Middle Preston River

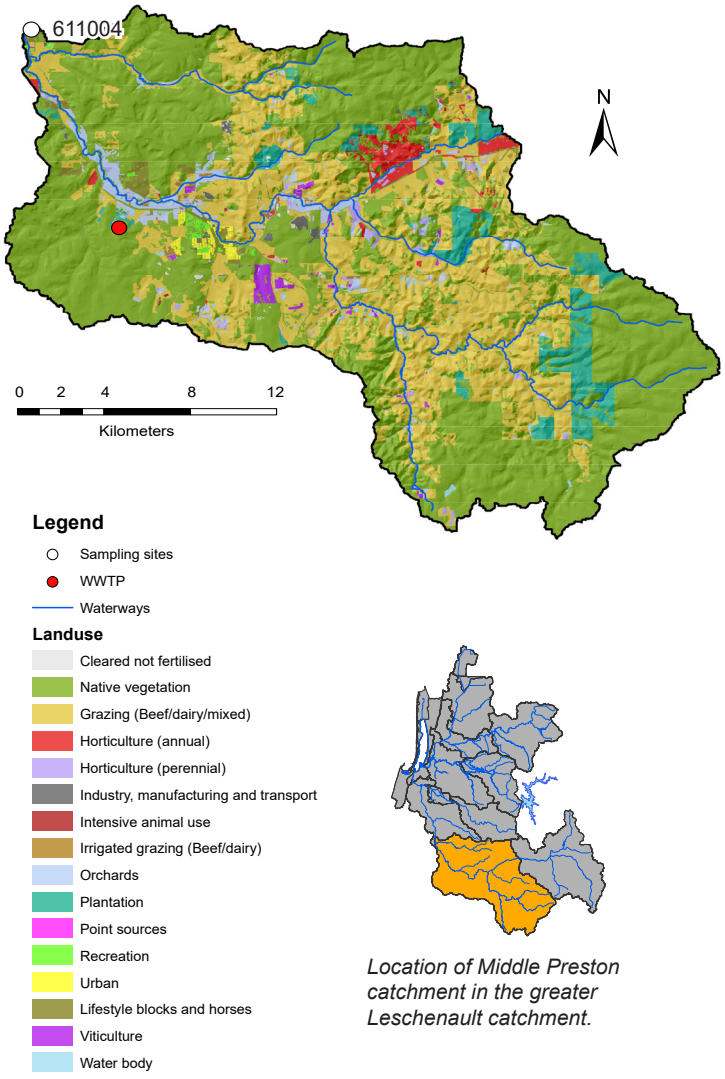
This data report provides a summary of the nutrients at the Preston River sampling site in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. Downstream of this site, the Preston River passes through the Lower Preston River catchment before discharging to the Leschenault Estuary. 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 Preston River catchment has an area of about 484 km^2, and is the largest of the monitored catchments of the Leschenault Estuary. The total catchment area upstream of the sampling site is 807 km^2 as it includes the Upper Preson catchment. Just over half the catchment remains covered by native vegetation, and a third is used for beef cattle grazing. The town of Donnybrook lies in the catchment, as does the Donnybrook Waste Water Treatment Plant. While a relatively large area of native vegetation remains in the catchment, the agricultural land use is concentrated around the waterways, resulting in much of the fringing vegetation being lost or in poor condition.

The Middle Preston River catchment lies almost entirely on the Darling Scarp and Darling Plateau and, because of this, has soils which bind phosphorus well. This means that phosphorus applied to the soil tends to be bound rather than moving to waterways.

Water quality is measured at site 611004, Boyanup Bridge, near where the Preston River passes under Bridge Street in Boyanup.



Location of Middle Preston catchment in the greater Leschenault catchment.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) were low; however, the proportion of nitrogen that was bioavailable was large. Nutrient loads were large compared with the other Leschenault catchment sites, driven by the large flow volumes. The relatively good water quality at this site was likely because of the presence of soils that bind phosphorus well, the small proportion of irrigated agriculture compared with other Leschenault catchment sites, and the relatively large amount of native vegetation remaining.

