Priority Action Plan for Lower Broken River Wetlands: Public Document

Project: 06-83

Prepared for:

Goulburn Broken Catchment Management Authority

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Executive Summary

Ecology Australia was commissioned by the Goulburn Broken Catchment Management Authority (GBCMA) to identify, map, classify and assess the condition of a representative sample of wetlands connected with the lower Broken River and to prepare a list of priority actions to protect or enhance their ecological values.

Wetlands on the floodplain of the lower Broken River between Benalla and Shepparton were identified by air photo interpretation prior to field survey in February 2007. A total of 236 wetlands were identified on private and public land.

In all 29 representative wetlands were selected for survey. Each wetland was assessed via the Index of Wetland Condition protocols; notes were compiled on the floristic composition and management issues; the wetland boundary was mapped; and photographs were taken.

Almost all wetlands were dry at the time of survey as a result of the extreme drought and lack of flooding on the regulated Broken River.

Wetland values are high with numerous wetlands of highly variable size on the floodplain of the Broken River. In Victoria it is unusual to find such a diversity of floodplain wetlands relatively unmodified (physically) and with a small suite of weed species despite the agricultural land-use history.

A suite of Ecological Vegetation Classes (EVCs) were recorded within the Floodplain Wetland and Billabong Wetland Aggregates. A total of 13 significant plant species was recorded (National, State or regional significance).

Wetland management issues were identified at each site. The most important issues are stock grazing and weed invasion – the latter includes weed species on the floodplain and along the Broken River. However, removing grazing from long-grazed wetlands may result in dominance by one or a few species of woody or tall perennial herbaceous species such as Phalaris (**Phalaris aquatica*). Therefore in some instances grazing may be a useful tool to manage weeds if appropriate stocking rates and times are employed.

A total of 22 weed species are identified for management (control or elimination). The most serious of these (apart from Phalaris) are woody weeds (Desert Ash, Box-elder Maple and Willows), and Arrowhead (**Sagittaria ?brevirostra*) an aquatic weed which is rated amongst the top six most significant aquatic weeds in Australia.

1 Introduction

The lower Broken River, downstream of Caseys Weir, meanders for over 63 km before its confluence with the Goulburn River at Shepparton. River Red-gum open forest dominates the vegetation associated with the river's narrow floodplain and provides feeding, breeding and drought refuge for an array of flora and fauna species. Billabongs of less than one hectare in area are common. In recognition of its biodiversity values, the lower Broken River is listed on the Directory of Important Wetlands in Australia (VIC051) (Australian Nature Conservation Agency 1996).

Despite the high value placed on the wetlands along the lower Broken River the number, location, type, area, values and conditions of the wetlands are not well understood.

Ecology Australia was commissioned by the Goulburn Broken Catchment Management Authority (GBCMA) to identify, map, classify and assess the condition of a representative sample of wetlands connected with the lower Broken River and to prepare a list of priority actions to protect or enhance their ecological values.

The objectives of the project were to:

- identify representative samples of wetlands in the study area;
- map representative samples of wetlands in the study area;
- classify representative samples of wetlands in the study area;
- assess the values, threats and condition of representative samples of wetlands in the study area; and
- prepare a list of priority actions to protect or enhance the ecological values of representative samples of wetlands in the study area.

2 Study Area

The lower Broken River is defined as the stretch of the Broken River downstream of Caseys Weir through to its confluence with the Goulburn River at Shepparton (Figure 1). It is located in the north-east of Victoria in the Victorian Riverina bioregion. Most of the catchment has been cleared for agriculture which supports dryland grazing, broad-acre cropping and irrigated agriculture (cropping, horticulture and pasture). Average annual rainfall is approximately 670 mm at Benalla and decreases to the west; annual rainfall at Dookie Agricultural College is c. 550 mm and c. 490 mm at Tatura (Bureau of Meteorology 2004).

Along the Broken River there is a complex mosaic of different land tenures and licensing regimes for relatively small parcels of land within a short stretch of river. Licensed Crown Land frontage covers approximately 21% (c. 32 km) of both banks, while unlicensed Crown land frontage covers approximately 31% (c. 45 km). There is often ambiguity over the exact alignments of Crown boundaries and fences do not always reflect land tenure (Earth Tech 2005).

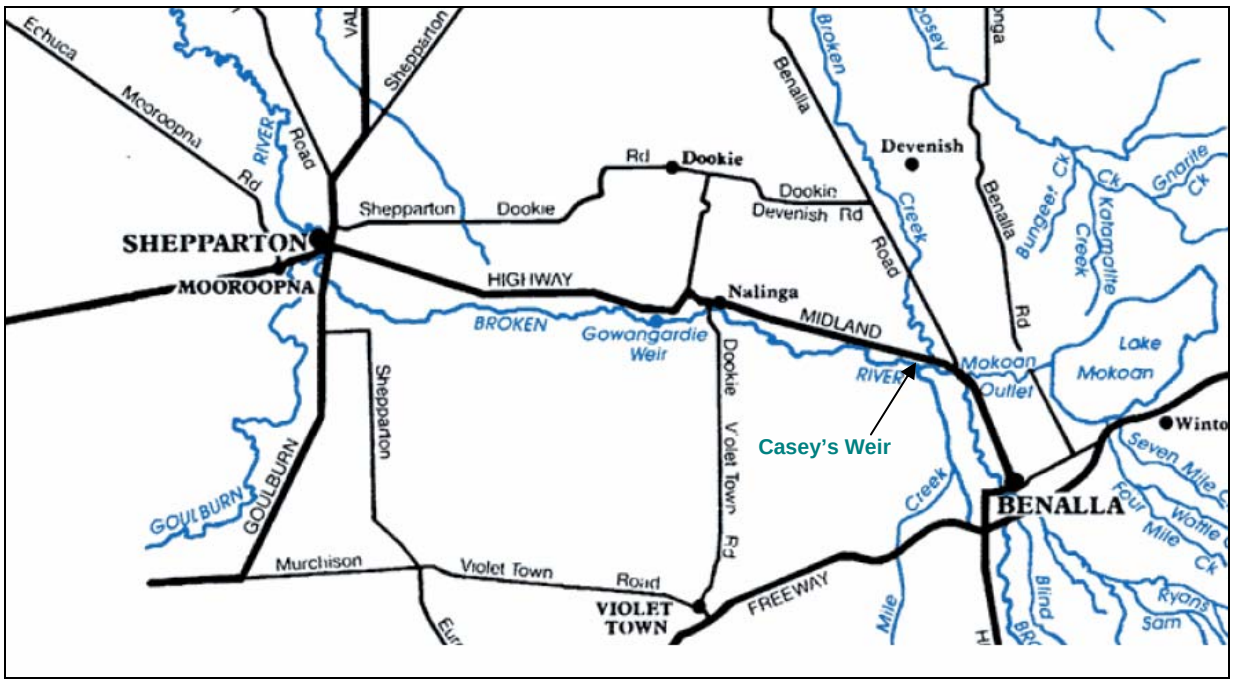


Figure 1 Broken River between Benalla and Shepparton showing locations of townships, Lake Mokoan and Gowangardie Weir and a proximate location of Casey's Weir (Courtesy of the Department of Primary Industries - Fishing and Aquaculture.)

The Broken River is the second largest stream in the GBCMA area (Earth Tech 2005) although streamflow is extremely variable between seasons and between years: annual stream flow has varied from a minimum of 5,000 ML in the drought year of 1943 to a maximum of more than 1,000,000 ML in the flood years of 1917 and 1956. The months of July, August and September generally account for over half the annual stream flow (GBCMA 2005).

Flows are diverted from the Broken River at a number of locations:

- Broken Weir is located approximately 8 km upstream of Benalla. At the weir water is diverted from the river into Lake Mokoan, a large shallow water storage built in the late 1960s. Water from the storage re-enters the Broken River downstream of Benalla.
- Caseys Weir, located c. 10 km downstream of Benalla, was constructed in 1885 and supplies water to the Broken Creek system for supply of irrigation entitlements.
- Gowangardie Weir, located approximately 30 km east of Shepparton, was constructed in 1897 and supplies water to the East Shepparton Stock and Domestic System Goulburn Murray Water (2006).

These reservoirs and weirs provide water for the agriculture industry and neighbouring towns.

3 Methods

The project was broken down into a number of parts:

1. Analysis of digital imagery and spatial databases were used to identify possible wetlands to visit during field survey;
2. Data review from databases and previous reports;
3. Field assessment of a minimum of 20 wetlands to document their values;
4. Report preparation; and
5. Creation of spatial database.

3.1 Desktop Review

3.1.1 Wetland identification from spatial information

Digital imagery (aerial photography) and spatial databases (WETLANDS_1994, WETLANDDIR, PLMMT100PLY and HYDRO25) were analysed in an attempt to identify possible wetlands. A map and associated list of approximately 230 wetlands was created (Appendix 1). This list was refined to c. 110 wetlands based on site accessibility – wetlands distant from access points (roads and driveways) were excluded. Landholders whose properties contained one or more of the wetlands from the refined list were contacted (by letter and telephone) in order to gain permission to access wetlands on their properties. A short-list of 52 wetlands was created that were deemed potentially worthy of assessment. Fifteen landholders gave permission to enter their properties to conduct a site assessment.

3.1.2 Data review

Information was reviewed, including:

- Flora records within 10 km from the river held in the Victorian Flora Information System, a state-wide database maintained by the Department of Sustainability and Environment (DSE 2006c);
- Ecological Vegetation Class (EVC) mapping/modelling of the area (DSE 2006d); and
- Previous reports on the Broken River, including the Regional River Health Strategy (GBCMA 2005), Broken River Crown Land assessment (Earth Tech 2005) and the Directory of Important Wetlands entry (Australian Nature Conservation Agency 1996).

3.2 Field Assessment

Twenty-nine (29) wetlands were assessed from 19 to 22 February 2007. The information collected at each site is outlined below.

3.2.1 Wetland mapping

The boundary of each wetland was mapped using a handheld GPS (using coordinate system GDA 1994, MGA Zone 55), or for larger wetlands, mapped using aerial photographs.

3.2.2 Wetland classification

Each wetland was classified according to the Victorian wetland classification system to subcategory level based on the estimated maximum potential water depth in the wetland and the duration of inundation (see Appendix 2).

Wetland vegetation was assigned to a Wetland Ecological Vegetation Class (EVC) Aggregate (see Section 4.1). The wetland EVC elements present at each site were identified and recorded.

3.2.3 Wetland condition assessment

The condition of each wetland was assessed using the Index of Wetland Condition (IWC) methodology. The IWC has six sub-indices: Wetland Catchment, Physical Form, Hydrology, Water Properties, Soils, and Biota. The measures within each sub-index are given in Table 1.

Table 1 Sub-indices of the IWC, with their components and measures (DSE 2006a)

IWC sub-index	Key ecological component	Measure
Wetland Catchment	Wetland Catchment	Percentage of land in different land use intensity classes adjacent to wetland
	Wetland Buffer	Average width of buffer
		Percentage of wetland perimeter with a buffer
Physical form	Area of the wetland	Percentage reduction in wetland area
	Wetland Form	Percentage of wetland where activities (excavation and landforming) have resulted in a change in bathymetry
Hydrology	Water regime	Severity of activities that change the water regime
Water properties	Macronutrients (such as nitrogen and phosphorus)	Activities leading to an input of nutrients to the wetland

IWC sub-index	Key ecological component	Measure
	Salinity	Factors likely to lead to wetland salinisation: • Input of saline water to the wetlands • Wetland occurs in a salinity risk area
Soils	Soil physical properties (soil structure, texture, consistency and profile)	Percentage and severity of wetland soil disturbance
Biota	Wetland plants	Wetland vegetation quality assessment

The Wetland Vegetation Quality Field Assessment is used to evaluate vegetation quality by comparison with a relatively undisturbed system, as described in the appropriate wetland benchmark. For this assessment this was based on the assigned Wetland EVC Aggregate. Four attributes are used to assess the quality of vegetation:

- **Critical lifeforms** – benchmark descriptions specify the critical lifeform groupings which are expected to be present. Scoring is based on the presence of lifeform groupings and whether they are substantially modified.
- **Presence of weeds** – scoring is based on assessing the proportional cover of weeds and whether the species present are high or low threat.
- **Indicators of altered processes –** assesses the extent of major changes occurring in the structure and composition of the vegetation, focusing on invasions of habitat by key indigenous indicator species or lifeforms.
- **Vegetation structure and health –** assesses the condition of the structurally predominant species or group of species within the relevant lifeform. The assessment utilizes a cover value and visual assessment of health.

(DSE 2006b).

In addition to the IWC sheets, a proforma (see Appendix 3) was completed. This recorded:

- site number, location and altitude;
- percentage of water, mud, damp soil or dry soil at each wetland;
- current water depth and maximum potential water depth;
- dominant native and exotic plant species present;
- significant indigenous plant species, which includes those listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999, Flora and Fauna Guarantee Act 1988*, classified as rare or threatened by DSE (2005) or otherwise considered regionally rare (based on the opinion of the authors);
- tree species and their health in four subjective categories (dead, poor, average, good);

- types of associated dryland vegetation, recorded as either predominantly indigenous, mixed indigenous and exotic, or predominantly exotic;
- connectivity to native vegetation;
- significant native and exotic fauna species present or significant faunal habitat; and
- land tenure and manager, dominant land-uses and land management issues for the area surrounding each wetland.

Notes were taken on any other pertinent observations. Digital photographs were taken of each wetland.

A list of all plant species recorded during the survey is given in Appendix 4.

3.3 GIS database

Spatial information and site attributes have been incorporated into a GIS database. This database can be used to access site specific information from an aerial map.

3.4 Taxonomy

Plant names used in this report follow 'A Census of the Vascular Plants of Victoria' (Ross and Walsh 2003). In some cases a broad species concept has been used where groups are taxonomically poorly resolved (e.g. *Lachnagrostis filiformis sens. lat.*) or material enabling ready identification was not available. The taxonomy of Alternanthera is poorly resolved and two entities were apparently present. Common names of plant species follow (DSE 2006c).

An asterisk (*) denotes exotic (introduced) species.

3.5 Limitations

As for all flora surveys, the seasonality of some plant species may be a limitation. Some species may have been overlooked because they were inconspicuous in the extreme drought conditions that prevailed, when the survey was conducted, or have been identified to genus level only due to the absence of fertile material. Flowering and/or fruiting was severely restricted in many species, and some have undoubtedly been overlooked. These limitations are unlikely to alter the findings regarding overall quality and conservation significance of the vegetation

4 Vegetation of the wetlands

The vegetation supported by the wetlands of the lower Broken River floodplain is classified as aggregate EVC Floodplain Wetland Aggregate, occurring within the context of Floodplain Riparian Woodland as the predominant vegetation of free-draining areas of the floodplain. The wetlands are typically supplied from the river by small floodway channels - the vegetation of these floodplain distributaries can be classified as EVC Drainage-line Aggregate. Wetlands can abut more elevated ground off the floodplain, where the main EVC is presumed to have been Plains Woodland (potentially with a component of Low Rises Woodland, though little evidence remains).

The annual rainfall of the lower Broken River is towards the lower end of the ecological range of Floodplain Riparian Woodland (at least as a broad-scale floodplain dominant). Geomorphological factors influencing the soils and local topography of the floodplain may also be influential in this transition. The component EVCs of the Floodplain Wetland Aggregate in the study area have affinities with floristic combinations and ecological patterns represented on a much larger scale along the Murray River floodplain (e.g. Barmah Forest) rather than with those of the valleys of cooler southern areas and the slopes of the Dividing Range.

Recognisable local components of the Floodplain Wetland Aggregate are (in a zoned sequence from the outer verges inwards) (Figures 2 and 3):

Upper zone: (i) River Red-gum (*Eucalyptus camaldulensis*) Riverine Sedgy Forest *with* sedges (*Carex* spp.) rushes, (*Juncus* spp.) can also be conspicuous, and are relatively tolerant of stock grazing; Riverine Sedgy Forest; or (ii) where Common Spike-sedge (*Eleocharis acuta*) or Spiny Mud-grass (*Pseudoraphis spinescens*) are dominant in fine-scale mosaic or patchy mixes with *Carex*-dominated areas, and Riverine Sedgy Forest / Riverine Swamp Forest complex.

Treeless pond areas: Variously including (in elevational sequence):

- Spike-sedge Wetland (dominated by Common Spike-sedge, *Eleocharis acuta*)
- Floodplain Grassy Wetland (dominated by Spiny Mud-grass, *Pseudoraphis spinescens* and/or River Swamp Wallaby-grass, *Amphibromus fluitans*)
- Floodway Pond Herbland (dominated by small herbs, and variously including Sneezeweeds (*Centipeda* spp.), especially Common Sneezeweed (*C. cunninghamii*), Knotweeds (*Persicaria* spp.), Small Knotweed (*Polygonum plebium*), Carpet Weeds (*Glinus* spp.), Globular Pigweed (*Dysphania glomulifera*), Joyweeds (*Alternanthera* spp.) and, during prolonged dry conditions, Common Blown-grass (*Lachnagrostis filiformis* var. 1).
- Aquatic Herbland (dominated by Water-milfoils, *Myriophyllum* spp. and/or Clove-strip, *Ludwigia peploides*) can alternate with Floodway Pond Herbland and /or unvegetated conditions according to the relevant stages of inundation and drying cycles of the wetland.

Where present, a component of Tall Marsh appears to be an artefact of water being pumped into wetlands to sustain levels artificially. However in some instances this vegetation can be indicative of natural seepage or springs.

Figure 2 Types of offstream wetlands on the floodplain of the lower Broken River derived from fluvial processes

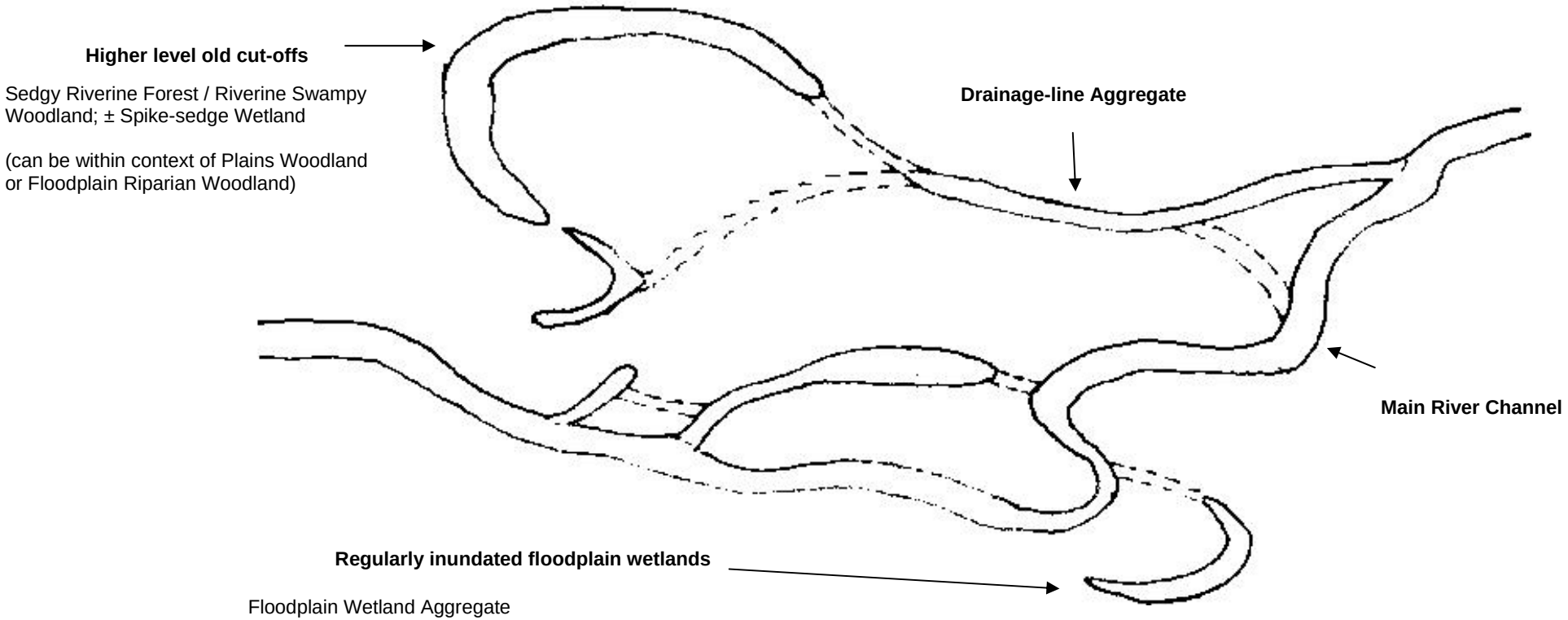
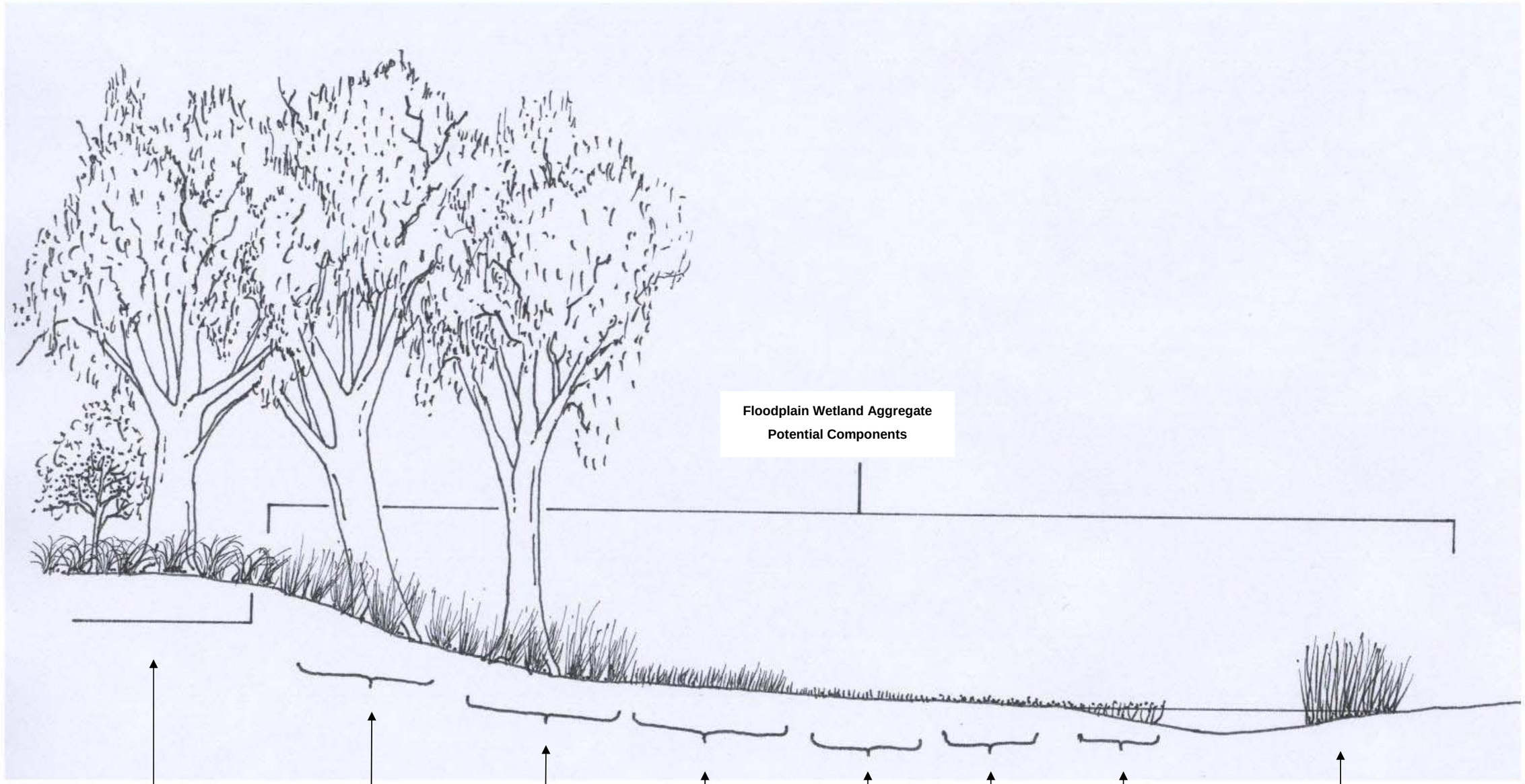


Figure 3 Floodplain Wetland Aggregate: Potential Components



4.1 Selection of EVC descriptors for vegetation assessment

The vegetation of the wetlands of the study area can comprise a range of EVC components occurring in extremely fine-scale zonation. These patterns may also be subject to seasonal variation in precise position, and also in the degree of expression of a particular zone. It was considered useful to indicate which component EVCs were present and which of these were predominant at a given wetland site. However, it was considered that production of fine-scale mapping of these EVC components (which sometimes overlap) would be neither realistic nor particularly informative, especially given the prevailing conditions of extreme drought.

The aggregate EVC Floodplain Wetland has been adopted in recognition of the potential (and probable) complexity of vegetation patterning within the wetland systems of more developed floodplains, and a relevant benchmark prepared for the IWC assessment process. In the current project, this benchmark was used in all instances where a treeless 'pond' component was evident within the vegetation.

4.2 Ecological Vegetation Classes recorded

The following EVC components were recorded during our survey of 29 wetlands on the floodplain of the lower Broken River:

EVC 653: Aquatic Herbland

EVC 168: Drainage-line Aggregate

EVC 809: Floodplain Grassy Wetland

EVC 56: Floodplain Riparian Woodland

EVC 172: Floodplain Wetland Aggregate

EVC 810: Floodway Pond Herbland

EVC 803: Plains Woodland (potentially with component of EVC 66: Low Rises Woodland)

EVC 815: Riverine Swampy Woodland

EVC 816: Sedgy Riverine Forest

EVC 817: Sedgy Riverine Forest / Riverine Swamp Forest Complex

EVC 819: Spike-sedge Wetland

EVC 821: Tall Marsh

EVC 990: 'Non Vegetation' [Unvegetated (open water / bare soil / mud)]

Descriptions of the EVCS recorded are detailed in Section 4.3, based on the wetland EVC typology of DSE (2006b) but tailored to reflect the floristic composition and conditions in wetlands

documented on the Broken River during this study. It should be noted that the descriptions may apply to wetlands containing water at a fairly optimum time of the year. Wetlands sampled during this study were universally dry, (with rare exceptions – where water had ponded in close proximity to the river).

4.3 Lower Broken River Wetlands: Ecological Vegetation Class descriptions

EVC 653: Aquatic Herbland

Defining characteristics: Semi-permanent to seasonal freshwater wetland vegetation, treeless (or nearly so), dominated by herbaceous aquatic species (typically with at least rootstocks tolerant of dry periods).

Structure: Herbland, floating mat to weakly emergent.

Habitat: Permanent to seasonal wetland, in suitably sheltered sites with reliable water supply and soils staying moist at depth.

Floristics: Aquatic species include Water-milfoils (*Myriophyllum* spp.), especially Upright Water-milfoil (*M. crispatum*), Clove-strip (*Ludwigia peploides*) and Azolla (*Azolla* spp.).

Vegetation Quality: Aquatic Herbland largely represents a relatively resilient flora capable of invading suitable artificial waterbodies such as farm dams. However, the relatively species-rich fringing zones can include a range of species which are sensitive to grazing or other ecological changes.

Comments: Evident only where wetlands have been artificially watered, but possibly more locally extensive during wetter phases following flooding.

EVC 168: Drainage-line Aggregate

Defining characteristics: Variable grassy/sedgy-herbaceous vegetation of intermittent drainage lines on drier northern plains, including floodway channels and associated seasonal ponds, at least fringed by River Red-gum (*Eucalyptus camaldulensis*).

Structure: Varies from grassy wetland to low open herbland or sedgeland, typically fringed by woodland with sedgy ground-layer.

Habitat: Ephemeral wetlands and floodways along defined drainage-lines on the Riverina Plain and riverine floodplain.

Floristics: Diversity is variable – species include River Red-gum (*Eucalyptus camaldulensis*), Poong'ort (*Carex tereticaulis*), Swamp Wallaby-grasses (*Amphibromus* spp.), Spike-sedges (*Eleocharis* spp.) and Rushes (*Juncus* spp). It is likely a number of smaller herbs were not apparent due to seasonal conditions.

Vegetation Quality: Mostly modified as a consequence of agricultural practises, with very few relatively intact remnants left. Remnants vulnerable to further fragmentation, edge effects and changes in land-use.

