



4. Priority assets and threats

4.1 Priority 'assets' and their status

In the consultation process for the development of this plan, the following 'key assets' were identified for the demonstration reach:

- Native fish community (including threatened species)
- Water
- Aquatic and in-stream habitats
- Riparian floodplain vegetation communities
- Threatened and migratory species (other than native fish)
- Iconic species
- Protected areas
- Aboriginal cultural heritage assets
- Social and other cultural assets

The key assets comprise natural, cultural and social attributes. The remaining part of this chapter briefly outlines each of these assets and the threats to them. Chapter 5 details management objectives, actions and targets in relation to the assets and the threats that they face. The order in which the key assets appear does not indicate their relative priority or importance.

Asset 1: Native fish community (including threatened species)**DESCRIPTION OF ASSET**

Nine native fish species, along with the Murray River crayfish, have been recorded in this reach of the Murrumbidgee River within the last 80 years (Lintermans 2002) (see Section 2.5.4 for details of threatened and other notable fauna including aquatic species of the UMDR). Interestingly these comprise both typically upland and lowland species. The upper distribution limit for the lowland Murray–Darling Basin fish species occurs near the middle of the reach at Gigerline Gorge (between Angle Crossing and Tharwa, ACT (see Plate 1).

The following native fish species occur, or are recorded from the reach:

- Trout cod (listed threatened under Cwlth, ACT,NSW legislation)
- Macquarie perch (listed threatened under Cwlth, ACT,NSW legislation)
- Murray cod (listed threatened under Cwlth and NSW legislation)
- Silver perch (listed threatened under Cwlth, ACT,NSW legislation)
- Golden perch
- Mountain galaxias
- Western carp gudgeon
- Australian smelt
- Blackfish (historic record only, presumably two-spined blackfish)

Additionally the reach is habitat of Murray River crayfish (listed threatened in ACT) and a range of other aquatic macro-invertebrates.

STATUS OF ASSET

The health of the local fish community has significantly declined in recent decades with native fish now comprising as little as 4% of the total fish abundance during monitoring surveys in the project area (Lintermans and Osborne 2002).

Macquarie perch have been detected at some sites in recent sampling (ACT Govt unpublished data 2010, unpublished data MDBA SRA 2010) and conservation stockings of trout cod continue at key locations. Silver perch are no longer recorded in or above ACT waters.

PRIMARY THREATS

- Loss of natural flow regime.
- Loss of instream and riparian habitat complexity (reduced amounts of large woody debris, and increased sediment input from upland tributaries).
- Competition, predation and disease from alien fish - carp, eastern gambusia and redfin perch.
- Poor water quality.
- Barriers to fish passage resulting in fragmentation of population and loss of genetic diversity.
- Loss of aquatic vegetation.
- Overfishing

Asset 1: Native fish community (including threatened species)



Murray cod (L) Photo: Gunther Schmida



Trout cod (U, L) Photo: Esther Beaton



Golden perch (L)
Photo: Gunther Shmida



Macquarie perch (U)
Photo: Esther Beaton



Silver perch (L) Photo: Guntha Schmida



Two-spined blackfish (U)
Photo: Mark Lintermans



Western carp gudgeon (L)
Photo: ACT Gov Archive



Australian smelt (L)
Photo: Gunther Shmida



Mountain galaxias (U, L)
Photo: Guntha Schmida



Murray River crayfish (U, L)
Photo: Mark Lintermans

In UMDR: (U) = Typically upland species, (L) = Typically lowland species

Asset 2: Water

DESCRIPTION OF ASSET

The Murrumbidgee River and tributaries are the major water source in the region. Water from the catchment provides for the needs of Canberra, the largest inland city in the Murray–Darling Basin, and surrounding lands.

Irrigated and dryland farming are the dominant land uses away from the urban area. In the Canberra region, especially, there is significant growth in the number of 'hobby farmers' on the peri-urban fringe.

The Murrumbidgee River has a total of 14 dams and eight large weirs regulating flows along its entire length. Water is currently extracted from the Murrumbidgee River within and above the demonstration reach at a number of points for agricultural use and human consumption (see Figure 3). The current largest major water management infrastructure impacting on the UMDR is Tantangara Dam near the headwaters of the Murrumbidgee River in NSW. At Tantangara Dam 99.6% of the Murrumbidgee flow (at that point) is diverted to Lake Eucumbene for use in the Snowy Hydro Scheme (see Section 2.4.1).

STATUS OF ASSET

Water availability and flow patterns

Historically the Upper Murrumbidgee River yielded high winter and spring flows due to higher rainfalls in the upper catchment at that time, and snow melt from August to October bringing floods.

Flood levels and frequency, as well as base flows, have decreased since the construction of Tantangara Dam (see below). Typical surface flow patterns in the Upper Murrumbidgee River currently remain governed by seasonal climatic factors with moderate to low flows maintained throughout the year, broken occasionally by floods of varying magnitude (NCDC 1981).

Summer flows are typically low, although high rainfall events in the mountain ranges of the upper catchment can provide some daily flow variability (Pendlebury 1997). However, analysis of flow duration data and flow event analysis for Mittagang Crossing (upstream of the project area) before and after the construction of Tantangara Dam has shown:

- a severe reduction of seasonal base flows
- reduction in the frequency of events across the range of event volumes
- halving of the frequency of flow events greater than 10000 ML/d
- halving of the number of high flow events, with the average duration decreasing by about two thirds
- significant reduction in the frequency of longer duration flow events as a result of the reduced seasonal base flow so that much longer periods occur between such flow events (Pendlebury 1997).

At Billilingara (20 km upstream of the demonstration reach) recent flows in the Murrumbidgee are only 54% of the historic pre-Tantangara Dam flows and at Lobbs Hole, in the centre of the reach, only 57% (Pendlebury 1997).

