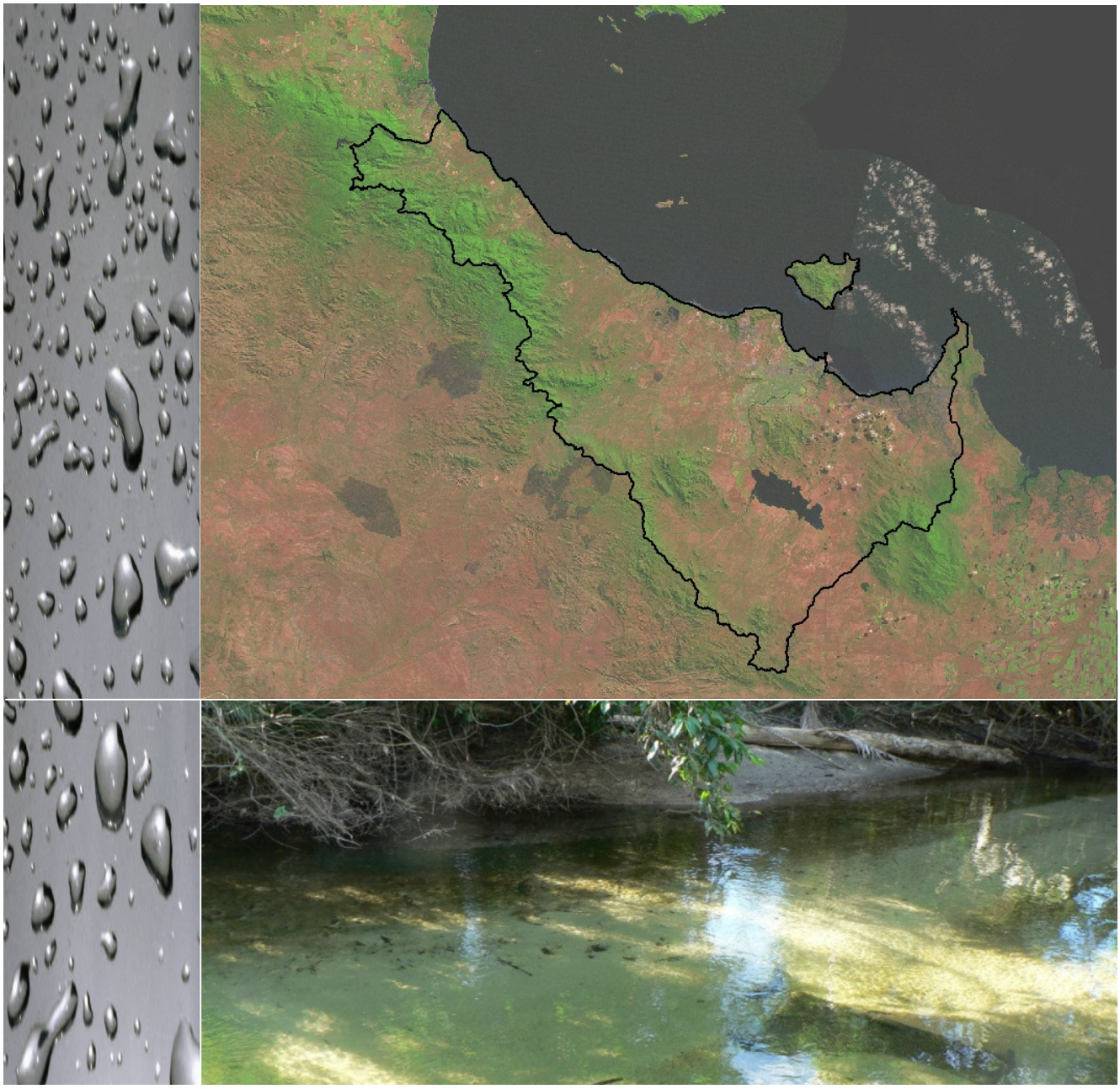

Creek to Coral Coastal Catchment Initiative

Development of a Report Card Format for the Waterways of the Black/Ross Basins

Townsville City Council

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Revision 1

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Executive Summary

The Creek to Coral program was formally launched in October 2003 as a combined Townsville and Thuringowa Local Government infrastructure-based initiative to maintain and enhance our healthy waterways in the coastal dry tropics. An aim of the Creek to Coral program is to determine Environmental Values and the associated Water Quality Objectives for the waterways of the Black River and Ross River Catchments.

The purpose of this document is to develop a report card format, which can be used in conjunction with the Black and Ross River Basins Water Quality Improvement Plan (WQIP). The intended users of the report card format include local government departments, industry, traditional owners, and research and community groups interested in local water quality management. The ultimate outcome is a river health score ranging in the standard A, B, C, D, E and F format. A report card is a useful tool to highlight the effectiveness of water quality improvement management measures implemented as part of the Black/ Ross WQIP. The report card will also to contribute input to the adaptive management strategy and thereby help set new directions for future actions.

The objective of a report card is to present condition assessment data in a non-technical format and to provide a consistent and repeatable way to measure progress made in water quality management. The report card has been developed for the freshwater catchments only due to a lack of information on indicators for the marine environment.

The key indicators for the Report Card are grouped into the following categories:

- Water quality
- Freshwater fish
- Aquatic vertebrates
- Aquatic vegetation
- Riparian vegetation
- Channel and floodplain features

The scoring system adopted enables available information to be utilised in the absence of one or more of the indices for each indicator type.

The proposed report card format is similar to that used by other catchment management authorities however there are several differences in the datasets that will form the basis of the assessment. Most of the required datasets are not based on laboratory testing. Some of the datasets need to be collected by people with specialist training and knowledge however much can be done by individuals that have undergone basic training. In order to progress the development of report cards for each waterway reach the following tasks need to be undertaken:

- Gap analysis of the datasets, other than water quality data;
- Identification or development of standardised forms for the collection of field data;
- Development of a standard for data storage e.g. standardised spreadsheets or a database so that report card data can be easily exchanged between interested parties;
- Discussion between interested parties about who should be responsible for data collection and dataset ownership;
- Prepare report cards for key catchments to test the suitability of the ratings and weightings used;
- Development of high quality templates (e.g. two page summaries) for report card outputs by a communications specialist.

In relation to the marine areas it is recommended that further discussion is held with the GBRMPA. It is important that work in this area is not repeated and it may be best that any data collection feeds into GBRMPA reporting rather than generating a separate level of reporting.

Contents

List of Figures and Tables

Abbreviations

CCI - Coastal Catchments Initiative
C2C - Creek to Coral
DO – Dissolved oxygen
WQIP - Water Quality Improvement Plan

1. Introduction

1.1 Background

The Coastal Catchments Initiative (CCI) is a Commonwealth Government funded program aimed at achieving targeted reductions in pollution discharges to coastal water quality 'hot spots'. Hot spots are broadly defined as coastal waters of high conservation value threatened by pollution, and where there is a strong jurisdictional commitment and capacity to improve water quality. The Great Barrier Reef Catchment is considered to be one hot spot.

