# Turnwood Creek

This data report provides a summary of the nutrients at the Turnwood Creek sampling site in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. Downstream of this site, the creek discharges to the Hardy Inlet. Nutrients (nitrogen and phosphorus) are compounds that are important for plants to grow. Excess nutrients entering waterways from effluent, fertilisers and other sources can fuel algal growth, decrease oxygen levels in water and harm fish and other species. Total suspended solids, pH and salinity data are also presented as they help us better understand the processes occurring in the catchment.

## About the catchment

Turnwood Creek has a catchment area of about 10 km$^2$. The dominant land use is softwood tree plantations (bluegums) which cover nearly 60 per cent of the catchment; the other major land use is beef and sheep grazing. More than half of the creek has had its fringing vegetation cleared or severely modified.

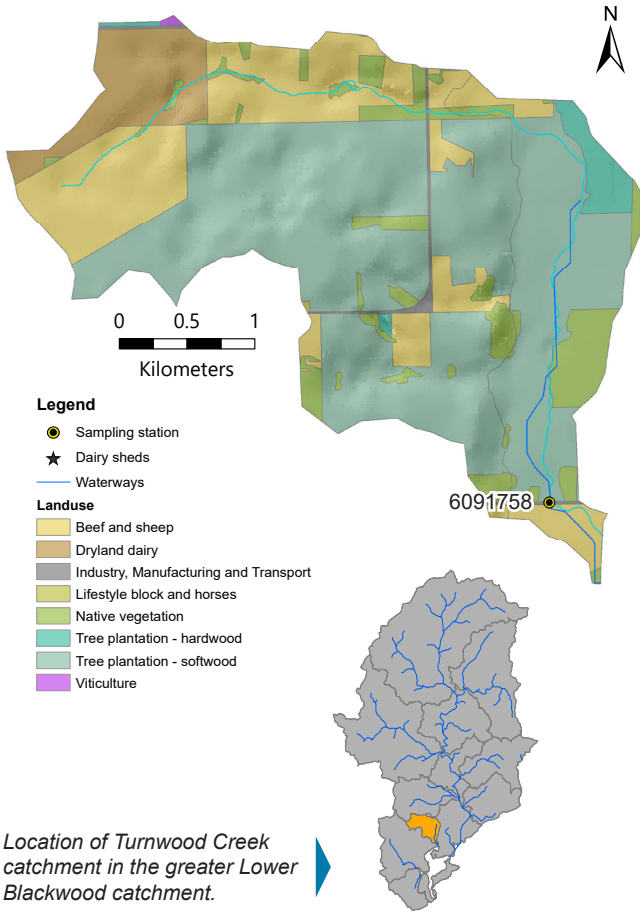
The soils in the catchment have a high phosphorus-binding capacity and so bind most of the phosphorus applied to them, reducing the amount that enters streams.

Turnwood Creek discharges to the North Bay of the Hardy Inlet, in Kudardup.

Water quality is measured at site 6091758, SCCAT7, where Turnwood Creek passes under Fisher Road in Kudardup. This site is just downstream of a large area of bluegum plantation and less than 5km from the discharge point to the Hardy Inlet.

## Results summary

Nutrient concentrations were low (total phosphorus) to moderate (total nitrogen) at the Turnwood Creek sampling site. The proportion of nitrogen present as bioavailable oxides of nitrogen in 2018 was large, suggesting fertiliser from the upstream bluegum plantations is entering the creek. This site also had some of the lowest pH levels recorded of the Blackwood catchment sites, indicating the groundwater at this site is possibly acidic.




