Wellesley River

This data report provides a summary of the nutrients at the two sampling sites in the Wellesley River catchment in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. The northern section of the Wellesley River has been converted into a drain, the Wellesley Diversion Drain, to remove water from agricultural land. Mangosteen Drain enters the Wellesley Diversion Drain from the north, downstream of the Hope Avenue sampling site. The Wellesley River discharges into the Brunswick River. 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

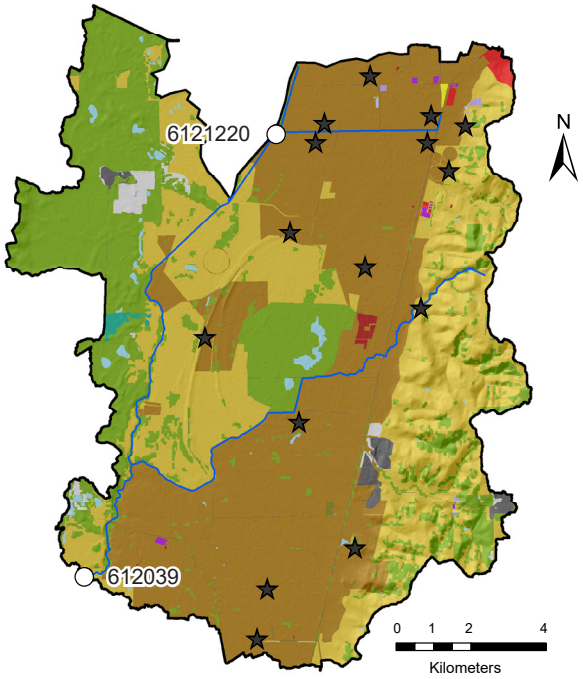
The Wellesley River has a catchment area of about 163 km^2, nearly three-quarters of which has been cleared for agriculture. Cattle grazing is the dominant land use and there are a number of dairy sheds present. The Harvey Irrigation district supplies the northern half of the catchment with irrigation water and the Collie River Irrigation District supplies the south. The Myalup State Forest lies along the west of the catchment and Benger Swamp Nature Reserve is in the centre of the catchment.

The phosphorus-binding capacity of soils in the catchment varies. Where soils bind phosphorus poorly, it can quickly move to waterways after it is applied. The lower section of the Wellesley River still retains fringing vegetation. However, further upstream the river has been de-snagged and straightened to improve drainage and there is little or no fringing vegetation left along this section or the other waterways in the catchment.

Water quality is measured at two sites: 612039 (Juegenup), on the Wellesley River where it passes under Devlin Road in Wellesley; and 6121220 (Hope Ave), on the Wellesley River Diversion Drain where it passes under Hope Avenue in Wokalup.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) were high at the Wellesley River sampling site and very high at the Wellesley Diversion Drain sampling site. The poor water quality at both sites can be attributed to the intensive agricultural land use in the catchment and the small amount of remnant vegetation.

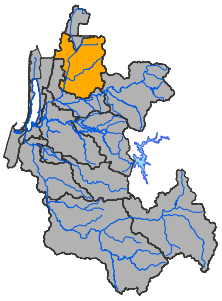


Legend

- Dairy sheds
- Sampling sites
- Waterways

Landuse

- Cleared not fertilised
- Native vegetation
- Grazing (Beef/dairy/mixed)
- Horticulture (annual)
- Horticulture (perennial)
- Industry, manufacturing and transport
- Intensive animal use
- Irrigated grazing (Beef/dairy)
- Orchards
- Plantation
- Point sources
- Urban
- Lifestyle blocks and horses
- Viticulture
- Water body



Location of Wellesley catchment in the greater Leschenault catchment.

