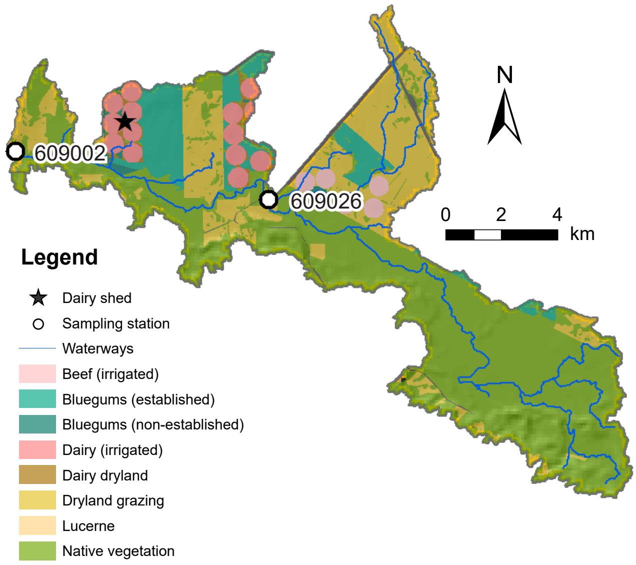
Middle Scott

This data report provides a summary of the nutrients at the two Middle Scott sampling sites in 2019 as well as historical data from 2005–19. This report was produced as part of Healthy Estuaries WA. Downstream of these sites, the river flows through the Lower Scott catchment before entering the Hardy Inlet.

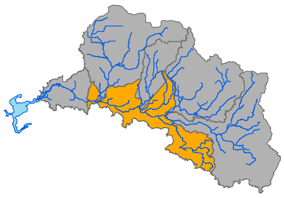


About the catchment

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.

Most of the soils in the catchment have a low capacity to bind phosphorus. This is often so poor that any phosphorus applied to them can be quickly washed into drains and other waterways.

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.



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

Facts and figures

Sampling site code	609002 (Brennans Ford) 609026 (Milyeannup Bridge)
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

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the two sites in the Middle Scott catchment were classified as moderate (nitrogen) to high (phosphorus). 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.

Estimated loads and flow at Brennans Ford

609002	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Flow (GL)	82	33	45	74	123	17	78	33	136	59	15	90	46	62	20
TN load (t)	93	39	52	87	143	20	92					104	52	72	24
TP load (t)	13.7	5.60	7.53	13.0	21.7	2.81	13.9					14.9	7.59	10.3	3.32

Middle Scott

Nitrogen over time (2005–19)

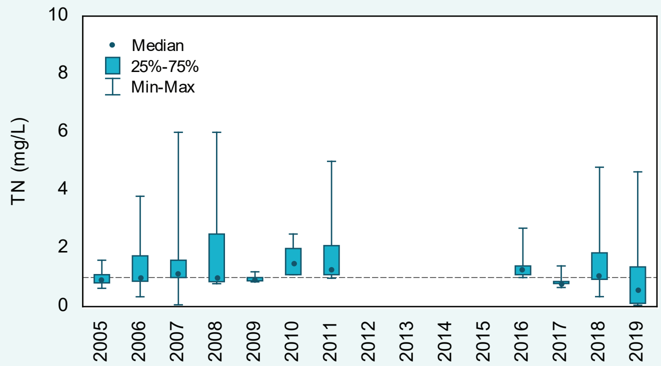
Concentrations

Total nitrogen (TN) concentrations fluctuated over the reporting period at both sites. At both sites, annual TN concentrations were classified as moderate using the State Wide River Water Quality Assessment (SWRWQA) methodology, and were also moderate compared with the other sites in the Scott River catchment. While the TN concentrations were classified as moderate, each year had a number of samples over the Water Quality Improvement Plan (WQIP) TN target. 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.

