Middle Collie River

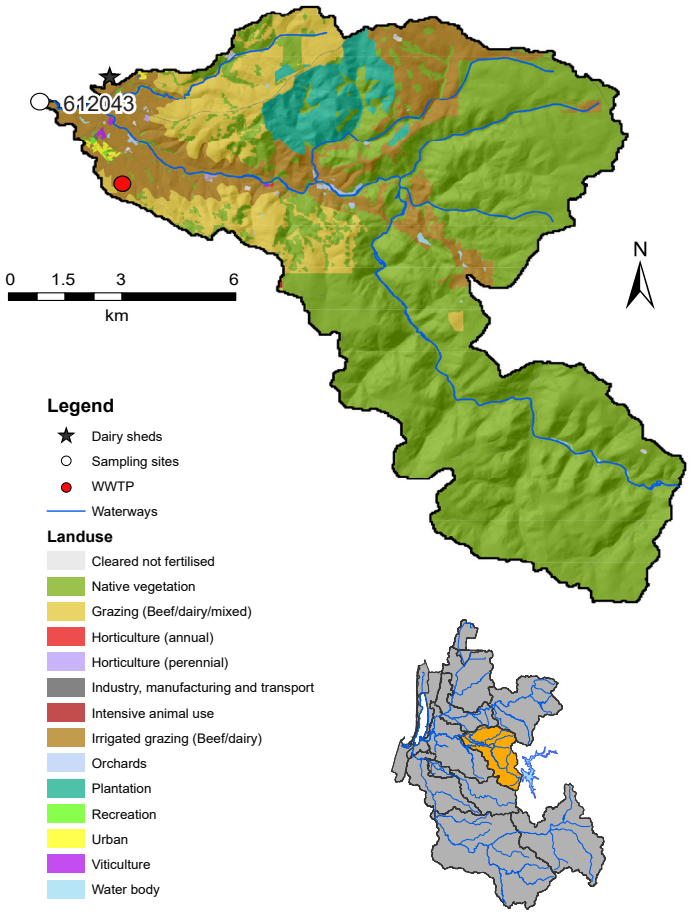
This data report provides a summary of the nutrients at the Middle Collie River sampling site in 2019 as well as historical data from 2005–19. This report was produced as part of Healthy Estuaries WA. Downstream of the site, the river flows through the Tidal Collie River catchment before discharging to the Leschenault Estuary.

About the catchment

The Middle Collie River has a catchment area of about 145 km^2, about 70 per cent of which is covered in native vegetation, mostly in the upper part of the catchment. The other major land use in the catchment is beef and dairy cattle grazing. Just upstream of the catchment boundary, on the Collie River, lies Wellington Dam, downstream of which there is a smaller dam, Burekup Weir. The weir is used to divert water into the open channels of the Collie River Irrigation Network. The town of Burekup also lies within the catchment, with its waste water treatment plant.

Most of the catchment lies on soils which bind phosphorus well, slowing the rate at which applied phosphorus moves to waterways.

Water quality is measured at site 612043, Rose Road, near Rose Road in Burekup.



Location of Middle Collie River catchment in the greater Leschenault catchment.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the Collie River sampling site were classified as low. The proportion of nitrogen present in a bioavailable type was large. Flow volumes and loads are influenced by releases from Wellington Dam, especially in dry years. Most of the catchment is on the Darling Plateau where soils tend to bind phosphorus well, contributing to the low phosphorus concentrations observed.

Facts and figures

Sampling site code	612043 (Rose Road)
Catchment area	145 km^2
Per cent cleared area (2018)	32%
River flow	Usually flows year round but will sometimes dry over summer
Main land use (2018)	Native vegetation and cattle grazing

Estimated loads and flow at Collie River

612043	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Flow (GL)	76	21	51	55	99	18	35	28	70	67	19	40	39	49	24
TN load (t)	45	9.8	29	33	67	7.1	20						20	27	11
TP load (t)	1.00	0.26	0.66	0.70	1.73	0.19	0.48						0.46	0.57	0.26

Middle Collie River

Nitrogen over time (2005–19)

