Middle Brunswick River

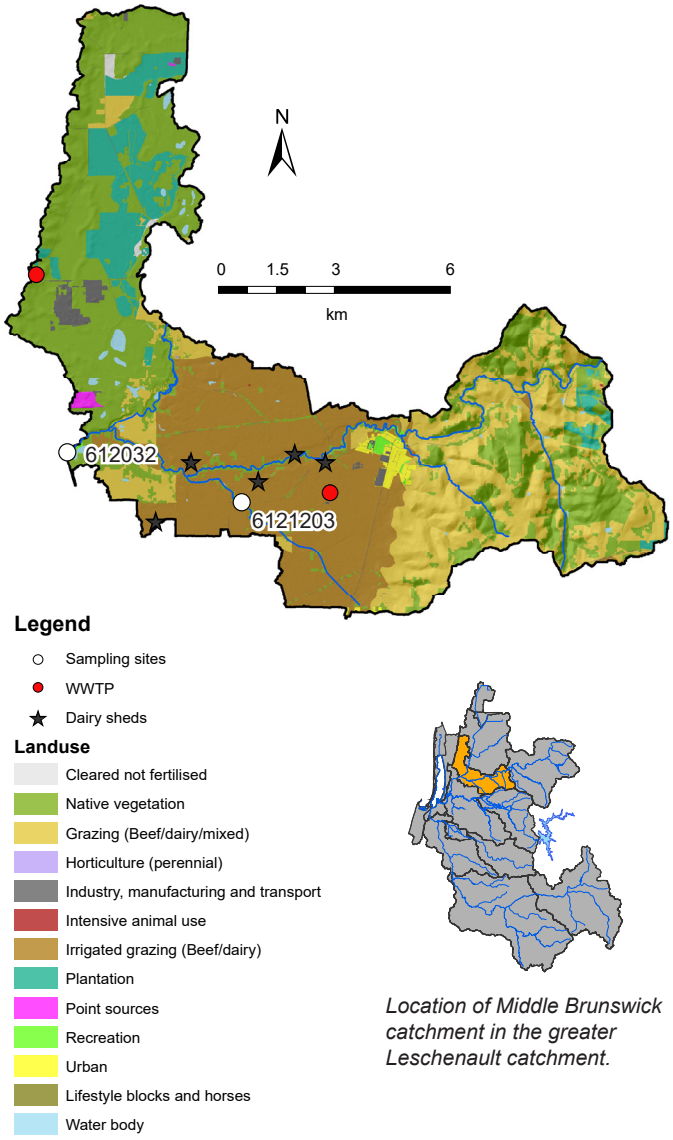
This data report provides a summary of the nutrients at the two Middle Brunswick River catchment sampling sites in 2019 as well as historical data from 2005–19. This report was produced as part of Healthy Estuaries WA. The Wellesley River flows into the Brunswick River from the north. Downstream of this catchment, the Brunswick River flows into the Collie River.

About the catchment

The Middle Brunswick River has a catchment area of about 99 km^2, more than half of which has been cleared, mostly for beef and dairy cattle grazing. About a third of the catchment is covered in native vegetation, the largest area of which lies in the north-west of the catchment. Part of the Collie Irrigation District lies over the central part of the catchment, below the Darling Scarp. The town of Brunswick Junction is on the Brunswick River. There are a number of dairy sheds in the catchment as well as the Brunswick Junction Waste Water Treatment Plant and the Brunswick Milk Processing Facility.

Most of the soils in the Swan Coastal Plain portion of the catchment have a low capacity to bind phosphorus, so any phosphorus applied quickly washes into drains and other waterways. The soils in the Darling Range and on the Darling Plateau are good at binding phosphorus. Fringing vegetation along the waterways has been largely lost or is degraded.

Water quality is measured at two sites. Elvira Gully (6121203) is on Elvira Gully where it passes under Clifton Road in Brunswick, and Cross Farm (612032) is on the Brunswick River where it passes under the Forrest Highway in Wellesley.



Location of Middle Brunswick catchment in the greater Leschenault catchment.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) were classified as moderate at the Brunswick River site and high at the Elvira Gully site, caused by the intensive agricultural land use and modified nature of the waterways. Dilution by better quality water from the scarp is the likely reason for the lower concentrations found at the Brunswick River site.

