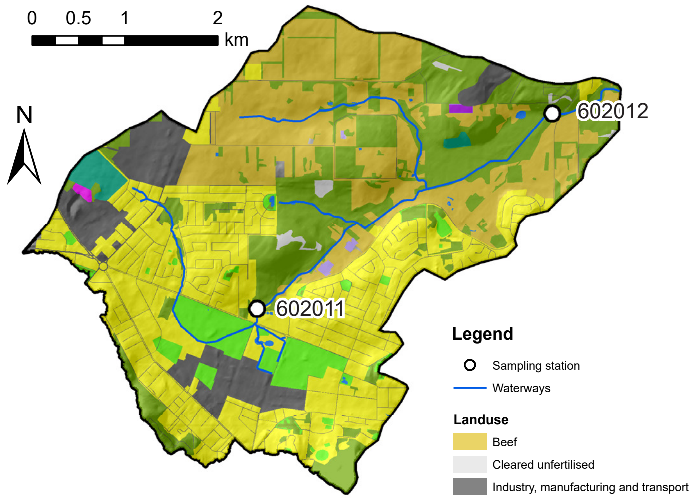
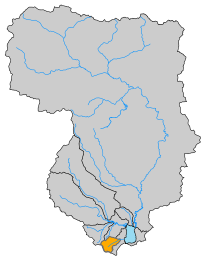
GOVERNMENT OF WESTERN AUSTRALIA
Department of **Water and Environmental Regulation**
Department of **Primary Industries and Regional Development**

Yakamia Creek

This data report provides a summary of the nutrients at the two Yakamia Creek sampling sites in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. Downstream of these sites, the creek discharges to Oyster Harbour. 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.





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.

Facts and figures

Sampling site code	602012 (Yakamia – Lower) 602011 (Yakamia – Upper)
Catchment area	17 km^2
Per cent cleared area (2018)	75%
River flow	Permanent
Annual flow (2018)	2 GL
Main land use (2018)	Urban, conservation and native vegetation, and beef cattle

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the two sites in the Yakamia Creek catchment were low, with concentrations slightly better at the Yakamia Lower than the Yakamia Upper site. 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.

Yakamia Creek

Nitrogen over time (2004–18)

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 one, with two annual medians over the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value at the Upper site and none at the Lower one. These differences are 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.

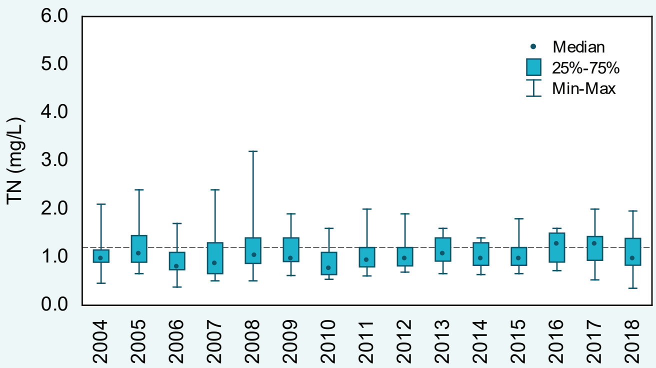
Trends

There were no trends present at the Yakamia Upper sampling site over the short- (2014–18) or long-term (2004–18). The Yakamia Lower sampling site had a decreasing short-term (2014–18) trend in TN concentrations of 0.05 mg/L/yr. Ongoing monitoring will help determine if this is because of natural fluctuations at this site or an actual improvement in water quality. There was no long-term (2004–18) trend present at this site.

Estimated loads

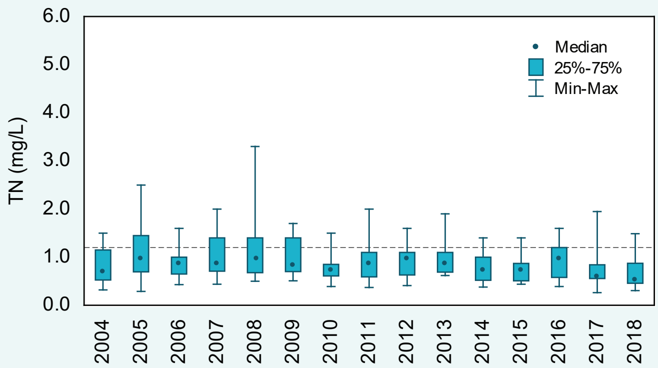
There was only year of flow data available at the Yakamia Upper site. Beause of this small amount of data it was not possible to calculate TN loads for this site as it was not possible to establish a good flow-concentration relationship.

