



Wetland Implementation Plan - Peatland and Spring-Soak Wetlands - Stage 1

Project 06-10

Prepared for:

Goulburn Broken Catchment Management Authority



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Summary

General background

Ecology Australia was commissioned by the Goulburn Broken Catchment Management Authority (GBCMA) to conduct a survey of Peatland and Spring-soak Wetlands occurring on both public and private land within the Goulburn Broken Catchment in north central Victoria. This is the first stage in a two-step process that will culminate in development of a Wetland Implementation Plan (WIP) for peatland and spring-soak wetlands within the Catchment.

This project was undertaken by a team of specialist firms and government enterprises and their role in the project is given below:

- Ecology Australia (EA): Geoff Carr - Principal Botanist, Emma Moysey - Zoologist and Project Manager, Steve Mathews - Botanical contractor to EA , Jamie McMahon - GIS specialist
- Pathways Bushland and Environment: Doug Frood - Consultant botanist
- Arthur Rylah Institute for Environmental Research (ARIER): Matt White - Senior plant ecologist
- Acromap PL: Dr Peter Griffioen - GIS programmer

Additional input was also sourced from a technical review and advisory panel which included Dr Neville Rosengren - Specialist Geomorphologist and Dr John Morgan – Plant Ecologist.

Findings

Data were collated from sources both within and outside the project team, and new sites found during field surveys were included.

In total, 174 sites were collated and added to the database from information provided to the project team. A further 250 sites were added to the database from field surveys.

Flora

The following Ecological Vegetation Classes (EVCs) relate to vegetation of peatlands and spring-soak habitats in north-east Victoria. Those relevant to this study are indicated by shading.

Sub-alpine zone (highest altitudes - e.g. Lake Mountain)

171	Alpine Fen
210	Sub-alpine Wet Heathland
288	Alpine Valley Peatland

Montane elevations (e.g. Lake Mountain, Blue Range, variants of EVCs 148 and 41 extending to lower elevations at Murrundindi)

40	Montane Riparian Woodland
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41	Montane Riparian Thicket
148	Montane Sedgeland
966	Montane Bog (still as EVC 318 Montane Swamp in Highlands Northern Fall bioregion)

Foothills to lower montane (e.g. Strathbogies, Highlands, Warby Ranges)

73	Rocky Outcrop Shrubland / Rocky Outcrop Herbland Mosaic
80	Spring-soak Woodland
83	Swampy Riparian Woodland
185	Perched Boggy Shrubland
191	Riparian Scrub
728	Forest Creekline Sedgy Swamp
937	Swampy Woodland

Spring-soaks and peatlands are rare habitats with unusual physical characteristics and unusual vegetation structure and floristic composition; as such they have a suite of plant species which are essentially confined to such habitats (at one extreme) or (at the other extreme) the wetland species occur opportunistically in such habitats but (at the other extreme) they occur much more widely. As part of the methodology for this project we listed all indigenous plant species in north-east Victoria known to occur in peatlands and spring-soaks and categorized them as having high, medium or low fidelity to such vegetation/habitats.

A large proportion of these species (42% of 188 species) are Victorian Rare or Threatened Species. During field work opportunistic observations were made and four VROT species were recorded. These state or nationally significant plant species are a very important resource in spring-soak/peatlands habitats and management of their populations is a major concern as degradation pressures (e.g. stock grazing and weed invasion) as well as 'natural' vegetation changes within a modified landscape will inevitably lead to the loss of important populations. Many more significant species will be identified and recorded during subsequent stages of this project.

Fauna

In total, 339 fauna species have been recorded for the overall study area from the fauna Data Review Area (DRA), including 233 bird species (11 exotic), 40 mammal species (eight exotic), 38 reptile species, 10 frog species, 16 fish species (six exotic) and two invertebrate species.

Sixty-six of these species are from a guild of fauna that would use wetlands during some part of their life history (i.e. foraging habitat, refuge); including 44 bird species, four mammal species, eight reptile species and nine frog species. Use of peatland spring-soak wetlands by fauna was assigned to the following broad categories; localised habitat use, general habitat use, drink at these sites only, forage at these sites only, provide refuge in drought periods.

Numerous threatened species were previously recorded in the fauna DRA. No species listed under the *EPBC Act* or *FFG Act* were recorded during the field surveys. Of the three bird species listed under the *EPBC Act* from the fauna DRA, only the Superb Parrot and Swift Parrot would be likely to use these wetland sites. These sites may be used for foraging and drinking activities and the LRO (Likelihood of regular occurrence) of these species at such sites would be low. A flock of five Superb Parrots was observed drinking at a spring-soak wetland in the Warby Ranges. No mammal, reptile, frog, fish or invertebrate species listed under the *EPBC Act* 1999 would be considered to regularly use these wetland sites.

Of the 23 bird species listed under the *FFG Act* 1998 (and not already mentioned under the *EPBC Act*) from the fauna DRA, only four species would be likely to use these wetland sites and all would hold a low LRO e.g. Diamond Dove, Glossy Black-Cockatoo, Turquoise Parrot, and Diamond Firetail. No mammal, reptile, fish or invertebrate species listed under the *FFG Act* 1988 would be considered to regularly use these wetland sites. One frog species, Rugose Toadlet is listed under this Act and would hold a moderate LRO at these sites.

Fifty-eight fauna species listed as threatened by DSE (2003) have previously been recorded in the fauna DRA: 41 bird species, four mammal species, 5 reptile species, three frog species, four fish species and one invertebrate species. Those species not already mentioned under the *EPBC Act* or *FFG Act* include the Brown Quail, Latham's Snipe, Glossy Ibis and Spotted Harrier. Latham's Snipe and Spotted Harrier would hold a moderate LRO at such wetland sites.

Land use-history and vegetation condition

Almost all spring-soak and peatlands vegetation encountered during field survey occurred on freehold land where two land uses prevailed:

- Grazing by stock - (predominantly cattle, but also sheep and horses) is almost universal (stock are rarely excluded by fencing)
- Water harvesting is also very frequent (farm dams have been constructed on, above or below spring-soaks because of the assured water supply).

These land use histories and associated activities have resulted in major direct and indirect alterations to the physical environments and to vegetation structure, floristic composition and faunal habitat attributes, both within the vegetation community and their catchments.

Physical alterations to hydrological regimes, substrates and water quality observed during field work include:

- Draining of wetlands (via channels)
- Dams constructed in, below, or above wetland
- Clearing of catchments (i.e. excellent runoff and reduced water use by vegetation in the often localized catchments as indigenous woody vegetation is replaced by exotic herbaceous pasture)
- Planting of exotic, high water-use trees, notably Willows (*Salix taxa*) and Poplars (*Populus spp.*) in wetland vegetation

- Depression of ground-water availability by planting of Radiata Pine (*Pinus radiata*) and (probably) Blue Gum (*Eucalyptus globulus*) plantations adjacent to or near wetlands
- Soil compaction by stock, thus reduced infiltration
- Localised turbidity caused by stock disturbance
- Eutrophication via cattle faeces and urine
- Often severe pugging of soils by cattle with consequent destruction of peat layer, ponding of water in microtopographic relief features, hence increased water loss by evaporation
- Destruction of peat layer by burning (e.g. as a result of the use of fire to control undesirable pasture plants such as Rushes (*Juncus* spp.)

Direct and/or indirect modifications to the vegetation of the wetlands, observed during field work include:

- Clearing of woody vegetation by cutting of trees or slashing of scrub (still a practice for example in the Strathbogie Ranges) and burning
- Grazing/browsing of vegetation by stock (cattle, sheep, horses), feral animals (rabbits, deer, hares, pigs) and indigenous mammals (Black Wallaby, Eastern Grey Kangaroo, Common Wombat)
- Weed invasion and inadvertent off-target damage to vegetation by poor herbicide use practices (Blackberries (**Rubus* spp.) are invariably the targeted weed species)
- Planting of trees in peatlands/spring-soaks (to enhance habitat or amenity values)

Management issues and threats to spring-soaks and peatlands identified during this study were:

- Weed invasion
- Grazing
- Dam construction
- Modifications with planted woody vegetation
- Draining

Permanent Upland Wetlands Modelling

All data collected were used to generate a model of Spring-soak and peatland wetlands within the study area. Preliminary ground-truthing of the modelled sites was undertaken. Overall the model performed very well in the southern uplands (i.e. Baw Baw Plateau and the Blue Range), and moderately well in the central part of the study area. In conclusion, the modelling appears to have been a useful exercise and has further narrowed the area in which more intensive searching can be conducted.

1 Introduction

1.1 Project Background

The Goulburn Broken Catchment Management Authority (GBCMA) commissioned an assessment of peatland and spring-soak wetlands occurring on both public and private land within the Goulburn Broken Catchment in north central Victoria (Figure 1).

This is the first stage in a two-step process that will culminate in development of a Wetland Implementation Plan (WIP) for peatland and spring-soak wetlands in the Catchment.

Peatland and Spring Soak Wetlands have a long history of disturbance relating to land-uses, including stock grazing, draining and vegetation clearing. Generally, this has resulted in degradation and loss of many of these wetlands throughout the GBCMA region. Informed management of remaining areas will be essential if the condition of these wetlands is to be maintained or improved. Where possible, this is the goal of the GBCMA.

Before a WIP can be prepared, the extent and distribution of peatland and spring-soak wetlands in the Catchment needed to be identified. This report presents the findings of this first stage of this process, the key objective of which was to identify and map all peatland and spring-soak wetlands in the Goulburn Broken Catchment.

To set the framework for the overall 2-stage process, the key objectives of the WIP are to:

- set management objectives for peatland and spring-soak wetlands in the planning area
- identify and analyse the ecological values of peatland and spring-soak wetlands in the planning area
- identify and analyse current and future threats to the ecological values of peatland and spring-soak wetlands in the planning area
- describe the current condition of peatland and spring-soak wetlands in the planning area
- rank peatland and spring-soak wetlands in the planning area based on their ecological attributes, threats and condition
- develop strategies and actions that protect or enhance the ecological values of peatland and spring-soak wetlands in the planning area
- identify knowledge gaps

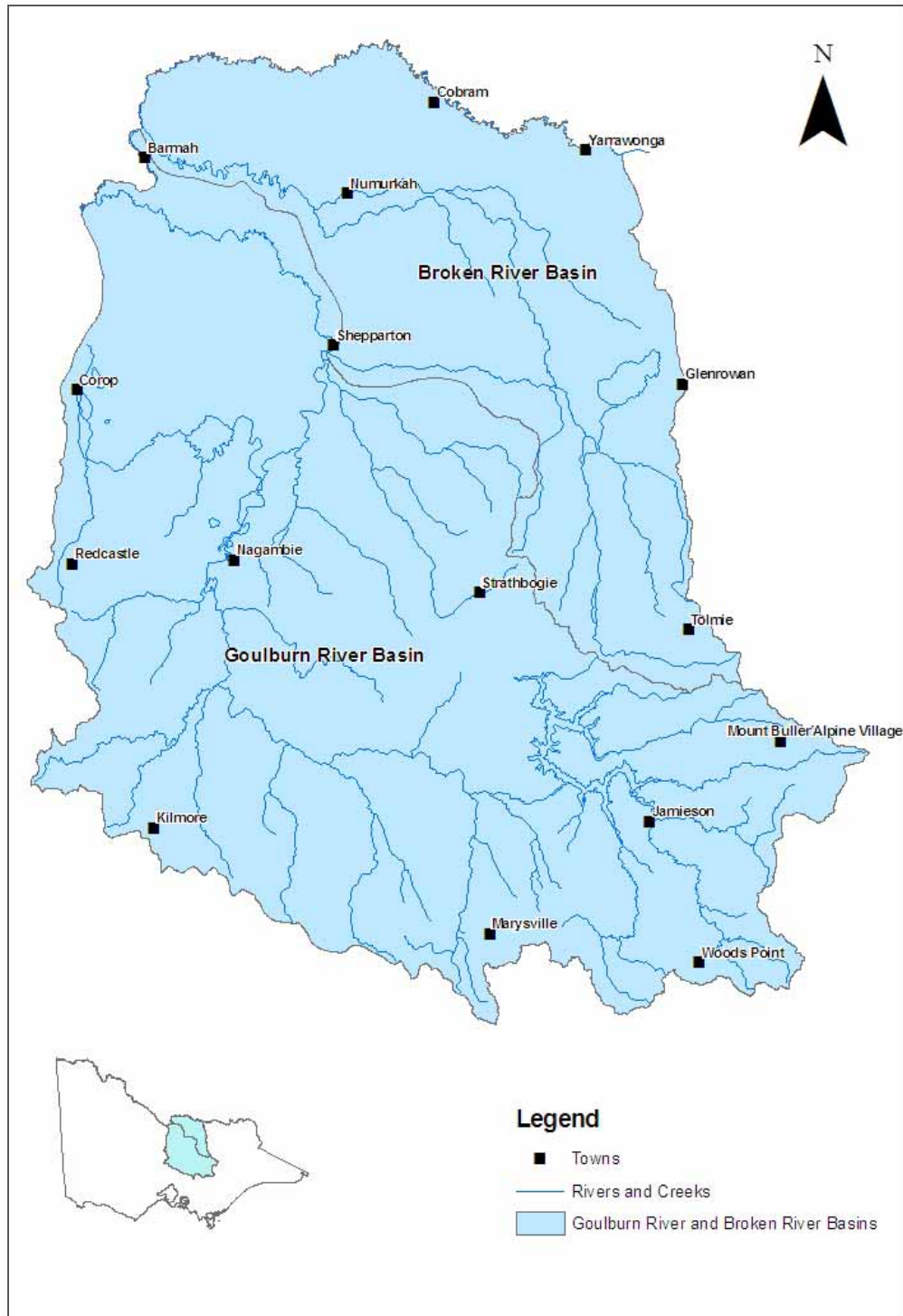


Figure 1 Location and extent of the area managed by the Goulburn Broken Catchment Management Authority (figure supplied by GBCMA).

1.2 Consultant team

An outline of the team of specialist firms and government enterprises and their role in the project is given below:

Ecology Australia (EA): Staff involved in this project were:

- Geoff Carr - Principal Botanist - workshop participation, collection of field data, report author
- Emma Moysey - Zoologist and Project Manager - workshop participation, collection of field data, report author
- Steve Mathews - Botanical contractor to EA – workshop participation, collection of field data, report author
- Jamie McMahon - GIS specialist

Pathways Bushland and Environment

- Doug Frood - Consultant botanist - workshop participation, collection of field data, report author

Arthur Rylah Institute for Environmental Research (ARIER):

- Matt White - Senior plant ecologist - workshop participation, and spatial and vegetation data analysis, report author

Acromap PL

- Dr Peter Griffioen - conducted GIS programming, database development and geospatial modelling and statistics

Additional input was also sourced from a technical review and advisory panel which included:

- Dr Neville Rosengren – La Trobe University, Specialist Geomorphologist
- Dr John Morgan – La Trobe University, Plant Ecologist

2 Study area

2.1 General background

The Goulburn Broken catchment region provides c. 11% of the Murray Darling Basin's stream flow and covers c.10.5% of Victoria. The rivers in the catchment are highly valued for a range of purposes, including irrigation, industrial and urban water supply, recreation, biodiversity and aesthetic attributes.

Peatlands and spring-soaks are distinct wetlands within the Goulburn Broken Catchment, and are restricted to areas where there is a near constant supply of surface or seepage water. These wetlands are known to support a number of unusual and rare vegetation types and threatened plant and animal species, and perform important hydrological functions.

There are several wetland types within the Goulburn Broken Catchment relevant to this project. A short description of each is provided below:

- **Sub-alpine peatlands** - Perched outcropping watertables generally above 1300 m asl in variable geomorphological settings – extensive in sub-alpine peneplain. Temperate climate results in the accumulation of peat. Known locations include Mt Bullfight, Lake Mountain, Mt Torbreck, The Bluff (possibly outside the CMA), and small degraded areas persisting on Mt Stirling and Mt Buller
- **Montane peatlands** - Perched outcropping watertables generally in granite tablelands above 900 m. A temperate climate results in the accumulation of peat. Known locations include the Blue Range (i.e. Storm Creek and Rubicon River headwaters) and higher parts of the Strathbogies and the Tolmie Wabonga area
- **Upland valley peatlands** - Found in areas subject to groundwater seepage on inactive terraces of rivers in high rainfall areas. Temperate climates (exacerbated by cold air drainage) generally results in the local accumulation of peats. Known locations include Royston, Acheron and Rubicon River Valleys (i.e. Buxton Gum Reserve, Buxton)
- **Upland swamps /springs** - Perched outcropping watertables generally in granite tablelands. A generally warm to subhumid climate precludes the accumulation of deep peat. Known locations include the Highlands area, Strathbogie Ranges and Mt. Samaria
- **Spring-soaks** - Seepage zones with or without peat formation, generally found on the footslopes of granite landscapes including several of the areas mentioned above and the Warby Ranges, Tallarook, Mt. Disappointment

Key landscapes within the Goulburn-Broken Catchment in which peatlands and Spring-soaks are broadly known to occur are shown in Figure 2.

2.2 Bioregional description

Peatland and spring-soaks in the GBCMA region generally occur within the Central Victorian Upland, Northern Inland slopes and Highlands Northern Fall bioregions.

A description of the geology, soils and vegetation types generally associated with these bioregions is given below.

Central Victorian Uplands is dominated by Lower Paleozoic deposits, giving rise to dissected uplands at higher elevations, amongst granitic and sedimentary terrain (with Tertiary colluvial aprons). Within this metamorphic and old volcanic rocks have formed steeply sloped peaks and ridges. The less arable soils of the hills support Grassy Dry Forest and Heathy Dry Forest. Herb-rich Foothill Forest and Shrubby Foothill Forest dominate on the deeper soils of arable outwash slopes. The granitic and sedimentary terrain (with Tertiary colluvial aprons) were dominated by variants of Grassy Woodlands which have been cleared. Lower lying valleys and plains are dominated by Valley Grassy Forest and Plains Grassy Woodland.

Highlands - Northern Fall is the northerly aspect of the Great Dividing Range. These dissected uplands have moderate to steep slopes, high plateaus and alluvial flats along the main valleys. The Palaeozoic geology is predominantly comprised of sedimentary and granitic rocks. The brown and red porous earths occur in the upper reaches, and yellow and red texture contrast soils become more prevalent within the valleys.

The vegetation is a mosaic of Herb-rich Foothill Forest with Shrubby Dry Forest dominating large areas of lower slopes; Montane Dry Woodland and Heathy Dry Forest on the upper slopes and plateau. Grassy Dry Forest and Valley Grassy Forest occur at lower elevations and are associated with the slopes of major river valleys.

Northern Inland Slopes consists of foothill slopes and minor ranges separated by river valleys that drain northward from the High Country to the Murray River. They are a complex of granitic and metamorphic geology, which protrudes through and is surrounded by the Riverine Plain. The Warby Ranges are of granitic and sedimentary origin, Mt. Major comprises various volcanic geologies and Terrick Terrick and Pyramid Hill are granitic. On the less arable soils of hills, the vegetation is dominated by Grassy Dry Forest, Box Ironbark Forest, Granitic Hills Woodland, Heathy Dry Forest and Shrubby Dry Forest. Herb-rich Foothill Forest occurs on the more arable soils of hills and outwashes. The arable soils of plains, gentle slopes, low rises and watercourses, variously support Grassy Woodland, Valley Grassy Forest, Plains Grassy Woodland, Floodplain Riparian Woodland, Riverine Grassy Woodland, Riverine Sedgy Forest and wetlands.

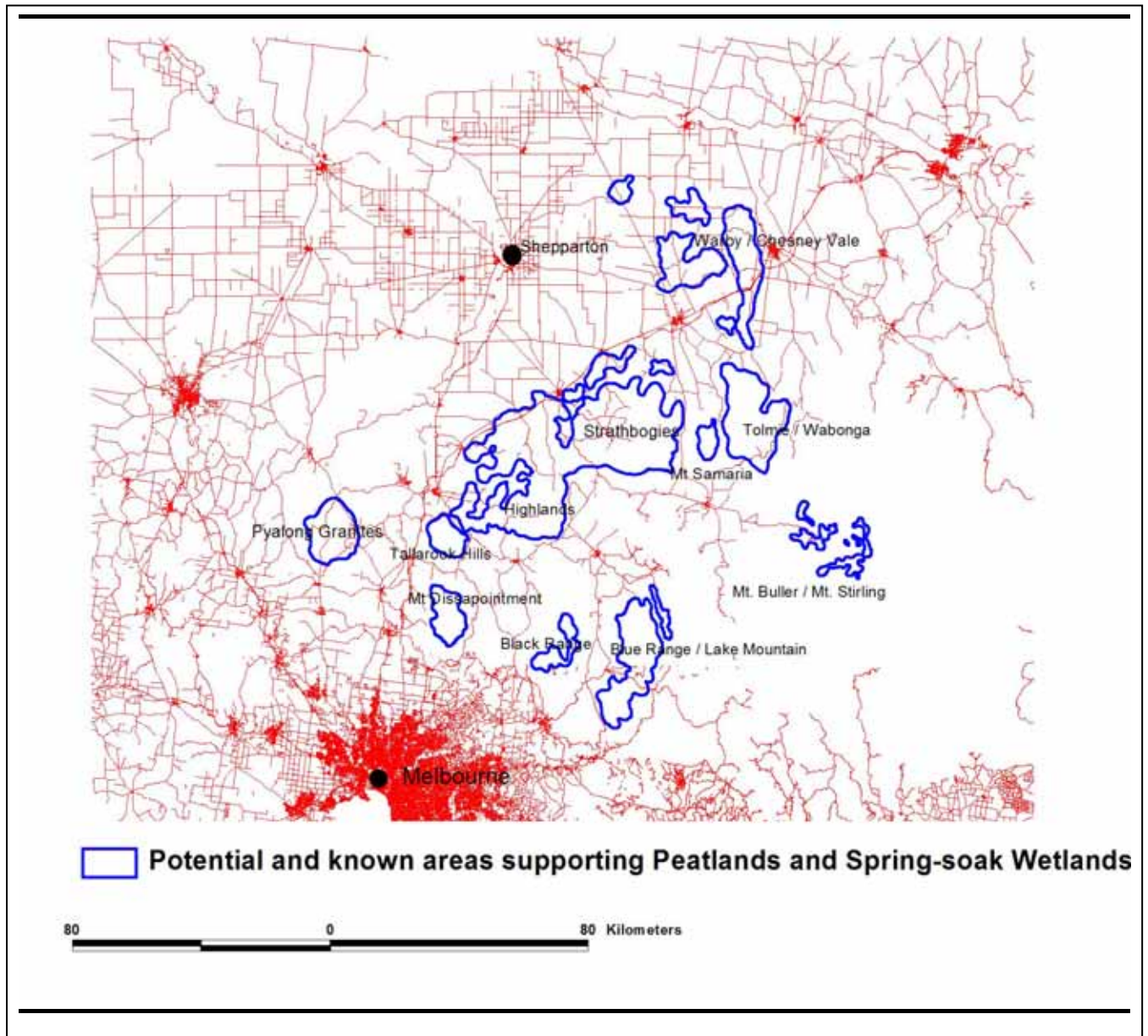


Figure 2. Potential and known areas supporting Peatlands and Spring-soak wetlands within the Goulburn-Broken Catchment.

3 Methodology

3.1 Overview

Peatlands and spring-soak wetlands are the result of geological and hydrographical process coincident with topology present in the Goulburn-Broken catchment. As a result, their distribution, though sparse, is not random. Whilst the details of the underlying geology may remain concealed, and therefore the occurrence of the wetlands may not be predicted as a direct result of their source, the locality of wetlands correlate with a number of physical attributes that may be measured. Thus, models predicting the likely occurrence of peatlands and spring-soak wetlands may be developed on the basis of these physical attributes.

Initially, the spatially distinct attributes associated with occurrence of peatlands and spring-soaks were identified (as many relevant exemplars were found to improve the spatial reach and statistical power of subsequent modelling). This was done by locating new and known soaks and peatlands, identifying the spatial and environmental attributes that are likely indicators and qualifying these indicators for each occurrence. New and known sites were identified by two main methods:

- Data collation
- Field work

Further discussion of modelling of permanent upland wetlands is given in Section 7.

3.2 Data collation

Information on known peatland and springs across the study area was collated. Sources of data are described below.

3.2.1 Anecdotal material from within the project team

Two workshops were conducted where an exchange of information regarding known sites occurred. Sources of data within the project team included:

- Dr John Morgan - provided detailed data on several previously unknown peatlands in the Wabonga/Tolmie area
- Matt White has visited numerous remote montane bogs in the Blue Range/Lake Mountain area and knows of several spring-soaks at the foot-slopes of the Warby Range massif
- Steve Mathews has a good knowledge of the swamps and spring-soaks of the Highlands

3.2.2 Anecdotal material from outside the project team

Extensive consultation and communication was conducted with members of the steering committee, local land-holders and members of relevant groups within the study area. These are given in Table 1 below.

Table 1 Sources of information and general area of data collated for project.

Name	Organisation	Area of information
Rebecca Nicoll	GBCMA	Strathbogies, Mt Piper
Joanne Gaudion	GBCMA	Tatong, Barjarg
Christine Glassford	GBCMA	Yea; Crystal, Boggy, Stewarts, Woolshed Creek
Sue Berwick	DSE	Tawonga, Strathbogie Plateau
Geoff Barrow	Parks Victoria – Wangaratta	Warby Ranges/ Chesneyvale
Ray Thomas	DSE Benalla	Winton Glenrowan
Doug Robinson	Trust for Nature	Strathbogies
Mike Dexter	Upper Goulburn Field Naturalists	Upper Goulburn Catchment
Janet Hayden, Scott McKay	Hughes Creek Catchment Group	Hughes Creek Catchment
Bertram Lobert	Local field Naturalist	Euroa/Mt Barrahnet

3.2.3 Database review and predictive analysis

Existing data sets – Flora

The Flora Information System (FIS) retains detailed information of the distribution of species characteristic of the target systems. A target list of plant species based on FIS data, field knowledge of most species, supplemented by data from the Flora of Victoria (Walsh and Entwistle 1994, 1996, 1999) was generated (see Appendix 1).

Plant names used in this report follow the Census of the Vascular Plants of Victoria (Ross and Walsh 2003). Common names are those used in the Flora Information System (FIS) database. An asterisk (*) denotes exotic species.

Existing data sets - Fauna

The Victorian Fauna Display (DSE 2005b), a CD-ROM version of the Atlas of Victorian Wildlife, was searched for a list of fauna species previously recorded from within the general study area. This search area is referred to as the fauna Data Review Area (DRA), the results of which are given in Appendix 2.

State Forest Resource Inventory (SFRImap) dataset - is a useful tool for finding treeless vegetation within the forest estate. The Ecological Vegetation Class (EVC) dataset has mapped some of the target systems – notably *Perched Boggy Shrubland* (EVC 185) and *Spring-soak Woodland* (EVC 80). In addition, staff at ARIER have recently compiled all existing spatial data on treeless alpine and sub-alpine vegetation across the state – these data are yet to be incorporated into the Corporate Geospatial Data Library.

Existing published and unpublished literature - Key documents include Kershaw (1993), Mount Stirling Environmental Effects Statement (1996) and Cameron and Turner (1994).

Geomorphology - Concurrently work was undertaken with the advice of Neville Rosengren, to identify environmental domains where active field searching for the target wetlands would be productive. This analysis was undertaken in a geographic information system employing a ‘likely’ environmental rules set. The following spatial data assisted this process: terrain models, streams, groundwater models, geology/geomorphology, slope, altitude and incident solar radiation models. To augment this approach we also used:

- Digital aerial photography to identify additional potential locations of upland peatlands. This was particularly useful in remote forest areas such as the Blue Range and Tolmie areas.
- Chronosequenced Landsat imagery between the years 1991 and 2004 to identify locations with stable spectral characteristics consistent with moist environments. Preliminary work suggested that this approach would be profitable in locating sites remote from roads within the pastoral landscape (see Figure 3).

3.3 Field work

Following collation of data and information, all known peatlands and spring-soaks were plotted on GIS mapping (Arcview). Hard copy maps of the entire study area were produced at an approximate 1:10 000 scale. These were used to navigate and to structure the field work program, as well as to record data.

Many of the roads and tracks within the study area were driven, in an attempt to locate and identify additional sites in the landscape.

Where necessary site access was arranged with the appropriate land-holder.

Field work was conducted at two levels depending on the availability of site access:

- Site access available - detailed surveys and assessment were conducted
- Site access unavailable – location of wetland noted, and brief field notes taken

A description of the methodology used is given below.