Facts and figures

Sampling site code	612039 (Juegenup) and 6121220 (Hope Ave)
Catchment area	163 km^2
Per cent cleared area (2018)	73%
River flow	612039 flows year round whereas 6121220 ceases to flow over summer
Main land use (2018)	Cattle grazing and native vegetation

Wellesley River

Nitrogen over time (2004–18)

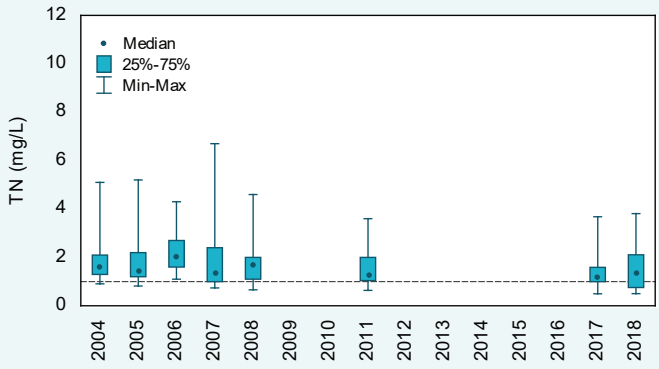
Concentrations

Total nitrogen (TN) concentrations were moderate to high at the Wellesley River site and high to very high at the Wellesley Diversion Drain site. Concentrations fluctuated over the reporting period; however, all annual medians at both sites were above the Leschenault Water Quality Improvement Plan (WQIP) TN target for lowland rivers. The annual ranges in TN samples were greater at the site on the Wellesley Diversion Drain and the annual medians at this site were also higher. This is likely driven by the land use in the catchment (there is very little native vegetation upstream of the Wellesley Diversion Drain site), and the fact that virtually all the waterways are drains.

Trends

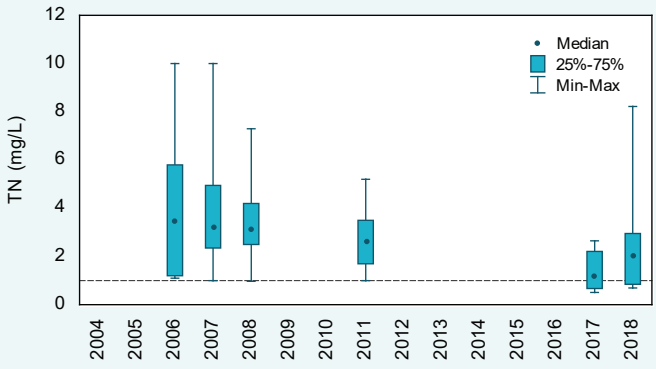
As both the Wellesley River sites were not sampled between 2012–16 it was not possible to test for trends at these sites. A minimum of five consecutive years of data are required to test for trends.

Wellesley River



Total nitrogen concentrations, 2004–18 at site 612039. The dashed line is the Leschenault WQIP target for lowland rivers.

Wellesley Diversion Drain



Total nitrogen concentrations, 2004–18 at site 6121220. The dashed line is the Leschenault WQIP target for lowland rivers.

The Wellesley Diversion Drain sampling site with low water levels, November 2018.

Wellesley River

Nitrogen (2018)

Types of nitrogen

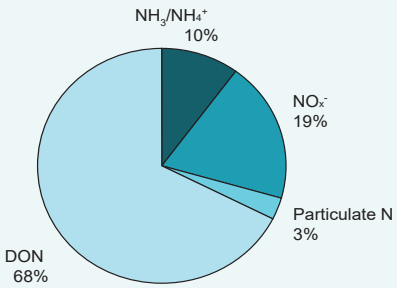
Total N is made up of many different forms of N. At both sites, about a quarter of the N was present as dissolved inorganic N (DIN – consisting of oxides of N, NO_x^-, and ammonia N, NH_3/NH_4^+). DIN is highly bioavailable and is likely sourced from animal wastes and fertilisers. Dissolved organic N (DON) made up the largest proportion of N at both sites. DON consists mainly of degrading plant and animal matter but may include other forms. DON varies in its bioavailability. Plant and animal matter usually needs to be further broken down before becoming available, whereas other forms of DON are readily bioavailable.

Concentrations

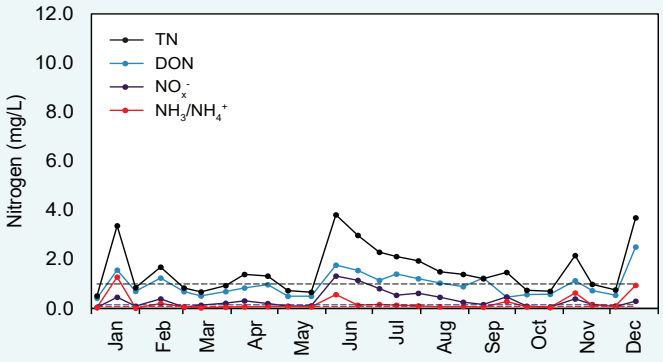
Nitrogen concentrations showed a seasonal response at both sites, being high in the middle of the year when rainfall and flow are at their highest. Both sites also had a number of peaks in N concentrations at other times of the year, not related to seasonal rainfall and flow. The reasons for these peaks are unclear but they may be related to discharge events upstream of the sampling sites, or irrigation returns. The peak in early December at the Wellesley Diversion Drain sampling site showed a very high NH_3/NH_4^+ concentration, possibly related to a discharge event because NH_3/NH_4^+ is usually converted to NO_x^- fairly quickly when there is adequate oxygen available in the water.

