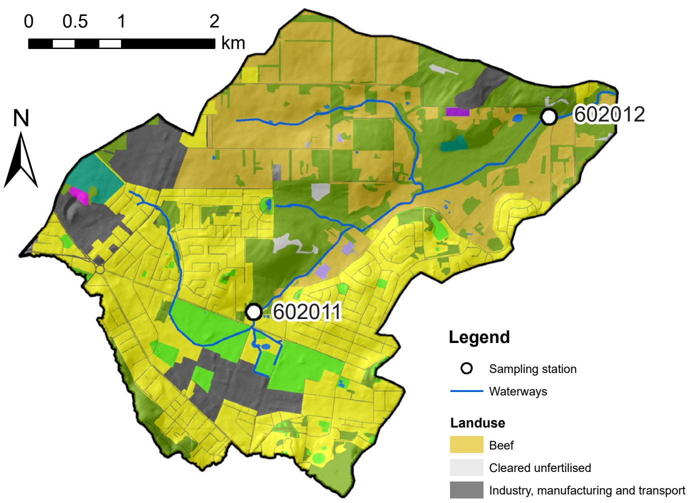
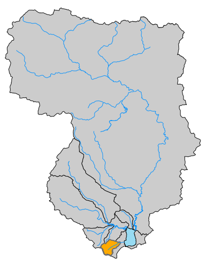
Department of Water and Environmental Regulation
Department of Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA

Yakamia Creek

This data report provides a summary of the nutrients at the two Yakamia Creek 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 creek discharges to Oyster Harbour.





Location of Yakamia Creek catchment in the greater Oyster Harbour Catchment.

About the catchment

The Yakamia Creek catchment has an area of about 17 km², about three-quarters of which has been cleared. The urban and industrial areas of the outskirts of Albany cover nearly half of the catchment. The remaining catchment is used mostly for beef cattle and conservation and native vegetation. Much of the creek has been converted into drains and has little or no fringing vegetation present.

Most of the soils in the catchment have a low phosphorus-binding capacity. This means that any phosphorus applied to them can be quickly washed into drains and other waterways.

There are two sites monitored in the Yakamia Creek catchment, both on Yakamia Creek itself. The upper site, 602011, Yakamia Upper – North Road, is just downstream of North Road in Albany. The second site, 602012, Yakamia Lower – Lower King Road, is a few kilometres downstream of the Yakamia Upper site, just upstream of where Yakamia Creek flows under King Road in Albany. There is a newly installed gauging station just downstream of the North Road site.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) were slightly better at the Yakamia Lower than the Yakamia Upper site. At the Yakamia Upper site, total nitrogen concentrations were classified as moderate, at the Yakamia Lower site they were classified as moderate to 2017 and low since then. Total phosphorus was classified as moderate at both sites. The proportion of nitrogen present in a bioavailable form was large, especially at the Yakamia Upper site which received most of its flow from urban land use. It appears that the nutrient concentrations are reduced between the two sites, suggesting that there is more nutrient runoff from the urban than the agricultural areas and that some nutrients are possibly being assimilated between the two sites.

Facts and figures

Sampling site code	602012 (Yakamia – Lower) 602011 (Yakamia – Upper)
Catchment area	17 km²
Per cent cleared area (2018)	75 per cent
River flow	Permanent
Main land use (2018)	Urban, conservation and native vegetation, and beef cattle

Yakamia Creek

Nitrogen over time (2005–19)