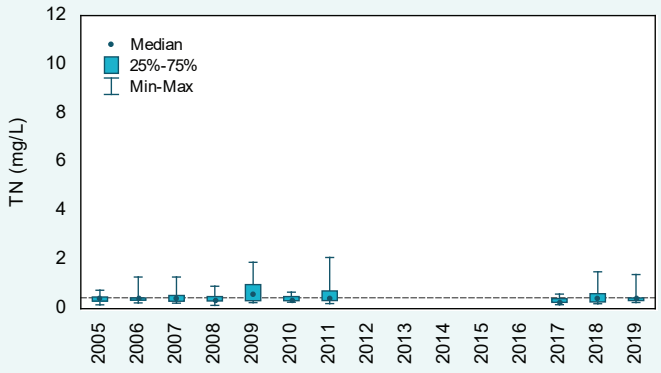
Concentrations

Total nitrogen (TN) concentrations at the Middle Collie River sampling site were low compared with the other sites sampled in the Leschenault catchment. The annual medians were below the Leschenault Water Quality Improvement Plan (WQIP) target for upland rivers in all years except 2009, though each year had some samples above the target. Using the State Wide River Water Quality Assessment (SWRWQA) methodology, all years with sufficient data were classified as having a low TN concentration.

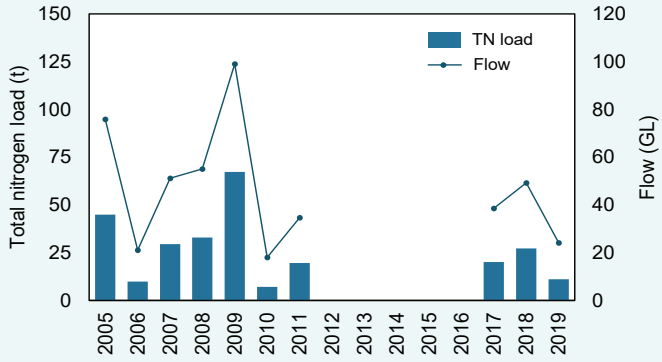
Estimated loads

In 2019, of the four sites with flow data in the Leschenault catchment, the Middle Collie River had a moderate to large estimated TN load of 11 t. Only the Middle Preston sampling site had a larger load (17 t) The Middle Collie River had the largest TN load per square kilometre at 84 kg/km^2. Flow volumes at the Middle Collie sampling site are influenced by releases from Wellington Dam, especially in dry years. This is why the flow volume at the Middle Collie River site tends to be more similar to the Middle Preston River site in dry rather than wet years. Annual TN loads were closely related to flow volumes; years with large annual flow volumes had large TN loads and vice versa.

Collie River



Total nitrogen concentrations, 2005–19 at site 612043. The dashed line is the Leschenault WQIP target for upland rivers.



Total nitrogen loads and annual flow, 2005–19 at site 612043.

A gilgie, Cherax quinquecarinatus, caught as part of a river health assessment in the Collie River, March 2017.

Middle Collie River

Nitrogen (2019)

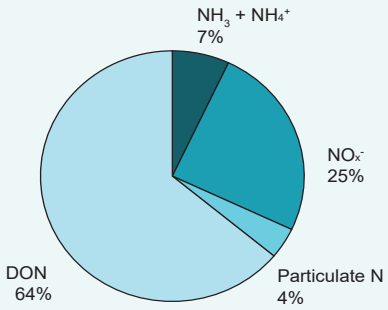
Types of nitrogen

Total N is made up of different types of N. At the Middle Collie River sampling site about a third of the N was present as highly bioavailable dissolved inorganic N (DIN – consisting of nitrate, NO_x^- and total ammonia, $NH_3 + NH_4^+$). DIN is commonly sourced from fertilisers and animal wastes. Most of the remainder of the N was present as dissolved organic N (DON). DON consists mainly of plant and animal matter but may include other types. DON varies in its bioavailability; plant and animal matter usually needs to be further broken down before it becomes available whereas other types of DON are readily bioavailable. High proportions of DIN are commonly seen in agricultural catchments.