Where there are no data shown in the Wellesley Diversion Drain graph, the site was not flowing.

Wellesley River

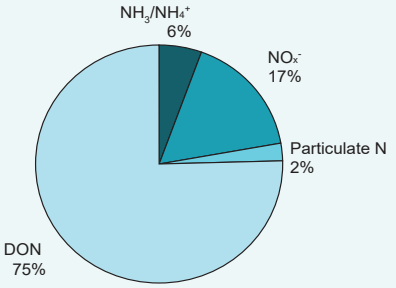


2018 average nitrogen fractions at site 612039.

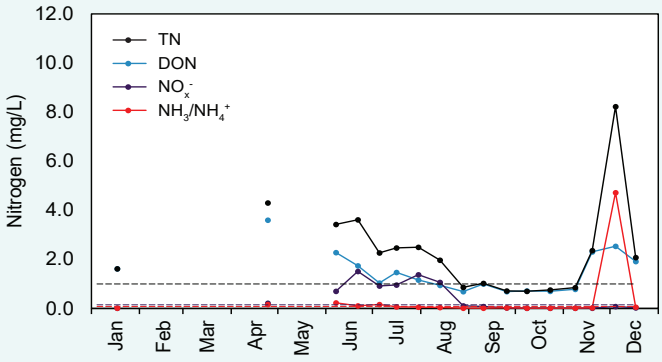


2018 nitrogen concentrations at 612039. The black dashed line is the Leschenault WQIP target for lowland rivers, the red and purple are the ANZECC trigger values for lowland rivers.

Wellesley Diversion Drain



2018 average nitrogen fractions at site 6121220.



2018 nitrogen concentrations at 6121220. The black dashed line is the Leschenault WQIP target for lowland rivers, the red and purple are the ANZECC trigger values for lowland rivers.

Wellesley River

Phosphorus over time (2004–18)

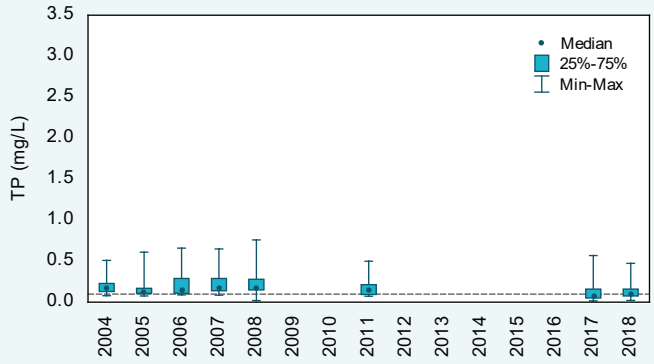
Concentrations

Total phosphorus (TP) concentrations were generally higher at the Wellesley Diversion Drain site than the Wellesley River sampling site. With the exception of 2017 at both sampling sites, all annual medians were above the Leschenault WQIP target for lowland rivers. The 2018 annual median (0.182 mg/L) at the Wellesley Diversion Drain site was the second highest of the 10 sites sampled in the Leschenault catchment. Only the site on Mangosteen Drain had a higher median (0.270 mg/L). The higher proportion of agricultural land use upstream of the Wellesley Diversion Drain site compared with the Wellesley River site is the likely cause of the higher TP concentrations.