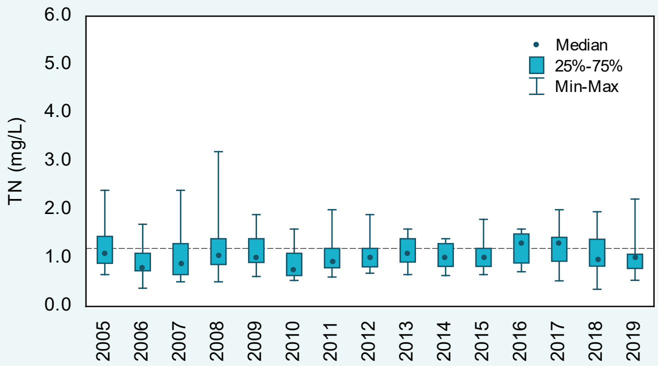
Concentrations

Total nitrogen (TN) concentrations fluctuated over the reporting period at both Yakamia Creek sampling sites. Concentrations were slightly higher at the Yakamia Upper site than the Lower site. Using the State Wide River Water Quality Assessment (SWRWQA) methodology, all years were classified as having moderate TN concentrations at the Upper site whereas at the Lower site, TN was classified as moderate until 2017 after which it was classified as low. This variation is likely because of the different land uses at the two sites, with the Upper site having mostly urban land use in its catchment and the land use between the two sites being more agricultural with relatively large areas of remnant vegetation present.

Estimated loads

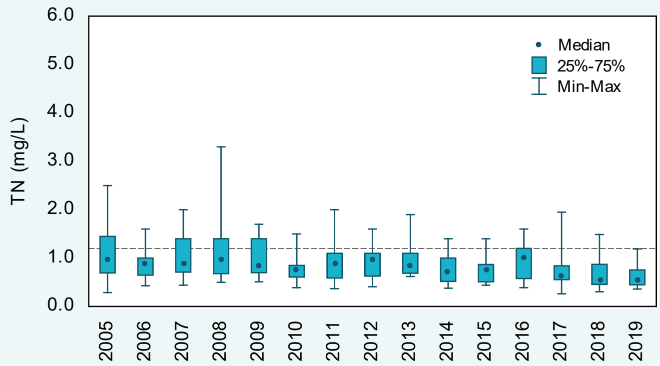
There was only two years of flow data available at the Yakamia Upper site. Because of this TN loads could not be calculated for this site as it was not possible to establish a good flow-concentration relationship.

Yakamia Creek – Upper



Total nitrogen concentrations, 2005–19 at site 602011. The dashed line is the ANZECC trigger value.

Yakamia Creek – Lower



Total nitrogen concentrations, 2005–19 at site 602012. The dashed line is the ANZECC trigger value.

The Yakamia Lower sampling site in January 2019. The vegetation immediately along the creek consists almost entirely of exotic species.

Nitrogen (2019)

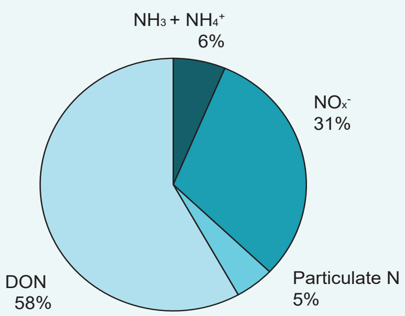
Types of nitrogen

Total N is made up of different types of N. Dissolved organic N (DON) was the dominant type of N at both sites. This type of N consists mainly of degrading plant and animal matter but may include other types. Its bioavailability varies, with degrading plant and animal matter needing to be further broken down, whereas some other types are highly bioavailable. The proportion of N present as dissolved inorganic N (DIN, consisting of total ammonia – NH_3 + NH_4^+ and nitrate – NO_x^-) was large at the Upper Yakamia site. This site had the largest proportion of N present as DIN of the six Oyster Harbour catchment sites. This type of N is readily bioavailable and is sourced mainly from fertilisers and animal wastes.

