HEALTHY WATERS PARTNERSHIP dry tropics

Townsville Dry Tropics
Waterways Report Card 2024

TECHNICAL REPORT

PART 3: Freshwater Results

Reporting on data collected 2022 - 2023

10 Freshwater Environment

Within the freshwater environment, water quality, pesticides, habitat and hydrology, and fish are the four indices scored. Each of these indices are made up of indicator categories and indicators which are updated on varying time scales from annually to every three to four years. All indicator categories use data provided by multiple partners of the Partnership. In the Townsville Dry Tropics region, the water quality and pesticides indices are updated annually, with the most recent data from the 2022–2023 financial year.

For the first time since the Partnership began reporting, the Pesticides index has been included in the technical report. However, as of the 2022-2023, report the pesticides index is not combined with the water quality index and is not representative of the entire Ross and Black Basins, but rather the specific sampling sites within the Ross and Black Basins. This is because it uses a different method of calculation in comparison to the other water quality measures and data is only sourced from two locations.

Index scores are calculated for the Ross Freshwater Basin and the Black Freshwater Basin. The extent of each basin is shown in Figure 17 (below), and the results are presented below.

10.1 Water Quality

The water quality index for the freshwater environment of the Townsville Dry Tropics regions consists of two indicator categories: Nutrients, and Physical-Chemical Properties. These are divided into five indicators and for each indicator the parameters used to calculate the scores were the:

- Water Quality Objectives (WQOs);
- Scaling factors (SF);
- Annual medians, calculated from the monthly medians; and
- 80th percentile (and 20th percentile for DO), calculated from the monthly medians, and,
- The weighted basin scores include the proportion of the sub basin area for each basin area.

The Townsville Dry Tropics Methods Document (2024) provides definition of the WQO and SF for each watercourse, and the conversion of the raw data to a standardised score using the annual medians and percentiles, and sub basin weights. Values can also be found in Appendix H and Appendix J.

The nutrients indicator category is comprised of two indicators, Dissolved Inorganic Nitrogen (DIN), and Total Phosphorus (TP) and the scores for nutrients are averaged from the scores of the two indicators. The physical-chemical properties indicator category is comprised of three indicators, Turbidity, High DO, and Low DO. The score is calculated as the average of Turbidity and the minimum score from High DO and Low DO.

10.1.1 Monitoring Sites

Data for the two freshwater indicator categories are collected from the same sites. There are 24 sites (codes) spread across the two basins, divided into eight (8) sub basins in line with the Water Quality Improvement Plan (WQIP) WQIP (Townsville City Council, Queensland Government, Australian Government 2010) (Table 23 and Figure 17).

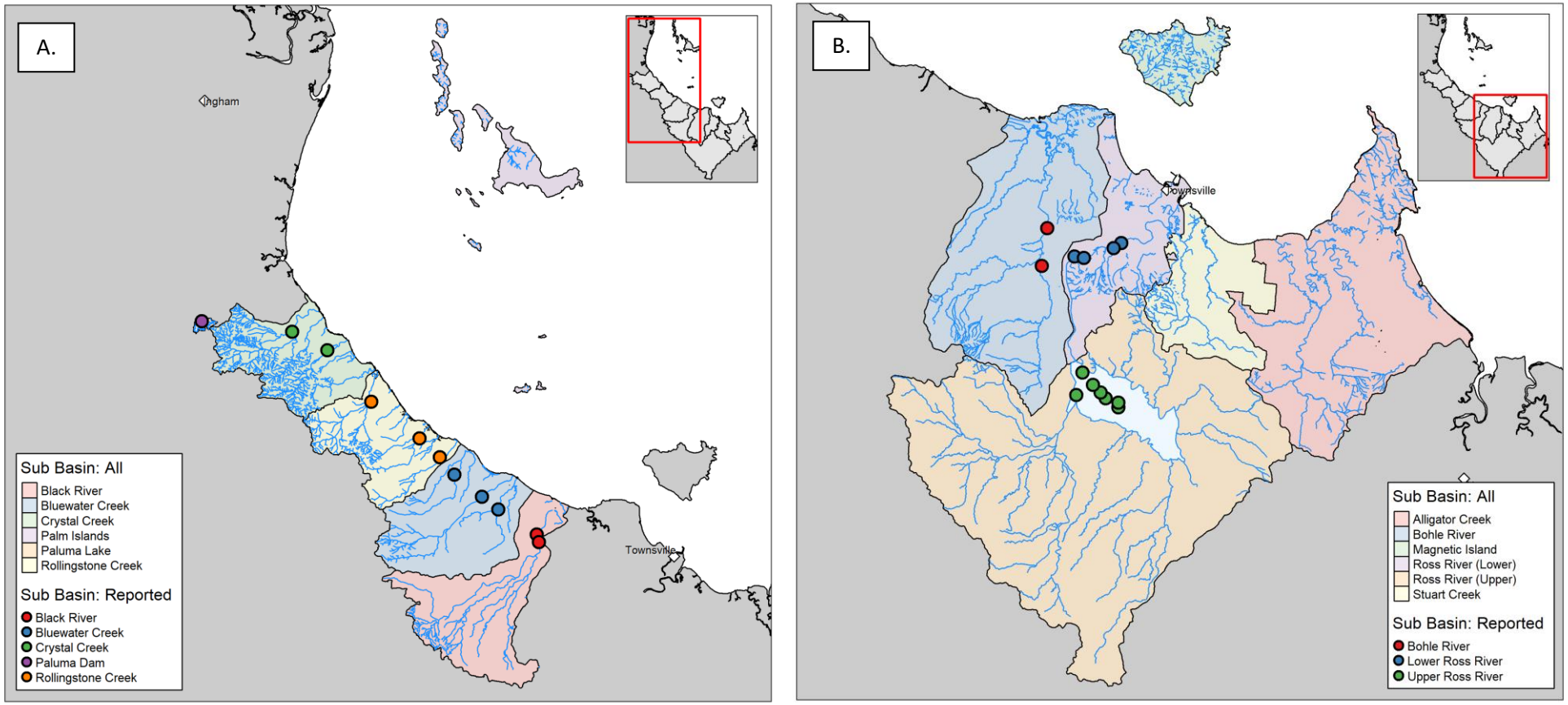

Figure 17. Freshwater basins (A. = Black, B. = Ross), and sub basins (see legend).