Estimated loads

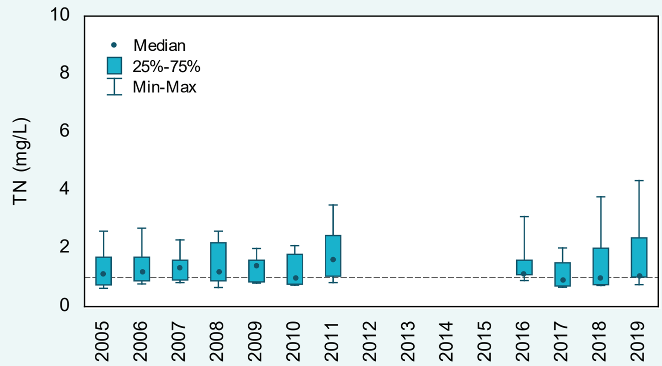
Brennans Ford was the only site in the Scott River catchment which had both nutrient and flow data available. Therefore, it was the only site for which estimated TN loads were calculated. As can be seen in the graph below, TN loads were closely related to flow volume; years with large annual flow volumes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

Brennans Ford

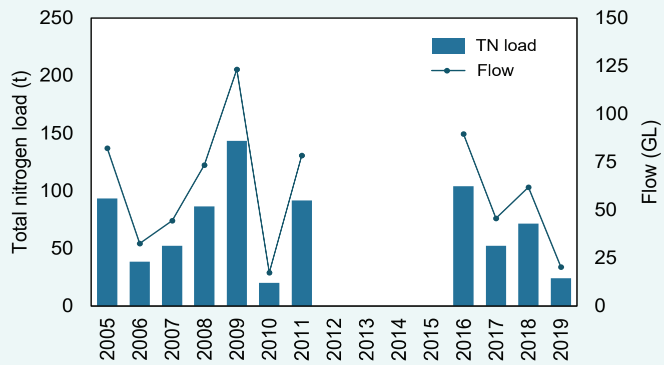


Total nitrogen concentrations, 2005–19 at site 609002. The dashed line is the Scott River WQIP target for median TN concentrations.

Milyeannup Bridge



Total nitrogen concentrations, 2005–19 at site 609026. The dashed line is the Scott River WQIP target for median TN concentrations.



Total nitrogen loads and annual flow, 2005–19 at site 609002.

Sampling at the Brennans Ford site in May, with the gauging station on the left. Note the orange colour of the water, likely caused by iron-oxidising bacteria.

Nitrogen (2019)

Types of nitrogen

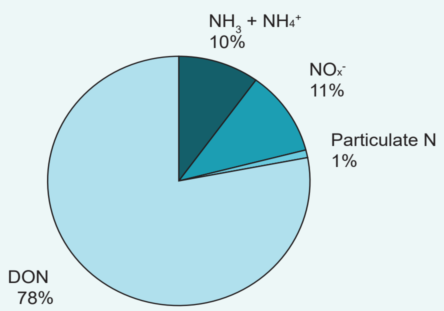
Total N is made up of different types of N. The proportion of N present in its different types was similar at both sites. Dissolved organic N (DON) was the dominant type. This type of N consists of degrading plant and animal matter which needs to be further broken down before it becomes available to plants and algae, as well as more bioavailable types. 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).

Concentrations

All types 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. Both sites had a large peak in total ammonia (NH_3 + NH_4^+) in June. The reason for this peak is unknown but is likely because of point-source pollution from a nearby, upstream land use washed in by the first flush. This is because total ammonia 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 this time. After the initial peak in N concentrations, they reduced at both sites and were mostly below their respective targets/trigger values.

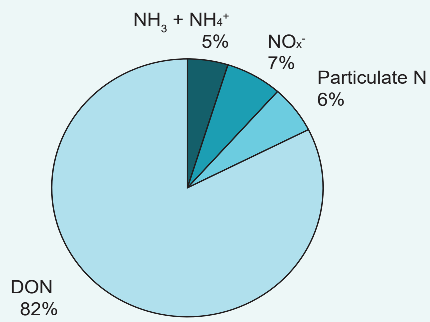
Where there are no data in the graphs below, the sites were not flowing.

Brennans Ford

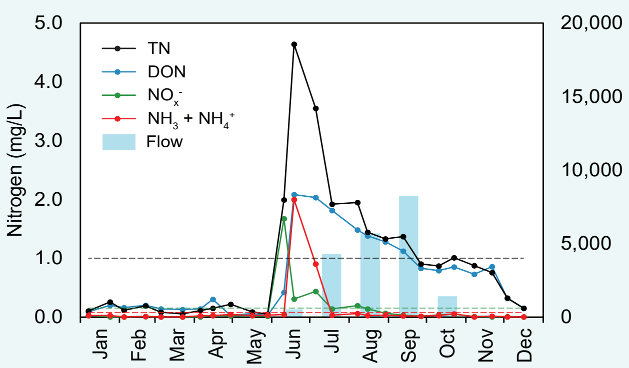


2019 average nitrogen fractions at site 609002.

