2. Location and setting

This section provides a summary of the location of the project. Reference should be made to Section 5 for a description of the strategic context of the project, Section 6 for a description of the construction and operation of the project, and Sections 8 – 16 for a description of specific aspects of the existing environment.

2.1 The Murray River system

2.1.1 Basin description

The Murray-Darling Basin (MDB) comprises the catchment of the Murray and Darling Rivers and their many tributaries, extending from north of Roma in Queensland to Goolwa in South Australia. The MDB covers more than 1 million km^2 (one-seventh) of mainland Australia, including parts of Queensland, New South Wales, South Australia, Victoria and all of the Australian Capital Territory. The MDB is bounded by the Great Dividing Range in the south and east. The Darling River (and its tributaries) drains southern Queensland and northern New South Wales, crosses the Darling Plain and joins the Murray River upstream of Wentworth. The Murray River and its tributaries harvest water from inland areas of southern New South Wales and northern Victoria. The Murray River dissects the Riverine Plain from east to west and flows to the Southern Ocean via the Lower Lakes system in South Australia. The Darling (2,740 km), the Murray (2,530 km) and the Murrumbidgee (1,690 km) are Australia's three longest rivers (CSIRO, 2008) (refer to Figure 2-1).

The Murray–Darling Basin Authority (MDBA) manages the Murray River system in close cooperation with state authorities to ensure reliable water supplies for all users. To regulate the River system, the MDBA has responsibility for the operation of a number of major structures, including Dartmouth and Hume reservoirs, Lake Victoria, Lake Mulwala, and Menindee Lakes, 13 locks and weirs, and five barrages.

2.1.2 Overview of the Murray River system

The Murray River rises in the Australian Alps, between Mt. Pilot and Forest Hill on the New South Wales/Victorian border and flows 2,530 km to enter the Southern Ocean through Lake Alexandrina in South Australia. The southern bank of the Murray River forms the border between New South Wales and Victoria for 1,880 km of its length (refer to Figure 2-1). Near its headwaters, the Murray River is augmented by waters diverted by the Snowy Mountains Scheme and is joined on the Victorian side by the Mitta Mitta River above Hume Reservoir.

While the Snowy Mountains Scheme was designed to produce electricity, one of the objectives was to mitigate the effects of drought on irrigated agriculture in NSW and Victoria. The Snowy Mountains Scheme collects and stores water, diverting it through trans-mountain tunnels and power stations and then releases it west of the Snowy Mountains into the catchments of the Murray River (the southern Snowy-Murray Development) and the Murrumbidgee River (Snowy-Tumut Development), where it can be used for water supply, irrigation and environmental uses.

The Lake Hume storage is the primary regulating storage operated by MDBA and is typically drawn down in the summer and autumn of every year (MDBC, 1998). Dartmouth Dam, located on the Mitta Mitta River, is the largest regulating storage in the Murray River system with a capacity of approximately 3,900 GL. Dartmouth Dam is primarily used as a reserve storage to supplement the Hume storage in dry years or sequences of years (MDBC, 1998).

Between Lake Hume and Yarrawonga the major tributaries joining the Murray River are the Kiewa River near Albury and the Ovens River upstream of Yarrawonga Weir. These rivers are both unregulated.

Yarrawonga Weir is the point of greatest diversion of water from the Murray River. The two main irrigation channels are the Mulwala Canal and Yarrawonga Main Channel. The Mulwala Canal, on the New South Wales side, has a discharge capacity of about 10,000 ML/day. The Yarrawonga Main Channel, on the Victorian side, has a discharge capacity of 3,200 ML/day. These two channels serve a total area of over 8,000 km^2 in New South Wales and Victoria (MDBA, 2009a)

The next major tributary joining the Murray River downstream of Yarrawonga Weir is the Goulburn River, upstream of Echuca. In the low lying areas of the Barmah-Millewa Forest to the east of Echuca, the river has developed a number of anabranches and distributaries, with those in the south returning to the river in a comparatively short distance, while those to the north flow into the Edward River system and return to the main system via the Edward and Wakool Rivers some 200 km downstream. Under high flows, between 20-25% of flows would flow north at the Barmah-Millewa Forest into the Edward–Wakool system, with the remainder flowing south along the Murray River (personal communication, D Green, MDBA, November 2009).

The Barmah Choke in the Murray River upstream of the Goulburn River confluence limits passage of water via the Murray River channel and is a major operational constraint for water deliveries during peak supply periods. Ongoing investigations by MDBA (2009b) are considering options to improve the targeted delivery of water to environmentally significant areas downstream of the Choke. The first phase of the study would assess the magnitude of the challenges associated with the Barmah Choke under current conditions and a range of possible future scenarios (MDBA, 2009b).

