PRINCIPLES FOR TREATING WATER SAVINGS AND ENVIRONMENTAL ALLOCATIONS

Principle 1. Arrangements should be put in place which provide incentives to water users to improve the efficiency of water use in the Basin.

Principle 2. Ownership of savings shall be retained by the 'owner' of the entitlements from which the saavings are made. In particular:

- farmers own savings made on the farm,
- irrigation districts own savings between the district off-take and the 'farm gate', and
- system losses (ie. losses upstream of the district off-takes) are owned;
  - by South Australia where losses occur in the South Australian section of the Murray, and
  - equally by Victoria and New South Wales where the losses occur from the 'upper River Murray' (in which event, in accordance with the MDB Agreement, South Australia would share those savings), and
  - by the States where losses occur from their tributaries.

Principle 3. The owners of savings may agree to share their savings with other parties (usually apportioned according to funding arrangements).

Principle 4. Before any water savings can be translated into new entitlements and sold it must be clearly demonstrated that the water savings:

- can be achieved across a range of seasonal conditions,
- do not reduce the security of other users, and
- do not diminish environmental values.

Principle 5. Savings from water usage that has been accounted for under the Cap may be re-allocated under the Cap.

Principle 6. The Cap must be adjusted before savings from water usage that has **not** been accounted for under the Cap is re-allocated for consumptive use.

Principle 7. Only those environmental allocations which are comparable to other consumptive water entitlements may be traded.

Principle 8. Environmental allocations will only be considered for trading where it can be shown that the environment benefits from the trade.

Principle 9. Returns of environmental allocations may be tradeable where –

- the initial allocation has been quantified at the off-take point,
- the volume of the returned water can be accurately determined and guaranteed,
- the quality of the returned water is acceptable, and
- the returns are predictable and useable.

Principle 10. Consumptive use of environmental allocations (refer Principle 7) should be included as diversions for the purpose of defining and implementing the Cap.

These principles are also reflected in a draft set of water sharing principles developed by the NSW Government to provide an interim policy platform for the further development of water sharing arrangements. Principle 9 states that:

> *The benefits flowing from on-farm water efficiency gains and those involving works which are fully funded by the holder of water rights should remain with the holder, and all other efficiency gains should remain with government.*

Over the last two years, DLWC and the NSW Murray Wetlands Working Group (MWWG) have sought to have water savings from the rehabilitation of Moira Lake quantified and recognised. These efforts have resulted in the recent allocation of the water savings as a trial to gauge the adequacy of arrangement for managing the water savings. This trial will be managed by DLWC and the MWWG over the next two years. While the trial is not intended to set a precedent, it has been developed to ensure the management of future water savings will provide benefits for the river system, and will be crucial in establishing rules for managing future water savings.

APPENDIX 6.
DEFINITION OF A RIPARIAN RIGHT

WATER ADMINISTRATION ACT

SECTION 7

RIGHTS OF OCCUPIERS OF RIPARIAN LAND

7. (**1**) Subject to subsections (1A) and (2), the occupier of land which forms the bank of a river or a lake has the right, without the need to obtain a license -

(a) to take and use the water then being in the river or lake -

(i) for domestic purposes;

(ii) for the purpose of watering stock;

(iii) for the purpose of irrigating gardens, not exceeding 2 hectares in area in the aggregate, which are cultivated in connection with the use of not more than one dwelling-house and of which the produce is not sold, bartered or exchanged or exposed or offered for sale, barter or exchange; and

(iv) for the purpose of irrigating land, not exceeding 2 hectares in area, which is used for the growing of crops or pastures to produce fodder for animals kept solely in connection with the use of not more than one dwelling-house.

(b) to construct or use for the purpose of taking or using water for any of the purposes specified in paragraph (a) a work to which this Part extends, but only if the capacity of the work does not exceed 50 litres per second or, if a lesser capacity is prescribed in relation to the river or lake, or to the part of it, from which the water is taken, that lesser capacity; and

(c) to construct or use a dam or an excavation in the river or lake or a work which obstructs the flow of water in the river, but only if -

(i) the storage capacity of the dam, excavation or work does not exceed 7 megalitres or, if a lesser capacity is prescribed in relation to the river or lake, or to the part of it, in which the dam, excavation or work is constructed, that lesser capacity;

(ii) the dam, excavation or work will not, in the opinion of the Ministerial Corporation, detrimentally affect the interests of any person; and

(iii) where, by notice given to the occupier by one of the methods specified in subsection (2), the Ministerial Corporation has directed that a means of passing a flow of water through or past the dam, excavation or work be provided - that means of passing a flow has been provided.

(**1A**) The occupier of land which forms the bank of a river or a lake shall not, after the date of assent to the Water (Amendment) Act, 1983, have the right, otherwise than pursuant to a license, group license, authority or permit -

(a) to construct a dam or an excavation in the river or lake or a work which obstructs the flow of water in the river; or

(b) to use any such dam, excavation or work constructed after that date,

unless -

(c) the storage capacity of the dam, excavation or work does not exceed 7 megalitres or, if a lesser capacity is prescribed in relation to the river or lake, or to the part of it, in which the dam, excavation or work is constructed, that lesser capacity; and

(d) that occupier so constructs or uses, as the case may be, the dam, excavation or work for one or more of the purposes specified in subsection (1)(a) and for no other purpose.

(**2**) Where the Ministerial Corporation is satisfied that any such occupier taking or using water in a river or lake in the exercise of the right conferred by subsection (1) is wasting the water so taken or where the water is being taken or used in a manner prescribed as being wasteful or where the Ministerial Corporation deems it necessary by reason of an actual or threatened shortage of water in any river or lake or suspend or modify the said right the Ministerial Corporation may give the occupier notice -

(a) personally; or

(b) by leaving the notice with any person apparently above the age of fourteen years resident or employed on the land of the occupier; or

(c) by registered letter addressed to the occupier at his address last known to the Ministerial Corporation,

that after the expiration of a period specified in the notice it is the intention of the Ministerial Corporation to suspend or modify the said right; and at the expiration of the period so specified the said right shall be deemed to be suspended or modified as stated in the said notice unless the Ministerial Corporation shall have annulled or withdrawn the notice in the meantime.

