Harvey River

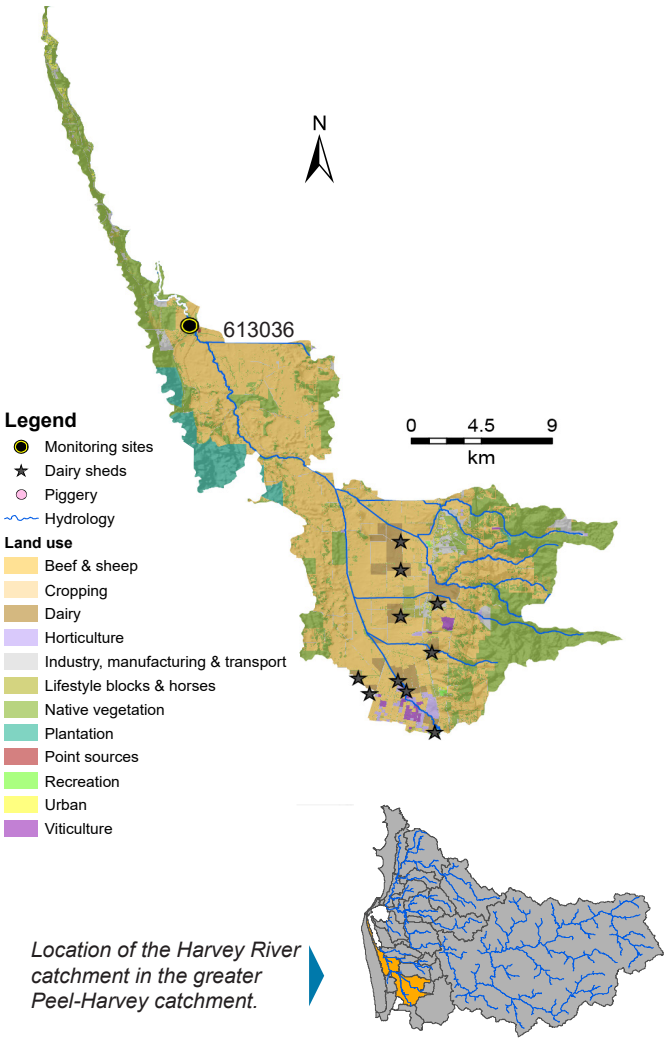
This data report provides a summary of the nutrients at the Harvey River sampling site in 2019 as well as historical data from 2005–19. This report was produced as part of Healthy Estuaries WA. Downstream of the site, the river flows into the Harvey Estuary.

About the catchment

The reported portion of the Harvey River has a catchment area of about 375 km^2 (the total catchment area that contributes flow to the sampling site is about 400 km^2). More than half has been cleared for agriculture, predominantly beef and sheep grazing. There are also a number of dairy sheds in the catchment. Upstream of the catchment is the Harvey Dam, on the Harvey River, one of the water supply points to the Harvey Water Irrigation Area which covers the coastal plain portion of the catchment. While the river close to the Harvey Estuary retains a natural form, elsewhere it has been converted into a straight drain and there are numerous other drains in the catchment to rapidly remove water from farmland. Some fringing vegetation remains along the more natural section of the river; however, there is very little along the drains.

About half of the soils in the coastal plain portion of the catchment, where much of the agriculture is, have a low capacity to bind phosphorus. This is often so poor that any phosphorus applied to them can be quickly washed into drains and other waterways.

Since 2017, water quality has been measured at site 613036, Forrest Highway, where the river passes under Forrest Highway on the border of Lake Clifton and Waroona. Before this, it was measured at site 613052, Clifton Park, a few hundred meters downstream of Forrest Highway.



Location of the Harvey River catchment in the greater Peel-Harvey catchment.

Results summary

Nutrient concentrations were classified as moderate (total nitrogen) and high (total phosphorus) at the Harvey River sampling site. Nutrient loads as well as the loads per square kilometre were large compared with the other Peel-Harvey catchment sites. The highly modified nature of the catchment and river, and agricultural land use, collectively contribute to the high nutrient concentrations and large loads observed.