Site access available - detailed surveys and assessment were conducted

At sites where access was available, the following data was collected:

- GPS locations of the site were taken, central location
- Mapped extent of wetland area
- Dominant plant species list
- Aspect, slope
- General condition of wetland
- Management issues noted:
 - Grazed by sheep/cattle, marsupials
 - Fenced
 - Serious environmental weeds present
- Site description, including geomorphological/hydrological context, and EVC typology
- Digital photos of each wetland surveyed

Where possible the following information was also collected:

- Opportunistic flora records, including significant indigenous flora and weeds of management concern (GPS positions collected, voucher specimens for lodging at the National Herbarium of Victoria)
- Opportunistic vegetation quadrat data within each site
- Confirmation of EVC classification of vegetation type(s) present
- Photographic records from each wetland, including vegetation types, significant species and major weed infestations

Site access unavailable – location of wetland noted, short field notes taken

At sites where access was not available, the following data were collected where possible:

- GPS position of closest access point to the wetland location (usually from a roadway), direction and approximate distance to wetland taken, as well as location marked on aerial photos, where possible
- Compass bearing and approximate distance of site from GPS location
- Dominant plant species list
- General condition of wetland
- Management issues noted:
 - Grazed by sheep/cattle, marsupials
 - Fenced
 - Serious environmental weeds present
- Site description including geomorphological/hydrological context, and EVC typology
- Digital photos of each wetland surveyed

A list of the data/information that should be collected by Field officers at new sites (which would then be added to future runs of the model) is given in Appendix 3.

4 Results

4.1 Ecological Vegetation Class typology

4.1.1 General discussion

During the field work component of this study, our observations indicated considerable structural and floristic variation in vegetation between sites within regions (e.g. Highlands) and between regions (e.g. Warby Ranges, Chesney Vale Hills, Highlands and the Strathbogies).

For example, Woolly Tea-tree (*Leptospermum lanigerum*) is apparently much more frequent and abundant in spring-soaks of the Highlands area compared with the Strathbogies, where Prickly Tea-tree (*L. continentale*) is the universal and extensive dominant (with Woolly Tea-tree fairly scarce). Mountain Baeckea (*Baeckea utilis*) is evidently rare in the Highlands area, but is abundant in the Strathbogies, and absent from the Warby Ranges area.

To what extent these regional and local floristic attributes and differences of spring-soak and peatland vegetation represent environmental differences (e.g. altitude, rainfall and other climatic factors, geology/substrates) or biogeographic factors, stochastic extinction events and land-use history, for example, remains to be determined (by detailed vegetation sampling).

As indicated below in the EVC descriptions, there is some uncertainty about the relevance of some EVCs to this project. This is partly a function of incomplete circumscription of some EVCs and partly the result of the often extensive modifications of the peatland spring-soak vegetation communities in terms of floristic composition and structure due to land-use history. These questions can only be resolved by floristic sampling of the vegetation, and description of the physical environments at each site sampled, including the land-use history.

4.1.2 Ecological Vegetation Classes relevant to the vegetation of peatlands and other spring-soak habitats

The following Ecological Vegetation Classes (EVCs) (DSE 2005c, Frood 2006) relate to vegetation of peatlands and spring-soak habitats in north-east Victoria. Those relevant to the Goulburn-Broken CMA project study area (this study) are indicated by shading. The vegetation structure and floristic composition (indigenous species) are outlined below each EVC description.

Sub-alpine zone (highest altitudes - e.g. Lake Mountain)

171	Alpine Fen
-----	------------

210	Sub-alpine Wet Heathland
-----	--------------------------

288	Alpine Valley Peatland
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Montane elevations (e.g. Lake Mountain, Blue Range, variants of EVCs 148 and 41 extending to lower elevations at Murrundindi)

40	Montane Riparian Woodland
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41	Montane Riparian Thicket
----	--------------------------

148	Montane Sedgeland
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966	Montane Bog (still as EVC 318 Montane Swamp in Highlands Northern Fall bioregion)
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Foothills to lower montane (e.g. Strathbogies, Highlands, Warby Ranges)

73	Rocky Outcrop Shrubland / Rocky Outcrop Herbland Mosaic
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80	Spring-soak Woodland
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83	Swampy Riparian Woodland
----	--------------------------

185	Perched Boggy Shrubland
-----	-------------------------

191	Riparian Scrub
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728	Forest Creekline Sedgy Swamp
-----	------------------------------

937	Swampy Woodland
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Sub-Alpine Zone

EVC: 171 Alpine Fen

Vegetation structure and key species: Sedgeland. Indicator species include *Carex gaudichaudiana*, *Mysiophyllum pedunculatum* and *Isolepis crassiuscula*.

Habitat: High elevation wetland basins subject to cold-air ponding, often in shallow ponds occurring in association with sphagnum-dominated bogs.

Distribution and status: Uncertain - rare and localized if present in highest elevation wetland sites.

Relevance to peatlands and spring-soaks project: Relevant if present.

EVC: 210 Sub-alpine Wet Heathland

Vegetation structure and key species: Heathland. Indicator species include *Baeckea gunniana*, *Epacris* spp. (notably *E. paludosa*) and *Empodisma minus*.

Habitat: Sub-alpine soaks or flats along streams.

Distribution and status: Restricted to bogs at highest elevations, notably Lake Mountain.

Relevance to peatlands and spring-soaks project: Relevant.

EVC: 288 Alpine Valley Peatland

Vegetation structure and key species: The vegetation (at least in relatively intact sites) is characterized by elevated hummocks of sphagnum moss in association with peat soils. A small range of low ericoid shrubs are typically immersed within the moss bed. Localized within higher mountains. Indicator species include *Sphagnum* spp., *Richea continentalis*, *Baeckea* spp. *Epacris* spp., *Callistemon ptyoides*, *Empodisma minus* and *Carex* spp.

Habitat: Bogs associated with soaks and seepage at sub-alpine elevations.

Distribution and status: Restricted to localized bogs at highest elevations, notably Lake Mountain.

Relevance to peatlands and spring-soaks project: Relevant.

Montane Elevations

EVC: 40 Montane Riparian Woodland

Vegetation structure and key species: Woodland, *Eucalyptus camphora* over sedgy-tussocky ground-layer with species of *Poa* and *Carex*, with associated species variously including *Sphagnum* spp., *Epilobium* spp. and *Hydrocotyle* spp., *Gonocarpus micranthus*, *Hypericum japonicum*, *Pratia surrepens*, *Geranium potentilloides*, *Acaena novae-zelandiae* and *Blechnum penna-marina*.

Habitat: Seepage areas on low-gradient drainage-lines at montane elevations.

Distribution and status: e.g. Tolmie.

Relevance to peatlands and spring-soaks project: Community of uncertain EVC interpretation, but with sphagnum and peat and clearly within scope of project.

EVC: 41 Montane Riparian Thicket

Vegetation structure and key species: Scrub dominated by *Leptospermum grandifolium*, in highest rainfall areas with *Nothofagus cunninghamii*. Ground-layer species can include *Wittsteinia vacciniacea* and *Blechnum penna-marina*.

Habitat: Springs and soaks at montane elevations (in higher rainfall areas).

Distribution and status: e.g. Lake Mountain, Tolmie, Murrundindi.

Relevance to peatlands and spring-soaks project: Marginally relevant

EVC: 148 Montane Sedgeland

Vegetation structure and key species: Low sedgeland (mostly < 0.5 m tall), with moss-bed and herb-dominated components. Species include *Carex gaudichaudiana*, *Carex appressa*, *Sphagnum* spp., *Epilobium* spp. and *Hydrocotyle* spp., variously in association with *Poa labillardierei*, *Eleocharis gracilis*, *Veronica gracilis s.l.*, *Gonocarpus micranthus*, *Austrofestuca hookeriana*, *Hydrocotyle tripartita*, *Hypericum japonicum*, *Pratia surrepens*, *Geranium potentilloides*, *Acaena novae-zelandiae*, *Luzula modesta*, *Oreomyrrhis eriopoda*, *Blechnum penna-marina*, *Juncus alexandri*, *Heirochloe redolens* and *Deyeuxia innominata*.

Habitat: Springs and soaks at montane elevations (in higher rainfall areas), where it occurs in association with Montane Riparian Thicket or Montane Riparian Woodland. Recorded from an elevation range of approximately 700 – 1300 m elevation.

Distribution and status: Extremely localized, e.g. Lake Mountain, Murrundindi. Disturbed sites vulnerable to invasion by weeds such as **Holcus lanatus* and **Anthoxanthum odoratum*.

Relevance to peatlands and spring-soaks project: Relevant.

EVC: 966 Montane Bog

Vegetation structure and key species: Low heathy, sedgy-mossy shrubland. Can be fringed by or include sparse eucalypts - variously *Eucalyptus pauciflora*, *E. stellulata*, *E. dalrympleana*, *E. rubida* and *E. delegatensis*. In the Central Highlands, species include *Baeckea utilis*, *Epacris* spp. (notably *E. paludosa*), *Sphagnum* spp. and *Empodisma minus*, with associated species including *Richea victoriana*, *Oxalis magellanica*, *Wittsteinia vaccinacea* and *Blechnum penna-marina*. *Nothofagus cunninghamii* and/or *Leptospermum grandifolium* can be present on the verges or scattered through the vegetation.

Habitat: Boggy sites in montane to sub-montane valleys.

Distribution and status: Rare, bogs in higher montane zone, e.g. Blue Range.

Relevance to peatlands and spring-soaks project: Relevant.

Foothills to lower montane

EVC: 73 Rocky Outcrop Shrubland / Rocky Outcrop Herbland Mosaic

Vegetation structure and key species: Shrubland dominated by *Kunzea parviflora* and/or *Calytrix tetragona* with extensive mossy and rocky areas.

Habitat: Dry rocky sites, typically with rapidly drying skeletal soils on granite.

Distribution and status: Dispersed within project area, apparently rare on the Tallarook plateau, locally extensive in Tolmie area.

Relevance to peatlands and spring-soaks project: Not relevant, but possibly open to confusion of interpretation (e.g. from aerial photography).

EVC: 80 Spring-soak Woodland

Vegetation structure and key species: Herbland to woodland with shrubby-herbaceous understorey, herb-rich. Indicator species include *Eucalyptus* spp. (variously *E. blakelyi*, *E. camaldulensis*, *E. goniocalyx* or *E. nortonii*), *Leptospermum continentale*, with *Goodenia macbarronii*, *Schoenus apogon* and a range of associated herbs, sedges and rushes – e.g. *Aphelia gracilis*, *Glossostigma elatinooides*, *Drosera peltata* ssp. *peltata*, *Centrolepis strigosa*, *Hypericum japonicum*, *Isotoma fluviatilis*, *Eragrostis brownii* and *Juncus* spp.

Habitat: Associated with soaks and springs within granitic terrain.

Distribution and status: Rare, north-east Victoria.

Relevance to peatlands and spring-soaks project: Wetter variants relevant. EVC includes several communities and EVC definition warrants further resolution.

EVC: 83 Swampy Riparian Woodland

Vegetation structure and key species: Woodland vegetation (in mosaic with scrub / reed-beds). In a more restricted sense of usage of the EVC label, indicator species include *Eucalyptus ovata*, *Melaleuca ericifolia*, *Phragmites australis*, *Persicaria decipiens*, *Calystegia sepium*, *Acacia melanoxyton* and *Poa labillardierei*.

Habitat: Associated with very low-gradient streams within areas subject to riparian processes. Typically constitutes linear wetland, but includes drier banks and levees, as for Floodplain Riparian Woodland.

Distribution and status: Relevant vegetation considered better referable to Montane Riparian Woodland.

Relevance to peatlands and spring-soaks project: Apparently not relevant.

EVC: 185 Perched Boggy Shrubland

Vegetation structure and key species: Dense mosaic of shrubland in association with a sedgey/herbaceous ground-layer in which mosses can be abundant, occurring on reliably saturated soils associated with impeding layers, soaks and springs. Indicator species include *Baeckea utilis*, *Sphagnum* spp., *Leptospermum continentale*, *Acacia verticillata*, *Gonocarpus micranthus*, *Ranunculus* spp. and *Gahnia sieberiana*.

Habitat: Swampy Riparian Woodland occurs in similar habitats to Perched Boggy Shrubland, but the former is associated with flowing water. Perched Boggy Shrubland Complex is reported as always surrounded by Herb-rich Foothill Forest [EVC # 23].

Distribution and status: Very restricted extent, confined to the north-east of the state.

Relevance to peatlands and spring-soaks project: Highly relevant.

EVC: 191 Riparian Scrub

Vegetation structure and key species: Closed scrub, with component of ferns and large sedges. Regionally dominated by *Leptospermum lanigerum* with *Gleichenia* spp. and typically *Gahnia sieberiana* and *Baumea* spp. From the available FIS quadrat data, *Leptospermum lanigerum* and *Blechnum nudum* provide the most cover, with *Coprosma quadrifida* and *Blechnum wattsi*. Additional species present include *Gleichenia microphylla*, *Tetrarrhena juncea* and *Veronica calycina* (and a range of incidental records of species of moist forest or muddy habitats).

Habitat: Associated with waterlogged ground along poorly-defined drainage-lines of higher rainfall areas, often in areas with less fertile sandy (or granite-derived) soils. At Mt Disappointment within elevation range c. 500 - 660 m.

Distribution and status: Mainly in higher rainfall southern areas. Extremely localized within project area, only recognized from the northern fall of the Wallaby Creek plateau (headwaters of Silver Creek) on Mt Disappointment, but possibly also headwaters of Strath Creek.

Relevance to peatlands and spring-soaks project: Probably not relevant (but note FIS Quadrat F26028).

EVC: 728 Forest Creekline Sedgy Swamp

Vegetation structure and key species: Sedgeland or reedbed. Indicator species include *Carex appressa*, *Carex fascicularis*, *Cyperus lucidus* and *Phragmites australis*, with herbs such as *Epilobium pallidiflorum*, *Gratiola* spp., *Lythrum salicaria*, and other associated species variously including *Acacia melanoxylon*, *Kunzea ericoides* s.l., *Rubus parviflorus*, *Stellaria flaccida*, *Hypolepis rugosula*, *Blechnum minus*, *Juncus gregiflorus* and *Persicaria decipiens*. *Lepidosperma elatius* can be dominant on the drier verges.

Habitat: Wetlands of drainage-line terraces within moist to wet forest areas.

Distribution and status: Very restricted occurrences, eastern highlands.

Relevance to peatlands and spring-soaks project: Outside scope of project.

EVC: 937 Swampy Woodland

Vegetation structure and key species: Regionally dominated by *Eucalyptus camphora*, variously with *Acacia* spp. (including *A. melanoxylon*, *A. verticillata*), *Goodenia ovata*, *Coprosma quadrifida*, *Lomandra longifolia*, *Ozothamnus ferrugineus*, *Poa* spp., *Carex* spp. and *Lepidosperma* spp.

Habitat: Swampy Woodland is a poorly understood vegetation type of poorly drained, seasonally waterlogged heavy soils. In the strict sense the label applies to at least seasonally waterlogged vegetation of wet flats and gentle slopes, not subject to direct flooding from major streams, but receiving water through seepage or surface run-off. In some instances Swampy Woodland can occur to the rear of current levees on floodplains, receiving water via minor side streams rather than direct flooding from the main watercourse. The distinctions between Swampy Riparian Woodland and Swampy Woodland become more difficult where the habitats occur in narrow bands along low gradient valleys in more dissected terrain. Swampy Woodland occurs as an outer zone to some wetland systems.

Distribution and status: Highlands. Relatively intact remnants extremely rare.

Relevance to peatlands and spring-soaks project: Sometimes present as outer zone to communities relevant to the project (e.g. Perched Boggy Shrubland).

4.2 Preliminary typology of peatland and spring-soaks

The degree to which soaks facilitate the formation of peat and provide the conditions required for the target vegetation varies with a range of factors, is discussed elsewhere. Developing a typology of soaks may help unravel the story behind their distribution.

During the fieldwork, all moist areas in the landscape were considered as potential sites and investigated and recorded. This enabled us to make a number of observations on the occurrence of spring-soaks in the landscape. These comments are limited to the Strathbogies, but may apply more widely.

Soaks occur where bedrock approaches the surface and the water table percolates through the upper layers of the soil horizon. These occur in a range of situations where the impervious granite bedrock, or other impervious layers such as kaolinite, are close to the surface, and may be seen on the lower slopes of hillsides up to the tops (Plate 1).

Bedrock-induced soaks may also occur above creek-lines. Creeks often follow jointing patterns in the underlying granite, and the resulting erosion pattern may produce rock shelves running parallel to streams. These soaks may extend for many hundreds of metres, parallel to the stream (Plate 2).

In some cases soaks are highly localized, and disappear back into the surrounding soil as the water table depth increases with increasing soil depth and better drainage conditions downslope (Plate 3).

Breaching of the water table was sometimes seen to initiate the formation of a drainage line. In these cases the soaks can be seen at the head of gullies, perched above the moist drainage line floor (Plate 4).

The persistence of these formations will depend on the nature of the impeding subsurface structure – if rock, they may be permanent, if clay or soil, the gully head may work its way back through the hillside, with the soak persisting as long as the gully floor is lower than the water table producing the soak.

Moist drainage lines in the Strathbogies had a number of plant species in common with more isolated hillside soaks, and in some cases had a wider range of species than was observed in the smaller soaks, perhaps due to their sometimes extensive area. The width of these drainage lines varied from narrow (e.g. only a few metres across), to broad (many tens of metres), often reflecting their position and slope of the landscape. For instance, broad moist drainage lines are more characteristic of gently sloped terrain and outwash valleys and plains, while those in steeper country tend to be much narrower (Plate 5).

Drainage lines may or may not have a defined channel with free flowing water. Extensive moist drainage lines often contained a number of soak types and a variety of moisture-loving vegetation types (Plate 6).

Soaks are often associated with localized ‘amphitheatre’-shaped catchments formed on hillsides, with the soaks occurring in the drainage line. These formations funnel both underground water and cold air along the drainage line (Plate 7).

Another feature worth noting from field inspections was the presence of kaolinite (sometimes yellow-mottled) associated with a number of soaks. These clays are considered to be good for dam building, due to their impermeability. It is likely that the presence of kaolinite contributes to conditions conducive to the formation of soaks, by acting as an impermeable subsurface layer. Kaolinite is also considered to be a good base for dam construction, meaning that kaolinite soaks are valued not only for their constant flow of water but also their suitability as dam sites. Dams are often seen constructed in these sites (see plate 3 above).

In some cases complex sites with a number of different types of soaks were observed. Examples include moist drainage line soaks with spring-initiated gully heads, and soaks on the break of slope where bedrock broaches parallel to the drainage line. In some cases soaks were discontinuous, disappearing then reappearing further down the drainage line. These can be considered to be complexes of interrelated sites, arising from the same physiographic, soil and bedrock conditions, and from the same aquifer (Plate 8).

Another important character feature of the soaks observed is the amount and seasonality of waterlogging. Soaks ranged from containing permanent, free water between vegetation tussocks, through to summer or drought-dry soils. Obviously these vary significantly in their vegetation and susceptibility to grazing – for instance, seasonally dry soaks are more tolerant of cattle grazing in summer when the soils are dry (Plate 9). Different management approaches are called for on a case-by-case basis.

Hopefully with further modeling and field observation, a more resolved and robust typology can be developed. This may also assist with developing management prescriptions.

4.3 Summary of sites

As mentioned in section 3.2, data were collated from sources both within and outside the project team, and new sites found during field surveys were included.

In total, 174 sites were collated and added to the database from information provided to the project team. A further 250 sites were added to the database from field surveys.

These results have been collated and are presented in Figures 5 - 12. The key map of the study area is shown in Figure 4.

Results from the field survey are presented in Table 2, and sites from the data collation are presented in Appendix 4.



Plate 1 Soak arising on rocky hillside near top, flowing into moist drainage line.



Plate 2 Series of soaks on rock shelf parallel to stream, following direction of joint in granite.



Plate 3 Soaks may disappear into better drained soils downslope.



Plate 4 Soak water at head of major gully head and stream complex.



Plate 5 Broad soak in gently sloping outwash valley between granite hills.



Plate 6 Linear moist drainage line soak.



Plate 7 Series of soaks in ‘amphitheatre’- shaped catchment



Plate 8 Soak on break of slope above moist drainage line soak– part of a complex containing several soak types, including a spring-induced gully head further upslope.



Plate 9 Seasonally dry sites are more tolerant of cattle grazing when dry, and may retain a number of interesting species.



Plate 10 At Highlands the peat was often up to 20-30 cm in depth (April 2006).



Plate 11 Sphagnum was observed in one site of excellent quality at Highlands (April 2006).



Plate 12 Extensive, high quality peatland vegetation with Button Grass (*Gymnoschoenus sphaerocephalus*) at Highlands (April 2006).



Plate 13 A remarkable spring-soak wetland on the outwash southern flank of the Warby Ranges, heavily grazed by sheep but of high significance. Red Gum (*Eucalyptus camaldulensis*) and Grey Box (*E. microcarpa*) are the tree dominants (April 2006).



Plate 14 Grazed (foreground) and ungrazed (beyond fence) Warby Range Swamp Gum (*Eucalyptus cadens*) vegetation on northern outwash slope of Warby Ranges (April 2006).



Plate 15 Peatland at Strathbogie Ranges, with Woolly Tea-tree (*Leptospermum lanigerum*) showing invasion by the seriously weedy Reed Sweet-grass (**Glyceria maxima*) (April 2006).



Plate 16 Spring-soak wetland dominated by Prickly Tea-tree (*Leptospermum continentale*) and sedges here being invaded by Cut-leaf Bramble (**Rubus laciniatus*) (Strathbogie Ranges) (April 2006).



Plate 17 Spring-soak wetland dominated by Prickly Tea-tree (*L. continentale*) on distant slopes, a common occurrence in the northern Strathbogie Ranges (April 2006).



Plate 18 Former Montane Riparian Woodland now cleared and planted with Reed Sweet-grass (*Glyceria maxima*) and Willows (*Salix matsudana* x *S. alba*) (Strathbogie Ranges)(April 2006).



Plate 19 Recent extensive clearing of spring-soak wetlands dominated by Prickly Tea-tree (*L. continentale*) now represented by mounds of debris in the distance (Strathbogie Ranges, April 2006).



Plate 20 Prickly Tea-tree (*L. continentale*) dominated spring-soak wetland here being slowly destroyed by invading Maritime Pine (**Pinus pinaster*) (Strathbogie Ranges) (April 2006).



Plate 21 A very extensive, high-quality peatland on private property at Strathbogie Ranges, dominated by Prickly Tea-tree (*L. continentale*) and Fine Twig-sedge (*Baumea arthropphylla*) (April 2006).



Plate 22 A formerly vast complex of Montane Riparian Woodland and spring-soaks dominated by Mountain Swamp Gum (*Eucalyptus camphora*) now destroyed by draining. Rushes (*Juncus* spp.) indicate the original extent of the complex (Strathbogie Ranges) (April 2006).



Plate 23 One of a remarkable, highly discrete pair of spring-soak wetlands south of the Warby Ranges dominated by sedges and Cumbungi (*Typha domingensis*). The Grassy Woodland vegetation is dominated by Red Box (*Eucalyptus polyanthemus*), White Box (*E. albens*) and Grey Box (*E. microcarpa*) (April 2006).



Plate 24 A small spring-soak on the northern flank of the Strathbogie Ranges showing a dramatic cross-fence comparison of the impacts of cattle grazing (indicated by the elimination of Common Reed (*Phragmites australis*) below the fence (April 2006).



Plate 25 A dam constructed on a spring-soak wetland in the Strathbogrie Ranges. The presence of the brownish-white kaolinite, an ideal dam substrate, is universal in these situations (April 2006).



Plate 26 Montane Riparian Thicket dominated by Mountain Tea-Tree (*Leptospermum grandifolium*) at Tolmie. The surrounding Radiata Pine (*Pinus radiata*) forest is likely to lead to the severe degradation of this vegetation (April 2006).



Plate 27 Very high quality Montane Riparian Woodland on the Tolmie Plateau dominated by Mountain Swamp Gum (*Eucalyptus camphora*) with a sedgy understorey (April 2006).

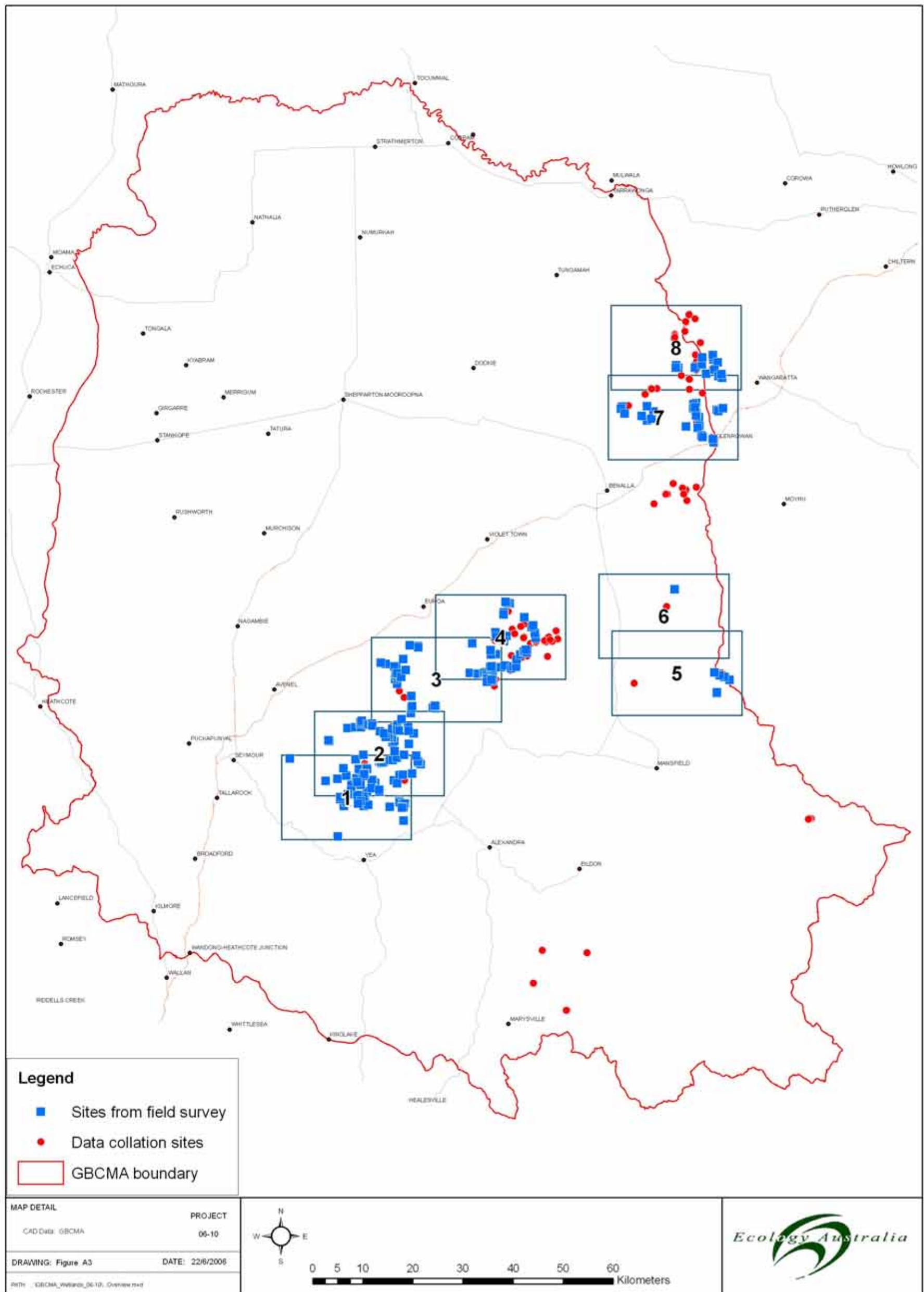


Figure 3 All spring-soak and peatland wetland sites known from the study area, including data collated from within the project team, external to the team and data collected during field trips.