The next major reach of River is between Echuca and Swan Hill. In this reach, the Murray River is also joined by the Campaspe River, below Echuca, and further downstream, by the Loddon River at Benjeroop and Avoca River at Swan Hill. The Koondrook-Perricoota Forest is located adjacent to the Murray River between the Campaspe and Loddon River confluences.

Torrumbarry Weir is located approximately 74 km downstream of Echuca and 133 km upstream of Swan Hill. The purpose of Torrumbarry Weir is to allow the diversion of flows for irrigation, particularly into the Cohuna, Kerang and Swan Hill areas of Victoria. The National Channel, which diverts into Victoria, carries water from the Torrumbarry Weir pool to farms in the adjacent areas (MDBA, 2009c). Torrumbarry Weir is located near the upstream end of the Koondrook–Perricoota Forest.

Two major tributaries enter the Murray River between Swan Hill and Mildura, these being the Edward River and Murrumbidgee River. The Murrumbidgee River catchment is a major sub-catchment of the Murray-Darling Basin and covers an area of 73,400 km^2. The Murrumbidgee catchment is bounded on the east by the Great Dividing Range, and lies between the Lachlan

catchment to the north and the Murray catchment to the south. The Murrumbidgee River flows for 1,690 km and includes 14 major dams and eight large weirs. The Snowy Mountains Hydro Electric Scheme assists with regulating water flow and supplying the 10,000 km of irrigation channels (CRC, 2009).

Euston Weir is located downstream of Swan Hill near the townships of Euston (NSW) and Robinvale (Victoria). Water drawn from the Euston Weir pool supports the irrigation regions of Sunraysia and Robinvale as well as providing urban water to the towns. The Weir can also maintain adequately high water levels in the river for navigation and operation of the weir pool can be varied to regulate flows between Hume Dam and the South Australian Border.

The last significant reach of the river extends from Mildura to Goolwa in South Australia. There are ten weirs/locks located in this reach of the River. The purpose of the weirs/ locks is to provide permanent navigation between the Murray Mouth and Wentworth and provide a relatively constant pool level to facilitate pumping for irrigation and water supply. At Weir 9, water levels are raised to allow gravity diversion to Lake Victoria. Lake Victoria is operated as part of South Australia's water supply and plays a key role in managing the flows in the entire Murray River. During periods of peak demand, water can be released from the Lake to continue to supply flows to South Australia. Without Lake Victoria it would be necessary to restrict demands upstream of Lake Victoria to ensure South Australia receives its entitlement.

The Darling River, which includes the Menindee Lakes system, is the last major tributary of the Murray River system. The Menindee Lakes storages consist of four large natural lakes (Wetherell, Pamamaroo, Menindee and Cawndilla) and several smaller interconnecting lakes. The purpose of the storages, when constructed, was to secure water for Broken Hill, provide water for irrigation and farm supplies in the lower Darling River downstream to Wentworth, meet stock and domestic requirements along the Great Darling Anabranch as well as supplementing resources of the Murray River system, including the supply of water to South Australia (State Water, 2009).

The Lower Lakes, Coorong and Murray Mouth extend over approximately 140,000 ha, covering 23 different wetlands types, from very fresh to saltier than the sea. The Coorong is 140 km long and is ranked among the top six waterbird sites in Australia, based on the diversity and number of species found there.

Legend

River

Murray Darling Basin

0 50 100 200
Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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Job Number 21-18573
Revision B
Date 10 FEB 2010

Figure 2.1 Murray River system

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: StreetMap - Navegate, Murray Darling Basin - MDBC, Drawn: Cwilson

2.2 Regional context

The Koondrook – Perricoota Forest is located in southwest NSW in the Riverina region. The dominant feature in the regional landscape is the River Murray, which includes the Murray River and its tributaries. The study area is relatively flat and the majority of the surrounding landscape has been modified for agricultural land uses and forested areas are often geographically isolated.

The Koondrook – Perricoota Forest is approximately 30 km northwest of Echuca on the NSW / Victoria border and occupies an area of about 32,000 ha. It is part of the Gunbower-Koondrook-Perricoota Forest which has a total area of approximately 50,000 ha. The Gunbower-Koondrook-Perricoota Forest is located downstream of Torrumbarry Weir, between Moama and Barham. The Murray River flows through the forests, with Gunbower on the southern side of the river in Victoria and Koondrook-Perricoota on the northern side of the river in NSW (Figure 2-2).

2.2.1 Forests and reserves in the region

Koondrook-Perricoota Forest is a State Forest managed by Forests NSW. It is listed on the Register of the National Estate and is part of the 84,000 ha of NSW Central Murray State Forests listed as wetlands of international importance under the Ramsar Convention. The Convention on Wetlands of International Importance aims to conserve natural resources and is named after the Iranian town of Ramsar in which it was signed. It is commonly referred to as the Ramsar convention. The Ramsar Convention's broad aims are to halt the worldwide loss of wetlands and to conserve, through wise use and management, those that remain. It encourages the designation of sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity.