Trends

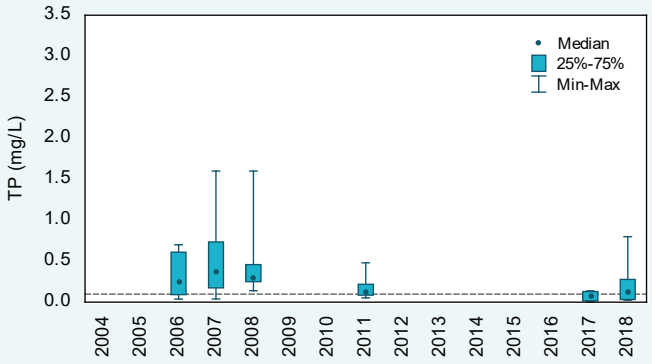
As both the Wellesley River sites were not sampled between 2012–16 it was not possible to test for trends at these sites. A minimum of five consecutive years of data are required to test for trends.

Wellesley River



Total phosphorus concentrations, 2004–18 at site 612039. The dashed line is the Leschenault WQIP target for lowland rivers.

Wellesley Diversion Drain



Total phosphorus concentrations, 2004–18 at site 6121220. The dashed line is the Leschenault WQIP target for lowland rivers.

The Wellesley River sampling site, November 2018.

Phosphorus (2018)

Types of phosphorus

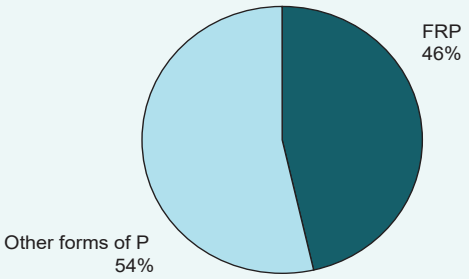
Total P is made up of different types of P. Filterable reactive P (FRP) is a form of P which is readily used by plants and algae to fuel growth and is typically derived from fertilisers, animal waste and natural sources. Because five of the 16 FRP samples collected at the Wellesley Diversion Drain site were below the limit of reporting (LOR), a pie chart was not constructed for this site. At the Wellesley River site, just under half of the P was present as highly bioavailable FRP. The remainder of the P was present as either particulate P, dissolved organic P (DOP) or both (shown as 'Other forms of P' in the charts below). Particulate P generally needs to be broken down before becoming bioavailable to algae. The bioavailability of DOP varies and is poorly understood.

Concentrations

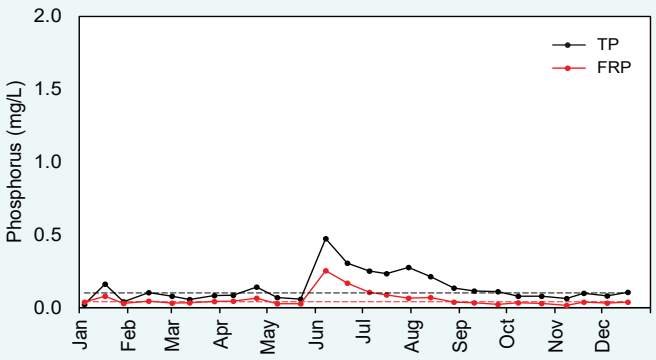
Both the Wellesley River and the Wellesley Diversion Drain sampling sites showed a seasonal pattern in P concentrations. TP and FRP peaked in early June at both sites when rainfall and flow increased, indicating that P was being washed into the waterways from upstream agricultural land use via surface flows. TP and FRP concentrations were also high in April at the Wellesley Diversion Drain site when unseasonal rains caused the drain to flow for a short period of time. This site also had a peak in TP concentrations later in the year, the reason for which is unclear. It is likely that much of the P at both these sites is coming from fertiliser and animal waste from agricultural land use in the catchment and that most of it is entering the streams via surface flows and irrigation runoff/returns.

Where there are no data shown in the Wellesley Diversion Drain graph, the site was not flowing.

Wellesley River

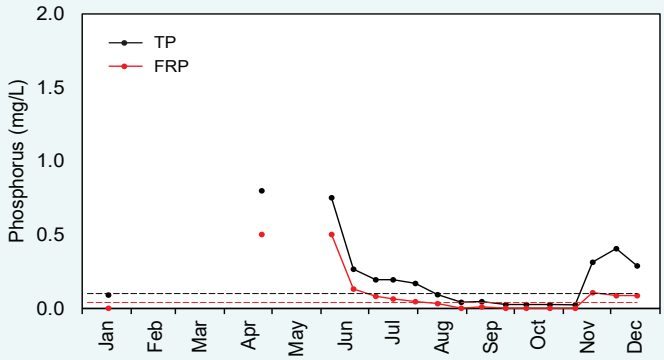


2018 average phosphorus fractions at site 612039.



