



Water Monitoring

Aquatic Habitat Assessment for Resource Operation Plan Monitoring

October 2008

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1. Purpose and Scope

The purpose of this method is to help identify habitat types and map them for aquatic ecosystem monitoring under Resource Operation Plans. Methods have been adapted from the State of the Rivers (SoR) Project.

2. Permits and Approvals

A general fisheries permit is required for all work that involves 'fish' as defined in s5 of the *Fisheries Act 1994*. Note that early life stages such as eggs, spat or spawn of fish are considered as fish under the Act. Water Accounting and Management (WAM) have obtained a general fisheries permit, which covers the majority of work conducted by officers of the Department of Natural Resources and Water (NRW), who act under the direction of the General Manager, Water Accounting and Management. This permit is valid from 21 May 2007 to 21 May 2012 and is suitable for all activities authorised by the permit. Before undertaking any work, ensure the department's General Fisheries Permit is current and covers the work outlined in this method. Refer to the General Fisheries Permit Work Practice (NRW staff), or contact the Department of Primary Industries and Fisheries (DPI&F) for more information.

Under the *Queensland Nature Conservation Act 1992* (NCA), approval from the Environmental Protection Agency (EPA) is required to conduct activities involving protected wildlife and locations. Failure to obtain approval prior to the commencement of activities is a breach under the NCA. Refer to the EPA permits work practice (NRW staff), or contact the EPA for more information.

Under the *Queensland Animal Care and Protection Act 2001* (the Act), approval from an Animal Ethics Committee (AEC) is required for the use of animals for scientific purposes. Failure to gain approval is a breach of the Act. It is a legal obligation to receive the approval from the AEC in writing, before any project can commence. For more information refer to the Animal Ethics Work Practice (NRW staff), or the DPI&F for more information.

To ensure staff have all the correct permits and approvals in place before using this method, refer to the Permits and approvals checklist (NRW staff), or contact the EPA and DPI&F for more information.

3. Workplace Health and Safety

Risk assessment is of vital importance in reducing risks from potential hazards in the workplace. In section 27A of the *Workplace Health and Safety Act 1995*, five basic steps are outlined that must be followed to manage exposure to risks. The Workplace Health and Safety Queensland Risk Management Code of Practice 2007 outlines the obligations of both the employer and employee when carrying out risk assessment in the workplace. More information can be found at:

- [Workplace Health and Safety Queensland Risk Management Code of Practice 2007](#)
- *Workplace Health and Safety Act 1995*

NRW recommends a minimum of two persons per sampling party for all fieldwork. Ensure that all risk assessment and trip approval paperwork is completed and that a ring-in schedule has been arranged. When working in areas potentially inhabited by estuarine crocodiles, additional protective measures must be taken. Refer to the appropriate guidelines.

Before following the methods contained in this document, a detailed risk assessment should be undertaken. Table 1 outlines the areas to be completed.

Table 1: Workplace health & safety risk for monitoring standard for aquatic habitat assessment for resource operations plan monitoring (See Appendix A for NRW risk analysis matrix and NRW Risk scores)

CONTEXT Define the context of what risks are to be covered & identify the specific activity to be assessed	HAZARDS Make a record of each hazard (a hazard is something with the potential to cause harm)	RISK List the risks to health & safety posed by each hazard	RISK RATING Evaluate the risks to health & safety posed by each hazard			CONTROL MEASURES List suitable control members to eliminate, substitute, isolate, reduce or engineer out the risks	MONITORING What monitoring is proposed or already in place, to ensure that controls are effective in reducing/eliminating risks of hazards	REVIEW DATE List suggested times for the review/update of monitoring procedures
			CONSEQUENCE	LIKELIHOOD	RATING			
FIELD OPERATIONS undertaking sampling on-site	Unpredictable water depths & velocities	Drowning Personal Injury	Major	Unlikely	Medium (14)	Life-jackets to be worn at all times Ensure staff are capable swimmers First Aid Qualifications	Life-jackets to be tested Updating of First Aid qualifications Appropriate call-in procedure in place	Annually
	Sun & heat exposure	Sunburn & heat exhaustion	Minor	Unlikely	Low (5)	Appropriate PPE to be utilised	Monitor condition of PPE	Annually
	Navigation of unstable terrain	Personal Injury	Minor	Possible	Medium (8)	Appropriate PPE to be utilised First Aid Qualifications Two staff members to travel together at all times	Monitor condition of PPE Updating of First Aid qualifications	Annually
	Collision Car Rollover Breakdown	Personal Injury	Catastrophic	Rare	Medium (15)	Recovery equipment to be carried at all times Drive with due care 4WD training qualifications	Condition of car & recovery equipment to be inspected prior to leaving office Updating of driving licences	Annually

Note: Table 1 has been filled out as an example only.

4. Skills/Competency and Experience Required

None identified. Staff skills, training and experience records should be kept up to date.