Facts and figures

Sampling site code	612032 (Cross Farm) and 6121203 (Elvira Gully)
Catchment area	99 km^2
Per cent cleared area (2018)	64%
River flow	612032 flows year round, whereas 6121203 ceases to flow over summer
Main land use (2018)	Cattle grazing and native vegetation

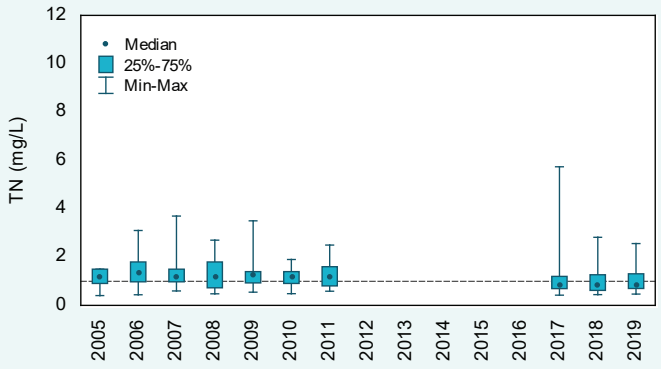
Middle Brunswick River

Nitrogen over time (2005–19)

Concentrations

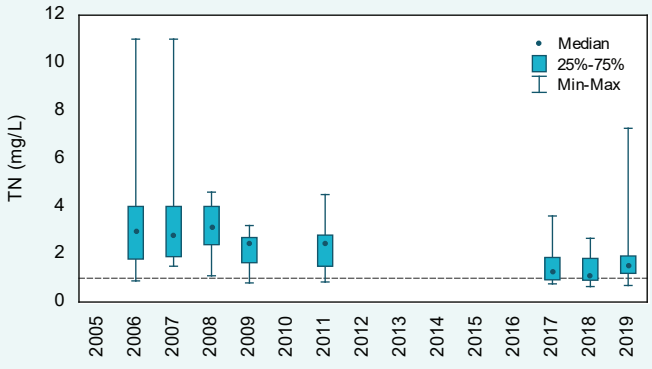
Total nitrogen (TN) concentrations were higher at the site in Elvira Gully than the one on the Brunswick River, especially before the break in monitoring. Using the State Wide River Water Quality Assessment (SWRWQA) methodology, all years with sufficient data were classified as moderate at the Brunswick River site whereas before the break in monitoring the Elvira Gully site was classified as very high, and as high after the break in monitoring. The Elvira Gully catchment has been almost completely cleared for agriculture, causing the very high TN concentrations observed. While the catchment immediately upstream of the Brunswick River site is similar to that of Elvira Gully, further upstream the catchment is more vegetated and consequently the river would have lower TN concentrations, diluting the poorer quality water from the Swan Coastal Plain.

Brunswick River



Total nitrogen concentrations, 2005–19 at site 612032. The dashed line is the Leschenault WQIP target for lowland rivers.

Elvira Gully



Total nitrogen concentrations, 2005–19 at site 6121203. The dashed line is the Leschenault WQIP target for lowland rivers.

Cattle with unrestricted access to the Brunswick River a few kilometres upstream of Brunswick Junction, December 2018. Cattle contribute nutrients directly to the river via their wastes as well as exacerbating erosion by trampling the rivers beds and banks.

Middle Brunswick River

Nitrogen (2019)

Types of nitrogen

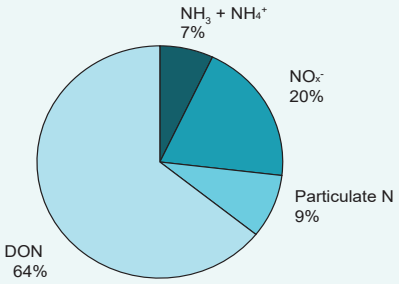
Total N is made up of different types of N. The composition of N was very similar at the two sampling sites in the Middle Brunswick River catchment. In 2019, most of the N was present as dissolved organic N (DON). This type of N consists mainly of plant and animal matter but may include other, bioavailable types. Just under a third of the N was present as dissolved inorganic N (DIN – consisting of nitrate, NO_x^-, and total ammonia, $NH_3 + NH_4^+$). DIN is readily bioavailable for plants and algae, fuelling rapid growth. DON varies in its bioavailability. Plant and animal matter usually needs to be further broken down before becoming bioavailable, whereas other types of DON are readily bioavailable.

