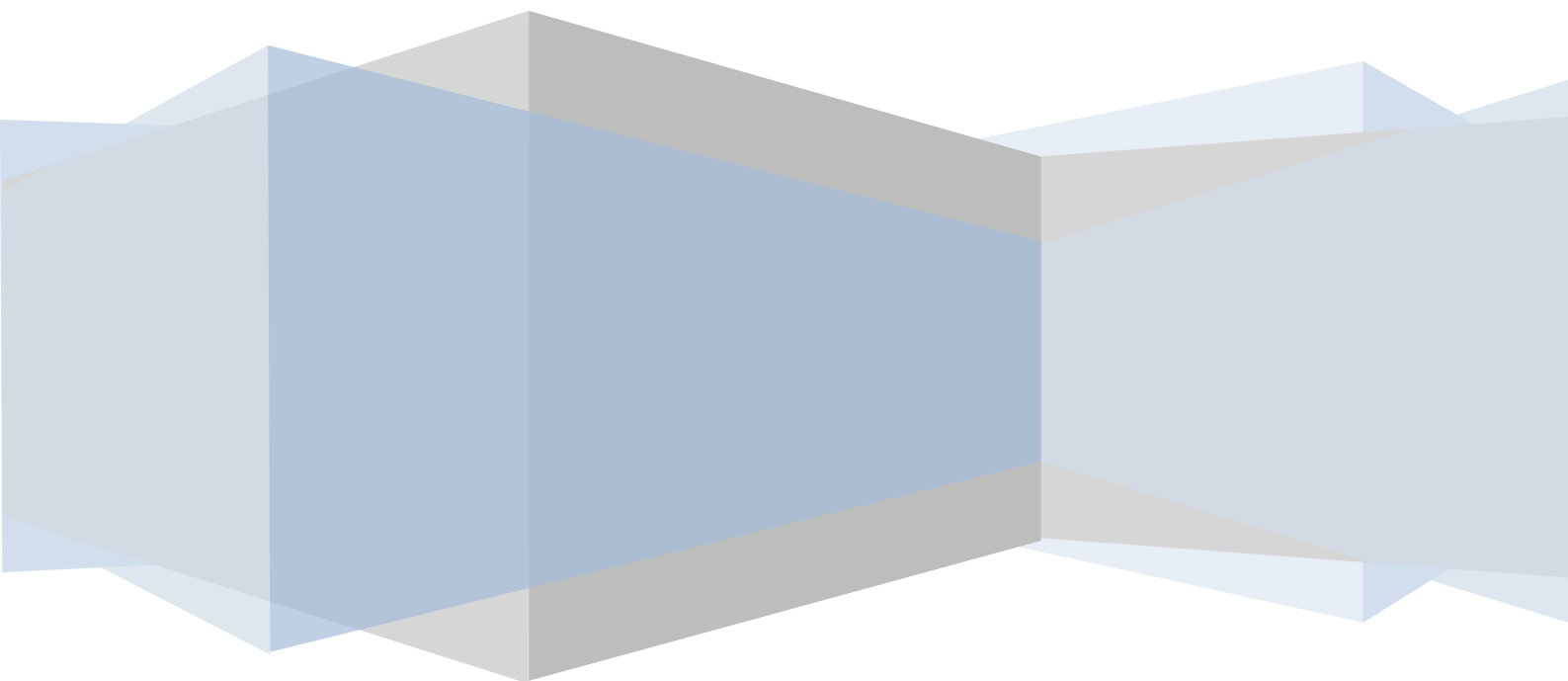


EM (Ecology Management) Pty Ltd

**Lower Balonne Aquatic
Ecological Condition
Report -
Spring 2011**



Smartrivers Aquatic Ecosystem Monitoring Spring 2011

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1. Introduction

This report represents the fourteenth since June 2000 recording the results of monitoring events sponsored by Smartrivers in the Lower Balonne. This sampling event was unique in the program to date as it involved a shared field sampling effort between Smartrivers field consultants (Hydrobiology) and DERM. DERM carried their own costs.

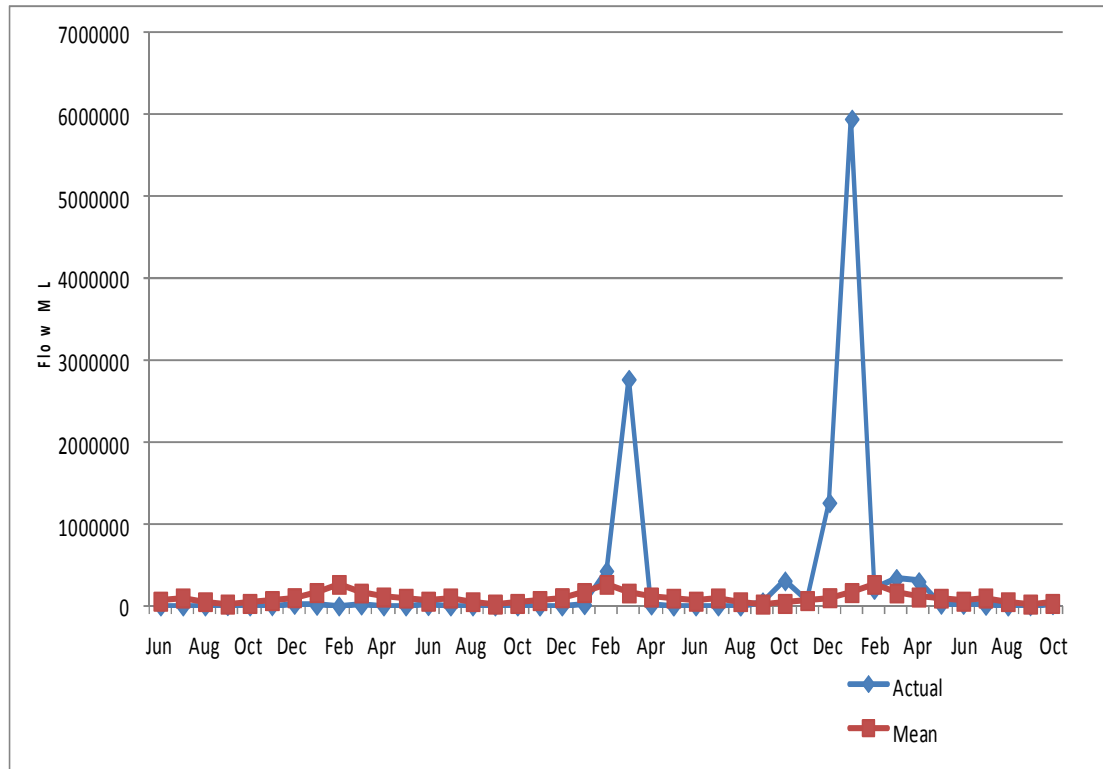
Sampling took place from late September to mid October 2011. The previous sampling event took place in May 2008. Flows in January of that year were the first reasonable flows since January 2004 and prior to that the only reasonable flow was in November 2001. The drought was undoubtedly an extreme event but the flows of March 2010 and January 2011 are even more extreme, but on the other end of the flow scale.

To place those floods in perspective, Connell Wagner estimated that in the natural case flows less than 10,000 ML/d at St George would generally remain confined to the major rivers and streams, while flows in the range 10,000 – 20,000 ML/d would disperse into certain defined channels within the floodplain and constitute “channel floods”. Flows in excess of 20,000 ML/d are required for water to spill out of these channels and on to the floodplain. Connell Wagner identified three degrees of flooding: no to light flooding (20,000 - 60,000 ML/d), light to medium flooding (60,000 – 120,000 ML/d) and heavy flooding (>120,000 ML/d).

Large (heavy) flood flows did not occur between May 1996 and March 2010. Medium flood levels were reached for relatively short periods of time in September 1998 and January 2004 (for just 1 day); otherwise peak flows were at best “small” (light) flood flows or failed to occur. The peak in January 2008 was 50,509 ML per day. The wet season failed again in 2009. Many of the floodplain wetlands with high commence to flow levels, such as Police Lagoon at Dirranbandi, only received water in 1998, 2004 and 2010 while many other wetlands and sections of river also dried completely at various times during the drought.

For the period of record at Jack Taylor Weir (from 2 October 1971), of the 30 highest daily flows, 20 occurred in January 2011 and 8 in March 2010. Prior to these floods, the highest daily flow was 218,897 ML recorded in April 1990. The recent floods added 11 records at higher levels, including a peak of 261,128 ML recorded on 7 March 2010. The flood of May 1983, representing the previous largest flood, had 16 days above the large flood level and a total flow of 3,338,742 ML while January 2011 had 30 days above the large flood level and a total flow of 5,952,549 ML. March 2010 recorded 11 days above the large flood level and a total volume of 2,771,521 ML. The floods of 2010 and 2011 are certainly very large floods and followed a period of extreme drought (**Figure 1.1**).

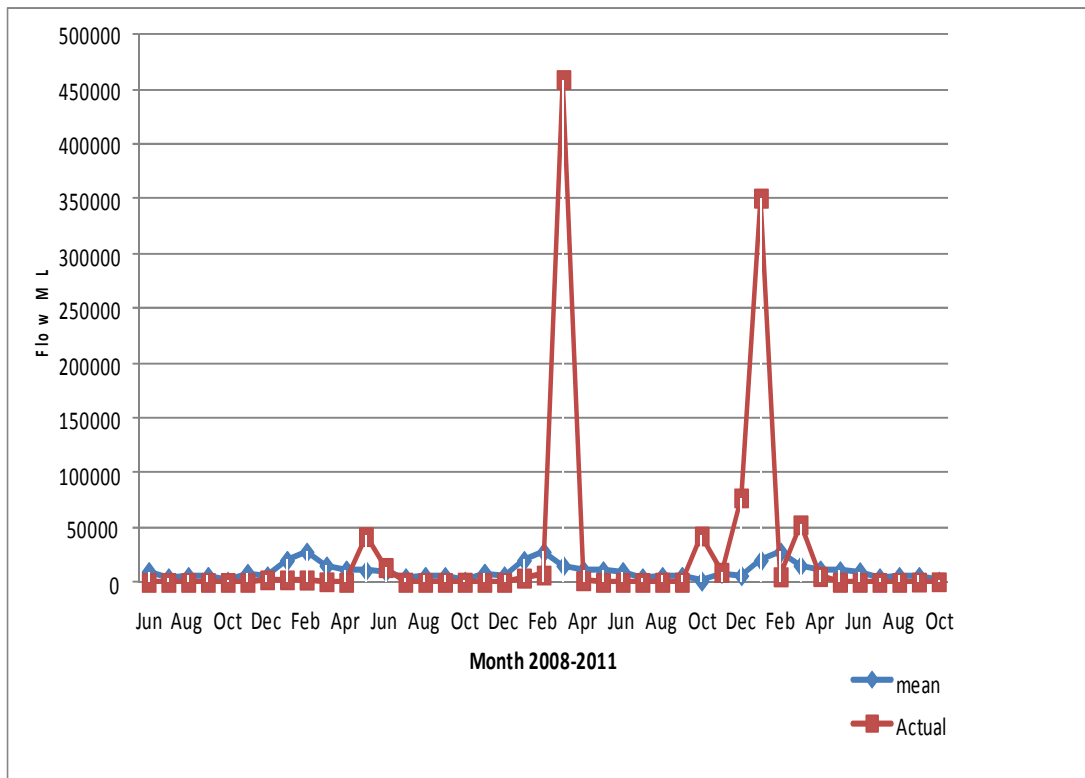
■ **Figure 1.1. Flows at St George from June 2008 compared to pre 2002 mean – uncapped axis**



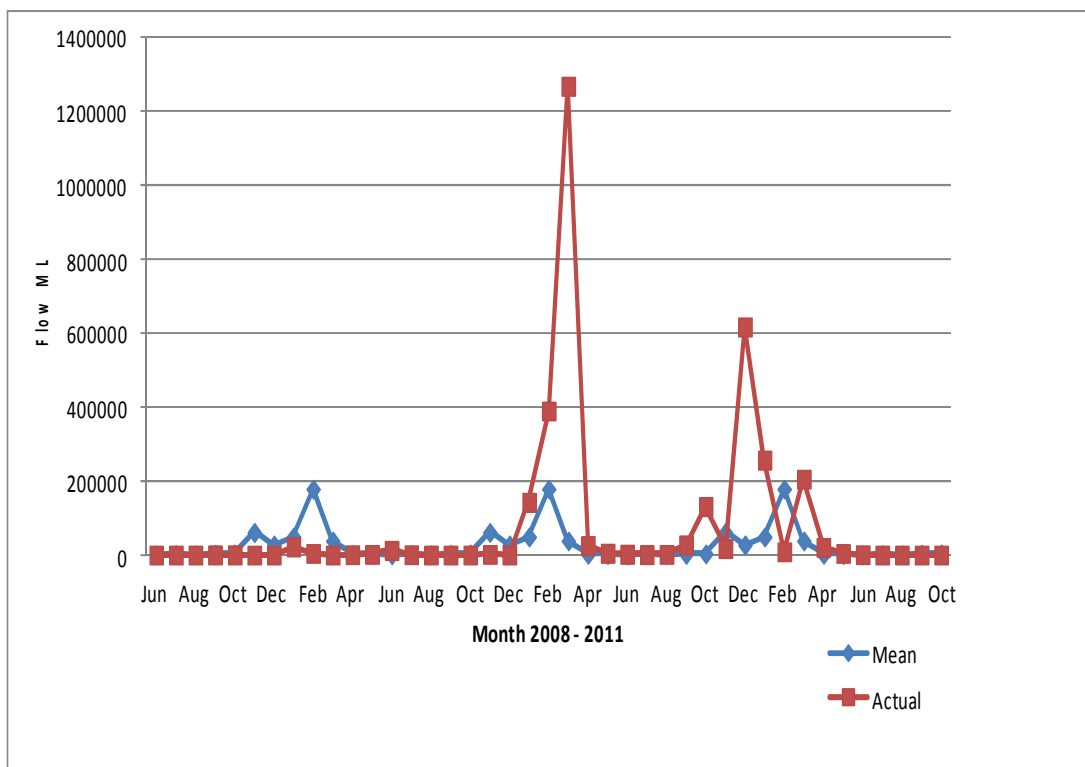
Flows in the reference rivers were also very significant in 2010 and 2011 but in both cases it was 2010 which was the larger. At Nindigully (Moonie River, **Figure 1.2**) the nine highest daily flows were in 1974 and 1976 while 10/03/2010 provided the tenth largest flow. The highest flow in January 2011 only ranked 34th. January 1974 and February 1976 remain the largest monthly flood events (595,540 ML and 548,318 ML respectively) while March 2010 is now the third largest (459,422 ML). January 2011 was smaller again with 351,041 ML. Hence, the recent floods in the Moonie were not anywhere near as extreme as those in the Balonne.

At Cunnamulla (Warrego River, **Figure 1.3**) the period of record is shorter (from 1992) and 2010 now represents the wettest year and March 2010 included the five highest daily flows (peak 135,889 ML). January 2008 included the next four largest daily flows. February 1997 remains the wettest month (1,337,583 ML) followed by March 2010 (1,269,684 ML).

■ **Figure 1.2 Flows at Nindigully from June 2008 compared to pre-2002 mean**



■ **Figure 1.3 Flows at Cunnamulla from June 2008 compared to pre-2002 mean**



2. Methods

Nineteen riverine and eleven floodplain sites were sampled. Sampling methods mirrored earlier events (Benson and Paton 2002) with respect to:

- Fish sampled by multiple gill and fyke nets, bait traps, seine and dip nets, with the actual nets deployed depending on site conditions, particularly the extent of water available. (Note that DERM did not use gill nets but used additional fyke nets).
- Water quality sampled by a multi-parameter data logging water quality meter. This was used for depth stratified sampling and when recording overnight was set within 25 cm of the surface.
- Macroinvertebrates sampled by replicated Surber samples in the edge habitat and by qualitative dip netting in specialised habitats when available.

Each team (DERM, Hydrobiology) sampled approximately half of the sites and met to confirm methods and field procedures prior to undertaking the sampling. Which team undertook the sampling is noted under individual site results. Macroinvertebrates were sorted by staff in the Hydrobiology laboratory and were identified and counted by staff of AQUEN Aquatic & Environmental Consulting. Subsampling was employed for larger samples.

3. Results

Results are initially presented by site. A regional appraisal is presented in Section 4. No significant changes to water levels or flow conditions occurred during sampling but passing storms were sometimes significant and produced local runoff at sites below Dirranbandi. Low level flows were being released from Jack Taylor Weir during the early sampling but all floodplain sites were isolated.

3.1 Balonne River at St George

This site is adjacent the gauging station below Jack Taylor Weir and was sampled by DERM. The banks have a fairly gradual slope and usually a good cover of grass and trees. This was particularly the case on this occasion. The substrate is mainly deep silt with large outcroppings of conglomerate rock. The river was approximately 90 m wide and the significant number of large snags that usually occurred near the gauge had been substantially removed by floods, as had the soil and vegetation on much of the bedrock near water level. Water level was very similar to previous sampling events and there was no flow.