3-5 (3)-(5) Repealed.

(**6**) Subsection (1) does not, with respect to a lake, confer on any occupier referred to in that subsection any right of access over or to the user of land not lawfully occupied by him.

(**7**) Any person who at the date of the commencement of the Water (Amendment) Act, 1930, is using under the powers conferred by the Acts relating to mining, or has the right to construct and use under the said Acts any work to which this Part extends, may enjoy and exercise such right to the extent to which he would have been able to enjoy and exercise it had the said Water (Amendment) Act, 1930, not been enacted, subject to the power of the Ministerial Corporation in the public interest to control temporarily, stop, or regulate at any time as in its opinion the circumstances warrant, any diversion of water made by him in the exercise of the right hereby conferred, from any river or lake which flows through or past or is situate within the land of two or more occupiers;

Providing that any such person shall not make in or in connection with any such existing work any alteration which would materially and prejudicially affect the quantity or quality of water in any such river or lake, unless such person shall first have obtained in respect of such alteration a license under this Part or unless the said proposed alteration is rendered necessary for maintenance or by reason of sudden or unforeseen emergency.

APPENDIX 7.
ESTIMATE OF ENVIRONMENTAL ALLOCATION FOR THE WANGANELLA SWAMP SYSTEM

Summary
This paper quantifies the water requirements for the Wanganella Swamp system following a natural flood event, and the commencement of waterbird breeding or the existence of other environmental requirements. Estimation of the environmental allocation involved an assessment of the volume, timing, duration, frequency and potential source of this flow. These details are discussed below.

- **A trigger flow of ≥400 ML/day at Warriston Weir (>1, 400 ML/day at Jerilderie) for at least 30 days during September, October and/or November** has been identified as an indication that waterbird breeding may be initiated and an environmental flow required.

- Estimates indicate that an **environmental flow is likely to be required 1 in every 3-4 years** to improve current waterbird breeding success.

- An environmental flow may be required to maintain water levels during **October, November, December and January (modelled average requirement ≈33 days).**

Background
Currently, State Water manages flows in Forest Creek to achieve a target replenishment flow of 100 Ml/day over Warriston Weir (50km upstream of Wanganella Swamp). An allowance has been made in these calculations for a future reduction in the replenishment flow to 80 Ml/day.

Trigger flow and frequency
A trigger flow of ≥400 Ml/day at Warriston Weir (>1, 400 Ml/day at Jerilderie for at least 40 days during September, October and/or November has been identified as an indication that waterbird breeding may be initiated, and an environmental flow required to enhance breeding success.

This trigger was determined using flow records for Warriston Weir (1980-98). The peak flow was identified for a relatively dry year when some waterbirds bred successfully (400 Ml/day), and an assessment made of the number of days this flow was achieved during 1989/90 (a 'small wet' season) (40 days).

The trigger flow of ≥400 ML/day at Warriston Weir for at least 40 days was applied to flow records for Warriston Weir (1980-1998) to determine how often an environmental flow (as identified in Table 1 below) would have been required (Table 2).

Of the 18 seasons assessed in Table 1, the trigger flow was met in 8 out of 18 years. Of these 8 years:

a) 3 years were wet enough that an environmental flow was not required; and
b) 5 years would have required an environmental flow.

This assessment shows that some waterbird species could have bred approximately 1 in every 2 years (8 in 18 years) (a & b)**. However, an environmental allocation would only have been required 1 in every 3-4 years (5 in 18 years) (b).**

Environmental flow requirements

a) Volume

Preliminary estimates indicate that **an environmental allocation of up to 4, 000 ML** (over four months) is required.

This figure is based on flow records at Warriston Weir (1980-1993), and an assessment of the maximum additional water that would have been required during this period to top up flows to the following volumes:

Table 1 *The average daily environmental flow estimated to be required at Warriston Weir.*

	Average Daily Flow (Ml/day)
October	80 (base flow) + **100 (environmental flow)**
November	80 (base flow) + **80 (environmental flow)**
December	80 (base flow) + **60 (environmental flow)**
January	80 (base flow) + **20 (environmental flow)**

An allowance has been made for losses (35%), and for a future reduction in the base flow at Warriston Weir (estimated as 20 ML/day less than the current flow, over approximately two months). This environmental allocation would be in addition to the existing base flow at Warriston Weir.

Transmission losses were estimated on the following basis:

- Colombo Creek: 35% (summer), 10% (autumn, winter, spring)
- Finley Escape: 10%

b) Timing

Assuming that the trigger flow has occurred and waterbird breeding has commenced or other environmental requirements exist, the base replenishment flow may need to be **topped up with an environmental allocation during October, November, December and January,** to reflect the patterns of flow during a medium sized flood.

High flows are most likely to occur in the Wanganella Swamp system during September/October. An environmental allocation is likely to be required over four months to ensure that important wetland processes are maintained, and to allow successful waterbird nesting and fledging of young (Table 3).

c) Duration

An assessment using historical flow data for Warriston Weir (1980-93), showed the modelled average requirement for an environmental allocation to be 33 days (ranging from 8 to 56 days).