Facts and figures

Sampling site code	613036
Catchment area	375 km^2
Per cent cleared area (2015)	67 per cent
River flow	Permanent
Main land use (2015)	Beef and sheep grazing and native vegetation

Estimated loads and flow at Harvey River

613036	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Flow (GL)	144	39	85	108	98	20	73	59	136	98	20	62	96	127	54
TN load (t)	280	58	168	209	193	25	136	100	269	195	25	111	185	249	99
TP load (t)	36.7	7.53	21.4	27.6	25.1	2.97	17.2	12.7	35.8	25.0	2.93	13.9	25.1	33.2	12.6

Harvey River

Nitrogen over time (2005–19)

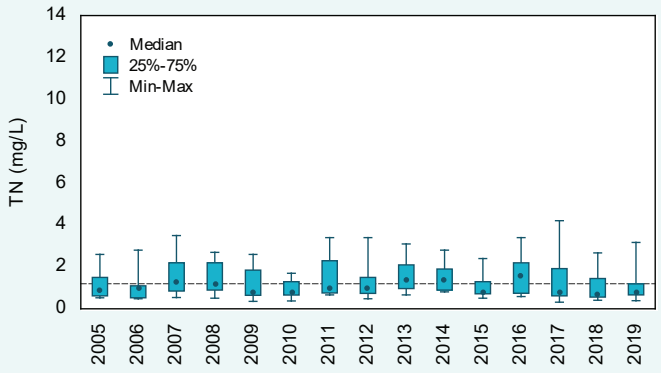
Concentrations

Total nitrogen (TN) concentrations at the Harvey River sampling site fluctuated over the reporting period. All years were classified as having moderate TN concentrations using the State Wide River Water Quality Assessment (SWRWQA) methodology. In 2019, the Harvey River site had the fifth-lowest median TN concentration of the 13 sites sampled in the Peel-Harvey catchment.

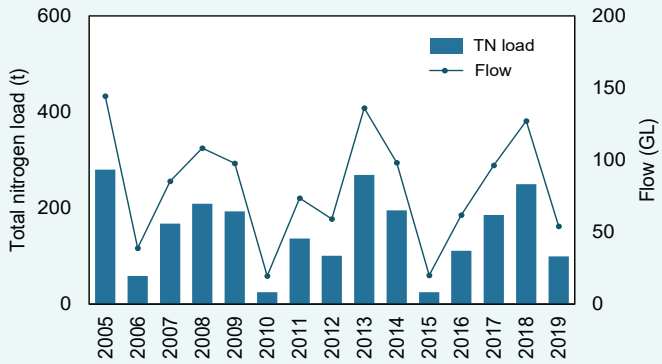
Estimated loads

Estimated TN loads at the Harvey River sampling site were very large compared with the other sites in the Peel-Harvey catchment. In 2019, the Harvey River had an estimated TN load of 99 t, the largest TN load of the 10 sites where it was possible to calculate loads. This large load was because of a combination of the moderate TN concentrations and relatively large flow volume (in 2019, the Harvey River had the second largest flow volume of 54 GL; only the combined Middle and Upper Murray catchment had a larger flow volume of 113 GL). The load per square kilometre was also large, at 248 kg/km^2 in 2019, the largest load per square kilometre of the Peel-Harvey catchments. TN loads were closely related to flow volume; years with large annual flow volumes had large TN loads and vice versa.

Harvey River



Total nitrogen concentrations, 2005–19 at site 613036. The dashed line is the protection plan TN target.



Total nitrogen loads and annual flow, 2005–19 at site 613036.

A drain in the Harvey River catchment. Almost all the fringing vegetation is exotic, mostly a mix of Watsonia and grasses, October 2001.

