

Samson North Drain

This data report provides a summary of the nutrients at the Samson North Drain sampling site in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. Downstream of the site, the drain enters the Harvey River and, from there, discharges into the Harvey Estuary. 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.

About the catchment

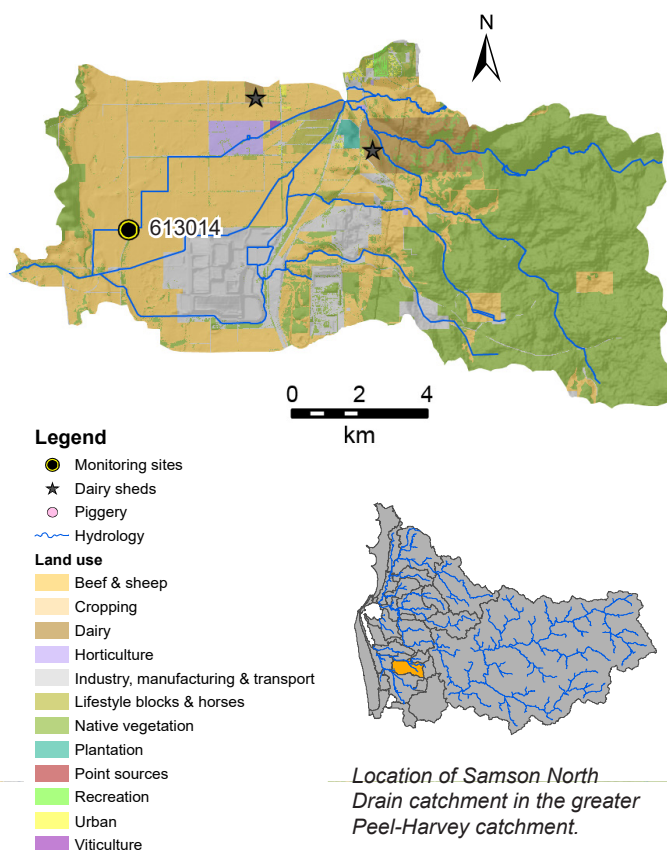
The Samson North Drain has a catchment area of about 138 km², just over half of which has been cleared, mostly for beef and sheep grazing. The eastern portion of the catchment, on the Darling Scarp, still retains large areas of native vegetation. There are a number of natural and man-made waterways in this catchment and only the Samson North Drain is sampled. Alcoa's Wagerup Refinery is in the catchment; however, it is not upstream of the sampling site.

The soils on the Swan Coastal Plain portion of the catchment 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. Soils in the Darling Scarp portion generally have a good phosphorus binding capacity and hence tend to bind phosphorus well, reducing the amount entering drains and waterways.

Water quality is sampled at site 613014, Somers Road, where Samson North Drain passes under Somers Road in Wagerup. The catchment area upstream of the sampling site is about 30 km². While there is a weir at this sampling site, flow is not currently measured.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the Samson North Drain sampling site were high. The proportion of nitrogen present as ammonia N, a highly bioavailable form of nitrogen, was large compared with the other monitored catchments. The agricultural land use as well as the modified drainage system present all contributed to the high nutrient concentrations recorded at this site.



Facts and figures

Sampling site code	613014
Catchment area	138 km ²
Per cent cleared area (2015)	56 per cent
River flow	Permanent
Main land use (2015)	Native vegetation, beef and sheep grazing



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Nitrogen over time (2004–18)