Facts and figures

Sampling site code	611004
Catchment area	484 km^2
Per cent cleared area (2018)	37%
River flow	Permanent
Annual flow (2018)	82 GL
Main land use (2018)	Native vegetation and beef cattle grazing

Middle Preston River

Nitrogen over time (2004–18)

Concentrations

Total nitrogen (TN) concentrations at the sampling site in the Middle Preston River were low and fluctuated over the reporting period. With the exception of 2005, all annual medians were below the Leschenault Water Quality Improvement Plan (WQIP) TN target for upland rivers. In 2018, the annual median at the Middle Preston River sampling site (0.20 mg/L) was the lowest of the 10 sites sampled in the Leschenault catchment.

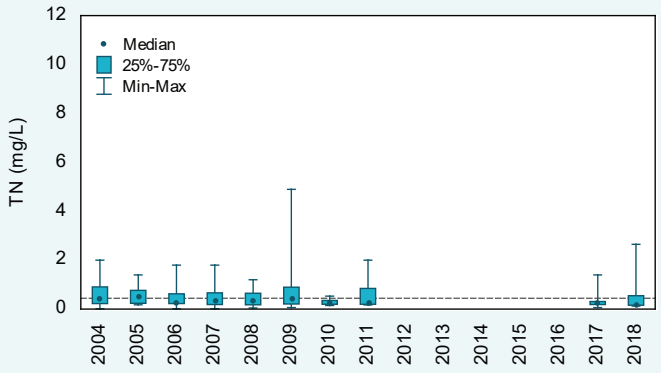
Trends

As the Middle Preston River site was not sampled between 2012–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

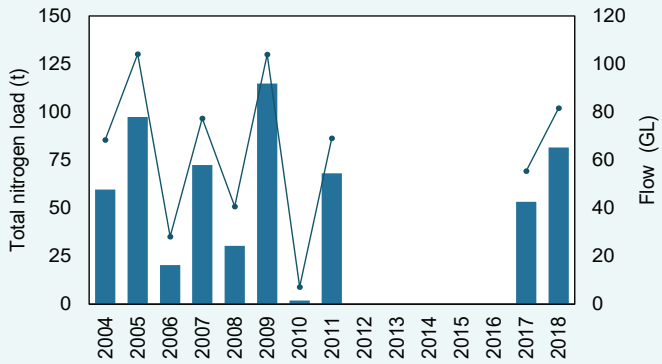
Estimated loads

The estimated TN loads at the Middle Preston River sampling site were large compared with the other three sites with flow data in the Leschenault catchment. In 2018, the estimated TN load (82 t) was the largest, with the Ferguson River site having the next largest load of 33 t. Since concentrations were generally low, the large load at this site is explained primarily by the large flow volume. In 2018, the Middle Preston River site had a flow volume of 82 GL compared with only 24 GL at the Ferguson River site. The load per unit area (101 kg/km^2) was the smallest of the three catchments where it was calculated. The next largest load per unit area was at the Middle Collie River site (206 kg/km^2). Annual TN loads were closely related to flow volumes; years with large annual flow volumes had large TN loads and vice versa.

Preston River



Total nitrogen concentrations, 2004–18 at site 611004, The dashed line is the Leschenault WQIP target for upland rivers.



Total nitrogen load and annual flow, 2004–18 at site 611004.

The weir at the Preston River sampling site, November 2018.

Middle Preston River

Nitrogen (2018)

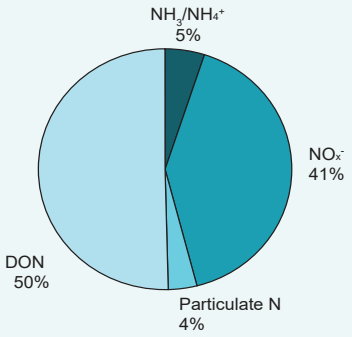
Types of nitrogen

Total N is made up of many different forms of N. At the Middle Preston River sampling site, almost half of the N was present as dissolved organic N (DIN – consisting of ammonia N, NH_3/NH_4^+ and oxides of N, NO_x^-) which is mainly sourced from fertilisers and animal wastes as well as septic tanks. DIN is readily bioavailable for plants and algae to use to fuel rapid growth. The remainder of the N was present as dissolved organic N (DON) which consists mainly of degrading plant and animal matter but may include other forms. DON varies in its bioavailability. Plant and animal matter usually needs to be further broken down before it becomes available whereas other forms of DON are readily bioavailable. The proportion of N present as DIN at this site was the highest of the 10 sites sampled in the Leschenault catchment. The site in the Upper Preston catchment was the next highest (39 per cent).