Nitrogen (2019)

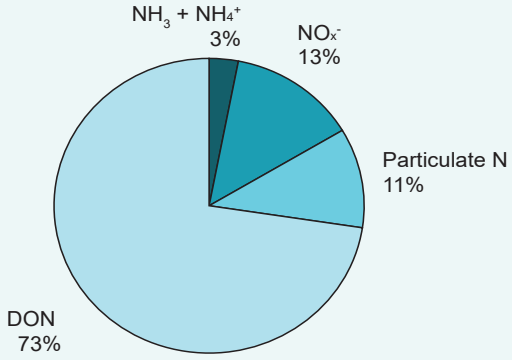
Types of nitrogen

Total N is made up of different types of N. In the Harvey River, nearly three-quarters of the N was present as dissolved organic N (DON). This type of N consists mainly of degrading 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 becoming available whereas other types are readily bioavailable. Sixteen per cent of the N was present as dissolved inorganic N (DIN – consisting of nitrate, NO_x^-, and total ammonia, NH_3 + NH_4^+). These types of N are likely sourced from fertilisers and animal wastes as well as mineralisation of organic N in soils, streams and drains, and are readily bioavailable for plants and algae to use to fuel rapid growth.

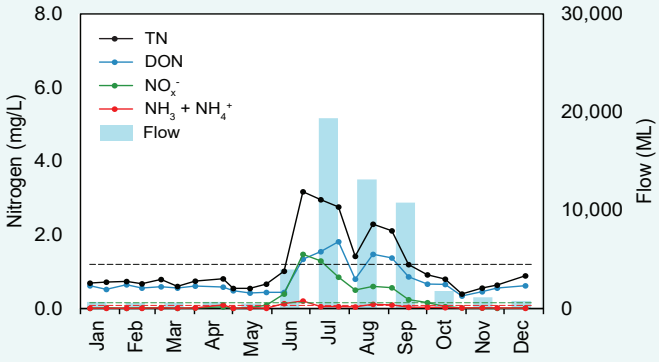
Concentrations

In 2019, there was a seasonal pattern in all types of N at the Harvey River site. The peak in June was likely because of a first flush effect where N was mobilised following heavy rainfall. Much of this N was likely to be the result of mineralisation of organic N in soils, streams and drains over the summer period, and runoff from grazing land, which builds up with animal waste and fertiliser over the drier months. It was likely also the result of organic N washing in from soils and remnant wetlands where it had built up over the same period. TN, DON and nitrate concentrations generally remained high during July and August, only starting to fall as rainfall and runoff started to ease, suggesting that proportionally more N at this site is coming from surface flows rather than shallow groundwater. The dip in TN, DON and nitrate in August was probably the result of a dry spell which caused parts of the catchment to dry out, therefore no longer contributing nutrients. This dip was present at many of the Peel-Harvey catchment sites in both N and P concentrations.

Harvey River



2019 average nitrogen fractions at site 613036.



2019 nitrogen concentrations and monthly flow at 613036. The black dashed line is the protection plan TN target, the red and green lines are the ANZECC trigger values for total ammonia and nitrate.

The Harvey River at the sampling site. The river is choked with macrophytes covered in filamentous algae, March 2016

Phosphorus over time (2005–19)

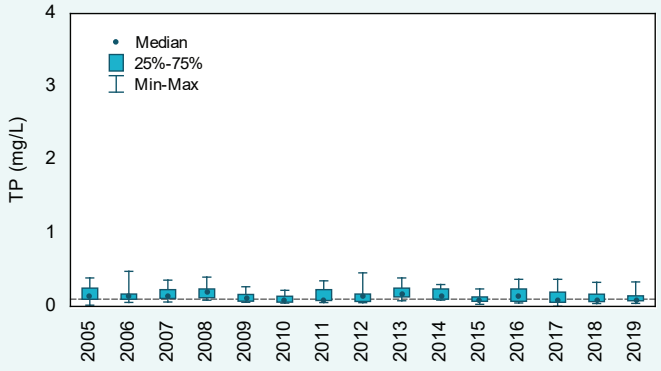
Concentrations

Total phosphorus (TP) concentrations fluctuated over the reporting period. Using the SWRWQA methodology, all years were classified as having high TP concentrations. The annual median concentrations were above the Bindjareb Djilba (Peel-Harvey estuary) Protection Plan water quality target in 10 of the past 15 years. In 2019, the Harvey River sampling site had the fourth-lowest median TP concentration of the 13 sites sampled in the Peel-Harvey catchment.