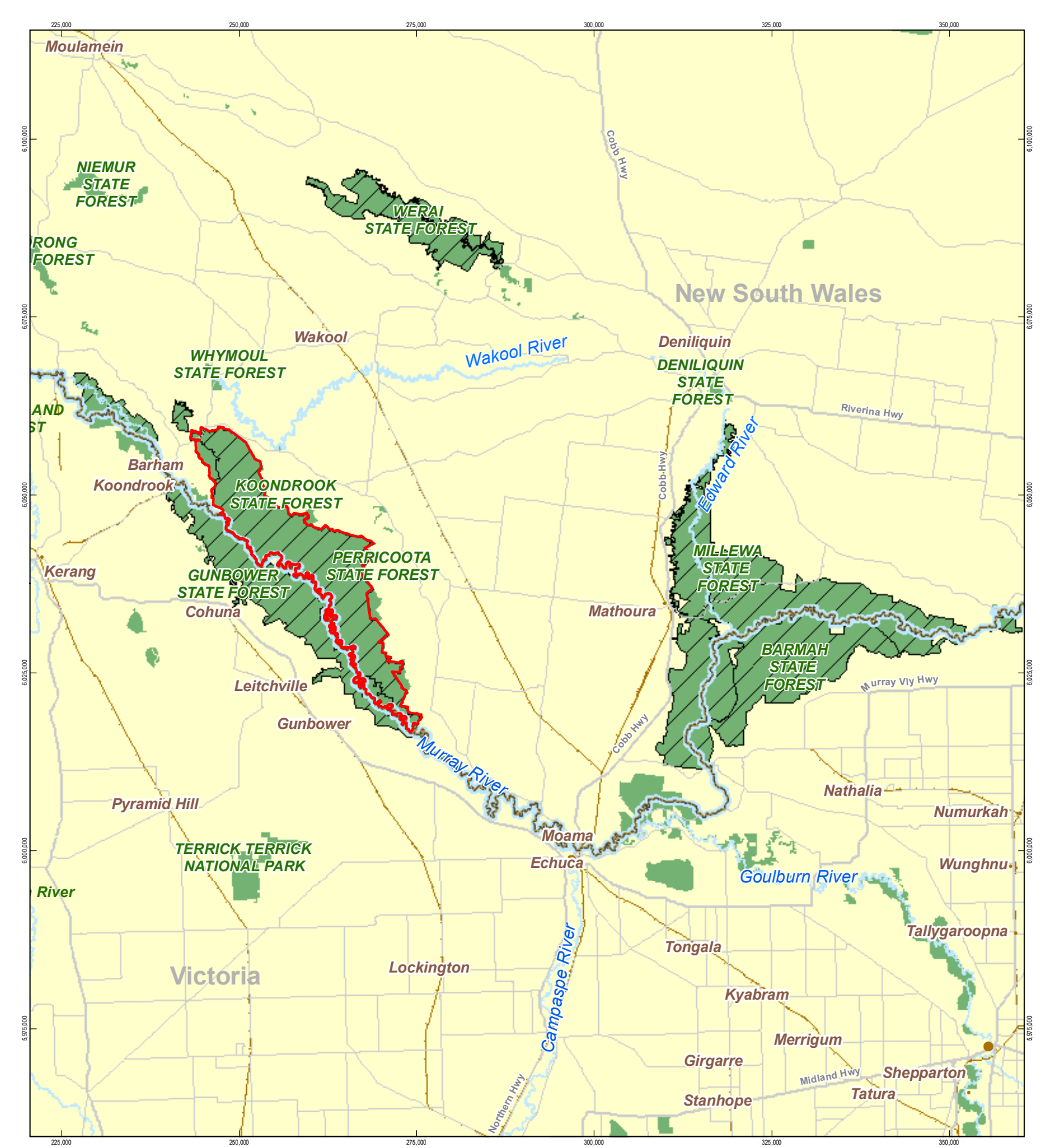
The NSW Central Murray State Forests was listed as a Ramsar site in 2003 and is located on the floodplain of the Murray River. It incorporates three units: the Millewa Forests located on the Murray River upstream of the site, the Werai Forests located on the Edward River to the north of the site, and the Koondrook Forests (refer to Figure 2-2).

There are a number of reserves and forests in the locality aside from Gunbower-Koondrook-Perricoota Forest. Those within a 30 km radius of the forest include:

- State Forests: Thule, Green Gully, Benarca, Moama, Whymoul and Campbells Island, Gulpa, Millewa, Moira, Bama, Horseshoe Lagoon, Banangalite, Werai, Stephens Weir, Morago, Barratta Creek, and Noorong.
- Reserves: Doherty Pines Flora Reserve, Terrick Terrick Native Grassland Reserve, and Gunbower Timber Reserve.

