Kalgan River

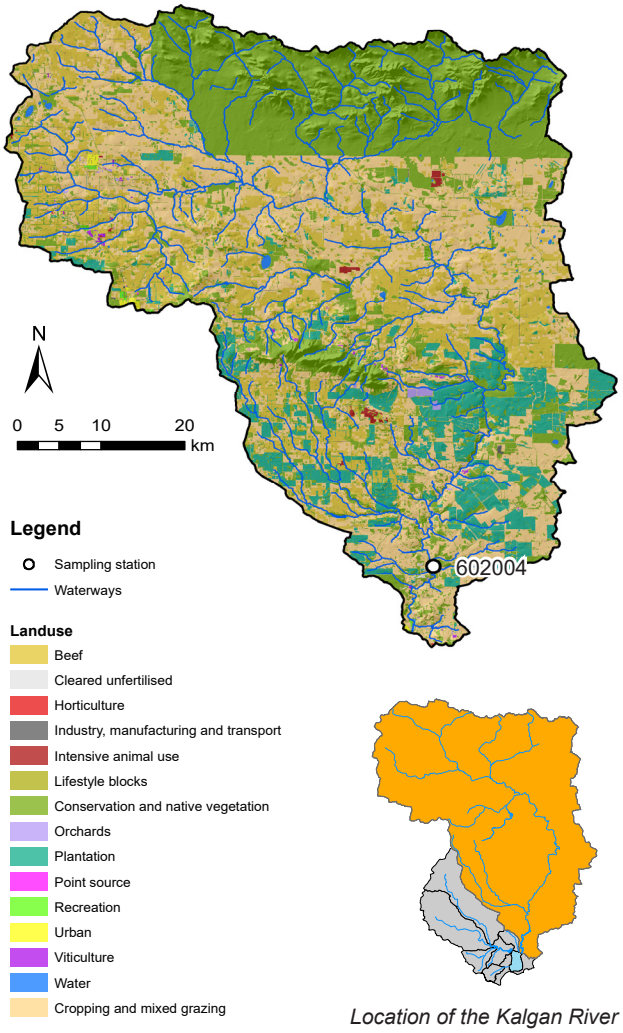
This data report provides a summary of the nutrients at the Kalgan River sampling site in 2019 as well as historical data from 2005–19. This report was produced as part of Healthy Estuaries WA. Downstream of the site, the river discharges into Oyster Harbour.

About the catchment

The Kalgan River has a catchment area of about 2,490 km^2, just over three-quarters of which has been cleared for agriculture. It is by far the largest of the Oyster Harbour catchments. The dominant land uses are cropping and mixed grazing, and conservation and native vegetation. There are also a number of bluegum plantations, mostly in the lower half of the catchment. The large area of conservation and native vegetation at the top of the catchment is part of the Stirling Range National Park and the smaller area near the centre of the catchment is the Porongurup National Park. The waterways have mostly retained their natural form and there is fringing vegetation along much of their length, though in places it is in poor condition or missing, especially on smaller waterways.

Most of the catchment has soils with a reasonably high capacity to bind phosphorus. This means that any phosphorus applied to them tends to bind to the soils, helping prevent it from entering the waterways.

Water quality is measured at site 602004, Stevens Farm, a little more than 1 km north of where the river passes under South Coast Highway, in Kalgan.



Location of the Kalgan River catchment in the greater Oyster Harbour catchment.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the Kalgan River sampling site were classified as low to moderate (total nitrogen) and moderate (total phosphorus). The total nitrogen loads were large, though the load contributed by each square kilometre of catchment was small. The Kalgan River was by far the saltiest of the Oyster Harbour catchments.

