F2.2: Lignum shrubland riparian zone or floodplain	8	0	-
Lower Murray	F1.8: Black box woodland riparian zone or floodplain	35 563	372	1.0
Lower Murray	F1.2: River red gum forest riparian zone or floodplain	11 190	278	2.5
Lower Murray	F1.4: River red gum woodland riparian zone or floodplain	35 798	190	0.5
Lower Murray	F2.4: Shrubland riparian zone or floodplain	27 184	176	0.6
Lower Murray	F2.2: Lignum shrubland riparian zone or floodplain	20 382	128	0.6
Lower Murray	F4: Unspecified riparian zone or floodplain	567	8	1.4
Lower Murray	F1.12: Woodland riparian zone or floodplain	1529	5	0.3
Lower Murray	F1.6: Black box forest riparian zone or floodplain	109	1	0.9
Lower Murray	F1.11: River cooba woodland riparian zone or floodplain	348	0	-
Macquarie	F1.2: River red gum forest riparian zone or floodplain	73 188	4167	5.7
Macquarie	F1.4: River red gum woodland riparian zone or floodplain	14 799	931	6.3
Macquarie	F1.10: Coolibah woodland and forest riparian zone or floodplain	50 855	338	0.7
Macquarie	F2.4: Shrubland riparian zone or floodplain	41 097	303	0.7
Macquarie	F1.11: River cooba woodland riparian zone or floodplain	2752	195	7.1
Macquarie	F1.8: Black box woodland riparian zone or floodplain	158 447	150	0.1
Macquarie	F1.6: Black box forest riparian zone or floodplain	20 284	117	0.6
Macquarie	F2.2: Lignum shrubland riparian zone or floodplain	6048	49	0.8
Macquarie	F4: Unspecified riparian zone or floodplain	104 669	0	-
Macquarie	F1.12: Woodland riparian zone or floodplain	6905	0	-
Macquarie	F3.2: Sedge/forb/grassland riparian zone or floodplain	142	0	-
Mitta Mitta	F1.12: Woodland riparian zone or floodplain	7466	0	-
Mitta Mitta	F1.4: River red gum woodland riparian zone or floodplain	320	0	-
Mitta Mitta	F2.4: Shrubland riparian zone or floodplain	37	0	-
Murrumbidgee	F1.2: River red gum forest riparian zone or floodplain	127 050	1870	1.5
Murrumbidgee	F2.2: Lignum shrubland riparian zone or floodplain	70 420	985	1.4
Murrumbidgee	F2.4: Shrubland riparian zone or floodplain	29 070	288	1.0
Murrumbidgee	F1.4: River red gum woodland riparian zone or floodplain	5154	47	0.9
Murrumbidgee	F1.8: Black box woodland riparian zone or floodplain	95 432	20	-
Murrumbidgee	F1.6: Black box forest riparian zone or floodplain	9120	0	-
Murrumbidgee	F4: Unspecified riparian zone or floodplain	80	0	-
Murrumbidgee	F1.12: Woodland riparian zone or floodplain	49	0	-
Murrumbidgee	F1.11: River cooba woodland riparian zone or floodplain	24	0	-
Murrumbidgee	F1.10: Coolibah woodland and forest riparian zone or floodplain	23	0	-
Namoi	F1.10: Coolibah woodland and forest riparian zone or floodplain	87 799	0	-
Namoi	F1.12: Woodland riparian zone or floodplain	26 612	0	-
Namoi	F1.8: Black box woodland riparian zone or floodplain	13 142	0	-
Namoi	F1.2: River red gum forest riparian zone or floodplain	10 920	0	-
Namoi	F1.6: Black box forest riparian zone or floodplain	3401	0	-
Namoi	F2.2: Lignum shrubland riparian zone or floodplain	2614	0	-
Namoi	F1.11: River cooba woodland riparian zone or floodplain	1513	0	-
Namoi	F1.4: River red gum woodland riparian zone or floodplain	599	0	-

Valley name	Australian National Aquatic Ecosystem (ANAE) floodplain type	Total Length (km)	Cew Length (km)	Percent
Namoi	F2.4: Shrubland riparian zone or floodplain	153	0	-