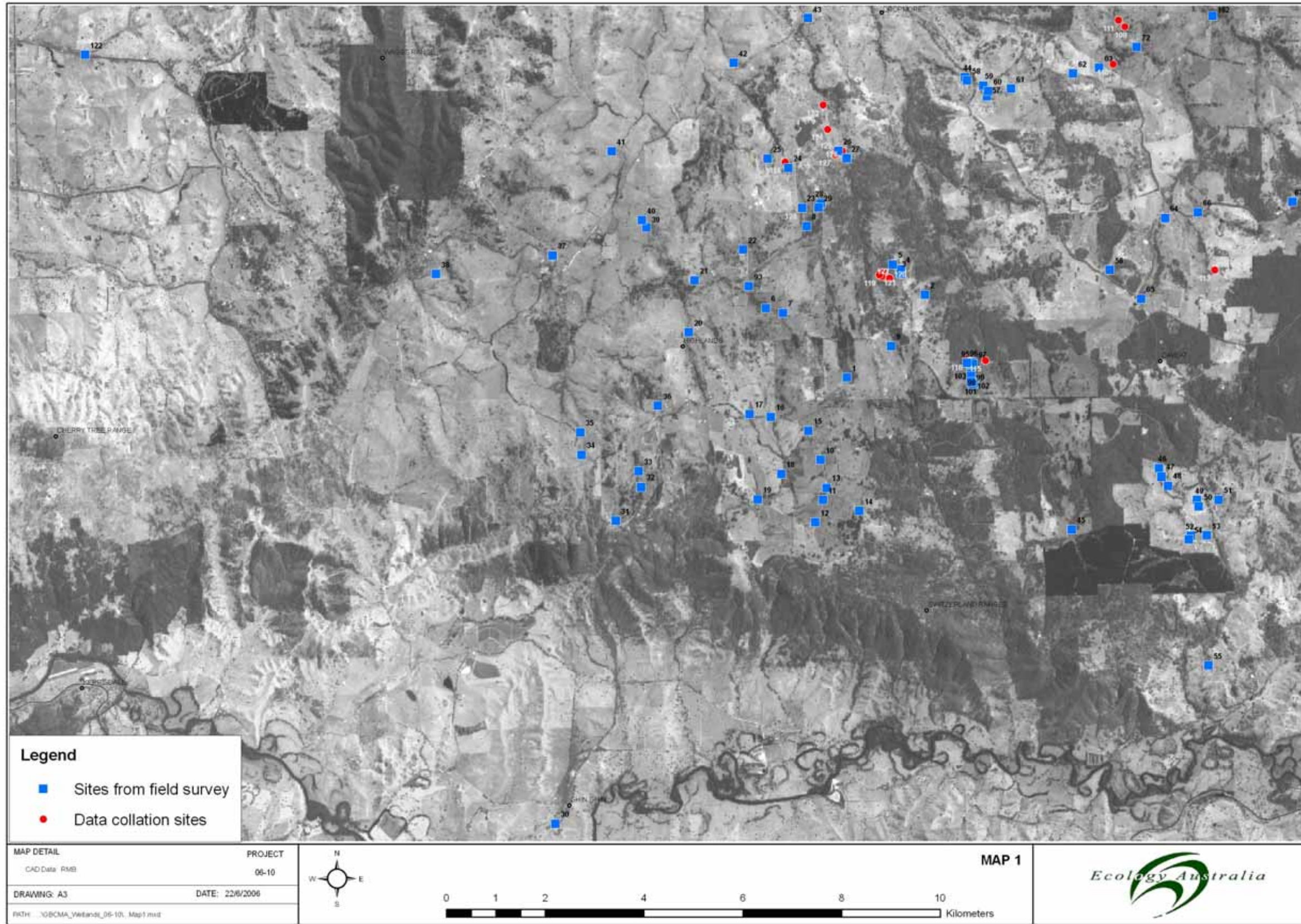


Figure 4 Spring-soak and peatland wetlands in Map 1 of the overall study area (see Key map), including data collated from within the project team, external to the team and data collected during field trips.

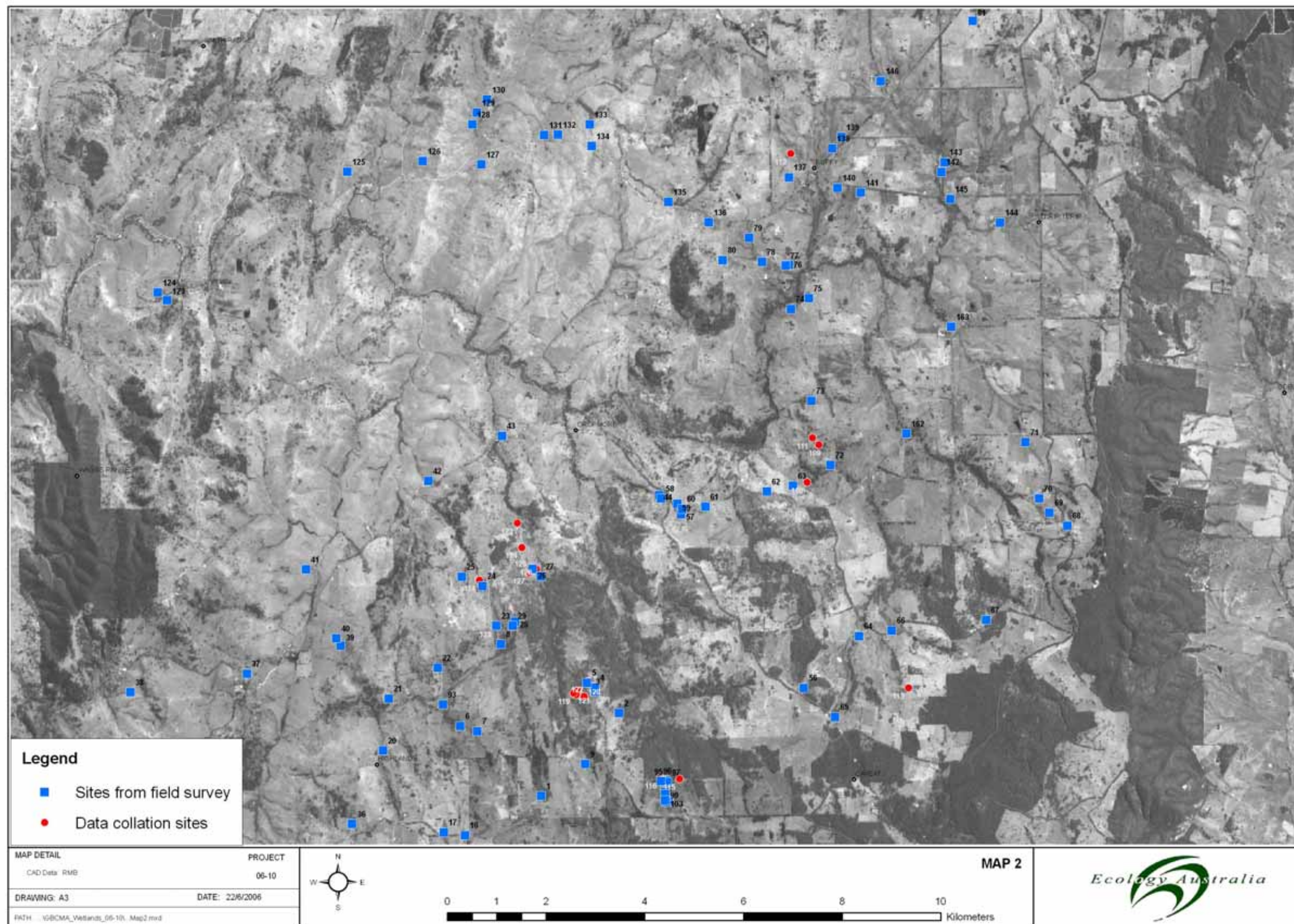


Figure 5 Spring-soak and peatland wetlands in Map 2 of the overall study area (see Key map), including data collated from within the project team, external to the team and data collected during field trips.

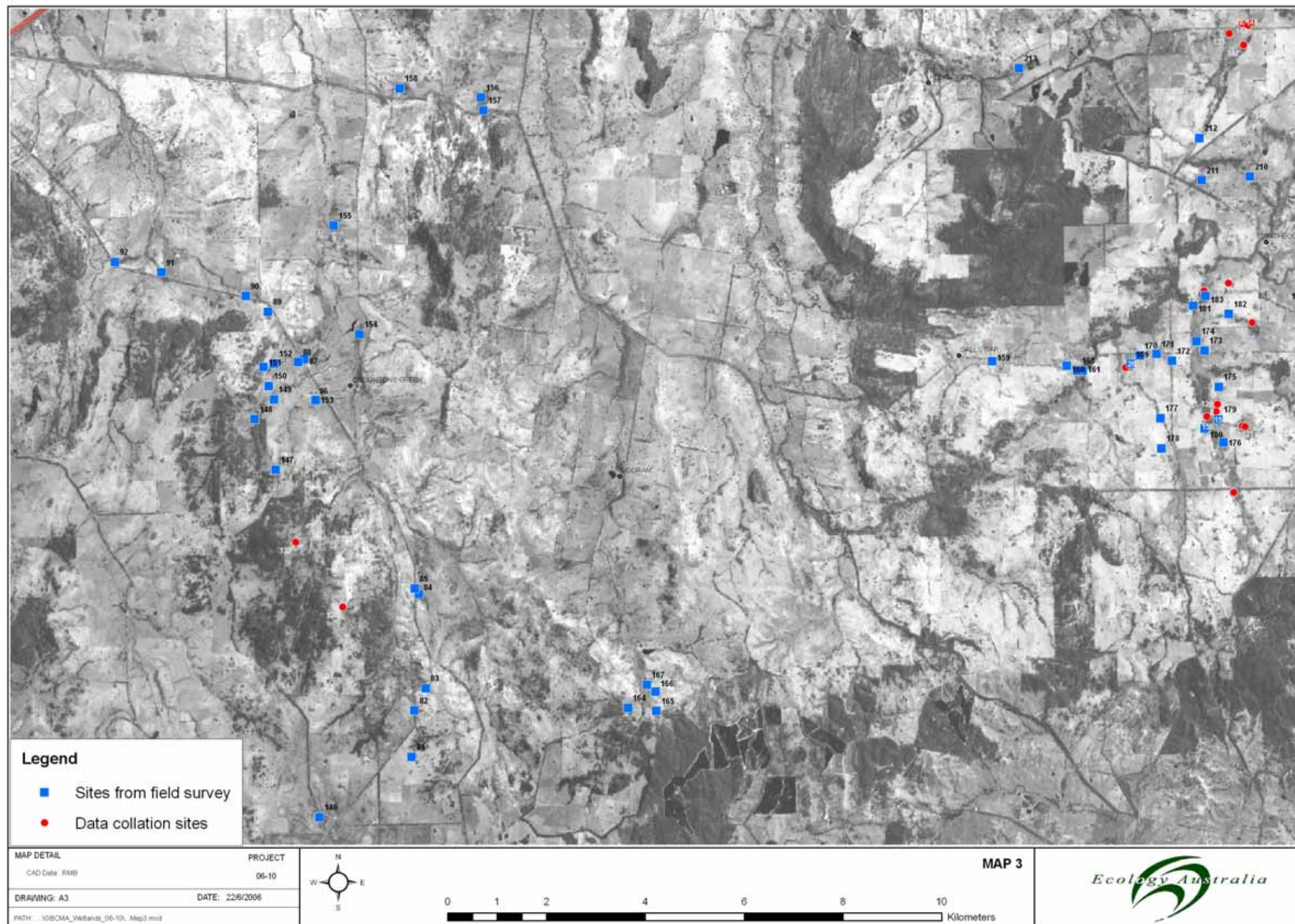


Figure 6 Spring-soak and peatland wetlands in Map 3 of the overall study area (see Key map), including data collated from within the project team, external to the team and data collected during field trips.

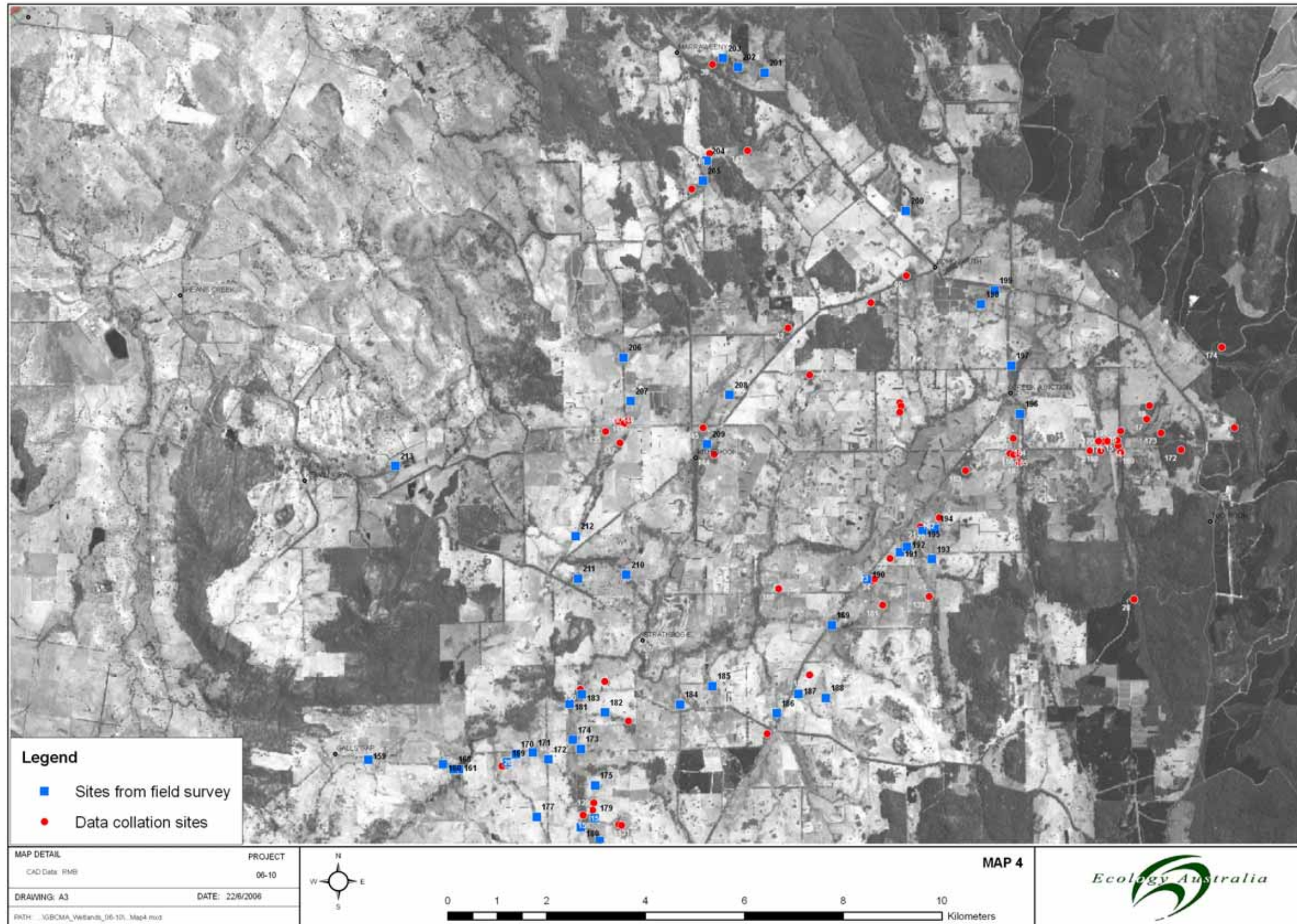


Figure 7 Spring-soak and peatland wetlands in Map 4 of the overall study area (see Key map), including data collated from within the project team, external to the team and data collected during field trips.

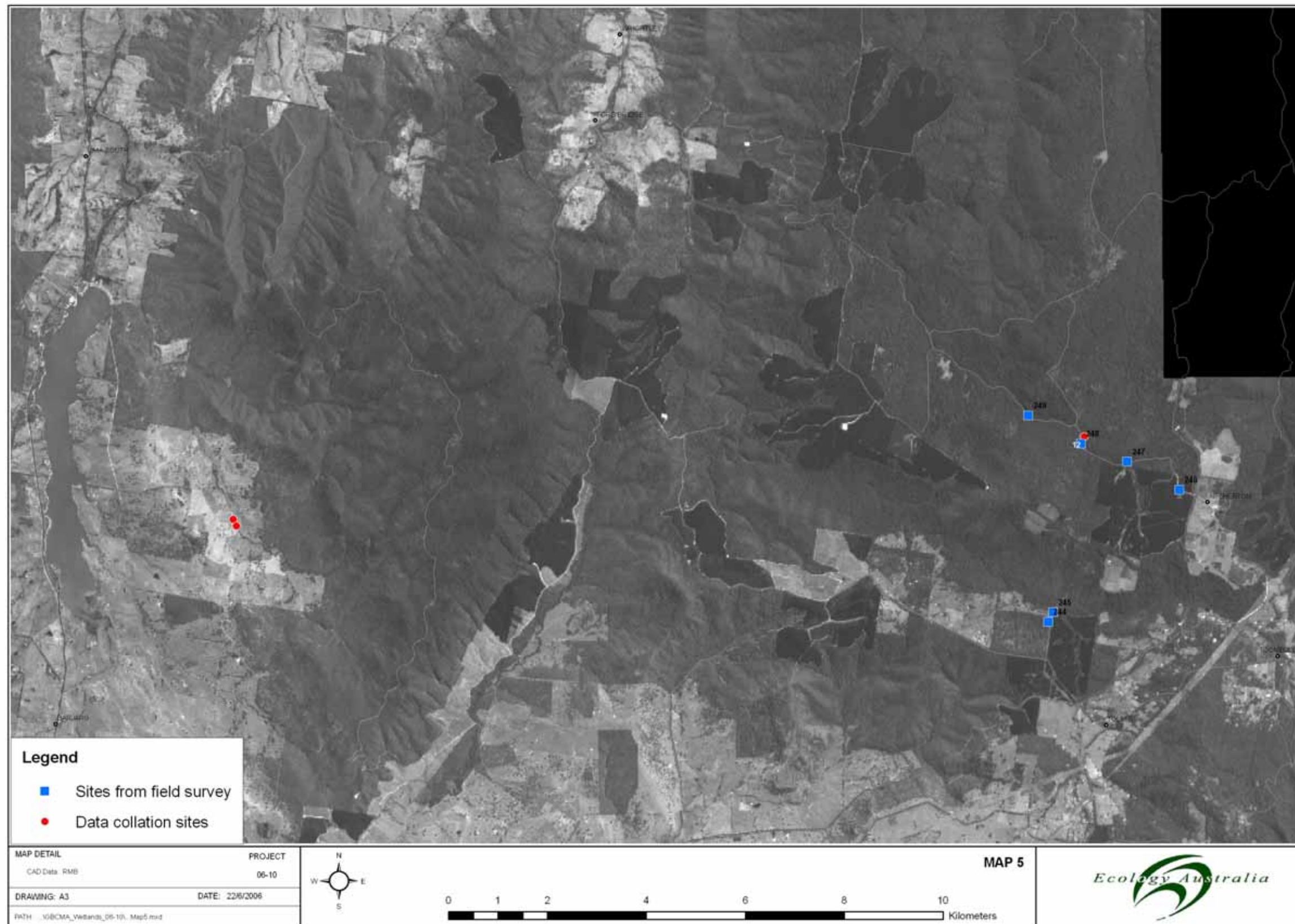


Figure 8 Spring-soak and peatland wetlands in Map 5 of the overall study area (see Key map), including data collated from within the project team, external to the team and data collected during field trips.

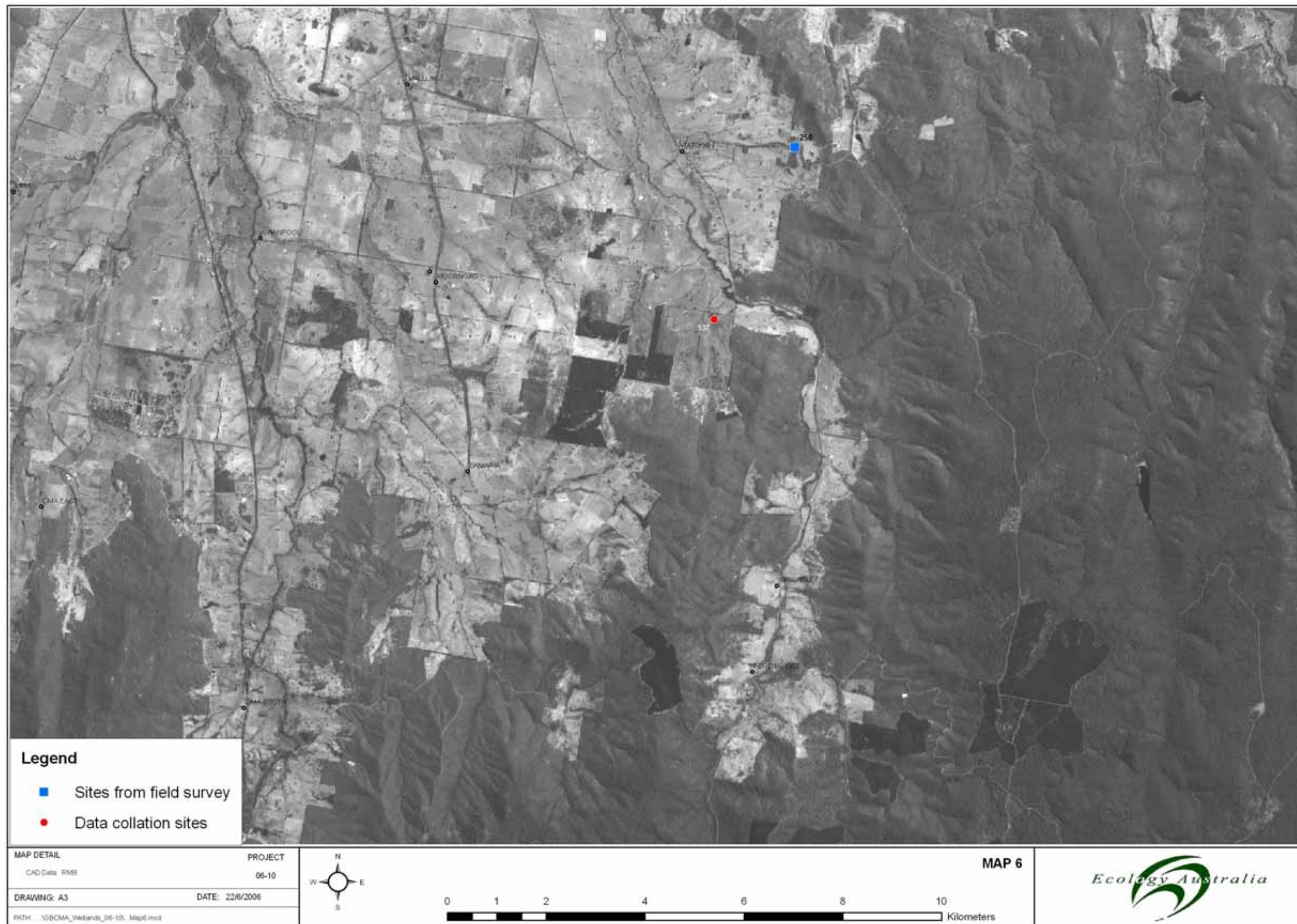


Figure 9 Spring-soak and peatland wetlands in Map 6 of the overall study area (see Key map), including data collated from within the project team, external to the team and data collected during field trips.

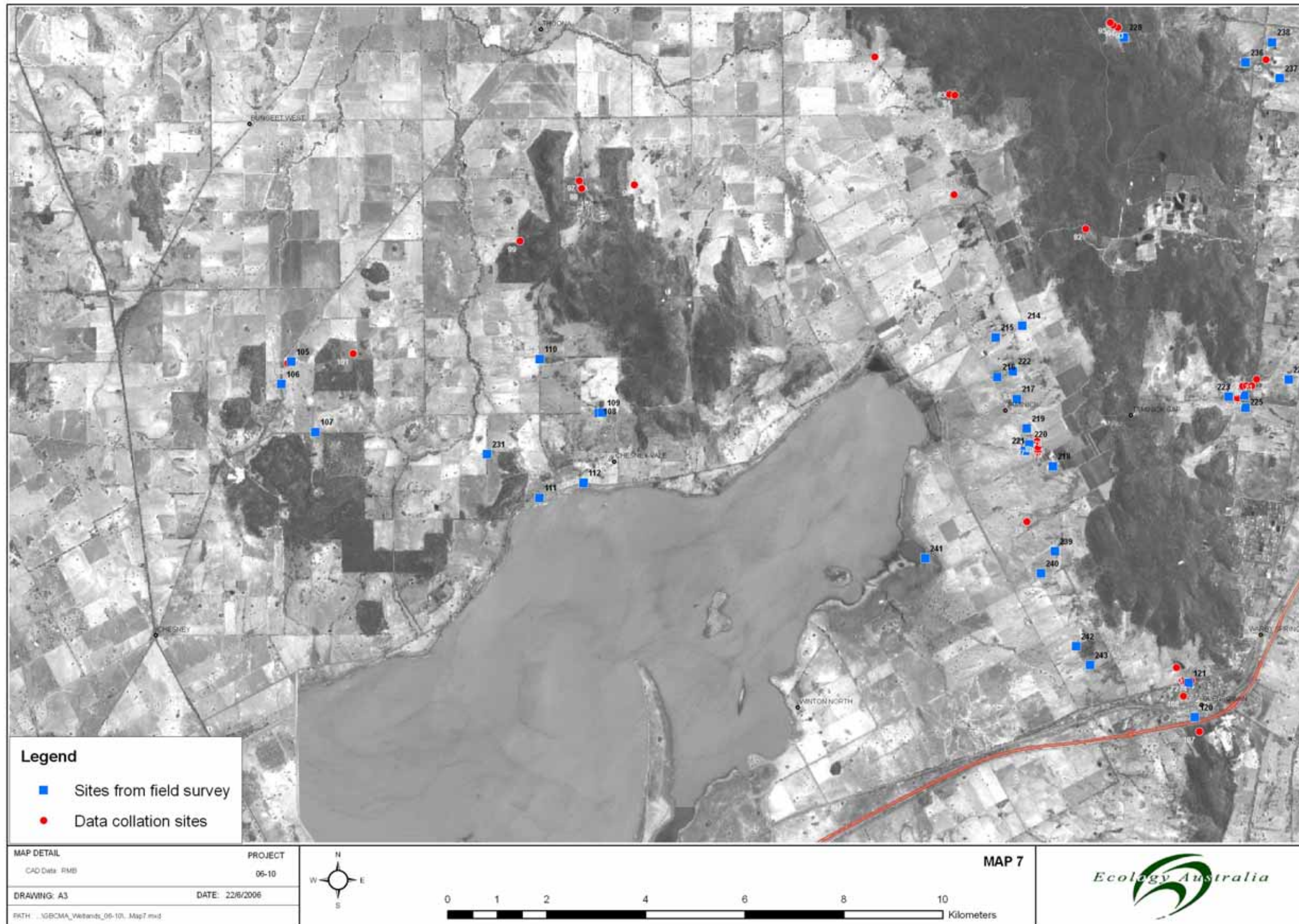


Figure 10 Spring-soak and peatland wetlands in Map 7 of the overall study area (see Key map), including data collated from within the project team, external to the team and data collected during field trips.

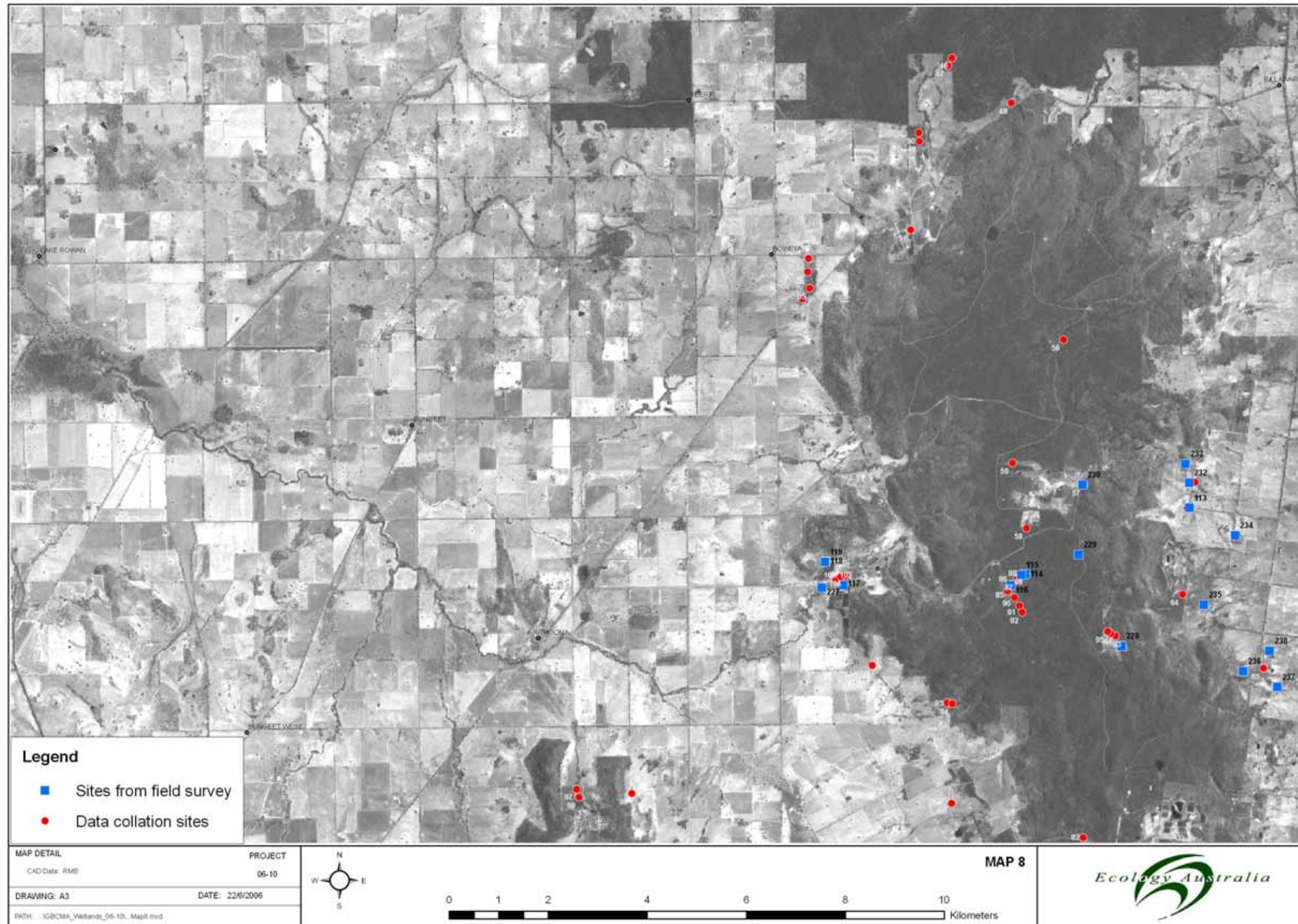


Figure 11 Spring-soak and peatland wetlands in Map 8 of the overall study area (see Key map), including data collated from within the project team, external to the team and data collected during field trips.

