

NSW Intersecting Streams valley annual surface water quality report: 2021-2022

Key Points

- Flow during July 2021 to June 2022 was characterised by heavy rain falling across much of the catchment. This rain resulted in several large flow events.
- Oxygen levels were at safe levels in the Intersecting Streams catchment and may have provided an oxygenated refuge for fish from the Barwon and Darling rivers.
- Flooding was the main driver of water quality in the Intersecting Streams catchment. The water quality index indicated that of the 6 sites in the catchment, one was rated as good and 5 were moderate. Compared to the 2020 to 2021 results, the water quality index score for 3 sites improved and the remaining 3 sites showed minimal change.
- All sites were below the Basin Plan agriculture and irrigation salinity target. The Warrego, Culgoa and Narran Rivers all exceeded their median and 80th percentile End-of-Valley salinity targets while Cuttabura Creek only exceeded the 80th percentile target.
- No algal blooms occurred in the Intersecting Streams catchment for 2021–2022.

The water quality data used in this report is collected on a monthly frequency at 6 sites for the Intersecting Streams water quality monitoring program. This program is responsible for collecting, analysing and reporting the ambient water quality condition of rivers in the Intersecting Streams on behalf of the Dumaresq-Barwon Border Rivers Commission. This annual report summarises the surface water quality data collected in the Intersecting Streams Valley from July 2021 to June 2022. The location of monitoring sites is shown in Figure 1.