3.1.1 Water quality

Spot water quality profiling was undertaken at the centre of the site (**Table 3-1.1**). The water column was well mixed.

■ **Table 3-1.1 Water quality depth profiling at St George.**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1445	Surface	19.9	70	211	252	7.8
	0.5	19.8	72	209		7.8
	1.0	19.7	69	209		7.8
	1.5	19.6	69	207		7.8

3.1.2 Macrophytes

Persicaria grew strongly on the right bank just downstream of the gauge (this patch has always been present).

3.1.3 Fish

Table 3-1.2 shows the catch by netting technique. Five native species and three introduced were captured. The seine haul was restricted due to the steeply sloping bed, as was the width to which fyke net wings could be opened. Yellowbelly ranged from 121 to 348 mm in length and Carp ranged from 107 to 449 mm with most in the 200 – 350 range. Fish were in a healthy state.

■ Table 3-1.2 Results of fishing at St George

Species	Common name	Gill (0)	Seine (2)	Fyke (5)	Bait	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly			13		13
<i>Nematolosa erebi</i>	Bony Bream		2	4		6
<i>Leiopotherapon unicolor</i>	Spangled perch		1	2		3
<i>Hypseleotris klunzingeri</i>	Carp Gudgeon			1		1
<i>Tandanus tandanus</i>	Eeltailed catfish			4		4
<i>Cyprinus carpio</i>	Carp		2	255		257
<i>Carrasius auratus</i>	Goldfish			12		12
<i>Gambusia holbrooki</i>	Mosquitofish		1			1
Total Numbers			6	291	0	297

Two *Chelodina longicollis* (Eastern snake-necked tortoise) and one *C. expansa* (Broad shelled tortoise) were captured in fyke nets.

3.1.4 Macroinvertebrates

Surber samples were collected from gravel / sand over bedrock or from silt/clay/sand mixes. A dip net sample was collected from tree roots. A total of 14 discrete (non-overlapping) taxa were identified, 10 from the surbers and 8 from the dip net (**Table 3-1.3**). The fauna was dominated by copepods. Bait traps collected 17 *Macrobrachium* (Palaemonidae, prawns) and they were common in the seine hauls.

■ Table 3-1.3 Aquatic macroinvertebrates recorded from St George

Taxa	Edge surber		Tree root dip
	Mean	std devn	
Hydra	0.2	0.5	
Copepoda	233.2	166.8	1344
Palaemonidae	0.2	0.5	2
Hydrophilidae	0.4	0.6	
Ceratopogonidae			1
Chironominae			5
Baetidae	0.2	0.5	
Caenidae	0.6	0.9	9
Leptophlebiidae			1
Corixidae	2.6	3.2	1
Saldidae	0.2	0.5	
Coenagrionidae	0.2	0.5	
Ecnomidae			1
Leptoceridae	0.2	0.5	
Taxa	3.8	2.7	8
Abundance	238	170.9	1364
Total taxa	10		14

3.2 Balonne River at Mooramanna

This site is on a straight stretch of river just upstream from the Brookdale pump station and was sampled by DERM. The channel is approximately 80 m wide and of trapezoidal shape with parallel benches. The bed substrate is largely sand and the banks are mainly black clay. Water levels were at base flow and no flow was evident. Maximum depth possibly reached 2 m on the western edge. The previously reported tea tree seedlings to 2 m on the sand bars and a significant amount of bank vegetation (grasses, sedges and shrubs) had been stripped by floods. There has also been some rearrangement and loss of snags on the right bank.

3.2.1 Water quality

Results from spot water quality profiling are shown in **Table 3-2.1**. Temperature and dissolved oxygen decreased with depth.

■ **Table 3-2.1 Water quality depth profiling at Mooramanna.**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1315	Surface	26.2	83	305	214	7.8
	0.5	23.2	71	287		7.8
	1.0	20.6	56	277		7.8
	1.5	20.2	49	277		7.7

3.2.2 Macrophytes and algae

None noted.

3.2.3 Fish

Table 3-2.2 shows the fish catch by netting technique. Seven native fish species and two introduced were recorded. Carp measured from 110 mm to 482 mm in length and the Cod was 361 mm. Fish were in a healthy state.

■ **Table 3-2.2 Fish catch by fishing technique at Mooramanna.**

Species	Common name	Gill (0)	Seine (2)	Fyke (4)	Bait	Total Numbers caught
<i>Maccullochella peelii</i>	Murray cod			1		1
<i>Macquaria ambigua</i>	Yellowbelly			5		5
<i>Nematolosa erebi</i>	Bony Bream			16		16
<i>Leiopotherapon unicolor</i>	Spangled perch			2		2
<i>Hypseleotris klunzingeri</i>	Carp Gudgeon		2			2
<i>Tandanus tandanus</i>	Eeltailed catfish			1		1
<i>Neosilurus hyrtlilii</i>	Hyrtl's tandan		3			3
<i>Cyprinus carpio</i>	Carp		2	66		68
<i>Carrasius auratus</i>	Goldfish			1		1
Total Numbers			7	92	0	99

Five *C. expansa* were captured in a single fyke net.

3.2.4 Macroinvertebrates

Surber samples were collected from silt (2), silt/sand (2) and sand/gravel. Dip nets were collected from tree roots. Eighteen discrete taxa were recorded at the site with all taxa showing low abundance (**Table 3-2.3**). Note that the two dip net samples produced very different results. Bait traps collected 42 *Macrobrachium* and they were common in the seine hauls.

■ **Table 3-2.3 Aquatic macroinvertebrates recorded from Mooramanna**

Taxa	Edge surber		Tree root dip (1)	Tree root dip (2)
	Mean	std devn		
Hydra	0.2	0.5		
Copepoda	2.2	3.0	2	1
Palaemonidae			9	
Carabidae			1	
Ditiscidae	0.2	0.5	1	
Elmidae	0.2	0.5		3
Hydreinidae			1	
Hydrophilidae	5.4	12.1	1	
Ptilidae			1	
Staphylinidae	0.2	0.5		
Ceratopogonidae	1.2	0.8	5	
Chironominae	1.2	2.2	2	
Tanypodinae	0.2	0.5	2	
Baetidae				3
Caenidae	18.4	39.5	4	1
Corixidae	14.8	29.8	1	1
Notonectidae	0.2	0.5	1	
Leptoceridae	0.2	0.5	1	1
Taxa	4.4	3.4	14	6
Abundance	44.6	86.9	32	10
Total taxa	13			18

3.3 Balonne River at Whyenbah

This site is within the pool formed by the bifurcation weirs and is just upstream of the bridge within a popular camping and fishing area. It was sampled by DERM. The right bank has a relatively gentle slope while the left is very steep for about 4 metres above the water line. The substrate is black soil or fine sand. The sand bar near the camping area was partially submerged. Grass cover on the left (eastern) bank was sparse and various weeds including thistles were present. There was no evidence of feral animals. There was no flow.

3.3.1 Water quality

Results from spot water quality profiling are shown in **Table 3-3.1**. The water column was well mixed though surface water was markedly warmer.

■ **Table 3-3.1 Water quality depth profiling at Whyenbah.**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1400	Surface	25.3	66	388	144	8.0
	0.5	21.1	58	350		7.9
	1.0	20.0	57	344		7.8
	1.5	19.8	57	343		7.7

3.3.2 Macrophytes

None recorded.

3.3.3 Fish

Results are presented in **Table 3-3.1**. Seven native species and one introduced were captured. Carp measured from 109 mm to 326 mm in length. The Cod measured 235 mm. Fish were in a healthy state.

■ **Table 3-3.1 Results of fishing the Balonne River at Whyenbah**

Species	Common name	Gill (0)	Seine (2)	Fyke (4)	Bait	Total Numbers caught
<i>Maccullochella peelii</i>	Murray cod			1		1
<i>Macquaria ambigua</i>	Yellowbelly			7		7
<i>Nematolosa erebi</i>	Bony Bream			2		2
<i>Leiopotherapon unicolor</i>	Spangled perch		1	2		3
<i>Hypseleotris klunzingeri</i>	Carp Gudgeon		1			1
<i>Retropinna semoni</i>	Smelt		4	1		5
<i>Tandanus tandanus</i>	Eeltailed catfish			2		2
<i>Cyprinus carpio</i>	Carp			67		67
Total Numbers			6	82	0	88

3.3.4 Macroinvertebrates

Surber samples were collected from sand, silt or mixtures. A dip net sample was collected from Melaleuca tree roots. Nineteen discrete taxa were identified with only corixids in any numbers (**Table 3-3.2**). One *Cherax* (yabby) and 24 prawns were captured in bait traps and prawns were common in the seine hauls.

■ **Table 3-3.2 Aquatic macroinvertebrates recorded from Whyenbah**

Taxa	Edge surber		Tree root dip
	Mean	std devn	
Acari	0.2	0.5	
Cladocera			16
Copepoda	0.8	1.8	13
Circulionidae			1
Dytiscidae	2.0	2.9	
Elmidae	0.4	0.6	
Hydraenidae	0.4	0.9	5
Hydrophilidae	2.2	3.4	1
Nanophyidae	0.6	0.9	
Ceratopogonidae	0.8	1.8	
Chironominae			1
Orthocladinae			1
Baetidae			2
Caenidae	1.2	1.1	1
Corixidae	19.6	18.7	81
Nepidae			1
Notonectidae	0.2	0.5	10
Veliidae	0.2	0.5	
Leptoceridae	1.0	2.2	2
Taxa	5.2	2.3	13
Abundance	29.6	28.8	135
Total taxa	13		19

3.4 Culgoa River at Whyenbah

This site is centred around an old high level bridge about 1.5 km downstream from the gauging station and weir and was sampled by DERM. It appears the banks have been stripped of weeds and grass cover and some further exposure of tree roots has occurred. Large woody debris was common and a mix of sand bars and clay banks adds to site complexity.

3.4.1 Water quality

Water quality was measured on the western side opposite the large red gum. Results from spot water quality profiling are shown in **Table 3.4.1**. The water column was well mixed.

■ **Table 3-4.1 Water quality profiling, Culgoa River at Whyenbah.**

Sample Time	Depth (m)	Temp. (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1230	Surface	19.6	73	310	149	8.0
	0.5	19.6	74	311		8.0
	1.0	19.5	73	311		8.0
	1.5	19.5	72	311		8.0

3.4.2 Macrophytes

No macrophytes or algae were noted.

3.4.3 Fish

Six native fish species and two introduced were recorded (**Table 3-4.2**). Eeltailed catfish and Spangled perch have been uncommon occurrences at this site while Yellowbelly and Rainbowfish were often in higher numbers. Carp were smaller at this site than upstream, ranging from 109 mm to 294 mm but with many less than 150 mm. *Tandanus* ranged from 84 mm to 138 mm. The Cod measured 241 mm. Fish were in a healthy state.

■ **Table 3-4.2 Results of fishing the Culgoa River at Whyenbah**

Species	Common name	Gill (0)	Seine (2)	Fyke (4)	Bait	Total Numbers caught
<i>Maccullochella peelii</i>	Murray cod			1		1
<i>Macquaria ambigua</i>	Yellowbelly			4		4
<i>Leiopotherapon unicolor</i>	Spangled perch			25		25
<i>Nematolosa erebi</i>	Bony Bream		3	17		20
<i>Melanotaenia fluviatilis</i>	Rainbowfish			1		1
<i>Tandanus tandanus</i>	Eeltailed catfish			14		14
<i>Cyprinus carpio</i>	Carp		4	251		255
<i>Carrasius auratus</i>	Goldfish		1	2		3
Total Numbers			8	315	0	323

3.4.4 Macroinvertebrates

Surber samples were collected from silt (3) sand/gravel and mixed substrate. A dip net sample was collected from tree roots. Seventeen discrete taxa were recorded with only corixids in any numbers (**Table 3-4.3**). Bait traps captured 50 prawns and they were common in seine hauls.

■ **Table 3-4.3 Aquatic macroinvertebrates recorded from Culgoa River at Whyenbah**

Taxa	Edge surber		Tree root dip
	Mean	std devn	
Oligochaeta	0.2	0.5	
Copepoda	1.4	2.6	2
Palaemonidae			5
Dytiscidae	6.6	12.0	
Elmidae	0.2	0.5	
Hydraenidae	1.0	1.0	10
Hydrophilidae	0.6	1.3	1
Nanophyidae	0.2	0.5	1
Staphylinidae			1
Chironominae			1
Baetidae			2
Caenidae	2.8	3.3	
Corixidae	32.0	25.5	4
Gerridae	0.2	0.5	
Notonectidae	0.4	0.6	2
Hydroptillidae			1
Leptoceridae	0.2	0.5	
Taxa	5.0	2.2	11
Abundance	45.8	27.0	30
Total taxa	12		17

3.5 Culgoa River at Cubbie

This site is about 1 km below the Cubbie Weir and was sampled by Hydrobiology. The western bank has a very thin riparian zone on the outer side of the meander and it is eroding. The banks are steep with little or no vegetation. The inner side of the meander has a much better riparian zone above the top bank but little or no understorey because of accumulated leaf, bark and branch litter. Snags are plentiful in the water but little other specialised habitat exists. The substrate tends to be very compact clay.

The river was flowing (just) when sampled and it rained overnight. The deepest part near the main snags probably reached about 1.2 m but most was <0.5 m. The river varied from 10-25 m wide.

No tracks or disturbances of the edge were observed.

3.5.1 Water quality

No water quality data is available.

3.5.2 Macrophytes

No macrophytes were observed.

3.5.3 Fish

Rain meant the nets could not be retrieved as planned so the soak time was about 40 hours. Three native fish species and two introduced were identified (**Table 3-5.2**). Carp ranged from 92 to 490 mm in length.

■ **Table 3-5.2 Results of fishing the Culgoa River at Cubbie**

Species	Common name	Gill	Seine	Fyke	Bait (9)	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	7		1		8
<i>Leiopotherapon unicolor</i>	Spangled perch			1		1
<i>Nematolosa erebi</i>	Bony Bream		2	6		8
<i>Cyprinus carpio</i>	Carp	115	3	181	27	326
<i>Carrasius auratus</i>	Goldfish			28		28
Total Numbers		122	5	217	27	371

Seven *C. longicollis* were captured in fyke nets.

3.5.4 Macroinvertebrates

Surber samples were collected from bare compact clay and a dip net from solid tree roots. Eleven taxa were identified (**Table 3-5.3**), all in low abundance. Bait traps collected 21 *Macrobrachium*. A total of 10 *Cherax* were collected from seine, fyke and gill nets.

■ **Table 3-5.3 Aquatic macroinvertebrates recorded from Culgoa River at Cubbie**

Taxa	Edge surber		Tree root dip
	Mean	Std devn	
Acari	0.2	0.5	
Ancylidae	0.2	0.5	
Copepoda	5.8	4.3	22
Cladocera	0.8	1.1	5
Dytiscidae	0.2	0.5	
Hydrophilidae	0.2	0.5	
Ceratopogonidae	0.6	0.6	
Chironominae	0.4	0.6	
Caenidae	0.4	0.6	1
Corixidae	8.6	3.5	26
Notonectidae			3
Taxa	4.6	1.1	5
Abundance	17.4	7.6	57
Total taxa	10		11

3.6 Culgoa River at Woolerbilla

This site is on a straight stretch of river, has a uniform trapezoidal bed and banks but with a bench on the right hand bank and was sampled by Hydrobiology. Tree cover in the riparian zone is good and there is reasonable grass cover. The river was flowing slowly when sampled and reached a depth of over 1 m. The channel was up to 25 m wide. Moderate snag piles are present and feral goats frequent the area.

3.6.1 Water quality

No water quality data is available.

3.6.2 Macrophytes

No macrophytes or fringing aquatic plants were noted.

3.6.3 Fish

The seine net was not used due to dangerous conditions but it should be noted that the seine has sometimes recorded the best catch at this site. Four native fish species plus two introduced were captured (**Table 3-6.2**). The Carp were between 166 and 425 mm in length with most between 295 and 395 mm. Yellowbelly ranged between 324 and 382 mm.

■ **Table 3-6.2 Results of fishing the Culgoa River at Woolerbilla**

Species	Common name	Gill	Seine (0)	Fyke	Bait	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	9		1		10
<i>Nematolosa erebi</i>	Bony Bream			8		8
<i>Leiopotherapon unicolor</i>	Spangled perch			1		1
<i>Cyprinus carpio</i>	Carp	28		74	6	108
<i>Carrasius auratus</i>	Goldfish			9		9
Total Numbers		37		93	6	136

3.6.4 Macroinvertebrates

Surber samples were collected from bare clay. A dip net was collected from tree roots. Nine taxa were identified, all in very low abundance (**Table 3-6.3**). Eight prawns were captured in bait traps and 24 yabbies were captured in fyke nets.