Yakamia Creek – Upper



Total nitrogen concentrations, 2004–18 at site 602011. The dashed line is the ANZECC trigger value for lowland rivers.

Yakamia Creek – Lower



Total nitrogen concentrations, 2004–18 at site 602012. The dashed line is the ANZECC trigger value for lowland rivers

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

Yakamia Creek

Nitrogen (2018)

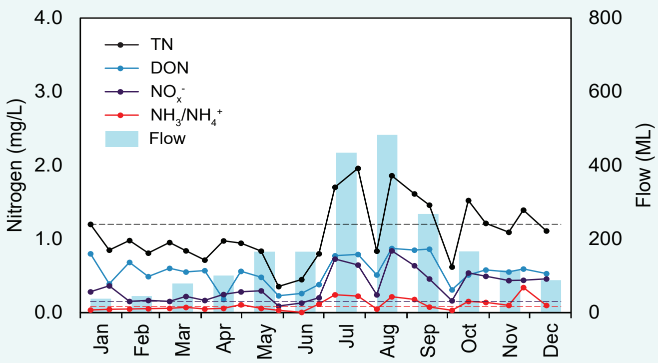
Types of nitrogen

Total N is made up of many different forms of N. Dissolved organic N (DON) was the dominant form of N at both sites. This form of N consists mainly of degrading plant and animal matter but may include other forms. Its bioavailability varies, with degrading plant and animal matter needing to be further broken down, whereas some other forms are highly bioavailable. The proportion of N present as dissolved inorganic N (DIN, consisting of ammonia N – NH_3/NH_4^+ and total oxides of N – 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 form of N is readily bioavailable and is sourced mainly from fertilisers and animal wastes.

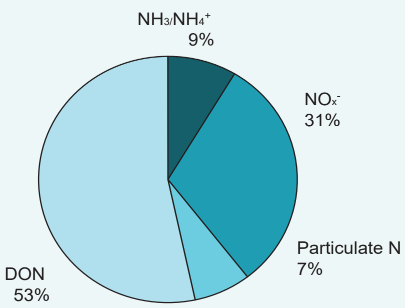
Concentrations

Nitrogen concentrations varied differently at the two Yakamia Creek sampling sites. The Yakamia Upper site showed less of a seasonal response, with concentrations fluctuating during the year. The Yakamia Lower site showed a more typical seasonal pattern, with concentrations increasing in late June when rainfall and flow were increasing before peaking in late July and then falling again. The pattern observed at the Yakamia Upper site was more typical of catchments with predominantly urban land use, whereas the Yakamia Lower site had a pattern more typical of agricultural catchments. NH_3/NH_4^+ concentrations were also 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

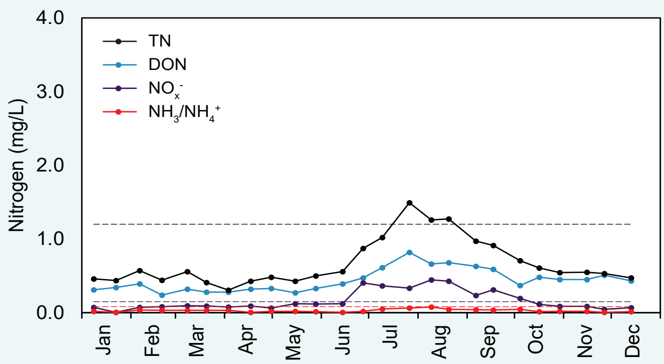


2018 nitrogen concentrations and flow at 602011. The dashed lines are the ANZECC trigger values for lowland rivers for the different N species.

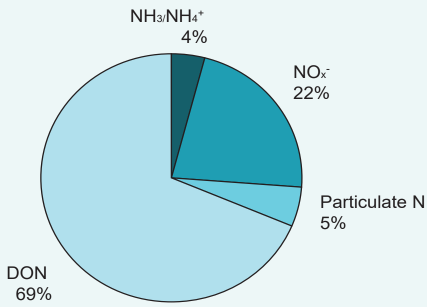


2018 average nitrogen fractions at site 602011.