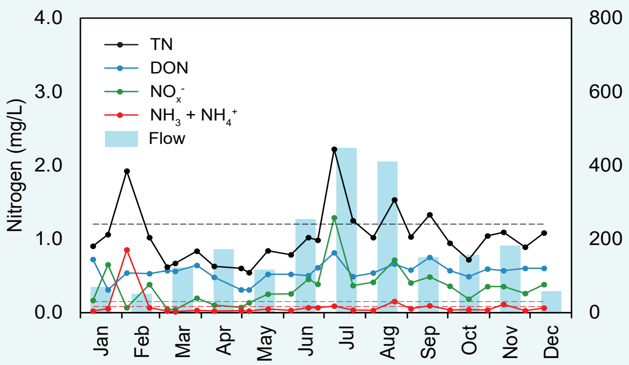
Concentrations

Nitrogen concentrations varied differently at the two Yakamia Creek sampling sites. The Yakamia Upper site had larger and more frequent fluctuations in concentrations during the year. Both sites showed a seasonal pattern, with concentrations increasing in late June when rainfall and flow were increasing before peaking in July and then falling again. Total ammonia concentrations were higher at the Yakamia Upper site, suggesting that it is being washed into the drain from fertilisers used on urban parks and gardens.

Yakamia Creek – Upper

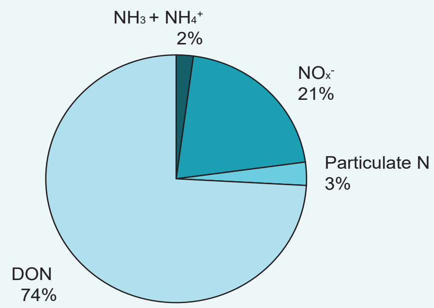


2019 average nitrogen fractions at site 602011.

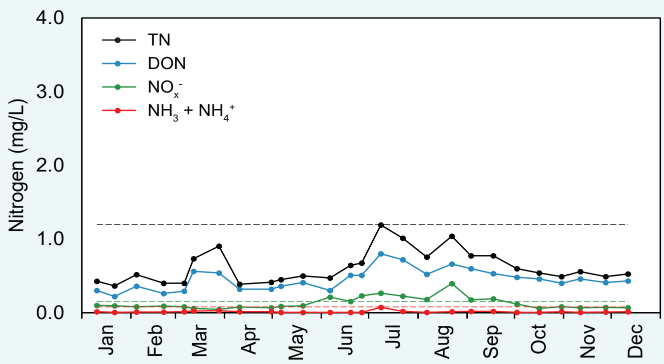


2019 nitrogen concentrations and flow at 602011. The dashed lines are the ANZECC trigger values for the different N species.

Yakamia Creek – Lower



2019 average nitrogen fractions at site 602012.



2019 nitrogen concentrations at 602012. The dashed lines are the ANZECC trigger values for the different N species.

Phosphorus over time (2005–19)

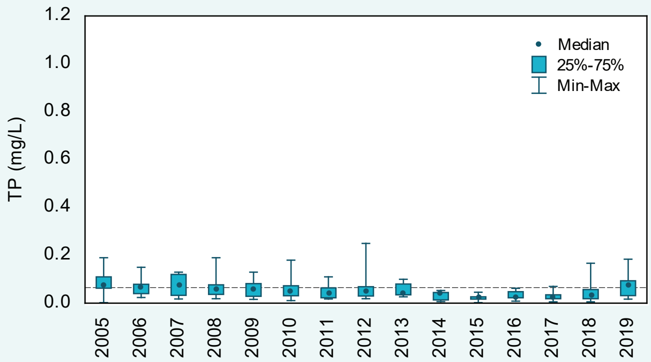
Concentrations

Total phosphorus (TP) concentrations were generally similar at both the Yakamia Creek sampling sites, with annual concentrations fluctuating over the reporting period. Using the SWRWQA methodology, all years were classified as having moderate TP concentrations at both sites.

Estimated loads

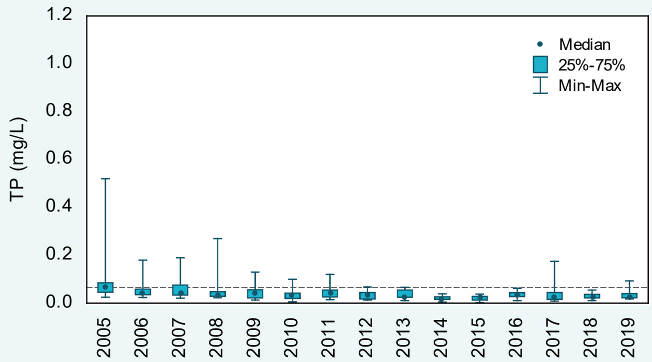
There were only two years of flow data available at the Yakamia Upper site. Because of this TP loads could not be calculated for this site as it was not possible to establish a good flow-concentration relationship.

