Middle Scott

This data report provides a summary of the nutrients at the two Middle Scott sampling sites in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. Downstream of these sites, the river flows through the Lower Scott catchment before entering 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.

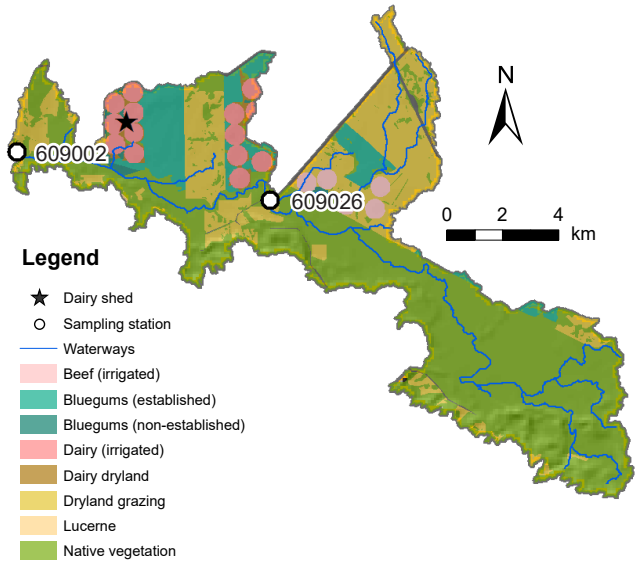
About the catchment

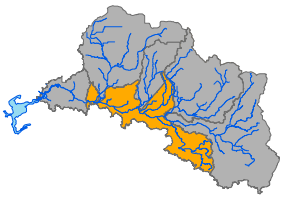
The Middle Scott catchment has an area of about 131 km^2. Just under half the catchment is covered by native vegetation, mostly in the southern and eastern portions of the catchment. There are also bluegum plantations, irrigated dairy and beef, and dryland grazing. Fringing vegetation is present along most of the Scott River. However, it is missing or severely degraded along much of the tributaries that pass through farmland in the northern sections of the catchment.

There are two sites monitored in the Middle Scott catchment, both on the Scott River. The upper site, 609026, Milyeannup Bridge, is where the Scott River passes under Milyeannup Coast Road. This site receives water from the Scott River as well as the south-eastern tributary. This tributary is on a sandy catchment where most of the rainfall infiltrates directly to groundwater and, as such, it rarely flows. Milyeannup Bridge is about 12 km upstream of the second sampling site, 609002, Brennans Ford, which is about 9 km upstream of the discharge point to the Hardy Inlet. There is a gauging station at Brennans Ford which has long-term flow data.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the two sites in the Middle Scott catchment were moderate to high. Nitrogen concentrations were worse at Brennans Ford than at Milyeannup Bridge, possibly because of the more intensive land use between these two sites than what is found immediately upstream of Milyeannup Bridge. Phosphorus concentrations were lower at Brennans Ford than Milyeannup Bridge.





Location of Middle Scott catchment in the greater Scott River catchment.

Facts and figures

Sampling site code	609002 (Brennans Ford) 609026 (Milyeannup Bridge)
Rainfall at Brennans Ford (2018)	850 mm
Catchment area	131 km^2
Per cent cleared area (2009)	37 per cent
River flow	Ephemeral
Main land use (2009)	Native vegetation, dryland grazing and bluegum plantations

Nitrogen over time (2004–18)

Concentrations

Total nitrogen (TN) concentrations fluctuated over the past 15 years at both sites. Compared with the other sites in the Scott River catchment, TN concentrations were moderate, with the 2018 median being just below the Water Quality Improvement Plan (WQIP) target at Milyeannup Bridge and just above at Brennans Ford. The annual range in TN concentrations was greater at Brennans Ford than Milyeannup, which may be because of pulses of nutrients entering the river from the more intensive land use between the two sites.

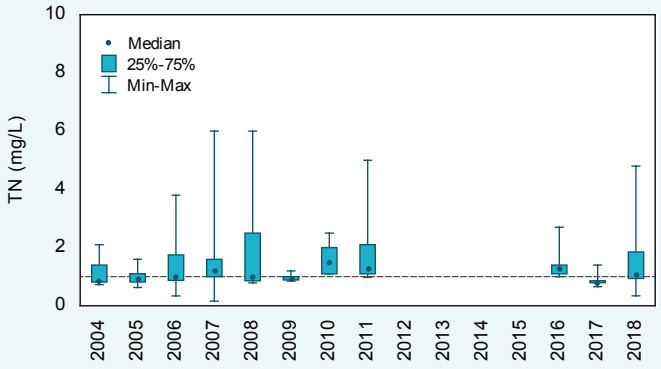
Trends

Because of the break in data between 2012–15 it was not possible to calculate trends in TN concentrations at either site as a minimum of five years of data are required to calculate trends.