Comments: Representing the floodway channels linking the small wetlands of the Broken River system.

EVC 809: Floodplain Grassy Wetland

Defining characteristics: Wetland dominated by floating aquatic grasses (which persist to some extent as turf during drier periods), occurring in the most flood-prone riverine areas.

Structure: Dense mat of floating rhizomatous grasses, developing during flood, and persisting as turf on damp ground. Typically treeless, but sometimes with thickets of saplings or scattered more mature specimens of River Red-gum (*Eucalyptus camaldulensis*).

Habitat: Occupying the zone between Spike-sedge Wetland and the wetter areas supporting Floodway Pond Herbland or Aquatic Herbland - as a narrow intermediate band around some floodway ponds, or sometimes the main vegetation within ponds.

Floristics: Dense mat of Spiny Mud-grass (*Pseudoraphis spinescens*) and/or sometimes River Swamp Wallaby-grass (*Amphibromus fluitans*), developing during flood, and persisting as mat on damp ground. Native Couch (*Cynodon dactylon* var. *pulchellus*) can be also present in examples on sandier soils. The vegetation is characteristically very species-poor.

Vegetation Quality: The degree to which pugging by cattle has reduced the diversity of associated aquatic species is unknown. The vegetation is dependent on reasonably regular inundation.

EVC 56: Floodplain Riparian Woodland

Defining characteristics: Eucalypt woodland of well developed floodplains, with dense tussocky understorey, often shrubby and including treeless wetland areas.

Structure: Medium to tall woodland, variously shrubby, with tussock-grass dominated understorey

Habitat: Floodplains of major watercourses in less arid areas, alluvial soils.

Floristics: River Red-gum (*Eucalyptus camaldulensis*), presumably with Silver Wattle (*Acacia dealbata*) and River Bottlebrush (*Callistemon sieberi*) formerly more prevalent. Common Tussock-grass (*Poa labillardierei*) is typically dominant in the ground layer of more intact remnants.

Vegetation Quality: Mostly extremely degraded within study area, frequently with native species almost totally eliminated, highly vulnerable to invasion by Phalaris (*Phalaris aquatica*). In many instances, stream regulation has diminished the extent of flooding.

Comments: Floodplain Riparian Woodland represents a mosaic of terraces, active floodways and former channels. Internal variation within the EVC has led to the additional labels Floodplain Riparian Woodland / Billabong Wetland Mosaic [EVC 690] and Floodplain Riparian Woodland / Floodplain Wetland Mosaic [EVC 256].

EVC 172: Floodplain Wetland Aggregate

Defining characteristics: Collective label for the various zones of vegetation associated with wetlands of riparian floodplains, best developed in association with Floodplain Riparian Woodland.

Structure: Potentially includes mosaics of reedbed, sedgeland, rushland, grassland and/or herbland zones.

Habitat: Floodplains of major streams, principally in less arid areas.

Floristics: The following components are variously recognisable within the treeless components of Floodplain Wetland in the study area: Aquatic Herbland, Tall Marsh, Floodway Pond Herbland, Floodplain Grassy Wetland, Spike-sedge Wetland and Dwarf Floating Aquatic Herbland.

Vegetation Quality: Generally more resilient to weed invasion than the adjacent Floodplain Riparian Woodland, provided inundation still occurs.

Comments: Billabong Wetland is also an aggregate EVC including many of these components.

EVC 810: Floodway Pond Herbland

Defining characteristics: Low herbland on the drying mud of floors of ponds on floodway systems (mainly riverine floodplains).

Structure: Low herbland, treeless (or virtually so), usually with a high content of ephemeral species.

Habitat: Drying mud within ponds on floodplains. It can occur as a temporal component within the Floodplain Wetland aggregate, in association with other wetland types, notably Aquatic Herbland or unvegetated phases.

Floristics: The floristics can be quite variable (both spatially and temporally), according to the traits of the relevant individual pond. The floristics also vary in temporal cycles with the 'unvegetated' unit and probably between seasons at some locations.

Major species variously include Sneezeweeds (*Centipeda* spp.), especially Common Sneezeweed (*C. cunninghamii*), Knotweeds (*Persicaria* spp.), Small Knotweed (*Polygonum plebium*), Carpet Weeds (*Glinus* spp.), Globular Pigweed (*Dysphania glomulifera*), Joyweeds (*Alternanthera* spp.) and, during prolonged dry conditions, Common Blown-grass (*Lachnagrostis filiformis* var. 1).

Vegetation Quality: Potentially subject to invasion by River Red-gum (*Eucalyptus camaldulensis*) seedlings under reduced frequency and depth of flooding. In general, often grazed and vulnerable to hydrological modification and nutrient run-off in agricultural areas.

Comments: Narrow fringes of Spiny Mud-grass (*Pseudoraphis spinescens*), Common Spike-sedge (*Eleocharis acuta*) and/or Sedges (*Carex* spp.) can be present, representing a contracted zonation of other EVCs within the Floodplain Wetland Aggregate.

EVC 803: Plains Woodland (potentially with component of EVC 66: Low Rises Woodland)

Defining characteristics: Grassy woodland, at best development rich in small chenopods, occurring on alluvial deposits outside of active floodplains. Apart from included small seasonal wetlands or associated gilgai depressions, lacking flood dependant species in the ground-layer.

Structure: Woodland, possibly including areas of former tussock grassland. In most remnants, shrubs are a minor component, but it is considered that the abundance and diversity of the shrub layer has generally been reduced by grazing.

Habitat: Low-lying areas within former drainage systems on heavy soils of plains. The habitat is not subject to flooding, though can include low-lying seasonally water-logged areas. Clay alluvial soils, sometimes with a shallow sandy overlay.

Floristics: Overstorey dominated by box eucalypts, variously Grey Box (*Eucalyptus microcarpa*), Yellow Box (*E. melliodora*) and /or Black Box (*E. largiflorens*), some remnants including Buloke (*Allocasuarina luehmannii*). Ground-layer grassy-herbaceous, dominated by mixtures of species of Wallaby-grass (*Austrodanthonia*) and Spear-grass (*Austrostipa*), Windmill Grass (*Chloris truncata*) and Spider Grass (*Enteropogon acicularis*), and variously with a diversity of small chenopod (saltbush) species (notably Bluebush *Maireana* and Saltbush *Atriplex* spp.). The shrubs component has mostly been eliminated by grazing.

Vegetation Quality: Outside of roadsides, very few relatively intact examples of Plains Woodland persist, and the EVC is extremely poorly represented in conservation reserves. The restricted public land examples are typically depauperate in indigenous species as a consequence of heavy grazing.

Comments: Sometimes formerly fringing wetlands where these abut the periphery of the floodplain.

EVC 815: Riverine Swampy Woodland

Defining characteristics: Eucalypt woodland to open woodland, ground-layer grassy -sedgy - herbaceous, with species indicative of periodic water-logging (and with floristic affinities with Plains Grassy Wetland).

Structure: Seasonally wet open woodland to woodland; ground-layer comprising mixtures or grassy, sedgy and herbaceous components.

Habitat: Areas subject to shallow and infrequent inundation only from higher-level flooding; can be seasonally water-logged from local rainfall run-off. Soils are typically heavy, cracking mottled grey-brown clays/clay-loams and water-retentive.

Floristics: River Red-gum (*Eucalyptus camaldulensis*), with species including Brown-back Wallaby-grass (*Austrodanthonia duttoniana*), Common Swamp Wallaby-grass (*Amphibromus nervosus*), Common Spike-sedge (*Eleocharis acuta*) and Small Spike-sedge (*Eleocharis pusilla*). Sparse tussocks of Poong'ort (*Carex tereticaulis*) and Rushes (*Juncus* spp.) can also be present. A range of herbs (e.g. Poison Pratia *Lobelia concolor*, River Bluebell *Wahlenbergia fluminensis*, Goodenia *Goodenia* spp., Burr Daisy *Calotis* spp., Nardoo *Marsilea* spp. and Woodland Swamp-

daisy *Brachyscome basaltica*) may potentially be present, but were not apparent at the few sites observed during the current study. This reflects a combination of seasonal conditions and elimination of the more sensitive of such species through land-use practises.

Vegetation Quality: Much of the former extent is cleared and heavily modified by agricultural use. Most remnants are grazed.

Comments: The interpretation of floodplain vegetation in wetland terms can be ambiguous. While much of a potentially active floodplain may periodically functionally represent wetland, practical usage will generally interpret the wetlands as those depressions within the floodplain which retain water after flood recession (i.e. 'swamps'). Riverine Swampy Woodland is subject to shallow flooding (at least from higher-level events) and can occur on the periphery of 'swamps', but would rarely if ever be regarded as representing wetland in the latter (i.e. 'swamp') context.

EVC 816: Sedgy Riverine Forest

Defining characteristics: Eucalypt forest (to woodland) with understorey dominated by larger sedges (to sedgy-herbaceous), floristics with some affinities to Red Gum Swamp.

Structure: Open forest to woodland with sedgy ground-layer.

Habitat: Typically on heavy clay/clay-loam soils in areas prone to only shallow (but more than occasional and originally reasonably regular) flooding, mostly occurring locally as a narrow fringe around the periphery of small treeless wetlands. The habitat can include billabongs, floodways and old anabranches within Floodplain Riparian Woodland towards the lower rainfall limits of this habitat.

Floristics: River Red-gum (*Eucalyptus camaldulensis*) with Sedges (*Carex* spp.), notably Poong'ort (*C. tereticaulis*). Associated species variously include Common Spike-sedge (*Eleocharis acuta*), Hollow Rush (*Juncus amabilis*) and Common Swamp Wallaby-grass (*Amphibromus nervosus*).

Vegetation Quality: While the floristic diversity was presumably at least partly obscured by seasonal conditions, in generally it appears to have been substantially reduced by grazing. Disturbed areas lacking regular flooding are vulnerable to weed invasion.

Comments: Obligate wetland species such as Common Spike-sedge (*Eleocharis acuta*) and Common Nardoo (*Marsilea drummondii*) may be prevalent in inter-tussock gaps following flooding, but are not dominant over sustained areas - if so, then the vegetation represents a complex with Riverine Swamp Forest.

EVC 817: Sedgy Riverine Forest / Riverine Swamp Forest Complex

Defining characteristics: Understorey dominants of Riverine Swamp Forest conspicuous in association or fine-scale mosaic with larger tussock or rhizomatous species characteristic of Sedgy Floodplain Forest.

Structure: Eucalypt forest (to tall open forest) with ground-layer comprising taller open sedgy component and smaller sedge or rhizomatous/stoloniferous grasses prevalent in gaps.

Habitat: Low-lying areas associated with floodways on river terraces prone to reasonably regular shallow flooding.

Floristics: River Red-gum (*Eucalyptus camaldulensis*), with Poong'ort (*Carex tereticaulis*) in association or mosaic with Common Spike-sedge (*Eleocharis acuta*) and/or Spiny Mud-grass (*Pseudoraphis spinescens*).

Vegetation Quality: While the floristic diversity is presumably at least partly obscured by seasonal conditions, in generally it appears to have been substantially reduced by grazing.

Comments: The interpretation of floodplain vegetation in wetland terms can be ambiguous. While much of a potentially active floodplain may periodically functionally represent wetland, practical usage will generally interpret the wetlands as those depressions within the floodplain which retain water after flood recession (i.e. 'swamps'). Sedgy Riverine Forest / Riverine Swamp Forest Complex ambiguously represents (or includes) marginal wetland in the latter (i.e. 'swamp') context.

EVC 819: Spike-sedge Wetland

Defining characteristics: Low sedgy vegetation of seasonal or intermittent wetlands, dominated by spike-rushes, usually species-poor.

Structure: Sedgeland (typically closed), mostly c. 0.2 - 0.5 m at maximum culm growth, with dead culms forming a dense prostrate mat during drier periods.

Habitat: Mostly confined to a narrow ring around the upper margins of floodway ponds, but extending onto the floors of more shallowly or less frequently flooded wetlands. Soils are typically heavy clays, occasionally silty near the surface. The relevant floristic balance appears to be determined by a subtle combination of reliability/variability, timing and depth of inundation, in association with soil characteristics (such that Common Spike-sedge *Eleocharis acuta* is able to form a competitive sward within stages of very shallow spring to early summer inundation). In some riverine sites, annual inundation is not reliable and the rhizomic rootstocks of *E. acuta* appear capable of surviving at least occasional periods of longer dormancy.

Floristics: Typically treeless, but sparse eucalypts (mostly River Red Gums *Eucalyptus camaldulensis*) can be present in marginal sites. Usually species-poor, with dense seasonal growth of Common Spike-sedge (*Eleocharis acuta*).

Vegetation Quality: Spike-rush Wetland is characteristically species-poor, particularly where it occurs as a component of Floodplain Wetland. However, the species-richness of the relevant systems can be further reduced by grazing of cattle (through selective grazing, pugging and trampling). While reasonably resilient to longer dry periods, deterioration and contraction of riverine floodplain occurrences can be anticipated as a consequence of reduced flooding.

Comments: Spike-rush Wetland unambiguously represents wetland vegetation.

EVC 821: Tall Marsh

Defining characteristics: Wetland dominated by tall emergent graminoids, typically in dense species-poor swards. Rushland, sedgeland or reedbed - locally closed to in association or fine-scale mosaic with Aquatic Herbland (e.g. along floodway lagoons).

Structure: Closed reed-bed/rushland to c. 3 or 4 m high.

Habitat: Shallow semi-permanent to permanent swamps or shallow lakes on floodplains and associated with lake verges, recorded from elevations ranging from < 5m ASL to c. 380 m elevation.

Floristics: At optimum development, the vegetation is treeless. Often virtually monospecific (due to competition in optimal conditions for growth in stable habitat), with dense stands of Common Reed (*Phragmites australis*) and/or Bullrushes (*Typha* spp.).

Variously with Common Reed (*Phragmites australis*), Bullrushes (*Typha* spp.), Giant Rush (*Juncus ingens*), and in more marginal sites sometimes also River Club-sedge (*Schoenoplectus tabernaemontanii*), Club Sedges (*Bolboschoenus* spp.) or Flat Sedges (*Cyperus* spp.). Associated species are quite variable and can include aquatics such as Pondweeds (*Potamogeton* spp.), Water-milfoils (*Myriophyllum* spp.), Matted Starwort (*Stellaria caespitosa*), River Swamp Wallaby-grass (*Amphibromus fluitans*) and Spiny Mud-grass (*Pseudoraphis spinescens*), Duckweeds (*Wolffia* spp.), Azolla (*Azolla* spp.), Large Duckweed (*Spirodela polyrhiza*) and Duckweeds (*Lemna* spp.). Large Bindweed (*Calystegia sepium*) and River Mint (*Mentha australis*) have localised occurrences (e.g. Boals Deadwoods).

Vegetation Quality: In the study area, the Tall Marsh component within some wetlands is presumed to be adventive as a consequence of artificially maintained water levels. Under these conditions wetlands are vulnerable to invasion by Arrowhead (**Sagittaria* spp.) and Water Couch (**Paspalum distichum*).

Comments: Under natural conditions Tall Marsh was probably a component of the stream verge vegetation.

EVC 990: 'Non Vegetation' [Unvegetated (open water / bare soil / mud)]

Defining characteristics: Low lying areas which are unvegetated (or nearly so), at least in relation to vascular flora. Widespread wetland component, which may or may not alternate with various vegetated EVCs.

Structure: Unvegetated

Habitat: Freshwater lakes / floodway channels.

Floristics: Unvegetated (to with sparse opportunistic species)

Vegetation Quality: Not relevant

Comments: Unvegetated can (at least temporally) be a significant component of wetland habitat.

5 Significant species

Several significant plant species were recorded during field work, including wetland and dryland species. These include state and nationally significant species (DSE 2005), as well as regionally significant species (rare or threatened at the bioregional level), as determined by Beauglehole (1986) in his floristic survey of the Murray Valley region (part of the Victorian Riverina bioregion), and according to our judgements based on extensive field experience in northern Victoria. Significant plant species are listed in Table 2.

Table 2 Significant plant species recorded on the lower Broken River floodplain, February 2007

Explanation of terms

Botanical name	Common name	Significance status			EPBC-listed	FFG-listed	Locations(s) recorded	References
		National	State	Regional				
Amphibromus fluitans	River Swamp Wallaby-grass	Vulnerable (V)	-	✓	Vulnerable	-	101, 201, 208, 213, 216	Carr (2006)
Callistemon sieberi	River Bottlebrush	-	-	✓	-	-	236, 211, 214	This study
Carex sp. (rhizomatous)	Sedge	-	-	✓	-	-	47, 48, 64, 82, 101, 236, 134, 214, 232	This study
Cynodon dactylon var. *pulchellus*	Native Couch	-	Insufficiently known (k)	-	-	-	64, 81, 82, 101, 236, 134, 201, 211, 213, 214, 216, 232	DSE (2005)
Dysphania glomulifera ssp. *glomulifera*	Globular Pigweed	-	-	✓	-	-	208	Beauglehole (1986)
Eleocharis gracilis	Slender Spike-sedge	-	-	✓	-	-	201	Beauglehole (1986)

Botanical name	Common name	Significance status			EPBC-listed	FFG-listed	Locations(s) recorded	References
		National	State	Regional				
Elymus multiflorus	Short-awned Wheat-grass	-	Insufficiently known (k)	✓	-	-	21	DSE (2005)
Glinus oppositifolius	Slender Carpet-weed	-	-	✓	-	-	82, 211	Beauglehole (1986)
Isolepis cernua	Nodding Club-sedge	-	-	✓	-	-	214	Beauglehole (1986)
Isolepis inundata	Swamp Club-sedge	-	-	✓	-	-	214	Beauglehole (1986)
Juncus psammophilus	Sand Rush	-	Rare	✓	-	-	232	DSE (2005)
Lachnagrostis filiformis var. 2	Wetland Blown-grass	-	Insufficiently known	✓	-	-	208	DSE (2005)
Panicum decompositum var. *decompositum*	Native Millet	-	-	✓	-	-	81, 82	Beauglehole (1986)

6 Site assessments

The data collected at 29 wetland sites are given in this section.

Wetlands are numbered based on the original number given during desktop wetland identification from spatial information. Those wetlands found in the field that were not identified during the wetland identification stage were given a unique number. Therefore instead of wetland site numbers ranging from 1-29, they range from 21-236.

6.1 Wetland Site Number: 21

DATE SURVEYED: 20/2/07
RECORDERS: L. V. Crowfoot and D. Frood
PLATES: 1
MAP: Figure 5 (Map 1) Part 1

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 355650 / 5970369
Datum:	GDA 94
Altitude:	112 m
Nearest Road Access:	Lincoln Drive
Land Tenure:	Crown
Land Use(s):	Conservation and Recreation
Wetland Area (ha):	0.519
Wetland Perimeter (m):	267

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		1 m		
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:**	100
Wetland Phase				
Filling:	**Full:**	**Drying:**	**Dry:**	X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			65**/120**		
Wetland Catchment:	7**/20**	**Physical Form:**	20**/20**	**Hydrology:**	0**/20**
Water Properties:	10**/20**	**Soils:**	20**/20**	**Biota:**	8**/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Floodway River Flats
Wetland subcategories:	-

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		marginal Floodplain Wetland within Floodplain Riparian Woodland	
Wetland Vegetation Quality Score:		40**/100**	
Critical lifeform groupings: 5**/25**	**Weeds:** 10**/25**	**Indicators of altered processes:** 5**/25**	**Vegetation structure and health:** 20**/25**
Dominant indigenous flora species by zone			
Zone: River Red Gum regeneration			
Eucalyptus camaldulensis		*Carex tereticaulis*	
Pseudoraphis spinescens		*Poa labillardierei* var. *labillardierei*	
Austrodanthonia duttoniana		*Elymus multiflorus*	
Hemarthria uncinata var. *uncinata*		*Paspalidium jubiflorum*	
Zone: Higher – area from road run-off			
Eucalyptus camaldulensis		*Carex* sp.	
Significant indigenous flora species:		**Status:**	
Elymus multiflorus		Insufficiently known	
Other indigenous flora species:			
Juncus amabilis			
Tree species:			
Eucalyptus camaldulensis		*Eucalyptus microcarpa*	
Tree Health:		Average	
Associated Dryland Vegetation:		Predominately exotic	
Connectivity to Native Vegetation:		Contiguous with riparian vegetation of the Goulburn Broken	
Significant/dominant weed species:			
**Acer negundo*		**Pennisetum clandestinum*	
**Araujia sericifera*		**Phalaris aquatica*	
**Avena barbata*		**Phoenix canariensis*	
**Cyperus eragrostis*			
**Cirsium vulgare*		**Exotic species that may become a threat in the future:**	
**Cynodon dactylon* var. *dactylon*			
**Fraxinus angustifolia* var *angustifolia*		**-**	
**Paspalum dilatatum*			

FAUNA

Significant fauna habitat:	Significant fauna species:
Scattered hollow-bearing trees	-

MANAGEMENT

Management Issues:
1. Altered hydrological regime
2. High threat weeds, particularly within the area receiving road run-off (localised)

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report

OTHER

Additional notes:
This site is highly modified and is marginally a wetland. It predominately consists of a dense River Red Gum regeneration patch within an open woodland. This condition is a result of the changed hydrology (i.e. lack of flooding). A small area adjoining the road receives run-off and is dominated by exotic grasses and *Carex* sp.

Plate 1 Dense River Red-gum regeneration of Wetland Site number 21. This regeneration is a result of a reduced flooding regime. Competition between the young trees results in some trees collapsing and dying (pictured) (February 2007).

6.2 Wetland Site Number: 31

DATE SURVEYED: 20/2/07
RECORDERS: L. V. Crowfoot and D. Frood
PLATES: 2
MAP: Figure 5 (Map 1) Part 2

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 359452 / 5967690
Datum:	GDA 94
Altitude:	121 m
Nearest Road Access:	Doyles Road
Land Tenure:	Private
Land Use(s):	Horse grazing
Wetland Area (ha):	0.306
Wetland Perimeter (m):	212

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:				2 m			
% Water:	80	**% Mud:**	5	**% Damp Soil:**		**% Dry:**	15
Wetland Phase							
Filling:		**Full:**	X (pumped)	**Drying:**		**Dry:**	

INDEX OF WETLAND CONDITION SCORE

IWC Score:			73**/120**		
Wetland Catchment:	6**/20**	**Physical Form:**	18**/20**	**Hydrology:**	0**/20**
Water Properties:	20**/20**	**Soils:**	13**/20**	**Biota:**	16**/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	Open water

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Aquatic Herbland Floodway Pond Herbland	
Wetland Vegetation Quality Score:		78**/100**	
Critical lifeform groupings: 10**/25**	**Weeds:** 18**/25**	**Indicators of altered processes:** 25**/25**	**Vegetation structure and health:** 25**/25**
Dominant indigenous flora species by zone **Zone:** Aquatic Herbland *Ludwigia peploides* subsp. *montevidensis* **Zone:** Floodway Pond Herbland *Alternanthera denticulata* *Polygonum plebeium* *Centipeda cunninghamii*		*Azolla filiculoides* *Persicaria lapathifolia* *Persicaria prostrata* *Pseudognaphalium luteoalbum*	
Significant indigenous flora species: -		**Status:**	
Other indigenous flora species: *Typha* sp. – edge of road		*Juncus amabilis* – scattered under trees	
Tree species: *Eucalyptus camaldulensis* (just outside the edge of the Herbland)			
Tree Health:		Good	
Associated Dryland Vegetation:		Predominately exotic	
Connectivity to Native Vegetation:		Tree canopy loosely contiguous with riparian vegetation of Broken River	
Significant/dominant weed species: **Xanthium strumarium* **Modiola caroliniana* **Cyperus eragrostis* **Rumex crispus* **Dittrichia graveolens* **Exotic species that may become a threat in the future:** -			

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Hollow-bearing trees	-

MANAGEMENT

Management Issues:
1. The road dividing the wetland
2. Horse grazing
3. Altered hydrology of the Broken River
4. Weed control

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
The site is heavily grazed by horses which has reduced the species diversity, especially the peripheral monocots. *Juncus amabilis* has been grazed to stubs and the edges of the wetland are almost bare. Some of the immature River Red Gums may have been planted.

The wetland used to be much larger and would have included the weed-infested wetland (receives nutrient run-off) on the west side of Doyles Road. Reconnecting the wetlands (via a culvert) and controlling nutrient run-off from the road would improve their condition.

Plate 2 Wetland Site number 31 showing elements of the Aquatic Herbland and Floodway Plain Herbland EVCs. The banks of the wetland support River Red Gums and the ground is almost devoid of vegetation due to grazing by horses (February 2007).

6.3 Wetland Site Number: 44

DATE SURVEYED: 20/2/07
RECORDERS: L. V. Crowfoot and D. Frood
PLATES: 3 and 4
MAP: Figure 5 (Map 1) Part 2

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 361095 / 5966936
Datum:	GDA 94
Altitude:	132 m
Nearest Road Access:	Laws Road
Land Tenure:	Crown
Land Use(s):	Conservation and resource zone
Wetland Area (ha):	0.191
Wetland Perimeter (m):	242

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:			2 m		
% Water:	95	**% Mud:**	**% Damp Soil:**	**% Dry:**	5
Wetland Phase					
Filling:		**Full:** X	**Drying:**	**Dry:**	

INDEX OF WETLAND CONDITION SCORE

IWC Score:			73**/120**		
Wetland Catchment:	8**/20**	**Physical Form:**	14**/20**	**Hydrology:**	0**/20**
Water Properties:	20**/20**	**Soils:**	20**/20**	**Biota:**	11**/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	Open water

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		modified Sedgy Riverine Forest and Floodplain Riparian Woodland modified Floodplain Grassy Wetland	
Wetland Vegetation Quality Score:		53**/100**	
Critical lifeform groupings: 10**/25**	**Weeds:** 0**/25**	**Indicators of altered processes:** 25**/25**	**Vegetation structure and health:** 18**/25**
Dominant indigenous flora species by zone **Zone:** Floodplain Riparian Woodland / Sedgy Riverine Forest - edge of pond *Eucalyptus camaldulensis* *Phragmites australis* *Poa labillardierei* var. *labillardierei* (planted?) *Typha* sp. *Carex tereticaulis* *Lomandra longifolia* ssp. *longifolia* (planted) **Zone:** Floodplain Grassy Wetland – small area on waters edge *Pseudoraphis spinescens* *Juncus amabilis* *Alternanthera denticulata*			
Significant indigenous flora species: -		**Status:**	
Other indigenous flora species: -			
Tree species: *Eucalyptus camaldulensis*			
Tree Health:		dead (within wetland), good (edge of wetland)	
Associated Dryland Vegetation:		Predominately exotic	
Connectivity to Native Vegetation:		Tree canopy continuous with riparian vegetation of Broken River	
Significant/dominant weed species: **Paspalum distichum* **Cyperus eragrostis* *Salix sp. **Rubus anglocandicans* **Exotic species that may become a threat in the future:** Planted non-indigenous natives around the wetland			

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Tree hollows, large logs and open water	-

MANAGEMENT

Management Issues:
1. Altered hydrological regime
2. Weed control
Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
This wetland has been dammed and water is pumped into it, which affects the hydrology of other wetlands (particularly Site 45) along the drainage line. The banks and surrounding area have been revegetated predominately with non-indigenous natives species. This site has been fenced from grazing.

Plate 3 Wetland Site number 44 has been dammed and water pumped into it. The banks and surrounding area support River Red-gums and non-indigenous native species (planted). The River Red-gums in standing water have died (February 2007).

Plate 4 A small area of Floodplain Grassy Wetland within Wetland Site number 44 (February 2007).