Table 2. *Calculation of the frequency of a trigger flow occurring and the environmental flow required at Warriston Weir. Calculations based on flow records for Warriston Weir from 1980-1998.*

	1980/81	**1981/82**	**1982/83**	**1983/84**	**1984/85**	**1985/86**	**1986/87**	**1987/88**	**1988/89**	**1989/90**	**1990/91**	**1991/92**	**1992/93**	**1993/94**	**1994/95 ***	**1995/96 ***	**1996/97 ***	**1997/98 ***
No. of days when a flow of > 400Ml/day was exceeded	0 days	66 days	0 days	57 days	60 days	14 days	55 days	7 days	18 days	41 days	68 days	48 days	94 days	no data	0 days	30 days**	30 days**	0 days
No. of days when the following environmental flow was required at Warriston Weir: 100Ml/day (Oct) 80Ml/day (Nov) 60Ml/day (Dec) 20Ml/day (Jan)		0 days		0 days	44 days (12 Nov – end Jan)		8 days (26 Nov – end Jan)			42 days (6 Oct – end Jan)	28 days (16 Oct – end Jan)	56 days (25 Oct – end Jan)	0 days					
Volume required to maintain the environmental flow during Oct, Nov, Dec, Jan.		not req.		not req.	968 Ml		246 Ml			1404 Ml	482 Ml	1736 Ml	not req.					
SUMMARY FOR EACH YEAR	no trigger	no flow req	no trigger	no flow req.	FLOW REQ.	no trigger	FLOW REQ.	no trigger	no trigger	FLOW REQ.	FLOW REQ.	FLOW REQ.	no flow req.		no trigger	no trigger	no trigger	no trigger

* data taken from Jerilderie because operation of offtake regulator may have excluded natural high flows from Forest Creek
** some missing data

Table 3. *Breeding characteristics of common waterbirds and minimum flood necessary for completion of breeding (Green, 1994).*

Species	Breeding season (inclusive)	Incubation period	Fledgling period	Minium flood required*
Great Crested Grebe	Nov-Jan	27-29 days	71-79 days	4.5 months
Australian Pelican	No regular season	35-38 days	90 days	4.5-5 months
Darter	?	26-30 days	50 days	4 months
White-faced Heron	Oct-Dec	24-25 days	38-42 days	3.5 months
Pacific Heron	Sep-Jan	?	?	?
Cattle Egret	Nov-Jan	22-26 days	30 days	3 months
Great Egret	Oct-Dec	25-26 days	42 days	3.5 months
Little Egret	Nov-Jan	21-22 days	40-45 days	3.5 months
Plumed Egret	Nov-Jan	24-27 days	35 days	3 months
Nankeen Night Heron	Sep-Apr	22 days	42-49 days	3.5 months
Little Bittern	Oct-Dec	16-21 days	25-30 days	2.5-3 months
Brown Bittern	Sep-Jan	?	?	?
Glossy Ibis	Oct-Dec	21 days	28 days	2.5 months
Sacred Ibis	Aug-Nov	20-25 days	28-35 days	2.5-3 months
Straw-necked Ibis	Aug-Jan	20-25 days	2835 days	2.5-3 months
Royal Spoonbill	Jul-Nov	25 days	28-35 days	3 months
Yellow-billed Spoonbill	Jul-Nov	?	?	?
Plumed Whistling Duck	Jan-May	28 days	?	?
Black Swan	Jul-Nov	35-45 days	113-160 days	6-8 months
Freckled Duck	Sep-Dec	26-28 days	63 days	4 months
Mountain Duck	Jun-Nov	30-35 days	?	?
Black Duck	Jul-Oct	26-28 days	47-59 days	3.5-4.5 months
Grey Teal	Aug-Nov	24-26 days	42 days	3.5 months
Chestnut Teal	Jun-Dec	26-28 days	56 days	4 months
Blue-winged Shoveller	Jul-Dec	24 days	?	?
Pink-eared Duck	No regular season	26 days	?	?
Hardhead	Sep-Dec	25 days	?	?
White-eyed Duck	Oct-Dec	25 days	?	?
Wood Duck	Sep-Nov	28 days	?	?
Blue-billed Duck	Sep-Dec	26-28 days	56 days	4 months
Musk Duck	Jun-Dec	?	?	?
Marsh Crake	Aug-Dec	14-16 days	35 days	2.5 months
Spotted Crake	Aug-Dec	?	?	?
Spotless Crake	Aug-Dec	19-22 days	?	?
Black-tailed Native Hen	No regular season	?	?	?
Dusky Moorhen	Sep-Dec	?	?	?
Purple Swamphen	Jul-Dec	23-25 days	?	?
Eurasian Coot	Sep-Dec	23-26 days	?	?
Brolga	Sep-Dec	32 days	?	?

*** Minimum flood required has been estimated from addition of the incubation and fledgling periods, plus approximately 4 weeks to allow for mating and nest building.**

APPENDIX 8.

CORRESPONDENCE FROM THE ENVIRONMENTAL CONTINGENCY ALLOWANCE (ECA) SUBCOMMITTEE OF THE MURRUMBIDGEE RIVER MANAGEMENT COMMITTEE

MURRUMBIDGEE RIVER MANAGEMENT COMMITTEE

Chair: Prof. Kath Bowmer, Locked Bag 588, Wagga Wagga 2678, P: 02 6933 2221 F: 02 6933 2060
Executive Officer: Jane Shields, PO Box 10, Wagga Wagga 2650 – P: 026923 0509 F: 02 6931 0395

ECA Sub-Committee

11th February 2000

Mr Colin Mc Crabb
Chairman
Forest Creek Management Plan Working Group

Dear Mr McCrabb

Wanganella Swamp system – access to environmental flows

Thank you for taking the time to attend the recent meeting of the ECA Sub-Committee to discuss the above matter. The Sub-Committee appreciated the presentation by Helen Glazebrook and the opportunity to visit Wanganella Swamp.

As discussed the endeavours of the Forest Creek Management Plan Working Group to use water savings as an environmental allocation for the Wanganella Swamp is supported by the Sub-Committee. This support is in line with the Sub-Committee's objective to provide wetland watering in the Murrumbidgee. However, it should also be noted that, to date, the principles for ECA water release have focussed on restoring some of the natural flooding regime of wetlands on the main river system.