Estimated loads

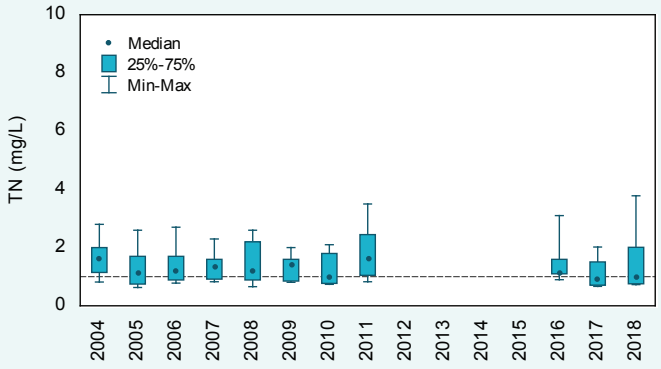
Brennans Ford was the only site in the Scott River catchment which had both nutrient and flow data available. Therefore, it was the only site for which estimated TN loads were calculated. As can be seen in the graph below, TN loads were closely related to flow volume, years with high annual flow having large TN loads and vice versa.

Brennans Ford

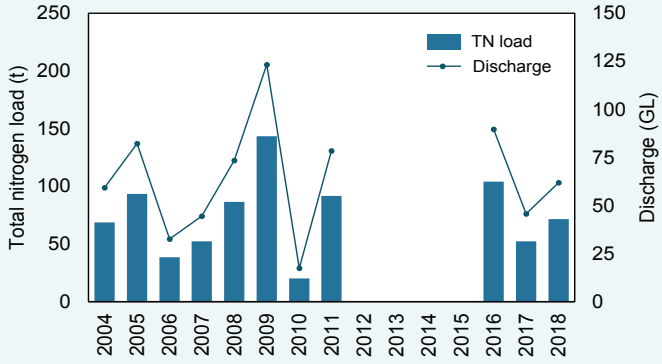


Total nitrogen concentrations, 2004–18 at site 609002. The dashed line is the Scott River WQIP target for median TN concentrations.

Milyeannup Bridge



Total nitrogen concentrations, 2004–18 at site 609026. The dashed line is the Scott River WQIP target for median TN concentrations.



Total nitrogen loads and annual flow, 2004–18 at site 609002.

Sampling at the Brennans Ford site in May, with the gauging station on the left.

Nitrogen (2018)

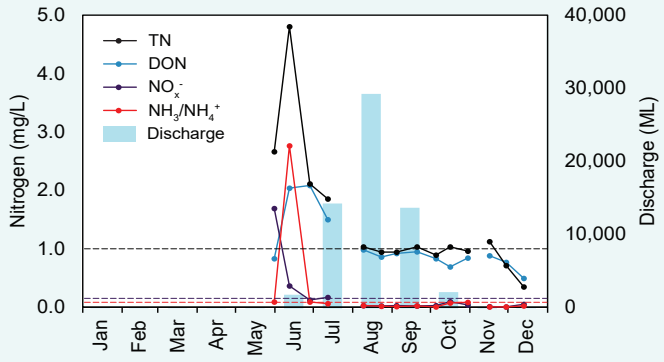
Concentrations

All forms of N varied similarly at Brennans Ford and Milyeannup Bridge. At both sites, concentrations were highest near the start of the year, likely because of a first-flush effect where N was mobilised following heavy rainfall. Much of this N was probably the result of mineralisation of organic N in soils and drains over the summer period, and runoff of high-concentration waters from irrigated pasture, which builds up with fertiliser and animal waste over summer. Brennans Ford had a large peak in ammonia N (NH_3/NH_4^+) in June which was not as evident at Milyeannup Bridge. The reason for this peak is unknown but is likely because of point-source pollution from a nearby, upstream land use as NH_3/NH_4^+ is usually rapidly converted to nitrate (NO_3^-) which is detected as NO_x^- (which consists of NO_3^- and NO_2^-) where there is sufficient oxygen (which there was at Brennans Ford). After the initial peak in N concentrations, they reduced at both sites and were mostly below their respective targets/trigger values.