Facts and figures

Sampling site code	602004
Catchment area	2,490 km^2
Per cent cleared area (2018)	77 per cent
River flow	Permanent
Main land use (2018)	Cropping and mixed grazing and conservation and native vegetation

Estimated loads and flow at Kalgan River

602004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Flow (GL)	147	13	14	39	33	10	18	21	22	18	23	66	58	16	12
TN load (t)	356	11	13	70	50	8.5	19	26	29	20	29	122	124	17	11
TP load (t)	21.0	0.28	0.33	3.38	1.56	0.22	0.49	0.90	0.92	0.55	0.84	5.32	7.03	0.46	0.29

Kalgan River

Nitrogen over time (2005–19)

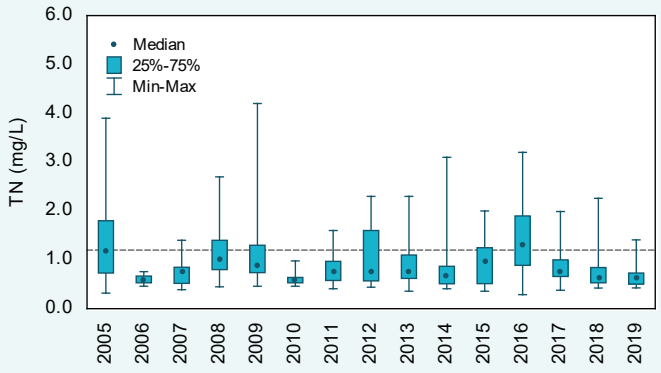
Concentrations

Total nitrogen (TN) concentrations fluctuated over the reporting period at the Kalgan River sampling site. Using the State Wide River Water Quality Assessment (SWRWQA) methodology, annual TN concentrations were classified as moderate from 2009–11 and 2016–18 and as low in all other years. All but one (2016) annual medians were below the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value.

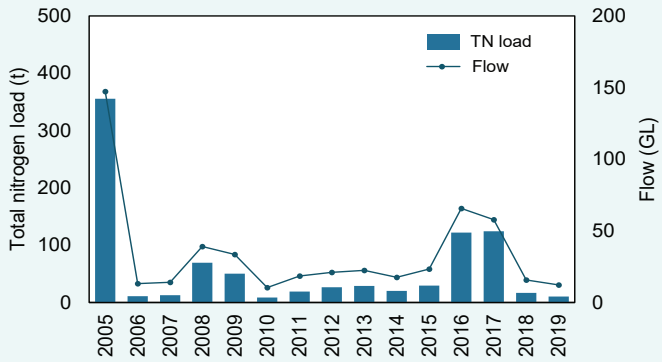
Estimated loads

Estimated TN loads at the Kalgan River sampling site were large compared with the other two sites in the Oyster Harbour catchment where it was possible to calculate loads. In 2019, the Kalgan River had the largest TN load of the three sites where it was possible to calculate loads (11 t; the King River site had the next largest load of 5.1 t). The large load was mostly because of the large flow volume (in 2019 the flow from the Kalgan River, at 12 GL, was three times larger than the next largest volume, the King River with 4.0 GL). The load per square kilometre was small, however, with the Kalgan River having the smallest load per square kilometre in 2019 (4 kg/km^2; Mill Brook had the next smallest load per square kilometre of 14 kg/km^2). The small load per square kilometre can be attributed to the large catchment area. The Kalgan River is by far the largest of the Oyster Harbour catchments. TN loads were closely related to flow volume; years with large annual flow volumes had large TN loads and vice versa.

Kalgan River



Total nitrogen concentrations, 2005–19 at site 602004. The dashed line is the ANZECC trigger value.



Total nitrogen loads and annual flow, 2005–19 at site 602004.

The Kalgan River, showing good riparian vegetation near Burnside Road in Woogenellup, November 2008.