It is recognised that the natural flooding pattern of Wanganella Swamp has been significantly changed by regulation. Essentially, regulation has provided more frequent flooding than under natural conditions, as previously this would onlky been inundated when the Murrumbidgee River was in flood or there was significant rainfall in the Billabong Catchment.

However, as outlined in the presentation Wanganella Swamp is recognised for its current ecological value in the catchment.

The ECA Sub-Committee would be prepared to consider the use of ECA water in the event that the anticipated water savings are not as great as predicted.

Included with this letter is an excerpt from the Minutes of the Sub-Committee as well as a copy of an Explanation of the Murrumbidgee Environmental Flow Rules for the information of your Working Group.

I look forward to hearing about the progress of the Forest Creek Management Plan.

Yours sincerely

Jane Shields
Executive Officer
Chair, ECA Sub-Committee

The ECA Sub-Committee is:

Michael Schultz:	Nature Conservation Council and Murrumbidgee Field Naturalists, Riverina Nature Environment Council
Dick Thompson	Murrumbidgee Catchment Management Committee (MCMC), and Chair, Murrumbidgee Irrigation
Tim Fisher	Australian Conservation Foundation
John Searson	NSW Agriculture
Roger Good	National Parks and Wildlife Service (NPWS)
Geoff Fishburn	Department of Land and Water Conservation
Mick Bales	Environment Protection Authority
Allan Lugg	NSW Fisheries

APPENDIX 9.
DELIVERY OF AN ENVIRONMENTAL ALLOCATION FOR THE WANGANELLA SWAMP SYSTEM

1. ISSUE
This paper has been prepared to highlight the importance of access to an environmental allocation for the Wanganella Swamp system, and to identify several options for the delivery of this water. It discusses the current water supply system, future water delivery scenarios including the possible use of the Murray Irrigation channel system, and the potential for sharing the delivery of environmental flows between the Murrumbidgee and Murray valleys.

Calculations indicate that an environmental allocation is likely to entail a supply of up to 4,000 Ml (flow + losses) between October and January inclusive (≈110 days maximum), 1 in every 3-4 years. This could represent an environmental flow of between 100 Ml/day in October, through to 20Ml/day in January. This would be in addition to a regulated base flow of 80 Ml/day at Warriston Weir (Appendix 5).

2. BACKGROUND
As part of the development of the Forest Creek Management Plan, a workshop was held in June 1999 to discuss the future management of this system. An important outcome to emerge from the workshop was the need to investigate the possibility of accessing environmental flows through the MIL channel system. In contrast to the delivery of flows via Colombo Creek, this option would enable a more rapid response to waterbird breeding, and would minimise transmission losses.

The demand for an environmental flow will overlap with the demand for irrigation water, and the difficulties this presents will vary according to seasonal conditions. However, sharing the delivery of an environmental flow between the Murrumbidgee and Murray valleys (via Colombo Creek and the channel system) may be the most practical way of addressing potential delivery difficulties.

3. OPTIONS FOR THE DELIVERY OF AN ENVIRONMENTAL FLOW
a) Current water sources
There are currently three sources of water for the Wanganella Swamp system.

Murrumbidgee catchment	
1. Colombo Creek	• Carries regulated and unregulated flows from the Murrumbidgee River
Murray catchment	
2. Billabong Creek	• Carries unregulated flows from the Billabong Creek catchment
3. Finley Escape (off Mulwala Canal)	• Supplements flows in Billabong Creek below Jerilderie and Forest Creek during the irrigation season

Colombo Creek: Colombo Creek is an inefficient carrier of water because of significant transmission losses. Transmission losses are in the order of 35% during the summer months. It is a relatively shallow watercourse and either side of the creek is lined with cumbungi. Depending on seasonal conditions it may be difficult to deliver both irrigation supplies and environmental flows. Bank-full capacity in Colombo Creek at Morundah is 600-650 Ml/day (*pers. comm*. Nicholls, 1999). Current entitlement on Colombo Creek is 16,425 Ml for the

purposes of stock, domestic, irrigation and town water supply (DLWC Stream Book, 29/9/1999).

In addition to capacity constraints and transmission inefficiencies, the travel time from the Yanco Creek offtake on the Murrumbidgee River to the Wanganella Swamp is approximately six weeks. It is very difficult to predict environmental flow requirements this far ahead.

Billabong Creek: Flood peaks in Billabong Creek tend to be of relatively short duration. The Billabong Creek catchment cannot always be relied upon to provide sustained, high flows after a flood event.

Finley Escape: Since the 1994/95 season, delivery of water via the Finley Escape has been used to supplement flows in Billabong Creek below Jerilderie and Forest Creek during the irrigation season (*pers. comm*. Jayawickrama, 1999). Due to the constraints of Colombo Creek and increasing irrigation demands, this supplementary flow has become a significant source of water for those systems.

b) Scenarios for the delivery of an environmental flow

Based on current knowledge of both the Colombo/Billabong Creek system and the channel system, **several scenarios** are presented for delivery of environmental flows to the Wanganella Swamp system. Each scenario is based on the following circumstances, which reflect likely on-ground conditions:

- the commencement of waterbird breeding is observed in mid-September;
- a base flow of 80 Ml/day at Warriston Weir is being supplied;
- an environmental flow of 100 Ml/day (Oct), 80 Ml/day (Nov), 60 Ml/day (Dec) and 20 Ml/day (Jan) at Warriston Weir is requested in addition to the base flow;
- transmission losses are based on 35% (summer) and 10% (autumn, winter, spring) in the Colombo/Billabong Creek system; and 10% in the channel system.