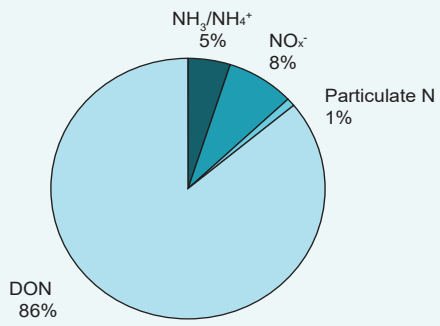
Types of nitrogen

Total N is made up of many different types of N. The proportion of N present in its different forms was similar at both sites. Dissolved organic N (DON) was the dominant type. This type of N consists of degrading plant and animal matter which needs to be further broken down before it becomes available to plants and algae, as well as more bioavailable forms. The proportions of the different types of N present are typical of sites in agricultural catchments where most of the N is coming from either diffuse sources or point sources which are well upstream of the sampling site (or a combination of both).

Brennans Ford

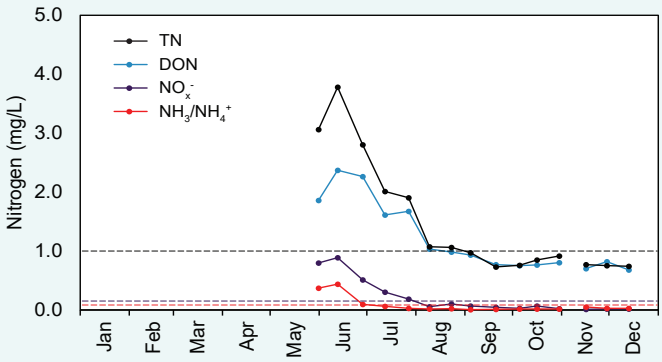


2018 nitrogen concentrations and flow at 609002. The black dashed line is the Scott River WQIP target for TN, the red and purple lines are the ANZECC trigger values for NH_3/NH_4^+ and NO_x^-.

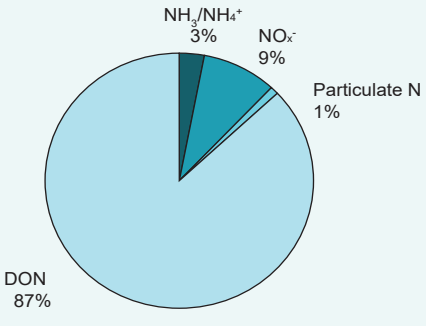


2018 average nitrogen fractions at site 609002.

Milyeannup Bridge



2018 nitrogen concentrations at 609026. The black dashed line is the Scott River WQIP target for TN, the red and purple lines are the ANZECC trigger values for lowland rivers for NH_3/NH_4^+ and NO_x^-.



2018 average nitrogen fractions at site 609026.

Phosphorus over time (2004–18)

Concentrations

Over the past 15 years, total phosphorus (TP) concentrations fluctuated at both sites in the Middle Scott catchment. Milyeannup Bridge had a larger annual range in TP concentrations than Brennans Ford, though the median annual TP concentrations were similar at both sites, being above the WQIP target most years.

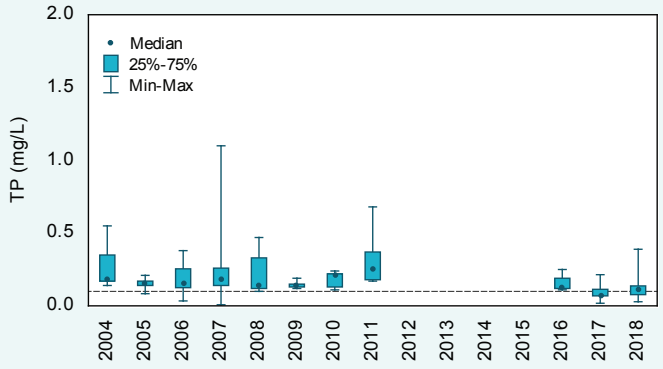
Trends

Because of the break in data between 2012–15 it was not possible to calculate trends in TP concentrations at either site as a minimum of five years of data are required to calculate trends.