Based on long-term climate outlooks, and under current trends, it is likely that these reduced flow levels and flow variability will continue. Further, the proposed Murrumbidgee to Googong Dam Pipeline, designed to increase domestic water security for the Canberra region, will further decrease surface water levels through the ACT section of the demonstration reach (ACTEW Corporation 2009). Flow extraction for this initiative is currently estimated to be approximately 640 ML per month.

Thirty-six surface and groundwater access entitlements (WAE) are current within the ACT-controlled portion of the reach (not including the Cotter Pump station). These have a total annual entitlement of 1893 ML (DECCEW 2009). An additional 20 WAEs (not including the Cotter River) with a total entitlement of 987 ML (DECCEW 2009) occur within the ACT tributaries. ACTEW currently extract water through three WAEs on the Cotter River (totalling 58000 ML) and the Murrumbidgee River at Cotter Pump Station.

Asset 2: Water

WATER QUALITY

While more data gathering is recommended, it appears that most water quality parameters along the UMDR are within acceptable limits for all uses. One of the major ongoing issues is sedimentation from the upstream portions of the Murrumbidgee River as it passes through the Cooma–Monaro Plains. Turbidity regularly reaches levels that are beyond recommended guidelines for extraction.

Sediment deposits stemming from sources such as the Numeralla and Bredbo River catchments are now common in the Upper Murrumbidgee River (see Plates 11 and 12) and are having increasingly significant impacts on water quality and fish habitat (Lintermans 2000).

GROUNDWATER

In the ACT groundwater tends to be found in low-yield fractured rock aquifers to approximately 100 m depth. The location of aquifers is based on topography and they tend to discharge to streams (i.e. valley low points) providing stream base flow. The groundwater resource is small compared to surface water. (Heath Chester pers comm. 2010; DECCEW 2009).

PRIMARY THREATS

- Lack of suitable environmental flow allocation
- Further flow diversions to support Canberra’s growing population.
- Drought conditions, climate change and reduced yields.
- Pollution of waterways from urban areas and rural activities (riparian erosion especially).
- Unsustainable use of surface and groundwater.
- Farm dams may pose a significant threat to overland flows to streams as their number continues to grow.



(a)



(b)

Contrasting surface flow.
Top: Murrumbidgee River looking upstream at Tharwa Sandwash recreation reserve during (a) high and (b) typical low discharge.

Bottom: View downstream from Tharwa Bridge during (c) high and (d) extreme low discharge.

Photos: (a-c) Luke Johnston, (d) Bill Phillips.



(c)



(d)

Asset 3: Aquatic and in-stream habitats

DESCRIPTION OF ASSET

Within the UMDR the river has many different forms, flowing through steep sided gorges to broad open slopes, all of which provide a diversity of habitats. Among these are:

- upland pool–riffle–run sequences
- drought refuge pools
- complex benthic substrates such as cobble, pebble and varied bedrock surfaces
- in-stream (macrophytes) and overhanging vegetation
- large woody debris (snags)
- off-stream wetlands.

STATUS OF ASSET

Approximately 400 km of the Upper Murrumbidgee River is listed as a natural place on the Register of the National Estate, extending from Tantangara Dam to the mouth of Oaky Creek, 300m south-west of Yeumburra Homestead and about 20km north of the northern border of the ACT, including 20m on either side of the river from bank full discharge level.

Within the UMDR, the river tends to be in relatively good condition through gorge sections largely because of inaccessibility and higher velocity scouring flows (see Plates 1, 4, 5 and below). These sections can pose a potential impediment to movement for some species at low flow levels and this impediment may be exacerbated by increased water extraction.

Shallow sandy substrates are common throughout the wider slower flowing sections. These areas have been significantly affected by sediment deposition and sand slugs where habitat diversity has been dramatically reduced since widespread landclearing took place in the catchment.

Off-channel riparian wetlands that contain stable wetland habitat features are known to exist particularly where bedrock comprises a large proportion of the floodplain.

In-stream infrastructure includes water off-take points, bridges and one fish weir at the downstream end of the reach. Connectivity between habitats is at present impacted by two low-level road crossings within the ACT.

PRIMARY THREATS

- Sediment input and reworking of existing bed load from upstream and tributaries.
- Main channel bed and bank erosion.
- Altered natural flow regimes and flow reduction caused by extraction for urban water supply, agricultural, stock and domestic use and of tributary and overland flow (farm dams) (See Asset 2).
- Clearing of riparian zones (reduced input of large woody debris, shading and leaf fall, grazing, fire, reduced buffering of sediment run-off).
- River crossings, roadway construction.
- Aquatic and riparian weed incursions.

Asset 3: Aquatic and in-stream habitats



(a)



(b)



(c)



(d)



(e)



(f)

A range of aquatic habitats occur in the UMDR project area.

(a) Deep pool in Black Rock Gorge at Scottsdale Bush Heritage property

(b) Rocky cascade in Black Rock Gorge

(c) Shallow sandy reach at Tharwa ACT

(d) Shallow rocky reach at Lobbs Hole near the southern ACT border

(e) Emergent macrophytes (*Phragmites australis*) occur in slower sections

(f) Refuges for fauna may be found within small off-stream wetlands such this one in Gigerline Gorge.

Photos (a) Mark Jakobsons and (b-f) Luke Johnston

Asset 4: Riparian floodplain vegetation communities

DESCRIPTION OF ASSET

Riparian floodplains are highly variable throughout the UMDR (Johnston et al. 2009; L Johnston pers. comm. 2010). They range from wide (greater than fifty metres) cobble and sand plains, to elevated sand and clay terraces, to less than one metre wide solid bedrock banks beside steep gorge walls. This diversity of floodplain creates diversity at both large and small scales among the riparian vegetation communities within the reach. As with the fish community there is also an upland to lowland gradation in the riparian vegetation, particularly the floodplain woodlands that are dominated by ribbon gum (*E. viminalis*) in the upper part, and river she-oak (*Casuarina cunninghamiana*) in the lower part of the UMDR. In conditions unfavourable to woodland development, river shrublands dominate. Instream and fringing vegetation occurs throughout the project area.