The CCI supports the development and implementation of Water Quality Improvement Plans in accordance with the Australian Government *Framework for Marine and Estuarine Water Quality Protection* (EA 2002). The Framework is based on the *National Water Quality Management Strategy* (DEW 2007) and the *National Principles for the Provision of Water for Ecosystems* (ARMCANZ and ANZECC 1996); both approved by Australian Government/State Ministerial Councils.

The Creek to Coral (C2C) program was formally launched in October 2003 as a combined Townsville and Thuringowa Local Government infrastructure-based initiative to maintain and enhance healthy waterways in the coastal dry tropics. The vision of Creek to Coral is to achieve, sustain and promote the benefits of a clean, fresh and marine water ecosystem and to encourage, educate and involve community in integrated waterway management.

C2C is managing the Townsville CCI project, which includes the development of a Water Quality Improvement Plan (WQIP) for the Black and Ross River Basins, the area covered by the C2C initiative. Development of the WQIP involves a number of interrelated tasks with the overall development of the plan to be coordinated by the managers of the C2C program.

An aim of the C2C program is to determine Environmental Values (EV) and the associated Water Quality Objectives for the waterways of the Black River (17) and Ross River (18) Basins as defined by the Australian Water Resources Council (AWR Basins). The Ross Basin has been enlarged to include the catchments of the Alligator Creek sub basin that extend to Cape Cleveland and drain to Cleveland Bay. This area is referred to as the study area in the remainder of this report and is shown in **Figure 1-1**.

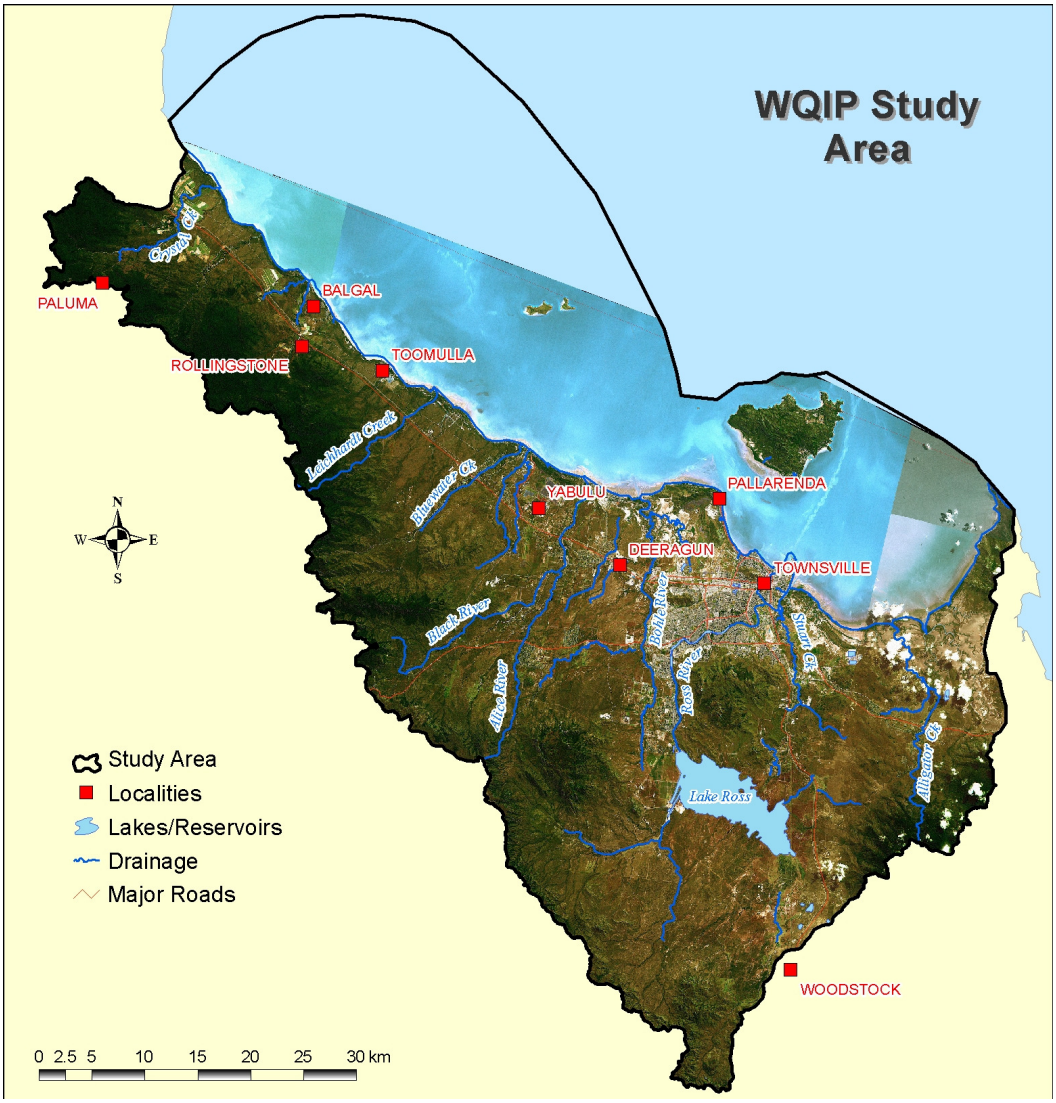


Figure 1-1 Black River and Ross River WQIP study area

1.2 Purpose of this document

The purpose of this document is to develop a report card format, which can be used in conjunction with the Black River and Ross River WQIP. A previous report by Gunn (2006) details the development of a draft report card format for the freshwater environment for the Townsville City Council Stormwater Quality Management Framework.

The intended users of the report card format include local government departments, industry, traditional owners, and research and community groups interested in local water quality management. The aim is to provide an assessment that is based on technical data, which is presented in a non-technical format. This includes an easy to understand rating system, with individual factors, such as water quality, flora and fauna, weighted according to importance and overall relevance to the ecosystem as a whole. The ultimate outcome is a river health score ranging in the standard A, B, C, D, E and F format. This report card is essential to develop effective management strategies for the Black/ Ross Basins.

2. Approach

2.1 General

The draft report card developed by Gunn (2006) is based on the State of the Environment (SOE) reporting with an indication of the Pressures, State and Responses for the waterway and its catchment.

The objective of a report card is to present condition assessment data in a non-technical format and to provide a consistent and repeatable way to measure progress made in water quality management. The non-technical format allows broader community groups to easily understand the current health status of the waterway. Report cards provide a one-off measurement that can be used to compare the present condition with respect to the ideal or natural condition of the creek. The generation of a report card for each waterway is essential in the ongoing development of effective management strategies for the Black/Ross Basins, as an integral component of an adaptive management framework. The publication of an annual report card also plays an important role in raising awareness of changes in condition of waterways and focusing management efforts to the protect the environmental values identified by the community.