■ **Table 3-6.3 Aquatic macroinvertebrates recorded from Culgoa River at Woolerbilla**

Taxa	Edge surber		Tree root dip
	Mean	Std devn	
Copepoda	0.2	0.5	3
Dytiscidae	0.4	0.6	
Hydrophilidae	0.2	0.5	
Nanophyidae	0.2	0.5	2
Ceratopogonidae	0.6	0.6	
Tabanidae	0.8	0.8	
Baetidae			1
Corixidae	0.4	0.9	3
Leptoceridae			1
Taxa	2.4	1.9	5
Abundance	2.8	2.2	10
Total taxa	7		9

3.7 Culgoa River at Balandool

The river was flowing at this site when sampled by Hydrobiology. Maximum depth was about 1 m and the channel width reached 20 m. The site has plenty of overhanging vegetation and is well snagged. There was no evidence of grazing animals or pig activity.

3.7.1 Water quality

Results from spot water quality profiling are shown in **Table 3-7.1**. The water column was well mixed but cool, turbid and with low dissolved oxygen.

■ **Table 3-7.1 Water quality profiling at Culgoa River at Balandool.**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1630	Surface	18.6	29.5	227	1353	6.4
	0.5	18.5	30.8	224	1335	6.6

Overnight logging was undertaken at this site. Little variation was evident but as the meter was set to read at two minute intervals, they may not be accurate. The recorded ranges for each parameter were:

Temperature: 17.7 – 18.6°C

Dissolved oxygen: 26.1 – 31.0 %sat

pH: 6.7 – 7.0

Conductivity: 224 – 225 µS/cm

Turbidity: 1123 – 1463 NTU.

3.7.2 Macrophytes

No macrophytes were noted.

3.7.3 Fish

All nets were set at this site but no seine haul was taken. One native fish species and two introduced were recorded (**Table 3-7.2**). This is a very poor catch for this site.

■ **Table 3-7.2 Results of fishing the Culgoa River at Balandool**

Species	Common name	Gill	Seine (0)	Fyke	Bait	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	2				2
<i>Cyprinus carpio</i>	Carp	4		4	2	10
<i>Carrasius auratus</i>	Goldfish			2		2
Total Numbers		6		6	2	14

3.7.4 Macroinvertebrates

Surber samples were collected from bare clay. A dip net sample was collected from tree roots. Sixteen taxa were recorded (**Table 3-7.3**). Copepods were the most common element but all taxa were in low abundance. Fourteen *Macrobrachium* were collected in bait traps.

■ **Table 3-7.3 Aquatic macroinvertebrates recorded from Culgoa River at Balandool**

Taxa	Edge surber		Tree root dip
	Mean	Std devn	
Oligochaeta	0.2	0.5	
Copepoda	17.6	8.6	45
Palaemonidae			4
Hydraenidae	0.8	1.1	1
Hydrophilidae	0.2	0.5	
Nanophyidae			3
Ptiliidae			2
Staphylinidae	0.2	0.5	
Chironominae	0.4	0.6	
Culicidae	0.4	0.6	
Simuliidae			1
Baetidae	0.4	0.6	
Caenidae	0.2	0.5	1
Corixidae	7.4	11.3	
Veliidae	0.6	1.3	
Ecnomidae			3
Taxa	4.2	1.8	8
Abundance	28.4	15.0	60
Total taxa	11		16

3.8 Balonne Minor River at Meigunyah

This site is approximately 1.5 km downstream from the first bifurcation weir where the mouth of Middle Creek marks the downstream end of a significant pool. It was sampled by DERM. At this point the Balonne Minor constricts and flows through a section well-treed with tea tree and with more sand and gravel than the pool upstream. The constricted section was not flowing at the time of sampling. The pool is permanent with a 2 m deep area near a large river red gum on the right bank. The base of the river is between 15 and 25 m wide in the pool. Snags of various sizes are common and river red gum roots are significant in places. The substrate in and near the riffle is sand/gravel while in the pool and on the banks it is black clay.

3.8.1 Water quality

Results from spot water quality profiling are shown in **Table 3-8.1**. The water column was well mixed but relatively low in oxygen.

■ **Table 3-8.1 Water quality profiling, Balonne Minor at Meigunyah**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1520	Surface	20.8	55	303	179	7.8
	0.5	19.6	47	295		7.6
	1.0	19.2	42	292		7.6
	1.5	18.9	43	290		7.6

3.8.2 Macrophytes

No macrophytes were observed. Fringing benthic algal growth was not observed but there was a slight surface scum.

3.8.3 Fish

Seven native fish species and three introduced were captured (**Table 3-8.1**). Yellowbelly ranged from 89 mm to 230 mm. Hyrtl's tandan was in a narrow length range from 109 mm to 134 mm. The Cod measured 580 mm. Lesions were observed on two Yellowbelly and the Cod.

■ Table 3-8.1 Results of fishing the Balonne Minor at Meigunyah.

Species	Common name	Gill (0)	Seine (2)	Fyke (4)	Bait	Total Numbers
<i>Maccullochella peelii</i>	Murray cod			1		1
<i>Macquaria ambigua</i>	Yellowbelly			10		10
<i>Leiopotherapon unicolor</i>	Spangled perch			4		4
<i>Nematolosa erebi</i>	Bony Bream			14		14
<i>Hypseleotris klunzingeri</i>	Carp Gudgeon		1			1
<i>Retropinna semoni</i>	Smelt		1			1
<i>Neosilurus hyrtlilii</i>	Hyrtl's tandan		2	15		17
<i>Cyprinus carpio</i>	Carp		2	117		119
<i>Carrasius auratus</i>	Goldfish			1		1
<i>Gambusia holbrooki</i>	Mosquitofish		1			1
Total Numbers			7	162		169

3.8.4 Macroinvertebrates

Three surber samples were collected from silt and two from mixed substrate. A dip net was collected from red gum roots. Sixteen taxa were recorded with copepods and cladocera most common. Twelve prawns were captured in bait traps while larger numbers were captured in the seine hauls.

■ Table 3-8.2 Aquatic macroinvertebrates recorded from the Balonne Minor at Meigunyah.

Taxa	Edge surber		Tree root dip
	Mean	std devn	
Nematoda			1
Oligochaeta	0.8	1.3	8
Copepoda	55.2	40.2	250
Cladocera	27.2	41.0	1000
Gyrinidae			1
Hydraenidae			1
Hydrophilidae	0.4	0.6	
Ceratopogonidae			3
Chironominae	0.4	0.9	2
Tanypodinae			1
Tabanidae	0.4	0.6	
Baetidae	0.2	0.5	14
Caenidae	3.0	5.7	2
Corixidae	2.0	2.0	5
Notonectidae	0.2	0.5	
Leptoceridae	0.4	0.6	1
Taxa	5.0	2.1	13
Abundance	90.2	64.0	1289
Total taxa	11		16

3.9 Balonne Minor at Trafalgar

This site is at the upper end of the weir pool and includes areas both upstream and downstream of the Cubbie intake channel. It was sampled by Hydrobiology. The water level was relatively high, with living trees and lignum partly submerged. Maximum depth was about 2 m and the channel width reached 40 m. A surface scum covered approximately 20% of the water surface. Reasonable snag density and overhang occurs here. Tree and lignum cover in the nearby area was good but the ground was otherwise bare. There was no evidence of grazing or feral animals.

3.9.1 Water quality

Results from spot water quality profiling are shown in **Table 3-9.1**. The water column was well mixed and with low dissolved oxygen.

■ **Table 3-9.1 Water quality profiling, Balonne Minor at Trafalgar**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
0900	Surface	17.8	26.2	203	611	6.2
	0.5	17.3	23.8	203	635	6.3
	1.0	17.3	23.6	202	601	6.4
	1.5	17.0	22.4	203	635	6.4

3.9.2 Macrophytes

No macrophytes were observed.

3.9.3 Fish

All nets were used at this site. Three native fish species and two introduced were captured (**Table 3-9.2**). Carp ranged from 109 to 318 mm in length with most less than 150 mm. While only 5 Bony bream were captured, they ranged from 224 to 495 mm, making them relatively large individuals.

■ **Table 3-9.2 Results of fishing the Balonne Minor at Trafalgar.**

Species	Common name	Gill	Seine (2)	Fyke	Bait	Total Numbers
<i>Macquaria ambigua</i>	Yellowbelly	2		1		3
<i>Nematolosa erebi</i>	Bony Bream	5				5
<i>Tandanus tandanus</i>	Eeltailed catfish	2				2
<i>Cyprinus carpio</i>	Carp	7	1	10	4	22
<i>Gambusia holbrooki</i>	Mosquitofish			1		1
Total Numbers		16	1	12	4	33

3.9.4 Macroinvertebrates

Surbers were collected from bare clay. A dip net sample was collected from tree roots and debris. Eighteen taxa were recorded with cladocera and corixids being the most common (**Table 3-9.3**). Eighteen prawns were captured in bait traps and they were common in seine and fyke nets.

■ **Table 3-9.3 Aquatic macroinvertebrates recorded from Balonne Minor at Trafalgar**

Taxa	Edge surber		Tree root Dip
	Mean	Std devn	
Oligochaeta	5.2	9.0	4
Copepoda	8.2	8.8	120
Palaemonidae	1	1.4	5
Parastacidae	0.8	0.8	
Cladocera	70.2	73.8	127
Elmidae	0.2	0.5	
Hydraenidae	1.2	2.2	
Hydrophilidae	0.2	0.5	1
Ceratopogonidae	0.2	0.5	
Chironominae			3
Tanypodinae	0.2	0.5	
Sciomyzidae			1
Tipulidae	0.2	0.5	
Caenidae			1
Corixidae	19.4	35.0	106
Notonectidae	0.2	0.5	
Veliidae	0.8	1.8	
Leptoceridae			2
Taxa	6.2	0.8	10
Abundance	108	61.7	370
Total taxa	14		18

3.10 Donegri Ck (Narran River) at Dirranbandi

The river was not flowing when sampled by Hydrobiology. The reach sampled consisted of pools on consecutive meanders with intervening straight sections and is a short distance downstream from the town weir. The largest pool was approximately 50x30 m and over 2 m deep. The outer edge of each meander was very steep with little vegetation but the top bank was well covered with shrubs, trees and lignum. Minor snags and overhangs were present but no aquatic vegetation. The substrate was black soil and occasional sand bars. A surface algal scum was present.

3.10.1 Water quality

Results from spot water quality profiling are shown in **Table 3-10.1**. The water column was well mixed but with low dissolved oxygen.

■ **Table 3-10.1 Water quality depth profiling at Donegri Creek.**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1700	Surface	20.7	49.3	233	510	6.4
	0.5	19.9	39.6	233	517	6.5
	1.0	18.8	32.5	231	529	6.6
	1.5	17.7	25.5	232	543	6.5
	2.0	17.3	23.7	232	587	6.5

Overnight logging was undertaken at this site (1730 to 0800 hrs). Little variation was evident. The recorded ranges for each parameter were:

Temperature: 18.7 – 21.3°C

Dissolved oxygen: 31 – 51.0 % sat

pH: 6.5 – 6.6

Conductivity: 232 – 234 µS/cm

Turbidity: 400 – 492 NTU.

3.10.2 Macrophytes

No macrophytes were noted.

3.10.3 Fish

Rain overnight prevented access so the soak time reached 23 hours. Four native fish species and two introduced were captured (**Table 3-10.2**). Carp ranged from 102 to 442 mm with a relatively even spread. Yellowbelly ranged from 346 to 422 mm. A small proportion of fish had lesions or parasites.

■ **Table 3-10.2 Results of fishing at Donegri Creek**

Species	Common name	Gill (3)	Seine (2)	Fyke	Bait	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	10		2		12
<i>Leiopotherapon unicolor</i>	Spangled perch		1			1
<i>Nematolosa erebi</i>	Bony Bream	1	8	1		10
<i>Neosilurus hyrtlii</i>	Hyrtl's tandan		1	1		2
<i>Cyprinus carpio</i>	Carp	28	4	24	1	57
<i>Carrasius auratus</i>	Goldfish		3	4		7
Total Numbers		39	17	32	1	89

Two *C. longicollis* were recorded from fyke nets.

3.10.4 Macroinvertebrates

Surbers were collected from the bare edge (clay). Sixteen taxa were recorded, all in low abundance (**Table 3-10.3**). Ninety-five prawns were recorded from bait traps and two yabbies were captured in fyke nets.

■ **Table 3-10.3 Aquatic macroinvertebrates recorded from Dongeri Ck**

Taxa	Edge surber		Tree root dip
	Mean	Std devn	
Oligochaeta	0.2	0.5	1
Copepoda	0.6	0.9	
Palaemonidae			3
Carabidae			1
Elmidae	0.2	0.5	
Hydraenidae	0.2	0.5	
Hydrophilidae	0.2	0.5	1
Ceratopogonidae	0.8	1.3	
Chironominae	0.8	0.5	
Tabanidae	0.6	0.9	1
Tipulidae	0.2	0.5	
Caenidae	0.4	0.6	
Corixidae	2.8	2.7	21
Gerridae	0.2	0.5	
Notonectidae			1
Ecnomidae			1
Taxa	4.4	2.3	8
Abundance	7.2	5.2	30
Total taxa	12		16

3.11 Narran River at Clyde

Water was continuous in both directions at the site and reached at least 1.5 m deep though most was much less. Width was generally 20-25 m and there was no flow. Only small amounts of large woody debris were present. A surface scum was present at one end of the sampled area. There were no signs of recent use by cattle or feral animals. The site was sampled by DERM.

3.11.1 Water quality

The results of spot measurements are shown in **Table 3-11.1**. Temperature dropped quickly between 0.5 and 1.0 m while oxygen dropped at even shallower depth.

■ **Table 3-11.1 Spot water quality readings – Narran River at Clyde**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1515	Surface	26.6	93	235	436	8.2
	0.5	24.6	48	225		8.0
	1.0	19.2	29	199		7.8
	1.5	18.8	22	199		7.6

3.11.2 Macrophytes

No macrophytes were recorded.

3.11.3 Fish

The catch comprised of five native fish species and three introduced (**Table 3-11.2**). Carp ranged between 98 and 526 mm in length (otherwise the longest was 309). Bony bream ranged between 78 and 230 mm.

■ **Table 3-11.2 Results of fishing the Narran River at Clyde**

Species	Common name	Gill (0)	Seine (2)	Fyke (4)	Bait	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly			4		4
<i>Leiopotherapon unicolor</i>	Spangled Perch			2		2
<i>Nematolosa erebi</i>	Bony Bream		3	33		36
<i>Melanotaenia fluviatilis</i>	Rainbowfish		1			1
<i>Neosilurus hyrtlii</i>	Hyrtl's tandan			2		2
<i>Cyprinus carpio</i>	Carp		15	83		98
<i>Carrasius auratus</i>	Goldfish			1		1
<i>Gambusia holbrooki</i>	Mosquitofish		1			1
Total Numbers			20	125	0	145

Two *C.longicollis* were captured in fyke nets.

3.11.4 Macroinvertebrates

Surbers were collected from silt. Twenty discrete taxa were recorded with copepods and corixids most common (**Table 3-11.3**). Four prawns were captured in bait traps and they were also captured in seine hauls.

■ **Table 3-11.3 Numbers of aquatic macroinvertebrates recorded from the Narran River at Clyde**

Taxa	Edge surber	
	Mean	std devn
Oligochaeta	3.2	3.4
Gastropoda	0.2	0.5
Ostracoda	0.6	0.9
Copepoda	178.0	96.6
Cladocera	4.2	4.0
Palaemonidae	0.4	0.6
Dytiscidae	0.2	0.5
Hydraenidae	0.4	0.9
Hydrophilidae	0.2	0.5
Staphylinidae	0.2	0.5
Ceratopogonidae	0.2	0.5
Chironominae	0.4	0.6
Tanypodinae	0.2	0.5
Culicidae	0.2	0.5
Tabanidae	1.2	1.3
Caenidae	0.6	0.9
Corixidae	36.2	20.9
Nepidae	0.2	0.5
Veliidae	0.2	0.5
Ecnomidae	0.2	0.5
Taxa	8.0	1.2
Abundance	227.2	115.9
Total taxa	20	

3.12 Narran River at Booligar

There was no flow and the downstream riffle was dry. Water was continuous for about 80 m, reaching 20 m wide and up to 1.5 m deep. There are few snags in the water and minor overhang. A surface algal scum was present and filamentous algae grew on sticks in the water. There was evidence of feral pig activity. The site was sampled by Hydrobiology.

3.12.1 Water quality

No water quality results are available.

3.12.2 Macrophytes

No macrophytes were noted and filamentous alga was poorly developed on sticks and litter.

3.12.3 Fish

Due to rain preventing access, the soak time was approximately 64 hours. Two native fish species and two introduced were captured (**Table 3-12.2**). Yellowbelly ranged from 258 to 427 mm. Carp ranged from 88 to 490 mm. A few fish had lesions.