Floodplain woodlands (from Johnston et al. 2009). Riparian floodplain sections of the reach with an alluvium or soil substrate are associated with floodplain tableland woodlands. Upstream from Point Hut Crossing in the ACT these floodplains were once dominated by Ribbon Gum (*Eucalyptus viminalis*) Tableland Riparian Woodland. Downstream of Point Hut Crossing the floodplains contain extensive tracts of mixed quality River She-oak (*Casuarina cunninghamiana*) Riparian Tableland Woodland (see Section 2.5.1, Plates 15 and 16).

Floodplain shrublands (from Johnston et al. 2009). High quality Riparian Tableland Shrublands are associated with bedrock-dominated floodplains, within the narrow steep-walled gorge sections and on river inner meander bends also. These predominantly contain river bottlebrush (*Callistemon sieberi*), river tea-tree (*Leptospermum obovatum*) and to varying extents burgan (*Kunzea ericoides*). Occasional small perched wetlands contain uncommon fringing species in the area such as the quillwort (*Isoetes muelleri* and *Isolepis inundata*). (see Section 2.5.1, Plates 13 and 14).

STATUS OF ASSET

The **floodplain woodlands** of the Upper Murrumbidgee have been heavily impacted by previous land use and fire. Less than 10% of the Ribbon Gum Tableland Riparian Woodland occurs in the ACT section of the UMDR and is in a state of decline (Johnston et al. 2009).

The She-oak Tableland Riparian Woodland has been heavily fire impacted within the reach and is recovering slowly and less vigorously than expected (see below). Recovery has been primarily restricted to wetter margins of the floodplain and riverbank (Johnston et al. 2009).

In nearly all situations in the gorge **floodplain shrublands** are in very good condition. The bedrock upon which they are established provides protection from weed invasion and within the gorges they are relatively protected from unfavourable growing conditions (Johnston et al. 2009).

The riparian zone in NSW is also in good condition through the extensive gorges where it is relatively inaccessible. Other large tracts that were previously cleared are now degraded and often dominated by willow and African lovegrass (L Johnston pers comm 2010).

PRIMARY THREATS

- Reduced occurrence of floods (see Asset 2).
- Weed invasion.
- Disturbance by feral animals.
- Overgrazing and bank disturbance.
- Clearing of riparian margins.

Asset 4: Riparian floodplain vegetation communities



(a)



(b)



(c)



(d)



(e)



(f)

Floodplain riparian vegetation communities of the Upper Murrumbidgee Demonstration Reach:

- (a) good quality river valley vegetation near Michelago with floodplain shrubland in the foreground in front of one of the few intact Ribbon Gum Riparian Woodlands;
- (b) a small isolated remnant of ribbon gum (large dark trees on the opposite riverbank), at Tharwa Sandwash;
- (c) healthy recovery of fire impacted river she-oak on the riverbank where soil moisture is high;
- (d) fire impacted river she-oak on the rearward edge of the floodplain being colonised by young dryland apple box eucalypt (*Eucalyptus bridgesiana*);
- (e) sparse bedrock floodplain shrubland at Red Rocks Gorge;
- (f) instream riparian fringing cumbungi (*Typha orientalis*) persisting in an off-stream perched wetland in Red Rocks Gorge.

Asset 5: Threatened and migratory species (other than native fish)

DESCRIPTION OF ASSET

Sections 2.5.3 and 2.5.4 provide the full lists of those plant and animal species found within the UMDR that are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) and/or NSW and ACT legislation. See Table 3 (for plant species) and Table 4 (for animal species). Table 5 lists those bird species classified as 'migratory' under the EPBC Act and which have been identified as potentially occurring within the UMDR.

Apart from the threatened native fish (see Asset 1) other species that have been identified occurring within the project area and warranting special attention through this plan are:

Murray River crayfish (*Euastacus armatus*) is listed as vulnerable under the *Nature Conservation ACT 1980* (ACT). The species inhabits the main channel of faster flowing cool waters. It uses the spaces between boulders and cobbles on the river bed for shelter.

Pink-tailed worm lizard (*Aprasia parapulchella*) (see below) occurs on rocky grassland slopes. The species is listed as vulnerable and has 'special protection status' under the *Nature Conservation ACT 1980* (ACT) and is listed as vulnerable under the EPBC Act and *Threatened Species Conservation Act 1995* (NSW).

Tuggeranong lignum (*Muehlenbeckia tuggeranong*) (see below) occurs at a small number of locations and is listed as endangered, both under the *Nature Conservation ACT 1980* (ACT) and the EPBC Act.

Many other uncommon vegetation species occur within the river corridor, including the Australian anchor plant (*Discaria pubescens*), pale pomaderris (*Pomaderris pallida*) (vulnerable (Cwlth, NSW) and austral toadflax (*Thesium australe*) (vulnerable Cwlth, NSW).

STATUS OF ASSET

The pink-tailed worm lizard is thought to be uncommon as it is restricted to specific rocky grassland sites in the region. Current research is being undertaken to improve the knowledge base for this unique reptile.

The Murray River crayfish is considered to be in a serious state of decline (ACT Govt 2007). A favourite edible species it is presumed that it has suffered from high levels of exploitation throughout its range; however, actual quantification of population status is difficult.

Tuggeranong lignum occurs within the reach in the vicinity of Pine Island Recreation Reserve in the ACT. There is a small *ex-situ* population at the Australian National Botanic Gardens.

Asset 5: Threatened and migratory species (other than native fish)

PRIMARY THREATS

Murray River crayfish

The major threats to the continued survival of this species are habitat alteration, overfishing and possibly interactions with introduced fish species.

Pink-tailed worm lizard

Habitat loss and fragmentation; removal of rocks; stock and rabbit grazing; stock trampling; invasion of habitat by weeds; inappropriate grass slashing for hazard reduction; habitat modification through tree-planting in native grasslands; altered fire regimes.