Scenario 1 **Delivery via Finley Escape (≈110 days)**
Scenario 2 **Delivery via Colombo Creek (90 days)**
Scenario 3 **Delivery shared between Finley Escape and Colombo Creek (≈110 days)**

A summary of these scenarios suggests that the most efficient delivery of environmental flows is via Finley Escape (**Scenario 1**). Although transmission losses are lower in Scenario 2 due to the shorter duration of supply (it is impractical to supply for more than 90 days due to the travel time delay), it is possible that rapidly falling water levels may cause waterbirds to abort their nests before the arrival of the environmental flow in early November. Consequently, Scenario 2 is likely to be least successful in terms of achieving improved waterbird breeding success.

Both **Scenarios 1 and 3** provide for a relatively rapid response to a breeding event as environmental flows are initially delivered via the Finley Escape. This response can be very important if tapering of an unregulated peak flow is required. However, there may be more potential for overlap with irrigation demands **in Scenario 1** (using only the Finley Escape). This is because in **Scenario 1** the environmental flow is delivered until the end of the first week in January (three weeks travel time means this will ensure supply at the Swamp until end January). Whereas, in **Scenario 3**, environmental flows are only delivered until mid-December (due to the six week travel time, this flow will maintain water levels at the Swamp until the end of January). The accuracy of the overlap with irrigation requirements in these scenarios is problematic, given that seasonal conditions play an important part in the timing of this overlap.

In summary, it would appear that delivery shared between Finley Escape and Colombo Creek (**Scenario 3**) offers a combination of a rapid response to waterbird breeding and the least potential overlap with irrigation requirements. Transmission losses are only marginally higher than in Scenario 1 (delivery via the Finley Escape only).

4. HOW COULD ENVIRONMENTAL FLOWS BE DELIVERED VIA THE MURRAY IRRIGATION CHANNEL SYSTEM?

Several options have been identified for the delivery of environmental flows via the channel system:

- Modifications have previously been made to the escape structures on Finley Escape so that this channel can carry up to 250 Ml/day.
- Wollamai Escape drops directly into Forest Creek several kilometres downstream of the Forest Creek offtake. It may be possible to deliver the water in several small channels directly to Forest Creek via the Wollamai Escape. However, using a number of channels presents a greater opportunity for water losses, and increases the likely requirement for additional structural modifications.
- Opportunistic use of rainfall rejection via the channel system where appropriate.

5. WHAT ARE THE BENEFITS OF ACCESSING FLOWS THROUGH THE CHANNEL SYSTEM?

- Access to an environmental flow through the channel system facilitates a comparably rapid response to waterbird breeding. Travel time from the Mulwala Canal to Wanganella Swamp (via Finley Escape) is approximately three weeks, compared with approximately six weeks from the Murrumbidgee River to Wanganella Swamp (via Colombo Creek).
- The channel system is a more efficient carrier of water than a natural watercourse. Therefore, delivery of water through the channel system would minimise transmission losses.
- Strain on the Colombo/Billabong Creek system could be minimised if the channel system was used in conjunction with Colombo Creek to deliver environmental flows. Depending on seasonal conditions, demand for irrigation water can mean that Colombo Creek is running at capacity during early October, and late December through to mid-January.

6. WHAT OPERATIONAL ISSUES HAVE BEEN IDENTIFIED?

Several suggestions have been made regarding the feasibility of delivering environmental flows via the channel system, and operational rules that may be appropriate:

- The MIL channel system is filled from approximately mid-August. Key times of maximum irrigation demand on both the channel system and the Colombo/Billabong Creek system are generally during the first three weeks of October (spring watering and filling rice bays), and from the end of December to mid-late January, depending on seasonal conditions. This indicates that it may only be possible to reliably deliver environmental flows from the last week in October to the third week in December (ie. 8 weeks or 60 days). Sharing the delivery of environmental flows between Colombo Creek and the channel system may be the most practical way of addressing potential supply difficulties.
- What would be the cost to the Department of delivering this environmental allocation?

- A proposed action with the management plan is that relevant agency representatives meet annually to review environmental requirements for the Forest Creek system, and the most appropriate means of delivering flows to meet these requirements.
- MIL has indicated that they are prepared to consider delivering environmental flows under the same conditions that they currently deliver a supplementary flow to Billabong Creek during the irrigation season. These conditions are that MIL customers receive their water requirements as a priority and that DLWC credit MIL for the water delivered (including an allowance for transmission losses) (*pers. comm*. Watts, 1999).
- Finley Escape is recognised within MIL's Licence (IC2) as a credited escape, which would facilitate the arrangement for delivering environmental flows.
- The request for environmental flows should come through State Water, in the same way that they currently request supplementary flows via Finley Escape for Billabong Creek. State Water would need to account for this water (*pers. comm*. Watts, 1999).
- State Water has suggested that the easiest way for it to manage an environmental flow to the Wanganella Swamp system is to have a target flow identified at Warriston Weir (*pers*. *comm*. Nicholls, 1999).
- As the Wanganella Swamp system is a 'flow-through' system there is potential for a portion (≈ 50%) of the environmental flow to be returned to Billabong Creek and re-credited for downstream use.

