

# DRAFT REPORT FOR THE MONITORING OF THE MULLOON CREEK NATURAL SEQUENCE FARMING DEMONSTRATION

Australian Government National Landcare Program Funding # 56319

MULLOON CREEK NATURAL FARMS,  
KING'S HIGHWAY, VIA BUNGENDORE



Produced by Southern Rivers CMA

June 2008

# DRAFT REPORT FOR THE MONITORING OF THE MULLOON CREEK

## NATURAL SEQUENCE FARMING DEMONSTRATION

June 2008

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## **Mulloon Creek Natural Sequence Farming Demonstration Hosted by Mulloon Creek Natural Farms**

### **Monitoring Update**

#### **OVERVIEW**

This project implements the monitoring for the third demonstration site for Peter Andrew's Natural Sequence Farming approach to landscape restoration. The project is conducted on the 4,300-acre Mulloon Creek Natural farms, which is located on the Southern Tablelands, approximately 40 minutes from Canberra.

#### **Project History**

The Southern Rivers Catchment Management Authority (CMA), Upper Shoalhaven Landcare Group, and Mulloon Creek Natural Farms owner Tony Coote are undertaking a series of state and federally funded projects over the property to rehabilitate and restore many of the ecological functions of the Upper Shoalhaven catchment at Mulloon Creek Natural Farms. Stream hydrology is currently being modified using a system known as "Natural Sequence Farming" and was developed by Peter Andrews, a Hunter Valley farmer.

#### **Site Description**

The site is located on "Mulloon Creek Natural Farms Home Farm", a property located between Braidwood to the east and Queanbeyan to the west on the Southern Tablelands of N.S.W (Figure 1). Mulloon Creek drains northwards from mountains of 1200-1330 m before flowing eastwards to the Shoalhaven River.

The property is within the Palerang Local Government Area, the Southern Rivers Catchment Management Area and is on the Manar 8827-3N 1:25,000 Topographic and Orthophoto mapsheet and the Braidwood 8827 1:100,000 Topographic mapsheet.

The average annual rainfall is approximately 700 mm.

Mulloon Creek has observable degradation, with tree removal, agricultural practises, changes in hydrology (such as swamp and wetland drainage) contributing to moderate to severe erosion, incision of streambank, biodiversity loss and degrading water quality issues.

#### **Environmental Monitoring**

##### **Photo Log and Video Log**

Photo log and video log was established in March 2006 on 21 sites (Figure 2) along Mulloon Creek at 'Mulloon Creek Natural Farms Home Farm' and several control site on downstream property 'Palerang', and one control site at 'Duralla'.

The Monitoring and Evaluation Plan states that the photo-log will be taken pre and immediately post installation of leaky weir structures, and will continue on an annual basis indefinitely. The photo log has been continuing monthly with the most recent photographic log taken in June 2008.

Updated aerial photography has been taken in March 2008 (See Appendix 2 for photographs).



Figure 1: UBD New South Wales map (Scale 1: 600 000)

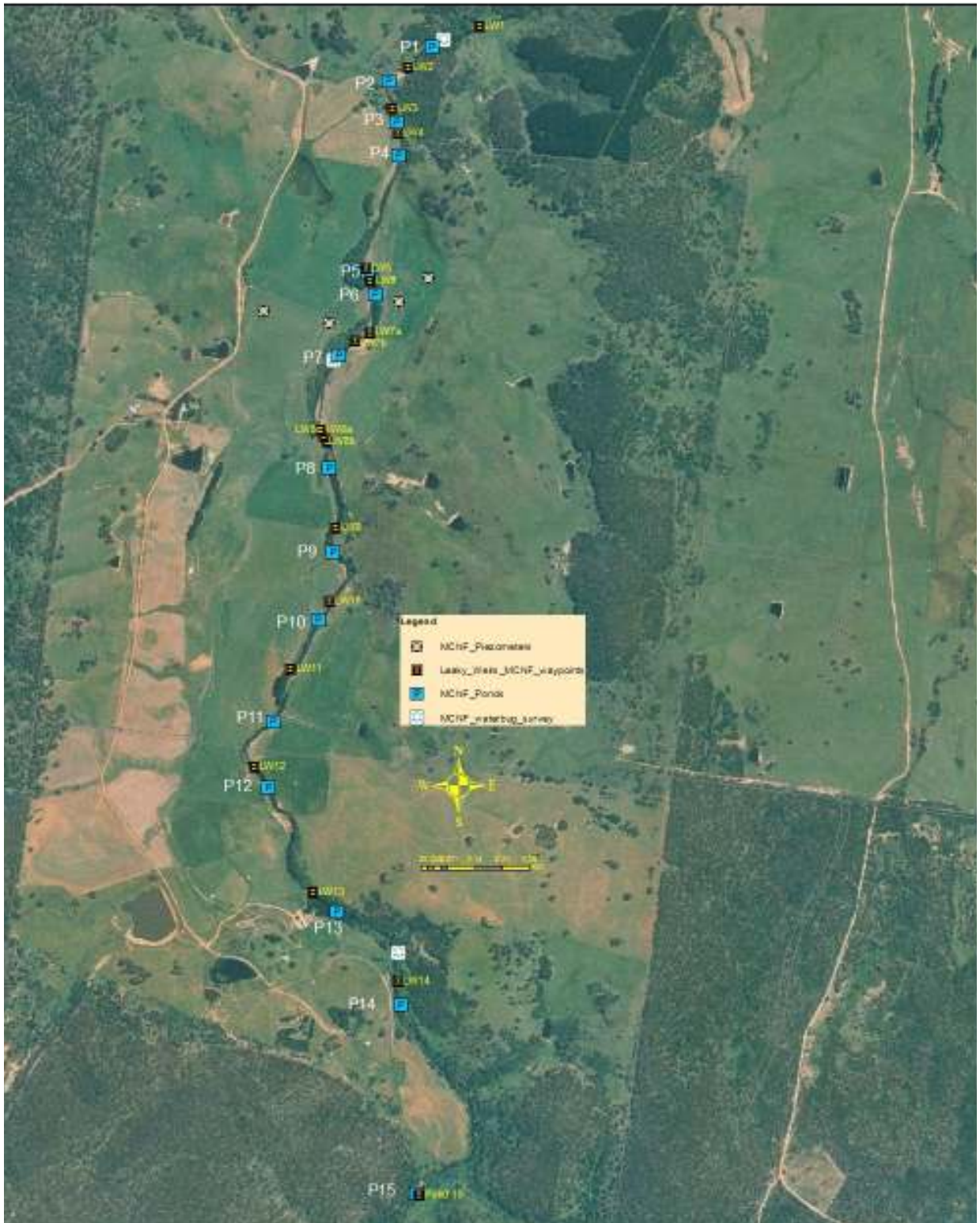
## Hydrology and Hydraulics

### Groundwater

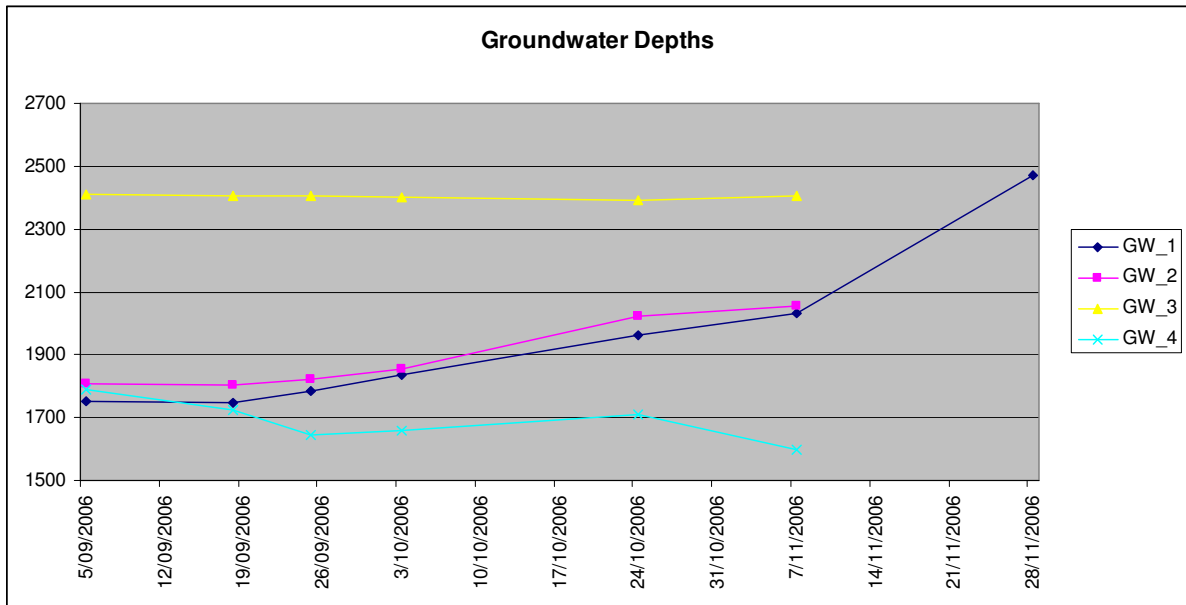
Four shallow Piezometers have been placed in a transect across the floodplain at MCNF. The installation of a further 8 Piezometers is underway. Dr John Fields from ANU is assisting in designing the transect, which is likely to be alternating depths of 10 metres and 15 metres, with 4 Piezometers placed on each side of Mulloon Creek across the floodplain. It is expected that the piezometers will be drilled prior to July 2008.