*Location of Turnwood Creek catchment in the greater Lower Blackwood catchment.*

## Facts and figures

| | |
|---|---|
| Sampling site code | 6091758 |
| Rainfall at Alexandra Bridge (2018) | 933 mm |
| Catchment area | 10 km$^2$ |
| Per cent cleared area (2001) | 90 per cent |
| River flow | Ephemeral |
| Main land use (2001) | Softwood tree plantations and beef and sheep grazing |

# Turnwood Creek

## Nitrogen over time (2004–18)

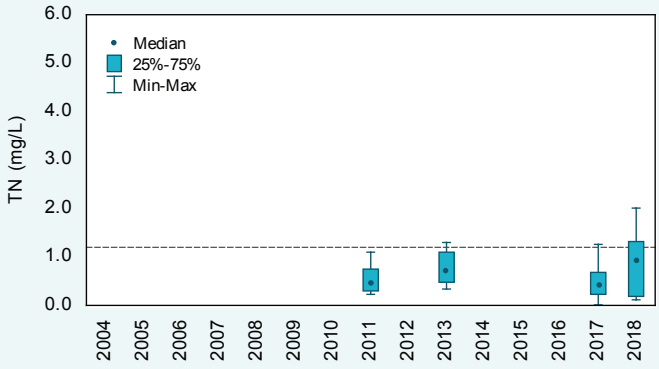
### Concentrations

The median TN concentrations were below the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value in each of the four years where there were sufficient data to graph. The highest median was recorded in 2018, when Turnwood Creek had the fourth highest median of the sites in the Blackwood River catchment (0.91 mg/L). 2018 also had the highest concentrations of all years, with more samples above the ANZECC trigger value than previously. Whether this is because of a deterioration in water quality or just part of the natural fluctuations at this site is unknown. Ongoing monitoring will help us determine this.

### Trends

As Turnwood Creek was only sampled sporadically over the past 15 years, it was not possible to calculate trends in TN concentrations at this site. A minimum of five years of data are required to test for trends.

## Turnwood Creek




*Total nitrogen concentrations, 2004–18 at site 6091758. The dashed line is the ANZECC trigger value for lowland rivers.*

*The Turnwood Creek sampling site which is dry, January 2018.*

## Nitrogen (2018)

### Types of nitrogen

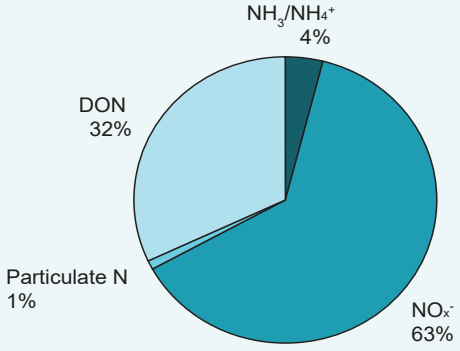
Total N is made up of many different types of N. Turnwood Creek had the largest average percentage of N present as oxides of N ($NO_x^-$) of the nine sites sampled in the Blackwood River catchment (63 per cent; Chapman Brook had the next highest percentage of 59 per cent). This form of N is readily bioavailable to plants and algae to fuel rapid growth. The main source of this kind of N was likely fertilisers. Only a relatively small amount of N was present as dissolved organic N (DON). This form of N consists mainly of degrading plant and animal matter, though it may also include other forms. Most forms of DON are not very bioavailable, though some are readily used by plants and algae to fuel growth. The large proportion of N present as $NO_x^-$ is typical of an agricultural catchment where most of the N is coming from non-natural sources (in this case, likely to be fertilisers applied to the young bluegum plantations upstream of the sampling site).

### Concentrations

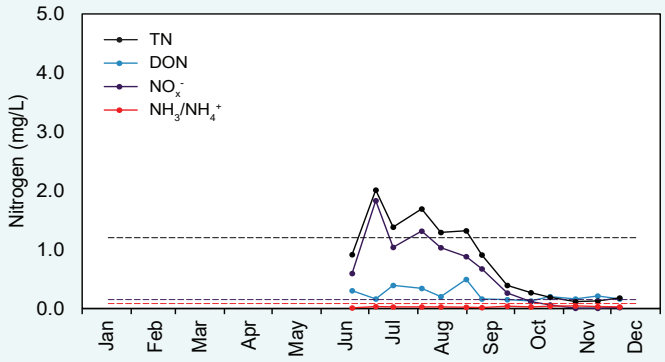
All forms of N, except for ammonia N ($NH_3/NH_4^+$), showed a first-flush effect where N was mobilised following heavy rainfall near the start of the flow year. Much of this N was probably the result of mineralisation of organic N in soils and streams over the summer period, and runoff of high-concentration waters from bluegum plantations and pastures, which build up with fertiliser and animal waste over the summer. After this, concentrations remained high while flow volumes were high, only dropping in September when the flow volumes in the creek were reducing.