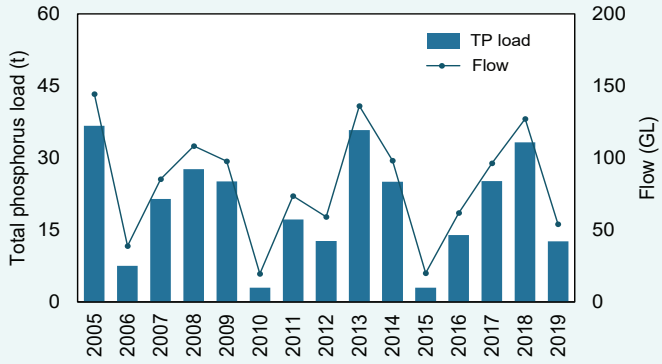
Estimated loads

Estimated TP loads at the Harvey River sampling site were very large compared with the other sites in the Peel-Harvey catchment. In 2019, the site had an estimated TP load of 12.6 t and a load per square kilometre of 31.5 kg/km^2, both of which were the largest of the 10 sites in the Peel-Harvey catchment where it was possible to calculate loads. The very large TP load was because of a combination of the high TP concentrations and relatively large flow volume (in 2019, the Harvey River had the second largest flow volume of 54 GL; only the combined Middle and Upper Murray catchment had a larger flow volume of 112 GL). TP loads were closely related to flow volume; years with high annual flow having large TP loads and vice versa.

Harvey River



Total phosphorus concentrations, 2005–19 at site 613036. The dashed line is the protection plan TP target.



Total phosphorus loads and annual flow, 2005–19 at site 613036.

Staff gauges at the Harvey River sampling site, March 2017.

Phosphorus (2019)

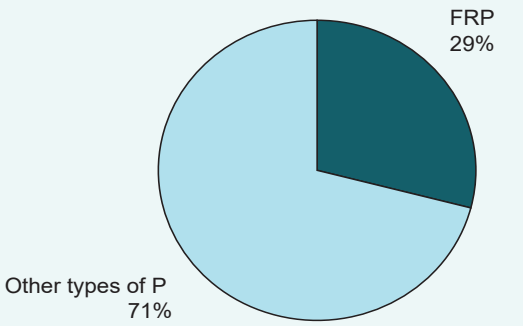
Types of phosphorus

Total P is made up of different types of P. At the Harvey River sampling site, nearly two-thirds of the 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. The remainder of the P was present as phosphate; measured as filterable reactive P (FRP), in surface waters this is mainly present as phosphate (PO_4^{3-}) species and is readily bioavailable. Phosphate was probably derived from animal waste and fertilisers as well as natural sources.

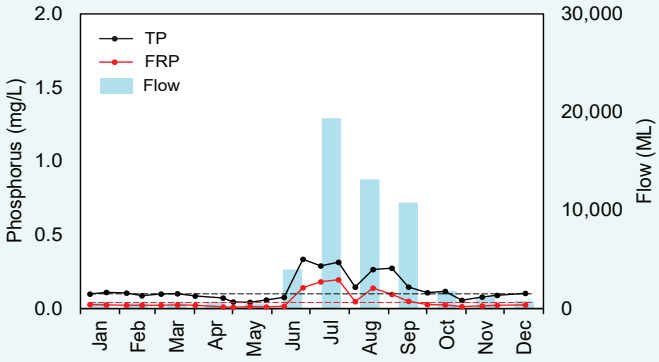
Concentrations

Total P and phosphate showed a seasonal pattern, increasing in June when rainfall and flow increased before decreasing again later in the year, when rainfall and flow eased. The increase in June was because of the start of winter rains washing P into the river from the surface soils of the mostly farmed land adjacent to the rivers. It is likely P is entering the river via surface flows with a minor contribution from shallow groundwater. P is also likely to be coming from in-stream sources such as erosion of banks and sediment-filled pools. The dip in TP and phosphate in August was probably the result of a dry spell which caused parts of the catchment to dry out, therefore no longer contributing nutrients. This dip was present at many of the Peel-Harvey catchment sites in both N and P concentrations.