6.4 Wetland Site Number: 45

DATE SURVEYED: 20/2/07
RECORDERS: L. V. Crowfoot and D. Frood
PLATES: 5
MAP: Figure 5 (Map 1) Part 2

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 361202 / 5966834
Datum:	GDA 94
Altitude:	123 m
Nearest Road Access:	Laws Road
Land Tenure:	Crown
Land Use(s):	Conservation and resource zone
Wetland Area (ha):	0.210
Wetland Perimeter (m):	393

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		1 m	
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:** 100
Wetland Phase			
Filling:	**Full:**	**Drying:**	**Dry:** X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			80**/120**		
Wetland Catchment:	8**/20**	**Physical Form:**	18**/20**	**Hydrology:**	0**/20**
Water Properties:	20**/20**	**Soils:**	20**/20**	**Biota:**	14**/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	Grass-dominated

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Floodplain Riparian Woodland Sedgy Riverine Forest Floodway Pond Herbland Tall Marsh	
Wetland Vegetation Quality Score:		72**/100**	
Critical lifeform groupings: 15**/25**	**Weeds:** 12**/25**	**Indicators of altered processes:** 25**/25**	**Vegetation structure and health:** 20**/25**
Dominant indigenous flora species by zone			
Zone: Floodplain Riparian Woodland / Sedgy Riverine Forest			
Eucalyptus camaldulensis		*Poa labillardierei* var. *labillardierei*	
Juncus amabilis		*Carex tereticaulis*	
Zone: Floodway Pond Herbland			
Lachnagrostis filiformis var. 1		*Alternanthera denticulata*	
Centipeda cunninghamii		*Persicaria lapathifolia*	
Zone: Tall Marsh (small area in one pond)			
Phragmites australis		*Typha* sp.	
Significant indigenous flora species:		**Status:**	
-			
Other indigenous flora species:			
-			
Tree species:			
Eucalyptus camaldulensis			
Tree Health:		average	
Associated Dryland Vegetation:		Predominately exotic	
Connectivity to Native Vegetation:		Tree canopy continuous with riparian vegetation of Broken River	
Significant/dominant weed species: **Phalaris aquatica* **Cirsium vulgare* **Exotic species that may become a threat in the future:** -			

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Scattered hollow-bearing trees and logs	-

MANAGEMENT

Management Issues:
1. Altered hydrological regime
2. Dumped hard rubbish
3. Weed control

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
This wetland consists of two dry ponds. The hydrology has been affected by the damming of Wetland 44. The site is within crown land and the river frontage has been fenced. Private properties surrounding the area are grazed.

Plate 5 Wetland Site number 45 shows elements of Floodway Pond Herbland (mid-foreground), Tall Marsh (mid-background) and Floodplain Riparian Woodland/Sedgy Riverine Forest EVCs (edge of wetland) (February 2007).

6.5 Wetland Site Number: 46

DATE SURVEYED: 20/2/07
RECORDERS: L. V. Crowfoot and D. Frood
PLATES: 6
MAP: Figure 5 (Map 1) Part 2

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 361541 / 5966820
Datum:	GDA 94
Altitude:	115 m
Nearest Road Access:	Laws Road
Land Tenure:	Crown
Land Use(s):	Conservation and resource zone
Wetland Area (ha):	0.078
Wetland Perimeter (m):	104

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		2 m	
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:** 100
Wetland Phase			
Filling:	**Full:**	**Drying:**	**Dry:** X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			81**/120**		
Wetland Catchment:	6**/20**	**Physical Form:**	20**/20**	**Hydrology:**	0**/20**
Water Properties:	20**/20**	**Soils:**	20**/20**	**Biota:**	15**/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	Red Gum-dominated, Herb-dominated

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Sedgy Riverine Forest/Riverine Swamp Forest Complex Floodway Pond Herbland	
Wetland Vegetation Quality Score:		75**/100**	
Critical lifeform groupings: 10**/25**	**Weeds:** 18**/25**	**Indicators of altered processes:** 25**/25**	**Vegetation structure and health:** 22**/25**
Dominant indigenous flora species by zone **Zone:** Sedgy Riverine Forest/Riverine Swamp Forest Complex – most of the wetland *Eucalyptus camaldulensis* *Juncus amabilis* *Juncus sarophorus* *Pseudoraphis spinescens* **Zone:** Floodway Pond Herbland (small patch) *Centipeda cunninghamii* *Poa labillardierei* var. *labillardierei* *Carex tereticaulis* *Eleocharis acuta*			
Significant indigenous flora species: -		**Status:**	
Other indigenous flora species: -			
Tree species: *Eucalyptus camaldulensis* *Eucalyptus microcarpa*			
Tree Health:		Dead - poor	
Associated Dryland Vegetation:		Predominately exotic	
Connectivity to Native Vegetation:		Tree canopy continuous with riparian vegetation of Broken River	
Significant/dominant weed species: **Phalaris aquatica* **Exotic species that may become a threat in the future:** -			

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Large logs and hollow-bearing trees	-

MANAGEMENT

Management Issues:
1. Altered hydrological regime
2. Weed control

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
This wetland predominately supports Riverine Sedgy Forest/Riparian Swamp Forest complex which show components of Spike-sedge wetland due to the high cover of *Eleocharis acuta*.

The river frontage has been fenced from grazing.

Plate 6 Wetland Site number 46 supports an open forest of River Red Gum, with *Eleocharis acuta* (Common Spike-sedge) dominating the understorey and *Poa labillardierei* var. *labillardierei* (Common Tussock Grass) and *Carex tereticaulis* (Poong'ort) growing on slightly elevated areas (February 2007).

6.6 Wetland Site Number: 47

DATE SURVEYED: 20/2/07
RECORDERS: L. V. Crowfoot and D. Frood
PLATES: 7
MAP: Figure 5 (Map 1) Part 2

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 361300 / 5966811
Datum:	GDA 94
Altitude:	123 m
Nearest Road Access:	Laws Road
Land Tenure:	Crown
Land Use(s):	Conservation and resource zone
Wetland Area (ha):	0.124
Wetland Perimeter (m):	269

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:				3 m			
% Water:	20	**% Mud:**	10	**% Damp Soil:**		**% Dry:**	70
Wetland Phase							
Filling:		**Full:**		**Drying:**	X	**Dry:**	

INDEX OF WETLAND CONDITION SCORE

IWC Score:			79**/120**		
Wetland Catchment:	6**/20**	**Physical Form:**	18**/20**	**Hydrology:**	0**/20**
Water Properties:	20**/20**	**Soils:**	20**/20**	**Biota:**	15**/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	Open Water, Reed-dominated, Herb-dominated

VEGETATION

EVC Aggregate:	Floodplain Wetland Aggregate (almost Drainage Line Aggregate)
EVC Elements:	Floodplain Riparian Woodland Sedgy Riverine Forest Floodway Pond Herbland Tall Marsh
Wetland Vegetation Quality Score:	76**/100**

Critical lifeform groupings: 15**/25**	**Weeds:** 18**/25**	**Indicators of altered processes:** 25**/25**	**Vegetation structure and health:** 18**/25**

Dominant indigenous flora species by zone

Zone: Floodplain Riparian Woodland / Sedgy Riverine Forest

Eucalyptus camaldulensis	*Poa labillardierei* var. *labillardierei*
Juncus amabilis	*Carex tereticaulis*
Carex sp. (rhizomatous)	*Eleocharis acuta*

Zone: Floodway Pond Herbland

Lachnagrostis filiformis var. 1	*Alternanthera* cf. *nodiflora*
Centipeda cunninghamii	*Persicaria lapathifolia*

Zone: Tall Marsh

Phragmites australis

Significant indigenous flora species:	**Status:**
Carex sp. (rhizomatous)	?

Other indigenous flora species:

-

Tree species:

Eucalyptus camaldulensis

Tree Health:	dead (in water), good (outside water)
Associated Dryland Vegetation:	Predominately exotic
Connectivity to Native Vegetation:	Tree canopy continuous with riparian vegetation of Broken River

Significant/dominant weed species:
**Phalaris aquatica*
**Cirsium vulgare*
**Cyperus eragrostis*
**Rorippa palustris*
**Echinochloa crus-galli*

Exotic species that may become a threat in the future:
-

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Scattered hollow-bearing trees and logs	-

MANAGEMENT

Management Issues:
1. Altered hydrological regime
2. Weed control

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Site 47 consists on three ponds (two with some water and one dry) along a drainage line. This drainage line is linked to Site 44. Not all vegetation zones identified above are in all ponds.

The site appears to be within Crown Land, which is fenced from neighbouring agriculture.

Plate 7 One of the three ponds of Wetland Site number 47 showing the bands of wetland vegetation communities regularly encountered during the study: Floodway Pond Herbland (inner zone), Tall Marsh (middle zone) and Floodplain Riparian Woodland/Sedgy Riverine Forest (outer zone) (February 2007).

6.7 Wetland Site Number: 48

DATE SURVEYED: 20/2/07
RECORDERS: L. V. Crowfoot and D. Frood
PLATES: 8
MAP: Figure 5 (Map 1) Part 2

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 361377 / 5966806
Datum:	GDA 94
Altitude:	118 m
Nearest Road Access:	Laws Road
Land Tenure:	Crown
Land Use(s):	Conservation and resource zone
Wetland Area (ha):	0.040
Wetland Perimeter (m):	74

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		1.5 m	
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:** 100
Wetland Phase			
Filling:	**Full:**	**Drying:**	**Dry:** X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			83**/120**		
Wetland Catchment:	8**/20**	**Physical Form:**	20**/20**	**Hydrology:**	0**/20**
Water Properties:	20**/20**	**Soils:**	20**/20**	**Biota:**	15**/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	Red Gum-dominated, Herb-dominated, Sedge-dominated

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Floodplain Riparian Woodland Sedgy Riverine Forest Floodway Pond Herbland Spike-sedge Wetland	
Wetland Vegetation Quality Score:		76**/100**	
Critical lifeform groupings: 15**/25**	**Weeds:** 18**/25**	**Indicators of altered processes:** 25**/25**	**Vegetation structure and health:** 18**/25**
Dominant indigenous flora species by zone **Zone:** Sedgy Riverine Forest/Floodplain Riparian Woodland *Eucalyptus camaldulensis* *Juncus amabilis* *Carex sp.* (rhizomatous) **Zone:** Floodway Pond Herbland *Lachnagrostis filiformis* var. 1 *Centipeda cunninghamii* **Zone:** Spike-sedge Wetland *Eleocharis acuta* *Poa labillardierei* var. *labillardierei* *Carex tereticaulis* *Pseudoraphis spinescens* *Lachnagrostis filiformis* var. 1			
Significant indigenous flora species: *Carex sp.* (rhizomatous)		**Status:** -	
Other indigenous flora species: -			
Tree species: *Eucalyptus camaldulensis*			
Tree Health:		Dead - poor	
Associated Dryland Vegetation:		Predominately exotic	
Connectivity to Native Vegetation:		Tree canopy continuous with riparian vegetation of Broken River	
Significant/dominant weed species: **Phalaris aquatica* **Exotic species that may become a threat in the future:** -			

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Scattered hollow-bearing trees and logs	-

MANAGEMENT

Management Issues:
1. Altered hydrological regime
2. Weed control

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
This site is currently very dry. Weed cover is low, but **Phalaris aquatica* may become more of an issue in the future.

Plate 8 The dominant EVC of Wetland Site number 48 is Spike-sedge Wetland (foreground) with a small area of Floodway Pond Herbland (mid-ground). The edges of the wetland show elements of both Floodplain Riparian Woodland and Sedgy Riverine Forest EVCs (February 2007).

6.8 Wetland Site Number: 64

DATE SURVEYED: 21/2/07
RECORDERS: L. V. Crowfoot and D. Frood
PLATES: 9
MAP: Figure 5 (Map 1) Part 3

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 365341 / 5967874
Datum:	GDA 94
Altitude:	136 m
Nearest Road Access:	Shepparton - Euroa Road
Land Tenure:	Private
Land Use(s):	Formerly grazed
Wetland Area (ha):	0.199
Wetland Perimeter (m):	192

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		1 m	
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:** 100
Wetland Phase			
Filling:	**Full:**	**Drying:**	**Dry:** X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			73**/120**		
Wetland Catchment:	8**/20**	**Physical Form:**	20**/20**	**Hydrology:**	0**/20**
Water Properties:	20**/20**	**Soils:**	20**/20**	**Biota:**	15**/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Flooded River Flats
Wetland subcategories:	

VEGETATION

EVC Aggregate: **EVC Elements:**		Floodplain Wetland Aggregate (equally Drainage-line Aggregate) Sedgy Riverine Forest/Riverine Swamp Forest Complex	
Wetland Vegetation Quality Score:		77**/100**	
Critical lifeform groupings: 15**/25**	**Weeds:** 12**/25**	**Indicators of altered processes:** 25**/25**	**Vegetation structure and health:** 25**/25**
Dominant indigenous flora species by zone **Zone:** Sedgy Riverine Forest/Riverine Swamp Forest complex *Eucalyptus camaldulensis* *Juncus amabilis* *Carex* sp. (rhizomatous) *Lythrum hyssopifolia* *Poa labillardierei* var. *labillardierei* *Carex tereticaulis* *Cynodon dactylon* var. *pulchellus* *Eleocharis acuta*			
Significant indigenous flora species: *Carex* sp. (rhizomatous) *Cynodon dactylon* var. *pulchellus*		**Status:** *?* Insufficiently known (DSE 2005)	
Other indigenous flora species: *Centipeda cunninghamii* (old channel) *Bothriochloa macra* (floodplain) *Pseudoraphis spinescens* (old channel)			
Tree species: *Eucalyptus camaldulensis*			
Tree Health:		Good	
Associated Dryland Vegetation:		Predominately exotic	
Connectivity to Native Vegetation:		Tree canopy continuous with riparian vegetation of Broken River	
Significant/dominant weed species: **Phalaris aquatica* **Avena barbata* **Bromus catharticus* var. *catharticus* **Bromus hordaceus* ssp. *hordaceus* **Lolium rigidum* **Romulea rosea* **Exotic species that may become a threat in the future:** -			

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Logs	-

MANAGEMENT

Management Issues:
1. Altered hydrology
2. Dumped hard rubbish
3. Weed control

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
This site is located at the junction of two floodways. It is recovering well after the removal of grazing (i.e. *Carex* establishing). Areas outside of the wetland are also being recolonised by native species (e.g. *Austrodanthonia* spp. and *Bothriochloa macra*). Some revegetation has been undertaken along the banks of the river.

Plate 9 Wetland Site number 64 supports the Sedgy Riverine Forest/Floodplain Riparian Woodland EVC. The site supports River Red Gums and a high cover of sedges (pictured) (February 2007).

6.9 Wetland Site Number: 81

DATE SURVEYED: 21/2/07
RECORDERS: L. V. Crowfoot and D. Frood
PLATES: 10
MAP: Figure 5 (Map 1) Part 4

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 372327 / 5968054
Datum:	GDA 94
Altitude:	133 m
Nearest Road Access:	Midland Highway (corner of Cochrans Lane)
Land Tenure:	Private
Land Use(s):	Grazing
Wetland Area (ha):	0.136
Wetland Perimeter (m):	198

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		0.5 m	
% Water: <5	**% Mud:** <5	**% Damp Soil:**	**% Dry:** 95
Wetland Phase			
Filling:	**Full:**	**Drying:** X	**Dry:**

INDEX OF WETLAND CONDITION SCORE

IWC Score:			59**/120**		
Wetland Catchment:	6**/20**	**Physical Form:**	18**/20**	**Hydrology:**	0**/20**
Water Properties:	20**/20**	**Soils:**	4**/20**	**Biota:**	11**/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Shallow Freshwater Marsh
Wetland subcategories:	Reed-dominated and Herb-dominated (when wet)

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Derived Tall Marsh Floodway Pond Herbland Floodplain Grassy Wetland	
Wetland Vegetation Quality Score:		57**/100**	
Critical lifeform groupings: 10**/25**	**Weeds:** 12**/25**	**Indicators of altered processes:** 10**/25**	**Vegetation structure and health:** 25**/25**
Dominant indigenous flora species by zone			
Zone: Derived Tall Marsh (centre)			
Typha spp.			
Zone: Floodway Pond Herbland (middle)			
Centipeda cunninghamii		*Alternanthera denticulata*	
Persicaria hydropiper		*Persicaria prostrata*	
Glossostigma sp.		*Lythrum hyssopifolia*	
Zone: Floodplain Grassy Wetland (outer edge)			
Enteropogon acicularis		*Amphibromus nervosus*	
Eleocharis pusilla		*Lachnagrostis filiformis* var. 1	
Eleocharis acuta		*Cynodon dactylon* var. *pulchellus*	
Panicum decompositum var. *decompositum*		*Eragrostis parviflora*	
Chloris truncata		*Eragrostis brownii*	
Juncus amabilis			
Significant indigenous flora species:		**Status:**	
Cynodon dactylon var. *pulchellus*		Insufficiently known (DSE 2005)	
Panicum decompositum var. *decompositum*		Regional (Beauglehole 1986)	
Other indigenous flora species:			
-			
Tree species:			
Eucalyptus camaldulensis (outer edge of Grassy Wetland)			
Tree Health:		Average	
Associated Dryland Vegetation:		Predominately exotic	
Connectivity to Native Vegetation:		Loosely contiguous with riparian vegetation of Broken River	

Significant/dominant weed species:
**Paspalum dilatatum*
**Paspalum distichum*
**Polypogon monspeliensis*
**Digitaria sanguinalis*
**Echinochloa crus-galli*
**Heliotropium europaeum*
**Cucumis myriocarpus* subsp. *leptodermis*

Exotic species that may become a threat in the future:
-

FAUNA

Significant fauna habitat:	**Significant fauna species:**
-	-

MANAGEMENT

Management Issues:
1. Altered hydrology
2. Grazing
3. Weed control

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
This site is located on the same floodway as Site 82. Given that both **Paspalum* species and *Typha* are doing well, this site is probably receiving water from the other wetland. This wetland has been modified (soil removed from the middle and placed around the banks) and is heavily pugged.

Plate 10 Wetland Site number 81 is characterised by a derived Tall Marsh (middle) and (outer) bands of Floodway Pond Herbland and Floodplain Grassy Wetland (foreground) (February 2007).

6.10 Wetland Site Number: 82

DATE SURVEYED: 21/2/07
RECORDERS: L. V. Crowfoot and D. Frood
PLATES: 11 and 12
MAP: Figure 5 (Map 1) Part 4

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 372414 / 5967990
Datum:	GDA 94
Altitude:	137 m
Nearest Road Access:	Midland Highway (corner of Cochrans Lane)
Land Tenure:	Private
Land Use(s):	Grazing
Wetland Area (ha):	0.133
Wetland Perimeter (m):	214

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		0.5 m	
% Water: 20	**% Mud:** <5	**% Damp Soil:**	**% Dry:** >75
Wetland Phase			
Filling:	**Full:**	**Drying:** X	**Dry:**

INDEX OF WETLAND CONDITION SCORE

IWC Score:			69**/120**		
Wetland Catchment:	6**/20**	**Physical Form:**	20**/20**	**Hydrology:**	0**/20**
Water Properties:	20**/20**	**Soils:**	8**/20**	**Biota:**	15**/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	Open Water

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Floodway Pond Herbland Floodplain Grassy Wetland Spike-sedge Wetland	
Wetland Vegetation Quality Score:		77**/100**	
Critical lifeform groupings: 10**/25**	**Weeds:** 18**/25**	**Indicators of altered processes:** 25**/25**	**Vegetation structure and health:** 24**/25**
Dominant indigenous flora species by zone			
Zone: Floodway Pond Herbland (middle)			
Centipeda elatinoides		*Alternanthera denticulata*	
Persicaria lapathifolia		*Persicaria prostrata*	
Potamogeton sp.		*Pseudognaphalium luteoalbum*	
Lachnagrostis filiformis var. 1		*Chenopodium pumilio*	
Glinus oppositifolius			
Zone: Floodplain Grassy Wetland (outer edge)			
Enteropogon acicularis		*Amphibromus nervosus*	
Pseudoraphis spinescens		*Lachnagrostis filiformis* var. 1	
Eleocharis acuta		*Cynodon dactylon* var. *pulchellus*	
Panicum decompositum var. *decompositum*		*Carex* sp. (rhizomatous)	
Chloris truncata		*Cyperus lucidus*	
Juncus amabilis			
Zone: Spike-sedge Wetland (outer edge)			
Eleocharis acuta			
Significant indigenous flora species:		**Status:**	
Carex sp. (rhizomatous)		?	
Cynodon dactylon var. *pulchellus*		Insufficiently known (DSE 2005)	
Glinus oppositifolius		Regional (Beauglehole 1986)	
Panicum decompositum var. *decompositum*		Regional (Beauglehole 1986)	
Other indigenous flora species:			
Carex tereticaulis (other pond)			
Tree species: *Eucalyptus camaldulensis* (outer edge of Grassy Wetland)			

Tree Health:	Average
Associated Dryland Vegetation:	Predominately exotic
Connectivity to Native Vegetation:	Tree canopy loosely contiguous with riparian vegetation of Broken River

Significant/dominant weed species:
**Paspalum dilatatum*
**Paspalum distichum*
**Polypogon monspeliensis*
**Digitaria sanguinalis*
**Echinochloa crus-galli*
**Heliotropium europaeum*
**Modiola caroliniana*
**Trifolium repens*
**Cyperus eragrostis*
**Cucumis myriocarpus* subsp. *leptodermis*

Exotic species that may become a threat in the future:
-

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Scattered hollow-bearing trees and logs	-

MANAGEMENT

Management Issues:
1. Altered hydrology
2. Grazing
3. Weed control

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
This site is made up of two ponds – one has water pumped into it and was full at the time of assessment and the other is almost dry (Plates 11 and 12). Both ponds have been mapped but the assessment was undertaken on the drier (less modified) pond. This area is grazed and pugging was evident.

Site 82 is on the same floodway as Site 81.

Plate 11 One of the ponds of Wetland Site number 82 showing bands of Floodway Pond Herbland (middle) and Floodplain Grassy Wetland (outer edge) (February 2007).

Plate 12 The other Pond that makes-up Wetland Site number 82 has water is pumped into it. The edge of the wetland is dominated by sedges and also supports scattered River Red Gums (February 2007).

6.11 Wetland Site Number: 94

DATE SURVEYED: 21/2/07
RECORDERS: L. V. Crowfoot and D. Frood
PLATES: 13
MAP: Figure 6 (Map 2) Part 5

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 375975 / 5967605
Datum:	GDA 94
Altitude:	136 m
Nearest Road Access:	River Road
Land Tenure:	Private
Land Use(s):	Grazing
Wetland Area (ha):	0.166
Wetland Perimeter (m):	203

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		1 m	
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:** 100
Wetland Phase			
Filling:	**Full:**	**Drying:**	**Dry:** X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			64**/120**		
Wetland Catchment:	6**/20**	**Physical Form:**	20**/20**	**Hydrology:**	0**/20**
Water Properties:	20**/20**	**Soils:**	4**/20**	**Biota:**	14**/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Shallow Freshwater Marsh
Wetland subcategories:	Sedge-dominated

VEGETATION

EVC Aggregate: **EVC Elements:**		Floodplain Wetland Aggregate (also Drainage Line Aggregate) Spike-sedge Wetland Sedgy Riverine Forest	
Wetland Vegetation Quality Score:		70**/100**	
Critical lifeform groupings: 10**/25**	**Weeds:** 10**/25**	**Indicators of altered processes:** 25**/25**	**Vegetation structure and health:** 25**/25**
Dominant indigenous flora species by zone **Zone:** Spike-sedge Wetland (majority of the wetland) *Eleocharis acuta* *Lythrum hyssopifolia* **Zone:** Sedgy Riverine Forest (outer edge) *Eucalyptus camaldulensis* *Juncus amabilis*		*Lachnagrostis filiformis* var. 1 *Carex tereticaulis* *Eleocharis acuta*	
Significant indigenous flora species: -		**Status:**	
Other indigenous flora species: *Eleocharis pusilla* (within another drainage line)		*Alternanthera denticulata* (within another drainage line)	
Tree species: *Eucalyptus camaldulensis*		*Eucalyptus microcarpa* (scattered)	
Tree Health:		Average	
Associated Dryland Vegetation:		Predominately exotic	
Connectivity to Native Vegetation:		Tree canopy contiguous with riparian vegetation of Broken River	
Significant/dominant weed species: **Hordeum hystrix* **Bromus madritensis* **Bromus hordaceus* ssp. *hordaceus* **Avena barbata* **Romulea rosea* **Exotic species that may become a threat in the future:** -			

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Large hollow-bearing trees and logs	-

MANAGEMENT

Management Issues:
1. Altered hydrology
2. Grazing
3. Weed control

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
A higher level floodway pond located in one of three drainage lines that drain into the river. The wetland is dry, heavily grazed and species-poor. It consists predominately of Common Spike-sedge (*Eleocharis acuta*), exotic grasses and leaflitter.

Plate 13. Wetland Site number 94 is located in a drainage line that flows into the Broken River. This wetland has been heavily grazed and is dominated by Common Spike-sedge and exotic annual grasses (February 2007).

6.12 Wetland Site Number: 95

DATE SURVEYED: 21/2/07
RECORDERS: L. V. Crowfoot and D. Frood
PLATES: 14
MAP: Figure 6 (Map 2) Part 5

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 376081 / 5967611
Datum:	GDA 94
Altitude:	134 m
Nearest Road Access:	River Road
Land Tenure:	Private
Land Use(s):	Grazing
Wetland Area (ha):	0.653
Wetland Perimeter (m):	640

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		1 m		
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:**	100
Wetland Phase				
Filling:	**Full:**	**Drying:**	**Dry:**	X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			64**/120**		
Wetland Catchment:	6**/20**	**Physical Form:**	20**/20**	**Hydrology:**	0**/20**
Water Properties:	20**/20**	**Soils:**	4**/20**	**Biota:**	14**/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Shallow Freshwater Marsh
Wetland subcategories:	Sedge-dominated

VEGETATION

EVC Aggregate: **EVC Elements:**		Floodplain Wetland Aggregate (also Drainage Line Aggregate) Spike-sedge Wetland Sedgy Riverine Forest	
Wetland Vegetation Quality Score:		70**/100**	
Critical lifeform groupings: 10**/25**	**Weeds:** 10**/25**	**Indicators of altered processes:** 25**/25**	**Vegetation structure and health:** 25**/25**
Dominant indigenous flora species by zone **Zone:** Spike-sedge Wetland (majority of the wetland) *Eleocharis acuta* *Eleocharis pusilla* *Lachnagrostis filiformis* var. 1 *Pseudoraphis spinescens* **Zone:** Sedgy Riverine Forest/Riverine Swamp Forest Complex (outer edge) *Eucalyptus camaldulensis* *Carex tereticaulis* *Juncus amabilis* *Eleocharis acuta*			
Significant indigenous flora species: - **Status:**			
Other indigenous flora species: -			
Tree species: *Eucalyptus camaldulensis* *Eucalyptus microcarpa* (scattered)			
Tree Health:		Average	
Associated Dryland Vegetation:		Predominately exotic	
Connectivity to Native Vegetation:		Tree canopy contiguous with riparian vegetation of Broken River	
Significant/dominant weed species: **Hordeum hystrix* **Bromus madritensis* **Bromus hordaceus* ssp. *hordaceus* **Avena barbata* **Romulea rosea* **Exotic species that may become a threat in the future:** -			

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Large hollow-bearing trees and logs	-

MANAGEMENT

Management Issues:
1. Altered hydrology
2. Grazing
3. Weed control

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
As for Site 94, this dry wetland is located within a drainage line that feeds into the Broken River. It is also heavily grazed and species poor.

Plate 14 A pond located on a higher level floodplain, Wetland Site number 95 is predominately made up of leaf litter, Common Spike-sedge and exotic annual grasses (foreground). Some Red Gum recruitment is occurring on the edge (background) (February 2007).