2018 phosphorus concentrations at 612039. The black dashed line is the Leschenault WQIP target for lowland rivers, the red is the ANZECC trigger value for lowland rivers.

Wellesley Diversion Drain



2018 phosphorus concentrations at 6121220. The black dashed line is the Leschenault WQIP target for lowland rivers, the red is the ANZECC trigger value for lowland rivers.

Total suspended solids over time (2004–18)

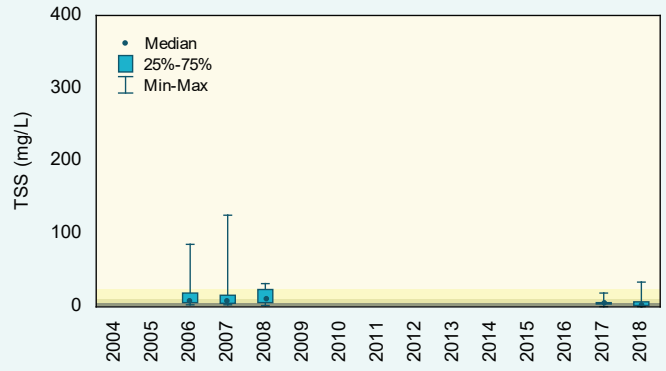
Concentrations

Total suspended solids (TSS) concentrations were higher at the Wellesley Diversion Drain site than the Wellesley River site. At both sites, concentrations were higher before the break in monitoring. At the Wellesley River site, all annual medians were classified as moderate using the SWRWQA classification bands, with the exception of 2018 which fell into the low band. At the Wellesley Diversion Drain site, the 2006–08 annual medians fell into the very high band whereas the 2017–18 medians were classified as moderate. The more intensive land use, higher proportion of drains and lack of fringing vegetation upstream of the Wellesley Diversion Drain site is the likely cause for the observed differences in TSS concentrations.

Trends

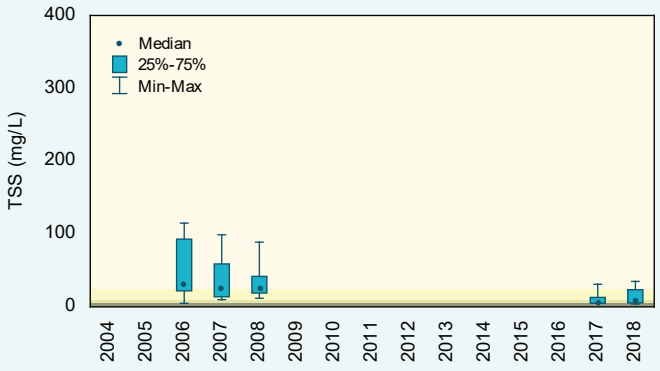
As both the Wellesley River sites were not sampled between 2009–16 it was not possible to test for trends at these sites. A minimum of five consecutive years of data are required to test for trends.

Wellesley River



Total suspended solids concentrations, 2004–18 at site 612039. The shading refers to the SWRWQA classification bands.

Wellesley Diversion Drain



Total suspended solids concentrations, 2004–18 at site 6121220. The shading refers to the SWRWQA classification bands.

very high high moderate low

Cattle grazing is one of the major land uses in the Wellesley catchment, January 2009.

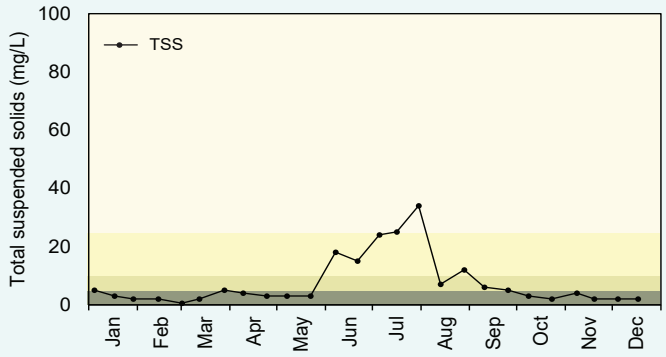
Total suspended solids (2018)

Concentrations

The Wellesley River sampling site showed a seasonal pattern in TSS concentrations in 2018. Concentrations increased in early June, coinciding with increased rainfall and flow before peaking in late July then dropping again in August. This suggests that most of the particulate matter at this site is sourced from surface flows and in-stream erosion. The Wellesley Diversion Drain site did not show a clear seasonal pattern, with TSS concentrations fluctuating over the year. It is likely that this is being driven by irrigation runoff/returns which likely make up a larger portion of the flow at this site compared with the Wellesley River site.