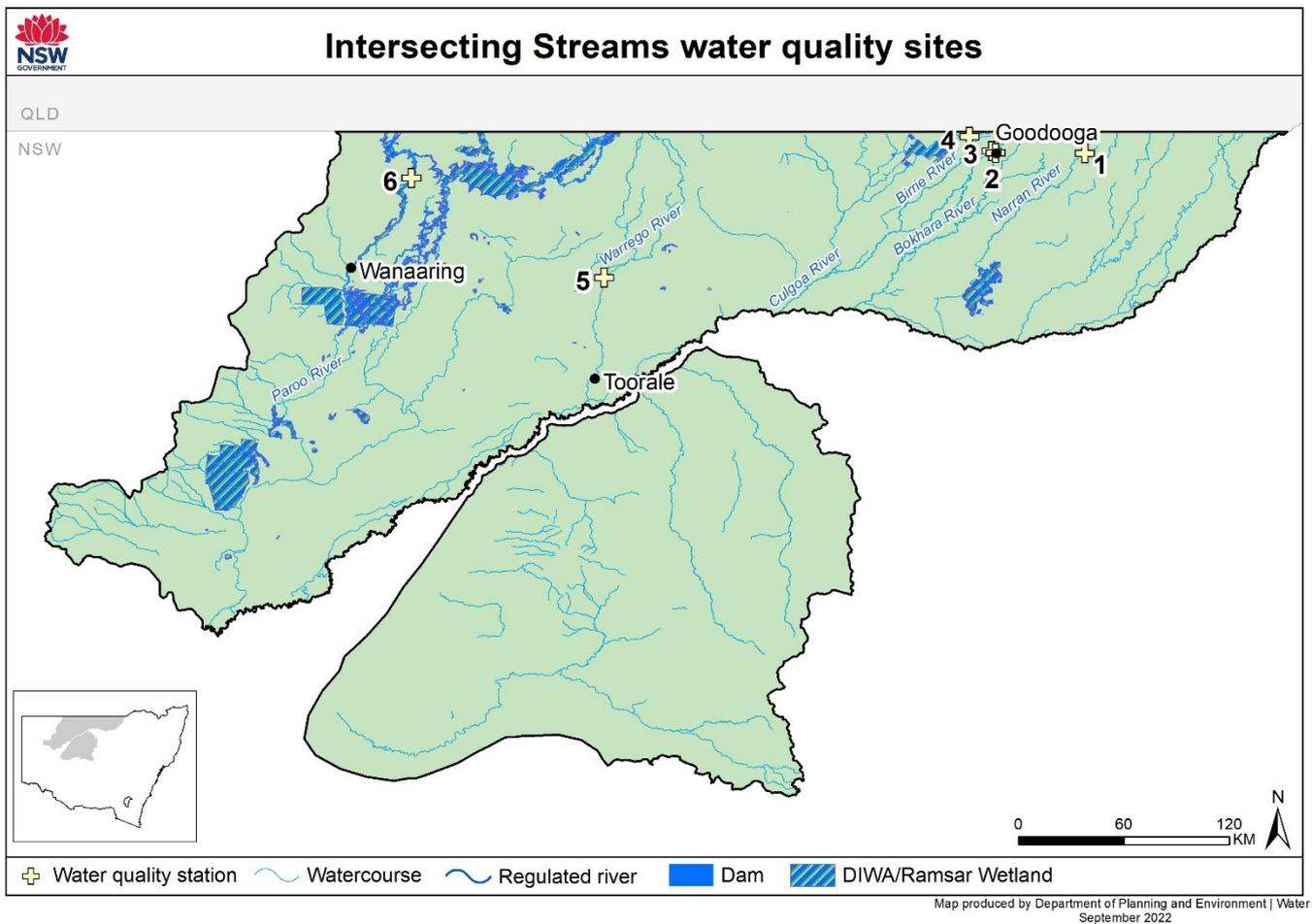


Figure 1: Location of routine water quality monitoring sites in the NSW Intersecting Streams

Table 1: Site information for each monitoring site in the Intersecting Streams catchment. Refer to Figure 1 and site numbers for location of each site

Site number	Site name	Water Quality Zone	Station number
1	Narran River at New Angledool	Intersecting Streams lowlands	422012
2	Bokhara River at Goodooga	Intersecting Streams lowlands	422014
3	Birrie River near Goodooga	Intersecting Streams lowlands	422013
4	Culgoa River at Brenda	Intersecting Streams lowlands	422015
5	Warrego River at Fords Bridge	Intersecting Streams lowlands	423002
6	Paroo River at Willara Crossing	Paroo lowlands	424002

Catchment description

The Intersecting Streams catchment is in north-western NSW and covers an area of approximately 120,000 km². The area comprises 6 catchments. The Yanda Creek catchment occurs entirely within NSW and is located to the south of the Darling River. The other 5 water sources originate in Queensland and flow across the border into NSW. These are the Narran, Culgoa, Moonie, Warrego

and Paroo Rivers. The Intersecting Streams are characterised by low relief with elevations ranging from 100 to 300 metres above sea level.

The Intersecting Streams consists of ephemeral streams and wetlands. Three of the wetlands in the Intersecting Streams are Ramsar sites. The terminal Narran Lake, at the end of the Narran River system, is listed under the Ramsar Convention for international ecological importance. One section of the site was listed in 1999, and a further 3,104 hectares was added in 2016. It now covers a total area of 8,447 hectares and comprises the whole floodplain area within Narran Lake Nature Reserve. The Paroo River wetlands Ramsar site consists of two parts: Nocolche Nature Reserve (71,133 hectares) near Wanaaring and the Peery Lake section of Paroo–Darling National Park (67,171 hectares) near White Cliffs. The Paroo River is considered the last free-flowing river in the Murray-Darling Basin and is protected through an inter-governmental agreement between NSW and Queensland.

Land use in the NSW Intersecting Streams valley is predominantly grazing with some opportunistic dryland cropping during wetter years. A detailed description of climate, land and water usage and water regulation infrastructures can be found in the Intersecting Streams resource description report (DoIW 2018, DPIE 2019).

Catchment conditions during 2021-2022

Flow during 2021–2022 was characterised by heavy rain falling across much of the catchment from November 2021 through to January 2022 and again in May (Figure 2A). Discharge within the intersecting streams catchment (Figure 2B) peaked on the Culgoa River at 22,600 ML/day in early January. Other high flows occurred in February on the Paroo River (over 7,800 ML/day) and from April until May on the Narran River peaking at above 8,200 ML/day. Discharge in the Warrego River remained low throughout the year peaking at 671 ML/d.