Namoi	F1.13: Paperpark riparian zone or floodplain	17	0	-
Ovens	F1.12: Woodland riparian zone or floodplain	11 406	0	-
Ovens	F1.4: River red gum woodland riparian zone or floodplain	6845	0	-
Ovens	F1.2: River red gum forest riparian zone or floodplain	1903	0	-
Paroo	F3.2: Sedge/forb/grassland riparian zone or floodplain	258 815	0	-
Paroo	F1.4: River red gum woodland riparian zone or floodplain	98 116	0	-
Paroo	F1.12: Woodland riparian zone or floodplain	62 687	0	-
Paroo	F4: Unspecified riparian zone or floodplain	33 734	0	-
Paroo	F2.4: Shrubland riparian zone or floodplain	20 116	0	-
Paroo	F1.8: Black box woodland riparian zone or floodplain	17 227	0	-
Upper Murray	F1.12: Woodland riparian zone or floodplain	3845	0	-
Upper Murray	F1.2: River red gum forest riparian zone or floodplain	2261	0	-
Upper Murray	F1.4: River red gum woodland riparian zone or floodplain	1475	0	-
Upper Murray	F2.4: Shrubland riparian zone or floodplain	265	0	-
Upper Murray	F2.2: Lignum shrubland riparian zone or floodplain	10	0	-
Warrego	F1.12: Woodland riparian zone or floodplain	18 687	128	0.7
Warrego	F4: Unspecified riparian zone or floodplain	273 342	58	-
Warrego	F1.4: River red gum woodland riparian zone or floodplain	60 448	0	-
Warrego	F3.2: Sedge/forb/grassland riparian zone or floodplain	30 732	0	-
Warrego	F2.2: Lignum shrubland riparian zone or floodplain	10 980	0	-
Warrego	F2.4: Shrubland riparian zone or floodplain	1048	0	-
Warrego	F1.8: Black box woodland riparian zone or floodplain	441	0	-
Warrego	F1.2: River red gum forest riparian zone or floodplain	96	0	-
Wimmera	F1.12: Woodland riparian zone or floodplain	16 032	0	-
Wimmera	F1.4: River red gum woodland riparian zone or floodplain	12 038	0	-
Wimmera	F1.8: Black box woodland riparian zone or floodplain	4416	0	-
Wimmera	F1.6: Black box forest riparian zone or floodplain	1373	0	-
Wimmera	F2.4: Shrubland riparian zone or floodplain	809	0	-
Wimmera	F2.2: Lignum shrubland riparian zone or floodplain	146	0	-
Wimmera	F1.13: Paperpark riparian zone or floodplain	1	0	-

Annex D. ANAE river channel types influenced by Commonwealth environmental water by valley

The length of river and stream channels of differing ANAE type influenced by the delivery of Commonwealth environmental water is presented in Table D1 as an in indicator of the contribution of Commonwealth environmental water towards ecosystem diversity within each valley. River length measurement is highly dependent on the resolution of the mapping with higher resolution mapping capturing more twists and turns in the river that increase the measured river length along the flow path between two points. The Basin ANAE waterway mapping compiles state data that varies in resolution from 1:70 000 to 1:100 000.

Commonwealth environmental water is typically delivered from storages into lowland rivers. In hilly landscapes and where rivers cut through gorges the ANAE classification often identifies individual river sections as high energy streams. These transition into low energy lowland rivers as the valleys widen and flatten further downstream. The different ANAE types recorded in Table D1 are mostly different ecosystem types identified on the same major river within each valley rather than separate watercourses.

