Nathan Dam on the Dawson River

Aquatic Flora and Fauna Dry Season Field Survey (November 2007)

Prepared for:

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Contents

Sumr	mary		i		
1	Introduction				
	1.1	Project Description	1		
2	Surve	ey Design Descriptions			
	2.1	Description of Study Area	2		
	2.2	Site Locations	2		
3	Meth	ods			
	3.1	Aquatic Habitat	15		
	3.2	Water Quality	15		
	3.3	Macrophytes	16		
	3.4	Macro-invertebrates	18		
	3.5	Fish and Macro-Crustaceans	19		
	3.6	Turtles	21		
	3.7	Aquatic Mammals	22		
	3.8	Quality Assurance / Quality Control	22		
4	Data	Summaries			
	4.1	Aquatic Habitat	23		
	4.2	Water Quality	34		
	4.3	Aquatic Macrophytes	41		
	4.4	Macro-Invertebrates	45		
	4.5	Fish and Macro-Crustaceans	55		
	4.6	Turtles	59		
	4.7	Aquatic Mammals and Amphibians	62		
5	Surve	ey Quality	63		
6	References 6				

Appendix A: Project Brief

Appendix B: Datasheets Used

Appendix C: Sampling Effort

Appendix D: Introduction to the Macro-invertebrate Data Analyses Used

List of Tables

Table 2.1	Summary of the surveys completed at each of the sites in	
	November 2007.	6
Table 2.3	Site locations and driving directions.	9
Table 4.1	Aquatic habitats at each site.	23
Table 4.2	Presence / absence of all aquatic macrophytes at each site, listed by growth form.	42
Table 4.3	Total abundance (for all replicates and habitats sampled) of each macro-invertebrate taxa sampled from the sites that held water.	46
Table 4.4	Total abundance of fish species at each site (all methods combined, including estimates of fish observed but not caught).	56
Table 4.5	Average fish lengths of each species, averaged across all of the sites (all methods combined).	57
Table 4.6	Total abundance of macro-crustaceans at each site (all survey methods combined, including estimates of macro-crustaceans observed but not captured).	58
Table 4.7	Abundance of each turtle species caught or observed at each site.	59

List of Figures

Figure 2.1	Survey sites.	5
Figure 2.2	Track logs showing routes to sites on the Becker property.	13
Figure 2.3	Track logs showing routes to sites on 'The Bentley' property.	14
Figure 4.1	Cropping in the study area.	30

Figure 4.2	The Glebe Weir is relatively high with no fishway installed.	30
Figure 4.3	Exposed tree roots and undercut banks at site 8 (Blackboy Creek).	31
Figure 4.4	Glebe Weir, showing the channel bar plain at site 4 upstream of the weir (Cockatoo Creek to the left).	32
Figure 4.5	Dead trees and fallen branches at site 12 (Cockatoo Creek) provided some physical in-stream habitat.	33
Figure 4.6	Physical habitat at site 2 included log-jams, macrophytes and overhanging vegetation.	33
Figure 4.7	Water temperature (°C) at each site before flooding, recorded at 0.5 m depth increments.	34
Figure 4.8	Water temperature (°C) at each site during flooding, recorded at 0.5 m depth increments.	35
Figure 4.9	Conductivity (μ S/cm) at each site before flooding, recorded at 0.5 m depth increments.	36
Figure 4.10	Conductivity (μ S/cm) at each site during flooding, recorded at 0.5 m depth increments.	36
Figure 4.11	pH at each site before flooding, recorded at 0.5 m depth increments.	37
Figure 4.12	pH at each site during flooding, recorded at 0.5 m depth increments.	38
Figure 4.13	Dissolved oxygen (% saturation) at each site before flooding, recorded at 0.5 m depth increments.	39
Figure 4.14	Turbidity (NTU) at each site before flooding, recorded at 0.5 m depth increments.	40
Figure 4.15	Turbidity (NTU) at each site during flooding, recorded at 0.5 m depth increments.	40
Figure 4.16	Number of aquatic macrophyte species (richness) at each site.	41
Figure 4.17	Percent cover of all aquatic macrophytes in the belt transect at each site.	43
Figure 4.18	The belt transect at site 4, situated along the left bank, had the highest aquatic macrophyte cover.	44

Figure 4.19	<i>Persicaria</i> spp. and sedges (family Cyperaceae and Juncaceae) growing at site 4.	44
Figure 4.20	Alternanthera denticulata growing at site 12.	45
Figure 4.21	Richness (the number of macro-invertebrate taxa, typically families) of the macro-invertebrate communities sampled from bed habitat at each site.	48
Figure 4.22	Richness (the number of macro-invertebrate taxa, typically families) of the macro-invertebrate communities sampled from edge habitat at each site.	49
Figure 4.23	Richness (the number of macro-invertebrate taxa, typically families) of the macro-invertebrate communities sampled from macrophyte habitat at each site.	49
Figure 4.24	Richness (the number of macro-invertebrate taxa, typically families) of the macro-invertebrate communities sampled from tree root habitat at each site.	50
Figure 4.25	SIGNAL 2 scores of the macro-invertebrate communities sampled from bed habitat at each site.	51
Figure 4.26	SIGNAL 2 scores of the macro-invertebrate communities sampled from edge habitat at each site.	51
Figure 4.27	SIGNAL 2 scores of the macro-invertebrate communities sampled from macrophyte habitat at each site.	52
Figure 4.28	SIGNAL 2 scores of the macro-invertebrate communities sampled from tree root habitat at each site.	52
Figure 4.29	PET richness of the macro-invertebrate communities sampled from bed habitat at each site.	53
Figure 4.30	PET richness of the macro-invertebrate communities sampled from edge habitat at each site.	54
Figure 4.31	PET richness of the macro-invertebrate communities sampled from macrophyte habitat at each site.	54
Figure 4.32	PET richness of the macro-invertebrate families sampled from tree root habitat at each site.	55
Figure 4.33	Fish abundance at each site (all methods combined).	56

Figure 4.34	Species richness of fish captured at each site (all methods combined).	57
Figure 4.35	Length frequency distribution of all fish captured (all methods combined).	58
Figure 4.36	Adult Emydura krefftii at site 4.	60
Figure 4.37	Intermediate Emydura krefftii at site 4.	60
Figure 4.38	Tachyglossus aculeatus (echidna) at site 11.	62

Summary

Project Description

frc environmental was commissioned by SunWater in November 2007 to undertake a dry season survey of aquatic habitat, flora and fauna within the Dawson River catchment. Watercourses upstream, downstream and within the inundation area of the proposed Nathan Dam were surveyed. This report presents a summary of that survey, and of the data collected.

Site Locations

Sixteen sites were chosen for survey, representing habitats in the main Dawson River channel and tributaries, within and outside the inundation area. However, due to flooding in the study area, surveys could only be completed at 7 sites, 3 of which were dry at the time of survey. Off-stream wetlands are known in the study area, but were not able to be surveyed during the survey period. Water quality during flooding was opportunistically measured.

Data Summaries

Aquatic Habitat

Overall, the waterways, riparian zones and adjoining land have been moderately to highly disturbed by human activity. The Glebe Weir is the most significant man-made structure within the waterways of the study area and it is not fitted with a fishway. Channel habitat diversity was generally low throughout the sites surveyed, and particularly in the Glebe Weir inundation area. Channel habitat diversity was highest at site 2 (Dawson River), where there were riffle, pool, run and glide habitats. The riparian zone was typically <20 m wide on each bank at the sites surveyed. Fine sediments (silts / clays) generally dominated the instream substrate throughout the study area. In contrast, the substrate at site 2 contained boulders, cobbles, pebble and gravel.

Water Quality

Water quality was generally similar across sites, and was characterised by moderately low dissolved oxygen levels and high turbidity. During the flora and fauna surveys, conductivity was relatively high at site 2 compared with the other sites surveyed. During

flooding, conductivity levels were lower than, and turbidity levels higher than, pre-flood levels.

Macrophytes

In total, 10 different species of aquatic macrophytes were recorded from the 7 sites surveyed. All species were emergents, growing on the margins of the channel and the lower banks. No floating or submerged macrophytes were found. The most abundant aquatic macrophyte found at any one site was *Persicaria* spp., which grew on exposed silty bars in the Glebe Weir inundation area (at site 4 on the main channel, and site 12 in Cockatoo Creek). All recorded aquatic macrophytes were native; none were listed as rare or threatened.

Macro-Invertebrates

Macro-invertebrates were sampled from bed and edge habitats at each of the sites surveyed that held water, and from tree root and macrophyte habitats where available. A total of 62 macro-invertebrate taxa were recorded in dip net and surber samples collected throughout the study area. Water boatmen were the most common and abundant taxa throughout the study area. Other common taxa throughout the study area included beetles (order Coleoptera), non-biting midge larvae and mayfly nymphs. Caddis fly larvae and blackfly larvae were abundant at site 2 on the Dawson River.

Average richness at each of the sites surveyed ranged from 2 - 10 in bed and edge habitats, and 5 - 19 in macrophyte and tree root habitats. SIGNAL Scores and PET Richness were generally highest at site 2 on the Dawson River.

Fish and Macro-Crustaceans

In total, 267 fish, comprised of 8 different species, were captured across the 4 sites surveyed that held water. Bony bream was the most abundant species captured across the sites surveyed, and they were swimming upstream during the flood. No one species was captured from more than 2 of the 4 sites surveyed.

Introduced mosquitofish were captured during the survey at site 2 on the Dawson River. Mosquitofish are declared noxious species in Queensland under the Fisheries Regulation 2008. Freshwater crayfish, freshwater shrimp and long-armed prawns were captured throughout the study area.

Turtles

Turtles were only captured from sites 4 and 12 within the Glebe Weir inundation area, and all were identified as Krefft's river turtles. No juvenile turtles were captured, and adults were more abundant than intermediate turtles. Turtles may breed within the Glebe Weir inundation area.

Survey Quality

The survey sites chosen represent the range of dry season habitat types in the study area. However, flooding and wet-weather access restricted our surveys to less than half of the nominated sites. All appropriate survey methods were used at each site. Water quality loggers were not set due to flooding. The track logs for the routes to sites 3 and 15, and the waypoint from site 3, could not be downloaded from the GPS. Dissolved oxygen levels measured during the flood have not been presented, as an air bubble was noted in the dissolved oxygen probe. There were no other equipment failures.

1 Introduction

1.1 Project Description

frc environmental was commissioned by SunWater in November 2007 to undertake a dry season survey of aquatic habitat, flora and fauna within the reaches of the Dawson River likely to be impacted by the construction of the proposed Nathan Dam. However, whilst the survey was intended to occur during the dry season, the Dawson River flooded during the survey (due to significant rainfall upstream of the study area); and rainfall during the survey caused flooding in the tributaries and access problems. Therefore, not all of the intended sites could be surveyed.

This report presents a summary of the surveys completed, and of the data collected.

2 Survey Design Descriptions

2.1 Description of Study Area

The Project involves the construction of the Nathan Dam at 315.3 km AMTD on the Dawson River. The proposed inundation area will flood 75 km of the Dawson River, and includes reaches of the river currently within the Glebe Weir inundation area. There are 18 permanent or intermittent tributaries that enter the proposed inundation area.

Downstream of the proposed dam site, the Gyranda Weir (35 km downstream of the dam site) inundation area backs up through the Nathan Gorge to the approximate location of the proposed dam site. The Orange Creek Weir lies 45 km downstream of the proposed dam site. The Dawson River eventually flows into the Fitzroy River, approximately 85 km south west of Rockhampton. The Dawson River is the largest tributary of the Fitzroy River, and the Dawson Catchment covers 35% of the Fitzroy Basin (Joo et al. 2000).

2.2 Site Locations

Sixteen sites were chosen for survey, representing habitats in the main Dawson River channel and tributaries, within and outside the inundation area (Figure 2.1).

The following sampling sites were proposed:

- 1 site above the inundation area on the main channel (site 1)
- 4 sites within the inundation area on the main channel (sites 2-5)
- 2 sites below the dam on the main channel (sites 6 & 7)
- 4 sites on tributaries above the inundation area (sites 8 11)
- 4 sites on tributaries within the inundation area (site 12 15)
- 1 site below the dam on a tributary (site 16)

However, due to flooding in the study area during our survey, surveys could only be completed at 7 of the 16 sites (



886	Nathan Dam, Aquatic Flora an	d Fauna Dry Season Field
frc environmental deep thinking. science.	Figure 2.1	Survey sites.
\cup	Source: Google Earth	

Table 2.1). Water quality data during the flood were collected opportunistically at 4 sites; and also in Bentley Creek upstream of the inundation area (site 17) (Figure 2.1; Table 2.1). An off-stream wetland located on 'The Bend' property could not be located during the survey period; and the Chain Lagoons (floodplain wetlands off Palm Tree Creek) were dry when visited.

Sites were selected in consultation with relevant agencies and contactable researchers (including Dr Leo Duivenvoorden (CQU), Dr Peter Long (DPI&F) and Andrew McDougall's research group (DNRW)) that work in the area, as outlined in the brief. In the study area, several of our sites have been previously, or are currently, surveyed by others (Figure 2.1;



Table 2.1).

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	Waterway	aterway Location	_ Surveyed by Others?	Surveyed in November 2007			
Site				Completed Survey	Dry at Time of Survey – Habitat descriptions Only	Flooded – Water Quality Measured	
1	Dawson River	Upstream of inundation area	DNRW long-term biological monitoring site (1303008)			V	
			DNRW yellowbelly (golden perch) spawning monitoring site*				
			State of the Rivers site				
2	Dawson River	In inundation area	In the vicinity of an IAS site	~		~	
			DNRW yellowbelly (golden perch) spawning monitoring site*				
3	Dawson River	In inundation area					
4	Dawson River	Dawson River In inundation area (at Glebe Weir)	State of the Rivers site	~			
			DPI&F fish survey site				

Table 2.1Summary of the surveys completed at each of the sites in November 2007.

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				Surveyed in November 2007		
Site	Waterway	Location	Surveyed by Others?	Completed Survey	Dry at Time of Survey – Habitat descriptions Only	Flooded – Water Quality Measured
5	Dawson River	In inundation area	In the vicinity of CQU and DNRW macro- invertebrate sample site (Duivenvoorden et al. 2003).			
6	Dawson River	Downstream of Dam	In the vicinity of IAS site			
7	Dawson River	Downstream of Dam	In the vicinity of DNRW yellowbelly (golden perch) spawning monitoring site*			
			In the vicinity of CQU and DNRW macro- invertebrate sample site (Duivenvoorden et al. 2003).			
			DPI&F fish survey site			
8	Blackboy Creek	Upstream of inundation area	IAS site	~		
9	Spring Creek	Upstream of inundation area				
10	Palm Tree Creek	Upstream of inundation area	State of the Rivers site			\checkmark
11	Cockatoo Creek	Upstream of inundation area			\checkmark	

		Location	Surveyed by Others?	Surveyed in November 2007			
Site	Waterway			Completed Survey	Dry at Time of Survey – Habitat descriptions Only	Flooded – Water Quality Measured	
12	Cockatoo Creek	In inundation area	IAS site	~			
13	Bentley Creek	In inundation area					
14	Spring Creek	In inundation area					
15	Scotchy Creek	In inundation area			\checkmark		
16	Price Creek	Tributary downstream of dam			\checkmark		
17	Bentley Creek	Upstream of inundation area				~	

* DNRW monitor the spawning of yellowbelly (golden perch) by sampling reproductive output (i.e. eggs) with plankton tows.

Table 2.2Site locations and driving directions.

Site			GPS Position (UTM, WGS 84)		
Number	Driving Directions	Zone	Easting	Northing	
1	Travel along Dawson St south out of Taroom, heading towards Theodore. Turn right before the Leichhardt Highway intersection, onto the old road (past a truck rest area with garbage bins etc.). Follow the road down to the old bridge crossing for access to the river. Site is downstream from the bridge.	55J	780 311.708	7 160 748.87	
2	Follow Taroom St (Main St of Taroom) to the east. Veer left onto Cracow Rd at the end of Taroom St (where it takes a hard right-hand turn towards Wondoan). Follow Cracow Rd for approximately 8 km before turning left into Bundulla Rd, which is signposted. Follow Bundulla Rd to the River Crossing (site lies both upstream and downstream of the crossing).	55J	787 792.641	7 168 572.261	
3	Travel along Dawson St south out of Taroom, turning right at the Leichhardt Highway intersection (heading towards Theodore). Follow the Leichhardt Highway for approximately 27 km before turning right onto Glebe Weir Rd (signposted). Follow Glebe Weir Rd for approximately 8.2 km before turning right onto The Bend Rd (signposted). Follow The Bend Rd for approximately 8.9 km, before veering left at the entrance to 'The Bend' property. Drive on the track past the homestead, sheds and horse yard, and access the paddock on the right-hand (southern) side via a barbed-wire gate. Follow the farm track down to the river. No track logs could be retrieved for this site.	55J	800 155	7 170 262	
4	Travel along Dawson St south out of Taroom, turning right at the Leichhardt Highway intersection (heading towards Theodore). Follow the Leichhardt Highway for approximately 27 km before turning right onto Glebe Weir Rd (signposted). Follow Glebe Weir Rd for approximately 26 km to the Glebe Weir camping facilities and boat ramp.	56J	201 694.69	7 180 309.021	
5	Travel along Dawson St south out of Taroom, turning right at the Leichhardt Highway intersection (heading towards Theodore). Follow Glebe Weir Rd for approximately 20 km to the point where the paved Glebe Weir Rd veers to the right. Continue straight ahead on Spring Ck Rd (dirt road). Follow this road for 3.1 km, and then veer right onto the driveway of the Becker's property. Access river via farm tracks through gates past the house and shed (refer to Figure 2.2).	56J	205 539.397	7 180 895.494	

Site		GPS Position (UTM, WGS 84)		
Number	Driving Directions		Easting	Northing
6	Travel along Dawson St south out of Taroom, turning right at the Leichhardt Highway intersection (heading towards Theodore). Follow Glebe Weir Rd for approximately 20 km to the point where the paved Glebe Weir Rd veers to the right. Continue straight ahead on Spring Ck Rd (dirt road). Follow this road for 3.1 km, and then veer right onto the driveway of the Becker's property. Access river via farm tracks through gates past the house and shed (refer to Figure 2.2). Go through gate into an area of remnant vegetation, and follow track as far as possible with car. Walk approximately 500 m south to the river.	56J	210 013.379	7 180 312.271
7	Follow Taroom St (Main St of Taroom) to the east. Veer left onto Cracow Rd at the end of Taroom St (where it takes a hard right-hand turn towards Wondoan). Follow Cracow Rd to the township of Cracow. Turn left (west) onto Eidsvold Theodore Rd. Follow for approximately 11 km, turn left (west) onto Gyranda Rd and follow to the Gyranda weir. Boat upstream to the site.	56J	800 155	7 170 262
8	Follow Taroom St (Main St of Taroom) to the east. Veer left onto Cracow Rd at the end of Taroom St (where it takes a hard right-hand turn towards Wondoan). Follow Cracow Rd for approximately 11.5 km. Site is downstream from the Cracow Rd Crossing.	55J	792 221.327	7 161 741.95
9	Travel along Dawson St south out of Taroom, turning right at the Leichhardt Highway intersection (heading towards Theodore). Follow Glebe Weir Rd for approximately 20 km to the point where the paved Glebe Weir Rd veers to the right. Continue straight ahead on Spring Ck Rd (dirt road). Follow this road for 3.1 km, and then veer right onto the driveway of the Becker's property. Access river via farm tracks through gates past the house and shed (refer to Figure 2.2). Go through gate and follow track to pumping station, which is at the site.	56J	207 094.653	7 183 476.946
10	Travel along Dawson St south out of Taroom, turning right at the Leichhardt Highway intersection (heading towards Theodore). Follow the highway for approximately 10 km. Site is downstream of the bridge crossing of Palm Tree Creek. Site can be accessed from the bridge crossing, or by turning right (east) onto a dirt road and walking from there.	55J	779 241.195	7 177 000.912

Site Number	Driving Directions -	GPS Position (UTM, WGS 84)		
		Zone	Easting	Northing
11	Follow Taroom St (Main St of Taroom) to the east. Veer left onto Cracow Rd at the end of Taroom St (where it takes a hard right-hand turn towards Wondoan). Follow Cracow Rd for approximately 13.5 km. Turn right onto Cockatoo Rd, follow this road until it ends in a T-intersection. Turn left at the T-intersection onto Nathan Rd. Follow Nathan Rd for approximately 1.5 km to the Cockatoo Creek Crossing. Site is downstream from the bridge.	56J	213 987.545	7 157 268.396
12	Travel along Dawson St south out of Taroom, turning right at the Leichhardt Highway intersection (heading towards Theodore). Follow the Leichhardt Highway for approximately 27 km before turning right onto Glebe Weir Rd (signposted). Follow Glebe Weir Rd for approximately 26 km to the Glebe Weir camping facilities and boat ramp. Travel by boat approximately 500 m upstream from the mouth of Cockatoo Creek to the site (be careful of submerged logs).	56J	201 530.052	7 179 656.546
13	Follow Taroom St (Main St of Taroom) to the east. Veer left onto Cracow Rd at the end of Taroom St (where it takes a hard right-hand turn towards Wondoan). Follow Cracow Rd for approximately 21 km, then turn left onto 'The Bentley' property. Follow the driveway to the homestead. Proceed through gates and follow farm track to the creek (Figure 2.3), at its confluence with the Dawson River.	55J	800 590.535	7 169 799.027
14	Travel along Dawson St south out of Taroom, turning right at the Leichhardt Highway intersection (heading towards Theodore). Follow Glebe Weir Rd for approximately 20 km to the point where the paved Glebe Weir Rd veers to the right. Continue straight ahead on Spring Ck Rd (dirt road). Follow this road for 3.1 km, and then veer right onto the driveway of the Becker's property. Access river via farm tracks through gates past the house and shed (refer to Figure 2.2). Head south along the track, turn left (east) at the river near Site 5. Follow the track to the crossing of Spring Creek.	56J	207 210.019	7 180 795.136

Site Number	Driving Directions	GPS Position (UTM, WGS 84)		
		Zone	Easting	Northing
15	Follow Taroom St (Main St of Taroom) to the east. Veer left onto Cracow Rd at the end of Taroom St (where it takes a hard right-hand turn towards Wondoan). Follow Cracow Rd for approximately 5 km, then turn left onto Brae Lane and enter 'The Brae' property. Go through a double gate and follow the track north towards the river. Before the river (with a pump), enter a wire gate and drive east along the fence line (following the Dawson River) until you reach the creek. The site will be on your left. No track logs could be retrieved for this site.	55J	788 041.143	7 165 966.676
16	Follow Taroom St (Main St of Taroom) to the east. Veer left onto Cracow Rd at the end of Taroom St (where it takes a hard right-hand turn towards Wondoan). Follow Cracow Rd for approximately 40 km. The site is upstream of the road, just past the Nathan Rd turn-off to the right.	56J	212 761.138	7 173 084.593
17	Follow Taroom St (Main St of Taroom) to the east. Veer left onto Cracow Rd at the end of Taroom St (where it takes a hard right-hand turn towards Wondoan). Follow Cracow Rd for approximately 13.5 km. Turn right onto Cockatoo Rd and follow it for approximately 9.3 km to the Bentley Creek crossing. Site is upstream from the road crossing.	56J	199 241.14	7 159 176.55

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3 Methods

Methods used were as per the 'Brief for Aquatic Flora and Fauna Dry Season Field Survey: Nathan Dam' developed by SunWater (Appendix A). A blank copy of the datasheets used in the field is provided in Appendix B.

3.1 Aquatic Habitat

The aquatic habitats of the study area were surveyed between the 26th of November 2007 and the 3rd of December 2007. During this period, the Dawson River flooded due to heavy rainfall upstream, and there was heavy rainfall in the study area on the 1st and 2nd of December 2007 (enough to cause flooding of the tributaries).

At each site, habitat descriptions and observations were recorded using the State of the Rivers method (Telfer 1995) (completed datasheets provided in Appendix B). The State of the Rivers method was used to allow for comparison to State of the Rivers assessments completed in the region (Telfer 1995) and the habitat descriptions completed during the Initial Impact Study (IAS) (Anderson & Howland 1997). To supplement the data collected on the State of the Rivers data sheets, a project datasheet was compiled using AusRivAS, Sustainable Rivers Audit and general biological descriptions.

To ensure consistency of date entry, a Senior Ecologist (Lauren Thorburn) completed the datasheets for each site. Completed data sheets were cross-checked by a trained team member prior to leaving the site.

A photographic record of each site is presented on the enclosed CD.

3.2 Water Quality

In Situ

Water quality was sampled in situ at each site using a TPS 90 FLMV water quality meter and WP88 turbidity meter. The TPS 90 FLMV water quality meter was used to measure:

- water temperature (°C)
- electrical conductivity (µS/cm)

- pH, and
- dissolved oxygen (mg/L and % saturation).

The WP88 turbidity meter measured turbidity in NTU (Nephelometric Turbidity Units).

In order to adequately describe the water quality of the entire water column, all measurements were taken at 0.5 m depth increments through the water column, starting at the surface.

Secchi depth (m) was measured with a Secchi disk where depth allowed. Discharge estimates were recorded on sheet 6 of the State of the Rivers data sheets; the floating chip method was used to estimate flow.

Logger Based

Due to flooding in the study area and the risk of losing data loggers, no diurnal measurements of water quality were taken.

3.3 Macrophytes

The description of flora included:

- submerged, floating (free-floating or rooted) and emergent aquatic macrophytes
- macroscopic algae, and
- the presence of any introduced or pest plants.

Aquatic macrophytes with a submerged growth form predominantly grow beneath the surface of the water, although flowers may protrude through the water surface, and some leaves may float on the water surface (Sainty & Jacobs 2003).

Aquatic macrophytes with a floating growth form can be either free-floating or rooted. Free-floating species are usually not attached to the substrate, whereas rooted species are attached to the substrate and normally have at least the mature leaves floating on the water surface (Sainty & Jacobs 2003).

Aquatic macrophytes with an emergent growth form are rooted in the substrate with stems, flowers and most of the mature leaves projecting above the water surface (Sainty & Jacobs 2003).

The field assessment methods were based on methods set out in the Brief and those used by the DNRW, summarised below.

