

Wetland classification

The Ramsar List was established in response to the Convention on Wetlands of International Importance (Ramsar, Iran 1971) and establishes that “wetlands should be selected for the List on account of their international significance in terms of ecology, botany, zoology, limnology or hydrology.”

Lakes Argyle and Kununurra are a declared Ramsar site that were included on the Ramsar list of wetlands according to criteria points 2,3,4, and 5 of the Ramsar Criteria for Justification. The table below gives a description of the criteria and the justification for their inclusion on the Ramsar list.

The Ramsar Information sheet for Lakes Argyle and Kununurra summarise the site and its characteristics (See Appendix 2).

Table 1: Ramsar criteria and justification for inclusion for Lakes Argyle and Kununurra (Australian Wetlands Database, 2003)

Ramsar criteria for inclusion A wetland should be considered internationally important if	Justification of criteria
2. The wetland supports vulnerable, endangered, or critically endangered species or threatened ecological communities.	The Site supports a large population of the vulnerable Freshwater Crocodile <i>Crocodylus johnstoni</i> , which is specially protected by the Western Australian Wildlife Conservation Act (1950), and the Commonwealth of Australia's Environment Protection and Biodiversity Conservation Act (1999).
3. The wetland supports populations of plants and/or animal species important for maintaining the biological diversity of a particular biogeographic region.	At least 15 species of freshwater fishes (mainly catfishes, grunters and gudgeons) are known to occur at the Site, while four fishes (two catfish <i>Arius spp.</i> , Strawman <i>Quirichthys stramineus</i> , and Giant Glassfish <i>Parambassis gulliveri</i>) are known in Western Australia only from the Site and other parts of the Ord River System. Three species of freshwater turtle are known from the Site and one of these, <i>Emydura australis</i> , is restricted to the Kimberley - Victoria River region.
4. The wetland supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.	Lakes Argyle and Kununurra are important dry-season refuges for waterbirds.
5. The wetland regularly supports 20,000 or more waterbirds.	The Site regularly supports very large numbers of waterbirds. In August 1986, Lake Argyle supported more than 180,000 while in September 1978, 12,000 were recorded using Lake Kununurra

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Information Sheet on Ramsar Wetlands (RIS)

Categories approved by Recommendation 4.7 of the Conference of Contracting Parties.

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Lakes Argyle and Kununurra, Western Australia - 32

1. Form compiled by: Compiled by the Department of Conservation and Land Management (DCLM). All inquiries should be directed to Jim Lane, Department of Conservation & Land Management (DCLM), 14 Queen Street, Busselton WA 6280, Australia, (Tel: +61-8-9752-1677; Fax: +61-8-9752-1432; email: jiml@calm.wa.gov.au).

2. Sheet last modified: November 2003.

3. Country: Australia

4. Name of Ramsar site: Lakes Argyle and Kununurra, Western Australia

5. Map of site included? a) hard copy: yes

b) digital (electronic) format: yes

6. Geographical coordinates: Latitude: (approx.) 15 degrees 48'S to 16 degrees 50'S; Longitude: (approx.) 128 degrees 28'E to 129 degrees 00'E.

7. General Location: Lakes Argyle and Kununurra are in the Shire of Wyndham - East Kimberley (local authority) in the State of Western Australia (population ca. 1.95 million in 2003). Lake Kununurra is located in and near the town of Kununurra (population ca. 6000 in 2003). Lake Argyle is immediately upstream.

8. Elevation: Lake Argyle - approximately 95m (Australian Height Datum).
Lake Kununurra - approximately 41m AHD.

9. Area: 117 495 ha.

10. Overview: A large system of two man-made reservoirs and associated wetlands that is used extensively by waterbirds, especially during the dry season when up to 200 000 waterbirds have been counted.

11. Ramsar Criteria: 2, 3, 4, 5,

12. Justification of criteria under point 11: 2: The Site supports a large population of the vulnerable Freshwater Crocodile *Crocodylus johnstoni*,

which is specially protected by the Western Australian Wildlife Conservation Act (1950) and the Commonwealth of Australia's Environment Protection and Biodiversity Conservation Act (1999).

3: At least 15 species of freshwater fishes (mainly catfishes, grunters and gudgeons) are known to occur at the Site, while four fishes (two catfish *Arius* spp., Strawman Quirichthys stramineus, and Giant Glassfish *Parambassis gulliveri*) are known in Western Australia only from the Site and other parts of the Ord River System. Three species of freshwater turtle are known from the Site and one of these, *Emydura australis*, is restricted to the Kimberley - Victoria River region.

4: Lakes Argyle and Kununurra are important dry-season refuges for waterbirds.

5: The Site regularly supports very large numbers of waterbirds. In August 1986, Lake Argyle supported more than 180,000 while in September 1978, 12,000 were recorded using Lake Kununurra.

13a. Biogeographic region: Victoria Bonaparte.

13b. Biogeographic regionalisation scheme: Environment Australia 2000. Revision of the Interim Biogeographic Regionalisation of Australia (IBRA) and the Development of Version 5.1. Summary Report. Department of Environment and Heritage, Canberra.

14. Physical Features: Lakes Argyle and Kununurra were formed by damming of the Ord River in 1963 (Lake Kununurra) and 1972 (Lake Argyle). Many of the associated wetlands which are connected to the lakes were seasonally inundated prior to the damming, however they are now permanent. When full, Lake Kununurra is approximately 25 m deep over the former river channel, with water levels exceeding 1 m in much of the swamp area. Lake Argyle is up to 50m deep over the river channel and large areas in the west exceed 5m while large areas in the south-east are less than 0.5m deep. Prior to 1995, Lake Argyle's water level occasionally fell below the spillway level e.g. briefly in 1979, 1985, 1991-92. In 1995-96, the spillway was raised from 86.7m AHD to 92.2m AHD to accommodate increased water use for hydro-electricity generation. As a result, Lake Argyle retains more nutrients and suspended sediment than previously, because the volume of surface water flushed from the lake has been substantially reduced. The new spillway has a foot valve which releases a small flow down spillway creek when the lake is below the overflow height (LeProvost Dames and Moore 1999).

Water levels in Lake Argyle have an annual fluctuation of about 4 metres. In the past, the water level in Lake Kununurra was lowered for about two

weeks once or twice per year to drain the fringing swamps and thereby control weed growth. However, since the mid 1980s, water levels have been kept relatively constant to meet the needs of tour operators and rural landowners at Packsaddle. Water is fresh throughout the system. Large fluctuation in water levels has prevented the establishment of much vegetation on most of the shore of Lake Argyle, although in some sections dense belts of trees have grown. Many aquatic plants grow in shallow water at the edge of the lake. There are dead trees throughout the wetland system as a result of trees which previously grew in seasonally-inundated or dry areas now being permanently flooded. Because water levels have been stable in Lake Kununurra and the wetlands associated with it since the mid 1980s, they have well developed fringing vegetation consisting of grassland, Typha and other "rushes", or woodland. Savannah woodland grows around the wetland complex.

15. Catchment Area: The Site experiences a dry tropical climate with Kununurra having an average annual rainfall of 779mm per year. Rainfall is monsoonal and is usually restricted to a hot, humid wet season from November to March and, typical of dry-tropics, variability in rainfall between years is pronounced. The dry season is characterised by warm, dry days with periods of steady south-easterly winds. Average maximum temperatures range from 38 degrees C in December to 30 degrees C in July.

16. Hydrological Values: The Site consists of dammed waterbodies which provide water supply to the Ord River Irrigation Area and the Argyle Diamond Mine (Lake Argyle).