■ **Table 3-12.2 Results of fishing the Narran River at Booligar.**

Species	Common name	Gill (2)	Seine (2)	Fyke	Bait (8)	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	7		3		10
<i>Nematolosa erebi</i>	Bony Bream		1			1
<i>Cyprinus carpio</i>	Carp	12	6	28		46
<i>Carrasius auratus</i>	Goldfish		4			4
Total Numbers		19	11	31	0	61

3.12.4 Macroinvertebrates

Surbers were collected from bare edge. Eighteen taxa were recorded. The fauna was dominated by copepods and cladocerans (**Table 3-12.3**). Bait traps collected 9 prawns and they were common in seine hauls. Seven yabbies were recorded from seine and fyke nets.

■ **Table 3-12.3 Aquatic macroinvertebrates recorded from Narran River at Booligar**

Taxa	Edge surber	
	Mean	Std devn
Hydra	0.2	0.5
Isosticidae	0.2	0.5
Oligochaeta	1.2	1.3
Spongillidae	0.2	0.5
Temnocephalidae	0.2	0.5
Cladocera	13.2	15.4
Copepoda	80.4	67.3
Palaemonidae	1.4	2.6
Elmidae	0.2	0.5
Hydraenidae	0.8	1.3
Hydrophilidae	1.2	2.2
Tabanidae	0.2	0.5
Ceratopogonidae	1.0	2.2
Chironominae	1.0	1.7
Tanypodinae	0.2	0.5
Tipulidae	0.4	0.6
Caenidae	0.4	0.6
Corixidae	2.0	2.9
Taxa	7.0	3.2
Abundance	104.4	65.5
Total taxa	18	

3.13 Balandool River at Cubbie

The river in this location has a shallow trapezoidal shape with bare banks of black clay. The river was flowing when sampled by Hydrobiology. The pool was about 15 m wide and depth reached possibly 0.5 m. The river here has few snags and little overhanging vegetation. There was no evidence of disturbance by stock or feral animals. A small amount of filamentous algae fringed the left bank.

3.13.1 Water quality

Spot water quality measurements were taken from the centre of the channel and results are shown in **Table 3-13.1**. Given this site is shallow, relatively open and was flowing, the strong thermal stratification is surprising.

■ **Table 3-13.1 Spot water quality readings – Balandool River at Cubbie**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
0730	Surface	17.8	25.1	212	2043	7.2
	0.5	12.6	25.1	212	2100	6.9

The ranges recorded overnight (1800 to 0715 hrs) for each parameter were:

Temperature: 17.9 – 23.1°C

Dissolved oxygen: 27 – 61 %sat

pH: 6.6 – 7.1

Conductivity: 211 – 213 µS/cm

Turbidity: 1519 - 1877 NTU.

When compared with data from the spot sample, the dissolved oxygen result indicates the time of collection of the spot sample was representative of the overnight minima.

3.13.2 Macrophytes and algae

No macrophytes were observed. A small amount of filamentous algae fringed the left bank.

3.13.3 Fish

Only one gill net was set due to the limited depth. Two native fish species and two introduced were recorded (**Table 3-13.2**). Carp ranged from 79 and 306 mm.

■ **Table 3-13.2 Results of fishing the Balandool River at Cubbie**

Species	Common name	Gill (1)	Seine	Fyke	Bait	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	2				2
<i>Leiopotherapon unicolor</i>	Spangled perch			6		6
<i>Cyprinus carpio</i>	Carp	7	4	22	20	53
<i>Carrasius auratus</i>	Goldfish		8	14		22
Total Numbers		9	12	42	20	83

3.13.4 Macroinvertebrates

Surber samples were collected from bare edge or edge with algae. A dip net was collected from tree roots and leaves. Twenty-one taxa were recorded with copepods, cladocera and corixids most common (**Table 3-13.3**). Nine prawns were captured in bait traps and good numbers were caught in seine hauls. Three yabbies were caught in various nets.

■ **Table 3-13.3 Aquatic macroinvertebrates recorded from Balandool River on Cubbie**

Taxa	Edge surber		Tree root and leaf dip
	Mean	Std devn	
Acari			2
Oligochaeta	2.4	3.8	1
Copepoda	54.6	41.3	319
Cladocera	15.8	15.6	258
Ostracoda	0.2	0.5	
Palaemonidae			4
Parastacidae			1
Dytiscidae	3.4	3.9	
Hydraenidae			23
Hydrophilidae			3
Staphylinidae			1
Ceratopogonidae	0.2	0.5	
Chironominae	13.4	9.6	6
Orthoclaadiinae			2
Tanypodinae	0.4	0.6	
Tabanidae	1.0	1.7	
Caenidae	0.2	0.5	7
Corixidae	51.8	43.2	42
Nepidae			1
Notonectidae			1
Ecnomidae			1
Taxa	6.6	1.8	16
Abundance	143.4	56.6	672
Total taxa	11		21

3.14 Balandool River at Euraba

Not sampled due to difficult wet weather access.

3.15 Bokhara River at Kirrima

The river was flowing but a few days earlier it had not been (though the channel held water). The channel below the weir was generally about 12 m wide and reached about 1 m deep. The reach was a black clay trapezoidal shape with very bare banks. The reach contained moderate snag piles and overhanging vegetation. Feral goats frequent this area. The site was sampled by Hydrobiology.

3.15.1 Water quality

Spot water quality measurements were taken from the centre of the channel 50 m downstream from the weir and results are shown in **Table 3-15.1**. The water column was well mixed, turbid and with low pH and dissolved oxygen.

■ **Table 3-15.1 Spot water quality readings – Bokhara River at Kirrima**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1610	Surface	20.3	41.2	197	945	5.6
	0.5	20.3	41.2	197	992	6.2

3.15.2 Macrophytes

No macrophytes or filamentous algae were observed.

3.15.3 Fish

Two native species of fish and two introduced were captured (**Table 3-15.2**). Yellowbelly ranged from 120 to 305 mm and Carp from 95 to 420 mm (though only 2 were over 245 mm).

■ **Table 3-15.2 Results of fishing the Bokhara River at Kirrima.**

Species	Common name	Gill	Seine (2)	Fyke	Bait	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	2	1	19		22
<i>Leiopotherapon unicolor</i>	Spangled perch		1	2		3
<i>Cyprinus carpio</i>	Carp	11	6	34	19	70
<i>Carrasius auratus</i>	Goldfish			7		7
Total Numbers		13	8	62	19	102

3.15.4 Macroinvertebrates

Surber samples were collected from bare edge. A dip net sample was collected from tree root / snag. Fourteen taxa were recorded, all in low abundance (**Table 3-15.3**). Bait traps captured 16 prawns and 1 yabby. They were also both captured in seine and fyke nets, the prawns in reasonable numbers.

■ **Table 3-15.3 Aquatic macroinvertebrates recorded from Bokhara River at Kirrima**

Taxa	Edge surber		Tree root dip
	Mean	Std devn	
Tetragnathidae			1
Cladocera	0.4	0.9	
Copepoda	8.0	17.9	
Ostracoda	0.2	0.5	
Carabidae	0.4	0.9	
Dytiscidae	4.4	3.5	4
Hydraenidae	1.0	1.2	8
Hydrophilidae	0.2	0.5	2
Orthoclaadiinae			1
Culicidae	0.2	0.5	1
Tabanidae	0.2	0.5	
Corixidae	11.0	14.6	7
Notonectidae	0.8	1.8	3
Veliidae			2
Taxa	4.0	1.4	9
Abundance	26.8	18.1	29
Total taxa	11		14

3.16 Bokhara River at Koala

The site is basically a long and near-permanent black soil pool. The pool was up to 25 m wide and 1.3 m deep. The site has moderate snag piles and overhanging vegetation. The river was flowing slowly when sampled by Hydrobiology.

3.16.1 Water quality

Spot water quality measurements were taken from the centre of the channel and results are shown in **Table 3-16.1**. The water column was well mixed but highly turbid with low pH and dissolved oxygen. Given the overnight pH range, the low spot measurements are questionable.

■ **Table 3-16.1 Spot water quality readings – Bokhara River at Koala**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1430	Surface	17.7	26.3	222	1130	5.6
	0.5	17.5	24.7	222	1167	6.0
	1.0	17.1	22.4	222	1300	6.2

Overnight water quality data were recorded at this site (1744 – 0800 hrs). The ranges recorded overnight for each parameter were:

Temperature: 16.8 – 17.7°C
 Dissolved oxygen: 21.1 – 25.7 %sat
 pH: 6.4 – 6.7
 Conductivity: 220 - 222µS/cm
 Turbidity: 774 - 1069 NTU.

3.16.2 Macrophytes

No macrophytes were recorded.

3.16.3 Fish

The seine net was not used at this site. Sampling captured one native species plus two introduced (**Table 3-16.2**). Carp ranged from 95 to 308 mm. Two of the Yellowbelly had parasites and low numbers had lesions.

■ **Table 3-16.2 Results of fishing the Bokhara River at Koala.**

Species	Common name	Gill	Seine (0)	Fyke	Bait (8)	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	4				4
<i>Cyprinus carpio</i>	Carp	7		13	2	22
<i>Carrasius auratus</i>	Goldfish			2		2
Total Numbers		11		15	2	28

3.16.4 Macroinvertebrates

Surber samples were collected from bare edge. A dip net sample was collected from tree roots. Twenty-one taxa were recorded with the dominant taxa being corixids and copepods (**Table 3-15.3**). Bait traps captured 9 prawns and 1 *Cherax* and they were otherwise rarely encountered.

■ **Table 3-16.3 Aquatic macroinvertebrates recorded from Koala**

Taxa	Edge surber		Tree root dip
	Mean	Std devn	
Hydra	0.2	0.5	1
Nematoda	0.2	0.5	
Oligochaeta	2.4	2.6	
Cladocera	4.2	6.4	16
Copepoda	35.8	54.3	48
Palaemonidae			1
Dytiscidae	0.2	0.4	11
Elmidae			3
Hydraenidae	0.6	0.5	4
Hydrophilidae	0.6	1.3	22
Chironominae			3
Tanypodinae	0.2	0.5	1
Ephyridae			1
Tabanidae	0.6	0.9	
Tipulidae	0.2	0.5	
Baetidae			1
Caenidae	0.6	1.3	5
Leptophlebiidae			1
Corixidae	42.6	45.7	95
Notonectidae	0.2	0.5	1
Leptoceridae			1
Taxa	5.4	1.7	17
Abundance	88.6	42.7	215
Total taxa	14		21

3.17 Warrego River at Shannonvale

The site consists of a long pool with a sand / gravel substrate below the Cunnamulla weir. There was no flow at the time of sampling. The pool was a maximum of about 30 m wide and 3-4 m deep at the downstream end and only small areas of the sand bars on the opposite bank were exposed. Pig tracks were evident on these banks. The side channel near the camping area had recently held water. Evidence of fishers, campers and motorcycle riders was common. The water was green from algal content. The site was sampled by DERM.

3.17.1 Water quality

Spot water quality measurements were taken from near the centre of the channel. Results are shown in **Table 3-17.1**. Oxygen was supersaturated near the surface, reflecting the algal content of the water, but rapidly declined with depth. Turbidity

was very low and this factor may have allowed the algal production to occur. The relatively high pH could also be indicative of a stagnating water body though flow had only ceased in mid-August.

■ **Table 3-17.1 Spot water quality readings – Warrego River at Shannonvale**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1530	Surface	24.6	107	215	22.3	8.8
	0.5	22.6	102	206		8.8
	1.0	19.3	79	190		8.6
	1.5	18.9	54	182		8.1

3.17.2 Macrophytes

No macrophytes were recorded.

3.17.3 Fish

Six species of native fish plus two introduced were captured (**Table 3-17.2**). It is unusual not to capture Hyrtl's tandan at this site, particularly given that 5 fyke nets were used and this is the best net type to capture this species. Carp measured from 158 mm to 295 mm while Yellowbelly ranged from 122 mm to 368 mm.

■ **Table 3-17.2 Results of fishing the Warrego River at Shannonvale.**

Species	Common name	Gill (0)	Seine (2)	Fyke (5)	Bait	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly			26		26
<i>Leiopotherapon unicolor</i>	Spangled perch			6		6
<i>Nematolosa erebi</i>	Bony Bream		2	9		11
<i>Hypseleotris klunzingeri</i>	Carp Gudgeon		2		1	3
<i>Retropinna semoni</i>	Smelt			1		1
<i>Tandanus tandanus</i>	Eeltailed catfish			1		1
<i>Cyprinus carpio</i>	Carp		1	119		120
<i>Carrasius auratus</i>	Goldfish			29		29
Total Numbers			5	191	1	197

3.17.4 Macroinvertebrates

Surbers were collected from mixtures of sand, gravel and silt. Dip nets were collected from fibrous tree roots and solid tree roots. Twenty-three taxa were collected (**Table 3-17.3**) with copepods and dytiscid beetles the most common though all were in low abundance. One hundred and fourteen *Macrobrachium* were captured in bait traps. Prawns were also captured in fyke and seine nets.

■ **Table 3-17.3 Aquatic macroinvertebrates recorded from Shannonvale**

Taxa	Edge surber		Tree root dip
	Mean	std devn	
Pisauridae			2
Oligochaeta	3.8	5.3	
Copepoda	17.8	12.3	31
Ostracoda	0.2	0.5	
Atyidae			3
Palaemonidae			1
Parastacidae	0.2	0.5	
Dytiscidae	10.4	11.0	1
Hydraenidae	1.2	2.7	2
Hydrochidae	0.6	0.9	
Hydrophilidae	2.0	3.5	1
Staphylinidae			2
Chironominae	1.0	1.2	9
Tanypodinae	1.8	2.2	
Orthocladinae	0.2	0.5	5
Tabanidae	0.2	0.5	1
Culicidae	0.6	0.9	
Baetidae	5.8	5.2	12
Caenidae	1.6	1.7	9
Corixidae	0.6	1.3	1
Hydrometridae			1
Ecnomidae			2
Leptoceridae	1.6	1.8	
Taxa	8	2.9	17
Abundance	49.6	26.5	83
Total taxa	17		23

3.18 Warrego River at Tinnenburra

There was no flow at the site and water levels were low. Width of the wetted channel reached 8 m and depth reached 1.5 m but it was generally much less. The water was strongly green. Paroo Shire Council was pumping water from the downstream end of the pool. A few isolated snags occurred in places and some roots reached the water. Banks were relatively bare and disturbance by pigs was evident. The site was sampled by DERM.

3.18.1 Water quality

Results of spot water quality samples are shown in **Table 3-18.1**. The data indicates a drying pool with increased algal production.

■ Table 3-18.1 Spot water quality readings – Warrego River at Tinnenburra

Sample time	Depth (m)	Temp (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1345	Surface	23.6	105	237	113	8.8
	0.5	20.1	74	222		8.6
	1.0	18.5	52	213		8.3
	1.5	18.3	45	215		7.6

3.18.2 Macrophytes

No macrophytes were observed.

3.18.3 Fish

Six native species and two introduced were captured (Table 3-18.2). It has not been unusual to record no introduced species at this site. Carp measured from 94 mm to 299 mm though many were less than 150 mm. Yellowbelly ranged from 83 mm to 320 mm. Fish were generally healthy. It was noted that two of the Hyrtl's tandan were different; these may have been *Porochilus*, which has been recorded in this program in the Warrego River.

■ Table 3-18.2 Results of fishing the Warrego River at Tinnenburra.

Species	Common name	Gill (0)	Seine (2)	Fyke (4)	Bait	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly			117		117
<i>Leiopotherapon unicolor</i>	Spangled perch			7		7
<i>Nematolosa erebi</i>	Bony Bream			34		34
<i>Melanotaenia fluviatilis</i>	Rainbowfish		2	7		9
<i>Retropinna semoni</i>	Smelt			1		1
<i>Neosilurus hyrtlui</i>	Hyrtl's tandan			7		7
<i>Cyprinus carpio</i>	Carp		89	617	7	713
<i>Carrasius auratus</i>	Goldfish		28	484		512
Total Numbers			119	1274	7	1400

3.18.4 Macroinvertebrates

Surber samples were collected from silt/sand and a dip net was collected from solid tree roots. Twenty-one taxa were collected (Table 3-18.3) with only copepods in significant numbers. One hundred and seventy-eight *Macrobrachium* and 11 *Cherax* were recorded from bait traps. They were also recorded in seine and fyke nets.

■ **Table 3-18.3 Aquatic macroinvertebrates recorded from Tinnenburra**

Taxa	Edge surber		Tree root dip
	Mean	std devn	
Pisauridae			2
Oligochaeta	3.0	3.7	1
Copepoda	111.6	97.7	120
Palaemonidae			1
Carabidae	0.2	0.5	
Dytiscidae	1.6	1.8	
Hydraenidae	1.4	2.1	13
Hydrophilidae			1
Staphylinidae	0.2	0.5	3
Ceratopogonidae	0.2	0.5	
Chironominae	0.4	0.6	5
Orthocladinae	0.2	0.5	
Tabanidae	0.4	0.9	1
Baetidae	1.0	1.0	5
Caenidae	3.6	4.3	1
Corixidae	3.8	5.4	
Gerridae			7
Hebridae			1
Pleidae	0.2	0.5	
Gomphidae	0.2	0.5	
Ecnomidae	0.4	0.6	3
Taxa	7.2	2.7	14
Abundance	128.4	110.6	164
Total taxa	16		21

3.19 Moonie River at Nindigully

There was no flow at the time of sampling. Width at the waterline was up to 30 m and depth to 1.7 m. No *Ludwigia* was present and the *Schoenoplectus* near the gauge was only just in the water. Banks were bare and the only disturbance to the edge appeared to be caused by birds. The water was turbid with a greeny brown surface scum in parts. The site was sampled by Hydrobiology and later by DERM. Hydrobiology data is presented unless otherwise stated.