Yakamia Creek – Lower



2018 nitrogen concentrations at 602012. The dashed lines are the ANZECC trigger values for lowland rivers for the different N species.



2018 average nitrogen fractions at site 602012.

Phosphorus over time (2004–18)

Concentrations

Total phosphorus (TP) concentrations were generally low at both the Yakamia Creek sampling sites, with most annual medians falling below the ANZECC trigger value. The Yakamia Upper site had slightly higher TP concentrations, though they were still low compared with the other sites sampled in the Oyster Harbour catchment.

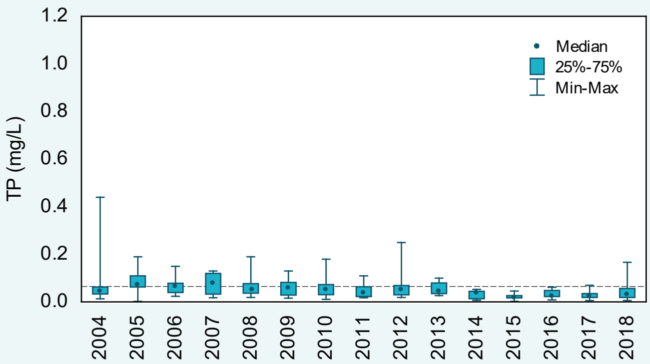
Trends

There were no short- (2014–18) or long-term (2004–18) trends in TP concentrations at the Yakamia Upper or the Yakamia Lower sampling sites.

Estimated loads

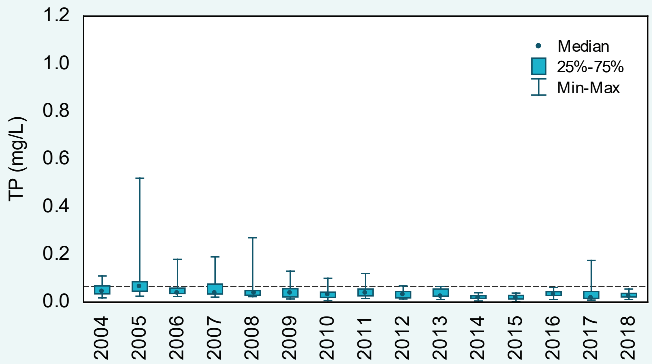
There was only one year of flow data available at the Yakamia Upper site. Because of this small amount of data it was not possible to calculate TP loads for this site as it was not possible to establish a good flow-concentration relationship.

Yakamia Creek – Upper



Total phosphorus concentrations, 2004–18 at site 602011. The dashed line is the ANZECC trigger value for lowland rivers.

Yakamia Creek – Lower



Total phosphorus concentrations, 2004–18 at site 602012. The dashed line is the ANZECC trigger value for lowland rivers.

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

Yakamia Creek

Phosphorus (2018)

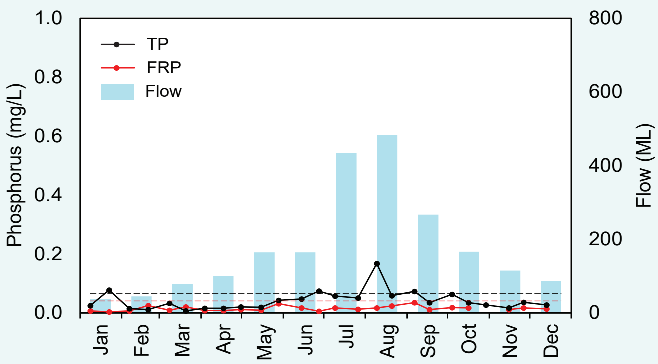
Types of phosphorus

Total P is made up of different forms of P. The proportion of P present as bioavailable FRP was larger at the Yakamia Upper site than the lower one. This form of P is sourced from animal waste and fertilisers, and is readily available for algae to use to fuel growth. It should be noted, however, that the actual concentrations of FRP were low, with all samples below the ANZECC trigger value at both sites. The remainder of the P was present as either particulate P or dissolved organic P (DOP). Particulate P generally needs to be broken down before becoming bioavailable to plants and algae. The bioavailability of DOP varies and is poorly understood.