When water was present, aquatic flora was assessed along a 10 m wide x 100 m long belt transect. In order to capture the range of aquatic macrophytes growing at each site (i.e. emergent, submerged and floating macrophytes), transects were positioned along 1 bank and included *at least* half the wetted channel width, with no more than 2 m of the transect width running along the lower bank. To ensure that observations were accurate, the belt transect was divided into 10 quadrats of equal size (10 x 10 m). The following was recorded for each quadrat:

- the presence of all native and exotic aquatic macrophytes, and their form, and
- the percent cover of each species in the quadrat (note, the percent cover of species that were not aquatic macrophytes, but that occurred in the quadrat, was also recorded).

Percent cover refers to the area of substrate (bed or bank) covered by vegetation. Due to the physical overlap of emergent, floating and submerged growth forms, total percent cover could exceed 100%.

Data from each quadrat was then analysed to provide the following information for each site:

- the presence of all native and exotic aquatic macrophytes
- total area covered by aquatic macrophytes
- percent cover of all species with cover exceeding 10% of the belt transect
- total area covered by submerged, emergent and floating aquatic vegetation
- percent cover of any of the listed rare and threatened aquatic macrophyte species under the Queensland Nature Conservation Act 1992, as listed in the Nature Conservation (Wildlife) Regulation 2006, or under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999, and
- percent cover of all declared noxious weeds under the Queensland Land Protection (Pest and Stock Route Management) Act 2002.

At dry sites, or where macrophyte diversity and abundance was low, only a limited survey of aquatic macrophytes was conducted. At these sites, the presence of any aquatic macrophyte species (such as sedges and rushes) was noted.

Photographs of macrophytes were taken at each site and species were identified in the field, where practical. Representative samples of indefinite identifications were collected

and pressed for later identification in the laboratory. The Census of Queensland Flora 2007 (Queensland Herbarium 2007) was used to classify macrophytes as native or exotic. For the purpose of this report, noxious weeds include noxious aquatic species and other (non-aquatic) noxious species recorded in the belt transect (which included part of the lower bank).

3.4 Macro-invertebrates

Up to 4 methods of macro-invertebrate sampling were used depending on the type of habitat present at each site. As macro-invertebrate community composition varies across habitats, each available habitat unit was sampled at each site, in order to adequately characterise the communities. Sampling effort for each site is provided in Appendix C.

A standard triangular-framed macro-invertebrate net with a cone shaped net of 250 μ m mesh was used to sample the macroinvertebrate communities in discrete habitat types such as within aquatic macrophyte beds and around tree roots. This style of net is used to undertake AusRivAS sampling of macro-invertebrates across Queensland. Samples were standardised to 20 seconds in duration, and 2 samples were collected where possible.

The same equipment was used to sample macro-invertebrates in riffle and soft sediment bed habitats, although a kick-netting style of sampling (square foot samples) was used. Five replicate samples were collected at each site. This style of sampling is a semiquantitative, replicated technique that allows greater statistical analysis, which is wellsuited to impact assessment (compared with broad-scale assessment techniques such as AusRivAS-style kick samples over 10 m length for example).

A Surber sampler was used to collect 5 replicate samples of macro-invertebrates from edge habitats adjacent to deep pools at each site. Surber sampling is a quantitative, replicated technique that allows greater statistical analysis, which is well-suited impact assessment (compared with broad-scale assessment techniques such as AusRivAS-style dip net samples over 10 m length for example). The area enclosed by the Surber approximated that sampled by kick-netting.

Collected samples were frozen and transported to frc environmental's Brisbane laboratory where invertebrates were sorted, counted and identified. Samples were processed whole and were not subsampled. Identification was to the level used by the Department of Natural Resources and Water (DNRW) for ambient monitoring, i.e. family-level for macro-crustaceans, molluscs and insects (except for Chironomidae, which was taken to sub-

family) and higher levels for other groups such as micro-crustacea, oligochaetes, nematodes and acarina.

A macro-invertebrate sample tracking log was kept, which included information about the site, date sampled, sample location, who the sample was taken by, the date picked, who the sample was picked and sorted by, who checked the picking and sorting, and the number of vials of macro-invertebrates created for each site.

Observations of larger macro-invertebrates (i.e. mussels) were recorded in situ.

3.5 Fish and Macro-Crustaceans

Sampling effort for fish and macro-crustaceans at each site is provided in Appendix C.

Gear Types

Fish and macro-crustacean surveys were carried out using gear types including:

- · boat-mounted electrofisher at deep sites with access
- backpack electrofisher at shallow sites
- seine nets
- gill nets, and
- · bait traps.

Gear types appropriate to the characteristics of sites and species being sampled were used; hence, not all gear types were deployed at each site. There were no suitable habitats for fyke netting in the survey.

Boat-Mounted Electrofishing

Boat electrofishing was conducted using a 2.5 GPP unit, and sampling was based on the methods outlined in the Brief and the Sustainable Rivers Audit methodology. All available habitat units were fished at each site for a total power-on time of approximately 1500 seconds at each site. Team members holding senior electrofishing operator accreditation supervised all electrofishing efforts. Electrofishing was conducted in accordance with the *Australian Code of Electrofishing Practice*. At sites where water depth was greater than

2 m, electrofishing was not efficient. In these instances, the electrofisher was used to herd fish into a set multi-panel gill net (see below).

All visible stunned fish were collected and blind netting was used where turbidity limited visibility. Immobilised fish were kept in a large aerated bin on the boat to monitor recovery before release.

Backpack Electrofishing

Backpack electrofishing was conducted using a Smith-Root LR-24 backpack electrofisher, in accordance with the methods outlined in the Brief and the Sustainable Rivers Audit methodology. All available habitat units were fished at each site. Where habitat was sufficiently extensive, 5 replicates of each habitat were fished, with each replicate area being fished for a total power-on time of approximately 150 seconds. Team members possessing senior electrofishing operator accreditation supervised all electrofishing efforts. Electrofishing was conducted in accordance with the *Australian Code of Electrofishing Practice*.

Visible fish were collected, and blind netting was used where turbidity limited visibility. Immobilised fish were placed in a bucket of aerated water to monitor recovery prior to release.

Bait Trapping

Bait traps were used at all sites where water depth exceeded the height of the traps' entry points. Ten collapsible bait traps, baited with cat biscuits, were set along the bank and adjacent to cover (vegetation, snags etc) and retrieved after 3 - 5.25 hours.

Seine Netting

Seine nest were used at sites that were suitably shallow with sand, mud or pebble bottoms and that lacked large snags.

The seine net (50 m long with 5 mm mesh) was towed in an arc, while a second person remained on the shore holding the trailing end. A minimum of 2 seines were taken at each site.

Gill Netting

At sites with sufficient depth and width (depth > 2 m), a multi-panel gill net was set. The net consisted of 3 panels of 20, 50, and 75 mm mesh size, each 15 m in length. Where boat electrofishing was possible, fish were 'hearded' into the net during electrofishing. If electrofishing were not possible, this type of net should bet set at dawn or dusk to target larger fish, as fish movement is greater at these times. Nets were closely monitored by team members to ensure that no turtles or other air-breathing species became tangled or trapped.

Data Collection for all Gear Types

For each gear type, fish caught were identified, counted, classed (juvenile, intermediate, and adult), and the presence of any wounds, lesions or deformities was recorded. At each site, 20 individuals of each species were measured (fork length, or total lengths for species with convex or truncate caudal fins). Almost all fish were released alive, but some specimens that were difficult to identify were euthanased and returned to the laboratory for confirmation of field identifications. Catches from each gear type and trap were recorded separately.

To prevent sampling the same fish by the multiple gear types used at each site, all fish captured were kept in a large bin on the shore until sampling was complete. The bin was kept in the shade and the water temperature was monitored and aerated to maintain oxygen levels.

Any prawns, shrimp, or crayfish captured or observed were identified to the lowest practical taxonomic level, and the number of each taxa was estimated and recorded. Catches from each gear type were recorded separately.

The sampling of fishes was conducted under General Fisheries Permit No. PRM37573J and Animal Ethics Approval No. CA 2006/03/106 issued to frc environmental.

3.6 Turtles

At sites where water depths were suitable, 5 large baited turtle traps were set along the bank and adjacent to cover (vegetation, snags etc.) for standard 2 hour periods. If turtles were not recorded in the first 2 hours, traps were left for a longer soak time. The design of the traps was consistent with traps used by the Environmental Protection Agency's

(EPA's) turtle research group (and by frc environmental on behalf of Fitzroy River Water, lower in the Fitzroy catchment in September 2007), and consisted of a series of collapsible chambers (totalling approximately 3.5 m in height, 0.7 m in diameter) with two one-way entrances in the lower baited chamber. Traps were deployed so that the top of the chamber was positioned to allow turtles access to the surface to breathe.

The sampling of turtles was conducted under Scientific Purposes Permit No. WISP05080608 and Animal Ethics Approval No. CA 2006/03/106 issued to frc environmental. Traps were closely monitored by team members, to ensure that no turtles or other air-breathing species became entangled or trapped below the surface. Turtles were occasionally captured by other techniques or observed and recorded outside traps. As the survey was undertaken during the nesting season for some species, potential nesting banks were inspected for tracks or signs of excavation.

Turtles captured or observed were identified to species and a photographic record was kept. Sampling effort for each site is provided in Appendix C.

3.7 Aquatic Mammals

Aquatic mammals, other reptiles and amphibians were not specifically targeted during this study; however, all observations and incidental captures were recorded.

3.8 Quality Assurance / Quality Control

As part of a Quality Assurance / Quality Control (QAQC) program, a site checklist was completed at each site. Each task was initialled by the team member who completed that task. While on site, the completed data sheets were reviewed and initialled by another team member. If a task was not completed, a reason was documented on the site checklist. A blank copy of the site checklist is provided in Appendix B. Once a site was completed, a Senior Ecologist (Ashley Morton / Lauren Thorburn) completed a thorough review of the datasheets and signed off the site checklist.

4 Data Summaries

4.1 Aquatic Habitat

A brief overview of the aquatic habitat at each site is provided in Table 4.1.

Reach	Description	Photograph
Site 1 Dawson River upstream of inundation area at the Leichhardt Highway crossing.	Not surveyed due to flooding. The Dawson River floodplain is extensive in the vicinity of this site; the site is on the main channel of the river.	

Table 4.1 Aquatic habitats at each site.

View upstream through the channel during the flood (03-12-2007).

Site 2

Dawson River within the inundation area, at the Bundulla Rd crossing. This site contained a variety of habitats at the time of survey, including: pool, run, glide, riffle and rapid habitats. Discharge was estimated at 0.06 m³/s in the glide habitat. The river was braided; however only the main channel was surveyed. The banks were generally steep, but well vegetated with little sign of erosion. Common species in the riparian zone included eucalypts, casuarinas, callistemons. melaleucas and Submerged tree roots, boulders and fallen logs and branches provided instream habitat. There were a variety of substrate types including boulders and cobbles, as well as finer sediments such as silt and sand.



View downstream through the channel before the flood (27-11-2007).

Reach

Photograph



View downstream from the right bank during the flood (3-12-2007).

Dawson River within the inundation area, on 'The Bend' property.

Site 3

Not surveyed due to flooding. It appeared that the river was braided and that there would be vegetated islands in the channel when water levels were lower.

Description



View upstream through the channel during the flood (30-11-2007).

Site 4

Dawson River within the inundation area, immediately upstream of Glebe Weir. This site was within the Glebe Weir inundation area, and there was no flow at the time of survey (i.e. there was only pool habitat). The banks were relatively stable and riparian vegetation was dominated by eucalypts and casuarinas. Bars of accumulated sediment along the edges of, and within, the inundation area supported dense beds of smart weed. Little instream physical habitat was observed, although the water was opaque so it was difficult to see. Fine sediments such as silt and clay dominated the substrate.



View downstream from the left bank before the flood (29-11-2007).

Reach

Description

Photograph



View upstream from the Glebe Weir (left bank) during the flood (2-12-2007).

Site 5

Dawson River within the inundation area, downstream of Glebe Weir, on the Becker property. Not surveyed due to flooding and access issues in the wet. This site was visited during a reconnaissance of the study area. At this time it was a pool on an anabranch of the Dawson River.



View downstream from the left bank before the flood (7-11-2007).

Site 6

Dawson River at the proposed dam wall site, on the Becker property. Not surveyed due to flooding and access issues in the wet. This site was visited during a reconnaissance of the study area. The river here forms a series of braided channels, which hold isolated off-stream pools. The main channel was flowing due to releases from Glebe Weir. Fallen branches and logs provided some in-stream habitat. Sedges were common on the edges of the main channel and on the floodplain area.



View of the main channel and off-stream pool before the flood, looking upstream from the left bank (7/11/2007).
Reach	Description	Photograph
Site 7 Dawson River downstream of the proposed dam.	Not surveyed due to flooding.	Not visited.
Site 8 Blackboy Creek upstream of the inundation area, at the Cracow Rd crossing.	The site was comprised of a series of isolated pools with no flow at the time of survey. There were signs of erosion along each of the banks, including exposed tree roots and patches of bare, eroded substrate. Grasses dominated the riparian zone, although there were some eucalyptus and casuarina trees. One prickly pear was noted growing adjacent to the creek. Rocks, exposed tree roots, submerged branches and fallen logs provided some in-stream habitat. The substrate was mainly silty, although there were some patches of boulder, cobble and gravel.	View downstream through the channel, before the flood (30-11-2007).
Site 9 Spring Creek upstream of the inundation area, on the Becker property.	Not surveyed due to flooding and access issues in the wet. This site was visited during a reconnaissance. The pool is relatively permanent as it is fed by a spring. The surrounding vegetation was relatively intact, and the water was less turbid that most sites in the study area.	

View upstream from the right bank before the flood (7-11-2007).

Reach

Site 10

Palm Tree Creek upstream of the inundation area, on the Leichhardt Highway crossing. Not surveyed due to flooding. The creek was braided in the vicinity of the site. As seen in the photographs, the main creek channel was deep and dry prior to the flood; and was full of water and flowing quickly after the flood. The Chain Lagoons on the floodplain adjacent to Palm Tree Creek were dry when visited on the 28-11-08; they were unable to be re-visited during the flood.

Description

Photograph



View from the left bank before the flood (28-11-2007)



View upstream from the left bank during the flood (04-12-2007).

Site 11

Cockatoo Creek upstream of the inundation area, on the Nathan Rd crossing. This site was dry at the time of survey. A variety of habitat types may occur during flow, including pools, runs and possibly some glide/riffle habitat. The banks were steep and moderately unstable, with disturbances such as cattle access and a dirt track to the creek contributing to this instability. However, the presence of large eucalypts helped to stabilise the bank in places. The substrate was dominated by sand, with some boulders, cobbles, gravel and silt.



View downstream through the channel before the flood (28-11-2007).

Reach

Site 12

Cockatoo Creek within the inundation area, within the Glebe Weir inundation area. This site was within the Glebe Weir inundation area, and there was no flow at the time of survey (i.e. there was only pool habitat). The left bank was very steep and moderately susceptible to erosion in high flows. Eucalyptus trees were relatively common in the riparian zone, along with casuarinas and callistemons; herbs such as smart weed and Chenopodium sp. grew on the lower banks. Bars of accumulated sediment along the edges of the channel supported smart weed and lesser joyweed. Dead trees and fallen branches provided in-stream habitat. Fine sediments such as silt and clay dominated the substrate.

Description

Photograph



View downstream from the left bank before the flood (29-11-2007).

Site 13

Bentley Creek within the inundation area, on ' The Bentley' property. Not surveyed due to flooding. This section of the creek is within the Glebe Weir inundation area and was visited during a reconnaissance of the study area. Smart weed was abundant on exposed silty bars and banks.



Bentley Creek looking upstream from the right bank, before the flood (6-11-2007).

Site 14

Not surveyed due to flooding.

Not available.

Spring Creek within the inundation area, on the Becker property.

Reach	Description	Photograph
Site 15 Scotchy Creek within the inundation area, on 'The Brae' property.	This site was dry at the time of survey. The creek had a relatively wide floodplain area, which is vegetated with eucalypts and grasses, and which contains many braided channels. The main channel would likely contain run and pool habitat when it holds water. The banks of the channel were relatively bare and highly eroded. Exposed tree roots and fallen terrestrial debris would provide some aquatic habitat when the creek holds water. Silt ('black soil') dominated the substrate.	View upstream through the channel before flooding (28-11-2007).
Site 16 Price Creek	This site was dry at the time of survey. The creek was braided with a vegetated island between the two	

Price Creek downstream of the inundation area, at the Cracow Rd crossing. This site was dry at the time of survey. The creek was braided with a vegetated island between the two channels. The main channel would likely contain run and pool habitat when it holds water. The banks of the channel were relatively bare and there were some signs of erosion. Exposed tree roots and fallen terrestrial debris would provide little aquatic habitat when the creek holds water. Silt and sand dominated the substrate.



View downstream through the channel (28-11-2007).

Site 17

Bentley Creek upstream of the inundation area, at the Cockatoo Rd crossing. This site was surveyed for water quality during the flood only. Sediments were generally silty, with some bedrock. The left bank was steep and eroded. Water was flowing rapidly and covered the ford crossing of the creek. Bony bream were noted swimming upstream.



View upstream from the right bank (2-12-2007).

Reach Environs

Overall, the land immediately adjacent to the riparian zone, including the floodplain and valley flat, has been moderately to highly disturbed by human activities. The predominant land use adjacent to the riparian zone was cattle grazing, although there was also some cropping in the study area (Figure 4.1). There had been riparian vegetation clearing at some sites, and cattle access to several sites had caused some disturbance.

Bridges and culverts cross the Dawson River and tributaries in places, however the Glebe Weir is the most significant man-made structure within the waterways of the study area (Figure 4.2). Aquatic habitat diversity is limited within the inundation area. The weir is not fitted with a fishway, and would act as a barrier to fish migration.

Figure 4.1

Cropping in the study area.



Photo taken during reconnaissance fly-over, 06-11-2007.

Figure 4.2

The Glebe Weir is relatively high with no fishway installed.



Photo taken from the left bank during the reconnaissance on the 07-11-2007.

Riparian Vegetation

Riparian zones were generally < 20 m wide (Appendix B). Riparian zone vegetation was more extensive where braided streams characterised the floodplain. Grasses and herbs were the dominant vegetation type, although trees covered at least 20% of the riparian zone at each site.

Riparian vegetation was dominated by native species, such as eucalypts, casuarinas, melaleucas, callistemons and sedges. Exotic species noted in the study area included *Opuntia* spp. (prickly pear) and *Verbena aristigera* (Mayne's pest).

Prickly pear is a declared Class 2 plant under the *Land Protection (Pest and Stock Route Management) Act 2002*, meaning it has already spread over large areas of Queensland and needs controlling to avoid further spread.

Bank Stability

The majority of banks across the study area showed some signs of erosion (e.g. Figure 4.3). In general, there were steeper, more eroded banks at the tributary sites, compared with those on the Dawson River.

Figure 4.3

Exposed tree roots and undercut banks at site 8 (Blackboy Creek).



Photo taken 30-11-2007

Bed Stability and Bars

In general, the stream beds of tributary sites were eroding, and the beds of the main river channel sites were aggrading. Aggradation of sediment was most obvious at sites within the Glebe Weir inundation area, where fine sediments were accumulating as a channel / bar plain on site 4 at Glebe Weir on the Dawson River (Figure 4.4), and as a low-flow meander infilled channel at site 12 in Cockatoo Creek.

Braided channels, bars in association with obstructions and mid-channel islands and bars were each relatively common features across the study area.

Figure 4.4

Glebe Weir, showing the channel bar plain at site 4 upstream of the weir (Cockatoo Creek to the left).



Photo taken during reconnaissance fly-over, 06-11-2007.

Channel Diversity

Channel diversity was low within the study area. At the time of the survey, most of the tributary sites were dry, or partially dry with only pool habitat available. Sites within the Glebe Weir inundation area (site 4 on the Dawson River and site 12 on Cockatoo Creek) were also characterised by pool habitat with little variation in depth and few bends to provide habitat diversity. Run, glide and riffle habitat was rare throughout the study area, although each of these habitats were found at site 2 (Dawson River, upstream of the Glebe Weir inundation area). During periods of flow, run and riffle habitats may occur at some of the other sites surveyed (based on observations of substrate characteristics).

Aquatic Habitat

Submerged exposed tree roots, large woody debris and overhanging vegetation were the most common habitat elements identified throughout the study area. Small patches of macrophyte habitat and rocks were also noted at some sites. Within the Glebe Weir inundation area, habitat diversity was generally low, although dead trees and associated fallen branches contributed to habitat (Figure 4.5). At the dry sites, cobbles, fallen logs and branches were noted as providing habitat to aquatic fauna when these sites held water. Site 2 on the Dawson River had the highest diversity of physical habitat of the sites surveyed (Figure 4.6).

Figure 4.5

Dead trees and fallen branches at site 12 (Cockatoo Creek) provided some physical in-stream habitat.



Photo taken 29-11-2007

Figure 4.6

Physical habitat at site 2 included log-jams, macrophytes and overhanging vegetation.



Photo taken 27-11-2007

4.2 Water Quality

Water Temperature

Before Flooding

Water temperature was similar across each of the sites surveyed that held water (around 25 °C), and did not vary greatly between surface waters and water 0.5 m deep (Figure 4.7).



Figure 4.7 Water temperature (°C) at each site before flooding, recorded at 0.5 m depth increments.

During Flooding

The water temperature of flooded sites was similar to pre-flood temperatures, but was higher at sites 2, 10 and 17 compared with sites 1 and 10 (Figure 4.8). This is likely to be because measurements at these sites were taken in the afternoon, and measurements at site 1 and 10 were taken in the morning. Water temperature did not vary with depth in the floodwaters at site 1 (Figure 4.8).



Figure 4.8 Water temperature (°C) at each site during flooding, recorded at 0.5 m depth increments.

Electrical Conductivity

Before Flooding

Conductivity was around twice as high at site 2 compared with the other sites surveyed (Figure 4.9). There were no substantial variations in conductivity with depth at any one site.

During Flooding

Conductivity during flood conditions was lower at each of the sites surveyed compared with pre-flood conditions (Figure 4.9 & Figure 4.10). Conductivity was generally similar across the sites surveyed, although conductivity at site 10 (Palm Tree Creek) was much lower than at any other site (Figure 4.10). There were no substantial variations in conductivity with depth.



Figure 4.9 Conductivity (μ S/cm) at each site before flooding, recorded at 0.5 m depth increments.



Figure 4.10 Conductivity (μ S/cm) at each site during flooding, recorded at 0.5 m depth increments.

рΗ

Before Flooding

pH ranged between 6.2 and 6.9 at each of the sites surveyed (Figure 4.11). pH did not vary substantially between surface waters and water 0.5 m deep.



Figure 4.11 pH at each site before flooding, recorded at 0.5 m depth increments.

During Flooding

pH ranged between 6.0 and 7.2 at each of the sites surveyed during flooding (Figure 4.12). pH slightly increased with depth at site 1 (Dawson River at Taroom) (Figure 4.12).



Figure 4.12 pH at each site during flooding, recorded at 0.5 m depth increments.

Dissolved Oxygen

Before Flooding

Dissolved oxygen (DO) levels were low (< 55% saturation) across the sites surveyed. DO was highest at the tributary site surveyed (site 8) compared with sites on the main river channel and within the Glebe Weir inundation area (Figure 4.13).

Due to failure of the oxygen probe, DO levels during flood conditions have not been presented.



Figure 4.13 Dissolved oxygen (% saturation) at each site before flooding, recorded at 0.5 m depth increments.

Turbidity

Before Flooding

Turbidity levels were high (around 600 NTU) at each of the sites surveyed prior to flooding (Figure 4.14). Turbidity did not generally vary with depth, except at site 8 (it is possible that sediments at this site were stirred up during sampling, resulting in a higher turbidity reading at 0.5 m depth).

Secchi depth ranged between 0.06 m and 0.12 m throughout the study area.

During Flooding

Turbidity was higher at each of the sites surveyed during flooding compared with pre-flood measurements (Figure 4.14 & Figure 4.15). Turbidity was >1 000 NTU at each of the sites surveyed during the flood, and was highest at site 10 (Palm Tree Creek). Turbidity slightly increased with depth at site 1 (Dawson River at Taroom) (Figure 4.15).



Figure 4.14 Turbidity (NTU) at each site before flooding, recorded at 0.5 m depth increments.



Figure 4.15 Turbidity (NTU) at each site during flooding, recorded at 0.5 m depth increments.

4.3 Aquatic Macrophytes

Presence / Absence and Richness

Ten different species of aquatic macrophyte were recorded across the 7 sites surveyed (Table 4.2). All recorded species had an emergent growth form; there were no floating or submerged species recorded in the study area (Table 4.2). Non-aquatic species were also found in the quadrats (Table 4.2). No macroscopic algae grew within the belt transects at any of the sites surveyed. A small amount of periphyton (covering <10% of the substrate) was observed outside of the transects at sites 8 and 12.

Aquatic macrophyte richness (the number of species present) ranged from no species at site 8 on Blackboy Creek and at the dry sites (sites 11, 15 & 16), to 8 species at site 4 (Figure 4.16).



Figure 4.16 Number of aquatic macrophyte species (richness) at each site.

GROWTH FORM / Family		Native				Site			
I Latin name	Common name	/ Exotic	2	4	8	11 ¹	12	15 ¹	16 ¹
SUBMERGED									
Nil									
FLOATING									
Nil									
EMERGENT									
Amaranthaceae									
Alternanthera denticulata	lesser joyweed	Ν	х				Х		
Cyperaceae									
Cyperus difformis	dirty dora	Ν	Х	Х					
Schoenoplectus				v					
mucronatus	sedge	Ν		~					
Gramineae									
	awnless barnyard			х					
Echinochloa inundata	grass	Ν							
Juncaceae									
Juncus prismatocarpus	rush	Ν		Х					
Juncus usitatus	common rush	Ν	Х	Х					
Lomandraceae									
Lomandra hystrix	creek mat rush	Ν	Х						
Polygonaceae									
Persicaria decipiens	slender knotweed	Ν	Х	Х			Х		
Persicaria orientalis	prince's feather	Ν		Х			Х		
Typhaceae									
Typha domingensis	cumbungi	Ν		Х					

Table 4.2Presence / absence of all aquatic macrophytes at each site, listed by growth
form.