Nitrogen (2019)

Types of nitrogen

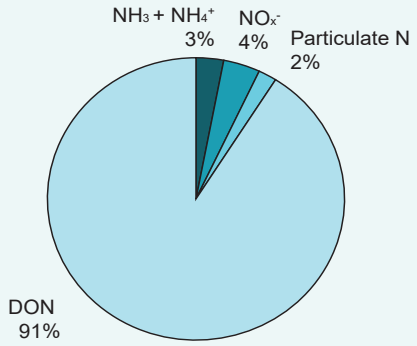
Total N is made up of different types of N. The dominant type of N in the Kalgan River was dissolved organic N (DON). DON consists mainly of degrading plant and animal matter but may also include other types. The bioavailability of DON varies depending on its type, some are highly bioavailable whereas others, like degrading plant and animal matter, often need to be further broken down. The proportion of N present as bioavailable dissolved inorganic N (total ammonia, NH_3 + NH_4^+ and nitrate, NO_x^-) was very low. Likely sources of this kind of N include fertilisers and animal wastes. It is worth noting that both nitrate and total ammonia concentrations were generally very low, with 11 of the 26 nitrate samples and 15 of the 26 total ammonia samples below their respective laboratory limits of reporting.

Concentrations

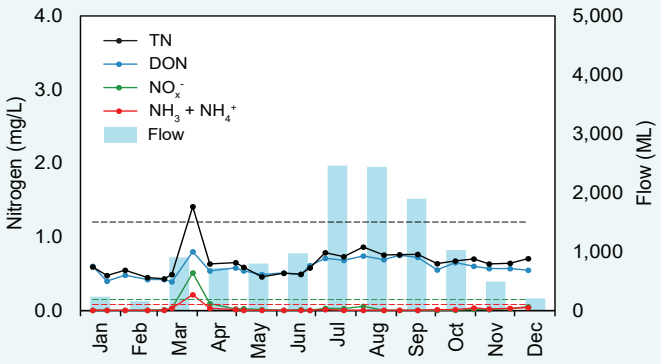
Similar to 2018, TN, DON and, to a lesser extent, nitrate concentrations showed a seasonal pattern, increasing after the onset of winter rains and the increase in flow, and then decreasing again from about September. The largest peak in all types of N occurred in late March. At this time, all types of N were above their respective ANZECC trigger values. The reason for this peak in N is unclear. There was a peak in flow about a week earlier and it is likely that the water that contributed to this peak in flow had high N concentrations. What caused the peak in flow is unclear as it had not rained heavily in the preceding days.

It is likely that most of the N at this site was entering the river via surface water runoff, groundwater and in-stream sources.

Kalgan River



2019 average nitrogen fractions at site 602004.



2019 nitrogen concentrations and monthly flow at 602004. The dashed lines are the ANZECC trigger values for the different N species.

The Kalgan River gauging station during high flows, September 2017.

Phosphorus over time (2005–19)

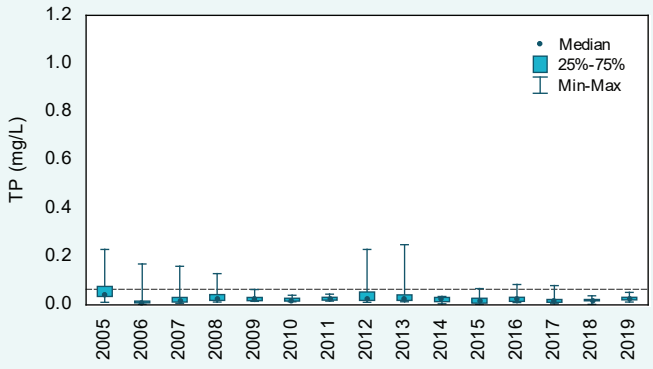
Concentrations

Total phosphorus (TP) concentrations fluctuated over the reporting period at the Kalgan River sampling site. Using the SWRWQA methodology, all years were classified as having moderate TP concentrations; however all annual medians, and most samples, were below the ANZECC trigger value and concentrations were low compared with the other Oyster Harbour catchment sites. In 2019, the Kalgan River had the smallest median TP concentration of the six sites sampled in the Oyster Harbour catchment.

