

Namoi Valley annual surface water quality report: 2021-2022

Key Points

- Flow during the 2021–2022 period was characterised by heavy rain falling across much of the catchment from December 2021 through to March 2022. Flooding occurred in all catchments across the Northern Basin with substantial increases in water storage levels.
- NSW Fisheries investigated 2 fish death reports. The first event was at Gunidgera Creek on 8 December. Approximately 100 dead fish were reported. A second event was investigated at Quipolly Creek, immediately downstream of Quipolly Dam on 22 December 2021. Approximately 100 dead fish were also reported.
- Flooding was the main driver of water quality in the Namoi Valley. The Water Quality Index showed that of the 11 monitoring sites, 4 were rated as good, 4 as moderate and 3 were poor. Three sites had an improved water quality index rating compared to the 2020-2021 results, while 2 sites declined.
- All sites in the main irrigation areas were below the Basin Plan agriculture and irrigation salinity target of 957 $\mu\text{S}/\text{cm}$ (microSiemens per centimetre). The median and 80th percentile at Goangra were both less than their respective End-of-Valley salinity targets of 475 $\mu\text{S}/\text{cm}$ and 715 $\mu\text{S}/\text{cm}$.
- Chaffey, Split Rock and Quipolly dams all recorded red alert warnings for blue-green algae during January and February 2022. Peel River downstream of Chaffey Dam also had a red alert warning for recreational use during this period.

The water quality data used in this report is collected on a monthly frequency at 11 sites in the Namoi valley for the State Water Quality Assessment and Monitoring Program. The program is responsible for collecting, analysing and reporting the ambient water quality condition of rivers in NSW. This annual report summarises the surface water quality data collected in the Namoi Valley from July 2021 to June 2022. The location of monitoring sites is shown in Figure 1.