Harvey River



2019 average phosphorus fractions at site 613036.



2019 phosphorus concentrations and monthly flow at 613036. The dashed black line is the protection plan TP target, the red is the ANZECC trigger value for phosphate.

Collecting flow measurements at the Harvey River sampling site, July 2016

Dissolved organic carbon over time (2005–19)

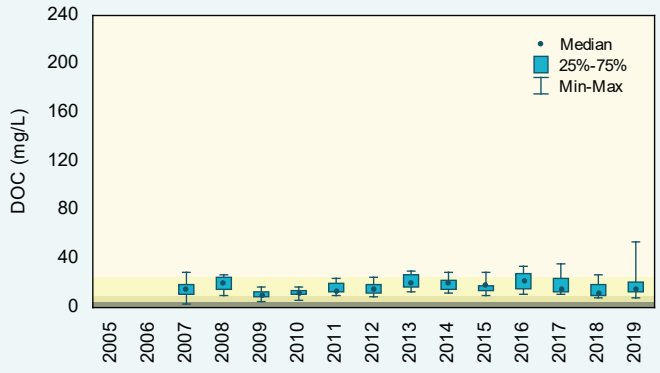
Concentrations

Dissolved organic carbon (DOC) concentrations fluctuated over the reporting period at the Harvey River sampling site. Using the SWRWQA methodology, all years were classified as having high DOC concentrations.

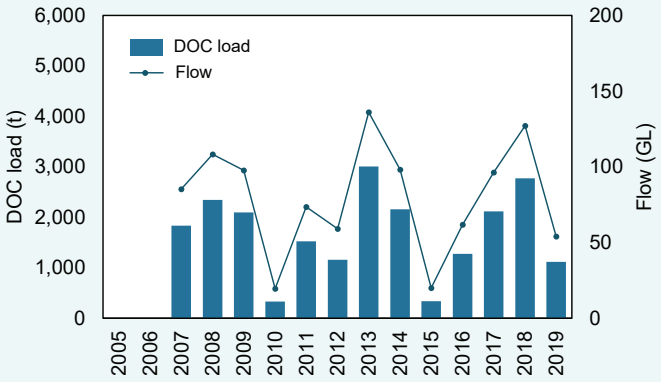
Estimated loads

Estimated DOC loads at the Harvey River sampling site were large compared with the other sites in the Peel-Harvey catchment. In 2019, the estimated DOC load was 1,118 t, the second largest of the 10 sites in the Peel-Harvey catchment where it was possible to calculate loads. The large DOC load was because of a combination of the high DOC concentrations and relatively large flow volumes (in 2019, the Harvey River had the second largest flow volume of 54 GL; only the combined Middle and Upper Murray catchment had a larger flow volume of 112 GL). The load per square kilometre of 2,796 kg/km^2 was the largest of the Peel-Harvey catchment sites. DOC loads were closely related to flow volume; years with large annual flow volumes had large DOC loads and vice versa.

Harvey River



Dissolved organic carbon, 2005–19 at site 613036. The shading refers to the SWRWQA classification bands.



Dissolved organic carbon loads and annual flow, 2005–19 at site 613036.

low moderate high very high

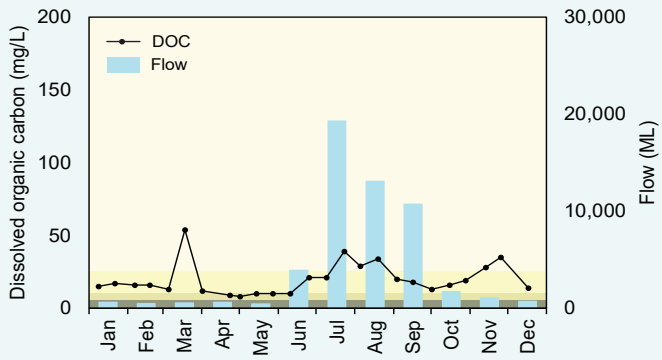
The rock weir at the Harvey River sampling site, March 2017.