Tuggeranong lignum

The main threat to survival of the Tuggeranong lignum population and therefore the species is likely to be deliberate or unintended actions associated with visitor and/or land management activities in the local area. The population consists of only eight individuals of which only one is female and therefore is also under threat due to lack of reproduction.



Murray River crayfish (*Euastacus armatus*) from Red Rocks Gorge.
Photo: Mark Jekabsons



Pink-tailed worm lizard (*Aprasia parapulchella*) Photo: ACT TAMS



Tuggeranong lignum (*Muehlenbeckia tuggeranong*) Photo: Luke Johnston

Asset 6: Iconic species

DESCRIPTION OF ASSET

As part of seeking to increase community engagement in this initiative, it is proposed that several species be promoted as 'icons' around which some activities (e.g. survey and monitoring or education and awareness raising activities might be focused). While other species may emerge as implementation commences (see accompanying Communication, Education and Public and Awareness Plan) initially the following have been proposed as iconic species.

- **Trout cod** (see Asset 1) are an iconic representative of the site, and are a good fish species to highlight as efforts are ongoing to rehabilitate populations of the species within the reach.
- **Platypus** occur throughout the project area, although little is known of its population health. Platypus has the ability to inspire a large community interest in the project and generate public relations and media opportunities.
- **Ribbon gum** (see Asset 4) are attractive large trees to 45 metres with long bark ribbons hanging in the forks and branches. The floodplain woodland community dominated by this species has been heavily impacted by past agricultural activities and now by reduced river flows and weeds. The remnant large trees along the project area are a symbol of upland riparian habitats that, with some effort, can be rehabilitated.

STATUS OF ASSETS

Trout cod are listed as endangered in Commonwealth, NSW and the ACT legislation. The species has suffered a major reduction in distribution and population.

Platypus are presently described as being common, but vulnerable (Carrick et al. 2008) because of the very specialised niche which the species occupies. Platypus are common throughout the UMDR but the density of individuals and population dynamics that more accurately indicate population health is unknown (L. Johnston pers comm., 2010).

Ribbon gum now occupies less than 10% of the habitat considered to have been suitable for it prior to European settlement. The floodplain community formed by ribbon gum is at threat of extinction. Possible review may provide Ribbon Gum Tableland Woodland with increased protection status.

PRIMARY THREATS

As with all aquatic species, reduction in habitat quality, alteration to flow regimes and competition from introduced species and fishing pressures continue to impact both trout cod and platypus. Furthermore, individual platypus are often tangled in litter and drowned in various types of nets and traps. Of note, opera-house nets, which kill platypus, are legally sold throughout the platypus range. Fyke or eel nets illegally set within rivers have been known to kill numerous individuals before being removed. The use of gill, mesh and trammel nets in both commercial and research fisheries is also a problem.

Ribbon Gum Tableland Riparian Woodland has historically suffered from land clearing as it occurs where the river valleys are more open and suitable for agricultural activities. It is now mostly under threat from lack of recruitment due in part to floodplain weed infestations and possibly reduced overbank flood events.

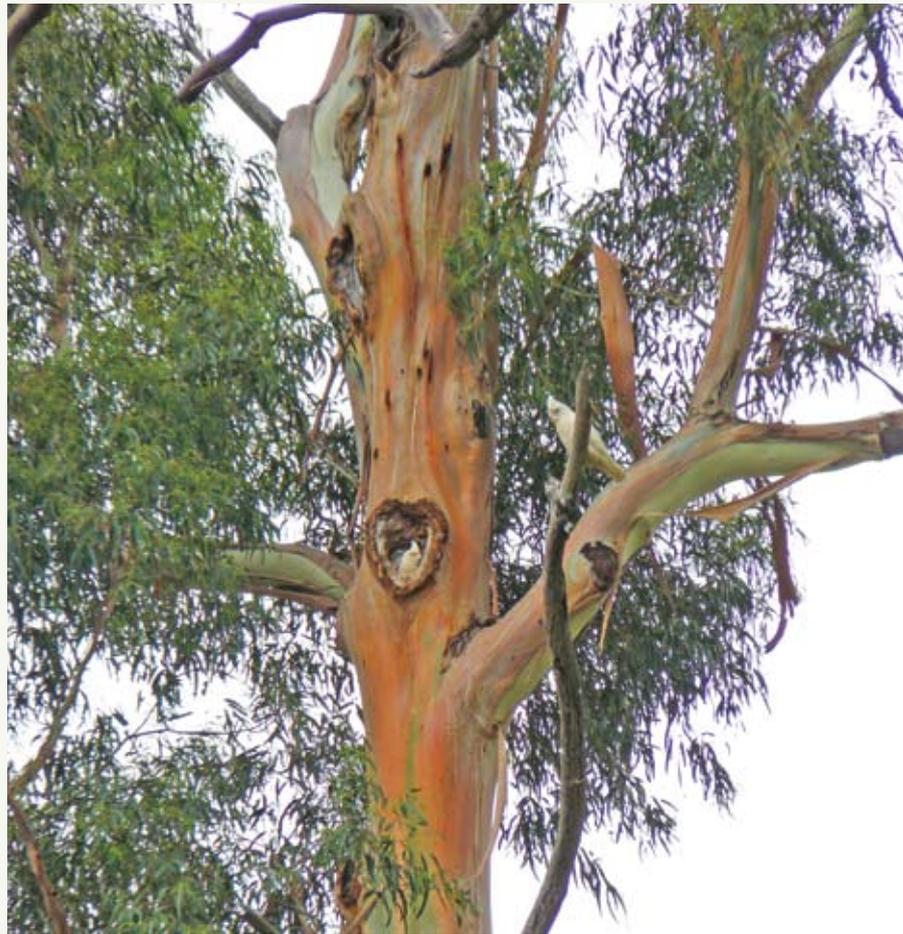
Asset 6: Iconic species



Trout Cod. Photo: Esther Beaton



Platypus. Photo: Kathryn Black



Ribbon gum with corellas using tree hollow and limb at Tharwa Sandwash.
Photo: Luke Johnston

Asset 7: Protected areas

DESCRIPTION OF ASSETS

Scottsdale Reserve covers 1328 hectares and is located near Bredbo in NSW with frontage to the Murrumbidgee River. It is the first property to be purchased as part of a landscape reconnection project entitled 'Kosciuszko to Coast' (K2C) that has a vision of re-establishing a network of habitats between the Australian Alps and the Great Escarpment of Eastern Australia. The property was purchased by Bush Heritage Australia, a major partner in K2C.