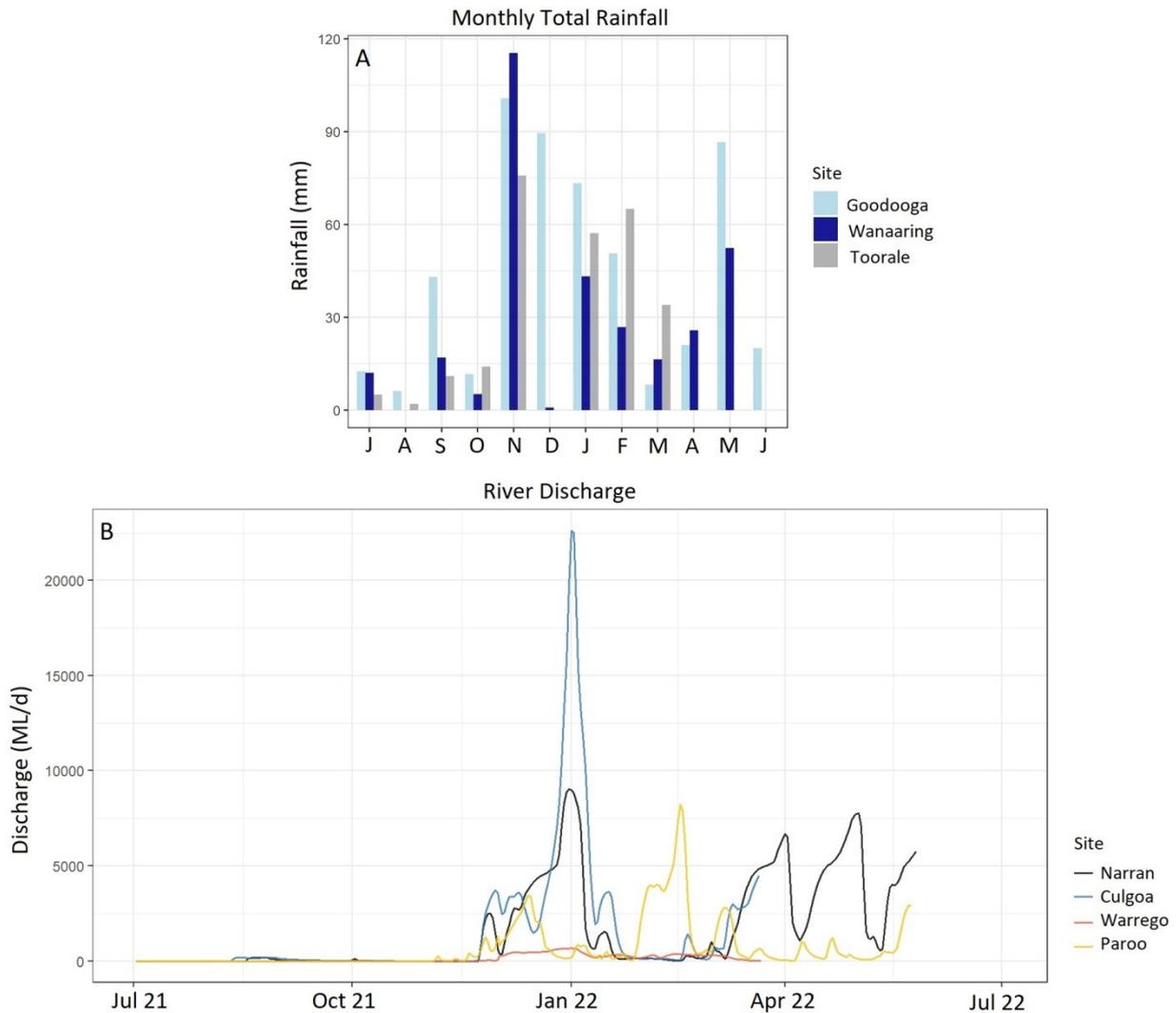


Figure 2: Catchment conditions for selected stations in the intersecting streams catchment from July 2021 to June 2022 for A: Monthly total rainfall (mm) B: River discharge (ML/day)