Dissolved organic carbon (2019)

Concentrations

DOC concentrations showed a seasonal pattern at the Harvey River sampling site. Concentrations increased in June to July as rainfall and flow increased. After this peak, concentrations fell again. There was also a peak in March and November; the reasons for these peaks are unknown. DOC is sourced mainly from degrading plant and animal matter, including from agricultural land and natural organic matter in soils and wetlands. It varies widely in its bioavailability. At the Harvey River sampling site, DOC was coming from surface flow and groundwater as well as in-stream sources.

Harvey River



2019 dissolved organic carbon concentrations and monthly flow at 613036. The shading refers to the SWRWQA classification bands.

low moderate high very high

Pelicans on the Harvey River, April 2004.

Total suspended solids over time (2005–19)

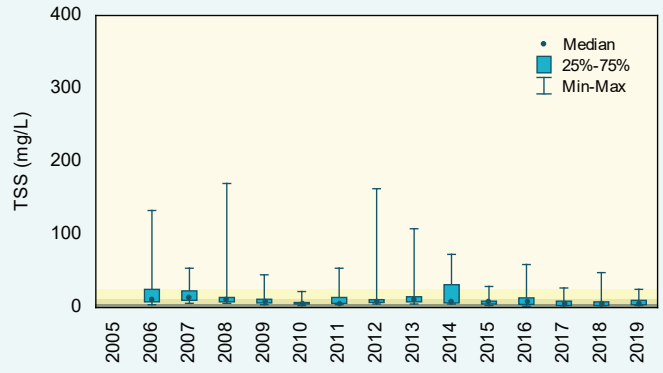
Concentrations

TSS concentrations fluctuated over the reporting period. Using the SWRWQA methodology, all years were classified as having moderate TSS concentrations.

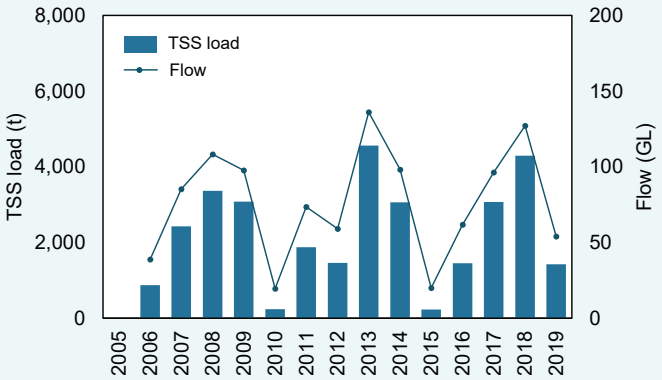
Estimated loads

Estimated TSS loads at the Harvey River sampling site were very large compared with the other sites in the Peel-Harvey catchment. In 2019, the estimated TSS load at this site was 1,420 t, the largest of the 10 sites in the Peel-Harvey catchment where it was possible to calculate loads. It also had the largest load per square kilometre (3,550 kg/km^2). The large TSS load was because of a combination of the moderate TSS concentrations and relatively large flow volumes (in 2019, the Harvey River had the second largest flow volume of 54 GL; only the combined Middle and Upper Murray catchment had a larger flow volume of 112 GL). TSS loads were closely related to flow volume; years with large annual flow volumes had large TSS loads and vice versa.

Harvey River



Total suspended solids concentrations, 2005–19 at site 613036. The shading refers to the SWRWQA classification bands.