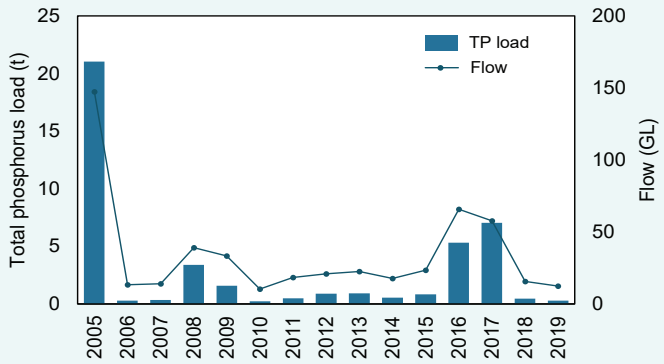
Estimated loads

Estimated TP loads at the Kalgan River sampling site were moderate compared with the other two sites in the Oyster Harbour catchment where it was possible to calculate loads. In 2019, the Kalgan River had the second largest TP load of the three sites where it was possible to calculate loads (0.29 t; the King River site had the largest load of 0.56 t). The load per square kilometre was small, with the Kalgan River having the smallest load per square kilometre in 2010 (0.1 kg/km^2; Mill Brook had the next smallest load per square kilometre of 1.1 kg/km^2). The small load per square kilometre can be attributed to the large catchment area; the Kalgan River is by far the largest of the Oyster Harbour catchments. TP loads were closely related to flow volume; years with large annual flow volumes had large TP loads and vice versa.

Kalgan River



Total phosphorus concentrations, 2005–19 at site 602004. The dashed line is the ANZECC trigger value.



Total phosphorus loads and annual flow, 2005–19 at site 602004.

The Kalgan River weir during low flow, May 2018.

Phosphorus (2019)

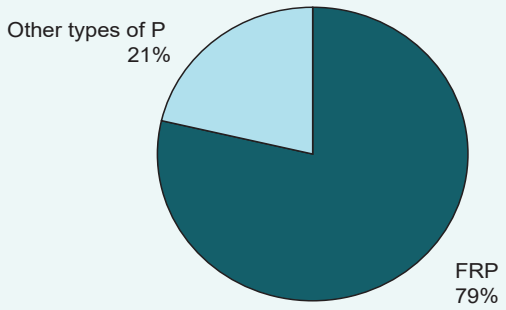
Types of phosphorus

Total P is made up of different types of P. At the Kalgan River sampling site, just over three-quarters of the P was present as phosphate, the highest proportion of the Oyster Harbour sites. Phosphate is measured as filterable reactive phosphorus (FRP) which in surface waters is mainly present as phosphate (PO_4^{3-}) species and is readily bioavailable. The phosphate at this site was probably derived from animal waste and fertiliser as well as natural sources. It is worth noting that while the proportion of P present as phosphate was high, the actual concentrations were low, with all samples well below the ANZECC trigger value. The remaining P was present as either particulate P, dissolved organic P (DOP) or both (shown as 'Other types of P' in the chart below). Particulate P generally needs to be broken down before becoming bioavailable. The bioavailability of DOP varies and is poorly understood.

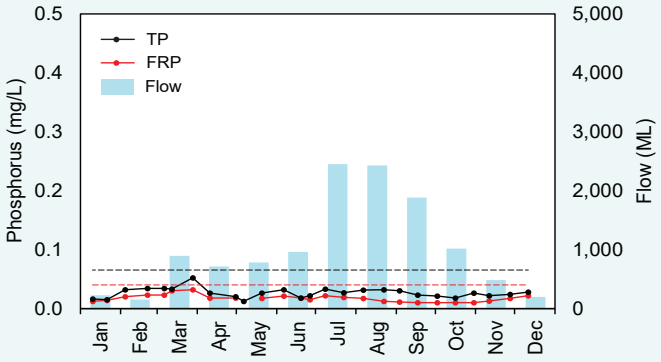
Concentrations

Total P and phosphate concentrations were consistently low in 2019 at the Kalgan River sampling site. All samples collected were below their respective ANZECC trigger values. With the exception of the peak in March (which occurred at the same time as the peak in N concentrations), P concentrations varied only slightly over the year. Like with N, the reason for the peak in P in March is unclear. It is likely that P was entering the river year-round via both surface and groundwater flows as well as coming from in-stream sources.