The key indicators for the Report Card are grouped into the following categories:

- Water quality
- Freshwater fish
- Aquatic invertebrates
- Aquatic vegetation
- Riparian vegetation
- Channel and floodplain features

3. Assessment Area

The ecosystem report card will generate information for 20 catchments, which have been defined for the Black Basin, 22 catchments that have been defined for the Ross Basin, and 9 catchments for Magnetic Island (refer to **Appendix A**).

Each of the waterways in the study area has been divided into water type reaches. It is envisaged that a report card will be developed for each waterway reach. The following water types have been defined for the study area:

- Upland freshwaters – above 150m AHD;
- Lowland freshwaters – between the upland freshwater and mid-estuarine reaches; and
- Mid-estuarine – based on intersection of waterways and landforms 1 and 2 in regional ecosystem mapping.

It is proposed that samples and/or data for each of the 6 indicators are collected at set representative locations within a section of the stream/waterway.

The report card has been developed for the freshwater catchments only due to a lack of information on indicators for the marine environment.

4. Condition Assessment Data

There is a range of assessment information that has or is currently being collected within the Black/Ross Basins and adjacent marine environment. Although the report cards incorporate a range of indicators, there are significant data gaps and variability within datasets collected for the Black/Ross Basins and adjacent marine environment. In the development of the Report Card format, the scoring scheme must be able to account for the variable and sparse data sources available in different areas of the region.

Although there is a wide range of water quality data currently being gathered for the region, considerable gaps exist within the data sets of a number of waterways within the Black/Ross Basins (Connell Wagner 2007). The main gaps identified within the data were:

- Confusion of GPS coordinates and locations of monitoring sites;
- Inconsistent and insufficient data regarding time and sampling periods; and
- Limited and inappropriate water quality parameters being measured.

Other condition assessment information that is incorporated into the Report Card format for the freshwater environment include fish, macroinvertebrates, riparian condition and channel and floodplain features. Currently there is limited data collected for such indicators, where the majority of data has been collected in such studies as:

- Townsville City Council – Ross Creek Scoping Study (Browne *et al*., 1994);
- Wetlands of the Townsville Area (Lukacs, 1996);
- South Townsville Stormwater Drainage Fish Survey (Webb, 1999);
- Survey of Coastal Vegetation in Townsville City Council Reserve at Rowes Bay (Lokkers, 2000);
- Thuringowa's Wetlands – Review of Status, Protection and Management Needs (Tait, 2006); and
- Event-based Water Quality Monitoring of the Ross and Black Basins during the 2006/07 Wet Season (Liessmann *et al.,* 2007).

The major gaps that are likely to exist within the remaining key indicators (fish, riparian, macroinvertebrates etc) data are:

- Inconsistent and insufficient data in regards to time ; and
- No or limited data for certain indicators (e.g., macroinvertebrates).

In order to satisfy the requirements for the Report Card format for the freshwater and marine environments, the indicators monitored and their frequency needs to be more extensively reviewed.

5. Freshwater Report Card Calculation

The scoring system adopted enables available information to be utilised in the absence of one or more of the indices for each indicator type. In the event that no information is available for an indicator type this is noted and the indicator type is left out of the overall report card calculations. The combination of indicator types are aggregated to give separate scores for water quality (physical and chemical measure, freshwater fish and aquatic invertebrates) and waterway and riparian landscapes which, when combined, give an overall ecosystem/catchment condition score (see Table 5-1). The scoring system for each indicator type is described in Section 6. Testing is required to determine relevance to the Townsville region and develop an appropriate range of scores for report card ratings.

Table 5-1 Description of Grades used in the Draft Report Card

Grade	Description
A	**Excellent.** Conditions meet all set ecosystem health values; all key processes are functional and all critical habitats are in near pristine condition.
B	**Very Good.** Conditions meet all set ecosystem health values in most of the reporting region; most key processes are functional and most critical habitats are intact.
C	**Good.** Most conditions just meet set ecosystem health values. Most key processes are functional, but some critical habitats may be under threat.
D	**Fair.** Conditions meet some of the set ecosystem health values in most of the reporting region; some key processes are functional but some critical habitats are impacted.
E	**Poor.** Conditions are unlikely to meet set ecosystem health values in most of the reporting region; many key processes are not functional and many critical habitats are impacted.
F	**Very Poor.** Conditions do not meet set ecosystem health values; most key processes are not functional and most critical habitats are severely impacted.

6. Report card format

The report card format outlined below (Table 6-1) generates an annual A (excellent) to F (fail) rating for each category, with a combined total score provided for the catchment as a whole. Each ecological indicator is rated and weighted according to relevance and the degree of importance on an ecosystem-wide scale. The weightings of some indices in the scoring system have been revised from those initially suggested by Gunn (2006). For example, nutrients are considered more relevant in terms of ecosystem processes than some physio-chemical parameters, such as conductivity and temperature. For some parameters, such as fecal coliforms, only limited data (if any) is likely to be available, so the scoring system excludes missing values and adjusts the relevant weightings accordingly.

An assessment of aquatic vegetation (i.e. plants living in the water column) has also been included in the report card, as a separate component to riparian vegetation (i.e. land plants growing on the river banks). For macrophytes, a high score would indicate sufficient biomass and/or coverage of beneficial aquatic plants that would be expected in a healthy waterway. Whereas a low score would be recorded for algae if a bloom was present (reported as Chlorophyll-*a*, cyanobacterial counts or a visual assessment of algal biomass).

A summary of the 'catchment condition' has been included with the Channel and Floodplain Features component. This includes an assessment of the extent of clearing and types of land uses within the catchment (industrial, agricultural, residential etc). Such information can generally be derived from topographic maps or GIS data.

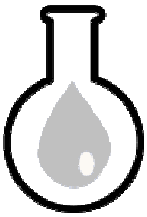
Table 6-1 Scoring System for the Draft Report Card

Group	Key Indicators	Maximum Score	Individual Grade
Water Quality - Physical and Chemical Measures	Dissolved oxygen	5	**A-F**
	pH	5	
	Total Suspended Solids or Turbidity	5	
	Nitrogen (Total N, NO_3^--N, NH_3-N)	6	
	Phosphorus (Total P or PO_4^{3-}-P)	6	
	Total (sum)	**27**	
Freshwater Fish	Native species richness	5	**A-F**
	Exotic Individuals	6	
	Fish assemblage/community composition	5	
	Total (sum)	**16**	
Aquatic Invertebrates	Invertebrate family richness	6	**A-F**
	PET richness	5	
	Signal Score	5	
	Total (sum)	**16**	
Aquatic Vegetation	Chlorophyll-*a*	3	**A-F**
	Nuisance algal blooms	3	
	"Healthy" macrophytes	5	
	Total (sum)	**11**	
Riparian Vegetation	Structural integrity/disturbance	5	**A-F**
	Remnant Veg (%) - Canopy	2	
	- Understorey	2	
	- Ground Cover	2	
	- Leaf Litter	2	
	Weeds (%)	5	
	Total (sum)	**18**	
Channel and Floodplain Features	Undercutting and slump erosion	3	**A-F**
	Gully erosion	3	
	Channel clearing (logs/snags/habitat)	3	
	Channel modification	1	
	Natural floodplain features	1	
	Floodplain modification	3	
	Catchment condition	3	
	Total (sum)	**17**	
All Indicators	**Total (sum)**	**105**	**A-F**

Notes:

- A high score is 'better".
- The total for each category is the sum of the raw score divided by the sum of the maximum possible score. Scores are adjusted for missing data - if a parameter has not been measured it is not included in the equation (i.e. missing values do not equal zero).
- Each indicator is weighted according to their importance in the ecosystem assessment process. For example, water quality is given a higher weighting than channel and floodplain features. In the attached spreadsheet, weighting is automatically adjusted for missing values.