Scottsdale protects endangered grassy box gum woodland that is home to many rare birds and reptiles along with threatened springs, bogs and temperate grasslands. It has one of the last intact ecosystems on the Murrumbidgee River.

The **Murrumbidgee River Corridor** is a government protected and managed strip of land and water up to 4 km wide along the full length of the ACT section of the Murrumbidgee River. It encompasses the entire land and river channel along the UMDR area downstream of the ACT border. The corridor contains and protects important aquatic ecosystems and many significant natural and cultural features

STATUS OF ASSETS

Scottsdale Reserve: Bush Heritage Australia's website notes:

By acquiring Scottsdale we have removed the main threats to the property: rural subdivision, agricultural intensification and further weed encroachment. In particular we have thwarted further attempts to 'improve' the productivity of this country through the introduction of additional exotic pasture species and crops.

<www.bushheritage.org.au/our_reserves/state_new_south_wales/scottsdale>

The Murrumbidgee River Corridor (MRC) within the demonstration reach includes three designated nature reserves: Gigerline, Bullen Range and Stony Creek. The corridor comprises nature reserves, low-impact recreation areas, cultural heritage places, community uses, and some rural land use. The MRC is managed in accordance with the Murrumbidgee River Corridor Management Plan (ACT Govt 1998).

PRIMARY THREATS

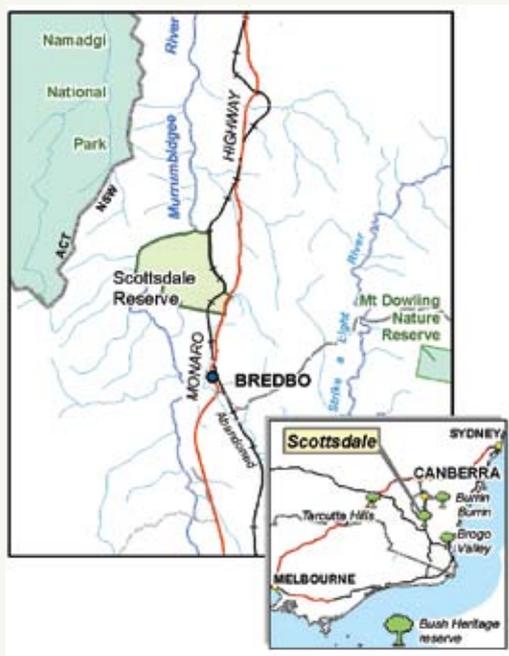
Scottsdale Reserve: Bush Heritage Australia website states:

The key management issue is weeds, particularly African lovegrass. Effective weed control and rehabilitation of the grasslands on parts of the property are likely to be costly, but there is strong support from a range of groups and agencies to set up a regional demonstration site at Scottsdale for the control of the significant weeds of the region.

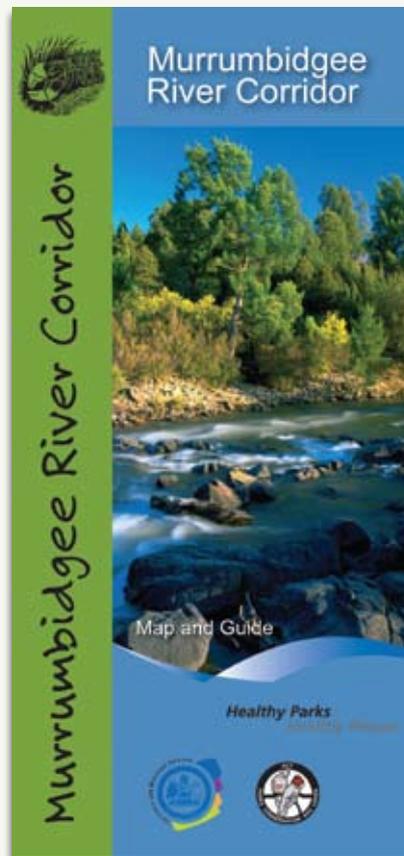
Within the river at Scottsdale, although the aquatic habitat is in good condition, recent fish monitoring for the UMDR detected 100% carp within the lower Black Rock Gorge fronting Scottsdale (ACT TAMS unpublished data 2010).

Threats to the **Murrumbidgee River Corridor** are essentially those outlined in Section 4.2. Because the MRC is so close to Canberra's expanding urban areas, threats from recreational uses, water pollution and soil erosion originating upstream are major issues. Controlling woody weeds and introduced fish (carp especially) are the other major challenges.

Asset 7: Protected areas



Above, location of Scottsdale and a photo of the Murrumbidgee River at that location (courtesy Bush Heritage Australia website).



Murrumbidgee River Corridor information leaflet (see Section 2.6)

Asset 8: Aboriginal cultural heritage assets

DESCRIPTION OF ASSET

The Murrumbidgee River itself is part of Aboriginal Dreaming. Likewise Murray cod, which are found within the Murrumbidgee, are a recognised part of the Dreaming. For ten's of thousands of years Aboriginal people sustainably occupied and managed the Murrumbidgee and its ecological resources using traditional ecological knowledge that ensured a healthy environment that supported its occupation.

Evidence suggests that the Murrumbidgee was certainly a major focal point of Aboriginal activity prior to European settlement that was occupied by the Ngunnawal and Ngarigo language groups. These Aboriginal peoples found food and shelter, produced tools and held gatherings associated with the collection of large numbers of Bogong moths over the summer period (Flood 1980; NSW Heritage Office and Dept Urban Affairs and Planning 1996). The river corridor and archaeological sites identified along the river continue to have cultural significance to Aboriginal people today.