Kalgan River



2019 average phosphorus fractions at site 602004.



2019 phosphorus concentrations and monthly flow at 602004. The dashed lines are the ANZECC trigger values for the different P species.

The Kalgan River weir completely drowned out during high flows, September 2017. This photograph was taken from a similar spot to the one on the previous page.

Total suspended solids over time (2005–19)

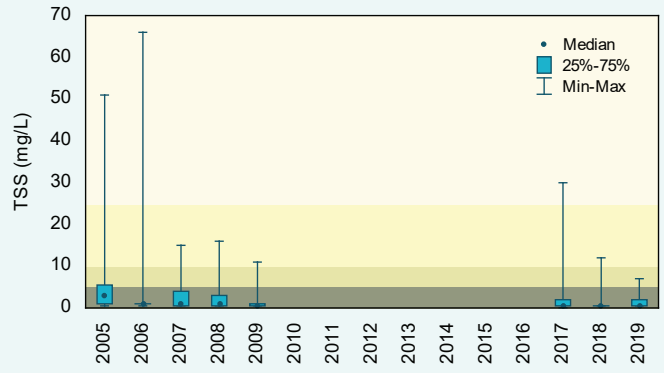
Concentrations

Total suspended solids (TSS) concentrations at the Kalgan River sampling site were generally low, with all years classified as having a low concentration using the SWRWQA methodology. However, the annual range in concentrations was quite large in some years.

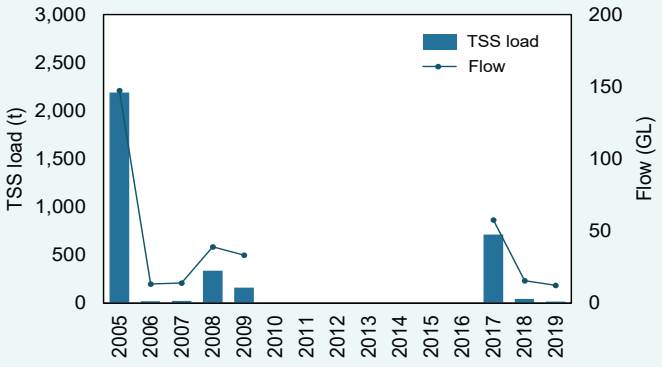
Estimated loads

Estimated TSS loads at the Kalgan River sampling site were moderate to large compared with the other sites in the Oyster Harbour catchment. In 2019, the Kalgan River had the second largest TSS load of the three sites where it was possible to calculate loads (18 t; the King River site had the largest load of 22 t). The large load was driven mainly by the large flow volume (in 2019 the flow from the Kalgan River, at 12 GL, was three times larger than the next largest flow volume at the King River of 4.0 GL). The load per square kilometre was small, however, with the Kalgan River having the smallest load per square kilometre in 2019 (7 kg/km^2; Mill Brook had the next smallest load per square kilometre of 71 kg/km^2). The small load per square kilometre can be attributed to the large catchment area; the Kalgan River is by far the largest of the Oyster Harbour catchments. TSS loads were closely related to flow volume; years with large annual flow volumes had large TSS loads and vice versa.

Kalgan River



Total suspended solids concentrations, 2005–19 at site 602004. The shading refers to the SWRWQA classification bands.



Total suspended solids loads and annual flow, 2005–19 at site 602004.

low moderate high very high

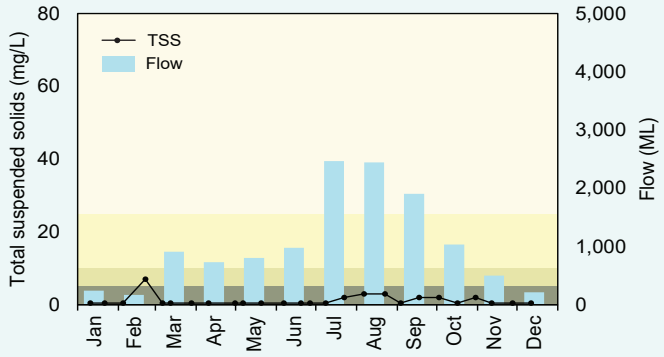
Livestock grazing is one of the main land uses in the Kalgan River catchment, August 2016.