Table 2 Data table of field survey results.

Wetland ID	Confidence	Confident - high	Confident - low	Photos_new	Species list	Comments	Eastings	Northing
1		1		1_1 - 1_7			361211	5894332
2		1		2_1 - 2_5		Fenced over c. 30 years (semi-effectively). Soil high organic content but not peat. Free water limited, but generally moist	362792	5896006
3		1		3_1 - 3_2		Grazed, small area remnant grassy/sedgy in paddock. Adjacent area, more remnant spp. Peat ~ 3 cm deep, half way between sapric and fibric, moist but not wet	362308	5896440
4		1		4_1 - 4_2		Small sedgy patch, within paddock area [2320/6550] 2-3 cm fibric peat. Grazed continuously for over 100 years	362305	5896523
5		1		5_1 - 5_5			362141	5896621
6		1		6_1 - 6_7		Swamp Rat gallery? Sedgy-grassy, close cropped "marsupial lawn". Highly intact Sedgy-Sphagnum with <i>Leptospermum lanigerum</i> and <i>Eucalyptus camphora</i> fringe. Photos 24-26 Sphagnum and habitat south sides. Fibric peat (Sphagnum derived) ~ 35 cm deep. Swamp from distance	359570	5895740
7		1		7_1 - 7_4		~4 cm Fibric peat over dark grey silty clay. (Protected remnant)	359918	5895639
8		1		8_1 - 8_4			360392	5897400
9		1		9_1 - 9_6		Spring-soak on drainage line at head of gully, not peaty on sides of valley (but peaty in middle where very wet - see sample collected by S. Mathews)	362106	5894972
10	K					Not site - record of <i>Baumea planifolia</i> on roadside	360676	5892665
11	K					Not site - <i>Juncus</i> spp.	360728	5891861
12	K					Site marked on aerial - but on inspection only <i>Juncus</i> present, not soak site	360572	5891409
13		1		13_1	<i>Juncus</i> spp., <i>Hemarthria uncinata</i> , <i>Carex appressa</i>	Small dam - neighbouring roadside, ~ 50% indig cover, grazed, mown	360803	5892106
14	K					Not site - Broom record	361459	5891640
15	K					Not site - <i>Lomandra</i> record	360432	5893255
16		1		16_1 - 16_2		Excellent quality - see S. Mathews notes	359666	5893533
17			2		<i>Juncus</i> spp.	Roadside north of Old Saleyard Lane	359239	5893593
18		1		18_1 - 18_4	<i>Phragmites</i> , <i>Carex</i> , <i>Juncus</i> , <i>Baumea</i> , <i>Cyprus lucidus</i> , <i>Gahnia sieberiana</i> , <i>Eucalyptus camphora</i>	Excellent quality	359880	5892378
19		1		19_1 - 19_2		Excellent quality, willows present, sheep access	359404	5891876
20		1		20_1	<i>Leptospermum lanigerum</i>	Soaks on Hillside, visible from Road, heavily grazed	358008	5895246
21	100		2			Soak on A. Lades, visible from Road	358122	5896299
22	200		2			2 dams/soaks visible from Road, heavily grazed, very boggy	359111	5896922
23		1		23_1 - 23_3		Heavily grazed, sheep, not fenced	360308	5897772
24		1		24_1		Excellent quality. Almost entirely fenced, plantings in area fenced off	360021	5898580
25	100		2			On remote hillside	359600	5898764
26		1		26_1		Site with extensive cattle damage	361041	5898921
27		1		27_1 - 27_2	<i>Gleichenia</i>	Grazed, extends to west into gully	361201	5898772
28		1				Degraded, many small soaks	360685	5897861
29		1		29_1		Degraded	360637	5897773
30		1			<i>Carex appressa</i> , <i>E. camphora</i>	Strictly outside study area	355306	5885304
31	50		2		<i>Carex</i> , treefern		356531	5891440
32		1			<i>Carex</i> , treefern	Head of gully, tributary to creek	357045	5892122
33		1			<i>Leptospermum continentale</i>		356991	5892432
34	K			34_1			355839	5892766
35	100		2	35_1			355811	5893221
36		1		36_1	<i>Leptospermum continentale</i> , <i>Carex appressa</i>	Grazed	357383	5893760
37	K					Soak on hillside (too distant to ID species), outfall from drainage line?)	355250	5896804
38	50		2			Water table breaching mid-slope, multiple gully head, grazed	352889	5896428
39	150		2			Excellent quality	357152	5897372
40	150		2				357063	5897517
41	150		2		<i>Juncus</i> spp	Heavily grazed	356448	5898914
42		1			<i>Juncus</i> spp, <i>L. lanigerum</i> , <i>E. camphora</i>	Heavily grazed	358921	5900704
43		1			<i>Carex</i> spp, <i>Juncus</i> spp., <i>E. camphora</i> , <i>Persicaria hydropiper</i>		360419	5901618
44	50		2			Small soak on hillside	363596	5900416
45		1			<i>Phragmites</i> , <i>Carex</i> spp.	Spaniaks Road	365761	5891264
46		1		46_1 - 46_2	<i>Carex</i> , <i>Phragmites</i> , <i>Acacia melanoxylon</i>	Excellent quality, soak at gully head, Grazed	367528	5892495
47		1			Tree fern, <i>A. melanoxylon</i> , <i>C. appressa</i> , <i>Eucalyptus globulus</i>	Soak on hillside at spring-fed gully head	367575	5892328
48		1		48_1 - 48_2	<i>Carex</i> , <i>A. melanoxylon</i> , <i>Juncus</i> , <i>Salix</i> just below soak	Isolated soak on hillside, heavily grazed	367710	5892149
49		1		49_1 - 49_2		Spring-fed gully head	368294	5891864
50		1		50_1 - 50_2			368329	5891731
51	200		2	51_1 - 50_2			368737	5891866
52	K			52_1		Hillside soak	368170	5891135
53	100		2	53_1		Inter spring gully complex	368496	5891144
54		1		54_1		Inter spring and gully complex	368133	5891063
55						Not site - potential tree poisoning on opposite side of valley	368531	5888509
56		1			<i>Baumea</i> , <i>Gleichenia</i> , <i>Carex</i> , <i>Poa labillierei</i> , <i>L. lanigerum</i> , <i>A. melanoxylon</i>	Hillside soak	366533	5896513
57	100		2			Hillside soak, spring-fed gully head, grazed below	364048	5900029
58		1		58_1	<i>Juncus</i> , <i>Carex</i>	Spring-fed hillside soak	363637	5900349
59		1			<i>Juncus</i> , <i>Carex</i>	Spring-fed gully head	363969	5900246

Wetland ID	Confidence	Confident - high	Confident - low	Photos_new	Species list	Comments	Easting	Northing
60		1			<i>Juncus</i> , <i>Carex</i> , <i>A. melanoxyton</i> , <i>Gleichenia</i> ??, <i>L. lanigremum</i> , <i>L. continentale</i> , <i>Salix</i> , <i>Eucalyptus melliodora</i>	Spring-fed gully head, grazed	364068	5900137
61		1			<i>L. continentale</i> , <i>Poa labillardierei</i> , <i>Carex</i> spp., <i>Blechnum nudum</i> , <i>Juncus</i>	Spring-fed Gully and hillside soak, grazed	364536	5900184
62	K				<i>Leptospermum</i> spp.	Hillside soak, break of slope, catchment basin bottom	365786	5900489
63		1			<i>Juncus</i> spp.	Spring-fed gully soak, heavily grazed, degraded	366316	5900606
64		1			<i>Juncus</i> spp., <i>Phragmites</i>	Spring-fed drainage line, not sure about this site	367650	5897564
65		1		65_1 - 65_4	<i>L. lanigerum</i>	Heavily grazed by cattle, bulldozed, possible storm damage, cleared	367167	5895927
66		1		66_1 - 66_2	<i>Carex</i> , <i>Phragmites</i> , <i>Juncus</i> , <i>Baumea</i>	Spring-fed hillside soak, draining into drainage line, may be part of a stream complex	368316	5897679
67		1		67_1 - 67_2	<i>Juncus</i> , <i>Carex</i> , <i>E. camphora</i>	Spring-fed hillside soak, heavily grazed and pugged	370226	5897889
68		1			<i>L. lanigerum</i> , <i>Hedera helix</i> , <i>E. camphora</i> , <i>Carex</i> , <i>Acacia melanoxyton</i> , <i>Rubus fruticosus</i>	<i>L. lanigerum</i> swamp at bottom of gully on roadside, fenced	371876	5899801
69		1		69_1	<i>E. camphora</i> , <i>L. lanigerum</i> , <i>Carex</i> , <i>Juncus</i> , <i>Baumea</i> , <i>Salix</i>	Fenced, but lightly grazed, small dam	371513	5900065
70		1			<i>L. lanigerum</i>	Ground water breach, hillside soak	371302	5900348
71		1		71_1 - 71_6	<i>Juncus</i> spp.	Soak in drainage line in paddock, heavily grazed	371025	5901489
72		1		72_1 - 72_3		Hillside spring-soak	367076	5901026
73		1		73_1	<i>L. lanigerum</i> , tree ferns, <i>Salix</i> in bottom	Hillside soak, not fenced, grazed	366683	5902327
74				74_1 - 74_5	<i>L. lanigerum</i> , <i>L. continentale</i> , <i>E. camphora</i> , <i>Carex</i> , <i>Acacia melanoxyton</i> , <i>Eucalyptus viminalis</i> , <i>Persicaria</i>	Extends 200-300m excellent quality, free water, cattle access, bulldozed, fenced	366271	5904187
75	50		2		<i>L. lanigerum</i> , <i>L. continentale</i> , <i>E. camphora</i> , <i>Carex</i> , <i>Acacia melanoxyton</i> , <i>Eucalyptus viminalis</i> , <i>Persicaria</i>	Extends 200-300m excellent quality, free water, cattle access, bulldozed, fenced	366638	5904402
76		1		76_1	<i>L. continentale</i>	Either side of road	366229	5905083
77		1			<i>L. lanigerum</i>	Either side of road	366167	5905062
78		1		78_1 - 78_5	~	Large spring-soak system on gentle hillslope draining along drainage line	365687	5905139
79	100		2	79_1 - 79_5	~	"	365424	5905626
80		1		80_1		Hillside soak, grazed, not fenced	364890	5905176
81	50		2	81_1	<i>Juncus</i> spp.	Hillside soak, paddock, grazed sheep	369957	5910023
82	K			82_1	<i>Aacia dealbata</i> , <i>Poa labillardierei</i>	Hillside spring-soak??	370014	5910959
83		1		83_1 - 83_2	<i>Juncus</i> , <i>Carex</i> , <i>A. melanoxyton</i> , <i>A. dealbata</i> , <i>Salix</i> spp., <i>L. lanigerum</i> , <i>L. continentale</i> , <i>Gahnia radula</i> , <i>Blechnum</i> spp.	Hillside spring-soak	370240	5911409
84		1		84_1	~	Hillside spring-soaks, heavily grazed	370103	5913314
85	K			85_1	~	Hillside spring-soaks, heavily grazed	370021	5913431
86		1			<i>Eucalyptus camaldulensis</i> , <i>Carex</i> , <i>Poa labillardierei</i> , <i>Lomandra longifolia</i>	Grazed, not fenced, low values, marginal	367998	5917217
87		1			<i>Juncus</i> , <i>Carex</i>	Low-lying soaks on either side of road, degraded, grazed	367785	5918062
88		1			<i>E. camaldulensis</i> , <i>Eucalyptus ovata</i> / <i>E. camphora</i>	Low-lying soaks on either side of road, degraded, grazed	367659	5918002
89		1		89_1 - 89_4	<i>Juncus</i> , <i>Baumea</i> , <i>L. lanigerum</i> , <i>Rubus fruticosus</i> , <i>E. camaldulensis</i> , <i>E. ovata</i> / <i>E. camphora</i> , <i>Typha</i> sp.	Large dam, grazed	367050	5919024
90			2			Not site - <i>Asparagus asparagoides</i> and <i>Dianella laevis</i> (collected by SM)	366601	5919341
91		1		91_1 - 91_3	<i>Juncus</i> spp., <i>E. camaldulensis</i> , <i>Phragmites</i> , <i>Juncus</i> , <i>Carex</i> spp.	Grazed	364889	5919822
92		1		92_1 - 92_2	<i>Vinca major</i> , <i>Gahnia radula</i> , <i>E. camaldulensis</i> , <i>A. melanoxyton</i> , <i>Ulex europaeus</i> , <i>Tradescantia fluminensis</i> , <i>Phragmites</i> , <i>Eleocharis</i>	On right side of roadway	363949	5920033
93		1					359222	5896179
94		1				<i>Baumea planifolia</i> , drier community western edge [3710/4620], no peat (organic sand).	363701	5894643
95		1				Wetter community, shallow fibric peat (3-4 cm), with high organic content silt below.	363711	5894617
96		1				?(3735/4640)	363741	5894637
97		1				Community and <i>Baumea planifolia</i> CS10	363763	5894603
98		1				?(3720/4400) Dry <i>L. continentale</i> scrub, no free water	363722	5894404
99		1					363725	5894363
100		1				Paddocky upper-edge near saddle, open <i>L. continentale</i> , <i>Hemarthria uncinata</i> , <i>Baumea arthropphylla</i> , etc., no free standing water, heavily grazed by marsupials, ~ 2 cm primarily fibric peat. Wetted subsoil: 7-5YR - 4/1: Dark Grey	363796	5894238
101		1				Dense <i>B. arthropphylla</i> , very peaty, fibric sapric peat, ~ 10cm (peat depth), subsoil 7.5 YR - 5/1 - grey, photos pugholes (recent incident)	363785	5894219
102		1				Wombat activities in <i>B. arthropphylla</i>	363749	5894204

Wetland ID	Confidence	Confident - high	Confident - low	Photos_new	Species list	Comments	Easting	Northing
103		1				Dam spoil - soil from stock watering hole, silt-clay [10YR - 6/4 - Light Yellowish Brown] from depth > 1 m - not holding water 1 m down, but in <i>Baumea</i> area, photos vegetation and soil mound	363722	5894244
104		1					363643	5894630
105		1				Warby Spring-soak - confined to a few small patches in north-east corner - little patch within box woodland (<i>Eucalyptus albens</i> , <i>E. polyanthemos</i> and <i>E. microcarpa</i>). At least partially dug-out ponds at spring end - water with colloidal suspension (white clay)	412136	5971300
106			2			<i>Typha</i> patch with <i>L. continentale</i> in paddock (remnant soak) - viewed c. 300 m south west from patch	411941	5970849
107			2			Clapped out, probably with former spring areas	412626	5969879
108			2			Patch <i>Eucalyptus blakelyi</i> and pasture grasses - moist, but not wet (= spring-soak Woodland Patch to north-east, north from road at WP55 and has <i>E. blakelyi</i> & <i>E. camaldulensis</i> and <i>Carex tereticaulis</i> , weedy	418343	5970263
109			2			Clapped out Spring-soak Woodland	418417	5970270
110			2			Remnant Spring-soak Woodland - Dam by road, wet flat behind, photos habitat and <i>Goodenia macbarronii</i> , herbland in broader wet bank under Red Gum (?species), no peat <i>Goodenia macbarronii</i> site	417154	5971357
111			2			Spring-soak Woodland - hardly developed as a soak, <i>L. continentale</i> patch, weedy with lots of bare earth surrounded by <i>E. blakelyi</i> and rabbit droppings	417149	5968555
112			2			Waypoint from road - site subtle, appears to be small soak area, with agricultural-useage landscape	418038	5968849
113			2			<i>E. blakelyi</i> woodland - shrubby/sedgy <i>Eucalyptus cadens</i> - sedgy/herbaceous, soil mineral as verges cow trampled, peaty soils in wetter core	430328	5980667
114			2			North-east end - Spring-soak woodland, closer to creek-line Herb-rich Woodland than <i>E. cadens</i> stuff, wetted stuff only is peaty.	427015	5979327
115			2			Dam, with <i>Typha</i> and <i>Juncus</i>	426937	5979311
116			2			Small area Spring-soak (organic silty soils), small but good quality (near dam)	426720	5979098
117			2			Viewed from adjacent road - potentially interesting for follow-up	423336	5979097
118			2			Interesting - as for WP 64	422978	5979582
119			2				422971	5979572
120			2			Glenrowan, with horse dung, mown grassy weeds - highly degraded, channel dry, overall site too dry to be of interest	430389	5964109
121			2			Glenrowan, damp area only several metres wide, not peaty, densely seedy, fades out after about 30 m.	430259	5964804
122		1				Not a site, GWC weed record Tall Wheat Grass in Grey Box Woodland	345787	5900872
123			2				353633	5904363
124		1		124_1	<i>Carex tereticaulis</i> , <i>E. camaldulensis</i> , <i>Juncus</i>	Out of study area, spring in flattish paddock, granite upslope 200 m; outwash.	353444	5904520
125		1		125_1	<i>Baumea</i> , <i>Carex</i> , <i>Juncus</i>	Tarcomb, outside study area? hillside soak, in small 'amphitheatre' basin, grazed (probably cattle), dam below.	357283	5906963
126		1		126_1 - 126-2	<i>Carex</i> , <i>Juncus</i> , <i>Pteridium esculentum</i>	Hillside soak in drainage line, grazed, dam below.	358812	5907178
127		1		127_1 - 127_2	<i>Carex appressa</i> , <i>C. gaudichaudiana</i> , <i>E. ovata</i> / <i>E. camphora</i> , <i>E. camaldulensis</i> nearby, <i>Salix fragilis</i> / <i>x rubens</i> in drainage line nearby, <i>Juncus</i> spp., <i>L. lanigerum</i> , <i>L. continentale</i> , <i>Populus</i> spp.	Soak in outwash gully; cattle grazed	360002	5907112
128	100		2	128_1	<i>Juncus</i> spp.	Spring on break of slope above drainage line	359814	5907923
129	100		2	129_1 - 129_2	<i>Carex appressa</i> , <i>Juncus</i>	Soak at head of drainage line, draining into creek?	359907	5908161
130	100		2	130_1 - 130_2	<i>Carex appressa</i> , <i>Juncus</i> ; <i>Salix</i> nearby below	Soak in drainage line	360113	5908425
131		1		131_1 - 131_8	<i>A. melanoxydon</i> , <i>Baumea arthrophylla</i> , <i>Carex appressa</i> , <i>C. gaudichaudiana</i> , <i>C. fascicularis</i> , <i>E. camphora</i> , <i>E. camaldulensis</i> , <i>L. lanigerum</i> , <i>Paspalum dilatatum</i> (in road reserve), <i>Persicaria</i> , <i>Phragmites australis</i>	Complex of sites, soaks in and above (on break of slope) drainage line that narrows and widens, extends above and below road, dam in paddock above, no channel, some free water, dam above, sample of <i>E. camphora</i> taken. Frogs.	361273	5907704
132		1		132_1	<i>Carex appressa</i> , <i>C. fascicularis</i> , <i>E. camaldulensis</i> (live and dead), <i>Juncus</i> , <i>Typha</i>	Dam in soak in broad drainage line that would have held target EVC, free water in dam.	361549	5907714
133		1		133_1 - 133_2	<i>A. melanoxydon</i> , <i>Baumea</i> , <i>Carex</i> , <i>Juncus</i> , <i>L. lanigerum</i> , <i>Persicaria</i> , <i>Rubus fruticosus</i> sl, <i>Salix</i> sp.	Swamp/soak in drainage line, extends up drainage line in some form approx 600m	362192	5907922
134		1		134_1 - 134_5	<i>A. dealbata</i> ssp. <i>dealbata</i> , <i>A. implexa</i> , <i>Baumea arthrophylla</i> , <i>Carex appressa</i> , <i>C. tereticaulis</i> , <i>Juncus</i> , <i>Populus nigra</i> (nearby), <i>Salix babylonica</i> (nearby), <i>S. x reichhardtii</i> , <i>S. x sepulcralis nothovar. sepu.</i>	Head of gully of site SM GWC 17, complex of four springs out of rock, soil, and drainage line system, frogs.	362233	5907485
135		1		135_1 - 135_3	<i>A. implexa</i> , <i>A. melanoxydon</i> , <i>Anthoxanthum odoratum</i> , <i>Carex appressa</i> , <i>C. fascicularis</i> , <i>Cyperus lucidus</i> , <i>Dianella tarda</i> , <i>L. continentale</i> , <i>L. lanigerum</i> , <i>Lythrum salicaria</i> , <i>Paspalum</i> sp., <i>Phragmites</i>	Drainage line soak, extensive maybe 3-4 ha +/- Wombat activity. Sample of <i>E. camphora</i> taken - associates <i>A. mearnsii</i> , <i>D. aff longifolia</i> , <i>Eucalyptus dives</i> , <i>E. melliodora</i> , <i>E. rubida</i> , <i>L. continentale</i> , <i>Lomandra filiformis</i>	363789	5906351

Wetland ID	Confidence	Confident - high	Confident - low	Photos_new	Species list	Comments	Easting	Northing
					<i>australis</i> , <i>Populus</i> sp, <i>Rubus fruticosus</i> sl, <i>Salix cinerea</i> , <i>S. x sepulcralis nothovar. sepu.</i> , <i>Themeda triandra</i>			
136		1		136_1 - 136_3	<i>Blechnum minus</i> , <i>C. appressa</i> , <i>C. fascicularis</i> , <i>E. camaldulensis</i> , <i>Juncus</i> , <i>Juncus planifolius</i> , <i>L. lanigerum</i> , <i>Rubus fruticosus</i> sl,	Spring on ridgetop forming a gully head, extends down drainage line, dam at top of soak. Extends up into road reserve where road has been cut down into water table.	364608	5905939
137		1		137_1	<i>Carex</i> , <i>Juncus</i> , <i>Leptospermum continentale</i>	Geocrinia victoriana, Ruffy Village	366230	5906854
138		1			<i>A. dealbata</i> ssp. <i>dealbata</i> , <i>Agrostis stolonifera</i> , <i>Burchardia umbellata</i> , <i>Carex appressa</i> , <i>E. camaldulensis</i> , <i>Juncus</i> , <i>Hermarthria uncinata</i> , <i>L. continentale</i> , <i>Pinus radiata</i>	Very large, extensive complex, <i>E. camphora</i> woodland, very big <i>Banksia marginata</i> (photo with Emma), dam. <i>Pinus radiata</i> drawing water from site.	367105	5907433
139		1					367294	5907664
140	50		2	140_1			367218	5906637
141		1		141_1 - 141_3			367684	5906542
142		1		142_1 - 142_4	<i>Acacia pravissima</i> , <i>Baumea arthropphylla</i> , <i>Baeckea utilis</i> , <i>Blechnum minus</i> , <i>Carex gaudichaudiana</i> , <i>Elaeocharis gracillis</i> , <i>Epacris gunnii</i> <i>Epacris paludosa</i> , <i>E. camphora</i> , <i>Gonocarpus micranthus</i> , <i>Goodenia elongata</i> , <i>Gratiola peruviana</i> , <i>Hermarthria uncinata</i> , <i>Juncus holoschoenus</i> , <i>J. sarophorus</i> , <i>L. continentale</i> , <i>L. lanigerum</i> , <i>Myriophyllum crispatum</i> , <i>Phragmites australis</i> , <i>Rubus fruticosus</i> sl (associated with creek line complex, at some distance away)	Very large and extensive complex, including the drainage line soak of 17a, and swampy areas along creek (photo SM DSCN0040). Very important site, high quality. Photo SM DSCN00641 shows creek 150m from 17a. Site 19 part of this complex	369320	5906960
143		1		143_1		Looks to be similar vegetation to 17a and associated stream soak complex	369383	5907157
144		1		144_1	<i>E. camphora</i> , <i>L. continentale</i>		370513	5905936
145		1		145_1	<i>A. melanoxylon</i> , <i>Baeckia utilis</i> , <i>E. camphora</i> , <i>Gahnia sieberiana</i> , <i>Rubus fruticosus</i> s.l	Heavily grazed, probably part of Site 17a complex.	369500	5906409
146		1					368089	5908800
147		1		147_1			367204	5915825
148		1		148_1 - 148_2		May be part artefact due to road embankment acting as a choke point; incised channel below.	366778	5916849
149		1		149_1 - 149_2			367168	5917248
150		1		150_1			367064	5917522
151	40		2	151_1		400m upslope of 26	366956	5917905
152		1		152_1		Same drainage line as 25, about 400m downslope	367174	5917977
153		1		153_1			368015	5917242
154		1		154_1			368897	5918568
155		1		155_1			368378	5920770
156		1		156_1	<i>Viminaria juncea</i> , <i>E. camphora</i> , <i>C. appressa</i> , <i>J. sarophorus</i> , <i>L. continentale</i> , <i>E. camaldulensis</i>	Large site, soak in very gentle drainage line, dam above. <i>Pennisetum clandestinum</i> in drainage line in road reserve.	371357	5923362
157		1		157_1		Same system as 31	371409	5923104
158		1					369717	5923550
159		1		159_1 - 159_2			381702	5918021
160		1		160_1 - 160_2			383217	5917934
161		1		161_1 - 160_8		Polly McQuinns (also inspected 28.4.06)	383539	5917835
162		1		162_1			368610	5901661
163		1		163_1 - 163_2		Senecio species collected GWC, bridge, on either side of road	369521	5903827
164		1		164_1			374335	5911014
165	100		2	165_1			374909	5910952
166	50		2	166_1			374895	5911340
167		1		167_1			374715	5911482
168		1				Polly McQuinns, where low altitude 'Epacrids' should be - could not find, very bad <i>Rubus fruticosus</i> sl infestation.	383427	5917833
169		1		169_1			384514	5917975
170		1		170_1 - 170_2			384690	5918135
171		1		171_1 - 170_4			385034	5918170
172		1		172_1 - 170_2			385345	5918027
173	100		2	173_1			386004	5918241
174		1		174_1			385843	5918427
175		1		175_1			386292	5917503
176	200		2	176_1			386389	5916379
177		1		177_1			385112	5916868
178		1		178_1 - 178_2			385134	5916256
179		1		179_1			386289	5916844
180	100		2				386010	5916657

Wetland ID	Confidence	Confident - high	Confident - low	Photos_new	Species list	Comments	Easting	Northing
181		1		181_1 - 181_3		NB GPS coords recorded incorrectly. Site is on the stream shown in site 47, photo 8007, where it crosses the road. Road follows line of stream and then turns right to cross stream, site above road.	385778	5919151
182	200		2				386492	5918978
183		1		183_1			386025	5919347
184		1		184_1			388009	5919139
185		1		185_1			388669	5919511
186		1		186_1 - 186_3			389967	5918960
187	200		2	187_1			390407	5919352
188	200		2	188_1			390962	5919272
189		1		189_1 - 189_2			391081	5920743
190		1		190_1 - 190_6	<i>C. gaudichaudiana, L. continentale</i>	Site was not inspected close-up - only from road, recently cleared, extends across road, some small areas fenced out. Property called 'Blythe Airie', lots new fencing - possibly new owners, small dam, road through middle of site.	391798	5921675
191		1		191_1 - 191_2		Two sites.	392460	5922221
192		1					392604	5922322
193	100		2	193_1		Site continues intermittently downstream on break of slope, many sites nearby	393112	5922075
194		1		194_1 - 194_6		Complex of several sites, part of extensive system of sites within about 1km radius.	393165	5922688
195	100		2	195_1 - 195_2			392914	5922645
196		1		196_1 - 196_2		Series of soaks on break of slope in background of photos, extend along contour for c. 300m.	394891	5925011
197		1					394715	5925984
198		1					394098	5927226
199		1					394375	5927504
200		1					392580	5929116
201		1					389719	5931903
202							389183	5932023
203		1					388881	5932198
204		1					388550	5930126
205		1					388472	5929723
206	100		2				386867	5926148
207		1					387011	5925270
208			2				389011	5925396
209	2		2				388557	5924398
210		1					386924	5921760
211		1					385946	5921685
212		1					385898	5922542
213			2				382250	5923959
214		1					426901	5972033
215		1					426364	5971794
216		1					426399	5970994
217		1					426797	5970546
218		1					427518	5969184
219		1					426991	5969949
220		1					427041	5969631
221		1					426961	5969497
222		1					426712	5971108
223		1					431074	5970591
224		1					431382	5970616
225		1					431407	5970367
226		1					432287	5970939
227		1					422908	5979050
228		1					428955	5977871
229		1					428090	5979721
230		1					428170	5981134
231		1					416094	5969426
232		1					430324	5981176
233		1					430247	5981557
234		1					431249	5980112
235		1					430620	5978705
236		1					431412	5977361
237		1					432104	5977043
238		1					431948	5977773
239		1					427559	5967470
240		1					427278	5967026
241		1					424941	5967330
242		1					427988	5965548
243		1					428268	5965167
244		1					430961	5913963
245		1					431060	5914154
246		1					433612	5916632
247		1					432556	5917194
248		1					431619	5917560
249		1					430554	5918133
250		1					422653	5934714

5 Flora and Fauna species

5.1 Flora

Spring-soaks and peatlands are rare habitats with unusual physical characteristics and unusual vegetation structure and floristic composition; as such they have a suite of plant species which are essentially confined to such habitats (at one extreme) or (at the other extreme) the wetland species occur opportunistically in such habitats but (at the other extreme) they occur much more widely. As part of the methodology for this project we listed all indigenous plant species in north-east Victoria known to occur in peatlands and spring-soaks and categorized them as having high, medium or low fidelity to such vegetation/habitats (Appendix 1).