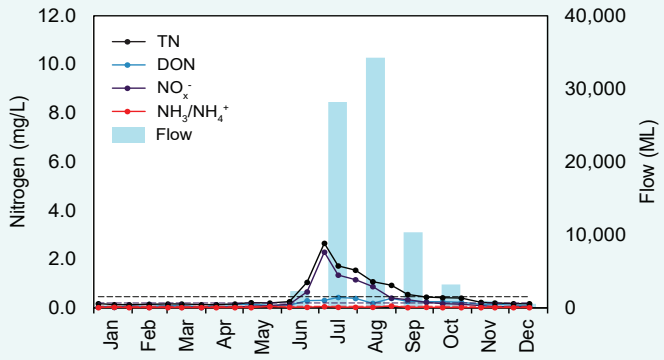
Concentrations

Total N, DON and NO_x^- all showed a seasonal pattern in 2018 at the Middle Preston River sampling site. Concentrations were very low in the early part of the year when there was little rainfall or flow. In June, as rainfall and flow started to increased, concentrations increased rapidly (especially TN and NO_x^-), before peaking in July and falling again. The peak in July was likely because of a first-flush response 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 agricultural land, where fertiliser and animal wastes build up over summer. Given the pattern in N concentrations seen at this site it is likely that most of the N is entering the river via surface flows with in-stream sources, and groundwater contributing proportionally less.

Preston River



2018 average nitrogen fractions at site 611004.



2018 nitrogen concentrations and monthly flow at 611004. The black dashed line is the Leschenault WQIP target for upland rivers, the red and purple are the ANZECC trigger values for upland rivers.

The river health assessment site on the Preston River. Note the horticulture close to the edge of the river, October 2009.

Middle Preston River

Phosphorus over time (2004–18)

Concentrations

Total phosphorus (TP) concentrations at the Middle Preston River were generally low compared with the other 10 sites sampled in the Leschenault catchment. All annual medians were below the Leschenault Water Quality Improvement Plan (WQIP) TP target for upland rivers, though each year had some samples over the target. The 2018 annual median (0.014 mg/L) was one of the lowest of the 10 sites sampled in the Leschenault catchment. Only the site in the Upper Preston (0.011 mg/L) and Middle Collie River (0.009 mg/L) catchments had lower annual medians.

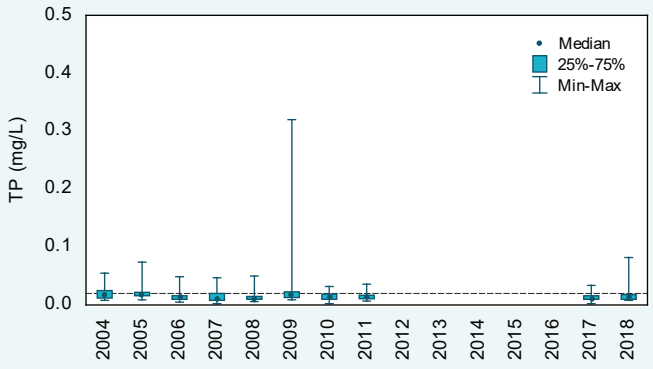
Trends

As the Middle Preston River site was not sampled between 2012–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

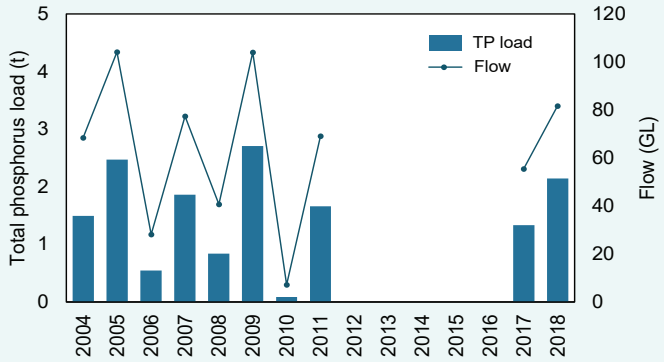
Estimated loads

The estimated TP loads at the Middle Preston River sampling site were large compared with the other three sites with flow data in the Leschenault catchment. In 2018, the estimated TP load (2.1 t) was the largest, with the Ferguson River site having the next largest load of 1.5 t. Since concentrations were generally low, the large P load at this site is explained primarily by the large flow volume. In 2018, the Middle Preston River site had a flow volume of 82 GL compared with only 24 GL at the Ferguson River site. The load per unit area (2.7 kg/km^2) was the smallest of the Leschenault sites. The next largest load per unit area was at the Middle Collie River site (4.3 kg/km^2). Annual TP loads were closely related to flow volumes; years with large annual flow volumes had large TP loads and vice versa.