GROWTH FORM / Family	Common name	Native				Site			
l Latin name		Exotic	2	4	8	11 ¹	12	15 ¹	16 ¹
NON-AQUATIC									
Amaranthaceae									
Chenopodium sp.	goosefoot	Ν					Х		
Verbenaceae									
Verbena aristigera	Mayne's pest	Е					Х		

1 Dry site; no belt transect done, observations only.

Total Cover of Submerged, Floating and Emergent Macrophytes

Aquatic macrophyte cover in the belt transects ranged from 5.3% at site 12 (Cockatoo Creek within the Glebe Weir inundation area) to 81.8% at site 4 (Dawson River at Glebe Weir) (Figure 4.17; Figure 4.18). Belt transects included a large proportion of the lower bank at each site, as no submerged or floating macrophytes were found in the study area. The only species with > 10% cover at any one site was *Persicaria orientalis* (Prince's feather) at site 4 (Figure 4.18).



Figure 4.17 Percent cover of all aquatic macrophytes in the belt transect at each site.

Figure 4.18

The belt transect at site 4, situated along the left bank, had the highest aquatic macrophyte cover.



Persicaria spp. (knotweeds) were the most common and most abundant aquatic macrophytes throughout the study area (Figure 4.19); present at 3 of the 7 sites. Other common emergents included *Alternanthera denticulata* (lesser joyweed; Figure 4.20) and sedges from the families Cyperaceae and Juncaceae (Figure 4.19), particularly *Cyperus difformis* (dirty Dora) and *Juncus usitatus* (common rush).

The sedges growing at site 4 were located in a small moist patch of the lower bank; water may be discharged here from the adjacent recreational and camping facilities.

Figure 4.19

Persicaria spp. and sedges (family Cyperaceae and Juncaceae) growing at site 4.



Figure 4.20

Alternanthera denticulata growing at site 12.



Native, Exotic and Noxious Species

All recorded aquatic macrophytes were native (Queensland Herbarium 2007); none were listed as rare or threatened under the Wildlife Conservation (Wildlife) Regulation 2006.

Two non-aquatic species grew on the lower bank in places, and were recorded in the aquatic macrophyte transects. Native *Chenopodium* sp. (goosefoot) grew at site 12 and exotic *Verbena aristigera* (Mayne's pest) grew at site 8.

4.4 Macro-Invertebrates

A total of 62 macro-invertebrate taxa were recorded in dip net and Surber samples collected throughout the study area (Table 4.3). Water boatmen (family Corixidae) were the most common and abundant taxa throughout the study area. Other common taxa throughout the study area included beetles (order Coleoptera), non-biting midge larvae (sub-family Tanypodinae) and mayfly nymphs (order Ephemoptera). Caddis fly larvae (order Trichoptera) and blackfly larvae (family Simuliidae) were abundant at site 2 on the Dawson River.

Orden	Femily / Sub femily		Site					
Order	Family / Sub-family	2	4	12	8			
Acaria	_	0	0	1	1			
Aranea	_	0	0	7	3			
Cladocera	_	0	0	2	35			
Conchostraca	-	0	0	0	1			
Copepoda	-	0	0	2	26			
Diptera	unidentified	2	0	1	2			
Gastrapoda	unidentified	0	0	0	1			
Nemertia	-	4	0	0	0			
Bivalvia	Hyriidae	1	0	0	0			
Coleoptera	Chrysomeliidae	0	1	21	1			
Coleoptera	Dytiscidae	0	2	16	39			
Coleoptera	Elmidae	0	2	5	0			
Coleoptera	Heteroceridae	0	0	0	1			
Coleoptera	Hydraenidae	0	0	5	14			
Coleoptera	Hydrochidae	0	0	2	2			
Coleoptera	Hydrophilidae	0	2	18	2			
Coleoptera	Limnichidae	0	0	17	0			
Coleoptera	Ptiliidae	1	0	0	0			
Coleoptera	Scirtidae	0	0	0	6			
Coleoptera	Staphylinidae	0	0	4	0			
Decapoda	Atyidae	20	1	8	0			
Decapoda	Palaemonidae	47	0	0	0			
Decapoda	Parastacidae	12	0	0	1			
Diptera	Ceratopogonidae	15	0	5	2			
Diptera	Chaoboridae	0	0	1	0			
Diptera	Chironominae	52	4	8	7			
Diptera	Culicidae	0	0	5	1			
Diptera	Dolichopodidae	0	0	0	1			

Table 4.3Total abundance (for all replicates and habitats sampled) of each macro-
invertebrate taxa sampled from the sites that held water.

0.1			Site						
Order	Family / Sub-family	2	4	12	8				
Diptera	Orthocladiinae	25	0	0	0				
Diptera	Simulidae	518	0	0	0				
Diptera	Tabanidae	5	0	8	4				
Diptera	Tanypodinae	89	10	17	55				
Diptera	Tipulidae	0	0	0	2				
Ephemeroptera	Baetidae	244	1	14	19				
Ephemeroptera	Caenidae	102	0	0	0				
Ephemeroptera	Leptophlebiidae	8	0	0	0				
Gastropoda	Hydrobiidae	0	0	3	0				
Gastropoda	Physidae	11	0	11	7				
Gastropoda	Planorbidae	0	0	0	5				
Gastropoda	Thiaridae	6	0	0	0				
Gastropoda	Viviparidae	1	7	0	0				
Hemiptera	Belostomatidae	0	0	1	0				
Hemiptera	Corixidae	17	116	125	41				
Hemiptera	Gerridae	6	0	0	4				
Hemiptera	Hydrometridae	0	0	32	1				
Hemiptera	Mesoveliidae	1	10	127	0				
Hemiptera	Notonectidae	0	2	35	28				
Hemiptera	Ochteridae	0	1	0	0				
Hemiptera	Pleidae	0	1	0	0				
Hemiptera	Saldidae	0	0	2	0				
Hemiptera	Veliidae	16	0	3	71				
Hirudinea	Erpobdellidae	6	0	0	0				
Lepidoptera	Pyralidae	0	1	3	0				
Odonata	Coenagrionidae	0	0	1	0				
Odonata	Lestidae	0	0	0	5				
Odonata	Libellulidae	0	1	7	1				
Odonata	Macromiidae	0	0	0	4				
Odonata	Synthemistidae	1	0	0	0				
Trichoptera	Calamoceratidae	2	0	0	0				

Order	Family / Sub-family	Site						
Order		2	4	12	8			
Trichoptera	Ecnomidae	58	0	0	2			
Trichoptera	Hydropsychidae	14	0	0	0			
Trichoptera	Leptoceridae	93	0	3	9			

Community Richness

Average richness at each of the sites surveyed ranged from 2 - 10 in bed and edge habitats, and 5 - 19 in macrophyte and tree root habitats (Figure 4.21 – Figure 4.24). Riffle habitats were only sampled at site 2; average macro-invertebrate richness here was 10.6 ± 1.1 taxa.



Figure 4.21 Richness (the number of macro-invertebrate taxa, typically families) of the macro-invertebrate communities sampled from bed habitat at each site.



Figure 4.22 Richness (the number of macro-invertebrate taxa, typically families) of the macro-invertebrate communities sampled from edge habitat at each site.



Figure 4.23 Richness (the number of macro-invertebrate taxa, typically families) of the macro-invertebrate communities sampled from macrophyte habitat at each site.



Figure 4.24 Richness (the number of macro-invertebrate taxa, typically families) of the macro-invertebrate communities sampled from tree root habitat at each site.

SIGNAL 2 Scores

Average SIGNAL 2 scores (refer to Appendix D for a description) for macro-invertebrate communities across the sites surveyed ranged from 2.2 - 4.7 for each habitat (Figure 4.25–Figure 4.28). SIGNAL 2 scores were highest at site 2 for each of the habitats surveyed. The average SIGNAL 2 score for macro-invertebrate communities sampled from riffle habitat at site 2 was 4.5 ± 0.1 .



Figure 4.25 SIGNAL 2 scores of the macro-invertebrate communities sampled from bed habitat at each site.



Figure 4.26 SIGNAL 2 scores of the macro-invertebrate communities sampled from edge habitat at each site.



Figure 4.27 SIGNAL 2 scores of the macro-invertebrate communities sampled from macrophyte habitat at each site.



Figure 4.28 SIGNAL 2 scores of the macro-invertebrate communities sampled from tree root habitat at each site.

PET Richness

Average PET richness across each of the sites surveyed generally ranged from 0 - 3.6 for each of the habitats surveyed. Similar to SIGNAL 2 scores, PET richness was typically highest at site 2 for each of the habitats sampled; apart from tree root habitat, where PET richness was slightly higher at site 8 (Figure 4.29–Figure 4.32). The average PET richness score for macro-invertebrate communities sampled from riffle habitat at site 2 was higher than for other habitats (4.2 ± 0.4).



Figure 4.29 PET richness of the macro-invertebrate communities sampled from bed habitat at each site.



Figure 4.30 PET richness of the macro-invertebrate communities sampled from edge habitat at each site.



Figure 4.31 PET richness of the macro-invertebrate communities sampled from macrophyte habitat at each site.



Figure 4.32 PET richness of the macro-invertebrate families sampled from tree root habitat at each site.

4.5 Fish and Macro-Crustaceans

Fish Species Captured

In total, 267 fish, comprised of 8 different species, were captured across the 4 sites surveyed that held water (Table 4.4). The highest abundance and richness of fish were captured at site 4 (Glebe Weir), and the lowest abundance and richness of fish were captured at site 8 (Blackboy Creek) (Figure 4.33 & Figure 4.34).

Nematalosa erebi (bony bream) was the most abundant species captured across the sites surveyed; we also noted bony bream swimming upstream when sampling water quality at site 17 (Bentley Creek) during the flood (one fish was hand-captured and the identification confirmed). No one species was captured from more than 2 of the 4 sites surveyed.

Introduced *Gambusia holbrooki* (mosquitofish) were captured during the survey at site 2 on the Dawson River. Mosquitofish are declared noxious species in Queensland under the Fisheries Regulation 2008.

				Total Abu	ndance ¹	
Family	Latin name	Common Name	Site 2	Site 4	Site 8	Site 12
Clupeidae	Nematalosa erebi	bony bream		106 (C) 55 (O)		35 (C)
Eleotridae	<i>Hypseleotris</i> species 1	Midgley's carp gudgeon	5 (C)	1 (C)	1 (C)	1 (C)
	Oxyeleotris lineolata	sleepy cod		4 (C)		
Melanotaeniidae	Melanotaenia splendida	eastern rainbowfish				3 (C)
Plotosidae	Neosilurus hyrtlii	Hyrtl's tandan	2 (C)	6 (C)		
	Tandanus tandanus	freshwater catfish		1 (C)		
Poecillidae	Gambusia holbrooki	mosquitofish	16 (C)			
Terapontidae	Leiopotherapon unicolor	spangled perch			31 (C)	

Table 4.4	Total	abundance	of	fish	species	at	each	site	(all	methods	combined,
	includ	ing estimates	s of	fish (observed	but	not ca	ught).		





Figure 4.33 Fish abundance at each site (all methods combined).



Figure 4.34 Species richness of fish captured at each site (all methods combined).

Fish Lengths

The largest species captured was *Tandanus tandanus* (freshwater catfish) from site 4 (1 individual of 331 mm total length). The smallest species captured was *Leiopotherapon unicolor* (spangled perch) (Table 4.5); juveniles dominated the catch for this species. The length frequency distribution for all fish captured is shown in Figure 4.35.

Family	Latin name	Common Name	Average Length (mm)	SE
Clupeidae	Nematalosa erebi	bony bream	82	6.79
Eleotridae	Hypseleotris Species 1	Midgley's carp gudgeon	32	3.41
	Oxyeleotris lineolata	sleepy cod	162	49.92
Melanotaeniidae	Melanotaenia splendida	eastern rainbowfish	52	13.69
Plotosidae	Neosilurus hyrtlii	Hyrtl's tandan	129	22.54
	Tandanus tandanus	freshwater catfish	331	_
Poecillidae	Gambusia holbrooki	mosquitofish	23	0.70
Terapontidae	Leiopotherapon unicolor	spangled perch	21	3.05

Table 4.5	Average fish lengths of each species, averaged across all of the sites (all
	nethods combined).



Figure 4.35 Length frequency distribution of all fish captured (all methods combined).

Macro-Crustacean Species Captured

An estimated 182 macro-crustaceans were captured and / or observed across the 4 sites that were surveyed for fish, with the highest abundance of macro-crustaceans captured and / or observed at site 2 (Table 4.6).

Four macro-crustacean species were positively identified: *Macrobrachium australiense* (common Australian river prawn), *Paratya australiensis* (Australian paratya) and *Caradina* sp. (freshwater shrimp) and *Cherax depressus* (orange-fingered yabby). However, during electrofishing, many more prawns and / or shrimp are observed than are caught in the net, and additional species may be present.

Table 4.6	Total abundance of macro-crustaceans at each site (all survey m					
	combined, including estimates of macro-crustaceans observed but r	not				
	captured).					

Family	Latin Name	Common name –	Abundance ¹				
			Site 2	Site 4	Site 8	Site 12	
Atyidae	Paratya australiensis / Caradina sp.	freshwater shrimp	20 (C)	1 (C)	8 (C)		

Family	Latin Name	Common name –	Abundance ¹				
			Site 2	Site 4	Site 8	Site 12	
Palaemonidae	Macrobrachium sp.	macrobrachium	152 (C)	3 (C)		1 (C)	
			50 (O)				
Parastacidae	Cherax depressus	orange-fingered yabby	25 (C)		13 (C)	1 (C)	

1 C = captured, O = observed

4.6 Turtles

Species Captured

During the study we captured turtles at 2 of the 4 sites surveyed (3 sites were dry; Table 4.7). *Emydura krefftii* (Krefft's river turtle) was the only species captured throughout the study area.

	Common name				Site			
Latin name		2 ¹	4	8 ¹	11 ²	12 ³	15 ²	16 ²
Emydura krefftii	Krefft's river turtle	_	11	_	_	1	_	_

 Table 4.7
 Abundance of each turtle species caught or observed at each site.

1 Nil captured; bait still in trap when removed from water

2 Dry site

3 Observed during electrofishing, nil captured in bait traps

Adult turtles were more abundant than intermediates, and no juveniles were captured. A pictorial record of each life history stage captured is provided in Figure 4.36 and Figure 4.37. No obvious turtle nesting banks were observed; however it is possible that turtles breed within the Glebe Weir inundation area when water levels are low.

Figure 4.36

Adult Emydura krefftii at site 4.



Figure 4.37

Intermediate *Emydura krefftii* at site 4.



Fitzroy River Turtle (Rheodytes leukops)

The Fitzroy River turtle (*Rheodytes leukops*) was first described in 1980 (Legler & Cann 1980). It is only found in the Fitzroy River and its tributaries, in central Queensland. Current records indicate that the species occurs within permanent freshwater reaches from the Fitzroy Barrage up to at least Theodore Weir in the Dawson River, to Duck Ponds on the Lower Nagoa River, throughout the permanent waters of Marlborough Creek, and to the isolated large permanent water holes of the upper Connors River (Limpus et al. 2007). This species is listed as 'vulnerable' under the Queensland *Nature Conservation Act 1992* (NCA); the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); and the International *IUCN Red List of Threatened Species 2007* (IUCN Red List 2007).

R. leukops are typically found in shallow, fast-flowing riffle zone habitats characterised by well-oxygenated water (Cann 1998; Tucker et al. 2001; EPA 2007). However, whilst riffle

zones may be present across the species distribution during the wet season, they are often dry or non-flowing for much of the year. During these drier periods, *R. leukops* has been observed in high abundance in large slow flowing pools and in non-flowing permanent water holes (Limpus et al. 2007).

Female *R. leukops* nest on sandy banks with a deep layer of sand and a low vegetative cover. Nests are typically laid in deep chambers (up to 170 mm) situated from 1 - 4 m above the water level, and have been observed up to 15 m back from the waters edge (Cogger et al. 1993; Cann 1998).

R. leukops was not captured in this survey. The species is particularly difficult to survey, as it rarely enters traps (Limpus et al. 2007; M. Gordos, Conservation Manager, NSW DPI, pers. comm. July 2007). The most successful, and therefore most commonly used, method to survey *R. leukops* is hand capture on snorkel (M. Gordos, Conservation Manager, NSW DPI, pers. comm. July 2007). However, snorkelling is ineffective in turbid waters as seen in the majority of the Fitzroy River catchment (Limpus et al. 2007). Night dip netting and spotlighting are also effective methods for catching *R. leukops*, however the success of these techniques is also limited by turbidity (Limpus et al. 2007). Seine netting has also been used to successfully capture *R. leukops* (frc environmental 2007; Limpus et al. 2007), however, the use of seine nets around snags and rocks is less effective (Limpus et al. 2007).

R. leukops has been recorded from the upper reaches of the Dawson River. In May 2002, a construction worker involved with the construction of a new highway bridge observed 116 *R. leukops* in the drained plunge pool downstream of the Theodore Weir (approximately 86 km downstream of the proposed Nathan Dam)(Limpus et al. 2007). Other records of *R. leukops* in the vicinity of the Theodore Weir include, an incidental capture by a local fisherman in August 2000, and an observation immediately downstream on the weir wall in December 2000 (Limpus et al. 2007). These observations represent the most upstream records for *R. leukops* in the Dawson River Drainage (Limpus et al. 2007). No *R. leukops* have been recorded from the site of the proposed dam, however such observations, coupled with the availability of suitable habitat, suggest the species may be present at the site.
4.7 Aquatic Mammals and Amphibians

Our survey did not target aquatic mammals. No aquatic mammals were observed.

Approximately 40 tadpoles (unidentified) were observed at site 8 (Blackboy Creek), and approximately 12 tadpoles (unidentified) were observed at site 12 (Cockatoo Creek within the Glebe Weir inundation area).

One *Tachyglossus aculeatus* (echidna) was observed on top of the bank at site 11 (Cockatoo Creek upstream of the inundation area) (Figure 4.38).

Figure 4.38 *Tachyglossus aculeatus* (echidna) at site 11.



5 Survey Quality

The survey sites chosen represent the range of habitat types of the study area during dry season conditions. Flooding in the Dawson River, and subsequent rainfall in the Taroom region, prevented the survey of just over half of the intended survey sites.

We used as many survey methods as were logistically practical given the prevailing conditions at each site. An air bubble was noted in the dissolved oxygen probe of the water quality meter during the survey of water quality during the flood. Therefore, we have not presented dissolved oxygen data for measurements taken during flooding. It is possible that sediments at site 8 were stirred up during water quality sampling at 0.5 m depth (before flooding).

The track logs for the routes to sites 3 and 15, and the waypoint from site 3, could not be downloaded from the GPS. It is possible that the GPS may not have had sufficient satellite signal to record track logs and GPS points during these times.

Recommendations for Future Surveys

The site surveyed on Price Creek during the IAS was located close to the Nathan Gorge, and was reported to have very good riparian vegetation and a range of habitat types (including pools, runs, riffles, cascades and rapids). The site surveyed in this study was further upstream and was surrounded by cleared grazing land. As this site was dry at the time of our survey, we recommend that it be moved further downstream (in the vicinity of IAS site 908) for the post-wet season survey if access is available. We also recommend that at least two off-stream wetlands (Palm Tree Creek Lagoons and the wetland at 'The Bend') be sampled in the post wet-season survey. Off-stream pools at each site should also be surveyed if they are present (e.g. at site 6 at the proposed dam wall).

The methods used during this survey were applicable to the site conditions at the time of survey. During the post-wet season survey, the water level in the Glebe Weir inundation area is likely to be much higher; and the water could be > 4 m deep, which may reduce the effectiveness of boat-based electrofishing. Where electrofishing is likely to be inefficient, we recommend setting multi-panel gill nets, across the waterways where possible, and using the boat electrofisher to both capture fish, and heard fish in to the net. Where boat electrofishing is not possible for practical reasons (for example site 6 at the proposed dam wall), we recommend setting a range of gill nets and fyke nets as close as practical to dawn or dusk to target larger fish (combined with the use of baited traps and seine netting to capture smaller fish).

In order to satisfy the likely requirements in the Terms of Reference for the EIS, seasonal surveys will be required. A dry season survey could not be achieved for just over half of the sites proposed. A post wet-season survey of all of the sites is intended. It is therefore possible that a second dry season survey may be required; either at those sites that could not be surveyed during the present event due to flooding; or at all of the sites (which would provide an indication of inter-annual variation at those sites that were surveyed during the present study).

To enable a comprehensive assessment of the impacts of this project, we recommend that aquatic habitat mapping be completed for the inundation area, and downstream of the proposed dam (for those reaches predicted to be heavily impacted).

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Appendix A Project Brief

Brief for Aquatic Flora and Fauna Dry Season Field Survey: Nathan Dam

1.	Project D	escription	. 1
2.	Existing	Information	. 3
3.	Scope of	Work	. 3
	3.1 Gen	eral	. 3
	3.2 Deta	iled Scope of Works	.4
	3.2.1	Stage 1: Site selection	. 4
	3.2.2	Stage 2: Finalisation of Field Methods	. 5
	3.2.2.1	Habitat description	. 5
	3.2.2.2	Water Quality	. 5
	3.2.2.3	Macrophytes	. 6
	3.2.2.4	Macroinvertebrates	. 7
	3.2.2.5	Fish	. 7
	3.2.2.6	Turtles	.9
	3.2.2.7	Aquatic mammals and other reptiles	.9
	3.2.3	Stage 3: Field Survey	.9
	3.2.4	Stage 4: Reporting	.9

1.PROJECT DESCRIPTION

The Project is the construction and operation of Nathan Dam at 315.3 km AMTD on the Dawson River (approx $25^0 29$ 'S $150^0 09$ 'E) in central Queensland. The Project also includes a pipeline to the Surat Basin to supply the coal mining and power generation sectors.

An Impact Assessment Study (IAS) on the site was released in October 1997. At that stage a number of Full Supply Levels (FSLs) were still being considered, from 170 m to 185 m. Further, the dam wall location was originally at 314 km AMTD, but was moved to 315.3 km AMTD in order to avoid sensitive areas near the proposed wall.

The 185 m AHD FSL option at 315.3 km AMTD has been selected as the preferred option for the current investigation. This will create an 880,000 ML storage which will flood 75 km of the Dawson River. 18 permanent or intermittent tributaries enter the proposed inundation area, the largest being Cockatoo Ck. These tributaries are marked below.



Number	Name	Area
		(km^2)
19	Kungay Mungay Ck	152.2
18	Unnamed - Lumped lateral inflow	55.4
17	Palm Tree Ck	5187.8
85	Scotchy Ck	49.6
73	Grass Tree Ck	32.0
75	Blackboy Ck	82.2
74	Unnamed Ck	32.3
86	Unnamed - Lumped lateral inflow	54.9
76	Double Stable Yard Gully & Scrubby Ck	49.7
16	Bentley Ck	347.9
77	Binghi Ck	56.8
78	Spring Gully	109.6
14	Cockatoo Ck	1029.5
15	Unnamed - Lumped lateral inflow	46.0
79	Unnamed Ck	21.4
80	Spring Ck	43.6
87	Unnamed Ck	18.6
72	Unnamed - Lumped lateral inflow	34.9

The natural river channel of the Dawson River is characterised by a series of long and deep relatively permanent pools. The middle and lower reaches are long and winding and are characterised by very low gradient (from the upstream limit of the proposed dam to its junction with the Fitzroy River, the fall is 150 m over 425 km). The Nathan Gorge

area is not related to falls or rapids, but to a narrowing of the floodplain as the river cuts through different bed material. The existing Glebe Weir would be flooded by the dam. Gyranda Weir and Orange Creek Weir exist some 30 and 45 km downstream respectively. When full, Gyranda Weir backs up through the gorge to the dam site. The weirs are not fitted with fishways.

The storage will back up to the town of Taroom, the only town in the immediate catchment, and will extend into several tributaries.

2.EXISTING INFORMATION

The IAS included stand alone reports on ecological attributes, including Aquatic Fauna (John Anderson and Michael Howland). The report focussed on aquatic and riparian habitat (State of the Rivers methods; over 50 existing and new sites), aquatic fauna (fish – using various nets and a back pack electrofisher; turtle and platypus – no extra methods; macroinvertebrates – bait traps only), and water quality (meter based top and bottom spot measurements at sample sites). Surveys were undertaken at 16 sites (8 main channel and 8 tributary) over 8 days in October 1996 following a period of good flow. Boat access to sites within the gorge area is restricted. Raw data for all sites is provided in the report. A review of the literature available at the time was also undertaken. This revealed mainly fisheries related reports. A hardcopy of the IAS appendix will be made available by the client.

Since that time substantially more information is available for the catchment from DNRW AusRivas surveys, DNRW Water Resource Planning Processes and investigations into suitable monitoring programs, DPI Fisheries research and monitoring programs, studies undertaken by Central Qld University and Griffith University, ROL holder monitoring reports, EPA turtle group data and stakeholder monitoring reports (Fitzroy Food & Fibre) and consultancy outputs (EM 2003 for Fitzroy Food & Fibre), amongst others.

3.SCOPE OF WORK

3.1General

The aim of the dry season aquatic environment survey project is to undertake standard field surveys across the range of available habitats of:

- Aquatic habitat
- Water quality
- Macrophytes
- Fish
- Turtles
- Aquatic mammals, and
- Macroinvertebrates.

The survey design and reporting should allow replication at a future date without the need to refer to other information. Representative habitats and from sites within, upstream of

and downstream from the Project, should provide semi-quantitative or quantitative data where possible and appropriate to the species or community, using standard approaches. The approaches used must be supported by references and justification for the methods chosen should be provided.

The habitats surveyed should include instream main channel and tributary habitats as well as offstream and floodplain habitats such as lakes, billabongs or other wetland types if they exist. If intermittent or ephemeral habitats are a likely important component of the aquatic environment, then they also should be surveyed. The assessment should include natural and man-made habitats where they are relevant (weir pools, offstream storages, farm dams). Important habitats in the local area not impacted by the dam or works should be included (e.g. important downstream tributaries).

It is expected that the sampling undertaken at each site will vary in accordance with the habitat present. Dry sites should be included where they are likely to provide aquatic habitat at a later date.

3.2Detailed Scope of Works

This project is a field survey only. The data and report will provide the basis for possible replication of the work and will serve as input to the Existing Environment component of the EIS. The stages of the project are:

- 1. Site selection
- 2. Finalisation of field methods
- 3. Field survey
- 4. Reporting

The tasks associated with these stages are described below.