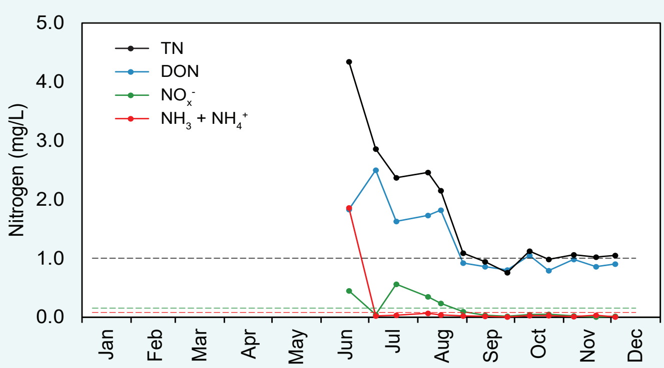
Milyeannup Bridge



2019 average nitrogen fractions at site 609026.



2019 nitrogen concentrations and flow at 609002. The black dashed line is the Scott River WQIP target for TN, the red and green lines are the ANZECC trigger values for total ammonia and nitrate.



2019 nitrogen concentrations at 609026. The black dashed line is the Scott River WQIP target for TN, the red and green lines are the ANZECC trigger values for total ammonia and nitrate.

Phosphorus over time (2005–19)

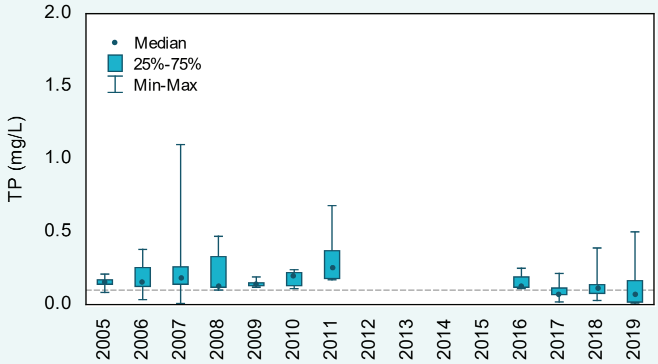
Concentrations

Total phosphorus (TP) concentrations fluctuated over the reporting period 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. Using the SWRWQA methodology, annual TP concentrations at both sites were classified as high.

Estimated loads

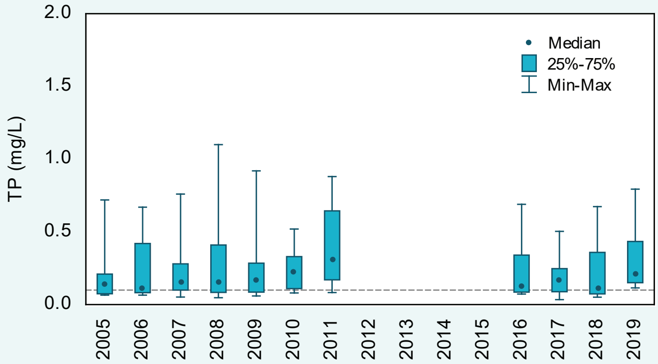
Brennans Ford was the only site in the Scott River catchment which had both nutrient and flow data available. Therefore, this was the only site for which TP loads were calculated. As can be seen in the graph below, TP loads are closely related to flow volume; years with large annual flow volumes had large TP loads and vice versa. This is evident in 2019 where the load was relatively small but concentrations were similar to previous years.