Table 23. Townsville Dry Tropics freshwater water quality site summary.

Basin	Sub Basin	Watercourse	Number of Sites
Ross	Upper Ross	Ross Lake	7
	Lower Ross	Ross River	4
	Bohle	Bohle River	2
Black	Black River	Black River	2
	Bluewater Creek	Althaus Creek	1
		Bluewater Creek	1
		Sleeper Log Creek	1
	Rollingstone Creek	Leichhardt Creek	1
		Saltwater Creek	1
		Rollingstone Creek	1
	Crystal Creek	Ollera Creek	1
		Crystal Creek	1
	Paluma	Paluma Lake	1

10.1.2 Overall Summary: Freshwater Water Quality

The overall water quality grade remained "good" in both the Black and Ross Freshwater Basins, however scores decreased noticeably in the Ross Basin (Table 24). This decrease in the Ross was largely driven by a change in grade and score for nutrients ("good"(69) to "moderate" (60)).

Table 24. Freshwater Water Quality Index Scores and Grades with comparison to previous years.

Basin	Nutrients	Phys-Chem Properties	Water Quality				
			22-23	21–22	20–21	19–20	18–19
Ross	60	74	67	70	73	70	66
Black	70	63	66	68	68	67	62

Standardised scoring range: Very Poor (E) = 0 to <21 | Poor (D) = 21 to <41 | Moderate (C) = 41 to <61 | Good (B) = 61 to <81 | Very Good (A) = 81 – 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

10.1.2.1 *Key Messages*

- The Ross Freshwater Basin grade remained "good" although the score declined slightly from 70 to 67.
    - Most influential was the decline in the score for Dissolved Inorganic Nitrogen (DIN) in the Bohle River which saw a decrease in score from 70 to 67 within the same grade of "good".
    - Nutrients in the Ross Freshwater Basin decreased from "good" to "moderate", whilst physical-chemical properties did not change grade.
- The Black Freshwater Basin score decreased from 68 to 66 within the same grade of "good".
    - Neither nutrients nor physical-chemical properties changed notably.
- The Bohle River Total Phosphorus (TP) grade remained "very poor" for the fifth year in a row, and the DIN grade decreased from "poor" to "very poor" compared with 2021-2022.

- Althaus Creek shows ongoing low scores and grades for the TP and Turbidity indicators, and further investigation would be required to isolate specific drivers.
- DIN values in the Upper Ross and Paluma Lake sub basins remain “NA” due to the Water Quality Objective values (WQOs) being equal to or less than the Limit of Reporting values (LOR).

10.1.3 Nutrients

For the 2022–2023 technical report the nutrients indicator category is comprised of two indicators, Dissolved Inorganic Nitrogen (DIN), and Total Phosphorus (TP). The scores and grades for the Ross and Black freshwater basins, and their associated sub basins are presented in Table 25. Annual medians, samples collected, months sampled, WQOs, and SFs are presented in Appendix H. Historical scores are presented in Appendix I.

As there have been continuous gaps in the data for TP, investigation is continuing into the potential to include Filterable Reactive Phosphorus (FRP) in the analysis. Discussions for this are ongoing.

10.1.3.1 *Results: Freshwater Nutrients*

The nutrient indicator category for the Ross Freshwater Basin was graded as “moderate” with a weighted score of 60, a decrease from the previous report of 69 (good). The Upper Ross sub basin maintained its “good” grade, however, did not receive DIN scores as the assigned water quality objective (WQO) is equal to or less than the limit of reporting (LOR). The Lower Ross sub basin maintained a “good” grade, whilst the Bohle River sub basins decreased from “poor” to “very poor”. The decrease in grades in the Bohle River sub basin was caused by a decrease in score and grade for the DIN indicator. The source of nutrient inputs continues to require investigation, so that management can be implemented to improve the water quality.

The nutrients indicator category for the Black Freshwater Basin was graded as “good” with a weighted score of 70, an increase from the previous report’s score of 68 (good). Sub basins grades for nutrients ranged from “moderate” to “very good”, with a “very poor” grade for the TP indicator at Althaus Creek. Despite an overall increase in basin score, TP scores continue to decline at Althaus Creek (Appendix I) and require additional investigation to determine the cause. Paluma Lake did not receive DIN scores due to issues with LOR and WQO values.

Table 25. Unweighted and weighted standardised scores and grades for the nutrient indicators and indicator category in the Townsville Dry Tropics Freshwater Basins.