3.2.1STAGE 1: SITE SELECTION

Site selection will be based on an initial site inspection in the company of the Principal, the 1998 IAS and discussion with applicable agencies and researchers who have worked in the area since that time. It is recommended that those discussions include:

- Central Qld University (Dr Leo Duivenvoorden)
- DPI Fisheries (Peter Long, Andrew Burghius, Eddie Jebreen)
- NRW (Chris Marshall and Jonathon Marshall (Miers Rd Indooroopilly re AusRivAS and ROP monitoring programs), Regional office Rockhampton regarding ROP monitoring)
- EPA (Col Limpus)
- Griffith University (Prof Stuart Bunn)

Sites should represent the habitats present in terms of main river channel, tributaries, floodplain wetlands, offstream waterbodies and artificial habitats. The pools formed by Glebe and Gyranda weirs should be included. A site may include more than one habitat.

The general location of all sites must be agreed with the Principal prior to survey. Historic sites will be replicated wherever possible and suitable. It is anticipated that there may be up to:

- 2 sites below the dam on the main channel
- 1 site below the dam on a tributary (Price Ck)
- 4 sites within the inundation area on the main channel
- 1 site above the inundation area on the main channel
- 4 sites on tributaries within the inundation area
- 4 sites on tributaries above the inundation area.

When a site includes multiple habitats, they should be sampled separately using methods appropriate to the habitat type and size. These habitats should be reported separately.

Access to sites will be in accordance with the Project protocols which will be supplied by the Principal. All initial contacts with landowners will be by the Principal.

All sites surveyed must be GPS located and a text description provided such that another party could find the area (roads, turns, tracks, gates etc).

3.2.2STAGE 2: FINALISATION OF FIELD METHODS

3.2.2.1HABITAT DESCRIPTION

Standardised habitat assessment procedures will be used to describe habitat characteristics at each site. The State of the Rivers method was used previously in the IAS. This should be repeated and supplemented by components of other methods (AusRivAS, Sustainable Rivers Audit).

All sites surveyed will be described using this method. Some sites, such as dry sites, will be described only by the habitat description.

A pictorial record of each site will be kept.

3.2.2.2WATER QUALITY

The focus of water quality data collection will be to determine the characteristics of the different aquatic habitats sampled. This will be achieved by meter-based sampling over short time frames (diurnally) and small spatial scales (vertically within the water column).

In-situ measurements through the depth profile

Measurements will be undertaken using a calibrated water quality instrument (Yeokal Model 611, YSI Model 6600 or similar) at 0.5m depth increments through the water profile, commencing as near as possible to the surface. Measurements will consist of:

- Water Temperature (°C)
- Electrical Conductivity (µS/cm)

- Salinity (g/L)
- pH
- Dissolved Oxygen (mg/L and % saturation)
- Turbidity (NTU)

Secchi Depth (m) will also be measured with a secchi disk where possible.

Flow will be measured using a hand-held flow meter or estimated within increments.

Logger-based measurements at representative sites

At selected sites, overnight logging of all meter-based parameters listed above will be undertaken just below the water surface. Sample increments should be no longer than 30 minutes.

3.2.2.3MACROPHYTES

The description of flora should include:

- emergent, submerged and floating (free-floating or rooted) macrophytes;
- macroscopic algae; and
- the presence of any introduced or pest plants.

The assessment methods that will be used are based on those used by the Queensland Department of Natural Resources and Mines for the waterway plants, making data gathered comparable to previous studies. Where macrophyte diversity and abundance is limited, full application of the sampling method would not be applicable.

When of sufficient coverage in river channels, aquatic flora will be assessed using belt transects (nominally 10 m wide x 100 m long). In wetlands, aquatic flora would be assessed using quadrats. The following will be recorded:

- 4. The presence/absence of all native and exotic aquatic macrophytes;
- 5. Total area covered by aquatic macrophytes at each site;
- 6. Total area covered by submerged, emergent and floating aquatic vegetation at each site;
- 7. % cover of any of the listed rare and threatened aquatic macrophyte species
- 8. % cover of all noxious aquatic weeds;
- 9. % cover of all species with cover exceeding 10% of the area of each site (defined as the area of the channel);
- 10. Characteristics of the site e.g. depth, substrate and morphology, and
- 11. Pictorial record of each site a digital photographic library of aquatic flora and survey sites will be kept.

Macrophyte species will be identified in the field, where possible. Where required, two representative samples will be collected and pressed for later identification in the laboratory or for submission to the Queensland Herbarium.

3.2.2.4 MACROINVERTEBRATES

Four main modes of macroinvertebrate sampling will be carried out. The use of each is dependent on the type of habitat sampled.

A standard triangular-framed macroinverebrate net with a cone shaped net of 250 μ m mesh will be employed to sample the macroinvertebrate assemblages in discrete habitat such as macrophyte and tree root. Samples will be of 20 seconds duration and two samples will be collected where the area of habitat allows.

The same equipment will be used to sample macroinvertebrates in riffle and glide habitats, although a kick-netting style of sampling ("square foot samples") will be used for these types of habitats. Five replicate samples will be collected at each site.

A surber sampler will be used to collect macroinvertebrates from edge habitats adjacent to deep pools. Five surber samples will be collected from the edge at each site. The area enclosed by the surber approximates that sampled by kick sampling.

All samples will be wholly preserved in the field in isopropyl alcohol and returned to the laboratory for sorting. Sub-sampling will be performed where necessary. Identification will be to the level used by NRW for ambient monitoring, being family-level for macrocrustaceans, molluscs and insects, except for Chironomidae which will be taken to sub-family, and higher levels for other groups such as micro-crustacea, oligochaetes, nematodes and acarina.

Bait traps used in the fishing program will likely capture crustaceans and these will be identified and counted in the field. Observations of larger macroinvertebrates (e.g.mussels) will be recorded.

3.2.2.5 FISH

Fish surveys will be carried out using a variety of gear types including:

- Boat-mounted electrofisher at deep sites with access;
- Backpack electrofisher at shallow sites;
- Seine Nets;
- Fyke Nets; and
- Bait Traps.

Gear types appropriate to the characteristics of sites and species being sampled will be used, and not all gear types will be deployed at each site. For example, boat-mounted electrofishing and fyke nets would not be applicable in small streams or waterholes.

Boat-Mounted Electrofishing

Electrofisher sampling should be based on Sustainable Rivers Audit methodology. This mode of electrofishing will be performed by qualified staff possessing senior electrofishing operator accreditation and status.

All visible fish will be collected, and "blind netting" will be used to overcome the limited visibility of fish in the turbid waters of some sites. The total numbers per species of fish will be recorded, along with fork lengths (or total lengths for species with convex or truncate caudal fins) for up to the first 20 of each species caught.

Backpack Electrofishing

Sampling will be based on a fixed number of samples (5 passes per habitat) using a fixed time per sample (usually 2.5 minutes). It is expected that there will be an asymptotic increase in the number of species encountered and the data acquired on relative abundances of each species will be quantitative. These will allow between-site and between-time comparisons of species composition, diversity and catch per unit effort.

As with the boat mounted electrofishing, the total numbers per species of fish will be recorded, along with fork lengths (or total lengths for species with convex or truncate caudal fins) for up to the first 20 of each species caught.

Fyke Netting

At sites with sufficient width of waterway and a depth of less than 1 metre but greater than 0.5m, fyke nets will be set with the entrance facing downstream, parallel to the bank.

Two nets will be set to fish as independently as possible (that is, one net will not channel fish into another). Nets should be set to sample as near as possible to dawn or dusk. Nets will be checked after 4 hours so that data can be standardised as catch per unit effort.

<u>Baitfish Trapping</u>

Traps will be used at all sites where water depths are suitable. Ten collapsible baitfish traps each baited with cat biscuits will be set from along the bank and adjacent to cover (vegetation, snags etc) when present. Bait traps will be checked after four hours so that data can be standardised as catch per unit effort. Any fish, prawns or crayfish caught in the traps will be identified and the number of each species recorded. Catches from each trap will be recorded separately.

Seine Netting

Seine netting will be carried out at suitably shallow sites, contingent upon substrate type and the amount of snags present. The mesh should be no coarser than 6mm.

The seine net will be deployed by a person wading out into the water with one end of the net before returning to the shore, while a second person remains on the shore holding the other end of the net. Depending on the depth and size of particular sites, the entire proportion of the net may not necessarily be fed out. More than one sample may be collected depending on site characteristics and the ability to use other methods.

Push seine netting may also be used.

Data collection for all gear types

For all gear types, all fish caught will be identified and counted, a proportion of individuals measured (fork length) and wounds, lesions and deformities will be recorded if present. Native fish will be released alive wherever possible. If introduced fish are collected, they will be euthanised. Where identification is difficult in the field, one or two specimens will be retained for identification in the laboratory.

3.2.2.6 TURTLES

The turtle sampling method must be confirmed with the EPA turtle group. It is envisaged that five large baited turtle traps will be set for standard 2 hour periods. Traps will be closely monitored by field operators to ensure turtles or other air-breathing species to do not become tangled or trapped. Turtles captured by other techniques or otherwise observed will be recorded. As the survey will be undertaken during nesting season for some species, potential nesting banks should be inspected for tracks or signs of excavation.

3.2.2.7 AQUATIC MAMMALS AND OTHER REPTILES

Aquatic mammals and other reptiles will be sampled by observation or incidental capture only. The report should include comment on the likely presence of such species.

3.2.3 STAGE 3: FIELD SURVEY

The field survey should be conducted as soon as possible after appointment and prior to any significant wet season flows.

The consultant will be responsible for all aspects of the field program, including obtaining and maintaining appropriate permits and licences for all aspects of the work, conforming with the land access protocols of the Principal and occupational health and safety requirements. A safety plan must be submitted and approved prior to undertaking the field work.

3.2.4 STAGE 4: REPORTING

The output is to be a field survey report including:

- Survey design description, including the number of sites and their location along with justification for that location relative to impact assessment purposes, previous surveys etc;
- site descriptions, including text (based on SOE field data sheets which must also be supplied), maps, locational information and photographs (digital and hardcopy);

- full description of all field methods and justification for their use;
- data summaries for all components of the work presented on a per site basis and summarised across sites where the data is applicable (fish or macroinvertebrate species presence and counts for example)
- raw data in electronic form
- a survey quality component which summarises the number of survey locations for each sampling method, any missing data (sites intended for inclusion but that could not be accessed, lost samples) or gear malfunctions (torn nets, water quality meter failure etc).

The data does not require analysis or discussion as this may be undertaken by others but as such, the report must be stand-alone and fully self-explanatory.

Appendix B Datasheets Used

Appendix B Datasheets Used

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SITE CHECKLIST

Site Number:

	Completed by	Checked By	If not completed, why?
Habitat Description			
GPS			
Pictures			
Water Quality			
Secchi Depth			
Diurnal WQ Sampling			
Macrophytes			
Pictures		7	
Samples if needed (2 of each unknown)			
Macroinvertebrates			
Discrete Habitat (macrophyte			
and tree root) 2 samples of a			
square foot for 20 seconds			
Riffle and Glide Habitat - five			
kick netting (square foot)			
replicate samples			
Edge Habitats - Five surber			
samples			
Fish			
Boat Electrofisher			
Backpack Electrofisher			
Fyke Netting (water depth <1m but >0.5m), 2 traps at dawn or dusk and checked after 4 hours			
Baitfish Trapping - 10 traps for			
4 hours, record catch from each			
trap separately			
Seine Netting - (<6mm mesh)			
Species Count		_	
FL or TL of 20 of each species			
Samples if needed (2 of each			
unknown)			

Turtles

Turtle traps - 5 traps for 2 hour		
periods		

Signatures

Project Manager - Lauren Thorburn

Field Coordinator - Ashley Morton

Field Crew Leader

]	Date (dd/mm/yy)	Recorder © 1992 J. Anderson
STATE OF THE RIVERS SHEET 3 Site Description Basin Subsection Site			Assistant
			Tuno of Sito
Gauging Station Type Region Site Description (locality name)	Location Des	cription (how to find it again)	Photograph Only
Man Number Grid Reference	Latitude Longitud	de GPS 2 Other Es	Full Survey Site
			Water Quality
Map Scale AMTD (from map) Total U/S Distance (add AMTD 1:	s) Is the Site Tidal ? Non-	Tidal	a (sq. km) 0 Other
Sketch : Show location of survey, access points, landmarks and key features su	ch as roads, houses and other	Photographs - The standard	et consists of one shot (opking
survey (the reach). Include an arrow for NORTH and also indicate the direction of where the GPS latitude and longitude were determined. The sketch should be an	f flow. Also mark the position	upstream, do	wnstream, lateral left (at left bank), (at right bank), reach environs (overview
again for future follow-up surveys.		Altitude (m) of the reach	from a distance) and other relevant
		Film No.	Shot Shot Shot Shot
	1	Upstream	┥ ┍╶┼╶┼╺ ┥┝ ╺┝╺┝╸┥╸ ╡
		Lateral Left	
		Lateral Right Reach Environs	╏ ╴╡╺┥ ╏╌┽╼┥┟╌┽╼┥╞╌┽╼┥
		Distant View	
		Feature	┥ ┝╍╈╍┿╍ ┥╞ ╶┥╶┥ ╴┥┝╶┽╺╇╼┥
		NOTES:	
	1		
	1.0	Date (dd/mm/yy)	Recorder © 1992 J. Anderson
Basin Subsection Site Tributary Name Record Informatic	n about the local land adjacent to the re	each on each side	
and about the correspondence of the large segment show not beyond the large segment and	ditions prevailing at the time of the sam id be restricted to the immediate vicinity ad bordering the riparian zone	of the reach-i.e. 1 Rainfores	st III 13 Grassland(isolated trees)
1 Water Level at sampling time 3 Channel Pattern 4 Loca	Land Use 5 Local	Disturbance 2 Eucalypt 3 Eucalypt	Wet Scierophyl 14 Other Shrubland Open Forest 15 Heathland
Completely dry	Cane Sand /	gravel mine 4 Eucalypt	woodland 16 Mangrove open woodland 17 Salt marsh / salt pans
Low Flow/ low level	ulture small crops/ vines 2 Other ulture tree crops/ fruit 3 Road	6 Cyprus P	ine forest
Moderate < water mark	ed broadacre row crops 4 Bridge d broadacre row crops 5 Ford /	and the second s	rub-open forest 20 Other plantation
High > water mark	ig - sown pasture	arge Pipe 9 Mulga Sh rv activities 10 Bendee/i	ancewood scrub 22 Other
Within 1 hr of High Tide	ig -native thinned	Mill ¹¹ Softwood	a forest
Within 1 hr of Low Tide Incoming/between Tide Incoming/between Tide	ig -native virgin timber	unoff, pipe outlet	a lorest
Outgoing/between Tide 11 11 11 10 - Verland Flow 110 11 Urbar 2 Failantid Table Floads late width (m)	residential 11 Chann manufact/ processing 12 River i	improvement I Oxbows	/ billabongs 3 State Park
Estimated Total Valley-flat width (m)	r Reserve / National, envir	Extraction 2 Remnan	aln scours
	Residential / hobby farm	g 4 Floodpla	ain deposits
EXTREME DISTURBANCE Tick one box for the overall rating HIGH DISTURBANCE	E Valley Flat Vegetation - Agricultural	Iand LOW DISTURBANCE	Other / Unknown
6 Valley Flat Vegetation - Agriculture and/or 4	and/or cleared on ONE side; native ve on the other clearly disturbed or with a	getation 2	<u>valley Flat vegetation</u> - Native vegetation present on BOTH sides of the river with a virtually intact canopy. Minor disturbances present through
cleared cleared virtually all exotic species (willows, pines etc.) cleared dist	percentage of introduced species pres Shoreline Vegetation - Bank veget	tation or minor undisturb.	introduced species.
A section present is extremely	intrusion of introduced species, though	native	Shoreline Vegetation - Native vegetation on BOTH sides of the river is generally in good
disturbed - i.e. dominated by exotic species. Native species rare or completely absent. Shoraline - Valley Flat	Note: Sites with valley flat vegetation of BOTH sides, but with shoreline vegetation	shoreline +	disturbance is minor.
	good condition, for example when it is off, should be included in this category	V LOW DISTUBBANCE	
5 Valley Flat Vegetation - Acriculture and/or 3	Valley Flat Vegetation - Agricultural	land 1	<u>Valley Flat Vegetation</u> - Native vegetation present on both sides of the river with an intact
cleared cleared land <u>BOTH</u> sides. Plants present are cleared undist virtually all exotic species (willows, pines,	and/or cleared on ONE side; native ve or on the other in reasonably undisturbed	getation undisturb. undisturb.	insignificant. No evidence of outside interference. Representative of natural vegetation
some native etc.). undisturb. or minor	Shoreline Vegetation - Native vegeta	ation on	in excellent condition.
Concreting vegetation - Some native vegetation present, but it is severely modified OTH sides by grazing or the intrusion of	BOTH sides with canopy intact or with species widespread and common in th shoreline zone. The intrusion of introduced		Shoreline Vegetation - Native vegetation on both sides of the river in an undisturbed state.
Shoreline introduced species. Native species severely reduced in numbers and cover.	species is minor and of moderate impact of moderate impact of moderate impact of the species	act.	Representative of natural vegetation in excellent condition.







STATE OF THE RIVERS SHEET 11 Scenic Recy & Consern Values											
STATE OF THE KIVEKS SHEET IT Scend, Red & Conserv. Values											
Basin Subsection Site Tributary Name											
Recreational Opportunity Type Allocate the site to ONE of the following types considering all aspects											
		Natural 1.	Natural 2. Semi-Natural	Natural 3. ³ Roaded- Natural	Rural 1.	Rural 2. ⁵ Developed Rural	Urban 1. Undeveloped Urban	Urban 2. ⁷ Developed Urban	Urban 3. [®] Highly Developed		
		Nature Reserve, Sanctuary	Developed Reserve, Area, e.g. waterfall limited walking access	Camping Reserve, Rest Area structured sites with facilities	Recreational settings in rural landscapes that are modified	Rural areas cleared for camping grounds, within rural towns	Undeveloped urban parks and bushland kept semi-natural	Urban Parks and Sports grounds. Walls along stream	Resort developments		
	Remoteness	3 km or more from all roads or tracks.	1 km or more from all roads.	not applicable	not applicable	not applicable	max of 500m to households	max of 500m to households	max of 2 km to households		
	Ассеза	only by foot and 4 WD vehicle into the area	only by foot and 4 WD vehicle into the area, tertiary roads only	Moderate road access primary & secondary roads	good road access primary & secondary roads	accessible to all vehicles	low level access, primary road access	no limít to access	no limit to access		
Human no structures or only minor human Moderate disturbance natural setting but greatly modified modified open space domina building pathone for the structures or influence, but small and development for greatly modified modified modified modified modified open space building the substantial residential residential residential residential residential residential modified modifi							dominated by buildings etc.				
	Expected rare, few other some contact with Moderate disturbance individuals but and some contact contact isolated with groups				moderate contact on roads and trial sites	moderate to high interaction	Regular use by local residents	moderate to high density use	high density and frequent use		
	Facilities, regulations & structure	s, Little or none some but subtle as formed tracks and signs to controls obvious, formed tracks and signs to controls obvious, formed tracks and signs to controls obvious, formed tracks and signs to controls obvious and the second se				barriers, signs and fences obvious Remnant area with some restrictions facilities facilities			highly developed facilities		
2 R	ecreation Typ	es suitable for the are	a	Scenic Value Asse	ssment	4 Ir	itial Conservation	Nalue Assessme	nt		
Ba	rbecue and picn shwalking - cam	ic ping Photogr	aphy	Overall So	cenic Value Rating	a Valua 1-10	Aquatic Plant or A	nant habitat for nimal spp.			
Bu	shwalking - day	trips Nature a	ppreciation		Natural Beauty (bush	c value land setting)			<u>_</u>		
Ca Ca	mping - car acce noeing / kyaking	ss Swimmi / rafting Water Sl	ng kiing	Inherent	Physical Beauty (wat	erfalls etc.)	Rate the site as remr Riparian Plant or Ai	nant habitat for nimal spp.			
Do	gs	Bird Wat	tching	Scenic R	ural Setting	1-10					
	ore Fishing	I heate		Scenic U	roan Setting						
HB	at fishing - large	boats Other			alue of a component e		Rate the value of the	site as a wiildlife corrid	or		
Fo	ur wheel driving	Other			and of a component o	.g. 1100 010. 1-10					
Ho Ho	rse Riding	·				5					
H [™]	tor bikes	Comments:					Rank the Site (1-10) i	n terms of its quality as	representative Aquatic		
H Ro	wing					— <u> </u>	Habitat for this type	of site in this catchment			
³⁴ ا						_ [Rank the Site (1-10) i Habitat for this type	in terms of its quality as of site in this catchment	representative <i>Riparian</i>		

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Aquatic Habitat

Instream Vegetation

Channel	
Site Length:	
Average Channel Width:	
Average Wetted Width:	
Average Depth	
Gradient:	%

Morphology

Site Name:

Substrate	%		Periphyton	N	0 .	1	2	3	4
Bedrock			Moss	N	0	1	2	3	4
Boulder (> 256 mm)			Filamentous Algae	N	0 .	1	2	3	4
Cobble (64-256 mm)			Macrophytes	N	0	1	2	3	4
Pebble (16-64 mm)			Detritus	N	0 .	1	2	3	4
Gravel (4-46 mm)				N = Nc	one	•			
Sand (1-4 mm)				0 = <1	0%)			
Silt/Clay (<1 mm)				1 = 10	-35	5%			
				2 = 35	-65	5%			
Embeddedness	NLMH			3 = 65	-90)%			
				4 = >9	0%)			
Complexity	L M H	L=1, M=2 or 3, M	>3 habitat types						
Flow Regime	Ephemeral	Intermittent	Perennial	1					

Water

Location			
Depth (every 0.5 m)	Location		
Temperature (C)	Depth (every 0.5 m)		
pH	Temperature (C)		
Conductivity (uS/cm)	pH		
Dissolved Oxygen (mg/L)	Conductivity (uS/cm)		
Dissolved Oxygen (% Sat)	Dissolved Oxygen (mg/L)		
Turbidity (NTU) Image: Constraint of the second secon	Dissolved Oxygen (% Sat)		
Odour Image: Constraint of the second s	Turbidity (NTU)		
Oils Image: Constraint of the second se	Odour		
Location Image: Constraint of the second secon	Oils		
Location			
Depth (every 0.5 m)	Location		
Temperature (C) Image: Conductivity (uS/cm) Image: Co	Depth (every 0.5 m)		
pH	Temperature (C)		
Conductivity (uS/cm)	pH		
Dissolved Oxygen (mg/L)	Conductivity (uS/cm)		
Dissolved Oxygen (% Sat)	Dissolved Oxygen (mg/L)		
Turbidity (NTU)	Dissolved Oxygen (% Sat)		
Odour	Turbidity (NTU)		
Oils	Odour		
	Oils		

Secchi Depth (m)

Other Aquatic Mammals Observed:

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Project Number: Site Name: METHOD: Belt Transect (10 m wide x 100 m long) or quadrant (wetland)

Total Area of Coverage (%)

Total Macrophyte Coverage	
Submerged	
Emergent	
Floating	
Rare	
Noxious	

í Т Т Т Т Т Т Т Т Т Т Т Т Т

100	10.00	
253.		
6624		
6405		
1621	•	
0206		
1000	_	
1661	_	
276.1		
1004		
1971		
2.6		
127.1		
Y-112-1		
1.5.2		
1.00		
6.62		
251		
CP1/C1		
10-1		
2.711		
0.25		
102		
2572		
SX-1		
F(3S)		
10.62		
0.001		
Sam		
2.621		
0251.4		
10.0		
10.21		
10.54		
17201		
107E		
ALC: 1		
10.014		
2.52		
228		
100		
2021		
41.54		
16.21		
10.00		
CTR1		
3454		
27,834		
(X)55.3		

Crew: Date:

Macrophyte species	Common name	% cover	Exotic/Native	Form (S/E/F)	Samples?	Photos
A						

Comments

Project Name: Project Number: Crew:

<u> </u>	Cito	Date		Sample	Picked	Date	Checked	# Viale	Commonto
#	Site	sampieu	Location		бу	PICKEU	Бу	VIdis	comments
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24								-	
25									
26									
27									
28									
29									

Macroinvertebrate Sample Tracking Log

Time:

Project Name: Project Number: Site Name:

Time: Crew: Date:

Nets

Net Type	Number of nets	Date In	Time In	Date Out	Time Out	Effort
=yke						
Saitfish						

Seine

Number of Seines	
Distance of seine	

Т

Backpack Electrofishing (5 passes per habitat with 150 seconds in each pass)

ort (s)								
Pulse Width (ms) Eff								
Frequency (Hz)								
Voltage			-					
Time Out								
Time In								
Date								
Location								

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FISH EFFORT cont.

Site Name:

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	 	 -	_	_	_	 _	_	_	 _	 _	_	_	 _	 	 -	_
Effort (s)																
Output Current (Amps)																
Pulses per Second																
Percent of Power																
Voltage																
Time Out																
Time In																
Date																
Location																

environmental FIS	SH CAPTURED	
611	environmental FISH	

 \bigcirc

Project Name: Project Number: Site Name:

Time: Crew: Date:

Fish Species Captured

LISH SPECIES	capital ca					
		Total Count ((A/I/C)			
Method	Species	Juvenile	Intermediate	Adult	Sample?	Photos?

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Project Name:

Project Number:

Time: Crew:

Site Name:

Date:

LHS = Life History Stage (Juvenile / Intermediate / Adult)

	Method	Species	LHS	FL or TL	Comments
1					
2	5				
3					
4					
5					
6					
7					<u>A</u>
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

	Method	Species	LHS	FL or TL	Comments
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

frc environmental	TURTLES
Project Name:	Time:
	inter O

Project Name: Project Number: Site Name:

Crew: Date:

Nets

Net Type	Number of nets	Date In	Time In	Date Out	Time Out	Effort	
				1			

Turtle Species Captured

Method	Species	Count (adult / juvenile)	Sample?	Photos?