Yakamia Creek – Upper



Total phosphorus concentrations, 2005–19 at site 602011. The dashed line is the ANZECC trigger value.

Yakamia Creek – Lower



Total phosphorus concentrations, 2005–19 at site 602012. The dashed line is the ANZECC trigger value.

The Yakamia Lower sampling site seen from above, March 2020. This site has subsequently undergone revegetation.

Yakamia Creek

Phosphorus (2019)

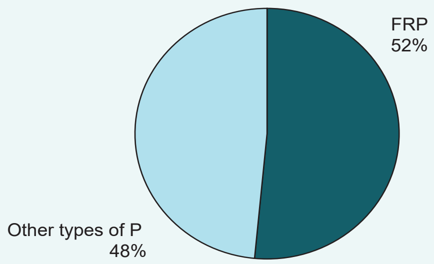
Types of phosphorus

Total P is made up of different types of P. The proportion of P present as bioavailable phosphate was larger at the Yakamia Upper site than the lower one. Phosphate is measured as filterable reactive phosphorus (FRP), in surface waters this is mainly present as phosphate (PO_4^{3-}) species. Phosphate is sourced from animal waste and fertilisers, and is readily bioavailable. 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 graphs below). Particulate P generally needs to be broken down before becoming bioavailable. The bioavailability of DOP varies and is poorly understood.

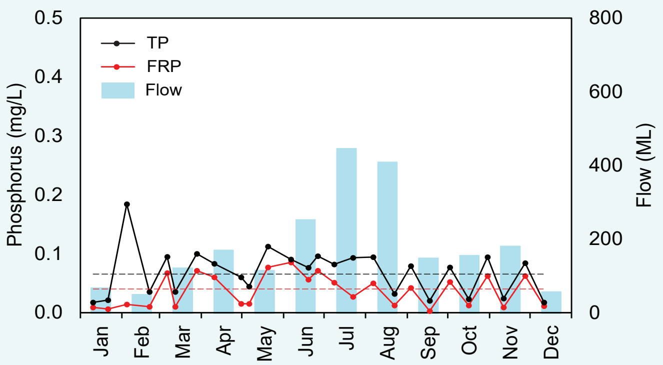
Concentrations

In 2019, TP and phosphate concentrations were higher at the Upper than the Lower Yakamia site. At both sites, concentrations fluctuated over the year but showed no seasonal pattern. It is likely that P is entering the creek via surface flows and groundwater as well as coming from in-stream sources. It is also likely that more P is entering the creek from the urban land use upstream of the Yakamia Upper site than from the agricultural land use and remnant vegetation found between the two sites.

Yakamia Creek – Upper

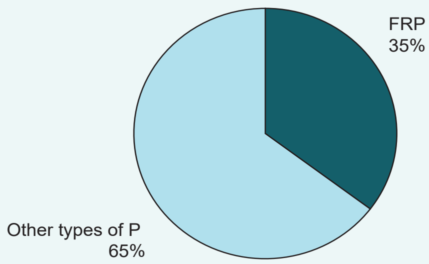


2019 average phosphorus fractions at site 602011.

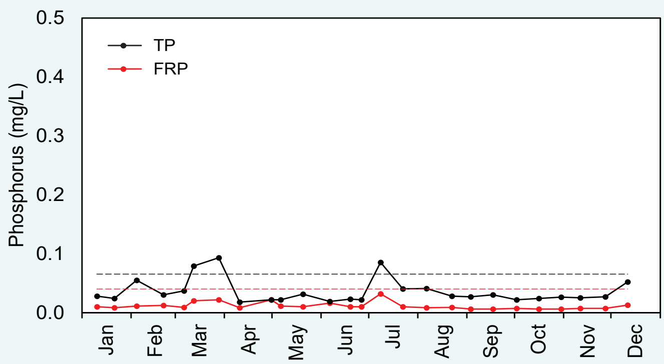


2019 phosphorus concentrations and flow at 602011. The dashed lines are the ANZECC trigger values for the different P species.