6.13 Wetland Site Number: 101

DATE SURVEYED: 22/2/07
RECORDERS: G. W. Carr, L. A. Ashby
PLATES: 15 and 16
MAP: Figure 6 (Map 2) Part 5

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 377661 / 5968299
Datum:	GDA 94
Altitude:	133 m
Nearest Road Access:	Bridge Road
Land Tenure:	Private
Land Use(s):	Grazing, irrigated cropping
Wetland Area (ha):	1.110
Wetland Perimeter (m):	1184

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		1.5 m	
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:** 100
Wetland Phase			
Filling:	**Full:**	**Drying:**	**Dry:** X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			72 **/120**		
Wetland Catchment:	4 **/20**	**Physical Form:**	20 **/20**	**Hydrology :**	10 **/20**
Water Properties:	10 **/20**	**Soils:**	9 **/20**	**Biota:**	19 **/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Shallow Freshwater Marsh
Wetland subcategories:	Grass-dominated

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Floodway Pond Herbland Spike-sedge Wetland Floodplain Grassy Wetland Sedgy Riverine Forest Floodplain Riparian Woodland	
Wetland Vegetation Quality Score:		97 **/100**	
Critical lifeform groupings: 25 **/25**	**Weeds:** 22 **/25**	**Indicators of altered processes:** 25 **/25**	**Vegetation structure and health:** 25 **/25**
Dominant indigenous flora species by zone			
Zone: Floodplain Riparian Woodland			
Poa labillardierei var. *labillardierei*			
Zone: Sedgy Riverine Forest			
Eucalyptus camaldulensis		*Carex tereticaulis*	
Juncus amabilis		*Carex sp.* (rhizomatous)	
Cynodon dactylon var. *pulchellus*		*Eleocharis acuta*	
Carex bichenoviana			
Zone: Spike-sedge Wetland			
Eleocharis acuta			
Zone: Floodplain Grassy Wetland			
Amphibromus nervosus		*Amphibromus fluitans*	
Pseudoraphis spinescens			
Zone: Floodway Pond Herbland			
Centipeda cunninghamii		*Persicaria prostrata*	
Chenopodium pumilio		*Lachnagrostis filiformis s.l.*	
Alternanthera denticulata		*Centipeda elatinoides*	
Significant indigenous flora species:		**Status:**	
Amphibromus fluitans		Vulnerable (EPBC Act 1999)	
Carex sp. (rhizomatous)		?	
Cynodon dactylon var. *pulchellus*		Insufficiently known (DSE 2005)	
Other indigenous flora species:			
Panicum decompositum var. *decompositum*			
Tree species:			
Eucalyptus camaldulensis			
Tree Health:		Good	
Associated Dryland Vegetation:		Predominantly exotic	
Connectivity to Native Vegetation:		One end of the billabong has a contiguous canopy with riparian vegetation along Broken River	

Significant/dominant weed species:
Phalaris aquatica
**Cirsium vulgare*
**Silybum marianum*

Exotic species that may become a threat in the future:
-

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Logs	-

MANAGEMENT

Management Issues:
1. Altered hydrology of Broken River
2. Grazing (sheep)
3. Seepage from irrigated terrace upslope
4. Weed invasion (**Phalaris aquatica*)

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Heavily sheep grazed throughout. Fairly extensive *Poa labillardierei* grassland contiguous with wetland – at best fairly structurally intact – on the slope above wetland and in swale between larger wetland and small wetland at terminus of system.

Plate 15 The bare floor of the Wetland Site number 101 in the foreground with Floodway Pond Herbland elements in the background (shown in more detail in the plate below) (February 2007).

Plate 16 The Floodway Pond Herbland element within Wetland Site number 101. The bright green vegetation is *Centipeda cunninghamii* (Common Sneezeweed), with *Lachnagrostis filiformis* (Common Blown-grass) (dried heads). (February 2007).

6.14 Wetland Site Number: 106

DATE SURVEYED: 22/2/07
RECORDERS: L. V. Crowfoot and D. Frood
PLATES: 17
MAP: Figure 6 (Map 2) Part 5

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 377888 / 5968305
Datum:	GDA 94
Altitude:	134 m
Nearest Road Access:	Midland Highway
Land Tenure:	Private
Land Use(s):	Cropping and grazing
Wetland Area (ha):	0.018
Wetland Perimeter (m):	58

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		< 1 m	
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:** 100
Wetland Phase			
Filling:	**Full:**	**Drying:**	**Dry:** X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			68**/120**		
Wetland Catchment:	4**/20**	**Physical Form:**	20**/20**	**Hydrology:**	0**/20**
Water Properties:	20**/20**	**Soils:**	11**/20**	**Biota:**	13**/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Flooded River Flats
Wetland subcategories:	-

VEGETATION

EVC Aggregate:	Drainage Line Aggregate (marginally a wetland)		
EVC Elements:	Spike-sedge Wetland modified Sedgy Riverine Forest and Floodplain Riparian Woodland		
Wetland Vegetation Quality Score:	67**/100**		
Critical lifeform groupings: 10**/25**	**Weeds:** 10**/25**	**Indicators of altered processes:** 25**/25**	**Vegetation structure and health:** 22**/25**

Dominant indigenous flora species by zone

Zone: Spike-sedge Wetland (floor)

Eleocharis acuta

Zone: modified Floodplain Riparian Woodland / Sedgy Riverine Forest (floor - edge)

Eucalyptus camaldulensis	*Carex tereticaulis*
Poa labillardierei var. *labillardierei*	*Carex bichenoviana*
Juncus amabilis	*Eleocharis acuta*

Significant indigenous flora species:	**Status:**
-	

Other indigenous flora species:

-

Tree species:

Eucalyptus camaldulensis

Tree Health:	Average
Associated Dryland Vegetation:	Predominately exotic
Connectivity to Native Vegetation:	Loosely connected with riparian vegetation via scattered trees

Significant/dominant weed species:
**Hordeum murinum*
**Bromus diandrus*
**Cirsium vulgare*

Exotic species that may become a threat in the future:
-

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Hollow-bearing trees	-

MANAGEMENT

Management Issues:
1. Altered hydrology
2. Grazing
Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Located within a drainage line of a floodway, this small site is marginally a wetland. It is currently dry but at best would be a shallow pool.

Plate 17 Wetland Site number 106 is a small pond within a drainage-line (centre) dominated by Common Spike-sedge with the remainder of the wetland supporting scattered Poong'ort and Common Tussock-grass (left and right) (February 2007).

6.15 Wetland Site Number: 116

DATE SURVEYED: 22/2/07
RECORDERS: L.V. Crowfoot and D. Frood
PLATES: 18 and 19
MAP: Figure 6 (Map 2) Part 6

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 379996 / 5967595
Datum:	GDA 94
Altitude:	138 m
Nearest Road Access:	Midland Highway
Land Tenure:	Private
Land Use(s):	Cropping and grazing
Wetland Area (ha):	0.888
Wetland Perimeter (m):	908

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		1 m	
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:** 100
Wetland Phase			
Filling:	**Full:**	**Drying:**	**Dry:** X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			77**/120**		
Wetland Catchment:	4**/20**	**Physical Form:**	20**/20**	**Hydrology:**	20**/20**
Water Properties:	10**/20**	**Soils:**	11**/20**	**Biota:**	12**/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Intermittent Shallow Freshwater Marsh
Wetland subcategories:	Red Gum-dominated and Sedge-dominated

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Spike-sedge Wetland Riverine Swampy Woodland	
Wetland Vegetation Quality Score:		60**/100**	
Critical lifeform groupings: 10**/25**	**Weeds:** 3**/25**	**Indicators of altered processes:** 25**/25**	**Vegetation structure and health:** 22**/25**
Dominant indigenous flora species by zone **Zone:** Spike-sedge Wetland (majority of the wetland) *Eleocharis acuta* **Zone:** Riverine Swampy Woodland (outer edge) *Eucalyptus camaldulensis* *Poa labillardierei* var. *labillardierei* *Amphibromus nervosus* *Juncus amabilis* *Austrodanthonia duttoniana* *Carex tereticaulis* *Carex bichenoviana* *Juncus pallidus* *Eleocharis acuta* *Elymus scaber*			
Significant indigenous flora species: -		**Status:**	
Other indigenous flora species: -			
Tree species: *Eucalyptus camaldulensis*			
Tree Health:		Average	
Associated Dryland Vegetation:		Predominately exotic	
Connectivity to Native Vegetation:		Loosely with riparian vegetation via scattered trees	
Significant/dominant weed species: **Hordeum murinum* **Bromus diandrus* **Lolium rigidum* **Avena barbata* **Exotic species that may become a threat in the future:** -			

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Very old trees with hollows	-

MANAGEMENT

Management Issues:
1. Grazing

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Shallow wetland located within a higher level channel that is rarely flooded (i.e. big flood events only). It is unlikely that the hydrology has been altered. The area is mostly cropped and sometimes grazed. The highest values for the site reside in the old growth River Red Gums (Plate 20).

Plate 18 Wetland Site number 116 is located on a higher level floodway that is flooded only in major events. The majority of this site supports the Spike-sedge Wetland EVC (foreground) with the edges showing elements of Riverine Swampy Woodland (background) (February 2007).

Plate 19 The highest faunal habitat values for Wetland Site number 116 reside in the large old River Red-gums (February 2007).

6.16 Wetland Site Number: 134

DATE SURVEYED: 21/2/07
RECORDERS: G. W. Carr, L. A. Ashby
PLATES: 20
MAP: Figure 6 (Map 2) Part 7

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 384706 / 5967867
Datum:	GDA 94
Altitude:	135 m
Nearest Road Access:	Midland Highway
Land Tenure:	Private
Land Use(s):	Grazing (with extensive irrigated pasture)
Wetland Area (ha):	0.330
Wetland Perimeter (m):	544

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		4 m	
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:** 100
Wetland Phase			
Filling:	**Full:**	**Drying:**	**Dry:** X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			68 **/120**		
Wetland Catchment:	8 **/20**	**Physical Form:**	20 **/20**	**Hydrology:**	10 **/20**
Water Properties:	10 **/20**	**Soils:**	6 **/20**	**Biota:**	14 **/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	Grass-dominated, dead timber-dominated

VEGETATION

EVC Aggregate:				Billabong Wetland Aggregate			
EVC Elements:				Floodway Pond Herbland Spike-sedge Wetland Floodplain Grassy Wetland Sedgy Riverine Forest Floodplain Riparian Woodland			
Wetland Vegetation Quality Score:				72 **/100**			
Critical lifeform groupings:	15 **/25**	**Weeds:**	22 **/25**	**Indicators of altered processes:**	25 **/25**	**Vegetation structure and health:**	10 **/25**
Dominant indigenous flora species by zone							
Zone: Outer edge, Sedgy Riverine Forest / Floodplain Riparian Woodland							
Eucalyptus camaldulensis				*Carex tereticaulis*			
Carex sp. (rhizomatous)				*Carex bichenoviana*			
Cyperus exaltatus				*Poa labillardierei* var. *labillardierei*			
Zone: Edge, Floodplain Grassy Wetland							
Amphibromus nervosus				*Pseudoraphis spinescens*			
Cynodon dactylon var. *pulchellus*				*Eleocharis acuta*			
Eleocharis pusilla							
Zone: Edge, Spike-sedge Wetland							
Eleocharis acuta							
Zone: Floor, Floodway Pond Herbland							
Lachnagrostis filiformis s.l.				*Pseudoraphis spinescens*			
Polygonum plebeium				*Centipeda cunninghamii*			
Centipeda elatinoides				*Alternanthera denticulata*			
Pseudognaphalium luteoalbum				*Persicaria hydropiper*			
Significant indigenous flora species:				**Status:**			
Carex sp. (rhizomatous)				?			
Cynodon dactylon var. *pulchellus*				Insufficiently known (DSE 2005)			
Other indigenous flora species:							
Juncus amabilis				*Bolboschoenus medianus*			
Cyperus gunnii							
Tree species:							
Eucalyptus camaldulensis				*Acacia dealbata* subsp. *dealbata*			
Tree Health:				Average (some dead trees)			

Associated Dryland Vegetation:	Predominantly exotic
Connectivity to Native Vegetation:	Contiguous canopy with riparian vegetation along Broken River

Significant/dominant weed species:
**Phalaris aquatica*
**Rosa rubiginosa*
**Schinus molle*
**Nassella neesiana*
**Cirsium vulgare*

Exotic species that may become a threat in the future:

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Logs, branches	

MANAGEMENT

Management Issues:
1. Altered hydrology of Broken River
2. Weed invasion, particularly **Phalaris aquatica*
3. Cattle grazing and pugging
4. Localised nutrient-rich run-off from irrigated paddocks nearby

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Fenced from main paddocks and intermittently grazed by dairy cows

Plate 20 View from the floor of Wetland Site number 134 showing high cover of *Lachnagrostis filiformis* (Common Blown-grass) and logs (February 2007).

6.17 Wetland Site Number: 200

DATE SURVEYED: 21/2/07
RECORDERS: G.W. Carr, L.A. Ashby
PLATES: 21
MAP: Figure 6 (Map 2) Part 8

SITE DETAILS

Location (Zone, Easting/Northing)**:**	
Datum:	GDA 94
Altitude:	152 m
Nearest Road Access:	Ballantine Road
Land Tenure:	Private
Land Use(s):	Grazing
Wetland Area (ha):	0.135
Wetland Perimeter (m):	187

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		1 m		
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:**	100
Wetland Phase				
Filling:	**Full:**	**Drying:**	**Dry:**	X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			60 **/120**		
Wetland Catchment:	4 **/20**	**Physical Form:**	20 **/20**	**Hydrology:**	10 **/20**
Water Properties:	10 **/20**	**Soils:**	0 **/20**	**Biota:**	16 **/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Shallow Freshwater Marsh
Wetland subcategories:	Sedge-dominated, Dead timber-dominated

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Spike-sedge Wetland Floodplain Grassy Wetland	
Wetland Vegetation Quality Score:		80 **/100**	
Critical lifeform groupings: 15 **/25**	**Weeds:** 15 **/25**	**Indicators of altered processes:** 25 **/25**	**Vegetation structure and health:** 25 **/25**
Dominant indigenous flora species by zone **Zone:** Outer edge, Sedgy Riverine Forest / Spike-sedge Wetland *Eucalyptus camaldulensis* *Eleocharis pusilla* *Juncus sp.* **Zone:** Floor, Floodplain Grassy Wetland *Lachnagrostis filiformis s.l.*		*Eleocharis acuta* *Amphibromus nervosus* *Pseudoraphis spinescens*	
Significant indigenous flora species: None recorded		**Status:**	
Other indigenous flora species: -			
Tree species: *Eucalyptus camaldulensis*			
Tree Health:		Average	
Associated Dryland Vegetation:		Predominantly exotic	
Connectivity to Native Vegetation:		Canopies of some *Eucalyptus camaldulensis* trees are contiguous with the riparian vegetation along the Broken River	
Significant/dominant weed species: **Cirsium vulgare* **Exotic species that may become a threat in the future:**			

FAUNA

Significant fauna habitat:	**Significant fauna species:**
-	-

MANAGEMENT

Management Issues:
1. Altered hydrology of Broken River
2. Sheep and cattle grazing
3. Enrichment from agricultural practices – sheep and cattle faeces
4. Reduced recruitment (grazing)

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Margins trampled by stock. Soils seriously compacted.

Plate 21 Wetland Site number 200 is shallow and essentially devoid of vegetation (February 2007).

6.18 Wetland Site Number: 201

DATE SURVEYED: 21/2/07
RECORDERS: G. W. Carr, L. A. Ashby
PLATES: 22
MAP: Figure 6 (Map 2) Part 8

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 394060 / 5964894
Datum:	GDA 94
Altitude:	156 m
Nearest Road Access:	Ballantine Road
Land Tenure:	Private
Land Use(s):	Grazing
Wetland Area (ha):	0.290
Wetland Perimeter (m):	318

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		0.5 m		
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:**	100
Wetland Phase				
Filling:	**Full:**	**Drying:**	**Dry:**	X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			61 **/120**		
Wetland Catchment:	4 **/20**	**Physical Form:**	20 **/20**	**Hydrology:**	10 **/20**
Water Properties:	10 **/20**	**Soils:**	0 **/20**	**Biota:**	17 **/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Shallow Freshwater Marsh
Wetland subcategories:	-

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Spike-sedge Wetland Floodplain Grassy Wetland Floodway Pond Herbland ?	
Wetland Vegetation Quality Score:		85 **/100**	
Critical lifeform groupings: 10 **/25**	**Weeds:** 25 **/25**	**Indicators of altered processes:** 25 **/25**	**Vegetation structure and health:** 25 **/25**
Dominant indigenous flora species by zone			
Zone: Outer, Spike-sedge Wetland/Floodplain Grassy Wetland			
Eleocharis acuta		*Eleocharis gracilis*	
Eleocharis pusilla		*Pseudoraphis spinescens*	
Amphibromus fluitans		*Amphibromus nervosus*	
Zone: Inner, Floodway Pond Herbland ?			
Lachnagrostis filiformis s.l.		*Myriophyllum crispatum*	
Significant indigenous flora species:		**Status:**	
Amphibromus fluitans		Vulnerable (EPBC Act 1999)	
Cynodon dactylon var. *pulchellus*		Insufficiently known (DSE 2005)	
Eleocharis gracilis		Regional (Beauglehole 1986)	
Other indigenous flora species:			
Cynodon dactylon var. *pulchellus*		*Eucalyptus camaldulensis*	
Tree species:			
None in wetland, *Eucalyptus camaldulensis* rooted outside wetland boundary			
Tree Health: N/A			
Associated Dryland Vegetation:		Predominantly exotic	
Connectivity to Native Vegetation:		Both ends of the wetland abut *Eucalyptus camaldulensis* trees that are part of the riparian vegetation along the Broken River	
Significant/dominant weed species: **Cirsium vulgare* **Lolium rigidum* **Exotic species that may become a threat in the future:**			

FAUNA

Significant fauna habitat:	Significant fauna species:
-	-

MANAGEMENT

Management Issues:
1. Altered hydrology of Broken River
2. Sheep grazing/cattle grazing (intensively grazed recently by sheep)

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Mostly situated in bare paddock with sheep grazing. Cattle grazed, but more intensively sheep grazed. Trees have been removed and there are no elements of Floodplain Riparian Woodland or Sedgy Riverine Forest present. Potential nutrient enrichment from the pasture/cropping land.

Plate 22 Photo of Wetland Site number 201 note absence of *Eucalyptus camaldulensis* (River Red-gum) around the edge (February 2007).

6.19 Wetland Site Number: 203

DATE SURVEYED: 21/2/07
RECORDERS: G.W. Carr, L.A. Ashby
PLATES: 23
MAP: Figure 6 (Map 2) Part 8

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 394489 / 5965164
Datum:	GDA 94
Altitude:	150 m
Nearest Road Access:	Ballantine Road
Land Tenure:	Private
Land Use(s):	Grazing and cropping
Wetland Area (ha):	0.231
Wetland Perimeter (m):	194

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		2.5 m	
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:** 100
Wetland Phase			
Filling:	**Full:**	**Drying:**	**Dry:** X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			86 **/120**		
Wetland Catchment:	6 **/20**	**Physical Form:**	20 **/20**	**Hydrology:**	10 **/20**
Water Properties:	10 **/20**	**Soils:**	20 **/20**	**Biota:**	20 **/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	Grass-dominated

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Floodway Pond Herbland Spike-sedge Wetland	
Wetland Vegetation Quality Score:		100 **/100**	
Critical lifeform groupings: 25 **/25**	**Weeds:** 25 **/25**	**Indicators of altered processes:** 25 **/25**	**Vegetation structure and health:** 25 **/25**
Dominant indigenous flora species by zone			
Zone: Outer, Spike-sedge Wetland/other			
Eleocharis acuta		*Eleocharis pusilla*	
Juncus amabilis		*Juncus subsecundus*	
Carex tereticaulis			
Zone: Floor, Floodway Pond Herbland			
Lachnagrostis filiformis s.l.		*Centipeda cunninghamii*	
Persicaria prostrata		*Centipeda elatinoides*	
Polygonum plebeium		*Pseudognaphalium luteoalbum*	
Significant indigenous flora species:		**Status:**	
None recorded			
Other indigenous flora species:			
Carex tereticaulis		*Eucalyptus camaldulensis*	
Austrodanthonia duttoniana		*Amphibromus nervosus*	
Rumex sp.			
Tree species:			
Eucalyptus camaldulensis			
Tree Health:		Average	
Associated Dryland Vegetation:		Predominantly exotic	
Connectivity to Native Vegetation:		Contiguous canopy with riparian vegetation along Broken River	
Significant/dominant weed species: **Phalaris aquatica* **Cirsium vulgare*			
Exotic species that may become a threat in the future:			

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Logs, branches	-

MANAGEMENT

Management Issues:
1. Altered hydrology of Broken River
2. Severely grazed by sheep
3. Failure of recruitment of *Eucalyptus camaldulensis*

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Carex tereticaulis is very scarce; all *Juncus* and *Carex* severely grazed.
Perhaps part of a chain of wetlands in a former river course but the terminal and largest wetland.
Failure of recruitment of *Eucalyptus camaldulensis* – fine old specimen only.

Plate 23 The floor of Wetland Site number 203 has a high cover of *Lachnagrostis filiformis* (Common Blown-grass) and Floodway Pond Herbland Elements (February 2007).

6.20 Wetland Site Number: 208

DATE SURVEYED: 19/2/07
RECORDERS: G.W. Carr, L.A. Ashby, D. Frood, L.V. Crowfoot
PLATES: 24
MAP: Figure 7 (Map 3) Part 9

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 397955 / 5964063
Datum:	GDA 94
Altitude:	163 m
Nearest Road Access:	Baddaginnie-Goomalibeee Road
Land Tenure:	Crown
Land Use(s):	Public Conservation and Resource
Wetland Area (ha):	0.659
Wetland Perimeter (m):	580

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		1.5 m		
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:**	100
Wetland Phase				
Filling:	**Full:**	**Drying:**	**Dry:**	X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			95**/120**		
Wetland Catchment:	6**/20**	**Physical Form:**	20**/20**	**Hydrology:**	10**/20**
Water Properties:	20**/20**	**Soils:**	20**/20**	**Biota:**	19**/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh (semi-permanent)
Wetland subcategories:	Red Gum-dominated, Sedge-dominated, Herb-dominated and Open water

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Floodway Pond Herbland Floodplain Grassy Wetland Floodplain Riparian Woodland Riverine Swamp Forest	
Wetland Vegetation Quality Score:		95**/100**	
Critical lifeform groupings: 25 **/25**	**Weeds:** 25**/25**	**Indicators of altered processes:** 25**/25**	**Vegetation structure and health:** 20**/25**
Dominant indigenous flora species by zone			
Zone: Outer, Floodplain Riparian Woodland / Riverine Swamp Forest			
Eucalyptus camaldulensis		*Carex tereticaulis*	
Poa labillardierei var. *labillardierei*		*Eleocharis acuta*	
Juncus amabilis			
Zone: Floodway Pond Herbland			
Centipeda cunninghamii		*Persicaria lapathifolia*	
Alternanthera cf. *nodiflora*		*Polygonum plebeium*	
Dysphania glomulifera ssp. *glomulifera*			
Zone: Floodplain Grassy Wetland			
Lachnagrostis filiformis var. 1		*Lachnagrostis filiformis* var. 2	
Amphibromus fluitans		*Amphibromus nervosus*	
Pseudoraphis spinescens			
Significant indigenous flora species:		**Status:**	
Amphibromus fluitans		Vulnerable (EPBC Act 1999)	
Dysphania glomulifera ssp. *glomulifera*		Regional (Beauglehole 1986)	
Lachnagrostis filiformis var. 2		Insufficiently known (DSE 2005)	
Other indigenous flora species:			
Pseudognaphalium luteoalbum		*Epilobium hirsutum*	
Senecio runcinifolius		*Hemarthria uncinata* var. *uncinata*	
Tree species:			
Eucalyptus camaldulensis			
Tree Health:		Average	
Associated Dryland Vegetation:		Predominately exotic	

Connectivity to Native Vegetation:	Contiguous canopy with riparian vegetation along Broken River

Significant/dominant weed species:
**Phalaris aquatica*
**Rorippa palustris*
**Lolium rigidum*

Exotic species that may become a threat in the future:
**Melia azedarach*

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Large trees with hollows and logs	-

MANAGEMENT

Management Issues:
1. Altered hydrology of Broken River
2. Worm digging for fish bait
3. Exotic weeds on the edge, particularly **Melia azedarach* and **Phalaris aquatica*

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
The site has been grazed in the past. Overall, a good quality wetland. Priority management actions need to be undertaken.

Plate 24 Wetland Site number 208 showing Floodplain Riparian Woodland / Riverine Swamp Forest, Floodplain Grassy Wetland and Floodway Pond Herbland components (February 2007).

6.21 Wetland Site Number: 211

DATE SURVEYED: 20/2/07
RECORDERS: G.W. Carr, L.A. Ashby
PLATES: 25
MAP: Figure 7 (Map 3) Part 9

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 402009 / 5963901
Datum:	GDA 94
Altitude:	171 m
Nearest Road Access:	Midland Highway
Land Tenure:	Private
Land Use(s):	Cropping and Grazing
Wetland Area (ha):	2.043
Wetland Perimeter (m):	1132

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		3.5 m	
% Water: 1	**% Mud:** 1	**% Damp Soil:**	**% Dry:** 98
Wetland Phase			
Filling:	**Full:**	**Drying:** X	**Dry:**

INDEX OF WETLAND CONDITION SCORE

IWC Score:			78 **/120**		
Wetland Catchment:	6 **/20**	**Physical Form:**	20 **/20**	**Hydrology:**	10 **/20**
Water Properties:	10 **/20**	**Soils:**	15 **/20**	**Biota:**	17 **/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	Red-gum dominated

VEGETATION

EVC Aggregate:				Billabong Wetland Aggregate			
EVC Elements:				Floodway Pond Herbland Floodplain Grassy Wetland Tall Marsh Sedgy Riverine Forest Floodplain Riparian Woodland			
Wetland Vegetation Quality Score:				84.5 **/100**			
Critical lifeform groupings:	25 **/25**	**Weeds:**	22 **/25**	**Indicators of altered processes:**	25 **/25**	**Vegetation structure and health:**	12.5 **/25**
Dominant indigenous flora species by zone							
Zone: Edge/outer, Sedgy Riverine Forest / Floodplain Riparian Woodland							
Eucalyptus camaldulensis				*Acacia dealbata* subsp. *dealbata*			
Carex tereticaulis				*Juncus amabilis*			
Zone: Floor, Floodway Pond Herbland / Tall Marsh / Floodplain Grassy Wetland							
Hemarthria uncinata				*Centipeda elatinoides*			
Centipeda cunninghamii				*Persicaria hydropiper*			
Persicaria prostrata				*Cynodon dactylon* var. *pulchellus*			
Pseudognaphalium luteoalbum				*Pseudoraphis spinescens*			
Phragmites australis							
Significant indigenous flora species:				**Status:**			
Callistemon sieberi				Regional			
Cynodon dactylon var. *pulchellus*				Insufficiently known (DSE 2005)			
Glinus oppositifolius				Regional (Beauglehole 1986)			
Other indigenous flora species:							
Acacia verniciflua				*Callistemon sieberi*			
Glinus lotoides				*Austrodanthonia racemosa*			
Carex appressa				*Cyperus exaltatus*			
Alternanthera denticulata				*Juncus sp.*			
Persicaria decipiens				*Poa labillardierei* var. *labillardierei*			
Persicaria lapathifolia				*Chenopodium pumilio*			
Lythrum hyssopifolia				*Microlaena stipoides*			
Ludwigia peploides subsp. *montevidensis*				*Alternanthera* cf. *nodiflora*			
Epilobium hirtigerum				*Juncus subsecundus*			

Tree species:	
Eucalyptus camaldulensis	*Acacia dealbata* subsp. *dealbata*
Tree Health:	Average
Associated Dryland Vegetation:	Predominantly exotic
Connectivity to Native Vegetation:	Contiguous canopy with riparian vegetation along Broken River
Significant/dominant weed species: **Xanthium strumarium* **Gladiolus undulatus* **Fraxinus angustifolia* var *angustifolia* **Rosa canina* **Cirsium vulgare* **Phalaris aquatica* **Exotic species that may become a threat in the future:**	

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Logs/snags	Long-necked tortoise
Mature trees with hollows	
When wet, waterholes	

MANAGEMENT

Management Issues:
1. Altered hydrology of Broken River
2. Grazing
3. Bank stabilisation (erosion from cattle)
4. Weeds
5. Failure of recruitment of woody species – *Callistemon sieberi*, *Acacia verniciflua* and *Acacia dealbata* subsp. *dealbata*

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Eastern grey Kangaroos potentially problematic as part of total grazing pressure. Evidence of Brush-tail Possum.

Very sandy substrate on beds and banks - granitic sand almost throughout, otherwise silty clay/alluvium.

Some small ponds (to 70 cm deep) close to River used by stock and are heavily pugged. *Phragmites australis* near ponds, grazed.

Failure of recruitment in some woody species *Callistemon sieberi*, *Acacia verniciflua* and *Acacia dealbata* subsp. *dealbata* – kangaroos may be having an effect, especially in the drought.

Billabong fills every year (Dennis Ryan pers. comm.). Springs that feed wetlands from the north bank at level of large *Eucalyptus camaldulensis* have dried up this year, which has not been observed previously by D. Ryan.

Plate 25 Wetland Site number 211, this wetland normally receives water from springs located on the left bank which have now dried up (February 2007).