Basin	Sub Basin	Watercourse	Unweighted Score and Grade					Weighted Score and Grade	
			DIN	TP	Nutrients[3]	Weighting (proportion)	Area (km2)	Sub Basin	Basin
Ross	Upper Ross	Ross Lake	NA[3]	73	73	0.32	458	23.4	60
	Lower Ross	Aplins Weir	62	ND	62	-	-	-	
		Gleesons Weir	59	ND	59	-	-	-	
		Blacks Weir	63	90	76	-	-	-	
			61	90	66	0.56	786	37.1	
	Bohle River	Bohle Mid-Field	0	0	0	-	-	-	
		Bohle Far-Field	0	0	0	-	-	-	
			0	0	0	0.12	169	0	
			37	40	45	1	1413		
Black	Black River	Black River	63	39	51	0.37	250	19.1	70
	Bluewater Creek	Althaus Ck	90	18	54	-	-	-	
		Bluewater Ck	73	90	81	-	-	-	
		Sleeper Log Ck	90	77	83	-	-	-	
			84	61	73	0.24	162	17.6	
	Rollingstone Creek	Leichhardt Ck	90	90	90	-	-	-	
		Saltwater Ck	90	90	90	-	-	-	
		Rollingstone Ck	61	90	75	-	-	-	
			80	90	85	0.21	145	18.3	
	Crystal Creek	Ollera Ck	90	90	90	-	-	-	
		Crystal Ck	90	90	90	-	-	-	
			90	90	90	0.17	116	15.5	
	Paluma Lake	Paluma Lake	NA[4]	90	90	0	2	0.3	
			82	76	79	1	675		

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 90. (Scores are capped at 90) | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

[3] Sites indicators are average within each indicator to calculate watercourse indicators which are averaged to calculate sub basin indicators. Watercourse indicators are averaged between each indicator to calculate watercourse indicator categories, which are averaged to calculate sub basin indicator categories.

[4] Data removed as the LOR was >= the WQO, and more than half (Ross Lake: 214 of 234, Paluma Lake: 17 of 24) of the concentration values were <= the WQO.

10.1.4 Physical-Chemical Properties

For the 2022–2023 technical report the physical-chemical properties indicator category is comprised of three indicators, Turbidity (NTU), High DO, and Low DO. The scores and grades for the Ross and Black freshwater basins, and their associated sub basins are presented in Table 26. Annual medians, samples collected, months sampled, WQOs, and SFs are presented in Appendix J. Historical scores are presented in Appendix K.

10.1.4.1 *Results: Freshwater Physical-Chemical Properties*

The physical-chemical indicator category for the Ross Freshwater Basin was graded as “good” with a weighted score of 74, an increase from the previous report of 68 (good). The Upper Ross sub basin was graded as “very good”, the Lower Ross sub basin was graded as “good”, and the Bohle River sub basin was graded as “moderate”. Both the Upper Ross and Bohle sub basins did not record a change in grade, however the Lower Ross basin increased (from “moderate” to “good”). This increase was driven by improvements in the low DO indicator at the Gleeson and Blacks Weir sites (increased from “very poor” to “good” and “moderate” respectively).

The physical-chemical indicator category for the Black Freshwater Basin was graded as “good” with a weighted score of 63, a slight decrease from the previous report of 64 (good). Sub basins grades ranged from “moderate” to “good”. However, turbidity was “very poor” at Althaus Creek and Sleeper Log Creek, and low DO was “very poor” at Ollera Creek. Despite little change in the overall basin score, turbidity scores continue to remain “very poor” at Althaus Creek and Sleeper Log Creek and require additional investigation to determine the cause.

Table 26. Unweighted and weighted standardised scores and grades for the physical-chemical properties indicators and indicator category in the Townsville Dry Tropics Freshwater Basins.

Basin	Sub Basin	Watercourse	Unweighted Score and Grade						Weighted Score and Grade	
			Turbidity	High DO	Low DO	PhysChem	Weighting (proportion)	Area (km2)	Sub Basin	Basin
Ross	Upper Ross	Ross Lake	90	90	90	90	0.32	458	28.8	74
	Lower Ross	Aplin's Weir	90	90	46	68	-	-	-	
		Gleesons Weir	90	90	67	78	-	-	-	
		Blacks Weir	90	90	44	67	-	-	-	
			90	90	53	71	0.56	786	40.0	
	Bohle River	Bohle Mid-Field	62	90	50	56	-	-	-	
		Bohle Far-Field	63	90	0	31	-	-	-	
			63	90	25	44	0.12	169	5.3	
			81	90	49	65	1	1413		
Black	Black River	Black River	72	64	90	68	0.37	250	25.4	63
	Bluewater Creek	Althaus Ck	0	51	90	25	-	-	-	
		Bluewater Ck	70	90	62	66	-	-	-	
		Sleeper Log Ck	13	90	72	43	-	-	-	
			28	77	75	45	0.24	162	10.8	
	Rollingstone Creek	Leichhardt Ck	68	90	62	65	-	-	-	
		Saltwater Ck	57	90	90	73	-	-	-	
		Rollingstone Ck	90	90	51	70	-	-	-	
			72	90	67	69	0.2148	145	15	
	Crystal Creek	Ollera Ck	90	90	0	45	-	-	-	
		Crystal Ck	90	90	90	90	-	-	-	
			90	90	45	67	0.1719	116	11.6	
	Paluma Lake	Paluma Lake	90	90	52	71	0.003	2	0.2	
			64	83	66	62	1	675	64	

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 90. (Scores are capped at 90) | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

10.1.5 Confidence Scores

There was low confidence in the water quality scores for the Ross Freshwater Basin due to limited spatial sampling in the basin, with only two rivers and Ross Lake sampled. There was moderate confidence in the water quality scores for the Black Freshwater Basin, with most major watercourses sampled. The score for each criterion is shown in Table 27.

Table 27. Confidence scores for the freshwater water quality indicator categories.