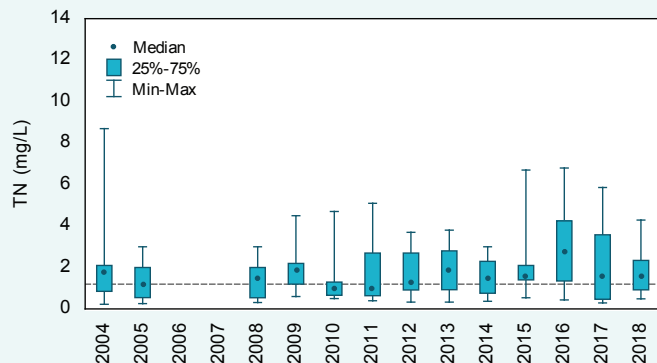
Concentrations

Total nitrogen (TN) concentrations at the Samson North Drain sampling site were high compared with the other Peel-Harvey catchment sampling sites. Concentrations fluctuated over the reporting period. The annual median TN concentrations were above the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value in 11 of the 13 years where there were sufficient data to graph. The annual range in TN concentrations were also relatively high compared with the other Peel-Harvey sites.

Trends

There was neither a short- (2014–18) or long-term (2008–18) trend in TP concentrations at the Samson North Drain sampling site.

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Total nitrogen concentrations, 2004–18 at site 613014. The dashed line is the ANZECC trigger value for lowland rivers.



The weir at the Samson North Drain sampling site, May 2005.

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Nitrogen (2018)

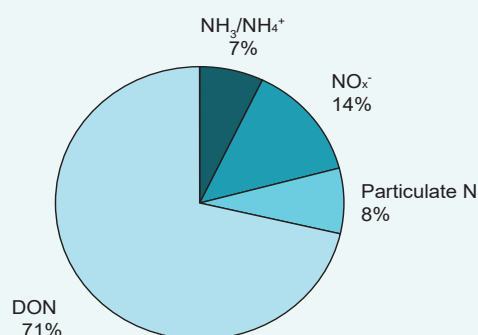
Types of Nitrogen

Total N is made up of many different types of N. At the Samson North Drain sampling site, a little over two-thirds of the N was present as dissolved organic N (DON) which consists mainly of degrading plant and animal matter but may also include other forms. Most forms of DON need to be further broken down to become available to plants and algae, though some forms are readily bioavailable. The proportion of N present as ammonia N ($\text{NH}_3/\text{NH}_4^+$) was high compared with the other Peel-Harvey catchment sites, being the equal highest (along with Drakes Brook–Waroona Drain). Along with oxides of N (NO_x^-), $\text{NH}_3/\text{NH}_4^+$ is readily bioavailable and is commonly sourced from fertilisers and animal wastes as well as natural sources.

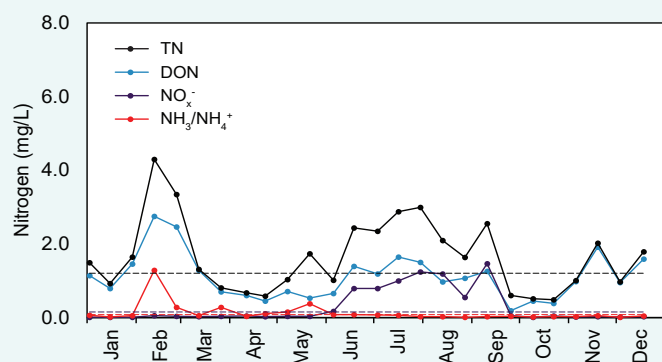
Concentrations

There were three main peaks in N concentrations at the Samson North Drain sampling site in 2018. The first was in February, where there was a peak in $\text{NH}_3/\text{NH}_4^+$, DON and TN concentrations. The reason for this peak is unknown, though it may be runoff from intensive land use further up in the catchment. The second peak occurred over the wetter winter months, when rainfall and flow were at their highest. This peak was most obvious in NO_x^- , TN and DON concentrations and was likely because of N being washed into the drain from surrounding land use via surface flows, the mobilisation of organic N that had been mineralised in soils and streams over the summer period and organic N from soils and streams over the summer period and organic N from soils and remnant wetlands. The last peak, in November, was in TN and DON only. The reason for this peak is unclear.

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2018 average nitrogen fractions at site 613014.



2018 nitrogen concentrations at 613014. The dashed lines are the ANZECC trigger values for lowland rivers for the different N species.