A large proportion of these species (42% of 188 species) are Victorian Rare or Threatened Species (DSE 2005d) (Table 3). During field work opportunistic observations were made and four VROT species were recorded (Table 3). These state or nationally significant plant species are a very important resource in spring-soak/peatlands habitats and management of their populations is a major concern as degradation pressures (e.g. stock grazing and weed invasion) as well as ‘natural’ vegetation changes will inevitably lead to the loss of important populations. Many more significant species will be identified and recorded during subsequent stages of this project. Many of these species are distributed in the alpine /subalpine zones, and are therefore not likely to be encountered during field work

Table 3 Victorian Rare or Threatened Plant Species recorded from the FIS database, with an indication of which species were recorded during field work for this study (in bold).

e- endangered in Victoria, E – Endangered in Australia

v – vulnerable in Victoria, V- Vulnerable in Australia

r- rare in Victoria, R- Rare in Australia

k – poorly known

Name Scientific	Common	DSE status	Fidelity to peatland vegetation		
			Low	Moderate	High
<i>Huperzia australiana</i>	Fir Clubmoss	r			√
<i>Lycopodium scariosum</i>	Spreading Clubmoss	r			√
<i>Botrychium australe</i>	Austral Moonwort	v			√
<i>Ophioglossum reticulatum</i>	Stalked Adder's-tongue	r		√	
<i>Thelypteris confluens</i>	Swamp Fern	e			√
<i>Baumea planifolia</i>	Rough Twig-sedge	k			√
<i>Carex alsophila</i>	Forest Sedge	r	√		
<i>Carex blakei</i>	Alpine Sedge	r			√
<i>Carex canescens</i>	Short Sedge	r			√
<i>Carex capillacea</i>	Hair Sedge	r			√
<i>Carex chlorantha</i>	Green-top Sedge	k		√	
<i>Carex echinata</i>	Star Sedge	v			√
<i>Carex hypandra</i>	Alpine Fen-sedge	v			√
<i>Carex jackiana</i>	Carpet Sedge	r			√
<i>Carex raleighii</i>	Raleigh Sedge	r			√
<i>Carpha alpina</i>	Small Flower-rush	r			√
<i>Carpha nivicola</i>	Broad-leaf Flower-rush	r			√
<i>Isolepis montivaga</i>	Fog Club-sedge	r			√
<i>Oreobolus oxycarpus</i> subsp. <i>oxycarpus</i>	Tuft-rush	r			√
<i>Oreobolus pumilio</i> subsp. <i>pumilio</i>	Alpine Tuft-rush	r			√
<i>Rhynchospora brownii</i>	Grassy Beak-sedge	e			√
<i>Scirpus polystachyus</i>	Large-head Club-sedge	r		√	
<i>Eriocaulon scariosum</i>	Common Pipewort	r			√
<i>Hypoxis vaginata</i> var. <i>brevistigmata</i>	Yellow Star	k		?√	
<i>Juncus brevibracteus</i>	Alpine Rush	r			√
<i>Juncus phaeanthus</i>	Dark-flower Rush	r			√
<i>Juncus thompsonianus</i>	Snowfield Rush	k			√
<i>Luzula atrata</i>	Slender Woodrush	v			√
<i>Prasophyllum niphopedium</i>	Marsh Leek-orchid	e			?√
<i>Pterostylis oreophila</i>	Blue-tongue Greenhood	e		√	
<i>Austrofestuca eriopoda</i>	Snow Fescue	r			√
<i>Deyeuxia affinis</i>	Allied Bent-grass	e			√
<i>Hierochloa submutica</i>	Alpine Holy-grass	v			√
<i>Lachnagrostis meionectes</i>	Alpine Blown-grass	r		√	
<i>Tetrarrhena turfosa</i>	Smooth Rice-grass	r		√	
<i>Diplaspis nivis</i>	Snow Pennywort	r			√
<i>Gingidia harveyana</i>	Slender Gingidia	v			√
<i>Oreomyrrhis pulvinifera</i>	Cushion Caraway	v			√
<i>Oschatzia cuneifolia</i>	Wedge Oschatzia	r			√
<i>Schizeilema fragoseum</i>	Alpine Pennywort	v			√

Name Scientific	Common	DSE status	Fidelity to peatland vegetation		
			Low	Moderate	High
<i>Celmisia sericophylla</i>	Silky Snow-daisy	v			√
<i>Craspedia alba</i>	White Billy-buttons	v			√
<i>Barbarea grayi</i>	Native Wintercress	v		√	
<i>Cardamine astoniae</i>	Spreading Bitter-cress	v			√
<i>Lobelia gelida</i>	Snow Pratia	V v			√
<i>Drosera arcturi</i>	Alpine Sundew	r			√
<i>Epacris celata</i>	Cryptic Heath	r			√
<i>Epacris glacialis</i>	Reddish Bog-heath	r			√
<i>Epacris microphylla s.s.</i>	Coral Heath	r			√
<i>Epacris microphylla var. rhombifolia</i>	Mountain Coral Heath	r			√
<i>Epacris petrophila</i>	Snow Heath	r			√
<i>Almaleea capitata</i>	Slender Parrot-pea	v		√	
<i>Pultenaea polifolia</i>	Dusky Bush-pea	r			√
<i>Pultenaea tenella</i>	Delicate Bush-pea	r		√	
<i>Pultenaea williamsonii</i>	Highland Bush-pea	r		√	
<i>Myriophyllum alpinum</i>	Alpine Water-milfoil	r			√
Goodenia macbarronii	Narrow Goodenia	V v	√		
<i>Myriophyllum lophatum</i>	Crested Water-milfoil	k			√
<i>Utricularia monanthos</i>	Tasmanian Bladderwort	v			√
<i>Nymphoides geminata</i>	Open Marshwort	r			√
<i>Nymphoides montana</i>	Entire Marshwort	r			√
<i>Baeckea latifolia</i>	Subalpine Baeckea	r			√
Eucalyptus cadens	Warby Range Swamp-gum	E e			√
<i>Epilobium curtisiae</i>	Bald-seeded Willow-herb	r			√
<i>Epilobium sarmentaceum</i>	Mountain Willow-herb	r			√
<i>Epilobium tasmanicum</i>	Snow Willow-herb	v			√
<i>Plantago alpestris</i>	Veined Plantain	r			√
<i>Caltha introloba</i>	Alpine Marsh-marigold	r			√
<i>Ranunculus collinus</i>	Strawberry Buttercup	r			√
<i>Ranunculus gunnianus</i>	Gunn's Alpine Buttercup	r			√
<i>Ranunculus millanii</i>	Dwarf Buttercup	r			√
<i>Coprosma moorei</i>	Turquoise Coprosma	r			√
<i>Euphrasia caudata</i>	Tailed Eyebright	r			√
<i>Euphrasia eichleri</i>	Bogong Eyebright	V v			√
<i>Gratiola nana</i>	Matted Brooklime	r		√	
<i>Stylidium montanum</i>	Montane Swamp Triggerplant	r			√
<i>Viola caleyana</i>	Swamp Violet	r		√	
<i>Viola fuscoviolacea</i>	Dusky Violet	r			√

5.2 Fauna

6.2.1 General discussion

In total, 339 fauna species have been recorded for the fauna Data Review Area (DRA), including 233 bird species (11 exotic), 40 mammal species (eight exotic), 38 reptile species, 10 frog species, 16 fish species (six exotic) and two invertebrate species (see Appendix 2, Table 4).

Sixty-six of these species are from a guild of fauna that would use wetlands during some part of their life history (i.e. foraging habitat, refuge), including 44 bird species, four mammal species, eight reptile species and nine frog species (Appendix 2, Table 4).

Use of peatland spring-soak wetlands by fauna can be assigned to the following broad categories (Appendix 2):

- localised habitat use
- general habitat use
- drink at these sites only
- forage at these sites only
- provide refuge in drought periods

Table 4 Summary of fauna species recorded from fauna Data Review Area for this study.

*denotes exotic species.

Vertebrate Group	Total	Wetland dependent
Birds	233 (*11)	44
Mammals	40 (*8)	4
Reptiles	38	8
Frogs	10	9
Fish	16 (*6)	0
Invertebrates	2	1
TOTAL	339	66

6.2.2 Significant fauna species

Criteria for assigning fauna significance are given in Appendix 5.

Numerous threatened species were previously recorded in the fauna DRA. The Likelihood of Regular Occurrence (LRO) of these species is considered below, based upon reporting rates of the species as given in the Atlas of Victorian Birds (Emison et al. 1987) and AVW Records (DSE 2004b), their known habitat requirements, the presence of suitable habitat and results of the field survey and literature review. Only species with at least a moderate LRO are regarded as being a potentially integral part of the fauna of the study area (see Appendix 2).

No species listed under the *EPBC Act* or *FFG Act* were recorded during the field surveys.

Of the three bird species listed under the *EPBC Act* from the fauna DRA, only the Superb Parrot and Swift Parrot would be likely to use these wetland sites. These sites may be used for foraging and drinking activities and the LRO of these species at such sites would be low (Table 5). A flock of five Superb Parrots was observed drinking at a spring-soak wetland in the Warby Ranges.

No mammal, reptile, frog, fish or invertebrate species listed under the *EPBC Act* 1999 would be considered to regularly use these wetland sites.

Of the 23 bird species listed under the *FFG Act* 1998 (and not already mentioned under the *EPBC Act*) from the fauna DRA, only four species would be likely to use these wetland sites and all would hold a low LRO e.g. Diamond Dove, Glossy Black-Cockatoo, Turquoise Parrot, and Diamond Firetail.

No mammal, reptile, fish or invertebrate species listed under the *FFG Act* 1988 would be considered to regularly use these wetland sites. One frog species, Rugose Toadlet is listed under this Act and would hold a moderate LRO at these sites.

Fifty-eight fauna species listed as threatened by DSE (2003) have previously been recorded in the fauna DRA: 41 bird species, four mammal species, five reptile species, three frog species, four fish species and one invertebrate species (Appendix 2). Those species not already mentioned under the *EPBC* or *FFG Act* include the Brown Quail, Latham's Snipe, Glossy Ibis and Spotted Harrier. Latham's Snipe (Near threatened – DSE 2003) and Spotted Harrier (Near threatened – DSE 2003) would hold a moderate LRO at such wetland sites (Table 5).

Table 5 Threatened fauna recorded from the AVW database (DSE 2005b) within the general study area i.e. Highlands, Strathbogie Ranges, Warby Ranges, Chesneyvale Hills and Tolmie that generally depend on wetlands.

Conservation Status

EPBC - *EPBC Act* 1999: Vul - Vulnerable; End - Endangered; CEn – Critically Endangered under the threatened fauna list of the Act

DSE - DSE (2003): NT - Near threatened, Vul - Vulnerable, End - Endangered, CEn - Critically endangered

FFG - *FFG Act* 1988: N - Nominated for listing, L - listed, X - rejected for listing

Guild - Use of peatland spring-soak wetlands by fauna: lh –localised habitat use, gh –general habitat use, d - drink at these sites only, f – forage at these sites only, r – provide refuge in drought periods

LRO - Likelihood of Regular Occurrence at Spring-soak/peatland wetlands; N - negligible, L - Low, M - Moderate, H - High

EPBC	DSE	FFG	Common Name	Scientific Name	Guild	LRO
	NT		Brown Quail	<i>Coturnix ypsilophora</i>	lh	L
	NT	L	Diamond Dove	<i>Geopelia cuneata</i>	d	L
	NT		Latham's Snipe	<i>Gallinago hardwickii</i>	lh	M
	NT		Glossy Ibis	<i>Plegadis falcinellus</i>	f	L
	NT		Spotted Harrier	<i>Circus assimilis</i>	f	M
	VU	L	Glossy Black-Cockatoo	<i>Calyptorhynchus lathamii</i>	d	L
VU	EN	L	¹ Superb Parrot	<i>Polytelis swainsonii</i>	d	L
	NT	L	Turquoise Parrot	<i>Neophema pulchella</i>	d,f	L
EN	EN	L	Swift Parrot	<i>Lathamus discolor</i>	d,f	L
	VU	L	Diamond Firetail	<i>Stagonopleura guttata</i>	gh	L
	EN		Brown Toadlet	<i>Pseudophryne bibronii</i>	lh	M
	DD	L	Rugose Toadlet	<i>Uperoleia rugosa</i>	lh	M

¹ A flock of five Superb Parrots was observed drinking at a Spring-soak wetland in the Warby Ranges.

6 Threats and Management

6.1 Land use-history and vegetation condition

Almost all spring-soak and peatlands vegetation encountered during field survey occurred on freehold land where two land uses prevailed:

- Grazing by stock - (predominantly cattle, but also sheep and horses) is almost universal (stock are rarely excluded by fencing)
- Water harvesting is also very frequent (farm dams have been constructed on, above or below spring-soaks because of the assured water supply).

These land use histories and associated activities have resulted in major direct and indirect alterations to the physical environments and to vegetation structure, floristic composition and faunal habitat attributes, both within the vegetation community and their catchments.

Physical alterations to hydrological regimes, substrates and water quality observed during field work include:

- Draining of wetlands (via channels)
- Dams constructed in, below, or above wetland
- Clearing of catchments (i.e. reduced water use by vegetation in the often localized catchments as indigenous woody vegetation is replaced by exotic herbaceous pasture)
- Planting of exotic, high water-use trees, notably Willows (*Salix taxa*) and Poplars (*Populus spp.*) in wetland vegetation
- Depression of ground-water availability by planting of Radiata Pine (*Pinus radiata*) and (probably) Blue Gum (*Eucalyptus globulus*) plantations adjacent to or near wetlands
- Soil compaction by stock, thus reduced infiltration
- Localised turbidity caused by stock disturbance
- Eutrophication via cattle faeces and urine
- Often severe pugging of soils by cattle with consequent destruction of peat layer, ponding of water in microtopographic relief features, hence increased water loss by evaporation
- Destruction of peat layer by burning (e.g. as a result of the use of fire to control undesirable pasture plants such as Rushes (*Juncus spp.*))

Direct and/or indirect modifications to the vegetation of the wetlands, observed during field work include:

- Clearing of woody vegetation by cutting of trees or slashing of scrub (still a practice for example in the Strathbogie Ranges) and burning
- Grazing/browsing of vegetation by stock (cattle, sheep, horses), feral animals (rabbits, deer, hares, pigs) and indigenous mammals (Black Wallaby, Eastern Grey Kangaroo, Common Wombat)
- Weed invasion (see Section 6.2 below) and inadvertent off-target damage to vegetation by poor herbicide use practices (Blackberries (**Rubus* spp.) are invariably the targeted weed species)
- Planting of trees in peatlands/spring-soaks (to enhance habitat or amenity values)
- Draining
- Dam construction

6.2 Management issues and threats

Management issues and threats to spring-soaks and peatlands identified during this study are outlined below. The comments here are preliminary pending detailed sampling and characterization of vegetation and faunal types and habitats, their environments and physical and biotic factors governing their distribution, extent and condition. It is likely that other threats and management issues will be identified with further studies; the identification of issues here will help determine the kinds of data that need to be collected in further studies.

Weed invasions

Weed invasions and stock grazing constitute the two most important management issues for spring-soaks and peatlands. Because of the structure of the vegetation – typically with a dense closed herbaceous or shrubby vegetation stratum – these wetlands are relatively resistant to weed invasion. Grazing, especially by cattle, greatly exacerbates weed invasion via soil disturbance and reduction in vegetation cover, allowing seed germination and establishment. Cattle are also major seed dispersal agents. During this study a suite of weeds was recorded (Table 6) which are categorized into woody weeds (trees and shrubs) and herbaceous perennial weeds. Of greatest concern are the woody weeds, particularly Grey Sallow (or Pussy Willow) (**Salix cinerea*) and Blackberry (**Rubus anglocandicans*) and other **R. fruticosus* spp. agg. taxa). These are both Weeds of National Significance (<http://www.deh.gov.au/biodiversity/invasive/weeds/wons.html>).

Several sources of weeds are identifiable:

1. Members of the ubiquitous ambient weed flora (notably grasses: Yorkshire Fog **Holcus lanatus*, Sweet Vernal Grass **Anthoxanthum odoratum*, and Cocks-foot **Dactylis glomerata*)
2. Species that have ‘escaped’ from nearby cultivation; mostly farm gardens or plantations (see Table 6)
3. Species deliberately planted for fodder or amenity (e.g. Reed Sweet-grass **Glyceria maxima*, and Willows **Salix* taxa).

Numerous additional weed species will be recorded with further field survey.

Grazing

Stock grazing (particularly by cattle) has been a severe factor in the degradation of these sites, resulting in: damage to soils and the peat layer (pugging, increased aeration and decay of peat, etc); hydrological modifications; grazing, browsing and physical destruction of vegetation and populations of particular species; spread of weeds; eutrophication; increased turbidity and other factors. Sheep appear to be far less damaging to soils, water quality and vegetation.

Grazing or browsing by indigenous and feral mammals is also a major influence on vegetation structure and floristic composition. Indigenous grazing and browsing species (macropods and

wombats) appear to be much less damaging than stock and are probably essential in allowing persistence of numerous herbaceous species (especially at the edge of these wetlands) that would otherwise disappear, e.g. through competition from more robust species.

There is little doubt that cattle grazing is inimical to maintenance of vegetation and faunal habitat values, reflected in the efforts to exclude stock by fencing. It may also be the case however that maintenance of grazing, at least by macropods and wombats, is essential to ensure survival of many plant, and perhaps fauna species. Grazing and browsing by deer (notably Sambar Deer) is highly damaging. Evidence of pigs has not been seen by us but they have disastrous impacts on vegetation and faunal habitat values in peatlands elsewhere in Victoria, e.g. at Shelly (G. Carr unpub. data).

Any fencing of peatlands and spring-soaks needs to allow for the option of introducing stock (sheep) for controlled grazing (at the most appropriate time of the year) by the installation of gates. Fencing should also allow continued marsupial access.

There is abundant evidence to suggest that fencing would allow the recovery of vegetation currently severely grazed, and that ostensibly only consists of pasture species. Such sites however often support a viable though suppressed indigenous flora.



Plate 28 Damage to spring-soak wetland caused by the impact of cattle access. Note pooling of water to the top of the soil layer. Small pools of standing water are unusual in spring-soak/peatland wetlands that have not been subject to grazing activities (Highlands, April 2006).



Plate 29 Pooling of water in these cattle-accessed and therefore badly drained areas leads to stagnation and a decrease in water quality (Highlands, April 2006).



Plate 30 Cattle will actively excavate a point source of water (Highlands, April 2006).



Plate 31 Cattle pugging causes disruption of soil layer leading to erosion, alteration of drainage patterns and also sites for weed establishment (Highlands, April 2006).



Plate 32 Sheep grazing eliminates grass tussocks associated with these wetlands (Highlands, April 2006).



Plate 33 Even large mobs of sheep cause relatively little damage to these wetlands if water sources are supplied outside the soak (Strathbogies, April 2006).



Plate 34 Wombat burrows are common around these wetland areas, and are often associated with the embankments of farm dams (Highlands, April 2006).



Plate 35 The excellent quality of this wetland shows that prevention of grazing pressure can do much to improve/maintain wetland values. Note extensive revegetation work undertaken by this landholder (Highlands, April 2006).



Plate 36 Excellent quality site where fencing allows only minimal stock grazing pressure (Highlands, April 2006).

Dam construction

Many hundreds of dams have been constructed in, above or below spring-soaks and peatlands because of the assured water supply and the kaolinite deposits at depth, creating a highly impermeable dam substrate. These dams have been very damaging to vegetation resulting in loss of the community and parts or whole populations of plant and animal species, smothering by dam spoil, drying of soaks due to drainage into the dam (evaporation, water extraction and drinking by stock) and extreme stock pressure as they access watering points.

Modifications with woody vegetation

While the vegetation in many spring-soaks and peatlands has been highly modified by land-use history (predominantly grazing) resulting in degradation, for many it may be most appropriate to essentially maintain the current condition. At many sites the tree and shrub component of vegetation – mostly Mountain Swamp Gum (*Eucalyptus camphora*) and the shrubs Woolly tea-tree and Prickly Tea-tree (*Leptospermum lanigerum* and *L. continentale*) has apparently been much reduced or substantially eliminated. However the woody component in some sites is increasing in cover because of:

1. natural recruitment by seed (*Leptospermum*) and/or suckers (e.g. Blackwood *Acacia melanoxydon*) and
2. planting of trees (mostly Mountain Swamp Gum).

Unassisted recruitment in shrubs or trees is likely to result from stock exclusion and cessation of mechanical damage and browsing, but it may be undesirable because the dense canopies that develop could outcompete the subordinate herbaceous stratum. By these means plant and animal species or populations may be directly or indirectly eliminated. The same applies to planted vegetation and it may be ill-advised to plant trees or shrubs in some locations.



Plate 37 Dams are often constructed on drainage lines and at source points of spring-soak and peatland wetlands (Highlands, April 2006).



Plate 38 Dams are common where these wetlands occur in the landscape, here three dams are constructed on spring-soaks (Highlands April 2006).



Plate 39 Unassisted recruitment in shrubs or trees (e.g. Blackwood *Acacia melanoxylon*) is likely to result from stock exclusion and cessation of mechanical damage and browsing (April 2006).

Table 6 Seriously invasive environmental weed species observed in peatlands and spring-soaks in the Goulburn Broken CMA study area.

Species	Common name
Woody Weeds	
<i>Crataegus monogyna</i>	Hawthorn
<i>Hedera helix</i>	Ivy
<i>Lonicera japonica</i>	Japanese Honeysuckle
<i>Pinus pinaster</i>	Cluster Pine
<i>Pinus radiata</i>	Radiata Pine
<i>Populus</i> spp.	Poplar
<i>Prunus cerasifera</i>	Cherry Plum
∟ <i>Rubus anglocandicans</i>	Blackberry
∟ <i>Rubus fruticosus</i> spp. agg.	Blackberry
∟ <i>Salix cinerea</i> ssp. <i>cinerea</i>	Grey Willow
∟ <i>Salix</i> x <i>sepulcralis</i> nothovar <i>sepulcralis</i>	Weeping Willow
Herbaceous weeds	
<i>Agrostis stolonifera</i>	Creeping Bent
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass
<i>Dactylis glomerata</i>	Cocksfoot
<i>Festuca arundinacea</i>	Tall Fescue
<i>Glyceria maxima</i>	Reed Sweet-grass
<i>Holcus lanatus</i>	Yorkshire Fog
<i>Juncus articulatus</i>	Jointed Rush
<i>Lotus corniculatus</i>	Bird's-foot Trefoil
<i>Lotus uliginosus</i>	Greater Bird's-foot Trefoil
<i>Mentha pulegium</i>	Pennyroyal
<i>Mimulus moschatus</i>	Musk Monkey-flower
<i>Paspalum distichum</i>	Water Couch
<i>Phalaris aquatica</i>	Toowoomba Canary-grass
<i>Poa pratensis</i>	Kentucky Blue-grass
<i>Ranunculus repens</i>	Creeping Buttercup

∟ - Weeds of National significance



Plate 40 Willows (*Salix taxa*) are a seriously invasive environmental weed observed in peatlands and spring-soaks in the study area (April 2006).



Plate 41 Control of Willow infestation is easily achievable at this early stage of growth (Highlands, April 2006).

7 Permanent Upland Wetlands Modelling

7.1 Study area

The study area for the modelling of the subject wetland types included all areas targeted in the field component of the project (Figure 13).

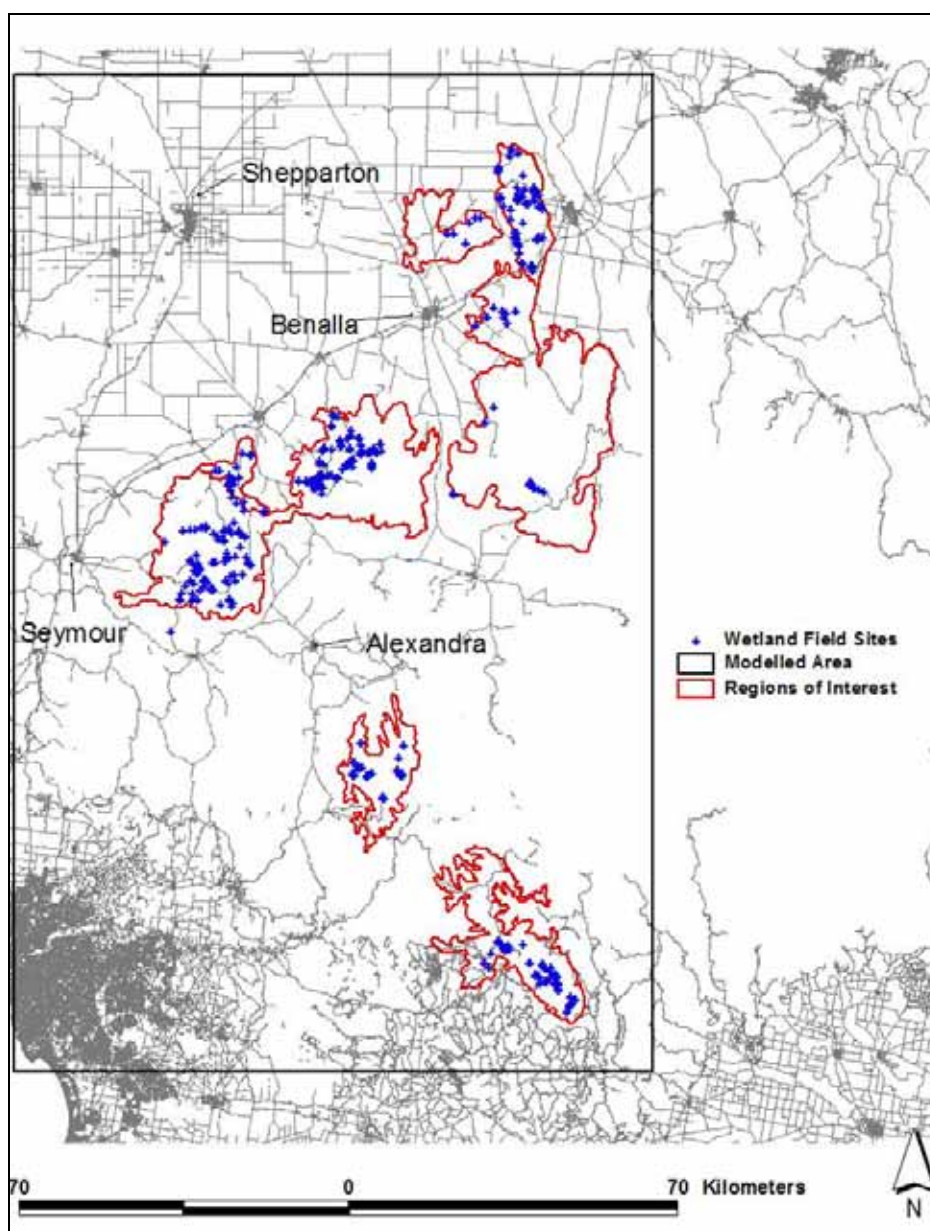


Figure 12 Study area overview.

7.2 Data

7.2.1 Peatland and Spring-Soak field observations

In order to build a spatial model of the likely occurrence of upland permanent wetlands (springs and peatlands) example sites of both their presence and absence are required to ‘train’ the relevant available spatial data. Exemplars for the presence of peatlands and spring soaks were obtained from the following sources:

- Field observations undertaken as part of this project supplied by Ecology Australia staff and subcontractors
- Field data obtained for the Warby Ranges area supplied by Geoff Barrow – Parks Victoria
- Field data obtained for the Strathbogie Ranges area supplied by Doug Robinson – Trust for Nature
- Field data obtained for the central highlands and highlands area supplied by CMA staff
- Field data from across the study area supplied by CMA staff
- Field data from across the study area supplied by DSE staff
- Field data from the central highlands and the Tolmie area supplied by John Morgan – La Trobe University

These data were vetted for accuracy without bias (ie only obviously incorrect exemplars such as one found to plot within the capacity of the Lake Mokoan impoundment were removed from the dataset. These amounted to a total of 571 wetland ‘presence’ observations. The creation of a binomial regression habitat models requires sites where the absence of the wetland has been observed. 5000 absence sites were generated randomly from across the study area. This was considered reasonable as upland wetlands represent a minute proportion of the study area. Three absence exemplars were removed from the subsequent analysis as they fell upon mapped (polygons) peatland EVC types in the central highlands. All observations were projected into VicGrid94. All spatial analyses were performed at 20m x 20m pixel resolution.