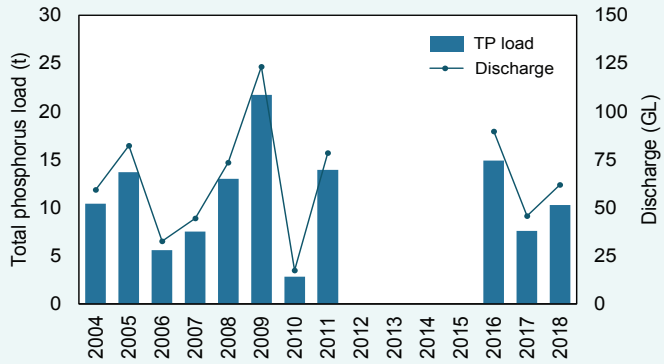
Estimated loads

Brennans Ford was the only site in the Scott River catchment which had both nutrient and flow data available. Therefore, this was the only site for which TP loads were calculated. As can be seen in the graph below, TP loads are closely related to flow volume, years with high annual flow having large TP loads and vice versa.

Brennans Ford

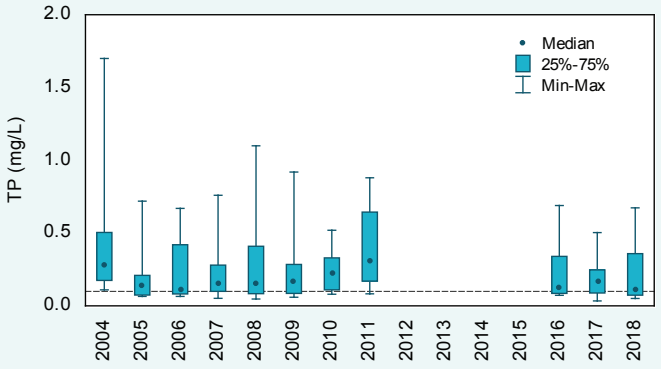


Total phosphorus concentrations, 2004–18 at site 609002. The dashed line is the Scott River WQIP target for median TP concentrations.



Total phosphorus loads and annual flow, 2004–18 at site 609002.

Milyeannup Bridge



Total phosphorus concentrations, 2004–18 at site 609026. The dashed line is the Scott River WQIP target for median TP concentrations.

The Milyeannup Bridge sampling site in December when the river is no longer flowing.

Phosphorus (2018)

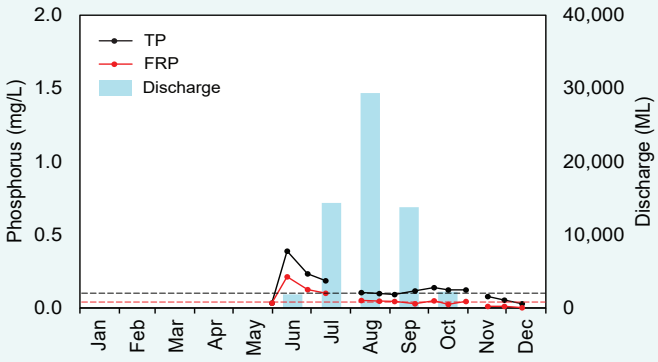
Concentrations

TP and filterable reactive phosphorus (FRP) concentrations varied in a similar way at both sites during 2018. There was a peak in both forms of P in June which was possibly related to a first-flush effect where early rainfall washed P into the river from surrounding land use as well as mobilising any P already present in the river. After this point, P concentrations decreased. P concentrations were higher at Milyeannup Bridge than Brennans Ford. It is likely that P was coming from in-stream sources as well as entering the river from surrounding land use and upstream point sources such as dairy sheds.

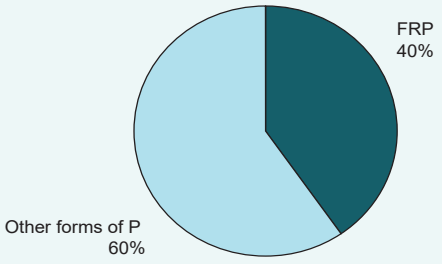
Types of phosphorus

Total P is made up of different types of P. The proportion of P present as bioavailable FRP was very similar at both sites. This form of P is sourced from animal waste and fertilisers and is readily available for algae to use to fuel growth. The remainder of the P was present as either particulate P or dissolved organic P (DOP). Particulate P generally needs to be broken down before becoming bioavailable to plants and algae. The bioavailability of DOP varies and is poorly understood.

Brennans Ford

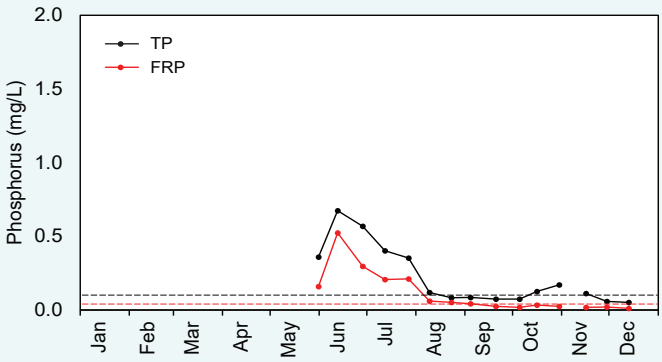


2018 phosphorus concentrations and flow at 609002. The black dashed line is the Scott River WQIP target for TP, the red is the ANZECC trigger value for lowland rivers for FRP.