### Manual Pond Depth levels

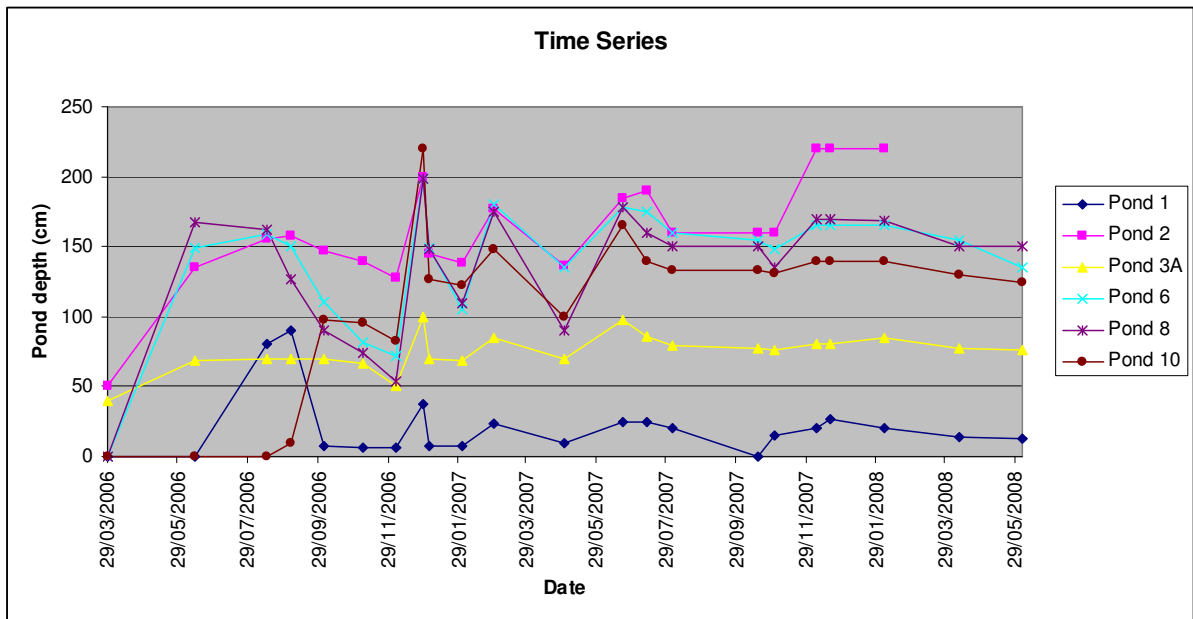
Depth gauges in 14 Ponds at Mulloon and 10 Ponds at Palerang were installed. During a high flow event depth gauges were damaged. Hydrometric Consulting Services has been engaged to install 0 – 2 metre depth gauges in six of the ponds. Installation will commence on the 16th June 2008. The gauges will also be configured to a known benchmark and AHD value. Depth has been recorded monthly at remaining gauge sites (see individual pond sheets below for more details). A summary of results is provided in Figure 3.



**Figure 2:** Map of structures and monitoring sites on Mulloon Creek at MCNF.



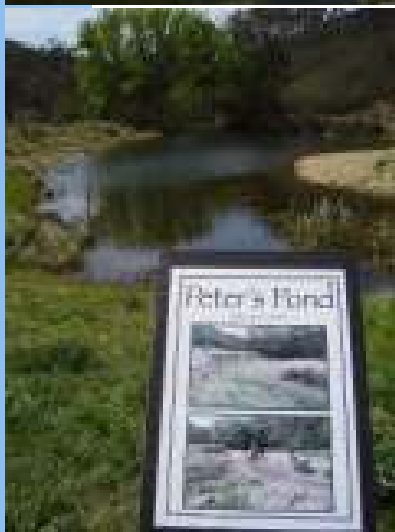
**Figure 3:** Time series showing groundwater levels (manual measured depth levels) on four piezometers in late 2006.



**Figure 4:** Time series showing pond levels (manual measured depth levels) on six ponds since March 2006.



## PONDS AND STRUCTURES DATA



## Leaky Weir 1 (LW1 Goldney's Gate) and Pond 1

**Location:** Most northerly Pond weir on the property. .

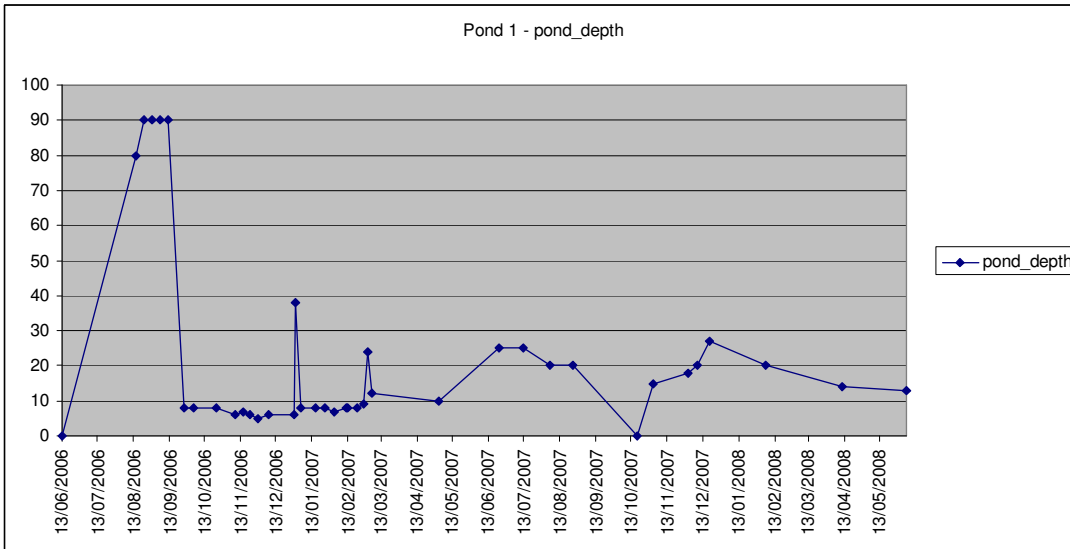
**Description:** Three large boulders arranged in a triangle



Photo log: 2006



April 2008



### Pond depth:

Pond 1 is not associated with LW1. LW1 is a de-energising leaky structure approximately 50 metres north from tP1.

Photo of Leaky Weir



### Observations:

P1 is automatically flow monitored.

Grey Fantail

*Crinia signifera*

*Litoria verreauxii*

*Limnodynastes tasmaniensis*

*Limnodynastes dumerilii*



## Leaky Weir 2 (LW2 – Peter’s Weir) and Pond 2 – “Peter’s Pond”

**Location:** Pond directly upstream of Leaky Weir 2 (LW2 – Peter’s Weir). At northern car park on property.

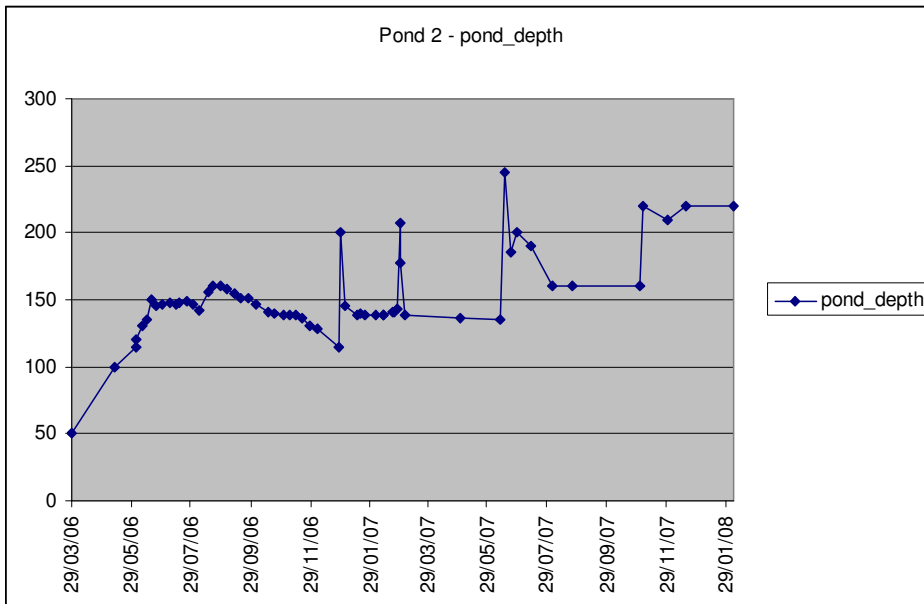
**Description:** Rock weir supported by large willow tree and Cumbungi. Bank shaping and planting



Photo log: 2006



June 2008



### Pond depth:

Pond depth is currently 220% greater than original depth prior to leaky weir installation. The trend is demonstrating that this is moderately rising.