Basin	Indicator category	Maturity (*0.36)	Validation (*0.71)	Representativeness (*2)	Directness (*0.71)	Measured error (*0.71)	Final Score	Rank
Ross	Nutrients	2	3	1	3	1	7.6	Low (2)
	Phys-chem	2	3	1	3	1	7.6	Low (2)
	Water quality index						7.6	Low (2)
Black	Nutrients	2	3	1.5	3	1	8.6	Mod (3)
	Phys-chem	2	3	1.5	3	1	8.6	Mod (3)
	Water quality index						8.6	Mod (3)

Rank based on final score: Very low (1): 4.5 – 6.3; Low (2): >6.3 – 8.1; Moderate (3): >8.1 – 9.9; High (4): >9.9 – 11.7; Very high (5): >11.7 – 13.5.

Confidence criteria were scored 1–3 and weighted by the value identified in parenthesis. Weighted scores were summed to produce a final score (4.5 – 13.5). Final scores were ranked from 1 to 5 (very low to very high).

10.2 Pesticides

The pesticides index (Pesticides Risk Metric – PRM) for the freshwater environment of the Townsville Dry Tropics region represent the average pesticide risk over the wet season for 182 days. 22 pesticides, including nine PSII herbicides (Photosystem II inhibitors), 10 non PSII herbicides and three insecticides were measured. The wet season is determined as commencing when a rise in river water level occurs, which coincides with an increase in aqueous pesticides concentrations (M.St.J. Warne 2023).

10.2.1 Monitoring Sites

Data for the pesticides index are collected from two sample sites, one in the Ross Freshwater Basin, along Ross River, and one in the Black Freshwater Basin, along Black River (Table 28, and Appendix O).

Table 28. Townsville Dry Tropics freshwater pesticides site summary.

Basin	Sub Basin	Watercourse
Ross	Lower Ross	Ross River
Black	Black	Black River

10.2.2 Overall Summary: Pesticides

As noted above, the pesticide index and pesticide results are not representative of the entire Ross and Black Basins, but rather the individual monitoring sites within each Basin. Further, the pesticides index is a risk matrix, even if scores are “very good”, this does not necessarily indicate the absence of pesticides completely.

The overall pesticides grade was “very good” at both sampling sites within the Black and Ross Freshwater Basins (81 and 82 respectively). (Table 24). This is the first year that pesticides data have been reported in the HWP Technical Report. Historical data shown has been back calculated.

Table 29. Freshwater Pesticides Index Scores and Grades with comparison to previous years.

Monitoring Site	Pesticides				
	22-23	21–22	20–21	19–20	18–19
Ross River	81 (A)	89 (A)	94 (A)	89 (A)	98 (A)
Black River	82 (A)	91 (A)	92 (A)	89 (A)	100 (A)

Standardised scoring range: ■ Very Poor (E) = 0 to <21 | ■ Poor (D) = 21 to <41 | ■ Moderate (C) = 41 to <61 | ■ Good (B) = 61 to <81 | ■ Very Good (A) = 81 – 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

10.2.2.1 *Key Messages*

- This is the first year in which pesticides data have been reported in the Townsville Dry Tropics Technical Report.
- Pesticide results and scores are not representative of the entire basin, as pesticides were only monitored at two sites (one in Ross River and one in Black River).
- The pesticides index is a risk metric, even if scores are “very good”, this does not necessarily indicate the absence of pesticides completely.
- Both pesticide sites received grades of “very good” with at least 99% of species protected.

10.2.3 Results: Pesticides

The scores and grades for the Ross and Black freshwater monitoring locations, are presented in Table 30. The relevant contribution of each of the pesticide classes are presented in Figure 46 and Figure 47 in Appendix P.

Table 30. The percentage of species protect and standardised scores for the pesticide risk metric in the Ross and Black freshwater basins.

Monitoring Site	Proportion: Insecticides	Proportion: Other Herbicides	Proportion: PSII Herbicides	% Protect	Standardised Scores
Ross River	0.45	0.44	0.11	99.0	81.0
Black River	0.39	0.61	<0.01	99.1	82.9

Pesticide risk metric scoring range: ■ Very Poor = <80% (very high risk)| ■ Poor = <90 to 80% (high risk)| ■ Moderate = <95 to 90% (moderate risk)| ■ Good = <99 to 95% (low risk)| ■ Very Good = ≥99% (very low risk). **Standardised scoring range:** ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

Analysis of the samples found that 5 unique pesticides were detected at the Ross River site (Fipronil, Fluroxypyr, MCPA, Tebuthiuron, Triclopyr), and 10 were detected at the Black River site (2,4-D, Atrazine, Diuron, Fipronil, Haloxyfop (acid), Hexazinone, Imazapic, MCPA, Tebuthiuron, Triclopyr). This is an increase in the number of unique pesticides detected at both locations during the 2021-2022 reporting period (Ross River: 3, Black River: 4).

10.2.4 Confidence Scores

There was low confidence in the pesticide scores for both the Ross and Black Freshwater Basins due to limited spatial and temporal sampling in the basin (only two rivers sampled and only for part of the year) (Table 31).

Table 31. Confidence scores for the freshwater pesticide index.

Index	Maturity (*0.36)	Validation (*0.71)	Representativeness (*2)	Directness (*0.71)	Measured error. (*0.71)	Final Score	Rank
Pesticides	3	2	1	2	2	7.3	Low (2)

Rank based on final score: Very low (1): 4.5 – 6.3; Low (2): >6.3 – 8.1; Moderate (3): >8.1 – 9.9; High (4): >9.9 – 11.7; Very high (5): >11.7 – 13.5.

Confidence criteria were scored 1–3 and weighted by the value identified in parenthesis. Weighted scores were summed to produce a final score (4.5 – 13.5). Final scores were ranked from 1 to 5 (very low to very high).

10.3 Habitat and Hydrology

The habitat and hydrology index in the freshwater environment consists of the habitat indicator categories (Freshwater Riparian Extent and Freshwater Wetland Extent), and the hydrology indicator category (Artificial Barriers). Results are provided by a combination of partners of the Partnership and from the Reef 2050 Report Card. Data is updated approximately every four years.