Samson North Drain flowing through farmland downstream of the sampling site, May 2020.

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Phosphorus over time (2004–18)

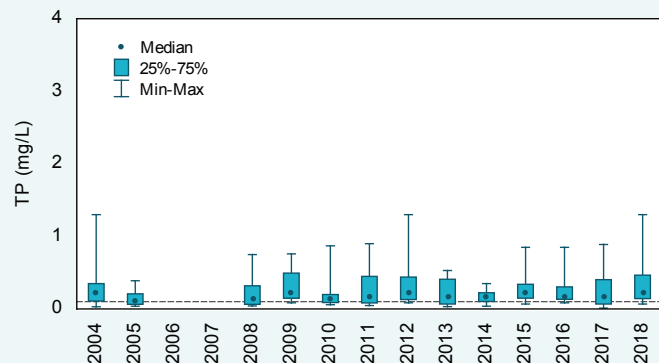
Concentrations

Total phosphorus (TP) concentrations fluctuated over the reporting period at the Samson North Drain sampling site. The annual median was above the ANZECC trigger value each year where there were sufficient data to graph and concentrations were generally high compared with the other sites sampled in the Peel-Harvey catchment.

Trends

There was no trend in TP concentrations over either the short- (2014–18) or long-term (2008–18) at the Samson North Drain sampling site.

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Total phosphorus concentrations, 2004–18 at site 613014. The dashed line is the Peel-Harvey WQIP target for winter median TP concentrations.



The v-notch weir at the Samson North Drain sampling site, May 2005.

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Phosphorus (2018)

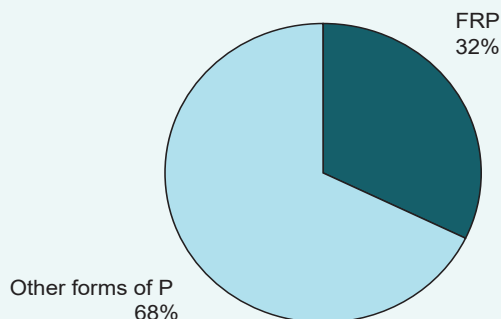
Types of phosphorus

Total P is made up of different types of P. At the Samson North Drain sampling site, about a third of the P was present as highly bioavailable filterable reactive P (FRP). This form of P is readily used by plants and algae to fuel growth and is likely sourced from fertilisers and animal wastes as well as natural sources. The remaining P was present as either particulate P or dissolved organic P (DOP) or both. Particulate P generally needs to be broken down before becoming bioavailable to algae. The bioavailability of DOP varies and is poorly understood.

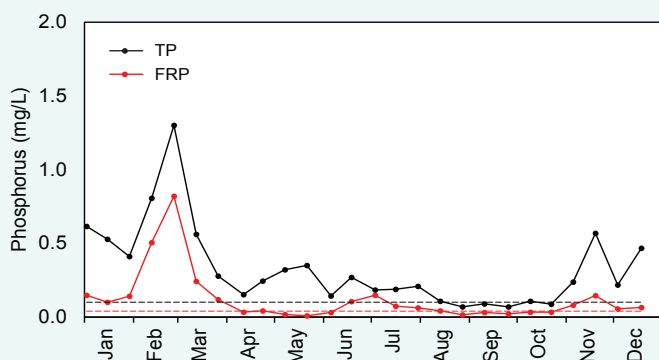
Concentrations

In 2018, P concentrations showed a similar pattern to N concentrations. The peak in FRP and TP in February was large and was possibly caused by runoff from intensive land use further up in the catchment. There was a second, smaller FRP peak in June to July which was most likely because of a first-flush effect where the commencement of winter rainfall washed P into the drain from surrounding land use. The reason for the last peak, in both TP and FRP concentrations in November is unclear. It is likely P is entering the drain via both surface and groundwater flows as well as coming from in-stream sources and possibly some form of discharge.

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2018 average phosphorus fractions at site 613014.