5. Chemicals

None identified. Users should refer to the appropriate Material Safety Data Sheets prior to using any chemicals <http://www.msds.com/>.

6. Equipment

The following equipment is required:

- Field datasheets
 - SoR datasheet three - Site description ([Appendix B](#))
 - SoR datasheet five - Channel habitat classification ([Appendix C](#))
 - SoR datasheet nine – Vegetation ([Appendix D](#))
 - SoR datasheet ten - Aquatic habitat ([Appendix E](#))
- Calculator
- Tape measures (100 m and 50 m)
- Camera and film or digital camera and batteries
- Stationery including pencils, erasers, clipboards, etc.
- Rangefinder
- Clinometer
- Global Positioning System (GPS)

7. Method

7.1 Aquatic Habitat Assessment

This method has been adapted from the SoR project methodology. Only datasheets three, five, nine and ten of this methodology are to be used for aquatic habitat assessments. Datasheet nine has been modified to only include the aquatic vegetation component.

7.1.1 Datasheet three – Site description

The aim is to provide a description of the site location, using a grid reference or a latitude/longitude (GPS preferred), as well as using local land marks. The description should be detailed and precise, so that follow-up surveys can find the exact spot again. A standard set of photographs is to be taken of the site.

Completing datasheet three

1. fill in mandatory information at the top of the sheet:

- Site Number
- Tributary Name
- Date
- Recorder (officers name)

2. Flows into – name of stream tributary flows into (e.g. Seven Mile Creek flows into Granite Creek, which flows into Baffle Creek)
3. Site description – broad description on how to get to the site (e.g. turn left into Three Mile Ck Rd, 500 m after Bruce Highway crossing of Granite Creek. Go along 4 km to low level crossing)
4. Location description – the location of the site on the actual stream (e.g. 200 m upstream of the low level crossing)
5. Sketch – draw mud map to aid in finding the site. Add any distinguishing features to make it easier to find
6. Type of site – mark the box corresponding to the type of site. In most cases it will be a 'Full Survey Site'
7. Map number – number of topographic map where site is located (e.g. 9248)
8. Grid reference – Eastings and Northings read off topographic map
9. Latitude and longitude – coordinates given by GPS in degrees, minutes and seconds
10. GPS – mark this box if the latitude and longitude were taken from a GPS unit. If not mark the 'Other' box
11. Map scale – scale of topographic map (e.g. 1:100 000)
12. Tidal/non-tidal – mark the relevant box whether the site is 'tidal' or 'non-tidal'
13. Photographs – for each new film a number should be allocated which is to be written on the film canister and the film container. That number is the 'Film No'. Take photos upstream, downstream, lateral left and lateral right, reach environs and any distinguishing feature or activity at the site

NOTE: Face downstream to determine left and right bank. Place the shot numbers of the camera in the appropriate box to correspond with the photo taken.

EXAMPLE: Taking photographs and capturing information for site description. This section of datasheet three is magnified below for clarification.

	Film No.	Shot	Shot
Upstream	3 2	1 0	
Downstream	3 2	1 1	
Lateral Left	3 2	1 5	
Lateral Right	3 2	1 3	
Reach Environs	3 2	1 2	
Distant View			
Feature <u>Logjam</u>	3 2	1 4	
Feature _____			

7.1.2 Datasheet five – Channel habitat classification

The aim is to classify the segments of the reach into the following broad types:

- waterfall
- cascade
- rapid
- riffle
- glide
- run

- pool
- backwater

These represent the broad range of aquatic habitats and the range of sediments, flows and depths present in the reach. This classification is important for both the physical and environmental condition of the stream.

Cross-sections are taken at the point of maximum thalweg depth (pool) and at the point of minimum thalweg depth (maximum bed height) (riffle) in the reach.

Completing datasheet five

1. Fill in mandatory information at the top of the sheet:

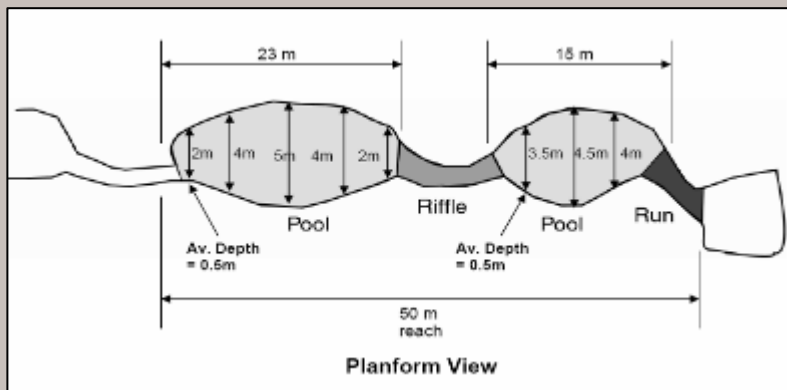
- Site Number
- Tributary Name
- Date
- Recorder (officers name)