Yakamia Creek – Lower



2019 average phosphorus fractions at site 602012.



2019 phosphorus concentrations at 602012. The dashed lines are the ANZECC trigger values for the different P species.

Yakamia Creek

Total suspended solids over time (2005–19)

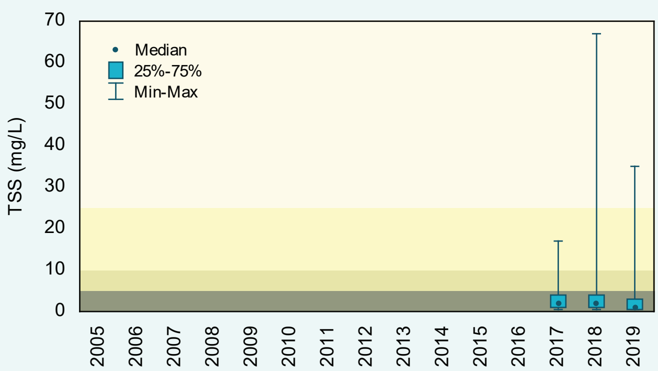
Concentrations

There were only three years with sufficient total suspended solids (TSS) data to graph at both of the Yakamia Creek sites. TSS concentrations were classified as low at both sites using the SWRWQA methodology. However, the annual range in TSS concentrations was much larger at the Yakamia Upper than the Yakamia Lower site.

Estimated loads

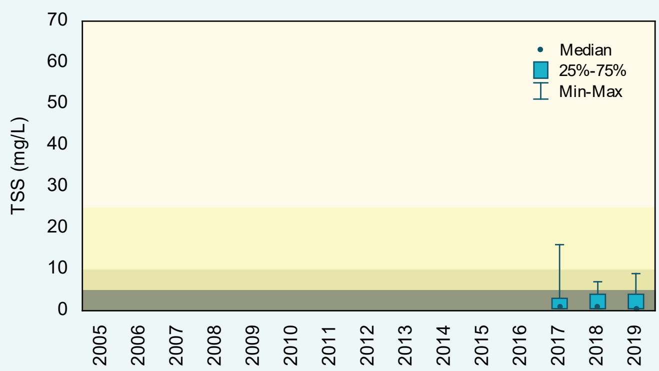
There was only two years of flow data available at the Yakamia Upper site. Because of this TSS loads for this site could not be calculated as it was not possible to establish a good flow-concentration relationship.

Yakamia Creek – Upper



Total suspended solids concentrations, 2005–19 at site 602011. The shading refers to the SWRWQA classification bands.

Yakamia Creek – Lower



Total suspended solids concentrations, 2005–19 at site 602012. The shading refers to the SWRWQA classification bands.

low moderate high very high

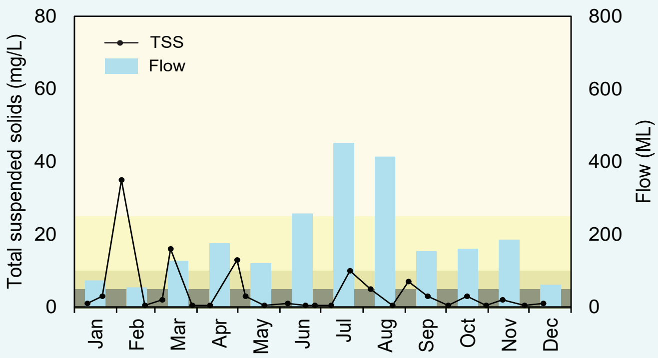
A sand slug in Yakamia Creek. This occurs where streamflow causes erosion upstream and the sand is then deposited where the flow is slower. Sand slugs reduce habitat for aquatic macroinvertebrates and fish, November 2018.