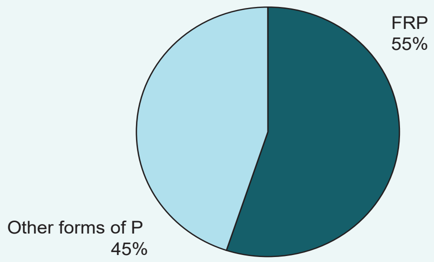
Concentrations

In 2018, TP and FRP concentrations were slightly higher at the Upper than the Lower Yakamia site. At the Yakamia Lower site concentrations fluctuated over the year but showed no seasonal pattern. The Yakamia Upper site showed a slight seasonal pattern, with concentrations marginally higher during the wetter months. 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 there is more P running into 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

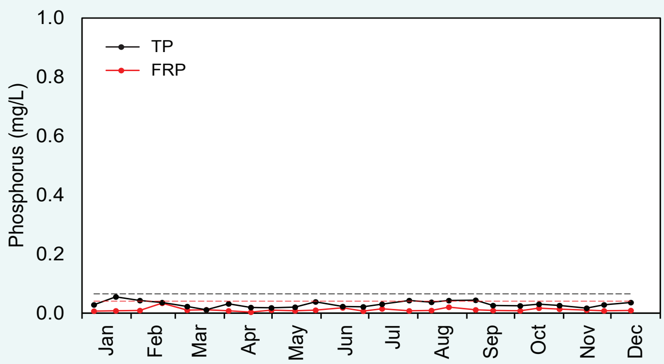


2018 phosphorus concentrations and flow at 602011. The dashed lines are the ANZECC trigger values for the different P species in lowland rivers.

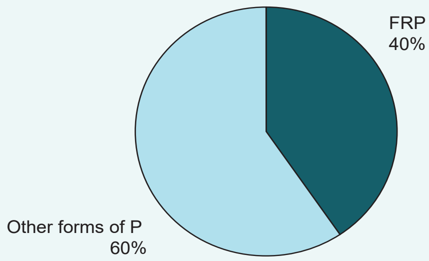


2018 average phosphorus fractions at site 602011.

Yakamia Creek – Lower



2018 phosphorus concentrations at 602012. The dashed lines are the ANZECC trigger values for the different P species in lowland rivers.



2018 average phosphorus fractions at site 602012.

Yakamia Creek

Total suspended solids over time (2004–18)

Concentrations

There were only two years with sufficient total suspended solids (TSS) data to graph at both of the Yakamia Creek sites. The annual medians at both sites fell into the low band of the State Wide River Water Quality Assessment (SWRWQA) classification bands. In 2018 in particular, the range in TSS concentrations was much larger at the Yakamia Upper than the Yakamia Lower site.

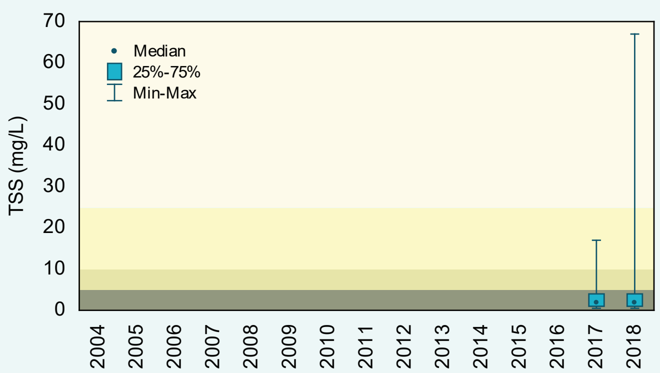
Trends

As there were only two years of TSS data available at both of the Yakamia Creek sites it was not possible to calculate trends. A minimum of five years of consecutive data is required to test for trends.

Estimated loads

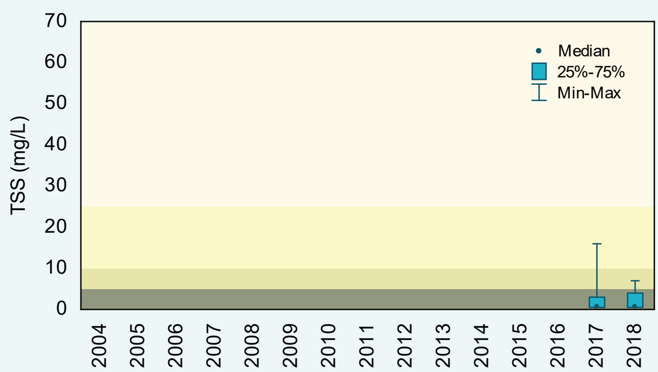
There was only one year of flow data available at the Yakamia Upper site. Because of this small amount of data it was not possible to calculate TSS loads for this site as it was not possible to establish a good flow-concentration relationship.