17. Wetland Type: O, M, 6

18. Ecological Features: Lakes Argyle and Kununurra are most important as dry-season refuges although 18 species have been recorded breeding in the Lake Kununurra wetlands. Very large numbers of waterbirds occur in the system, which regularly supports more than 20 000 waterbirds. Lake Kununurra and surrounding wetlands contained about 12 000 waterbirds in September 1978 and October 1979 and about 7 000 in November 1980. Lake Argyle contains some of the largest aggregations of waterbirds in northern Australia; 181 400 were counted in August 1986. Records for abundant species include:

Glossy Ibis *Plegadis falcinellus* 6 000 Aug 1979

Magpie Goose *Anseranas semipalmata* 10 500 Aug 1986

Wandering Whistling-Duck *Dendrocygna arcuata* 11 000 Aug 1986

Plumed Whistling-Duck *D. eytoni* 4 300 Jul 1981

Pacific Black Duck *Anas superciliosa* 16 000 Nov 1979

Grey Teal *A. gracilis* 17 200 Aug 1986

Pink-eared Duck *Malacorhynchus membranaceus* 1 800 Sep 1980

Hardhead *Aythya australis* 51 400 Aug 1986

Green Pygmy-goose *Nettapus pulchellus* 1 524 Aug 1986

Eurasian Coot *Fulica atra* 50 756 Aug 1986

The two lakes are the stronghold of the Comb-crested Jacana *Irediparra gallinacea* in Western Australia; 120 were counted along a small section of the shore of Lake Kununurra in May 1986, while 296 were recorded on aquatic plant mats in Lake Argyle in August 1986.

At least 15 species of freshwater fishes (mainly catfishes, grunters and gudgeons) are known to occur at the Site. The Archerfish *Toxotes chatareus* is abundant, while four fishes (two catfish *Arius* spp., Strawman *Quirichthys stramineus*, Giant Glassfish *Parambassis gulliveri*) are known in Western Australia only from the Site and other parts of the Ord River System. The widespread freshwater crayfish *Macrobrachium rosenbergii* ('Cherrabun') also occurs at the Site. Three species of freshwater turtle are known from the Site, one of these, *Emydura australis*, is restricted to the Kimberley - Victoria River region.

Some of the wetlands associated with the lakes support lush growth of aquatic plants, including *Nymphoides indica*, *Nymphaea gigantea*, *Najas graminea*, *Hydrilla verticillata*, *Potamogeton tricarlinatus*, *Myriophyllum verrucosum*, *Vallisneria spiralis* and *Chara* sp. The main "rushes" are *Typha domingensis* and *Eleocharis* spp. Tree species growing on the shores of the lakes and wetlands are *Melaleuca viridiflora*, *Eucalyptus microtheca*, *E. camaldulensis*, *Nauclea orientalis*, *Sesbania formosa* and *Lophostemon grandiflorus*. The main species in the fringing grassland are *Eriachne sulcata*, *Echinochloa kimberleyensis*, *Oryza australiensis* and a large number of ephemeral herbs. The savannah woodland is dominated by *Eucalyptus* spp. and *Bauhinia cunninghamii*.

19. Noteworthy Flora: There are no nationally rare or threatened species known at the Site. Several endemic species of herbs have been found on the periphery of the Lakes, particularly the seasonal wetlands.

Several exotic plants have become established at the Site including: *Leucaena leucaena leucocephala*, Date Palm *Phoenix dactylifera*, Rubber Tree *Calotropis procera* and *Parkinsonia aculeata* at Lake Kununurra; and *Parkinsonia*, Rubber Tree and Bellyache Bush *Jatropha gossypifolia* at Lake Argyle.

20. Noteworthy Fauna: The Site supports large numbers of the vulnerable Freshwater Crocodile *Crocodylus johnstoni* which is specially protected by State and Federal legislation, and is a major breeding area for this species. Breeding occurs predominantly in the upstream (southern) end of Lake Kununurra where soft, sandy substrates for nest excavation occur alongside the river. From surveys conducted in 1988, 1989 and 1994, the

population of Lake Kununurra has been estimated to number 3000 - 5000 individuals. Estimates of the non-hatchling population of Freshwater Crocodiles in Lake Argyle have varied from 6,000-12,000 to 25,000 individuals; it is probably the largest population of this species in the world at one wetland.

Lake Argyle supports the highest number of the specially protected Radjah Shelduck *Tadorna radjah* counted in Western Australia (900 in May 1980).

The native Water Rat *Hydromys chrysogaster* also occurs at the site.

21. Social and Cultural Values: Principal social values include water supply (for irrigation, domestic and commercial use) and both commercial and recreational fishing. The Lakes ensure a constant water supply to the Ord River Irrigation Area and water discharged at the base of the dam wall is used to generate electricity for the Argyle Diamond Mine and the towns of Kununurra and Wyndham. Plans for piping lake water to southern Australia have been promoted by some, but have not been adopted by Government due to the relatively high cost. The large population of Silver Cobbler *Arius midgleyi* in Lake Argyle supports a commercial fishery, with the annual potential catch of fish, including unmarketable species, being c. 4000 tonnes. The largest of these catfish are c. 20 kg. The crocodile industry has been issued permits to remove saltwater crocodiles and their eggs to stock farms. A pilot Barramundi *Lates calcarifer* aquaculture industry producing up to 100 tonnes per year in penned cages is based at Bamboo Cove in Lake Argyle (LeProvost Dames and Moore 1999). The Western Australian Department of Fisheries has initiated plans to develop an intensive Barramundi aquaculture industry in Lake Argyle capable of producing up to 2000 tonnes annually (LeProvost Dames and Moore 1999). Tourism is a substantial and growing use. All of these values are consistent with the maintenance of current ecological values. Lakes Argyle and Kununurra are within the traditional lands of the Miriuwung and Gajerrong language groups. Past and present cultural significance of the Ord River to the traditional owners is evidenced by the Miriuwung and Gajerrong Native Title claim and hearings, currently before the Federal Court of Australia. Indigenous people have a complex and spiritual tie to the land and waters of the Ord River, and there are numerous significant cultural heritage sites associated with the river that are protected by the Western Australian Aboriginal Heritage Act (1972) (Lane 2003).

22. Land tenure/ownership: (a) within the Ramsar site: Lake Argyle, Lake Kununurra and wetlands directly connected to them have been proposed as reserves for the purpose of water management, except in the case of the Packsaddle Swamps (and the seasonal wetlands south of them) which will also be reserved for nature conservation. All reserves except that

containing Packsaddle Swamps and seasonal wetlands to the south will be vested in the Water Corporation of Western Australia; the latter reserve will be jointly vested in the Water Corporation and the Conservation Commission of Western Australia. The reserves will be managed by the Water Corporation or the Water Corporation and the Department of Conservation & Land Management, according to vesting. The site is within a large area of the eastern Kimberley which is subject to a Native Title claim by the Miriung and Gajerrong people (LeProvost Dames and Moore 1999). This claim is awaiting determination by the Federal Court of Australia and outcomes are expected by 2005. (b) in the surrounding area: The surrounding area includes freehold agricultural land and pastoral leases for rangeland grazing. The surrounding area is subject to Native Title claims by a number of Aboriginal groups including the Miriung and Gajerrong people.