Table D1. Length of river and stream ecosystem types influenced by the delivery of Commonwealth environmental water (shaded blue) as represented by the Basin ANAE waterways data set in each valley

Valley name	Australian National Aquatic Ecosystem (ANAE) waterway type	Total Length (km)	Cew Length (km)	Percent
Avoca	Rp1.1: Permanent high energy upland stream	1	0	-
Avoca	Rp1.2: Permanent transitional zone stream	25	0	-
Avoca	Rp1.4: Permanent lowland stream	41	0	-
Avoca	Rt1.1: Temporary high energy upland stream	1031	0	-
Avoca	Rt1.2: Temporary transitional zone stream	1840	0	-
Avoca	Rt1.3: Temporary low energy upland stream	84	0	-
Avoca	Rt1.4: Temporary lowland stream	1976	0	-
Barwon Darling	Rp1.4: Permanent lowland stream	4777	2521	52.8
Barwon Darling	Rt1.4: Temporary lowland stream	21 363	83	0.4
Barwon Darling	Ru1: Unspecified river (landform unknown)	14	6	42.9
Barwon Darling	Rp1.1: Permanent high energy upland stream	4	1	25.0
Barwon Darling	Rw1: Permanent river (landform unknown)	1	1	100
Barwon Darling	Rp1.2: Permanent transitional zone stream	38	0	-
Barwon Darling	Rt1.1: Temporary high energy upland stream	1325	0	-
Barwon Darling	Rt1.2: Temporary transitional zone stream	7163	0	-
Barwon Darling	Rt1.3: Temporary low energy upland stream	185	0	-
Border Rivers	Rp1.4: Permanent lowland stream	2690	890	33.1
Border Rivers	Rt1.4: Temporary lowland stream	13 799	573	4.2
Border Rivers	Rp1.2: Permanent transitional zone stream	2580	74	2.9
Border Rivers	Rt1.1: Temporary high energy upland stream	10 282	68	0.7
Border Rivers	Rt1.2: Temporary transitional zone stream	10 572	15	0.1
Border Rivers	Rp1.1: Permanent high energy upland stream	3676	9	0.2
Border Rivers	Rp1.3: Permanent low energy upland stream	2	0	-
Border Rivers	Rt1.3: Temporary low energy upland stream	80	0	-
Border Rivers	Ru1: Unspecified river (landform unknown)	10	0	-
Border Rivers	Rw1: Permanent river (landform unknown)	6	0	-
Broken	Rt1.4: Temporary lowland stream	1614	177	11.0
Broken	Rp1.1: Permanent high energy upland stream	86	0	-
Broken	Rp1.2: Permanent transitional zone stream	47	0	-
Broken	Rp1.3: Permanent low energy upland stream	1	0	-
Broken	Rp1.4: Permanent lowland stream	75	0	-
Broken	Rt1.1: Temporary high energy upland stream	1575	0	-
Broken	Rt1.2: Temporary transitional zone stream	548	0	-
Broken	Rt1.3: Temporary low energy upland stream	61	0	-
Broken	Ru1: Unspecified river (landform unknown)	13	0	-
Broken	Rw1: Permanent river (landform unknown)	3	0	-

Valley name	Australian National Aquatic Ecosystem (ANAE) waterway type	Total Length (km)	Cew Length (km)	Percent
Campaspe	Rp1.1: Permanent high energy upland stream	128	0	-
Campaspe	Rp1.2: Permanent transitional zone stream	66	0	-
Campaspe	Rp1.3: Permanent low energy upland stream	20	0	-
Campaspe	Rp1.4: Permanent lowland stream	98	0	-
Campaspe	Rt1.1: Temporary high energy upland stream	1821	0	-
Campaspe	Rt1.2: Temporary transitional zone stream	2106	0	-
Campaspe	Rt1.3: Temporary low energy upland stream	42	0	-
Campaspe	Rt1.4: Temporary lowland stream	652	0	-
Campaspe	Ru1: Unspecified river (landform unknown)	2	0	-
Campaspe	Rw1: Permanent river (landform unknown)	9	0	-
Castlereagh	Rp1.1: Permanent high energy upland stream	194	0	-
Castlereagh	Rp1.2: Permanent transitional zone stream	458	0	-
Castlereagh	Rp1.3: Permanent low energy upland stream	43	0	-
Castlereagh	Rp1.4: Permanent lowland stream	483	0	-
Castlereagh	Rt1.1: Temporary high energy upland stream	2554	0	-
Castlereagh	Rt1.2: Temporary transitional zone stream	4168	0	-