Brennans Ford

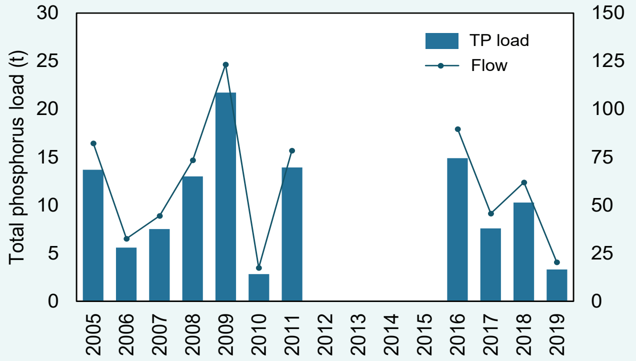


Total phosphorus concentrations, 2005–19 at site 609002. The dashed line is the Scott River WQIP target for median TP concentrations.

Milyeannup Bridge



Total phosphorus concentrations, 2005–19 at site 609026. The dashed line is the Scott River WQIP target for median TP concentrations.



Total phosphorus loads and annual flow, 2005–19 at site 609002.

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

Middle Scott

Phosphorus (2019)

Types of phosphorus

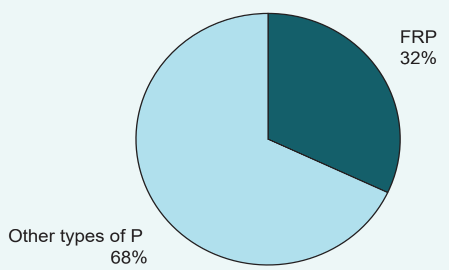
Total P is made up of different types of P. The proportion of P present as phosphate was very similar at both sites. This type of P is sourced from animal waste and fertilisers. Phosphate is measured as filterable reactive phosphorus (FRP) and in surface waters is mainly present as phosphate (PO_4^{3-}) species. The remainder of the P was present as either particulate P or dissolved organic P (DOP), or both (shown as 'Other types of P' in the pie charts below). Particulate P generally needs to be broken down before becoming bioavailable. The bioavailability of DOP varies and is poorly understood.

Concentrations

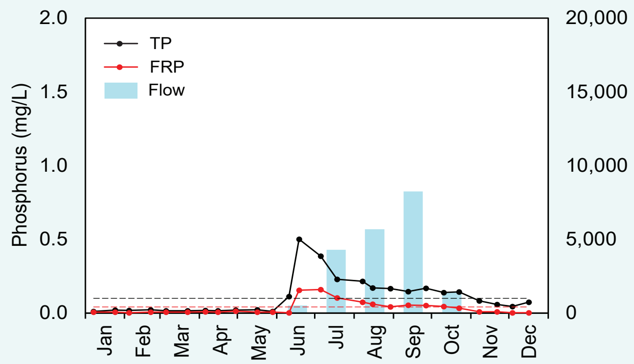
TP and phosphate concentrations varied in a similar way at both sites during 2019. There was a peak in both types of P in June which was possibly related to a first flush effect where early rainfall washed P into the river from surrounding land use as well as mobilising any P already present in the river. After this time, 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.

Where there are no data in the graphs below, the sites were not flowing.

Brennans Ford

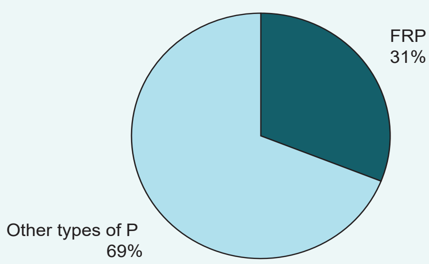


2019 average phosphorus fractions at site 609002.

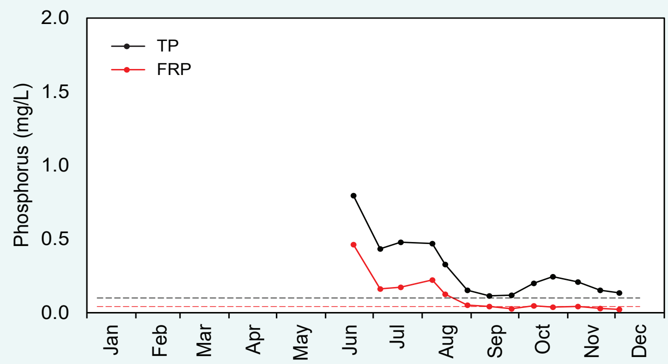


2019 phosphorus concentrations and flow at 609002. The black dashed line is the Scott River WQIP target for TP, the red is the ANZECC trigger value for phosphate.

Milyeannup Bridge



2019 average phosphorus fractions at site 609026.