23. Current land use: (a) within the Ramsar site: The lakes provide water for the Ord River Irrigation Area and for hydro-electricity generation for Argyle Diamond Mine and the towns of Kununurra and Wyndham, and their levels are managed for this purpose. Lake Kununurra and associated wetlands have a constant level while that in Lake Argyle (the primary water source) fluctuates according to the balance between rainfall, evaporation and requirements for irrigation. There is recreational boating and a professional and amateur fishery in the lakes, which are increasingly being used for tourism. A float 'plane is based on Lake Kununurra and there are boat tours of both lakes. Approval has been granted to operate ten houseboats on Lake Kununurra (Watkins et al. 1997). Diamond mining currently occurs within the wetland boundary (Bow River Project) and there are other tenements around the southern part of Lake Argyle and between the dam wall of Lake Argyle and Kununurra. Argyle Diamond Mine draws water from the lake near Smoke Creek. (b) in the surroundings/catchment: The surrounding areas are used for irrigated agriculture and horticulture, cattle grazing and diamond mining.

24. Factors adversely affecting ecological character (past, present, potential): (a) within the Ramsar site: The Ord River Irrigation Area Stage 2 (ORIA Stage 2 - the M2 Channel) expansion proposal is currently undergoing feasibility studies. If implemented, it will draw water from Kununurra Dam to irrigate a further 30 500 ha of agricultural land in close proximity to the site (Wesfarmers Sugar Company et al 2000; EPA 2000, 2001).

To balance the environmental flow requirements of the Ord River with the water requirements of the ORIA (Stage 1 and 2) and other commercial users in the area (notably diamond mines), the Department of Environment (formerly the Water and Rivers Commission) is currently determining water

allocations for the river (Water and Rivers Commission 1999a; EPA 1999; Doupe and Pettit 2002, Trayler et al. 2002, Water and Rivers Commission, 2003).

Past (including recent past) management of water levels has proved beneficial to waterbirds. However, it has created a eutrophic system in the wetlands which will probably result in continuing changes in floral composition, some of which may be undesirable. Some active management of the vegetation may be necessary in the future.

When Argyle Dam was originally designed, it was estimated that the average sediment load for the Ord River was 24 Mt per year. Survey work suggests that approximately 380 Mm³ of sediment was deposited in Lake Argyle in the 16 years following construction of the dam, which represents a sediment transport rate of 24 Mt per year, as predicted (Water and Rivers Commission 1999b). After 23 years, the storage volume in the reservoir below the spillway level was been reduced by 3.3% (Water and Rivers Commission 1999b). Recent studies of severe gully erosion in the upper Ord River catchment have revealed that the area is characterised by very high natural erosion rates, and that gully erosion was a predominant feature of the catchment prior to European settlement, contrary to previous beliefs (Callow 2001; Sandercock 2003). These studies suggest that the revegetation strategy, including declaration of the Ord River Regeneration Area (see item 25) which was adopted to reduce erosion in the catchment, might not substantially reduce the rate of sedimentation in Lake Argyle.

It has been suggested that cultured Barramundi *Lates calcarifer* escaping from fish farms in Lake Argyle could threaten the genetic integrity of the wild population present in the site by interbreeding (Doupe and Lymbery 1999). Tighter controls are needed to minimise escapes from fish farms. Introduced Red Claw, which are also abundant in Lake Argyle, may compete with native species of crustaceans. Cane Toads *Bufo marinus* invading the Northern Territory and (potentially) Western Australia may also have a substantial impact on native wildlife.

(b) in the surrounding area: Exploration and mining for diamonds will continue, subject to appropriate environmental constraints that are consistent with maintenance of the ecological character of the Site.

25. Conservation measures taken: Some upstream pastoral leases have been relinquished to form the Ord River Regeneration Area to allow regeneration of vegetation in the upper catchment in the expectation that this would assist in reducing severe catchment erosion resulting in siltation of Lake Argyle. The Lakes are listed on the Register of the National Estate.

26. Conservation measures proposed: The proposed Carr Boyd National Park abuts Lake Argyle.

27. Current scientific research and facilities: The impact of damming on the fluvial geomorphology of the lower Ord River, and the rapid siltation of the Ord River Estuary has recently been studied (Warman 1999; Wolanski et al. 2001). Other studies have focussed on the causes and nature of river channel changes and gully erosion in the upper Ord River catchment (Callow 2001; Sandercock 2003). The hydrology of the Ord River and Lakes Argyle and Kununurra, including water quality, water availability, and current and future water demands has been investigated (Water and Rivers Commission 1999b). To assist in the assessment of the expansion of the ORIA, the Water and Rivers Commission undertook a series of studies into the hydrogeological regime of the ORIA including an airborne geophysical survey, installation of monitoring bores, pumping tests, chemical analyses and groundwater modelling (Water and Rivers Commission 2001).

28. Current conservation education: None.

29. Current recreation and tourism: The lakes are used for recreational fishing and boating, charter boat and float plane scenic tours, and birdwatching.

30. Jurisdiction &

31. Management authority: Territorial: State Government of Western Australia. Functional: The Water Corporation of Western Australia, the Department of Environment and the Department of Conservation and Land Management. Management authority: The Lakes are managed by the Water Corporation which controls the supply of water for irrigation. The Department of Environment is responsible for water allocation, water quality aspects and also authorises other uses (tourism, recreation, and irrigation waste water treatment) (Watkins et al. 1997). The Department of Conservation and Land Management is responsible for maintenance of the Site's Ramsar values. There is a local management group, the Ord River Waterways Management Group (ORWVG) comprised of representatives of the Shire of Wyndham - East Kimberley, the Kimberley Regional Economic Aboriginal Corporation, the Department of Environment, the Water Corporation, Ord Land and Water, and the Department of Conservation and Land Management.

32. Bibliographical references: Callow, J.N. 2001. The Controls in Gully Erosion in the Upper Ord River Catchment, Northwestern Australia. Honours dissertation presented to the University of Western Australia, Perth.

Cummings, B. and Hardy, A. 2000. Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1 - Summary Report. Environment Australia, Canberra. (Also available online at <http://www.ea.gov.au/parks/nrs/ibra/version5-1/summary-report/index.html>).

Doupe, R.G. and Lymbery, A.J. 1999. Escape of cultured barramundi (*Lates calcarifer* Bloch) into impoundments of the Ord River system, Western Australia. *Journal of the Royal Society of Western Australia*, 82, 131-136.

Doupe, R.G. and Pettit, N.E. 2002. Ecological perspectives on regulation and water allocation for the Ord River, Western Australia. *River Research and Applications* 18, 307-320.

EPA. 1999. Draft Interim Water Allocation Plan, Ord River: Advice to the Minister for the Environment from the Environmental Protection Authority under Part IV of the Environmental Protection Act 1986. Environmental Protection Authority, Perth. Bulletin 965.

EPA. 2000. Ord River Irrigation Area Stage 2 (M2 Supply Channel), Kununurra, Part 1 - Biodiversity Implications: Report and recommendations of the Environmental Protection Authority. Environmental Protection Authority, Perth, Western Australia. Bulletin 988.

EPA. 2001. Ord River Irrigation Area Stage 2 (M2 Supply Channel), Kununurra, Part 2 - Management: Report and recommendations of the Environmental Protection Authority. Environmental Protection Authority, Perth, Western Australia. Bulletin 1016.

Gowland, P.N. 1983. A guide to the ecology and management of bird pests of commercial agriculture in the Ord River Irrigation Area, No. 2. Waterbirds. Royal Australasian Ornithologists Union Microfiche Series M35.

Jaensch, R.P. and Vervest, R.M. 1990. Waterbirds at remote wetlands in Western Australia, 1986-88. Part One: Lake Argyle and Lake Gregory. Royal Australasian Ornithologists Union Report 32, 1-25.

Lane, R. 2003. History, mobility and landuse of Aborigines and farmers in the East Kimberley in north west Australia. In: Stewart, P.J. and Strathern, A. (Eds.). *Landscape, History and Memory: Anthropological Perspectives*. Pluto Press, London. Pp 136-165.