6.22 Wetland Site Number: 213

DATE SURVEYED: 20/2/07
RECORDERS: G.W. Carr, L.A. Ashby
PLATES: 26
MAP: Figure 7 (Map 3) Part 9

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 402815 / 5964067
Datum:	GDA 94
Altitude:	149 m
Nearest Road Access:	Midland Highway
Land Tenure:	Private
Land Use(s):	Grazing, cropping
Wetland Area (ha):	0.220
Wetland Perimeter (m):	182

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		0.9 m		
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:**	100
Wetland Phase				
Filling:	**Full:**	**Drying:**	**Dry:**	X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			57 **/120**		
Wetland Catchment:	4 **/20**	**Physical Form:**	20 **/20**	**Hydrology:**	10 **/20**
Water Properties:	10 **/20**	**Soils:**	0 **/20**	**Biota:**	13 **/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Shallow Freshwater Marsh
Wetland subcategories:	Grass-dominated

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Floodplain Grassy Wetland	
Wetland Vegetation Quality Score:		63 **/100**	
Critical lifeform groupings: 15 **/25**	**Weeds:** 3 **/25**	**Indicators of altered processes:** 20 **/25**	**Vegetation structure and health:** 25 **/25**
Dominant indigenous flora species by zone			
Zone: Outer			
Eucalyptus camaldulensis		*Juncus amabilis*	
Zone: Inner			
Amphibromus fluitans			
Significant indigenous flora species:		**Status:**	
Amphibromus fluitans		Vulnerable (EPBC Act 1999)	
Cynodon dactylon var. *pulchellus*		Insufficiently known (DSE 2005)	
Other indigenous flora species:			
Austrodanthonia caespitosa		*Epilobium hirtigerum*	
Cynodon dactylon var. *pulchellus*		*Juncus semisolidus*	
Persicaria prostrata		*Poa labillardierei* var. *labillardierei*	
Eleocharis acuta		*Lachnagrostis filiformis* s.l.	
Juncus subsecundus			
Tree species:			
Eucalyptus camaldulensis			
Tree Health:		Good (all young trees)	
Associated Dryland Vegetation:		Predominantly exotic	
Connectivity to Native Vegetation:		10 m from wetland with canopy contiguous with riparian vegetation along Broken River	
Significant/dominant weed species: **Phalaris aquatica* **Rosa rubiginosa* **Cirsium vulgare* **Exotic species that may become a threat in the future:**			

FAUNA

Significant fauna habitat:	**Significant fauna species:**
-	-

MANAGEMENT

Management Issues:
1. Altered hydrology of Broken River
2. Weed invasion
3. Grazing and pugging by stock

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Small circular wetland next to road. Base covered with **Lolium rigidum*, in wet times would be replaced by *Amphibromus fluitans.* Currently, the major indigenous species is *Juncus amabilis* surrounded by, and being invaded by pasture grasses. **Rosa rubiginosa* plant located on fenceline parallel with the Midland Highway. Young *Eucalyptus camaldulensis* around edge, approximately 6 are invading the floor of the wetland.

Fills with water approximately 7 years in 10 (based on average climatic conditions, Dennis Ryan pers. comm.) Fills with water from river flooding and run-off from the road, up to 1.8 m deep.

Severe cattle pugging but not recently.

Plate 26 Wetland Site number 213 covered in a sward of Wimmera Rye-grass (*Lolium rigidum*) (February 2007).

6.23 Wetland Site Number: 214

DATE SURVEYED: 20/2/07
RECORDERS: G.W. Carr, L.A. Ashby
PLATES: 27
MAP: Figure 7 (Map 3) Part 9

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 402773 / 5964044
Datum:	GDA 94
Altitude:	155 m
Nearest Road Access:	Midland Hwy
Land Tenure:	Private
Land Use(s):	Cropping, grazing
Wetland Area (ha):	0.501
Wetland Perimeter (m):	385

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:				2 m			
% Water:	1	**% Mud:**	1	**% Damp Soil:**	0	**% Dry:**	98
Wetland Phase							
Filling:		**Full:**		**Drying:**	X	**Dry:**	

INDEX OF WETLAND CONDITION SCORE

IWC Score:			63 **/120**		
Wetland Catchment:	6 **/20**	**Physical Form:**	20 **/20**	**Hydrology:**	10 **/20**
Water Properties:	10 **/20**	**Soils:**	2 **/20**	**Biota:**	15 **/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	Herb-dominated, Grass-dominated

VEGETATION

EVC Aggregate:		Billabong Wetland Aggregate		
EVC Elements:		Floodway Pond Herbland Tall Marsh (if not grazed) Sedgy Riverine Forest / Floodplain Riparian Woodland		
Wetland Vegetation Quality Score:		74.5 **/100**		
Critical lifeform groupings:	25 **/25**	**Weeds:**	12 **/25**	**Indicators of altered processes:** 25 **/25**	**Vegetation structure and health:** 12.5 **/25**
Dominant indigenous flora species by zone				
Zone: Banks/edge, Sedgy Riverine Forest / Floodplain Riparian Woodland				
Eucalyptus camaldulensis		*Juncus amabilis*		
Zone: Floor, Floodway Pond Herbland				
Lachnagrostis filiformis s.l.		*Persicaria hydropiper*		
Alisma plantago-aquatica		*Cynodon dactylon* var. *pulchellus*		
Significant indigenous flora species:		**Status:**		
Callistemon sieberi		Regional		
Carex sp. (rhizomatous)		?		
Cynodon dactylon var. *pulchellus*		Insufficiently known (DSE 2005)		
Isolepis inundata		Regional (Beauglehole 1986)		
Other indigenous flora species:				
Acacia dealbata subsp. *dealbata*		*Callistemon sieberi*		
Phragmites australis		*Poa labillardierei* var. *labillardierei*		
Pseudognaphalium luteoalbum		*Isolepis inundata*		
Carex sp. (rhizomatous)		*Persicaria lapathifolia*		
Centipeda elatinoides		*Isolepis cernua*		
Juncus bufonis		*Lythrum hyssopifolia*		
Tree species:				
Eucalyptus camaldulensis		*Acacia dealbata* subsp. *dealbata*		
Tree Health:		Good		
Associated Dryland Vegetation:		Mixed indigenous/exotic		
Connectivity to Native Vegetation:		Contiguous canopy with riparian vegetation along Broken River		
Significant/dominant weed species: **Phalaris aquatica*				

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Logs/snags	-
Mature Trees	
Waterholes	

MANAGEMENT

Management Issues:
1. Altered hydrological regime – Broken River
2. Stock grazing/pugging
3. Erosion

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Wetland of fairly poor quality – high cover of weed and few of indigenous species. Old river channel.

Plate 27 Wetland Site number 214, like most other wetlands along the lower Broken River, was part of the old river course (February 2007).

6.24 Wetland Site Number: 216

DATE SURVEYED: 19/2/07
RECORDERS: G.W. Carr, L.A. Ashby, D. Frood, L.V. Crowfoot
PLATES: 28
MAP: Figure 7 (Map 3) Part 9

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 403408 / 5963554
Datum:	GDA 94
Altitude:	170 m
Nearest Road Access:	Midland Highway
Land Tenure:	Private
Land Use(s):	Grazing
Wetland Area (ha):	0.899
Wetland Perimeter (m):	391

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		2 m		
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:**	100
Wetland Phase				
Filling:	**Full:**	**Drying:**	**Dry:**	X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			59 **/120**		
Wetland Catchment:	6 **/20**	**Physical Form:**	20 **/20**	**Hydrology:**	10 **/20**
Water Properties:	10 **/20**	**Soils:**	0 **/20**	**Biota:**	13 **/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	Grass-dominated

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Floodplain Grassy Wetland	
Wetland Vegetation Quality Score:		63 **/100**	
Critical lifeform groupings: 10 **/25**	**Weeds:** 3 **/25**	**Indicators of altered processes:** 25 **/25**	**Vegetation structure and health:** 25 **/25**
Dominant indigenous flora species by zone			
Zone: Outer			
Eucalyptus camaldulensis		*Carex tereticaulis*	
Zone: Inner, Floodplain Grassy Wetland			
Eleocharis acuta		*Eleocharis pusilla*	
Cynodon dactylon var. *pulchellus*		*Lachnagrostis filiformis s.l.*	
Eragrostis elongata		*Centipeda elatinoides*	
Pseudognaphalium luteoalbum		*Oxalis perennans*	
Chloris truncata		*Alternanthera* cf. *nodiflora*	
Juncus amabilis		*Juncus subsecundus*	
Amphibromus fluitans			
Significant indigenous flora species:		**Status:**	
Amphibromus fluitans		Vulnerable (EPBC Act 1999)	
Cynodon dactylon var. *pulchellus*		Insufficiently known (DSE 2005)	
Other indigenous flora species:			
Pseudoraphis spinescens			
Tree species:			
Eucalyptus camaldulensis			
Tree Health:		Good	
Associated Dryland Vegetation:		Mixed indigenous/exotic	
Connectivity to Native Vegetation:		Contiguous canopy with riparian vegetation along Broken River	
Significant/dominant weed species: **Cirsium vulgare*			
Exotic species that may become a threat in the future:			

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Mature trees	-

MANAGEMENT

Management Issues:
1. Altered hydrology of Broken River
2. Grazing by Stock (Cattle and Goats) and pugging

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Highly modified. Exotic grass invasion except in deepest ponds. Cover of indigenous species is low. Stock grazing and pugging a management issue. Ecologically substantially simplified. Needs inundation.

Plate 28Wetland Site number 216 showing impacts of heavy stock grazing (February 2007).

6.25 Wetland Site Number: 232

DATE SURVEYED: 22/2/07
RECORDERS: G.W. Carr, L.A. Ashby
PLATES: 29
MAP: Figure 6 (Map 2) Part 5

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 377270 / 5968183
Datum:	GDA 94
Altitude:	143 m
Nearest Road Access:	Bridge Road
Land Tenure:	Public
Land Use(s):	Recreation/Conservation, adjoining land pasture and cropping (c.15 m away)
Wetland Area (ha):	0.506
Wetland Perimeter (m):	366

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		1.5 m	
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:** 100
Wetland Phase			
Filling:	**Full:**	**Drying:**	**Dry:** X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			88 **/120**		
Wetland Catchment:	6 **/20**	**Physical Form:**	20 **/20**	**Hydrology:**	20 **/20**
Water Properties:	10 **/20**	**Soils:**	15 **/20**	**Biota:**	17 **/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	Grass-dominated

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Floodway Pond Herbland Spike-sedge Wetland Floodplain Grassy Wetland Sedgy Riverine Forest Floodplain Riparian Woodland	
Wetland Vegetation Quality Score:		87 **/100**	
Critical lifeform groupings: 15 **/25**	**Weeds:** 22 **/25**	**Indicators of altered processes:** 25 **/25**	**Vegetation structure and health:** 25 **/25**
Dominant indigenous flora species by zone			
Zone: Outer, Sedgy Riverine Forest/Floodplain Riparian Woodland			
Eucalyptus camaldulensis		*Carex tereticaulis*	
Carex sp. (rhizomatous)		*Juncus psammophilus*	
Juncus amabilis		*Poa labillardierei* var. *labillardierei*	
Eleocharis pusilla		*Carex inversa*	
Cynodon dactylon var. *pulchellus*			
Zone: Intermediate, Spike-sedge Wetland/Floodplain Grassy Wetland			
Eleocharis acuta		*Pseudoraphis spinescens*	
Zone: Floor, Floodway Pond Herbland			
Lachnagrostis filiformis s.l.		*Centipeda cunninghamii*	
Centipeda elatinoides		*Alternanthera denticulata*	
Persicaria prostrata		*Pseudognaphalium luteoalbum*	
Significant indigenous flora species:		**Status:**	
Cynodon dactylon var. *pulchellus*		Insufficiently known (DSE 2005)	
Carex sp. (rhizomatous)		?	
Juncus psammophilus		Regionally significant	
Other indigenous flora species:			
Acacia dealbata subsp. *dealbata*		*Eucalyptus melliodora*	
Eucalyptus microcarpa			
Tree species:			
Eucalyptus camaldulensis		*Eucalyptus melliodora*	
Eucalyptus microcarpa		*Acacia dealbata* subsp. *dealbata*	
Tree Health:		Average	
Associated Dryland Vegetation:		Mixed indigenous/exotic	

Connectivity to Native Vegetation:	Contiguous canopy with riparian vegetation along Broken River

Significant/dominant weed species:
**Phalaris aquatica*
**Pennisetum clandestinum*
**Cirsium vulgare*

Exotic species that may become a threat in the future:
**Opuntia monacantha*

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Logs/branches	Brown Tree Creeper
Mature trees with hollows	Peaceful Dove

MANAGEMENT

Management Issues:
1. Altered hydrology of Broken River
2. Weeds - **Phalaris aquatica, *Pennisetum clandestinum, *Cirsium vulgare, *Opuntia monacantha*
3. Soil disturbance/Recreational Impacts – digging for worms (fish bait), vehicle driving through wetland, pile of hard rubbish

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Wetland located just north-west of bridge over Broken River on Bridge Road (opposite Exton property). Close to the river. Wetland large and broad by standards so far seen.
Eastern edge of wetland disturbed by digging for worms and other soil disturbance – perhaps road making material was extracted (?).
Wheel tracks in wetland are deep – caused by truck.
Rubbish dumping – tin and old fencing material – has introduced **Pennisetum clandestinum*.

Plate 29 Wetland Site number 232 with dead Common Blown-grass (*Lachnagrostis filiformis s.l*) and Common Sneezeweed (*Centipeda cunninghamii*) (February 2007).

6.26 Wetland Site Number: 233

DATE SURVEYED: 22/2/07
RECORDERS: G.W. Carr, L.A. Ashby
PLATES: 30
MAP: Figure 6 (Map 2) Part 6

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 378880 / 5967863
Datum:	GDA 94
Altitude:	143 m
Nearest Road Access:	Bridge Road
Land Tenure:	Private
Land Use(s):	Grazing
Wetland Area (ha):	0.089
Wetland Perimeter (m):	155

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		1.5 m		
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:**	100
Wetland Phase				
Filling:	**Full:**	**Drying:**	**Dry:**	X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			93 **/120**		
Wetland Catchment:	6 **/20**	**Physical Form:**	20 **/20**	**Hydrology:**	10 **/20**
Water Properties:	20 **/20**	**Soils:**	20 **/20**	**Biota:**	16.6 **/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	Sedge-dominated, dead-timber dominated, open water-dominated (if wet)

VEGETATION

EVC Aggregate:				Floodplain Wetland Aggregate			
EVC Elements:				Spike-sedge Wetland Sedgy Riverine Forest Floodplain Riparian Woodland			
Wetland Vegetation Quality Score:				83 **/100**			
Critical lifeform groupings:	15 **/25**	**Weeds:**	18 **/25**	**Indicators of altered processes:**	25 **/25**	**Vegetation structure and health:**	25 **/25**
Dominant indigenous flora species by zone **Zone:** Banks/edge, Sedgy Riverine Forest / Floodplain Riparian Woodland *Poa labillardierei* var. *labillardierei* *Carex tereticaulis* *Juncus amabilis* **Zone:** Banks/edge, Spike-sedge Wetland *Eleocharis acuta*				*Eucalyptus camaldulensis* *Juncus amabilis* *Hemarthria uncinata* var. *uncinata*			
Significant indigenous flora species: None recorded				**Status:**			
Other indigenous flora species: *Amphibromus nervosus* *Muellerina eucalyptoides*				*Amyema miquelii*			
Tree species: *Eucalyptus camaldulensis*				*Acacia dealbata* subsp. *dealbata*			
Tree Health:				Average			
Associated Dryland Vegetation:				Predominantly exotic			
Connectivity to Native Vegetation:				Canopy contiguous with riparian vegetation along Broken River			
Significant/dominant weed species: **Phalaris aquatica* **Exotic species that may become a threat in the future:** **Rosa canina*							

FAUNA

Significant fauna habitat:	**Significant fauna species:**
A few logs	-

MANAGEMENT

Management Issues:
1. Altered hydrology of Broken River
2. Weed invasion - **Phalaris aquatica, *Rosa canina*

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Grazing to the south of wetland – fence approximately 30 metres away, probably intermittently cattle grazed.

Surrounds of wetland are basically fully exotic **Phalaris aquatica, *Bromus diandrus, *Vulpia myuros.*

**Phalaris aquatica* is a very serious weed.

Plate 30 Wetland Site number 233 showing *Carex tereticaulis* (Poong'ort) and *Poa labillardierei* var. *labillardierei* (Common Tussock-grass) tussocks and branches. The fenceline separating the wetland and surrounds from the rest of the property is to the left of the photo, the Broken River to the right (February 2007).

6.27 Wetland Site Number: 234

DATE SURVEYED: 20/2/07
RECORDERS: G.W. Carr, L.A. Ashby
PLATES: 31 and 32
MAP: Figure 6 (Map 2) Part 6

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 380499 / 5967443
Datum:	GDA 94
Altitude:	173 m
Nearest Road Access:	Unnamed road from Midland Highway into Nature Conservation Reserve
Land Tenure:	Crown and Private
Land Use(s):	Nature Conservation Reserve and Residential property
Wetland Area (ha):	0.068
Wetland Perimeter (m):	95

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:				3 m			
% Water:	0	**% Mud:**	0	**% Damp Soil:**	0	**% Dry:**	100
Wetland Phase							
Filling:		**Full:**		**Drying:**		**Dry:**	X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			78 **/120**		
Wetland Catchment:	6 **/20**	**Physical Form:**	20 **/20**	**Hydrology:**	0 **/20**
Water Properties:	20 **/20**	**Soils:**	20 **/20**	**Biota:**	12 **/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	-

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Sedgy Riverine Forest / Floodplain Riparian Woodland	
Wetland Vegetation Quality Score:		60 **/100**	
Critical lifeform groupings: 5 **/25**	**Weeds:** 25 **/25**	**Indicators of altered processes:** 5 **/25**	**Vegetation structure and health:** 25 **/25**
Dominant indigenous flora species by zone **Zone:** Banks/edge (Sedgy Riverine Forest / Floodplain Riparian Woodland) *Eucalyptus camaldulensis* *Carex tereticaulis* **Zone:** Floor (? Floodway Pond Herbland) -			
Significant indigenous flora species:		**Status:**	
None recorded			
Other indigenous flora species: *Acacia dealbata* subsp. *dealbata*			
Tree species: *Eucalyptus camaldulensis*			
Tree Health:		Good	
Associated Dryland Vegetation:		Mixed indigenous/exotic	
Connectivity to Native Vegetation:		Contiguous canopy with dryland vegetation in Nature Conservation Reserve	
Significant/dominant weed species: None currently **Exotic species that may become a threat in the future:** **Schinus molle* **Asparagus officinale* **Marrubium vulgare* **Prunus cerasifera* All with small populations at edge of dry billabong			

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Logs	-

MANAGEMENT

Management Issues:
1. Altered hydrological regime – Broken River and dam on private property preventing water flow to public part of wetland
2. Invasion of garden-escape weeds: **Schinus molle, *Asparagus officinale*
3. Rabbit grazing/kangaroo grazing

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Over half the billabong is dammed to create permanent water on adjoining residential property as evidenced by the fully topped wetland (see plates). This may deprive the lower part of the billabong of at least some of the flood flows. It is devoid of vegetation except Red Gums on the margins.

Plate 31 The dry half of Wetland Site number 234 showing the dry leaf-littered floor and surrounding *Eucalyptus camaldulensis* (River Red-gums) (February 2007).

Plate 32 The dammed section and dam wall of Wetland Site number 177. The dry section is to the right of the photo (February 2007).

6.28 Wetland Site Number: 235

DATE SURVEYED: 21/2/07
RECORDERS: G. W. Carr, L. A. Ashby
PLATES: 33
MAP: Figure 6 (Map 2) Part 7

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 384054 / 5967554
Datum:	GDA 94
Altitude:	135 m
Nearest Road Access:	Midland Highway
Land Tenure:	Private
Land Use(s):	Grazing (with areas of irrigated pasture)
Wetland Area (ha):	0.027
Wetland Perimeter (m):	74

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		1 m		
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:**	100
Wetland Phase				
Filling:	**Full:**	**Drying:**	**Dry:**	X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			91 **/120**		
Wetland Catchment:	6 **/20**	**Physical Form:**	20 **/20**	**Hydrology:**	10 **/20**
Water Properties:	20 **/20**	**Soils:**	20 **/20**	**Biota:**	15 **/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Deep Freshwater Marsh
Wetland subcategories:	-

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Floodway Pond Herbland (in a better year) Spike-sedge Wetland Sedgy Riverine Forest Floodplain Riparian Woodland	
Wetland Vegetation Quality Score:		75 **/100**	
Critical lifeform groupings: 15 **/25**	**Weeds:** 10 **/25**	**Indicators of altered processes:** 25 **/25**	**Vegetation structure and health:** 25 **/25**
Dominant indigenous flora species by zone **Zone:** Edge, Sedgy Riverine Forest/Floodplain Riparian Woodland *Poa labillardierei* var. *labillardierei* *Carex tereticaulis* **Zone:** Edge, Spike-sedge Wetland *Eleocharis acuta* **Zone:** Floor, Floodway Pond Herbland *Lachnagrostis filiformis s.l.* *Alternanthera denticulata*		*Eucalyptus camaldulensis* *Juncus amabilis* *Glyceria australis*	
Significant indigenous flora species: None recorded		**Status:**	
Other indigenous flora species: *Amphibromus nervosus* *Centipeda cunninghamii*		*Centipeda elatinoides*	
Tree species: *Eucalyptus camaldulensis*			
Tree Health:		Average	
Associated Dryland Vegetation:		Mixed indigenous/exotic	
Connectivity to Native Vegetation:		Contiguous canopy with riparian vegetation along Broken River	
Significant/dominant weed species: **Cirsium vulgare* **Phalaris aquatica* **Nassella neesiana* **Paspalum dilatatum* **Exotic species that may become a threat in the future:** **Sagittaria ?brevirostra* - in irrigation channel nearby. GPS locations: 55 384130E 5967646N and 55 384144E 5967646N **Rosa rubiginosa*			

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Logs	-
Mature trees with hollows	

MANAGEMENT

Management Issues:
1. Altered hydrology of Broken River
2. Weed invasion, particularly **Phalaris aquatica, *Nassella neesiana* and **Sagittaria ?brevirostra*
Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Fenced – cattle occasionally are let in for shade/shelter on hotter summer days (F. O'Connor pers. comm.).

There is a reasonable cover (up to 10%) of *Poa labillardierei* var. *labillardierei* around the edge of the wetland.

Wetland is adjacent to grazed paddocks and near irrigation channels.

Plate 33 Wetland Site number 235 showing Floodway Pond Herbland EVC elements on the floor with *Carex tereticaulis* (Poong'ort) tussocks around the edge. The fences separating the wetland and surrounds from the rest of the property can be seen in the right on the photo (February 2007).

6.29 Wetland Site Number: 236

DATE SURVEYED: 21/2/07
RECORDERS: G. W. Carr, L. A. Ashby
PLATES: 34 and 35
MAP: Figure 6 (Map 2) Part 7

SITE DETAILS

Location (Zone, Easting/Northing)**:**	55 384095 / 5967566
Datum:	GDA 94
Altitude:	138 m
Nearest Road Access:	Midland Highway
Land Tenure:	Private
Land Use(s):	Grazing (with areas of irrigated pasture)
Wetland Area (ha):	0.231
Wetland Perimeter (m):	304

INUNDATION STATUS OF WETLAND

Maximum Potential Water Depth:		>2 m		
% Water:	**% Mud:**	**% Damp Soil:**	**% Dry:**	100
Wetland Phase				
Filling:	**Full:**	**Drying:**	**Dry:**	X

INDEX OF WETLAND CONDITION SCORE

IWC Score:			93 **/120**		
Wetland Catchment:	8 **/20**	**Physical Form:**	20 **/20**	**Hydrology:**	10 **/20**
Water Properties:	20 **/20**	**Soils:**	20 **/20**	**Biota:**	15 **/20**

VICTORIAN WETLAND CLASSIFICATION

Wetland Category:	Shallow Freshwater Marsh and Deep Freshwater Marsh
Wetland subcategories:	Sedge-dominated, reed-dominated, open water (if wet)

VEGETATION

EVC Aggregate:		Floodplain Wetland Aggregate	
EVC Elements:		Tall Marsh Spike-sedge Wetland Floodplain Grassy Wetland Sedgy Riverine Forest Floodplain Riparian Woodland	
Wetland Vegetation Quality Score:		77 **/100**	
Critical lifeform groupings: 15 **/25**	**Weeds:** 12 **/25**	**Indicators of altered processes:** 25 **/25**	**Vegetation structure and health:** 25 **/25**
Dominant indigenous flora species by zone			
Zone: Edge/banks, Sedgy Riverine Forest/ Floodplain Riparian Woodland			
Poa labillardierei var. *labillardierei*		*Eucalyptus camaldulensis*	
Carex bichenoviana		*Carex tereticaulis*	
Carex sp. (rhizomatous)		*Juncus amabilis*	
Acacia dealbata subsp. *dealbata*		*Callistemon sieberi*	
Zone: Edge/floor, Floodplain Grassy Wetland			
Pseudoraphis spinescens		*Cynodon dactylon* var. *pulchellus*	
Eleocharis acuta		*Eleocharis pusilla*	
Zone: Floor, Spike-sedge Wetland			
Eleocharis acuta			
Zone: Floor, Tall Marsh			
Bolboschoenus medianus		*Phragmites australis*	
Cyperus exaltatus			
Significant indigenous flora species:		**Status:**	
Callistemon sieberi		Regional	
Carex sp. (rhizomatous)		?	
Cynodon dactylon var. *pulchellus*		Insufficiently known (DSE 2005)	
Other indigenous flora species:			
Austrostipa sp.			
Tree species:			
Eucalyptus camaldulensis		*Acacia dealbata* subsp. *dealbata*	
Callistemon sieberi			
Tree Health:		Average (some dead trees)	
Associated Dryland Vegetation:		Mixed indigenous/exotic	

Connectivity to Native Vegetation:	Contiguous at all structural levels with riparian vegetation along Broken River

Significant/dominant weed species:
**Rosa rubiginosa*
**Phalaris aquatica*
**Nassella neesiana* – nearby, probably here too.

Exotic species that may become a threat in the future:
**Sagittaria ?brevirostra* - in irrigation channels nearby. GPS locations: 55 384130E 5967646N and 55 384144E 5967646N

FAUNA

Significant fauna habitat:	**Significant fauna species:**
Many logs, branches	Black Wallaby
Mature trees with hollows	Red-browed Finches nesting in **Rosa rubiginosa*

MANAGEMENT

Management Issues:
1. Altered hydrology of Broken River
2. Weeds

Priority management actions:
1. Allocate environmental flows to place water in wetlands
2. Implement weed control according to species and priorities given in Table 3 of this report.

OTHER

Additional notes:
Wetland within fenced area, further from paddocks and closer to Broken River than 235.
Surrounded by vegetation that is not grazed and has a high indigenous component.
There are very fine specimens of *Callistemon sieberi*, (Plate 35) but there is inadequate recruitment of this species.
This system continues beyond fence into grazed sections, but these have not been documented.
Evidence of kangaroos.

Plate 34 Wetland Site number 236 showing tussocks of *Carex tereticaulis* (Poong'ort) and *Poa labillardierei* var. *labillardierei* (Common Tussock-grass). The lower Broken River in the far left of the photo (February 2007).

Plate 35 Fine, old specimen of River Bottlebrush (*Callistemon sieberi*) growing on the bank of the Broken River near Wetland Site number 236. Specimens of this size and age are now very rare in Victoria (February 2007).