Concentrations

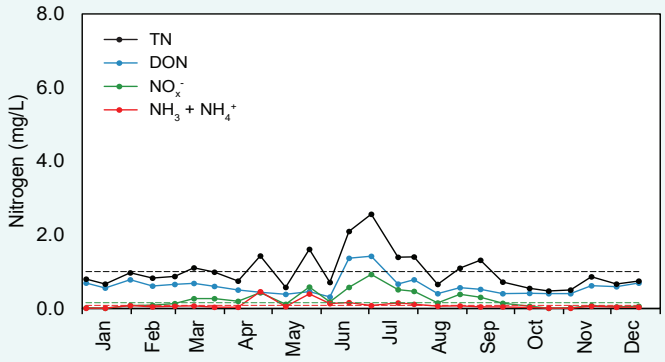
In 2019, with the exception of the peak in December at Elvira Gully, N concentrations showed a very similar pattern at the two sites in the Middle Brunswick River catchment. Both sites showed a seasonal response, with TN, DON and nitrate all increasing in June as rainfall and flow increased. This suggests that much of the N at this time was being washed into the rivers via surface runoff, with groundwater and in-stream sources contributing somewhat less. There was also a large peak in TN, total ammonia and nitrate in December at the Elvira Gully site. At this time, the stream was only just flowing, suggesting that the N is possibly coming from a discharge upstream of the sampling site.

Where there are no data shown in the Elvira Gully graph, the stream was not flowing.

Brunswick River

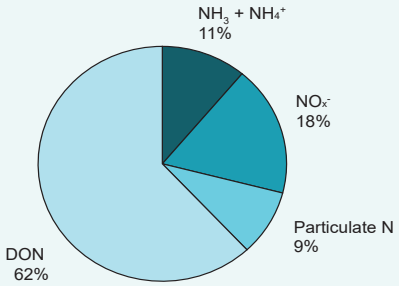


2019 average nitrogen fractions at site 612032.

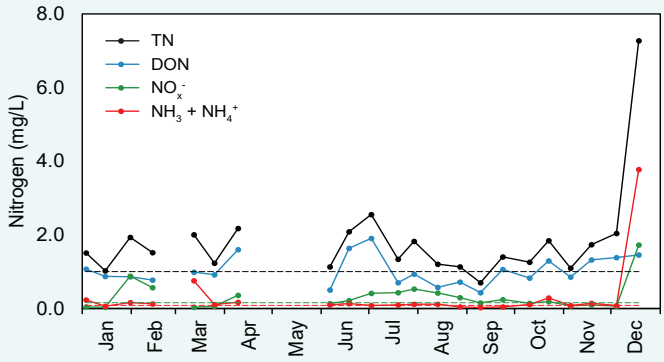


2019 nitrogen concentrations at 612032. The black dashed line is the Leschenault WQIP target for lowland rivers, the red and green are the ANZECC trigger values for total ammonia and nitrate.

Elvira Gully



2019 average nitrogen fractions at site 6121203.



2019 nitrogen concentrations at 6121203. The black dashed line is the Leschenault WQIP target for lowland rivers, the red and green are the ANZECC trigger values for total ammonia and nitrate.

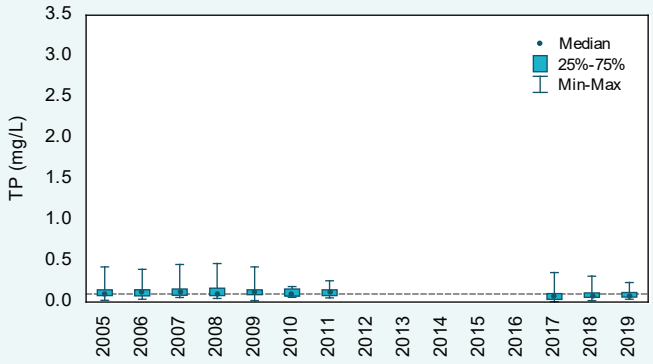
Middle Brunswick River

Phosphorus over time (2005–19)

Concentrations

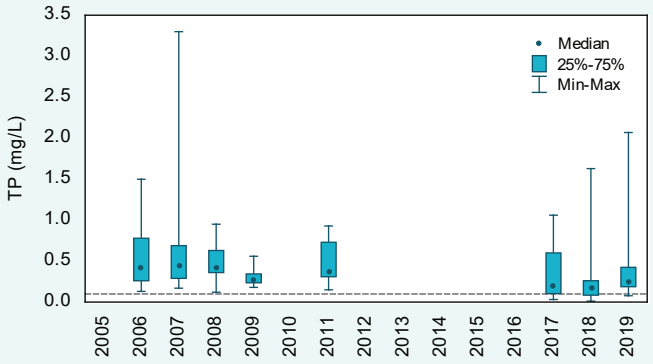
Total phosphorus (TP) concentrations differed at the two sampling sites in the Middle Brunswick River catchment, being much higher at the Elvira Gully than the Brunswick River site. At the Brunswick River site, annual TP concentrations were classified as high until 2018 and moderate in 2019 using the SWRWQA methodology. At the Elvira Gully site, annual TP concentrations were classified as very high before the break in monitoring and high since then. There are likely two main reasons for the disparity in TP concentrations at these sites. Firstly, the entire Elvira Gully sub-catchment lies on soils with a poor phosphorus-binding capacity whereas the upper part of the Brunswick River catchment has soils with a high-phosphorus binding capacity. Secondly, the relatively undisturbed upper catchment of the Brunswick River likely contributes better water quality which dilutes the poorer quality water found in the agricultural coastal plain portion of the catchment.