Total suspended solids (2019)

Concentrations

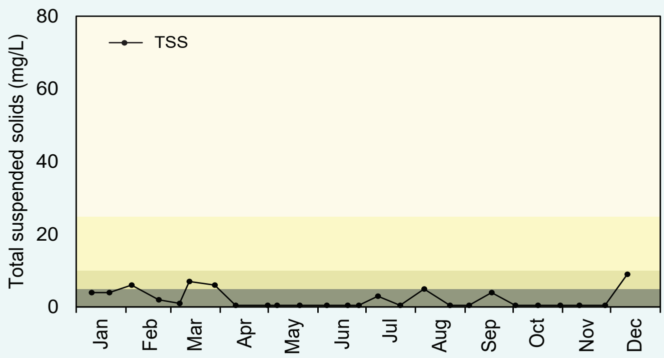
In 2019 TSS concentrations fluctuated at both of the Yakamia sites, with no clear evidence of a seasonal pattern. At both sites it is likely that particulate matter was being washed into the creek via surface runoff as well as coming from in-stream sources such as erosion.

Yakamia Creek – Upper



2019 total suspended solids concentrations and flow at 602011. The shading refers to the SWRWQA classification bands.

Yakamia Creek – Lower



2019 total suspended solids concentrations at 602012. The shading refers to the SWRWQA classification bands.

low moderate high very high

Yakamia Creek where it flows under North Road, near Barnesby Drive in Albany, August 2018. Note how much particulate matter is suspended in the water at this time.

Yakamia Creek

pH over time (2005–19)

pH values

pH values at the Yakamia Upper site were generally higher than at the Yakamia Lower site. At the Yakamia Lower site there were a number of samples below the lower Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value and none above the upper ANZECC trigger value; the opposite was true at the Yakamia Upper site.

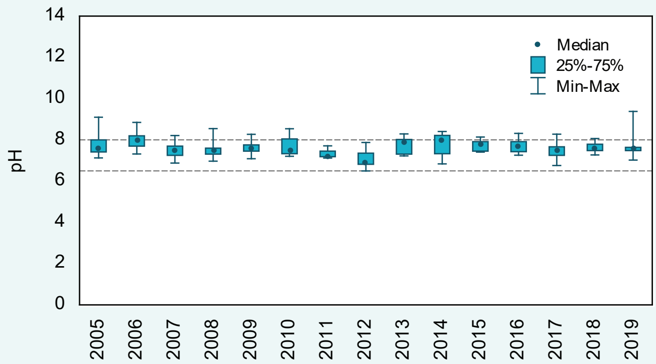
There is some concern that the probe used to collect the pH data from the catchments of Oyster Harbour (including the Yakamia Creek sites) from about October 2016 to October 2017 was not functioning correctly. This may have caused lower-than-actual pH values to be recorded. From October 2017, a new probe was used. Although there is no way of verifying the 2016 and 2017 pH data, they have still been presented.

pH (2019)

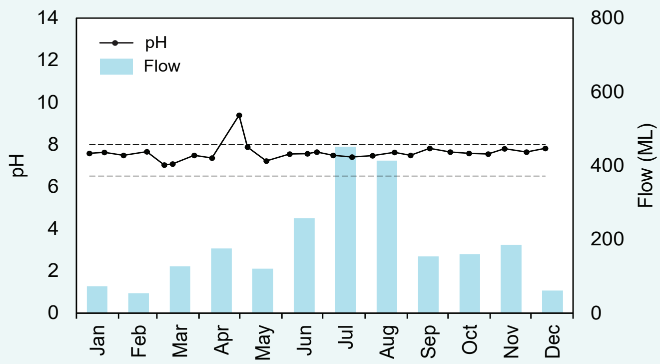
pH values

In 2019, pH values were slightly lower at the start of the year at both sampling sites in the Yakamia Creek catchment. The reason for the high pH value at the Yakamia Upper site in April is unknown.