Water quality for water dependent ecosystems

NSW uses a Water Quality Index (WaQI) as a tool to communicate complex and technical water quality data in a simple and consistent way. The WaQI score was calculated for each monitoring site using total nitrogen, total phosphorus, turbidity, pH, dissolved oxygen and electrical conductivity. The index compares the monthly water quality results against a set of predetermined water quality targets to calculate a score between 1 and 100. A score of 100 represents a site in pristine condition, while a score of one is a very highly degraded site. The results from the WaQI are summarised in Figure 3. Sites where there has been a change of less than 5 points in WaQI score, have been identified with horizontal arrows. Arrows pointing up or down indicate the score has increased/decreased by more than 5 points.

The Paroo River at Willara Crossing was the only site in the Intersecting Streams to be rated as good. All other sites were rated as moderate. High rainfall and flooding during 2021–2022 restricted access to monitoring sites and closed roads in many areas of the Intersecting Streams. This restricted the collection of samples during high flows when turbidity and nutrient concentrations are likely to exceed targets. This could have led to slightly better water quality index scores.

Compared to the 2020–2021 results, the water quality index score for 3 sites improved (Bokhara River at Goodooga, Birrie River near Goodooga, and Paroo River at Willara Crossing) and the remaining 3 sites showed minimal change.