Total suspended solids loads and annual flow, 2005–19 at site 613036.

low moderate high very high

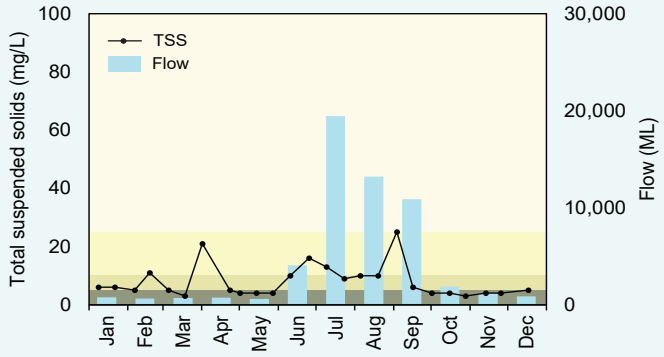
A walkway over the Harvey River. Note the grazing land in the background, beef and sheep grazing is a major land use in the Harvey River catchment, October 2001.

Total suspended solids (2019)

Concentrations

There was a seasonal pattern present in the 2019 TSS concentrations at the Harvey River sampling site. Concentrations were generally highest during the wetter months with more flow (with the exception of the peak in early April). In June, rainfall washed particulate material that had accumulated over the drier months into the river as well as mobilising any that was present in dry drains or streams in the catchment. In-stream erosion was also contributing particulate matter.

Harvey River



2019 total suspended solids concentrations and monthly flow at 613036. The shading refers to the SWRWQA classification bands.

low moderate high very high

Revegetation on the bank of the Harvey River at the sampling site. This helps stabilise the banks and reduces erosion, December 2008.

Harvey River

pH over time (2005–19)

pH values

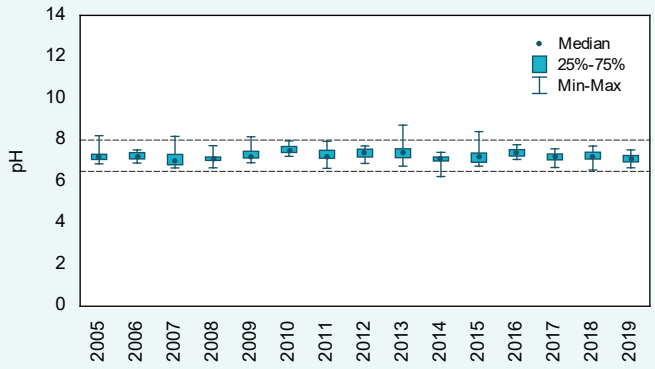
pH fluctuated over the reporting period with all annual median concentrations within the upper and lower Australian and New Zealand Environment and Conservation Council (ANZECC) trigger values. Only six years had any samples which lay above or below the ANZECC trigger values, and the number of these samples was very low.

pH (2019)

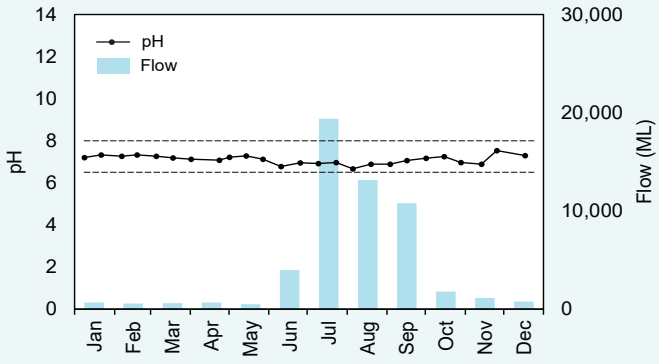
pH values

In 2019, all samples collected at the Harvey River site fell within the upper and lower ANZECC trigger values. Values fluctuated over the year with no clear evidence of a seasonal pattern present.

Harvey River



pH levels, 2005–19 at site 613036. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels and monthly flow at 613036. The dashed lines are the upper and lower ANZECC trigger values.

The old Harvey River sampling site at Clifton Park, August 2012.