The closest national park to the project is Yanga National Park, which is near Balranald, approximately 80 km northwest of the site.

Management of the Gunbower Forest is under the jurisdiction of the Victorian Department of Sustainability and Environment.



Legend

- Site Location
- State Border
- Ramsar Site
- National Parks
  State Forests & reserves

0 5 10 20
Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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NSW Office of Water
Koondrook-Perricoota Flood Enhancement Works
Figure 2.2 Regional context of the Koondrook-Perricoota Forest site

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: StreetMap - Navegate, Drawn: Cwilson

2.2.2 Urban settlements

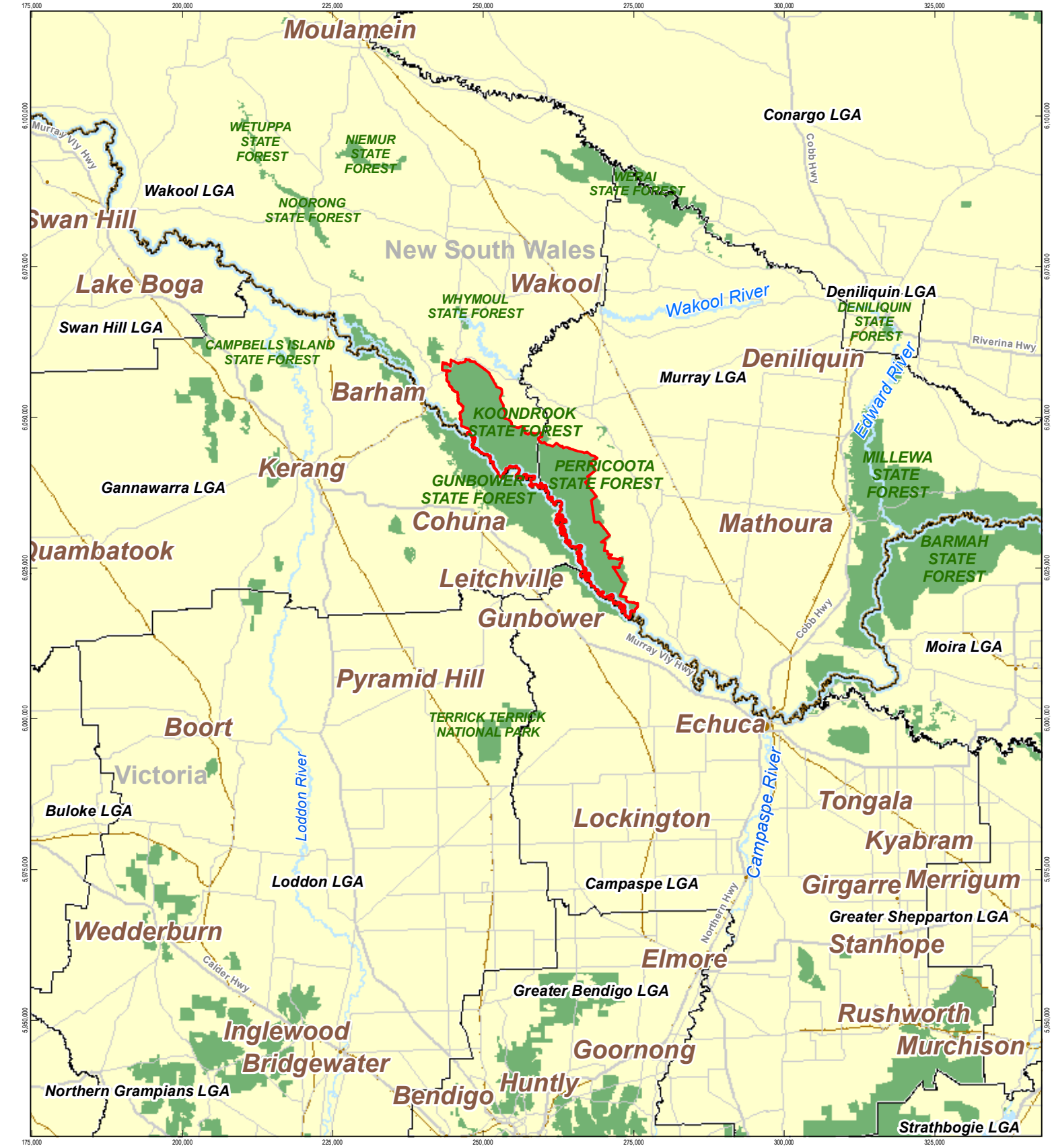
The Koondrook–Perricoota Forest is located in both the Murray Shire Council and the Wakool Shire Council Local Government Areas (LGAs). The upstream area of the Forest is in Murray LGA, while the downstream area is in Wakool LGA. The Deniliquin LGA encompasses the town of Deniliquin, which is located approximately 80 km to the north east of the Forest. It is the largest town in the region within NSW and has a population of about 8,000. Echuca is the largest town in the region on the Victoria side of the border with a population of about 12,400.