An example of a completed Report Card is provided in **Appendix B**.



6.1.1 Water Quality

Assessment of water quality within the study area has been undertaken by Connell Wagner for the Creek to Coral program (Water Quality Condition Report). The assessment used the *Queensland Water Quality Guidelines 2006* (QWQG, 2006) for slightly-moderately disturbed systems in Tropical Australia[1]. The assessment compared the median, 20th an 80th percentiles against the guideline value for a given water type. The assessment used a three rank system however this has been modified for the report card format. The guidelines for scoring for the report card are shown in Table 6-3.

Table 6-2 Guideline values

Central region water type	Physio-chemical indicator and guideline value (slightly-moderately disturbed systems)													
	Amm N	Oxid N	Org N	Total N	FiltR P	Total P	Chl-a	DO (% sat)		Turb	Secchi	SS	pH	
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	Lower	Upper	NTU	m	mg/L	Lower	Upper
Open coastal	6	3	130	140	6	20	1.0	95	105	1	5	10	8	8.4
Enclosed coastal	8	3	180	200	6	20	2.0	90	105	6	1.5	15	8.0	8.4
Mid-estuarine and tidal canals, constructed estuaries, marinas and boat harbours	10	10	260	300	8	25	4.0	85	105	8	1.0	20	7.0	8.4
Upper Estuarine	30	15	400	450	10	40	10.0	70	105	25	0.4	25	7.0	8.4
Lowland streams	20	60	420	500	20	50	5.0	85	110	50	N/A	10	6.5	8.0
Upland streams	10	15	225	250	15	30		90	110	25	N/A		6.5	7.5
Freshwater lakes/reservoirs	10	10	330	350	5	10	5.0	90	110	1-20	Nd	Nd	6.5	8.0
Wetlands	Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd

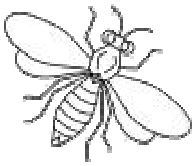
Table 6-3 Scoring for Water Quality

Criteria	Score
The median, 20th and 80th percentiles all within the guideline	5
The median and (20th OR 80th) percentiles within the guideline	4
The 20th OR 80th percentile is within the guideline and the median is outside the guideline	3
The median is outside the guideline, the 20th percentile is less than the guideline and the 80th percentile is greater than the guideline	1
The median, 20th and 80th percentile are either all more or all less than the guideline	0

Only those parameters, which have a guideline limit, have been included in the report card assessment.

[1] Queensland Environmental Protection Agency (2006). *Queensland Water Quality Guidelines 2006.*

6.1.2 Macroinvertebrates



The macroinvertebrate assessment consists of three indices recommended by the *Southeast Queensland Regional Water Quality Management Strategy*[2] – invertebrate family richness, PET richness and the SIGNAL score for pollution sensitivity, described in Table 6-4 and Table 6-6.

The invertebrate family richness score (Table 6-6) is based on the premise that a healthy site will have more families than an unhealthy site because only a few tolerant groups can withstand degraded habitats and poor water quality. Greater than 32 families is considered the upper end of the scale as it is rare to record more than 40 invertebrate families at a single site. Determining the relevant grades to be used is regionally dependent, so the scoring system described here must be tested to determine relevance to the Townsville region. It is recommended that a midpoint of 17 families is used initially to test the regional relevance.

Another assessment of stream health is the PET richness score, which includes three orders of aquatic macroinvertebrates most sensitive to water quality and disturbance. These orders are - Plecoptera (stoneflies – 4), Ephemeroptera (mayflies – 9), and Trichoptera (caddisflies - 22). The total number of families (35 from SIGNAL II Appendix) of these groups occurring at sites can be used to assess degradation of habitat and water quality. This is useful for regional comparisons only as different regions and river systems have natural variation in PET numbers, i.e. the PET richness score should not be used to compare different regions. As above, this index needs to be tested against other water quality measures to determine regional relevance.

Table 6-4 Invertebrate Family Richness score

Invertebrate Family Richness	
Number of Families	**Scoring**
0	0
1 – 5	1
6 – 10	2
11 - 16	3
17 – 25	4
26 – 32	5
> 32	6

Table 6-5 PET Richness score

PET richness	
Number of 'PET' Families	**Scoring**
0	0
1	1
2 – 3	2
4 – 6	3
7 – 11	4
> 11	5

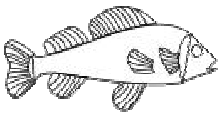
[2] For further details, see: Bunn, S.E. and Smith, M.J. Design and implementation of an ecosystem health monitoring program for streams and rivers in Southeast Queensland, Australia: an overview. *Southeast Queensland Regional Water Quality Management Strategy*. Available URL: http://www98.griffith.edu.au/dspace/bitstream/10072/9103/1/21471.pdf

The SIGNAL (Stream Invertebrate Grade Number Average Level) score is calculated by averaging the pollution sensitivity grade numbers of all invertebrate families present at a site (Table 6-6). For example, taxa with sensitivity grades 8 - 10 are classified as sensitive taxa, whereas grades < 4 are considered pollution tolerant.

Table 6-6 SIGNAL Score for Macro-invertebrate Sensitivity

Description	SIGNAL Score	Scoring
Very poor water quality, no habitat, only pollution-tolerant bugs remain.	< 1	0
Poor water quality and significant habitat disturbance, few pollution-sensitive bugs remain.	1 – 2	1
Fair water quality, potential loss of habitat, average biodiversity and some loss of pollution-sensitive bugs.	3 – 4	2
Excellent water quality, high biodiversity and many high-scoring sensitive water bugs present.	5 – 6	3
Pristine water quality and habitat, with very high biodiversity and many sensitive species.	7 – 8	4
	9 – 10	5

The Townsville City Council Creek to Coral program in conjunction with Conservation Volunteers Australia (CVA) and the Environmental Protection Agency (EPA) have held discussions on the cataloguing of the suite of local/regional macro invertebrates as an identification tool for community Creek Watch groups. Any work to develop regionally relevant macro invertebrate stream health guidelines should be done in conjunction with this partnership as a starting point.



6.1.3 Freshwater Fish Scoring

The scoring system for freshwater fish is adapted from methodology described in the *Southeast Queensland Regional Water Quality Management Strategy* and Gunn (2006). The scoring system for freshwater fish described in Table 6-7 needs to be further refined and tested to determine relevance to the Townsville region. In addition, appropriate reference sites (i.e. relatively un-impacted sites) should be identified and/or surveyed to obtain background data regarding the numbers of fish and species composition of fish communities that would be expected at healthy sites within this region.