Yakamia Creek – Upper



Total suspended solids concentrations, 2004–18 at site 602011. The shading refers to the SWRWQA classification bands.

Yakamia Creek – Lower



Total suspended solids concentrations, 2004–18 at site 602012. The shading refers to the SWRWQA classification bands.

very high | high | moderate | low

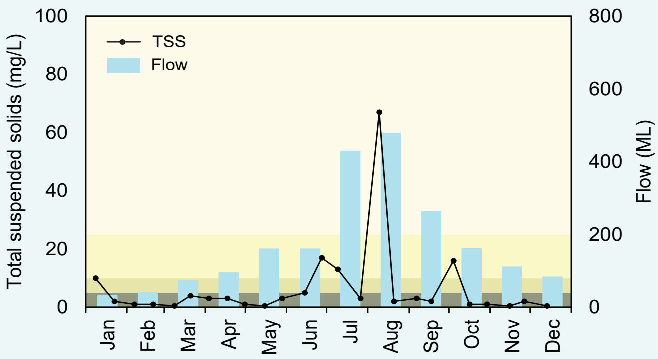
A sand slug in Yakamia Creek. This occurs where streamflow causes erosion upstream and the sand is then deposited where the flow is slower. Sand slugs reduce habitat for aquatic macroinvertebrates and fish, November 2018.

Total suspended solids (2018)

Concentrations

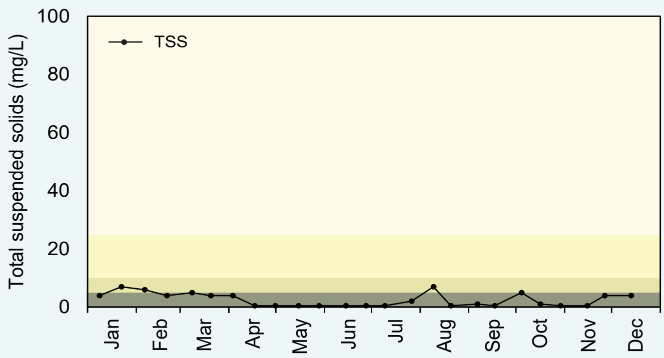
In 2018 TSS concentrations fluctuated at the Yakamia Lower site, with no clear evidence of a seasonal pattern. The Yakamia Upper site had more evidence of a seasonal pattern, with concentrations generally higher during the months with higher flows. The peak at both sites in August coincided with consistent rain over the preceding week as well as rain on the day of sampling. At both sites it is likely that particulate matter is being washed into the creek via surface runoff as well as coming from in-stream sources such as erosion.

Yakamia Creek – Upper



2018 total suspended solids concentrations and flow at 602011. The shading refers to the SWRWQA classification bands.

Yakamia Creek – Lower



2018 total suspended solids concentrations at 602012. The shading refers to the SWRWQA classification bands.

very high high moderate low

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 (2004–18)

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 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.

Trends

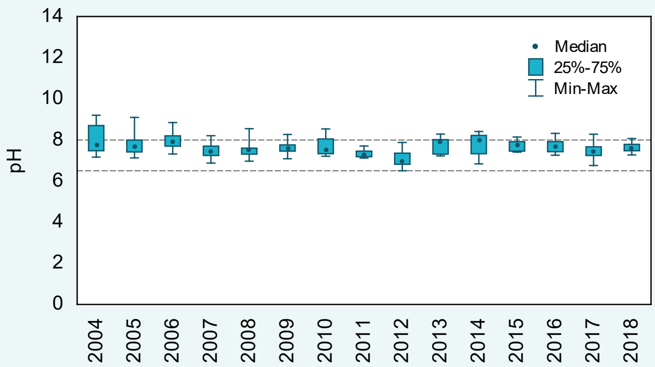
There were no long- (2004–18) or short-term (2014–18) trends in pH values at either of the Yakamia Creek sampling sites.

pH (2018)