Preston River



Total phosphorus concentrations, 2004–18 at site 611004. The dashed line is the Leschenault WQIP target for upland rivers.



Total phosphorus loads and annual flow, 2004–18 at site 611007.

A sand slug on the side of the Preston River. This sand is mobile and can be transported downstream during high flows, October 2009.

Middle Preston River

Phosphorus (2018)

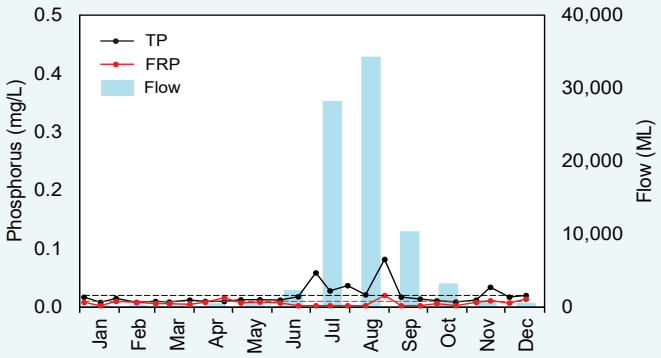
Types of phosphorus

Total P is made up of different forms of P. Because a number of filterable reactive phosphorus (FRP) samples were below the laboratory limit of reporting in 2018, phosphorus fraction pie charts were not generated for the Middle Preston River site. At this site, nine of the 26 FRP samples were below their limit of reporting (0.005 mg/L). FRP is readily bioavailable and is used by plants and algae to fuel rapid growth.

Concentrations

Total P showed a seasonal response, generally being highest during the wetter months. This pattern was not as evident in FRP concentrations which tended to be low year-round, with some small peaks throughout the year, not linked to flow events. The peaks in TP recorded in July and August coincide with high TSS concentrations and large daily flow volumes. This suggests there was input of particulate matter from surrounding land use or in-stream erosion. The reason for the peak in November is unclear. It is likely that much of the P is entering the river as particulate P via surface flows or in-stream erosion at this site. The fact that the catchment has soils with a large capacity to bind P helps explain the relatively low P concentrations because any P that is applied to the soil as fertiliser or animal waste tends to bind quickly to the soil. This helps reduce its movement through the catchment and into the rivers.

Preston River



2018 phosphorus concentrations and monthly flow at 611004. The black dashed line is the Leschenault WQIP target for upland rivers, the red is the ANZECC trigger value for upland rivers.

Erosion and slumping along the banks of the Preston River, October 2009.

Middle Preston River

Total suspended solids over time (2004–18)

Concentrations

Compared to the other sites sampled in the Leschenault catchment, total suspended solids (TSS) concentrations were generally low to moderate at the Middle Preston River sampling site. All annual medians were classified as low using the Statewide River Water Quality Assessment (SWRWQA) classification bands; however, there were some samples each year that fell in the very high classification band. In 2018, the Middle Preston River sampling site had the equal smallest median TSS concentration (both this site and the one in the Upper Preston River catchment had a median that was below the limit of reporting for TSS of 1 mg/L).

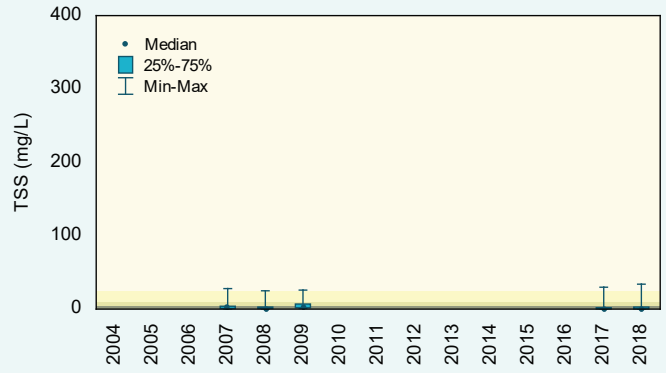
Trends

As the Middle Preston River site was not sampled between 2010–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