Table 6-7 Freshwater Fish Assessment

Parameter	Description	Percentage	Scoring
Native Species Richness	Percentage of Native Species Expected (PONSE): the number of native fish species present at each site compared to the number of fish species expected at the site if it were healthy.	No native species	0
		1 – 20%	1
		20 – 40%	2
		40 – 60%	3
		60 – 80%	4
		> 80%	5
Exotic Species	The proportion of fish at each site that were exotic/introduced species. The relative abundance of exotic species is a measure of increasing environmental stress and degraded water quality and habitat conditions.	> 45%	0
		25 – 45%	2
		5 – 25%	4
		< 5%	6
Fish Community Composition	Fish assemblage O/E ratio: a comparison of the fish community expected (E) with the species composition of the community observed (O) during sampling gives a score reflecting the health of the fish community.	< 15%	0
		15 – 35%	1
		35 – 55%	2
		55 – 65%	3
		65 – 85%	4
		> 85%	5

6.1.4 Aquatic Vegetation

Aquatic vegetation includes submerged, emergent or floating macrophytes (i.e. plants visible to the naked eye, including macroalgae) and microalgae, including cyanobacteria (blue-green algae).

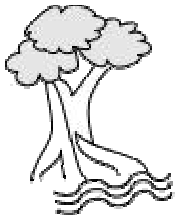
As all aquatic plants, including algae, contain Chlorophyll-*a*, this parameter is often used to indicate plant biomass and the potential for algal blooms. The *Queensland Water Quality Guidelines* (2006) define a Chlorophyll-*a* trigger value of 5.0 µg/L for lowland streams and freshwater lakes/reservoirs of the Central Coast Queensland region. Chl-*a* concentrations above 5 µg/L indicate the potential for phytoplankton and macroalgal blooms. Blooms of cyanobacteria are more common in freshwater reservoirs and other still water bodies with low flow and where stratification of the water column may occur. The ANZECC (2000) guidelines do not provide trigger values for cyanobacteria, but suggest there is a risk to livestock health if counts of toxic *Microcystis* exceed 11,500 cells/mL.

For large aquatic macrophytes, percentage cover, leaf length, biomass and the proportion of dead/dying leaves are often used to assess plant health, but these survey methods are labour intensive and often destructive to the macrophyte beds. Biomass and leaf length are usually species-specific measures and may be applied where detailed knowledge of each species is known. In place of detailed data, however, a general visual assessment can be made of macrophyte health using Table 6-8.

Table 6-8 Assessment of Aquatic Vegetation

Aquatic Vegetation	Description	Score
"Healthy" macrophytes	Degraded: no native species present, greater than 50% coverage of exotic aquatic species (e.g., water hyacinth, water lettuce, salvinia)	0
	Below expected natural extent: some exotic species present, less than 50% coverage of beneficial submerged or emergent macrophytes (excluding winter die-back).	1
	Expected natural extent: no exotic species present, 50 - 75% coverage of native submerged macrophytes.	3
	Above expected natural extent: no exotic species present, greater than 75% cover of submerged or emergent native macrophyte species (e.g. families Hydrocharitaceae, Characeae, Cyperaceae, Lemnaceae, Potamogetonaceae, etc).	5
Nuisance Algal Blooms (macroalgae, phytoplankton cyanobacteria)	Eutrophic - Excessive nuisance algal growth: thick scum of >80% coverage OR microalgae levels >15,000 cells/mL OR free-floating macroalgal bloom OR toxic cyanobacterial bloom. Waterways are choked, beneficial aquatic plants are smothered and fish kills are likely to occur.	0
	Medium algal growth: light scum of < 80% coverage OR microalgae levels 5,000-15,000 cells/mL OR toxic cyanobacterial species (e.g., Microcystis) < 10,000 cells/mL OR heavy filamentous algal growth on native macrophytes, with the potential to detach and result in free-floating blooms.	1
	Light algal growth: sufficient macroalgae and microalgae present to provide a food source for aquatic fauna. For example, some growth of filamentous algae on macrophytes, rocks and other hard substrate. No nuisance algal blooms or toxic cyanobacterial species present.	3
Chlorophyll-*a*	The median, 20th and 80th percentiles all within the guideline	3
	The 20th OR 80th percentile is within the guideline and the median is outside the guideline	2
	The median is outside the guideline, the 20th percentile is less than the guideline and the 80th percentile is greater than the guideline	1
	The median, 20th and 80th percentile are either all more or all less than the guideline	0
Maximum Score		**11**

* Note: 1 - 2 µg/L is a common limit of detection for Chlorophyll-*a* at many analytical laboratories.



6.1.5 Riparian Vegetation

Riparian vegetation incorporates terrestrial plants growing on, or near, the banks of rivers, streams and other water courses and water bodies. The scoring system is described in the tables below.

Table 6-9 Structural Integrity and Disturbance of Riparian Vegetation

Proportion of Riparian Zone Disturbed	Description	Score
100% Modified	Riparian zone is significantly modified and/or cleared. Natural vegetation has been replaced by exotic species, mown or grazed areas, or is bare, paved or built on. Very few natural features remain.	0
Highly Disturbed	A sparse density of original native tree species remain (< 50%), clearing has occurred, with major infestation of weeds (> 50%) in the understorey.	1
Moderate disturbance	A moderate density of remnant native tree species remains (50 – 75%). Landscape may have been cleared, but regrowth of native tree species has occurred, with major infestation of exotic species in the understorey (> 50%).	2
Moderate disturbance	Native vegetation remains but understorey or canopy have been disturbed or invaded by exotic tree species. Weeds or exotic species comprise less than 25% of the total area of the understorey or < 25% of tree stems.	3
Minor Disturbance	Some minor alterations may have occurred to the landscape due to the removal of individual trees, minor encroachment of exotic species or other minor disturbance of the creek edges.	4
Undisturbed	Native vegetation appears undisturbed and intact. Exotic species are minimal.	5

Table 6-10 Percent Cover of Native Riparian Vegetation

Riparian Vegetation	Description	Percent Cover of Native Riparian Species	Score
Canopy (> 5m high)	Native vegetation (remnant or regrowth), usually 5 – 18m high. Canopy is important for habitat, bank stability and shading to prevent growth of weeds and algae.	< 25%	0
		25 – 50%	1
		> 50%	2
Understorey (1 – 5m high)	Provides shading and important habitat for terrestrial fauna (birds, mammals, etc).	< 25%	0
		25 – 50%	1
		> 50%	2
Ground Cover (< 1m high)	Provides shading, terrestrial habitat and a source of food (berries, etc) for aquatic fauna, such as fish and turtles	< 25%	0
		25 – 50%	1
		> 50%	2
Leaf Litter	Important as a source of decaying organic matter and nutrients for growth of vegetation. Also provides protection from raindrop impact and reduces sediment erosion.	< 25%	0
		25 – 50%	1
		> 50%	2
Maximum Score			**8**

Note: The percentage vegetation cover for each of the structural components needs to be related to the Regional Ecosystems (REs) that naturally occur/would have occurred, in the riparian zone and the scoring system adjusted accordingly to suit the characteristics of the REs. For example the percentage cover for the various structural components of a closed forest community is different to that of a woodland community. It should also be noted that the presence and condition of native vegetation in the riparian zone is not a water quality health indicator but rather a terrestrial biodiversity health indicator i.e. catchment condition.