Brunswick River



Total phosphorus concentrations, 2005–19 at site 612032. The dashed line is the Leschenault WQIP target for lowland rivers.

Elvira Gully



Total phosphorus concentrations, 2005–19 at site 6121203. The dashed line is the Leschenault WQIP target for lowland rivers.

Agricultural land in the Middle Brunswick River catchment, January 2009.

Middle Brunswick River

Phosphorus (2019)

Types of phosphorus

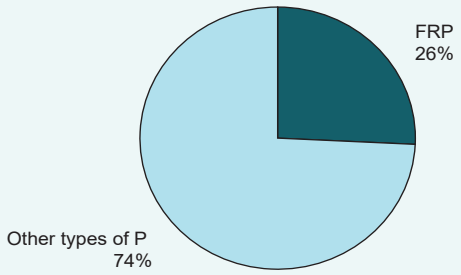
Total P is made up of different types of P. The composition of P at the two sites in the Middle Brunswick River catchment was more similar in 2018 than 2019. In 2019, highly bioavailable phosphate made up about a quarter of the P at the Brunswick River site and about a third at the Elvira Gully site. Phosphate is measured as filterable reactive phosphorus (FRP) which in surface waters is mainly present as phosphate (PO_4^{3-}) species. The phosphate was probably derived from animal waste and fertilisers as well as natural sources. The remaining P was present as either particulate P, dissolved organic P (DOP) or both (shown as 'Other types of P' in the charts below). Particulate P generally needs to be broken down before becoming bioavailable. The bioavailability of DOP varies and is poorly understood.

Concentrations

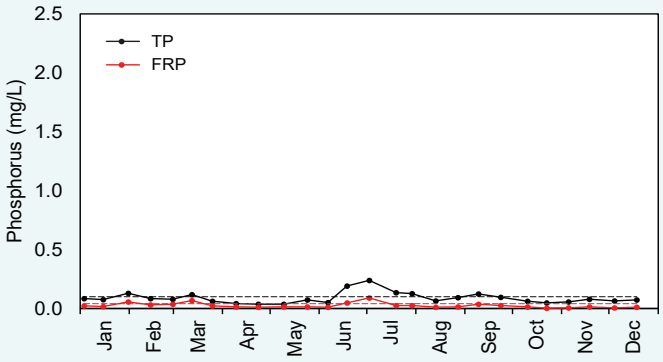
A seasonal pattern was present at both sites in the Middle Brunswick River catchment in 2019. TP and phosphate concentrations increased in June as rainfall and flow increased, indicating that P was being washed into the streams from upstream agricultural land use via surface flows. However, P concentrations fluctuated more at the Elvira Gully site with multiple peaks during the year, including the large peak in both TP and phosphate in December, coinciding with the peaks in N. At this time, most of the P is possibly coming from a discharge upstream of the sampling site. During the rest of the year, it is likely that much of the P at both these sites is coming from fertiliser and animal waste from agricultural land use in the catchment, and that most of it is entering the streams via surface flows and irrigation runoff/returns.

Where there are no data shown in the Elvira Gully graph, the stream was not flowing.

Brunswick River

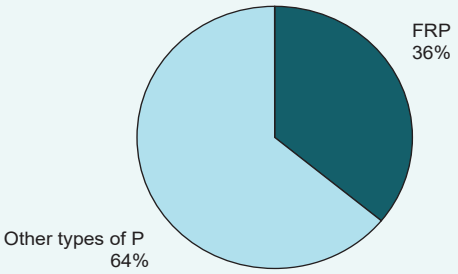


2019 average phosphorus fractions at site 612032.