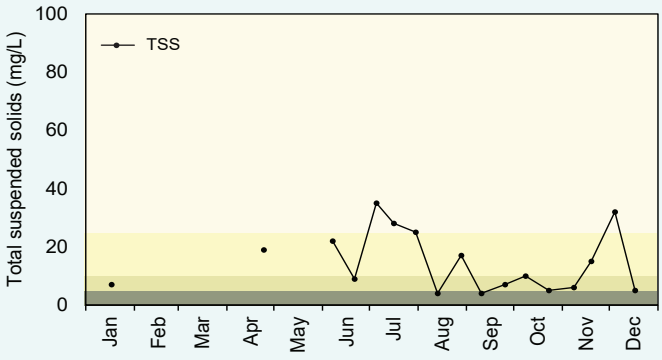
Where there are no data shown in the Wellesley Diversion Drain graph, the site was not flowing.

Wellesley River



2018 total suspended solids concentrations at 612039. The shading refers to the SWRWQA classification bands.

Wellesley Diversion Drain



2018 total suspended solids concentrations at 6121220. The shading refers to the SWRWQA classification bands.

very high high moderate low

Bank erosion is causing these trees to slowly tip over into the river. Fringing vegetation, including trees, help to stabilise the banks as the fringing vegetation is lost, erosion occurs more quickly, contributing particulate matter to the river, January 2009.

Wellesley River

pH over time (2004–18)

pH values

The two sites in the Wellesley River catchment had similar pH values. pH fluctuated over the reporting period, with all annual medians (at both sites) falling within the upper and lower ANZECC trigger values.

Trends

As both the Wellesley River sites were not sampled between 2014–16 it was not possible to test for trends at these sites. A minimum of five consecutive years of data are required to test for trends.

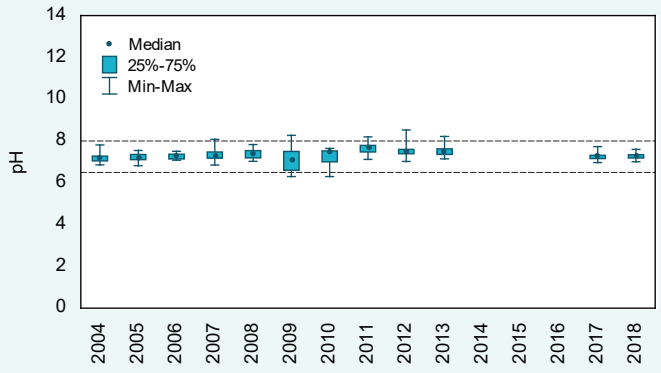
pH (2018)

pH values

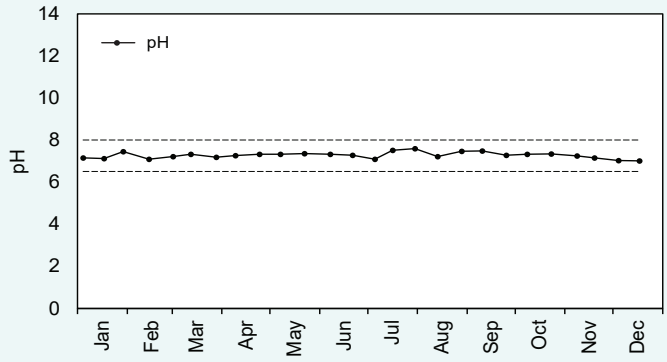
In 2018, there was no evidence of a seasonal pattern in pH values at either site in the Wellesley River catchment. All samples collected at the Wellesley River site fell within the upper and lower ANZECC trigger values whereas there was one sample, collected in late December, at the Wellesley Diversion Drain site that fell above the upper ANZECC trigger value.

Where there are no data shown in the Wellesley Diversion Drain graph, the site was not flowing.