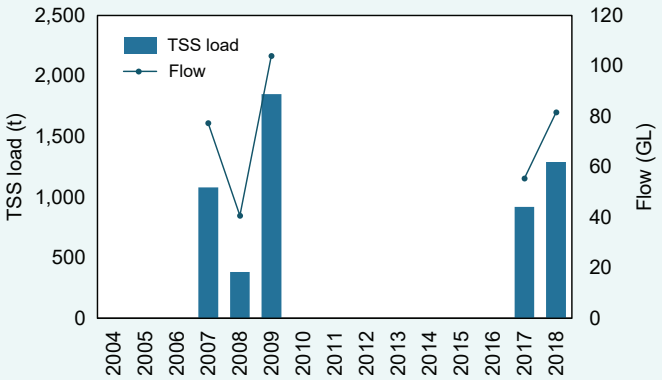
Estimated loads

The estimated TSS loads at the Middle Preston River sampling site were large compared with the other three sites with flow data in the Leschenault catchment. In 2018, the estimated TSS load (1,290 t) was the largest, with the Ferguson River site having the next largest load of 759 t. Since concentrations were generally low, the large load at this site is explained primarily by the large flow volume. In 2018, the Middle Preston River site had a flow volume of 82 GL compared with only 24 GL at the Ferguson River site. The load per unit area (1,598 kg/km^2) was the second largest of the three sites where it was calculated (and similar to the Middle Collie site, 1,097 kg/km^2). The load per unit area at the Ferguson River site was much larger, 5,492 kg/km^2. Annual TSS loads were closely related to flow volumes; years with large annual flow volumes had large TSS loads and vice versa.

Preston River



Total suspended solids concentrations, 2004–18 at site 611004. The shading refers to the SWRWQA classification bands.



Total suspended solids loads and annual flow, 2004–18 at site 611004.

very high high moderate low

The Preston River a few kilometres downstream of Donnybrook, October 2009.

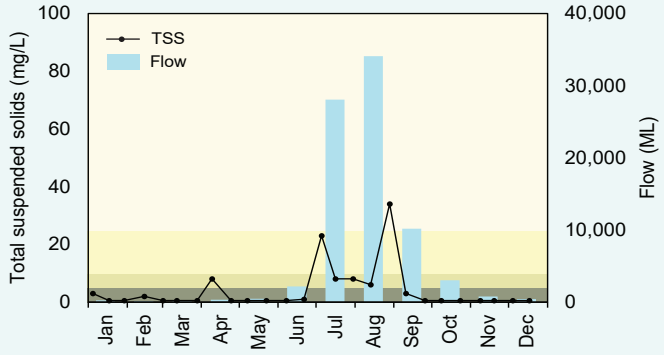
Middle Preston River

Total suspended solids (2018)

Concentrations

TSS concentrations showed a seasonal pattern at the Middle Preston River site in 2018. Concentrations were generally lower during the drier months before increasing in June as flow and rainfall increased. At this time, particulate matter was entering the river via surface flow as well as coming from in-stream erosion. The TSS peaks in July and August coincided with increased flow volumes on those days. This was potentially washing particulate matter into the river from surrounding land use as well as mobilising in-stream sediments and increasing erosion.

Preston River



2018 total suspended solids concentrations and monthly flow at 611004. The shading refers to the SWRWQA classification bands.

very high | high | moderate | low

A fyke net in the Preston River, used to monitor fish populations as part of a river health assessment, October 2009.

Middle Preston River

pH over time (2004–18)

pH values

At the Middle Preston River sampling site, pH values fluctuated slightly over the reporting period. The annual medians fell between the upper and lower ANZECC trigger values each year where there were sufficient data to graph.