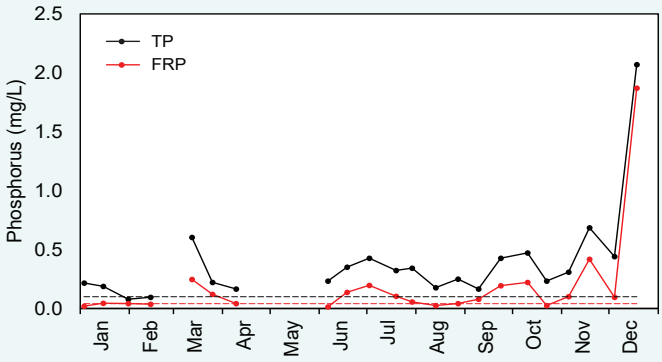


2019 phosphorus concentrations at 612032. The black dashed line is the Leschenault WQIP target for lowland rivers, the red is the ANZECC trigger value for phosphate.

Elvira Gully



2019 average phosphorus fractions at site 6121203.



2019 phosphorus concentrations at 6121203. The black dashed line is the Leschenault WQIP target for lowland rivers, the red is the ANZECC trigger value for phosphate.

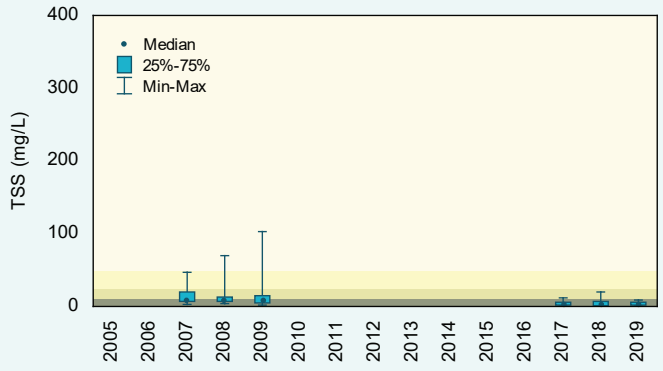
Middle Brunswick River

Total suspended solids over time (2005–19)

Concentrations

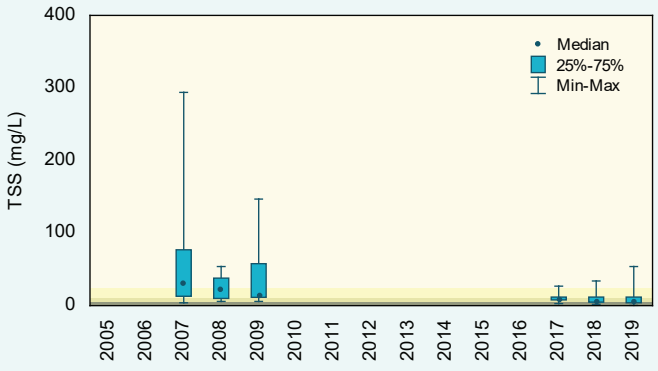
Total suspended solids (TSS) concentrations were higher at the Elvira Gully site than the Brunswick River site, with concentrations at both sites higher before the break in monitoring. Using the SWRWQA methodology, annual TSS concentrations at the Brunswick River site were classified as moderate before the break in monitoring and low afterwards. At the Elvira Gully site, annual TSS concentrations were classified as very high before the break in monitoring and moderate since. The most likely reason for the difference in TSS concentrations between the two sites is the different land uses in the sub-catchments. Upstream of the Elvira Gully site, the catchment is almost entirely cleared for agriculture so there is a large potential for particulate matter to run off into the stream, as well as in-stream erosion. Immediately upstream of the Brunswick River site the land use is also agriculture; however, further upstream the catchment is less disturbed so likely contributes water of better quality which will help dilute the poor quality water from the Swan Coastal Plain portion of the catchment. This leads to lower TSS concentrations at the sampling site.

Brunswick River



Total suspended solids concentrations, 2005–19 at site 612032. The shading refers to the SWRWQA classification bands.

Elvira Gully



Total suspended solids concentrations, 2005–19 at site 6121203. The shading refers to the SWRWQA classification bands.

fresh marginal brackish saline

The Brunswick River sampling site, December 2018.