10.3.1 Overall Summary: Freshwater Habitat and Hydrology

For the 2022-2023 reporting period the standardised scores for the habitat and hydrology index improved in both freshwater basins This was driven by an improved score in the riparian extent indicator category. The Ross Freshwater Basin received a score of 61 (good), and the Black Freshwater Basin received a score of 79 (good) (Table 32). For the first time since the beginning of this technical report, sub basin results have also been calculated and presented.

Table 32. Standardised scores for the habitat and hydrology indicator categories and index in the Ross Freshwater Basin and Black Freshwater Basin.

Basin	Riparian Extent	Wetland Extent	Artificial Barriers	Habitat and Hydrology Index			
				22-23	21–22	20–21	19–20
Ross	54	80	49	61	X	X	51
Black	81	64	100	79	X	X	71

Standardised scoring range: Very Poor (E) = 0 to <21 | Poor (D) = 21 to <41 | Moderate (C) = 41 to <61 | Good (B) = 61 to <81 | Very Good (A) = 81 – 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

10.3.1.1 *Key Messages*

- Standardised scores for the habitat and hydrology index increased in both freshwater basins.
    - The riparian extent indicator category improved in both basins, with the Black Freshwater Basin recording its first increased in freshwater riparian vegetation since the beginning of this Dry Tropics Technical Report.
- Sub basin scores have been calculated and presented for the first time. This allowed for several new observations such as:
    - Identifying the Stuart Creek sub basin as the location with the greatest loss of riparian vegetation extent between 2019 and 2021.
    - Identifying the Bluewater and Rollingstone Creek sub basins as the locations with the greatest loss of wetland extent between 2019 and 2021.
    - Identifying several sub basins with the Black Freshwater Basins that have gained riparian vegetation extent between 2019 and 2021.

10.3.2 Freshwater Riparian Extent

The Partnership uses methods sourced from the Reef Water Quality Report Card, although presents results at a sub basin level. Data is scored based on the amount of vegetation coverage in comparison to the most recent previous dataset. For this report 2021 vegetation data (published in late 2023) is compared against 2019 data. The objective of this index is to record zero loss in vegetation between datasets.

10.3.2.1 *Monitoring Sites*

The area for the riparian extent indicator category is provided in Appendix Q and Appendix R.

10.3.2.2 *Results: Freshwater Riparian Extent*

For the 2022–2023 reporting period no sub basins in the Ross Basin gained vegetation, and no sub basins in the Black Basin lost vegetation (Table 33). The Stuart Creek sub basin had greatest percent-loss change, possibly due to the "state development area" within its boundaries (Queensland Government State Development and Infrastructure 2003).

Table 33. Riparian extent area, loss and standardised score in the freshwater basins and sub basins of the Townsville Dry Tropics.

Basin/Sub Basin	Freshwater Riparian Extent						
	Area (ha)				Extent Change (19-21)		Standardised Score
	Pre-Clear	…	2019	2021	ha	%	
Alligator Creek	5,303.2	…	4,551	4,542.7	-8.3	-0.18	57
Bohle River	6,544.4	…	4,874.3	4,868.5	-5.9	-0.12	60
Magnetic Island	2,013.0	…	1,916.1	1,916.1	0	0	80
Ross River (Lower)	2,097.5	…	1,527.5	1,527.5	0	0	80
Ross River (Upper)	19,426.9	…	16,328.2	16,282.2	-46.0	-0.28	52
Stuart Creek	2,889.8	…	2,307.7	2,292.8	-14.9	-0.64	35
Ross freshwater	38,274.8	…	31,504.9	31,429.8	-75.1	-0.24	54
Black River	9,918.1	…	8,904.9	8,909.2	+4.3	+0.05	81
Bluewater Creek	7,614.3	…	6,896.2	6,908.2	+12.0	+0.17	81
Crystal Creek	7,071.3	…	6,337.7	6,345.7	+8.0	+0.13	81
Palm Islands	901.2	…	775.1	775.1	0	0	80
Paluma Lake	121.7	…	28	28	0	0	80
Rollingstone Creek	5,806.1	…	5,396.7	5,406.5	+9.8	+0.18	81
Black freshwater	31,432.7	…	28,338.5	28,372.6	+34.1	+0.12	81

Riparian extent scoring range: ■ = Very Poor: >1% loss | ■ = Poor: 0.51 to 1% loss | ■ = Moderate: 0.11 to 0.5% loss | ■ = Good: 0 to 0.1% loss| ■ = Very Good: increase in vegetation.

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

The final standardised scores were 54 (moderate) in the Ross Basin, and 81 (very good) in the Black Basin. Notably, the Black Basin recorded an increase in freshwater riparian vegetation, however it is not clear if this is the result of growth of native vegetation or weed species (Table 34). Further, it should be noted that because vegetation is compared to most recent previous assessment, a score of "good" simply means that there was no vegetation loss since the previous assessment, not since "pre-European times". Historic vegetation trends for each basin are presented in Appendix S and Appendix U.

Table 34. Historic standardised score for the Freshwater Riparian indicator category.

Basin	Freshwater Riparian Extent Standardised Scores				
	22-23	21-22	20-21	19-20	18-19
Ross Freshwater	54	X	X	X	44
Black Freshwater	81	X	X	X	56

Riparian extent scoring range: ■ = Very Poor: >1% loss | ■ = Poor: 0.51 to 1% loss | ■ = Moderate: 0.11 to 0.5% loss | ■ = Good: 0 to 0.1% loss| ■ = Very Good: increase in vegetation.