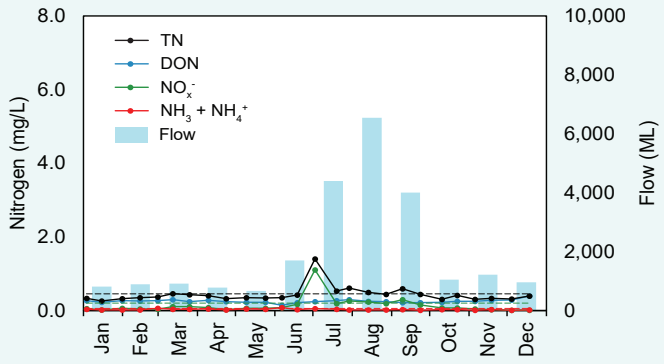
Concentrations

In 2019, TN and nitrate concentrations showed a seasonal pattern, increasing in July when river flow increased and then decreasing again later in the year. This early peak is evidence 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 from agricultural land where fertilisers and animal wastes build up over the summer period.

Collie River



2019 average nitrogen fractions at site 612043.



2019 nitrogen concentrations and monthly flow at 612043. The black dashed line is the WQIP target for upland rivers, the red and green are the ANZECC trigger values for total ammonia and nitrate.

Water being released from Wellington Dam, March 2017. The dam is on the Collie River, just upstream of the Middle Collie River catchment boundary.

Middle Collie River

Phosphorus over time (2005–19)

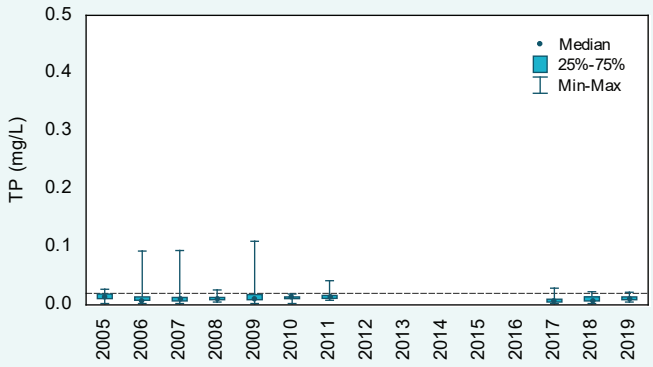
Concentrations

Total phosphorus (TP) concentrations at the Middle Collie River sampling site were low compared with the other sites in the Leschenault catchment. All annual medians were below the WQIP TP target for upland rivers though most years had some samples above the target. Using the SWRWQA methodology, all years with sufficient data were classified as having a low TP concentration. The low TP concentrations at the Middle Collie River site are likely because of the large areas of native vegetation in the upper catchment and the soils found in the catchment which have a large capacity to bind P.

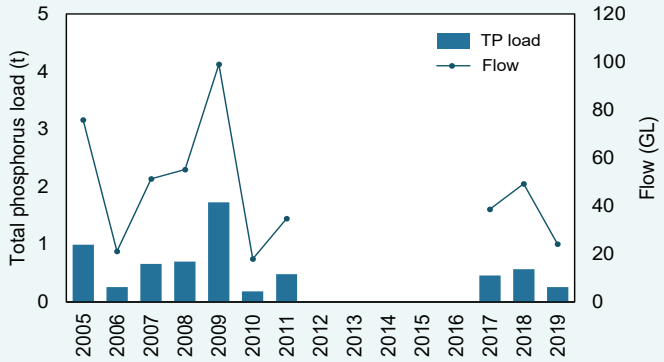
Estimated loads

In 2019, of the four sites with flow data in the Leschenault catchment, the Middle Collie River had a moderate estimated TP load (0.26 t) which was similar to the load at the Ferguson River site (0.32 t). The small load was driven by the relatively low TP concentrations; the 2019 flow at the Middle Collie River site was the second largest (24.1 GL, the Middle Preston site was 24.9 GL). The load per square kilometre was the second largest of the catchments at 2.0 kg/km^2, similar to the Ferguson River site (2.3 kg/km^2). Flow volumes at the Middle Collie sampling site are influenced by releases from Wellington Dam, especially in dry years. This is why the flow volume at the Middle Collie River site tends to be more similar to the Middle Preston River site in dry rather than wet years. Annual TP loads were closely related to flow volumes; years with large annual flow volumes had large TN loads and vice versa.

Collie River



Total phosphorus concentrations, 2005–19 at site 612043. The dashed line is the Leschenault WQIP target for upland rivers.



Total phosphorus loads and annual flow, 2005–19 at site 612043.

The Collie River upstream of Honeymoon Pool in Worsley, March 2007. The river here is in a largely natural state.

