Ferguson River

This data report provides a summary of the nutrients at the Ferguson River 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 river discharges into the Preston 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

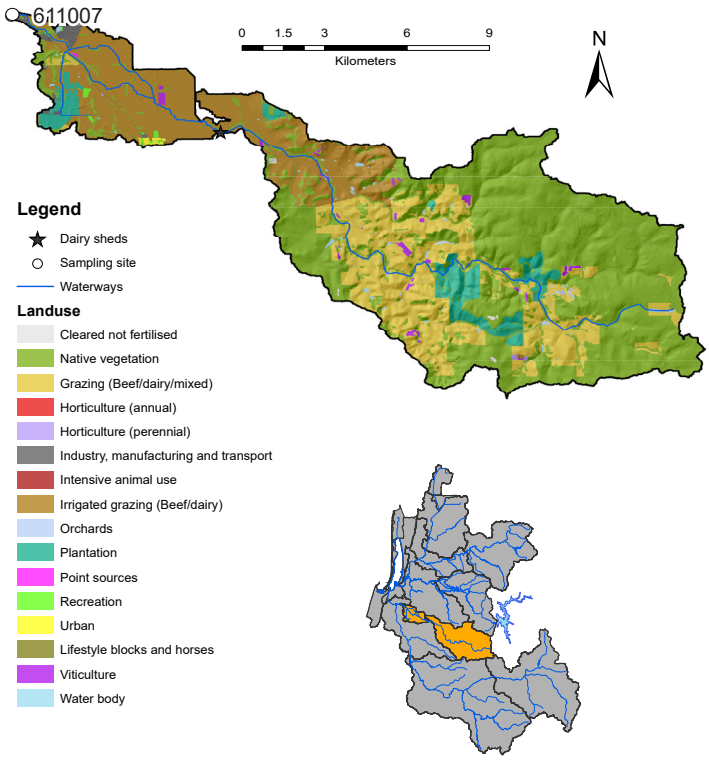
The Ferguson River has a catchment area of about 138 km^2, nearly half of which is covered by native vegetation. This vegetation is mostly present in the upper catchment, on the Darling Scarp and Plateau. Land use in the coastal plain portion of the catchment consists mostly of agriculture, predominantly beef and dairy cattle grazing with one dairy shed in the catchment. The Collie River Irrigation District lies, in part, on the coastal plain portion of the Ferguson River catchment and there is a discharge point into the Lower Ferguson River, just upstream of the sampling site.

Fringing vegetation has been lost or is badly degraded along much of the river and tributaries, especially on the coastal plain. Most of the catchment has soils with a high capacity to bind phosphorus applied to them, helping to reduce the amount entering waterways.

Water quality is measured at site 611007, South Western Highway Ferguson, near where the river passes under the Boyanup-Picton Road in Picton.

Results summary

Nutrient concentrations were low to moderate (total phosphorus) and moderate (total nitrogen). The proportion of nitrogen present in a bioavailable form was reasonably large, caused by the agricultural land use in the catchment and the highly modified nature of the river systems.



Location of Ferguson catchment in the greater Leschenault catchment.

Facts and figures

Sampling site code	611007
Catchment area	138 km^2
Per cent cleared area (2018)	48%
River flow	Permanent
Annual flow (2018)	24 GL
Main land use (2018)	Native vegetation and cattle grazing

Ferguson River

Nitrogen over time (2004–18)

Concentrations

Total nitrogen (TN) concentrations fluctuated over the reporting period at the Ferguson River sampling site. All annual medians (with the exception of 2005) were below the Leschenault Water Quality Improvement Plan (WQIP) TN target for lowland sites, though there were some samples over the target each year. TN concentrations were moderate to high. In 2018, the Ferguson River site had the fourth lowest TN concentration of the 10 sites sampled in the Leschenault catchment. Only the sites in the Middle and Upper Preston and the site in the Middle Collie River catchment had lower median TN concentrations.