3.19.1 Water quality

Results of spot water quality samples are shown in **Table 3-19.1**. The water column was highly turbid with a warm surface layer and was generally low in oxygen. The low spot pH is not reflected by the overnight logging, suggesting perhaps the meter did not have time to settle prior to the reading being taken.

■ **Table 3-19.1 Spot water quality readings – Moonie River at Nindigully**

Sample time	Depth (m)	Temp (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1400	Surface	24.7	65	119	1947	5.4
	0.5	19.9	37	118	2124	5.9
	1.0	18.0	28	105	2742	5.9
	1.4	18.1	28	98	2696	5.9

Overnight water quality data were recorded at this site. The ranges recorded overnight (1700 hrs to 0800 hrs) for each parameter were:

Temperature: 19.2 – 24.2°C

Dissolved oxygen: 34 – 70 %sat

pH: 6.0 – 6.5

Conductivity: 96 - 123µS/cm

Turbidity: 1624 - 2366 NTU.

3.19.2 Macrophytes

No macrophytes were observed.

3.19.3 Fish

Three native fish species and two introduced were recorded (**Table 3-19.2**).

Yellowbelly ranged from 152 to 450 mm with 12 being over 300 mm; Bony bream from 200 to 291 mm. Most of the Goldfish had lesions but other species were healthy.

When sampled by DERM (no gill nets, 4 fyke nets and 2 seine hauls) no *Tandanus* were recorded but one Western Carp gudgeon was captured in a seine haul.

■ **Table 3-19.2 Results of fishing the Moonie River at Nindigully.**

Species	Common name	Gill	Seine (0)	Fyke	Bait (9)	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	14		5		19
<i>Nematolosa erebi</i>	Bony Bream	15				15
<i>Tandanus tandanus</i>	Eeltail catfish	9				9
<i>Cyprinus carpio</i>	Carp	10		7		17
<i>Carrasius auratus</i>	Goldfish			6		6
Total Numbers		48		18	0	66

DERM captured one *C. longicollis* in a fyke net.

3.19.4 Macroinvertebrates

Surber samples were collected firm bare mud. A dip net was collected from solid tree roots. Fourteen taxa were identified (**Table 3-19.3**) with only corixids in any abundance. Four *Macrobrachium* were captured in fyke nets and DERM captured 17 in seine hauls.

■ **Table 3-19.3a Aquatic macroinvertebrates recorded from Nindigully by Hydrobiology**

Taxa	Edge surber		Tree root dip
	Mean	Std devn	
Acari			1
Pisauridae	0.2	0.5	
Isotomidae	0.2	0.5	
Ancylidae	0.4	0.9	3
Cladocera			4
Copepoda	0.8	1.3	
Palaemonidae	0.6	0.9	7
Dytiscidae	1.0	1.2	
Hydraenidae	0.2	0.5	
Culicidae	0.2	0.5	1
Baetidae	0.2	0.5	
Corixidae	23.2	23.5	117
Notonectidae	0.2	0.5	
Coenagrionidae			1
Taxa	3.6	2.6	7
Abundance	27.2	24.5	134
Total taxa	11		14

DERM also sampled this site for the results shown below. In this case no dip net was used but 19 taxa were recorded from surbers alone. Mean taxa and mean abundance were markedly higher than above as a result of the numbers of copepod, cladocera and corixids.

■ **Table 3-19.3b Aquatic macroinvertebrates recorded from Nindigully by DERM**

Taxa	Edge surber	
	average	std devn
Hydra	0.2	0.5
Oligochaeta	1.8	1.9
Polycladida	0.2	0.5
Ancylidae	0.2	0.5
Cladocera	59.2	20.8
Copepoda	72.6	52.7
Ostracoda	3.0	3.2
Palaemonidae	0.2	0.5
Dytiscidae	1.8	1.5
Hydraenidae	0.4	0.9
Ceratopogonidae	2.6	2.7
Chironominae	1.2	1.6
Tanypodinae	2.2	1.9
Culicidae	0.4	0.6
Baetidae	0.6	0.9
Caenidae	0.4	0.6
Corixidae	73.2	44.3
Coenagrionidae	0.8	1.8
Leptoceridae	0.6	0.6
Taxa	10.6	1.7
Abundance	221.6	43.8
Total taxa	19	

3.20 Moonie River at Fenton

The pool was continuous in both directions, generally about 30 m wide and with a maximum depth of about 1.5 m. The grass cover on the banks was reasonable though it was grazed. Patches of algal or foamy scum were present. There was no flow and no evidence of feral animals. The site was sampled by DERM.

3.20.1 Water Quality

Spot water quality data are shown in **Table 3-20.1**. The water column was reasonably well mixed though DO and temperature decreased with depth.

■ **Table 3-20.1 Spot water quality readings – Fenton**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (% sat.)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1445	Surface	23.1	60	62	821	7.3
	0.5	22.1	58	61		7.1
	1.0	20.6	48	58		7.1
	1.5	19.3	36	57		7.0

3.20.2 Macrophytes

No macrophytes were noted.

3.20.3 Fish

Two native species and two introduced were captured (**Table 3-20.2**). This is very similar to historical catches.

■ **Table 3-20.2 Results of fishing at Fenton.**

Species	Common name	Gill (0)	Seine (2)	Fyke (4)	Bait	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly			7		7
<i>Nematolosa erebi</i>	Bony Bream		1	2		3
<i>Cyprinus carpio</i>	Carp		3	35		38
<i>Carrasius auratus</i>	Goldfish					7
Total Numbers			4	51	0	55

Four long-necked turtles were captured in fyke nets.

3.20.4 Macroinvertebrates

Surber samples were collected from silt. Fourteen discrete taxa were identified with copepods and corixids the only taxa in any abundance (**Table 3-20.3**). Bait traps captured 2 *Macrobrachium* and seine nets captured a further 34.

■ **Table 3-20.3 Macroinvertebrates captured at Fenton**

Taxa	Edge surber	
	Mean	std devn
Pisauridae	0.2	0.5
Oligochaeta	0.8	1.3
Cladocera	6.0	5.0
Copepoda	58.6	20.6
Ostracoda	1.0	1.2
Palaemonidae	0.2	0.5
Dytiscidae	0.2	0.5
Heteroceridae	0.2	0.5
Hydraenidae	0.8	1.3
Culicidae	0.2	0.5
Caenidae	1.8	4.0
Corixidae	58.0	28.3
Notonectidae	0.2	0.5
Leptoceridae	0.2	0.5
Taxa	5.8	1.3
Abundance	128.4	44.6
Total taxa	14	

3.21 Lower Plains Lagoon

The pool was essentially continuous and up to 2 m deep but commonly much shallower. It contained very few snags and little vegetation was overhanging the water. The water was clear and there was no sign of feral animals. The site was sampled by DERM.

3.21.1 Water Quality

Spot water quality data are shown in **Table 3-21.1**. The water column was reasonably mixed though the surface was warmer and with more oxygen.

■ **Table 3-21.1 Spot water quality readings –Lower Plains Lagoon**

Sample Time	Depth (m)	Temp. (°C)	DO (% sat.)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1100	Surface	23.5	68	378	322	8.1
	0.5	22.9	59	373		8.1
	1.0	22.7	45	371		8.0
	1.5	21.3	38	371		8.0

3.21.2 Fish

Six native species and three introduced were captured. Carp ranged between 126 and 462 mm in length; Yellowbelly from 129 to 362 and Bony bream from 26 to 292 mm. All fish captured were in good health.

Table 3-21.2 Results of fishing Lower Plains Lagoon.

Species	Common name	Gill (0)	Seine (2)	Fyke (4)	Bait	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly			10		10
<i>Leiopotherapon unicolor</i>	Spangled Perch			3		3
<i>Nematolosa erebi</i>	Bony Bream		2	60		62
<i>Hypseleotris klunzingeri</i>	Carp Gudgeon		4	2		6
<i>Retropinna semoni</i>	Smelt		2	1		3
<i>Neosilurus hyrtlilii</i>	Hyrtl's tandan		1	18		19
<i>Cyprinus carpio</i>	Carp		3	30		33
<i>Carrasius auratus</i>	Goldfish			2		2
<i>Gambusia holbrooki</i>	Mosquitofish			1		1
Total Numbers			12	127	0	139

Two *C.longicollis* were also captured.

3.21.3 Macrophytes

No macrophytes were observed.

3.21.4 Macroinvertebrates

Surber samples were collected from soft silt substrate. No dip net samples were collected. Sixteen discrete taxa were identified with the most common being

cladocera, copepods and corixids. Fifty-five *Macrobrachium* were recorded in bait traps and they were also common in the seine hauls.

■ **Table 3-21.3 Macroinvertebrates captured at Lower Plains Lagoon**

Taxa	Edge surber	
	Mean	std devn
Acari	0.2	0.5
Hydra	1.2	1.3
Nematoda	0.4	0.9
Oligochaeta	14.2	23.4
Polycladida	1.0	1.2
Cladocera	118.8	174.4
Copepoda	105.0	140.0
Ostracoda	18.8	21.2
Dytiscidae	0.6	0.9
Ceratopogonidae	2.2	3.5
Chironominae	5.0	7.4
Tanypodinae	0.2	0.5
Tabanidae	0.2	0.5
Caenidae	1.0	1.0
Corixidae	34.0	34.1
Leptoceridae	1.0	0.7
Taxa	10.0	2.0
Abundance	303.8	362.8
Total taxa	16	

3.22 Beardie Lagoon

The lagoon was reasonably full, with water generally abutting the riparian trees and the two channels fully joined. Maximum width of the lagoon was about 150 m and depth reached 2.5 m but was often much less. The riparian zone on the left bank was narrow (10 m) and bordered by a wheat crop. Snags were common, the water was clear and there was no evidence of pigs. The site was sampled by DERM.

3.22.1 Water Quality

Spot water quality data are shown in **Table 3-22.1**. It is evident that the lagoon has not yet begun to substantially dry out or to develop a strong algal flora, though the pH was relatively high.

■ **Table 3-22.1 Spot water quality readings – Beardie Lagoon**

Time	Depth (m)	Temp. (°C)	DO (% sat.)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1430	Surface	25.7	80	395	221	8.3
	0.5	25.4	76	391		8.3
	1.0	23.2	59	376		8.2
	1.5	20.6	51	354		8.1

3.22.2 Fish

Four native species and three introduced were captured (**Table 3-22.2**), all in low numbers. Carp ranged from 256 mm to 352 mm. All fish were healthy.

■ **Table 3-22.2 Results of fishing Beardie Lagoon.**

Species	Common name	Gill (0)	Seine (2)	Fyke (4)	Bait	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly			2		2
<i>Leiopotherapon unicolor</i>	Spangled Perch			1		1
<i>Nematolosa erebi</i>	Bony Bream		1			1
<i>Hypseleotris klunzingeri</i>	Carp Gudgeon		1			1
<i>Cyprinus carpio</i>	Carp		1	4		5
<i>Carrasius auratus</i>	Goldfish			2		2
<i>Gambusia holbrooki</i>	Mosquitofish		1	1		2
Total Numbers			4	10		14

3.22.3 Macrophytes

Green filamentous alga was noted in the seine haul.

3.22.4 Macroinvertebrates

Surber samples were collected from silt. No dip net habitat was available. Twenty discrete taxa were collected with copepods and corixids the only taxa in any abundance. One hundred and three prawns and one yabby were captured in bait traps and prawns were also recorded in seine hauls.

■ **Table 3-22.3 Macroinvertebrates captured at Beardie Lagoon**

Taxa	Edge surber	
	Mean	std devn
Acari	0.6	1.4
Pisauridae	0.2	0.5
Hydra	0.2	0.5
Oligochaeta	1.6	1.5
Physidae	0.4	0.9
Ancylidae	1.2	1.6
Copepoda	54.0	69.2
Otracoda	1.6	2.1
Atyidae	0.2	0.5
Hydraenidae	1.0	1.7
Dytiscidae	9.2	17.9
Chironominae	0.6	0.6
Orthocladinae	0.4	0.9
Tanypodinae	1.2	2.2
Tabanidae	1.0	1.7
Caenidae	0.2	0.5
Notonectidae	1.0	1.2
Corixidae	70.0	66.7
Leptoceridae	2.6	1.8
Ecnomidae	0.2	0.5
Taxa	9.6	1.8
Abundance	147.4	103.6
Total taxa	20	

3.23 Whyenbah Lagoon

This lagoon is adjacent the Balonne River at Whyenbah and was sampled by DERM. The lagoon was basically full, being 25 m wide, several hundred metres long and over 1.5 m deep. A wheat crop was on the left bank and the access track is on the right, leaving a narrow riparian zone. There had been no recent cattle access. This lagoon has on occasion been totally covered by *Ludwigia* and/or *Azolla* but no such plants were recorded.

3.23.1 Water Quality

Results from water quality sampling are presented in **Table 3.23.1**. The water column was well mixed but with low dissolved oxygen and the turbidity was noticeably higher than in the nearby river while conductivity was lower.

■ **Table 3-23.1 Spot water quality readings – Whyenbah lagoon**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (% sat.)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1245	Surface	18.8	56	116	572	7.5
	0.5	18.5	52	115		7.3
	1.0	18.4	50	116		7.2
	1.5	18.3	40	116		7.2

3.23.2 Macrophytes

No macrophytes were recorded.

3.23.3 Fish

Four native species and two introduced were captured (**Table 3-23.1**). Carp ranged from 82 mm to 451 mm but most were less than 150 mm.

■ **Table 3-23.1 Results of fishing Whyenbah Lagoon.**

Species	Common name	Gill (0)	Seine (2)	Fyke (4)	Bait	Total Numbers
<i>Macquaria ambigua</i>	Yellowbelly			2		2
<i>Leiopotherapon unicolor</i>	Spangled perch			1		1
<i>Nematolosa erebi</i>	Bony Bream			1		1
<i>Neosilurus hyrtlilii</i>	Hyrtl's tandan			4		4
<i>Cyprinus carpio</i>	Carp		32	77		109
<i>Gambusia holbrooki</i>	Mosquitofish		6			6
Total Numbers			38	85		123

3.23.4 Macroinvertebrates

Surber samples were collected from silt/clay. A dip net sample was taken amongst tree roots. Twenty-seven taxa were collected (**Table 3-23.2**). While diverse, abundances were very low. Bait traps captured 3 *Macrobrachium* and 10 *Cherax* and they were also captured in low numbers in the seine hauls.

■ **Table 3-23.2 Macroinvertebrates captured at Whyenbah Lagoon**

Taxa	Edge surber		Tree root dip 1	Tree root dip 2
	Mean	std devn		
Acari	0.4	0.6		
Pisauridae			1	1
Oligochaeta	0.8	1.3		
Ancylidae	0.6	0.6		
Copepoda	2.0	3.4	6	4
Palaemonidae				2
Atyidae				8
Hydrophilidae	1.0	1.7		5
Hydrochidae	1.2	1.1	1	
Hydraenidae	2.4	2.0	8	13
Elmidae	0.2	0.5		
Dytiscidae	1.2	1.3		
Circulionidae				1
Chironominae	0.2	0.5	1	6
Tanypodinae	0.2	0.5		
Tipulidae	0.4	0.6		
Tabanidae	0.2	0.5		
Culicidae	0.2	0.5		
Caenidae	0.2	0.5		4
Baetidae	2.6	2.5	1	52
Veliidae			3	
Notonectidae	0.6	0.9	1	3
Gerridae			1	1
Corixidae	5.6	6.1	4	
Coenagrionidae	0.2	0.5		1
Leptoceridae	0.2	0.5		
Ecnomidae	0.4	0.9		
Taxa	8.8	2.4	10	13
Abundance	20.8	6.7	27	101
Total taxa	21			27

3.24 Police Lagoon

The lagoon was largely continuous and up to 70 m wide and 3 m deep. There was very little evidence of disturbance to the waters' edge though pugging was evident in places. No scum or algae were evident. Snags were not common. The site was sampled by Hydrobiology and later by DERM and the Hydrobiology data is presented unless otherwise noted.

3.24.1 Water Quality

Results from water quality sampling are presented in **Table 3.24.1**. The water column was well mixed a turbid deep layer with lower dissolved oxygen. Interestingly,

DERM took their water quality readings from a slightly different location in shallower water and recorded noticeably higher pH and DO (supersaturated at the surface).