Middle Brunswick River

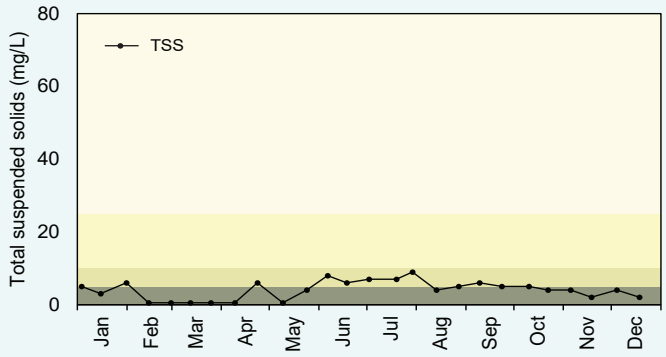
Total suspended solids (2019)

Concentrations

TSS concentrations showed different patterns at the two sampling sites in the Middle Brunswick River catchment. At the site on the Brunswick River, TSS showed a seasonal response, being generally low in the first part of the year before increasing as rainfall and flow increased in May to June. Concentrations then remained higher during the wetter months before falling again later in the year. This suggests that much of the particulate matter was being washed into the stream via surface flows at this site. The Elvira Gully site showed a different pattern; having multiple spikes in TSS concentrations during the year. This suggests that particulate matter was likely entering the stream via surface runoff as well as potentially coming from irrigation returns as well as in-stream erosion. If cattle have access to the stream then this will be exacerbating the erosion.

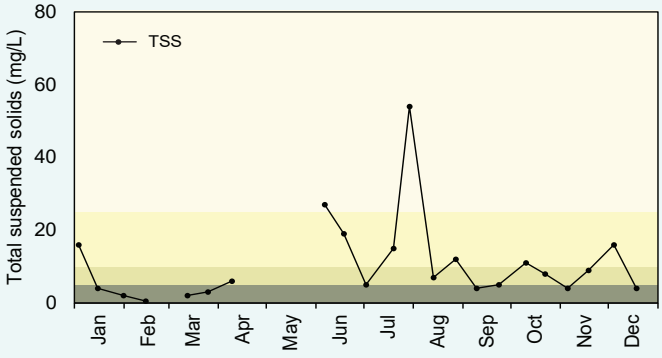
Where there are no data shown on the Elvira Gully graph, the stream was not flowing.

Brunswick River



2019 total suspended solids concentrations at 612032. The shading refers to the SWRWQA classification bands.

Elvira Gully



2019 total suspended solids concentrations at 6121203. The shading refers to the SWRWQA classification bands.

fresh marginal brackish saline

The Elvira Gully sampling site, November 2018. The channel is mostly overgrown by exotic grasses.

Middle Brunswick River

pH over time (2005–19)

pH values

The two sites in the Middle Brunswick Catchment had similar pH values. While pH values fluctuated over the reporting period, all annual medians fell within the upper and lower Australian and New Zealand Environment and Conservation Council (ANZECC) trigger values.

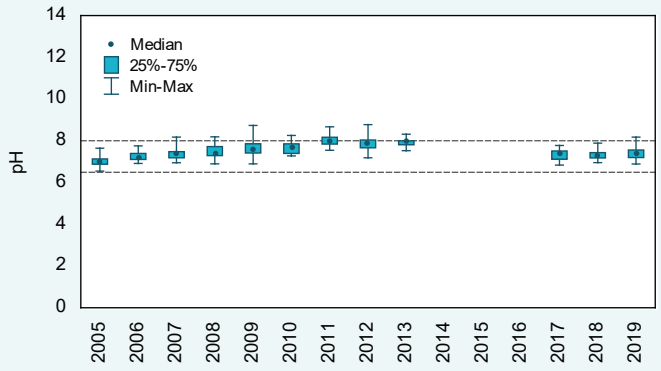
pH (2019)

pH values

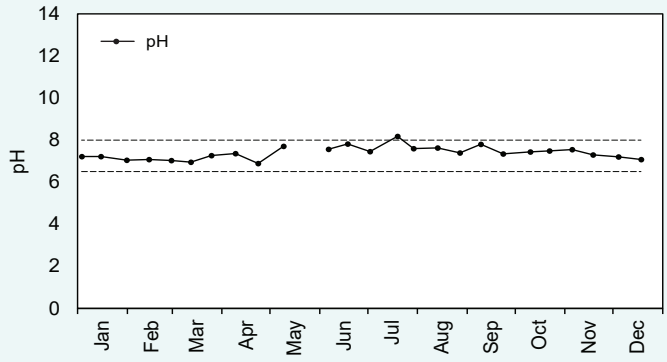
In 2019 pH values fluctuated at both sampling sites in the Middle Brunswick River catchment. With the exception of a single sample collected in July at the Brunswick River site, all samples collected at both sites fell within the upper and lower ANZECC trigger values.

Where there are no data shown on the Elvira Gully graph, the stream was not flowing. At the Brunswick River site, the missing data point in May was because of a faulty probe, the river was flowing at this time.