APPENDIX 10.
SUMMARY OF BORE LOG INFORMATION

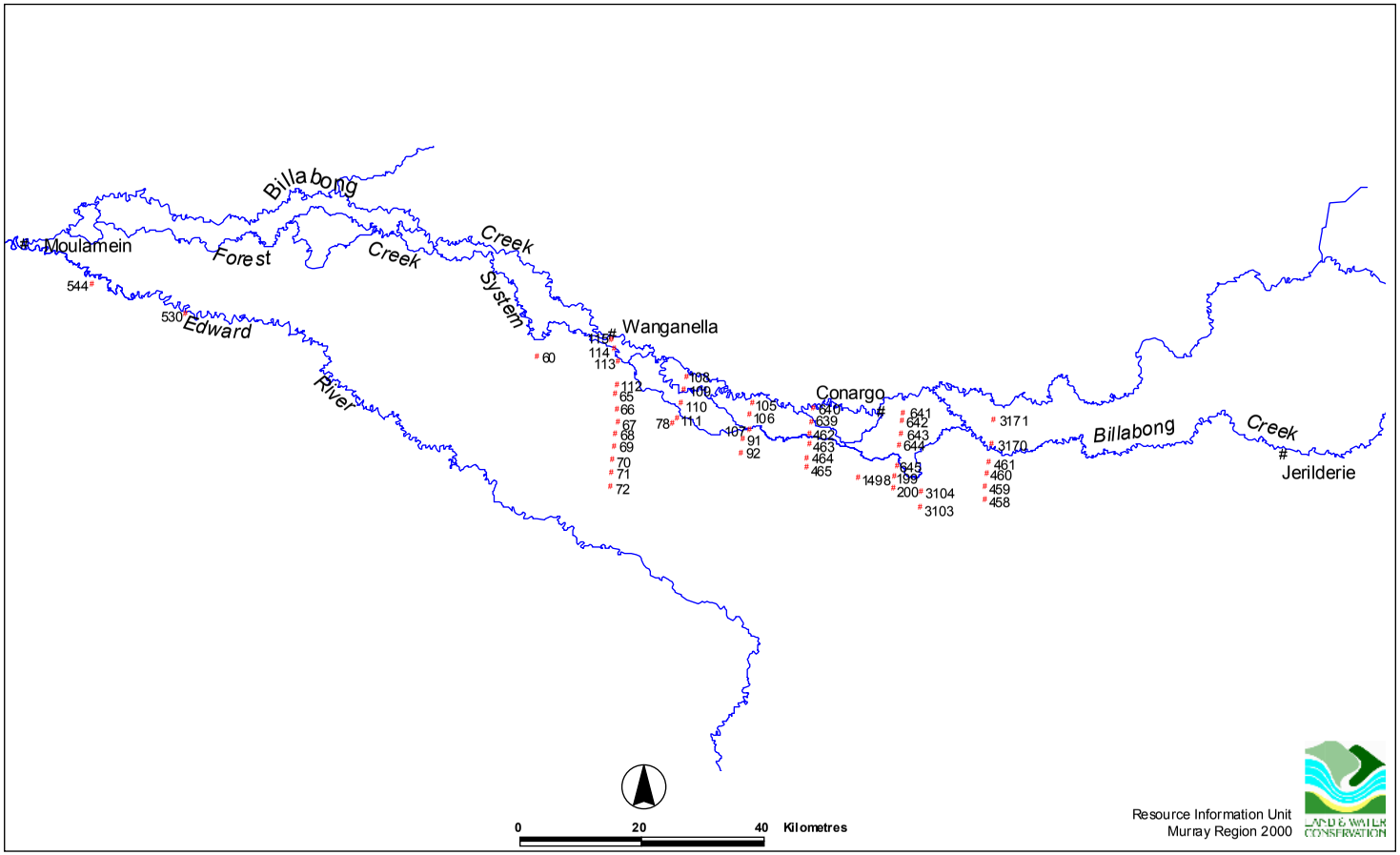

Figure 1. *Location of existing groundwater bores in the vicinity of the Forest Creek system.*