■ **Table 3-24.1 Spot water quality readings – Police lagoon**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (% sat.)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1245	Surface	23	60	315	NA	7.2
	0.5	23	60	316	NA	7.9
	1.0	23	60	316	NA	7.9
	1.5	21.3	49	316	10	7.6
	2.0	19.6	36	318	51	7.3
	2.3	19.1	34	318	142	7.1

NA = malfunction

Overnight water quality data were recorded at this site. The ranges recorded overnight (1730 hrs to 0800 hrs) for each parameter were:

Temperature: 20.8 – 22.9°C

Dissolved oxygen: 44 – 59 %sat

pH: 7.7 – 7.9

Conductivity: 315 - 317µS/cm

Turbidity: NA.

3.24.2 Macrophytes

Nardoo occurred sporadically in recently dried backwaters and generally as a thin band adjacent to the water's edge.

3.24.3 Fish

Five native fish species and two introduced were captured (**Table 3-24.2**). Carp ranged from 222 to 430 mm in length. Bony bream ranged from 200 to 300 mm with most relatively large. DERMs catch was quite different and is discussed in Section 4.

■ **Table 3-24.2 Results of fishing at Police Lagoon.**

Species	Common name	Gill	Seine (2)	Fyke	Bait	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	1				1
<i>Leiopotherapon unicolor</i>	Spangled Perch		1			1
<i>Nematolosa erebi</i>	Bony Bream	104				104
<i>Melanotaenia fluviatilis</i>	Rainbowfish			1		1
<i>Hypseleotris klunzingeri</i>	Carp Gudgeon		6			6
<i>Cyprinus carpio</i>	Carp	35				35
<i>Gambusia holbrooki</i>	Mosquitofish		9	6		15
Total Numbers		140	16	7		163

3.24.4 Macroinvertebrates

Surber samples were collected from firm bare mud. A dip net sample was collected from solid tree roots. Sixteen taxa were collected (**Table 3-24.3**) with only corixids in

any significant numbers. Surprisingly, no micro-crustaceans were recorded. Two *Macrobrachium* and 1 *Cherax* were captured in bait traps and small numbers were recorded in other nets.

■ **Table 3-24.3a Aquatic macroinvertebrates recorded from Police Lagoon by Hydrobiology**

Taxa	Edge surber		Tree root dip
	Mean	Std devn	
Acari			1
Oligochaeta	0.4	0.6	1
Parastacidae	0.4	0.9	2
Hydrochidae	0.2	0.5	
Hydrophilidae	0.4	0.9	1
Staphylinidae	0.2	0.5	
Ceratopogonidae			1
Chironominae	3.0	1.0	7
Orthoclaadiinae	0.8	0.8	8
Tanypodinae	2.6	1.7	24
Tabanidae	0.4	0.6	
Baetidae	0.8	0.8	3
Caenidae	1.6	2.2	
Corixidae	17.4	6.8	99
Ecnomidae	0.2	0.5	
Leptoceridae	0.6	0.9	1
Taxa	6.8	2.4	11
Abundance	29	5.7	148
Total taxa	14		16

DERM's catch of macroinvertebrates was quite different and is shown below. Twenty-nine taxa were recorded with the three micro-crustacean taxa (Cladocera, Copepoda and Ostracoda) the most common in surber samples.

■ **Table 3-24.3b Aquatic macroinvertebrates recorded from Police Lagoon by DERM**

Taxa	Edge surber		Tree root dip
	Mean	Std devn	
Acari	0.2	0.5	
Pisauridae			2
Hydra	0.2	0.5	
Oligochaeta	0.2	0.5	
Cladocera	100.8	112.2	4
Copepoda	39.2	44.9	7
Ostracoda	20.8	22.4	1
Atyidae			1
Parastacidae	1.8	1.8	
Dytiscidae	0.4	0.9	
Elmidae			2
Hydraenidae			26
Hydrochidae	0.2	0.5	14
Hydrophilidae			3
Staphylinidae			27
Ceratopogonidae	0.6	0.9	
Chironominae	2.6	2.9	
Orthocladinae	0.4	0.9	
Tanypodinae	1.6	2.1	4
Tabanidae	1.0	1.0	
Baetidae	1.4	1.7	4
Caenidae	3.4	3.2	
Corixidae	6.6	9.6	1
Hebridae			1
Hydrometridae			2
Notonectidae			1
Veliidae			1
Ecnomidae	0.4	0.6	2
Leptoceridae	1.2	1.3	
Taxa	9.8	3.1	18
Abundance	183	172.8	103
Total taxa	19		29

3.25 Belah Waterhole

This site was at about bank full level when sampled (~ 40 m wide) but not flowing. Maximum depth was about 1 m. The land surrounding the waterhole has been cleared and planted to wheat. The riparian zone remains at between 20 and 30 m wide. The waterhole has belah snags occupying about 15% of the surface and vegetation

overhanging about 10%. A surface scum covered approximately 15% of the waterhole. The site was sampled by Hydrobiology.

3.25.1 Water Quality

Results from spot water quality sampling are shown in **Table 3-25.1**. A very strong thermocline and surface layer supersaturated with oxygen reflected the algal bloom occurring.

■ **Table 3-25.1 Spot water quality readings –Belah Waterhole**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (% sat.)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1500	Surface	28.7	114	177	790	8.2
	0.5	19.1	32	175	900	7.1
	1.0	17.8	26	176	925	6.9

3.25.2 Macrophytes

No macrophytes were observed.

3.25.3 Fish

All nets were deployed at this site. Four native fish species and two introduced were recorded (**Table 3-25.1**). The carp ranged from 83 to 400 mm with none between 85 and 225 mm.

■ **Table 3-25.1 Results of fishing Belah Waterhole.**

Species	Common name	Gill	Seine (2)	Fyke	Bait	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	3				3
<i>Leiopotherapon unicolor</i>	Spangled Perch			1		1
<i>Nematolosa erebi</i>	Bony Bream	11				11
<i>Neosilurus hyrtlilii</i>	Hyrtl's tandan			2	1	3
<i>Cyprinus carpio</i>	Carp	42	1	6	8	57
<i>Carrasius auratus</i>	Goldfish	1				1
Total Numbers		57	1	9	9	76

3.25.4 Macroinvertebrates

Five surber samples were collected from bare edge and a dip net was collected from tree roots (**Table 3-25.2**). Twenty-one taxa were identified and only corixids were in any abundance. Bait traps captured 7 *Macrobrachium* and a further 28 were also recorded from seine hauls.

■ **Table 3-25.2 Aquatic macroinvertebrates recorded from Belah Waterhole**

Taxa	Edge surber		Tree root dip
	Mean	Std devn	
Oligochaeta	0.2	0.5	1
Physidae	0.2	0.5	
Cladocera			1
Copepoda	0.6	0.9	3
Ostracoda	0.2	0.5	1
Palaemonidae	0.6	1.3	5
Hydraenidae			4
Hydrophilidae			6
Staphylinidae			1
Chironominae	1.0	1.4	7
Orthoclaadiinae			18
Tanypodinae	0.2	0.5	1
Tabanidae			2
Baetidae	0.6	0.6	2
Caenidae	1.0	1.7	1
Corixidae	21.2	20.6	28
Hebridae	0.2	0.5	
Nepidae			1
Saldidae	0.2	0.5	
Veliidae	0.4	0.9	
Leptoceridae	0.4	0.9	5
Taxa	4.4	2.7	17
Abundance	27	24.5	87
Total taxa	14		21

3.26 Clyde Lagoon

The lagoon has little or no snag habitat and little overhanging vegetation. This lagoon often has significant *Ludwigia* but there was none present on this occasion. Cattle pugging was common. Width of the water surface was approximately 40 m and maximum depth about 2.5 m. The edges were steep such that seine and fyke nets were only effective to a short distance from the edge. The site was sampled by Hydrobiology.

3.26.1 Water Quality

Spot water quality data are shown in **Table 3-26.1**. The water column was well mixed below a surface layer of warm water with higher levels of dissolved oxygen.

■ **Table 3-26.1 Spot water quality readings – Clyde Lagoon**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (% sat.)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1430	Surface	22.7	72.5	191	1858	6.2
	0.5	19.5	36.5	189	2005	6.6
	1.0	17.9	26.8	189	1870	6.7
	1.5	17.4	24.5	189	1936	6.7
	2.0	17.1	22.5	190	2006	6.7
	2.5	16.9	21.4	190	2161	6.6

3.26.2 Macrophytes

No macrophytes were recorded.

3.26.3 Fish

Four native fish species and two introduced were captured (**Table 3-26.2**). The tandans ranged from 68 to 200 mm in length but the latter was an exception. Bony bream ranged from 46 to 280 mm with none between 109 and 205. Carp ranged from 83 to 410 mm with a reasonable spread throughout the range. Only one fish affected by parasites was observed.

■ **Table 3-26.2 Results of fishing Clyde lagoon**

Species	Common name	Gill	Seine (2)	Fyke	Bait (7)	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	5				5
<i>Nematolosa erebi</i>	Bony Bream	27	27			54
<i>Leiopotherapon unicolor</i>	Spangled Perch	2	1	2		5
<i>Neosilurus hyrtlilii</i>	Hyrtl's tandan		23	26		49
<i>Cyprinus carpio</i>	Carp	17	12	50	10	89
<i>Carrasius auratus</i>	Goldfish		7	1		8
Total Numbers		51	70	79	10	210

3.26.4 Macroinvertebrates

Surber samples were collected from bare edge. Nine discrete taxa were identified (**Table 3-26.3**) with only corixids showing any abundance. Five *Macrobrachium* were captured in bait traps and 11 were captured in seine hauls. Six yabbies were recorded from various nets.

■ **Table 3-26.3 Aquatic macroinvertebrates recorded from Clyde Lagoon**

Taxa	Edge surber	
	Mean	Std devn
Acari	0.2	0.5
Oligochaeta	1.2	1.3
Dytiscidae	3.6	4.2
Ceratopogonidae	0.2	0.5
Chironominae	5.6	3.5
Tanypodinae	0.2	0.5
Tabanidae	0.2	0.5
Tipulidae	0.2	0.5
Corixidae	17.2	13.8
Taxa	4.2	1.3
Abundance	28.6	17.1
Total taxa	9	

3.27 Chinaman Creek

The pool was complete in both directions as far as could be seen. Width was approximately 35 m and maximum depth at least 2.5 m. The sand bar upstream which had previously had significant regrowth was submerged and the regrowth not visible. Similarly the patches of *Juncus* and *Persicaria* were not present. The pool held approximately 20% snags and 25% overhang. The riparian zone was good but weedy, including thistles. Storms occurred overnight. Sampling was conducted by Hydrobiology.

3.27.1 Water Quality

Spot water quality data are shown in **Table 3-27.1**. The water column was reasonably well mixed though temperature and DO showed a slight gradient. The spot pH data again did not correspond well with overnight recordings.

■ **Table 3-27.1 Spot water quality readings – Chinaman Ck**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (% sat.)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1500	Surface	20.4	41	170	1125	5.9
	0.5	20.4	41	170	1185	6.3
	1.0	18.6	30	169	1158	6.4
	1.5	17.6	26	170	1203	6.4
	2.0	17.4	24	170	1328	6.4

Overnight logging (1700 – 0645 hrs) of water quality parameters produced the following range of results:

Temperature: 17.6 – 18.0 °C
 Dissolved oxygen: 25.1 – 27.5 %sat
 pH: 6.6 – 6.7
 Conductivity: 167 – 174 µS/cm
 Turbidity: 912 - 1185 NTU.

3.27.2 Macrophytes

None recorded.

3.27.3 Fish

Three native fish species and one introduced were captured (**Table 3-27.2**). Carp ranged from 99 to 396 mm. Fish were largely healthy.

■ **Table 3-27.2 Results of fishing Chinaman Creek.**

Species	Common name	Gill	Seine (0)	Fyke	Bait	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly			3		3
<i>Leiopotherapon unicolor</i>	Spangled Perch			1		1
<i>Nematolosa erebi</i>	Bony Bream			5		5
<i>Cyprinus carpio</i>	Carp	42		51	9	102
Total Numbers		42		60	9	111

3.27.4 Macroinvertebrates

Surber samples were collected from bare edge and a dip net from tree roots. Seventeen taxa were recorded with other than corixids in low abundance (**Table 3-27.3**). Bait traps captured 3 *Macrobrachium* and small numbers, along with 2 *Cherax* were caught in fyke nets.

■ **Table 3-27.3 Aquatic macroinvertebrates recorded from Chinaman Creek**

Taxa	Edge surber		Tree root dip
	Mean	Std devn	
Pisauridae	0.2	0.5	
Oligochaeta	0.4	0.55	
Ancylidae	1.6	1.1	1
Cladocera	0.6	0.9	29
Copepoda	3.4	3.6	269
Palaemonidae	0.4	0.6	
Carabidae	0.2	0.5	1
Dytiscidae	0.2	0.5	
Hydraenidae	0.8	1.3	7
Hydrochidae	0.2	0.5	
Chironominae	1.4	1.5	1
Baetidae	0.2	0.5	3
Caenidae	0.2	0.5	
Corixidae	18.0	12.8	15
Notonectidae	0.2	0.45	
Ecnomidae	0.2	0.5	1
Leptoceridae	0.2	0.5	
Taxa	6.4	3.2	9
Abundance	28.4	11.6	327
Total taxa	17		17

3.28 Walla Lagoon

Maximum depth in the lagoon was at least 1.25 m and it was generally about 60 m wide. Water was continuous in both directions. The lagoon has few snags (5%) and some overhang at these high water levels (15%). Sampling was by Hydrobiology.

3.28.1 Water Quality

Spot water quality data are shown in **Table 3-28.1**. The water column showed a temperature and DO decline below 0.5 m.

■ **Table 3-28.1 Spot water quality readings – Walla Lagoon**

Sample Time	Depth (m)	Temp (°C)	Dissolved Oxygen (% sat.)	Conductivity (µS/cm)	Turbidity (NTU)	pH
1430	Surface	24.9	85	227	1030	7.8
	0.5	23.4	61	223	1061	7.5
	1.0	17.6	26	224	1088	7.1

Overnight logging (1900 – 1100 hrs) of water quality parameters produced the following range of results:

Temperature: 17.5 – 22.0 °C

Dissolved oxygen: 25 – 52 % sat

pH: 7.0 – 7.4

Conductivity: 223 – 226 µS/cm

Turbidity: 957 - 1098 NTU.

3.28.2 Macrophytes

No macrophytes were observed.

3.3283 Fish

Four native species and one introduced were captured (**Table 3-28.1**). The Carp ranged between 90 and 470 mm in length.

■ **Table 3-28.1 Results of fishing Walla Lagoon.**

Species	Common name	Gill	Seine (0)	Fyke	Bait	Total
<i>Macquaria ambigua</i>	Yellowbelly	1				1
<i>Leiopotherapon unicolor</i>	Spangled Perch			8		8
<i>Nematolosa erebi</i>	Bony bream			1		1
<i>Neosilurus hyrtl</i>	Hyrtl's tandan			5		5
<i>Cyprinus carpio</i>	Carp	68		32	2	102
Total Numbers		69		46	2	117

3.28.4 Macroinvertebrates

Surber samples were collected from bare edge and a dip net was collected from tree roots / snag. Nineteen taxa were recorded with corixids most common (**Table 3-28.2**). Forty three *Macrobrachium* were captured in bait traps and they were also present in fyke samples.

■ **Table 3-28.1 Aquatic macroinvertebrates recorded from Walla lagoon**

Taxa	Edge surber		Tree root dip
	Mean	Std devn	
Oligochaeta	1.4	1.7	
Ancylidae			1
Cladocera	0.8	0.8	1
Copepoda	9.2	2.7	89
Ostracoda	3.6	8.1	
Dytiscidae	0.4	0.9	2
Hydraenidae	0.6	0.9	3
Hydrophilidae	0.2	0.5	
Ptiliidae	0.6	0.6	
Ceratopogonidae	0.6	0.6	
Chironominae	1.2	1.3	1
Tanypodinae	0.2	0.5	
Culicidae	2	2.8	
Tabanidae	0.2	0.5	1
Tipulidae	0.2	0.5	
Caenidae	0.2	0.5	7
Corixidae	128.4	125.3	79
Notonectidae	0.2	0.5	3
Ecnomidae			1
Taxa	7.4	1.5	11
Abundance	150	132.8	188
Total taxa	17		19

3.29 Woolerbilla Lagoon

The lagoon was relatively full but isolated, being about 40 m wide and up to 1 m deep. There were few snags in the water (10%) but substantial riparian zone overhang. Some pig diggings were evident but there was no sign of cattle. Sampling was by Hydrobiology.

3.29.1 Water Quality

Spot surface water quality data were collected from this site (**Table 3-29.1**). The water column was well mixed but with low dissolved oxygen.