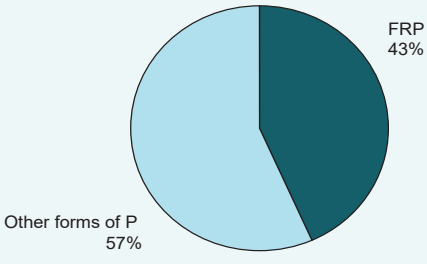


2018 average phosphorus fractions at site 609002.

Milyeannup Bridge



2018 phosphorus concentrations and flow at 609026. The black dashed line is the Scott River WQIP target for TP, the red is the ANZECC trigger value for lowland rivers for FRP.



2018 average phosphorus fractions at site 609026.

Total suspended solids over time (2004–18)

Concentrations

Total suspended solids (TSS) concentrations appear to have improved over time at both sites, with medians being slightly higher before the break in monitoring. With the exception of 2004 at Milyeannup Bridge, when the median was classified as moderate, annual median TSS concentrations were classified as low using the Statewide River Water Quality Assessment (SWRWQA) classification bands. 2004 was an outlier at Milyeannup Bridge with TSS concentrations being much higher than subsequent years. The reason for this is unknown.

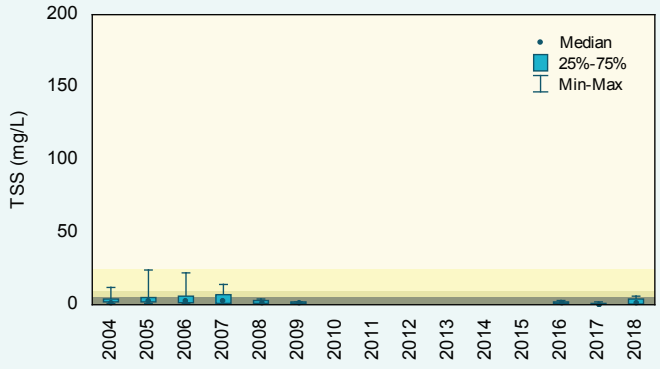
Trends

Because of the break in data between 2010–15 it was not possible to calculate trends in TSS concentrations at either site as a minimum of five years of data are required to calculate trends.

Estimated loads

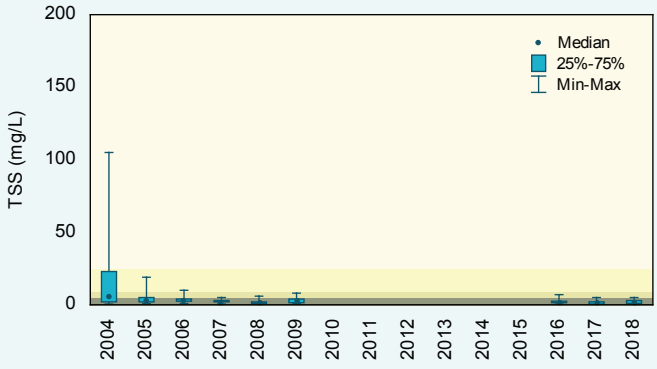
Brennans Ford was the only site in the Scott River catchment which had both nutrient and flow data available. Therefore, this was the only site for which TSS loads were calculated. As can be seen in the graph below, TSS loads are closely related to flow volume, years with high annual flow having large TSS loads and vice versa.

Brennans Ford

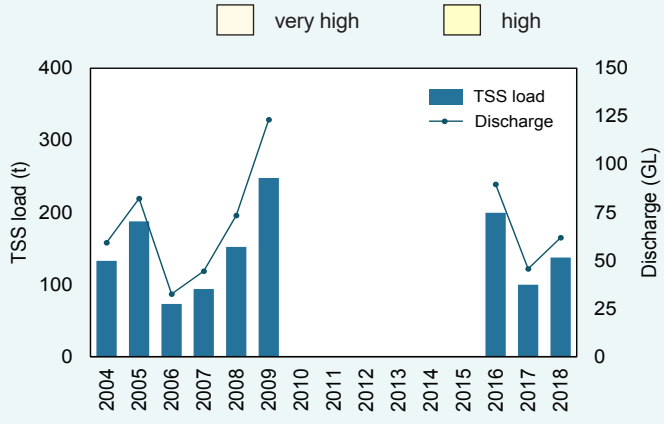


Total suspended solids concentrations, 2004–18 at site 609002. The shading refers to the SWRWQA classification bands.