7/12

STATE OF THE RIVERS SHEET 3 Site Description Basin Subsection Site	Date (dd/mm/yy) Recorder Thorburn Address
Inducary Name River Flows into	Flows into
Man Number 555 Grid Reference Latitude Longitud	Bend id and Bundula Rd
Map Scale AMTD (from map) Total U/S Distance (add AMTD(a))	GPS ? Other Est. Position Error 3 Unit to the state of t
1: Is the Site Tidal ? Non-Sketch : Show location of survey, across points leadwarks and key fortune such as used a house and other	Tidal Catchment Area (sq. km)
buildings. Also show the key features about the stream environs and its location. Also mark the boundaries for the survey (the reach). Include an arrow for NORTH and also indicate the direction of flow. Also mark the position where the GPS latitude and longitude ware determined. The setch should be adequate for misleting flow the site	Photographs - The standard set consists of one shot looking upstream, downstream, lateral left (at left bank), lotter light (of tight hand) more barriers to set the set of the
again for future follow-up surveys.	Altitude (m) photographs
logiam	Vpstream
	Downstream
	Lateral Right Reach Environs
Ris -stow A	Feature
The Aboulders	NOTES:
I I I I I I I I I I I I I I I I I I I	
Tegetated Jack	
Complained 1	
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STATE OF THE RIVERS SHEET 4 Reach Environs -temporal & spatial	Date (dd/mm/yy) Recorder © 1992
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Hecreatio	nal Opportunity Ty	pe Allocate the	site to ONE of the fol	lowing types consider	ring all aspects			
	Natural 1. Pristine Natural Nature Reserve, Sanctuary	Natural 2. Semi-Natural Developed Reserve, Area, e.g. waterfall limited walking access	Natural 3. <i>Roaded- Natural</i> Camping Reserve, Rest Area structured sites with facilities	Rural 1. Undeveloped Rural Recreational settings in rural landscapes that are modified	Rural 2. ⁵ Developed Rural Rural areas cleared for camping grounds, within rural towns	Urban 1. Undeveloped Urban Undeveloped urban parks and bushland kept semi-natural	Urban 2. ⁷ Developed Urban Urban Parks and Sports grounds. Walls along stream	Urban 3. [*] Highly Developed Resort developments
Remoteness	3 km or more from all roads or tracks.	1 km or more from all roads.	not applicable	not applicable	not applicable	max of 500m to households	max of 500m to households	max of 2 km to households
Ассева	only by foot and 4 WD vehicle into the area	only by foot and 4 WD vehicle into the area, tertiary roads only	Moderate road access primary & secondary roads	good road access primary & secondary roads	accessible to all vehicles	low level access, primary road access	no limit to access	no limit to access
Human Impact and Development	no structures or exotic plants, pristine condition	only minor human influence, but small clearings O.K.	Moderate disturbance and development of facilities	natural setting but greatly modified	substantial modifications, rural residential	remnant bushland	modified open space	dominated by buildings etc.
Expected human contacts	rare, few other visitors	some contact with individuals but isolated	Moderate disturbance and some contact with groups	moderate contact on roads and trial sites	moderate to high interaction	Regular use by local residents	moderate to high density use	high density and frequent use
Facilities, regulations & structure	Little or none	some but subtle as formed tracks and signs	Minimal facilities, no powered sites etc.	Controls obvious, more complete facilities	barriers, signs and fences obvious	Remnant area with some restrictions	highly developed facilities	highly developed facilities
'1" for potential	and "2' for actual use		Rate the site from 1 - 1	0 relative to other site cenic Value Rating	es in the area	Rate the site as remr Aquatic Plant or A	nant habitat for nimal spp.	_

STATE OF THE RIVERS SHEET 3 Site Description	Date (dd/mm/yy) 29/10/07 CAREN THORBURN
Basin Subsection Site Tributary Name Flows into	Flows into Assistant A SAVAGE
Gauging Station Type Region Site Description (<i>locality name</i>)	Description (how to find it again) Type of Site
Man Number Crid Reference Latitude Long	tude
	and the sec intermediate GPS ? Other Est. Position Error > Stream Gauge
Map Scale AMTD (from map) Total U/S Distance (add AMTD's) 1: Is the Site Tidal ? N	on-Tidal Catchment Area (sq. km)
Sketch : Show location of survey, access points, landmarks and key features such as roads, houses and other buildings. Also show the key features about the stream environs and its location. Also mark the boundaries for th	Photographs - The standard set consists of one shot looking
survey (the reach). Include an arrow for NORTH and also indicate the direction of flow. Also mark the position where the GPS latitude and longitude were determined. The sketch should be adequate for quickly finding the site	upstream, downstream, lateral left (at left bank), a lateral right (at right bank), reach environs (overview
	Altitude (m) of the reach from a distance) and other relevant photographs
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STATE OF THE RIVERS SHEET 4 Reach Environs -temporal & spatial Basin Subsection Sile Tributary Name and about the local land adjacent to the assessment should be restricted to the immediate vicin to the conditions prevailing at the time of the sa assessment should be restricted to the immediate vicin to the conditions prevailing at the time of the sa assessment should be restricted to the immediate vicin to the conditions prevailing at the time of the sa assessment should be restricted to the immediate vicin to the conditions prevailing at the time of the sa assessment should be restricted to the immediate vicin to the conditions prevailing at the time of the sa assessment should be restricted to the immediate vicin to the conditions prevailing at the time of the sa assessment should be restricted to the immediate vicin to the vicin the reparan zone Completely dry Isolated pools, no flow Low Flow/ low level Moderate < water mark High > water flavecostation + flav High Plavessession High = the costatio	Date (dd/mm/yy) Recorder 1992 reach on each side Image: Construction of the reach last of the reach of the river with a without on the reach of the river with a number of the ri
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Basin Subsection Site Tributary Name Selecting a Reach Channel Habitat Types Waterfall Gradient > 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im Gradient 5 - 60 deg Step Height < Im	_
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Height > 1m Gradient > 60 deg Waterfail Waterfail Gradient > 60 deg % of section Est. Av. length (m) Est.	
Step Height < Im Gradient 5 - 60 deg	
Strong Currents Est. AV. length (m) Est. AV. height (m) Est. AV. Gradient (deg.)	
Depth > 0.3 m Gradient 3 - 5 deg Strong Currents Rocks break surface	
Depth 0.1 - 0.3 m Gradient 1- 3 deg Moderate Currents Surface unbroken but unsmooth	-
Depth < 0.1 m Gradient 1- 3 deg Small Currents Surface unbroken and smooth	-
Depth > 0.3 m Gradient 1-3 deg Small but distinct & uniform current Surface unbroken Bet Av. depth (m) Est. Av. depth (m) Est. Av. depth (m) Est. Av. depth (m)	
Depth > 0.5 m where stream widens or deepens and current declines Est. Av. Width (m)	
Depth e 0.3m a reasonable size (>20% of channel width) cut-off section way from the channel Est. Av. Width (m)	-
STATE OF THE RIVERS SHEET 6 Cross- Sections Date (dd/mm/yy) Recorder @	1992
Basin Subsection Site Section Number for this reach	
One or more cross-sections (separate sheets) are required for each channel habitat type within the reach. Begin at the water's margin on the left bank and Run 2 af Yore (m) Sediment classes are those of the SAA which are easier to estimate visually - estimate % of total inorganic volume occupied by each	
take a series of distance and depth measurements. A minimum of 3 measurements is required for each cross-section including the width of stream. Also measure the width, height and slope for the left and right banks.	
Lower bank = surface to water mark. If bed dry measure depth at water mark level. Upper bank = water mark to inflexion point on the bank	
Bank Sediments Left Lower Upper Right Lower Upper P. Organics = particulate organics - estimate as % of the total volume.	
L 1 Pres. % by vol. pres. % by	R
L Upper Bank See Sheet 7 5 2 - 5 1 5 2 - 5 1 5 1 5 2 - 5 1 5 1 5 2 5 1 5 1 5 2 5 1 5 1 5 2 5 1 5 1	1
T Upper water back width back width back with back with back with back width back width back width back with back wi	H
Bould > 300 P.Organics	Ť
A Bank height	B
N Flows measured at Bank width of F1 of F2 of F3 of F4 of F5 of F6 of F7 of F8 of F9 of F9 of F9 of F9 of F0 Bank width	AN
Bed Dry Water Mark CROSS- - Depthe ack covered -no Water mark in CROSS- Cross- section readings across the bed (minimum of 3, maximum 15) - Depthe ack intervention of the mark intervention of	ĸ
S LEFT LOWER BANK Dist (m) Image: mask of mask of the second secon	
Width (m) Depth (m) Flow (mis) Depth (m) Flow (mis)	
Slope (deg.) 500 (deg.	
Image: State of the s	
Width (m) 5.20 Eight (m) Eig	
Bould > 300 Height (m) Z+C P.Organics Image: Company of the second	



Date (dd/mm/yy) Recorder © 1992 STATE OF THE RIVERS --- SHEET 9 Vegetation LT The Riparian Zone The Riparian Zone is the corridor of vegetation along the edge of a stream or river which is intimatedly linked with the stream both in providing leaf and branch litter to the stream and being affected by the extra moleture avalable. It is the dialinet vegetation zone along the stream. Estim its width (to a maximum of 50m). The strip chosen should be relatively Trees may be very narrow. Is in the stream and the stream being affected vegetation stream affected vegetation zone along the stream. Estim rom the water mark, up & over the bank to edge of stream affected vegetation in the stream affected vegetation in the stream stream. Estim the stream affected vegetation in the stream being affected vegetation stream affected vegetation and the stream being affected vegetation in the stream stream stream. The stream str Basin Subsection Site Dawson hiver **Riparian Zone - LEFT BANK** The method of assessment is the percentage cover of the designated surafce area for each zone. Refer to cover examples as a guide. - from the water mark, up and over the bank to edge of stream affected vegetation from the water mark, up & over the bank to edge of stream affected vegetation Width of Riparian Zone (m) Herbs/ forbs Floating 1 5 10 Width of Riparian Zone (m) 56 % Bare - no vegetation Emergent 60 % Bare - no vegetation Trees = woody, > 2m, 1 stem Shrub= woody, < 2m / 1 stem or, > 1 stem Herb = not woody, > 1 stem, short Sedge & Rush = herbaceous, tufted
 Vegetation Cover of the Riparlan Zone -overlaps allow record presence for rare types % cover for abundant sp.

 Type
 % Cover % Exotic spp.
 Grasses Sedges Vegetation Cover of the Riparian Zone -overlaps allowed record presence for rare types % cover for abundant sp. 6 Type % Cover % Exotic spp. W New C 2 6 Trees > 30 m Trees > 30 m Riparian Verge Banks Submerged Y Trees 10 - 30 m Trees 10 - 30 m Trees < 10 m Trees < 10 m Woody Shrubs (> 2m Submerged Aquatic Zone **Biparian Zone** Woody Shrubs (> 2m) Woody Shrubs (< 2m) Woody Shrubs (< 2m) Vines Assessment is made in terms of the % cover of the All Aquatic Vegetation
 submerged bod, within the w perimeter of the stream 8 Assessment is made in terms of the 30 cover of a surface area for the zone specified for each type (submerged lands, banks or riparlan verge) Vines Rushes & Sedges Rushes & Sedges 15 Herbs/Forbs (Not wo 1 Herbs/Forbs (NOT WOO うち Grasses W II II きら シン 20 Visible depth (m) Grasses Tree Ferns Too turbid - pres only Tree Ferns Ferns / Bracken C Æ 0 % Bare - no vegetation Ferns / Bracken Mosses C Tot.% Weed & exotic sp. 15 % co Mosses 5 % cover 10 % cover 13 000 Mangroves Mangroves 0 10 Submerged / Floating leaf Salt Marsh Salt Marsh only record '-99' = not assessed Total Cover Palms 000 Palms Freshwater Wetland **Total % exotics** 8 10 10 90 % cov reshwater Wetland Coastal Heath Filamentous Alga blank = a **Coastal Heath** Freshwater Algae cover 3 Total % Weeds and exotic spp. in zon 7 4 1 C Total % Weeds and exotic spp. in zo Marine / estuarine algae e Checklist - Recorded - Yes No Identified Local Specie 12 Emergent Veg. % Submerge Local Species Checklist - Recorded - Yes No Chara / Nitella **Crofton Week** allisneria/strap ant 2 Pepperina (pepper tee) Condamine Couc (Lippia) Honey locust are Condant 2 Pepperina (pepper tree) Condamine Cour (Lippla) Honey locust Rainforest Salvinia Total emergents] Rainforest 1 Herb like forms Total % exotic emerc Vine Forest Vine Forest Eucalyptus Casuarina Myrlophyllu Eucalyptus Casuarina -Z Phragmites Elodea Typha (bull rush) Vines/Creeper Thornapple 1 Vines/Creepe Melaleuca paperbark) Callistemor potikobrush Exotic Pine Milky weed sp Triglochin spp. Para Grass F Melaleuca \Box , \Box liky weed sp 11 Floating Vegetation Other Rushes & Sedges African Boxth ibmerg lands 18 B Callistemon pottebrush Exotic Pines African Boxth Encroaching willows 2 B Thistles Total Floating Total % Exotic Floating 13 Thistles 8 Blackberry Willow Other Shrubs & Trees Blackberry Willow Poplar Chinese Celti (Chinese Em) Ficus spp. (Rge) Rag weeds Burrs Mat Rushe Water Hyacinth Local Sp. 1 Poplar Chinese Celti (Chinese Eim) Ficus spp. (figs) Rag weeds Burrs Acacla (wattle) Callitris (native pine) Privet Azoli \Box, \Box Local Sp. 2 Acacia (wattle) Callitris (native pine) Privet Water Lilles Local Sp. 3 Local Sp. 4 Local Sp. 1 sheet Se AYC data Date (dd/mm/yy) STATE OF THE RIVERS --- SHEET 10 C 1992 J. Anderson Recorder Aquatic Habitat 29/11/07 Basin Subsection Site Tributary Name River LANSON LEFT BANK

 INSTREAM DEBRIS COVER
 Assessment is made in terms of the % cover of the pres. only recorded
 Water too turbid to estimate pres. only recorded

 INSTREAM DEBRIS COVER
 Assessment is made in terms of the % cover of the pres. only recorded
 Water too turbid to estimate pres. only recorded

 Individual log
 patches (record No.)
 patches (record No.)
 patches

 Image / deep submerged Veg.
 patches
 manual patches

 Image / deep submerged Veg.
 patches
 Marine - zostera etc

 RIGHT BANK Canopy Cover 160 % bank length type present QD 4 bank length type present Est. Av. width (m) Est. Av. width (m) Vegetatio % bed cover % bed cover type present w bank length type present dlam. > 300 mm Log jam > 50% dense patches Mangroves. AN A STARY Plas. Est. Av. width (m) patches Marine Est. Av. width (m) % bed cover \$ < 1 m diam. > 300 mm Large patches of Floating Veg. -4 patches dax. o patches Root Overhand 6 bed cover 150 % bank length type present % bank length type present % bed cover diam. < 300 mm Branch pile < 50% dense Emergents perm. water > 0.5 m deep 12th Est. Av. width (m) O patches O patches Est. Av. width (m) AX \$<1m V % bed cover A. diam. < 300 m % bed cover R nch pile > 50% dense Tree Roots A 0 patch O patches A Bank Overhang % bank length type present % bank length type present % bed cover dlam. < 300 % bed cover Terrestial leaves & twigs Rock faces, boulders, cobbles patches possible near % bed cover WEIV · 唐子 4 patches Est. Av. width (m) Est. Av. width (m) 000/ 30 % bed cover \$ < 1 m Macrophyte Fragments Perm. pool hab. deeper than 1 m Man-made Overhang % bank length type present % bed cover % bank length type present % bed cover Algal clumps and debris patches MAN Man-made structures and debris A Est. Av. width (m) patches Well Est. Av. width (m) a % bed cover \$ 3 OVERALL AQUATIC RATING FOR ALL AQUATIC LIFE POOR * low diversity of depths and substrates * moderate disturbance * low diversity of cover * poor canopy & other veg. cover \$ VERY HIGH / PRISTINE Record the number of patches of each high diversity of depths and substrates little or no disturbance 9 Combining all the assessment items ar the general signs at the site, give it an overall rating for fish, invertebates, birds & mammals abundant and diverse cover 10 % cove type presen and % cove excellent vegetation cover GOOD good diversity of depths and substrates * little disturbance VERY POOR • no diversity of depths and substrates • high disturbance only record -99' = not * diverse cover * excellent canopy & other veg. cover high disturbance
 no cover or low diversity
 no canopy cover, other cover po assessed = absent '0'

7/15

Recreational (I Opportunity Ty I Opportunity Ty Pristine Natural Natura Reserve, Sanctuary km or more from all oads or tracks. nly by foot and 4 WD ehicle into the area no structures or exotic plants, pristine condition rareo, few other	PP Allocate the Allocate the Developed Reserve, Area, e.g. waterfall limited walking access 1 km or more from all roads. only by foot and 4 WD vehicle into the area, tertiary roads only only minor human influence, but small clearings O.K.	e site to ONE of the fol Natural 3. Roadod- Natural Camping Reserve, Rest Area atructured aites with facilities not applicable Moderate road access primary & secondary roada Moderate disturbance and development of facilities	lowing types conside Rural 1. Undeveloped Rural Recreational settings in rural landscapes that are modified not applicable good road access primary & secondary roads natural setting but greatly modified	ring all aspects Rural 2. Developed flural Rural areas cleared for camping grounds, within rural towns not applicable accessible to all vehicles substantial modifications, rural	Urban 1. Undeveloped Urban Undeveloped Urban Undeveloped Urban Darke and bushland kept semi-natural max of 500m to households low level access, primary read access remnant bushland	Urban 2. ⁷ Developed Urban Urban Parks and Sports grounds. Walls along stream max of 500m to households no limit to access modified open space	Urban 3. ⁶ Highly Developed Resort development max of 2 km to households no limit to access dominated by
Remotences 3 kr roa Access onh Impact and ex Development pri Expected human ran human ran burden via	Natural 1. Pristine Natural Nature Reserve, Sanctuary km or more from all boads or tracks. Inly by foot and 4 WD ehicle into the area no structures or exotic plants, pristine condition rare, few other	Natural 2. ² Semi-Natural Developed Reserve, Area, e.g. waterfall limited walking access 1 km or more from all roads. only by foot and 4 WD vehicle into the area, tertiary roads only only minor human influence, but small clearings O.K.	Natural 3. Roaded- Natural Camping Reserve, Rest Area structured aites with facilities not applicable Moderate road access primary & secondary roads Moderate disturbance and development of facilities	Rural 1. Undeveloped Rural Recreational settings in rural landscapes that are modified not applicable good road access primary & secondary roads natural setting but greatly modified	Rural 2. ⁵ Developed Rural Rural areas cleared for camping grounds, within rural towns not applicable accessible to all vehicles substantial modifications, rural	Urban 1. Undeveloped Urban Undeveloped urban Darke and bushland kept semi-natural max of 500m to households low level access, primary road access remnant bushland	Urban 2. ⁷ Developed Urban Urban Parke and Sports grounds. Walls along stream max of 500m to households no limit to access modified open space	Urban 3. ⁸ Highly Developed Resort development max of 2 km to households no limit to access dominated by
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Human Impact and Development Expected human contacts	no structures or exotic plants, pristine condition rare, few other	only minor human influence, but small clearings O.K.	Moderate disturbance and development of facilities	natural setting but greatly modified	substantial modifications, rural	remnant bushland	modified open space	dominated by
Expected rai human vis contacts	rare, few other	and a second second second			residential			buildings etc.
	VIBILORS	individuals but isolated	Moderate disturbance and some contact with groups	moderate contact on roads and trial sites	moderate to high interaction	Regular use by local residents	moderate to high density use	high density and frequent use
Facilities, Lit regulations & structure	Little or none	some but subtle as formed tracks and signs	Minimal facilities, no powered sites etc.	Controls obvious, more complete facilities	barriers, signs and fences obvious	Remnant area with some restrictions	highly developed facilities	highly developed facilities
ecreation Types su [*] for potential and "2 becue and picnic thwalking - camping thwalking - carping thwalking - carping thwalking - carping the carping	suitable for the area "2' for actual use "2' A sture ap s 2 Nature ap Swimmin afting Water Ski Q Bird Water other other other other other other	a 3 R ppreciation ling ching 5 ho 11- ()	Scenic Value Asset State the site from 1 - 1 Overall Sc Rank the Inherent f Scenic Rt Scenic Rt Artistic m Scenic Value Cother	sament O relative to other site senic Value Rating o components for Scenic Vatural Beauty (bushi Physical Beauty (wate ural Setting than Setting reit or value lue of a component e.	es in the area (a) In (c) Value (c) Value	Itilal Conservation Rate the site as remn Aquatic Plant or Al Itilate the site as remn Rate the site as remn Riparian Plant or Al Rate the value of the	n Value Assessmen nant habitat for nimal spp. hant habitat for nimal spp.	н

	Date (dd/mm/yy) Becorder () © 1992
STATE OF THE RIVERS SHEET 3 Site Description	50/11/08 Lawren Ahorburn
Tributary Name Flows into Dawson RIV	Flows into
Gauging Station Type Region Site Description (<i>locality name</i>)	Ion Description (how to find it again) Type of Site
Map Number Grid Reference the Latitude to the	ongitude
	Imm
1: Is the Site Tidal ?	Non-Tidal Catchment Area (sq. km)
Sketch : Show location of survey, access points, landmarks and key features such as roads, houses and othe buildings. Also show the key features about the stream environs and its location. Also mark the boundaries for	Photographs - The standard set consists of one shot looking
survey (the reach). Include an arrow for NORTH and also indicate the direction of flow. Also mark the position where the GPS latitude and longitude were determined. The sketch should be adequate for quickly finding the position for the set of the set	n upstream, downstream, lateral left (at left bank), a site lateral right (at right bank), reach environs (overview
again for future follow-up surveys.	Altitude (m) of the reach from a distance) and other relevant photographs
	Film No. Shot Shot Shot Shot
Cracon Ka	Downstream
COMIXINATION DUIDESIGN	Lateral Left 104 183 9
	Reach Environs
H loom	Feature Part 4 1014 1812 61
	Feature <u>POKMAN 104</u> 1825 1824
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Basin Subsection Site Tributary Name Record Information about the local land adjacent to and about the conditions prevailing at the time of th assessment should be restricted to the immediate v	b the reach on each side 6 Local Veg. Type vicinity of the reach-i.e 1, Rainforest 13 Grassland(isolated trees)
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Basin Subsection Site Tributary Name Strategy Water Level at sampling time Completely dry Isocale Completely dry I	be reach on each side be sampling. The vicinity of the reach-i.e 1 Rainforest 2 Eucalypt We Scierophyl 2 Eucalypt We Scierophyl 3 Eucalypt We Scierophyl 4 Other Shrubland 3 Eucalypt Woodland 0 ther mine Cocal Disturbance 5 Eucalypt open woodland 0 ther mine 8 Copyrus Pine forest 7 Belak/ Brigalow Gidgee 19 Pine plantation
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3/14 4

© 1992 J. Anderson Modified 10/10/93 Date (dd/mm/yy) STATE OF THE RIVERS --- SHEET 5 **Channel Habitat** 30/11/02 Basin Subsection Site Tributary BIOC Khor Selecting a Reach Choose an appropriate Reach for the remaining assessment. It should: 1. Preferably contains at least 2 complete pools and riffle / run habitats 2. The whole length of the reach should be visible at one location. 3. The pool should be the largest and deepest in the area. Sketch the reach showing the location and dimensions of the major habitat types. Measure the length width of each channel habitat type and take a transect across each type located at right angles to the shoreline and passing over the point of maximum depth in a pool (low flow area) and maximum flow / bed height for a run or riffle habitat i.e. the transect where flows would be expected to be maximal. Reach 1 Channel REACH DETAILS Habitat Types Waterfall % of section Height > 1m Gradient > 60 de Est. Av. length (m) Est. Av. height (m) Est. Av. Gradient (deg.) Step Height < 1m Gradient 5 - 60 deg Strong Currents % of section Cascad Reach Est. Av. length (m) 2 Est. Av. height (m) Est. Av. Gradient (deg.) Total Length of reach (m) Depth > 0.3 m Gradient 3 - 5 deg Strong Currents Rocks break surface Rapid % of section Riffle Pool Est. Av. length (m) aton Est. Av. depth (m) p001 4 Est. Av. Width (m) Sketch the reach showing the channel pattern and the distribution of channel habitat types and key features. A cross-section profile showing the bank shape and vegetation types would also be helpful if there is time Riffle Depth 0.1 - 0.3 m Gradient 1- 3 deg Moderate Current Surface unbroker but unsmooth % of section baldles large pool 5 Est. Av. length (m) Est. Av. depth (m) P0013 Est. Av. Width (m) cobbles evice Glide Depth < 0.1 m % of section Gradient 1- 3 deg Small Currents Surface unbroken calyp Est. Av. length (m) tree. Est. Av. depth (m) Est. Av. Width (m) and smooth ags Depth > 0.3 m Gradient 1- 3 deg Small but distinct & uniform current Surface unbroker Run % of section obbles 3 Est. Av. length (m) R Est. Av. depth (m) boubles Est. Av. Width (m) Depth > 0.5 m where stream widens or deep and current declines Pool 160 Podl % of section 0 Pool 2 Est. Av. length (m) 8 Est. Av. depth (m) 4 5 Est. Av. Width (m) N Depth < 0.3m a reasonable siz (>20% of channe width) cut-off Backwater % of section Pages Est. Av. length (m) Est. Av. depth (m) section away fro Est. Av. Width (m) the channe - aball dry * 40% 1001-15 150 and poo water presend 1.0 Date (dd/mm/yy) Recorder G 1992 STATE OF THE RIVERS --- SHEET 6 **Cross-Sections** 30/11/07 LT TYPE Pool , Length of 624 Subsection Basin Section Number for this reach Site Sediment Classification III Pool D Sediment classes are those of the SAA which are easier to estimate visually - estimate % of total inorganic volume occupied by each category, Estimate organics as % of total vol. Record presence of each type (esp. max, and min. sizes) and % vols for major fractions. One or more cross-sections (separate sheets) are required for each channel habitat type within the reach. Begin at the water's margin on the left bank and take a series of distance and depth measurements. A minimum of 3 measurements is required for each cross-section including the width of stream. Also measure the width, height and slope for the left and right banks. Lower bank = surface to water mark. If bed dry measure depth at water mark level. Upper bank = water mark to inflexion point on the bank Av. Width of Type (m) Run Glide Av. Depth of Type (m) Fines Sand Gravel Cobles Boulder+Rock at fine medium fine medium coarse 0.1mm arg grain raw agar pea coin ball 0.5mm 2mm 5mm 20mm 60 mm 300 mm Cascade Rapid Backwater Other 10 Lower Upper Left Right Bank Sediments Lower Upper P. Organics = particulate organics - estimate as % of the total volum % by vol. pres, % by vo ores, % by vol. pres. % by vol mm < 0.06 Inorganic components are estimated from the inorgan fraction only (i.e. omitting the organics) lc mm < 0.06 fines R L 06 - 0.5 11 Rock Outcrops sand 06 - 0.5 sand E Upper Bank 0.5 - 2 2 - 5 5 -20 0.5 - 2 2 - 5 5 - 20 Upper Bank height Left Lower bank F See Sheet 7 for definition gravel gravel G 2 Left Upper bank height 10 10 10 ³ Right Lower bank ⁴ Right Upper bank ⁵ Bed 20 - 60 20 - 60 н Т Upper Bank width Upper Bank width water mark 8 60 - 300 8 60 - 300 т ld > 300 d> 300 P.Organics P.Organics * None в Lower Bank heig See fre sheet - L 4 etc. ►L3 P12 Bank height L1 A в D 2 03 D4 D 5 0.6 D 7 DB D 9 D 10 Lower Bank width A Ν Bank width Flows measured at E9 4 F 8 F2 F3 8 F 4 ES. F6 60% of the depth are optional N κ 5 κ Total Width (m) at the water surface or where transect taken CROSS-SECTION 52 Bed Dry Water Mark Openation Water Mark water mark lower bank Cross- section readings across the bed (minimum of 3, maximum 15) AT SURFAC Reading 2 Reading 5 Reading 6 Reading 7 Reading 1 Reading 3 Reading 4 Reading 8 Page No. for Extra Readings 5 LEFT LOWER BANK Dist (m) 8 RIGHT LOWER BANK Depth (m) +2
 Width (m)
 30