2. Select your reach (see datasheet five for guidelines on selecting a reach)

3. Complete sections one, two and three. You may find it easier to complete these sections back to front:

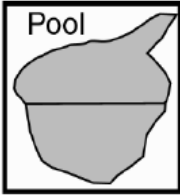
- Section one: Sketch – draw the reach including all habitat types, widths, lengths, direction of flow and any other key features. TIP: Use diagrams and descriptions on data sheet to help you identify habitat types
- Section two: Total length of reach - in metres
- Section three: Channel habitat types – for each habitat you have identified in the reach, indicate what proportion (out of 100 percent) of that reach is made up of those habitats and place this percentage in the ‘% of section’ box. For each habitat, estimate the AVERAGE length, depth, width and height and gradient (where applicable). Please note, it is the average, therefore if you have two pool habitats and one is 15 m long and the other is 23 m long, then the average is 19 m

EXAMPLE: Completing channel habitat classification section one:



Continued on next page

EXAMPLE: Completing channel habitat classification section three:

Depth > 0.5 m where stream widens or deepens and current declines		<table border="1"> <tr><td></td><td>7</td><td>6</td></tr> <tr><td></td><td>1</td><td>9</td></tr> <tr><td></td><td>0</td><td>5</td></tr> <tr><td></td><td></td><td>3</td><td>6</td></tr> </table>		7	6		1	9		0	5			3	6	% of section	Calculations:
				7	6												
				1	9												
				0	5												
		3	6														
Est. Av. length (m)	$\% \text{ of section} = \frac{23m + 15m}{50m}$																
Est. Av. depth (m)	$\text{Est. Av. length (m)} = \frac{23m + 15m}{2}$																
Est. Av. Width (m)	$\text{Est. Av. width (m)} = \frac{2m + 4m + 5m + 4m + 2m + 3.5m + 4.5m + 4m}{8}$																

7.1.3 Datasheet nine – Vegetation (in part)

Riparian and aquatic vegetation is becoming recognised as one of the most important features for assessing the condition of streams. Riparian vegetation acts to:

- Stabilise the banks
- Provide shade and shelter
- Provide leaf litter and other organic debris to the stream
- Provide a remnant wildlife corridor
- Provide for enhanced fish habitat
- Provide a buffer zone for intercepting sediments and nutrients

Riparian and aquatic vegetation is assessed in terms of percentage cover for various growth forms and key local native and weed species. The percentage of each group, which has been replaced by exotic species, is also assessed.

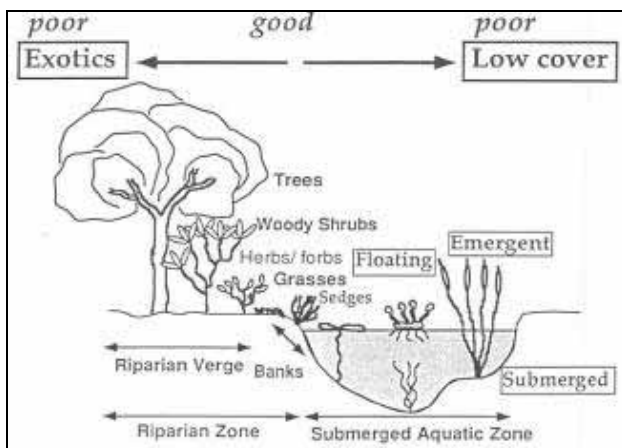


Figure 2: Vegetation assessment

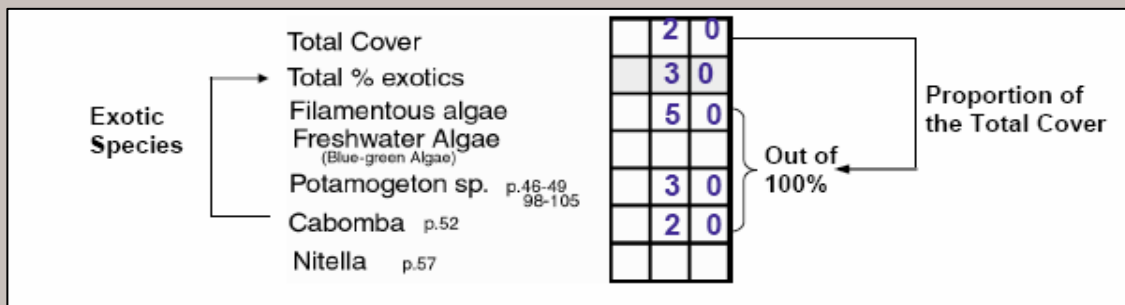
Completing datasheet nine (in part)

1. fill in mandatory information at the top of the sheet:

- Site Number
- Tributary Name
- Date

- Recorder (officers name)
2. Complete section nine: All aquatic vegetation
- Visible depth (m) – record to what depth you can see into the water
 - Too turbid (presence only) – mark this box if you cannot see into the water at all. This means you will only be recording the presence of aquatic vegetation by placing a '1' in the box and do not need to record the percent cover for each type.
 - % Bare (no vegetation) – what percentage of the bed area is not covered by aquatic vegetation (i.e. bare of vegetation).
 - Total % weed and exotic species – what proportion of the total cover provided by the aquatic vegetation is actually provided by exotic species.
3. Complete section ten: Submerged/floating leaf
- Total cover – what percentage of the bed area is covered by submerged aquatic vegetation (out of 10 percent).
 - Total % exotics – what proportion of the cover provided by submerged vegetation is actually provided by exotic species.
 - Species composition – for each submerged vegetation species present, assess the proportion of the total cover that is provided by that species. These values must add up to 100 percent.

EXAMPLE: Submerged vegetation provides cover over 30 percent of the bed surface. Of that 30percent, 50 percent is Filamentous Algae, 30 percent is Potamogeton sp. and the remaining 20 percent is Cabomba. This also means that the cover is made up of 20 percent exotic species, because Cabomba is an introduced species.



4. Complete Sections 11 (floating vegetation) and 12 (emergent vegetation):

- Complete the same as section 10 but for floating and emergent vegetation

NOTE: The total covers for submerged, floating and emergent aquatic vegetation can add up to more than 100 percent as the zone of habitation for each type may overlap.

7.1.4 Datasheet ten - Aquatic habitat

Some of the attributes collected on the other sheets are important for assessing aquatic habitat. These include:

- Channel habitats (pool, riffles and runs)
- Depth
- Bed substrates

Cover of various types is also important for fish and invertebrates. In stream cover in the form of logs and branches provide shelter and attachment points, and also increase the diversity of flow and depth in the channel. Bank and vegetation cover also provide shade and shelter for the stream.

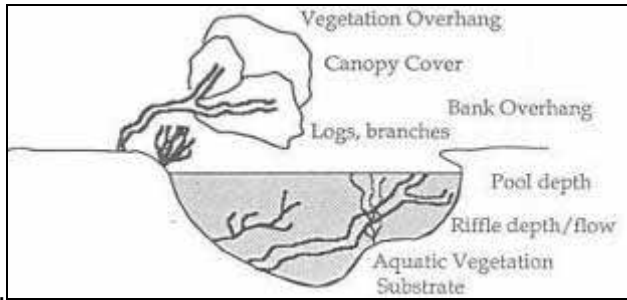



Figure 4: Aquatic habitat assessment

Completing datasheet ten

1. fill in mandatory information at the top of the sheet:
 - Site Number
 - Tributary Name
 - Date
 - Recorder (officers name)
2. Water too turbid to estimate – if the water is too turbid then mark this box. Only record the ‘presence’ of instream debris. TIP: This means you indicate presence by putting a ‘1’ in the patches box and do not need to record % cover.
3. Instream debris cover – for each debris type record the number of patches and the percentage of the bed area covered by the debris. TIP: in the bottom left hand corner of the datasheet there are examples of what certain % cover may look like.

EXAMPLE: There are five individual logs that provide cover over 5 percent of the bed area.

 diam. > 250 mm	<table border="1" style="border-collapse: collapse;"> <tr> <td colspan="3" style="text-align: center;">Individual log</td> </tr> <tr> <td style="text-align: center; width: 20px;">5</td> <td colspan="2" style="text-align: center;">patches (record No.)</td> </tr> <tr> <td style="width: 20px;"></td> <td style="width: 20px;"></td> <td style="text-align: center;">5 % bed cover</td> </tr> </table>	Individual log			5	patches (record No.)				5 % bed cover
Individual log										
5	patches (record No.)									
		5 % bed cover								

4. Stream cover – for the left and right banks determine the percentage of the bank length that provides canopy cover, vegetation overhang, root overhang, bank overhang and man-made overhang over the stream. Record the average width of the stream bed that is covered by each of the cover types.
5. Canopy cover - vegetation overhang, root overhang, bank overhang and man-made overhang over the stream. Record the average width of the stream bed that is covered by each of the cover types.

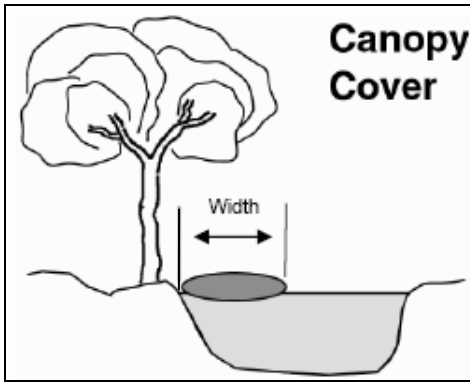


Figure 5: Canopy cover assessment

6. Overall aquatic rating for all aquatic life – using all the information you just recorded mark one box to best describe the overall condition of the aquatic habitat of the site.