Intersecting Streams water quality index scores 2021-2022

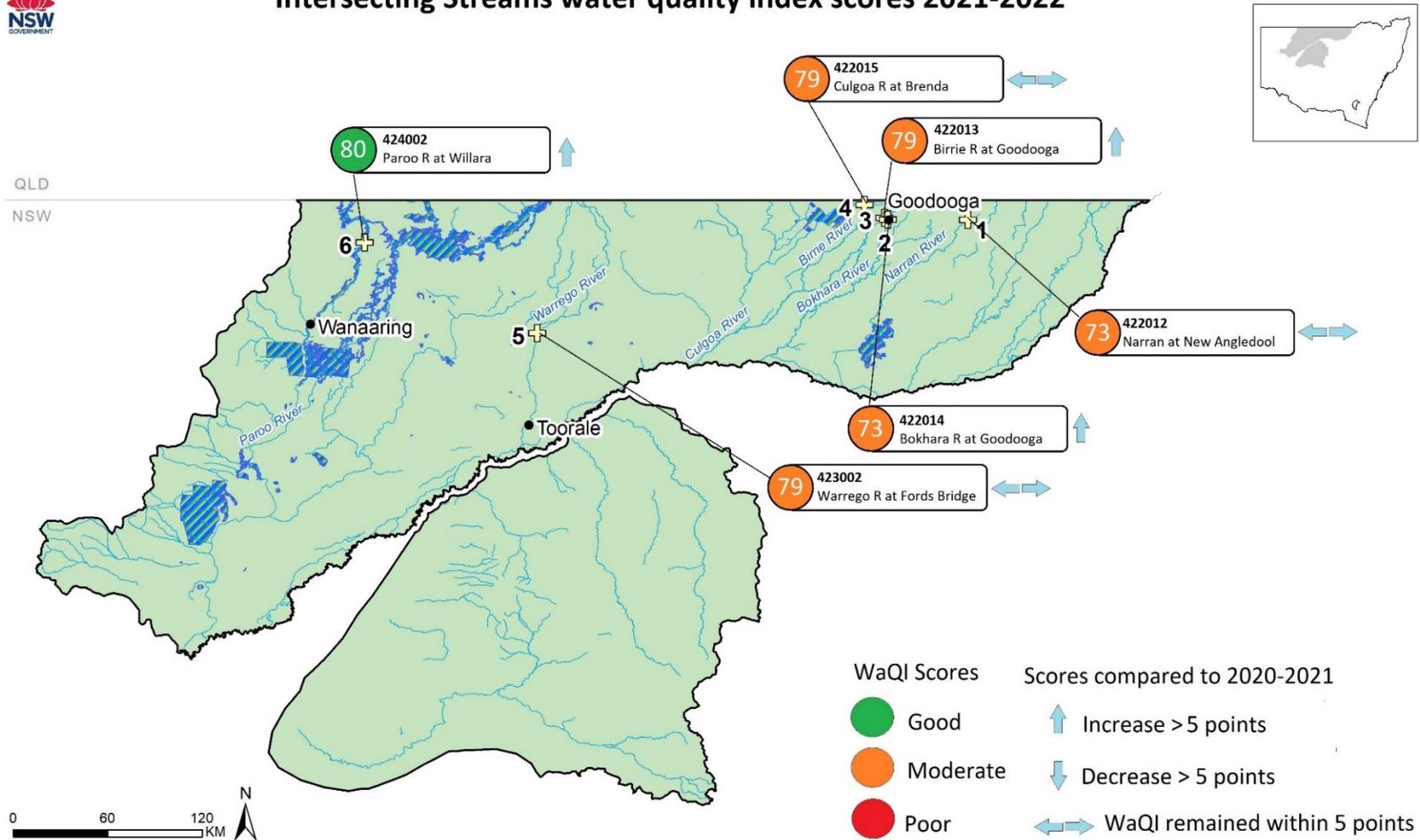


Figure 3: Water quality index scores for the Intersecting Streams valley

Apart from electrical conductivity, there was only minor variability in water quality between the 6 Intersecting Streams monitoring sites. The pH, turbidity, total nitrogen and total phosphorus was consistent across the Narran, Culgoa, Birrie and Bokhara rivers, with very little variation in median values across the valleys.

The median pH was around 7.5 at all sites, with some lower readings in Paroo River. There is unlikely to be any impact on the health of aquatic ecosystems or agricultural enterprises from these lower pH readings.

Despite the lower flows in the Warrego River than the other monitoring sites during 2021 to 2022, the median turbidity was the highest of the 6 sites. In the Intersecting Streams, the bulk of suspended sediment is made up of very fine clay particles. These very fine clay particles remain in suspension in the water column, even when the river is not flowing, giving the river a muddy or turbid appearance.

Dissolved oxygen levels were lower in the Narran, Bokhara, Birrie and Culgoa rivers, though the median dissolved oxygen levels were above critical levels for fish health. Major flooding in western Queensland resulted in the flushing of organic matter off the lowland floodplains and into waterways. The rapid breakdown of this material by bacteria can cause dissolved oxygen levels to decline. However, oxygen levels in the Intersecting Streams were better than those being experienced in the Barwon and Darling rivers, and may have provided oxygenated refuge areas for fish to move into during December 2021.

River salinity is generally not a major water quality issue in the Intersecting Streams compared to other catchments, maintaining the continued use of the water for human needs. Electrical conductivity was consistent across the Narran, Bokhara, Birrie and Culgoa rivers with lower results in the Warrego and Paroo Rivers.

Summary statistics for the key water quality parameters at each monitoring site in the NSW Intersecting Streams have been displayed as box plots (Figure 4). The box plots show the annual 25th, 50th and 75th percentile values, with error bars indicating the 10th and 90th percentile values for each site.