2019 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 phosphate.

Total suspended solids over time (2005–19)

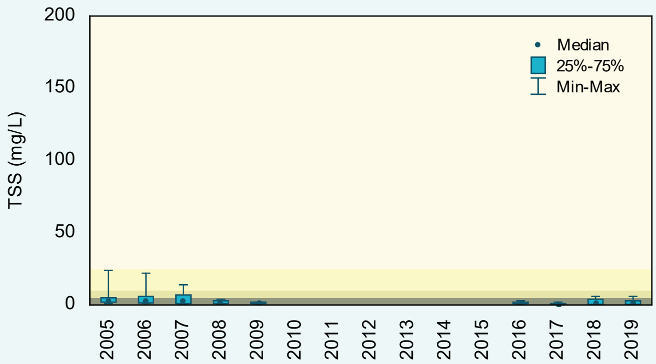
Concentrations

Total suspended solids (TSS) concentrations appear to have improved over time at both sites, with medians being slightly lower after the break in monitoring. Using the SWRWQA methodology, annual TSS concentrations at both sites were classified as low.

Estimated loads

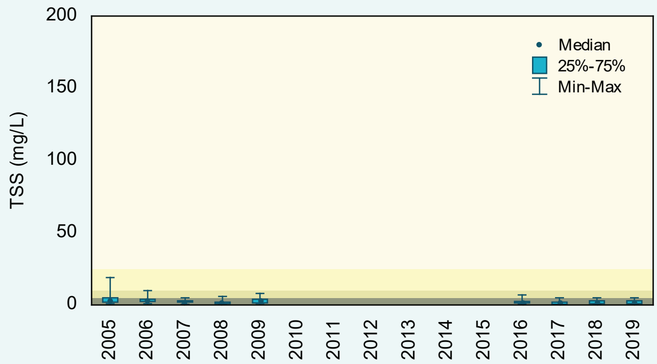
Brennans Ford was the only site in the Scott River catchment which had both nutrient and flow data available. Therefore, this was the only site for which TSS loads were calculated. As can be seen in the graph below, TSS loads are closely related to flow volume; years with large annual flow volumes had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

Brennans Ford



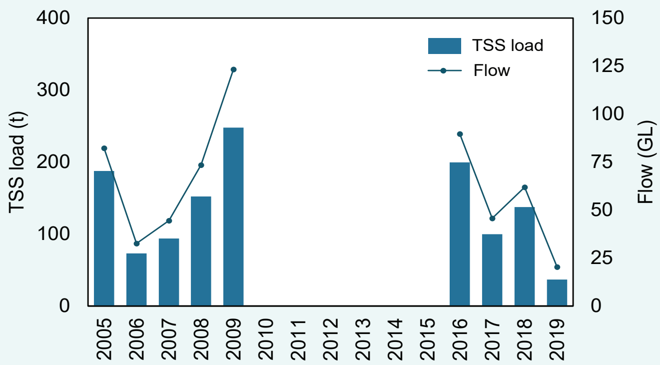
Total suspended solids concentrations, 2005–19 at site 609002. The shading refers to the SWRWQA classification bands.

Milyeannup Bridge



Total suspended solids concentrations, 2005–19 at site 609026. The shading refers to the SWRWQA classification bands.

low moderate high very high



Total suspended solids loads and annual flow, 2005–19 at site 609002.

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

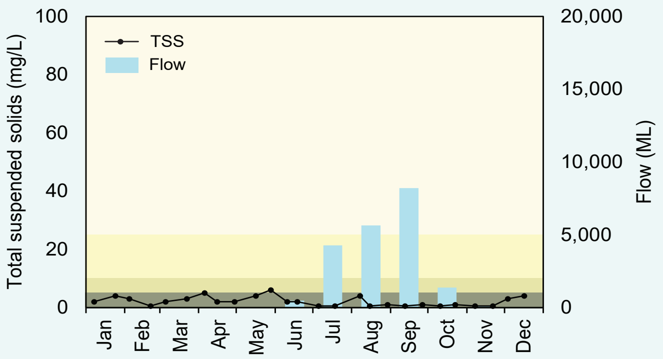
Total suspended solids (2019)

Concentrations

TSS concentrations fluctuated during 2019 at both sites with no clear seasonal patterns present. Most of the samples collected fell into the low band of the SWRWQA, with the exception of a few samples which fell into the moderate band. The moderate concentrations of TSS at Brennans Ford in early April and late May may be linked to iron-oxidising bacteria which cause the river to become a rusty orange colour at this site in times of low flow. In December 2019, mats of cyanobacteria formed at the surface at Brennans Ford and likely contributed to the increase in TSS. Abundant cyanobacteria indicate poor water quality.