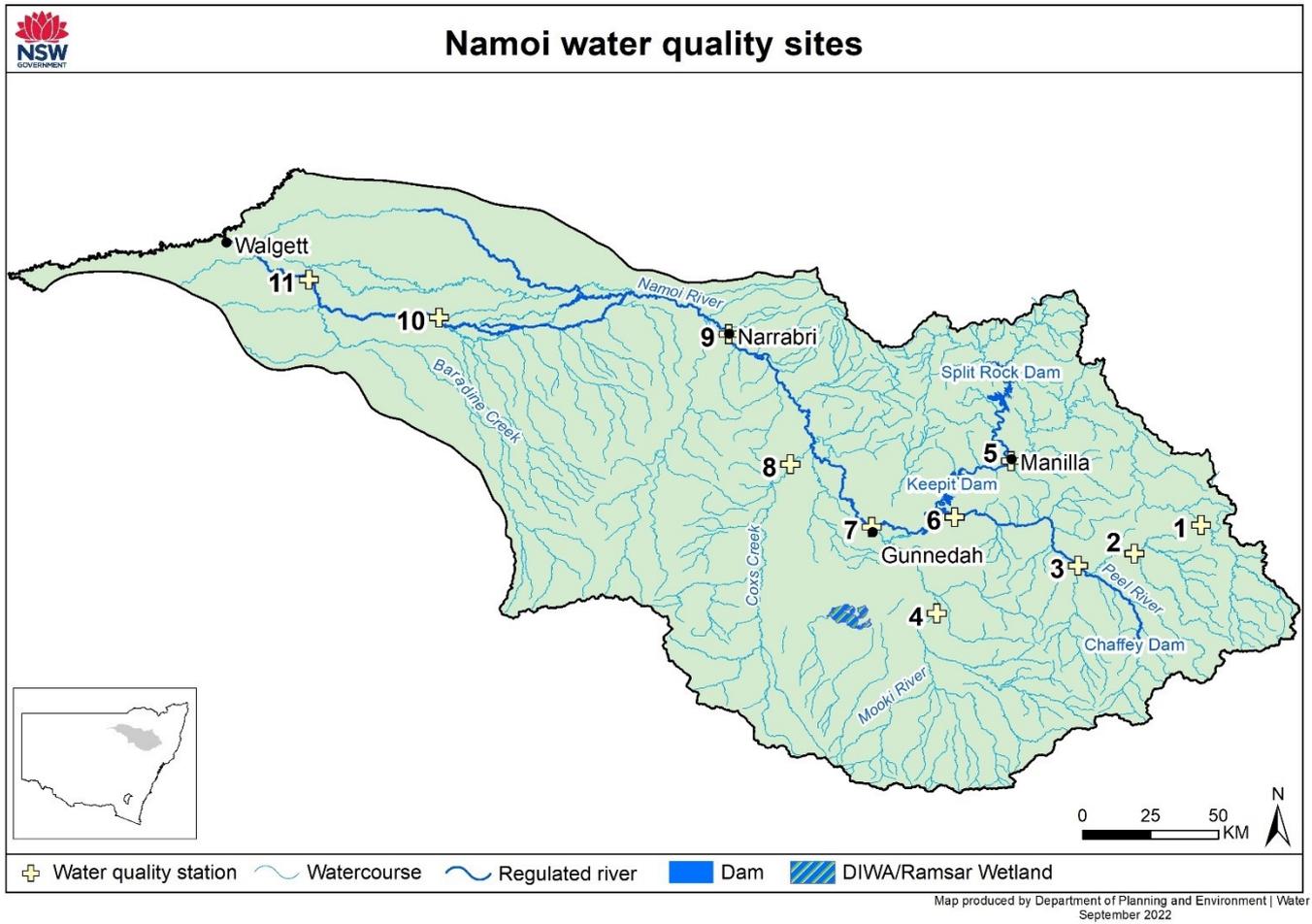


Figure 1: Location of routine water quality monitoring sites in the Namoi valley

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

Site number	Site name	Water Quality Zone	Station number
1	Macdonald River at Woolbrook	Namoi Montane	419010
2	Cockburn River at Mulla Crossing	Namoi Unregulated Uplands	419016
3	Peel River upstream Paradise Weir	Namoi Regulated Peel River	419024
4	Mooki River at Breeza	Namoi Liverpool Plains	419027
5	Namoi River at Manilla	Namoi Regulated uplands	419022
6	Peel River at Carrol Gap	Namoi Regulated Peel River	419006
7	Namoi River at Gunnedah	Namoi Regulated uplands	419001
8	Coxs Creek at Boggabri	Namoi Liverpool Plains	419032
9	Narrabri Creek at Narrabri	Namoi Regulated uplands	419003
10	Namoi River at Bugilbone	Namoi Lowlands	419021
11	Namoi River at Goangra	Namoi Lowlands	419026

Catchment description

The Namoi River catchment is in north-west New South Wales and covers approximately 42,000 km². The Namoi River is around 700 km in length and rises in the rugged terrain of the Great Dividing Range, meandering westward onto the riverine plain to join the Barwon River at Walgett.

Several major tributaries flow into the Namoi River. The Macdonald and Peel Rivers are in the eastern catchment area. The Mooki River and Coxs Creek join the Namoi River mid-catchment at Gunnedah and Boggabri respectively. Smaller tributaries, anabranches and effluent channels characterise the lower catchment.

Flows in the Namoi River are regulated by large dams and several in-stream regulatory structures. Chaffey Dam is in the upper sections of the Peel River. The Manilla River lies in the north-east of the catchment and flows into Split Rock Dam. Keepit Dam is the largest storage in the region and is located on the Namoi River upstream of the junction with the Peel River. There are three weirs situated on the Namoi River downstream of Narrabri. Mollee Weir is designed to hold and re-regulate flows to improve the precision with which water can be supplied to the lower valley. Gunidgera Weir is located at Wee Waa and assists with re-regulation. Its main function is to pass regulated flows into Gunidgera and Pian Creeks.