Photo of Leaky Weir



### Observations:

*Crinia signifera*  
*Crinia parinsignifera*  
*Litoria verreaxii*  
*Limnodynastes tasmaniensis*  
*Limnodynastes dumerilii*  
 Eastern Water Dragon  
 Feral Goat

## Leaky Weir 3 (LW3), Pond 3a and 3b

**Location:** Pond directly upstream of Leaky Weir 3 (LW3 –). At the large *E. Viminalis*

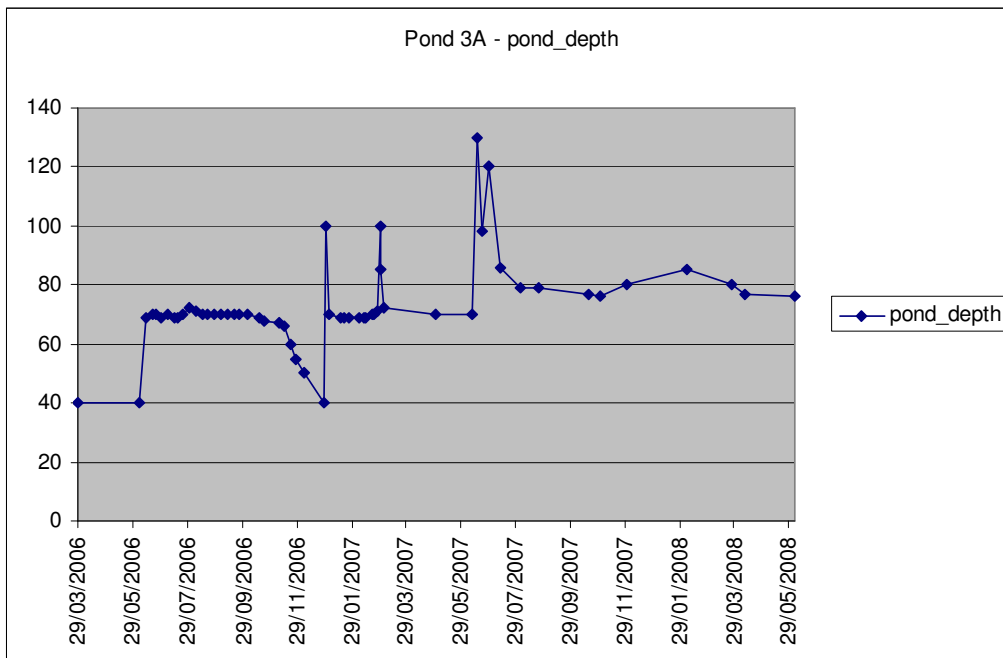
**Description:** Rock baffles



Photo log: 2006



June 2008



Pond depth:

Pond depth is currently 190% greater than original depth prior to leaky weir installation. The trend is demonstrating that this is rising.

Photo of Leaky Weir



**Observations:**  
*Crinia signifera*

## Leaky Weir 4 (LW4), Pond 4 – “Weather Station Crossing”

**Location:** Pond directly adjacent to electronic weather station (LW4 – “Weather Station Crossing”).

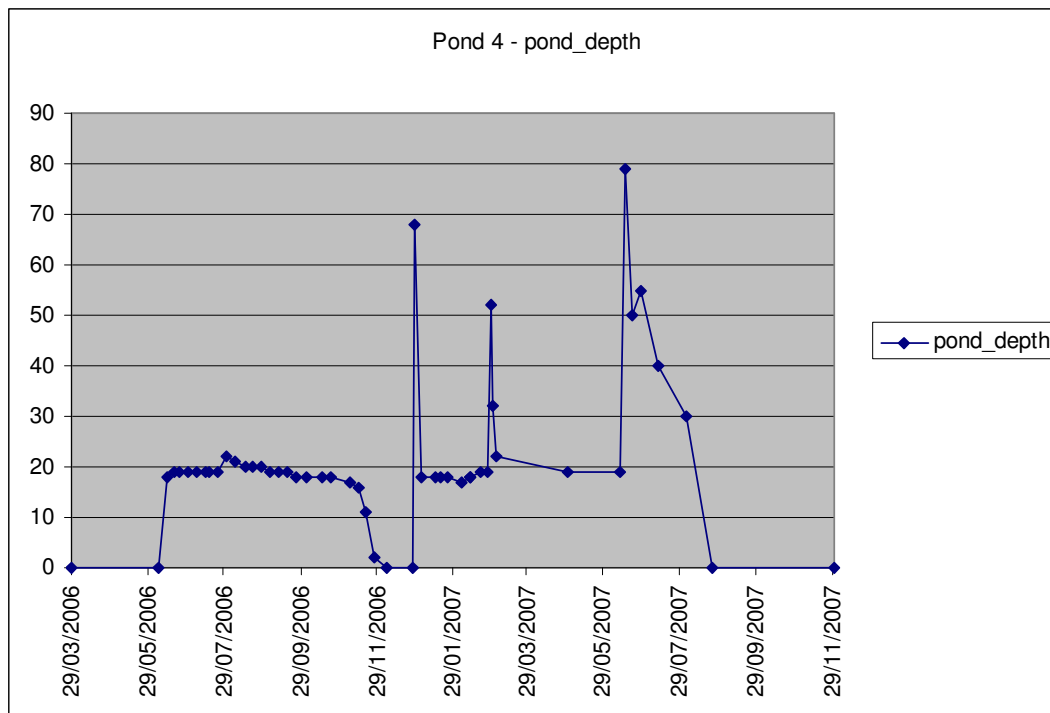
**Description:** Rubble crossing



Photo log: 2006



June 2008



### Pond depth:

Pond depth is was last assessed 30/11/2007 and it was 0 cm depth. This site will have a manual measuring gauge installed in mid June 2008.

Obs: The pond maintains water levels for most of the year.

Photo of Leaky Weir



### Observations:

*Crinia signifera*  
Pacific Black Duck

## Leaky Weir 5 (LW5), Pond 5

**Location:** Pond directly downstream of Leaky Weir 6 – Willow Complex Crossing

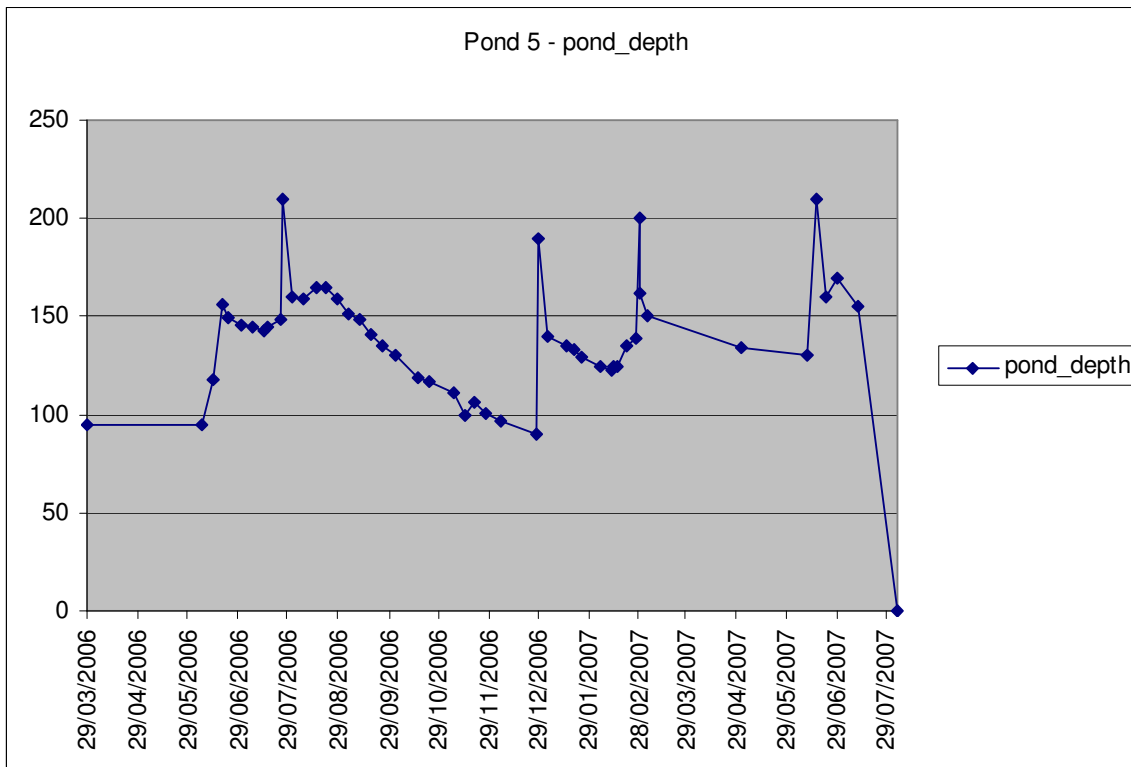
**Description:** two constructed side channels, pond lengthening, two rock baffles and a constructed pond. Bank tapering.