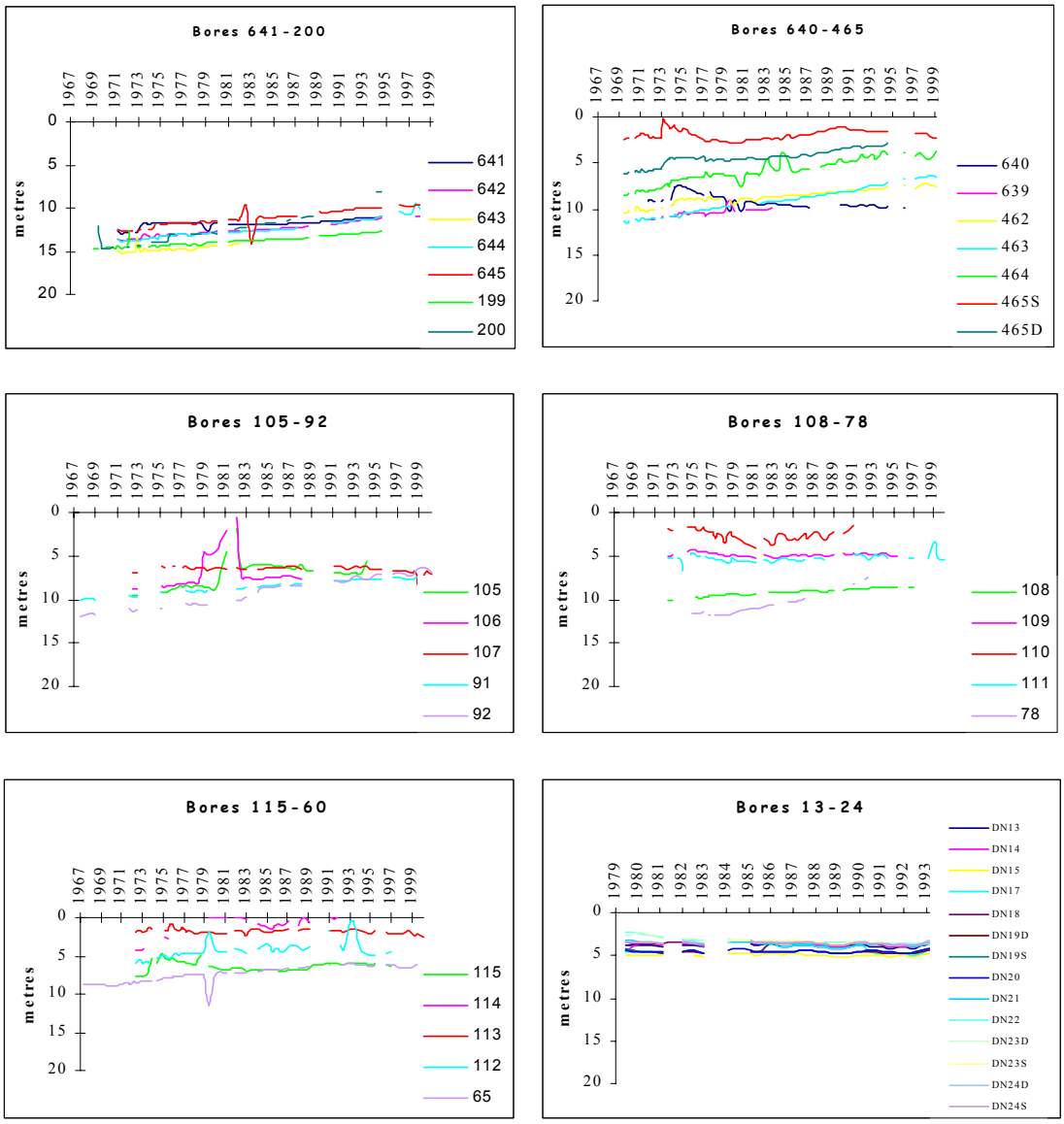

Figure 2. *Summary of groundwater readings from bores in the vicinity of the Forest Creek system between 1967 and 1999.*

APPENDIX 11.

NATIVE VEGETATION INCENTIVE PROGRAMS IN THE MURRAY CATCHMENT (from a brochure produced by the Murray Catchment Management Committee)

What you get …	Murray CMC/Greening Australia Fencing Incentives Program	DLWC Management Contracts	DLWC Property Agreements - fixed term	DLWC Property Agreements 60 years + to in perpetuity	NPWS Voluntary Conservation Agreements	RLPB Billabong Creek Renascence Project [1]	Holbrook Landcare Rebirding Project [2]	WWF/NHT Grassy Eco-systems Grants
Site inspection (to determine eligibility)	√	√	√	√	√	√	√	ϕ
Incentive payment for fencing ($1200/km)	√	√				√	√	√
Incentive payment for revegetation – shrubs and seedlings (up to $250/ha)	√	√			√		√	
Full material costs (including fencing and re-vegetation)			√	√				
Full material and labour costs				√	√			
Weed and pest control within native vegetation area/s		√	√	√	√			√
Alternative watering points for stock			√	√	√	√		
Rate and land tax relief					√			
What you sign up to…								
Signed Agreement	√	√	√	√	√	√	√	√
Registered on title - fixed term			√					
Registered on title - in perpetuity (forever)				√	√			
How long it takes to process…								
Approximate process time	30 days	40 days	3-6 months	3-6 months	1-2 years	30 days	Immediate	3 months

[1] Available to landholders along Billabong Creek and its tributaries within the Hume & Murray RLPB areas. [2] Available to landholders in the Holbrook district.

ϕ Written application. **Please note:** As at 1 May 2000, budgets are fully allocated. Draft Contracts/Agreements can still be prepared. However, landholders will be placed on a register and finalisation & payment will not be made until additional funds become available.

APPENDIX 12.

LIST OF STRUCTURES ON THE FOREST CREEK SYSTEM

This list supplements information stored on the DLWC Murray Structures Database. This database is currently being updated through the NSW Weir Review process.

NAME OF STRUCTURE	LOCATION	LICENCE NO.	ORIGINAL PURPOSE
CLARKES CREEK			
Offtake Regulator		-	Control diversions into Clarkes Creek
Un-named Dam		7646	Conservation of water for stock
Un-named Dam		6314	Conservation of water for stock.
Bonney's Dam		3515	Conservation of water for stock.
Un-named Dam		4292	Conservation of water for stock.
Un-named Dam		7235	Conservation of water for stock.
Un-named Dam		6882	Conservation of water for stock.
Bull Paddock Dam		7838	Conservation of water for stock.
Un-named Dam		7646	Conservation of water for stock.
EIGHT MILE CREEK			
Junction Dam (Back 10 Mile Weir)	Peppinella	State structure	Permit increased diversions to Eight Mile Creek.
Four Mile Dam (block bank and bywash)	Wanganella	Lapsed (3592)	Conservation of water for stock.
Five Mile Dam (block bank and bywash)	Wanganella	Lapsed (2408)	Conservation of water for stock.
Eight Mile Dam (Brocken Weir) (block bank and bywash)	Wanganella	Lapsed (943)	Conservation of water for stock.
ESTUARY CREEK			
Estuary Creek Regulator	Wanganella	State structure	To divert water away from Cobb Highway during high flows, and help manipulate water levels in Wanganella Swamp when required.
Un-named Weir	Wanganella	Lapsed (13079)	Conservation of water for stock.
FOREST CREEK			
Forest Creek Offtake Regulator		State structure	Regulate flows to Forest Creek system.
Parry's Dam	Whiporie Park	4037	Conservation of water for stock.
Driver's Dam	Marong	4193	Conservation of water for stock and domestic.
Quiamong Dam	Forest Creek	2067	Conservation of water for stock.
Warriston Weir	Warriston	Lapsed (2410)	Conservation of water for stock and domestic.
Un-named block bank	Warriston	Lapsed (2410	Controls diversions into Picccaninny Creek. This offtake comes out of the Warriston weirpool.
Wanganella Homestead Dam (Cow Paddock Weir)	Wanganella	1323	Conservation of water for stock and domestic purposes.
Pine Grove Dam	Peppinella	4501	Conservation of water for stock.
Mortimer's Weir	Peppinella	State structure	Permit increased diversions to Eight Mile Creek.
Cameron's Weir	Wanganella	3560	Conservation of water for stock.
Jackson's Weir	Wanganella	6301	Conservation of water for stock.