Land use is largely grazing in the upper catchment with increased cultivation for dryland farming on the Liverpool Plains and the lower catchment. Irrigated agriculture is mostly located adjacent to the Peel River near Tamworth, Mooki River and Coxs Creek on the Liverpool Plains and on the Namoi floodplain downstream of Gunnedah.

Catchment conditions during 2021-2022

Flow during 2021–2022 was influenced by heavy rain falling across much of the catchment from December 2021 through to March 2022 with the heaviest falls in the mid-catchment at Gunnedah in November (Figure 2A). This resulted in large flood events on the Namoi River with discharge at Gunnedah peaking at 162,000 megalitres per day (ML/day) on 29 November 2021, with contributions from the Namoi, Peel and Mooki Rivers (Figure 2C). The November flow event extended to the lower Namoi with discharge at Goangra peaking at over 50,000 ML/day on 10 December 2021.

On 1 July 2021, both Chaffey and Keepit dams were at ~80% capacity (Figure 2B). By August 2021 both dams had filled to 100% capacity and remained near that level until the end of June 2022. In contrast, Split Rock Dam contained just over 30% capacity on 1 July 2021 and had reached 73% capacity by the end of June 2022 (Figure 2B).

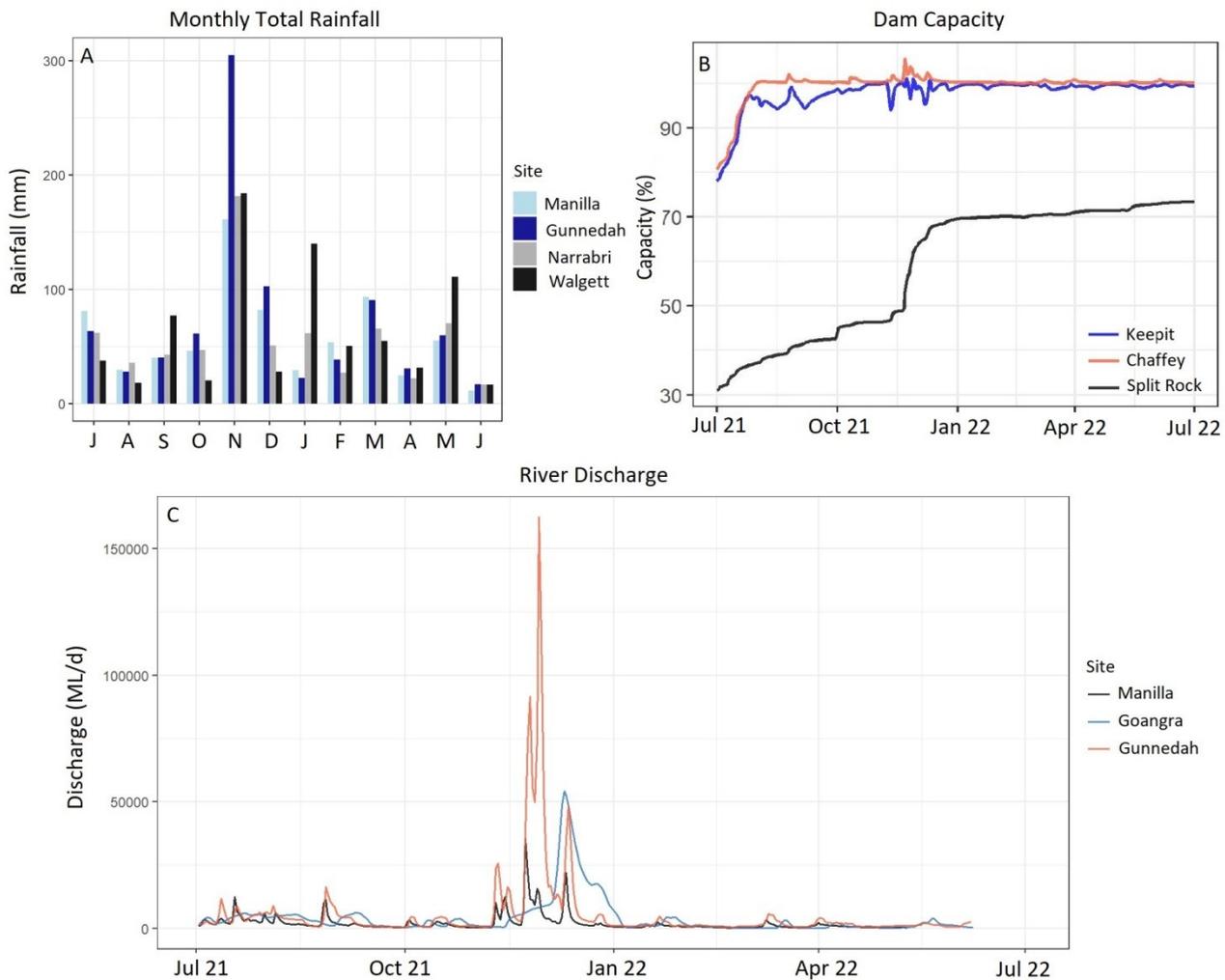


Figure 2: Catchment conditions for selected stations in the Namoi Valley from July 2021 to June 2022 for A: Monthly total rainfall (mm) B: Dam capacity (%) and C: River discharge (ML/day)

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 Peel River at Carroll Gap, Coxs Creek at Boggabri and Narrabri Creek at Narrabri all rated as poor, largely due to high turbidity, total nitrogen and total phosphorus results following major

flooding across the catchment. Cockburn River at Mulla Crossing, Namoi River at Manilla and Gunnedah and Mooki River at Breeza were rated as good, with all other sites, moderate.

Compared to the 2020 to 2021 results, the water quality index score for 3 sites improved. The Namoi River at Manilla and Gunnedah improved from moderate to good, while the score for Coxs Creek at Boggabri improved, but was still rated as poor. In contrast, water quality in Narrabri Creek at Narrabri and the Namoi River at Goangra declined in response to the widespread flooding. All other monitoring sites showed minimal change in water quality compared to the previous year.