LeProvost Dames and Moore. 1999. Kimberley Aquaculture Development Strategy: Lake Argyle Barramundi Aquaculture Industry Strategic Environmental Review. A report prepared by LeProvost Dames and Moore, East

Perth, for Fisheries Western Australia.

Sandercock, P.J. 2003. Causes and Nature of River Channel Changes in the Upper Ord River Catchment. PhD thesis presented to the University of Western Australia, Perth.

Trayler, K., Loh, I., Rodgers, S, and Worley, S. 2002. Environmental flow determination for the Ord River, Western Australia. In: Proceedings of the International Conference on Environmental Flows for River Systems. Cape Town, South Africa. March 3-8, 2002.

Warman, C. 1999. The impact of damming on the fluvial geomorphology of the lower Ord River, Western Australia. Honours dissertation presented to the University of Western Australia, Perth.

Water and Rivers Commission. 1999a. Draft Interim Water Allocation Plan: Ord River, Western Australia. Water and Rivers Commission, Perth. Water Resource Allocation and Planning Series WRAP 2.

Water and Rivers Commission. 1999b. Hydrology of the Ord River. Water and Rivers Commission, Perth. Water Resources Technical Series WRT 24.

Water and Rivers Commission. 2001. Hydrogeology of the Ord River Irrigation Area. Water and Rivers Commission, Perth. Hydrogeological Record Series Report HG 7.

Water and Rivers Commission. 2003. Productivity and Water Flow Regulation in the Ord River of North-western Australia: Environmental Flows Initiative Project - Final Report on Sampling, May 2003. Report prepared for Environment Australia by the Water and Rivers Commission, Perth.

Watkins, D., Brennan, K., Lange, C., Jaensch, R. and Finlayson, M. 1997. Management planning for Ramsar sites in the Kimberley Region of Western Australia. Report prepared by Wetlands International - Oceania for the Department of Conservation & Land Management

Wesfarmers Sugar Company Pty Ltd., Marubeni Corporation and the Water Corporation of Western Australia. 2000. Ord River Irrigation Area Stage 2: Environmental Review and Management Programme; and Proposed Development of the M2 Area: Draft Environmental Impact Statement. Report prepared by Kinhill Pty Ltd.

Wolanski, E., Moore, K., Spagnol, S., D'Adamo, N. and Pattiaratchi, C.

2001. Rapid, Human Induced Siltation of the Macro-Tidal Ord River Estuary,
Western Australia. *Estuarine, Coastal and Shelf Science*, 53, 717-732.

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Appendix 2: GPS points for quadrats and photo reference points

GPS points for quadrats and photo reference points			
Quadrat	Photo Ref Point	Description	GPS Points
Q1.1		on the western edge of the precinct, accessed from Packsaddle Road.	15 47 54.14S 128 41 126.1E
Q1.2		east of Q1 directly opposite where Lily Creek enters Lake Kununurra. This site was accessed by boat.	15 48 8.06 128 46 51.88E
Q2.1	Yes	to the west of Swim Beach	15 47 32.48S 128 41 57.68E
Q2.2		central to the precinct and on the northern side of the levee bank road.	15 47 27.51S 128 42 17.27E
Q3.1		to the north of the levee bank road opposite Cumbungi Inlet,	15 47 25.47S 128 42 48.54E
Q3.2		to the north of the Kona access road opposite the caravan park.	15 47 26.04S 128 43 16.69E
Q4.1	Yes	south of the Kona access road at the interface of the P1 PDWSA and Kona Inlet Conservation Area.	15 47 23.04S 128 43 20.85E
Q4.2	Yes	on the western edge of Lily Creek Lagoon.	15 47 24.58S 128 44 2.58E
Q5.1		located in the south east of the precinct off the Old Darwin Road adjacent to Hamilton inlet.	15 47 46.49S 128 44 28.66E
Q5.2	Yes	located in the north east corner on the banks of Lily Lagoon adjacent Casuarina Drive, Lakeside.	15 47 24.68S 128 44 40.94E
Q6.1	Yes	adjacent to the T Junction of Messmate Way and the Victoria Highway on the edge of Lily Lagoon heading back into Lily Creek.	15 46 47.67S 128 44 32.16E
Q6.2	Yes	south of the Pump House between Casuarina Drive and Lily Lagoon.	15 47 4.79S 128 44 33.66E

Appendix 3: Vegetation condition tables for each land management unit (LMU)

Vegetation Condition Tables

The following tables summarise the condition of the vegetation in each LMU. The overall vegetation condition is dependent upon the levels of disturbance, weed cover and vegetation structure for each of the LMU. This information was used to prioritise recommended management actions for each LMU. These ratings will be used in the future to indicate whether vegetation condition in each LMU has improved or degraded further.

Vegetation condition in LMU 1

	Conservation VMU	Riparian VMU
Vegetation condition	Fair – Good	Good – Very Good
Vegetation structure	Modified, some weed species expected to become dominant.	Intact
% weed cover	20%	5%
Disturbance	Vehicle and walking tracks evident.	Minimal signs of disturbance
Dominant indigenous species	Cajuput (<i>Melaleuca leucadendra</i>) Water couch grass (<i>Cynodon dactylon</i>) Dragon tree (<i>Sesbania formosa</i>)	Cumbungi (<i>Typha domingensis</i>) <i>Ipomoea aquatica</i> Dragon tree (<i>Sesbania formosa</i>) Pandanus (<i>Pandanus sp</i>)
Dominant weed species	Wild passionfruit (<i>Passiflora foetida</i>) Rain tree (<i>Albizia lebeck</i>) Neem (<i>Azadirachta indica</i>)	Wild passionfruit (<i>Passiflora foetida</i>)

Vegetation condition of LMU 2

	Conservation VMU	Parkland VMU	Riparian VMU
Vegetation condition	Fair – Good	Poor	Poor
Vegetation structure	Modified, many weed species appear to have spread along levee bank track	Heavily modified, many weed species already dominant	Heavily modified, weed species out competing riparian vegetation
% weed cover	20-40%.	50-60%.	20-50%
Disturbance	Obvious vehicle and walking tracks, rubbish and fire	High disturbance due to recreational use, many walking tracks, some vehicle tracks, rubbish and fire	High disturbance due to recreational use and access to the water
Dominant indigenous species	River red gum (<i>Eucalyptus camaldulensis</i>) Eucalyptus sp (1) Dragon tree (<i>Sesbania formosa</i>) Pandanus (<i>Pandanus sp</i>) Cajuput (<i>Melaleuca</i>	River red gum (<i>E. camaldulensis</i>) Cajuput (<i>M. leucadendra</i>), Water couch grass (<i>Cynodon dactylon</i>), Green plum (<i>T. platyphylla</i>) Dragon tree (<i>S.</i>	Dragon tree (<i>S. formosa</i>), Pandanus (<i>Pandanus sp</i>), Cumbungi (<i>T. domingensis</i>)

	<i>leucadendra)</i> <i>Ipomea aquatica</i> Green plum (<i>Terminalia platyphylla</i>)	<i>formosa</i>),	
Dominant weed species	Wild passionfruit (<i>Passiflora foetida</i>) Rain tree (<i>Albizia lebeck</i>) Mesquite (<i>Prosopis sp</i>) Coffee Bush (<i>Leuceana leucocephala</i>) Giant rubber bush (<i>Calatropis gigantea</i>) Convulvulus creeper (<i>Merremia dissecta</i>) Neem (<i>Azadirachta indica</i>).	Wild passionfruit (<i>P. foetida</i>) Rain tree (<i>A. lebeck</i>) Grass sp (1) Coffee Bush (<i>Leucaena leucocephala</i>) <i>Sorghum alum</i> <i>Clitoria sp.</i> Giant Rubber Bush (<i>C. gigantea</i>) Convulvulus creeper (<i>M. dissecta</i>) Neem (<i>A. indica</i>)	Coffee Bush (<i>Leuceana leucocephala</i>) Convulvulus creeper (<i>Merremia dissecta</i>) Wild passionfruit (<i>Passiflora foetida</i>)