 Height (m)
 107

 Slope (deg.)
 400
 0 Г 0 0 Flow (m/s) Width (m) mm < 0.06 .06 - 0.5 0.5 - 2 by by vo pre Height (m) 6 LEFT UPPER BANK 2 - 5 5 - 20 9 RIGHT UPPER BANK gravel Width (m) 40 Height (m) 10 Slope (deg.) 40 18 Width (m) 3C Height (m) 20 20 - 60 8 60 - 300 Slope (deg.) 90 Id > 300 rganics P.Orga



Date (dd/mm/vv) © 1992 STATE OF THE RIVERS --- SHEET 9 Vegetation LT 30/110/017 Basin Subsection Site The Riparian Zone The Riparian Zone is the which is intimatedly linked with the stream being affected by the extra moisture available lits width (to a maximum of 50m). The strip chosen should be relatively Trees may be very narrow. corridor of vegetation along the edge of a stream or river oth in providing leaf and branch litter to the stream and BALLHON CX is the distinct vegetation zone along the stream.Estimate Riparian Zone - LEFT BANK The method of assessment is Riparian Zone - RIGHT BANK the percentage cover of the designated suraice area for each zone. Refer to cover from the water mark, up and over stream affected vegetation from the water mark, up & over the bank to edge of stream affected vegetation Width of Riparian Zone (m) the bank to edge Herbs/ forts Floating 1 Width of Riparian Zone (m) 5 examples as a guide. Emergent 8 Bare - no vegetation 20 % Bare - no vegetation Trees = woody, > 2m, 1 stem Shrub= woody, < 2m / 1 stem or, > 1 stem Herb = not woody, > 1 stem, short Sedge & Rush = herbaceous, tufted Grasses Sedges Vegetation Cover of the Riparian Zone -overlaps allowed record presence for rare types % cover for abundant sp. Type % Cover % Exotic spp. Vegetation Cover of the Riparian Zone -overlaps allowed W rd presence for rare typ es % cover foi abundant sp. Type Trees > 30 m Mat Submerged % Cover % Exotic spp % Cover % 6 Type
 Type
 Cover

 Trees > 30 m
 Image: Cover of the second secon perennial ПТ Riparian Verge Banks Trees 10 - 30 m Trees 10 - 30 m Trees < 10 m Trees < 10 m Woody Shrubs (> 2m) IJ Woody Shrubs (> 2m) Submerged Aquatic Zone **Riparian Zone** Woody Shrubs (< 2m) Woody Shrubs (< 2m) Assessment is made in terms of the % cover of the Vines 00 9 Vines 0 All Aquatic Vegetation surface area for the zone specified for each type (submerged lands, banks or riparian verge) **Rushes & Sedges 1**90 Rushes & Sedges submerged bed, within perimeter of the stream 000000 Herbs/Forbs (NOT WOOD Herbs/Forbs(NOT WOO まる 変を NY NY Grasses 6 Grasses シン 1/ Visible depth (m) 6 Tree Ferns Tree Ferns Too turbld - pres only 0 ø Ferns / Bracken mickly 7 Q Ferns / Bracken % Bare - no vegetation Tot.% Weed & exotic sp. Mosses 00 Mosses 5 % cover 0 5 % cover 10 % cover plar -25 % cover Mangroves 10 Submerged / Floating leaf '1' = presence only record '-99' = not assessed Mangroves individuor Salt Marsh 0 0 Salt Marsh 000 Total Cover Palms 600 Palms shwater Wetland H Total % exotics 90 % covr eshwater Wetland Filamentous Algae Freshwater Algae blank = absent Coastal Heath Coastal Heath 50 % cover 75 Other species identified 6 cover 3 Total % Weeds and exotic spp. in zon Marine / estuarine algae Emergent Veg. % Submerge 12 Local Species Checklist - Recorded - Yes No Local Species Checklist - Recorded - Yes No Chara / Nitella Crofton Weed ant 2 Pepperina (pepper tee) Condamine Couct (Lippia) Honey locust allisneria/strap like to are VÍ rare abundant Total emergents Rainforest \Box , \Box Pepperina (pepper tree) Rainforest 2 Herb like torms Total % exotic emerge 7 (pepper tree) Condamine Couc (Lippia) Honey locust Salvini Vine Forest Vine Forest Myriophyllum Phragmites Eucalyptus Casuarina Melaleuca N Eucalyptus 1 1 10 Typha (bull rush) Elodea Casuarina /Ines/Creeper Thorr Vines/Creeper 12 Melaleuca Triglochin spp. Para Grass Milky weed spi Milky weed sp paperbark Callistemon pottlebrush Exotic Pines \Box , \Box Other Rushes & Sedges 11 Floating Vegetation an Boxt ibmerg lands Callister frican Boxthe ndra Encroaching willows Exotic Pines Thistles Total Floating Total % Exotic Floating Thisties Commo ۵. Willow Other Shrubs & Trees 101 Blackberry Willow Blackberry 11 Mat Ru Chinese Celtin (Chinese Em) Ficus spp. (lige) Rag weeds Burrs Water Hyacinth Azolla ishe Local Sp. 1 100 Poplar Poplar Chinese Celti Chinese Em) Ficus spp. (fige) Rag weeds \Box , \Box Local Sp. 2 Acacia (wattle) Callitris (native pine) Privet Acacla Callitris (native pine) Privet Water Lilles Local Sp. 3 ", ° Local Sp. 4 Local Sp. 1 Burra Ll macrophyte 610 Date (dd/mm/yy Recorder 9 1992 J. Anderson STATE OF THE RIVERS --- SHEET 10 Aquatic Habitat 30/111/07 Subsection Site Basin DIACKboy Jushi Subsection Site LEFT BANK **RIGHT BANK**

 could implement is made in terms of the % cover of the pres. only recorded
 Water too turbld to estimate pres. only recorded

 iarea for the zone specified for each type.
 Large / deep submerged Veg.

 [0,]
 patches
 Freshwater

 [0,]
 Large / deep submerged Veg.

 [1,]
 patches
 Freshwater

 [1,]
 State and submerged Veg.

 Canop INSTREAM DEBRIS COVER Assessment surface area QD w bank length type present w bank length type present Individual log patches (record No.) 2 C Est. Av. width (m) ITC Est. Av. width (m) 1 % bed cover diam. > 250 mm Large / deep submerged Veg. patches Marine - zost % bed cover Log Jam < 50% dense patches Y AN mill Vegetation w bank length type present % bed cove w bank length type present diam. > 300 mm Log Jam > 50% dense ÍM. angroves. MAN AN ALL P DO Est. Av. width (m) Pile 30 Est. Av. width (m) patches Marine % bed cover O patches % bed cove 1 m 犐 diam. > 300 m > Large patches of Floating Veg. 0000 4) patches patches AAK Root Branch pile < 50% dense w bank length type present % bank length type present % bed cover < 300 Overhand Emergents perm. water > 0.5 m deep 12× 10 Est. Av. width (m) Est. Av. width (m) patches O patche AX 2 % bed cover \$ < 1 m % bed cover A diam. < 300 mm Branch pile > 50% dense Tree Roots A O patches patch Bank Overhang A w bank length type present w bank length type present % bed cover 10% bed cover diam. < 300 mm Terrestial leaves & twigs Rock faces, boulders, cobbles patches CTZ Est. Av. width (m) 044 Est. Av. width (m) 1 patches 0001 < 1 m Z 5 % bed cover 10 % bed cover Perm. pool hab. deeper than 1 m Macrophyte Fragments O pa Man-made Overhang type present type present % bed cove 5 % bed cover Algal clumps and debris patches A A Ċ. -made structures and debris 11111 Est. Av. width (m) Est. Av. width (m) patches 7% bed cover Mar bridge % bed co POOR • low diversity of depths and substrates • moderate disturbance • low diversity of cover • poor canopy & other veg. cover 23 5 OVERALL AQUATIC RATING VERY HIGH / PRISTINE high diversity of depths and substra little or no disturbance abundant and diverse cover FOR ALL AQUATIC LIFE Record the number of patches of e 9 Combining all the assessment items and the general signs at the site, give it an overall rating for fish, invertebates, birds & mammals 15 % excellent vegetation cover type present, and % cover GOOD . '1' = prese VERY POOR • no diversity of depths and substrates good diversity of depths and substrates only record -99' = not * little disturbance * diverse cover * excellent canopy & other veg. cover high disturbance
 no cover or low diversity • no canopy cover, other cover poor

TILA

Date (dd/mm/yy) Recorder

Urban 1.

Undeveloped Urban

Undeveloped urban parks and bushland kept semi-natural

low level access, primary road access

remnant bushland

Regular use by local residents

Remnant area with some restrictions

Rate the site as remnant habitat for Aquatic Plant or Animal spp.

4 Initial Conservation Value Assessment

Rate the site as remnant habitat for Riparian Plant or Animal spp.

Rate the value of the site as a wiildlife corridor

max of 500m to

households

Urban 2.

⁷ Developed Urban

Urban Parks and Sports grounds. Walls along stream

max of 500m to

no limit to access

modified open space

moderate to high density use

highly developed facilities

Rank the Site (1-10) in terms of its quality as representative Aquatic Habitat for this type of site in this catchment.

Rank the Site (1-10) in terms of its quality as representative *Riparian* Habitat for this type of site in this catchment.

households

STATE OF THE RIVERS --- SHEET 11 Scenic, Recr & Conserv. Values

Tributary Name

Natural 2.

Semi-Natural

Developed Reserve, Area, e.g. waterfall limited walking acces

1 km or more from al

only by foot and 4 WD vehicle into the area, tertiary roads only

only minor human influence, but small clearings O.K.

some contact with

some but subtle as formed tracks and signs

ndividuals but isolated

roads.

C

Natural 3.

Roaded- Natural

Camping Reserve, Rest Area. - structu sites with facilities

not applicable

Moderate road access primary & secondary roads

Moderate disturbance and development of facilities

Moderate disturbance and some contact

Minimal facilities, no

3 Scenic Value Assessment

Other

powered sites etc.

with groups

626377

Allocate the site to ONE of the following types considering all aspects

4

Rural 1.

Undeveloped Rura

not applicable

Recreational settings

in rural landscapes that are modified

good road access

natural setting but greatly modified

moderate contact on roads and trial sites

Controls obvious,

Rank the components for Scenic Value

Inherent Natural Beauty (bushland setting)

Inherent Physical Beauty (waterfalls etc.)

Scenic value of a component e.g. tree etc.

more complete facilities

Rate the site from 1 - 10 relative to other sites in the area

Overall Scenic Value Rating

Scenic Rural Setting

Scenic Urban Setting

Artistic merit or value

primary & secondary roads

Rural 2.

Developed Rural

Rural areas cleared for camping ground within rural towns

not applicable

accessible to all vehicles

substantial modifications, rural residential

moderate to high interaction

barriers, signs and fences obvious

1-10

5

1-10

17

1-10

7

5

Basin

Subsection

Remotenes

Access

Human Impact and Development

Expected human contacts

Facilities, regulations & structure

Barbecue and picnic

Canoeing / kya Dogs Shore Fishing Boat fishing - a Boat fishing - 1

Horse Riding

Rowing Sailing

Motor bikes

Bushwalking - camping

Bushwalking - day trips

Canoeing / kyaking / rafting

Boat fishing - small boats

Boat fishing - large boats

Four wheel driving

Camping - car access

Site

Natural 1.

Pristine Natural

Nature Reserve, Sanctuary

3 km or more from a roads or tracks.

only by foot and 4 WE vehicle into the area

no structures or exotic plants, pristine condition

rare, few other visitors

Little or none

[Photography

Swimming

Bird Watching

Other_

Other 11

Other

Comments:

Water Skiing

Nature appreciation

Í

Other

2 Recreation Types suitable for the area

Mark "1" for potential and "2' for actual use

1 Recreational Opportunity Type

R

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Urban 3.

Highly Developed

Resort developments

max of 2 km to households

dominated by buildings etc.

high density and frequent use

highly developed facilities

no limit to access

3/7

STATE OF THE RIVERS SHEET 3 Site Description	Date (dd/mm/yy) Recorder Photom Andrean
Basin Subsection Site Tributary Name CYark Flows into	Flows into Assistant Johnana Savage
Gauging Station Type Region Site Description (<i>locality name</i>) Location De	escription (how to find it again)
Map Number Grid Reference Latitude unin tee deg unin tee	ude GPS ? Other Est. Position Error Stream Gauge
Map Scale AMTD (from map) Total U/S Distance (add AMTD's)	Water Quality Water Quality Water Quality
1: Is the Site Tidal ? Nor Sketch : Show location of survey, access points, landmarks and key features such as roads, houses and other	n-Tidal Calchiment Area (sd. km) • Other Other
buildings. Also show the key features about the stream environs and its location. Also mark the boundaries for the survey (the reach). Include an arrow for NORTH and also indicate the direction of flow. Also mark the position where the GPS latitude and longitude were determined. The sketch should be adequate for quickly inding the site	Photographs - The standard set consists of one shot looking upstream, downstream, lateral left (at left bank), lateral right (at right bank), reach environs (overview
again for future follow-up surveys.	Altitude (m) of the reach from a distance) and other relevant photographs
Notharsing.	Upstream
N cockatoo	Downstream 102 143 41 1 Lateral Left 103 51 737 1
property	Lateral Right 1.22 2.23 2.24 Reach Environs 1.02 1.24 4.11 4.50
	Distant View Image: Constraint of the second seco
(tigs	Feature
the second secon	*Small channel in the without
E Cockatao	of V-shaped valley.
Elan & Creek	
ETIO	No a logetrack a planate
	She when whater plesertt.
STATE OF THE RIVERS SHEET 4 Reach Environs -temporal & snatial	Date (dd/mm/yy) Hecorder @ 1992
Basin Subsection Site Tributary Name Record information about the local land adjacent to the re	each on each side
Basin Subsection Site Tributary Name Add about the local land adjacent to the ra and about the conditions prevailing at the time of the sam assessment should be restricted to the immediate vicinity not beyond the land beyo	each on each side 6 Local Veg. Type ppling. The 6 Local Veg. Type y of the reach- I.e 1 Rainforest 13 Grassland(Isolated trees)
Basin Subsection Site Tributary Name Image: Striccore Tributary Name Image: Stricore Tributary Name <	ach on each side ach on each side ach on each side b Local Veg. Type y of the reach- I.e 2 Eucalypt Wet Sclerophyl 14 Other Shrubland 2 Eucalypt Open Forest 14 Mangrove 4 Eucalypt Open Forest 15 Mangrove 4 Eucalypt Open Forest 15 Mangrove 4 Eucalypt Open Forest 16 Mangrove 17 Mangrove 17 Mangrove 17 Mangrove 18 Mangrove 18 Mangrove 18 Mangrove 19 Mangro
Basin Subsection Site Tributary Name Strictore Tributary Name Strictore Strictore Strictore Stratight Strictory Iow Ievel 2 String the rest stratight 1 Stratight 2 Stratight 2 Stratight 3 Basin Subsection Stratight 3	Andereen
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Basin Subsection Site Tributary Name Record information about the local land adjacent to the rand about the conditions prevailing at the time of the sam assessment should be restricted to the immediate vicinity of the land beyond thelevice the land beyond the land beyond the	ach on each side 6 Local Veg. Type y of the reach-L.e I Rainforest 13 Grassland(Isolated trees) y of the reach-L.e I Rainforest 14 Other Shrubland I Disturbance 2 Eucalypt Wet Sclerophyl 14 Other Shrubland / gravel mine 2 Eucalypt Open Forest 19 Heathland / gravel mine 4 Eucalypt open woodland 19 Statmarsh / salt pans 6 Cyprus Pine forest 19 Freshwater marsh 1 7 Belah/ Brigalow (Sidgee 19 Pine plantation 2 Other plantation 20 Other plantation 11 19 Bendee/lancewood scrub 20 Other
Basin Subsection Site Tributary Name Record information about the local land adjacent to the ra and about the conditions prevailing at the time of the same and about the conditions prevails and about the conditions prevaing and about the condit and about the condit and about the condi	ach on each side E Local Veg. Type ppling. The 9 I. Local Veg. Type y of the reach- I.e. 1 Rainforest 13 2 Eucalypt Wet Sclerophyl 14 Other Shrubland 1 1 Scassland(Isolated trees) 2 Eucalypt Open Forest 14 Heathland 4 Eucalypt Open woodland 15 Statmarsh / sait pans 6 Cyprus Pine forest 19 Preshwater marsh 8 Culvert / wharf 7 Belah/ Brigalow/ Gidgee 19 9 Mulga Strub-open forest 10 Other plantation 17 Other plantation 10 Other plantation 18 19 Softwood Scrub 10 Cotal Land Tenure 12 Mulag ascrub-open forest 1 Freehold/ leasehold 1 111 112 Softwood Scrub 10 Local Land Tenure 12 Melaleuca forest 1 1 Freehold/ leasehold 111 10 1 0xbows / billabongs 3 State Park
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Date (dd/mm/yy) © 1992 Recorde STATE OF THE RIVERS --- SHEET 7 **Bank Condition** 1-1 Basin Sub-section Site Tributary Name The "Water Mark" is left at the normal inundation level in the stream. Its location is shown by the limit of the terrestial grasses etc. which can only withstand short periods of inundation, or by an eroded area or boundary in the bank sediment types STREET, STREET Assess the condition of the banks on the left and right side of the stream (acing downstream) identify the major types of instability (eroding, slumping and aggrading) and mark the location where they occur on the lower and upper banks. Also record the elope and shape of the banks, and make an overall assessment of instability. Bank Top LEFT Width
 13
 I Natural

 Levee Banks
 Man-made

 Absent
 Absent
 RIGHT See sea Height Width Height Width Mire Bank Top LEFT RIGHT Water Ma I LOWER BANK 2 UPPER BANK LOWER BANK BANK Water Lovel* 11 12 BANK Bare of Veg Bare of Veg Bare of Veg 120 Bare of Veg 2.C Artificial Bank Protection Measures Record of bank length Record % of bank BI FET BANK B RIGHT BANK Slope (Rank types) Factors Stable Stable Stable Stable Affecting Slope (Rank types) lenath Stability LOCATION for Instability LOCATIO Eroding Aggrading Eroding Aggrading Eroding Aggrading Eroding Aggrading Trees & Other Plants for 80-90 deg Flow & Waves Slope 80.90 de Instability Siumping eeg el Slumping eleva 2 Slumping every Vertic Z 51000 60-90 de Slope 50-80 de Seepag Rock wall or layer 12 Ċ Ċ μĻ Ster - 🔟 Ċ. Г bends Slope to Slope an ×, Runoff Fence Structure At floodplain scours At floodplain Moder Moderat Г Slope 10-30 de Г Stope 10-30 deg ۶R Fenced watering points ----oodplair Scours 3. . Los ANKS At the £# Stope < 10 de a 10 deg Г **_**s Fenced human access Stock at ---------ALEFT BANK at obstacles -----BRIGHT BANK Shape (Rank types) 1 TA Shape (Rank types) TA Logs strapped to bank People tracks at seepage Г at seepage runoff poin - 🗉 🔲 -----, Vermin Cond 2 Г 2 Ford, road culvert or bridge Break water - 🗆 🗖 ------ 🗆 🗆 🗆 Irregula Irregular Π, Г R Clearing (Vegetatio Other 3. ٦. Gravel/san--🗷 🗆 🗆 ·Z 🗆 🗆 all along Г all alons Other Ξ. 10 5 Г Г Mod Mining High **Rate the Overall Rate the Overall** High Mod Min Other Overall Instability **Overall Instability** Condition of the **Condition of the** ØØØ Left Bank Susceptibility to erosion **Right Bank** Susceptibility to erosion Date (dd/mm/yy) Recorder C 1992 STATE OF THE RIVERS --- SHEET 8 Bed and Bar Condition Site Basin Subsection Tributary Name PASSAGE FOR FISH AND OTHER ORGANISMS CK 6 Factors No Pas 9 ŧ Affecting Stability Record the total % of bed surface along the reach protruding out of the water <u>at the water</u> <u>mark</u> and forming a bar. Identify its type, the features of the bed and gravel if present, the overall stability of the bed and the controls and factors affecting the stability of the bed. 0 1. Score the general passage for the Now Wat Mark Sand & Grave prevailing conditions (now) and for the stage equivalent to the water mark. . xtractic 2. For Obstructions give type, height above water mark and stage when by-passed 1 BAR TYPE ł Bed deeper ling ¥ Bars Absent 5 Bed Compaction BAR SIZE % of bed surface forming a bar @ Yr Mar or over-topped. 0.1 r Г High dam weir, or waterfall Tightly packed, armou Water M @ 1/3 2/3 bank flood Now extreme flood never deep Bank Erosion array of sizes tightly packed overlapping hard to dislodge AAA 1 3 Gravel Features ł ł Channelisation Shape 10.3 Cascade rapid or log jam Angularity Г Now deer Cut-off of supply Sphere Packed, but not arm narrow . . Very Angular of alluvial array of sizes Partly 1.5 M materials Г ted Mid-channel ł ł Low weir, pipe culvert, ford, bridge 1 Mining sland short= interm interm = long lightly packed overlapping can be dislodged 0.5 m bridge Г Now Disc Agriculture or grazing Π. narro croaching 80 Good oderate Compaction Single log branch plie, rock 1 assage array of sizes ł ł Ant short < interm Other Low feature essily by-passed 0.5 -1 m Blade Around Г Now 17 ome packing wide no torrent Unrestricted . . 7 Controls little overlapping can be dislodged KI short << interm nterm < long V Stabilising ł ow Compaction Compacia Channel bar the Bed ŧ poor grading some packing & structure little overlap can be dislodged easily Rod Bridge Ford or Culvert Partie > 1 m deep & almo a Other -Now 1 Water Well Ro channel wide Rock Outcrops short << interm interm = long w flow Meande du MAKNONIN. 1 NO OOVIOUS D B Overall Bed Stability Rating Fallen Tree ow Compaction Unstable / Eroding 4 Gravel surface Г Unstable / Aggrading - Stable 5 e oose array no packing or structure Bed stabilising structures Severe Erosion Moderate Erosion **Bed Stable** Mod. Aggradation Severe Aggrad. Gravel covered by algae / silt Gravel - 'clean Little alluvium Signs of deepening Eroded banks Bed deep & narrow Steep bed 2 Unconsoildated Bed scoured of sam Signs of deepening Bare eroded banks Bed consolidated algae covered Bed & bar material the same size Alluvium balanced Banks stable Mod. build-up at obstructions & bars Bed flat and uniform Bed wide & shallow Flat bed. Г Flat bed, channel blocked & wide but shallow. Bars large covering most of bed / bank bed loose, 5 unconsolidated 100 Other no overlap 1 None Erosion heads easily moved Some minor over- 4 bank siltation Erosion causes Steep bed

Recorder Date (dd/mm/v © 1992 STATE OF THE RIVERS --- SHEET 9 Vegetation 28/11/01 The Riparian Zone The Riparian Zone is the which is initimatedly linked with the stream being affected by the extra moisture availab its width (to a maximum of 50m). The strip chosen should be relatively Trees may be very narrow. Basin Subsection Site corridor of vegetation along the edge of a stream or river oth in providing leaf and branch litter to the stream and Cockofoo CK s the distinct vegetation zone a ong the stream.Estima The method of assessment is the percentage cover of the designated surafce area for each zone. Refer to cover examples as a guide. Riparian Zone - LEFT BANK **Riparian Zone - RIGHT BANK** from the water mark, up & over the bank to edge of stream affected vegetation n the water mark, up a am affected vegetation Width of Riparian Zone (m) Width of Riparian Zone (m) 5 Herbs/ forbs Floating Emergent 8 Bare - no vegetation 20 % Bare - no vegetation Trees = woody, > 2m, 1 stem Shrub= woody, < 2m / 1 stem or, > 1 stem Herb = not woody, > 1 stem, short Sedge & Rush = herbaceous, tufted Grasses Vegetation Cover of the Riparian Zone -overlaps allowed record presence for rare types % cover for abundant sp. Vegetation Cover of the Riparian Zone -overlaps allowed record presence for rare types % cover for abundant sp. % Cover % Exotic spp % Cover % Exotic spp 2 M
 Type
 70000