Brunswick River

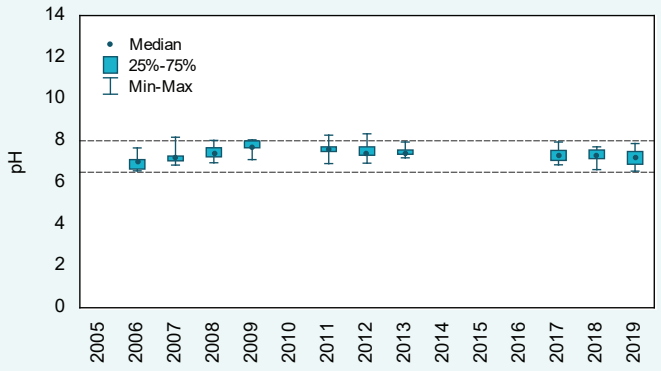


pH levels, 2005–19 at site 612032. The dashed lines are the upper and lower ANZECC trigger values.

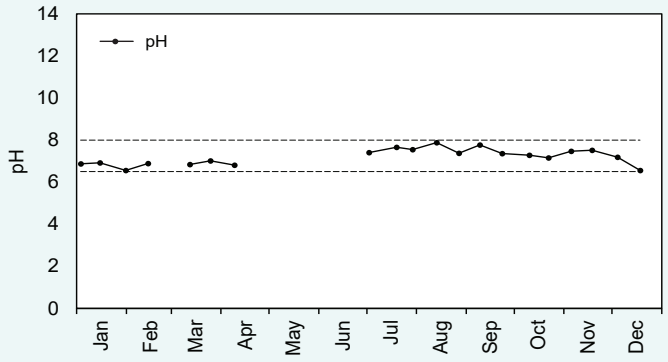


2019 pH levels at 612032. The dashed lines are the upper and lower ANZECC trigger values.

Elvira Gully



pH levels, 2005–19 at site 6121203. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels at 6121203. The dashed lines are the upper and lower ANZECC trigger values.

Middle Brunswick River

Salinity over time (2005–19)

Concentrations

Median annual salinity was a little lower at the Elvira Gully sampling site than the site on the Brunswick River. This is driven by the fact that the Elvira Gully site ceases to flow for a time over summer/autumn, when salinity is normally at its highest. Otherwise, the salinity concentrations are similar at the two sites. Using the Water Resources Inventory 2014 salinity bands, the Brunswick River site was classified as marginal before the break in monitoring and brackish after. At Elvira Gully, all years were classified as marginal. (Note, the 2018 nutrient report used the SWRWQA bands.)

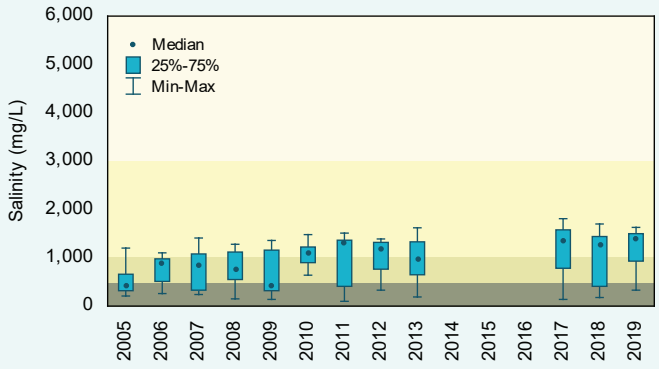
Salinity (2019)

Concentrations

Salinity at both sites was lowest over June to September, coinciding with winter rainfall and higher streamflow. At both sites, salinity was higher in the other months, when much of the water present was likely derived from groundwater and irrigation returns. This suggests that the surface water runoff at these sites is fresher than the groundwater and possibly the irrigation returns. Evapoconcentration of salinity may also be occurring in the drier months. The peak in salinity in October at both sites was likely the result of evapoconcentration and increased groundwater contribution. Salinity was lower again in early November, as about 25 mm of rain fell a few days before these samples were collected, before rising sharply as water levels dropped once more.