Trends

As the Middle Preston River site was not sampled between 2014–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

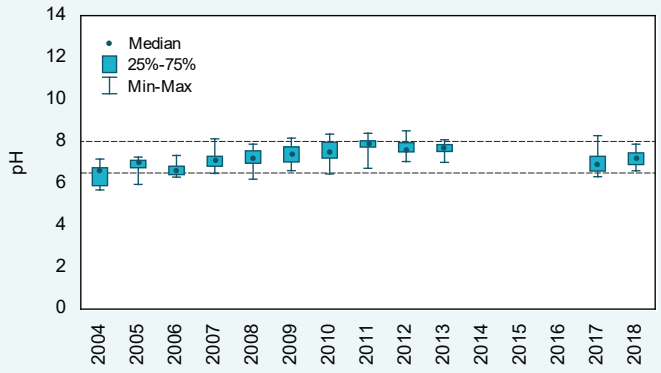
pH (2018)

pH values

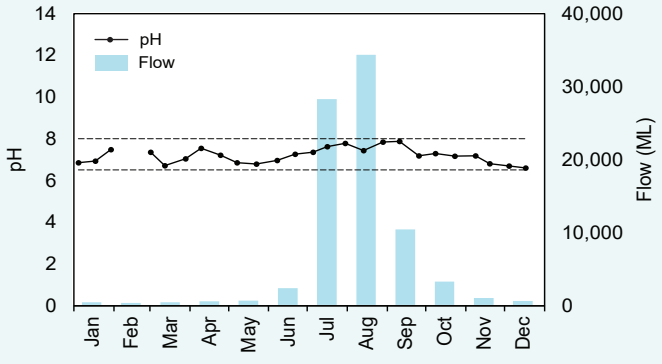
There was a slight seasonal pattern evident in the 2018 pH values at the Middle Preston River sampling site. pH started to increase in June as rainfall and flow increased, and was higher during the remainder of the wetter months before falling again in September. This suggests that the surface water runoff is slightly more alkaline (has a higher pH) than the groundwater at this site. There were also some peaks in pH in the early part of the year though, the reason for these are unclear.

The missing data point in February was because pH data were not collected on that sampling occasion at this site. The river was flowing.

Preston River



pH levels, 2004–18 at site 611004. The dashed lines are the upper and lower ANZECC trigger values for upland rivers.



2018 pH levels and monthly flow at 611004. The dashed lines are the upper and lower ANZECC trigger values for upland rivers.

Low water levels at the Preston River sampling site, November 2018.

Middle Preston River

Salinity over time (2004–18)

Concentrations

The Middle Preston River sampling site was the freshest of the 11 sites sampled in the Leschenault catchment. Almost all samples collected were classified as fresh using the SWRWQA classification bands.

Trends

As the Middle Preston River site was not sampled between 2014–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

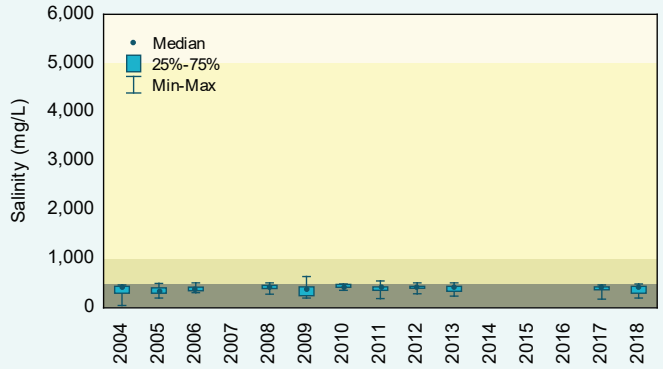
Salinity (2018)

Concentrations

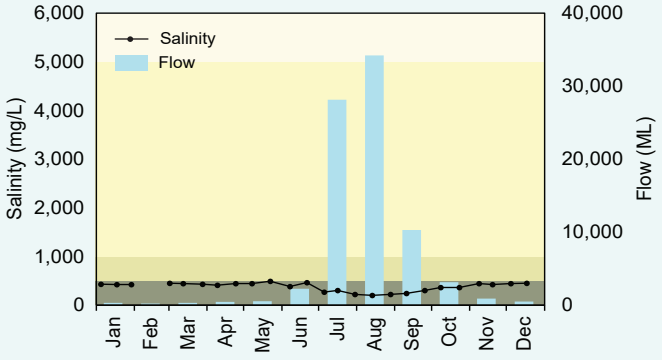
In 2018, salinity showed a slight inverse relationship to flow at the Middle Preston River sampling site. During the first part of the year, salinity was higher (though still classified as low) before it fell in July as rainfall and flow increased. It then remained lower before increasing again in September. This suggests that the groundwater at this site is slightly more saline than the surface water.