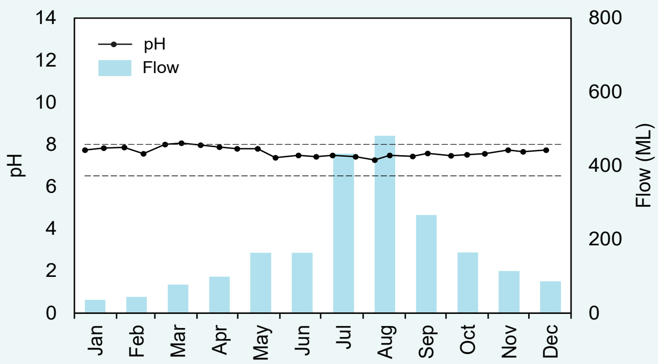
pH values

In 2018, pH values were slightly higher at the start of the year at both sampling sites in the Yakamia Creek catchment. The range in pH values was larger at the Lower than the Upper site. Most samples collected at both sites fell within the upper and lower ANZECC trigger values.

Yakamia Creek – Upper

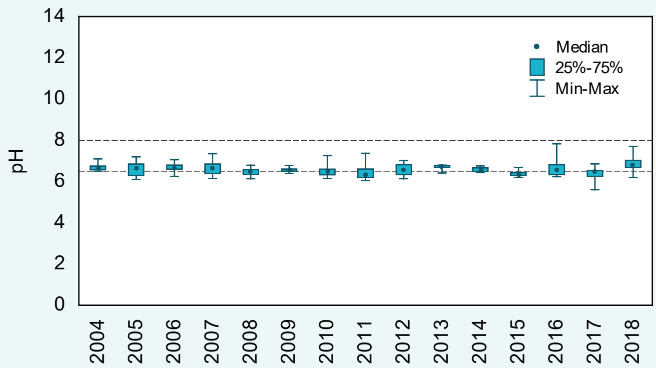


pH levels, 2004–18 at site 602011. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

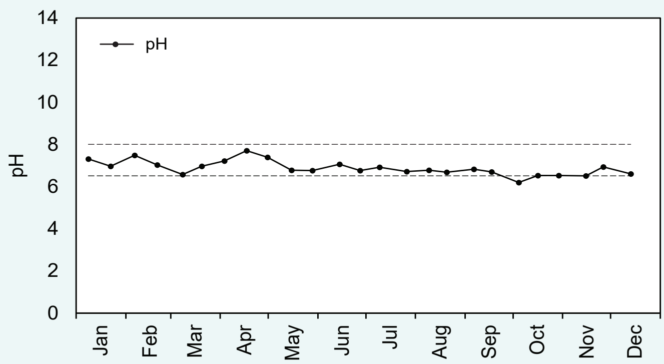


2018 pH levels and flow at 602011. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Yakamia Creek – Lower



pH levels, 2004–18 at site 602012. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels at 602012. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Yakamia Creek

Salinity over time (2004–18)

Concentrations

Salinity fluctuated over the reporting period at both sites in the Yakamia Creek catchment. The creek was fresh, with all annual medians falling into the fresh band of the SWRWQA classification bands.

Trends

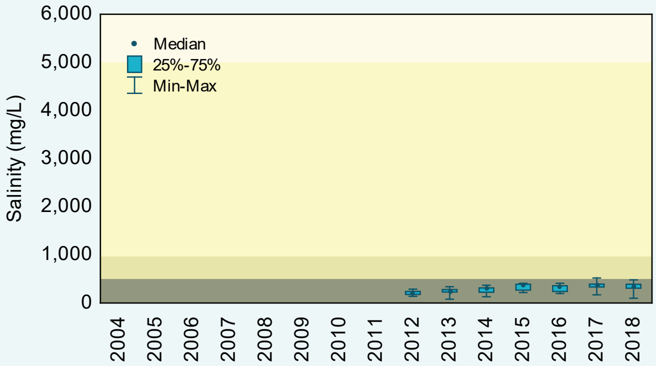
There was a short-term (2014–18) increasing trend present in salinity at the Yakamia Upper sampling site of 10 mg/L/yr. Ongoing monitoring will help determine if this is because of natural fluctuations at this site or an actual increase in salinity. There was no short-term (2014–18) trend present at the Yakamia Lower sampling site.