Vegetation condition of LMU 3

Issue	Conservation	Parkland	Riparian
Vegetation condition	Fair – Good	Poor	Fair - Good
Vegetation structure	Modified, many weed species appear to have spread along levee bank track	Heavily Modified, many weed species present	Modified due to tourism use otherwise fairly intact
% weed cover	20-40%	50-60%.	10-20%
Disturbance	Obvious vehicle and walking tracks, rubbish and fire	Landscape heavily modified	Medium levels of disturbance at caravan park otherwise only minor signs of disturbance
Dominant indigenous species	River red gum (<i>Eucalyptus camaldulensis</i>) Eucalyptus sp (1) Dragon tree (<i>Sesbania formosa</i>) Pandanus (<i>Pandanus sp</i>) Cajuput (<i>Melaleuca leucadendra</i>) Green plum (<i>Terminalia platyphylla</i>)	River red gum (<i>E. camaldulensis</i>) Eucalyptus sp (1) Cumbungi (<i>T. domingensis</i>), Dragon tree (<i>S. formosa</i>) Pandanus (<i>Pandanus sp</i>) Cajuput (<i>M. leucadendra</i>) Green plum (<i>T. platyphylla</i>)	Cumbungi (<i>Typha domingensis</i>) Pandanus (<i>Pandanus sp</i>) Green plum (<i>Terminalia platyphylla</i>) <i>Ipomea aquatica</i> Dragon tree (<i>Sesbania formosa</i>)
Dominant weed species	Wild passionfruit (<i>Passiflora foetida</i>) Rain tree (<i>Albizia lebeck</i>) Mesquite (<i>Prosopis sp</i>) Coffee Bush (<i>Leuceana leucocephala</i>) Giant rubber bush (<i>Calatropis gigantea</i>) Convulvulus creeper (<i>Merremia dissecta</i>) Neem (<i>Azadirachta indica</i>)	Wild passionfruit (<i>P. foetida</i>) Rain tree (<i>A. lebeck</i>) Coffee Bush (<i>Leucaena leucocephala</i>) Giant rubber bush (<i>C. gigantea</i>) Convulvulus creeper (<i>M. dissecta</i>) Neem (<i>A. indica</i>)	Coffee Bush (<i>Leucaena leucocephala</i>) Rain tree (<i>A. lebeck</i>) Convulvulus creeper (<i>M. dissecta</i>)

Vegetation condition of LMU 4

Issue	Conservation	Parkland	Riparian
Vegetation condition	Fair – Good	Poor	Fair
Vegetation structure	Modified, many weed species prevalent	Heavily Modified, many weed species present	Modified, <i>Leucaena</i> Sp dominant
% weed cover	20%	50-60%.	40%
Disturbance	Obvious tracks, rubbish and fire	Landscape heavily modified	Minor disturbance except for Kimberley Land where riparian vegetation has been cleared for access and views.
Dominant indigenous species	River red gum (<i>Eucalyptus camaldulensis</i>) Eucalyptus sp (1) Eucalyptus sp (2) Dragon tree (<i>Sesbania formosa</i>) Pandanus (<i>Pandanus</i> sp) Cajuput (<i>Melaleuca leucadendra</i>) Green plum (<i>Terminalia platyphylla</i>) Bauhinia (<i>Bauhinia cunninghamii</i>)	River red gum (<i>E. camaldulensis</i>) Eucalyptus sp (2) Dragon tree (<i>S. formosa</i>) Pandanus (<i>Pandanus</i> sp) Cajuput (<i>M. leucadendra</i>) Green plum (<i>T. platyphylla</i>) Cumbungi (<i>T. domingensis</i>)	Cumbungi (<i>T. domingensis</i>) Green plum (<i>T. platyphylla</i>) Dragon tree (<i>S. formosa</i>) Cumbungi (<i>Typha domingensis</i>) Pandanus (<i>Pandanus</i> sp)
Dominant weed species	Wild passionfruit (<i>Passiflora foetida</i>) Rain tree (<i>Albizia lebbbeck</i>) Coffee Bush (<i>Leucaena leucocephala</i>) Giant rubber bush (<i>Calatropis gigantea</i>) Convulvulus creeper (<i>Merremia dissecta</i>) Neem (<i>Azadirachta indica</i>)	Wild passionfruit (<i>P. foetida</i>) Rain tree (<i>A. lebbbeck</i>) Coffee Bush (<i>Leucaena leucocephala</i>) Giant rubber bush (<i>C. gigantea</i>) Convulvulus creeper (<i>M. dissecta</i>) Neem (<i>A. indica</i>)	Coffee Bush (<i>Leucaena leucocephala</i>) Date Palm Rain tree (<i>Albizia lebbbeck</i>)

Vegetation condition of LMU 5

	Conservation	Riparian
Vegetation condition	Fair – Good	Fair-Good
Vegetation structure	Modified, some weed species expected to become dominant.	Modified, some weed species expected to become dominant.
% weed cover	20%	20%
Disturbance	Some tracks evident and fire	Minimal
Dominant indigenous species	Dragon tree (<i>Sesbania formosa</i>) Cajuput (<i>Melaleuca leucadendra</i>) Water couch grass (<i>Cynodon dactylon</i>) Cane grass (<i>Sorghum stipoideum</i>)	Cumbungi (<i>Typha domingensis</i>) Dragon tree (<i>Sesbania formosa</i>)
Dominant weed species	Wild passionfruit (<i>Passiflora foetida</i>) Rain tree (<i>Albizia lebbbeck</i>) Neem (<i>Azadirachta indica</i>) Giant rubber bush (<i>Calatropis gigantea</i>) Purpletop Chloris (<i>Chloris barbata</i>)	Coffee Bush (<i>Leucaena leucocephala</i>) Date Palm Rain tree (<i>Albizia lebbbeck</i>) Neem (<i>Azadirachta indica</i>)

Vegetation condition of LMU 6

	Riparian	Parkland
Vegetation condition	Poor	Poor
Vegetation structure	Heavily Modified due to recreational use of the foreshore	Heavily Modified, many weed species dominant.
% weed cover	30-40%	50-60%
Disturbance	Urbanised landscape	Urbanised landscape
Dominant indigenous species	Cumbungi (<i>Typha domingensis</i>) Dragon tree (<i>Sesbania formosa</i>)	Cumbungi (<i>Typha domingensis</i>) Dragon tree (<i>Sesbania formosa</i>) Cajuput (<i>Melaleuca leucadendra</i>) Water couch grass (<i>Cynodon dactylon</i>) Green plum (<i>Terminalia platyphylla</i>)
Dominant weed species	Leucaena (<i>Leucaena leucocephala</i>) Wild passionfruit (<i>Passiflora foetida</i>) Rain tree (<i>Albizia lebbek</i>)	Wild passionfruit (<i>Passiflora foetida</i>) Rain tree (<i>Albizia lebbek</i>) Grass sp (1) Leucaena (<i>Leucaena leucocephala</i> , <i>Sorghum alum</i>) Convolvulus creeper (<i>Merremia dissecta</i>)