Namoi water quality scores 2021-2022

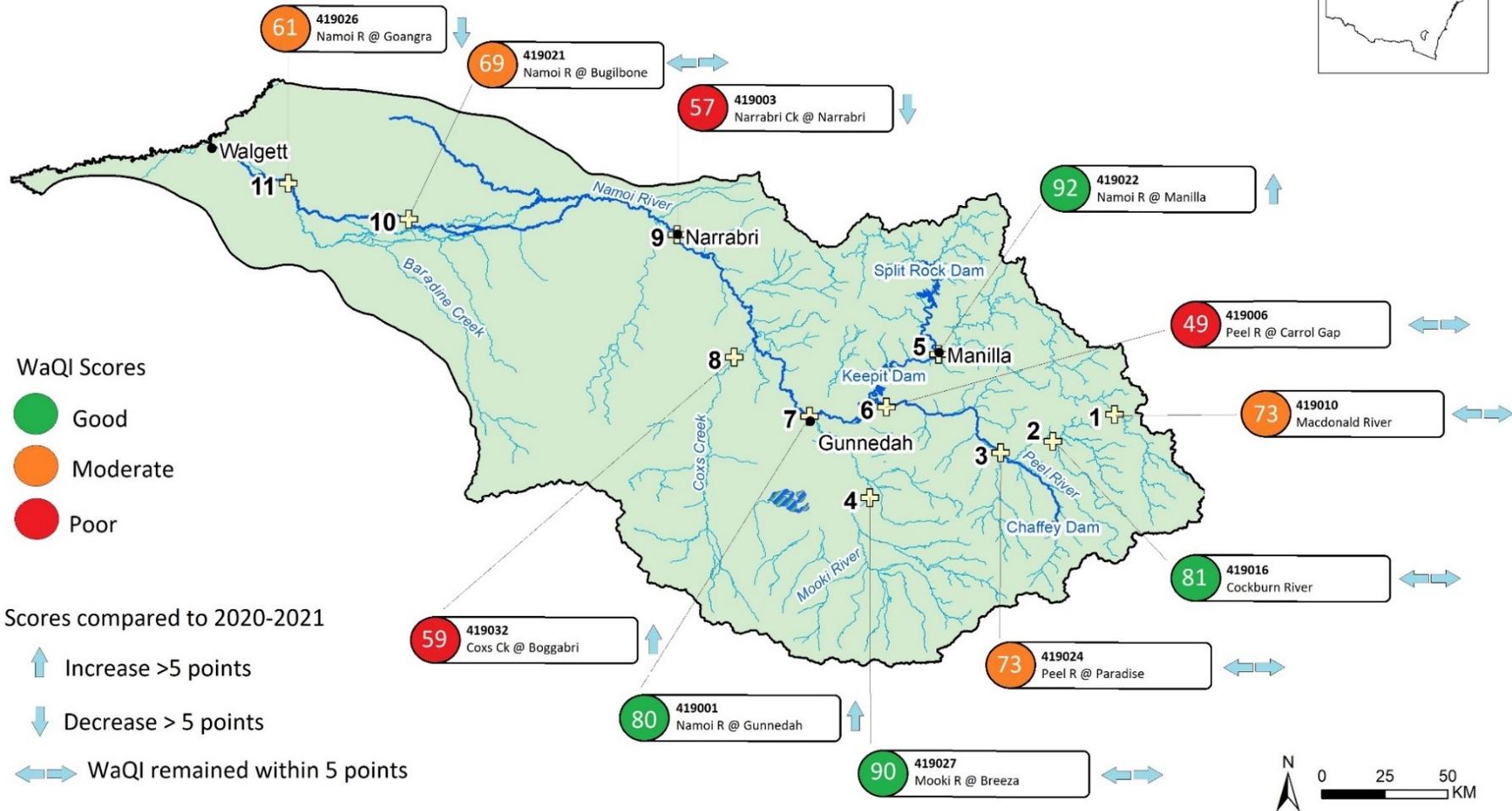
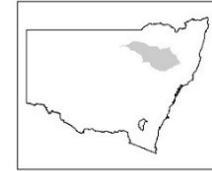


Figure 3: Water quality index scores for the Namoi valley

Turbidity increased with distance down the catchment, reflecting the impact of the cumulative effects of high flows, land use, soil disturbance and human activity on water quality.

The fertile alluvial clay soils in the Liverpool Plains catchment are naturally high in phosphorus. As these soils are eroded into the Mooki River and Coxs Creek by floods and runoff events, the associated nutrients are transported downstream. The high flows resulted in high nitrogen concentrations in Coxs Creek and the Namoi River downstream.

The largest fluctuation in dissolved oxygen levels was in Coxs Creek. High nutrient concentrations may have triggered increased algal growth at this site, resulting in increased photosynthesis and elevated oxygen levels.

The lowest dissolved oxygen readings were in the lower catchment, where high turbidity reduces light penetration, reducing aquatic plant growth and higher water temperature reduces the solubility of oxygen in the water column. In addition, major flooding resulted in the flushing of organic matter off the lowland floodplains and into waterways. The rapid breakdown of this material by bacteria caused dissolved oxygen levels in the lower Namoi catchment to decline to critical levels for fish health in December 2021.

The Mooki River at Breeza had the highest median electrical conductivity followed by the Peel River at Carroll Gap. These sites have historically had high electrical conductivity caused by rainfall and runoff mobilising salts stored in the soil, geology of the landscape and inputs from shallow saline groundwater. Due to its ephemeral nature, there is limited reliance on the Mooki River for irrigation, reducing the risk of soil and crop damage from saline water.