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

10.3.3 Freshwater Wetland Extent

The Partnership uses methods sourced from the Reef Water Quality Report Card, however, presents results at a sub basin level with minor changes to the assessed area: including Magnetic Island and the Palm Island group in the analysis of wetland extent. Data is scored based on the amount of wetland coverage in comparison to the most recent previous dataset. For this report 2019 wetland data (published in late 2023) is compared against 2017 data. The objective of this index is to record zero loss in vegetation between datasets.

10.3.3.1 *Monitoring Sites*

The area for the wetland extent indicator category is provided in Appendix V and Appendix W.

10.3.3.2 *Results: Freshwater Wetland Extent*

For the 2022–2023 reporting period only the Bluewater Creek and Rollingstone Creek sub basins recorded a loss in vegetation, no sub basins recorded a gain in vegetation (Table 35).

Table 35. Freshwater wetland area, loss and standardised score in the freshwater basins and sub basins of the Townsville Dry Tropics.

Basin/Sub Basin	Freshwater Wetland Extent						
	Area (ha)				Extent Change (17-19)		Standardised Score
	2001	...	2017	2019	ha	%	
Alligator Creek	528.1	...	526.5	526.5	0.0	0.0	80
Bohle River	227.4	...	206.1	206.1	0.0	0.0	80
Magnetic Island	28.3	...	28.3	28.3	0.0	0.0	80
Ross River (Lower)	62.5	...	61.0	61.0	0.0	0.0	80
Ross River (Upper)	46	...	46.0	46.0	0.0	0.0	80
Stuart Creek	11.1	...	11.1	11.1	0.0	0.0	80
Ross freshwater	903.4	...	879.0	879.0	0.0	0.0	80
Black River	33.5	...	33.5	33.5	0.0	0.0	80
Bluewater Creek	52.1	...	45.1	44.9	-0.2	-0.46	43
Crystal Creek	222	...	219.1	219.1	0.0	0.0	80
Palm Islands	61.9	...	61.9	61.9	0.0	0.0	80
Paluma Lake	ND	...	ND	ND	ND	ND	ND
Rollingstone Creek	77.7	...	76.9	76.8	-0.2	-0.2	56
Black freshwater	447.3	...	436.6	436.2	-0.4	-0.08	64

Wetland extent scoring range: ■ = Very Poor: >3% loss | ■ = Poor: 0.51 to 3% loss | ■ = Moderate: 0.11 to 0.5% loss | ■ = Good: 0 to 0.1% loss| ■ = Very Good: increase in vegetation.

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

The final standardised scores were 54 (moderate) in the Ross Basin, and 81 (very good) in the Black Basin. It should be noted that although no increases in wetland vegetation were detected, due to selective nature of the assessment (only measuring pristine palustrine) this does not mean that there wasn't a gain/loss of other types of wetlands within the area. Further, because vegetation is compared to most recent previous assessment, a score of "good" simply means that there was no vegetation loss since the previous assessment, not since the "pre-European times". Historic vegetation trends for each basin are presented in Appendix X and Appendix Y.

Table 36. Historic standardised score for the Freshwater wetland indicator category.

Basin	Freshwater Wetland Extent Standardised Scores				
	22-23	21-22	20-21	19-20	18-19
Ross Freshwater	80	X	X	40	45
Black Freshwater	64	X	X	58	40

Wetland extent scoring range: ■ = Very Poor: >3% loss | ■ = Poor: 0.51 to 3% loss | ■ = Moderate: 0.11 to 0.5% loss | ■ = Good: 0 to 0.1% loss| ■ = Very Good: increase in vegetation.

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

10.3.3.3 *Updated Wetlands Dataset*

The data and method used to map wetland extent was updated in 2023 (Version 6.0). Although results can no longer be compared to previous technical reports the latest data includes a remapping of all previous years of data. This remapping has been used to back calculate all historic scores presented in Table 36. A comparison between new and old scores is shown in Appendix Z.

10.3.4 Freshwater Artificial Barriers

The artificial barriers indicator category is comprised of two indicators: impoundment length and fish barriers. Both indicators are updated approximately every four years, with impoundment length updated in 2022 and fish barriers scheduled to be updated in 2024.

10.3.4.1 *Monitoring Sites*

The area for the artificial barriers indicator category is provided in Appendix AA and Appendix BB.

10.3.4.2 *Results: Freshwater Artificial Barriers*

There is no change to the results for the artificial barriers indicator category or the impoundment length and fish barrier indicators in this technical report. The Black Freshwater Basin received a standardised score of 100 (very good) due to the lack of artificial barriers, and the Ross Freshwater Basin received a standardised score of 49 (moderate) due to the high frequency of barriers, and their proximity to the downstream limit of the water way, particularly in the Ross River (Table 37).

Table 37. Standardised scores for the artificial barrier's indicator category in the Ross Freshwater Basin and Black Freshwater Basin.

Basin	Impoundment Length	Fish Barriers	Artificial Barriers
Ross freshwater	34	65	49
Black freshwater	100	100	100

Standardised scoring range: ■ Very Poor (E) = 0 to <21 | ■ Poor (D) = 21 to <41 | ■ Moderate (C) = 41 to <61 | ■ Good (B) = 61 to <81 | ■ Very Good (A) = 81 – 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

10.3.4.3 *Results: Freshwater Impoundment length*

Impoundment length in the Townsville Dry Tropics region has remained consistent between reporting periods. The Black Basin received a score of 100 (very good), with no impoundments. In the Ross Basin, of the 895km of assessed waterways, 72km were impounded. The Ross basin received a score of 34 (poor) due to the Ross River Dam, and three weirs (Black, Gleeson and Aplin's) on the Ross River.

Table 38. Natural and Impounded stream length and standardised score in the freshwater basin of the Townsville Dry Tropics.