Appendix 4: List of plant species identified from fieldwork undertaken between July 2006 and October 2006

List of Plant Species Identified from Fieldwork Undertaken Between July 2006 and October 2006

Trees & Shrubs

<u>Scientific Name</u>	<u>Common Name</u>
Acacia tumida	Pindan wattle
Adansonia hemiglauca	Boab
Barringtonia acutangula	Whitewood
Brachychiton sp.	Kimberley rose
Buchanania obovata	Darlung
Cathormion umbellatum	
Cochlospermum fraseri	Cotton tree
Ehretia saligna	Coonta
Erythrina vesperilio	Bat wing coral tree
Erythrophleum cholorostachys	Cooktown ironwood
Eucalyptus camldulensis	River redgum
Eucalyptus confertifolia	Cabbage gum
Eucalyptus foelscheana	Smooth barked bloodwood
Eucalyptus microtheca	Coolibah
Eucalyptus polycarpa	Longfruit bloodwood
Eucalyptus pruinosa	Silverleaf box
Excocaria parvifolia	Guttapercha tree
Ficus coronulata	River fig
Ficus opposita	Sandpaper fig
Ficus racemosa	Cluster fig
Ficus sp.	Fig
Gyrocarpus americanus	Stinkwood
Leucaena leucocephala	Leucaena
Bauhinia cunninghamii	Jigal
Melaleuca leucadendron	Cajuput
Nauclea coadunata	Leichhardt pine
Owenia vernicosa	Emu apple
Pandanus spp	Screw pine
Parkinsonia aculeata	Parkinsonia
Petalostigma pubescens	Quinine tree
Sesbania formosa	Swamp cork wood
Terminalia platphylla	Wild plum
Tristania grandiflora	
Acacia farnesiana	Mimosa bush
Acacia nilotica	
Acacia translucens	
Aerva javanica	Kapok bush
Calotropis procera	Rubber Bush
Carissa lanceolata	Konkerberry
Grewia retusifolia	Donkeyberry
Securinega melathesoides	Dogwood
Sesbania cannabina var. cannabina	Sesbania Pea
Sesbania cannabina var. sericea	

Emergent Riparian Vegetation: Sedges /Rushes

Cyperus albomarginatus	
Cyperus difformis	Dirty dora
Cyperus holoschoenus	
Cyperus marcostachyos	
Cyperus polystachyos	Bunchy sedge
Cyperus vaginatus	Stiffleaf sedge
Eleocharis atropurpurea	
Eleocharis brassii	Spike rush
Eleocharis phillippinensis	
Eleocharis sphacelata	Tall spike rush
Eleocharis spiralis	
Fimbristylis bisumbellata	
Fimbristylis dichotoma	
Fimbristylis littoralis	
Phragmites sp.	
Scirpus laevis	
Typha domingensis	Cumbungi

Grasses

Cenchrus setiger	Birdwood grass
Chloris barbata	Purpletop chloris
Cynodon dactylon	Couch
Dichanthium annulatum	Sheda grass
Dichanthium fecundum	Curly bluegrass
Diplachne parviflora	Silvertop
Echinochloa colonum	Barnyard grass
Eragrostis spp.	
Eriachne sulcata	
Heteropogon contortus	Black speargrass
Leptochloa neesii	
oryza rufipogon	Wild rice
Panicum cymbiforme	
Sorghum alnum	Columbus grass
sorghum stipoides	Annual native sorghum
Sorghum kimberleyensis	

Forbs

Aeschynomene indica	Budda pea
Alternanthera denticulata	Lesser joyweed
Alternanthera nana	Hairy joyweed
Alternanthera repens	Khaki weed
Atylosia marmorata	
Boerhavia diffusa	Tarvine
Cleome viscosa	Tickweed
Crotolaria retusa	Wedgeleaf rattlepod
Crotolaria trifoliatrum	Trefoil rattlepod
Ipomoea aquatica	Potato vine
Ludwigia octovalvis	Willow primrose

Ludwigia perennis
Macrotillium atropurpureum
Macrotillium lathyroides
Monochoria cyanea
Passiflora foetida
Polygonum attenuatum
Polygonum orientale
Pterigeron odorus
Sida acuta
Sphenoclea zeylanica
Tinospora smilacina
Trianthema portulacastrum
Waltheria indica

Purple bean
Phasey bean
Wild Passionfruit
Smartweed
Prince's Feather
Smelly bush
Spinyhead sida
Goonda
Strangle vine
Giant pigweed

Submerged or Surface Aquatics: Waterplants

Aponogeton elongatus
Hydrilla verticillata
Myriophyllum verrucosum
Najas graminea
Nymphaea gigantea
Nymphaea indica
Potamogeton tricarlinatus
Vallisneria spiralis

Hydrilla
Milfoil
Naiad
Giant waterlily
Water snowflake
Floating pondweed
Ribbon weed

Ferns

Marsilea spp

Nardoo

Appendix 5: DEC flora and fauna searches

21/08/2007

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT
DECLARED RARE AND PRIORITY FLORA LIST
21 December 2006

Page 1

SPECIES / TAXON	CONS CODE	CALM REGION	DISTRIBUTION	FLOWER PERIOD
<i>Acacia richardsii</i>	3	K,*	Kununurra, Keep River N.P., Northern Carr Boyd Ranges, Gardner Plateau, N.T.	Mar-Aug
<i>Brachychiton tuberculatus</i>	3	K	Ord River, Kununurra	Aug-Nov
<i>Desmodium flagellare</i>	1	K	Kununurra, Ord River Basin	
<i>Eucalyptus ordiana</i>	2	K	Kununurra	Jan,Jun,Jul
<i>Ficus lilliputiana</i>	4	K,*	Ord River, Lake Argyle, Hidden Valley, Kununurra, Northern Territory	Apr-Oct
<i>Fuirena nudiflora</i>	1	GLD,K,*	Rawlinson Range, Kununurra, NT, Qld	Jun
<i>Goodenia durackiana</i>	1	K	Ord River, Kununurra	Mar
<i>Goodenia strangfordii</i>	1	K	Kununurra, Sturt Creek	Sep
<i>Platysace saxatilis</i>	2	K*	Hidden Valley, Kununurra, NT	Mar-May,Sep
<i>Stylidium prophyllum</i>	3	K	Mt Hart Stn, Beverley Springs Stn, Kununurra	May-Jun
<i>Typhonium</i> sp. Kununurra (AN Start 1467)	1	K	Kununurra	

15.3339 °S 128.2462 °E / 16.2557 °S 129.0864 °E Lily Creek Lagoon & Lake Kun. (plus ~50km buffer)

* *Date* *Certainty* *Seen* *Location Name* *Method*

Schedule 1 - Fauna that is rare or is likely to become extinct

***Rhinonicterus aurantius* Orange Leaf-nosed Bat 7 records**

This species of bat occurs in a few scattered locations in the Pilbara, as well as the Kimberley. It roosts in caves and is sensitive to human disturbance.

<i>Date</i>	<i>Certainty</i>	<i>Seen</i>	<i>Location Name</i>	<i>Method</i>
1964	1			
1964	1	1	Kununurra	
1964	1	1	Ivanhoe	
1965	1	1	Kununurra	
1980	1	1	Kununurra	
1999	1	1		Caught or trapped
2006	1	1	Kununurra	Caught or trapped

***Erythroriorchus radiatus* Red Goshawk 2 records**

A rare inhabitant of well-wooded country, this species nests in large trees and preys largely on birds but also on reptiles and mammals.