Middle Collie River

Phosphorus (2019)

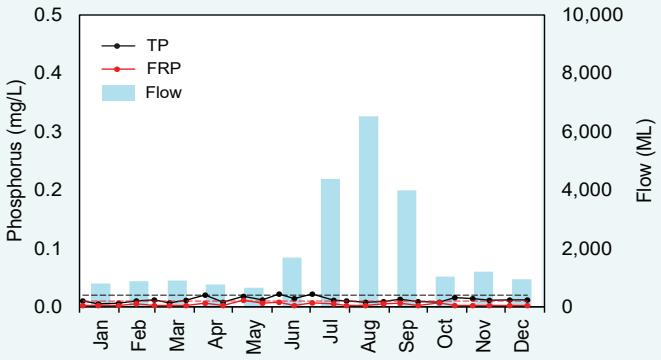
Types of phosphorus

Total P is made up of different types of P. Because a large number of samples were below the laboratory limit of reporting (LOR) in 2019, phosphorus fraction pie charts were not generated for the Middle Collie River site. At this site, 15 of the 25 phosphate samples were below their LOR (0.005 mg/L in each case). Phosphate is measured as filterable reactive phosphorus (FRP), in surface waters this is mainly present as phosphate (PO_4^{3-}) species. Phosphate is a highly bioavailable type of P and is generally sourced from animal wastes and fertilisers as well as natural sources.

Concentrations

In 2018, total P showed a slight seasonal pattern at the Middle Collie River sampling site, increasing slightly in June as rainfall and flow increased, before falling again in August. This pattern was not evident in 2019, when TP concentrations tended to fluctuate during the year. Most of the P at this site was likely entering the river via surface flows, in-stream sources and groundwater contributing proportionally less.

Collie River



2019 phosphorus concentrations and monthly flow at 612043. The black dashed line is the WQIP target for upland rivers, the red is the ANZECC trigger value for upland rivers for phosphate.

The Collie River has a healthy fish community. Freshwater cobbler (Tandanus bostocki) were caught downstream of Burekup Weir during a river health assessment, January 2009.

Middle Collie River

Total suspended solids over time (2005–19)

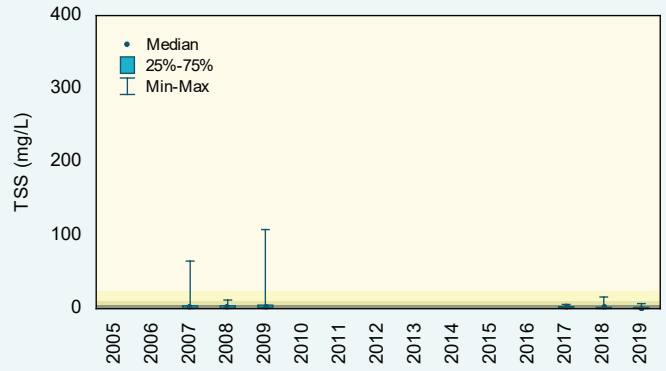
Concentrations

Using the SWRWQA methodology, all years with sufficient data were classified as having low TSS concentrations. Compared with the other sites sampled in the Leschenault catchment, TSS concentrations at the Middle Collie River site were low, with the 2019 median being the equal second lowest (1 mg/L, the same as the Upper Preston River site). Only the Middle Preston River site had a lower 2019 TSS median of 0.5 mg/L.