The missing data point in February was because salinity data were not collected on that sampling occasion at this site. The river was flowing.

Preston River

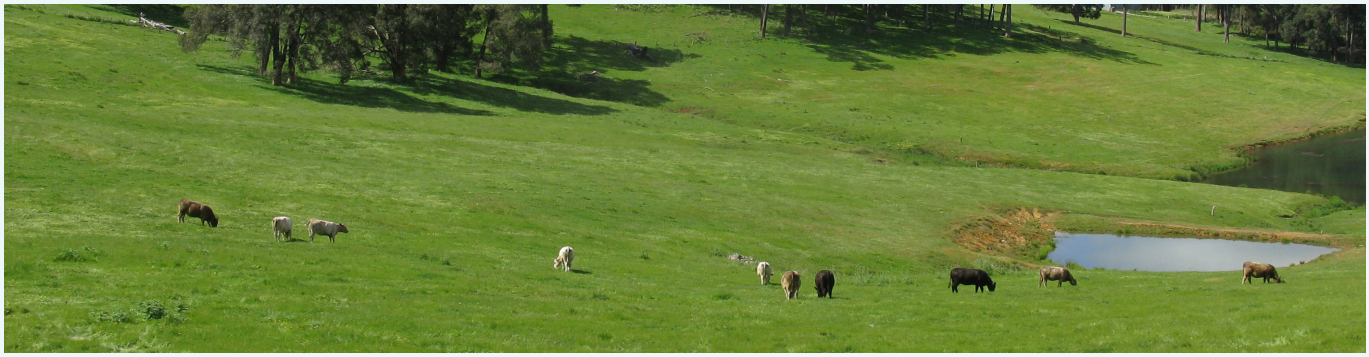


Salinity concentrations, 2004–18 at site 611004. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations and monthly flow at 611004. The shading refers to the SWRWQA classification bands.

saline brackish marginal fresh



Cattle grazing is one of the major land uses in the Middle Preston River catchment, October 2009.

Middle Preston River

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 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.

You can find the latest data on the condition of the Leschenault Estuary at estuaries.dwer.wa.gov.au/estuary/leschenault-estuary

The Regional Estuaries Initiative partners with the Leschenault Catchment Council to fund best-practice fertiliser, 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 Leschenault Catchment Council go to www.leschenaultcc.org.au
- To find out more about the health of the rivers in the Leschenault Estuary Catchment go to rivers.dwer.wa.gov.au/assessments/results

Methods

Total phosphorus and total nitrogen concentrations were compared with the Leschenault Estuary WQIP targets. These targets represent the allowable annual median winter concentrations in both lowland (TN 1.0 mg/L, TP 0.1 mg/L) and upland (TN 0.45 mg/L, TP 0.02 mg/L) catchments. Sites were compared with the appropriate target. 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 represents the acceptable pH range. Where there were no ANZECC trigger values (for TSS and salinity), the SWRWQA classification bands were used to allow samples and sites to be classified and compared. For all parameters, the full year of data were used when comparing with targets, trigger values and classification bands.

Gaps in the data meant it was not possible to calculate trends for the Leschenault catchment sites. A minimum of five consecutive years of data are required.

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.

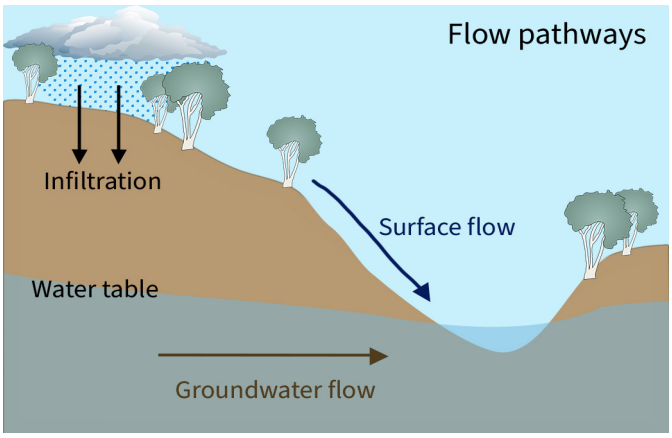
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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



Middle Preston River Issue 1
Publication date: Aug 2021
ISSN: 2209–6779 (online only)