7.2.2 GIS Layers

There are vast amounts of GIS data available in the DSE Corporate Geographical Data Library (CGDL). Most of these data sets are of limited value to ecosystem modelling. The vast majority, such as roads, land tenure, bioregion boundaries, fire history, plantation details etc, provide very little numerical data that would be useful in delimiting natural systems. The most useful layer within the CGDL for this study was the 1:25,000 Digital Elevation Model (DEM). From this data set a number of additional data were created (see below). Airborne radiometric maps that provide basic (unspecified) differentiation between soil types were also used. In addition, raw Landsat image data (visible and IR band values) and NVDI (a combination of band values) for each site were included in the preliminary analysis. Temporal regressions of the Landsat data between the years 1989 and

2004 were also derived for each point (25m pixel) in the state. The statistics of the fit of these regressions are useful in identifying areas of change such as intensive farming. The maps of these statistics were also included as potential wetland independent variables.

The independent variables considered to create the model were:

- Altitude (ALT). 20m DEM from CGDL
- Terrain Position Index (TPI). Derived from DSE's 25,000 DEM. Topographic position is arranged about zero which is equivalent to flat terrain
- Topographic Wetness Index (TWI). Derived from DSE's 25,000 DEM. Models the rate that water runs-off a surface
- Textural interpretation of Topographic Wetness Index (TWI/TEX). Derived from TWI
- Incident Solar Radiation (RAD). Modelled solar radiation across the study area at the equinox. Derived from Shuttle radar altimetry. 100m data resampled to 20 m
- Slope. Derived from the DEM.
- Thorium / InversePotassium (TH_K). Airborne radiometric data, corrected and combined as an index to minimise systematic errors present in the individual Thorium and Potassium layers. Original data at 50 m resolution and resampled to 20 m
- Raw Landsat Data. Bands 1, 2, 3, 4, 5, 7 for the years 1989, 1991, 1992, 1995, 1998, 2000, 2002 and 2004
- Normalised Vegetation Difference Index (NVDI). for the years 1989, 1991, 1992, 1995, 1998, 2000, 2002 and 2004
- Landsat Regression Error Statistics. Regression fit error at each pixel for regression through all 8 years of images for each of the bands 4, 5, 7 and NVDI.

The list above describes a potential 96 independent variables that could be included in the analysis. Obviously, far few would be used in the final model. The initial culling process involves reducing the selection of data by minimising very similar or highly correlated layers, as well as identifying those of little value for this modelling study.

7.3 Methods

The general methodology used for developing the model was as follows:

1. Collate all target wetland sites
2. Collate GIS data layers may be useful in producing a model of these wetlands
3. Determine suitability and sensitivity of selected GIS layers for model creation
4. Select candidate GIS layers to form preliminary models. Create models and examine model statistics
5. Map the best model while critically examining model fit to the supplied data and known wetlands sites

6. Re-assess the list of GIS layers used to create the model in light of inadequacies apparent on the predicted wetlands and apply this knowledge to create an optimised model
7. Critically assess the final predicted wetland model/map noting how improvements may be applied if more data become available

The model developed was a neural network classification. This modelling approach was chosen as neural networks can provide a good fit to complex non-linear data where the underlying functions and relationships between the data are unknown. This type of networks is not degraded by correlated 'independent' variables or variables that do not have normal distributions. In addition, the software tool to develop these networks (Statistica) automates many of the difficult tasks such as variable selection via sensitivity analyses and network design optimisation.

7.4 Results

Variable selection was performed by the automatically generating hundreds of neural networks of various designs and with subsets of candidate inputs variables. Sensitivity analyses were performed on the best of these networks and the results were summarised. Variables were then ranked from which the optimum subset was selected by observing the breakpoint at which the addition of further added little to the performance of the networks. This resulted in 9 variables listed below being selected to form the model (hence referred to as model 18).

Table 7 Variables used to form the model.

Sensitivity Rank	Variable
1	Height
2	Terrain Wetness (TWI)
3	Radiometric Index
4	Band5_Mean8
5	Band6_Mean8
6	TWI/TPI
7	Band2_Mean8
8	B5_StdError8
9	Slope

Examination of the applied wetland prediction map of neural network model 18 indicated that whilst the fit was excellent (92% correct for absences, 91% for presence), in the Strathbogies and Highlands area the model was predicting unlikely linear wetlands in roadside vegetation and in other rectilinear settings such as the interface between vegetation blocks and the surrounding farmland. This is the manifestation of a common problem in image classification, where the signal of the object you are looking for is lost in the context of surrounding objects. This is often referred to as a 'mixel' problem. The small size of many of the bogs and the inevitable spatial inaccuracies of the data (although this was kept to a minimum where possible) meant that many of the training sites were comprised of mixed pixels or pixels that contained the combined spectral signature of the

wetlands and other adjacent land cover types (such as forest, pasture etc). Thus a peatland – in a paddock may have more in common spectrally with the edge of a forest than with another wetland – say a peatland within a forest. In order to mitigate this problem, an additional model was built – model 13 - using the physical attributes of the landscape only. The following variables were used and sensitivity rankings shown.

Table 8 Sensitivity ranking of variables.

Sensitivity Rank	Variable
1	Height
2	Terrain Wetness (TWI)
3	Radiometric Index
4	TWI/TPI
5	Slope
6	Terrain Position Index (TPI)

Model 13 did not perform as well as model 18 in predicting sites with peatlands and springs – however it did not predict that the edges of forests or roadsides were likely to be wetlands. Both models 13 and 18 were added together in the central region of the study area (i.e. the Tolmie, Strathbogie and Highlands areas) such that parts of the model that performed well in both models would be highlighted.

Table 9 Classification of wetland sites, model 18.

	Wetland Absent	Wetland Present
Total	5000	571
Correct	4623	521
Wrong	77	50
Correct (%)	92.46	91.22
Wrong (%)	7.54	8.78

The output of the neural network consists of a classification (Wetland present/absent) for each site and a probability for this value. The activation level of the probability (i.e. the value at which present or absent is selected) is normally set to 0.5. This value can be chosen to be any value between 0 and 1. A low activation level, say 0.3, selects more points to be marked as Wetland present, while a higher level, say 0.95, restricts the output to describe regions where wetlands are most likely present. Examination of the output map coupled with knowledge of likely wetland areas suggested that a suitable probability activation value would be around 0.8. While this value degraded the apparent performance of the network in predicting the presence of wetlands, the resultant map is considered to have far more predictive power.

The results of the export of the neural network model to a spatially explicit map are shown in figures 13 to 18.

7.5 Discussion

Preliminary ground-truthing of the modelled sites has been undertaken in the field and employing high-resolution aerial photography. Overall the model performs well to excellent in the southern uplands (i.e. Baw Baw Plateau and the Blue Range) probably as a consequence of the more consistent relationship between the variables – particularly the spectral data - and the presence of wetlands. Bogs at high altitude are less likely to have overtopping/overhanging trees that may obscure the wetland vegetation. In the central part of the study area the model is thought to perform moderately well. However, important cues for the development of upland wetlands in granite landscapes are primarily hydrogeological in nature. Unfortunately we currently do not have the fine scale maps/models of aquifers and ground water across this region sufficient for the detection of spring-fed wetlands. In the Warby Ranges and associated hills the model appears to perform well as there is good spectral contrast between the dry woodlands and wetlands. However, the model does tend to over estimate the likelihood of the presence of wetlands on the summit of the granite massif possibly on the basis of slope characteristics elsewhere in the study area. In addition, the model has detected a number of irrigated crops/horticultural areas as having a high probability of supporting the subject wetlands. In conclusion, the modelling appears to have been a useful exercise and has further narrowed the area in which more intensive searching can be conducted. This is not to say that additional wetlands will not be found outside the “80% or highly probable” threshold.

The precision certainty of the modelling was limited by a number of factors:

- Scale issues – many of the wetlands are small less than 50 m across this is not significantly larger than the spatial data used to detect wetlands.
- Diversity of wetland types – in the absence of a definitive typology the various wetlands were modelled together. We were attempting to model a very wide range of types from sub-alpine peatlands at Lake Mountain to springs with Red Gums and Grey Box at the foot of the Warby Ranges.
- Lack of definitive data on the groundwater processes crucial to the permanence of wetlands in lower rainfall areas such as the Strathbogie and Warby Ranges.

The model outputs cannot predict the location of springs with absolute certainty. It would be reasonable to consider sites modelled, as above the 0.8 probability threshold are possible wetlands and/or places where further searching should be undertaken.

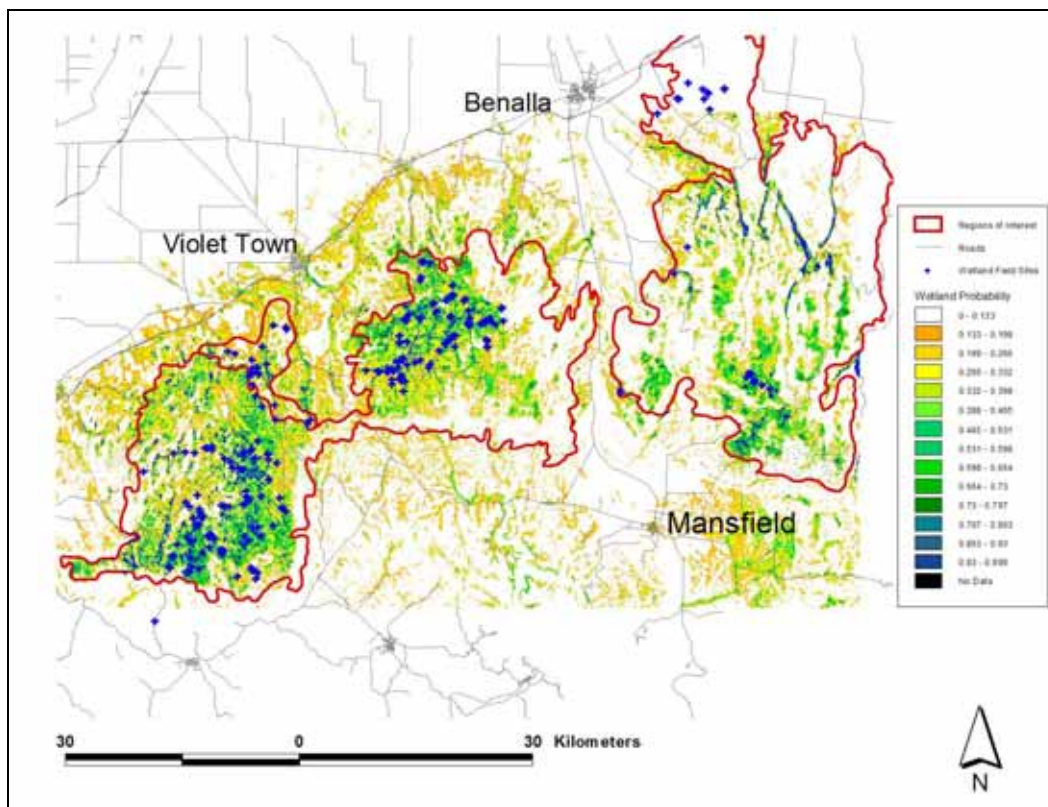


Figure 13 Probability of wetland presence across the central region of the study area.

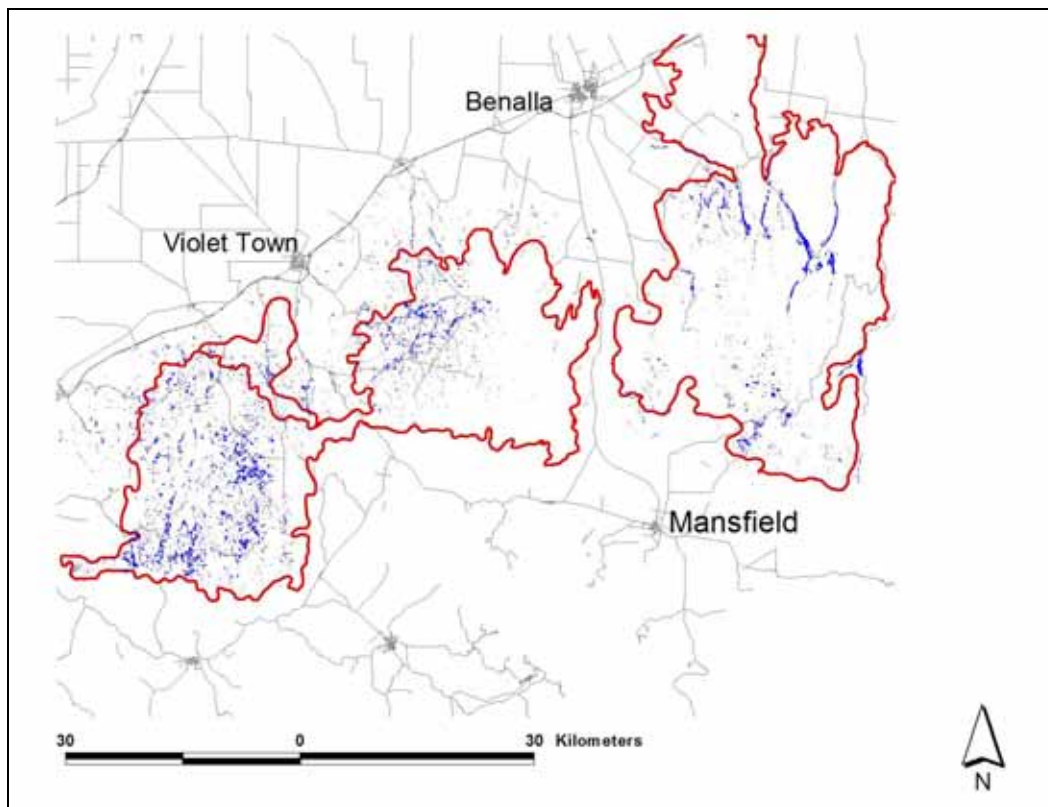


Figure 14 Greater than 80% probability of wetland presence across the central region of the study area.

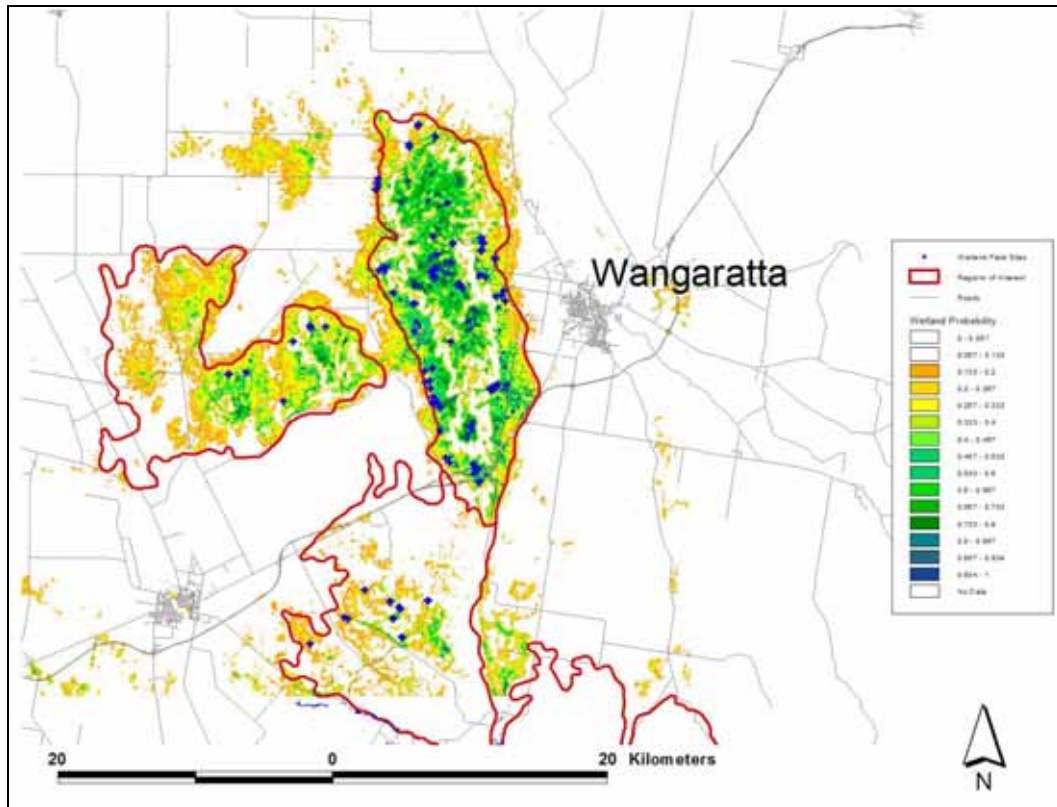


Figure 15 Probability of wetland presence across the northern region of the study area.

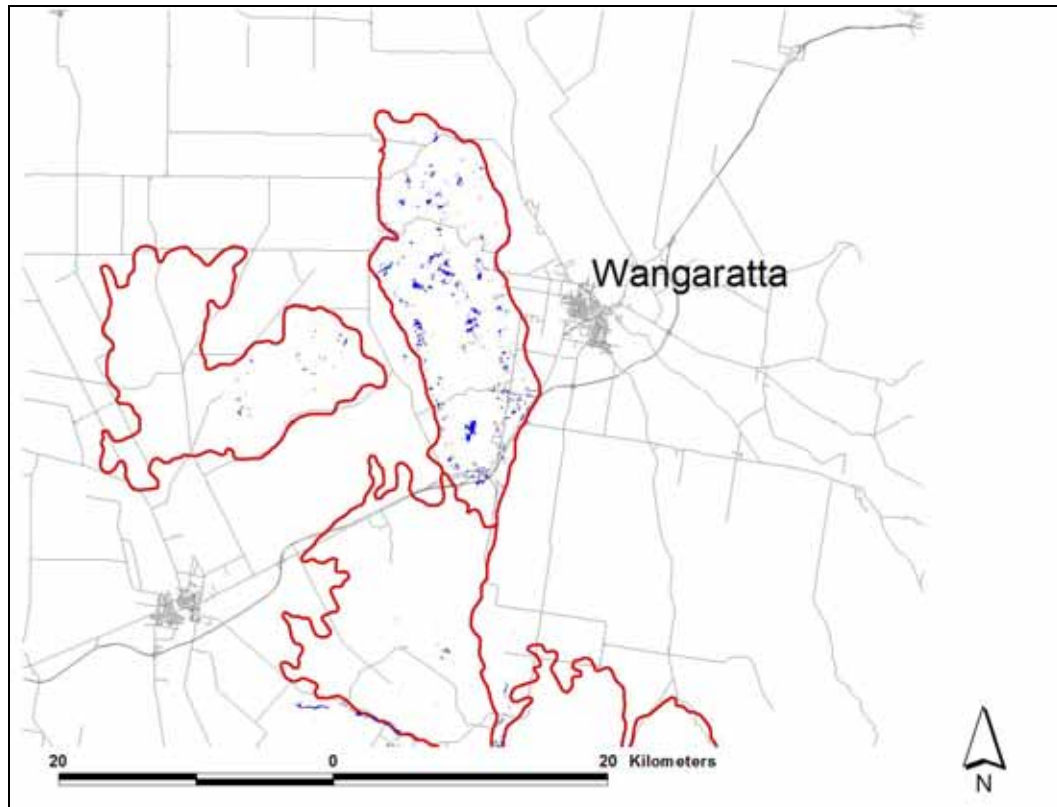


Figure 16 Greater than 80% probability of wetland presence across the northern region of the study area.

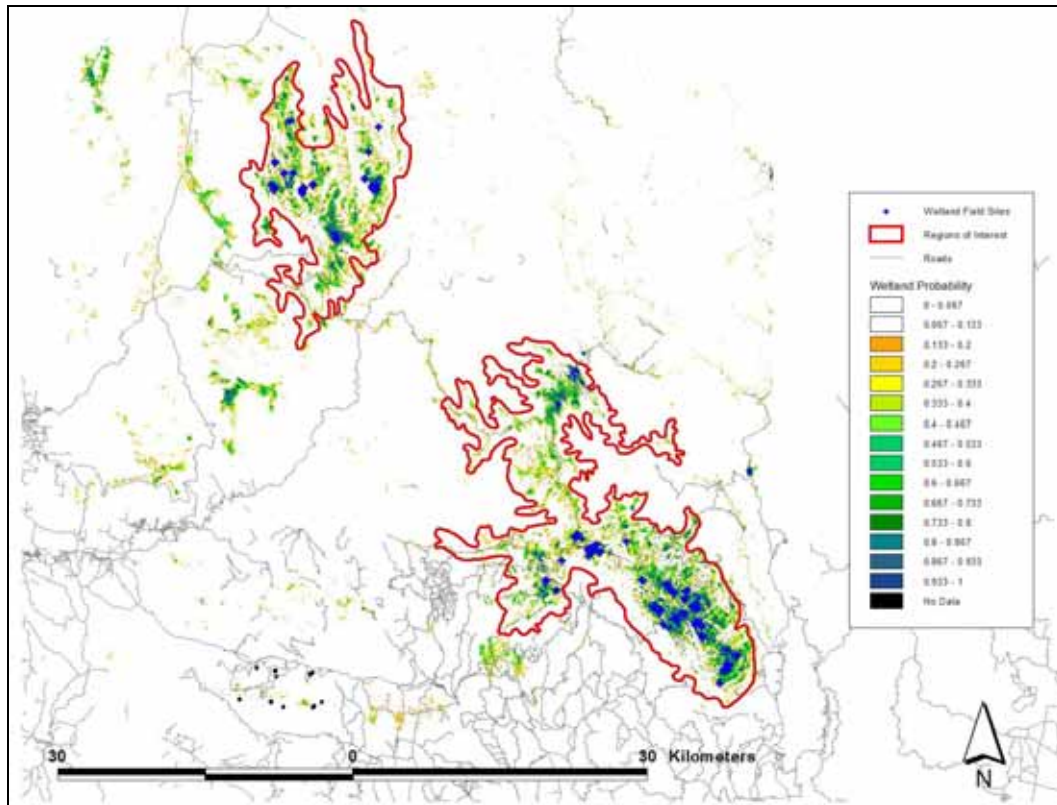


Figure 17 Probability of wetland presence across the southern region of the study area.

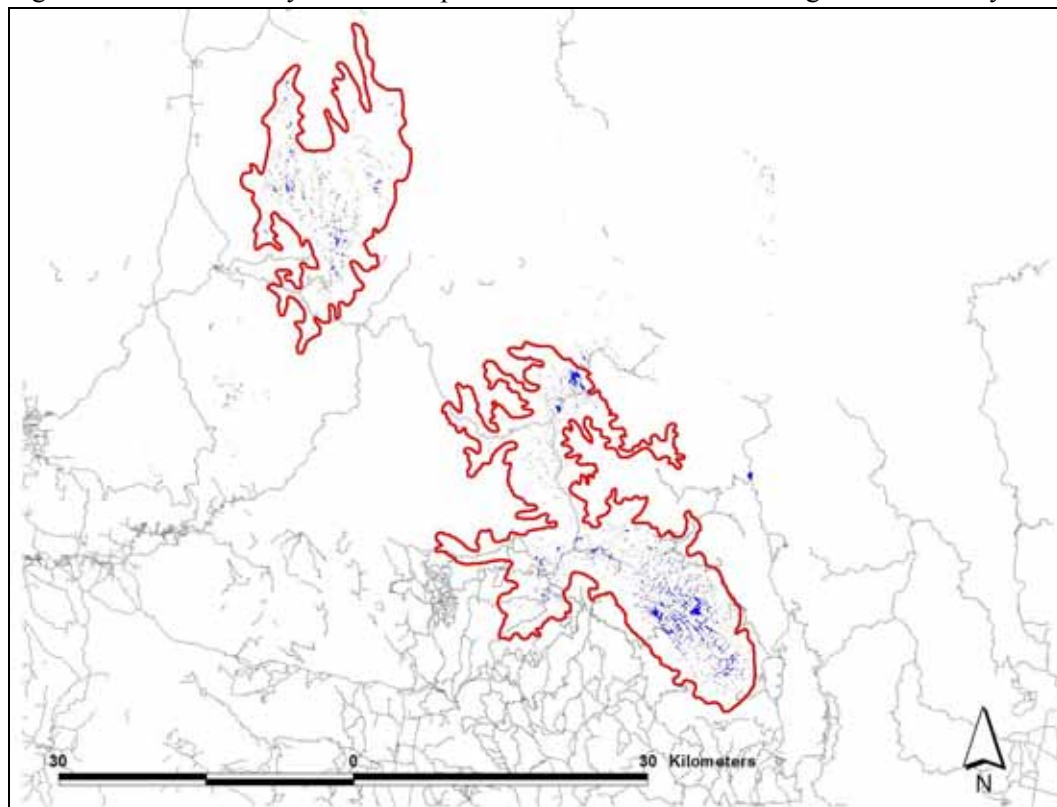


Figure 18 Greater than 80% probability of wetland presence across the southern region of the study area.

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Appendix 1. Target plant species for Peatland and Spring-soak wetlands within the GBCMA region.

Selection of plant species

Based on the field knowledge of most species, supplemented by data from Flora of Victoria. Numerous species are excluded which although frequent in peatland vegetation are common/frequent in non-peaty wetlands or moist sites, or only occasionally appear in peatlands. The genus, *Prasophyllum* with numerous undescribed taxa, is poorly resolved and others could be added. The polygon from which the floristic list is captured is appended. Not all listed species will occur in the study area

Fidelity to peatland vegetation

This is based on the field knowledge supplemented by data from Flora of Victoria within elevated (hilly to alpine) north-east Victoria above about 600m ASL.