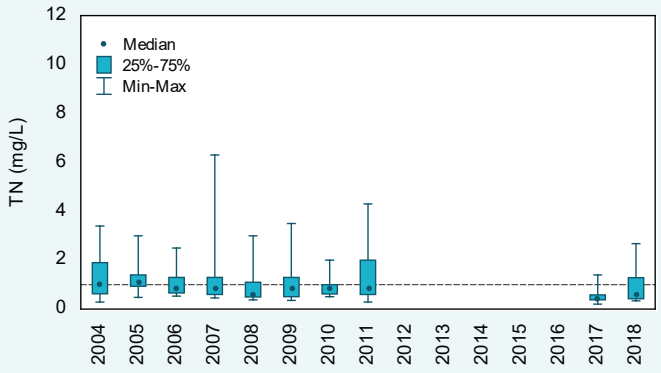
Trends

As the Ferguson River site was not sampled between 2012–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

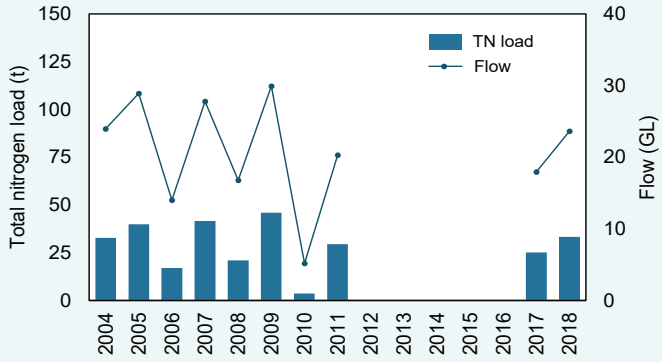
Estimated loads

The estimated TN loads at the Ferguson River sampling site were small to moderate compared with the other three sites with flow data in the Leschenault catchment. In 2018, the estimated TN load (33 t) was similar to the load at the Upper Preston River site (28 t) and the Middle Collie River site (27 t). Only the Middle Preston site had a larger TN load at 82 t. The load per unit area for the Ferguson River catchment was the largest of all the catchments at 241 kg/km^2. The Middle Collie River site had the next largest load per unit area of 206 kg/km^2. Annual TN loads were closely related to flow volumes; years with large annual flow volumes had large TN loads and vice versa.

Ferguson River



Total nitrogen concentrations, 2004–18 at site 611007, The dashed line is the Leschenault WQIP target for lowland rivers.



Total nitrogen loads and annual flow, 2004–18 at site 611007.

The weir at the Ferguson River sampling site, November 2018.

Nitrogen (2018)

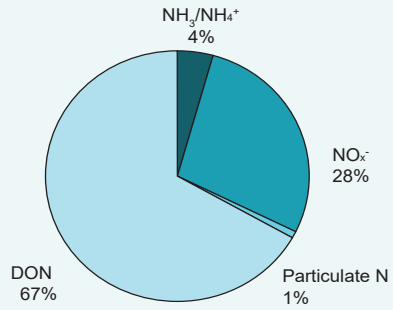
Types of nitrogen

Total N is made up of many different forms of N. At the Ferguson River sampling site, two-thirds of the N was present as dissolved organic N (DON). This form of N consists mainly of plant and animal matter but may include other bioavailable forms. About a third 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 readily bioavailable for plants and algae, fuelling rapid growth. DON varies in its bioavailability. Plant and animal matter usually needs to be further broken down before becoming bioavailable, whereas other forms of DON are readily bioavailable.

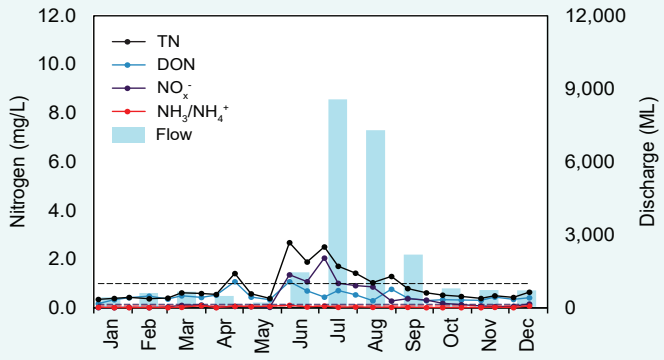
Concentrations

Total N, DON and NO_x^- all showed a seasonal response in 2018, increasing as rainfall and flow increased before decreasing again later in the year. The peak in June was likely because of a first-flush response where N was mobilised following heavy rainfall. Much of this N was probably the result of mineralisation of organic N in soils and drains over the summer period, and runoff of high-concentration waters from agricultural land where fertiliser and animal wastes build up over the summer. There was a second peak in TN and DON in April. The reason for this peak is unclear; it was not linked to a flow event. The pattern observed in N concentrations at this site suggest that most of the N was entering the river via surface flows, with groundwater and in-stream sources contributing proportionally less.