Figure 4 Overview of aerial photo maps

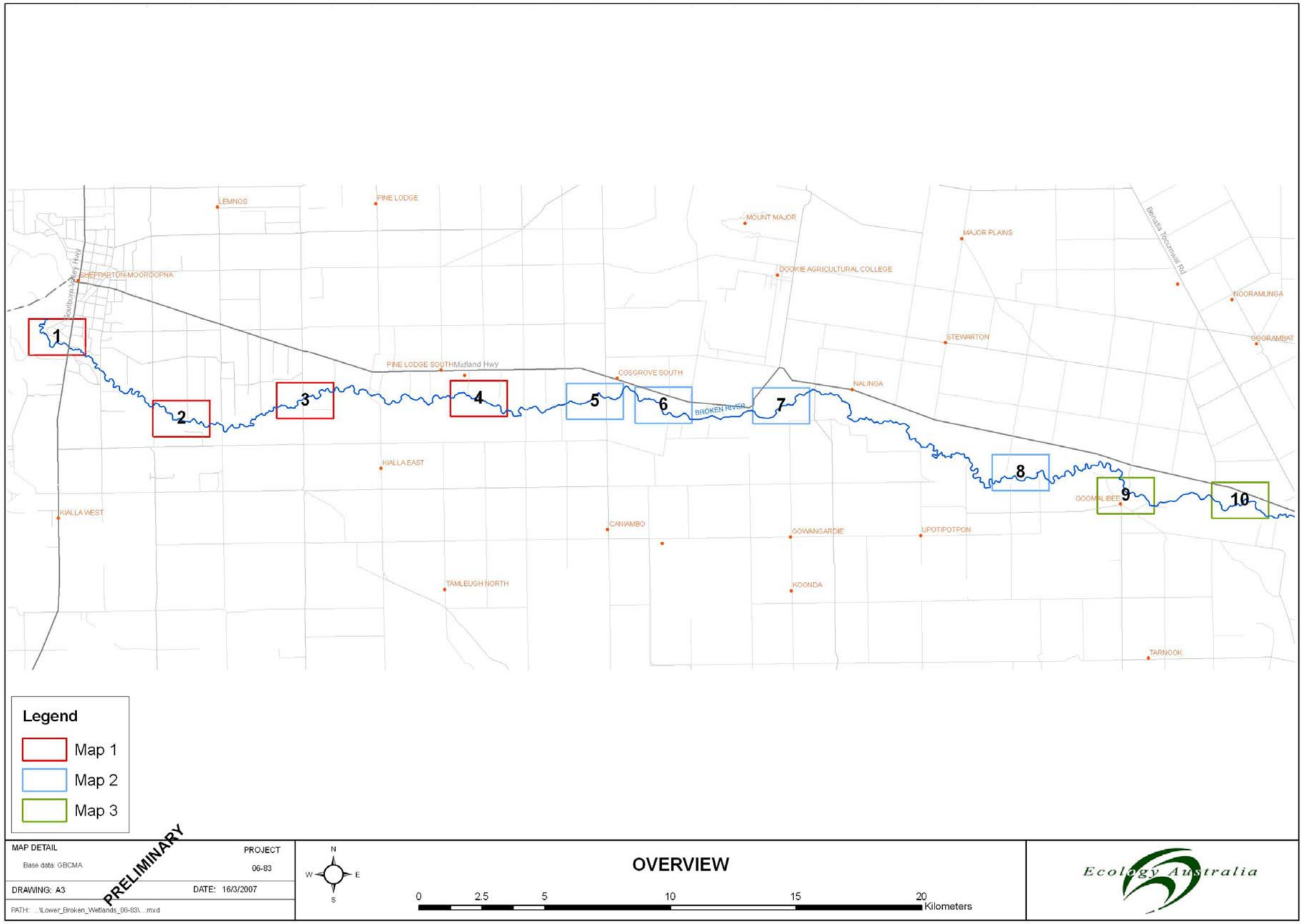


Figure 5 Map 1: Wetland Sites 21 (Part 1), 31, 44, 45, 46, 47 (Part 2), 64 (Part 3) 81, 82 (Part 4)

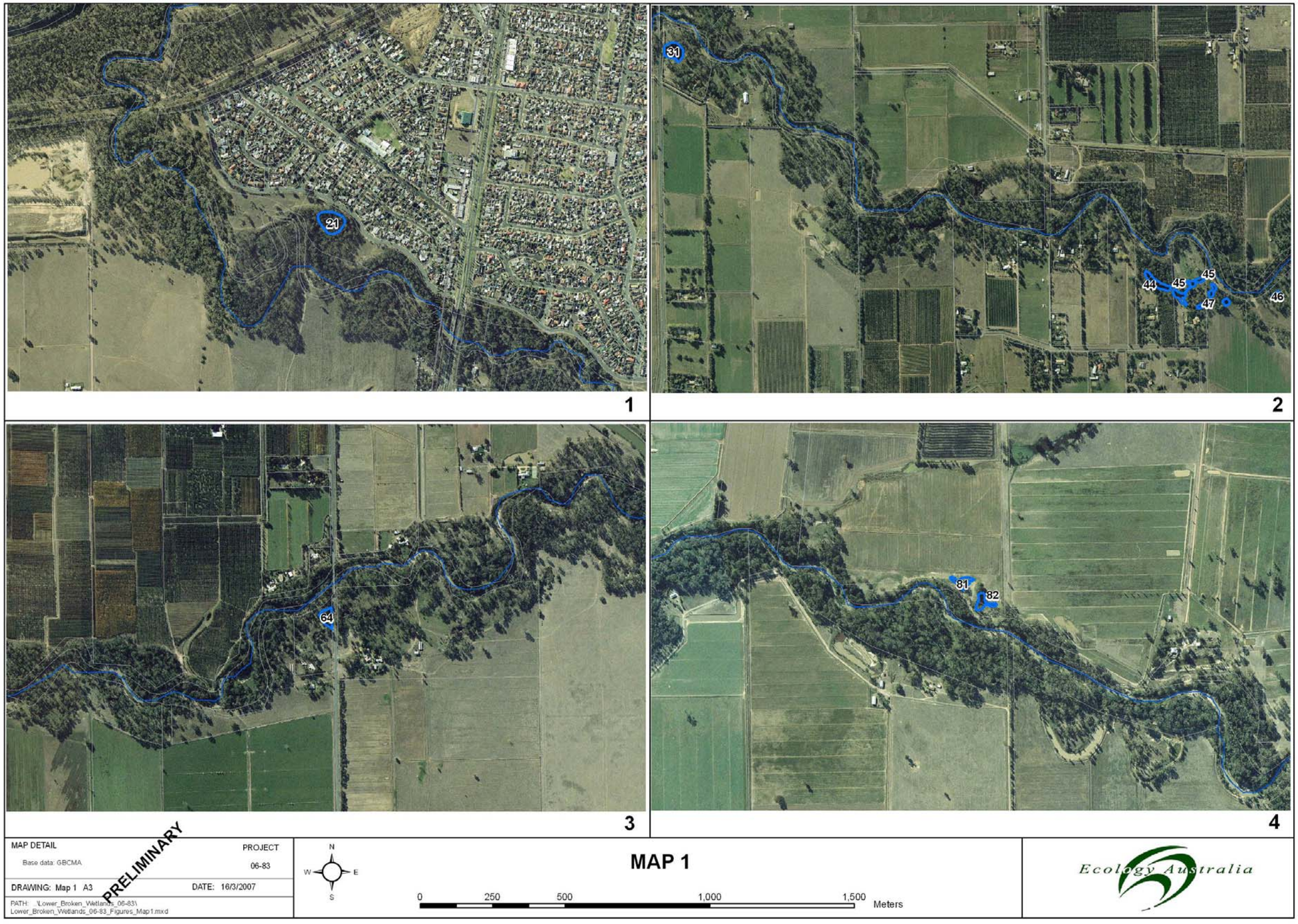


Figure 6 Map 2: Wetland Sites 94, 95, 101, 106, 232 (Part 5), 116, 233, 234 (Part 6), 134, 235, 236 (Part 7), 200, 201, 203, (Part 8)

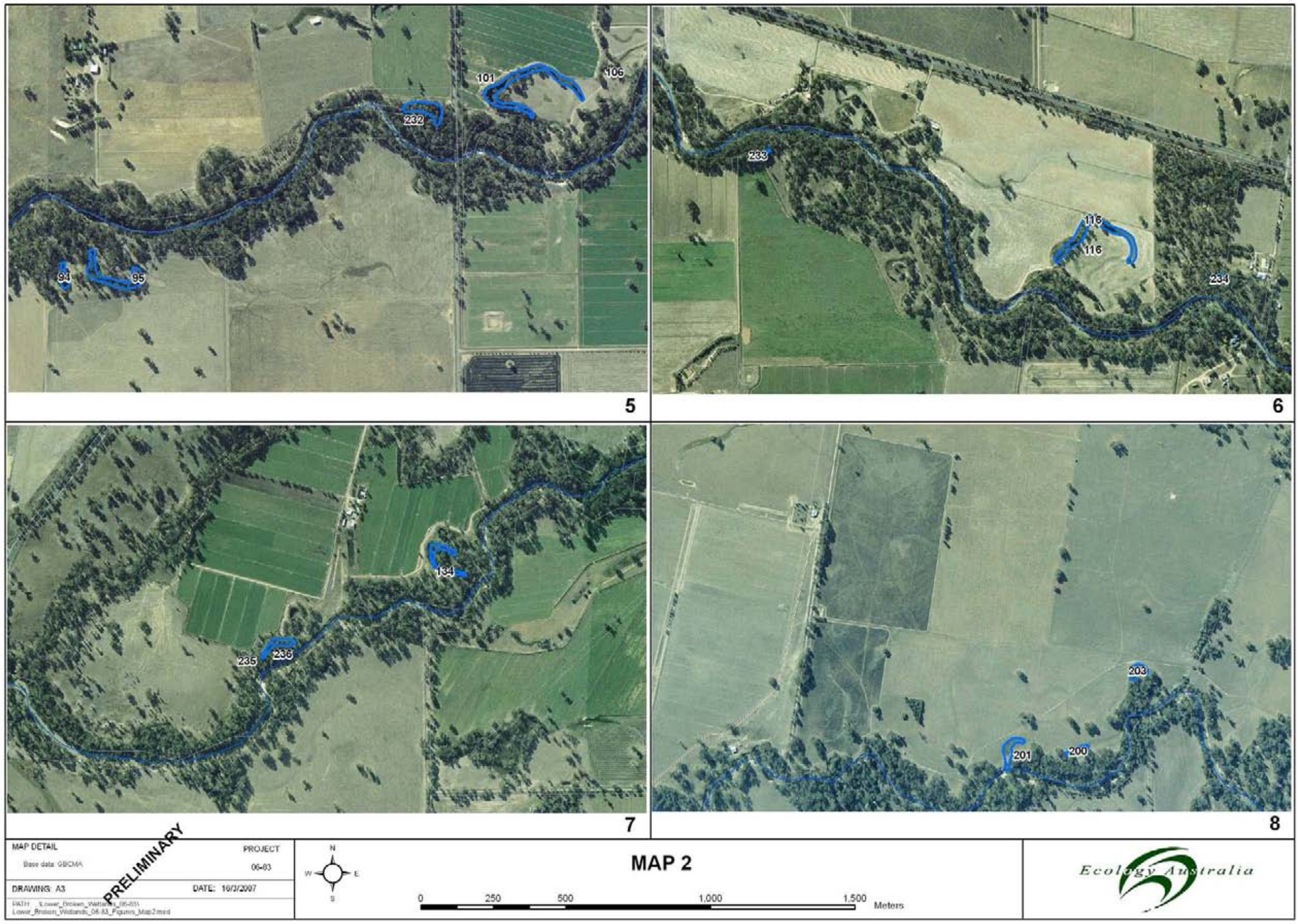
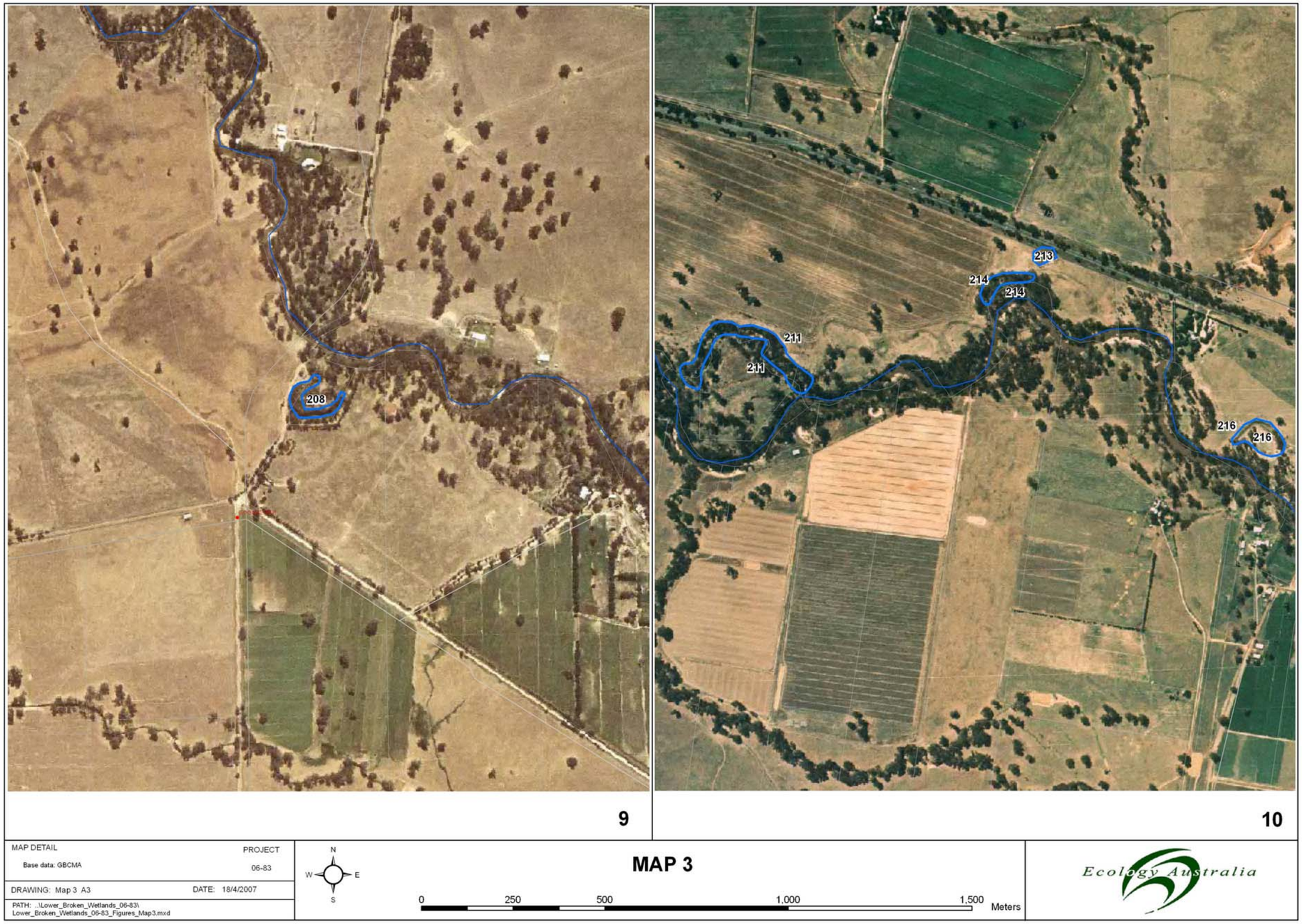


Figure 7 Map 3: Wetland Sites 208 (Part 9), 211, 213, 214, 216 (Part 10)



7 Management issues and recommendations

Management issues for the lower Broken River study area, as documented in this survey are outlined below. This does not purport to be a definitive list of issues nor does it address whole-of-catchment issues (e.g. eutrophication), and was based on field work at the driest time of an extremely dry year (unprecedented drought intensity). Other issues may be evident in a 'normal' year.

The general comments here may or may not apply to particular wetlands and are not intended to identify management directions for individual wetlands. Nor do they imply criticism of the management regime of particular wetlands. Any management decisions for wetlands – to enhance biodiversity or functional values – must be made in the context of an inventory of the full resource of wetlands on the Broken River, only a small proportion of which are documented here, and with the agreement and cooperation of the landowners. Further discussion of these issues is outside the scope of this report.

7.1 Weed invasion

The weed flora recorded falls into several, not necessarily mutually exclusive, categories (Table 3) which has management implications:

(i) ubiquitous species such as grasses which are extremely abundant in the landscape;

(ii) species which have 'escaped' from cultivation upstream and are dispersed downstream by water (e.g. Box-elder Maple **Acer negundo* cultivated in Benalla) or which have 'escaped' local cultivation (e.g. White Cedar **Melia azedarach*);

(iii) species cultivated for pasture or crops (e.g. Wheat **Triticum aestivum*).

In all 76 weed (exotic) species were recorded during fieldwork (Appendix 5). This is an inaccurate reflection of the total weed flora, being species recorded in wetlands and on wetland margins (which included opportunistic dryland species) as well as woody weed species of the floodplain and riverbed (moisture-dependent and incidental species). In an 'average' year, rather than a severe drought year, we would expect to record substantially more weed species, or larger populations, as well as seasonal, summer-dormant species such as Bridal Creeper (**Asparagus asparagoides* and Soursob *(*Oxalis pes-caprae*) during winter-spring.

7.1.1 Weed management rationale

In the absence of weed management, the indigenous vegetation, indigenous plant species, and much of the fauna habitat values will be lost from the study area. The extent of weed invasions and the threats they pose are extreme in the medium to long-term (several decades). In this section the following are outlined: the weed management rational and strategy and statutory

responsibilities; distribution and population status; invasiveness and risk rating; and generic control methods, as well as priority of control or elimination.

7.1.2 Weed species selection criteria

Of the 76 weed species/taxa recorded in the study area (Appendix 5), 22 species are identified for control or elimination (Table 3). Of these, 14 are trees or shrubs, and eight are perennial, biennial or annual herbs. Lifeforms are given in Table 3. Selection criteria are as follows:

- robust species that are capable (as invaders) of eliminating the indigenous vegetation (including the upper stratum and subordinate strata); these will become structural dominants of the vegetation at various time scales (no time constraint is applied here);
- species whose current populations are so small that their elimination is feasible;
- species with high visual impact because of their size, and discordance with the indigenous vegetation in terms of form, texture or colour of foliage, and species with showy floral displays.

Excluded are numerous species that are ubiquitous or locally abundant members of the ambient weed flora with vast populations, high seed or propagule production, and very effective dispersal; these are all herbaceous species, however they may need to be managed in connection with particular revegetation exercises or management of populations of significant plant species. Effective control of these species is generally not feasible.

The **elimination** of some species is advocated because populations are small enough or the species is so seriously invasive that it poses a major threat, and **control** is advocated for others where populations are very large or the seed rain into the study area is a major ongoing factor. The **containment** approach is also advocated for extremely serious species which are widely distributed and for which elimination is not feasible, in other words they should if possible be kept out of areas they have not yet invaded.

7.1.3 Fauna habitat values and weeds

Weed infestations can provide habitat values for fauna otherwise unavailable in the indigenous flora. This mostly relates to habitats for small birds, notably Superb Fairy-wrens which utilise numerous exotic species for cover, often in the absence of indigenous vegetation and spring shrubs which are the preferred nesting sites of the Red-browed Finch (Briar **Rosa canina* and *R. rubiginosa*). No weed species would be excluded from the targeted list because of its faunal habitat values but weed removal may need to be staged to allow indigenous revegetation to provide appropriate cover, after which the weeds can be removed. For example Hedge Wattle (*Acacia paradoxa*) is ideal nesting habitat for Red-browed Finches in lieu of *Rosa* spp.

7.1.4 Statutory responsibilities

The *Catchment and Land Protection Act 1994* (CALP Act) obliges management agencies and owners to effect control of noxious weed species listed under the Act as ‘Regionally Prohibited’ or

'Regionally Controlled' within the relevant Catchment Management Authority region, in this case the Goulburn Broken Catchment Management Authority. No weed species are listed as 'Prohibited' but four species are listed as regionally 'Controlled' and five are listed as regionally 'Restricted'. Most of these weed species are noxious weeds of agriculture (grazing or cropping systems) and pose little threat to biodiversity values in the context of the study area (numerous other species could be similarly categorised). Other regionally 'controlled' weed species are among the most invasive and destructive identified in this study.

7.1.5 Weeds of National Significance

The Commonwealth Government recently identified and declared 20 weed species as Weeds of National Significance (WONS) (www.weeds.org.au) because of the threat they pose to the economy, biodiversity and other values at a national scale. Under the WONS program national strategies are to be prepared for each species, identifying biology, ecology, threats and control options; several have been published for species occurring in the study area (e.g. Willows **Salix* spp. and Blackberry **Rubus fruticosus* spp. agg.). Five of the weed species/taxa recorded in this study are WONS and most are rated here as highly invasive with a high priority for control. There is no statutory obligation to manage these weeds.

Table 3 Weed species identified for control or elimination, lower Broken River Wetland Survey, March 2007

Life form (mostly after Carr et al. 1992)

A	annual	Gt	tuberous geophyte	S	small to medium shrub
B	biennial	Ls	large shrub	Sa	submergent aquatic
Ea	emergent aquatic	Pr	perennial herb (rhizomatous or stoloniferous)	Ss	subshrub
Fa	floating aquatic	Pt	perennial herb (tufted or tussock-forming)	T	tree
Gb	bulbous geophyte	Pa	parasite	V	vine
Gc	cormous geophyte	Rc	root climber	X	succulent herb, subshrub or shrub
Gr	rhizomatous geophyte				

Noxious weed/WONS

C – listed as a Controlled weed species under the *Catchment and Land Protection Act 1994* for the Goulburn Broken Catchment Management Authority region

R – listed as a Restricted weed species under the *Catchment and Land Protection Act 1994* for the Goulburn Broken Catchment Management Authority region

WONS – Weed of National Significance (www.weeds.org.au)

Distribution and population status

1 widespread, medium to large populations
2 widespread, small populations
3 limited distribution, medium to large populations
4 limited distribution, small populations
5 rare or localised, medium to large populations
6 rare or localised, small populations

Invasiveness and risk rating (in the context of the study area)

1 Highly invasive and a very serious threat to riparian, wetland or upslope vegetation *or* its recruitment
2 Moderately invasive and a serious threat to riparian, wetland or upslope vegetation *or* its recruitment
3 Weakly invasive or a slow invader; a minor threat to riparian, wetland or upslope vegetation *or* its recruitment
4 A minor threat to riparian or upslope vegetation but a species with moderate to high visual impact (life form, foliage and/or flowers)

Control method(s)

A Herbicide treatments
1 Herbicide applied to foliage with spray, wick applicator, etc.; annuals must be sprayed well before seed ripening.
2 Cut down and concentrated herbicide immediately applied to stump or stems, or bark "frilled" and herbicide applied.
3 Stem drilled and injected with concentrated herbicide.
B Physical treatments
4 Physical removal – most plants can be physically removed by hand-weeding or with tools when small and/or isolated but soil disturbance is kept to a minimum.
5 Cut off at ground level (species that will not resprout from basal buds).
6 Cut leaves and flowering stems below water to starve rhizome of oxygen (*Typha* ssp.).
7 Cut off near ground level and the vigorous resprouts/shoots then sprayed with herbicide.
8 Ringbarking.

Control priority (for existing populations and future colonisation)

1 – high priority, 1-5 year time frame
2 – moderate priority, 6-10 year time frame
3 – low priority, 10+ year time frame
C – control weed populations in designated areas (note that different criteria indicating control may apply in different zones or situations)
E – eliminate all populations in all zones

Species	Common name	Family	Life form	Listed species		Distribution and population status	Invasiveness and risk rating				Control (C) / Eliminate (E)	Control methods	Priority
				WONS	CALP Act		1	2	3	4			
Acer negundo	Box-elder Maple	Aceraceae	T	–	–	2	1				E	2/3	1
Asparagus asparagoides	Bridal Creeper	Asparagaceae	Gt	✓	R	?2	1				E	1	1
Asparagus officinale	Asparagus	Asparagaceae	Gr	–	–	4		2			E	1	1
Fraxinus angustifolia var *angustifolia*	Desert Ash	Oleaceae	T	–	–	2	1				E	2/3	1
Gladiolus undulatus	Wild Gladiolus	Iridaceae	Gc	–	–	?6	1				C	1	1
Marrubium vulgare	Horehound	Lamiaceae	Pt	–	C	6			3		C	1	2
Melia azedarach	White Cedar	Meliaceae	T	–	–	6			3		E	2/3	2
Nassella neesiana	Chilean Needle-grass	Poaceae	Pt	✓	–	?5	1				C	1	1
Opuntia monacantha	Drooping Prickly-pear	Cactaceae	X	–	R	6		2			E	3	1
Phalaris aquatica	Phalaris	Poaceae	Pt	–	–	1	1				C	1	1
Phoenix canariensis	Canary Island Date-palm	Arecaceae	T	–	–	6			3		E	5	2
Prunus cerasifera	Cherry Plum	Rosaceae	T	–	–	6			3		C	2/3	2
Prunus persica	Peach	Rosaceae	T	–	–	6				4	C	2/3	2
Rosa canina	Dog Rose	Rosaceae	Ls	–	–	2	1				C	1, 2/3	1
Rosa rubiginosa	Sweet Briar	Rosaceae	Ls	–	C	2	1				C	1, 2/3	1
Rubus anglocandicans	Blackberry	Rosaceae	Ls	✓	C	6	1				E	1	1
Sagittaria ?brevirostra	Arrowhead	Alismataceae	Ea (Pr)	–	–	?6	1				E	1	1
Salix babylonica	Weeping Willow	Salicaceae	T	–	R	?6	1				E	2/3	1
Salix x *rubens*	Basket Willow	Salicaceae	T	✓	R	4	1				E	2/3	1
Salix x *sepulcralis* nothovar. *sepulcralis*	Weeping Willow	Salicaceae	T	✓	R	4	1				E	2/3	1
Schinus molle	Pepper Tree	Anacardiaceae	T	–	–	4			3		C	2/3	3
Xanthium strumarium	Noogoora Burr	Asteraceae	A	–	C	6	1				C	1,4	1

In Table 3 we give data of management implications in several fields:

i Distribution and population status in the study area;

ii Invasiveness and risk rating in the study area;

iii Whether the species should be controlled or eliminated; and

iv Generic control methods for the species concerned.

For any particular wetland a formal weed management plan would need to be prepared, taking into account factors such as: land tenure and management agency/landowner(s); suite of weed species present and their local distribution or population status; whether species should be controlled or eliminated; appropriate means of control (e.g. physical, mechanical, chemical); identification of assured funding for the duration of the project; and time lines and performance criteria. It is also the case that the distribution and population status of some weed species needs to be further evaluated before sensible management plans can be devised, that is if the species is tractable. For example, Arrowhead (**Sagittaria ?brevirostra*) (Plates 36 and 37), an extremely serious aquatic weed species it is likely to be restricted in distribution; we recorded a fairly small population in an irrigation channel at Dookie Agricultural College's Dairy Farm (Wetland Site 235 and 236). Another weed species requiring survey is Wild Gladiolus (**Gladiolus undulatus*) found in one location (Wetland Site 211). While a very serious weed species, it is extremely difficult to manage, if not intractable; the feasibility of control can only be evaluated with further data. It is a summer-dormant species and must be surveyed in winter-spring.

The seriously invasive tree weed species, Willows (**Salix* taxa), Box-elder Maple (**Acer negundo*) and Desert Ash (**Fraxinus angustifolia* var *angustifolia*) essentially occur only along the river where propagules (seeds, branches) are dispersed by water (Plates 38 and 39). No population level of these species can be tolerated on the river or its wetlands, however the difficulty of eliminating the sources (mostly planted, and naturalised widely, in Benalla) while highly desirable is probably too difficult – unless these are declared as prohibited weed species in the new version of the *Catchment and Land Protection Act* weed list, currently being prepared.

It is also the case that some of the source-populations for weed species (e.g. **Fraxinus angustifolia* var *angustifolia*, **Acer negundo*, **Melia azedarach*, **Schinus molle*, **Prunus* spp.) are cultivated in gardens on farms and as public amenity plantings. Elimination of such cultivated sources is also highly desirable but would only be undertaken for seriously invasive species such as **Fraxinus angustifolia* var *angustifolia* and **Acer negundo*, and not for example for **Melia azedarach*.

Plate 36 Arrowhead (**Sagittaria ?brevirostra*) growing in an irrigation channel at Dookie Agricultural College's Dairy Farm, near Wetland Sites 235 and 236. This is amongst the 6 most serious aquatic weeds in Australia (February 2006).

Plate 37 Close-up of Arrowhead (**Sagittaria ?brevirostra*) flowers (February 2006).

Plate 38 Saplings of Box-elder Maple (**Acer negundo*) growing along the Broken River. These are dispersed downstream from cultivated/naturalised sources in Benalla. It is one of the most serious of riparian weed species (February 2007).

Plate 39 Weeping Willow (**Salix* X *sepulcralis* nothovar *sepulcralis*) and Basket Willow (**Salix rubens* X *rubens*) on the Broken River. The Basket Willow is heavily browsed by possums (February 2007).