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

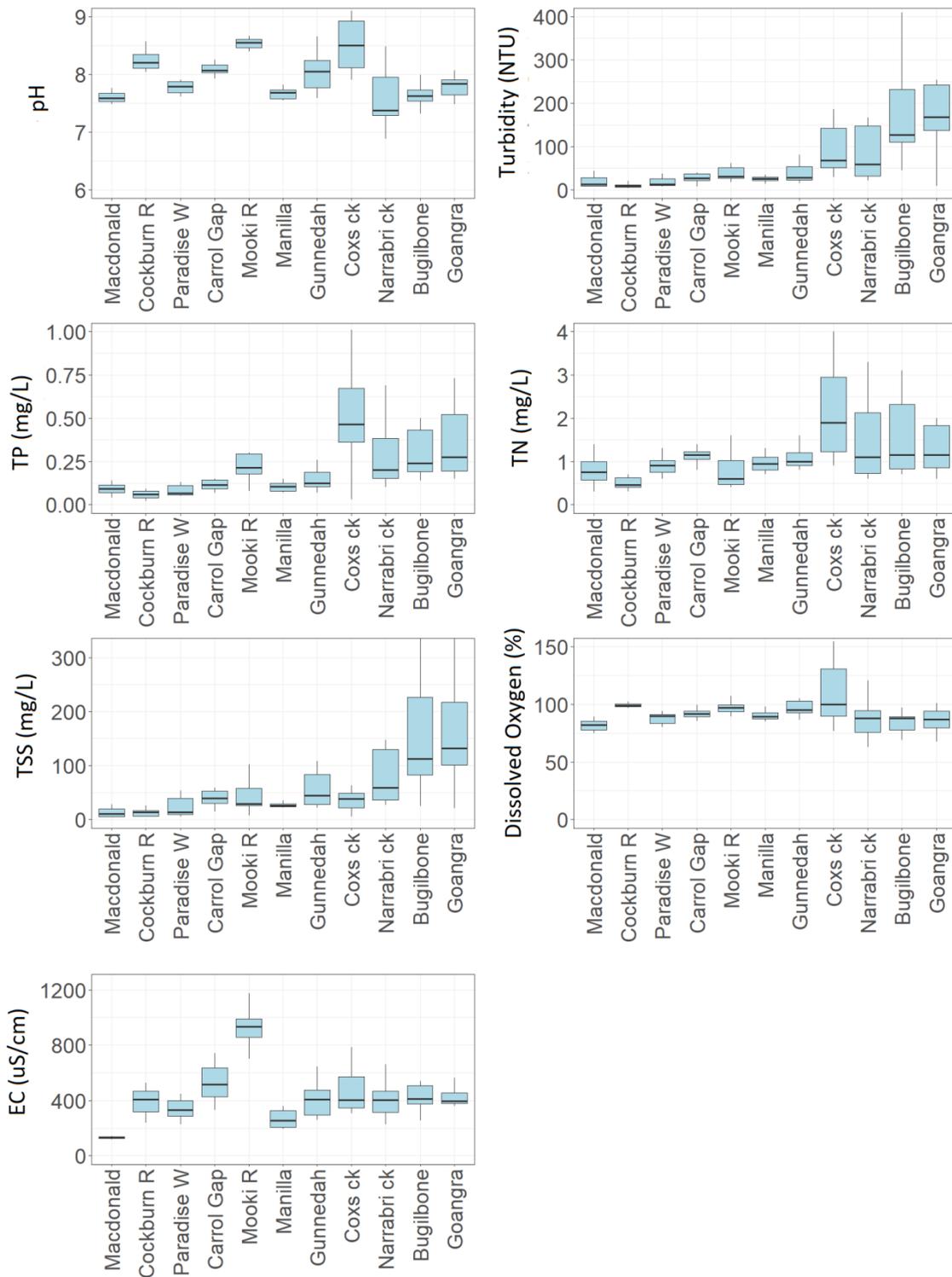


Figure 4: Water quality data for each monitoring site in the Namoi Valley. The parameters shown are pH, Turbidity, Total phosphorus (TP), Total nitrogen (TN), Total suspended solids (TSS), Dissolved oxygen, and electrical conductivity (EC).