Surveys such as that by Barz and Winston-Gregson (1981, 1982) and many other surveys and studies have well documented much of the Aboriginal cultural heritage of the riverine area. One well-known publically listed Aboriginal heritage site in the project area is the Lanyon Canoe Tree, 450 m north-north west of the historic Lanyon Homestead (See Asset 9).

STATUS OF ASSET

The traditional owners that occupied the Murrumbidgee River valley were heavily impacted by the colonising European settlers. Present day Aboriginal people descended from the traditional owners remain within the Murrumbidgee region, as well as Aboriginal peoples from nations around the country who have settled in the ACT region. Many are passionate to have cultural and spiritual connections to the land and waterways recognised, and to contribute to the development both an enhanced understanding of the importance of the Murrumbidgee and its country to Aboriginal people.. Traditional ecological knowledge of sustainable land and water management still exists and could be an asset incorporated into contemporary natural resource management of the Murrumbidgee. Ongoing dialogue with Aboriginal representatives in NSW and the ACT will ensure that the understanding and protection of these Aboriginal values and cultural assets continues in the upper Murrumbidgee region.

Aboriginal sites identified by Barz and Winston-Gregson (1981, 1982) along the Murrumbidgee River Corridor are listed on the ACT Heritage Register.



Asset 8: Aboriginal cultural heritage assets

PRIMARY THREATS

- Accidental or intentional damage to Aboriginal sites.
- Lack of awareness about the cultural values of the Murrumbidgee River corridor and their continued conservation and management.
- Lack of engagement with Aboriginal people into decision making about natural resource management in the region.
- Lanyon Canoe Tree is healthy and is protected by a small fence. Its main threat is damage by bush fire. Interpretation is needed.



Canoe Tree at Lanyon. Photo: Luke Johnston

Asset 9: Other cultural assets

DESCRIPTION OF ASSET

The Murrumbidgee and surrounding lands have an ongoing significance to all people of the region, historically, at the present day and into the future. The Murrumbidgee River environs are generally recognised as a scenic and recreational resource within the capital region. The river gorges and steep valleys have spectacular scenery, some of which can be readily accessed along well maintained walking trails in the ACT, for example, Red Rocks Gorge only a few kilometres from the southern suburbs of Canberra.

In contrast rural land adjoining the river is often less dramatic having easier access to the river and containing a range of sites of cultural heritage interest such as the Lanyon Homestead within the Lanyon Landscape Conservation area.

There are no established recreation sites within the NSW section of the UMDR; however, within the Murrumbidgee River Corridor in the ACT (see Asset 7 above) government maintained public sites include Angle Crossing, Tharwa Sandwash, Point Hut, Pine Island, Kambah Pool and Casuarina Sands.

Recreational use within the UMDR is mainly oriented toward maintained picnic sites and activities such as swimming, walking, sightseeing, children's play activity, rock climbing, boating and canoeing, and fishing.

European registered heritage sites listed under the ACT Heritage list and/or Register of the National Estate (see Status of Assets below) within the ACT portion of the project area include:

- Tharwa village (nominated)
- Tharwa bridge
- Tharwa primary school
- Tharwa general cemetery
- St Edmunds Anglican Church
- De Sallis cemetery
- De Sallis memorial cairn
- Cuppacumbalong homestead precinct
- Cuppacumbalong cemetery and avenue of elms
- Cuppacumbalong garden
- Cuppacumbalong woolshed
- Lanyon Bowl
- Lanyon homestead
- Lambrigg homestead, wheat paddock & Farrer gravesite
- Cotter pumping station precinct, Cotter pumping station and electricity substation
- Cotter bridge
- Tuggeranong boundary wall



Asset 9: Other cultural assets

Items of heritage significance listed under the NSW Heritage list and/or Register of the National Estate within the NSW UMDR region include:

- Bredbo cemetery
- Bredbo Inn
- Bredbo River rail bridge
- Bredbo school
- Bredbo Station
- Cappawidgee Eucalyptus pulverulenta site
- St Bartholomew's Anglican Church
- Ingalara railway bridge SHR: Michelago rail bridge over Ingalara Creek
- Micalago gardens

STATUS OF ASSETS

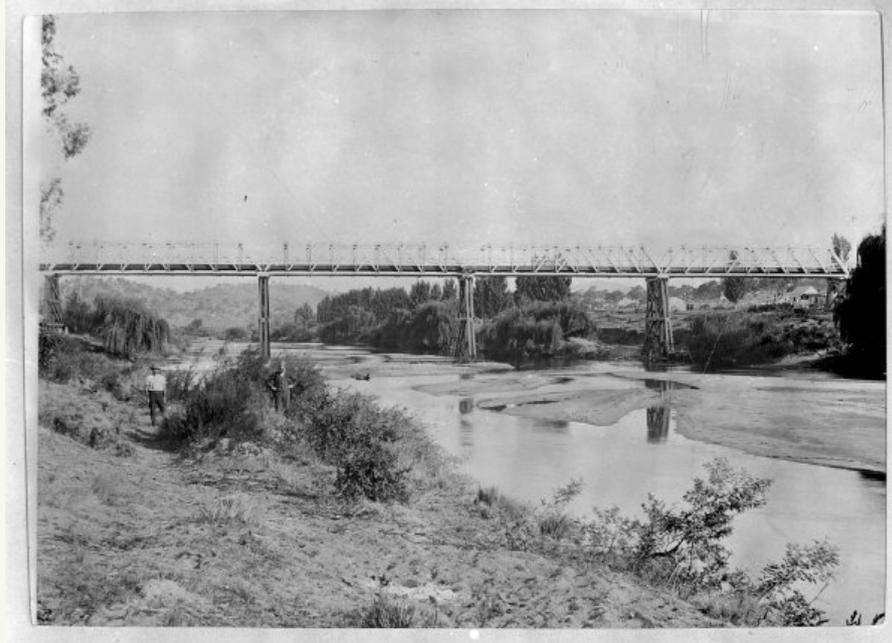
The specific sites noted above are listed on, and therefore protected under, the ACT Heritage Register under the *Heritage Act 2004* and/or the NSW State Heritage Register under the *Environmental Planning and Assessment Act 1979*.