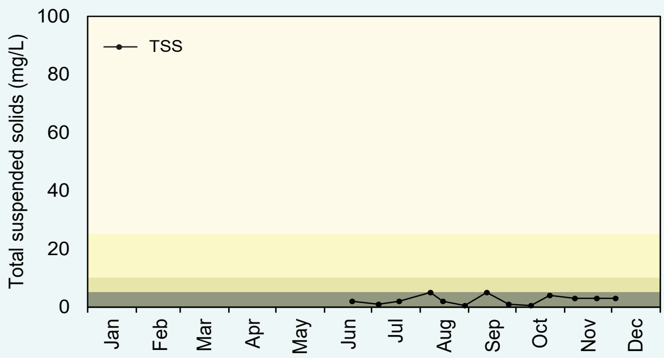
Where there are no data in the graphs below, the sites were not flowing.

Brennans Ford



2019 total suspended solids concentrations and flow at 609002. The shading refers to the SWRWQA classification bands.

Milyeannup Bridge



2019 total suspended solids concentrations at 609026. The shading refers to the SWRWQA classification bands.

low moderate high very high

Brennans Ford during low flows in December. Note the mats of cyanobacteria floating on the surface of the water.

Middle Scott

pH over time (2005–19)

pH values

pH fluctuated over the reporting period at both sites. The annual median pH was between the upper and lower Australian and New Zealand Environment and Conservation Council (ANZECC) trigger values for all years for which there were data.

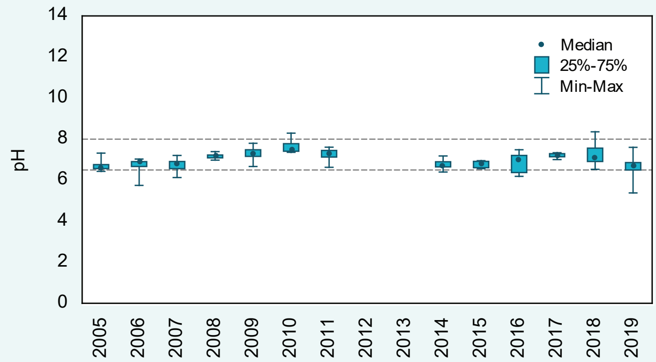
pH (2019)

pH values

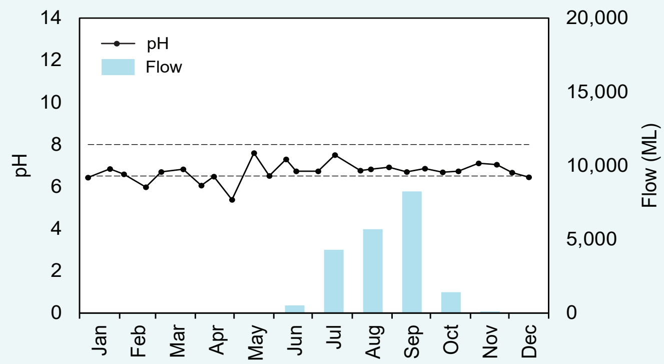
In 2019, pH showed no clear seasonal pattern at either site. At Milyeannup Bridge four samples fell just below the lower ANZECC trigger value. At Brennans Ford there were six samples below the lower ANZECC trigger value, mostly in the first half of the year.

Where there are no data in the graphs below, the sites were not flowing.