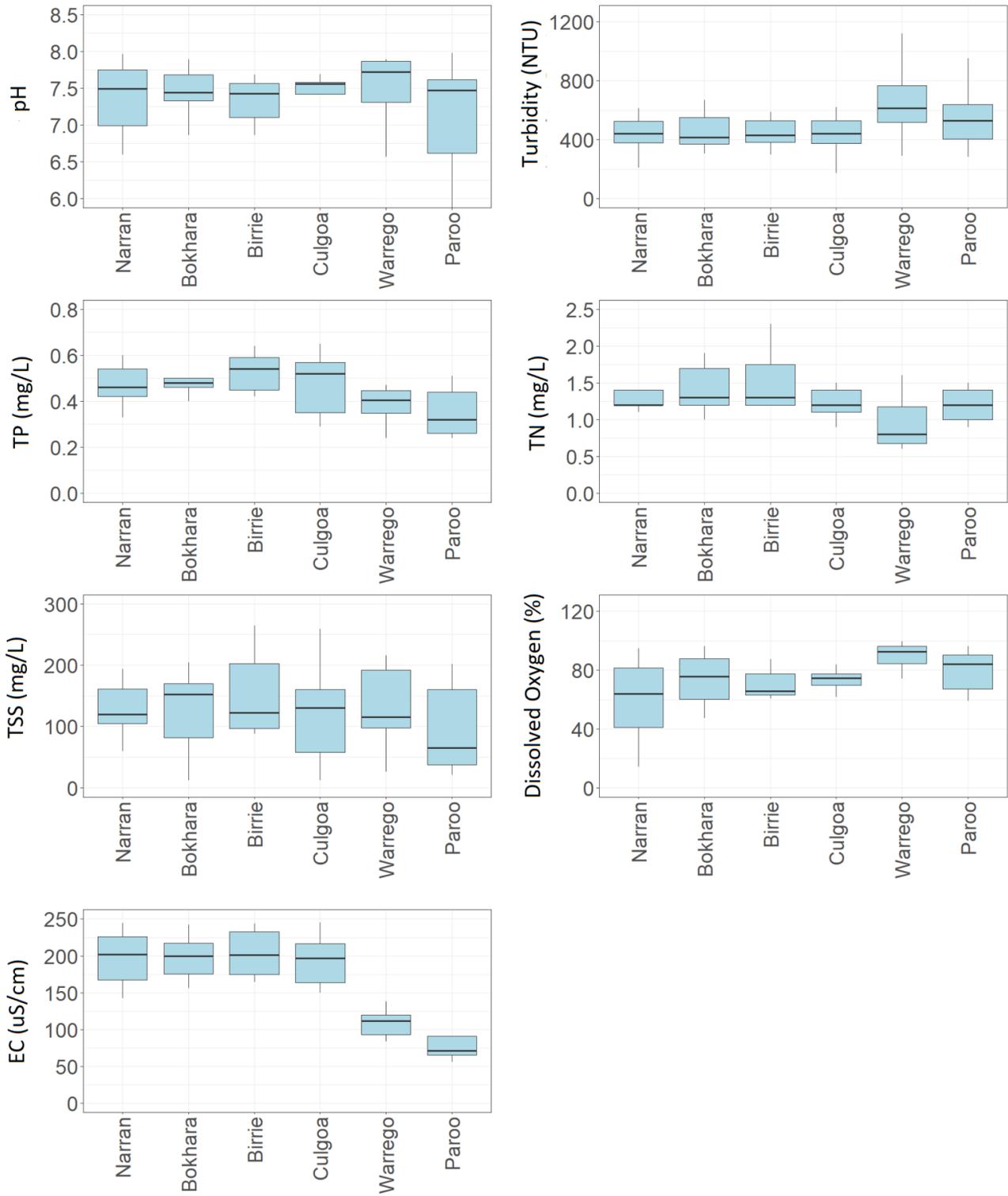


Figure 4: Water quality data for water quality parameters by site

Irrigation and salinity

There are 6 continuous electrical conductivity monitoring sites in the NSW portion of the Intersecting Streams. Due to data gaps, only 4 sites are plotted in Figure 5. This figure shows electrical conductivity was higher in the Narran and Culgoa rivers than in the Warrego River and Cuttaburra Creek.

The Basin Plan agriculture and irrigation salinity target in the Paroo and Warrego rivers is 838 $\mu\text{S}/\text{cm}$. For all other catchments, this target is 957 $\mu\text{S}/\text{cm}$. All of the Intersecting Streams sites had electrical conductivity below their respective Basin Plan agriculture and irrigation salinity targets.