Table 6-11 Percent Cover of Terrestrial Weeds (Exotic Species)

Description	Weeds (% cover)	Score
Weed species likely to occur in North Queensland (Townsville region) catchments include: para grass, guinea grass, hymenachne, rubber vine, Chinee apple, lantana and African tulips.	> 75%	0
	50 – 75%	2
	25 – 50%	3
	< 25%	5

6.1.6 Channel and Floodplain Features

The channel and floodplain features component of the scorecard incorporates clearing and modification of creek channel itself, the surrounding floodplain and land uses in the broader catchment. The major land uses in catchments of the Townsville region are likely to be clearing for urban or commercial developments and agriculture (e.g. grazing or cropping, predominantly sugar cane). The proportion of catchment cleared and various land uses can generally be derived from topographic maps, aerial photographs or GIS data (e.g. Geoscience Australia).

Table 6-12 Channel and floodplain features

Indices	Description	Scoring
Undercutting and slump erosion	Major U & S erosion	0
	Moderate U & S erosion	1
	Minor U & S erosion	2
	No U & S visible	3
Gully erosion	Major gully erosion	0
	Moderate gully erosion	1
	Minor gully erosion	2
	No gully erosion	3
Channel clearing (logs/snags, habitat, etc)	All of channel cleared (concrete-lined drains, etc)	0
	Significant channel clearing (>50%)	1
	Some channel clearing (<25 %)	2
	Pristine, no channel clearing has occurred	3
Channel modification (weirs, etc)	Weir or dam present at site or nearby	0
	No weirs at site or within 1 km upstream or downstream of site	1
Natural floodplain features	No natural floodplain features present	0
	Natural floodplain features present	1
Floodplain modification	Major clearing and development of floodplain, mostly impervious surfaces (>60%) with few natural features remaining.	0
	Moderate clearing and floodplain development, some impervious surfaces (25-60%) but some natural features and vegetation remain.	1
	Minor clearing, with some light development (housing, lawns etc), with few impervious surfaces (<25%).	2
	No visible evidence of floodplain clearing.	3
Catchment condition (land use, etc)	Heavily impacted: heavy industry and/or sewage treatment plant discharging treated or untreated effluent into waterways.	0
	Moderate impacts: medium density industrial or commercial, heavy agricultural (e.g., cropping, fertilisers) land uses, with high probability of significant pollutants entering waterways via stormwater runoff or wet weather overflow, etc.	1
	Minor impacts: light residential, commercial or agricultural (e.g., grazing) land uses, with likelihood of minor pollutants entering waterways via stormwater runoff, etc.	2
	Catchment in near pristine condition with little or no land uses or anthropogenic activities likely to impact on waterways.	3
Maximum Score		**17**

7. Graphical Representation of Report Card

The Report Card generates an annual A (excellent) to F (fail) for the 6 categories before quantifying a final grade for individual catchments. To visually represent the individual categories and final catchment scores of the Black/Ross Basins as a whole, it is proposed that this information is graphically represented on layers of the Black and Ross Basins, which have previously been divided into catchments. This graphical representation will allow the end audience to easily identify the catchments within the Black or Ross Basins and their corresponding indicator and catchment scores.

The first process of graphically representing the report card scores, is the assignment of individual colours to the grades A to F (refer to Table 7-1).

Table 7-1 Colours representation of grades

Grade	Description
A	**Excellent.** Conditions meet all set ecosystem health values; all key processes are functional and all critical habitats are in near pristine condition.
B	**Very Good.** Conditions meet all set ecosystem health values in most of the reporting region; most key processes are functional and most critical habitats are intact.
C	**Good.** Most conditions just meet set ecosystem health values. Most key processes are functional, but some critical habitats may be under threat.
D	**Fair.** Conditions meet some of the set ecosystem health values in most of the reporting region; some key processes are functional but some critical habitats are impacted.
E	**Poor.** Conditions are unlikely to meet set ecosystem health values in most of the reporting region; many key processes are not functional and many critical habitats are impacted.
F	**Very Poor.** Conditions do not meet set ecosystem health values; most key processes are not functional and most critical habitats are severely impacted.

For each catchment, a pie divided into 6 equal segments will represent the 6 indicators. Each indicator will be represented by a figure symbolic of each indicator (refer to **Figure 7-1**). Following the determination of grades for each indicator, the section of the pie relating to its individual indicator will be shaded with the grades corresponding colour. The final catchment score will also be displayed by shading the entire catchment with its grades corresponding colour. An example which illustrates what a basin layer may resemble, once both its catchments and corresponding indicators have been assigned has been displayed in **Figure 7-2**.