Salinity (2018)

Concentrations

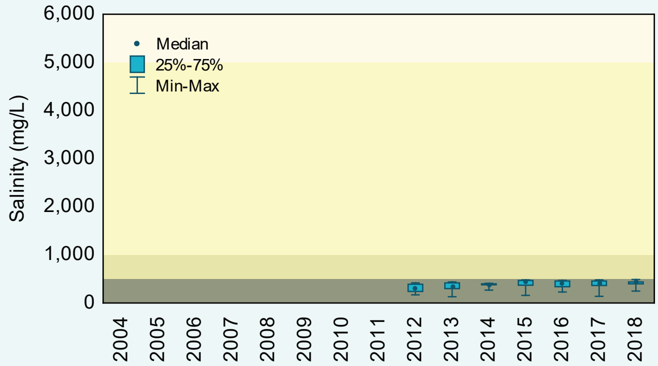
Salinity fluctuated in a similar way at both Yakamia Creek sites, with concentrations being slightly lower over the months with higher flows. All samples at both sites fell into the low band of the SWRWQA classification bands. It is likely that salts are entering the creek via both surface flows and groundwater.

Yakamia Creek – Upper



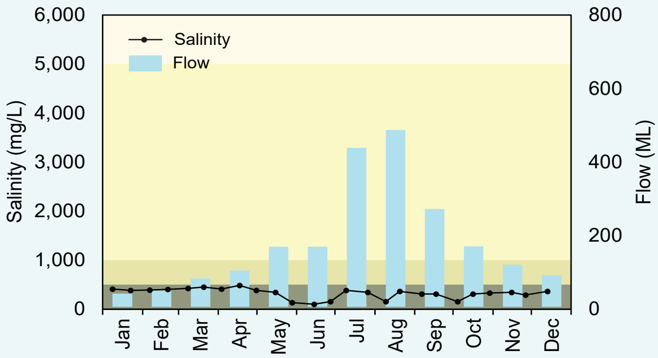
Salinity concentrations, 2004–18 at site 602011. The shading refers to the SWRWQA classification bands.

Yakamia Creek – Lower

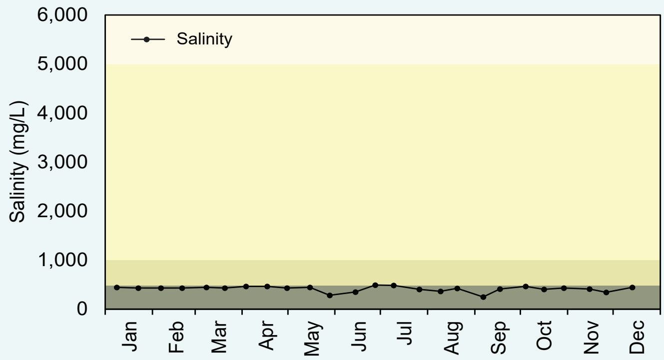


Salinity concentrations, 2004–18 at site 602012. The shading refers to the SWRWQA classification bands.

saline brackish marginal fresh



2018 salinity concentrations and flow at 602011. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at 602012. The shading refers to the SWRWQA classification bands.

Yakamia Creek

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 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 Oyster Harbour at estuaries.dwer.wa.gov.au/estuary/oyster-harbour/

The Regional Estuaries Initiative partners with the Oyster Harbour Catchment Group 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 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

Where possible, 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 represent the acceptable pH range. Where there were no ANZECC trigger values available (for TSS and salinity) the SWRWQA classification bands were used to allow samples and sites to be classified and compared.

Trend testing was carried out using either the Mann or Seasonal Kendall tests as appropriate. Where there were flow data available and there was a flow-concentration relationship, the data were flow-adjusted before trend analysis.

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.

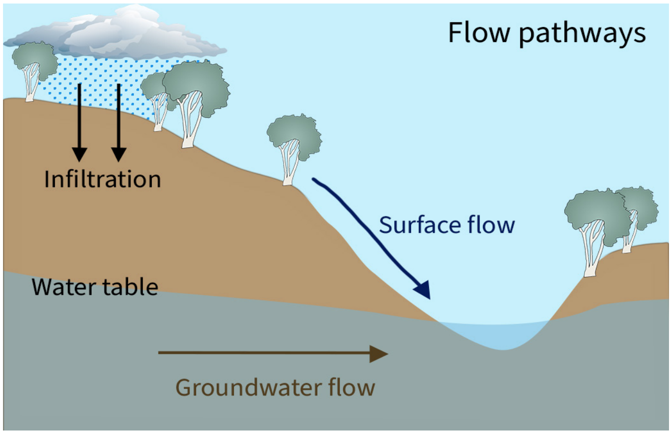
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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



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