■ **Table 3-29.1 Spot water quality readings – Woolerbilla Lagoon**

Sampling Time	Depth (m)	Temp. (°C)	DO (% sat.)	Conductivity (µS/cm)	Turbidity NTU	pH
1000	Surface	18.8	31	262	968	7.5
	0.5	18.0	28	262	1001	7.4

3.29.2 Fish

Five native species and three introduced were captured. Carp measured between 88 and 589 mm in length, Spangled perch from 60 to 103 mm and Bony bream from 55 to 350 mm though the majority were less than 100 mm.

■ **Table 3-29.2 Results of fishing Woolerbilla Lagoon.**

Species	Common name	Gill	Seine (2)	Fyke	Bait	Total
<i>Macquaria ambigua</i>	Yellowbelly		1			1
<i>Leiopotherapon unicolor</i>	Spangled Perch		19	5	1	25
<i>Nematolosa erebi</i>	Bony bream	3	28			31
<i>Hypseleotris</i> sp.	Carp gudgeon		1			1
<i>Neosilurus hyrtlii</i>	Hyrtl's tandan			1		1
<i>Cyprinus carpio</i>	Carp	14	7	7	1	29
<i>Carassius auratus</i>	Goldfish		12	2		14
<i>Gambusia holbrooki</i>	Mosquito fish		4	1		5
Total Numbers		17	72	16	2	107

Two *C. longicollis* were also captured.

3.29.3 Macrophytes

No macrophytes were present.

3.29.4 Macroinvertebrates

Surber samples were collected from bare edge and a dip net was collected from tree roots. Sixteen taxa were collected with copepods and corixids in good numbers. Fifteen prawns were captured in bait traps and small numbers were caught in seine and fyke nets. A total of 4 yabbies were captured in various nets.

■ **Table 3-29.3 Aquatic macroinvertebrates recorded from Woolerbilla lagoon**

Taxa	Edge surber		Tree root dip
	Mean	Std devn	
Pisauridae	0.2	0.5	
Oligochaeta	0.8	0.8	1
Cladocera	4.6	3.8	35
Copepoda	413.8	246.4	876
Ostracoda	0.4	0.9	
Carabidae			1
Dytiscidae	0.6	0.9	1
Hydrophilidae	0.4	0.6	2
Ceratopogonidae	1.0	1.0	1
Chironominae	9.6	7.7	28
Tanypodinae			1
Baetidae	0.4	0.9	
Caenidae			1
Corixidae	104.6	54.8	80
Notonectidae	0.2	0.5	5
Leptoceridae	1.4	2.1	2
Taxa	7.4	1.1	13
Abundance	538	285.3	1034
Total taxa	13		16

3.30 Pilgra Lagoon Upstream

The lagoon was approximately 30 m wide and had a maximum depth of at least 0.75 m. This is the top end of the waterhole. Some filamentous green alga was present, there were few snags and about 15% overhang. A large flock of Rufus night herons were present about 300 m downstream. Sampling was by Hydrobiology.

3.30.1 Water Quality

No spot water quality sampling was undertaken.

Overnight logging (1700 – 0800 hrs) of water quality parameters produced the following range of results:

Temperature: 16.6 – 19.2 °C

Dissolved oxygen: 20 – 35 % sat

pH: 6.9 – 7.2

Conductivity: 202 – 203 µS/cm

Turbidity: 1296 - 1773 NTU.

The water was very turbid and low in oxygen.

3.30.2 Fish

Four native species and two introduced were captured. Carp ranged from 74 to 404 mm. Goldfish ranged from 70 to 135 mm, with the latter an exception. Few fish had lesions.

■ **Table 3-30.2 Results of fishing Pilgra Lagoon Upstream.**

Species	Common name	Gill	Seine (2)	Fyke	Bait (8)	Total
<i>Macquaria ambigua</i>	Yellowbelly	3				3
<i>Leiopotherapon unicolor</i>	Spangled Perch			1		1
<i>Nematolosa erebi</i>	Bony bream	1		3		4
<i>Neosilurus hyrtlilii</i>	Hyrtl's tandan			2		2
<i>Cyprinus carpio</i>	Carp	44	7	16	7	74
<i>Carassius auratus</i>	Goldfish		41	11		52
Total Numbers		48	48	33	7	136

3.30.3 Macrophytes

Filamentous green alga formed a bath tub ring.

3.30.4 Macroinvertebrates

Five surber samples were collected from bare edge with algae. A dip net was collected from tree roots. Eighteen discrete taxa were recorded (**Table 3-30.3**) with copepods being by far the most abundant. Bait traps captured twelve *Macrobrachium* and they were also present in the seine and fyke nets. Two *Cherax* were captured in gill nets.

■ **Table 3-30.3 Aquatic macroinvertebrates recorded from Pilgra lagoon US**

Taxa	Edge surber		Tree root dip
	Mean	Std devn	
Acari	0.2	0.5	
Nematoda	0.2	0.5	
Oligochaeta	0.4	0.9	2
Temnocephalidae	0.2	0.5	
Cladocera	3.0	4.5	22
Copepoda	258.4	160.2	1680
Dytiscidae			1
Hydraenidae	0.2	0.5	4
Scirtidae	0.2	0.5	
Sperchidae			1
Ceratopogonidae	0.8	1.3	
Chironominae	2.6	1.7	2
Orthocladinae			2
Tanypodinae	0.2	0.5	
Corixidae	3.2	2.6	19

Notonectidae			2
Ecnomidae			1
Leptoceridae			3
Taxa	5.0	2.2	12
Abundance	269.6	164.9	1739
Total taxa	12		18

3.31 Pilgra Lagoon Downstream

The lagoon was continuous in both directions, about 40 m wide and generally less than 1 m deep. Few snags were noted and little overhang. A significant cormorant flock was roosting just upstream of the site. Sampling was by Hydrobiology.

3.31.1 Water Quality

Spot water quality data are shown in **Table 3-31.1**. The water column was well mixed with low dissolved oxygen.

■ **Table 3-31.1 Spot water quality readings –Pilgra Lagoon downstream**

Sampling Time	Depth (m)	Temp. (°C)	DO (% sat.)	Conductivity (µS/cm)	Turbidity NTU	pH
1130	Surface	18.0	28	285	671	6.9
	0.5	17.7	25	284	652	7.4

3.31.2 Macrophytes

No macrophytes were noted.

3.31.3 Fish

Four native species and three introduced were captured (**Table 3-31.2**). The Carp were between 75 and 446 mm in length. While many of the Goldfish had lesions, native fish were noted as in good condition.

■ **Table 3-31.2 Results of fishing Pilgra Lagoon Downstream.**

Species	Common name	Gill	Seine (2)	Fyke	Bait	Total
<i>Macquaria ambigua</i>	Yellowbelly	4				4
<i>Nematolosa erebi</i>	Bony Bream	1	1	2		4
<i>Leiopotherapon unicolor</i>	Spangled Perch			1		1
<i>Neosilurus hyrtlil</i>	Hyrtl's tandan			2		2
<i>Cyprinus carpio</i>	Carp	82	26	38	2	148
<i>Carrasius auratus</i>	Goldfish		7	9		16
<i>Gambusia holbrooki</i>	Mosquitofish		1			1
Total Numbers		87	35	52	2	176

3.31.4 Macroinvertebrates

Surber samples were collected from bare edge and a dip net sample was collected from tree roots and leaf litter. Seventeen taxa were recorded (**Table 3-31.3**) with copepods and corixids the most common. Bait traps captured 32 *Macrobrachium* and 1 *Cherax*. They were also present in fyke nets.

■ **Table 3-31.3 Aquatic macroinvertebrates recorded from Pilgra Lagoon DS**

Taxa	Edge surber		Tree root and leaf dip
	Mean	Std devn	
Nematoda	0.2	0.5	
Isotomidae			1
Oligochaeta	3.2	2.3	5
Ostracoda	0.2	0.5	1
Copepoda	86.2	57.6	566
Cladocera	0.4	0.6	20
Carabidae			1
Dytiscidae	0.4	0.6	1
Hydraenidae			1
Hydrophilidae	0.2	0.5	1
Staphylinidae			1
Ceratopogonidae	0.4	0.6	
Chironominae	4.0	3.7	
Caenidae			1
Corixidae	60.4	74.4	6
Notonectidae	0.2	0.5	1
Sisyridae			3
Taxa	5.8	1.1	14
Abundance	155.8	101.9	609
Total taxa	11		17

4. Discussion

4.1 Water quality

Table 4-1 summarises the results from all sites sampled in autumn 2011. Note that the time series data represents overnight recordings rather than 24 hr recordings hence often does not include the middle of the day. Spot recordings on the other hand tend to be taken when logged data is not recorded.

■ **Table 4-1 Summary Water Quality Data for autumn 2011.**

	Temperature °C	Dissolved O ₂ % sat	Conductivity µS/cm	Turbidity NTU	pH
Balonne-St George	19.9	70	211	252	7.8
Balonne-Mooramanna	26.2	83	305	214	7.8
Balonne at Whyenbah	25.3	66	388	144	8.0
Culgoa at Whyenbah	19.6	73	310	149	8.0
Culgoa at Cubbie	NA				
Culgoa at Woolerbilla	NA				
Culgoa at Balandool	17.7-18.6	26-31	224-225	>1000	6.7-7.0
Balonne Minor - Meigunyah	20.8	55	303	179	7.8
Balonne Minor-Trafalgar	17.8	26	203	611	6.2
Narran at Donegri	18.7-21.3	31-51	232-234	400-492	6.5-6.6
Narran at Clyde	26.6	93	235	436	8.2
Narran at Booligar	NA				
Balandool on Cubbie	17.9-23.1	27-61	211-213	>1000	6.6-7.1
Balandool at Euraba	NA				
Bokhara at Kirrima	20.3	41	197	945	5.6
Bokhara at Koala	16.8-17.7	21-26	220-222	624->1000	6.4-6.7
Warrego-Shannonvale	24.6	107	215	22	8.8
Warrego-Tinnenburra	23.6	105	237	113	8.8
Moonie at Nindigully	19.2-24.2	34-70	96-123	624->1000	6.0-6.5
Moonie at Fenton	23.1	60	62	821	7.3
Lower Plains	23.5	68	378	322	8.1
Beardie	25.7	80	395	221	8.3
Whyenbah	18.8	56	116	572	7.5
Police Lagoon	20.8-22.9	44-59	315-317	32	7.7-7.9
Belah Creek	28.7	114	177	790	8.2
Clyde Lagoon	22.7	73	191	>1000	6.2
Chinaman Ck	17.6-18.0	25-28	167-174	912->1000	6.6-6.7
Walla	17.5-22.0	25-52	223-226	957->1000	7.0-7.4
Woolerbilla Lagoon	18.8	31	262	968	7.5
Pilgra US	16.6-19.2	20-35	202-203	>1000	6.9-7.2
Pilgra DS	18.0	28	285	671	6.9

Note: Ranges are from overnight logged data. Single data points are surface recordings from stratification data. River or floodplain systems are either shaded or unshaded. Lagoons are below the bold line.

Conductivity tended to be 50-100 µS/cm higher at riverine sites than when last sampled in May 2008 though not greatly different from historic ranges. Given the large volume of floodwaters that had passed through the system this may reflect the draining of the landscape following those peaks, and the leaching of salts as the soils drain back to the rivers. There was no trend of increasing conductivity in a downstream direction and in fact the highest recordings were in the Balonne, rather than in the distributary rivers. Floodplain sites showed similar conductivity to riverine sites, including a tendency to be higher at the upstream end (Lower Plains, Beardie) while other results were relatively low (Whyenbah, Belah) and may reflect local geology and soil conditions.

Turbidity was relatively low compared to historic levels in the Balonne and Warrego but higher in the Moonie and at some lower distributary sites. The recording at Police Lagoon is not a malfunction of the meter because this site was sampled by both Hydrobiology and DERM and both teams recorded very low turbidity but Hydrobiology used depth profiling and showed that turbidity increased markedly near the bottom. This lagoon is the first to be isolated from flood flows (as it has a high commence-to-flow level) and is relatively unaffected by grazing but such low turbidity has not been recorded here previously.

pH tended to be relatively high in the Balonne but at the low end of the historic range in the distributary system. The recording of 5.6 at Kirrima is unusually low and may reflect a common observation wherein spot readings were often lower than all logged readings from the same site, perhaps suggesting the probe had not settled when the spot reading was taken. Lagoons showed a similar result, that is, reflecting river trends.

Stratification varied such that sites a short distance below discharging weirs showing none or very little (St George, Culgoa at Whyenbah, Bokhara at Kirrima) while some sites showed significant dissolved oxygen and / or temperature stratification (Mooramanna, Narran at Clyde) even when they were not within a weir pool. Sites on the Warrego showed significant stratification including oxygen super saturation at the surface indicative of algal productivity (the weir had not discharged since August). Overnight variations were slight at some sites (Chinaman, Koala) but more significant at others (Walla, Nindigully), probably reflecting where that particular site was in the drying cycle but also local site characteristics of openness or shade.

4.2 Macrophytes, algae and other habitat

Persicaria was noted at St George. Otherwise, only benthic filamentous green algae was reported and it was very uncommon. The flows of 2008 removed most of the algae from the system though some *Ludwigia* and *Azolla* was still present at that time. It appears the recent floods stripped sites of remaining macrophytes and continued variable flow along with high turbidity has probably prevented their return.

There was a notable lack of coarse organic debris (leaf litter etc) or fibrous roots in the water. This equates to a lack of habitat diversity overall. It is assumed that the floods stripped all of this accumulated material as well as the seedlings that had established on exposed sand bars or lower banks during the drought.

4.3 Fish

Before discussing the results it should be reiterated that sites sampled by DERM did not employ gill nets but used additional fyke nets, including both large and small varieties. Similarly the seine net was not employed at all sites. The seine is generally effective at catching species such as Smelt, Carp gudgeon and Rainbowfish, amongst others. Two sites were sampled by both field teams as a means of evaluating the significance of the difference in gear (albeit only in a small scale test). It is acknowledged that the same scale of difference may have also have occurred simply by using the same set of gear a few days apart, so the result may not be solely related to gear type. At Nindigully, Hydrobiology caught 9 Eeltailed catfish, all in gill nets, and DERM did not record the species. DERM did catch Carp gudgeon in a seine at this site and Hydrobiology did not record it (they did not use a seine here). The comparative results from Police Lagoon are shown below (**Table 4-2**). The Hydrobiology results at this site are a rare example of where the gill net catch was more productive or more diverse than the fyke net catch.

■ **Table 4-2 Comparison of catches at Police Lagoon**

Common name	Gill	Seine	Fyke	Bait	Total	DERM seine	DERM fykes	DERM Total
Yellowbelly	1				1			0
Spangled Perch		1			1	3	1	4
Bony Bream	104				104	1	18	19
Rainbowfish			1		1		9	9
Carp Gudgeon		6			6		2	2
Hyrtl's tandan					0		2	2
Carp	35				35		1	1
Goldfish					0		2	2
Mosquitofish		9	6		15		2	2
	140	16	7	0	163	4	37	41

Highlighted species were caught by one set of methods but not the other

For the entire survey, in a total catch of 5128 individuals, 9 native species of fish (with *Hypseleotris* pooled) were identified from 15 river sites in the Lower Balonne, 7 native species from the 11 floodplain sites and 8 native species from the four river reference sites. Three introduced species were captured at test sites and two (not *Gambusia*) at reference sites. The number of taxa is in accord with historical sampling and the species list only varies with respect to rare occurrences such as Silver perch and *Porochilus*. The latter may have been present but misidentified as Hyrtl's tandan.

Table 4-3 summarises the fish catch across all sites. Shading in the table marks each river and sites are placed from upstream to downstream within each river. The number of native species recorded at river test sites varied between 1 and 7. Floodplain sites recorded between 3 and 6 native species while river reference sites recorded between 2 and 6 native species. The number of individuals captured varied from 14 (Balandool) to 371 (Cubbie on Culgoa) at test river sites and from 14 (Beardie) to 210 (Clyde) at test lagoon sites. At reference sites the number of individuals captured varied from 55 (Fenton) to 1400 (Tinnenburra).

The most diverse native fauna (7 species) was found on the Balonne River at Mooramanna and Whyenbah, and Balonne Minor at Meigunyah. The least diverse fauna was recorded on the Culgoa River at Balandool and the Bokhara River at Koala (single native species) while several sites recorded only 2 native species. This is in line with historic results which show a change at about Whyenbah where the larger sandy systems give way to smaller black soil streams.

The most commonly encountered species were Yellowbelly and Carp (all 30 sites), Bony bream (26 sites) and Spangled perch (24 sites). The most abundant species overall was Carp followed by Goldfish, Bony bream and Yellowbelly. Eeltailed catfish and Cod were not captured at lagoon sites and Mosquitofish was not captured at reference river sites.