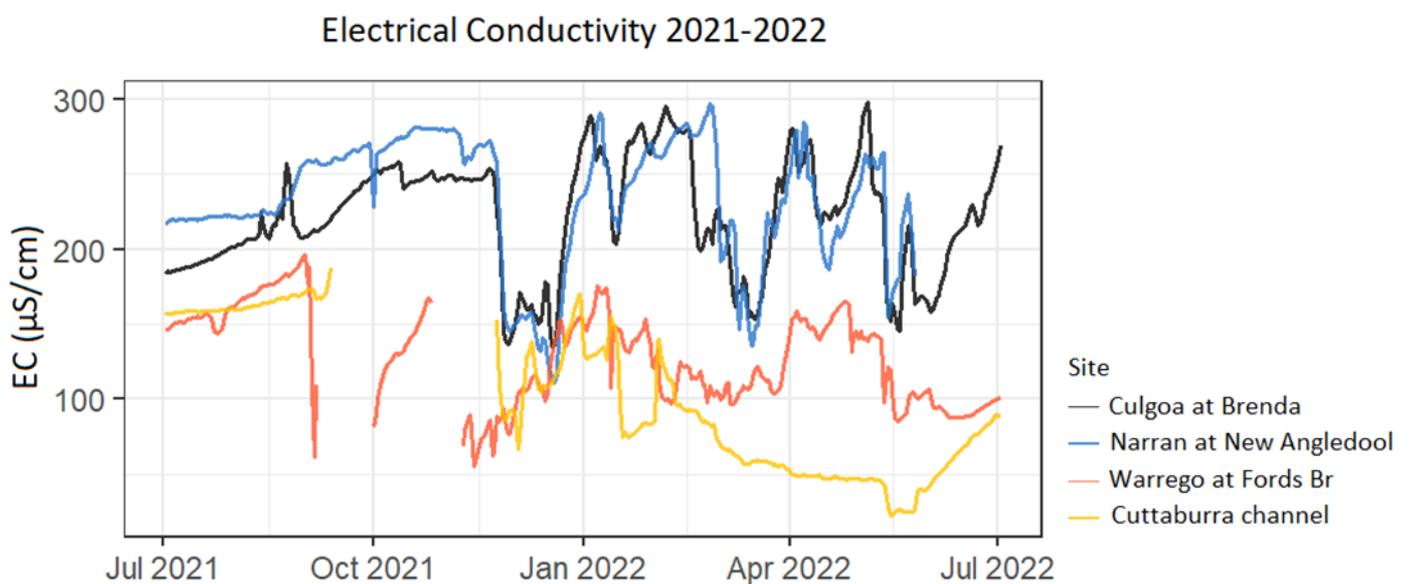


Figure 5: Electrical conductivity ($\mu\text{S}/\text{cm}$) at selected sites in the Intersecting Streams valley

There are four End-of-Valley salinity sites located in the NSW Intersecting Streams.

- Narran River at Angledool
- Warrego River at Barringun
- Culgoa at Brenda
- Cuttaburra Creek at Turra

Table 2 compares the electrical conductivity results to the target values (target values in brackets). The median electrical conductivity in Cuttaburra Creek at Turra was the only site to meet the Basin Salinity Management Strategy End-of-Valley salinity targets in the Intersecting Streams. High flows transported high salt loads that exceeded targets in all systems. Despite an instrumentation malfunction resulting in some data loss, the Warrego River still exceeded the salt load target.

Table 2: End-of-Valley salinity results for Intersecting Streams (targets in brackets)

Assessment site	Median electrical conductivity ($\mu\text{S/cm}$)	80 percentile electrical conductivity ($\mu\text{S/cm}$)	Salt load (t/year)
Narran River at New Angledool	240 (160)	270 (210)	77,794 (10,000)
Culgoa River at Brenda	224 (170)	254 (210)	261,059 (29,000)
Warrego River at Barrington	113 (101)	145 (110)	6,554 (4,800)
Cuttaburra Creek at Tura	86 (100)	159 (130)	6,704 (5,500)

* values in red indicate readings have exceeded the salinity target

Recreation

Exposure to blue-green algae (cyanobacteria) through ingestion, inhalation or contact during recreational use of water can impact on human health. A colour alert scale is used with a green alert warning indicating low numbers of blue-green algae but requiring monitoring, an amber alert warning being a heightened level of alert with increased sampling and surveillance, and a red alert warning being a state of action where waters are unsuitable for recreational use. For more information about blue-green algae and algal alerts see the WaterNSW algae web page ([Algae - WaterNSW](#)).