Basin	Waterway				Standardised Score (Grade)
	Natural	Impounded	Total	% Impounded	
Ross freshwater	824km	72km	895km	8.0%	34
Black freshwater	659km	0km	659km	0.0%	100

Standardised scoring range: ■ = Very Poor: ≥10% impoundment ■ = Poor: 7 to <10% ■ = Moderate: 4 to <7% ■ = Good: 1 to <4% ■ = Very Good: <1% impoundment | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

10.3.4.4 *Results: Freshwater Fish Barriers*

In the Ross Basin, there were 12 barriers across five measured waterways, four were classified as impassable, and all were located on the Ross River. In the Black Freshwater Basin 92km of the Black River was assessed, and no fish barriers, passable or impassable, were identified (Table 39). Barrier density in the Ross Basin ranged from 3.5km of waterway per barrier, to 65.9km per barrier, and the percentage of stream to first barrier ranged from 0.4% to 100%. In the Black Basin, percentage of stream to first barrier was 100% (Table 40). The fish barrier indicator received a standardised score of 65 (good) in the Ross Basin, and 100 (very good) in the Black Basin (Table 40).

Table 39. Waterway characteristics and fish barriers in the Ross Freshwater Basin and Black Freshwater Basin.

Basin	Waterway Name	Waterway length	Number of Barriers: Passable	Number of Barriers: Impassable	Length to first barrier: Passable	Length to first barrier: Impassable
Ross freshwater	Ross River	263.6km	0	4	1.0km	1.0km
	Bohle River	51.1km	2	0	7.2km	51.1km
	Stuart Creek	17.5km	5	0	11.9km	17.5km
	Alligator Creek	13.7km	1	0	0.7km	13.7km
	Whites Creek	11.1km	0	0	11.1km	11.1km
Ross Average		71.4km	1.6	0.8	6.4km	18.9km
Black freshwater	Black River	92.0km	0	0	0.0km	92.0km

Table 40. Standardised scores for the components of the fish barrier's indicator.

Waterway	Barrier density (km/barrier)	Percentage of stream to first … barrier: Passable	Percentage of stream to first … barrier: Impassable	Standardised Score (Grade)
Ross River	65.9km	0.4%	0.4%	40
Bohle River	25.5km	14.1%	100%	61
Stuart Ck	3.5km	68.2%	100%	60
Alligator Ck	13.7km	5.2%	100%	60
Whites Ck	NA	100%	100%	100
Ross Average	27.2km	37.6%	80.1%	65
Black River	NA	100%	100%	100

Standardised scoring range: ■ Very Poor (E) = 0 to <21 | ■ Poor (D) = 21 to <41 | ■ Moderate (C) = 41 to <61 | ■ Good (B) = 61 to <81 | ■ Very Good (A) = 81 – 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

10.3.5 Confidence Scores

Confidence in the riparian extent, wetland extent, and artificial barriers indicator categories was low or very low with a rank of 1, 1, and 2 out of 5 respectively.

Table 41. Confidence scores for the mangrove and saltmarsh extent and riparian extent indicator categories.

Indicator Category	Maturity (x0.36)	Validation (x0.71)	Representativeness (x2)	Directness (x0.71)	Measured error (x0.71)	Score (Rank)
R. Extent	2	2	1	2	1	6.3 (1)
W. Extent	2	2	1	2	1	6.3 (1)
A. Barriers	2	1	2	2	1	7.6 (2)

Rank based on score: 1 (very low) = 4.5 to 6.3; | 2 (low) = >6.3 to 8.1; | 3 (moderate) = >8.1 to 9.9; | 4 (high) = >9.9 to 11.7; | 5 (very high) = >11.7 to 13.5.

10.4 Fish

The Fish index for the freshwater basin of the Townsville Dry Tropics regions consists of two indicator categories, the Proportion of Indigenous Species Expected (POISE), and the Proportion of Non-Indigenous Species (PONIS). Results for this index are provided by partners of the Partnership and are updated every three years. The latest update occurred in the 2022–2023. technical report using data collected in 2021-2022. This is the second time since the beginning of the report card that the fish index has been measured.

10.4.1 Monitoring Sites

The monitoring sites used for the fish index are provided in Appendix CC.

10.4.2 Overall Summary: Freshwater Fish

For the 2022-2023 reporting period the standardised scores for the fish index declined in both freshwater basins. The Ross Basin received a score of 49 (moderate), and the Black Basin received a score of 55 (moderate) (Table 42).

Table 42. Standardised scores for the POISE and PONIS indicator categories and fish index in the Ross and Black Basins.

Basin	POISE	PONIS	Fish Index			
			22-23	21-22	20-21	19-20
Ross	58	41	49	X	X	57
Black	25	84	55	X	X	78

Standardised scoring range: Very Poor (E) = 0 to <21 | Poor (D) = 21 to <41 | Moderate (C) = 41 to <61 | Good (B) = 61 to <81 | Very Good (A) = 81 – 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

10.4.2.1 *Key Messages*

- This is the second time the fish index has been measured and scores for the fish index declined in both basins.
    - The primary driver was the PONIS indicator category in the Ross Basin (decreased from 60 to 41), and the POISE indicator category in the Black basin (decreased from 66 to 25).
- Within the Ross Basin, 4011 fish from 29 species were caught during sampling.
    - 86% (3447) were indigenous and were released after identification.
    - 14% (564) were non-indigenous and were euthanised.
        - 529 fish were alien, 35 were translocated.
    - Scores indicate that most waterways were “moderate”.
- Within the Black Basin, 2217 fish from 25 species were caught during sampling.
    - 83% (1830) were indigenous and were released after identification.
    - 17% (387) were non-indigenous and were euthanised.
        - All non-indigenous species were alien.
    - Scores indicate that some waterways were “very good’ whilst others were “very poor”.
    - The significant decrease in the POISE indicator category score is most likely connected to heavy rainfall before sampling dispersing the fish populations.