■ Table 4-3. Summary of fish catch by site; Spring 2011

Site	<i>Maccullochella peelii peelii</i>	<i>Maquaria ambigua</i>	<i>Leiopotherapon unicolor</i>	<i>Nematalosa erebi</i>	<i>Hypseleotris spp</i>	<i>Melanotaenia fluviatilis</i>	<i>Retropinna semoni</i>	<i>Tandanus tandanus</i>	<i>Neosilurus hyrtlili</i>	<i>Cuprinus carpio</i>	<i>Carrasius auratus</i>	<i>Gambusia holbrooki</i>	T total count	Natives	Introduced
St George		13	3	6	1			4		257	12	1	297	5	3
Mooramanna	1	5	2	16	2			1	3	68	1		99	7	2
Whyenbah	1	7	3	2	1		5	2		67			88	7	1
Culgoa at Whyenbah	1	4	25	20		1		14		255	3		323	6	2
Culgoa at Cubbie		8	1	8						326	28		371	3	2
Culgoa at Woolerbilla		10	1	8						108	9		136	4	2
Culgoa at Balandool		2								10	2		14	1	2
Meigunyah	1	10	4	14	1		1		17	119	1	1	169	7	3
Trafalgar		3		5				2		22		1	33	3	2
Balandool on Cubbie		2	6							53	22		83	2	2
Bokhara at Kirrima		22	3							70	7		102	2	2
Bokhara at Koala		4								22	2		28	1	2
Donegri Ck		12	1	10					2	57	7		89	4	2
Narran at Clyde		4	2	36		1			2	98	1	1	145	5	3
Narran at Booligar		10		1						46	4		61	2	2
River summary	4	116	51	124	5	2	6	23	23	1578	99	4	2038	9	3
Lower Plains		10	3	62	6		3		19	33	2	1	139	6	3
Beardie		2	1	1	1					5	2	2	14	4	3
Whyenbah		2	1	1					4	109		6	123	4	2
Police Lagoon		1	1	104	6	1				35		15	163	5	2
Belah Waterhole		3	1	11					3	57	1		76	4	2
Clyde Lagoon		5	5	54				49		89	8		210	4	2
Chinaman Ck		3	1	5						102			111	3	1
Walla		1	8	1					5	102			117	4	1
Woolerbilla Lagoon		1	25	31	1				1	29	14	5	107	5	3
Pilgra US		3	1	4					2	74	52		136	4	2
Pilgra DS		4	4	1					2	148	16	1	176	4	3
Lagoon summary	0	35	51	275	14	1	3	0	85	783	95	30	1372	7	3
Test site summary															
Shannonvale		26	6	11	3		1	1		120	29		197	6	2
Tinnenburra		117	7	34		9	1		7	713	512		1400	6	2
Nindigully		19		15				9		17	6		66	3	2
Fenton		7		3						38	7		55	2	2
Reference summ		169	13	63	3	9	2	10	7	888	554		1718	8	2

Relative abundance across the habitats sampled is shown in **Table 4-4**. The figures for reference rivers are strongly influenced by the large number of Carp and Goldfish recorded from fyke nets at Tinnenburra which on their own represented 28.4% of all introduced fish captured across all sites.

■ **Table 4-4 Proportional composition of the fish catch across habitats (common species)**

	Test river	Test lagoon	Warrego	Moonie
Carp	77.4	57.1	52.2	45.5
Goldfish	4.9	6.9	33.9	10.7
Mosquitofish	0.2	2.2	0	0
Bony bream	6.1	20.0	2.1	14.9
Yellowbelly	5.7	2.6	9.0	21.5
Spangled perch	2.5	3.7	0.4	0
Hyrtl's tandan	1.1	6.2	0.4	0

Introduced species contributed 82.5% of the catch at test river sites, 66.2% at lagoon sites and 83.9% at reference river sites. The reference rivers were again very different from each other with the Warrego showing a moderate to high diversity of native species (6 at each site for 8 overall), a relatively abundant fauna but a very high representation of introduced species (86.1%) while the Moonie showed similar or lower diversity (3 overall), low to moderate abundance but a lower proportion (56.2%) of the total catch was introduced species.

The catch of introduced species is by far the largest recorded to date (**Table 4-5**).

■ **Table 4-5 Historical proportional representation by introduced species**

Sampling event	Test river	Test lagoon	Reference	Dominant species
Autumn 2000	35.1	NA	20.0	Mosquito fish
Autumn 2001	12.1	24.6	NA	Carp
Spring 2001	20.4	26.7	12.3	Carp
Autumn 2002	10.9	NA	3.3	Mosquito fish
Spring 2003	20.9	20.8	4.0	Mosquito fish
Autumn 2004	30.5	60.3	13.2	Mosquito fish
Spring 2004	20.1	31.5	14.8	Mosquito fish
Autumn 2005	18.5	23.8	2.1	Mosquito fish
Spring 2005	14.0	13.0	10.0	Goldfish
Autumn 2006	14.7	10.1	2.5	Mosquito fish
Spring 2006	33.2	9.3	14.7	Carp
Autumn 2007	55.1	14.1	15.3	Mosquito fish
Autumn 2008	8.1	55.0	5.4	Carp
Spring 2011	82.5	66.2	83.9	Carp

The “boom” by Carp and to a lesser extent Goldfish has not been mirrored by Mosquito fish, which has generally been the most abundant of the introduced species though it has been rare in the reference rivers. The “boom” occurred across all rivers and on the floodplain.

Other notable changes to the catch of individual species include a decline in the numbers of Smelt and an increase in the number of Eeltailed catfish. Other species have shown historic changes apparently caused by the drought (declining Carp gudgeon, Rainbowfish and Silver perch) and they have not recovered following the floods. **Table 4-6** shows changes in the catch of selected species. Readers should be aware that the sampling effort is not consistent between events, with floodplain sites under-represented in early years and fewer sites sampled in total in 2006 and 2007 (though less sites actually held water also).

■ **Table 4-6 Changes in catch of selected species over time in the Lower Balonne**

Sampling event	Smelt	Carp gudgeon	Rainbow fish	Silver perch	Eeltailed catfish	Carp	Mosquito fish
Autumn 2000	137	18	2	0	0	153	174
Autumn 2001	13	84	23	0	4	262	70
Spring 2001	67	328	73	3	9	164	89
Autumn 2002	118	690	23	1	1	58	98
Spring 2003	2532	142	57	1	0	44	694
Autumn 2004	30	120	81	1	5	285	1830
Spring 2004	313	196	74	9	0	201	317
Autumn 2005	227	133	76	4	0	99	424
Spring 2005	1705	91	5	2	1	239	88
Autumn 2006	246	55	11	0	1	116	171
Spring 2006	236	31	2	0	3	107	16
Autumn 2007	168	0	3	0	0	43	447
Autumn 2008	1004	2	5	1	2	333	250
Spring 2011	9	19	3	0	23	2370	34

4.4 Macroinvertebrates

Table 4-7 summarises the macroinvertebrate data for all sites. The 165 surber samples and 27 dip net samples produced 27,022 individuals and 60 discrete taxa. The total number of taxa is the second highest recorded in the program to date, the highest being 62 recorded in November 2008 though the sampling effort on this occasion is also the greatest. The total taxa per site is in line historic results but the density estimates in terms of either the number of taxa or number of individuals per surber is often very low. The results at Woolerbilla (Culgoa) and Donegri (Narran) and Cubbie (Culgoa) are the lowest recorded at those sites.

Amongst the lagoons several show good results for both taxa and abundance while the remainder show comparatively low abundances despite at times good diversity (Whyenbah lagoon).

These observations suggest the fauna is resilient as the overall species complement remains intact but the abundances in the rivers have probably been reduced by repeated flooding. The lowest abundances on the floodplain are commonly at sites with the lowest commence-to-flow levels, suggesting they may be behaving more like the nearby river (e.g. Whyenbah, Chinaman, Belah). Abundances at floodplain sites that are not so severely affected by flood flows (in terms of flow velocity and scouring) or which have been isolated for some time are at more significant levels so are further along the recovery path.

■ **Table 4-7 Summary of macroinvertebrate data recorded in Spring 2011**

	Mean taxa (Surber)	Taxa (dips)	Taxa Total	Mean Individuals (surber)
Balonne at St George	3.8 +/- 2.7	8	14	238 +/- 171
Balonne at Mooramanna	4.4 +/- 3.4	16	18	45 +/- 87
Balonne at Whyenbah	5.2 +/- 2.3	13	19	30 +/- 29
Culgoa at Whyenbah	5.0 +/- 2.2	11	17	46 +/- 27
Culgoa at Cubbie	4.6 +/- 1.1	5	11	17 +/- 8
Culgoa at Woolerbilla	2.4 +/- 1.9	5	9	3 +/- 2
Culgoa at Balandool	4.2 +/- 1.8	8	16	28 +/- 15
Balonne Minor at Trafalgar	6.2 +/- 0.8	10	18	108 +/- 62
Balonne Minor at Meigunyah	5.0 +/- 2.1	13	16	90 +/- 64
Narran at Donegri	4.4 +/- 2.3	8	16	7 +/- 5
Narran at Clyde	8.0 +/- 1.2		20	227 +/- 116
Narran at Booligar	7.0 +/- 3.2		18	104 +/- 66
Balandool on Cubbie	6.6 +/- 1.8	16	21	143 +/- 57
Balandool on Euraba	NA			NA
Bokhara at KIRRIMA	4.0 +/- 1.4	9	14	27 +/- 18
Bokhara at Koala	5.4 +/- 1.7	17	21	89 +/- 43
Lower Plains Lagoon	10.0 +/- 2.0		16	304 +/- 363
Beardie lagoon	9.6 +/- 1.8		20	147 +/- 104
Whyenbah lagoon	8.8 +/- 2.4	16	27	21 +/- 7
Belah Creek	4.4 +/- 2.7	17	21	27 +/- 25
Police Lagoon (Hydro)	6.8 +/- 2.4	11	16	29 +/- 6
Police Lagoon (DERM)	9.8 +/- 3.1	18	29	183 +/- 173
Clyde Lagoon	4.2 +/- 1.3		9	29 +/- 17
Chinaman Ck	6.4 +/- 3.2	9	17	28 +/- 12
Walla Lagoon	7.4 +/- 1.5	11	19	150 +/- 133
Woolerbilla lagoon	7.4 +/- 1.1	13	16	538 +/- 285
Pilgra lagoon US	5.0 +/- 2.2	12	18	270 +/- 165
Pilgra lagoon DS	5.8 +/- 1.1	14	17	156 +/- 102
Warrego at Shannonvale	8.0 +/- 2.9	17	23	50 +/- 27
Warrego at Tinnenburra	7.2 +/- 2.7	14	21	128 +/- 111
Moonie at Nindigully (Hydro)	3.6 +/- 2.6	7	14	27 +/- 25
Moonie at Nindigully (DERM)	10.6 +/- 1.7		19	222 +/- 44
Moonie at Fenton	5.8 +/- 1.3		14	128 +/- 45

The most common taxon were copepods (56.8% of the total count), corixids (19.4%) and cladocerans (13.6%). No other taxon provided more than 1.4% of the total count. This is a common result in the region. Fourteen taxa were represented by single individuals Dip net samples were collected only from tree roots (solid roots, not fibrous) because there was no macrophyte habitat available. The number of taxa recorded from the dip nets was often greatly less than historic results from other habitats.

The number of *Macrobrachium* and *Cherax* recorded in bait traps or by any other means was relatively low.

When comparing the results for Police Lagoon between the two teams, reviewing the data from individual surber samples shows that Hydrobiology's were very consistent with respect to abundance (23-37 individuals – hence the relatively low standard deviation) while DERMs had both the lowest abundance from any single surber at this site (7 individuals) and the highest (357 and 363 individuals). This suggests Hydrobiology sampled from very uniform habitat while DERM's samples included quite varied habitat. The same is true of the dip net in which Hydrobiology only

captured one individual of one beetle species while DERM captured 72 individual beetles across 5 species. The difference in this case could be as simple as Hydrobiology sampled from well submerged roots while DERM's sample possibly included shallow edge habitat where these beetles tend to scavenge. Nindigully was the only other site sampled by both teams and again DERM's results showed higher diversity and abundance. The result does not suggest that one team consistently samples in a manner that produces relatively high or low results because both teams produced results from other sites that were at both ends of the spectrum. The result may reflect the patchiness of a recovering environment.

4.5 Current Status

An immediately apparent observation at nearly all sites was the lack of habitat diversity. During the drought, the flora and fauna in areas of the rivers and floodplain which dried completely will have perished, though some bivalves, resistant eggs, spores, or roots may have survived. In areas that maintained low water levels, exposure of sand banks, lack of flushing of banks etc, had allowed seedlings to establish, for leaf and twig debris to accumulate and for macrophytes and fringing filamentous algae to become well established. The fauna reacted to this in various ways, some benefited; some did not. The drying status of any particular waterbody, plus its location in the landscape (basically above or below Whyebah) dictated the community that was present on any single sampling occasion.

The relatively small floods of December 2007 to March 2008 were of a magnitude that refreshed water quality, reconnected the river systems and the rivers to the floodplain (other than those sites with a high commence to flow level such as Police Lagoon) but did not entirely strip the system of various habitat features or its flora and fauna. While macrophyte abundance was significantly reduced, dip net samples could still be collected from that habitat at four sites in the sampling event which followed.

The floods of 2010 and 2011 produced a very different result to those of 2008. They were of a magnitude and duration such that much of the habitat was stripped from the system along with its flora and fauna. The effect appears to have been greater in the rivers than on the floodplain and perhaps in those sections of river that have a very trapezoidal shape so flow velocities remain high till the flood breaks the banks. Floodplain lagoons that are essentially shallow depressions within a broad floodplain were not so significantly affected so the resident fauna was not dislodged and colonising fauna was able to establish quickly.

The report of Autumn 2008 noted that many small individuals of carp, yellowbelly and bony bream were captured, possibly reflecting breeding in response to the summer flows. The current sampling does not show such a high proportion of small specimens, particularly of the native species, though eeltailed catfish, yellowbelly and bony bream had recently bred at some sites. In the current data Carp showed a wide size range and cursory inspection suggests at least two significant cohorts. This may partly be because the latest sample was collected in spring so last year's young have already grown significantly. The report of Autumn 2004 (following small flood flows in January) suggested that large carp moved to the extremities of the floodplain when access was available. Following that sampling event the lagoons largely dried out, many completely, and most of the fish in them perished. The most recent results follow years of repeated flood flows and the lagoons have not dried out so they have

supported repeated breeding and as they have often been connected to the rivers, migration between the two environments has been relatively easy. All native fish species captured in the rivers were also captured in the lagoons except Cod, which is rare, and Tandanus.

The commonly reported phenomenon of an increase in diversity and abundance of macroinvertebrates in surber samples as one progresses downstream is not evident, probably broken down by the floods.

As the system is currently “full”, that is, the maximum amount of usable habitat is currently available, the low macroinvertebrate abundances and taxonomic density may in part reflect dispersion within the available space. However it could also in part reflect a true reduction in the abundance of the fauna as a result of the floods. Invertebrates and smaller fish species generally cannot withstand highly elevated flow velocities so they are flushed from the system, usually with the less stable components of their habitat; leaves, twigs, silt, macrophytes, micro-algae etc.

The affect of different sized floods is of considerable interest to river managers. The smaller floods in this region probably mobilise material and shift it to the floodplains, depositing it there as the floods recede. Larger floods tend not to deposit it but to carry it through and even pick up further material from the floodplain, basically exporting it from the region. In terms of the strictly aquatic environment, very large floods are as detrimental an event as very severe drought. Few obligate aquatic species directly benefit from either while many are negatively affected, certainly at least in the short term. Floodplain terrestrial vegetation and soils, groundwater, the estuary, the ocean, downstream floodplain environments which become depositional, all benefit from major floods but the local aquatic community largely does not.

The fish productivity is substantial, particularly of Carp. This species is well known for rapid growth in environments with little habitat diversity because it largely feeds by grubbing along the muddy bottom. It has been reported as causing permanent turbidity and of uprooting aquatic plants and while the former may be true in the Lower Balonne, the latter is unlikely as macrophytes here tend to be floating. If turbidity does remain higher and for longer than natural, it may affect the “bath tub ring” of filamentous green alga and this could lead to substantial ecological consequences. Carp is a very good competitor and as it is now the dominant species in terms of biomass and numerical abundance, it is likely to cause substantial changes to the regional aquatic ecology.

Management of Carp to reduce its numbers and its impacts is a critical future action and there are a number of programs and actions already in place throughout the Murray Darling Basin with this aim.

The boom by Carp was across all catchments and all habitats so is not an impact that is related to water resource development in the Lower Balonne. It also mirrors the expansion of its range and increase in abundance which occurred in the southern Murray Darling Basin in the high flow period of mid-1970's.

The Lower Balonne aquatic ecosystem is clearly resilient. It has now survived the most significant drought on record followed by consecutive major floods and its

aquatic faunal diversity has essentially been maintained as has its secondary productivity. Given time and some respite from either of these extremes, habitat diversity will increase as leaf and twig litter builds up and algae / macrophytes can again become established. Invertebrate and fish abundances will increase again. The greatest risk to this outcome now is Carp.

5. References

Benson L and Paton M (2002) *Ecological Condition of the Lower Balonne River*. 4th Qld Environmental Conference, Environmental Engineering Society.

Note earlier survey reports are available from Smartrivers.