<i>Date</i>	<i>Certainty</i>	<i>Seen</i>	<i>Location Name</i>
1956	1		Ivanhoe
1992	2	1	Lake Argyle

***Rostratula benghalensis australis* Australian Painted Snipe 6 records**

A rare summer visitor to the watered areas of the north-west and swamps on the Swan Coastal Plain.

<i>Date</i>	<i>Certainty</i>	<i>Seen</i>	<i>Location Name</i>	<i>Method</i>
1986	1	2	Wyndham	Day sighting
1986	1	0	Wyndham	Feathers
1991	1	3	Saw Ranges	Day sighting
1995	1	2	Wyndam	Day sighting
1995	1	5	Wyndam	Day sighting
1996	1	1	Kingston Rest	Day sighting

***Erythrura gouldiae* Gouldian Finch 5 records**

This species of finch inhabits savanna woodlands around permanent waters and has declined dramatically across its range.

<i>Date</i>	<i>Certainty</i>	<i>Seen</i>	<i>Location Name</i>	<i>Method</i>
1955	1		Ivanhoe	Day sighting
1993	1		Kununurra	
1993	1	100		Day sighting
1996	1	6	Saw Ranges	Day sighting
1998	1	1	Lake Argyle	Day sighting

***Falcunculus frontatus whitei* Crested Shrike-tit (northern subsp) 2 records**

This species is a rare inhabitant of woodlands.

<i>Date</i>	<i>Certainty</i>	<i>Seen</i>	<i>Location Name</i>
1955	1		Ord River
1956	1		Ivanhoe

***Cristilabrum isolatum* Cristilabrum isolatum 6 records**

<i>Date</i>	<i>Certainty</i>	<i>Seen</i>	<i>Location Name</i>	<i>Method</i>
1980	1	0	Ningbing Ranges	Caught or trapped
1980	1	0	Ningbing Ranges	Caught or trapped
1984	1	0	Ningbing Ranges	Caught or trapped

15.3339 °S 128.2462 °E / 16.2557 °S 129.0864 °E Lily Creek Lagoon & Lake Kun. (plus ~50km buffer)

* Date	Certainty	Seen	Location Name	Method
1984	1	0	Ningbing Ranges	Caught or trapped
1986	1		Limestone Mill	Caught or trapped
1986	1		Limestone Mill	Caught or trapped

Cristilabrum spectaculum **Cristilabrum spectaculum** *9 records*

1980	1	0	Ningbing Ranges	Caught or trapped
1980	1	0	Ningbing Ranges	Caught or trapped
1980	1	0	Ningbing Ranges	Caught or trapped
1980	1	0	Ningbing Ranges	Caught or trapped
1984	1		Jeremiah Hills	Caught or trapped
1984	1		Jeremiah Hills	Caught or trapped
1986	1		Jermiah Hills	Caught or trapped
1995	1	0	Ningbing Ranges	Caught or trapped
1996	1	0	Ningbing Ranges	Caught or trapped

Ordtrachia elegans **Ordtrachia elegans** *1 records*

1988	1		Point Spring	Caught or trapped
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Schedule 4 - Other specially protected fauna

Falco peregrinus **Peregrine Falcon** *2 records*

This species is uncommon and prefers areas with rocky ledges, cliffs, watercourses, open woodland or margins with cleared land.

1956	1		Ivanhoe	
1999	1	2	Kingston Rest	Day sighting

Tadorna radjah rufitergum **Burdekin Duck** *1 records*

This uncommon species inhabits freshwater lagoons and river pools and occurs along the middle and lower Ord River.

1999	1	400	Kununurra	Day sighting
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Priority One: Taxa with few, poorly known populations on threatened lands

Lonchura flaviprymna **Yellow-rumped Mannikin** *1 records*

1996	1	44		Day sighting
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Priority Four: Taxa in need of monitoring

Macroderma gigas **Ghost Bat** *1 records*

This species is Australia's only carnivorous bat and has a patchy distribution across northern Australia. It shelters in caves, mine shafts and deep rock fissures and is sensitive to disturbance.

1999	1	1		Caught or trapped
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Hydromys chrysogaster **Water-rat (Rakali)** *7 records*

This species occurs in waterways and wetlands that support its main prey items such as molluscs and crustaceans.

1	1		Kununurra	
1	1		Kununurra	

15.3339 °S 128.2462 °E / 16.2557 °S 129.0864 °E Lily Creek Lagoon & Lake Kun. (plus ~50km buffer)

* Date	Certainty	Seen	Location Name	Method
1982	1	1	Kununurra	
1995	1	1	Kununurra	
2000	1	1	Kununurra	
2000	1	1	Kununurra	
2002	1	1	Kununurra	

Ixobrychus minutus **Little Bittern** 1 records

This cryptic species inhabits dense reeds and rushes bordering swamps, lakes and watercourses.

1982	1	7	Lake Kununurra	Day sighting
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Ardeotis australis **Australian Bustard** 2 records

This species is uncommon and may occur in open or lightly wooded grasslands.

1998	1	81	Kingston Rest	Day sighting
1999	1	20	Kingston Rest	Day sighting

Burhinus grallarius **Bush Stonecurlew** 2 records

A well camouflaged, ground nesting bird which prefers to 'freeze' rather than fly when disturbed. It inhabits lightly timbered open woodlands.

1956	1		Ivanhoe	
1999	1		Kingston Rest	Heard

Numenius madagascariensis **Eastern Curlew** 1 records

This species is a migratory visitor and has been observed on reef flats and sandy beaches along the West Australian coast and in coastal estuaries.

1956	1		Ivanhoe	
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Geophaps smithii smithii **Partridge Pigeon (eastern ssp)** 1 records

1902	1		Kununurra	
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Phaps histrionica **Flock Bronzewing** 5 records

This species is gregarious and occurs in treeless or sparsely wooded grassy plains within reach of open water.

1985	1	3	Kununurra	Day sighting
1986	1	200	Wyndham	Day sighting
1986	1	150		Day sighting
1988	1		Wyndham	Day sighting
1988	1	50	Lake Argyle	Day sighting

Heteromunia pectoralis **Pictorella Mannikin** 1 records

This species of finch occurs in the drier northern tropical grasslands of Australia.

1996	1		Saw Ranges	Day sighting
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Malurus coronatus coronatus **Purple-crowned Fairy-wren (western ssp)** 1 records

This subspecies is found in riverine habitats but has become very rare in the Kimberley.

1981	1		Lake Argyle	Day sighting
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15.3339 °S 128.2462 °E / 16.2557 °S 129.0864 °E Lily Creek Lagoon & Lake Kun. (plus ~50km buffer)

<i>* Date</i>	<i>Certainty</i>	<i>Seen</i>	<i>Location Name</i>	<i>Method</i>
			<i>Neochima ruficauda subclarescens</i>	
			Star Finch (western)	
				<i>3 records</i>
A nomadic species inhabiting grasslands and eucalypt woodlands near water.				
1996	1		Saw Ranges	Day sighting
1999	1		Kingston Rest	Day sighting
1999	1	100	Kingston Rest	Night sighting