Wellesley River

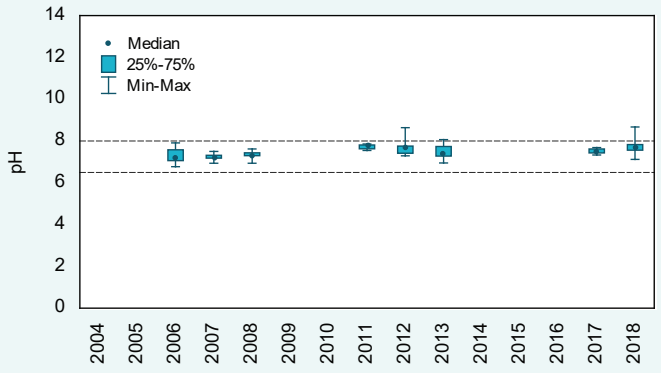


pH levels, 2004–18 at site 612039. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

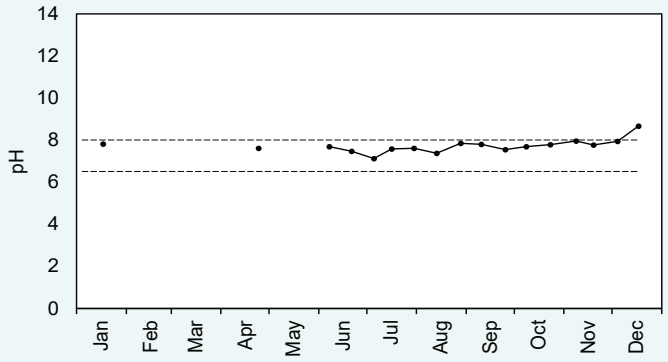


2018 pH levels at 612039. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Wellesley Diversion Drain



pH levels, 2004–18 at site 6121220. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels at 6121220. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Wellesley River

Salinity over time (2004–18)

Concentrations

The Wellesley River sampling site was more saline than the Wellesley Diversion Drain site. With the exception of 2004 which was classified as marginal, all annual medians at the Wellesley River site were classified as brackish using the SWRWQA bands. At the Wellesley Diversion Drain site, all annual medians were classified as fresh with the exception of 2018 which was marginal.

Trends

As both the Wellesley River sites were not sampled between 2014–16 it was not possible to test for trends at these sites. A minimum of five consecutive years of data are required to test for trends.

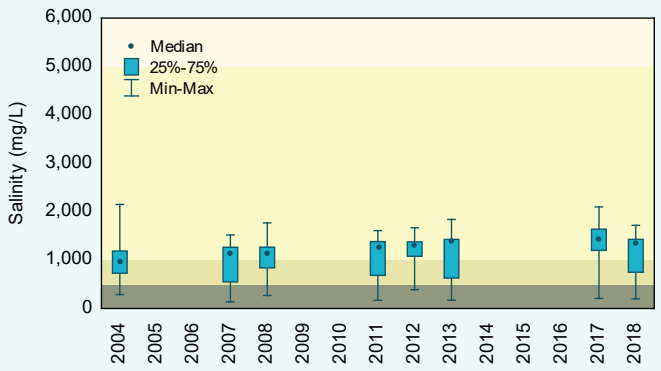
Salinity (2018)

Concentrations

Salinity at the Wellesley River site was highest at the beginning and end of the year and fell in June when rainfall and flow increased. This suggests that the groundwater is more saline than the surface water at this site. This pattern was not as evident at the Wellesley Diversion Drain site, which flowed only intermittently during the drier months. The reason for the large peak in salinity in early November at this site is unknown; it may be related to a discharge of more saline water into the drain somewhere upstream of the sampling site.

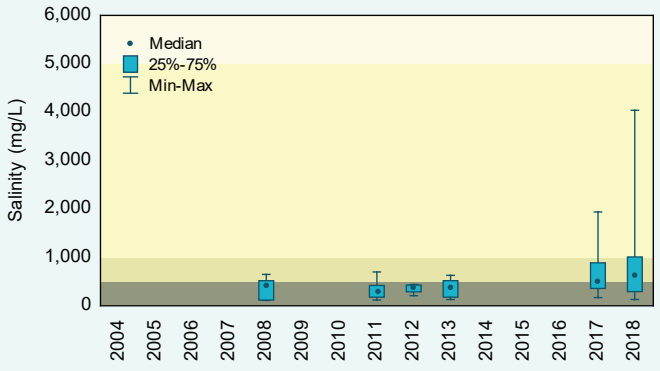
Where there are no data shown in the Wellesley Diversion Drain graph, the site was not flowing.