Where there are no data shown on the graph, the creek was not flowing.

## Turnwood Creek




*2018 average nitrogen fractions at site 6091758.*




*2018 nitrogen concentrations at 6091758. The dashed lines are the ANZECC trigger values for lowland rivers for the different N species.*

*Looking downstream from Fisher Road along Turnwood Creek, July 2018.*

# Turnwood Creek

## Phosphorus over time (2004–18)

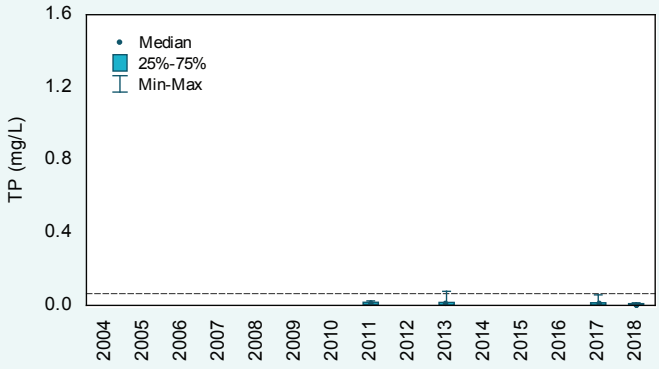
### Concentrations

Total phosphorus (TP) concentrations were low in Turnwood Creek with only one sample, collected in 2013, over the ANZECC trigger value. In each year for which there were sufficient data to graph, the median TP concentration was well below the ANZECC trigger value and there was at least one sample below the laboratory limit of reporting (0.005 mg/L). The high P-binding capacity of the soils present in the catchment will be contributing to the low P concentrations recorded.

### Trends

As Turnwood Creek was only sampled sporadically over the past 15 years, it was not possible to calculate trends in TP concentrations at this site. A minimum of five years of data are required to test for trends.

## Turnwood Creek




*Total phosphorus concentrations, 2004–18 at site 6091758. The dashed line is the ANZECC trigger value for lowland rivers.*

*A shallow drain which runs between Fisher Road and the bluegum plantation and contributes flow to Turnwood Creek, September 2018.*

## Phosphorus (2018)

### Types of phosphorus

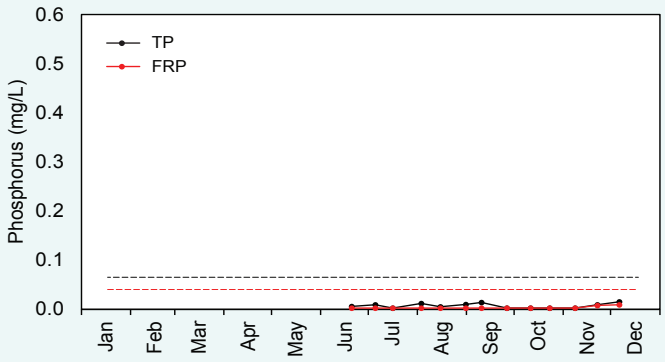
Total P is made up of different types of P. Because a large number of samples were below the limit of reporting in 2018, a phosphorus fraction pie chart was not generated for the Turnwood Creek site. At this site, five of the 13 TP samples and 11 of the 13 FRP samples were below their limits of reporting (0.005 mg/L in each case).

### Concentrations

Both TP and FRP concentrations were low year-round in Turnwood Creek. While concentrations fluctuated over the year there was no clear evidence of a seasonal pattern and all samples were well below their respective ANZECC trigger values. The high P-binding capacity of the soils present in the catchment will be contributing to the low P concentrations recorded.

Where there are no data shown on the graph, the creek was not flowing.