2018 phosphorus concentrations at 613014. The dashed black line is the Peel-Harvey WQIP target, the red line is the ANZECC trigger value for lowland rivers.



The staff gauge and weir at the Samson North Drain sampling site, May 2006.

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Dissolved organic carbon over time (2004–18)

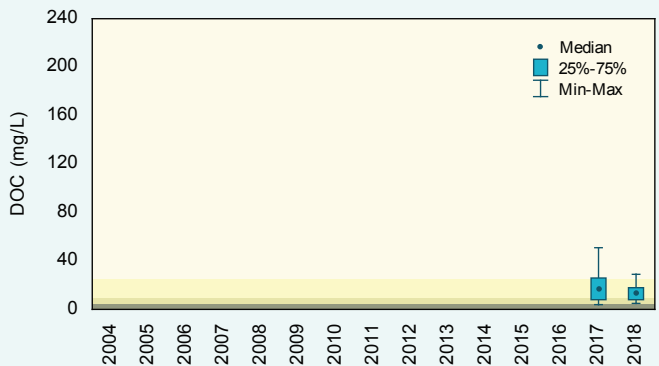
Concentrations

There were only two years with enough dissolved organic carbon (DOC) data to graph at the Samson North Drain sampling site. Using the Statewide River Water Quality Assessment (SWRWQA) bands, both annual medians were classified as high. Both years also had some samples that fell within the very high band.

Trends

It was not possible to calculate trends in DOC concentrations at the Samson North Drain site as there were only two years of data present. A minimum of five years of data are required to test for trends.

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Dissolved organic carbon concentrations, 2004–18 at site 613014. The shading refers to the SWRWQA classification bands.

very high high moderate low



Mcknoes Brook, a tributary of Samson North Drain on the Darling Scarp. The brook is in a largely natural state, December 2008.

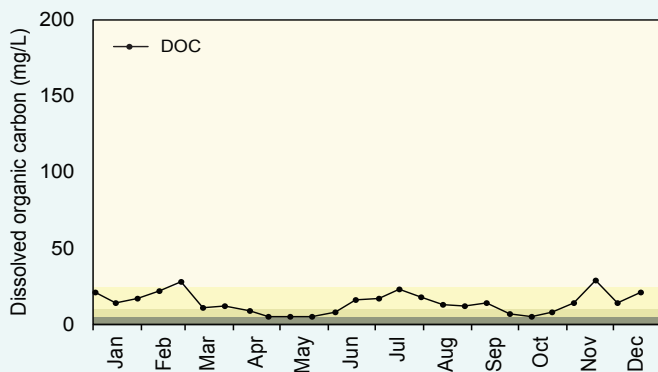
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Dissolved organic carbon (2018)

Concentrations

Dissolved organic carbon concentrations varied throughout the year at the Samson North Drain sampling site. There was a small peak in DOC concentrations in July, driven by the increase in rainfall and flow which flushed DOC into the drain from surrounding land use at this time. After the peak, concentrations fell then increased again later in the year. The reason for the peak in February is unknown. DOC was entering the Samson North Drain via surface and groundwater flows as well as coming from in-stream sources. DOC is sourced mainly from degrading plant and animal matter, including natural organic matter in soils and wetlands, with many wetlands on deep sands typically generating high DOC concentrations. It varies widely in its bioavailability.

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2018 total dissolved organic carbon concentrations at 613014. The shading refers to the SWRWQA classification bands.

very high high moderate low



Mcknoes Brook on the Darling Scarp. Note the dense fringing vegetation consisting of a mix of native species, February 2010.