Photo log: 2006



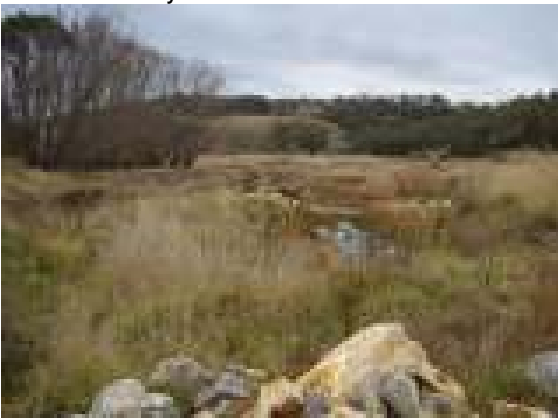
June 2008



### Pond depth:

Pond depth is currently 163% greater than original depth prior to leaky weir installation. The trend is demonstrating that this is rising slightly.

Photo of Leaky Weir structures



### Observations:

Poss. *Gambusia holbrookii*  
Iron flock seasonal fluctuations noted

Site has several structures and contour banking

## Leaky Weir 6 (LW6), Pond 6 – “Willows Complex Crossing”

**Location:** Pond directly upstream of LW6 adjacent to willow dominated riparian vegetation.

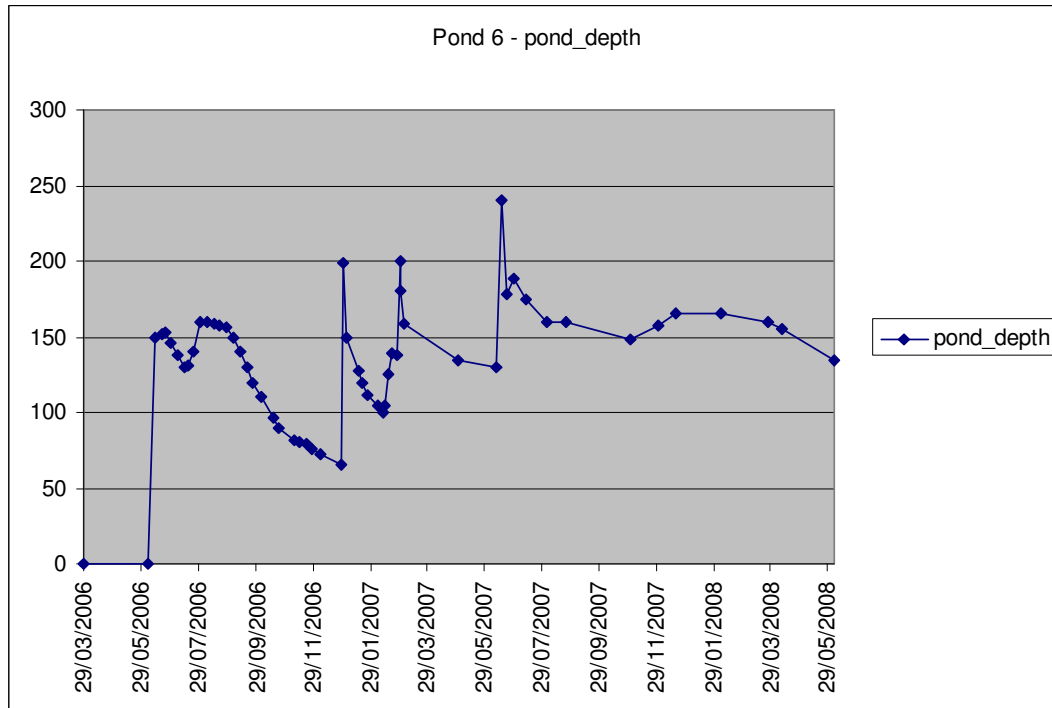
**Description:** Three weirs, two constructed side channels, pond lengthening, two rock baffles and a constructed pond. Bank tapering.



Photo log: 2006



June 2008



### Pond depth:

Pond depth is currently 135 cm, which was 0 cm prior to leaky weir installation. The trend is demonstrating that this is moderately rising.

Photo of Leaky Weir



### Observations:

*Crinia signifera*  
*Crinia parinsignifera*  
*Limnodynastes tasmaniensis*  
 Australian Wood Duck  
 Pacific Black Duck  
 Red Bellied Black Snake  
 Eastern Brown Snake  
 Rabbits

## Leaky Weir 7 (LW7a and LW7b), Pond 7 – “Williams Wallow”

**Location:** Pond directly upstream of Leaky Weir 7a and b

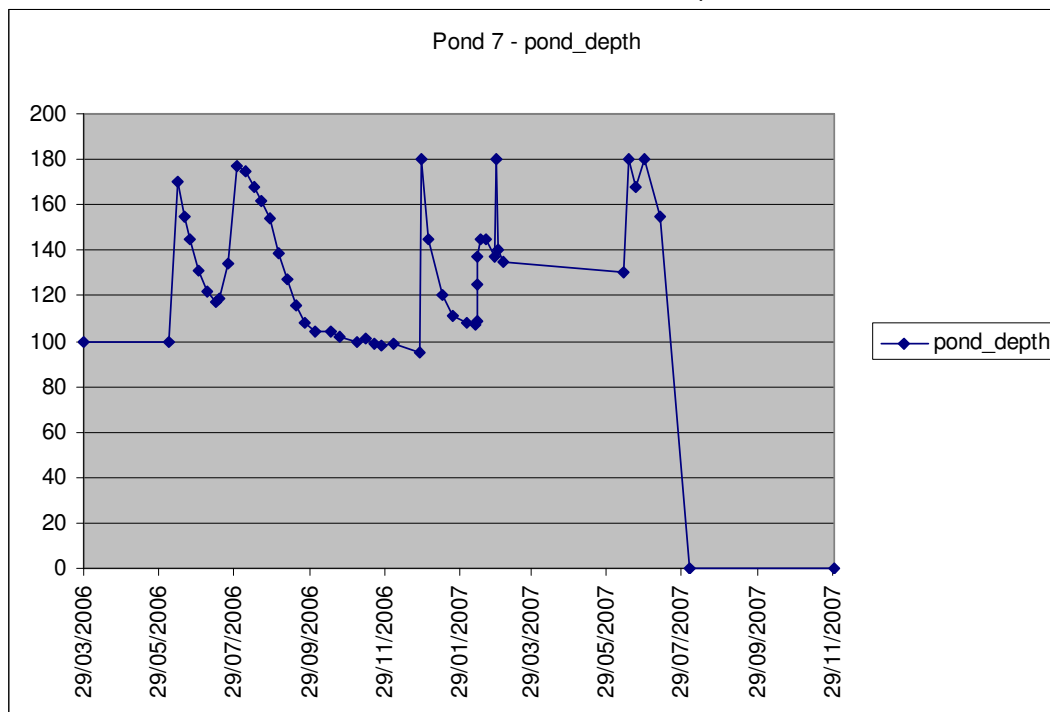
**Description:** Two log and rock weirs, a constructed levy and pond.



Photo log: 2006



April 2008



Pond depth:

Pond depth is currently 155% greater than original depth prior to leaky weir installation. The trend is demonstrating that this is rising slightly.

Photo of Leaky Weir



**Observations:**

- Limnodynastes dumerilii*
- Little Pied Cormorant
- Laughing Kookaburra
- Australian Magpie
- Australian Raven



## Leaky Weir 8 (LW8a + b = c), Pond 8 "Triple Ponds Crossing"

**Location:** Ponds adjacent to Managers Office and Homestead

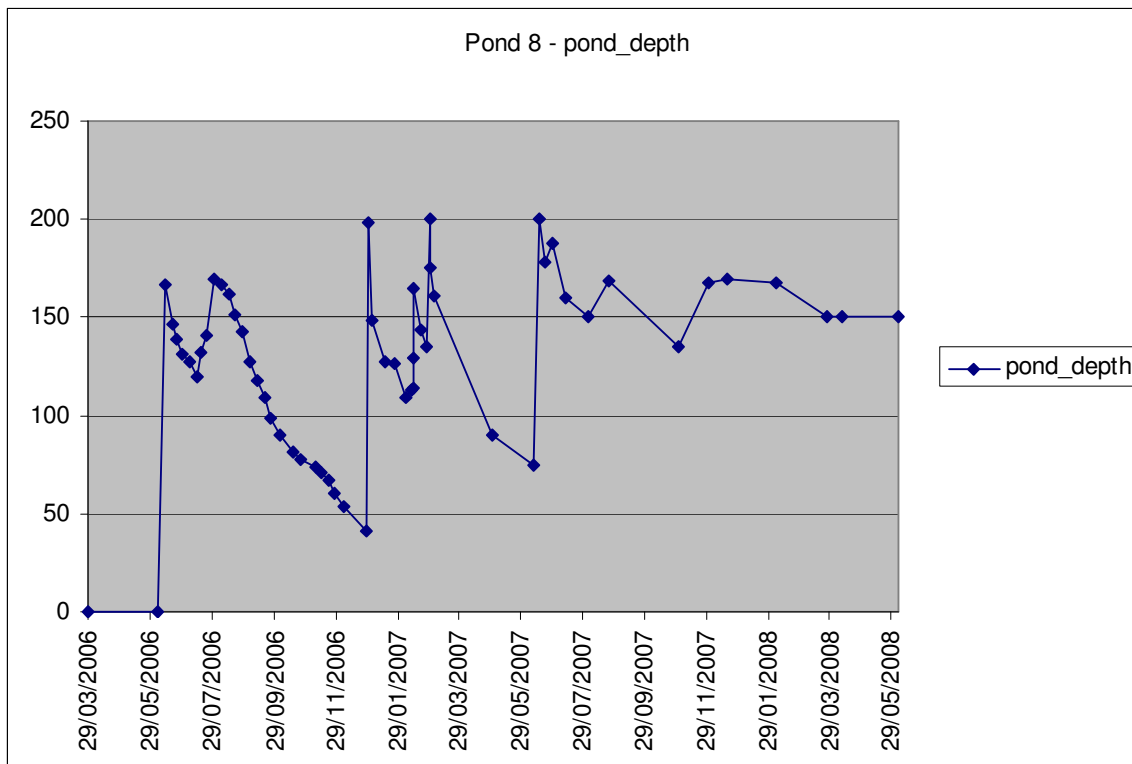
**Description:** Series of three weirs. Bank tapering



Photo log: 2006



June 2008



### Pond depth:

Pond depth is currently 150 cm, which was 0 cm prior to leaky weir installation. The trend is demonstrating that this is steadily rising.