Nutrient-rich flows from the upper catchment, combined with warm, still water during summer, provide ideal conditions for algal growth. Phosphorus and nitrogen concentrations in the Intersecting Streams are not limiting to algal growth. Yet despite this, harmful algal blooms are a rare occurrence highlighting other issues such as high turbidity that could restrict algal growth. No blooms were reported from 2021 to 2022.

Extreme water quality events

November 2021 was Australia's wettest November since national records began in 1900 (BoM, 2022). It was also the wettest November on record for New South Wales and for the entire Murray-Darling Basin. The heavy rains led to substantial increases in water storage levels, with many storages spilling. With flooding on this scale came an increased risk of hypoxic blackwater events. Hypoxic, or low oxygen blackwater is a feature of Australian lowland river systems and occurs when organic material, such as sticks, leaves, bark and grass is broken down in the floodwater or washed off the floodplain into the river. The breakdown of this material by bacteria can rapidly use up all the oxygen in the water and may lead to fish deaths. The dark appearance of the water is due to the release of tannins as the organic matter decays.

Although the adjacent Barwon-Darling catchment experienced a month of low dissolved oxygen levels below the critical threshold for fish health, monitoring in the Intersecting Streams showed oxygen levels were at safer levels. There were no fish deaths reported in the Intersecting Streams. This may have provided an oxygenated refuge area for fish from the Barwon and Darling rivers to move into.

Summary

The quality of the water in a river or stream is a reflection of underlying climate and geology and the multiple activities and land uses occurring in a catchment area. Numerous factors contribute to the observed results.

In 2021 to 2022, flooding was the main water quality driver. Agencies and scientific experts worked together to monitor the dissolved oxygen levels throughout the river system and assess the risk to aquatic life. The lack of extended heatwave conditions and cooler water temperatures during the 2021/2022 summer meant that there was less stress on aquatic animals.

Although hypoxic blackwater events may result in the loss of fish and other aquatic life, the impacts of these events on the environment are usually short-term, as the river water re-oxygenates again as the flooding subsides. Naturally occurring events such as these underpin the broad health of rivers. They provide nutrients to drive the overall production of our river and wetland systems. In the longer term, native fish, water birds and other organisms benefit from the increased production in the river, boosting food supplies and supporting breeding cycles.

For more detailed information about water quality issues in the Intersecting Streams catchment see the Intersecting Streams surface water quality technical report (https://www.industry.nsw.gov.au/___data/assets/pdf_file/0020/305750/Water-quality-technical-report-for-the-Intersecting-Streams-surface-water-resource-plan-area-SW13.pdf).

References and further information

Bureau of Meteorology (BoM) 2022. Special Climate Statement 75 – Australia's wettest November on record. Issued 14 February 2022: <http://www.bom.gov.au/climate/current/statements/scs75.pdf?20220214>

DoIW. 2018. Intersecting Streams water resource plan surface water resource description. Department of Industry Water, Parramatta: https://www.industry.nsw.gov.au/___data/assets/pdf_file/0005/236453/intersecting-streams-wrpa-description.pdf

DPIE, 2019. Intersecting Streams Long Term Water Plan Parts A and B. Department of Planning, Industry and Environment, Sydney: <https://www.mdba.gov.au/sites/default/files/pubs/intersecting-streams-long-term-water-plan-parts-a-and-b-draft-for-exhibition.pdf>

NSW DPE water for the environment: <https://www.environment.nsw.gov.au/topics/water/water-for-the-environment/other-regions/intersecting-streams-annual-environmental-water-priorities>

MDBA Water Management: <https://www.mdba.gov.au/water-management/catchments>