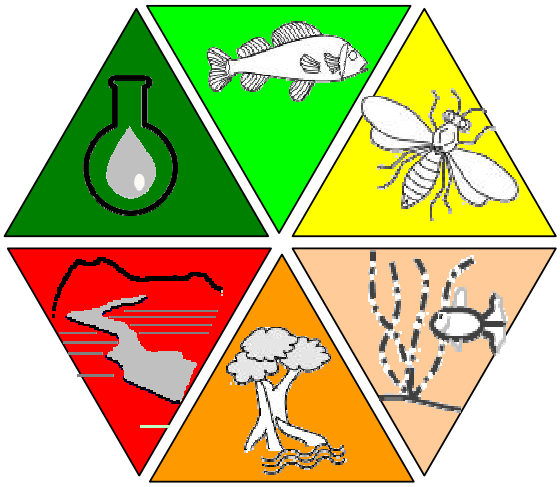


Figure 7-1 Example graphic of report card results

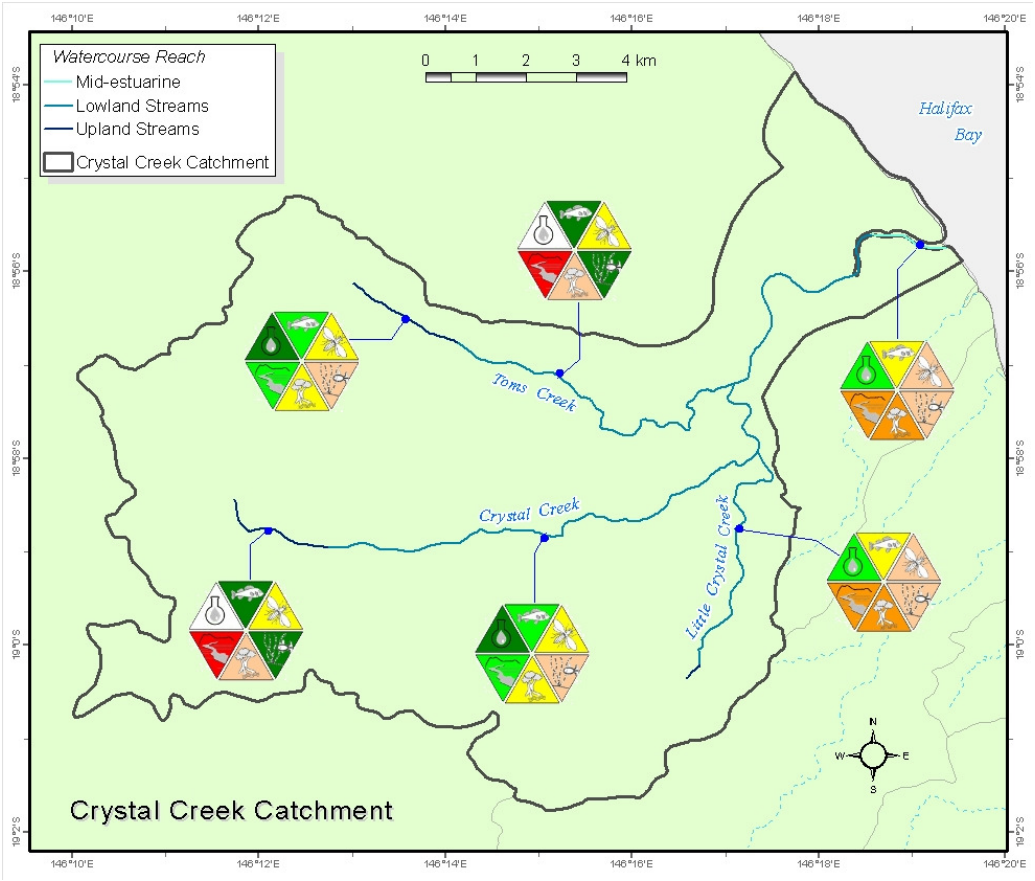


Figure 7-2 Example of catchment map showing report card results

8. Conclusions

The report card concept has been used extensively in recent years to provide information on the catchment health to a non-technical audience. It is a valuable communication tool to demonstrate how actions taken (and dollars spent) are actually impacting on the catchment. The baseline data proposed for the study area can be used to report to a variety of audiences (see Figure 8-1). Much of the proposed data for the report card has multiple uses, and for some catchments data has been already collected. A gap analysis has been performed for the water quality data for the study area but a similar analysis needs to be performed for the other proposed datasets.

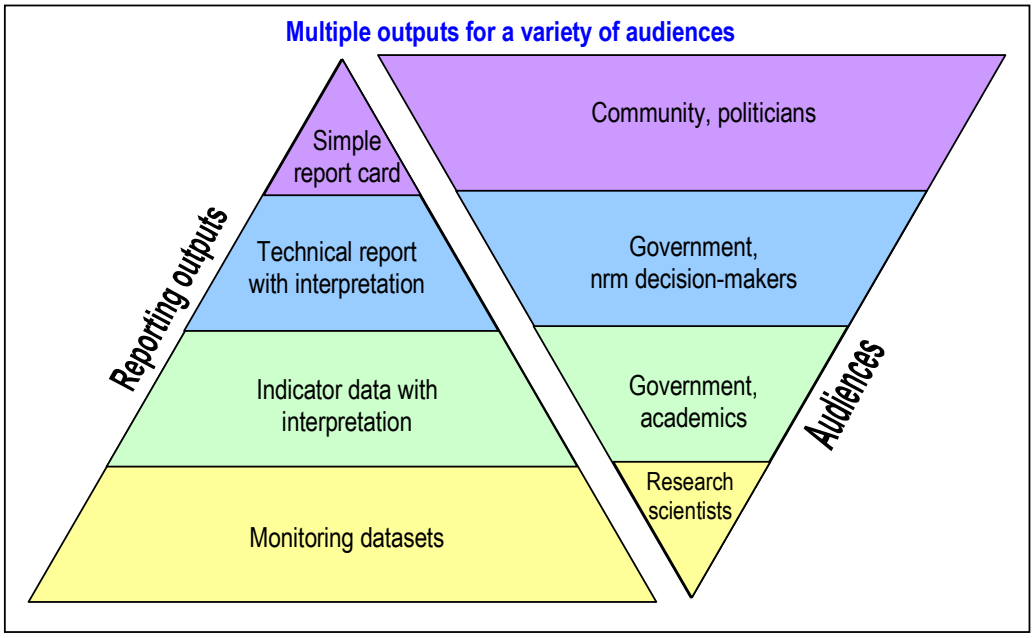


Figure 8-1 Relationship between reporting card outputs and target audience (Vandergragt 2008)

The proposed report card format is similar to that used by other catchment management authorities however there are several differences in the datasets that will form the basis of the assessment. Most of the required datasets are not based on laboratory testing. With the exception of the water quality data, some of which needs to be laboratory tested, the data will need to be collected in the field. Some of the datasets need to be collected by people with specialist training and knowledge however much can be done by individuals that have undergone basic training.

Unlike datasets that rely on testing of parameters in the water, most of the datasets for the report card only need to be collected 1-2 times per year. Due to the variability of parameters in the water column it is necessary to perform testing at least monthly to determine a representative value.

The likely frequency of data collection and the level of training required for each of the datasets is shown in Table 8-1.

Table 8-1 Monitoring frequency and training required for report card datasets

Group	Indices	Specialist Assessment	Frequency
Water Quality - Physical and Chemical Measures	Dissolved oxygen	Laboratory testing Non-specialist collection	Monthly (events)
	pH		
	Total Suspended Solids or Turbidity		
	Nitrogen (Total N, NO_3^--N, NH_3-N)		
	Phosphorus (Total P or PO_4^{3-}-P)		
Freshwater Fish	Native species richness	Specialist training	Wet & dry season
	Exotic Individuals		
	Fish assemblage/community composition		
Aquatic Invertebrates	Invertebrate family richness	Specialist training	Wet & dry season
	PET richness		
	Signal Score		
Aquatic Vegetation	Chlorophyll-*a*	Laboratory testing	Wet & dry season
	Nuisance algal blooms	Basic training	
	"Healthy" macrophytes		
Riparian Vegetation	Structural integrity/disturbance	Basic training	Annually
	Remnant Veg (%) - Canopy		
	- Understorey		
	- Ground Cover		
	- Leaf Litter		
	Weeds (%)		
Channel and Floodplain Features	Undercutting and slump erosion	Basic training	Annually
	Gully erosion		
	Channel clearing (logs/snags/habitat)		
	Channel modification		
	Natural floodplain features		
	Floodplain modification		
	Catchment condition		

9. Recommendations

In order to progress the development of report cards for each waterway reach the following tasks need to be undertaken:

- Gap analysis of the datasets, other than water quality data;
- Identification or development of standardised forms for the collection of field data;
- Development of a standard for data storage eg. Standardised spreadsheets or a database so that report card data can be easily exchanged between interested parties;
- Discussion between interested parties about who should be responsible for data collection and dataset ownership;
- Prepare report cards for key catchments to test the suitability of the ratings and weightings used; and
- Development of high quality templates (eg two page summaries) for report card outputs by a communications specialist.