Photo of Leaky Weir



### Observations:

*Crinia signifera*  
*Litoria verreaxii*  
*Crinia parinsignifera*  
 Pied Cormorant  
 Laughing Kookaburra  
 White faced Heron  
 Pacific Black Duck

## Leaky Weir 9 (LW9), Pond 9 – “Platypus Pond”

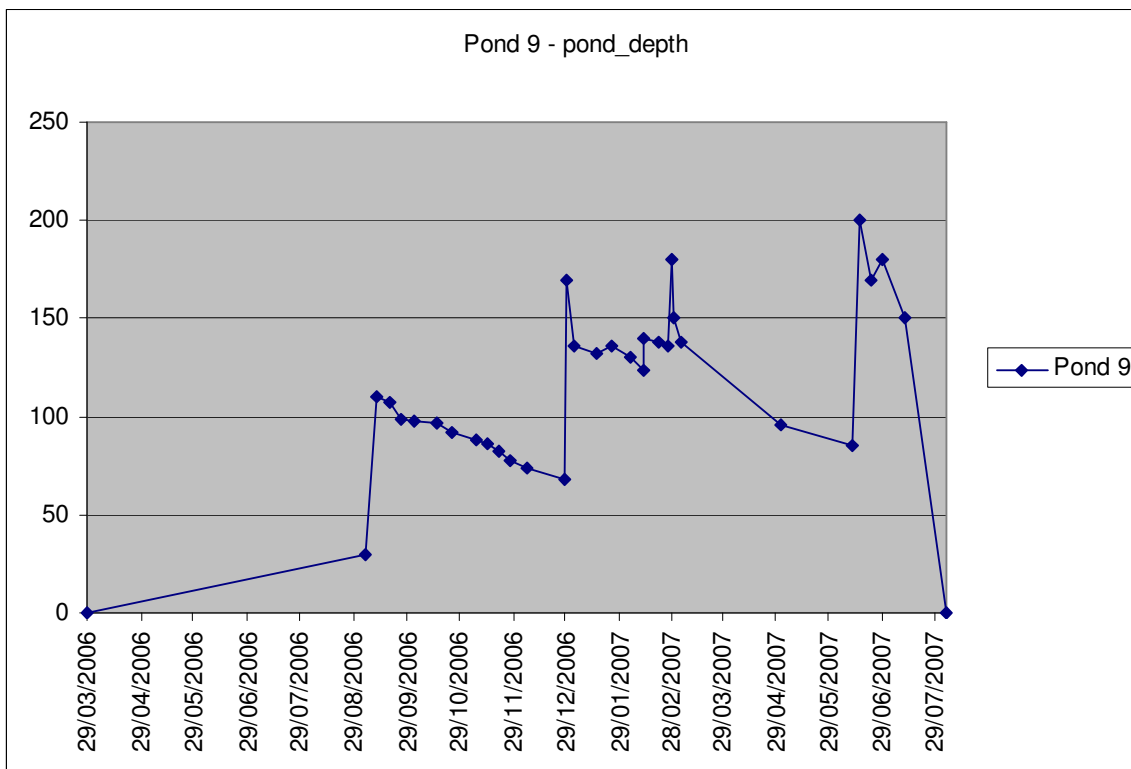
**Location:** Pond upstream of Triple Ponds crossing, immediately downstream of ‘Go Back Way Back’ crossing  
**Description:** One weir made from rubble and willow branches. Bank tapering.



Photo log: 2006

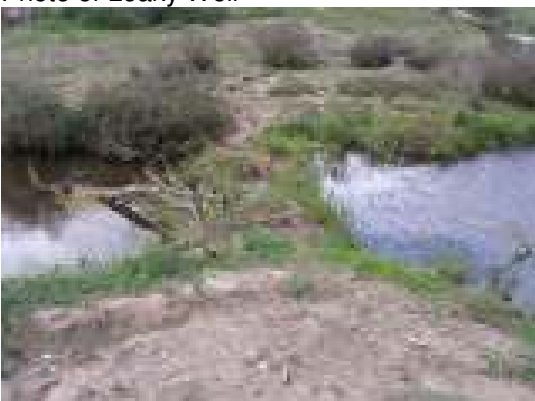


June 2008



**Pond depth:**  
 Pond depth is currently 150 cm, which was 0 cm prior to leaky weir installation. The trend is demonstrating that this is steadily rising.

Photo of Leaky Weir



**Observations:**  
 Crimson Rosella  
 Superb Fairy-wren  
 Red-browed Finch  
 Eastern Water dragon

## Leaky Weir 10 (LW10), Pond 10 – “Mitchell’s Weir”

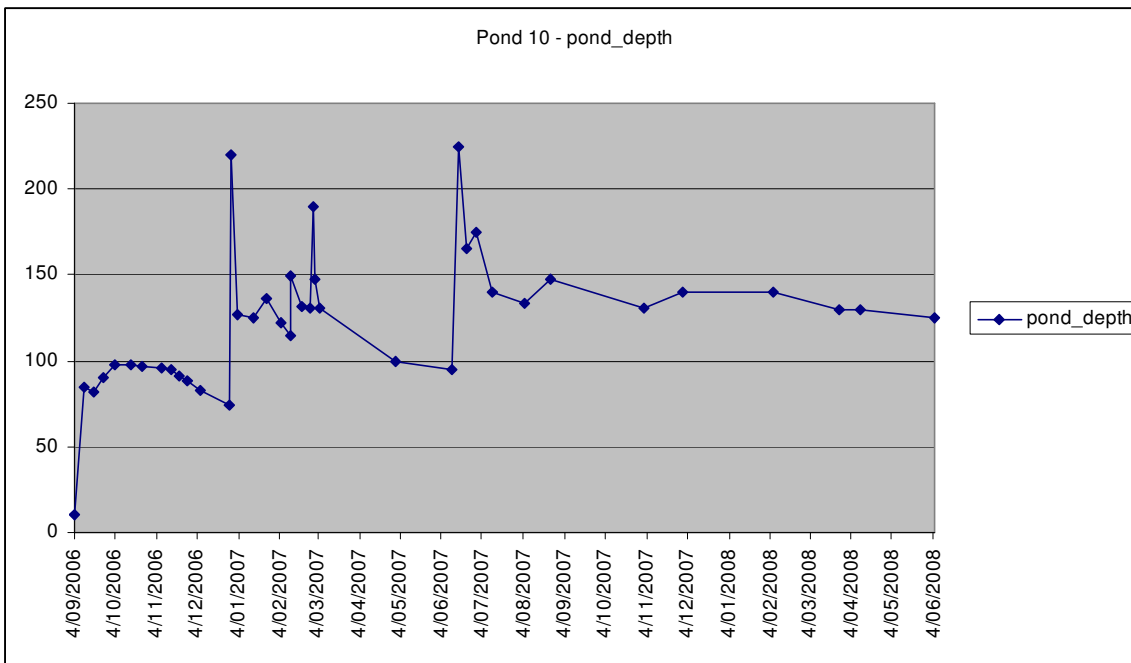
**Location:** Pond directly upstream of ‘Go Back Way Back’ crossing  
**Description:** Rock and rubble piled up around a felled willow tree



Photo log: 2006



June 2008



### Pond Depth

Pond depth is currently 1250% greater than original depth prior to leaky weir installation. The trend is demonstrating that this is rising slightly.