NOTE: A new national heritage system under the *Environment Protection and Biodiversity Conservation Act 1999* commenced on 1 January 2004 under which the former national system based on the Register of the National Estate will cease to have a statutory basis from February 2012. This transition period is to allow time to transfer places on the Register of the National Estate to other local, state, territory and Australian Government registers. More information can be obtained at <http://www.environment.gov.au/heritage/places/rne/index.html>.

PRIMARY THREATS

Threats to all heritage sites include inadequate protection, damage by natural events or vandalism, and lack of awareness or interpretation.

Asset 9: Other cultural assets



Tharwa Bridge (c.1895). Photo: courtesy National Library Australia



Cotter Pumping Station. Photo: Luke Johnston



4.2 Threatening processes impacting on the priority 'assets'

4.2.1 Changes to surface water flows and seasonal patterns

Reduced in-stream flows are due to several factors including extractions from Tantangara Reservoir, interceptions by farm dams, and agricultural and domestic extraction. Low rainfall during the first decade of this century has caused further reductions. The possible impact of the proposed water extraction from the Murrumbidgee River at Angle Crossing as part of the ACTEW Murrumbidgee to Googong Reservoir water transfer is still under consideration.

Some of the specific threats from changes to surface water flows and seasonal patterns include:

- a reduced incidence of medium-high flood events
- impacts of the timing of reduced flow events on critical life history stages of fish and other biota
- reduced fish community connectivity and increased obstruction to fish passage through shallow zones (e.g. Angle and Point Hut road crossings, Tharwa Sandwash, and the several narrow gorges) during periods of low flow.

4.2.2 Reduced water quality

For the UMDR the greatest water pollution threats are from high sediment loads and associated pathogens, nutrient enrichment from run-off, and point source and gross pollution from urban areas.

High sediment loads from the upper catchment accumulate at depositional zones (Bredbo, Bumbalong, Angle Crossing and Tharwa area), filling in deep habitat pools and creating uniform sand-dominated substrate zones. The estimated annual bed material transport rate is between 30 000 and 60 000 m³ (Lintermans 2004a).

4.2.3 Groundwater depletion

Little is known at present about groundwater interactions across the region. This knowledge gap is a high priority for further investigation.

4.2.4 Climate change impacts on water availability

The possible medium to long term impacts of climate change on water availability in the demonstration reach are another knowledge gap and could be a high priority for further investigation.

4.2.5 Physical disturbances

Physical disturbances can take many forms and hence impacts on the river vary. Most common among these threats are:

- sand and gravel extraction
- land clearing
- farm dam construction
- road, bridge or river crossing construction
- urban and rural building construction.
- extreme flood events

4.2.6 Loss of in-stream habitat connectivity (impediments to fish passage) and complexity

The loss of in-stream connectivity (impeding fish passage) can result from several factors acting together or in isolation from one another. These factors include low river flows (especially at critical life cycle stages), in-stream structures such as weirs and low level crossings, and the accumulation of impassable sediment slugs.

Loss of habitat complexity can result from:

- sedimentation
- degradation of riparian margins
- bank or river bed degradation or erosion
- low flows
- reduced variability of flows
- infilling of in-stream habitats by sediment slugs and similar.

4.2.7 Loss of riparian habitat connectivity and biodiversity

Several factors can contribute to loss of riparian habitat connectivity and biodiversity including clearing of riparian, floodplain and surrounding woodland vegetation, and unregulated access of grazing stock to riparian zones (see Section 4.2.10). As well as fragmenting habitats, these can exacerbate the spread of woody weed species.

4.2.8 Introduced plant species

For the UMDR the primary introduced plant threats include:

- willows
- blackberries
- serrated tussock
- African love grass
- poplars
- Chilean needle grass.

While control measures for all of these are already underway, increased effort and resources are needed, especially in areas identified as priority habitats. It is noted that willows and blackberries do provide some habitat values for nesting waterbirds and small woodland birds, respectively, in the absence of the former tree and shrub cover.

4.2.9 Introduced animal species

Introduced animal species of primary concern are as follows.

Alien fish species

Seven alien fish species are recorded from the UMDR (Lintermans 2002):

- carp: known to comprise up to 96% of fish biomass within the project area and some of its tributaries (Lintermans 1998; Lintermans et al. 2001; Lintermans unpublished data; Jakobsons and Lintermans 2006)
- goldfish: widespread and common throughout the UMDR
- oriental weatherloach: common and widespread at and below Angle Crossing; not as common upstream
- redfin perch: common in the river below the Gigerline Gorge. Species is capable of spreading the EHN virus



- eastern Gambusia: widespread with no current control methods known
- rainbow trout: formerly more common than at present
- brown trout: formerly more common than at present

Note: Rainbow trout and brown trout are recreational species that are currently managed in NSW under the *Fisheries Management Act* (1994)

Mammals

- Rabbits: The abundance of rabbits varies greatly, depending on factors that include disease status (myxomatosis, rabbit haemorrhagic disease), fox abundance and control history. The power of uncontrolled rabbit populations to alter the landscape is illustrated by the rate of sediment accumulation in Burrinjuck Reservoir (and other impoundments) that slowed sharply after the spread of the myxomatosis virus in 1951. Thus, rabbits can be regarded as a factor potentially affecting water quality.
- Deer: These are a newly emerging pest species requiring control (ACT CSE 2008). Three deer species occur in the ACT: sambar, fallow and red deer. The abundance of all three seems to be increasing (Lintermans, 2010, pers. comm.). Monitoring of the population is needed to track population growth, identify potential impacts and develop control methods.
- Foxes: Generally fox numbers are highest in sheep-raising areas and the first two kilometres of bushland. Foxes have widespread impacts on native fauna, (ACT CSE 2008). Fox control should be integrated with rabbit control to avoid outbreaks of the latter.
- Feral cats: The impact of feral cats has not been quantified in this region to date. There are no practical methods of control at present.
- Feral pigs: These are a potentially important agricultural pest in the UMDR and can have conservation impacts also. Effective control of pig impacts depends on co-ordination at sufficient geographic scale, and effective methods; poisoning being more efficient than trapping or shooting.
- Feral goats: These are present on the surrounding ranges, but abundance is too low at present to be associated with significant impacts due to previous shooting efforts and dingo predation.