Irrigation and salinity

There are 8 continuous electrical conductivity monitoring sites in the Namoi valley. Figure 5 plots selected sites and shows electrical conductivity fluctuated throughout the year in response to flooding events.

All sites in the main irrigation areas had a 95th percentile electrical conductivity lower than the Basin Plan agriculture and irrigation salinity target of 957 $\mu\text{S}/\text{cm}$ for 2021 to 2022.

The Basin Salinity Management Strategy End-of-Valley salinity targets for the Namoi River at Goangra are:

- the median electrical conductivity does not exceed 475 $\mu\text{S}/\text{cm}$
- the 80th percentile electrical conductivity does not exceed 715 $\mu\text{S}/\text{cm}$ and:
- the annual salt load does not exceed 127,600 t/year.

The median (466 $\mu\text{S}/\text{cm}$) and 80th percentile (570 $\mu\text{S}/\text{cm}$) were both less than the End-of Valley targets. Due to the high flows, the annual salt load of 366,354 t/year exceeded the End-of-Valley target value.

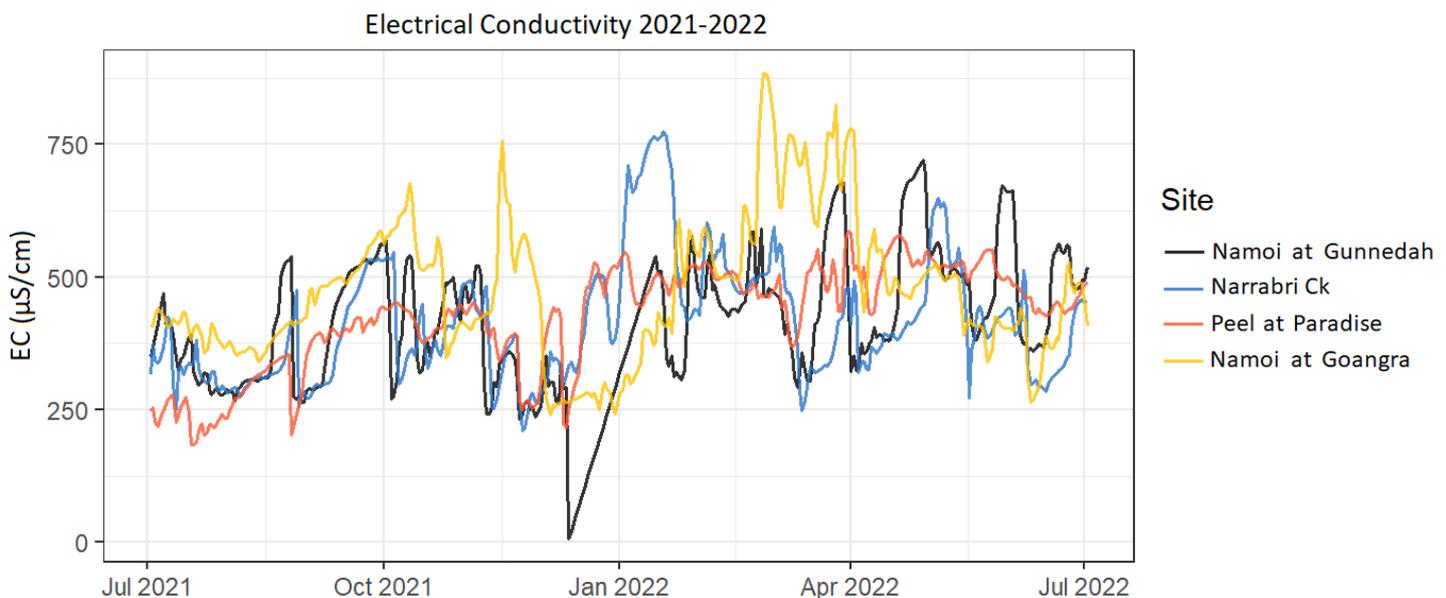


Figure 5: Electrical conductivity (EC) in the Namoi valley

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](#)).

Blue-green algae have historically been a major issue in Chaffey and Quipolly Dams due to stratification and warm water temperatures. Less frequent blooms usually occur in Keepit and Split Rock dams. Blooms during low flows can occur in the Namoi River at Walgett due to high nutrient inputs. Table 2 indicates the distribution of algal alerts from July 2021 to June 2022. The majority of red alert warnings for recreational use occurred over the summer months for Chaffey Dam, the Peel River downstream of Chaffey Dam and Quipolly Dam.

Table 2: Distribution of algal alert levels in Namoi Valley Dams July 2021 to June 2022

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Chaffey Dam	*											
Peel River (downstream Chaffey)	*											
Split Rock Area	*	*	*	*	*	*	*	*	*	*	*	*
Keepit Dam	*	*	*	*	*	*	*	*	*	*	*	*
Quipolly Dam	*	*	*	*	*	*	*	*	*	*	*	*
Namoi River at Walgett	*	*	*	*	*	*	*	*	*	*	*	*

Key: * Nil/Low alert Green alert Amber alert Red alert

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. Flooding occurred in all catchments across the Northern 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 and a high risk of significant fish deaths.

