Beenup

This data report provides a summary of the nutrients at the Beenup catchment sampling site in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. 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

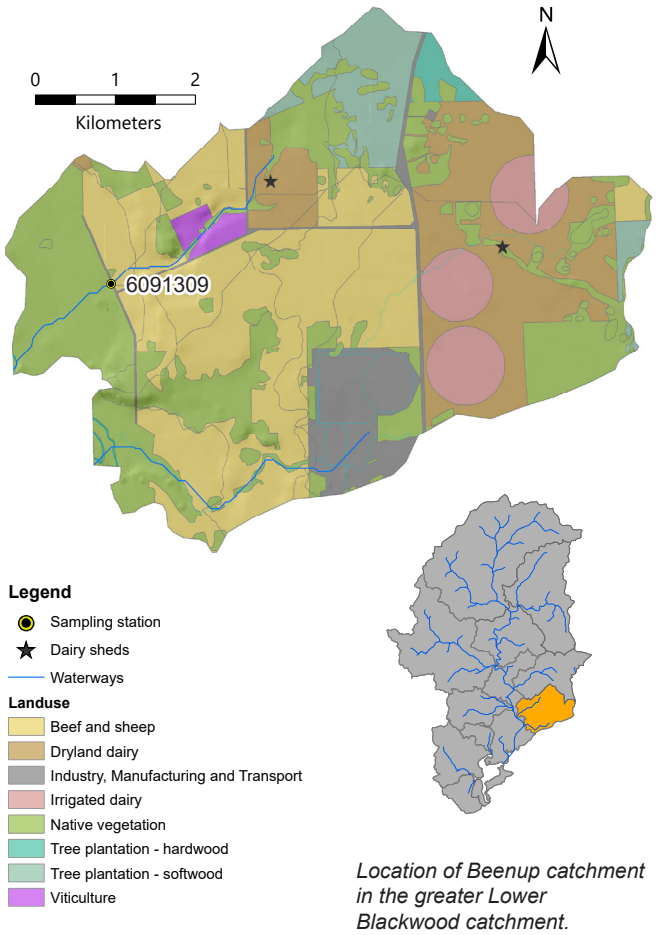
Beenup has a catchment area of about 31 km^2, with native vegetation and beef and sheep grazing the major land uses, covering roughly a third of the catchment each. Dryland dairy is the next largest land use and there are two dairy sheds present in the catchment. Two main streams drain the Beenup catchment, of which only the northern is monitored. Much of the fringing vegetation has been cleared, especially where the streams pass through agricultural land.

The soils in the catchment have a moderate to high capacity to bind phosphorus (P). This means that any P applied to them tends to be bound, reducing the amount that enters streams.

Water quality is measured at site 6091309, Payne Road, which is close to Payne Road, in Courtenay, on the northern stream in the catchment. Downstream of this site, the stream passes through the Scott National Park before discharging to the Blackwood River.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the Payne Road sampling site in the Beenup catchment were high. Most of the nutrients were entering the stream from the agricultural land use upstream of the sampling site.



Location of Beenup catchment in the greater Lower Blackwood catchment.

Facts and figures

Sampling site code	6091309
Rainfall at Alexandra Bridge (2018)	933 mm
Catchment area	31 km^2
Per cent cleared area (2001)	69 per cent
River flow	Ephemeral
Main land use (2001)	Native vegetation, beef and sheep grazing and dryland dairy

Nitrogen over time (2004–18)

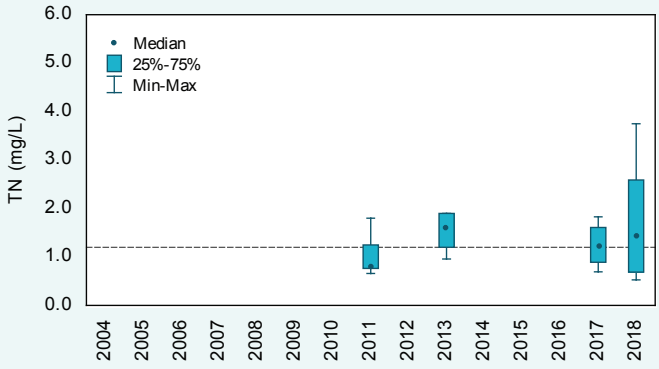
Concentrations

Total nitrogen (TN) concentrations at Payne Road were high. While TN varied in the four years with sufficient data to graph, the median TN concentration was above the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value in all but one of these years. The site had the highest 2018 median TN concentration (1.4 mg/L) of the nine sites sampled in the Blackwood River catchment. The high TN concentrations can be attributed to the upstream agricultural land use. The fact that much of the catchment is cleared, and the lack of fringing vegetation and fencing along waterways, allows nutrients to be washed into the stream quickly following rainfall.