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Total suspended solids over time (2004–18)

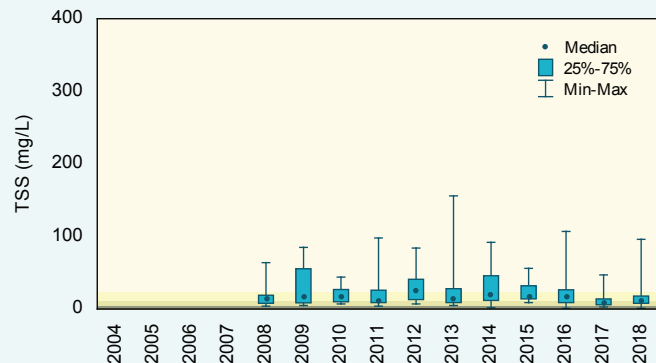
Concentrations

Total suspended solids (TSS) concentrations fluctuated over the reporting period at the Samson North Drain site. Using the SWRWQA bands, the annual medians were classified as high in most years, with the exception of 2012 (very high) and 2017–18 (moderate). All years had some samples that were classified as very high.

Trends

There was a short-term (2014–18) decreasing trend in TSS concentrations of 3 mg/L/yr. This may be because of natural fluctuations at this site or an actual decrease in TSS concentrations. Ongoing monitoring will help determine if the water quality is improving at this site. There was no long-term (2008–18) trend present.

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Total suspended solids concentrations, 2004–18 at site 613014. The shading refers to the SWRWQA classification bands.

very high high moderate low



Samson North Drain where it flows under Somers Road, September 2018.

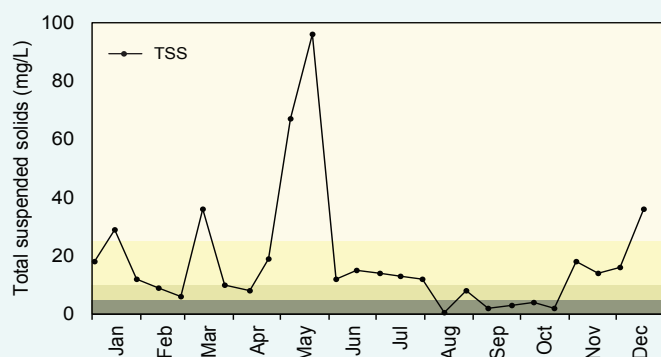
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Total suspended solids (2018)

Concentrations

There was not a clear seasonal pattern present in TSS concentrations at the Samson North Drain. Concentrations were generally lower from about June to October when rainfall and flow were at their highest, suggesting that surface runoff was not the main source of particulate matter at this site. There were a number of peaks in TSS concentrations, including a large one in May. These peaks may have been because of some kind of discharge into the drain upstream of the sampling site (though it is not possible to verify this) or stock accessing the drains for water. Another possibility is some kind of drain maintenance which disturbed the bed or banks, causing an increase in particulate matter in the water.

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2018 total suspended solids concentrations at 613014. The shading refers to the SWRWQA classification bands.

very high high moderate low



In vegetated catchments such as McKnoes Brook, the ash from bushfires can contribute significant amounts of nutrients and particulate matter to waterways, January 2016.

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pH over time (2004–18)

Levels

pH at the Samson North Drain sampling site fluctuated over the reporting period. The annual median was within the upper and lower ANZECC trigger values every year though some samples fell outside these values in a number of years.

Trends

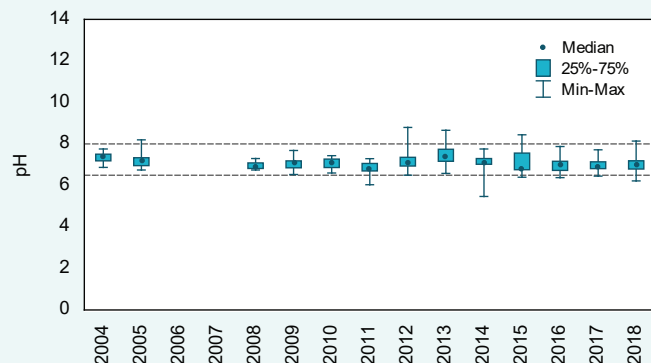
There was no trend in pH at Samson North Drain over either the short- (2014–18) or long-term (2008–18).

pH (2018)