The Murray and Wakool LGA's are largely rural and the main settlements include: Moama, Barham, Mathoura, Moulamein, Womboota, Tooleybuc, Wakool, Bunnaloo, Bullatale, and the villages of Caldwell, Goodnight, Koraleigh, Kyalite and Murray Downs (Wakool Shire Council, 2008 and Murray Shire Council, 2007). The LGAs are sparsely populated, and the main land use in the area surrounding the forest is associated with agricultural production. The total population of the two LGAs is approximately 23,700.

Barham is the closest township to the Forest and is only a few kilometres from the downstream end of the Forest, within Wakool LGA (refer to Figure 2-3). The main roads in the vicinity of the site include:

- Barham East Road, which is an arterial road that provides access to Barham town centre. It is a two lane rural road which generally runs in the eastward direction from Barham then shifts southbound leading in to Koondrook Forest at its eastern end;
- Moulamein Road is a two-lane, single-carriageway road linking Barham in the south with Moulamein in the north; and
- Perricoota Road is a two lane north-south road on the eastern side of the Koondrook-Perricoota Road. It connects to Moama in the south and intersects with Moulamein Road at its northern end.

There is also an extensive network of tracks within the Forest that are used by Forests NSW and the general public.



Legend

- Site Location
- State Border
- LGA boundaries
- River
- National Parks / State Forests / Reserves

0 5 10 20
Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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Figure 2.3 Townships in the vicinity of the study area

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: StreetMap - Navegate, Drawn: Cwilson

2.3 The site

The Koondrook-Perricoota Forest site, as defined for the purpose of this Environmental Assessment, is shown in Figure 2-4 and is subsequently referred to as the 'Forest'. The Forest boundary differs from those of the Koondrook and Perricoota State Forests, and the Gunbower-Koondrook-Perricoota Icon Site because:

- It does not include the Gunbower Forest, which is located in Victoria;
- It does not include areas of the Koondrook Forest (that also form part of the Gunbower-Koondrook-Perricoota Icon Site), located outside the downstream levee, such as Pollack Swamp; and
- It includes private property that has been purchased for the project but is yet to be formally added to the Icon site.

Construction of the project would be undertaken near both the upstream and downstream boundaries of the Forest, as well as a number of sites more centrally located within the Forest. During operation, the project would inundate approximately 16,000 ha of the Forest for a period of about 100 days.

2.3.1 Koondrook–Perricoota Forest

The Gunbower-Koondrook-Perricoota Forest is the second largest River Red Gum forest in Australia, the largest being the Barmah-Millewa Forests. The Forest is important for ecological, economic and cultural heritage values, recreation, organic carbon storage, water supply and purification, groundwater recharge, flood control and maintenance of flow regimes. It provides habitat for numerous threatened plant and animal species including birds, fish and reptiles (MDBC, 2006).

River Red Gum (*Eucalyptus camaldulensis*) is the predominant overstorey species, which occupies over 80% of the Forest. It usually forms pure stands and only occurs with other eucalypt species on less frequently flooded sites. Tree height and diameter are related to moisture availability, with better quality forests occurring on frequently flooded areas or on sites with shallow water tables (MDBC, 2006).

Black Box (*E. largiflorens*) also occurs on areas that are infrequently flooded. Other overstorey species, such as Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*) and White Cypress Pine (*Callitris glaucophylla*), occur above the level of the floodplain on lighter textured soils and sandhills (MDBC, 2006).

The forest provides habitat for many fauna species including the nationally vulnerable Murray Cod (*Maccullochella peelii peelii*). Fish such as Golden Perch (*Macquaria ambigua*), Silver Perch (*Bidyanus bidyanus*), Flathead Gudgeon (*Philypnodon grandiceps*), Flat-headed Galaxias (*Galaxias rostrata*), Flyspecked Hardyhead (*Craterocephalus stercusmuscarum fulvus*) and Crimson-spotted Rainbowfish (*Melanotaenia fluviatilis*) use the Forest as habitat and for breeding and recruitment when flooding allows.