Ferguson River



2018 average nitrogen fractions at site 611007.



2018 nitrogen concentrations and monthly flow at 611007. The black dashed line is the Leschenault WQIP target for lowland rivers, the red and purple are the ANZECC trigger values for lowland rivers.

The Ferguson River near Dowdells Line in Henty, October 2009.

Phosphorus over time (2004–18)

Concentrations

Total phosphorus (TP) concentrations at the Ferguson River sampling site were low to moderate compared with the other sites in the Leschenault Catchment. While all annual median concentrations were below the WQIP TP target for lowland sites, most years had some samples over the target. The 2018 median concentration was the fourth lowest of the 10 sites sampled. Only the sites in the Middle and Upper Preston and the Middle Collie River catchments had lower 2018 median concentrations.

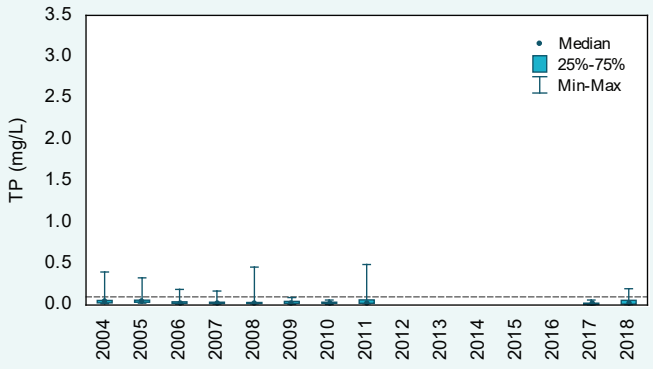
Trends

As the Ferguson River site was not sampled between 2012–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

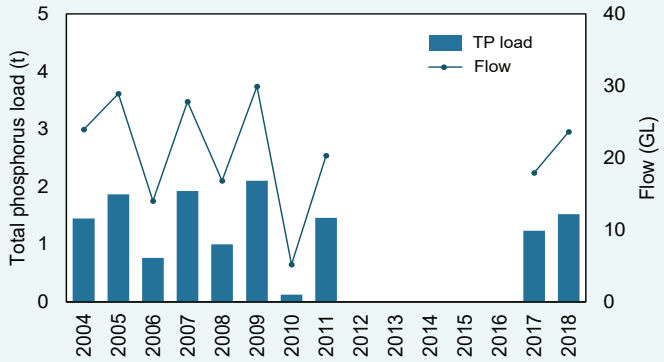
Estimated loads

The estimated TP load at the Ferguson River sampling site were moderate compared with the other three sites with flow data in the Leschenault catchment. In 2018, the Ferguson River site had the second largest TP load of 1.5 t. Only the Middle Preston River site had a larger load of 2.1 t. Loads were smaller at the Upper Preston River site (0.42 t) and the Middle Collie River site (0.57 t). The larger load at the Middle Preston River site was because of its larger flow volume (82 GL v 24 GL at the Ferguson River site in 2018). TP concentrations at the Ferguson River site were higher than the Middle Preston River site. In 2018 the load per unit area at the Ferguson River site was the largest of the Leschenault sites (11 kg/km^2). The Middle Collie River site had the next largest load per unit area (4.3 kg/km^2). Annual TP loads were closely related to flow volumes; years with large annual flow volumes had large TP loads and vice versa.

Ferguson River



Total phosphorus concentrations, 2004–18 at site 611007. The dashed line is the Leschenault WQIP target for lowland rivers.



Total phosphorus loads and annual flow, 2004–18 at site 611007.

A freshwater mussel (Westralunio carteri) collected from the Ferguson River in Henty. This species is listed as vulnerable and plays an important role as a filter feeder, October 2009.