Trends

As Payne Road 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.

Payne Road



Total nitrogen concentrations, 2004–18 at site 6091309. The dashed line is the ANZECC trigger value for lowland rivers.

Collecting a water quality sample at the Payne Road sampling site, June 2019.

Nitrogen (2018)

Types of nitrogen

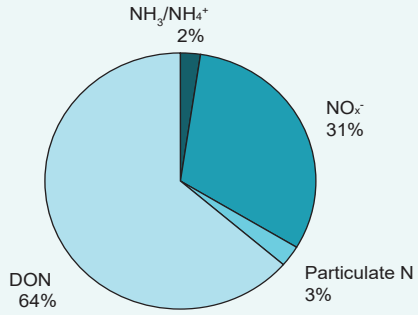
Total N is made up of many different types of N. At Payne Road, nearly a third of N was present as oxides of N (NO_x^-) which can be used by plants and algae to fuel rapid growth. Likely sources of NO_x^- in an agricultural catchment like Beenup include fertilisers and animal waste with natural sources contributing less. Having a relatively large proportion of the N present as NO_x^- is typical of agricultural catchments like Beenup. Only a small amount of N was present as particulate N and ammonia N (NH_3/NH_4^+). The largest proportion was present as dissolved organic N (DON) which consists mainly of degrading plant and animal matter but may also include other forms. Most forms of DON need to be further broken down to become available to plants and algae, though some forms are readily bioavailable.

Concentrations

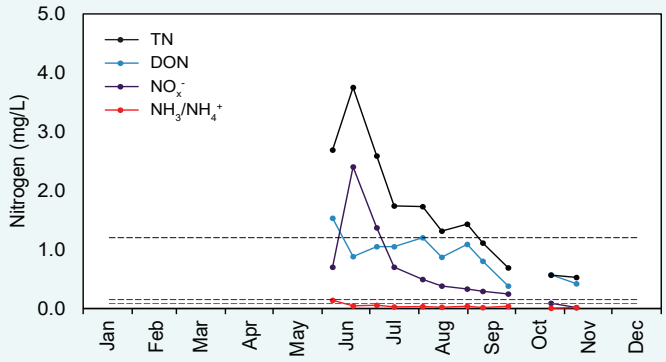
Nitrogen concentrations showed a seasonal pattern with TN and NO_x^- both peaking in June, shortly after the stream started flowing, before reducing over the rest of the year. DON and NH_3/NH_4^+ were at their highest on the first sampling occasion (which was also the only time NH_3/NH_4^+ was above the ANZECC trigger value). These early peaks are indicative of a first-flush effect where N was mobilised following heavy rainfall. For NO_x^- and NH_3/NH_4^+, 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 pasture which builds up with fertilisers and animal waste over the summer. DON was likely washed from soils and remnant wetlands where it had built up over the summer period. NO_x^- concentrations were high, with all but two of the samples collected over the ANZECC trigger value.

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

Payne Road



2018 average nitrogen fractions at site 6091309.



2018 nitrogen concentrations at 6091309. The dashed lines are the ANZECC trigger values for lowland rivers for the different N species.

Dense growth of pennyroyal mint (Mentha pulegium), an environmental weed, at the sampling site. October 2019. High nutrient levels help promote this kind of growth.