Total suspended solids (2019)

Concentrations

Total suspended solids concentrations were low for most of 2019, with almost all samples falling into the low band of the SWRWQA. There was some evidence of a seasonal pattern, with concentrations slightly higher from July to October, when rainfall and flow were at their highest suggesting that particulate matter was being washed into the river or being dislodged from the bed and banks of the river at this time. The reason for the peak in February is unknown, it does not coincide with a peak in rainfall or flow. It may be because of a disturbance close to or at the sampling site dislodging particulate matter.

Kalgan River



2019 total suspended solids concentrations and monthly flow at 602004. The shading refers to the SWRWQA classification bands.

low moderate high very high

Aerial view of Chelgiup Creek, a tributary of the Kalgan River. Note the thin band of fringing vegetation along the creek, March 2020.

Kalgan River

pH over time (2005–19)

pH values

pH at the Kalgan River sampling site fluctuated over the reporting period; however, almost all samples collected fell within the upper and lower ANZECC trigger values.

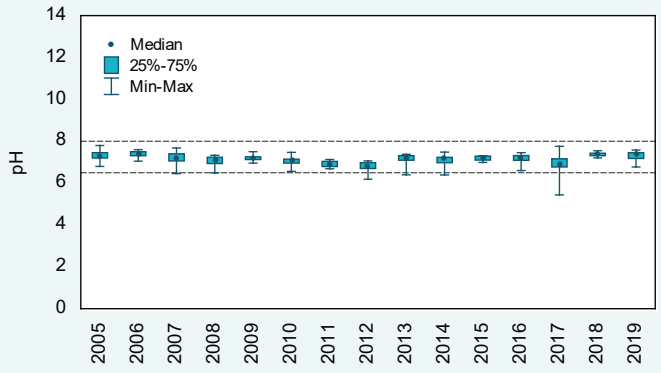
There is some concern that the probe used to collect the pH data from the catchments of Oyster Harbour (including the Kalgan River site) from about October 2016 to October 2017 was not functioning correctly. This may have caused lower-than-actual pH values to be recorded. From October 2017, a new probe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

pH (2019)

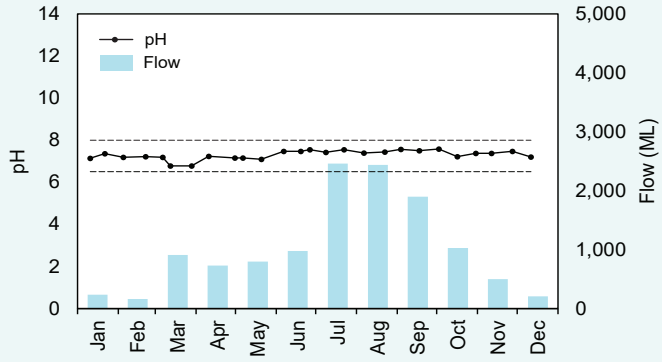
pH values

In 2019, all samples collected at the Kalgan River sampling site fell within the upper and lower ANZECC trigger values. There was little variation observed in pH over the year.

Kalgan River



pH levels, 2005–19 at site 602004. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels and monthly flow at 602004. The dashed lines are the upper and lower ANZECC trigger values.

Chelgiup Creek, a tributary of the Kalgan River. Note the dominance of exotic grasses in the fringing vegetation, March 2020.