Milyeannup Bridge



Total suspended solids concentrations, 2004–18 at site 609026. The shading refers to the SWRWQA classification bands.



Total suspended solids loads and annual flow, 2004–18 at site 609002.

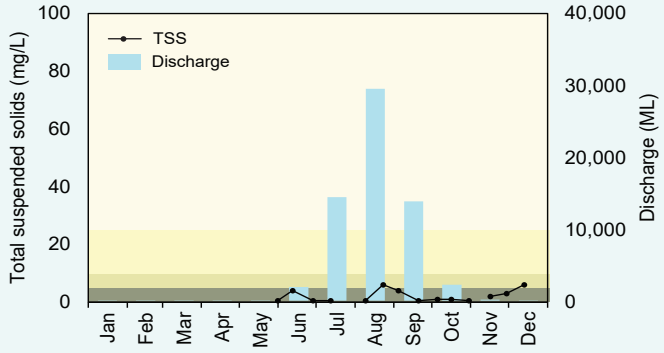
Brennans Ford in September. Note the tannin-stained water.

Total suspended solids (2018)

Concentrations

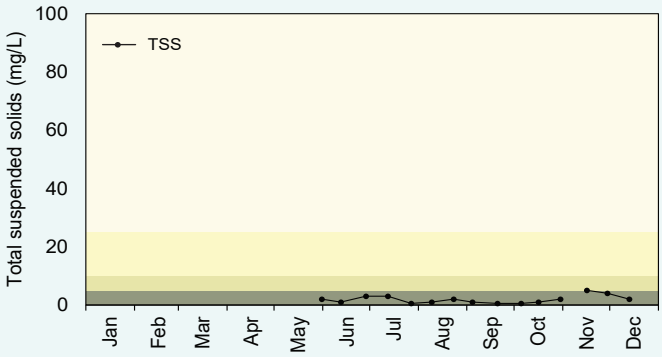
TSS concentrations fluctuated during 2018 at both sites with no clear seasonal patterns present. Most of the samples collected were classified as low using the SWRWQA classification bands, with the exception of a few samples which were classified as moderate. It is likely that TSS was coming from a number of sources, including particles washed into the river from surrounding land use as well as in-stream sources such as erosion.

Brennans Ford



2018 total suspended solids concentrations and flow at 609002. The shading refers to the SWRWQA classification bands.

Milyeannup Bridge



2018 total suspended solids concentrations at 609026. The shading refers to the SWRWQA classification bands.

very high high moderate low

The Scott River, note the dense, mostly endemic, fringing vegetation.

pH over time (2004–18)

pH values

Over the past 15 years, pH fluctuated at both sites. The annual median pH has been between the upper and lower Australian and New Zealand Environment and Conservation Council (ANZECC) trigger values for all years for which there were data.

Trends

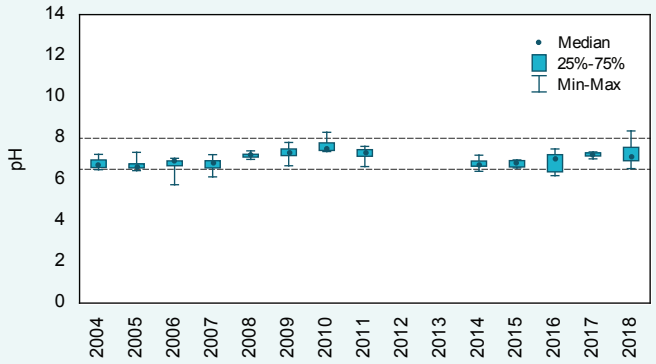
Short-term (2014–18) increasing trends were present at both sites, though the size of the trends were only small. At Brennans Ford there was an increasing short-term trend of 0.1 pH units per year; at Milyeannup Bridge the trend was 0.2 pH units per year. It is likely that these trends are because of natural fluctuation in pH at these sites rather than an actual change in pH levels. Ongoing monitoring will help determine whether the pH is actually increasing at these sites.

pH (2018)