Wellesley River

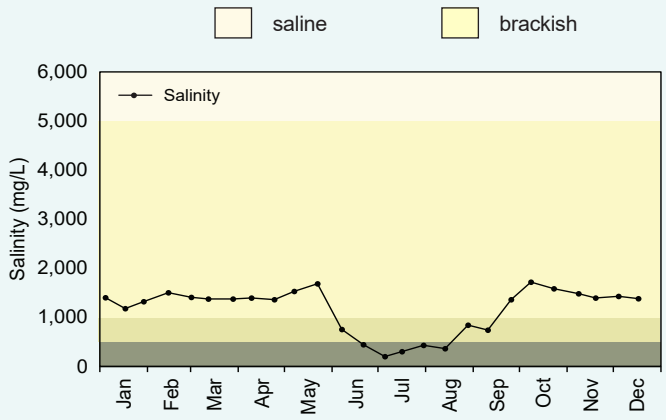


Salinity concentrations, 2004–18 at site 612039. The shading refers to the SWRWQA classification bands.

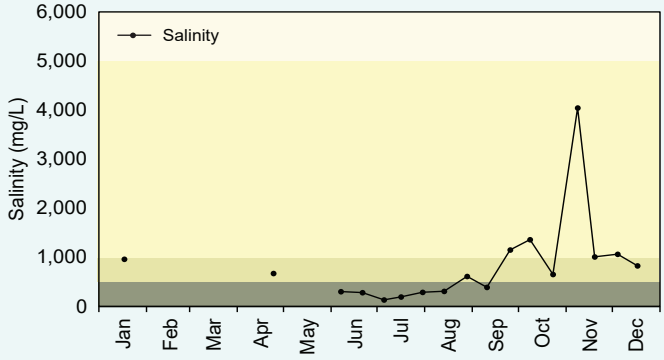
Wellesley Diversion Drain



Salinity concentrations, 2004–18 at site 6121220. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at 612039. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at 6121220. The shading refers to the SWRWQA classification bands.

Wellesley River

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 on 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 the Leschenault Estuary at estuaries.dwer.wa.gov.au/estuary/leschenault-estuary

The Regional Estuaries Initiative partners with the Leschenault Catchment Council 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 Leschenault Catchment Council go to www.leschenaultcc.org.au
- To find out more about the health of the rivers in the Leschenault Estuary Catchment go to rivers.dwer.wa.gov.au/assessments/results

Methods

Total phosphorus and total nitrogen concentrations were compared with the Leschenault Estuary WQIP targets. These targets represent the allowable annual median winter concentrations in both lowland (TN 1.0 mg/L, TP 0.1 mg/L) and upland (TN 0.45 mg/L, TP 0.02 mg/L) catchments. Sites were compared with the appropriate 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 represents the acceptable pH range. Where there were no ANZECC trigger values (for TSS and salinity), the SWRWQA classification bands were used to allow samples and sites to be classified and compared. For all parameters, the full year of data were used when comparing with targets, trigger values and classification bands.

Gaps in the data meant it was not possible to calculate trends for the Leschenault catchment sites. A minimum of five consecutive years of data are required.

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.

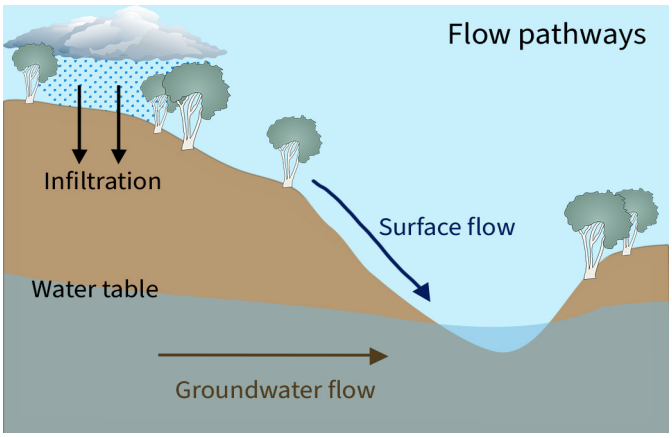
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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