Brennans Ford

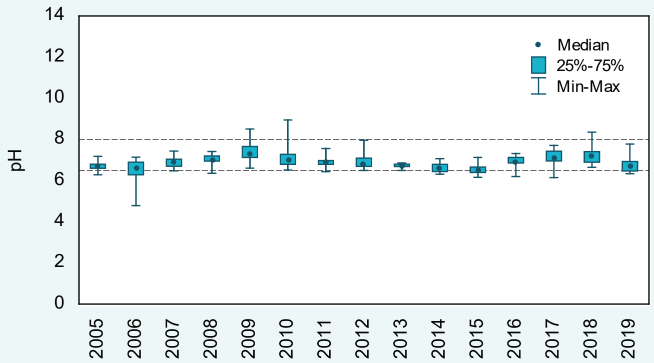


pH levels, 2005–19 at site 609002. The dashed lines are the upper and lower ANZECC trigger values.

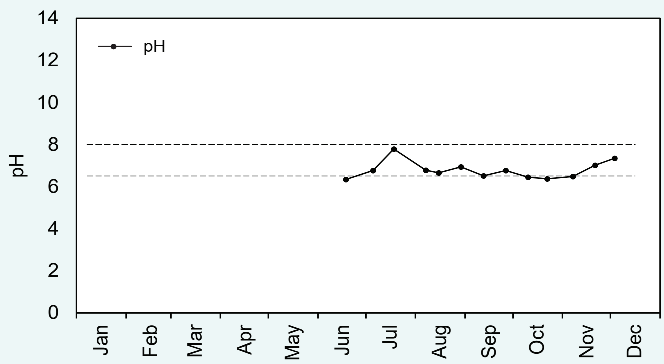


2019 pH levels and flow at 609002. The dashed lines are the upper and lower ANZECC trigger values.

Milyeannup Bridge



pH levels, 2005–19 at site 609026. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels at 609026. The dashed lines are the upper and lower ANZECC trigger values.

Salinity over time (2005–19)

Concentrations

Salinity fluctuated over the reporting period at both sites in the Middle Scott catchment over the reporting period. Using the Water Resources Inventory 2014 salinity ranges, all years were classified as fresh (note the 2018 nutrient report used the SWRWQA bands). In fact, most of the samples collected fell into the fresh band.

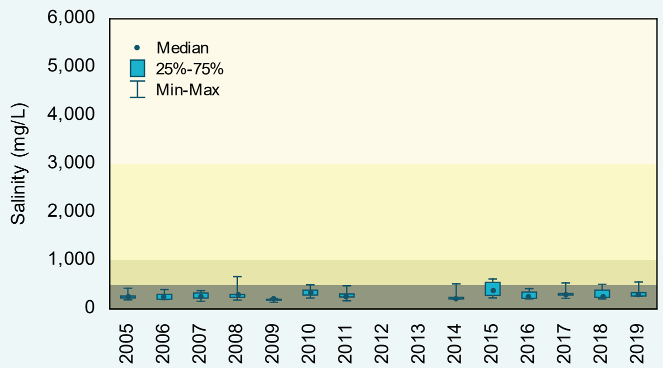
Salinity (2019)

Concentrations

Salinity showed a very slight reverse seasonal pattern at Milyeannup Bridge, 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 possibly because of evapoconcentration. While this same pattern was evident at Brennans Ford in 2018, it is not as obvious in 2019, with salinities being fairly stable throughout the year with the exception of the small peak in June and again in November. It should be noted that both sites were fresh with only one sample (collected at Brennans Ford) falling into the marginal band.

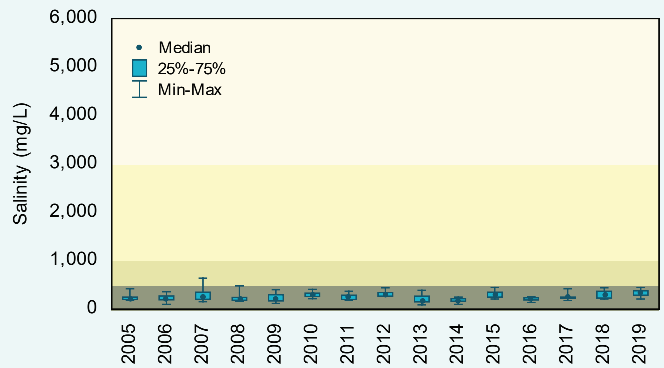
Where there are no data in the graphs below, the sites were not flowing.