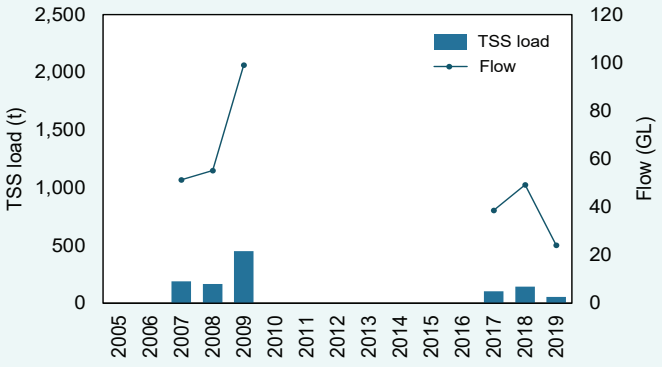
Estimated loads

The estimated TSS loads at the Middle Collie River sampling site were small compared with the other three sites with flow data in the Leschenault catchment. In 2019, the estimated TSS load (55 t) was the second smallest of the Leschenault catchment sites, only the Upper Preston site had a smaller load of 20 t. In 2019, flow at the Middle Collie River site was the second largest (24.1 GL, the Middle Preston site was 24.9 GL). Flow volumes at the Middle Collie sampling site are influenced by releases from Wellington Dam, especially in dry years. This is why the flow volume at the Middle Collie River site tends to be more similar to the Middle Preston River site in dry rather than wet years. The load per square kilometre was the second largest of the catchments at 399 kg/km^2, only the Ferguson River site had a larger load per square kilometre of 726 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.

Collie River



Total suspended solids concentrations, 2005–19 at site 612043. The shading refers to the SWRWQA classification bands.



Total suspended solids loads and annual flow, 2005–19 at site 612043.

low moderate high very high

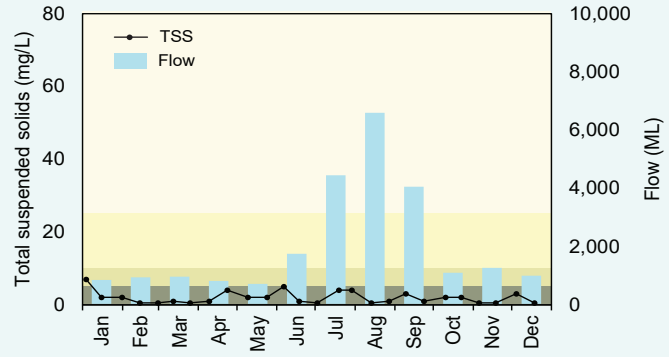
The Collie River, not far downstream of Wellington Dam, March 2017. Note the intact fringing vegetation along much of the banks (though there is some erosion along the bank furthest from the photographer).

Total suspended solids (2019)

Concentrations

In 2018, TSS concentrations showed a seasonal pattern, increasing in early July as rainfall and flow increased before falling again in August. This pattern was not evident in 2019, when TSS concentrations fluctuated during the year. With the exception of the sample collected in early January, all samples fell into the low classification band.

Collie River



2019 total suspended solids concentrations and monthly flow at 612043. The shading refers to the SWRWQA classification bands.

low moderate high very high

Burekup Weir, April 2018. This weir diverts water from the Collie River to the Collie River Irrigation Network.

Middle Collie River

pH over time (2005–19)

pH values

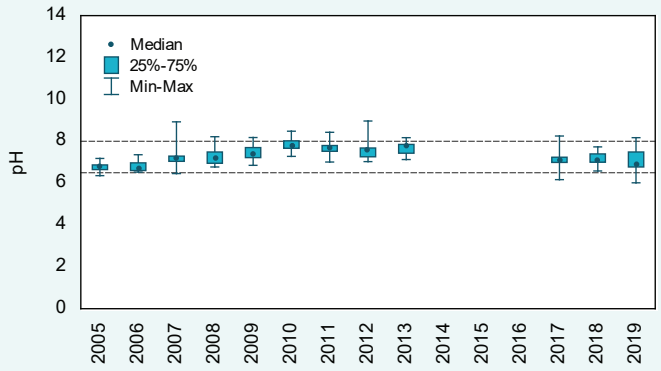
At the Middle Collie River sampling site, pH values fluctuated over the reporting period. All annual medians were within the upper and lower ANZECC trigger values; however, there were a number of years with samples that fell either above the upper trigger value or below the lower one.

pH (2019)

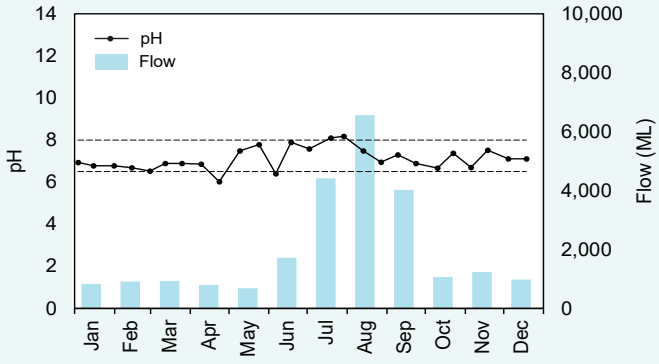
pH values

There was no clear seasonal pattern in pH at the Middle Collie River sampling site, with values fluctuating during the year. The reason for the dips in pH in April and June is unknown.