## Turnwood Creek




*2018 phosphorus concentrations at 6091758. The dashed lines are the ANZECC trigger values for lowland rivers for the different P species.*

*Collecting a water quality sample from Turnwood Creek, June 2019.*

## Total suspended solids over time (2004–18)

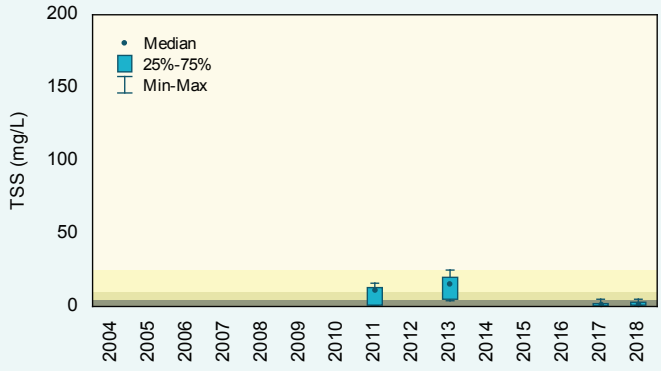
### Concentrations

Using the Statewide River Water Quality Assessment (SWRWQA) bands, the median total suspended solids (TSS) concentration in Turnwood Creek was classified as high in 2011 and 2013, and low in 2017–18. Ongoing monitoring will help determine if the apparent decrease is because of an actual improvement in TSS concentrations or just part of the natural variation at this site.

### Trends

As Turnwood Creek was only sampled sporadically over the last 15 years, it was not possible to calculate trends in TSS concentrations at this site. A minimum of five years of data are required to test for trends.

## Turnwood Creek




*Total suspended solids concentrations, 2004–18 at site 6091758. The shading refers to the SWRWQA classification bands.*

very high high moderate low

*The culverts through which Turnwood Creek passes under Fisher Road, October 2019.*

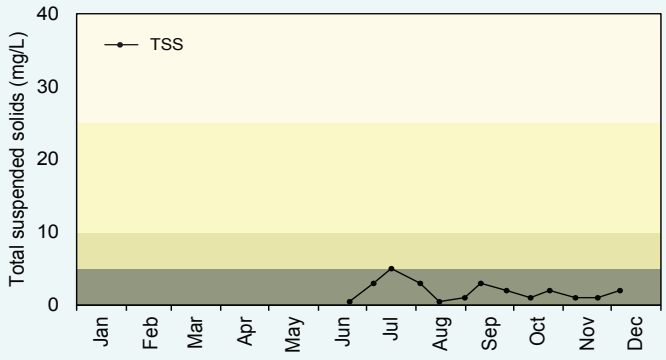
## Total suspended solids (2018)

### Concentrations

TSS concentrations fluctuated in 2018 with evidence of a slight first-flush effect in June to July, shortly after the creek started flowing. At this time, heavy rainfall would have washed particulate matter into the creek from surrounding land use as well as mobilising any particulate matter present in the creek itself. All of the samples but one were classified as low using the SWRWQA bands.

Where there are no data shown on the graph, the creek was not flowing.

## Turnwood Creek




*2018 total suspended solids concentrations at 6091758. The shading refers to the SWRWQA classification bands.*

very high high moderate low

*The Turnwood Creek sampling site, October 2019. As the creek starts to dry up, the water becomes more cloudy.*

# Turnwood Creek

## pH over time (2004–18)

### pH values

The median pH was within the upper and lower ANZECC trigger values in each of the years for which there were sufficient data to graph. Each year had a proportion of samples below the lower ANZECC trigger value, with the lowest pH recorded in 2018 (4.1) being well below.

### Trends

As Turnwood Creek was only sampled sporadically over the past 15 years, it was not possible to calculate trends in pH at this site. A minimum of five years of data are required to test for trends.

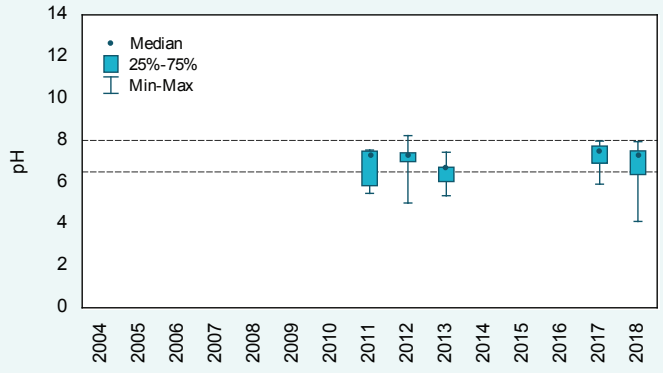
## pH (2018)