During flood periods, the forest becomes a large waterbird breeding area, with over 22 waterbird species recorded, including waterfowl, ibis, egret and cormorant species. The only record of Intermediate Egret (*Ardea intermedia*) breeding in Victoria is in the Gunbower Forest

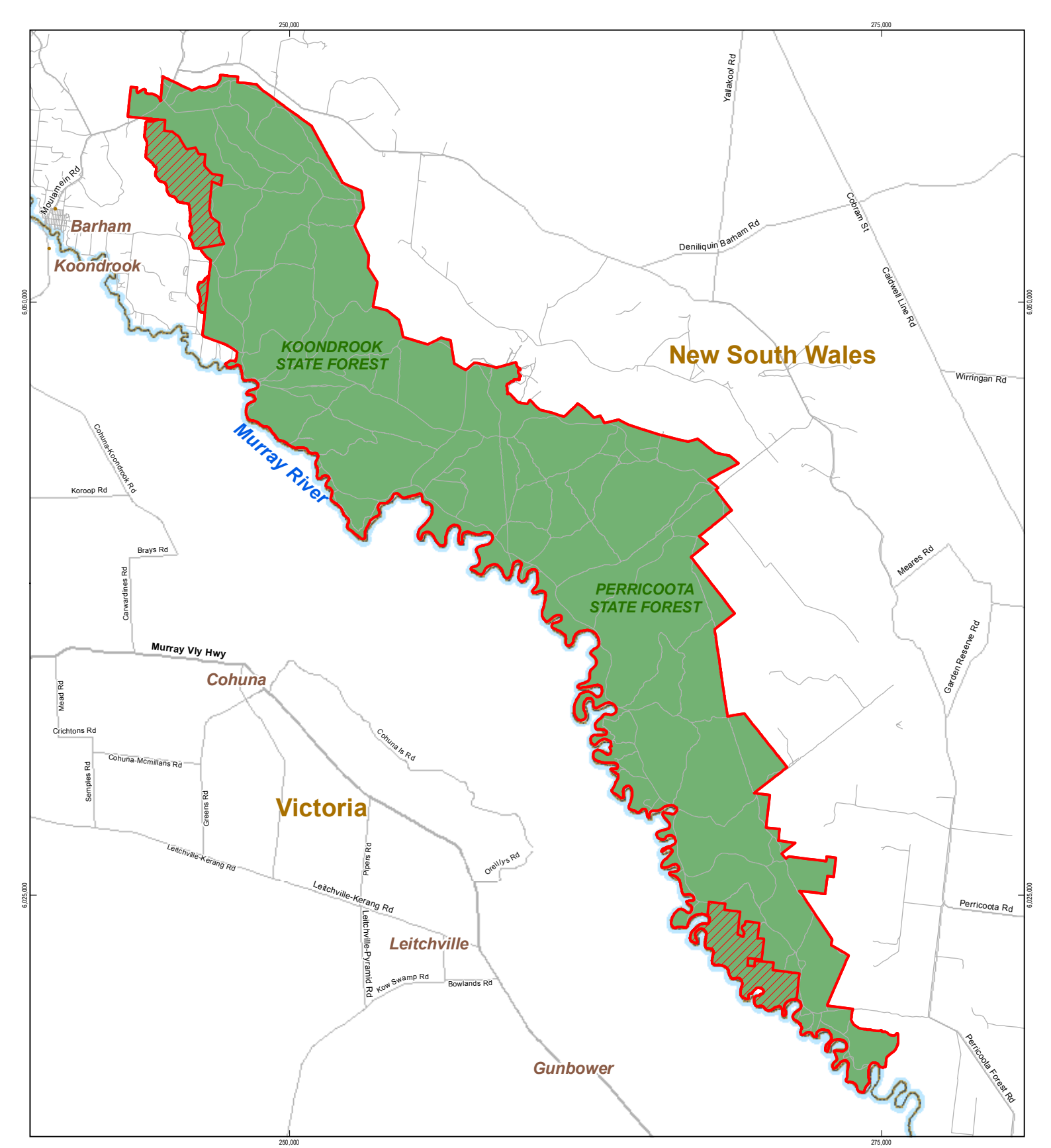
(in 1974 there were an estimated 500 nests, and in 1982 there were over 100 nests). Breeding colonies of the Rufous Night Heron (*Nycticorax caledonicus*), the Little Egret (*Egretta garzetta*), and the Great Egret (*Ardea alba*) have also been recorded. Birds such as the Regent Honeyeater (*Anthochaera phrygia*) and Australasian Bittern (*Botaurus poiciloptilus*) have been recorded in the Forest and three bird species listed under the Japan Australia Migratory Birds Agreement (JAMBA) and five species listed under the China Australia Migratory Birds Agreement (CAMBA) have been recorded within its boundaries.

2.3.2 Land tenure and use

The Koondrook-Perricoota Forest is designated Crown Land managed by Forests NSW. It is dedicated as State Forest under the New South Wales *Forestry Act 1916* for the purposes of timber production and other matters in the public interest. Public forest management in NSW operates in a controlled and regulated operational environment. In managing State forests, Forests NSW is guided by legislative, policy and licensing requirements. Forests NSW has an ISO 14001 externally certified Environmental Management System, which provides a systematic and accountable approach to measuring, monitoring and managing performance related to ecological sustainability. It also has third party certification under the Australian Forestry Certification Scheme's Australian Forestry Standards, and internationally by the Program for the Endorsement of Forest Certification schemes.