Photo of Leaky Weir



**Observations:**  
*Crinia signifera*  
*Crinia parinsignifera*

## Leaky Weir 11 (LW11) – Porkoney’s Pond Crossing, Pond 11

**Location:** Pond adjacent to Hazellbank

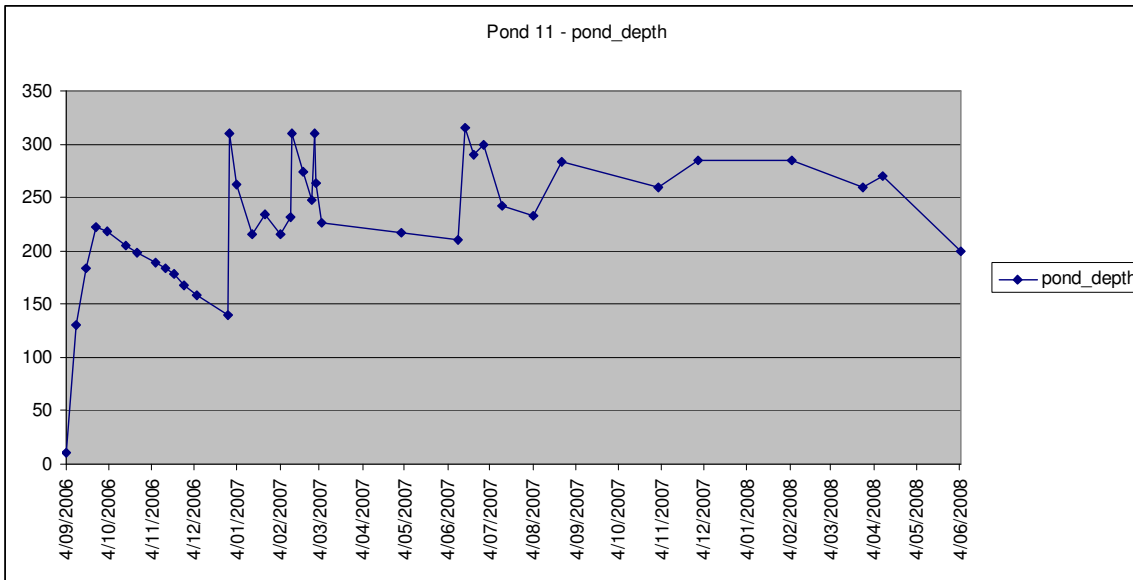
**Description:** Rock, cobble, soil and vegetation weir



Photo log: 2006



June 2008



### Pond Depth

Pond depth is currently 2000% greater than original depth prior to leaky weir installation. The trend is demonstrating that this is rising slightly.

Photo of Leaky Weir



### Observations:

Pacific Black Duck  
White faced Heron

# Leaky Weir 12 (LW12), Pond 12 – ‘Poplar’s Crossing’

**Location:** Upstream of Hazellbank

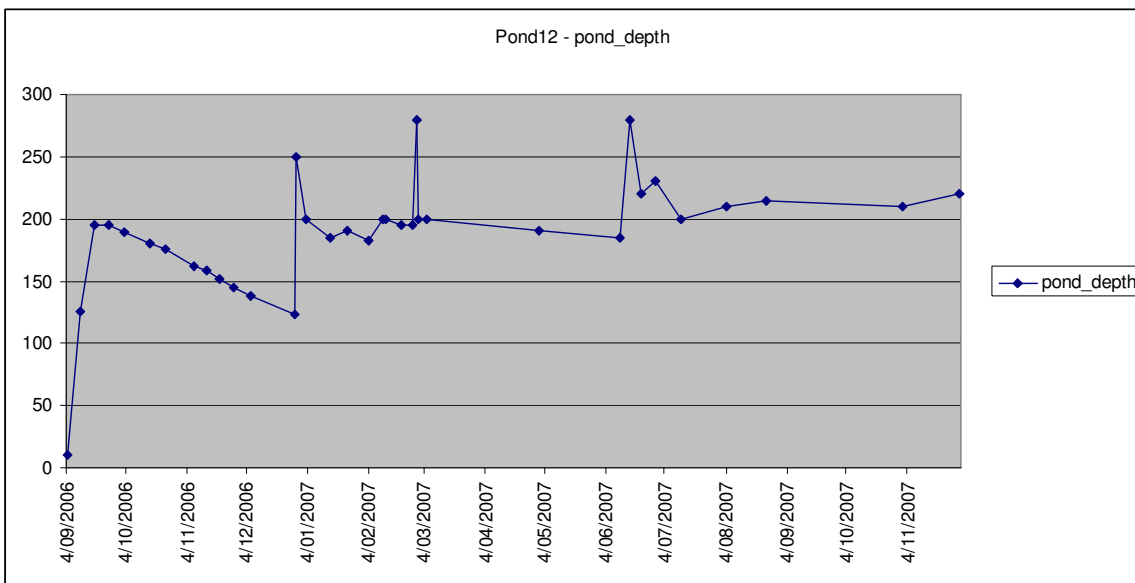
**Description:** Rocks, logs, rubble and vegetation crossing. Low flow directed through pipe



Photo log: 2006



June 2008



**Pond depth:**  
 Pond depth is currently 220 cm, which was 10 cm prior to leaky weir installation (rise by 2200%). The trend is demonstrating that this is steadily rising.

Photo of Structure



**Observations:**

*Crinia parinsignifera*  
 Yellow-rumped thornbills

## Leaky Weir 13 (LW13), Pond 13 – “Willy’s Ripi”

**Location:** Pond adjacent to stables near main Homestead

**Description:** Limestone Outcrop



Photo log: August 2007



June 2008

**Pond depth: No pond depths have been taken from this site**

Photo of Leaky Weir

**Observations:**

Australian Wood Duck

Crested Pigeon

Eastern Rosella



## Leaky Weir 14 (LW14), Pump Shed Weir

**Location:** Adjacent to pump station southern end of floodplain

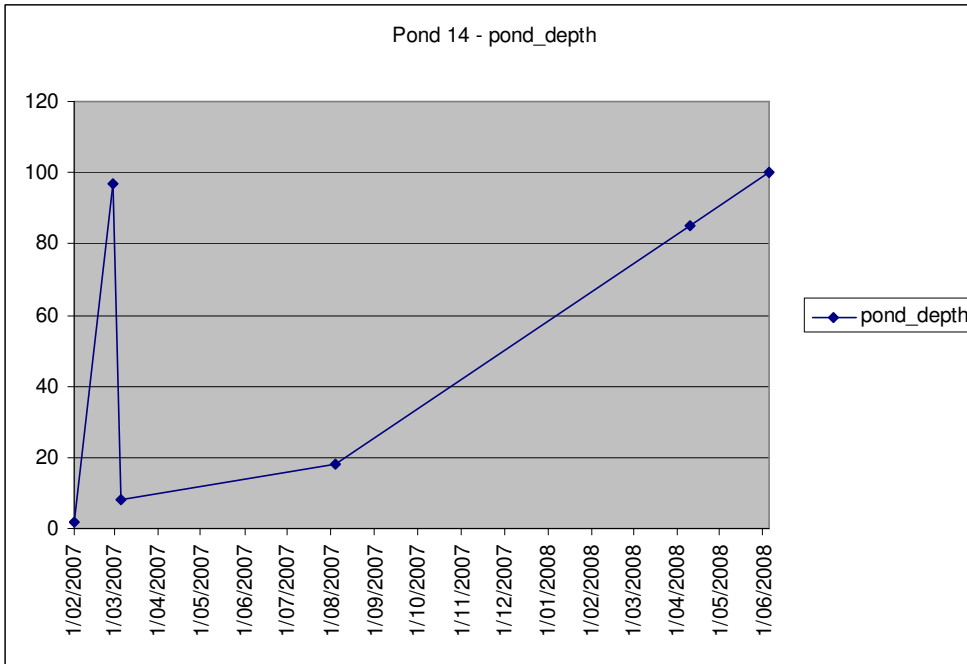
**Description:** Rock Weir. Flow directed against the bedrock



Photo log: 2006



June 2008



### Pond depth:

Pond depth has increased from 0 to over 100 cm. Observations of the pond have shown that the levels have relatively stable since the installation of the leaky weir structure.

Photo of Leaky Weir



### Observations:

Grey Butcherbird  
 White-winged chough  
 Silvereyes  
*Crinia signifera*  
 Superb Fairy-wren  
 Noisy Miner

**NB Pond below invertebrate sampling pond**

## Control Pond 15 - 'Black Jacky'

**Location:** Southerly bedrock controlled pond.

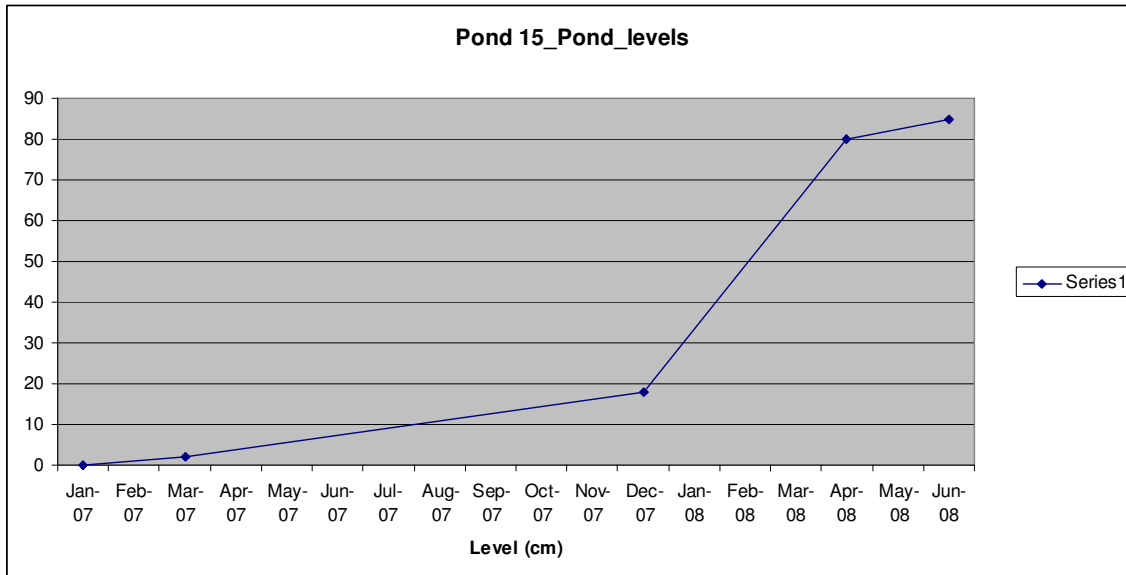
**Description:** Bedrock controlled Pond. Automatic Flow Monitoring