Date compiled - 15 February 2006 (G.Carr), amended 07 March 2006 (D. Frood, M. White)

Name Scientific	Common	DSE status	Fidelity to peatland vegetation		
			Low	Moderate	High
MOSSES					
Sphagnaceae					
<i>Sphagnum australe</i>	Peat Moss				√
<i>Sphagnum cristatum</i>	Peat Moss				√
<i>Sphagnum novozelandicum</i>	Peat Moss				√
<i>Sphagnum</i> spp.	Peat Moss				√
FERNS AND ALLIES					
Blechnaceae					
<i>Blechnum penna-marina</i> subsp. <i>alpina</i>	Alpine Water-fern			√	
<i>Blechnum minus</i>	Soft Water-fern		√		
Gleicheniaceae					
<i>Gleichenia dicarpa</i>	Pouched Coral-fern				√
<i>Gleichenia microphylla</i>	Scrambling Coral-fern			√	
Lycopodiaceae					
<i>Huperzia australiana</i>	Fir Clubmoss	r			√
<i>Lycopodiella lateralis</i>	Slender Clubmoss				√
<i>Lycopodium scariosum</i>	Spreading Clubmoss	r			√
Ophioglossaceae					
<i>Botrychium australe</i>	Austral Moonwort	v			√
<i>Ophioglossum reticulatum</i>	Stalked Adder's-tongue	r		√	
Osmundaceae					
<i>Todea barbara</i>	Austral King-fern			√	
Selaginellaceae					
<i>Selaginella gracillima</i>	Tiny Selaginella				√
Thelypteridaceae					
<i>Thelypteris confluens</i>	Swamp Fern	e			√
MONOCOTYLEDONS					
Asteliaceae					
<i>Astelia alpina</i> var. <i>novae-hollandiae</i>	Silver Astelia				√
Cyperaceae					
<i>Baumea arthrophylla</i>	Fine Twig-sedge			√	
<i>Baumea gunnii</i>	Slender Twig-sedge				√

Name Scientific	Common	DSE status	Fidelity to peatland vegetation		
			Low	Moderate	High
<i>Baumea planifolia</i>	Rough Twig-sedge	k			√
<i>Baumea rubiginosa s.l.</i>	Soft Twig-rush			√	
<i>Baumea rubiginosa s.s.</i>	Soft Twig-sedge			√	
<i>Carex alsophila</i>	Forest Sedge	r	√		
<i>Carex blakei</i>	Alpine Sedge	r			√
<i>Carex brownii</i>	Stream Sedge				√
<i>Carex canescens</i>	Short Sedge	r			√
<i>Carex capillacea</i>	Hair Sedge	r			√
<i>Carex chlorantha</i>	Green-top Sedge	k		√	
<i>Carex echinata</i>	Star Sedge	v			√
<i>Carex gaudichaudiana</i>	Fen Sedge		√		
<i>Carex gunniana</i>	Swamp Sedge			√	
<i>Carex hypandra</i>	Alpine Fen-sedge	v			√
<i>Carex jackiana</i>	Carpet Sedge	r			√
<i>Carex raleighii</i>	Raleigh Sedge	r			√
<i>Carpha alpina</i>	Small Flower-rush	r			√
<i>Carpha nivicola</i>	Broad-leaf Flower-rush	r			√
<i>Carpha spp.</i>	Flower Rush				√
<i>Cyperus sanguinolentus</i>	Dark Flat-sedge				√
<i>Cyperus sphaeroideus</i>	Globe Kyllinga				√
<i>Eleocharis gracilis</i>	Slender Spike-sedge		√		
<i>Gahnia sieberiana</i>	Red-fruit Saw-sedge		√		
<i>Isolepis aucklandica</i>	New Zealand Club-sedge				√
<i>Isolepis crassiuscula</i>	Alpine Club-sedge				√
<i>Isolepis habra</i>	Wispy Club-sedge				√
<i>Isolepis montivaga</i>	Fog Club-sedge	r			√
<i>Isolepis subtilissima</i>	Mountain Club-sedge				√
<i>Oreobolus distichus</i>	Fan Tuft-rush				√
<i>Oreobolus oxycarpus</i> subsp. <i>oxycarpus</i>	Tuft-rush	r			√
<i>Oreobolus pumilio</i> subsp. <i>pumilio</i>	Alpine Tuft-rush	r			√
<i>Oreobolus</i> spp.	Tuft Rush				√
<i>Rhynchospora brownii</i>	Grassy Beak-sedge	e			√
<i>Scirpus polystachyus</i>	Large-head Club-sedge	r		√	
Eriocaulaceae					
<i>Eriocaulon scariosum</i>	Common Pipewort	r			√
Hypoxidaceae					
<i>Hypoxis vaginata</i> var. <i>brevistigmata</i>	Yellow Star	k		?√	
<i>Libertia pulchella</i>	Pretty Grass-flag				√
Juncaceae					
<i>Juncus alexandri</i> subsp. <i>alexandri</i>	Mountain Rush			√	
<i>Juncus brevibracteus</i>	Alpine Rush	r			√
<i>Juncus phaeanthus</i>	Dark-flower Rush	r			√

Name Scientific	Common	DSE status	Fidelity to peatland vegetation		
			Low	Moderate	High
<i>Juncus sandwithii</i>	Alpine Joint-leaf Rush				√
<i>Juncus thompsonianus</i>	Snowfield Rush	k			√
<i>Luzula atrata</i>	Slender Woodrush	v			√
<i>Luzula modesta</i>	Southern Woodrush				√
Orchidaceae					
<i>Chiloglottis cornuta</i>	Green Bird-orchid			√	
<i>Prasophyllum niphopedium</i>	Marsh Leek-orchid	e			?√
<i>Pterostylis falcata s.l.</i>	Sickle Greenhood			√	
<i>Pterostylis falcata s.s.</i>	Large Sickle Greenhood			√	
<i>Pterostylis monticola</i>	Montane Greenhood			√	
<i>Pterostylis oreophila</i>	Blue-tongue Greenhood	e		√	
<i>Spiranthes australis</i>	Austral Ladies' Tresses			√	
<i>Thelymitra cyanea</i>	Veined Sun-orchid				√
Phormiaceae					
<i>Thelionema caespitosum</i>	Tufted Lily				√
Poaceae					
<i>Agrostis parviflora s.l.</i>	Hair Bent				√
<i>Agrostis parviflora s.s.</i>	Hair Bent				√
<i>Austrofestuca eriopoda</i>	Snow Fescue	r			√
<i>Austrofestuca hookeriana</i>	Hooker Fescue			√	
<i>Deyeuxia affinis</i>	Allied Bent-grass	e			√
<i>Deyeuxia brachyathera</i>	Short Bent-grass			√	
<i>Deyeuxia gummiana</i>	Bog Bent-grass				√
<i>Hierochloa redolens</i>	Sweet Holy-grass				√
<i>Hierochloa submutica</i>	Alpine Holy-grass	v			√
<i>Isachne globosa</i>	Swamp Millet		√		
<i>Lachnagrostis meionectes</i>	Alpine Blown-grass	r		√	
<i>Poa costiniana</i>	Bog Snow-grass				√
<i>Poa helmsii</i>	Tall Mountain Tussock-grass				√
<i>Tetrarrhena turfosa</i>	Smooth Rice-grass	r		√	
Restionaceae					
<i>Baloskion australe</i>	Mountain Cord-rush				√
<i>Empodisma minus</i>	Spreading Rope-rush				√
DICOTYLEDONS					
Apiaceae					
<i>Diplaspis nivis</i>	Snow Pennywort	r			√
<i>Gingidia harveyana</i>	Slender Gingidia	v			√
<i>Hydrocotyle algida</i>	Mountain Pennywort			√	
<i>Hydrocotyle sibthorpioides</i>	Shining Pennywort		√		
<i>Lilaeopsis polyantha</i>	Australian Lilaeopsis		√		
<i>Oreomyrrhis ciliata</i>	Fringed Caraway				√
<i>Oreomyrrhis eriopoda</i>	Australian Caraway			√	

Name Scientific	Common	DSE status	Fidelity to peatland vegetation		
			Low	Moderate	High
<i>Oreomyrrhis pulvinifera</i>	Cushion Caraway	v			√
<i>Oschatzia cuneifolia</i>	Wedge Oschatzia	r			√
<i>Schizeilema fragoseum</i>	Alpine Pennywort	v			√
Asteraceae					
<i>Celmisia sericophylla</i>	Silky Snow-daisy	v			√
<i>Cotula alpina</i>	Alpine Cotula			√	
<i>Craspedia alba</i>	White Billy-buttons	v			√
<i>Craspedia coolaminica</i>	Ashen Billy-buttons				√
<i>Craspedia paludicola</i>	Swamp Billy-buttons		√		
<i>Erigeron paludicola</i>	Swamp Fleabane				√
<i>Lagenophora montana</i>	Mountain Bottle-daisy			√	
<i>Olearia glandulosa</i>	Swamp Daisy-bush				√
Brassicaceae					
<i>Barbarea grayi</i>	Native Wintercress	v		√	
<i>Cardamine astoniae</i>	Spreading Bitter-cress	v			√
Campanulaceae					
<i>Isotoma fluviatilis</i> subsp. <i>australis</i>	Swamp Isotome		√		
<i>Lobelia gelida</i>	Snow Pratia	V v			√
<i>Lobeila surrepens</i>	Mud Pratia			√	
<i>Wahlenbergia ceracea</i>	Waxy Bluebell				√
Caryophyllaceae					
<i>Stellaria angustifolia</i>	Swamp Starwort			√	
Droseraceae					
<i>Drosera arcturi</i>	Alpine Sundew	r			√
Epacridaceae					
<i>Epacris breviflora</i>	Drumstick Heath				√
<i>Epacris celata</i>	Cryptic Heath	r			√
<i>Epacris glacialis</i>	Reddish Bog-heath	r			√
<i>Epacris gunnii</i>	Ace of Spades				√
<i>Epacris microphylla</i> s.l.	Coral Heath				√
<i>Epacris microphylla</i> s.s.	Coral Heath	r			√
<i>Epacris microphylla</i> var. <i>rhombofolia</i>	Mountain Coral Heath	r			√
<i>Epacris paludosa</i>	Swamp Heath				√
<i>Epacris petrophila</i>	Snow Heath	r			√
<i>Richea continentis</i>	Candle Heath				√
<i>Richea victoriana</i>	Victorain Richea				√
Fabaceae					
<i>Almaleea capitata</i>	Slender Parrot-pea	v		√	
<i>Almaleea subumbellata</i>	Wiry Bush-pea			√	
<i>Pultenaea polifolia</i>	Dusky Bush-pea	r			√
<i>Pultenaea tenella</i>	Delicate Bush-pea	r		√	
<i>Pultenaea williamsonii</i>	Highland Bush-pea	r		√	

Name Scientific	Common	DSE status	Fidelity to peatland vegetation		
			Low	Moderate	High
Gentianaceae					
<i>Chionogentias muelleriana</i> subsp. <i>muelleriana</i>	Mueller's Snow-gentian			√	
Goodeniaceae					
<i>Goodenia elongata</i>	Lanky Goodenia		√		
<i>Goodenia macbarronii</i>	Narrow Goodenia	V v	√		
<i>Scaevola hookeri</i>	Creeping Fan-flower				√
<i>Velleia montana</i>	Mountain Velleia				√
Haloragaceae					
<i>Myriophyllum alpinum</i>	Alpine Water-milfoil	r			√
<i>Myriophyllum lophatum</i>	Crested Water-milfoil	k			√
<i>Myriophyllum pedunculatum</i> subsp. <i>longibracteolatum</i>	Mat Water-milfoil				√
<i>Myriophyllum pedunculatum</i> subsp. <i>pedunculatum</i>	Mat Water-milfoil				√
Lamiaceae					
<i>Lycopus australis</i>	Australian Gipsywort		√		
<i>Mentha laxiflora</i>	Forest Mint		√		
Lentibulariaceae					
<i>Utricularia dichotoma</i> s.l.	Fairies' Aprons				√
<i>Utricularia dichotoma</i> s.s.	Fairies' Aprons				√
<i>Utricularia monanthos</i>	Tasmanian Bladderwort	v			√
Lythraceae					
<i>Lythrum salicaria</i>	Purple Loosestrife			√	
Menyanthaceae					
<i>Nymphoides geminata</i>	Open Marshwort	r			√
<i>Nymphoides montana</i>	Entire Marshwort	r			√
Mimosaceae					
<i>Acacia siculiformis</i>	Dagger Wattle			√	
Myrtaceae					
<i>Baeckea gunniana</i>	Alpine Baeckea				√
<i>Baeckea latifolia</i>	Subalpine Baeckea	r			√
<i>Baeckea utilis</i> s.l.	Mountain Baeckea				√
<i>Baeckea utilis</i> s.s.	Mountain Baeckea				√
<i>Callistemon pallidus</i>	Lemon Bottlebrush				√
<i>Callistemon pityoides</i>	Alpine Bottlebrush				√
<i>Eucalyptus cadens</i>	Warby Range Swamp-gum	E e			√
<i>Eucalyptus camphora</i> subsp. <i>humeana</i>	Mountain Swamp-gum				√
<i>Eucalyptus crenulata</i>	Buxton Gum			√	
<i>Eucalyptus neglecta</i>	Omeo Gum			√	
<i>Eucalyptus stellulata</i>	Black Sallee			√	
<i>Leptospermum brevipes</i>	Slender Tea-tree			√	
<i>Leptospermum continentale</i>	Prickly Tea-tree			√	
<i>Leptospermum grandifolium</i>	Mountain Tea-tree			√	
<i>Leptospermum lanigerum</i>	Woolly Tea-tree			√	

Name Scientific	Common	DSE status	Fidelity to peatland vegetation		
			Low	Moderate	High
<i>Leptospermum myrtifolium</i>	Myrtle Tea-tree			√	
Onagraceae					
<i>Epilobium billardierianum</i> subsp. <i>hydrophilum</i>	Robust Willow-herb				√
<i>Epilobium curtisiae</i>	Bald-seeded Willow-herb	r			√
<i>Epilobium gunnianum</i>	Gunn's Willow-herb				√
<i>Epilobium pallidiflorum</i>	Showy Willow-herb				√
<i>Epilobium sarmentaceum</i>	Mountain Willow-herb	r			√
<i>Epilobium tasmanicum</i>	Snow Willow-herb	v			√
Plantaginaceae					
<i>Plantago alpestris</i>	Veined Plantain	r			√
Polygalaceae					
<i>Comesperma retusum</i>	Mountain Milkwort				√
Proteaceae					
<i>Hakea microcarpa</i>	Small-fruit Hakea				√
Ranunculaceae					
<i>Caltha introloba</i>	Alpine Marsh-marigold	r			√
<i>Ranunculus collinus</i>	Strawberry Buttercup	r			√
<i>Ranunculus gunnianus</i>	Gunn's Alpine Buttercup	r			√
<i>Ranunculus millanii</i>	Dwarf Buttercup	r			√
Rosaceae					
<i>Geum urbanum</i> var. <i>strictum</i>	Common Avens			√	
Rubiaceae					
<i>Coprosma moorei</i>	Turquoise Coprosma	r			√
<i>Coprosma nitida</i>	Shining Coprosma				√
<i>Nertera granadensis</i>	Matted Nertera				√
Scrophulariaceae					
<i>Euphrasia caudata</i>	Tailed Eyebright	r			√
<i>Euphrasia collina</i> subsp. <i>paludosa</i>	Purple Eyebright				√
<i>Euphrasia eichleri</i>	Bogong Eyebright	V v			√
<i>Gratiola nana</i>	Matted Brooklime	r		√	
<i>Veronica</i> sp. 2	Thread Speedwell			√	
Stylidiaceae					
<i>Stylidium montanum</i>	Montane Swamp Triggerplant	r			√
Violaceae					
<i>Viola caleyana</i>	Swamp Violet	r		√	
<i>Viola fuscoviolacea</i>	Dusky Violet	r			√

Appendix 2. Fauna species recorded from the AVW database (DSE 2005b) within the general study area, i.e. Highlands, Strathbogie Ranges, Warby Ranges, Chesneyvale Hills and Tolmie. Species detected in general study area, and those associated with wetlands surveyed during this survey are also indicated.

EPBC - EPBC Act 1999: Vul - Vulnerable; End - Endangered; CEn - Critically Endangered under the threatened fauna list of the Act

Mi/Ma: Mi - nominated under the list of Migratory species, M - nominated under the list of Marine species of the EPBC Act 1999

DSE - DSE (2003): NT - Near threatened, Vul - Vulnerable, End - Endangered, CEn - Critically endangered

FFG - FFG Act 1988: N - Nominated for listing, L - listed, X - rejected for listing

Feral: * - Feral/ introduced species

Guild - Use of peatland spring-soak wetlands by fauna: lh - localised habitat use, gh - general habitat use, d - drink at these sites only, f - provide only foraging sites for this species, r - wetlands provide refuge during drought periods

EPBC	DSE	FFG	Feral	Common Name	Scientific Name	Current survey		Guild
						General area	Peatland/spring-soak wetlands	
				Stubble Quail	<i>Coturnix pectoralis</i>			
	NT			Brown Quail	<i>Coturnix ypsilophora</i>			lh
				Painted Button-quail	<i>Turnix varia</i>			
	NT			Little Button-quail	<i>Turnix velox</i>			
				Peaceful Dove	<i>Geopelia striata</i>			d
	NT	L		Diamond Dove	<i>Geopelia cuneata</i>			d
				Common Bronzewing	<i>Phaps chalcoptera</i>	*		
				Brush Bronzewing	<i>Phaps elegans</i>			
				Crested Pigeon	<i>Ocyphaps lophotes</i>			
	VU	L		Lewin's Rail	<i>Rallus pectoralis</i>			
				Buff-banded Rail	<i>Gallirallus philippensis</i>			lh
				Australian Spotted Crake	<i>Porzana fluminea</i>			
				Black-tailed Native-hen	<i>Gallinula ventralis</i>			lh
				Dusky Moorhen	<i>Gallinula tenebrosa</i>	*		lh
				Purple Swamphen	<i>Porphyrio porphyrio</i>	*	*	lh
				Eurasian Coot	<i>Fulica atra</i>	*		lh
				Great Crested Grebe	<i>Podiceps cristatus</i>			
				Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	*		
				Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>			
				Great Cormorant	<i>Phalacrocorax carbo</i>			
				Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>			
	NT			Pied Cormorant	<i>Phalacrocorax varius</i>			
				Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>			
				Darter	<i>Anhinga melanogaster</i>			
				Australian Pelican	<i>Pelecanus conspicillatus</i>			
	NT			Whiskered Tern	<i>Chlidonias hybridus</i>			
				Silver Gull	<i>Larus novaehollandiae</i>			
				Red-kneed Dotterel	<i>Erythrogonys cinctus</i>			
				Masked Lapwing	<i>Vanellus miles</i>	*		gh
				Double-banded Plover	<i>Charadrius bicinctus</i>			
				Black-fronted Dotterel	<i>Elsayornis melanops</i>			
				Black-winged Stilt	<i>Himantopus himantopus</i>			
				Sharp-tailed Sandpiper	<i>Calidris acuminata</i>			
	NT			Latham's Snipe	<i>Gallinago hardwickii</i>			lh
	EN	L		Bush Stone-curlew	<i>Burhinus grallarius</i>			
	NT			Glossy Ibis	<i>Plegadis falcinellus</i>			f
				Australian White Ibis	<i>Threskiornis molucca</i>	*		f
				Straw-necked Ibis	<i>Threskiornis spinicollis</i>			f
	VU			Royal Spoonbill	<i>Platalea regia</i>			
				Yellow-billed Spoonbill	<i>Platalea flavipes</i>			
	EN	L		Little Egret	<i>Egretta garzetta</i>			
	CR	L		Intermediate Egret	<i>Ardea intermedia</i>			

EPBC	DSE	FFG	Feral	Common Name	Scientific Name	Current survey		Guild
						General area	Peatland/spring-soak wetlands	
	VU	L		Great Egret	<i>Ardea alba</i>			
				White-faced Heron	<i>Egretta novaehollandiae</i>	*		f
				White-necked Heron	<i>Ardea pacifica</i>			
	NT			Nankeen Night Heron	<i>Nycticorax caledonicus</i>			
	EN	L		Little Bittern	<i>Ixobrychus minutus</i>			
	EN	L		Australasian Bittern	<i>Botaurus poiciloptilus</i>			
	VU			Magpie Goose	<i>Anseranas semipalmata</i>			
				Australian Wood Duck	<i>Chenonetta jubata</i>	*		
				Black Swan	<i>Cygnus atratus</i>			
				Plumed Whistling-Duck	<i>Dendrocygna eytoni</i>			
				Australian Shelduck	<i>Tadorna tadornoides</i>	*		
				Pacific Black Duck	<i>Anas superciliosa</i>	*		
				Garganey	<i>Anas querquedula</i>			
				Chestnut Teal	<i>Anas castanea</i>			
				Grey Teal	<i>Anas gracilis</i>			
	VU			Australasian Shoveler	<i>Anas rhynchotis</i>			
				Pink-eared Duck	<i>Malacorhynchus membranaceus</i>			
	EN	L		Freckled Duck	<i>Stictonetta naevosa</i>			
	VU			Hardhead	<i>Aythya australis</i>			
	EN	L		Blue-billed Duck	<i>Oxyura australis</i>			
	VU			Musk Duck	<i>Biziura lobata</i>			
	NT			Spotted Harrier	<i>Circus assimilis</i>			
				Swamp Harrier	<i>Circus approximans</i>	*		f
				Brown Goshawk	<i>Accipiter fasciatus</i>			
				Collared Sparrowhawk	<i>Accipiter cirrhocephalus</i>			
				Wedge-tailed Eagle	<i>Aquila audax</i>	*		
				Little Eagle	<i>Hieraaetus morphnoides</i>			
	VU	L		White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>			
				Whistling Kite	<i>Haliastur sphenurus</i>			
				Black Kite	<i>Milvus migrans</i>			
				Black-shouldered Kite	<i>Elanus axillaris</i>	*		f
				Australian Hobby	<i>Falco longipennis</i>			
				Peregrine Falcon	<i>Falco peregrinus</i>			
	VU			Black Falcon	<i>Falco subniger</i>			
				Brown Falcon	<i>Falco berigora</i>			
				Nankeen Kestrel	<i>Falco cenchroides</i>	*		
				Southern Boobook	<i>Ninox novaeseelandiae</i>			
	EN	L		Barking Owl	<i>Ninox connivens</i>			
	VU	L		Powerful Owl	<i>Ninox strenua</i>			
				Barn Owl	<i>Tyto alba</i>			
				Musk Lorikeet	<i>Glossopsitta concinna</i>			
				Purple-crowned Lorikeet	<i>Glossopsitta porphyrocephala</i>			
				Little Lorikeet	<i>Glossopsitta pusilla</i>			
	VU	L		Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>			d
				Yellow-tailed Black-Cockatoo	<i>Calyptorhynchus funereus</i>			d
				Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>			d
				Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	*		d
				Little Corella	<i>Cacatua sanguinea</i>			d
				Long-billed Corella	<i>Cacatua tenuirostris</i>			d
				Galah	<i>Cacatua roseicapilla</i>	*		d

EPBC	DSE	FFG	Feral	Common Name	Scientific Name	Current survey		Guild	
						General area	Peatland/spring-soak wetlands		
VU	EN	L		Cockatiel	<i>Nymphicus hollandicus</i>			d	
				Superb Parrot	<i>Polytelis swainsonii</i>		*	d	
				Australian King-Parrot	<i>Alisterus scapularis</i>				d
EN	EN	L		Crimson Rosella	<i>Platycercus elegans</i>			d,f	
				Eastern Rosella	<i>Platycercus eximius</i>	*		d,f	
				Red-rumped Parrot	<i>Psephotus haematonotus</i>				d,f
				Turquoise Parrot	<i>Neophema pulchella</i>				d,f
				Blue-winged Parrot	<i>Neophema chrysostoma</i>				d,f
				Swift Parrot	<i>Lathamus discolor</i>				d,f
				Budgerigar	<i>Melopsittacus undulatus</i>				d,f
				Tawny Frogmouth	<i>Podargus strigoides</i>				
				Australian Owllet-nightjar	<i>Aegotheles cristatus</i>				
				Dollarbird	<i>Eurystomus orientalis</i>				
EN	EN	L		Azure Kingfisher	<i>Alcedo azurea</i>				
				Laughing Kookaburra	<i>Dacelo novaeguineae</i>	*			
				Sacred Kingfisher	<i>Todiramphus sanctus</i>				
				Rainbow Bee-eater	<i>Merops ornatus</i>				
				White-throated Nightjar	<i>Eurostopodus mystacalis</i>				
				Spotted Nightjar	<i>Eurostopodus argus</i>				
				White-throated Needletail	<i>Hirundapus caudacutus</i>				
				Fork-tailed Swift	<i>Apus pacificus</i>				
				Pallid Cuckoo	<i>Cuculus pallidus</i>				
				Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>				
EN	EN	L		Brush Cuckoo	<i>Cacomantis variolosus</i>				
				Black-eared Cuckoo	<i>Chrysococcyx osculans</i>				
				Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>				
				Shining Bronze-Cuckoo	<i>Chrysococcyx lucidus</i>				
				Superb Lyrebird	<i>Menura novaehollandiae</i>				
				Welcome Swallow	<i>Hirundo neoxena</i>				
				Tree Martin	<i>Hirundo nigricans</i>				
				Fairy Martin	<i>Hirundo ariel</i>				
				Grey Fantail	<i>Rhipidura fuliginosa</i>				
				Rufous Fantail	<i>Rhipidura rufifrons</i>				
EN	EN	L		Willie Wagtail	<i>Rhipidura leucophrys</i>	*			
				Leaden Flycatcher	<i>Myiagra rubecula</i>				
				Satin Flycatcher	<i>Myiagra cyanoleuca</i>				
				Restless Flycatcher	<i>Myiagra inquieta</i>				
				Jacky Winter	<i>Microeca fascinans</i>				
				Scarlet Robin	<i>Petroica multicolor</i>				
				Red-capped Robin	<i>Petroica goodenovii</i>				
				Flame Robin	<i>Petroica phoenicea</i>				
				Rose Robin	<i>Petroica rosea</i>				
				Hooded Robin	<i>Melanodryas cucullata</i>				
EN	EN	L		Eastern Yellow Robin	<i>Eopsaltria australis</i>	*			
				Golden Whistler	<i>Pachycephala pectoralis</i>				
				Rufous Whistler	<i>Pachycephala rufiventris</i>				
				Gilbert's Whistler	<i>Pachycephala inornata</i>				
				Grey Shrike-thrush	<i>Colluricincla harmonica</i>				
				Magpie-lark	<i>Grallina cyanoleuca</i>	*			
				Crested Shrike-tit	<i>Falcunculus frontatus</i>				
				Eastern Whipbird	<i>Psophodes olivaceus</i>				

EPBC	DSE	FFG	Feral	Common Name	Scientific Name	Current survey		Guild
						General area	Peatland/spring-soak wetlands	
				Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>			
				White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>			
				White-winged Triller	<i>Lalage sueurii</i>			
	EN	L		Grey-crowned Babbler	<i>Pomatostomus temporalis</i>			
				White-browed Babbler	<i>Pomatostomus superciliosus</i>			
				White-fronted Chat	<i>Epthianura albifrons</i>			gh
				White-throated Gerygone	<i>Gerygone olivacea</i>			
				Western Gerygone	<i>Gerygone fusca</i>			
				Weebill	<i>Smicronis brevirostris</i>			
				Southern Whiteface	<i>Aphelocephala leucopsis</i>			
				Striated Thornbill	<i>Acanthiza lineata</i>			
				Yellow Thornbill	<i>Acanthiza nana</i>			
				Brown Thornbill	<i>Acanthiza pusilla</i>			
				Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>			
				Buff-rumped Thornbill	<i>Acanthiza reguloides</i>			
				Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>			
	VU	L		White-browed Scrubwren	<i>Sericornis frontalis</i>			
				Speckled Warbler	<i>Chthonicola sagittata</i>			
				Brown Songlark	<i>Cincloramphus cruralis</i>			
				Rufous Songlark	<i>Cincloramphus mathewsi</i>			
				Little Grassbird	<i>Megalurus gramineus</i>			lh
				Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>			lh
				Golden-headed Cisticola	<i>Cisticola exilis</i>			lh
				Superb Fairy-wren	<i>Malurus cyaneus</i>	*	*	gh
				White-breasted Woodswallow	<i>Artamus leucorhynchus</i>			
				Masked Woodswallow	<i>Artamus personatus</i>			
				White-browed Woodswallow	<i>Artamus superciliosus</i>			
				Black-faced Woodswallow	<i>Artamus cinereus</i>			
				Dusky Woodswallow	<i>Artamus cyanopterus</i>			
				Varied Sittella	<i>Daphoenositta chrysoptera</i>			
	NT			Brown Treecreeper	<i>Climacteris picumnus</i>			
				White-throated Treecreeper	<i>Cormobates leucophaeus</i>			
				Red-browed Treecreeper	<i>Climacteris erythroptis</i>			
				Mistletoebird	<i>Dicaeum hirundinaceum</i>			
				Spotted Pardalote	<i>Pardalotus punctatus</i>			
				Silvereye	<i>Zosterops lateralis</i>			
				White-naped Honeyeater	<i>Melithreptus lunatus</i>			
	NT			Black-chinned Honeyeater	<i>Melithreptus gularis</i>			
				Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>			
				Black Honeyeater	<i>Certhionyx niger</i>			
				Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>			
	VU	L		Painted Honeyeater	<i>Grantiella picta</i>			
EN	CR	L		Regent Honeyeater	<i>Xanthomyza phrygia</i>			
				Lewin's Honeyeater	<i>Meliphaga lewinii</i>			
				Singing Honeyeater	<i>Lichenostomus virescens</i>			
				Fuscous Honeyeater	<i>Lichenostomus fuscus</i>			
				Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>			
				White-eared Honeyeater	<i>Lichenostomus leucotis</i>			gh
				Yellow-tufted Honeyeater	<i>Lichenostomus melanops</i>			
				Yellow-plumed Honeyeater	<i>Lichenostomus ornatus</i>			
				White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>			

EPBC	DSE	FFG	Feral	Common Name	Scientific Name	Current survey		Guild
						General area	Peatland/spring-soak wetlands	
				Crescent Honeyeater	<i>Phylidonyris pyrrhoptera</i>			
				New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>			
				Noisy Miner	<i>Manorina melanocephala</i>	*		
				Little Wattlebird	<i>Anthochaera chrysoptera</i>			
				Red Wattlebird	<i>Anthochaera carunculata</i>	*		
				Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>			
				Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>			
				Noisy Friarbird	<i>Philemon corniculatus</i>			
				Little Friarbird	<i>Philemon citreogularis</i>			
				Richard's Pipit	<i>Anthus novaeseelandiae</i>			
				Singing Bushlark	<i>Mirafrja javanica</i>			
	VU	L		Diamond Firetail	<i>Stagonopleura guttata</i>			gh
				Zebra Finch	<i>Taeniopygia guttata</i>			gh
				Double-barred Finch	<i>Taeniopygia bichenovii</i>			gh
				Red-browed Finch	<i>Neochmia temporalis</i>			gh
				Olive-backed Oriole	<i>Oriolus sagittatus</i>			
				Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>			
				White-winged Chough	<i>Corcorax melanorhamphos</i>			
				Pied Currawong	<i>Strepera graculina</i>			
				Grey Currawong	<i>Strepera versicolor</i>			
				Pied Butcherbird	<i>Cracticus nigrogularis</i>			
				Grey Butcherbird	<i>Cracticus torquatus</i>	*		
				Australian Magpie	<i>Gymnorhina tibicen</i>	*		
				Bassian Thrush	<i>Zoothera lunulata</i>			
				Australian Raven	<i>Corvus coronoides</i>	*		
			*	Mallard	<i>Anas platyrhynchos</i>			
				Little Raven	<i>Corvus mellori</i>			
			*	Rock Dove	<i>Columba livia</i>			
				Striated Pardalote	<i>Pardalotus striatus</i>			
				Cattle Egret	<i>Ardea ibis</i>			
			*	Spotted Turtle-Dove	<i>Streptopelia chinensis</i>			
			*	Common Blackbird	<i>Turdus merula</i>	*		
			*	Skylark	<i>Alauda arvensis</i>			
			*	Eurasian Tree Sparrow	<i>Passer montanus</i>			
			*	House Sparrow	<i>Passer domesticus</i>			
			*	European Goldfinch	<i>Carduelis carduelis</i>			
			*	European Greenfinch	<i>Carduelis chloris</i>			
			*	Common Myna	<i>Acridotheres tristis</i>			
			*	Common Starling	<i>Sturnus vulgaris</i>	*		
				Platypus	<i>Ornithorhynchus anatinus</i>			
				Short-beaked Echidna	<i>Tachyglossus aculeatus</i>	*		
VU	EN	L		Spot-tailed Quoll	<i>Dasyurus maculatus</i>			
	VU	L		Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>			
				Yellow-footed Antechinus	<i>Antechinus flavipes</i>			
				Agile Antechinus	<i>Antechinus agilis</i>			
				Long-nosed Bandicoot	<i>Perameles nasuta</i>			gh
				Common Brushtail Possum	<i>Trichosurus vulpecula</i>	*		
				Mountain Brushtail Possum	<i>Trichosurus caninus</i>			
				Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>			
				Greater Glider	<i>Petauroides volans</i>			
	EN	L		Squirrel Glider	<i>Petaurus norfolcensis</i>			