 Trees > 30 m
 5

 Trees < 10 m</td>
 10

 Jy Shrubs (> 2m)
 5

 Jy Shrubs (< 2m)</td>
 5
 Туре 6 Type perennial Trees > 30 m Riparlan Verge Banks Trees 10 - 30 m Trees 10 - 30 m Submerged Trees < 10 m Trees < 10 m Woody Shrubs (> 2m) Submerged Aquatic Zone Woody Shrubs (> 2m) Riparian Zone 77 18 85 Woody Shrubs (< 2m Woody Shrubs (< 2m) Assessment is made in terms of the % cover of the surface area for the zone specified for each type (submerged lands, banks or riparlan verge) 0000 All Aquatic Vegetation
 submerged bed, within the wetted perimeter of the stream Vines Vines Rushes & Sedges Rushes & Sedges Herbs/Forbs (NOT W Herbs/Forbs (NOT WOO をある NAN AN ある Grasses 10 11 1. ダン Grasses Visible depth (m) 1 Tree Ferns Tree Ferns 00 Too turbid - pres only 9 15 % cover Ferns / Bracken Ferns / Bracken % Bare - no vegetation 1 · cove Mosses 0 Mosses Tot.% Weed & exotic sp. 10 % cover 25 % cover 5 % cover Mangroves '1' = presence only record '-99' = not assessed blank = absent Mangroves 00 10 Submerged / Floating leaf Salt Marsh Salt Marsh Total Cover Palms Palms Total % exotics hwater Wetland reshwater Wetland 対話に 90 % cover 00 Filamentous Algae Freshwater Algae **Coastal Heath** Coastal Heath 50 % cover 7 Other species identified % cover 7 Total % Weeds and exotic spp. In zon 3 Total % Weeds and exotic spp. in zo Marine / estuarine algae 12 Emergent Veg. % Submerg Local Species Checklist - Recorded - Yes No Local Species Checklist - Recorded - Yes No Chara / Nitella Crofton Wee Salvinia 4 Bainforest rare abundant Vallisneria/strap like form are at undan nda ant 2 Pepperina (peppor tree) Condamine Coucl (Lippla) Honey locust Ant 2 Pepperina (pepper tee) Condamine Couct (Lippia) Honey locust **Total emergents** Rainforest Total % exotic en Herb like forms Vine Forest Vine Forest Myrlophyllum Phragmites Eucalyptus Casuarina Melaleuca Eucalyptus Casuarina 1 12 0 202 Typha (bull rush) Elodea Thornapple Vines/Creeper Vines/Creepers Triglochin spp. Para Grass Melaleuca Milky weed sp Milky weed sp \Box , \Box Other Rushes & Sedges 11 Floating Vegetation % Submerge lands Callistemon bottlebrusti Exotic Piner African Boxth Lomandra Callistemon frican Boxth Encroaching willows Total Floating Total % Exotic Floating Exotic Pines Thistles Thisties 100 Other Shrubs & Trees Willow Blackberry Willow Blackberry Mat R Poplar Water Hyacinth Local Sp. 1 Poplar Chinese Celt (Chinese Elm) Ficus spp. (fig+) Rag weeds Chinese Celtis (Chinese Elm) Ficus spp. (fige) Rag weeds Burre 1 Acacia (wattle) Callitris (native pine) Privet Acacia (wante) Callitris (native pine) Privet Z Local Sp. 2_ Azolla Water Lilles Local Sp. 3 Ϊ, Local Sp. 4 Burrs Local Sp. 1 Dru Date (dd/mm/yy) C 1992 Anderson Recorder STATE OF THE RIVERS --- SHEET 10 Aquatic Habitat Basin Subsection Site Tributary Name LEFT BANK **RIGHT BANK** Water too turbid to estimate pres. only recorded Canopy Cover INSTREAM DEBRIS COVER Assessment surface area QD 30 % bank length type present 25 % bank length type present Individual log Vian Est. Av. width (m) Est. Av. width (m) 1 patches (record No.) patches Freshwater % bed cover llam. > 250 m Log jam < 50% dense Large / deep submerged Veg. Yest mil patches Marin % bed cover patches Marine - zostera etc. 0 Vegetation % bed cover 20 % bank length type present w bank length type present diam. > 300 mm 12 Log jam > 50% dense Mangroves. Est. Av. width (m) Est. Av. width (m) ATTE: W. patches Marine % bed cover patches 2 \$ < 1 m % bed cover diam. > 300 mm Large patches of Floating Veg. Individual Branch 0.20 5 patches patches 4 AX Root Overhang % bank length type present % bank length type present C % bed cover % bed cover diam. < 300 mm 12th Branch pile < 50% dense Emergents perm, water > 0.5 m deep Est. Av. width (m) Est. Av. width (m) patches AX \$ < 1 m A 5 % bed cove % bed cover dlam. < 300 mm Branch pile > 50% dense Tree Roots X patches A patches Bank Overhang % bank length type present % bank length type present % bed cover 5 % bed cover diam. < 300 m Te ock faces, boulders, cobbles 教学 Est. Av. width (m) Est. Av. width (m) 6 patches patches \$ < 1 m 0001 4 0 % bed cover 10% bed cover 6 rophyte Fragments Perm. pool hab. deeper than 1 m 5 C patches X patches Man-made Overhang % bank length type present w bank length type present 6 bed cover % bed cover Algai clumps and debris Man-made structures and debris A MAAM Est. Av. width (m) Est. Av. width (m) patches patches 0 % bed cover 0 % bed cover WHAT OVERALL AQUATIC RATING FOR ALL AQUATIC LIFE \$3 5 VERY HIGH / PRISTINE POOR high diversity of depths and substrates little or no disturbance Record the number of patches of each type present, and % cover or presence low diversity of depths and substrates moderate disturbance 9 0 Combining all the abundant and diverse cover excellent vegetation cover low diversity of cover poor canopy & other veg. cover the general signs at the seneral signs at the site, give it an overall rating for fish, invertebates, birds & mammals 25 % cove 10 % cover 5% cove GOOD 2 good diversity of depths and substrates • little disturbance VERY POOR • no diversity of depths and substrates • high disturbance • no cover o low diversity • no canopy cover, other cover poor = presence only record '= not assessed - absent 41 Ittle disturbance
 diverse cover
 excellent canopy & other veg. cover

in Subsection	n Site	Tributary Name	CV		1221.0			
Recreation	nal Opportunity Ty	pe Allocate the	site to ONE of the fol	lowing types conside	ring all aspects			
	Natural 1. Pristine Natural Nature Reserve, Sanctuary	Natural 2. ² Semi-Natural Developed Reserve, Area, e.g. waterfall limited walking access	Natural 3. <i>Roaded- Natural</i> Camping Reserve, Rest Area structured sites with facilities	Rural 1. Undeveloped Rural Recreational settings in rural landscapes that are modified	Rural 2. ⁵ Developed Rural Rural areas cleared for camping grounds, within rural towns	Urban 1. Undeveloped Urban Undeveloped urban parks and bushland kept semi-natural	Urban 2. ⁷ Developed Urban Urban Parks and Sports grounds. Walls along stream	Urban 3. [®] Highly Develope Resort developme
Remoteness	3 km or more from all roads or tracks.	1 km or more from all roads.	not applicable	not applicable	not applicable	max of 500m to households	max of 500m to households	max of 2 km to households
Access	only by foot and 4 WD vehicle into the area	only by foot and 4 WD vehicle into the area, tertiary roads only	Moderate road access primary & secondary roads	good road access primary & secondary roads	accessible to all vehicles	low level access, primary road access	no limit to accese	no limit to acces
Human Impact and Development	no structures or exotic plants, pristine condition	only minor human influence, but small clearings O.K.	Moderate disturbance and development of facilities	natural setting but greatly modified	substantial modifications, rural residential	remnant bushland	modified open space	dominated by buildings etc.
Expected human contacts	rare, few other visitors	some contact with individuals but isolated	Moderate disturbance and some contact with groups	moderate contact on roads and trial sites	moderate to high interaction	Regular use by local residents	moderate to high density use	high density and frequent use
Facilities, regulations & structure	Little or none	some but subtle as formed tracks and signs	Minimal facilities, no powered sites etc.	Controls obvious, more complete facilities	barriers, signs and fences obvious	Remnant area with some restrictions	highly developed facilities	highly develope facilities
Teceretion typ if for potential a inbecue and picn ishwalking - cam ishwalking - day imping - car acce inoeing / kyaking ygs iore Fishing oat fishing - smal oat fishing - smal oat fishing - iargi pur wheel driving rose Riding	es solution for ine are not "2' for actual use nic nping Photogra- trips Nature a ses Swimmi g / rafting Water Si Bird Wat Other i boats Other other	aphy ppreciation ng kiing cching	Rate the site from 1 - 1 Coverall Sc Rank the Ra	o relative to other site senic Value Rating <i>e components for Sceni</i> Natural Beauty (bush Physical Beauty (wat ural Setting reban Setting nerit or value site of a component e	es in the area ic Value 1-10 land setting) erfails etc.) 1-10 .g. tree etc. 1-10	Rate the site as remm Aquatic Plant or A Rate the site as remm Riparian Plant or A Riparian Plant or A Rate the value of the	ant habitat for nimal spp.	
otor bikes owing	Echi(tha seen	on bank	K.	- "	Rank the Site (1-10) i Habitat for this type	n terms of its quality as of site in this catchment.	representative Aq





STATE OF THE RIVERS SHEET 7	Bank Condition	1	Date (dd/mm/yy) Recorder	9 1992 7. Anderson
Basin Sub-section Site Tributary Name	ck		The "Water Mark" is left at the norm shown by the limit of the terrestial g periods of inundation, or by an erod	al inundation level in the strea rasses etc. which can only wit ed area or boundary in the bar	m. Its location is hstand short nk sediment types.
Assess the condition of the banks on the left and right side of the (facing downstream), identify the major types of instability (erod slumping and aggrading) and mark the location where they occ	he stream ling, sur on the	- manager	13 Levee Banks	atural LEFT an-made Height Width	RIGHT Height Width
of the banks, and make an overall assessment of instability.	Bank Top			bsent t	
BANK Record % Bare of Veg 40 Bare of Veg 60	Water Level	11 12	BANK Becord % Bare of Veg	IK 2 UPPER BANK)
of bank length LOCATION Erecting Aggrading Erecting	Slope (Rank types)	Affecting Bank Stability Protection	of bank length	Stable	BRIGHT BANK Slope (Rank types)
for Instability 21 Slumping 2 Slumping 2	Vertical	Flow & Trees & Other Plante	for Instability I Slumping	Eroding Aggrading Aggrading Aggrading Aggrading	
		Seepage Rock wall or		where the second	Shope 60-80 deg. Shepe
	Siope 30-60 deg. Moderate	Runoff 2 Fence Structures	2 bends		Stope and 30-60 and Moderate
	Stope stag.	Floodplain Scours	3 At floodplain		5000 tog
	Fial 5	Stock S Fenced			slope < 10 deg. Flat 5
obstracles	A LEFT BANK Shape (Rank types)	People tracks	s obstacles		I RIGHT BANK Shape (Rank types)
at seepage &	Consen	Vermin Concrete	* at seepage 4 runoff points -		Concave
	Convex 2	Ford, road Break -			
	Sinced ,	Clearing of Other	·		Second 23
		Gravel/sand	all along		Wide Javer Jarrah
Bate the Overall	igh Mod Low Min	Mining 10	" Bate the Overall	H	Undersut s
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STATE OF THE RIVERS SHEET 8	Bed and Bar Condition 3 Ck	6 Factors Affecting Stability	Date (dd/mm/yy) Reco No Passage No Passage Reco C PAS OR OR	Ger SSAGE FOR FISH AN GANISMS	Andrean ND OTHER
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STATE OF TH	E RIVERS SH	IEET 11 Scenic,	Recr & Conserv.	. Values	29		-T	ž
Basin Subsectio	n Site	Tributary Name						
1 Recreation	al Opportunity Ty	pe Allocate the	site to ONE of the fol	lowing types conside	ring all aspects			
	Natural 1. Pristine Natural Nature Reserve, Sanctuary	Natural 2. ² Semi-Natural Developed Reserve, Area, e.g. waterfall limited walking access	Natural 3. <i>Roaded- Natural</i> Camping Reserve, Rest Area structured sites with facilities	Rural 1. Undeveloped Rural Recreational settings in rural landscapes that are modified	Rural 2. ⁵ Developed Rural Rural areas cleared for camping grounds, within rural towns	Urban 1. Undeveloped Urban Undeveloped urban parks and bushland kept semi-natural	Urban 2. ⁷ Developed Urban Urban Parks and Sports grounds. Walls along stream	Urban 3. [®] Highly Developed Resort developments
Remoteness	3 km or more from all roads or tracks.	1 km or more from all roads.	not applicable	not applicable	not applicable	max of 500m to households	max of 500m to households	max of 2 km to households
Access	only by foot and 4 WD vehicle into the area	only by foot and 4 WD vehicle into the area, tertiary roads only	Moderate road access primary & secondary roads	good road access primary & secondary roads	accessible to all vehicles	low level access, primary road access	no limit to access	no limit to access
Human Impact and Development	no structures or exotic plants, pristine condition	only minor human influence, but small clearings O.K.	Moderate disturbance and development of facilities	natural setting but greatly modified	substantial modifications, rural residential	remnant bushland	modified open space	dominated by buildings etc.
Expected human contacte	rare, few other visitors	some contact with individuals but isolated	Moderate disturbance and some contact with groups	moderate contact on roads and trial sites	moderate to high interaction	Regular use by local residents	moderate to high density use	high density and frequent use
Facilities, regulations & structure	Little or none	some but subtle as formed tracks and signs	Minimal facilities, no powered sites etc.	Controls obvious, more complete facilities	barriers, signs and fences obvious	Remnant area with some restrictions	highly developed facilities	highly developed facilities
Recreation Type lark "1" for potential a Barbecue and pion Bushwalking - carr Camping - car accr Canoeing / kyaking Dogs Shore Fishing Boat fishing - smal Boat fishing - smal Boat fishing - large Four wheel driving Horse Riding Motor bikes Rowing Sailing	es suitable for the are ind "2' for actual use ic ping Photogr. Irips Nature a ses 1/ rafting Water Si 1 boats Other 0 ther 0 ther	a (1) ppreciation ng ding ching RIVAL PYOT OCCEPS	Scenic Value Asse Rate the site from 1 - 1 Overall Sc Rank the Inherent I U Scenic R Scenic U Artistic m Scenic U Other Scenic Value Market Scenic Value Scenic V	ssment 0 relative to other site cenic Value Rating e components for Sceni Natural Beauty (bush Physical Beauty (bush Physical Beauty (bush riban Setting reban Setting nerit or value live of a component e MAC, AAH C, WE, C,	es in the area (c Value 1-10 land setting) erfalls etc.) 1/2 1.10 .g. tree etc. 1-10 5	Itial Conservation Rate the site as remm Aquatic Plant or Ai Highly McO Rate the site as remm Riparian Plant or Ai Superior View Abbox Rate the value of the Analt the Site (1-10) i Rank the Site (1-10) i	Nalue Assessment and habitat for nimal spp. Amed . and habitat for nimal spp. G. Tri good site as a willdlife corride MIGN VEG n terms of its quality as of site in this catchment. n terms of its quality as	nt

Date (dd/mm/yy) Recorder Lawren 1 **STATE OF THE RIVERS --- SHEET 3** Site Description 28/111/02 Assistant AIO Basin Subsection Site Scolenny Flows into Flows into CREK River Dawson Type of Site Site Description (locality name) Region Location Description (how to find it again) Gauging Station Type Photograph Only Full Survey Site Latitude Longitude WPT Map Number Grid Reference GPS'? Other Est. Position Error Stream Gauge $\overline{}$ ± Water Quality Map Scale AMTD (from map) Other Total U/S Distance (add AMTD's) Catchment Area (sq. km) Other 1: Is the Site Tidal ? Non-Tidal Other Sketch : Show location of survey, access points, landmarks and key features such as roads, houses and other buildings. Also show the key features about the stream environs and its location. Also mark the boundaries for the survey (the reach). Include an arrow for NORTH and also indicate the direction of flow. Also mark the position where the GPS latitude and longitude were determined. The sketch should be adequate for quickly finding the site Photographs - The standard set consists of one shot looking upstream, downstream, lateral left (at left bank), lateral right (at right bank), reach environs (overview of the reach from a distance) and other relevant again for future follow-up surveys. Altitude (m) photographs HOCK from house the Bore) \square Film No. Shot Shot Shot Shot 102 1744 Upstream 0 174 5 102 Downstream Reg V 102 1+47 1746 Lateral Left 1749 Lateral Right 102 1748 102 (QUV) **Reach Environs** Distant View 102 1751 2 Feature é Feature 3 NON NOTES: vegetation 0 Flog PS. Viaideo and channels ASSESSME on NGIN Chank × maine braided channels etsmer FRACK Date (dd/mm/yy) C 1992 J. Anderson STATE OF THE RIVERS --- SHEET 4 Reach Environs -temporal & spatial 28/11/03 LI Basin Subsection Site Record information about the local land adjacent to the reach on each side and about the conditions prevailing at the time of the sampling. The assessment should be restricted to the immediate vicinity of the reach- i.e not beyond the land bordering the riparlan zone **Tributary Name** 6 Local Veg. Type 13 Grassland(isolated trees) Rainforest Eucalypt Wet Sclerophyl 14 Other Shrubland 1 Water Level at sampling time 3 Channel Pattern 4 Local Land Use 5 Local Disturbance **Eucalypt Open Forest** 15 Heathland Map Not Determined \vee Eucalypt woodland 16 Mangrove Completely dry , Sugar Cane Sand / gravel mine 17 Salt marsh / salt pans Eucalypt open woodlan Other mine Isolated pools, no flow Straight Horticulture small crops/ vines V 18 Freshwater marsh Cyprus Pine forest Low Flow/ low level Mildly sinu Horticulture tree crops/ fruit Road ¹⁹ Pine plantation Belah/ Brigalow/ Gidgee Moderate < water mark Bridge / culvert / wharf _ Irregular Irrigated broadacre row crops 20 Other plantation Mulga scrub-open fores Normal at water mark Ford / ramp Reg. Meanders Rainfed broadacre row crops 21 Other High > water mark Non Irreg. Meanders V Grazing - sown pasture Discharge Pipe Mulga Shrubland Bendee/lancewood scrub 22 Other Flood > bankfull 7 Grazing -native --- cleared Forestry activities 1 Softwood Scrub Within 1 hr of High Tide 3 -Grazing -native --- thinned Sugar Mill Local Land Tenure Braided 8 V Grazing -native --- virgin timber Sewerage Effluent 12 Melaleuca forest Swampy Within 1 hr of Low Tide 10 Freehold/ leasehold \sim 10 Intensive Livestock-pig,fowl,com Outgoing/between Tide Incoming/between Tide 10 Irrig. runoff, pipe outlet Channelised 7 Floodplain features National Park ¹¹ Urban residential 11 Channelisation Overland Flow State Park 12 River Improven Oxbows / billabongs 200 12 Urban manufact/ processing Estimated Total Floodplain width (m) Estimated Total Valley-flat width (m) Reserve-timber,envir P 13 Park or Reserve / National, envir Remnant Channels 13 Water Extraction State Forest "Dredging Floodplain scours V Est. Local Meander wavelength (m) 70 14 Urban Park or Reserve 6 Urban Reserve 15 Grazing Floodplain deposits 15 Rural Residential / hobby farm OVERALL DISTURBANCE RATING Urban 16 Other Prominent flood channels 8 Other / Unknown EXTREME DISTURBANCE Tick one box for the overall rating <u>Valley Flat Vegetation</u> - Agricultural land and/or cleared on ONE side; native vegetatic on the other clearly disturbed or with a high percentage of introduced species present. HIGH DISTURBANCE LOW DISTURBANCE Valley Flat Vegetation - Native vegetation present on BOTH sides of the river with a virtually intact canopy. Minor disturbances present through Valley Flat Vegetation - Agriculture and/or cleared land <u>BOTH</u> sides. Plants present are virtually all exotic species (willows, pines etc.) 4 6 2 undisturb. cleared cleared percentage of Introduced species present. Shoreline Veqetation - Bank vegetation moderately disturbed by stock or through the intrusion of introduced species, though native species remain. Note: Sites with valley flat vegetation cleared BOTH sides, but with shoreline vegetation in good condition, for example when it is fenced off should be included in this category. distu undisturb introduced species. or exoti only or minor minor disturb . fr Shoreline Vegetation - Native vegetation on BOTH sides of the river is generally in good condition with few introduced species present. Any Shoreline Vegetation - Absent or severely reduced. Vegetation present is extremely disturbed - i.e. dominated by exotic species. Native species rare or completely absent. Pin . **.**817 undisturb 4 disturbance is Valley Flat Shoreline > Valley Flat + off, should be included in this category VERY HIGH DISTURBANCE V. LOW DISTURBANCE <u>Valley Flat Vegetation</u> - Native vegetation present on both sides of the river with an intact canopy. Introduced species are absent or insignificant. No evidence of outside interference. <u>Representative of natural vegetation</u> in excellent condition MODERATE DISTURBANCE 5 Valley Flat Vegetation - Agriculture and/or cleared land <u>BOTH</u> sides. Plants present are virtually all exotic species (willows, pines, 3 Valley Flat Vegetation - Agricultural land and/or cleared on ONE side; native vegetatio on the other in reasonably undisturbed state. undistur or minor cleared cleare cleared undisturb. undisturb some native etc.). pristine undisturb. but disturb in excellent condition. à. Shoreline Vegetation - Native vegetation or or minor Shoreline Vegetation - Some native vegetation present, but it is severely modifie BOTH sides by grazing or the intrusion of introduced species. Native species severely reduced in numbers and cover. The state BOTH sides with canopy intact or with native species widespread and common in the shoreline zone. The intrusion of introduced species is minor and of moderate impact. STP 1 Shoreline Vegetation - Native vegetation on both sides of the river in an undisturbed state. Shoreline + Valley Flat -Shoreline + Valley Flat ++ Introduced species are rare or insignificant. Shoreline -> Valley Flat -> Representative of natural vegetation in excellent

4/7

STATE OF THE RIVERS SHEET 5 Chann	el Habitat	Date (dd/mm/yy) Recorder I.Anderson Medited 10/1093
Basin Subsection Site Tributary Name	Salacting a Basch	
Channel eshivated-dry	Choose an appropriate <i>Reach</i> for the remaining assessment. 1. Preferably contains at least 2 complete pools and riffl 2. The whole length of the reach should be visible at one	It should:- e / run habitats location.
Types Waterfall % of section	3. The pool should be the largest and deepest in the are Sketch the reach showing the location and dimensions of the babilit broke. Measure the longth width of each channel habit	a. major al type
Gradient > 60 deg	and take a transect across each type located at right angles to shoreline and passing over the point of maximum depth in a p	the col (low flow area)
Step Height < Im Cascade % of section	and maximum flow / bed height for a run or riffle habitat i.e. the flows would be expected to be maximal. Reach	le transect where
Gradient 5 - 60 deg Strong Currents Est. Av. length (m) Est. Av. height (m)		2
Depth > 0.3 m Rapid % of section		Total Length of reach (m)
Gradient 3 - 5 deg Strong Currents	Pool Pool	Run
surface Est. Av. Width (m)	প্র Sketch the reach showing the channel pattern and the distribu	ion of channel habitat types and key features. A cross-section profile
Depth 0.1 - 0.3 m Gradient 1-3 deg	showing the bank shape and vegetation types would also be h	elptul if there is time
Surface unbroken but unsmooth	1095.	
Depth < 0.1 m Gradient 1- 3 deg Gilde Set. Av. length (m)	1.01	
Small Currents Surface unbroken and smooth Est. Av. Width (m)		1
Depth > 0.3 m Run % of section	H	
Small but distinct & uniform current		
Depth > 0.5 m Pool 30 % of section		Allering
where stream widens or deepens and current Est. Av. length (m) Est. Av. depth (m)	h	Jar elocol
declines Est. Av. Width (m)	10050	fallen trees, 2
a reasonable size (>20% of channel width) aut off	1 - > loop exposed	exposed racks.
section away from the channel Est. Av. Width (m)	1 1 1005 GFC.	el.,
	Dat	e (dd/mm/yy) Recorder © 1992
STATE OF THE RIVERS SHEET 6 Cross Basin Subsection Site Section Number for this r	- Sections Dry Z	(dd/mm/yy) Recorder © 1992 Anderson
STATE OF THE RIVERS SHEET 6 Cross Basin Subsection Site Section Number for this r	- Sections Pach TYPE Pool Carter Type (m) Riffie 2 As Width	a (dd/mm/yy) Recorder Sediment Classification Sediment classes are those of the SAA which are easier to estimate visually - estimate % of total increanic volume occupied by each
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ATE OF THE	E RIVERS SH	IEET 11 Scenic,	Recr & Conserv.	Values	28		T	
in Subsection	n Site	Tributary Name	C100 X					
		*	01001					
Recreation	al Opportunity Ty	Allocate the	site to ONE of the fol	lowing types consider	ring all aspects			
	Natural 1. Pristine Natural Nature Reserve, Sanctuary	Natural 2. Semi-Natural Developed Reserve, Area, e.g. waterfail limited walking access	Natural 3. ³ Roaded- Natural Camping Reserve, Rest Area structured sites with facilities	Rural 1. Undeveloped Rural Recreational settings in rural landscapes that are modified	Rural 2. ⁵ Developed Rural Rural areas cleared for camping grounds, within rural towns	Urban 1. Undeveloped Urban Undeveloped urban parks and bushland kept semi-natural	Urban 2. ⁷ Developed Urban Urban Parks and Sports grounds, Walls along stream	Urban 3. [®] Highly Developed Resort development:
Remotences	3 km or more from all roads or tracks.	1 km or more from all roads.	not applicable	not applicable	not applicable	max of 500m to households	max of 500m to households	max of 2 km to households
Ассева	only by foot and 4 WD vehicle into the area	only by foot and 4 WD vehicle into the area, tertiary roads only	Moderate road access primary & secondary roads	good road access primary & secondary roads	accessible to all vehicles	low level access, primary road access	no limit to access	no limit to access
Human Impact and Development	no structures or exotic plants, pristine condition	only minor human influence, but small clearings O.K.	Moderate disturbance and development of facilities	natural setting but greatly modified	substantial modifications, rural residential	remnant bushland	modified open space	dominated by buildings etc.
Expected human contacts	rare, few other visitors	some contact with individuals but isolated	Moderate disturbance and some contact with groups	moderate contact on roads and trial sites	moderate to high interaction	Regular use by local residents	moderate to high density use	high density and frequent use
Facilities, regulations & structure	Little or none	some but subtle as formed tracks and signs	Minimal facilities, no powered sites etc.	Controls obvious, more complete facilities	barriers, signs and fences obvious	Remnant area with some restrictions	highly developed facilities	highly developed facilities
Recreation Type	es suitable for the are	a] [3	Scenic Value Asse	ssment	41	nitial Conservation	Value Assessme	nt
"1" for potential an arbecue and picni ushwalking - cam lushwalking - day	nd "2' for actual use ic ping Photogr trips Nature a	aphy	Rate the site from 1 - 1 Overall So Rank the	0 relative to other site cenic Value Rating e components for Scent	es in the area	Rate the site as remn Aquatic Plant or A	nant habitat for nimal spp.	_
amping - car acce anoeing / kyaking ogs	/ rafting Swimmi Bird Water Sl	ng kiing tehing	Inherent Scenic R	Physical Beauty (bush ural Setting	erfalls etc.) 1-10	Rate the site as remu Riparian Plant or A	nant habitat for nimal spp.	
nore rishing loat fishing - small loat fishing - large our wheel driving	I boats Other boats Other		Artistic m Scenic va	nerit or value alue of a component e	.g. tree etc.	Rate the value of the	site as a willdlife corrid	or
orse Riding lotor bikes owing	Comments:	on leosely	Old Other			Rank the Site (1-10)	in terms of its quality as	representative Aqual
ailing	- invit v	- united	NUCLES			Rank the Site (1-10)	in terms of its quality as	representative Ripari