NSW Fisheries investigated 2 fish death reports in the Namoi Valley in December 2021. The first report was Gunidgera Creek, near Wee Waa on 8 December. Approximately 100 dead fish were reported. Species affected included Bony Herring and Common Carp (introduced species). NSW Fisheries determined the cause was likely widespread flooding in the Namoi Valley and associated organic material entering waterways resulting in the deoxygenation of the water and subsequent fish deaths.

The second fish death report occurred at Quipolly Creek, immediately downstream of Quipolly Dam on 22 December 2021. Approximately 100 dead fish were reported. Species affected included Golden Perch and Common Carp (introduced species). NSW Fisheries suspected the affected fish washed over the spillway of Quipolly Dam following high rainfall and became stranded in a series of pools downstream of the dam. Water quality in those pools then deteriorated in the following days leading to a reduction in dissolved oxygen.

Summary

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

In 2021 to 2022, major flooding across the catchment was the key driver of water quality. Increased runoff carried high volumes of sediment and nutrients into waterways resulting in 7 of 11 water quality monitoring sites being rated as moderate or poor. In contrast, the high flows maintained electrical conductivity below irrigation targets.

The flood flows resulted in a hypoxic blackwater event in the lower Namoi catchment which contributed to low oxygen levels in the Barwon and Darling rivers. 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. The dark appearance of the water is due to the release of tannins as the organic matter decays. NSW Fisheries investigated 2 fish death reports in the Namoi Valley.

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.

The flushing of nutrients into Chaffey, Split Rock and Quipolly dams by floodwaters may have contributed to the high potentially harmful blue-green algal numbers, with Chaffey Dam being on either amber or red alert warnings for all of 2021 to 2022.

For more detailed information about water quality issues in the Namoi catchment see the Namoi surface water quality technical report (https://www.industry.nsw.gov.au/___data/assets/pdf_file/0003/305742/Water-quality-technical-report-for-the-Namoi-surface-water-resource-plan-area-SW14.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>

Fish kills in NSW: <https://www.dpi.nsw.gov.au/fishing/habitat/threats/fish-kills>

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