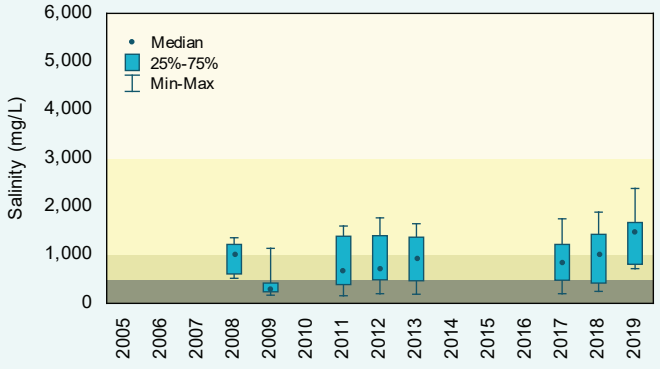
Where there are no data shown on the Elvira Gully graph, the stream was not flowing. At the Brunswick River site, the missing data point in May was because of a faulty probe, the river was flowing at this time.

Brunswick River

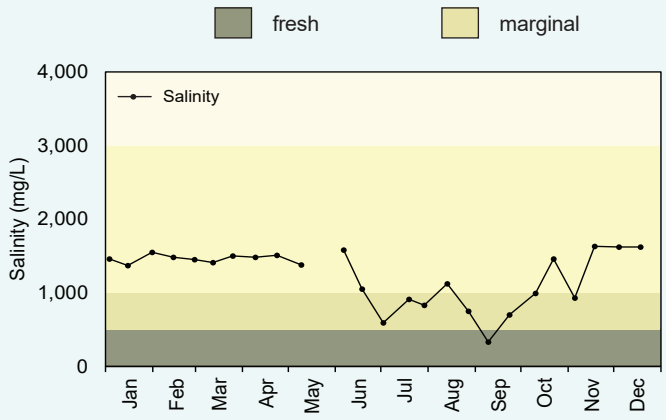


Salinity concentrations, 2005–19 at site 612032. The shading refers to the Water Resources Inventory 2014 salinity ranges.

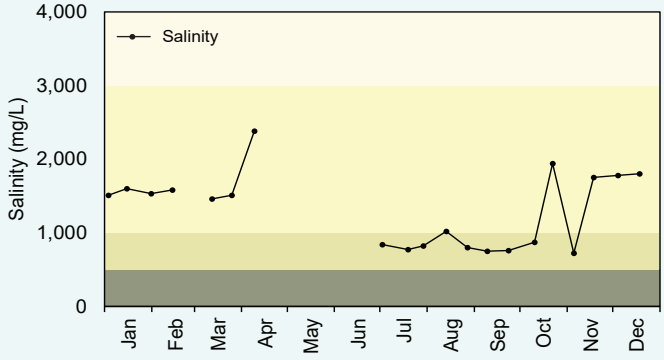
Elvira Gully



Salinity concentrations, 2005–19 at site 6121203. The shading refers to the Water Resources Inventory 2014 salinity ranges.



2019 salinity concentrations at 612032. The shading refers to the Water Resources Inventory 2014 salinity ranges.



2019 salinity concentrations at 6121203. The shading refers to the Water Resources Inventory 2014 salinity ranges.

Middle Brunswick River

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 on 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.

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 information on the condition of the Leschenault Estuary at estuaries.dwer.wa.gov.au/estuary/leschenault-estuary

Healthy Estuaries WA partners with the Leschenault Catchment Council to fund best-practice management 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 Leschenault Catchment Council go to leschenaultcc.org.au
- To find out more about the health of the rivers in the Leschenault Catchment go to rivers.dwer.wa.gov.au/assessments/results

Methods

Variables were compared with the Leschenault Estuary water quality improvement plan concentration targets or ANZECC trigger values where available, or the SWRWQA bands or the 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 per volume of 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.

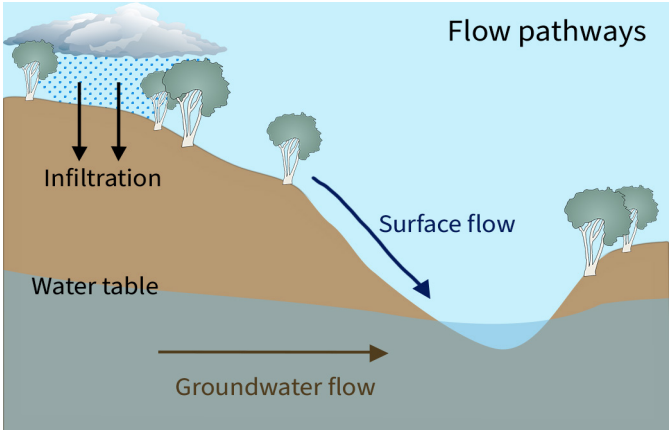
Laboratory limit of reporting: (LOR) this is the lowest concentration of an analyte that can be reported by a laboratory.

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.



Middle Brunswick River Issue 2
Publication date: July 2023
ISSN: 2209–6779 (online only)