Photo log: 2006



June 2008



Pond depth:

Pond depth has increased from 2 to over 85 cm. The trend is demonstrating that this is slightly rising

Photo of Bedrock Control



**Observations:**

- Crinia signifera*
- Crinia parinsignifera*
- Australian Raven
- Welcome Swallow
- Jacky Winter
- Australian Magpie
- Silvereyes
- White-browed Scrubwren
- Brown Songlark
- Superb Fairy-wren
- Freshwater Yabby

## Automatic Flow Monitoring

Pressure transducers (Divers) were installed at 3 locations on the 11th August 2006. These are:

**Table 1:** Diver locations

Diver	Location
Upstream logger	Black Jacky – Pond 15
Mid stream logger	Pond 1
Barometer	Adjacent to Pond 1
Downstream logger	'Duralla' Control Pond 1 – 8km downstream of MCNF

The Divers automatically measure and register the time, water level and temperature every thirty (30) minutes. It does this by an accurate pressure sensor, which measures the 'weight' of the water column above the instrument. The data collected from the instruments are then offset with barometric data – which compensates for variations in air pressure (see Figure 4).

Hydrometric Consulting Services (HCS) have been engaged to provide theoretical flow discharge rating tables for each of the 3 monitoring sites by undertaking a series of cross-sections and bed slopes, and then applying this information to specialised software. Additionally HCS will undertake a flow measurement at each site that will assist in the rating table derivation.

## Meteorology

Weather station data from MCNF is uploaded regularly. Data has been collected since 20/06/2006, every fifteen minutes. A second WeatherMaster 2000 weather station has been provided by Environdata for the project. This will be installed at Palerang near the site of the pressure transducer on 'Palerang' in June 2008.

The last ten years at MCNF has been below the average (700 mm).

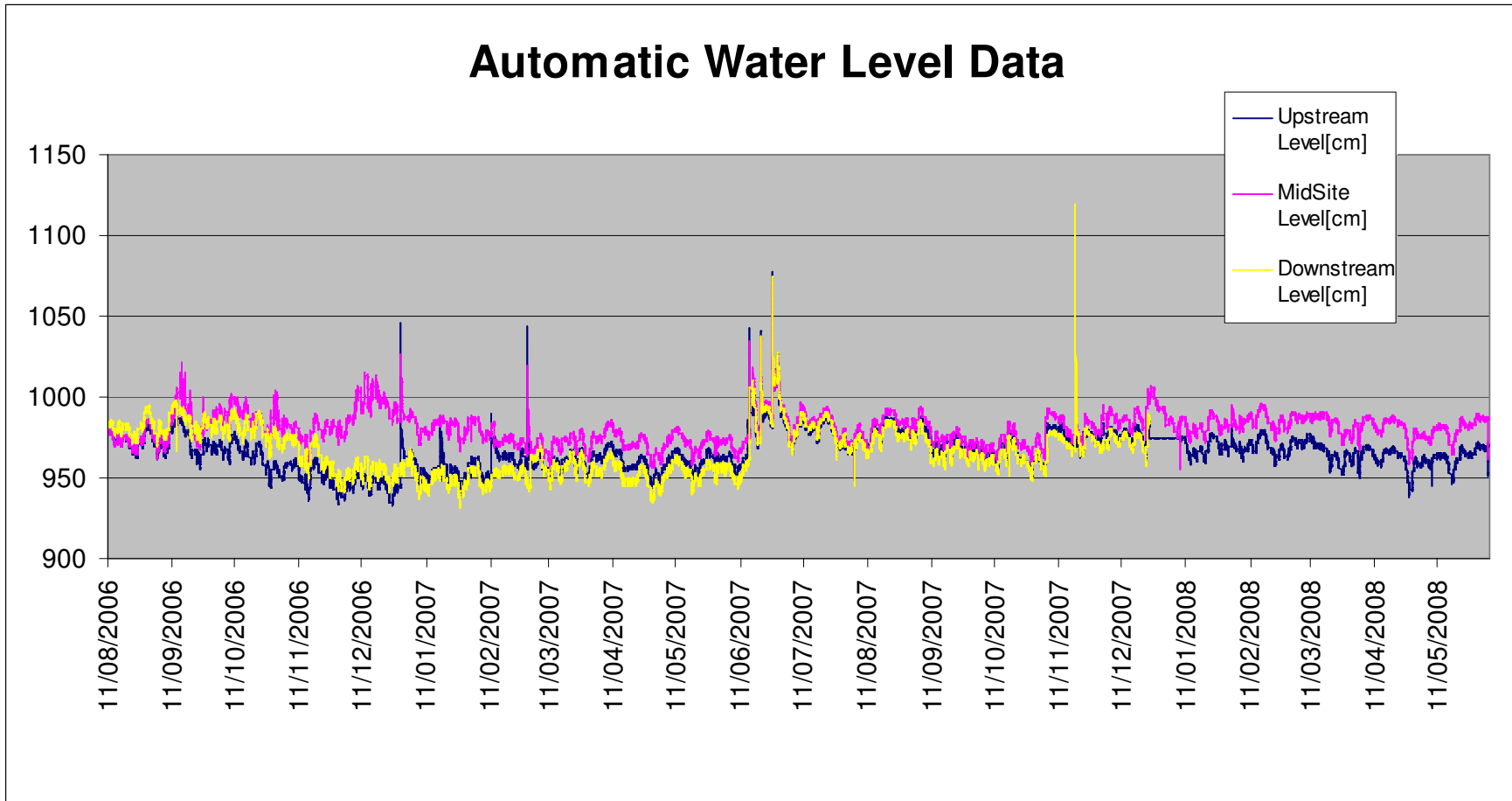


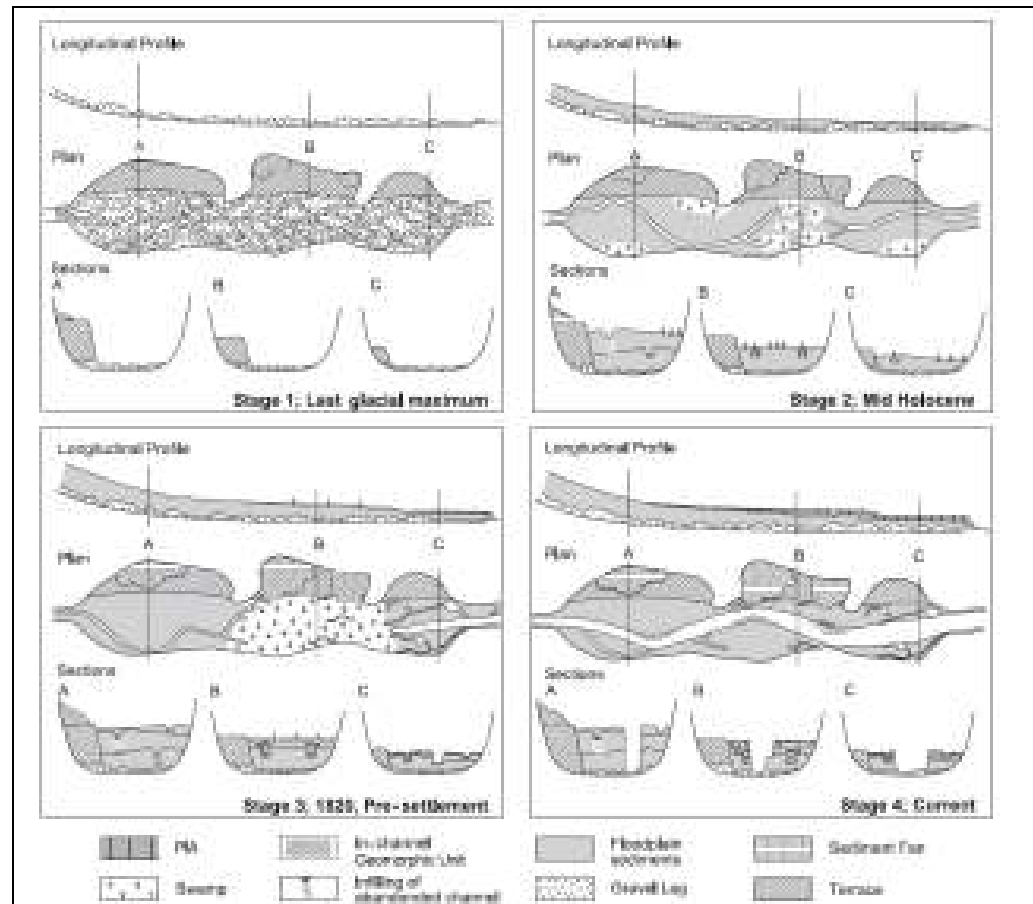
Figure 5: Time series of automatic monitoring at Mulloon Creek.