Yakamia Creek – Upper

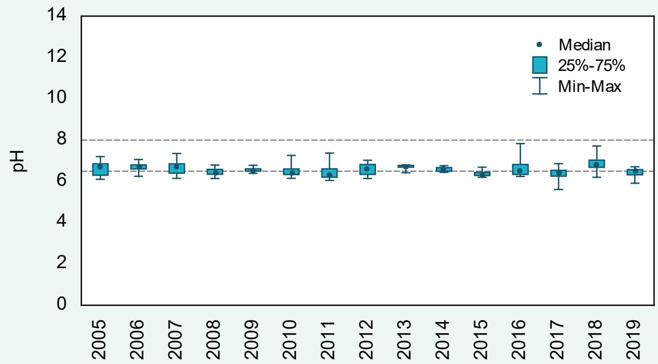


pH levels, 2005–19 at site 602011. The dashed lines are the upper and lower ANZECC trigger values.

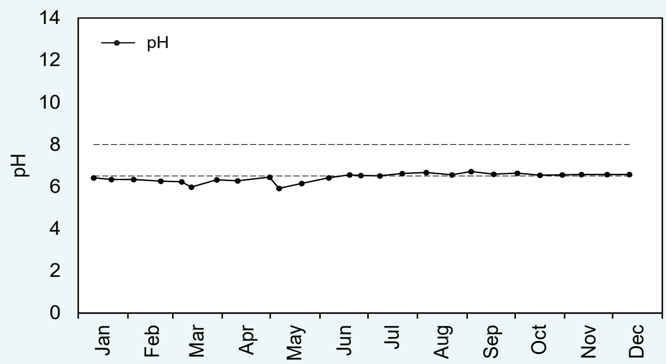


2019 pH levels and flow at 602011. The dashed lines are the upper and lower ANZECC trigger values.

Yakamia Creek – Lower



pH levels, 2005–19 at site 602012. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels at 602012. The dashed lines are the upper and lower ANZECC trigger values.

Yakamia Creek

Salinity over time (2005–19)

Concentrations

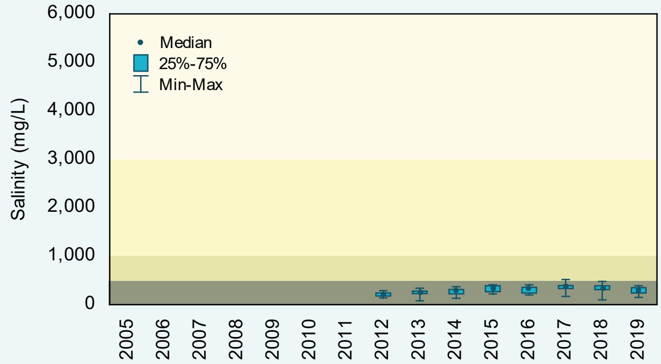
Salinity fluctuated over the reporting period at both sites in the Yakamia Creek catchment. Using the Water Resources Inventory 2014 salinity ranges, all years were classified as fresh at both sites (note, the 2018 nutrient report used the SWRWQA bands).

Salinity (2019)

Concentrations

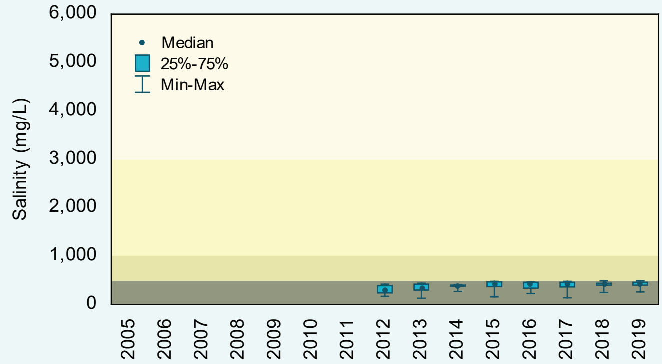
Salinity fluctuated in a similar way at both Yakamia Creek sites, with concentrations being slightly lower over the months with higher flows. It is likely that salts are entering the creek via both surface flows and groundwater.