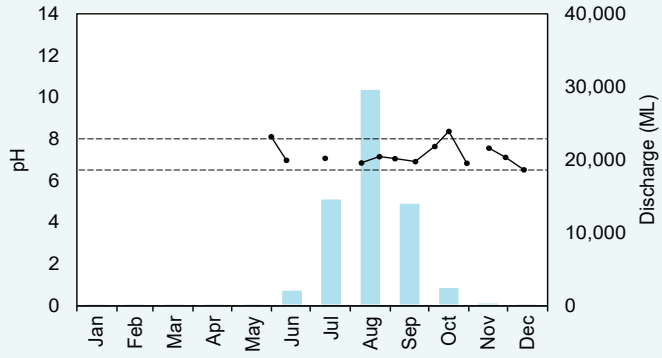
pH values

In 2018, pH showed a similar pattern at both sites with no clear seasonal pattern present. At Milyeannup Bridge all the samples, except for one in October, fell within the upper and lower ANZECC trigger values. At Brennans Ford there were two samples above the upper ANZECC trigger value. Overall, the 2018 pH values were acceptable at both of these sites.

Brennans Ford

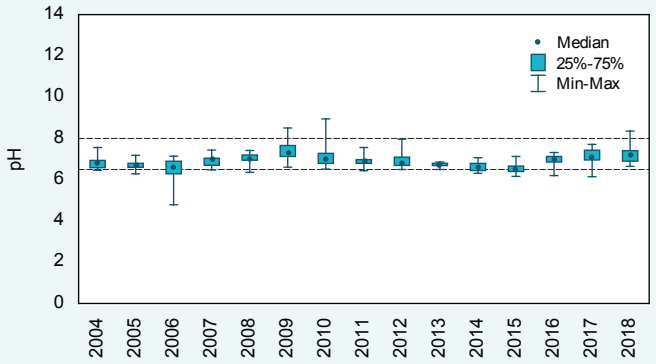


pH levels, 2004–18 at site 609002. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

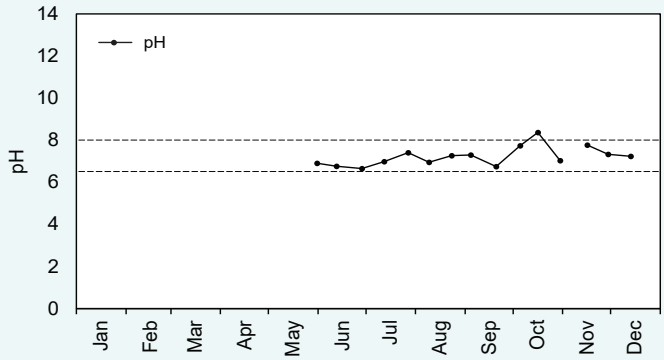


2018 pH levels and flow at 609002. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Milyeannup Bridge



pH levels, 2004–18 at site 609026. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels at 609026. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Middle Scott

Salinity over time (2004–18)

Concentrations

Salinity fluctuated at both sites in the Middle Scott catchment over the past 15 years. Using the SWRWQA classification bands, both Brennans Ford and Milyeannup Bridge had annual medians that were classified as fresh for every year for which there were data, though some years had samples that were classified as marginal.

Trends

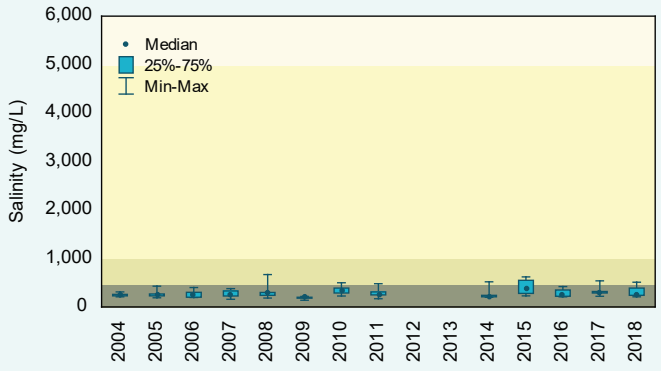
There was no short-term (2014–18) trend present in salinity at Brennans Ford. At Milyeannup Bridge there was no long-term (2009–18) trend present but there was an increasing short-term (2014–18) trend of 10 mg/L/yr. It is likely that this trend is because of natural fluctuations in salinity at this site rather than an actual change in salinity levels. Ongoing monitoring at this site will help determine if the salinity is increasing.