Kalgan River

Salinity over time (2005–19)

Concentrations

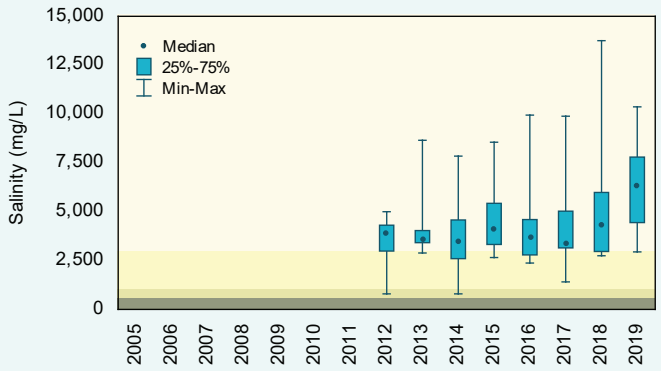
The Kalgan River was by far the saltiest of the five catchments sampled in the Oyster Harbour catchment. Using the Water Resources Inventory 2014 salinity ranges, all years were classified as saline (note, the 2018 nutrient report used the SWRWQA bands). In 2019, the Kalgan River had the highest median salinity (6,300 mg/L, the next highest median was at Mill Brook with 1,765 mg/L). It is likely that much of the salts at this site are originating from the inland portion of the catchment where historical clearing has led to salinisation within the catchment.

Salinity (2019)

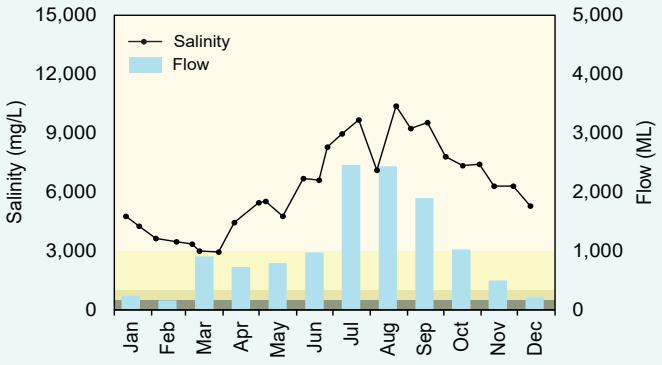
Concentrations

Salinity showed a seasonal response at the Kalgan River sampling site with concentrations increasing from about March, when rainfall and river flow increased before peaking in August and then dropping again. It is likely that much of the salt is coming from further up in the catchment where historical clearing has caused salinisation. Rainfall washed the salt into the river from surrounding land, where it had accumulated over the drier months. The reason for the dip in salinity in early August is unclear; however it was raining on that day so it is possible that the sample was influenced by the fresher water from the rainfall.

Kalgan River



Salinity concentrations, 2005–19 at site 602004. The shading refers to the Water Resources Inventory 2014 salinity ranges.



2019 salinity and monthly flow at site 602004. The shading refers to the Water Resources Inventory 2014 salinity ranges.

fresh marginal brackish saline

The Kalgan River at the sampling site. Note the mostly intact fringing vegetation at this location, August 2016.

Kalgan River

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 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.

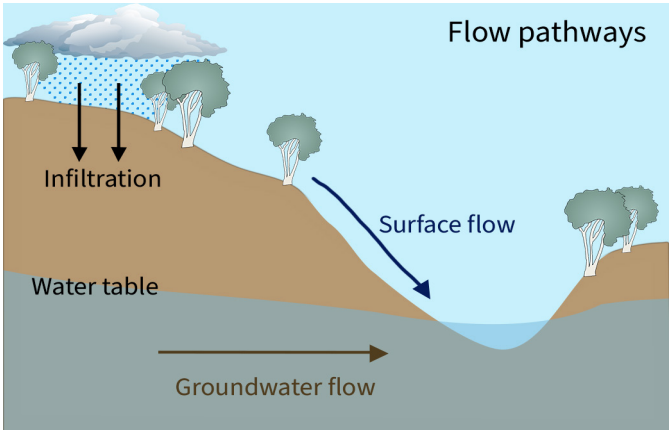
Laboratory limit of reporting: (LOR) this is the lowest concentration of an analyte that can be reported by a laboratory.

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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