Phosphorus over time (2004–18)

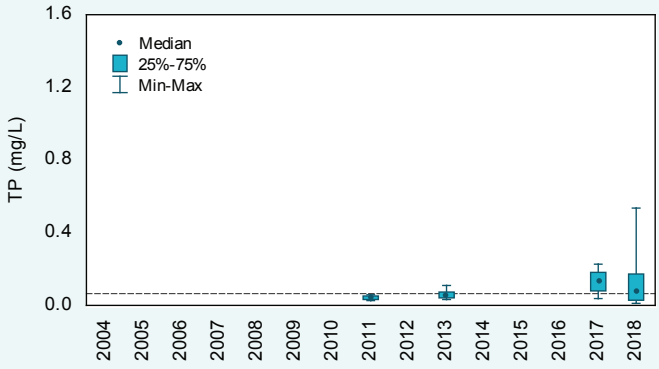
Concentrations

Total phosphorus (TP) concentrations were high at Payne Road compared with the other sites in the Blackwood River catchment. Only four years had sufficient TP data to graph; from these, it appears that TP concentrations increased between 2013 and 2017. Currently there are insufficient data to confirm whether this is the case. Ongoing monitoring will help determine if water quality has deteriorated or if the higher TP concentrations in 2017–18 are part of the natural fluctuations at this site. In 2018, Payne Road had the second-highest median TP concentration of the nine sites monitored in the Blackwood River catchment (0.074 mg/L; only Courtney Road had a higher median of 0.087 mg/L).

Trends

As Payne Road was only sampled sporadically over the last 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.

Payne Road



Total phosphorus concentrations, 2004–18 at site 6091309. The dashed line is the ANZECC trigger value for lowland rivers.

The Payne Road sampling site, November 2018. It stopped flowing shortly after this photograph was taken.

Phosphorus (2018)

Types of phosphorus

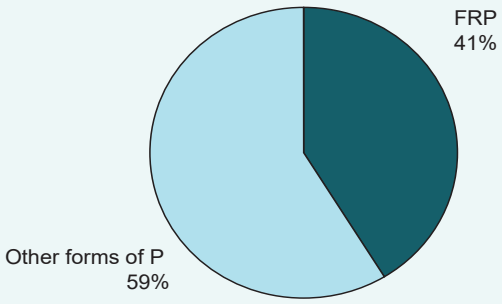
Total P is made up of different types of P. At Payne Road, a little over a third of the P was present as highly bioavailable filterable reactive P (FRP). This form of P is readily used by plants and algae to fuel growth and is likely sourced from fertilisers and animal waste as well as natural sources. The remaining P was present as either particulate P or dissolved organic P (DOP) or both. Particulate P generally needs to be broken down before becoming bioavailable to algae. The bioavailability of DOP varies and is poorly understood.

Concentrations

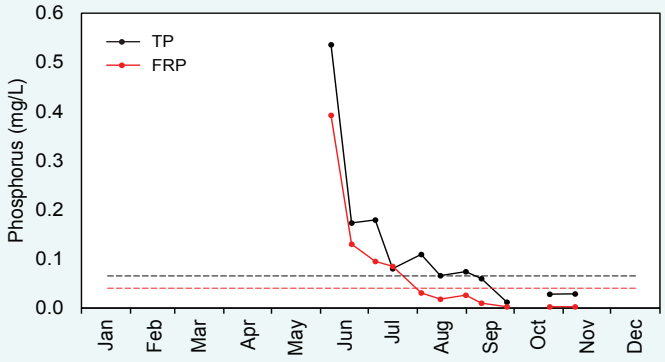
Total P and FRP showed a very similar pattern in 2018. Both were at their highest in June when the stream first started to flow before reducing over the rest of the year. This suggests a large amount of P was entering the stream because of a first-flush effect, where nutrients that were present in the dry stream and on the ground surrounding the stream were flushed into the stream following heavy rainfall. The agricultural land use and lack of fringing vegetation and fencing along this stream will be contributing to the relatively high P concentrations observed at this site.

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

Payne Road



2018 average phosphorus fractions at site 6091309.



2018 phosphorus concentrations at 6091309. The dashed lines are the ANZECC trigger values for lowland rivers for the different P species.

The Payne Road sampling site, August 2018. The water levels are much higher than in the previous photograph, taken in November 2018.