4.2.10 Rural land use practices

Land use practices can have a major impact on water quality and in-stream habitats. Grazing practices may result in loss of groundcover, increased soil erosion and in-stream sedimentation. Likewise, stock can trample or consume riparian regrowth or directly impact on bank areas along the river, therefore accelerating sedimentation. Gully erosion, if uncontrolled causes similar problems. Exposed areas may be colonised by introduced plant and weed species that can spread downstream.

Access tracks, construction works or the emplacement of river or creek crossings can have negative downstream impacts and reduce in-stream connectivity. Interception of run-off by farm dams is having a generalised impact across the catchment by reducing in-stream flows. Improving on-farm irrigation efficiency will also help to keep the river healthy. The uses of chemicals, fertilisers and sprays on rural land also needs to be managed carefully to avoid damage to the river system.

As well as traditional rural land users, it is important to draw 'hobby farmers' into education and awareness raising programs associated with the UMDR project.

4.2.11 *Urban activities*

The urban areas provide their own range of threatening processes. Stormwater run-off can be laden with various pollutants. Domestic householders continue to use their stormwater drains as disposal points for many unwanted waste products that are hazardous to river life. Nutrient-enriched run-off (from fertilisers in the main) remains a problem. Pollution of the river from users of recreational areas along the Murrumbidgee River Corridor in the ACT (Angle Crossing, Tharwa Sandwash, Point Hut, Pine Island; Kambah Pool; Casuarina Sands) is a constant challenge for managers.

Urban areas are also the origin of uncontrolled domestic pets that may kill small birds and reptiles along the river corridor. There are also garden plant escapees and these can make their way to the river by run-off or illegal dumping. Likewise the disposal of unwanted aquarium fish in rivers, streams, creeks and lakes is an ongoing problem. The introduction of oriental weatherloach in the ACT is thought to have originated from this source.

Construction works (buildings and roads) in Canberra's rapidly expanding rural–urban fringe can also result in impacts on the Murrumbidgee River, especially through sedimentation.

4.2.12 *Recreational activities*

Illegal fishing activities can have a direct impact on native fish or platypus populations either through direct or delayed mortality from capture, and through the human-assisted dispersal of alien fish species (Lintermans 2004b). Use of bait fish also warrants further investigation.

4.2.13 *Threats to cultural heritage assets*

A range of cultural heritage assets, both Aboriginal and early European, are found within the UMDR. Direct threats to these include:

- vandalism
- accidental damage or destruction during construction works
- natural disasters
- degradation resulting from surrounding land uses
- lack of understanding among the general public around the concept of 'cultural significance'.

4.2.14 *Changes to fire regime*

Fire can have a major impact on river health. Run-off immediately following fires in the catchment can have a serious negative impact on water quality. A series of fish kills in the Murrumbidgee River followed the 2003 bushfire affecting Murray cod, Macquarie perch and golden perch. A single post-2003 fire rainfall event is estimated to have deposited more than 8000 tons of sediment into the Cotter River, a major tributary of the lower UMDR.

Changes to fire regime itself alter the levels of intensity and frequency at which fire events occur. This can have impacts on not only in-stream river health but also the composition and structure of the vegetation in the river corridor.

With predictions of hotter, drier summers under climate change scenarios this threat is one of concern to management of the riverine ecosystem.



4.2.15 Lack of understanding and appreciation

Although there are several groups within the community who have a great knowledge and connection to the river, it is seen as a high priority to overcome a lack of understanding and appreciation of the values and assets of the river among many of those who live around and along the demonstration reach. A priority is to undertake a range of actions to encourage people take on a stewardship and caretaker role. Landholders along the river are a primary target group as their land use practices can have immediate and direct negative impacts of river health (see the separate Communications, Education, Participation and Awareness Plan).

4.3 Analysis of threats

ASSETS	Native fish community (including threatened species)	Water	Aquatic and in-stream habitats	Riparian and floodplain vegetation communities	Iconic species (such as platypus)	Rare, threatened or endangered species and ecological communities (other than native fish)	Protected areas	Aboriginal cultural heritage assets	Social and cultural assets
Changes to surface water flows and seasonal patterns	High	High	High	Medium	High	Medium	Low	Low	Medium
Reduced water quality	High	High	High	Medium	High	Low	Low	Low	Medium
Groundwater depletion	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Climate change	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Physical disturbances	Medium	Medium	Medium	Medium	High	Low	Low	High	High
Loss of in-stream habitat connectivity and complexity	High	-	High	-	High	Low	High	-	Medium
Loss of riparian habitat, connectivity and biodiversity	Medium	Low	Medium	High	Medium	Medium	Medium	Low	Low
Introduced plant species	Medium	Low	Medium	High	High	Medium	High	Unknown	Medium
Introduced animal species	High	Medium	High	Medium	High	Medium	High	Unknown	Medium
Rural land use practices	High	High	High	High	Medium	Medium	Medium	Unknown	Low
Urban activities	Medium	Medium	Medium	Low	Medium	Medium	Medium	Unknown	High
Recreational activities	Low	-	Low	Low	Medium	Low	Medium	Unknown	High
Threats to cultural heritage assets	-	-	-	-	-	-	Low	High	Medium
Changes to fire regime	Low	Low	Low	High	Low	Medium	High	Unknown	High
Lack of understanding and appreciation	Medium	Low	Medium	Low	Medium	Low	Low	High	High