Castlereagh	Rt1.3: Temporary low energy upland stream	187	0	-
Castlereagh	Rt1.4: Temporary lowland stream	4776	0	-
Central Murray	Rp1.4: Permanent lowland stream	3516	2243	63.8
Central Murray	Rt1.4: Temporary lowland stream	3991	198	5.0
Central Murray	Rp1.3: Permanent low energy upland stream	73	48	65.8
Central Murray	Rp1.2: Permanent transitional zone stream	153	33	21.6
Central Murray	Rp1.1: Permanent high energy upland stream	458	9	2.0
Central Murray	Rw1: Permanent river (landform unknown)	5	5	100
Central Murray	Rt1.3: Temporary low energy upland stream	122	1	0.8
Central Murray	Rt1.1: Temporary high energy upland stream	2594	0	-
Central Murray	Rt1.2: Temporary transitional zone stream	1131	0	-
Central Murray	Ru1: Unspecified river (landform unknown)	6	0	-
Condamine Balonne	Rt1.4: Temporary lowland stream	31 556	1227	3.9
Condamine Balonne	Rp1.4: Permanent lowland stream	1440	911	63.3
Condamine Balonne	Ru1: Unspecified river (landform unknown)	27	2	7.4
Condamine Balonne	Rw1: Permanent river (landform unknown)	1	1	100
Condamine Balonne	Rp1.1: Permanent high energy upland stream	29	0	-
Condamine Balonne	Rp1.2: Permanent transitional zone stream	28	0	-
Condamine Balonne	Rp1.3: Permanent low energy upland stream	1	0	-
Condamine Balonne	Rt1.1: Temporary high energy upland stream	4072	0	-
Condamine Balonne	Rt1.2: Temporary transitional zone stream	18 656	0	-
Condamine Balonne	Rt1.3: Temporary low energy upland stream	126	0	-
Edward Wakool	Rp1.4: Permanent lowland stream	2299	959	41.7
Edward Wakool	Rt1.4: Temporary lowland stream	1067	74	6.9
Edward Wakool	Rp1.3: Permanent low energy upland stream	1	0	-
Goulburn	Rp1.4: Permanent lowland stream	557	347	62.3
Goulburn	Rp1.1: Permanent high energy upland stream	1258	111	8.8
Goulburn	Rp1.2: Permanent transitional zone stream	356	48	13.5
Goulburn	Rt1.4: Temporary lowland stream	2513	10	0.4
Goulburn	Rt1.2: Temporary transitional zone stream	3570	5	0.1
Goulburn	Rt1.3: Temporary low energy upland stream	240	2	0.8
Goulburn	Rp1.3: Permanent low energy upland stream	65	1	1.5
Goulburn	Rt1.1: Temporary high energy upland stream	14 778	0	-
Goulburn	Ru1: Unspecified river (landform unknown)	20	0	-
Goulburn	Rw1: Permanent river (landform unknown)	39	0	-
Gwydir	Rp1.4: Permanent lowland stream	1652	346	20.9
Gwydir	Rt1.4: Temporary lowland stream	3429	159	4.6
Gwydir	Rp1.2: Permanent transitional zone stream	3577	153	4.3
Gwydir	Rp1.1: Permanent high energy upland stream	3985	116	2.9
Gwydir	Rp1.3: Permanent low energy upland stream	115	45	39.1
Gwydir	Rt1.3: Temporary low energy upland stream	145	27	18.6
Gwydir	Rt1.1: Temporary high energy upland stream	8314	0	-

Valley name	Australian National Aquatic Ecosystem (ANAE) waterway type	Total Length (km)	Cew Length (km)	Percent
Gwydir	Rt1.2: Temporary transitional zone stream	4323	0	-
Gwydir	Ru1: Unspecified river (landform unknown)	8	0	-
Gwydir	Rw1: Permanent river (landform unknown)	10	0	-
Kiewa	Rp1.1: Permanent high energy upland stream	136	0	-
Kiewa	Rp1.2: Permanent transitional zone stream	5	0	-
Kiewa	Rp1.3: Permanent low energy upland stream	2	0	-
Kiewa	Rp1.4: Permanent lowland stream	187	0	-
Kiewa	Rt1.1: Temporary high energy upland stream	2427	0	-
Kiewa	Rt1.2: Temporary transitional zone stream	171	0	-
Kiewa	Rt1.3: Temporary low energy upland stream	2	0	-
Kiewa	Rt1.4: Temporary lowland stream	102	0	-
Kiewa	Ru1: Unspecified river (landform unknown)	1	0	-
Lachlan	Rp1.4: Permanent lowland stream	4565	1311	28.7
Lachlan	Rt1.4: Temporary lowland stream	15 023	87	0.6