Salinity (2018)

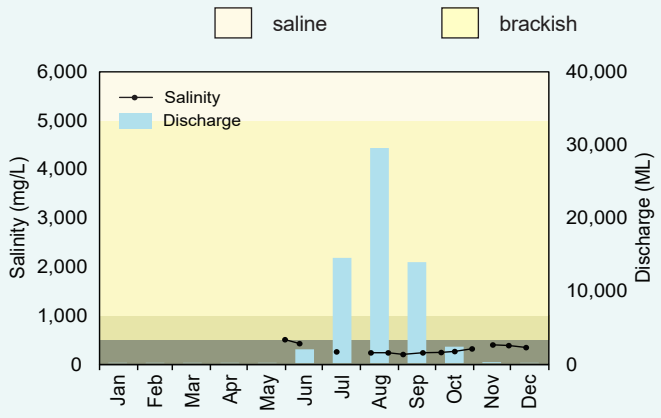
Concentrations

Salinity showed a very slight reverse seasonal pattern at both sites, being marginally higher at the start and end of the flow year than the middle of the year. This suggests that salt was being mobilised at the beginning of the flow year by early rainfall which flushed salt into the river from surrounding land as well as dissolving salt left behind in the river after it dried up the previous summer. Later in the year, salinity increased again as the river dried up because of evapoconcentration. It should be noted both sites were fresh with only one sample, collected at Brennans Ford in May, being classified as marginal.

Brennans Ford

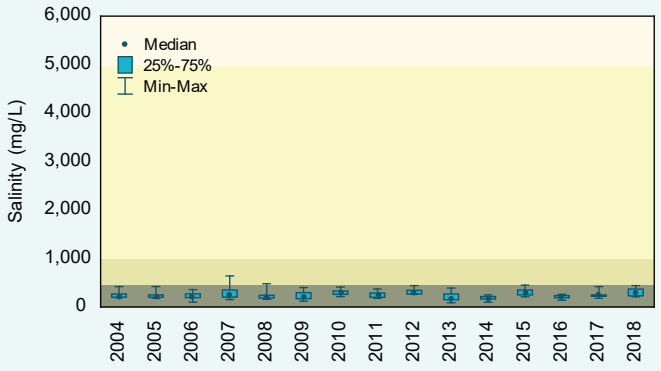


Salinity concentrations, 2004–18 at site 609002. The shading refers to the SWRWQA classification bands.

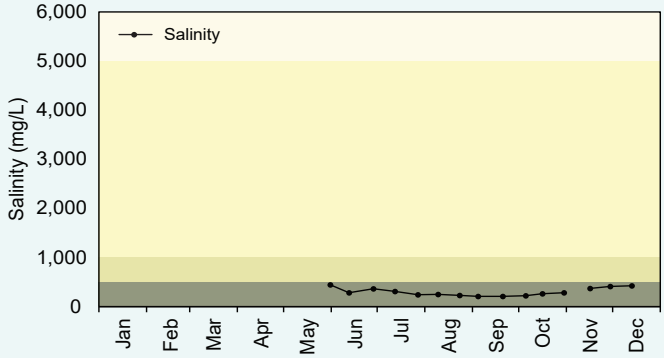


2018 salinity concentrations and flow at 609002. The shading refers to the SWRWQA classification bands.

Milyeannup Bridge



Salinity concentrations, 2004–18 at site 609026. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at 609026. The shading refers to the SWRWQA classification bands.

Middle Scott

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 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

Total nitrogen and TP concentrations were compared with the Scott River WQIP targets. These targets represent the historical median winter concentration where lyngbya blooms were not observed in the upper Hardy Inlet. They were developed for use at Brennans Ford but have been used at all Scott River sites to allow for comparisons between sites. Where possible, other 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 concentrations 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.

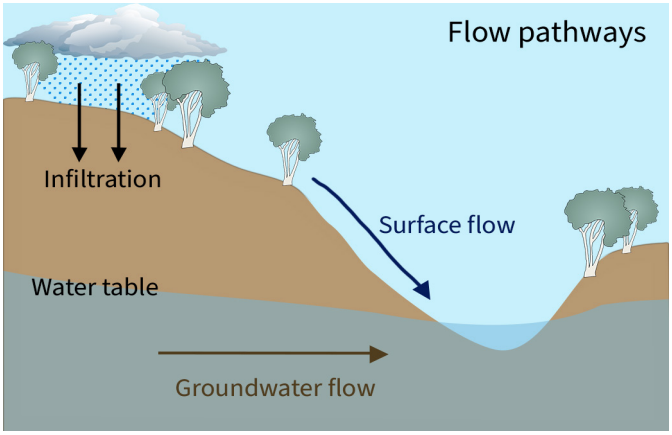
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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.



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