Phosphorus (2018)

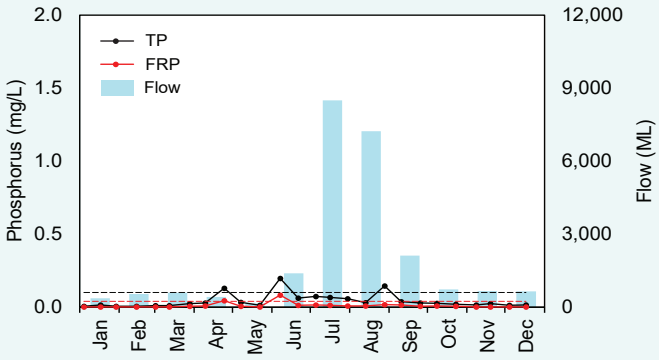
Types of phosphorus

Total P is made up of different forms of P. At the Ferguson River site, nine of the 26 filterable reactive phosphorus (FRP) samples were below the limit of reporting (0.005 mg/L) which is why a P fraction pie chart was not generated. FRP is a form of P which is readily used by plants and algae to fuel growth and is typicallys sourced from fertilisers, animal waste and natural sources.

Concentrations

Total P and FRP concentrations were low, below the WQIP lowland river TP target and the Australian and New Zealand Environment and Conservation Council (ANZECC) FRP trigger value for much of the year. As for N, there was a small spike in both TP and FRP concentrations in April. The reason for this spike is unclear (it was not linked to a flow event). A second spike in early June was probably because of a first-flush effect where P was mobilised following heavy rainfall. Much of this P was likely from fertilisers used on upstream agricultural land use. The reason for the peak in TP concentrations in late August is unknown, though it does coincide with a large peak in total suspended solids (TSS) concentrations. Flow also increased on this day, suggesting that it may be because of particulate matter washed into the river, or in-stream erosion which may be exacerbated by livestock access to the river. Surface runoff and in-stream sources were likely the major sources of P, with groundwater contributing proportionally less.

Ferguson River



2018 phosphorus concentrations and monthly flow at 611007. The black dashed line is the Leschenault WQIP target for lowland rivers, the red is the ANZECC trigger value for lowland rivers.

Farmland along the edge of the Ferguson River in Henty, October 2009.

Total suspended solids over time (2004–18)

Concentrations

Using the Statewide River Water Quality Assessment (SWRWQA) classification bands, the annual median total suspended solid concentration (TSS) was classified as low for each year where there were sufficient data to graph. The range in TSS concentrations appears to have reduced over the break in sampling from 2010–16. Compared with the other sites in the Leschenault catchment, TSS concentrations at the Ferguson River sampling site were low to moderate. The 2018 annual median concentration was the third lowest at 2 mg/L, which was the same as recorded at the Middle Collie River site (only the two sites on the Preston River had lower median concentrations).

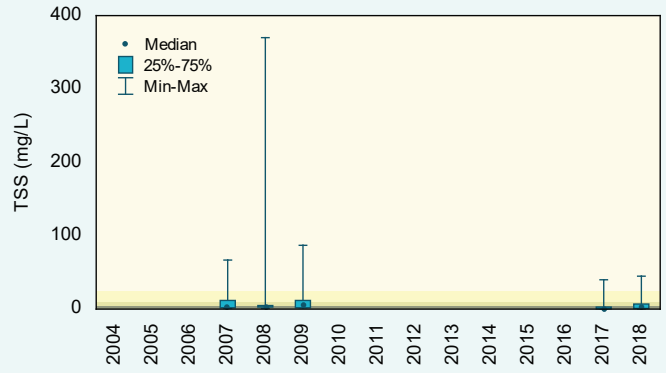
Trends

As the Ferguson River site was not sampled between 2010–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

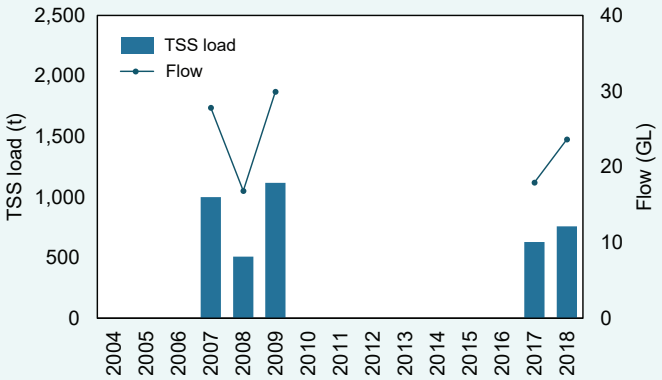
Estimated loads

The estimated TSS loads at the Ferguson River site were moderate compared with the other three sites in the Leschenault Catchment with flow data. In 2018, the TSS load was 759 t, the second highest behind the Middle Preston River site (1290 t). Both the Upper Preston River (91 t) and the Middle Collie River (144 t) sites had much smaller loads. The load per unit area at the Ferguson River site was large (5,492 kg/km^2), the largest of the Leschenault sites. The Middle Preston River site had the next largest load per unit area of 1,598 kg/km^2. Annual TSS loads were closely related to flow volumes; years with high annual flow had large TSS loads and vice versa.