Yakamia Creek – Upper



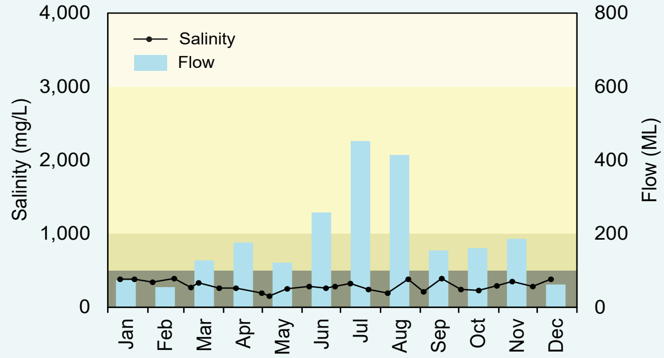
Salinity concentrations, 2005–19 at site 602011. The shading refers to the Water Resources Inventory 2014 salinity bands.

Yakamia Creek – Lower

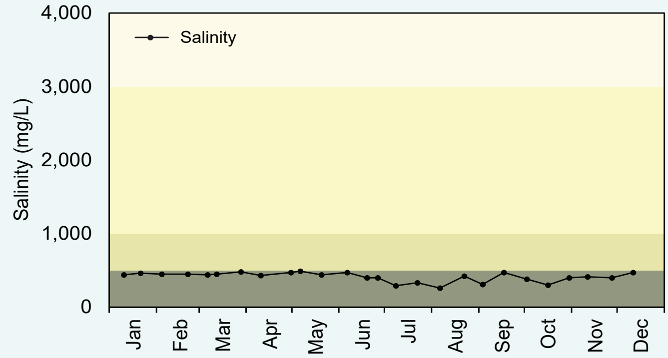


Salinity concentrations, 2005–19 at site 602012. The shading refers to the Water Resources Inventory 2014 salinity bands.

fresh marginal brackish saline



2019 salinity concentrations and flow at 602011. The shading refers to the Water Resources Inventory 2014 salinity bands.



2019 salinity concentrations at 602012. The shading refers to the Water Resources Inventory 2014 salinity bands.

Yakamia Creek

Background

Healthy Estuaries WA is a State Government program launched in 2020 and will build 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 the 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 information on the condition of Oyster Harbour at estuaries.dwer.wa.gov.au/estuary/oyster-harbour

Healthy Estuaries WA partners with the Oyster Harbour Catchment Group 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 Oyster Harbour Catchment Group go to ohcg.org.au
- To find out more about the health of the rivers in the Oyster Harbour catchment go to rivers.dwer.wa.gov.au/assessments/results

Methods

Variables were compared with the 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 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.

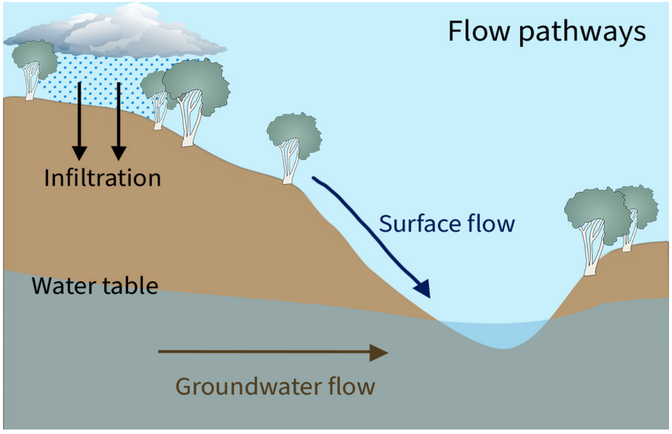
Laboratory limit of reporting: (LOR) this is the lowest concentration of an analyte that can be reported by a laboratory.

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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