7.2 Variation to method

None identified.

7.3 Limitations of Use

This method is used for aquatic habitat assessment for resource operation plan monitoring only.

8. Quality Assurance

Complete and accurate completion of field sheets.

9. References

NRM 2004, Guide to datasheets, State of the rivers methodology, Queensland Department of Natural Resources and Mines, Brisbane.

Anderson, J.R. 1993, State of the rivers project: Report 1: development and validation of the methodology. East Lismore, N.S.W AquaEco Services.

10. Appendices

Appendix A

Table 2: NRW risk analysis matrix

LIKELIHOOD	CONSEQUENCES				
	Insignificant No measurable physical effects on staff/public, no medical treatment, incident of low level short term inconvenience.	Minor Minor effects on staff/public, minimal medical treatment, minor threat to safety systems, low level incident.	Moderate Serious harm to staff/public (<30%), medical treatment required, safety system breach, significant incident.	Major Single fatality or major physical harm to staff/public (30%), serious medical treatment/hospitalisation, safety systems major failure.	Catastrophic Multiple fatalities or significant irreversible damage to public/staff (>50%), large-scale medical attention/hospitalisation, complete breakdown of safety system.
Almost certain is expected to occur in most circumstances >90%	Medium (11)	Medium (16)	High (20)	Extreme (23)	Extreme (25)
Likely Will probably occur in many circumstances 70%	Low (7)	Medium (12)	High (17)	High (21)	Extreme (24)
Possible Will probably occur at some time 30-70%	Low (2)	Medium (8)	Medium (13)	High (18)	High (22)
Unlikely Could occur at some time but it is improbable 10-30%	Low (2)	Low (5)	Medium (9)	Medium (14)	High (19)
Rare May occur only in exceptional circumstances <10%	Low (1)	Low (3)	Low (6)	Medium (10)	Medium (15)

Table 3: NRW risk scores

Risk Level	Risk Score	Definition/Action Required
Extreme	23-25	Grave risk, risk not acceptable, immediate urgent action required. Stop activity immediately.
High	17-22	Risk not acceptable. Prompt management action required.
Medium	8-16	Prompt action is highly desirable. Scheduled management action required.
Low	1-7	Scheduled corrective actions as part of normal operations.

Appendix B

STATE OF THE RIVERS --- SHEET 3			<i>Site Description</i>			Date (dd/mm/yy) []/[]/[]	Recorder _____																																																						
Basin [] [] [] []	Sub-section [] [] [] []	Site [] [] [] []	Tributary Name _____	Flows into _____	Flows into _____	Assistant _____																																																							
Gauging Station [] [] [] []	Type [] []	Region [] [] []	Site Description (locality name) _____	Location Description (how to find it again) _____			Type of Site																																																						
Map Number [] [] [] []	Grid Reference E [] [] [] [] N [] [] [] []	Latitude [] [] [] [] [] [] [] []	Longitude [] [] [] [] [] [] [] []	GPS ? <input type="checkbox"/>	Other <input type="checkbox"/>	Est. Position Error ± [] [] [] m	<input type="checkbox"/> Photograph Only <input type="checkbox"/> Full Survey Site <input type="checkbox"/> Stream Gauge <input type="checkbox"/> Water Quality <input type="checkbox"/> Other _____ <input type="checkbox"/> Other _____																																																						
Map Scale 1: [] [] [] []	AMTD (from map) [] [] [] []	Total U/S Distance (add AMTD's) [] [] [] []	Is the Site Tidal ? <input type="checkbox"/>	Non - Tidal <input type="checkbox"/>	Catchment Area (sq. km) [] [] [] []																																																								
<p>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 again for future follow-up surveys.</p> <div style="border: 1px solid black; height: 400px; width: 100%;"></div>				<p>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 photographs</p> <p>Altitude (m) [] [] []</p> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>Film No.</th> <th>Shot</th> <th>Shot</th> <th>Shot</th> <th>Shot</th> </tr> </thead> <tbody> <tr><td>Upstream</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td></tr> <tr><td>Downstream</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td></tr> <tr><td>Lateral Left</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td></tr> <tr><td>Lateral Right</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td></tr> <tr><td>Reach Environs</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td></tr> <tr><td>Distant View</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td></tr> <tr><td>Feature _____</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td></tr> <tr><td>Feature _____</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td><td>[] [] []</td></tr> </tbody> </table> <p>NOTES: _____ _____ _____ _____ _____ _____ _____ _____</p>					Film No.	Shot	Shot	Shot	Shot	Upstream	[] [] []	[] [] []	[] [] []	[] [] []	[] [] []	Downstream	[] [] []	[] [] []	[] [] []	[] [] []	[] [] []	Lateral Left	[] [] []	[] [] []	[] [] []	[] [] []	[] [] []	Lateral Right	[] [] []	[] [] []	[] [] []	[] [] []	[] [] []	Reach Environs	[] [] []	[] [] []	[] [] []	[] [] []	[] [] []	Distant View	[] [] []	[] [] []	[] [] []	[] [] []	[] [] []	Feature _____	[] [] []	[] [] []	[] [] []	[] [] []	[] [] []	Feature _____	[] [] []	[] [] []	[] [] []	[] [] []	[] [] []
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Appendix C