### pH values

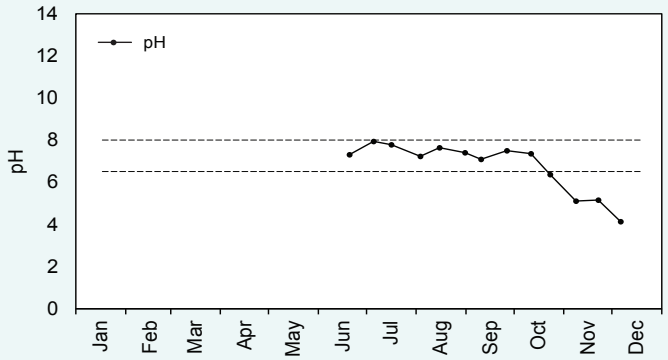
There was a seasonal pattern present in the 2018 pH data at Turnwood Creek. pH was relatively stable for the first part of the flow year, before reducing from October. At this time, the relative proportion of groundwater in the stream would be increasing as rainfall and surface flows decrease. This suggests the pH of the groundwater is more acidic than the surface water at this site.

Where there are no data shown on the graph, the creek was not flowing.

## Turnwood Creek




*pH levels, 2004–18 at site 6091758. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.*




*2018 pH levels at 6091758. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.*

*Fast flows in Turnwood Creek looking downstream from Fisher Road, August 2018.*

# Turnwood Creek

## Salinity over time (2004–18)

### Concentrations

Most of the samples collected at Turnwood creek were classified as fresh using the SWRWQA bands. There were a small number of samples classified as marginal in 2012 and 2017–18.

### Trends

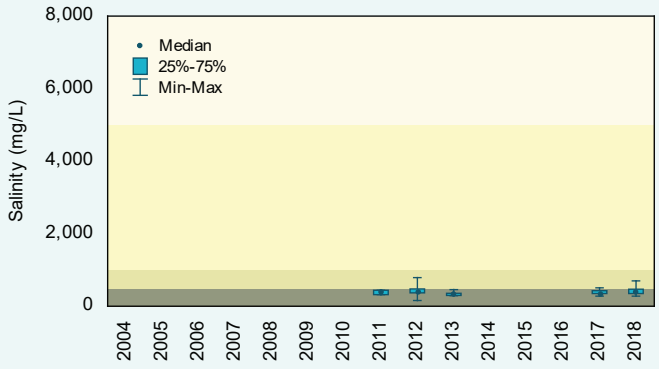
As Turnwood Creek was only sampled sporadically over the past 15 years, it was not possible to calculate trends in salinity at this site. A minimum of five years of data are required to test for trends.

## Salinity (2018)

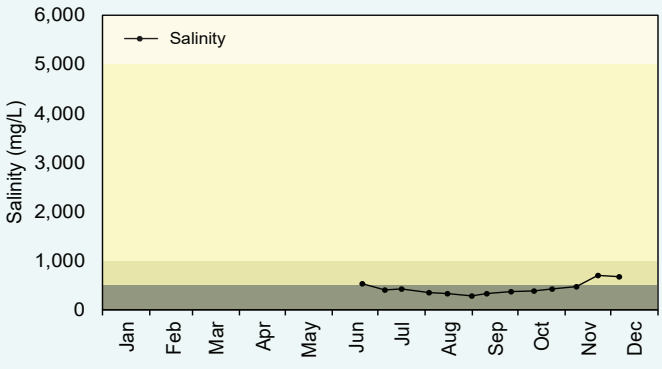
### Concentrations

Salinity showed a very slight inverse seasonal relationship. That is, salinity was highest at the start and end of the flow year. The slightly higher salinity recorded in June is likely because of a first-flush effect where the onset of winter rains flushed salt from surrounding land use into the creek as well as mobilising salts that had been left behind after the creek dried the previous summer. Salinity levels then dropped as flow increased before increasing again in November. It is possible that the groundwater at this site is more saline than the surface water; as the surface water dries up, the proportion of water in the creek coming from groundwater increases, leading to increased salinity. Evapoconcentration may also be causing the increased salinity seen at this time.