* Information relating to any records provided for listed species:-

Date: date of recorded observation

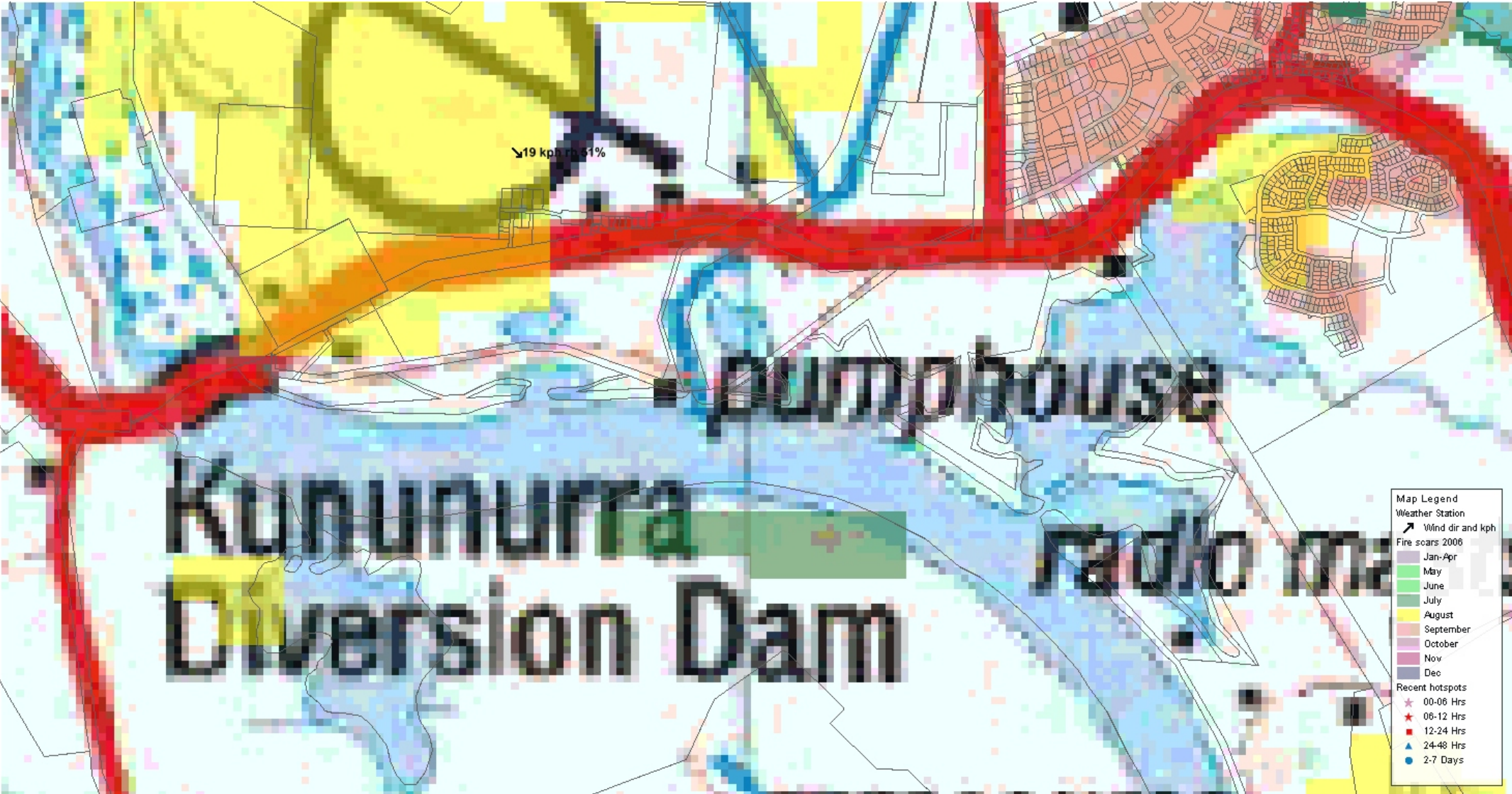
Certainty (of correct species identification): 1=Very certain; 2=Moderately certain; and 3=Not sure.

Seen: Number of individuals observed.

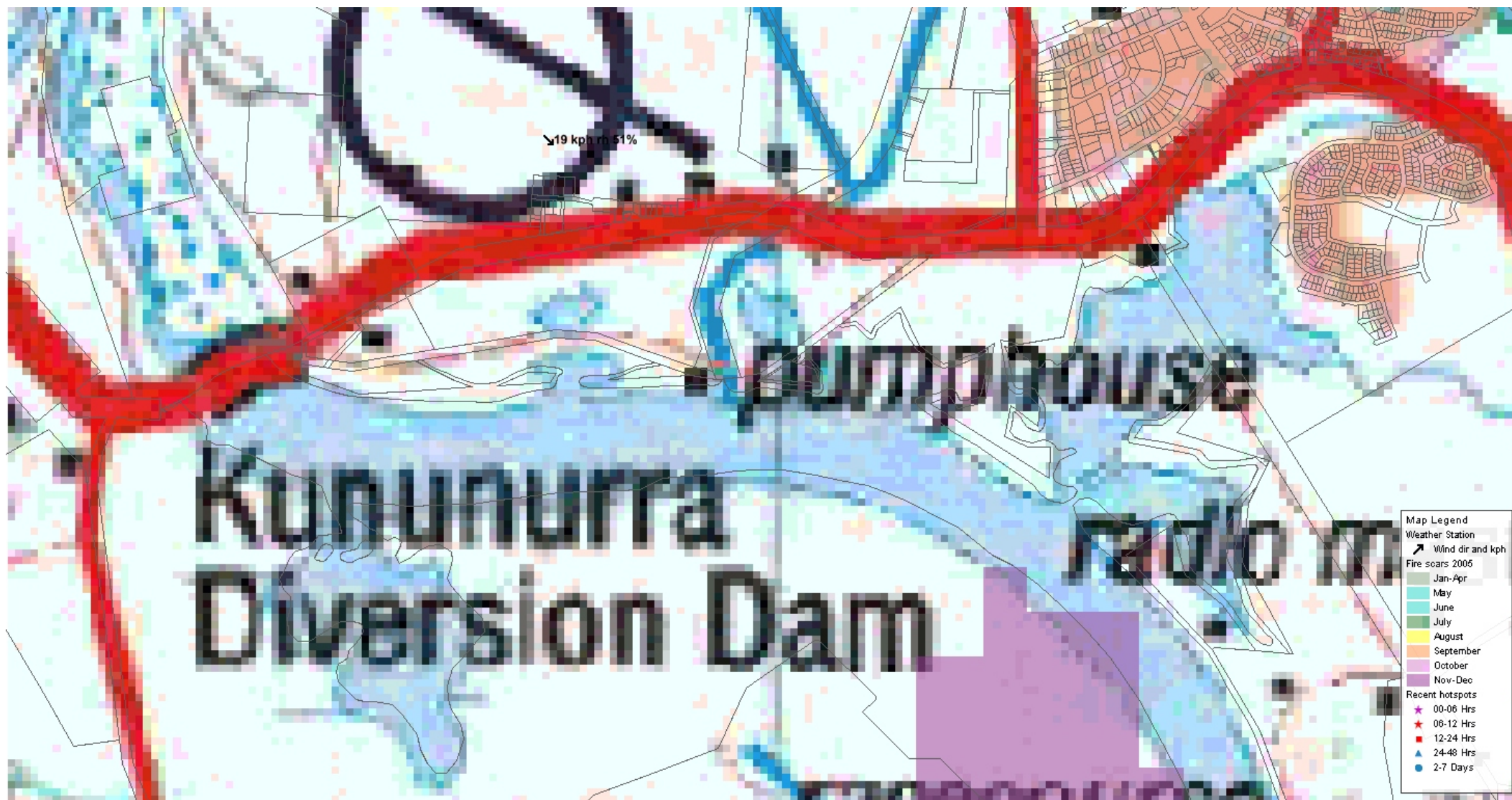
Location Name: Name of reserve or nearest locality where observation was made

Method: Method or type of observation

Appendix 6: fire scar map 2006



Appendix 7: fire scar 2005



Extracted from: <http://www.firenorth.org.au/nafi/app/init.jsp>