Ferguson River



Total suspended solids concentrations, 2004–18 at site 611007. The shading refers to the SWRWQA classification bands.



Total suspended solids loads and annual flow, 2004–18 at site 611007.

very high high moderate low

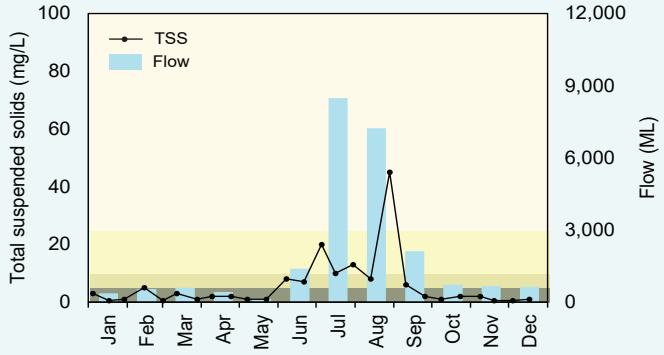
The Ferguson River in Henty. The fringing vegetation has been replaced by exotic grasses, October 2009.

Total suspended solids (2018)

Concentrations

In 2018, TSS concentrations showed a seasonal pattern at the Ferguson River sampling site, increasing in June as rainfall and flow increased before reducing again as rainfall and flow eased in September. The reason for the peak in late August is unknown. As mentioned for TP, the peak does coincide with an increase in flow so may be because of particulate matter being washed into the river or in-stream erosion (which can be exacerbated by stock access to the river). Most of the TSS at this site was likely coming from surface runoff and in-stream erosion.

Ferguson River



2018 total suspended solids concentrations and monthly flow at 611007. The shading refers to the SWRWQA classification bands.

very high | high | moderate | low

Erosion along the bank of the Ferguson River in Henty, October 2009.

Ferguson River

pH over time (2004–18)

pH values

pH values at the Ferguson River sampling site fluctuated over the reporting period. All annual median concentrations fell between the upper and lower ANZECC trigger values though there were samples that fell outside the trigger values in some years.

Trends

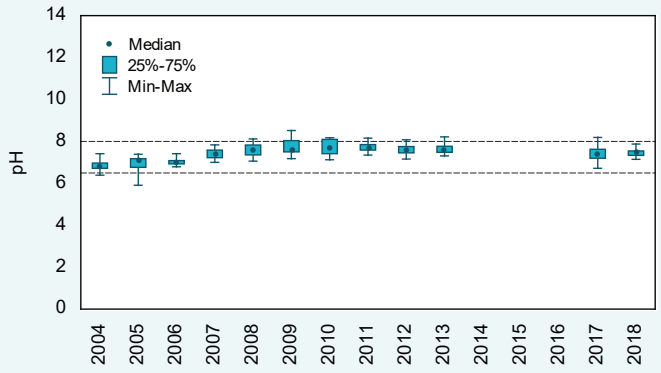
As the Ferguson River site was not sampled between 2014–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

pH (2018)

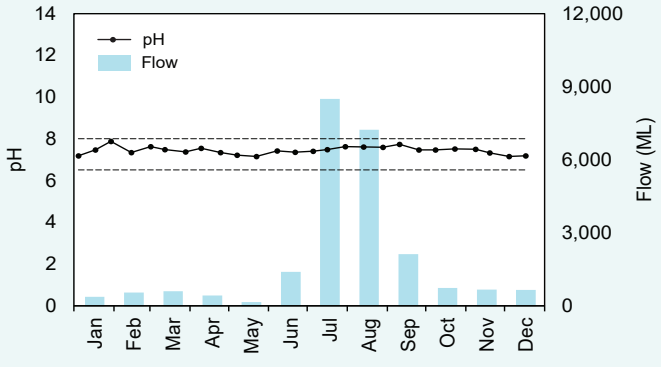
pH values

There was no clear evidence of a seasonal pattern in pH at the Ferguson River sampling site, with values fluctuating in 2018. All samples collected fell within the upper and lower ANZECC trigger values.