Total suspended solids over time (2004–18)

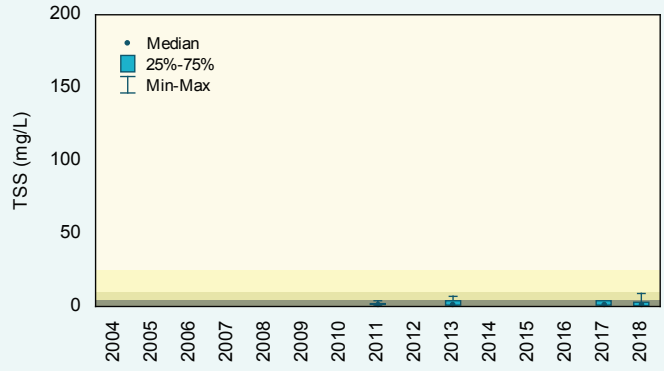
Concentrations

Total suspended solids (TSS) concentrations were consistently low at Payne Road. Using the Statewide River Water Quality Assessment (SWRWQA) bands, the median TSS concentration was classified as low for all years for which there were data. In fact, most of the data collected fell within the low band.

Trends

As Payne Road was only sampled sporadically over the past 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.

Payne Road



Total suspended solids concentrations, 2004–18 at site 6091309. The shading refers to the SWRWQA classification bands.

very high | high | moderate | low

Near the Payne Road sampling site, August 2019.

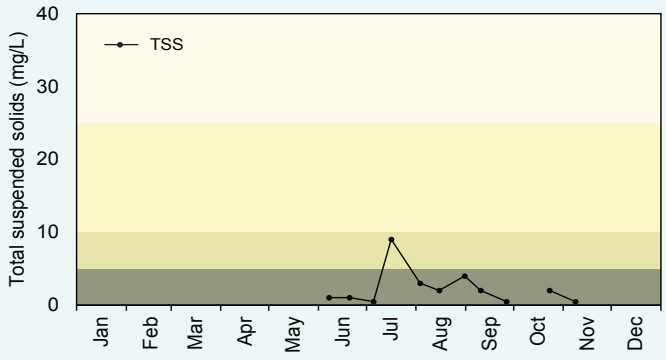
Total suspended solids (2018)

Concentrations

In 2018, all samples collected fell in the low band except for one in July which was classified as moderate. The peak in early July may have been caused by heavy rainfall in the four days before sampling which may have washed particulate matter into the stream, or caused in-stream erosion. There was a slight seasonal pattern present, with concentrations a little higher in July to September when streamflow would have been at its highest. At this time, particulate matter would have been entering the stream via surface flow as well as coming from in-stream sources such as erosion.

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

Payne Road



2018 total suspended solids concentrations at 6091309. The shading refers to the SWRWQA classification bands.

very high high moderate low

The Payne Road sampling site, July 2019.

pH over time (2004–18)

pH values

pH at Payne Road fluctuated in the years for which there were sufficient data to graph. It appears that pH may have increased following the gap in sampling from 2014–16; however, there are not enough data to verify this. Ongoing monitoring will allow us to determine if pH has increased at this site or if the higher values in 2017–18 are part of the natural fluctuations at this site. In 2018, the median pH was just below the upper ANZECC trigger value.

Trends

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

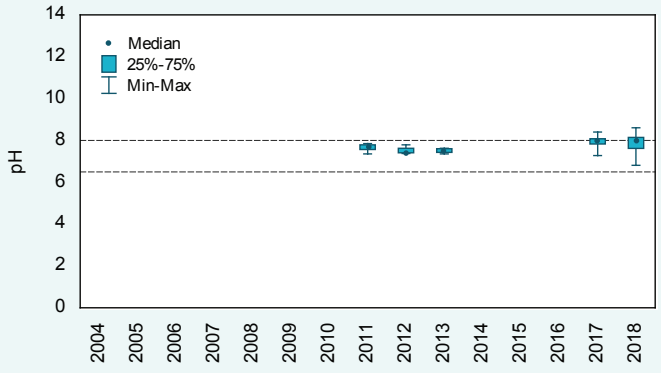
pH (2018)

pH values

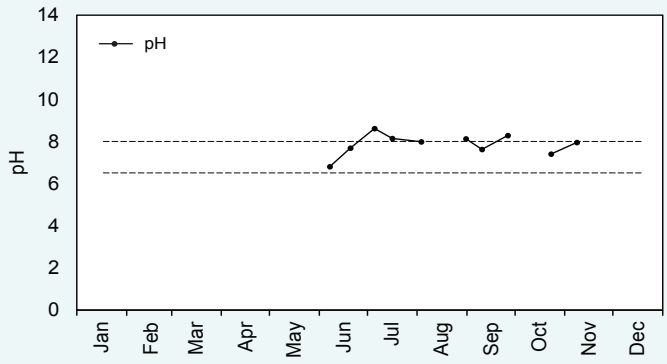
A number of pH samples were above the upper ANZECC trigger value in 2018. Values fluctuated over the year, being lowest at the start of the year when the stream first started flowing.