STATE OF THE RIVERS --- SHEET 5 *Channel Habitat*

Date (dd/mm/yy) / /

Recorder _____

Basin Sub-section Site Tributary Name

Selecting a Reach

1 Channel Habitat Types

Habitat Type	Illustration	% of section	Est. Av. length (m)	Est. Av. height (m)	Est. Av. Gradient (deg.)	Est. Av. length (m)	Est. Av. depth (m)	Est. Av. Width (m)
Waterfall Height > 1m Gradient > 60 deg		<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Cascade Step Height < 1m Gradient 5 - 60 deg Strong Currents		<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Rapid Depth > 0.3 m Gradient 3 - 5 deg Strong Currents Rocks break surface		<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Riffle Depth 0.1 - 0.3 m Gradient 1- 3 deg Moderate Currents Surface unbroken but unsmooth		<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Glide Depth < 0.1 m Gradient 1- 3 deg Small Currents Surface unbroken and smooth		<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Run Depth > 0.3 m Gradient 1- 3 deg Small but distinct & uniform current Surface unbroken		<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Pool Depth > 0.5 m where stream widens or deepens and current declines		<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Backwater Depth < 0.3m a reasonable size (>20% of channel width) cut-off section away from the channel		<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

2 REACH DETAILS

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.

Total Length of reach (m)

3

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

Appendix D

STATE OF THE RIVERS --- SHEET 9

Vegetation

Basin Sub-section Site Tributary Name

Date (dd/mm/yy)

Recorder

Riparian Zone - LEFT BANK
- from the water mark, up & over the bank to edge of stream affected vegetation

1 Width of Riparian Zone (m)

% Bare - no vegetation

Vegetation Cover of the Riparian Zone - over/upto allowed record presence for rare types % cover for abundant sp.

Type	% Cover	% Exotic spp.
Trees > 30 m	<input type="checkbox"/>	<input type="checkbox"/>
Trees 10 - 30 m	<input type="checkbox"/>	<input type="checkbox"/>
Trees < 10 m	<input type="checkbox"/>	<input type="checkbox"/>
Woody Shrubs	<input type="checkbox"/>	<input type="checkbox"/>
Vines	<input type="checkbox"/>	<input type="checkbox"/>
Rushes & Sedges	<input type="checkbox"/>	<input type="checkbox"/>
Herbs/ non-woody S	<input type="checkbox"/>	<input type="checkbox"/>
Grasses	<input type="checkbox"/>	<input type="checkbox"/>
Tree Ferns	<input type="checkbox"/>	<input type="checkbox"/>
Ferns / Bracken	<input type="checkbox"/>	<input type="checkbox"/>
Mosses	<input type="checkbox"/>	<input type="checkbox"/>
Mangroves	<input type="checkbox"/>	<input type="checkbox"/>
Salt Marsh	<input type="checkbox"/>	<input type="checkbox"/>
Palms	<input type="checkbox"/>	<input type="checkbox"/>

Local Sp.

Local Sp.

Local Sp.

3 Total % Weeds and exotic spp. in zone

Local Species Checklist - Recorded - Yes No

	rare	abundant		rare	abundant
Rainforest	<input type="checkbox"/>	<input type="checkbox"/>	2 Exotic grasses	<input type="checkbox"/>	<input type="checkbox"/>
Casuarina	<input type="checkbox"/>	<input type="checkbox"/>	Lomandra	<input type="checkbox"/>	<input type="checkbox"/>
Melaleuca	<input type="checkbox"/>	<input type="checkbox"/>	Longitola	<input type="checkbox"/>	<input type="checkbox"/>
Callistemon	<input type="checkbox"/>	<input type="checkbox"/>	Bunya Pine	<input type="checkbox"/>	<input type="checkbox"/>
Exotic Pines	<input type="checkbox"/>	<input type="checkbox"/>	Guava	<input type="checkbox"/>	<input type="checkbox"/>
Willow	<input type="checkbox"/>	<input type="checkbox"/>	Acacia	<input type="checkbox"/>	<input type="checkbox"/>
Poplar	<input type="checkbox"/>	<input type="checkbox"/>	Callitris (native pine)	<input type="checkbox"/>	<input type="checkbox"/>
Campfor laural	<input type="checkbox"/>	<input type="checkbox"/>	Palms	<input type="checkbox"/>	<input type="checkbox"/>
Lantana	<input type="checkbox"/>	<input type="checkbox"/>	Privet	<input type="checkbox"/>	<input type="checkbox"/>
Rubber vine	<input type="checkbox"/>	<input type="checkbox"/>	Chinese elm	<input type="checkbox"/>	<input type="checkbox"/>
Para Grass	<input type="checkbox"/>	<input type="checkbox"/>	Sand paper fig	<input type="checkbox"/>	<input type="checkbox"/>

The Riparian Zone is the corridor of vegetation along the edge of a stream or river which is intrinsically linked with the stream both in providing leaf and branch litter to the stream and being affected by the extra moisture available. Its width (to a maximum of 50m). The strip chosen should be relatively homogeneous. Disturbed zones may be very narrow.