Lachlan	Rp1.1: Permanent high energy upland stream	8412	68	0.8
Lachlan	Rp1.2: Permanent transitional zone stream	2399	36	1.5
Lachlan	Rp1.3: Permanent low energy upland stream	38	4	10.5
Lachlan	Rt1.1: Temporary high energy upland stream	15 564	0	-
Lachlan	Rt1.2: Temporary transitional zone stream	9639	0	-
Lachlan	Rt1.3: Temporary low energy upland stream	219	0	-
Lachlan	Ru1: Unspecified river (landform unknown)	10	0	-
Lachlan	Rw1: Permanent river (landform unknown)	27	0	-
Loddon	Rp1.4: Permanent lowland stream	467	457	97.9
Loddon	Rp1.2: Permanent transitional zone stream	70	52	74.3
Loddon	Rt1.4: Temporary lowland stream	5410	15	0.3
Loddon	Rp1.1: Permanent high energy upland stream	96	4	4.2
Loddon	Rt1.2: Temporary transitional zone stream	4089	1	<0.1
Loddon	Rt1.1: Temporary high energy upland stream	2132	0	-
Loddon	Rt1.3: Temporary low energy upland stream	95	0	-
Loddon	Ru1: Unspecified river (landform unknown)	8	0	-
Lower Darling	Rp1.4: Permanent lowland stream	1883	1198	63.6
Lower Darling	Rt1.4: Temporary lowland stream	3450	34	1.0
Lower Darling	Rp1.2: Permanent transitional zone stream	50	6	12.0
Lower Darling	Rp1.1: Permanent high energy upland stream	2	2	100
Lower Darling	Rt1.2: Temporary transitional zone stream	557	1	0.2
Lower Darling	Rt1.1: Temporary high energy upland stream	34	0	-
Lower Darling	Rt1.3: Temporary low energy upland stream	43	0	-
Lower Murray	Rp1.4: Permanent lowland stream	1495	713	47.7
Lower Murray	Rt1: Temporary stream	175	85	48.6
Lower Murray	Rp1: Permanent stream	294	80	27.2
Lower Murray	Rt1.4: Temporary lowland stream	7871	26	0.3
Lower Murray	Rp1.1: Permanent high energy upland stream	26	22	84.6
Lower Murray	Rp1.3: Permanent low energy upland stream	56	20	35.7
Lower Murray	Rw1: Permanent river (landform unknown)	58	4	6.9
Lower Murray	Rp1.2: Permanent transitional zone stream	44	1	2.3
Lower Murray	Rt1.1: Temporary high energy upland stream	4758	1	<0.1
Lower Murray	Rt1.2: Temporary transitional zone stream	5455	1	<0.1
Lower Murray	Rt1.3: Temporary low energy upland stream	209	0	-
Lower Murray	Ru1: Unspecified river (landform unknown)	64	0	-
Macquarie	Rp1.4: Permanent lowland stream	5236	590	11.3
Macquarie	Rp1.2: Permanent transitional zone stream	3030	143	4.7
Macquarie	Rp1.1: Permanent high energy upland stream	11 442	61	0.5
Macquarie	Rt1.4: Temporary lowland stream	12 967	14	0.1
Macquarie	Rp1.3: Permanent low energy upland stream	8	0	-
Macquarie	Rt1.1: Temporary high energy upland stream	22 520	0	-
Macquarie	Rt1.2: Temporary transitional zone stream	10 939	0	-
Macquarie	Rt1.3: Temporary low energy upland stream	113	0	-
Macquarie	Ru1: Unspecified river (landform unknown)	7	0	-

Valley name	Australian National Aquatic Ecosystem (ANAE) waterway type	Total Length (km)	Cew Length (km)	Percent
Macquarie	Rw1: Permanent river (landform unknown)	31	0	-
Mitta Mitta	Rp1.1: Permanent high energy upland stream	769	0	-
Mitta Mitta	Rp1.2: Permanent transitional zone stream	86	0	-
Mitta Mitta	Rp1.4: Permanent lowland stream	132	0	-
Mitta Mitta	Rt1.1: Temporary high energy upland stream	8472	0	-
Mitta Mitta	Rt1.2: Temporary transitional zone stream	149	0	-
Mitta Mitta	Rt1.3: Temporary low energy upland stream	3	0	-
Mitta Mitta	Rt1.4: Temporary lowland stream	46	0	-
Mitta Mitta	Ru1: Unspecified river (landform unknown)	14	0	-
Mitta Mitta	Rw1: Permanent river (landform unknown)	26	0	-
Murrumbidgee	Rp1.4: Permanent lowland stream	4104	1562	38.1
Murrumbidgee	Rp1.1: Permanent high energy upland stream	16 241	377	2.3