Ferguson River



pH levels, 2004–18 at site 611007. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels and monthly flow at 611007. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Conducting a river health assessment on the Ferguson River in Henty. The fyke net is used to catch fish and crayfish, October 2009.

Ferguson River

Salinity over time (2004–18)

Concentrations

The annual median salinity fluctuated over the reporting period; however, the annual range in salinity remained fairly constant. Most annual medians were classified as marginal using the SWRWQA classification bands though some were fresh (2008 and 2009) and some brackish (2004, 2011 and 2017).

Trends

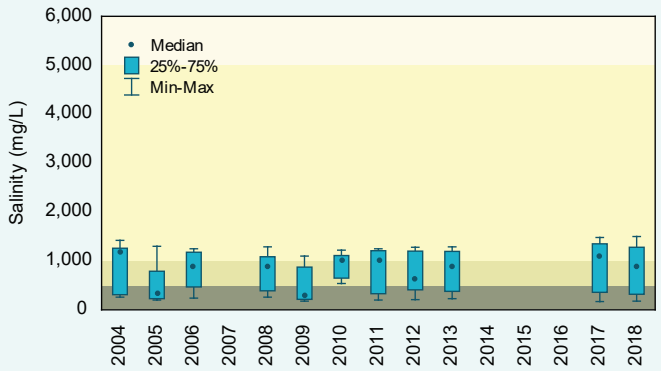
As the Ferguson River site was not sampled between 2014–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

Salinity (2018)

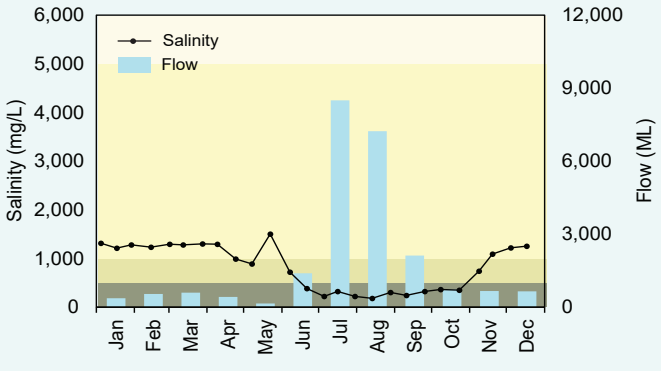
Concentrations

Salinity showed an inverse relationship to flow at the Ferguson River sampling site. Salinity was relatively low from mid-June to October when rainfall and flow were at their greatest, with all samples classified as fresh using the SWRWQA bands. Early and late in the year, however, salinity was higher and classified as marginal or brackish. At these times, most of the water in the river was either groundwater or irrigation returns, suggesting that either (or both) of these sources are more saline than the surface water runoff. Evapoconcentration may also be playing a role, with salinity increasing as water levels drop.

Ferguson River



Salinity concentrations, 2004–18 at site 611007. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations and monthly flow at 611007. The shading refers to the SWRWQA classification bands.

saline brackish marginal fresh

A small froglet of the Crinia genus, found in the Ferguson River in Henty, October 2009.

Ferguson 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 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.

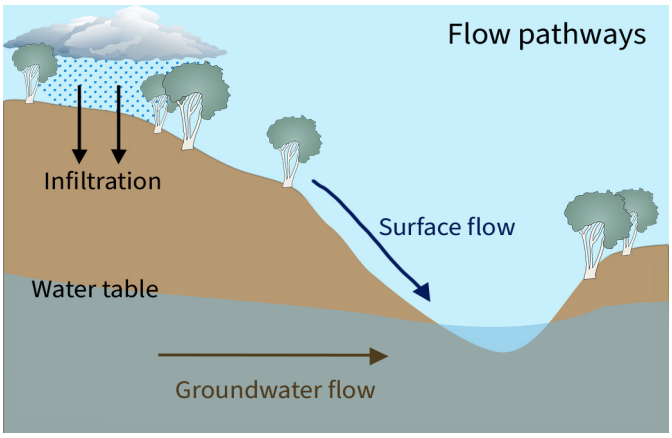
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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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