The NSW Government has identified that the overriding intention of forest management across all tenures is the maintenance and enhancement of all forest values in the environmental, social and economic interests of the State. The regulatory regime is embodied through compliance with and, where necessary, approvals and licences from the Commonwealth and NSW. The site has been purposefully managed for timber production for over 100 years and features a suite of multiple use forest management activities including:

- Timber harvesting and associated silvicultural activities;
- Hydrological management, through maintenance of effluent sills;
- Infrastructure construction and maintenance, including roads, culverts and drainage works;
- Weed and pest management;
- Fire management;
- Grazing, including purposeful management for economic gain, fuel load reduction and weed management;
- Apiary;
- Conservation of cultural heritage;
- Recreational hunting;
- Biodiversity management;
- Management of public recreation uses;
- Scientific research; and
- Public education.



Legend

- Private property purchased for the project
- Site Location
- State Border

0 1.5 3 6
Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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Figure 2.4 Koondrook-Perricoota Forest site

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: StreetMap - Navegate, Drawn: Cwilson

The main land use within the Koondrook-Perricoota Forest is commercial timber production which is undertaken in accordance with the Riverina Ecological Sustainable Forest Management Plan (Forests NSW, 2008). The Forest provides a perpetual and sustainable source of timber that is used for a range of products. The timber harvesting process is sustainably managed to ensure the patchwork of tree sizes and ages throughout the forest are maintained to provide a diverse habitat. Harvesting is carried out in accordance with a harvesting plan, which ensures that across the harvest area a portion of trees are marked and retained. The plan ensures that flora, fauna and archaeological values are protected.

The Forest attracts a high level of recreational use, including four-wheel driving, motorcycling, horse riding, picnicking, camping, swimming, boating, skiing, fishing, orienteering, canoeing, and nature study. It is a popular place to visit in summer months with visitation dropping significantly during winter. Most areas are readily accessible via an extensive network of dry weather roads. A large number of simple, widely dispersed recreation facilities have been developed, primarily in riverside locations (MBDC, 2007).

The area surrounding the forest is predominantly in freehold title and is dominated by irrigated and dryland cereal cropping and pastures. Other adjacent land uses include horticulture, private native forestry and rural residential development.

Parcels of public land other than State Forest also adjoin the site in NSW and are managed by the NSW Department of Lands and the Livestock Health and Pest Authority. The Murray River marks the southern boundary of the site and the southern bank is the State border. The majority of the southern bank adjacent to the Koondrook-Perricoota Forest is part of the Gunbower Forest which is public land managed by the Victorian Department of Sustainability and Environment.

The administrative bodies responsible for Aboriginal interest in the site and surrounding lands are the Cumergunja Local Aboriginal Land Council, Moama Local Aboriginal Land Council and the Deniliquin Local Aboriginal Land Council. The Barapa Barapa Aboriginal Nation and Yorta Yorta Aboriginal Nation are the traditional owners. A number of other groups may have connections and interests in the site or a particular area, including native title claimants, knowledge holders (such as elders groups) and Aboriginal corporations (Forests NSW, 2008).

Property acquired for the project

The site includes lands purchased to facilitate the operation of the project. These additional lands include the 871 ha former Toorangabby property which was a freehold landholding within the Perricoota State Forest that contains Swan Lagoon and the commencement of the two Burrumbury Creek effluents. This property was used for agricultural purposes, including timber harvesting by an owner that operated a sawmill.

Water that leaves the Murray River via the two entry points into Swan Lagoon and the two Burrumbarry Creeks accounts for the vast majority of water naturally entering the forests and so this land purchase was very important to the operation of the project. As early as the 1970s, foresters working for the (then) Forest Commission of NSW recognised that reduced frequency, extent and duration of flooding, brought about by river regulation, was impacting on the health of the forest. It was also recognised that an opportunity existed to construct an artificial creek off

the Torrumbarry Weir pool to introduce a managed flood into the forest. Hydrological modelling and preliminary engineering design showed that securing the Toorangabby property was critical to enable management of artificial flooding of the forest. With this in mind, Toorangabby was jointly purchased by Forests NSW and the MDBC in May 2007. This 871 ha parcel of land has been added to the Perricoota State Forest and the NSW Central Murray State Forests Ramsar Site (pers. comm. Mike Erny).

The site also includes about 800 ha of former private property at the downstream end of the Forest that has historically been used for agricultural purposes. During development of the concept design it was determined that the preferred alignment for the downstream levee is along the alignment of the existing levee that provides Barham with flood protection. The existing levee is located to the west of the Koondrook Forest boundary. As the area between the existing levee and the forest boundary would be inundated by the project, this private property has been purchased and added to the Koondrook State Forest.