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

Payne Road



pH levels, 2004–18 at site 6091309. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels at 6091309. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Algae growing attached to submerged plants at the Payne Road sampling site, October 2018.

Salinity over time (2004–18)

Concentrations

Salinity was consistently low at Payne Road, with all samples collected falling within the low category of the SWRWQA bands. The 2018 median salinity at Payne Road was one of the lowest of the nine sites sampled in the Blackwood River catchment (215 mg/L; Courtney Road and McLeod Creek had the next lowest median of 220 mg/L).

Trends

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

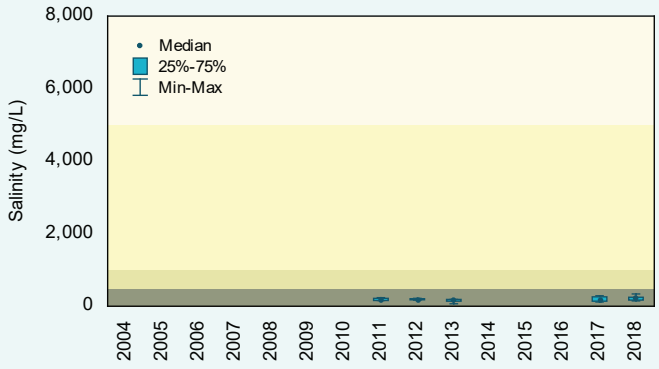
Salinity (2018)

Concentrations

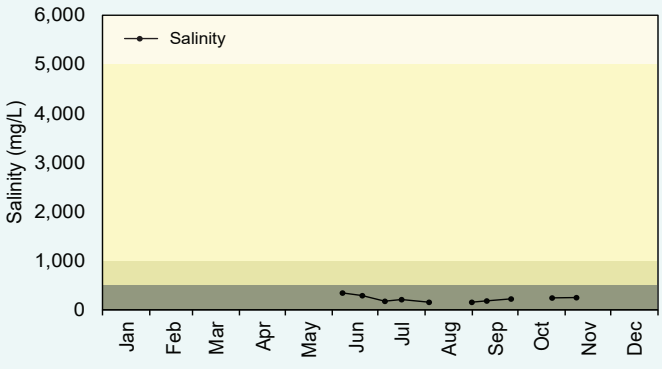
Salinity showed a very slight inverse seasonal relationship, with concentrations being highest at the start and end of the flow year. This suggests that the start of the winter rains washed salts into the stream from surrounding land use as well as mobilising salts left behind in the stream after it dried the previous summer. Concentrations then decreased over winter as water levels rose, before increasing again slightly at the end of the flow year when the proportion of groundwater in the stream increased. At this time, evapoconcentration of the salts in the water will also be occurring.

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

Payne Road



Salinity concentrations, 2004–18 at site 6091309. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at site 6091309. The shading refers to the SWRWQA classification bands.

saline brackish marginal fresh

High water levels, September 2019.

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.

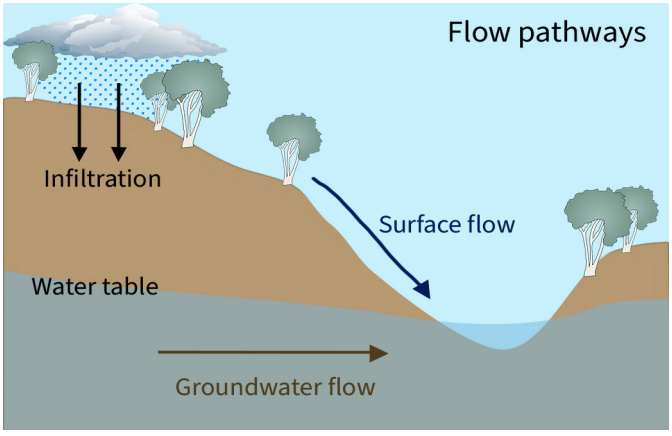
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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.



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