In relation to the marine areas it is recommended that further discussion is held with the GBRMPA. It is important that work in this area is not repeated and it may be best that any data collection feeds into GBRMPA reporting rather than generating a separate level of reporting.

10. References

ANZECC & ARMCANZ (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* National Water Quality Management Strategy Paper no. 4, Australian and New Zealand Environment and Conservation Council, Canberra.

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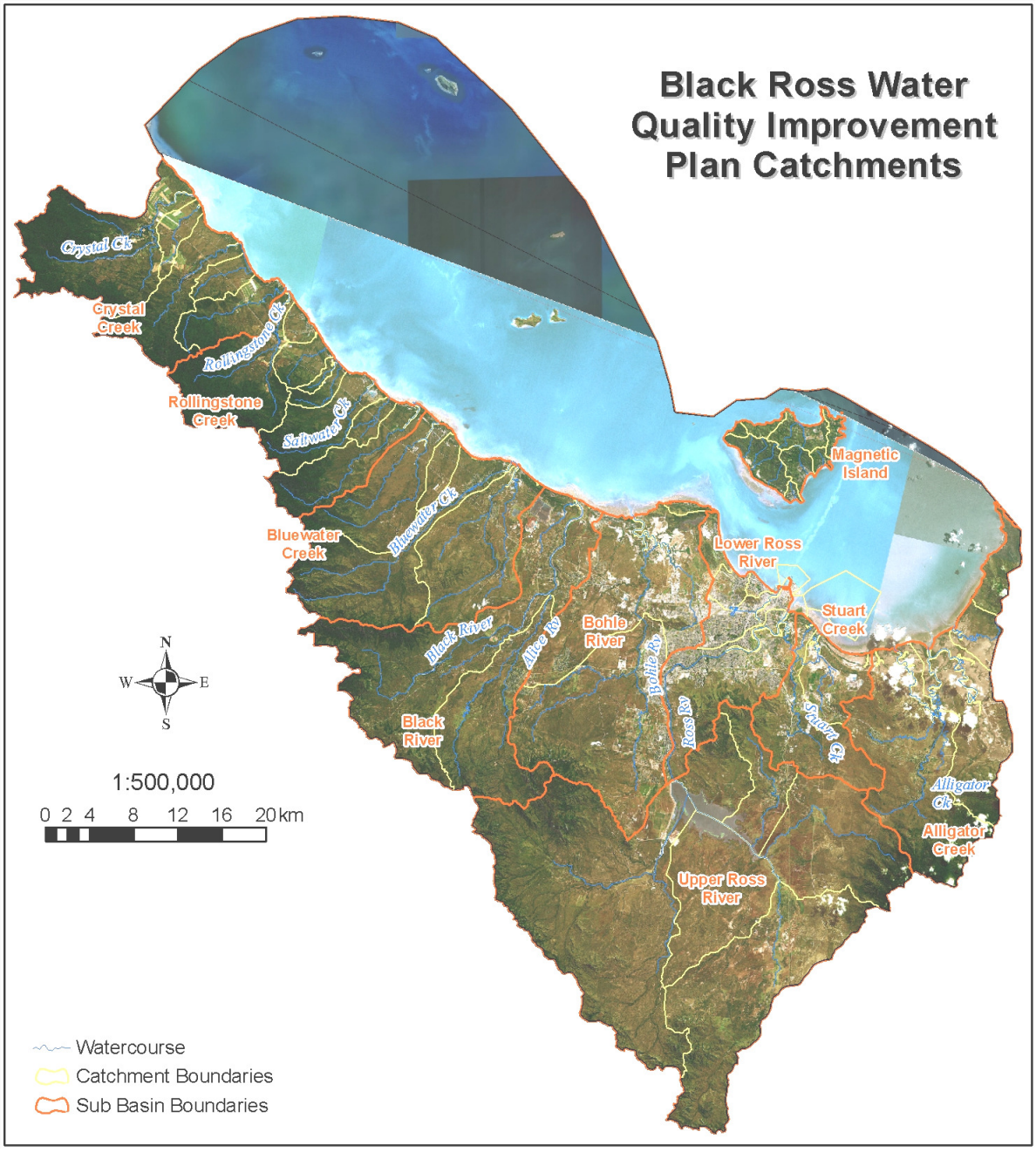
Vandergragt, Maria (2008), What's in a report card: lessons from the Great Barrier Reef. Coast to Coast '08. 18-22 August 2008 Darwin.

Appendix A

Catchments in the study area

Appendix A

Catchments in the study area



Appendix B

Example score card

Appendix B

Example score card

Connell Wagner

File : 27807-004
Env : KLR
QA : NAP

Townsville City Council - Creek to Coral Coastal Catchment Initiative
Example of Completed Report Card

Group	Indices	Raw Score	Maximum Score	Raw / Max Score	Individual Grade	Reliability of Grade
Water Quality - Physical and Chemical Measures	Dissolved oxygen	4	5	80%	C	OK
	pH	4	5	80%		
	Conductivity	3	3	100%		
	Water Clarity (Total Suspended Solids or Turbidity)		5	ND		
	Nitrogen (Total N, NO_3-N, NH_3-N)	3	6	50%		
	Phosph -P)	5	6	83%		
	Total (	19	33	76%		
Freshwater Fish	Native		5	ND	no data	
	Exotic		6	ND		
	Fish as composition		5	ND		
	Total (		16			
Aquatic Invertebrates	Inverte		6	ND	no data	
	PET ric		5	ND		
	Signal Score		5	ND		
	Total (sum)		16			
Aquatic Vegetation	Chlorophyll-*a*	3			A	Not enough data - grade unreliable
	Nuisance algal blooms					
	"Healthy" macrophytes					
	Total (sum)	3				
Riparian Vegetation	Structural integrity/disturbance	4			D	OK
	Remnant Veg (%) - Canopy	1				
	Remnant Veg (%) - Understorey	1				
	Remnant Veg (%) - Ground Cover	1				
	Remnant Veg (%) - Leaf Litter	2				
	Weeds (%)	3				
	Total (sum)	12	18	67%		
Channel and Floodplain Features	Undercutting and slump erosion		3	ND	C	OK
	Gully erosion	3	3	100%		
	Channel clearing (logs/snags/habitat)		3	ND		
	Channel modification	0	1	0%		
	Natural floodplain features	1	1	100%		
	Floodplain modification	2	3	67%		
	Catchment condition (landuse, clearing, industry)	2	3	67%		
	Total (sum)	8	17	73%		
All Parameters	Total (sum)	42	111			

Missing values are discounted and do not affect the scoring system.

In this case, there is only limited data available for the aquatic vegetation component; therefore, the grade given probably has a fairly low level of reliability.

Note: "ND" = no data available for that parameter

Final Grade: C

The "Final Grade" summarises all available data and provides an overall assessment of river and catchment health.