7.2 Grazing

Stock grazing and browsing (sheep and cattle, horses, goats) and to a lesser extent grazing/browsing by feral and native animals (rabbits, hares, Eastern Grey Kangaroo and Black Wallaby) is a major management issue. These introduced and native animals have had, and continue to have, a profound impact on vegetation, fauna habitats and ecosystem function. Impacts, from historical to contemporary times, and largely by cattle, include:

- elimination or severe modification of indigenous vegetation cover and indigenous species composition in favour of exotic species (especially herbs);
- extinction of numerous plant and animal species (the latter directly or indirectly by habitat elimination or modification);
- pugging (sometimes severe) of wetlands and other mechanical damage to soils and vegetation;
- soil compaction, and erosion caused by stock breaking down banks of wetlands, stream channels or the Broken River;
- increased nutrient input (faeces and urine of cattle);
- facilitation of weed invasion by soil disturbance and creation of mineral earth seed-beds;
- spread of weed propagules (mostly seeds) externally and internally in faeces;
- promotion of populations of unpalatable weed species by selectively grazing palatable species which would otherwise compete with weeds.

The effects of stock grazing (DNRE 1996) may vary with:

- the season;
- duration of grazing;
- type(s) of stock;
- stocking rate(s);
- the vegetation type(s); and
- climatic conditions.

While the impacts of grazing have been profound and the single most important influence on biodiversity, hydrological and water quality at landscape scales, stock grazing has produced ecosystem transformations such that a new and very different set of environmental conditions prevail. In many cases cessation of stock grazing, intuitively the 'correct' management intervention, may be undesirable because weed populations – otherwise kept in check by stock – may rebound with adverse consequences. We refer particularly to the robust grass Phalaris (**Phalaris aquatica*) which is abundant on the floodplain. It is preferred by cattle which keep its biomass and reproductivity suppressed. If stock are excluded at sites where Phalaris is a component of the vegetation it may become the dominant understorey of the floodplain to the edge

of the outer zone of wetlands. Phalaris invasion of this kind would result in the direct elimination of much of the remnant indigenous herbaceous vegetation of the floodplain and wetland margins and prevent recruitment of indigenous vegetation (Plate 40). This is a widespread phenomenon, locally and regionally where stock are excluded, particularly road reserves. Very high fuel loads would also result, such that the intensity of uncontrolled fire may be harmful to indigenous vegetation, its recruitment, and also faunal habitats.

A very useful review and summary of livestock grazing impacts and the applicability of stock grazing in wetlands was published by DNRE (1996) in the *Manual of Wetlands Management*. The authors point out that grazing impacts can be deleterious (as noted above) as well as beneficial, as even hoofed animals may be more 'natural' than no grazing. In the situations where stock grazing causes deleterious impacts they are part of a suite of degradation processes. They reinforce the important point that wetlands cannot be restored to any state approximating the natural pre-European conditions (which in any case are unknown but not difficult to infer based on the biology and ecology of species in the wetland flora). The charges resulting from grazing are not readily reversible and the removal of grazing may result in dominance within wetlands by one or few indigenous wetlands species (e.g. Common Reed, *Phragmites australis*) unless:

- the natural hydrological regime prevails;
- there is a local or proximate supply of propagules of indigenous plant species (for recolonisation);
- the composition of the weed flora is favourable, i.e. there are no seriously invasive weed species present (not the case in the lower Broken River study area); and
- there has been no significant increase in soil and water nutrient levels (DNRE 1996).

Modifications within the lower Broken River study area in respect to the above conditions seem particularly unfavourable for restoration of wetland values.

The authors of the *Manual of Wetland Management* (DNRE 1996) point out the management of wetlands should aim to minimise the adverse effects of degrading processes, including grazing. Where this is not practicable it may be necessary to maintain wetlands under 'opposing artificial influences' (of which stock grazing may be one); livestock grazing however may be part of the management 'mix'.

While stock grazing of wetlands is a potentially useful management tool, very little scientific information is available regarding wetland grazing management, and there are very few examples of livestock being used to manage wetlands for conservation values (DNRE 1996); the objectives of grazing may include: habitat manipulation (vegetation structure and composition), fuel reduction, control of pest animal habitat (e.g. cover for feral animals) and control of weeds (DNRE 1996).

Guidelines are given in the *Manual of Wetlands Management* (DNRE 1996) for determining the appropriateness of grazing in wetland management at a given site. Considerations include: current

and recent grazing history (and we would include long-term grazing history); determining the grazing regime; palatability of plant species; determining grazing-sensitive sites and species; type of livestock; stocking rates; timing of grazing; managing other degrading agents and processes; fencing; and access to water (for stock).

Implicit and explicit in these guidelines are the potential logistic and technical difficulties in managing grazing in wetlands and the necessity of appropriate documentation and monitoring (which ideally includes collection of quantitative data). Monitoring procedures are outlined, including timing, use of grazing exclosures, collection of baseline data, repeat sampling (of vegetation) and using the monitoring data in decision making.

The impacts of indigenous grazing and browsing animals – Eastern Grey Kangaroos and Black Wallabies – on vegetation in the study area have not been evaluated, but in other contexts elevated kangaroo numbers have proved disastrous to biodiversity and environmental values; this is most unlikely to be the case in the study area. Only minor amounts of kangaroo dung were observed and only a few fairly small flocks of animals were observed which suggests that kangaroos are not problematic.

Black Wallaby numbers are obviously very low and these animals do not constitute a management issue, except for potential revegetation; they may have deleterious impacts as browsers of planted or naturally recruited shrubs.

Rabbit and hare numbers are unknown but they are widespread and may be a localised problem. However, control can only be justified as part of a much larger control program which would need to be ongoing. Where revegetation is undertaken, guards may need to be used to protect young plants.

In situations where fencing is required to exclude stock, its location is an important issue. Fencing is typically located on the edge of the upper terraces outside normal floodlines because of the risk to fences posed by floods. Several landowners commented on the inadvisability of locating fences to exclude stock from individual wetlands, and reported extensive loss of fences, most recently in the 1 in 100 year flood event of Spring 1993 in the catchment of the Broken River

Plate 40 A striking cross-fence grazing comparison: the sheep-grazed foreground vegetation is dominated by indigenous Wallaby-grasses (*Austrodanthonia* spp.) whereas full cover of Phalaris occurs in the background, illustrating the effects of excluding sheep (Lake Mokoan, January 2006). Such Phalaris invasion is predicted on the Broken River if stock is excluded.

7.3 Recruitment of indigenous plant species

The quality or condition of indigenous vegetation on the floodplain (cf. wetlands which are much more resilient) indicates a massive decline in the indigenous flora, such that most non-wetland vegetation is essentially exotic. For the greater part no management intervention is possible or feasible to reverse this situation, other than to prevent invasion of the weed species identified in Section 7.1, Table 3 (and others – 'new species' – which may appear or were not detected in this survey.

Decline in populations of woody species (trees and shrubs) is a much more tractable management issue which can be addressed by revegetation. In particular River Bottlebrush (*Callistemon sieberi*) (Plate 35) would have been abundant but it is in serious decline and the long-term trajectory is extinction – as evidenced by the age-structure of the meta-population – because of mortality of old trees and failure of recruitment (the result of weed invasion, cattle grazing and hydrological modifications). Another species, the shrub Varnish Wattle (*Acacia verniciflua*) is extremely rare and only one plant was seen. It is unquestionable that some species have been driven to extinction e.g. River Tea-tree (*Leptospermum oboratum*).

7.4 Rare and threatened plant species

Several rare or threatened plant species were recorded as well as regionally significant species (Section 5, Table 1). Ostensibly the most significant of these species is the EPBC Act listed Floating Swamp Wallaby-grass which is rated as nationally vulnerable. No species management intervention is required for this species which was recorded from numerous wetlands as a dominant or co-dominant in its respective wetland zone or EVC. The species is highly resilient to stock grazing (Carr 2005) and within the study area only wants for water.

No particular management intervention is identified here for other state or regionally significant species, however, management intervention may be required for some significant species such as the rare Sand Rush (*Juncus psammophilus*). Assisted recruitment of species such as River Bottlebrush (*Callistemon sieberi*) (see above) is advocated.

7.5 Revegetation

Wetland vegetation is highly resilient to disturbance and hydrological change; moreover aquatic and amphibious species are highly mobile and most are adapted to dispersal by seed transported by waterfowl (internally or externally), or in a few species, wind is the dispersal mechanism (e.g. Cumbungi, *Typha* spp.). Thus, if a plant species is lost from a particular wetland as a result of drought, and soil-stored seed-banks are absent, it has a good chance of being reintroduced when favourable conditions are restored. We therefore do not advocate revegetation of wetland species (except on new, constructed wetlands) in the study area, although some strategic re-introductions (species enrichment planting) may be appropriate in future.

There is limited scope for revegetation of dryland vegetation, because recruitment of eucalypts and Silver Wattle (*Acacia dealbata*) on the floodplain mostly seems adequate; however assisted recruitment of River Bottlebrush and other species is appropriate (see Section 7.3).

7.6 Eutrophication from irrigated pastures or crops upslope

Eutrophication of the Broken River, its floodplain wetlands and other waterbodies in the region (e.g. Lake Mokoan) is a widespread and large-scale catchment-wide phenomenon resulting from agricultural and urban land-uses. During this study we noted several locations where irrigation of crops or pastures on high-level terraces or plains above the floodplain causes nutrient-rich water to percolate into adjacent wetlands at a lower level on the floodplain (Plate 41). Lush growths of weeds result, notably the seriously invasive Water Couch (**Paspalum distichum*) which appears to be competitively excluded in most wetlands in the absence of demonstrable eutrophication, for example by Moira Grass (*Pseudoraphis spinescens)*. There seems to be no management intervention available to counter this localised problem.

7.7 Hydrological management

All ‘wetlands’ we documented were dry because of the combined effects of severe drought and (we assume) river regulation. The need to reinstate flooding was the overwhelming important management action identified, that is allocation of environmental flows on the lower Broken River by the management agencies. If the water allocations were of sufficient amplitude all floodplain wetland would benefit, not just a suite of the larger or otherwise significant wetlands.

Plate 41 Nutrient enrichment of wetlands from irrigated cropping on the high-level river terrace. The exotic Water Couch (**Paspalum distichum*) (bright green) is now dominant.

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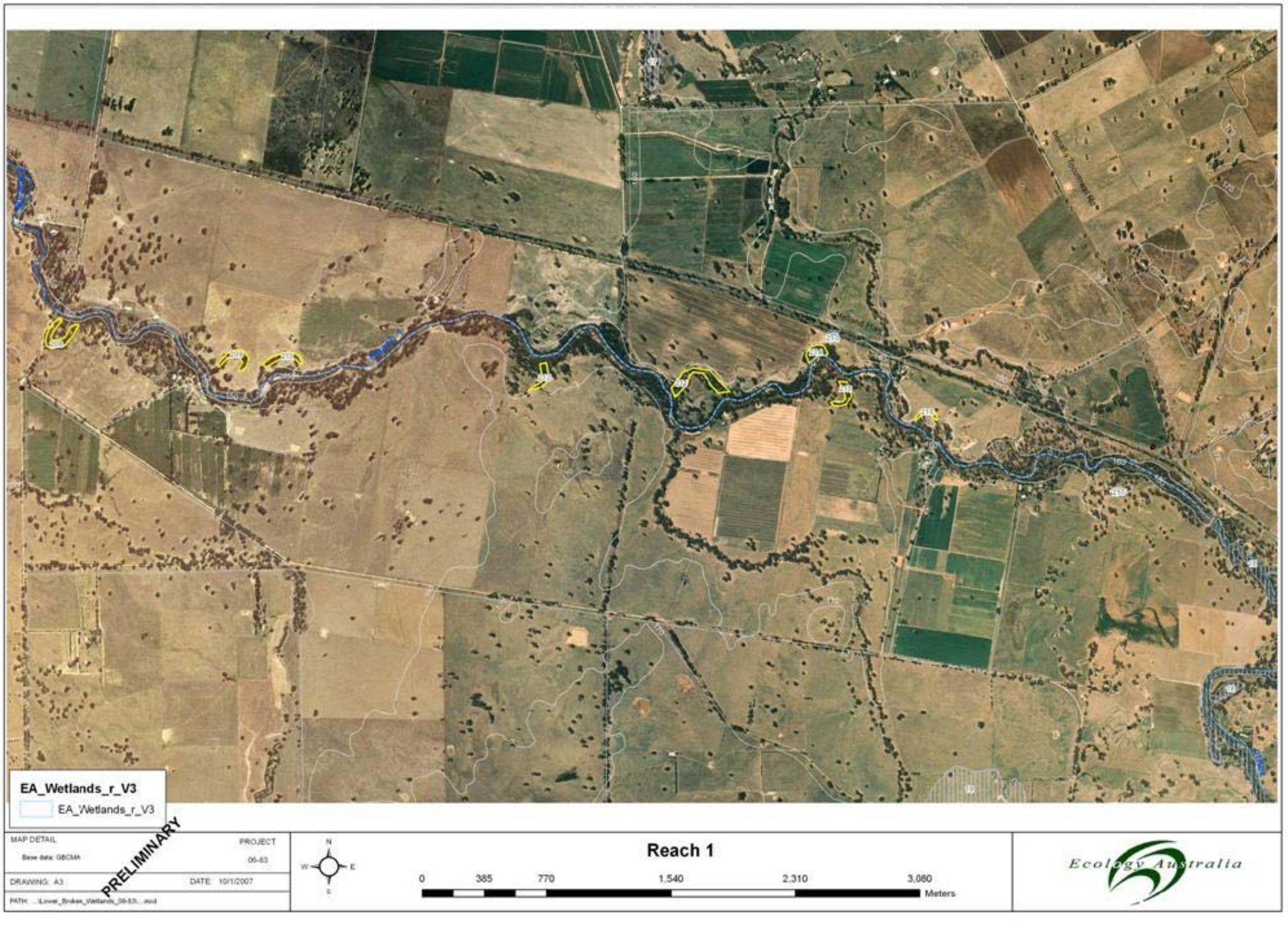
Appendix 1 Wetlands identified from digital imagery and spatial databases

The following nine figures (labelled Reach 1-9) show the location of the approximately 230 wetlands identified from digital imagery (aerial photography) and spatial databases (WETLANDS_1994, WETLANDDIR, PLMMT100PLY and HYDRO25). The reaches are sections of the Broken River roughly equivalent in length. They are numbered from east to west (Reach 1 begins at Casey's Weir, Reach 9 ends at the Goulburn River confluence in Shepparton).

From the original list only 29 wetlands were assessed in the field. The locations of some wetlands were visited but either no wetland was present or the hydrological feature found was not considered a wetland (in the following figures these 'absent' wetlands are numbered 79, 103, 104, 105, 108, 110, 111, 115, 199, 202). Overall the desktop identification was quite accurate.

Some wetlands were renumbered following the field assessment. The following table lists those wetlands that changed number following field assessment:

Wetland number in report	Original wetland number as shown in Reach Figures
200	201
201	201
232	Not identified from digital imagery and spatial databases – found in field
233	109
234	117
235	126
236	126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06-83
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W
E
S
Reach 1
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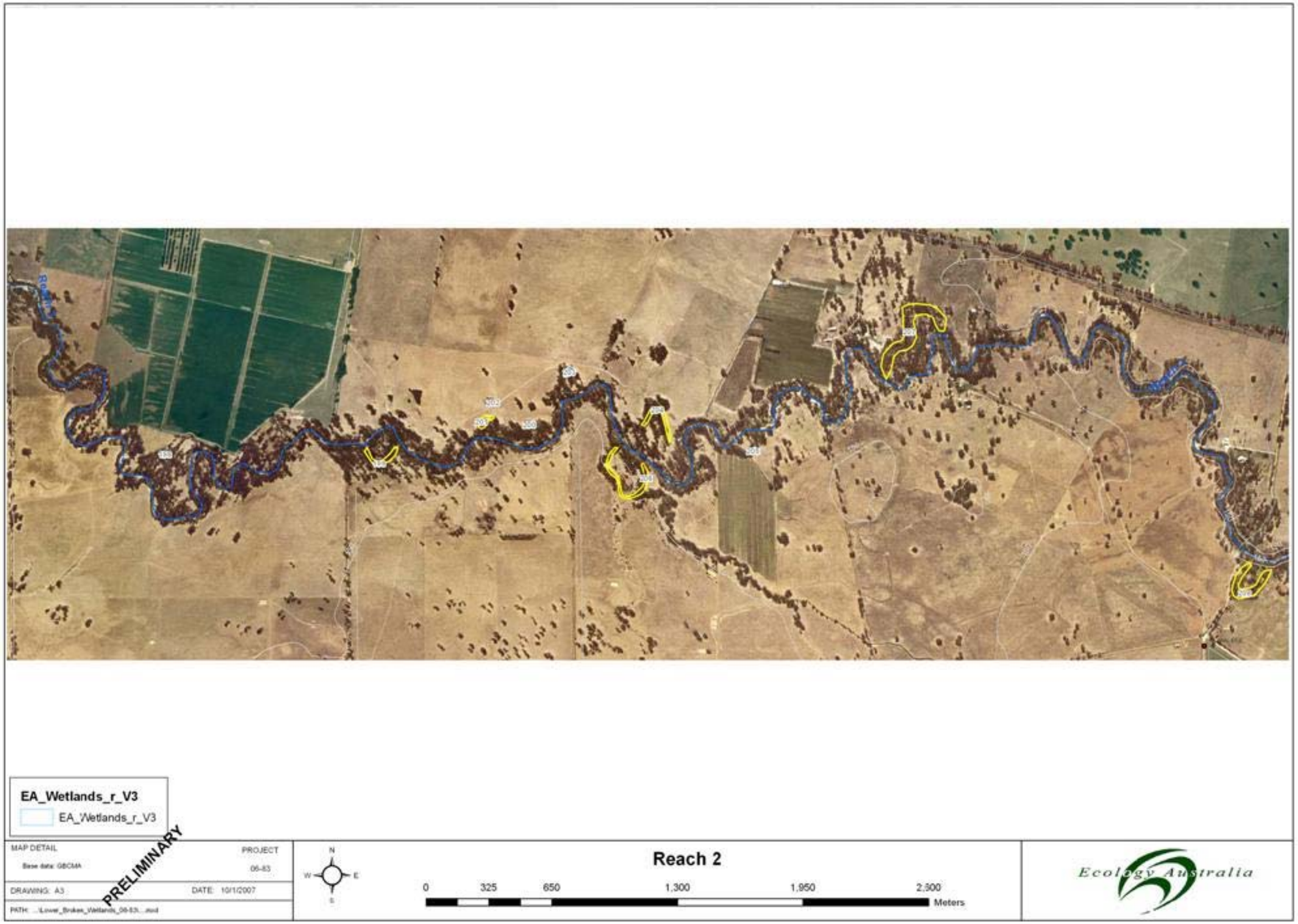
385
770
1,540
2,310
3,080
Meters
Ecology Australia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W
E
S
Reach 2
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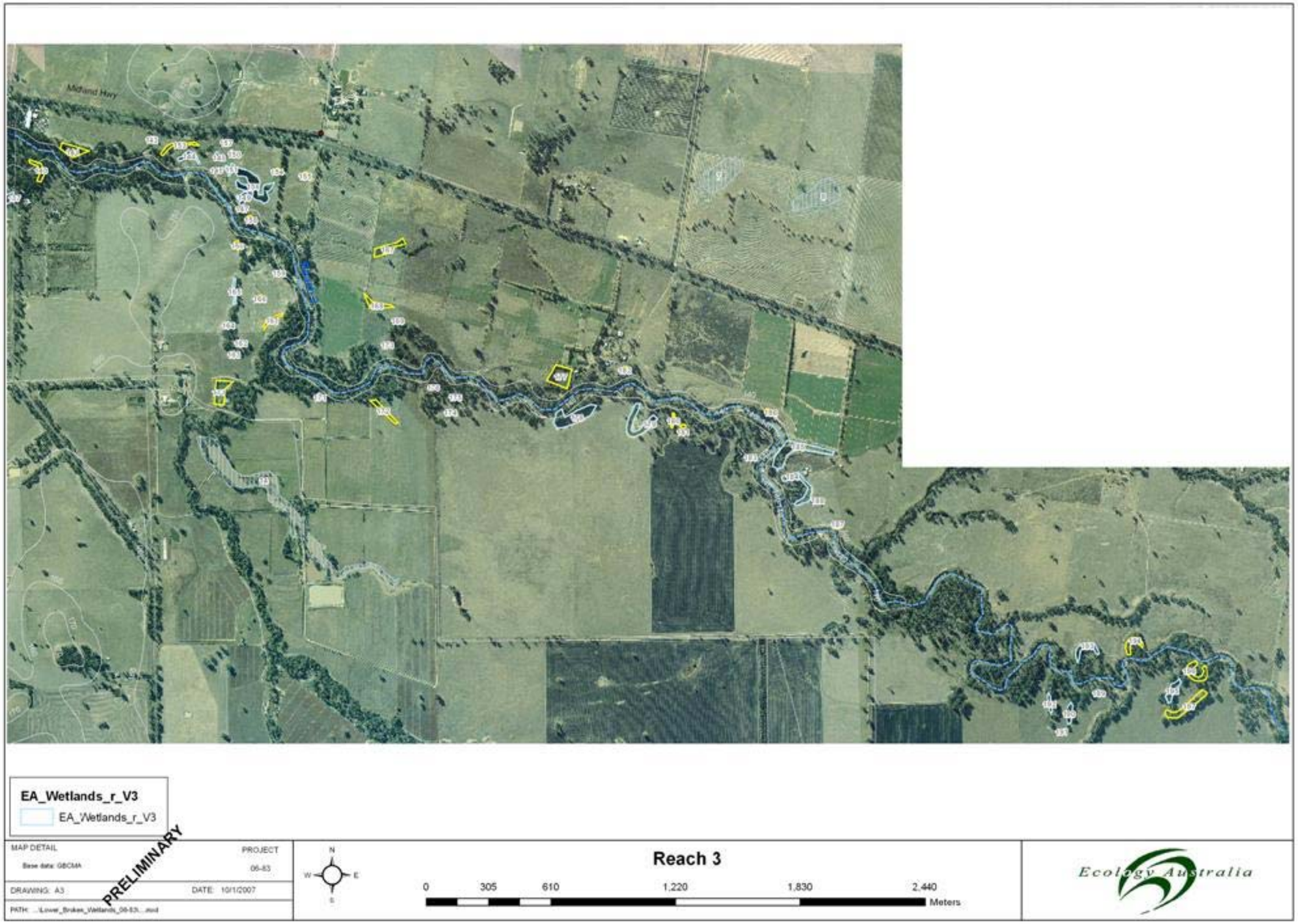
325
650
1,300
1,950
2,600
Meters
Ecology Australia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S
Reach 3
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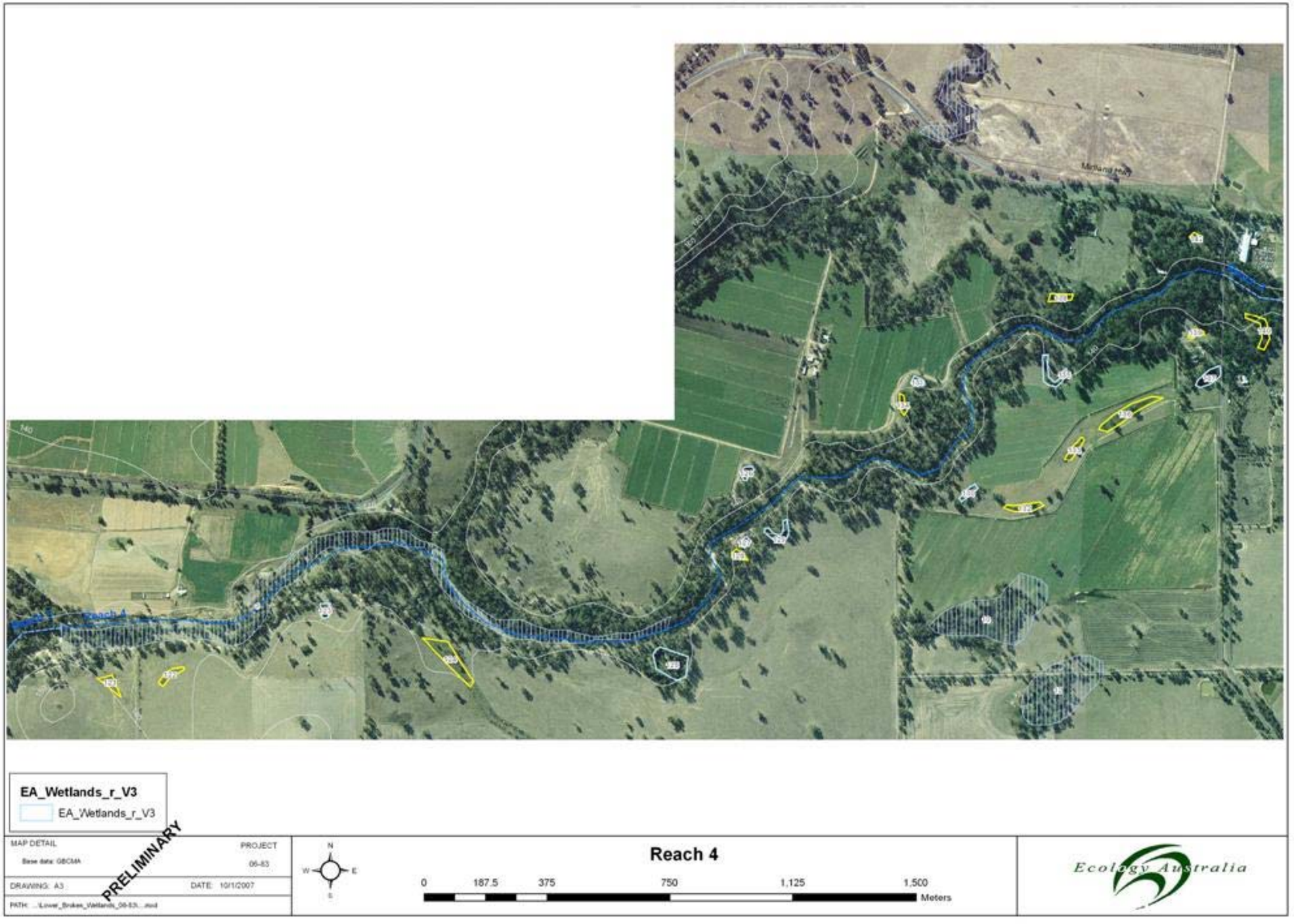
1,220
1,830
2,440
Meters
Ecology Australia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W
E
S
Reach 4
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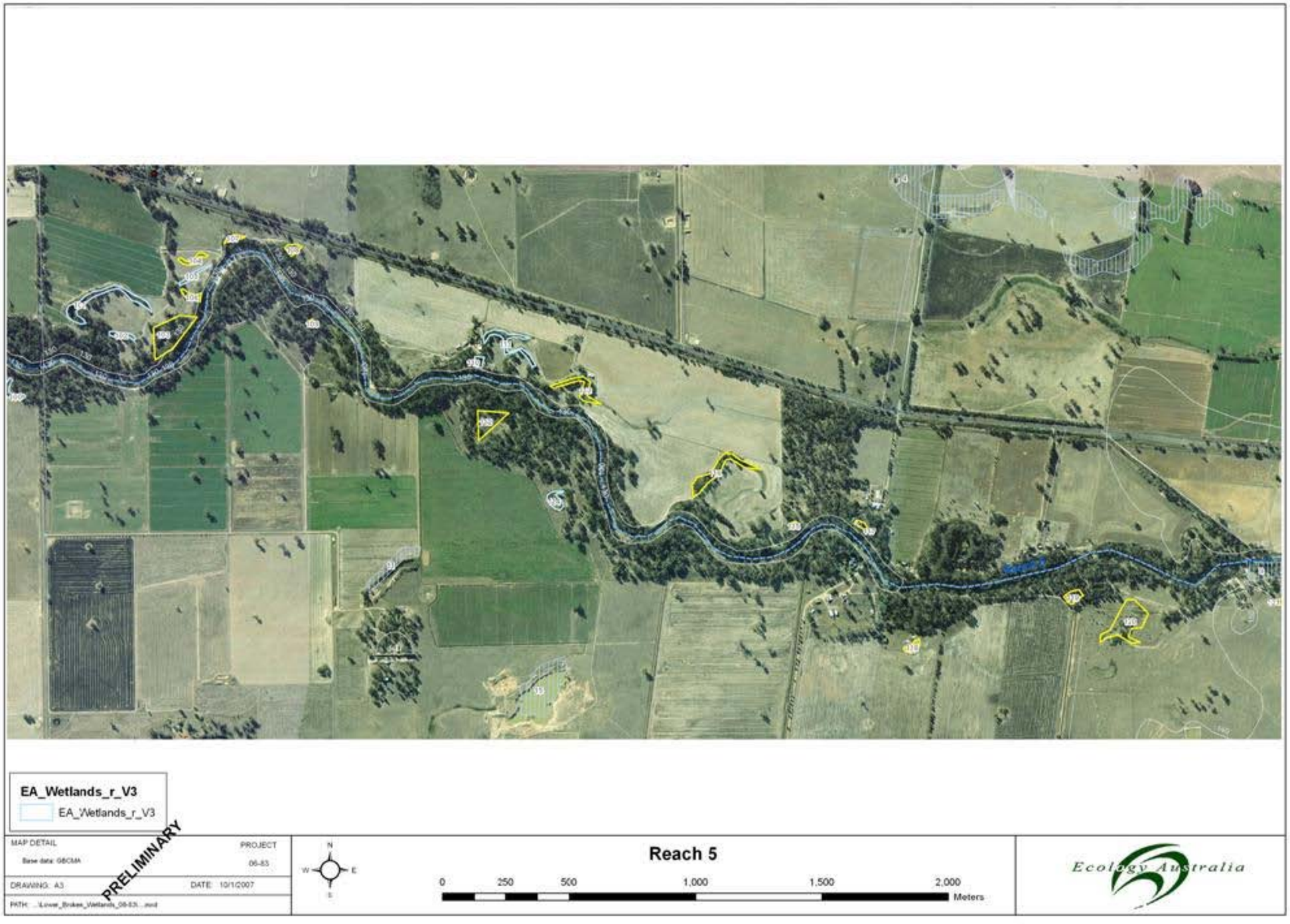
187.5
375
750
1,125
1,500
Meters
Ecology Australia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Reach 5
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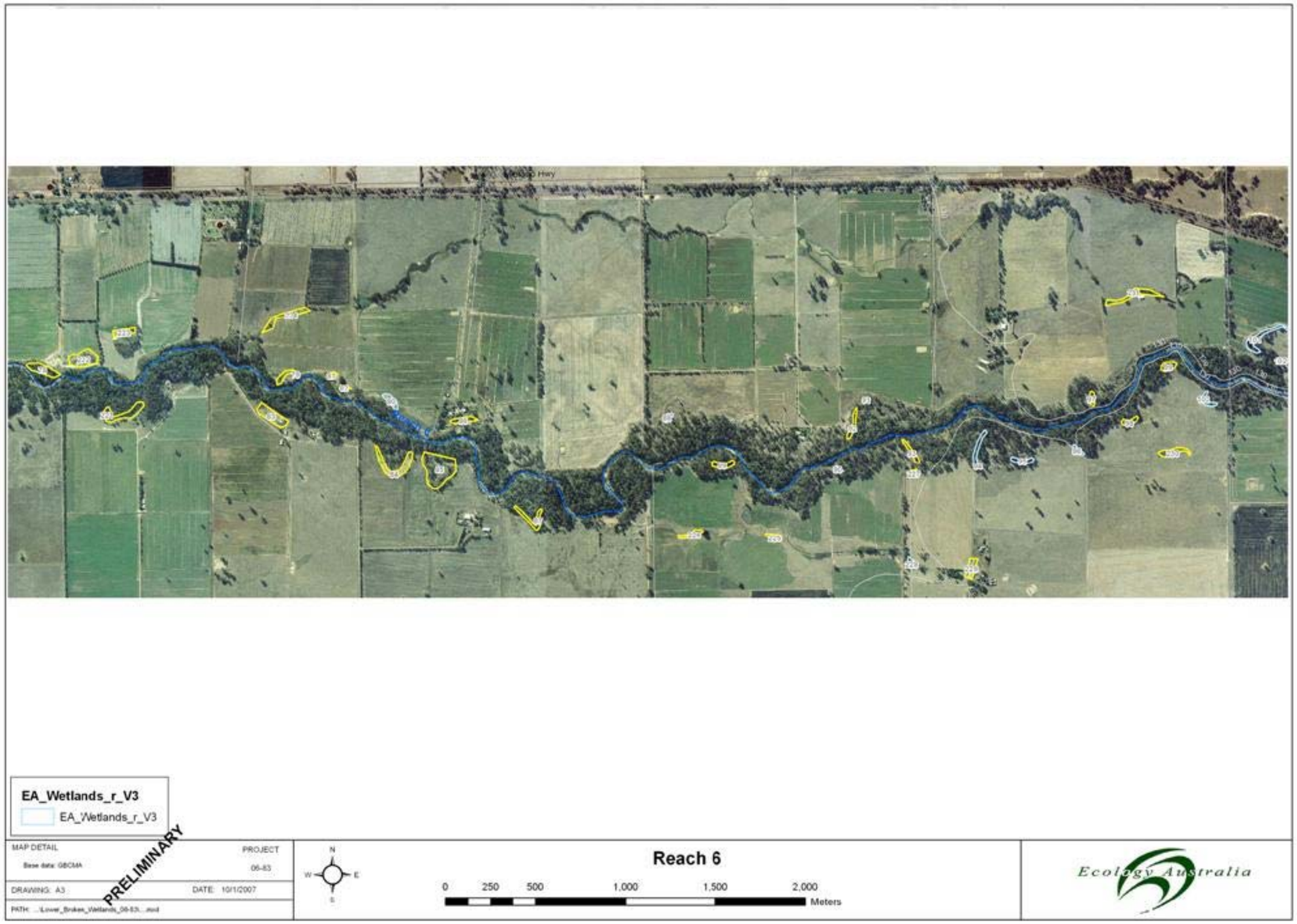
250
500
1,000
1,500
2,000
Meters
Ecology Australia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PRELIMINARY
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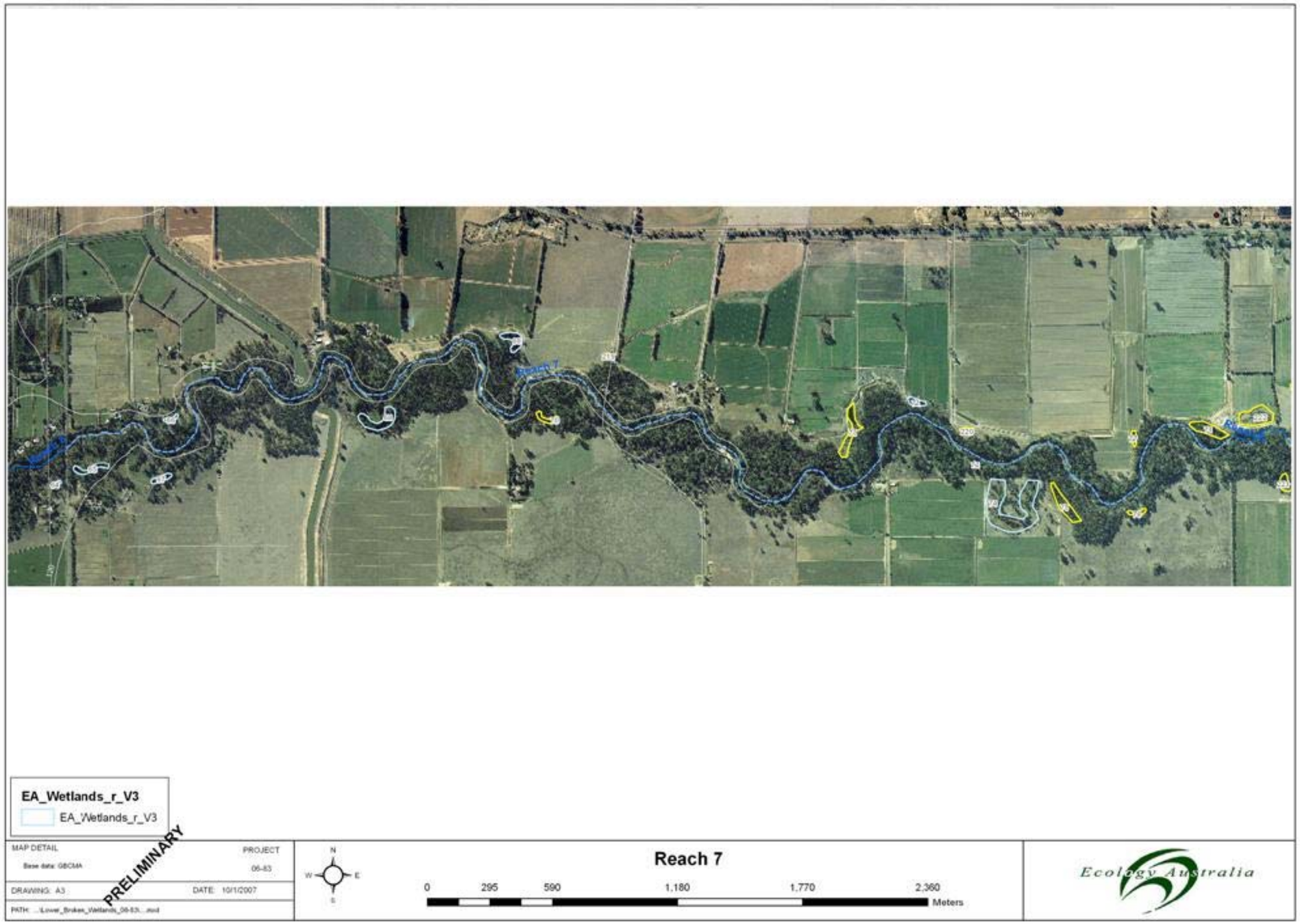
Reach 6
0 250 500 1,000 1,500 2,000
Meters
Ecology Australia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S
Reach 7
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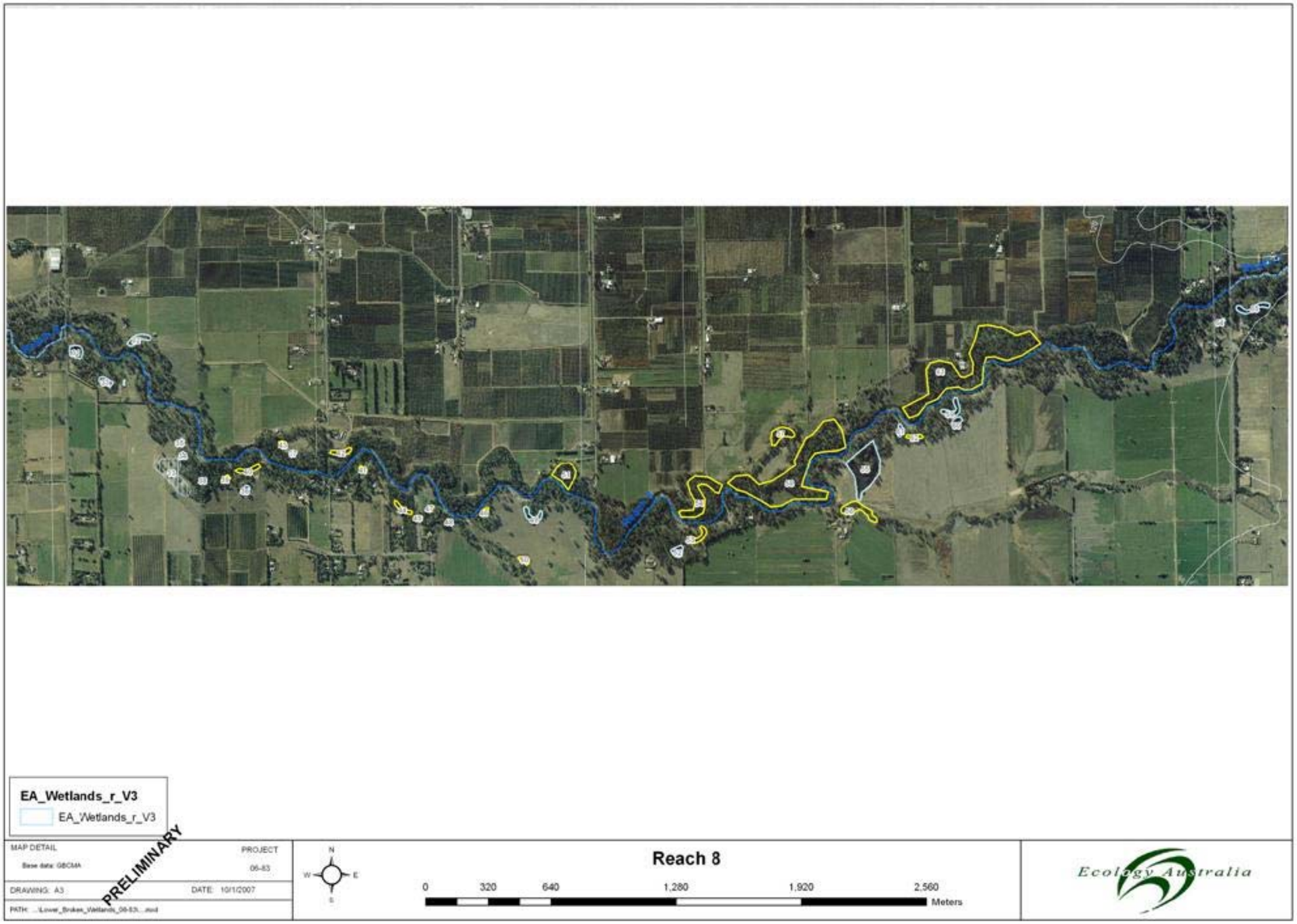
590
1,180
1,770
2,360
Meters
Ecology Australia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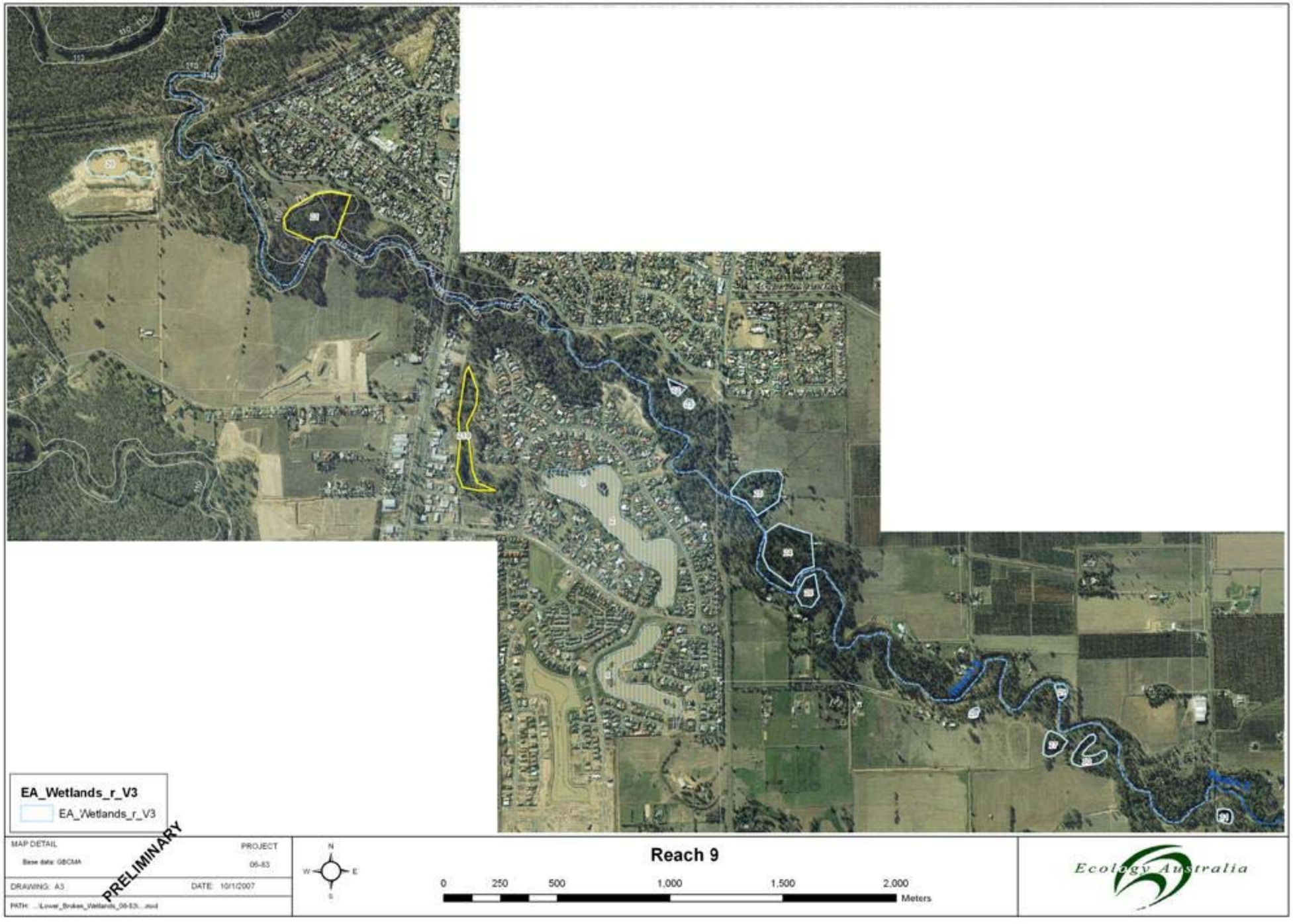
Meters
Ecology Australia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PRELIMINARY
N
W
E
S
Reach 9
0
250
500
1,000
1,500
2,000
Meters
Ecology Australia

Appendix 2 Victorian Wetland Classification System3

Category		Sub Category	Depth (m)	Duration of Inundation
1	Flooded River Flats		<2	<1 mth
2	Freshwater Meadows		<0.3	<4 mths
2.1		herb dominated		
2.2		sedge-dominated		
2.3		Red Gum-dominated		
2.4		lignum-dominated		
2.5		Black Box-dominated		
2.6		Cane Grass-dominated		
3	Shallow Freshwater Marshes		<0.5	<8 mths
3.1		herb dominated		
3.2		sedge-dominated		
3.3		Cane Grass-dominated		
3.4		Red Gum-dominated		
3.5		Black Box-dominated		
3.6		dead timber		
4	Deep Freshwater Marshes		<2	permanent
4.1		shrub-dominated		
4.2		reed-dominated		
4.3		sedge-dominated		
4.4		rush-dominated		
4.5		open water		
4.6		Cane Grass-dominated		
4.7		lignum-dominated		
4.8		Red Gum-dominated		
4.9		dead timber		
4.1		Black Box		
5	Permanent Open Freshwater			permanent
5.1		Shallow	<2-3	
5.2		Deep	>2-3	
5.3		Impoundments		
5.4		Red Gum-dominated		
5.5		Cane Grass		
5.6		dead timber		
5.7		Black Box		
5.8		rush		
6	Semi-permanent Saline Wetland		<2-3	< 8 mths
6.1		salt pan		
6.2		salt meadow		
6.3		salt flats		
6.4		sea rush dominated		
6.5		hypersaline lakes		
6.6		Melaleuca		
6.7		dead timber		
7	Permanent Saline Wetlands			permanent
7.1		shallow	<2-3	
7.2		deep	>2-3	
7.3		intertidal flats		
20	Sewage Ponds			
21	Salt Works			

Appendix 3 Field Proforma

Goulburn Broken CMA Lower Broken River Wetland Assessment – Ecology Australia

Site number……..…..Wetland Condition Assessment Sheets Completed (no.)……
Date……..Recorder(s)..……
GPS coordinates (Datum = GDA)…E……N……..…..……..Accuracy……
Location (incl. road and dist. and direction from nearest town)

Wetland name?
Altitude……..Waypoint no(s)……Photographs……

Wetland category:……...……
Subcategories present:……...……
Ecological Vegetation Class(es):……..
……
……
……
……
Water: % Mud: % Damp Soil: % Dry: %
Water depth……**Maximum potential water depth**……
Approximate area……
Land tenure and manager: ……..
Land use(s):……..……
Land management issues:
Altered hydrological regime ☐ Erosion ☐ Run-off ☐ Stock grazing ☐ Other ☐

Dominant indigenous flora species and zonation:……..……
……
……
……
……
Significant indigenous flora species:...……
……
……
Tree species:……
……

Tree health: poor ☐ average ☐ good ☐ dead ☐ NA ☐

Associated dryland vegetation:
Predominantly indigenous ☐ Mixed indigenous/exotic ☐ Predominantly exotic ☐
Connectivity to native vegetation ……
……
……
Significant/dominant weed species: ……
……
……
……
Significant fauna species/habitat: …… …….. ……
……
……
……

Threatening processes/Management issues (ranked):

1.……

2.……

3.……

4.……

5.……

6.……

Priority management actions (ranked):

1.……

2.……

3.……

4.……

5.……

6.……

Additional notes:……

Appendix 4 Indigenous plant species recorded during the field survey (incidental list)

Species in bold are considered significant.

Acacia dealbata subsp. *dealbata*	Silver Wattle
Acacia verniciflua	Varnish Wattle
Alisma plantago-aquatica	Water Plantain
Alternanthera denticulata	Lesser Joyweed
Alternanthera cf. *nodiflora*	Common Joyweed
Amphibromus fluitans	**River Swamp Wallaby-grass**
Amphibromus nervosus	Common Swamp Wallaby-grass
Amyema miquelii	Box Mistletoe
Austrodanthonia caespitosa	Common Wallaby-grass
Austrodanthonia duttoniana	Brown-back Wallaby-grass
Austrodanthonia racemosa var. *racemosa*	Stiped Wallaby-grass
Austrostipa sp.	Spear-grass
Azolla filiculoides	Pacific Azolla
Bolboschoenus medianus	Marsh Club-sedge
Bothriochloa macra	Red-leg Grass
Callistemon sieberi	**River Bottlebrush**
Carex appressa	Tall Sedge
Carex bichenoviana	Plains Sedge
Carex inversa	Knob Sedge
***Carex* sp. (rhizomatous)**	**Sedge**
Carex tereticaulis	Poong'ort
Centipeda cunninghamii	Common Sneezeweed
Centipeda elatinoides	Elatine Sneezeweed
Chenopodium pumilio	Clammy Goosefoot
Chloris truncata	Windmill Grass
Cynodon dactylon var. pulchellus	**Native Couch**
Cyperus exaltatus	Tall Flat-sedge

Cyperus gunnii	Flecked Flat-sedge
Cyperus lucidus	Leafy Flat-sedge
Dysphania glomulifera* ssp. *glomulifera	**Globular Pigweed**
Eleocharis acuta	Common Spike-sedge
Eleocharis gracilis	**Slender Spike-sedge**
Eleocharis pusilla	Small Spike-sedge
Elymus multiflorus	**Short-awned Wheat-grass**
Elymus scaber	Common Wheat-grass
Enteropogon acicularis	Spider Grass
Epilobium hirsutum	Great Willow-herb
Eragrostis brownii	Common Love-grass
Eragrostis diandra	Close-headed Love-grass
Eragrostis parviflora	Weeping Love-grass
Eucalyptus camaldulensis	River Red Gum
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
Glinus oppositifolius	**Slender Carpet-weed**
Glossostigma sp.	Mud Mat
Hemarthria uncinata var. *uncinata*	Mat Grass
Isolepis cernua	**Nodding Club-sedge**
Isolepis inundata	**Swamp Club-sedge**
Juncus amabilis	Hollow Rush
Juncus bufonis	Toad Rush
Juncus pallidus	Pale Rush
Juncus psammophilus	**Sand Rush**
Juncus sarophorus	Broom Rush
Juncus semisolidus	Plains Rush
Juncus sp.	Rush
Juncus subsecundus	Finger Rush
Lachnagrostis filiformis s.l.	Common Blown-grass
Lachnagrostis filiformis var. 1	Common Blown-grass

***Lachnagrostis filiformis* var. 2**	**Wetland Blown-grass**
Lomandra longifolia ssp. *longifolia*	Spiny-headed Mat-rush
Ludwigia peploides subsp. *montevidensis*	Clove-strip
Lythrum hyssopifolia	Small Loosestrife
Microlaena stipoides	Weeping Grass
Muellerina eucalyptoides	Creeping Mistletoe
Myriophyllum crispatum	Upright Water-milfoil
Oxalis perennans	Grassland Wood-sorrel
Panicum decompostium* var. *decompositum	**Native Millet**
Paspalidium jubiflorum	Warrego Summer-grass
Persicaria decipiens	Slender Knot-weed
Persicaria hydropiper	Water Pepper
Persicaria lapathifolia	Pale Knotweed
Persicaria prostrata	Creeping Knotweed
Phragmites australis	Common Reed
Poa labillardierei var. *labillardierei*	Common Tussock-grass
Polygonum plebeium	Small Knotwed
Potamogeton sp.	Pondweed
Pseudognaphalium luteoalbum	Jersey Cudweed
Pseudoraphis spinescens	Spiny Mud-grass
Rumex sp.	Dock
Senecio runcinifolius	Tall Fireweed
Typha spp.	Bulrush

Appendix 5 Exotic plant species list recorded during the field survey (incidental list)

**Acetosella vulgaris*	Sheep Sorrel
**Asparagus officinalis*	Asparagus
**Aster subulatus*	Aster-weed
**Avena barbata*	Bearded Oat
**Bromus catharticus var. catharticus*	Prairie Grass
**Bromus diandrus*	Great Brome
**Bromus hordaceus* ssp. *hordaceus*	Soft Brome
**Bromus madritensis*	Madrid Brome
**Chenopodium ambrosioides*	Mexican Tea
**Cirsium vulgare*	Spear Thistle
**Conyza bonariensis*	Flaxleaf Fleabane
**Conyza sumatrensis*	Tall Fleabane
**Cucumis myriocarpus* subsp. *leptodermis*	Paddy Melon
**Cynodon dactylon* var. *dactylon*	Couch
**Cynosurus echinatus*	Rough Dog's-tail
**Cyperus eragrostis*	Drain Flat-sedge
**Dactylis glomerata*	Cocksfoot
**Digitaria sanguinalis*	Summer Grass
**Dittrichia graveolens*	Stinkwort
**Echinochloa crus-galli*	Barnyard Grass
**Fraxinus angustifolia* var *angustifoli*	Desert Ash
**Galium aparine*	Cleavers
**Gladiolus undulatus*	Wild Gladiolus
**Heliotropium europaeum*	Common Heliotrope
**Helminthotheca echioides*	Ox-tongue
**Holcus lanatus*	Yorkshire Fog
**Hordeum hystrix*	Mediterranean Barley-grass
**Hordeum murinum*	Barley-grass
**Hypochaeris radicata*	Cat's Ear

**Juncus articulatus*	Jointed Rush
**Lactuca saligna*	Willow-leaf Lettuce
**Lactuca serriola*	Prickly Lettuce
**Lolium rigidum*	Wimmera Rye-grass
**Ludwigia palustris*	Marsh Ludwigia
**Marrubium vulgare*	Horehound
**Melia azedarach*	White Cedar
**Modiola caroliniana*	Red-flower Mallow
**Nassella neesiana*	Chilean Needle-grass
**Opuntia monacantha*	Drooping Prickly-pear
**Panicum coloratum*	Coolah Grass
**Paspalum dilatatum*	Paspalum
**Paspalum distichum*	Water Couch
**Pennisetum clandestinum*	Kikuyu
**Phalaris aquatica*	Phalaris
**Phoenix canariensis*	Canary Island Date-palm
**Plantago lanceolata*	Ribwort
**Poa annua*	Annual Meadow-grass
**Polygonum arenastrum*	Wireweed
**Polygonum aviculare*	Prostrate Knotwed
**Polypogon monspeliensis*	Annual Beard-grass
**Prunus cerasifera*	Cherry Plum
**Prunus persica*	Peach
**Ranunculus sceleratus*	Celery Buttercup
**Romulea rosea*	Onion Grass
**Rorippa palustris*	Marsh Yellow-cress
**Rosa canina*	Dog Rose
**Rosa rubiginosa*	Sweet Briar
**Rubus anglocandicans*	Blackberry
**Rumex conglomerates*	Clustered Dock
**Rumex crispus*	Curled Dock

**Rumex pulcher*	Fiddle Dock
**Sagittaria ?brevirostra*	Arrowhead
*Salix sp.	Willow
**Schinus molle*	Pepper Tree
**Silybum marianum*	Variegated Thistle
**Sonchus asper* subsp. *asper*	Rough Sow-thistle
**Sonchus asper* subsp. *glaucescens*	Blue Sow-thistle
**Sonchus oleraceus*	Common Sow-thistle
**Trifolium fragiferum* var. *fragiferum*	Strawberry Clover
**Trifolium repens*	White Clover
**Trifolium subterraneum*	Subterranean Clover
**Triticum* sp.	Wheat
**Vulpia muralis*	Wall Fescue
**Vulpia myuros*	Rat's-tail Fescue
**Vulpia* sp.	Fescue
**Xanthium strumarium*	Noogoora Burr