2.3.3 Hydrology of the forest

The Murray River defines the hydrology of the site via flow into streams across the site and overbank flow onto the floodplain during flood events. Surface flooding restores soil moisture reserves necessary for tree growth and sustains large wetland habitats. Groundwater systems generally only influence localised areas and are important to forest health where they are present. Their ecological significance is secondary to overland flooding (MDBC, 2007).

Floods occur as two main types of flow pattern:

- Channel flow, which involves inundation of effluent streams, channels, depressions or leads. This occurs primarily as through-flows with limited overbank flow and ponding in depressions during moderate increases in flow; and
- Broad-area flooding, which involves inundation of broad areas of the floodplain. These events occur as lateral overbank flow from channels which spread over broader areas and pond in depressions or return to channels when flow recedes (MDBC, 2005; Maunsell, 1992a).

Other River Red Gum forests in the region feature a system of regulators on their effluents to provide for efficient transfer of river flow downstream and avoid unfavourable flooding of the forests. None of the effluents that lead to flooding of the site currently have regulators. This is because typical river flows in this reach of the Murray River are well below the level of depressions in the banks that would allow water to flow into the Forest.

Murray River flow as it relates to the hydrology of the site is measured at the MDBA gauging station downstream of Torrumbarry Weir and is expressed in mega litres per day at downstream Torrumbarry Weir (ML/day). Flow of floodwater through Koondrook-Perricoota Forest is dominated by the Burrumbarry-Barbers Creek system and flows to this system are sourced naturally from Swan Lagoon on the Murray River. Water enters the site in the southeast, via the two inflow effluents to Swan Lagoon, when flow in the Murray River exceeds about 18,000 ML/day (DECC, 2008c). Water passes through the first 15 km of the system via several deep, well-defined channels known as the Burrumbarry Creeks. These channels then break down into a myriad of smaller, interlinked runners covering an area of approximately 4,500 ha. The intakes

from the river start to flow when the flow in the Murray River is about 18,000 ML/day but the creeks only start flowing when the river reaches about 20,000 ML/day.

Progressive filling of the flood runners occurs at flows of between 18-20,000 ML/day (DECC, 2008c). These runners eventually coalesce into several defined streams, the largest of which is Myloc Creek. The Myloc flows westward in conjunction with subsidiary runners, before becoming Barbers Creek, which is the primary drainage system for the western end of the site. In addition to the Myloc, a second flow runs north westerly, without a defined channel, eventually forming the secondary drain of Cow Creek (Wyatt, 1992).

Downstream of Swan Lagoon are a number of other oxbow lagoons, several of which have associated natural effluents that form secondary inflow points during very high flows in the Murray. The most significant of these are Horseshoe Lagoon and Dead River Lagoon. As river levels rise above about 25-30,000 ML/day downstream of Torrumbarry Weir, an increasing number of these smaller channels begin to flow. Substantial broad area inundation occurs when flows exceed the channel capacity of the Murray River (>30,000 ML/day downstream of Torrumbarry Weir). Outflow from the forest occurs primarily via Thule Creek, about halfway through the Forest, and through Barbers, Calf and Cow Creeks at its western end. During large floods, water also drains out of Axe and Pothole Creeks and floods into adjoining private properties (MDBC, 2007b; Wyatt, 1992).

Monthly Murray River flows at Torrumbarry Weir have been significantly lower since January 1997 than those observed over the previous 20 years. The lack of high, flooding flows (defined as mean monthly flow > 30,000 ML/day downstream of Torrumbarry Weir) during the last 10 years has been significant. Under the current flood regime, the site does not receive sufficient flooding to maintain the ecological health and productivity of the forests and the forest is in a state of decline (Turner and Kathuria, 2008l; MDBC, 2007c).

River regulation has been implicated in the steady decline of ecosystem health of the site and other River Red Gum Forests in the central Murray region over the last 75 years (GHD, 2009a; MDBC, 2007). In this heavily regulated system, access to environmental flows is critical to the ongoing health and ecological productivity of the site.

The MDBA and other regulatory authorities integrate the management of environmental flows for the maintenance of natural ecosystems with consumptive water allocations. Site managers may access and utilise environmental water entitlement from a range of sources, for example the Living Murray Initiative. This aims to recover up to 500 GL/year of water entitlement to improve environmental flows and achieve ecological objectives at six Icon sites along the Murray River. These include Gunbower-Koondrook-Perricoota Forest (containing the site). Use of the water is governed by the Environmental Watering Group who considers a range of factors, including ecological need and water availability to collectively determine where and for what purpose water should be used in any given year (refer to Section 5.2).