Trees
Woody Shrubs
Herbs/ forbs
Grasses
Floating
Emergent
Sedges
Submerged

Riparian Zone Submerged Aquatic Zone

2 The method of assessment is the percentage cover of the designated surface area for each zone. Refer to cover examples as a guide.

Trees = woody, > 2m, 1 stem
Shrub = woody, < 2m / 1 stem or, > 1 stem
Herb = not woody, > 1 stem, short
Sedge & Rush = herbaceous, tufted perennial

8 All Aquatic Vegetation - submerged bed, within the wetted perimeter of the stream

Visible depth (m)

Too turbid - pres only

% Bare - no vegetation

Tot. % Weed & exotic sp.

10 Submerged / Floating level

3 % cover	10 % cover	15 % cover	25 % cover

*1 = presence only record
*00 = not assessed
blank = absent

12 Emergent Veg. % Submerged lands

Total emergents	% Submerged lands
Total % exotic emergents	<input type="checkbox"/>
Phragmites	<input type="checkbox"/>
Typha	<input type="checkbox"/>
Para Grass	<input type="checkbox"/>
Other Rushes & Sedges	<input type="checkbox"/>
Encroaching willows	<input type="checkbox"/>
Other Shrubs & Trees	<input type="checkbox"/>
Local Sp. 1	<input type="checkbox"/>
Local Sp. 2	<input type="checkbox"/>
Local Sp. 3	<input type="checkbox"/>
Local Sp. 4	<input type="checkbox"/>

11 Floating Vegetation % Submerged lands

Total Floating	% Submerged lands
Total % Exotic Floating	<input type="checkbox"/>
Water Hyacinth	<input type="checkbox"/>
Azolla	<input type="checkbox"/>
Water Lilies	<input type="checkbox"/>
Local Sp. 1	<input type="checkbox"/>
Local Sp. 2	<input type="checkbox"/>

9 Vegetation Cover of the Riparian Zone - over/upto allowed record presence for rare types % cover for abundant sp.

Type	% Cover	% Exotic spp.
Trees > 30 m	<input type="checkbox"/>	<input type="checkbox"/>
Trees 10 - 30 m	<input type="checkbox"/>	<input type="checkbox"/>
Trees < 10 m	<input type="checkbox"/>	<input type="checkbox"/>
Woody Shrubs	<input type="checkbox"/>	<input type="checkbox"/>
Vines	<input type="checkbox"/>	<input type="checkbox"/>
Rushes & Sedges	<input type="checkbox"/>	<input type="checkbox"/>
Herbs/ non-woody S	<input type="checkbox"/>	<input type="checkbox"/>
Grasses	<input type="checkbox"/>	<input type="checkbox"/>
Tree Ferns	<input type="checkbox"/>	<input type="checkbox"/>
Ferns / Bracken	<input type="checkbox"/>	<input type="checkbox"/>
Mosses	<input type="checkbox"/>	<input type="checkbox"/>
Mangroves	<input type="checkbox"/>	<input type="checkbox"/>
Salt Marsh	<input type="checkbox"/>	<input type="checkbox"/>
Palms	<input type="checkbox"/>	<input type="checkbox"/>

Local Sp.

Local Sp.

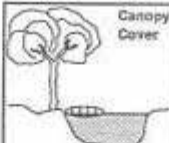

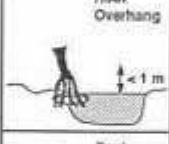
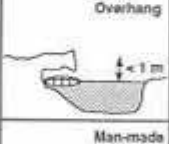
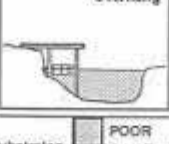




Local Sp.