3/2

STATE OF THE RIVERS SHEET 3 Site Description	Date (dd/mm/yy) Rec	corder Aby Banderson
Basin Subsection Site Tributary Name Elows into	Flows into Ass	sistant mala Savage
Gauging Station Type Region Site Description (locality name)	ocation Description (how to find it again)	Type of Site
Map Number Grid Reference Latitude	Longitude GPS 2 Other Est Po	Full Survey Site
Map Scale AMTD (from map) Total U/S Distance (add AMTD's)		Water Quality
1: Is the Site Tidal	Pon-Tidal Catchment Area (sq.	km) • Other
Sketch : Show location of survey, access points, landmarks and key features such as roads, houses an buildings. Also show the key features about the stream environs and its location. Also mark the bounda survey (the reach), include an arrow for NORTH and also indicate the direction of flow. Also mark the port of the stress of the stre	d other ries for the Photographs - The standard set	consists of one shot looking
where the GPS latitude and longitude were determined. The sketch should be adequate for quickly findi again for future follow-up surveys.	ng the site lateral right (at rig Altitude (m) of the reach from	ght bank), reach environs (overview n a distance) and other relevant
1/2 100 m	Film No. S	Shot Shot Shot Shot
	Upstream UCZ	
	Lateral Left	
Rice CV	Reach Environs	
e act	Feature (035 102	76 5
3	Feature 1095 104 1	
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E	-N	
	Date (dd/mm/vy) Rec	corder @ 1992
STATE OF THE RIVERS SHEET 4 Reach Environs -temporal & spatial Basin Subsection Site Tributary Name Record Information about the local land adja	Date (dd/mm/yy) Rec	Corder © 1992 J. Anderson
STATE OF THE RIVERS SHEET 4 Reach Environs -temporal & spatial Basin Subsection Site Tributary Name	Date (dd/mm/yy) Rec 22 / / / / / / / / / / / / / / / / / /	ype
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STATE OF THE RIVERS SHEET 7 Basin Sub-section Site Tributary Name	Bank Condition		Date (dd/mm/yy)	Recorder undation level in the stream seas etc. which can only with area or boundary in the ban	© 1992 J. Anderson m. Its location is retand short k sodiment types.	
Assess the condition of the banks on the left and right side of (facing downstream) identify the major types of instability (eroc slumping and aggrading) and mark the location where they oc lower and upper banks. Also record the slope and shape of the banks, and make an overall assessment of instability.	the stream ling, ur on the Bank Top		13 i Natur Levee Banks 7 Abse	al LEFT made Height Width nt	RIGHT Helght Width	
LUCET I BANK BARAK Bare of Veg Bare of Veg Bare of Veg Bare of Veg Stable Conding Aggrading Froding Aggrading Broding Ag	Water Level Water	tors ability Tress & Tress & Tress & Tress & Tress & Tress & Tress & Tres	Right BANK Record % of bank longh LOCATION Eroding Aggrading for instability bends at Boophin A Boophin A Boophin at Boophin regular at along Bate the Overall Condition of the		BRIGHT BANK Slope (Rank types)	
Len Bank Susceptibility to erosion		NK	Right Bank Su	sceptionity to erosion [
STATE OF THE RIVERS SHEET 8	Bed and Bar Condition	NIC	Date (dd/mm/yy), Recorde	r	G 1992 Anderson	
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Recreation	al Opportunity Ty	Pe Allocate the	site to ONE of the fol	llowing types conside	ring all aspects			
	Natural 1. Pristine Natural Nature Reserve, Sanctuary	Natural 2. ² Semi-Natural Developed Reserve, Area, e.g. waterfall limited walking access	Natural 3. ³ Roaded- Natural Camping Reserve, Rest Area structured sites with facilities	Rural 1. Undeveloped Rural Recreational settings in rural landscapes that are modified	Rural 2. ⁵ Developed Rural Rural areas cleared for camping grounds, within rural towns	Urban 1. Undeveloped Urban Undeveloped urban parks and bushland kept semi-natural	Urban 2. ⁷ Developed Urban Urban Parks and Sports grounds. Walls along stream	Urban 3. [*] Highly Developed Resort developme
Remoteness	3 km or more from all roads or tracks.	1 km or more from all roads.	not applicable	not applicable	not applicable	max of 500m to households	max of 500m to households	max of 2 km to households
Accese	only by foot and 4 WD vehicle into the area	only by foot and 4 WD vehicle into the area, tertiary roads only	Moderate road access primary & secondary roads	good road access primary & secondary roads	accessible to all vehicles	low level access, primary road access	no limit to access	no limit to access
Human Impact and Development	no structures or exotic plants, pristine condition	only minor human influence, but small clearings O.K.	Moderate disturbance and development of facilities	natural setting but greatly modified	substantial modifications, rural residential	remnant bushland	modified open space	dominated by buildings etc.
Expected human contacts	rare, few other visitors	some contact with individuals but isolated	Moderate disturbance and some contact with groups	moderate contact on roads and trial sites	moderate to high interaction	Regular use by local residents	moderate to high density use	high density and frequent use
Facilities, regulations & structure	Little or none	some but subtle as formed tracks and signs	Minimal facilities, no powered sites etc.	Controls obvious, more complete facilities	barriers, signs and fences obvious	Remnant area with some restrictions	highly developed facilities	highly developed facilities
Tris for potential a larabecue and pien bushwalking - cam bushwalking - day camoeing / kyaking bogs canoeing / kyaking bogs chore Fishing soat fishing - smal soat fishing - large four wheel driving forse filding	I boate o board water Si o trips ping	aphy reclation ng tiking teching	Rate the site from 1 - 1 Rate the site from 1 - 1 Rank the Inherent I Scenic R Scenic Vi Artistic m Scenic va Other	ionentia lo relative to other site cenic Value Rating e components for Scenn Natural Beauty (bush Physical Beauty (wat ural Setting rban Setting nerit or value alue of a component e	s in the area c Value 1-10 land setting) prfalls etc.) g. tree etc. 1-10 1-10 1-10 1-10	Rate the site as remm Aquatic Plant or A: Bate the site as remm Rate the site as remm Riparian Plant or A: Bate the value of the	ant habitat for nimal spp.	
towing ailing						Rank the Site (1-10) i Habitat for this type	n terms of its quality as of site in this catchment.	representative Aq

Appendix C Sampling Effort

Table C.1Sampling effort at site 1.

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro- invertebrates	20 sec sweep	Macrophyte	-	-	-	_	_	Flood water quality only
	20 sec sweep	Tree root	-	-	_	-	_	Flood water quality only
	Square foot kick netting	Pool	-	_	_	-	_	Flood water quality only
	Surber	Edge	-	-	-	-	-	Flood water quality only
Fish	Backpack Electrofishing	_	_	_	_	_	_	Flood water quality only
	Boat Electrofishing	_	-	_	_	-	_	Flood water quality only
	Bait Trap	_	-	_	_	-	_	Flood water quality only
	Gill Net	_	-	_	_	-	_	Flood water quality only
	Seine Net	-	-	-	-	-	-	Flood water quality only
Turtles	Cathedral Trap	-	-	-	-	_	-	Flood water quality only

Table C.2Sampling effort at site 2.

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro- invertebrates	20 sec sweep	Macrophyte	27/11/07	-	-	-	2 replicates	
		Tree root	27/11/07	_	_	_	2 replicates	
	Square foot kick netting	Glide	27/11/07	_	_	_	5 replicates	
		Riffle	27/11/07	_	-	_	5 replicates	
	Surber	Edge	27/11/07	-	-	-	5 replicates	
Fish	Backpack Electrofishing	Run 1	27/11/07	1607	1619	Voltage: 200 Volts	147	
						Frequency: 30 Hz		
						Pulse Width: 4 ms (12%)		
		Run 2	27/11/07	1626	1637	Same as Run 1	136	
		Run 3	27/11/07	1650	1703	Same as Run 1	162	
		Glide 1	27/11/07	1705	1711	Same as Run 1	124	
		Riffle 1	27/11/07	1713	1717	Same as Run 1	83	
		Glide 2	27/11/07	1718	1723	Same as Run 1	133	
		Pool 1	27/11/07	1724	1727	Same as Run 1	40	
		Run 4	27/11/07	1728	1736	Same as Run 1	146	
	Boat Electrofishing	_	_	_	_	_	_	Too shallow
	Bait Trap		27/11/07	815	1230	-	10 traps set for 4.25 hours each = 42.5 hours	

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
	Gill Net	_	_	_	_	-	_	
	Seine Net	Upstream glide	27/11/07	-	-	-	2 seines	
		Downstream glide	27/11/07	-	-	-	1 seine	
Turtles	Cathedral Trap		27/11/07	1130	1550	-	5 traps set 4 hours each 20 hours	for =

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro- invertebrates	20 sec sweep	Macrophyte	-	-	_	_	-	Not sampled due to flooding
		Tree root	-	-	-	-	-	Not sampled due to flooding
	Square foot kick netting	Pool	-	-	-	-	-	Not sampled due to flooding
	Surber	Edge	-	-	-	-	-	Not sampled due to flooding
Fish	Backpack Electrofishing	-	-	_	_	-	_	Not sampled due to flooding
	Boat Electrofishing	_	_	_	_	-	_	Not sampled due to flooding
	Bait Trap	_	_	_	_	-	_	Not sampled due to flooding
	Gill Net	_	-	-	-	-	-	Not sampled due to flooding
	Seine Net	-	-	-	-	-	-	Not sampled due to flooding
Turtles	Cathedral Trap	-	-	-	-	-	-	Not sampled due to flooding

Table C.3Sampling effort at site 3.
Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro- invertebrates	20 sec sweep	Macrophyte	_	-	-	_	-	No suitable macrophyte habitat
	20 sec sweep	Tree root	-	-	-		-	No suitable tree root habitat
	Square foot kick netting	Bed	29/11/07	-	-	-	5 replicates	
	Surber	Edge	29/11/07	_	-	-	5 replicates	
Fish	Backpack Electrofishing	-	_	-	-	_	-	Too deep
	Boat	Pool	29/11/07	1010	1115	Volts: 50-1000	1961 seconds	
	Electrofishing					Percent of Power: 60		
						Pulses per second: 60		
						Output Current (amps): 1– 3		
	Bait Trap	-	29/11/07	1245	1645	_	10 traps set for 4 hours each = 40 hours	
	Gill Net	-	_	_	-	_	-	
	Seine Net	-	_	-	-	-	-	
	Multi-panel block net	Mouth of Cockatoo Ck	29/11/07	1515	1715	-	2 hours	

Table C.4Sampling effort at site 4.

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Turtles	Cathedral Trap		29/11/07	1345	1745	-	5 traps set fo 4 hours each 20 hours	or =

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro-invertebrates	20 sec sweep	Macrophyte	_	_	_	_	_	Not surveyed due to flooding
	20 sec sweep	Tree root	_	_	_	_	_	Not surveyed due to flooding
	Square foot kick netting	Pool	-	-	-	-	-	Not surveyed due to flooding
	Surber	Edge	-	-	-	-	-	Not surveyed due to flooding
Fish	Backpack Electrofishing	_	-	-	-	-	-	Not surveyed due to flooding
	Boat Electrofishing	_	_	_	_	_	_	Not surveyed due to flooding
	Bait Trap	-	_	-	_	_	-	Not surveyed due to flooding
	Gill Net	-	_	-	_	_	-	Not surveyed due to flooding
	Seine Net	_	-	-	-	-	-	Not surveyed due to flooding
Turtles	Cathedral Trap	_	_	_	_	_	_	Not surveyed due to flooding

Table C.5Sampling effort at site 5.

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro-invertebrates	20 sec sweep	Macrophyte	_	_	-	_	_	Not surveyed due to flooding
	20 sec sweep	Tree root	-	_	-	-	_	Not surveyed due to flooding
	Square foot kick netting	Pool	-	-	-	_	-	Not surveyed due to flooding
	Surber	Edge	-	-	-	_	-	Not surveyed due to flooding
Fish	Backpack Electrofishing	-	-	-	-	_	_	Not surveyed due to flooding
	Boat Electrofishing	-	-	_	-	_	-	Not surveyed due to flooding
	Bait Trap	_	_	_	_	_	_	Not surveyed due to flooding
	Gill Net	-	-	_	-	-	_	Not surveyed due to flooding
	Seine Net	-	-	-	-	_	-	Not surveyed due to flooding
Turtles	Cathedral Trap	-	-	-	-	-	_	Not surveyed due to flooding

Table C.6Sampling effort at site 6.

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro- invertebrates	20 sec sweep	Macrophyte	-	-	-	-	-	Not surveyed due to flooding
	20 sec sweep	Tree root	-	_	-	-	-	Not surveyed due to flooding
	Square foot kick netting	Pool	_	_	-	_	-	Not surveyed due to flooding
	Surber	Edge	_	-	-	-	-	Not surveyed due to flooding
Fish	Backpack Electrofishing	-	_	_	-	_	-	Not surveyed due to flooding
	Boat Electrofishing	-	_	-	-	-	-	Not surveyed due to flooding
	Bait Trap	-	_	_	-	_	-	Not surveyed due to flooding
	Gill Net	-	_	_	-	_	-	Not surveyed due to flooding
	Seine Net	-	_	_	-	_	-	Not surveyed due to flooding
Turtles	Cathedral Trap	-	-	-	-	-	-	Not surveyed due to flooding

Table C.7Sampling effort at site 7.

Table C.8Sampling effort at site 8.

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro- invertebrates	20 sec sweep	Macrophyte	-	-	-	_	-	No suitable macrophyte habitat
	20 sec sweep	Tree root	30/11/07	_	_	_	2 replicates	
	Square foot kick netting	Bed	30/11/07	-	-	-	5 replicates	
	Surber	Edge	30/11/07	-	-	_	5 replicates	
Fish	Backpack Electrofishing	Pool 1	30/11/07	1030	1054	Voltage: 200 Volts Frequency: 30 Hz Pulse Width: 4 ms (12%)	165	
		Pool 5	30/11/07	1050	1054	Same as Pool 1	20	Very small pool
		Pool 4	30/11/07	1510	1516	Voltage: 175 Volts Frequency: 30 Hz Pulse Width: 4 ms (12%)	154	
		Pool 3	28/11/07	1455	1508	Same as Pool 4	175	
		Pool 2	28/11/07	-	-	-	-	Too deep
	Bait Trap	Pool	30/11/07	0945	1345	-	10 traps set for 4 hours each = 40 hours	
	Seine Net	Pool 2	-	_	-	-	2 seines	
Turtles	Cathedral Trap	Pool	30/11/07	1000	1204	-	5 traps set for 2 hours each = 10 hours	

Nathan Dam on the Dawson River, Aquatic Flora and Fauna Dry Season Field Survey (November 2007)

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro- invertebrates	20 sec sweep	Macrophyte	_	_	_	_	_	Not surveyed due to flooding and ground conditions (access in wet)
	20 sec sweep	Tree root	-	-	-	-	-	Not surveyed due to flooding and ground conditions (access in wet)
	Square foot kick netting	Pool	-	-	-	-	-	Not surveyed due to flooding and ground conditions (access in wet)
	Surber	Edge	-	-	-	-	_	Not surveyed due to flooding and ground conditions (access in wet)
Fish	Backpack Electrofishing	-	-	_	-	-	_	Not surveyed due to flooding and ground conditions (access in wet)
	Boat Electrofishing	-	-	-	-	-	-	Not surveyed due to flooding and ground conditions (access in wet)
	Bait Trap	-	-	-	-	-	-	Not surveyed due to flooding and ground conditions (access in wet)
	Gill Net	-	-	-	-	-	-	Not surveyed due to flooding and ground conditions (access in wet)
	Seine Net	-	-	-	-	-	_	Not surveyed due to flooding and ground conditions (access in wet)
Turtles	Cathedral Trap	-	-	-	-	_	_	Not surveyed due to flooding and ground conditions (access in wet)

Table C.9Sampling effort at site 9.

Table C.10	Sampling effort at site 10.
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Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro- invertebrates	20 sec sweep	Macrophyte	-	-	_	_	_	Not surveyed due to flooding, water quality sampled
	20 sec sweep	Tree root	-	-	-	_	-	Not surveyed due to flooding, water quality sampled
	Square foot kick netting	Pool	_	-	-	-	-	Not surveyed due to flooding, water quality sampled
	Surber	Edge	-	-	-	-	_	Not surveyed due to flooding, water quality sampled
Fish Backpack Electrofishing Boat Electrofishing		-	-	-	-	-	-	Not surveyed due to flooding, water quality sampled
		-	-	-	-	-	-	Not surveyed due to flooding, water quality sampled
	Bait Trap	-	-	-	-	_	-	Not surveyed due to flooding, water quality sampled
	Gill Net	-	-	-	-	_	-	Not surveyed due to flooding, water quality sampled
	Seine Net	-	-	-	-	-	-	Not surveyed due to flooding, water quality sampled
Turtles	Cathedral Trap	-	-	-	-	-	_	Not surveyed due to flooding, water quality sampled

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro- invertebrates	20 sec sweep	Macrophyte	_	-	_	-	_	Dry, habitat descriptions only
	20 sec sweep	Tree root	_	-	_	_	_	Dry, habitat descriptions only
	Square foot kick netting	Pool	_	-	_	_	-	Dry, habitat descriptions only
	Surber	Edge	_	-	_	_	-	Dry, habitat descriptions only
Fish	Backpack Electrofishing	_	_	_	_	_	_	Dry, habitat descriptions only
	Boat Electrofishing	_	_	_	_	_	_	Dry, habitat descriptions only
	Bait Trap	_	_	-	_	_	-	Dry, habitat descriptions only
	Gill Net	_	-	-	_	-	-	Dry, habitat descriptions only
	Seine Net	_	-	_	_	-	_	Dry, habitat descriptions only
Turtles	Cathedral Trap	-	-	_	_	-	-	Dry, habitat descriptions only

Table C.11Sampling effort at site 11.

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro- invertebrates	20 sec sweep	Macrophyte	29/11/07	_	_	_	2 replicates	
	20 sec sweep	Tree root	29/11/07	_	_	_	2 replicates	
	Square foot kick netting	Bed	29/11/07	-	-	-	5 replicates	
	Surber	Edge	29/11/07	_	-	-	5 replicates	
Fish	Backpack Electrofishing	-	_	_	_	-	_	Too deep
	Boat Electrofishing	Pool	29/11/07	1445	1600	Volts: 50-1000 Percent of Power: 60 Pulses per second: 60 Output Current (amps): 2	1842 seconds	
	Bait Trap	-	29/11/07	0940	1340	-	10 traps set for 4 hours each = 40 hours	
	Gill Net	_	-	-	-	-	-	
	Seine Net	-	-	-	-	-	-	Many snags
Turtles	Cathedral Trap	-	29/11/07	1040	1240	-	5 traps set for 2 hours each = 10 hours	

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro- invertebrates	20 sec sweep	Macrophyte	-	-	_	-	-	Not surveyed due to flooding
	20 sec sweep	Tree root	_	-	-	-	-	Not surveyed due to flooding
	Square foot kick netting	Pool	_	-	-	-	-	Not surveyed due to flooding
	Surber	Edge	-	-	-	-	_	Not surveyed due to flooding
Fish	Backpack Electrofishing	_	_	_	_	_	_	Not surveyed due to flooding
	Boat Electrofishing	-	-	-	-	-	-	Not surveyed due to flooding
	Bait Trap	-	-	-	-	-	_	Not surveyed due to flooding
	Gill Net	-	-	-	-	-	_	Not surveyed due to flooding
	Seine Net	-	-	-	-	-	_	Not surveyed due to flooding
Turtles	Cathedral Trap	-	-	_	_	_	-	Not surveyed due to flooding

Table C.13Sampling effort at site 13.

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro- invertebrates	20 sec sweep	Macrophyte	-	-	-	-	-	Not surveyed due to flooding and ground conditions (access in wet)
	20 sec sweep	Tree root	-	-	-	-	-	Not surveyed due to flooding and ground conditions (access in wet)
	Square foot kick netting	Pool	-	-	-	-	-	Not surveyed due to flooding and ground conditions (access in wet)
	Surber	Edge	-	-	-	-	-	Not surveyed due to flooding and ground conditions (access in wet)
Fish	Backpack Electrofishing	-	-	-	-	-	-	Not surveyed due to flooding and ground conditions (access in wet)
	Boat Electrofishing	-	-	-	-	-	-	Not surveyed due to flooding and ground conditions (access in wet)
	Bait Trap	-	-	-	-	-	-	Not surveyed due to flooding and ground conditions (access in wet)
	Gill Net	_	-	-	-	-	-	Not surveyed due to flooding and ground conditions (access in wet)
	Seine Net	-	_	-	-	-	-	Not surveyed due to flooding and ground conditions (access in wet)
Turtles	Cathedral Trap	-	_	-	-	-	-	Not surveyed due to flooding and ground conditions (access in wet)

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro- invertebrates	20 sec sweep	Macrophyte	_	_	_	-	_	Dry, habitat descriptions only
	20 sec sweep	Tree root	-	-	-	-	_	Dry, habitat descriptions only
	Square foot kick netting	Pool	_	-	_	-	-	Dry, habitat descriptions only
	Surber	Edge	-	-	-	-	_	Dry, habitat descriptions only
Fish	Backpack Electrofishing Boat Electrofishing Bait Trap Gill Net	- - -	- - -	- - -	- - -	- - -	- - -	Dry, habitat descriptions only Dry, habitat descriptions only Dry, habitat descriptions only
		—	_	_	_	_	_	
Turtles	Cathedral Trap	-	-	-	-	_	-	Dry, habitat descriptions only

Table C.15 Sampling effort at site 15.

Target	Method	Habitat	Date	Time In	Time Out	Settings	Effort	Comments
Macro- invertebrates	20 sec sweep	Macrophyte	_	_	-	-	_	Dry, habitat descriptions only
	20 sec sweep	Tree root	-	-	-	-	-	Dry, habitat descriptions only
	Square foot kick netting	Pool	-	-	-	-	-	Dry, habitat descriptions only
	Surber	Edge	-	-	-	-	-	Dry, habitat descriptions only
Fish	Backpack Electrofishing	-	-	-	-	-	-	Dry, habitat descriptions only
	Boat Electrofishing	-	-	-	-	-	-	Dry, habitat descriptions only
	Bait Trap	-	-	-	-	-	-	Dry, habitat descriptions only
	Gill Net	_	_	-	_	-	_	Dry, habitat descriptions only
	Seine Net	_	_	-	_	_	_	Dry, habitat descriptions only
Turtles	Cathedral Trap	_	_	-	_	-	-	Dry, habitat descriptions only

Table C.16Sampling effort at site 16.

Appendix D Introduction to the Macro-invertebrate Data Analyses Used

Physical and chemical monitoring of water quality can only provide a snapshot of the conditions in an aquatic ecosystem. Biological monitoring provides a more time-integrated picture of ecosystem health, and may for example, indicate the pollution history of an environment. Macroinvertebrates are often used in biological monitoring as they are widespread; occupy many different niches and are an integral part of the food web; are sensitive to the effects of surrounding landuses such as turbidity, eutrophication, increased salinity and high toxicant levels; and have relatively long life-cycles. The effects of changes in water quality on populations can be long lasting; and impacts can thus be detected for some time after they occur.

A number of macro-invertebrate indices are effective indicators of ecosystem health (EHMP 2004). Use of multiple indices contributes to the robustness and reliability of any assessment. These indices have all been found to be effective indicators of ecological health (EHMP 2004).

Taxonomic Richness

Taxonomic richness is the number of taxa (typically families) in a sample. Taxonomic richness is the most basic and unambiguous diversity measure, and is considered to be among the most effective diversity measures. It is however, affected by arbitrary choice of sample size. Where all samples are considered to be of equal size, species richness index is considered to be a useful tool when used in conjunction with other indices. Richness does not take into account the relative abundance of each taxa, so rare taxa have as much 'weight' as common ones.

SIGNAL 2 Scores

SIGNAL (Stream Invertebrate Grade Number — Average Level) scores are also based on the sensitivity of each macroinvertebrate family to pollution or habitat degradation. The SIGNAL system has been under continual development for over 10 years, with the current version known as SIGNAL 2. Each macroinvertebrate family has been assigned a grade number between 1 and 10 based on their sensitivity to various pollutants. A low number means that the macroinvertebrate is tolerant of a range of environmental conditions, including common forms of water pollution (e.g. suspended sediments and nutrient enrichment).

SIGNAL 2 scores are weighted for abundance, such that the relative abundance of tolerant or sensitive taxa can be taken into account (instead of only the presence / absence of these taxa). The overall SIGNAL 2 score for a site is based on the total of the SIGNAL grade (multiplied by the weight factor) for each taxa present at the site, divided by the total of the weight factors for each taxa at the site.

PET Richness

While some groups of macroinvertebrates are tolerant of pollution and environmental degradation, others are sensitive to these stressors (Chessman 2003). The Plecoptera (stoneflies), Ephemoptera (mayflies), and Trichoptera (caddisflies) are referred to as PET taxa, and they are particularly sensitive to disturbance. There are typically more PET families in sites with good habitat and water quality than in degraded sites, and PET Taxa are often the first to disappear when water quality or environmental degradation occurs (EHMP 2004). The lower the PET score, the greater the inferred degradation.

References

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- EHMP 2004, *Ecosystem Health Monitoring Program, 2002-2003 Annual Technical Report*, Moreton Bay Waterways and Catchment Partnership, Brisbane.