Harvey River

Salinity over time (2005–19)

Concentrations

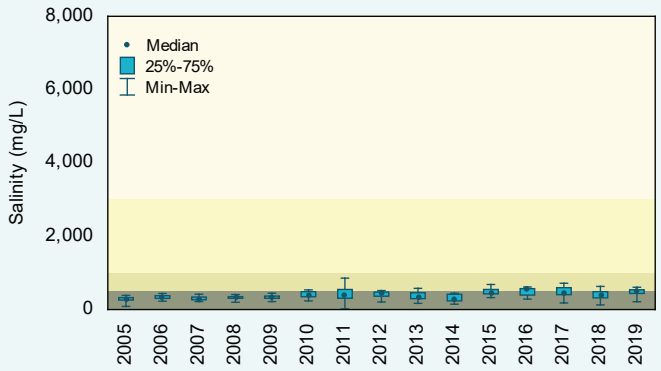
Salinity was generally low at the Harvey River sampling site with all annual concentrations classified as fresh using the Water Resources Inventory 2014 salinity ranges (note, the 2018 nutrient reports used the SWRWQA bands). Why salinities appear to be slightly higher since 2010 is unknown.

Salinity (2019)

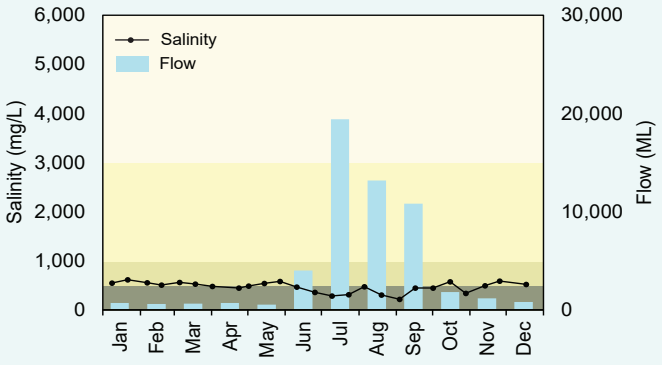
Concentrations

Salinity concentrations were stable in the early part of the year before decreasing in June to early July when winter rainfall and flows commenced. After the lowest concentration recorded in July, salinity increased again slowly (with some fluctuations) during the rest of the year. This suggests the groundwater at this site is slightly more saline than the surface water. During the first part of the year, a larger proportion of the water in the river was from groundwater. It is important to note that while there was a pattern present in salinity at this site, concentrations were low year-round.

Harvey River



Salinity concentrations, 2005–19 at site 613036. The shading refers to the Water Resources Inventory 2014 salinity ranges.



2019 salinity concentrations and monthly flow at 613036. The shading refers to the Water Resources Inventory 2014 salinity ranges.

fresh marginal brackish saline

High flows at the Harvey River sampling site, July 2018.

Harvey 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 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 Peel-Harvey estuary at estuaries.dwer.wa.gov.au/estuary/peel-harvey-estuary/

Healthy Estuaries WA partners with the Peel-Harvey 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 Peel-Harvey Catchment Council go to peel-harvey.org.au
- To find out more about the health of the rivers in the Peel-Harvey Catchment go to rivers.dwer.wa.gov.au/assessments/results

Methods

Variables were compared with the Bindjareb Djilba (Peel-Harvey estuary) Protection 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.

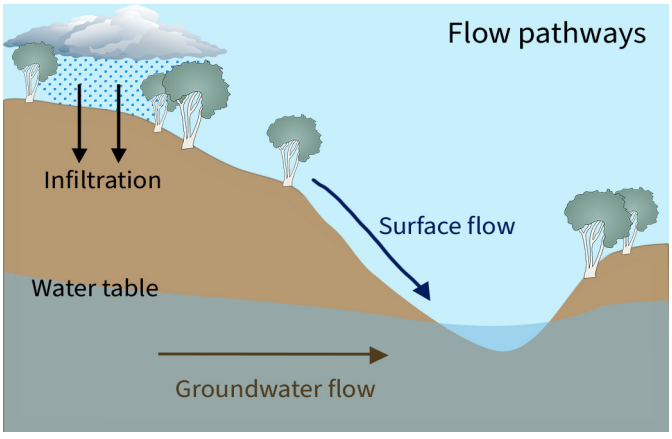
Laboratory limit of reporting: (LOR) this is the lowest concentration of an analyte that can be reported by a laboratory.

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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