Brennans Ford



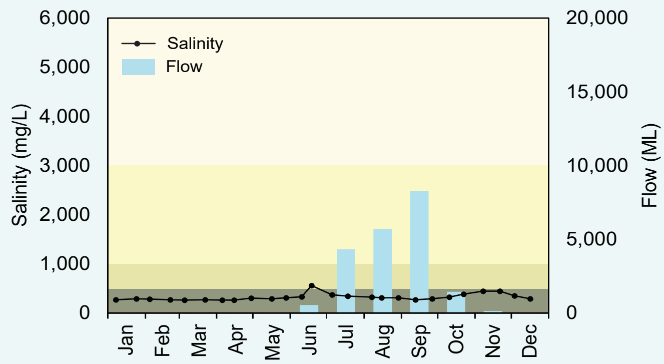
Salinity concentrations, 2005–19 at site 609002. The shading refers to the Water Resources Inventory 2014 salinity ranges.

Milyeannup Bridge

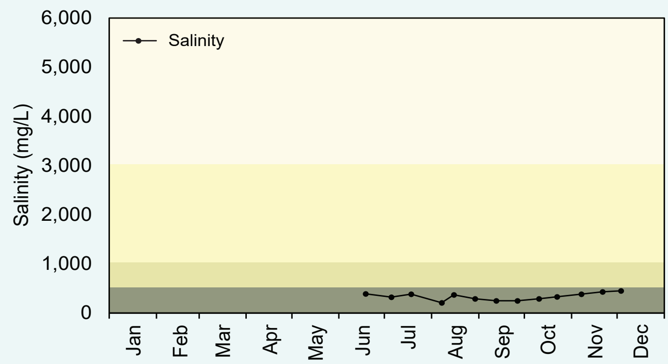


Salinity concentrations, 2005–19 at site 609026. The shading refers to the Water Resources Inventory 2014 salinity ranges.

fresh marginal brackish saline



2019 salinity concentrations and flow at 609002. The shading refers to the Water Resources Inventory 2014 salinity ranges.



2019 salinity concentrations at 609026. The shading refers to the Water Resources Inventory 2014 salinity ranges.

Middle Scott

Background

Healthy Estuaries WA is a State Government program launched in 2020 and builds 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; both the catchment and estuary. 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.

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 the water and harm fish and other species. Total suspended solids, pH and salinity data are also presented as these help us better understand the processes occurring in the catchment.

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

Healthy Estuaries WA partners with the Lower Blackwood Land Conservation District Committee (Lower Blackwood LCDC) to fund best-practice managment of fertiliser, dairy effluent and watercourses 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

Variables were compared with the Scott River WQIP targets or ANZECC trigger values where available, or the SWRWQA bands or 2014 Water Resources Inventory ranges. They were classified using the SWRWQA methodology. Standard statistical tests were used to calculate trends and loads. For further information on the methods visit estuaries.dwer.wa.gov.au/nutrient-reports/data-analysis

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.

First flush: material washed into a waterway by the first rainfall after an extended dry period. The first flush is often associated with high concentrations of nutrients and particulate matter.

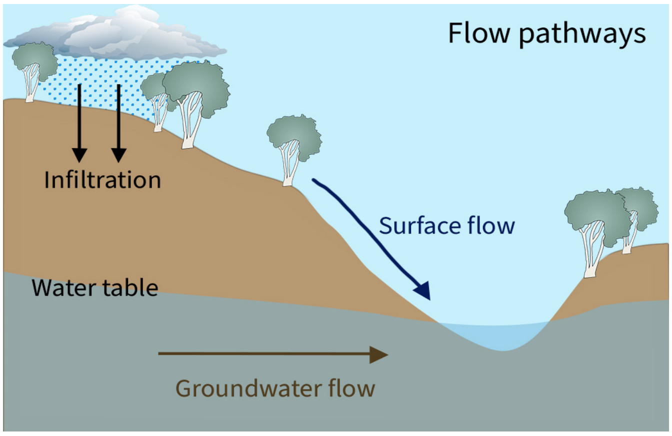
Laboratory limit of reporting: this is the lowest concentration (or amount) of an analyte that can be reported by a laboratory.

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

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

Nitrate: The measurement for the nutrient nitrate actually measures both nitrate (NO_3^-) and nitrite (NO_2^-), which is reported as NO_x^-. We still refer to this as nitrate as in most surface waters nitrite is present in very low concentrations.

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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