Collie River



pH levels, 2005–19 at site 612043. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels and monthly flow at 612043. The dashed lines are the upper and lower ANZECC trigger values.

The River Road bridge over the Collie River in Worsley, March 2017.

Middle Collie River

Salinity over time (2005–19)

Concentrations

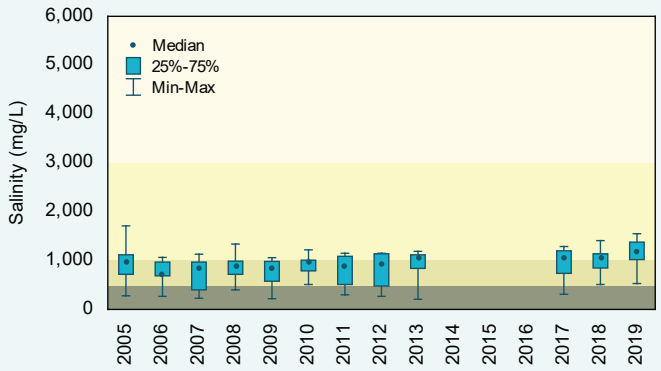
Using the Water Resources Inventory 2014 salinity ranges, salinity was classified as marginal before the break in monitoring and brackish afterwards, suggesting that salinity has increased at this site. (Note, in 2018, the SWRWQA classification bands were used).

Salinity (2019)

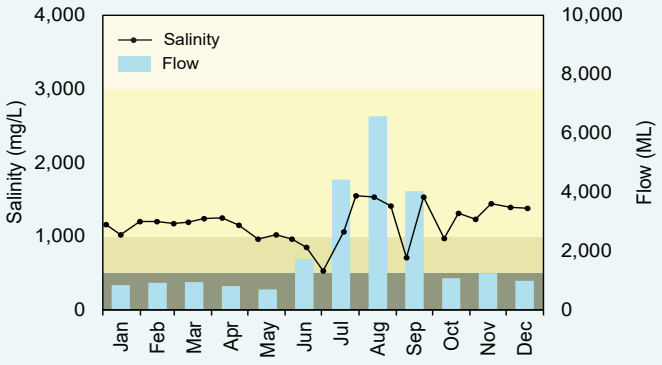
Concentrations

In 2019, salinity was higher at the start of the year before falling in early July, as rainfall and flow increased (this drop coincides with an increase in N concentrations). After this, salinity increased again and then fluctuated for the remainder of the year. It is likely that salts are entering the Middle Collie River via both surface and groundwater flows.

Collie River



Salinity concentrations, 2005–19 at site 612043. The shading refers to the Water Resources Inventory 2014 salinity ranges.



2019 salinity concentrations and monthly flow at 612043. The shading refers to the Water Resources Inventory 2014 salinity ranges.

fresh marginal brackish saline

The Collie River sampling site, January 2019.

Middle Collie 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.

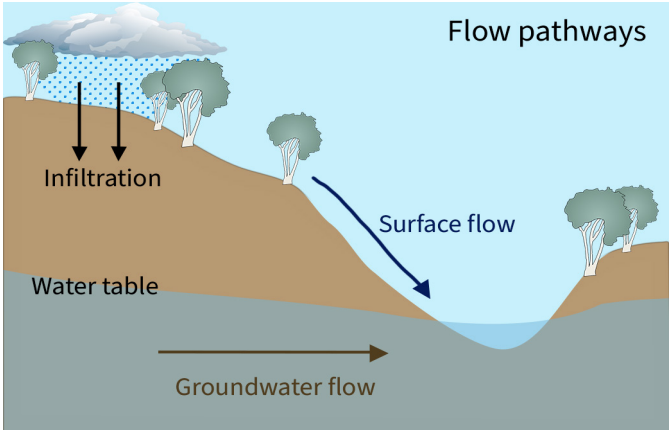
Laboratory limit of reporting: (LOR) this is the lowest concentration of an analyte that can be reported by a laboratory.

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.



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