## Channel and Floodplain Geomorphology

### Stream and Floodplain form survey

A baseline Stream and floodplain form survey has been completed. A second survey will commence after a flood event occurs (at this stage we are hoping that this will occur in June/July), therefore the second survey can be completed in October.

An important reference point for this work is the paper *Late Quaternary river evolution of floodplain pockets along Mulloon Creek, New South Wales, Australia* by Johnson, P and Brierley, G (2006).



**Figure 6:** A schematic representation of late Quaternary floodplain evolution of Mulloon Creek (from Johnson & Brierley, 2006).

The above diagram represents how floodplain pockets developed through the system, and shortly after white-settlement these floodplain pockets incised to form gravel-bed channels.

### Soil Surveys

Soil surveys have commenced by ANU – Honours student of Dr John Field is looking specifically at soil organic matter, soil organic carbon, total phosphorus and total nitrogen, pH, EC, Bulk Density and aggregate stability.

### Environmental History

All copies of historical material relating to the project area are being collected.

## Water Quality, aquatic and riparian habitat

### Physical chemical

Next sampling will be undertaken in June 2008.

The last chemical analysis was completed on the 17<sup>th</sup> June 2007, and shows the following:

**Table 2:** Water quality results June 2007.

Test	Peters Pond	Pump Site
Susp. Solids (mg/L)	46	54
Ammonia (asN) (mg/L N)	0.04	0.04
Total Nitrogen (mg/L)	1.4	1.4
Tot. Phosp (asP)	0.25	0.35
Faecal Coliform (CFU/100ml)	1800	3500

*Susp. solids have decreased slightly, whereas nitrogen, phosphorus and faecal coliform counts have fluctuated. Further water quality data is needed to build a picture of how the structures are influencing changes in quality*

### Biology

Twice yearly aquatic invertebrate sampling is undertaken in spring and autumn (sampling was undertaken 4 June 08).

Other biological monitoring and ecological characteristics are undertaken opportunistically during the depth gauge reading.

Dr Paul Cooper from the School of Botany and Zoology at ANU has indicated that he has students that are able to carry out fauna and flora assessments. The CMA will be working with the ANU to ensure that survey design allows for ongoing monitoring of the project site. In early June 2008 pasture composition, cover and abundance assessments will be carried out over the floodplain. Three (3) monitoring sites have been set up which can then be re-surveyed annually during spring.

### Ecological Characteristics

Fauna and flora observations such as evidence of fauna, bird and frog calls and/or their observations, flora flowering, observable changes in flora abundance etc is collected during pond depth gauge readings.

**Table 3:** Opportunistic observations of fauna species recorded during structure assessments by Peter Hazell and Sky Kidd.

Common Name	Species name	Observation Type
<b>Bird Species</b>		
Pied Cormorant	<i>Phalacrocorax varius</i>	Obs
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>	Obs.
Pacific Black Duck	<i>Anas superciliosa</i>	Obs.
Australian Wood Duck	<i>Chenonetta jubata</i>	Obs.
White faced Heron	<i>Egretta novaehollandiae</i>	Obs.
Australian White Ibis	<i>Threskiornis molucca</i>	Obs
Masked Lapwing	<i>Vanellus miles</i>	Obs.
Wedge-tailed Eagle	<i>Aquila audax</i>	Obs.
Brown Falcon	<i>Falco berigora</i>	Obs.
Crested Pigeon	<i>Ocyphaps lophotes</i>	Obs.
Yellow-tailed Black-Cockatoo	<i>Calyptorhynchus funereus</i>	Obs
Galah	<i>Cacatua roseicapilla</i>	Obs.
Sulphur-Crested Cockatoo	<i>Cacatua galerita</i>	Obs.
Crimson Rosella	<i>Platycercus elegans</i>	Obs.
Eastern Rosella	<i>Platycercus eximius</i>	Obs.
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	Obs
Superb Fairy-wren	<i>Malurus cyaneus</i>	Obs.
White-browed Scrubwren	<i>Sericornis frontalis</i>	Obs.
Buff-Rumped Thornbill	<i>Acanthiza reguloides</i>	Obs.
Yellow-Rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	Obs.
Noisy Miner	<i>Manorina melanocephala</i>	Obs.
Jacky Winter	<i>Microeca fascinans</i>	Obs.
Willie Wagtail	<i>Rhipidura leucophrys</i>	Obs.



<b>Common Name (cont.)</b>	<b>Species name</b>	<b>Observation Type</b>
Grey Fantail	<i>Rhipidura fuliginosa</i>	Obs.
Magpie-Lark	<i>Grallina cyanoleuca</i>	Obs
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	Obs
Grey Butcherbird	<i>Cracticus torquatus</i>	Obs.
Australian Magpie	<i>Gymnorintha tibicen</i>	Obs.
Australian Raven	<i>Corvus coronoides</i>	Obs.
White-winged Chough	<i>Corcorax melanorhamphos</i>	Obs.
Richards Pipit	<i>Anthus novaeseelandiae</i>	Obs
Welcome Swallow	<i>Hirundo neoxena</i>	Obs.
Brown Songlark	<i>Cincloramphus cruralis</i>	Obs.
Red-browed Finch	<i>Neochmia temporalis</i>	Obs.
Silvereye	<i>Zosterops lateralis</i>	Obs.
Tree Martin	<i>Hirundo nigricans</i>	Obs.
<b>Herpetofauna</b>		
Common Eastern Froglet	<i>Crinia signifera</i>	Heard
Beeping Froglet	<i>Crinia parinsignifera</i>	Heard
Eastern Banjo Frog	<i>Limnodynastes dumerilii</i>	Heard, Obs.
Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>	Heard Egg mass observed
Bleating Tree Frog	<i>Litoria dentata</i>	Heard
Whistling Tree Frog	<i>Litoria verreauxii</i>	
<b>Common Name (cont.)</b>	<b>Species name</b>	<b>Observation Type</b>
Eastern Brown Snake	<i>Pseudonaja textilis</i>	Obs.
Common Garden Skink	<i>Lampropholis guichenoti</i>	Obs.
Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>	Obs.
Eastern Water Dragon	<i>Physignathus lesuerii</i>	Obs.
<b>Mammals</b>		
Common Wombat	<i>Vombatus ursinus</i>	Burrow, scats
Insectivorous Bat	<i>Unknown</i>	Obs
Feral Goat	<i>Capra hircus</i>	Obs
Rabbit	<i>Oryctolagus cuniculus</i>	Obs
Domesticated Dog	<i>Canis familiaris</i>	Scats

## Time Line for Monitoring 2008:

Below is a timeline for monitoring of the Natural Sequence farming Demonstration Site at Mulloon Creek for 2008.

<b>May 2008</b>	Meeting at MCNF re Piezometer transect placement (ANU, SRCMA/ MCNF) <b>Complt</b> Ongoing monitoring (SRCMA) <b>Complete</b>
<b>June 2008</b>	Depth Gauge installation (Hydrometric Consulting Services) in 6 ponds Autumn Macro-Invertebrate Surveys (SRCMA) <b>Complete</b> Installation of second WeatherMaster 2000 weather station at Palerang (SRCMA, Tuisk) Pasture Composition, abundance and cover assessments to be carried out (SRCMA) June Monitoring (SRCMA) <b>Complete</b> Stream Flow modelling provided (HCS) Piezometer transact installation (ANU/SRCMA)
<b>July 2008</b>	Intensive analysis of Mulloon data (SRCMA) Monitoring update including data to be distributed to stakeholders (SRCMA) July monitoring (SRCMA)
<b>August 2008</b>	Development monitoring protocols and procedures (SRCMA) August Monitoring (SRCMA) Soil Surveying (ANU) - Ongoing
<b>September 2008</b>	Handover Monitoring to MCNF (SRCMA MCNF)  Spring Ecological Assessments (ANU) September Monitoring (MCNF)
<b>October 2008</b>	Spring Aquatic Invertebrate sampling (MCNF) Pasture Composition, abundance and cover assessment monitoring (SRCMA) October Monitoring (MCNF) Second stream and floodplain form survey (SRCMA)
<b>November 2008- Indefinitely</b>	Ongoing monthly monitoring – uploaded data from pressure transducers, weather station, Piezometer reading, depth gauge readings

## References

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# APPENDIX 1

## SOILS





Mulloon Creek Floodplain RLU Map Legend	
	AOsw - Alluvial Overbank alluvial swamp
	AOst - Alluvial Overbank floodplain
	ACch - Alluvial Channel alluvial channel
	AOso - Alluvial Overbank floodplain
	ACat - Alluvial Channel alluvial terrace
	CHst - Colluvial Sheet flow alluvial channel
	RLU boundary
	Unspecified RLU boundary

## APPENDIX 2

### AIR PHOTO'S MARCH 2008