EPBC	DSE	FFG	Feral	Common Name	Scientific Name	Current survey		Guild
						General area	Peatland/spring-soak wetlands	
				Sugar Glider	<i>Petaurus breviceps</i>			
				Feathertail Glider	<i>Acrobates pygmaeus</i>			
				Koala	<i>Phascolarctos cinereus</i>	*		
				Common Wombat	<i>Vombatus ursinus</i>	*	*	r
				Black Wallaby	<i>Wallabia bicolor</i>	*	*	r
				Eastern Grey Kangaroo	<i>Macropus giganteus</i>	*		r
				Little Red Flying-fox	<i>Pteropus scapulatus</i>			
	VU	L		Eastern Horseshoe Bat	<i>Rhinolophus megaphyllus</i>			
				White-striped Freetail Bat	<i>Tadarida australis</i>			
				Gould's Long-eared Bat	<i>Nyctophilus gouldi</i>			
				Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>			
		L		Common Bent-wing Bat	<i>Miniopterus schreibersii</i>			
				Gould's Wattled Bat	<i>Chalinolobus gouldii</i>			
				Chocolate Wattled Bat	<i>Chalinolobus morio</i>			
				Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>			
				Southern Forest Bat	<i>Vespadelus regulus</i>			
				Little Forest Bat	<i>Vespadelus vulturnus</i>			
				Large Forest Bat	<i>Vespadelus darlingtoni</i>			
				Bush Rat	<i>Rattus fuscipes</i>			
			*	Black Rat	<i>Rattus rattus</i>			
			*	House Mouse	<i>Mus musculus</i>			
				Water Rat	<i>Hydromys chrysogaster</i>			
			*	European Rabbit	<i>Oryctolagus cuniculus</i>	*		
			*	Brown Hare	<i>Lepus capensis</i>			
			*	Pig (feral)	<i>Sus scrofa</i>			
			*	Sheep (feral)	<i>Ovis aries</i>	*		
			*	Red Fox	<i>Canis vulpes</i>	*		
			*	Cat (feral)	<i>Felis catus</i>			
	EN	L		Broad-shelled Tortoise	<i>Chelodina expansa</i>			
				Common Long-necked Tortoise	<i>Chelodina longicollis</i>			
				Murray River Tortoise	<i>Emydura macquarii</i>			
				Wood Gecko	<i>Diplodactylus vittatus</i>			
				Marbled Gecko	<i>Phyllodactylus marmoratus</i>			
				Olive Legless Lizard	<i>Delma inornata</i>			
				Burton's Snake-Lizard	<i>Lialis burtonis</i>			
	DD			Eastern Bearded Dragon	<i>Pogona barbata</i>			
				Tree Dragon	<i>Amphibolurus muricatus</i>			
				Sand Goanna	<i>Varanus gouldii</i>			
	VU			Tree Goanna	<i>Varanus varius</i>			
				Southern Rainbow Skink	<i>Carlia tetradactyla</i>			
				Large Striped Skink	<i>Ctenotus robustus</i>			
				Cunningham's Skink	<i>Egernia cunninghami</i>			
				White's Skink	<i>Egernia whitii</i>			
				Three-toed Skink	<i>Hemiergis decresiensis</i>			
				Garden Skink	<i>Lampropholis guichenoti</i>			
				Weasel Skink	<i>Saproscincus mustelinus</i>			
				Coventry's Skink	<i>Niveoscincus coventryi</i>			
				Bougainville's Skink	<i>Lerista bougainvillii</i>			
				Boulenger's Skink	<i>Morethia boulengeri</i>			
				Blotched Blue-tongued Lizard	<i>Tiliqua nigrolutea</i>			
				Common Blue-tongued Lizard	<i>Tiliqua scincoides</i>			

EPBC	DSE	FFG	Feral	Common Name	Scientific Name	Current survey		Guild
						General area	Peatland/spring-soak wetlands	
				Stumpy-tailed Lizard	<i>Tiliqua rugosa</i>			
				Gray's Blind Snake	<i>Ramphotyphlops nigrescens</i>			
	NT			Woodland Blind Snake	<i>Ramphotyphlops proximus</i>			
				Eastern Small-eyed Snake	<i>Rhinoplocephalus nigrescens</i>			lh, f
				Tiger Snake	<i>Notechis scutatus</i>			lh, f
				Eastern Three-lined Skink	<i>Bassiana duperreyi</i>			lh, f
				Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>			lh, f
				Eastern Brown Snake	<i>Pseudonaja textilis</i>			lh, f
				Dwyer's Snake	<i>Suta dwyeri</i>			lh, f
				Little Whip Snake	<i>Suta flagellum</i>			lh, f
				Bearded Dragon	<i>Pogona sp.</i>			
				Black Rock Skink	<i>Egernia saxatilis intermedia</i>			
				Yellow-bellied Water Skink	<i>Eulamprus heatwolei</i>			
	EN	L		Carpet Python	<i>Morelia spilota metcalfei</i>			
				Lowland Copperhead	<i>Austrelaps superbus</i>			lh
				² Eastern Smooth Frog	<i>Geocrinia victoriana</i>	*	*	lh
				Southern Bullfrog	<i>Limnodynastes dumerilii</i>			lh
				Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>			lh
				Common Spadefoot Toad	<i>Neobatrachus sudelli</i>			lh
	EN			Brown Toadlet	<i>Pseudophryne bibronii</i>			lh
				Plains Froglet	<i>Crinia parinsignifera</i>			lh
				Common Froglet	<i>Crinia signifera</i>	*		lh
	DD	L		Rugose Toadlet	<i>Uperoleia rugosa</i>			lh
				Plains Brown Tree Frog	<i>Litoria paraewingi</i>			lh
				Peron's Tree Frog	<i>Litoria peronii</i>			lh
VU	EN	L		Growling Grass Frog	<i>Litoria raniformis</i>			
			*	Rainbow Trout	<i>Oncorhynchus mykiss</i>			
			*	Brown Trout	<i>Salmo trutta</i>			
				Australian Smelt	<i>Retropinna semoni</i>			
		L		Mountain Galaxias	<i>Galaxias olidus</i>			
			*	Goldfish	<i>Carassius auratus</i>			
			*	Carp	<i>Cyprinus carpio</i>			
			*	Oriental Weatherloach	<i>Misgurnus anguillicaudatus</i>			
EN	CR	L		Trout Cod	<i>Maccullochella macquariensis</i>			
VU	EN	L		Murray Cod	<i>Maccullochella peelii peelii</i>			
	VU			Golden Perch	<i>Macquaria ambigua</i>			
EN	EN	L		Macquarie Perch	<i>Macquaria australasica</i>			
				Southern Pigmy Perch	<i>Nannoperca australis</i>			
			*	Redfin	<i>Perca fluviatilis</i>			
				Two-spined Blackfish	<i>Gadopsis bispinosus</i>			
				River Blackfish	<i>Gadopsis marmoratus</i>			
				Western Carp Gudgeon	<i>Hypseleotris klunzingeri</i>			
	VU	L		Bullant	<i>Myrmecia sp. 17</i>			
				Common Yabbie	<i>Cherax destructor</i>			lh

² Not recorded in Fauna Data Review Area, recorded during field surveys

Appendix 3. Data collection by field officers.

The following list includes information that should be collected by Field officers when undertaking assessments of peatland and spring-soak wetlands:

- GPS position - centre of wetland, edge of wetland
- Records which datum the data is recorded in i.e. AGD66, WGS84
- Bog type
- General notes on condition
- Type(s) of land-use (e.g. grazing, water harvesting)
- Photographs of site
- Degrading factors
- Structurally dominant plant species (indigenous and exotic)

Appendix 4. Summary of all sites collated from data collected for this project.

Site	Collector	Easting	Northing	Site	Collector	Easting	Northing
1	John Morgan	449799	5888883	52	Geoff Barrow	422508	5984891
2	John Morgan	449934	5888903	53	Geoff Barrow	422635	5985706
3	John Morgan	449577	5888884	54	Geoff Barrow	422616	5985431
4	John Morgan	399227	5924728	55	Geoff Barrow	422655	5985107
5	John Morgan	396300	5924266	56	Geoff Barrow	427782	5984061
6	John Morgan	401133	5850564	57	Geoff Barrow	428199	5981127
7	John Morgan	400988	5850485	58	Geoff Barrow	427032	5980250
8	John Morgan	386265	5917149	59	Geoff Barrow	426756	5981572
9	John Morgan	405127	5862027	60	Geoff Barrow	430278	5980655
10	John Morgan	394424	5855939	61	Geoff Barrow	430226	5981568
11	John Morgan	449348	5888699	62	Geoff Barrow	430442	5981183
12	John Morgan	431688	5917702	63	Geoff Barrow	431273	5980056
13	John Morgan	396150	5862526	64	Geoff Barrow	430187	5978910
14	Ray Thomas	396869	5924362	65	Geoff Barrow	431825	5977415
15	Ray Thomas	396857	5924475	66	Geoff Barrow	431349	5970804
16	Ray Thomas	396921	5924658	67	Geoff Barrow	431427	5970812
17	Ray Thomas	397448	5924903	68	Geoff Barrow	431531	5970812
18	Ray Thomas	397508	5925172	69	Geoff Barrow	431354	5970605
19	Ray Thomas	394872	5924029	70	Geoff Barrow	431241	5970557
20	Ray Thomas	392924	5922691	71	Geoff Barrow	431630	5970942
21	Ray Thomas	392865	5922731	72	Geoff Barrow	430126	5964849
22	Ray Thomas	392257	5922087	73	Geoff Barrow	430204	5964819
23	Ray Thomas	391889	5921633	74	Geoff Barrow	430308	5964849
24	Ray Thomas	391947	5921675	75	Geoff Barrow	430010	5965108
25	Ray Thomas	384540	5917965	76	Geoff Barrow	426994	5968068
26	Ray Thomas	384682	5918132	77	Geoff Barrow	427028	5969620
27	Ray Thomas	386489	5919596	78	Geoff Barrow	427214	5969460
28	Ray Thomas	397197	5921256	79	Geoff Barrow	427218	5969568
29	Ray Thomas	425090	5952459	80	Geoff Barrow	427201	5969685
30	Ray Thomas	424918	5954509	81	Geoff Barrow	426760	5970523
31	Ray Thomas	424832	5954620	82	Geoff Barrow	428178	5973988
32	Ray Thomas	424173	5954999	83	Geoff Barrow	425434	5976711
33	Ray Thomas	424403	5953757	84	Geoff Barrow	425537	5976698
34	Ray Thomas	426927	5955128	85	Geoff Barrow	426652	5978979
35	Ray Thomas	418475	5951789	86	Geoff Barrow	426721	5979113
36	Ray Thomas	392451	5925233	87	Geoff Barrow	426847	5979213
37	Ray Thomas	392482	5925166	88	Geoff Barrow	426911	5979286
38	Ray Thomas	392458	5925039	89	Geoff Barrow	427037	5979334
39	Ray Thomas	388665	5932072	90	Geoff Barrow	426790	5978845
40	Ray Thomas	392586	5927799	91	Geoff Barrow	426894	5978681
41	Ray Thomas	391868	5927257	92	Geoff Barrow	426950	5978547
42	Ray Thomas	390190	5926744	93	Geoff Barrow	428830	5978068
43	Ray Thomas	422295	5955824	94	Geoff Barrow	428735	5978120
44	Ray Thomas	421136	5953721	95	Geoff Barrow	428675	5978163
45	Ray Thomas	420888	5953784	96	Geoff Barrow	419063	5974882
46	Geoff Barrow	425530	5989760	97	Geoff Barrow	417948	5974963
47	Geoff Barrow	425450	5989605	98	Geoff Barrow	417998	5974806
48	Geoff Barrow	426725	5988851	99	Geoff Barrow	416751	5973741
49	Geoff Barrow	424874	5988072	100	Geoff Barrow	412060	5971267
50	Geoff Barrow	424864	5988249	101	Geoff Barrow	413386	5971460
51	Geoff Barrow	424697	5986285	102	Geoff Barrow	423187	5979218

Site	Collector	Easting	Northing	Site	Collector	Easting	Northing
103	Geoff Barrow	423281	5979269	139	Bec Nicholls	414540	5915900
104	Geoff Barrow	423387	5979294	140	Robinson	388243	5929553
105	Geoff Barrow	423921	5977475	141	Robinson	388607	5930270
106	Geoff Barrow	425524	5974685	142	Robinson	389375	5930323
107	Geoff Barrow	430475	5963813	143	Robinson	390630	5925789
108	Geoff Barrow	430155	5964537	144	Robinson	388699	5924191
109	Sue Berwick	366839	5901432	145	Robinson	388476	5924725
110	Sue Berwick	366596	5900676	146	Robinson	386758	5924859
111	Sue Berwick	366706	5901569	147	Robinson	386789	5924424
112	Sue Berwick	366266	5907331	148	Robinson	386873	5924809
113	Sue Berwick	368650	5896508	149	Robinson	386968	5924880
114	Sue Berwick	359959	5898693	150	Robinson	385992	5919441
115	Sue Berwick	364011	5894670	151	Robinson	384408	5917894
116	Sue Berwick	363627	5894696	152	Robinson	386966	5918800
117	Sue Berwick	361946	5896457	153	Robinson	386820	5916695
118	Sue Berwick	361915	5896369	154	Robinson	386050	5916898
119	Sue Berwick	361869	5896403	155	Robinson	386235	5917001
120	Sue Berwick	362076	5896338	156	Robinson	386277	5916861
121	Sue Berwick	362290	5896417	157	Robinson	386590	5915372
122	Sue Berwick	362147	5896646	158	Robinson	389771	5918540
123	Sue Berwick	360729	5899848	159	Robinson	390634	5919733
124	Sue Berwick	360815	5899355	160	Robinson	390006	5921475
125	Sue Berwick	360995	5898940	161	Robinson	392112	5921142
126	Sue Berwick	361111	5898916	162	Robinson	393252	5922907
127	Sue Berwick	360965	5898840	163	Robinson	393782	5923864
128	Sue Berwick	360285	5897759	164	Robinson	394688	5924206
129	Sue Berwick	386265	5917149	165	Robinson	394763	5924182
130	Sue Berwick	396150	5862526	166	Robinson	394851	5924212
131	Bec Nicholls	386765	5916708	167	Robinson	394754	5924509
132	Bec Nicholls	393054	5921317	168	Robinson	396519	5924261
133	Bec Nicholls	367610	5914364	169	Robinson	396919	5924221
134	Bec Nicholls	396588	5924446	170	Robinson	396480	5924451
135	Bec Nicholls	386499	5924656	171	Robinson	396659	5924451
136	Bec Nicholls	368560	5913049	172	Robinson	398145	5924279
137	Bec Nicholls	421020	5931220	173	Robinson	397739	5924624
138	Bec Nicholls	414480	5916030	174	Robinson	398969	5926356

Appendix 5. Criteria for determining conservation significance of flora and fauna.

Definition of significance

Significance in the biological context has a similar meaning as in general use, *significant* being defined as noteworthy or of considerable importance (Oxford Dictionary). Sites of botanical significance are areas where features of the vegetation meet defined botanical criteria. These assessments are independent of land-use classifications (e.g. biological reserves) or land ownership (e.g. public or private), instead being an assessment of the qualities of the remnant indigenous vegetation in the context of its current distribution, conservation status and integrity.

Significance has two components - scale and degree. The assessment of *degree* of significance (e.g. high or moderate) is based on the values of the site in relation to the overall distribution, condition or importance of sites possessing these values - within the range delineated by the *scale* of reference, i.e. national, state, regional or local. In general usage, scale and degree are combined into levels of significance denoted by scale alone. In the context of the present study the following areas apply to the scale of significance:

Significance of Plant Species

The assessment of significance of plant species recorded from the sites during this study is based on the application of one or more of the following criteria:

- Naturally uncommon or rare in Australia, Victoria, the region or the municipality;
- Formerly widespread in Australia, Victoria, the region or the municipality but now depleted through habitat destruction or degradation;
- Remnant population(s) with important information content on floristics of the regional or local vegetation;
- Species which are taxonomically or biogeographically interesting, e.g. geographic forms of more widespread species, disjunct populations; or
- Species which may play a keystone role in particular environments or display unusual characteristics.

Species are of *National significance* if they are rare, threatened or endangered on an Australia-wide basis. Relevant authorities include the list of Rare or Threatened Australian Plant Species (ROTAPS) by Briggs and Leigh (1995), ANZECC (1999), DSE (2005b), or listed on the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. Listings are updated on the basis of new data.

Species which are rare, threatened or endangered in Victoria are listed on the *FFG Act 1988* and/or DSE (2005b), although additional species may be similarly categorised as further information comes to hand. All such species are considered to be of at least *State significance*.

Species are considered to be *Regionally significant* if they occur in 1 percent or less of the sites on the DSE flora database for the Highlands - Southern Fall bioregion and / or to a population of plants demonstrating important information on the range and habitat of the species. The Melbourne region is not considered useful in this context due to the range of biogeographic zones it incorporates (including the western basalt plains and coastal areas).

All indigenous species are accorded at least local significance.

Vegetation Communities & Ecological Vegetation Classes

The three main attributes which determine significance are as follows:

Rarity: distribution and abundance in the context of Bioregion, the State and Nationally, and level of depletion since European settlement;

Landscape Context: patch size, degree of isolation / continuity, linkage role; and

Vegetation Condition: the level of anthropogenic disturbance, e.g. physical modification and weed invasion.

The JANIS criteria (JANIS 1997) were developed as a nation-wide system for assessing the conservation status of forested vegetation types. The criteria focus largely on rarity and landscape context. This assessment has been refined by DSE (2002) to

make assessments more relevant in a Victorian context and more generally applicable to both public and private land. These criteria, tabulated below, provide protocols for assessment of the conservation status of Ecological Vegetation Classes.

Definitions	
rare	total range generally <10 000ha; or pre-European extent in Victorian bioregion <1000 ha; or patch size generally <100 ha
naturally restricted range	pre-European extent in Victorian bioregion <10 000 ha. area of smallest concave polygon which includes all occurrences
subject to threatening process	includes currently acting threats that will lead to moderate degradation OR risk of significant rapid change
majority	greater than 50% of area
minority	greater than 10% and up to 50% of area
severely degraded	floristic and/or structural diversity is greatly reduced and unlikely to recover naturally in medium to long term
moderately degraded	floristic and/or structural diversity is significantly reduced (or being reduced) but may recover naturally with removal of threatening processes
little to no degradation	floristic and/or structural diversity is largely intact

Bioregional Conservation Status of Ecological Vegetation Classes (EVCs)

Status		Criteria
Presumed Extinct	X	Probably no longer present in the bioregion
Endangered	E1	Contracted to less than 10% of former range; or Less than 10% of the pre-European extent remains;
	E2	Combination of depletion, degradation, current threats and rarity is comparable overall to E1: 10 to 30% pre-European extent remains <u>and</u> severe degradation over a majority of this area; or naturally restricted EVC reduced to 30% or less of former range and subject to moderate degradation and/or a threatening process over a majority of remaining area; or rare EVC cleared and / or subject to moderate degradation and/or a threatening process over a majority of former area.
Vulnerable	V1	10 to 30% pre-European extent remains;
	V2	Combination of depletion, degradation, current threats and rarity is comparable overall to V1: greater than 30% and up to 50% pre-European extent remains and subject to moderate degradation and/or a threatening process over a majority of this area; or greater than 50% pre-European extent remains and severely degraded over a majority of this area; or naturally restricted EVC where greater than 30% pre-European extent remains <u>and</u> subject to moderate degradation and/or a threatening process over majority of this area; or rare EVC cleared and/or subject to moderate degradation and/or a threatening process over a minority of former area.
Depleted	D1	Greater than 30% and up to 50% pre-European extent remains;
	D2	Combination of depletion, degradation and current threats is comparable overall to D1, and: Greater than 50% pre-European extent remains moderately degraded over a majority of this area;
Rare	R	Rare EVC
Least Concern	LC	Greater than 50% pre-European extent remains and subject to little to no degradation over a majority of this area

Conservation significance of an Ecological Vegetation Class (EVC) at a site

Victoria is implementing a new approach to the assessment of remnant vegetation through the 'Habitat hectare' system (a measure of size and condition), as set out in *Victoria's Native Vegetation Management – A Framework for Action* (DNRE 2002). Of particular relevance is Table 5 (Appendix 3) of that document which is largely summarised in the table below.

To assist in planning for biodiversity conservation, Victoria is divided into 27 'bioregions' - geographic units based on a common suite of biophysical characteristics. The Ecological Vegetation Classes occurring within each bioregion have been assessed, based on the degree of depletion / clearing that has occurred since European settlement and the area of extant vegetation secured in a conservation reserve, to determine their conservation status. The condition score (h) of a particular remnant is then combined with the bioregional conservation status of the relevant EVC to determine the conservation significance of the EVC at the site.

The relationship between EVC Conservation Status, Vegetation Condition, and Conservation Significance (Low – Very High).

Conservation Status*	Condition Score (h)									
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Endangered	HIGH			VERY HIGH**						
Vulnerable	MEDIUM		HIGH	VERY HIGH						
Rare	MEDIUM		HIGH			VERY HIGH				
Depleted	LOW		MEDIUM			HIGH				
Least Concern	LOW					MEDIUM				

* As determined by reference to relevant bioregional plan / EVC database

** Other attributes (such as population size of a threatened taxon) may over-ride condition score alone.

Criteria for determining zoological significance

Zoological significance of taxa:

- State** A taxon is considered significant at a State level if it is:
 listed under Schedule 2 of the Victorian *Flora and Fauna Guarantee Act 1988*; or
 listed under the *Advisory List of Threatened Vertebrate Fauna in Victoria – 2003* (DSE 2003); or
 Listed as Data Deficient or Insufficiently Known under the following Australian Action Plans: Bannister *et al.* (1996), Cogger *et al.* (1993), Duncan *et al.* (1999), Garnett and Crowley (2000), Lee (1995), Maxwell *et al.* (1996), Pogonoski *et al.* (2002), Tyler (1997), Wager and Jackson (1993), or Sands and New (2002).
- National** A taxon is considered significant at a National level if it is:
 listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependant or Presumed Extinct on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*; or
 listed as Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable Rare or Lower Risk (near threatened, conservation dependent or least concern) under the following Australian Action Plans: Bannister *et al.* (1996), Cogger *et al.* (1993), Duncan *et al.* (1999), Garnett and Crowley (2000), Lee (1995), Maxwell *et al.* (1996), Pogonoski *et al.* (2002), Tyler (1997), Wager and Jackson (1993), or Sands and New (2002).

Appendix 6. *Quadrat data from sites for the GBCMA peatland/spring-soak wetland assessment.*

Wetland Site No. 7 – see Table 2

U00274

Recs 43 Date : 10 Apr 2006 Location : 145°25'03" 37°04'10" Altitude : 571 Collector : GWC

+ 160	* <i>Agrostis stolonifera</i>	Creeping Bent
+ 5169	<i>Amyema pendula subsp. pendula (s.s.)</i>	Drooping Mistletoe
+ 236	* <i>Anthoxanthum odoratum</i>	Sweet Vernal-grass
+ 374	<i>Baumea arthropphylla</i>	Fine Twig-sedge
+ 376	<i>Baumea gunnii</i>	Slender Twig-sedge
+ 408	<i>Blechnum nudum</i>	Fishbone Water-fern
+ 623	<i>Carex appressa</i>	Tall Sedge
+ 639	<i>Carex gaudichaudiana</i>	Fen Sedge
+ 651	<i>Carex tereticaulis</i>	Poong'ort
+ 706	<i>Centella cordifolia</i>	Centella
+ 8264	<i>Craspedia spp.</i>	Billy Buttons
+ 932	<i>Cyperus sanguinolentus</i>	Dark Flat-sedge
+ 1141	<i>Eleocharis gracilis</i>	Slender Spike-sedge
+ 1169	<i>Epacris paludosa</i>	Swamp Heath
+ 4444	<i>Epilobium billardierianum subsp. billardierianum</i>	Smooth Willow-herb
+ 4446	<i>Epilobium billardierianum subsp. hydrophilum</i>	Robust Willow-herb
+ 1218	r <i>Eriocaulon scariosum</i>	Common Pipewort
+ 1259	<i>Eucalyptus camphora subsp. humeana</i>	Mountain Swamp-gum
+ 3749	<i>Euchiton involucratus s.l.</i>	Common Cudweed
+ 1440	<i>Gleichenia dicarpa</i>	Pouched Coral-fern
+ 3851	<i>Gonocarpus micranthus</i>	Creeping Raspwort
+ 1524	<i>Gratiola peruviana</i>	Austral Brooklime
+ 1555	<i>Gymnoschoenus sphaerocephalus</i>	Button Grass
+ 1654	<i>Hemarthria uncinata var. uncinata</i>	Mat Grass
+ 1692	* <i>Holcus lanatus</i>	Yorkshire Fog
+ 1728	<i>Hydrocotyle sibthorpioides</i>	Shining Pennywort
+ 1743	<i>Hypericum japonicum</i>	Matted St John's Wort
+ 1748	* <i>Hypochoeris radicata</i>	Cat's Ear
+ 1775	<i>Isolepis fluitans</i>	Floating Club-sedge
+ 1827	<i>Juncus alexandri subsp. alexandri</i>	Mountain Rush
+ 1833	<i>Juncus planifolius</i>	Broad-leaf Rush
+ 8601	<i>Juncus spp.</i>	Rush
+ 1895	* <i>Leontodon taraxacoides subsp. taraxacoides</i>	Hairy Hawkbit
+ 1956	<i>Leptospermum continentale</i>	Prickly Tea-tree
+ 1958	<i>Leptospermum lanigerum</i>	Woolly Tea-tree
+ 2058	* <i>Lotus corniculatus</i>	Bird's-foot Trefoil
+ 979	<i>Notodanthonia semiannularis</i>	Wetland Wallaby-grass
+ 2497	<i>Phragmites australis</i>	Common Reed
+ 4694	<i>Poa labillardierei var. labillardierei</i>	Common Tussock-grass
+ 2907	<i>Ranunculus amphitrichus</i>	Small River Buttercup
+ 3056	<i>Schoenus tesquorum</i>	Soft Bog-sedge
+ 3223	<i>Spiranthes australis</i>	Austral Ladies' Tresses
+ 3479	<i>Utricularia dichotoma s.l.</i>	Fairies' Aprons

U00275

Recs 20 Date : 11 Apr 2006 Location : 145°26'25" 37°05'24" Altitude : 614 Collector : GWC

Site # 4

+	57		<i>Acacia melanoxylon</i>	Blackwood
+	160	*	<i>Agrostis stolonifera</i>	Creeping Bent
+	236	*	<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass
+	374		<i>Baumea arthropphylla</i>	Fine Twig-sedge
+	376		<i>Baumea gunnii</i>	Slender Twig-sedge
+	639		<i>Carex gaudichaudiana</i>	Fen Sedge
+	651		<i>Carex tereticaulis</i>	Poong'ort
+	1141		<i>Eleocharis gracilis</i>	Slender Spike-sedge
+	1259		<i>Eucalyptus camphora subsp. humeana</i>	Mountain Swamp-gum
+	1395		<i>Gahnia sieberiana</i>	Red-fruit Saw-sedge
+	1692	*	<i>Holcus lanatus</i>	Yorkshire Fog
+	8581		<i>Isolepis spp.</i>	Club Sedge
+	3803	*	<i>Juncus acuminatus</i>	Prickly Rush
+	1827		<i>Juncus alexandri subsp. alexandri</i>	Mountain Rush
+	1820		<i>Juncus gregiflorus</i>	Green Rush
+	1956		<i>Leptospermum continentale</i>	Prickly Tea-tree
+	1958		<i>Leptospermum lanigerum</i>	Woolly Tea-tree
+	2058	*	<i>Lotus corniculatus</i>	Bird's-foot Trefoil
+	4694		<i>Poa labillardierei var. labillardierei</i>	Common Tussock-grass
+	5111	*	<i>Salix cinerea subsp. cinerea</i>	Grey Sallow