## Turnwood Creek




*Salinity concentrations, 2004–18 at site 6091758. The shading refers to the SWRWQA classification bands.*




*2018 salinity concentrations at 6091758. The shading refers to the SWRWQA classification bands.*

saline brackish marginal fresh

*Turnwood Creek sampling site, January 2018. The site was dry at this time.*

# Turnwood Creek

## Background

The Regional Estuaries Initiative is a State Government program to improve the health of waterways and estuaries in the south-west of Western Australia. Healthy Estuaries WA is a Royalties for Regions program launched in 2020 and will build on the work of the Regional Estuaries Initiative. Collecting and reporting water quality data, such as in this report, helps build understanding of the whole system. By understanding the whole system, we can direct investment towards the most effective actions in the catchments to protect and restore the health of our waterways.

You can find the latest data on the condition of Hardy Inlet at estuaries.dwer.wa.gov.au/estuary/hardy-inlet/

The Regional Estuaries Initiative partners with the Lower Blackwood Land Conservation District Committee (Lower Blackwood LCDC) to fund best-practice fertilisers, dairy effluent and watercourse management on farms.

- To find out how you can be involved visit estuaries.dwer.wa.gov.au/participate
- To find out more about the Lower Blackwood LCDC go to lowerblackwood.com.au
- To find out more about the health of the rivers in the Hardy Inlet catchment go to rivers.dwer.wa.gov.au/assessments/results

## Methods

Where possible, parameters were compared with the ANZECC trigger values for lowland rivers in south-west Australia. These values provide a value above which there may be a risk of adverse effect. For pH there is both an upper and lower trigger value which represent the acceptable pH range. Where there were no ANZECC trigger values available (for TSS and salinity) the SWRWQA classification bands were used to allow samples and sites to be classified and compared.

Trend testing was carried out using either the Mann or Seasonal Kendall tests as appropriate. Where there were flow data available and there was a flow-concentration relationship, the data were flow-adjusted before trend analysis.

Annual loads were calculated by multiplying daily flow with daily nutrient concentrations and aggregating over the year. Measured daily concentrations were not available as samples were collected fortnightly at best, so daily concentration data were calculated using the locally estimated scatterplot smoothing algorithm (LOESS).

## Glossary

**Bioavailable**: bioavailable nutrients refers to those nutrients which plants and algae can take up from the water and use straight away for growth.

**Concentration**: the amount of a substance present in the water.

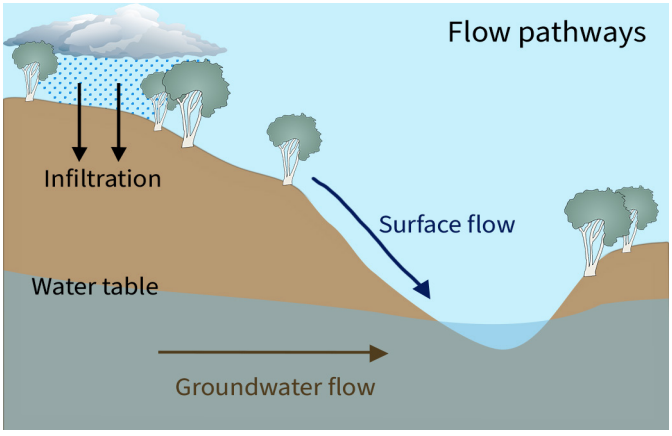
**Evapoconcentration**: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

**Laboratory limit of reporting**: this is the lowest concentration (or amount) of an analyte that can be reported by a laboratory.

**Load**: the total mass of a substance passing a certain point.

**Load per unit area**: the load at the sampling site divided by the entire catchment area upstream of the sampling site.

The schematic below shows the main flow pathways which may contribute nutrients, particulates and salts to the waterways. Connection between surface water and groundwater depends on the location in the catchment, geology and the time of year.






Turnwood Creek Issue 1
Publication date: May 2021
ISSN: 2209–6779 (online only)