Murrumbidgee	Rp1.2: Permanent transitional zone stream	2672	154	5.8
Murrumbidgee	Rt1.4: Temporary lowland stream	9 311	96	1.0
Murrumbidgee	Rp1.3: Permanent low energy upland stream	87	31	35.6
Murrumbidgee	Rt1.1: Temporary high energy upland stream	23 149	1	<0.1
Murrumbidgee	Rt1.2: Temporary transitional zone stream	7391	1	<0.1
Murrumbidgee	Rt1.3: Temporary low energy upland stream	62	0	-
Murrumbidgee	Ru1: Unspecified river (landform unknown)	5	0	-
Murrumbidgee	Rw1: Permanent river (landform unknown)	44	0	-
Namoi	Rp1.4: Permanent lowland stream	2406	843	35.0
Namoi	Rp1.1: Permanent high energy upland stream	6437	71	1.1
Namoi	Rp1.2: Permanent transitional zone stream	1819	58	3.2
Namoi	Rt1.4: Temporary lowland stream	7700	37	0.5
Namoi	Rp1.3: Permanent low energy upland stream	20	12	60
Namoi	Rt1.3: Temporary low energy upland stream	266	5	1.9
Namoi	Rt1.1: Temporary high energy upland stream	19518	0	-
Namoi	Rt1.2: Temporary transitional zone stream	7758	0	-
Namoi	Ru1: Unspecified river (landform unknown)	3	0	-
Namoi	Rw1: Permanent river (landform unknown)	24	0	-
Ovens	Rp1.4: Permanent lowland stream	396	292	73.7
Ovens	Rt1.4: Temporary lowland stream	1182	136	11.5
Ovens	Rp1.1: Permanent high energy upland stream	481	46	9.6
Ovens	Rp1.2: Permanent transitional zone stream	54	8	14.8
Ovens	Rp1.3: Permanent low energy upland stream	2	2	100
Ovens	Rt1.1: Temporary high energy upland stream	8227	0	-
Ovens	Rt1.2: Temporary transitional zone stream	799	0	-
Ovens	Rt1.3: Temporary low energy upland stream	49	0	-
Ovens	Rw1: Permanent river (landform unknown)	1	0	-
Paroo	Rp1.2: Permanent transitional zone stream	40	0	-
Paroo	Rp1.4: Permanent lowland stream	1220	0	-
Paroo	Rt1.1: Temporary high energy upland stream	383	0	-
Paroo	Rt1.2: Temporary transitional zone stream	5688	0	-
Paroo	Rt1.3: Temporary low energy upland stream	140	0	-
Paroo	Rt1.4: Temporary lowland stream	25 114	0	-
Paroo	Ru1: Unspecified river (landform unknown)	27	0	-
Upper Murray	Rp1.1: Permanent high energy upland stream	5348	0	-
Upper Murray	Rp1.2: Permanent transitional zone stream	393	0	-
Upper Murray	Rp1.3: Permanent low energy upland stream	5	0	-
Upper Murray	Rp1.4: Permanent lowland stream	497	0	-
Upper Murray	Rt1.1: Temporary high energy upland stream	8889	0	-
Upper Murray	Rt1.2: Temporary transitional zone stream	567	0	-
Upper Murray	Rt1.3: Temporary low energy upland stream	7	0	-
Upper Murray	Rt1.4: Temporary lowland stream	277	0	-
Upper Murray	Ru1: Unspecified river (landform unknown)	1	0	-
Upper Murray	Rw1: Permanent river (landform unknown)	24	0	-
Warrego	Rt1.4: Temporary lowland stream	19 608	947	4.8
Warrego	Rp1.4: Permanent lowland stream	799	375	46.9

Valley name	Australian National Aquatic Ecosystem (ANAE) waterway type	Total Length (km)	Cew Length (km)	Percent
Warrego	Rt1.2: Temporary transitional zone stream	6695	33	0.5
Warrego	Rt1.3: Temporary low energy upland stream	247	12	4.9
Warrego	Rp1.3: Permanent low energy upland stream	9	0	-
Warrego	Rt1.1: Temporary high energy upland stream	639	0	-
Warrego	Ru1: Unspecified river (landform unknown)	2	0	-
Warrego	Rw1: Permanent river (landform unknown)	1	0	-
Wimmera	Rp1.2: Permanent transitional zone stream	46	0	-
Wimmera	Rp1.4: Permanent lowland stream	47	0	-
Wimmera	Rt1.1: Temporary high energy upland stream	2225	0	-
Wimmera	Rt1.2: Temporary transitional zone stream	2980	0	-
Wimmera	Rt1.3: Temporary low energy upland stream	84	0	-
Wimmera	Rt1.4: Temporary lowland stream	4215	0	-
Wimmera	Ru1: Unspecified river (landform unknown)	10	0	-