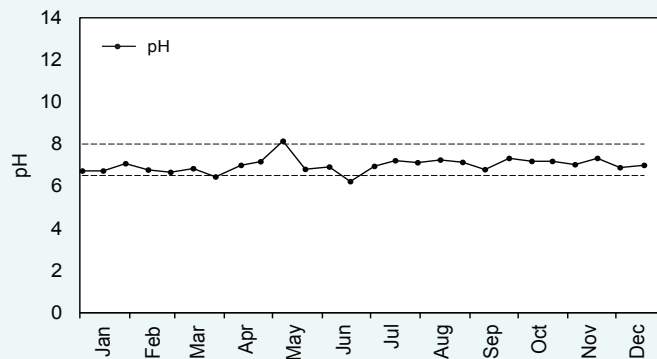
Levels

pH levels fluctuated during the year at the Samson North Drain sampling site. Most of the samples collected fell within the upper and lower ANZECC trigger values.

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pH levels, 2004–18 at site 613014. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels at 613014. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



There is a small area of viticulture a few kilometres upstream of the Samson North Drain sampling site, May 2020.

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Salinity over time (2004–18)

Concentrations

Salinity fluctuated over the reporting period at the Samson North Drain sampling site. However, almost all samples collected, and all annual medians, were classified as fresh using the SWRWQA classification bands.

Trends

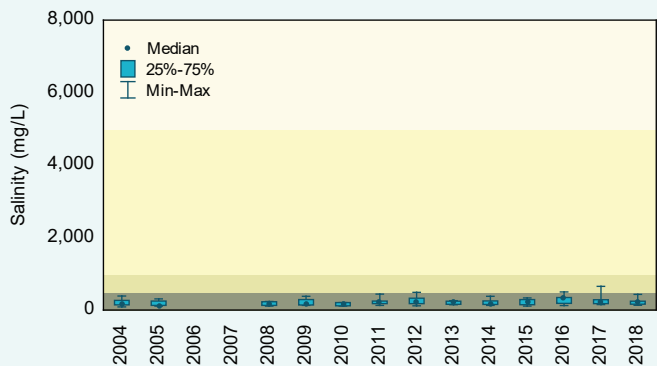
There was neither a short- (2014–18) or long-term (2008–18) trend in salinity at the Samson North Drain sampling site.

Salinity (2018)

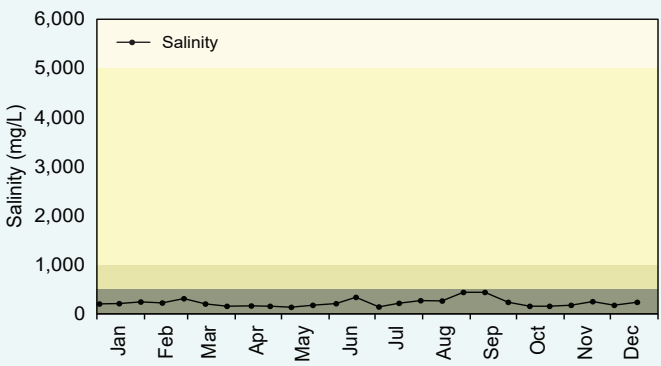
Concentrations

Salinity did not show a seasonal pattern at the Samson North Drain sampling site, with concentrations fluctuating through the year. All samples collected in 2018 were classified as fresh using the SWRWQA bands.

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Salinity concentrations, 2004–18 at site 613014. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at 613014. The shading refers to the SWRWQA classification bands.

saline brackish marginal fresh



Native Jarrah forest on the Darling Scarp in the Samson North Drain catchment, December 2010.

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

The Regional Estuaries Initiative partners with the Peel-Harvey Catchment Council to fund best-practice fertilisers, 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 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

Total phosphorus concentrations were compared with the Peel-Harvey WQIP target. This target represents the median winter concentration that is required for each of the subcatchments to meet their load reduction target. Where possible, other 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 DOC, 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.