7 Total % Weeds and exotic spp. in zone

Local Species Checklist - Recorded - Yes No

	rare	abundant		rare	abundant
Rainforest	<input type="checkbox"/>	<input type="checkbox"/>	2 Exotic grasses	<input type="checkbox"/>	<input type="checkbox"/>
Casuarina	<input type="checkbox"/>	<input type="checkbox"/>	Lomandra	<input type="checkbox"/>	<input type="checkbox"/>
Melaleuca	<input type="checkbox"/>	<input type="checkbox"/>	Longitola	<input type="checkbox"/>	<input type="checkbox"/>
Callistemon	<input type="checkbox"/>	<input type="checkbox"/>	Bunya Pine	<input type="checkbox"/>	<input type="checkbox"/>
Exotic Pines	<input type="checkbox"/>	<input type="checkbox"/>	Guava	<input type="checkbox"/>	<input type="checkbox"/>
Willow	<input type="checkbox"/>	<input type="checkbox"/>	Acacia	<input type="checkbox"/>	<input type="checkbox"/>
Poplar	<input type="checkbox"/>	<input type="checkbox"/>	Callitris (native pine)	<input type="checkbox"/>	<input type="checkbox"/>
Campfor Laural	<input type="checkbox"/>	<input type="checkbox"/>	Palms	<input type="checkbox"/>	<input type="checkbox"/>
Lantana	<input type="checkbox"/>	<input type="checkbox"/>	Privet	<input type="checkbox"/>	<input type="checkbox"/>
Rubber vine	<input type="checkbox"/>	<input type="checkbox"/>	Chinese elm	<input type="checkbox"/>	<input type="checkbox"/>
Para Grass	<input type="checkbox"/>	<input type="checkbox"/>	Sand paper fig	<input type="checkbox"/>	<input type="checkbox"/>

Appendix E

STATE OF THE RIVERS --- SHEET 10 <i>Aquatic Habitat</i>				Date (dd/mm/yy) [][]/[][]/[][]	Recorder _____		
Basin	Sub-section	Site	Tributary Name				
[][]	[][]	[][]	[][]				
INSTREAM DEBRIS COVER <small>Assessment is made in terms of the % cover of the surface area for the zone specified for each type.</small>				<small>Water too turbid to estimate pres. only recorded</small>			
Individual Log patches (record No.) [][] % bed cover diam. > 250 mm		Large / deep submerged Veg. patches Freshwater [][] % bed cover		LEFT BANK [][] % bank length type present [][] Est. Av. width (m) [][] % bank length type present [][] Est. Av. width (m) [][] % bank length type present [][] Est. Av. width (m) [][] % bank length type present [][] Est. Av. width (m) [][] % bank length type present [][] Est. Av. width (m) [][] % bank length type present [][] Est. Av. width (m) [][] % bank length type present [][] Est. Av. width (m)			
Log jam < 50% dense patches [][] % bed cover diam. > 300 mm		Large / deep submerged Veg. patches Marine - Zostera etc [][] % bed cover					
Log jam > 50% dense patches [][] % bed cover diam. > 300 mm		Mangroves patches Marine [][] % bed cover					
Individual Branch patches [][] % bed cover diam. < 300 mm		Large patches of Floating Veg. patches [][] % bed cover					
Branch pile < 50% dense patches [][] % bed cover diam. < 300 mm		Emergents perm. water > 0.5 m deep patches [][] % bed cover					
Branch pile > 50% dense patches [][] % bed cover diam. < 300 mm		Tree Roots patches [][] % bed cover					
Terraestrial leaves & twigs patches [][] % bed cover		Rock faces, boulders, cobbles patches [][] % bed cover					
Macrophyte Fragments patches [][] % bed cover		Perm. pool hab. deeper than 1 m patches [][] % bed cover					
Algal clumps and debris patches [][] % bed cover		Man-made structures and debris patches [][] % bed cover		RIGHT BANK [][] % bank length type present [][] Est. Av. width (m) [][] % bank length type present [][] Est. Av. width (m) [][] % bank length type present [][] Est. Av. width (m) [][] % bank length type present [][] Est. Av. width (m) [][] % bank length type present [][] Est. Av. width (m) [][] % bank length type present [][] Est. Av. width (m)			
 Canopy Cover [][] % bank length type present [][] Est. Av. width (m)		 Vegetation Overhang [][] % bank length type present [][] Est. Av. width (m)					
 Root Overhang [][] % bank length type present [][] Est. Av. width (m)		 Bank Overhang [][] % bank length type present [][] Est. Av. width (m)					
 Man-made Overhang [][] % bank length type present [][] Est. Av. width (m)							
Record the number of patches of each type present, and % cover or presence  5% cover  10% cover  15% cover  25% cover '1' = presence only record '99' = not assessed '∅' = absent		OVERALL AQUATIC RATING FOR ALL AQUATIC LIFE Combining all the assessment items and the general signs at the site, give it an overall rating for fish, invertebrates, birds & mammals					
		VERY HIGH / PRISTINE high diversity of depths and substrates * little or no disturbance * abundant and diverse cover * excellent vegetation cover				POOR low diversity of depths and substrates * moderate disturbance * low diversity of cover * poor canopy & other veg. cover	
		GOOD good diversity of depths and substrates * little disturbance * diverse cover * excellent canopy & other veg. cover				VERY POOR no diversity of depths and substrates * high disturbance * no cover or low diversity * no canopy cover, other cover poor	