10.4.3 Proportion of Indigenous Species Expected (POISE)

The proportion of indigenous species expected (POISE) indicator category is a measure of observed versus expected species and compares the richness of indigenous[5] species. Presence/Absence and site scores are provided in Appendix DD to Appendix FF.

10.4.3.1 *Results: POISE*

The POISE indicator category was measured to be 0.645 in the Ross Basin and 0.429 in the Black Basin, showing that despite the large number of indigenous species, presence is still lower than the pre-disturbance model for both basins. Standardised scores were 58 (moderate) and 25 (poor) in the Ross and Black Basins respectively (Table 43). The grade did not change within the Ross Basin (moderate) however did decrease from "good" to "poor" in the Black Basin. This grade change was most likely driven by heavy rainfall preceding sampling that dispersed the fish populations. Several site locations had to be altered as they were no longer suitable due to significantly increased water depth.

Table 43. The Proportion of Indigenous Species Expected (POISE) indicator category raw and standardised scores for each basin in the Townsville Dry Tropics Region.

Basin	POISE	Standardised Score			
		22-23	21-22	20-21	19-20
Ross	0.645	58	X	X	54
Black	0.429	25	X	X	66

Scoring range (POISE): ■ = Very Poor: 0 to <0.40 | ■ = Poor: 0.40 to <0.53 | ■ = Moderate: 0.53 to <0.67 | ■ = Good: 0.67 to <0.80 | ■ = 0.80 to 1.

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

In the Ross Basin 4011 fish of 29 species were caught, 86% (3447) of which were indigenous. In the Black Basin 2217 fish of 25 species were caught, 83% (1830) of which were indigenous. All indigenous species were released after identification. Despite the similar percentages, the standardised score for the Black Freshwater Basin was notably lower (58 compared to 25). This is because the standardised scores are calculated from the median POISE value. In turn this indicates that the Black Freshwater Basin had a great number of waterways with a very poor number of indigenous species found compared to what was expected, and a few waterways with an exceptional (very good) number of indigenous species. Comparatively, most waterways in the Ross Freshwater Basin were moderate.

10.4.4 Proportion of Non-Indigenous Species (PONIS)

The proportion of non-indigenous species (PONIS) indicator category is a measure of observed translocated and alien species compared to the total number of observed species. Presence/Absence and site score are provided in Appendix DD to Appendix FF.

[5] Species classification definitions can be found in "Methods for Townsville Dry Tropics 2022–2023 Report Card (released in 2024)".

10.4.4.1 *Results: PONIS*

Within the PONIS indicator category, the median proportion of translocated species was measured to be 0.0 in both the Ross Freshwater Basin and Black Freshwater Basin, due to the very low presence of translocated species (note that although some translocated species were reported, the median measurement was 0.0). While the median proportion of alien species was 0.102 in the Ross Freshwater Basin, and 0.029 in the Black Freshwater Basin. Thus, the PONIS indicator category was also measured to be 0.102 and 0.029 in the Ross and Black Basins respectively. Standardised scores were 41 (moderate) in the Ross Basin and 96 (very good) in the Black Basin (Table 44).

Table 44. The Proportion of Non-Indigenous Species (PONIS) indicator category raw and standardised scores for each basin in the Townsville Dry Tropics Region.

Basin	Proportion of:		PONIS	Standardised Score			
	Translocated	Alien		22-23	21-22	20-21	19-20
Ross	0.0	0.102	0.102	41	X	X	60
Black	0.0	0.029	0.029	96	X	X	91

Scoring range (PONIS): ■ = Very Poor: >0.2 to 1 | ■ = Poor: >0.1 to 0.2 | ■ = Moderate: >0.05 to 0.1 | ■ = Good: >0.03 to 0.05 | ■ = 0 to 0.03.

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

In the Ross Basin, of the 4011 fish caught, 14% (564) were non-indigenous (529 alien, 35 translocated). In the Black Basin, of the 2217 fish caught, 17% (387) were non-indigenous (all of which were alien). All non-indigenous species were euthanised. Once again, despite similar percentages, the standardised scores for each basin are notably different (41 compared to 96). This is because the standardised scores are calculated from the median PONIS value. In turn this indicates that the Black Freshwater Basin had a great number of waterways with a very good (low) numbers of non-indigenous species, and a few waterways with a very poor (high) numbers of non-indigenous species. Comparatively, most waterways in the Ross Freshwater Basin were moderate.

10.4.5 Confidence Scores

Confidence in the fish index was moderate with a rank of 3 out of 5. The fish index received a maturity score of 2, as the methodology has been peer-reviewed, but not yet published. A validation score of 2 as frequent in-field observations were conducted, however a level of modelling was required to calculate pre-disturbance populations. A representativeness of 2 due to a limited sample size and number sampling locations relative to the population. A directness of 3 as the fish species were measured directly, and a measured error of 1 as the final scores are reliant on modelled populations (Table 45).

Table 45. Confidence scores for the fish index in the freshwater basin of the Townsville Dry Tropics.

Index	Maturity (x0.36)	Validation (x0.71)	Representativeness (x2)	Directness (x0.71)	Measured error (x0.71)	Score (Rank)
Fish	2	2	2	3	1	9.7 (3)

Rank based on score: 1 (very low) = 4.5 to 6.3; | 2 (low) = >6.3 to 8.1; | 3 (moderate) = >8.1 to 9.9; | 4 (high) = >9.9 to 11.7; | 5 (very high) = >11.7 to 13.5.