WANGANELLA SWAMP			
McCrabb's Regulator	Avenel	State structure	To improve the success of waterbird breeding by maintaining a stable water level in Wanganella Swamp after a high flow.
FOREST ANABRANCH			
Un-named Dams (2)	Avenel	3883	Prevent return flows to Billabong Creek. Conservation of water for stock.
Zara Dam	Zara	1978	Conservation of water for stock and domestic.
Un-named Dam (Kerribirri Weir)	Barratta	8653	Conservation of water for stock and domestic.
Rhyola Block Dam 1	Rhyola	20405	Prevent return flows to Billabong Creek.
Rhyola Block Dam 2	Rhyola	20405	Prevent return flows to Billabong Creek.
Rhyola Block Dam 3	Rhyola	20405	Conservation of water for stock. Provides access across Kerribirri Creek.
Rhyola Block Dam 4	Rhyola	20405	Prevent return flows to Billabong Creek.
Levee Bank	Rhyola	20405	Prevent return flows to Billabong Creek.
Rhyola Homestead Dam	Rhyola	20405	Conservation of water for stock and domestic. Divert water down Kerribirri Creek.
Daly Dam	Rhyola	9847	Permit diversion of water down Murgha Creek.
Un-named Dam	Woorooma	5694	Conservation of water for stock.
MURGHA CREEK			
Cutting and offtake regulator	Rhyola	State structure	Regulate diversions into Murgha Creek.
Regulators (2)	Inverness	6876	Conservation of water for stock (backs up and holds water in un-named flood runner)
GUM CREEK			
Un-named block banks	Woorooma	5694	Conservation of water for stock.

APPENDIX 13.
GLOSSARY OF TERMS

Allocation — The amount of water a licence holder can extract from the river during a year (does not include off-allocation water). This is calculated by multiplying the amount of entitlement to water of a water licence by the percentage allocation for the current water year (declared by DLWC). This depends on how much water is in the dams and the minimum inflow of tributaries below the dam.

Anabranch — A stream that leaves the river and re-joins it further down.

Biodiversity — The variety of all life forms, comprising genetic diversity (within species), species diversity (between species) and ecosystem diversity.

Block Bank — An earth bank placed in a waterway or on a floodplain to divert water passage.

Cap — A limit on the amount of water which may be diverted from the river for consumptive uses, eg the Murray Darling Basin Ministerial Council announced a cap on water use in the Murray Darling Basin in 1995.

Catchment — The area of land drained by a river and its tributaries.

Channel Capacity — The volume of water which can pass along the river channel at a certain point without spilling over the tops of banks.

Confluence — The point at which two or more streams flow together.

Contingency Allowance — A volume of water reserved in a supply dam for release in response to ecological and/or water quality needs, eg release may be required to maintain water levels in a wetland to enable waterbirds to complete breeding, or to flush an algal bloom.

Dryland Salinity — Accumulation of salt in the soil and water of non-irrigated areas, caused by clearing vegetation in areas with saline watertables; the uptake of water by plants is reduced, allowing the watertable with soluble salts to rise, killing plants and creating bare areas of land prone to erosion.

Ecosystem — Any system in which there is an interdependence upon an interaction between living organisms and their immediate physical, chemical and biological environment, such as a pond, forest or wetland.

Effluent Creek — A creek which leaves a watercourse and does not rejoin it (the opposite of a tributary).

Environment — The *Protection of the Environment Administration Act 1991* defines the environment as:

components of the earth including:

- land, air and water
- any layer of the atmosphere
- any organic or inorganic matter and any living organism
- human-made or modified structures and areas, and includes interacting

natural ecosystems that include components of the above.

Environmental Flows	Flows, or characteristics of flow patterns, which are either protected or created for environmental purposes.
Ephemeral	Temporary or intermittent, for instance a creek or wetland which dries out periodically.
Extraction	Water taken from rivers for off-stream or consumptive use.
Fishway	A structure designed to enable fish to move through a physical barrier (dam or weir) in a waterway. Sometimes called a fish ladder.
Flood Runner	A natural channel in a floodplain which carries flowing water only during a flood.
Floodplain	Flat land adjacent to a river that is inundated when the river overflows its banks during floods.
Floods	Flows which are high enough at their peak to overrun river banks or cause flow through to high-level anabranches, flood runners or wetlands.
Flow Regime	The pattern of flow in river which can be described in terms of quantity, frequency, duration and seasonal nature of water flows.
Freshes	Flows that produce a substantial rise in river height for a short period, but which do not overrun the river banks or inundate adjacent land.
Groundwater	Underground water filling the void in rocks; water in the zone of saturation in the earth's crust.
Habitat	The type of environment in which plants and animals occur.
Hydrology	The study of the distribution and movement of water.
Indicator	Any physical, chemical or biological characteristic used as a measure of environmental quality.
Median value	The middle value in a sequence.
Megalitre (ML)	One million litres.
Natural Flow Regime	The likely pattern of flow before European settlement in Australia.
Off-Allocation Flows	Water which has not been released from storage, but comes from dam spills and/or inflows from tributaries below the dam.
Regulated	A river or creek where water is released from major government-owned storages to meet diversion requirements.
Regulator	A structure used to control the flow of water, for example, diverting water away from the main channel down an effluent stream.

Retaining Bank	A constructed embankment to prevent river overflow.
Riparian Zone	Land which adjoins, or directly influences a body of water.
Tributary	A river or creek which flows into a larger river.
Unregulated	A river or stream where water is not released from major storages to meet user requirements. There may still be dams or weirs built on unregulated streams by private users.
Watertable	The surface of a groundwater body.
Wetland	Areas that are wet for a long enough period such that the plants and animals living in them are adapted to, and often dependent on, living in wet conditions for at least party of their life cycle. The inundation determines the type and productivity of the soils and plant and animal communities.

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