Chapman Brook

This data report provides a summary of the nutrients at the Chapman Brook 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, Chapman Brook discharges into the Blackwood River and, subsequently, the Hardy Inlet. 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

Chapman Brook has a catchment area of about 187 km^2, just over half of which is covered in native vegetation. The other major land use is beef and sheep grazing, which covers nearly a quarter of the catchment. There are two major watercourses: the Upper Chapman Brook which drains the northern part of the catchment; and Chapman Brook which drains the western portion of the catchment. These combine a few kilometres upstream of the sampling site. The brook enters the Blackwood River in Forest Grove, just downstream of the Warner Glen Campsite.

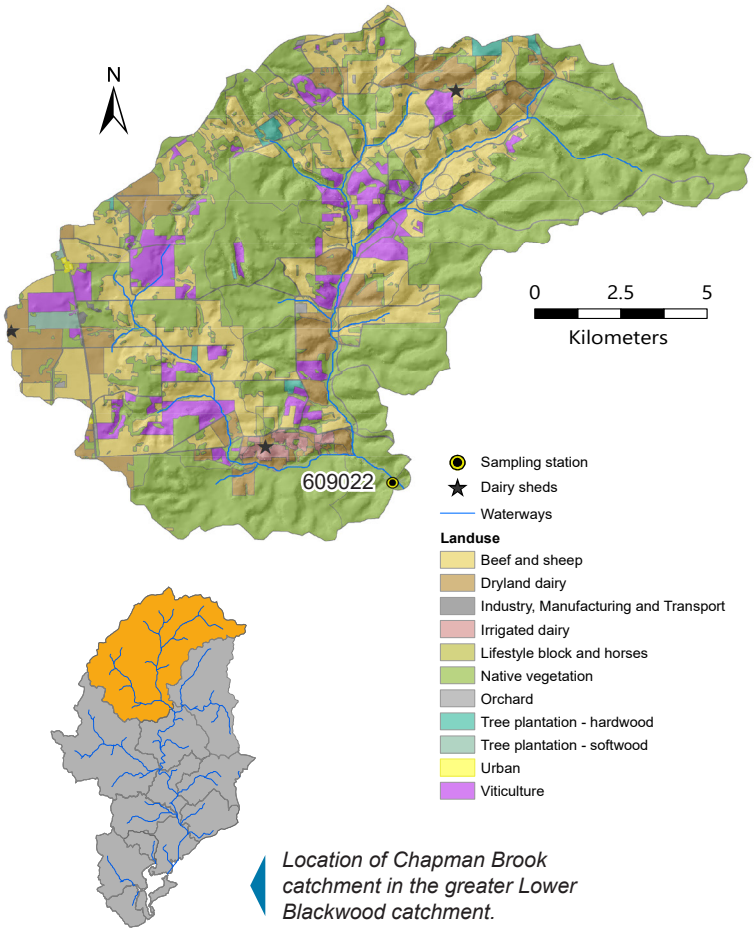
While fringing vegetation is still present along much of the Upper Chapman Brook, and sections of Chapman Brook, it has been cleared from many of their tributaries and a number of these tributaries also have dams on them.

Most of the soils in the catchment have a high phosphorus-binding capacity and so bind most of the phosphorus applied to them, reducing the amount that enters streams.

Water quality is measured at site 609022, White Elephant Bridge, close to Warner Glen Road.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) in the Chapman Brook catchment were low. This can be attributed to the relatively large amount of native vegetation remaining in the catchment, including fringing vegetation along the banks, and the high P-binding capacity of the soils found in the catchment.



Location of Chapman Brook catchment in the greater Lower Blackwood catchment.

Facts and figures

Sampling site code	609022
Rainfall at Alexandra Bridge (2018)	933 mm
Catchment area	187 km^2
Per cent cleared area (2001)	44 per cent
River flow	Ephemeral, dries over summer
Annual flow (2018)	42.9 GL
Main land use (2001)	Native vegetation and beef and sheep grazing

Chapman Brook

Nitrogen over time (2004–18)

Concentrations

Total nitrogen (TN) concentrations were low compared with the other sites sampled in the Blackwood River catchment. The median TN concentrations were below the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value in all three years in which there were sufficient data to graph. Over this same time period, there was only one sample (collected in 2018) that was greater than the ANZECC trigger value.

Trends

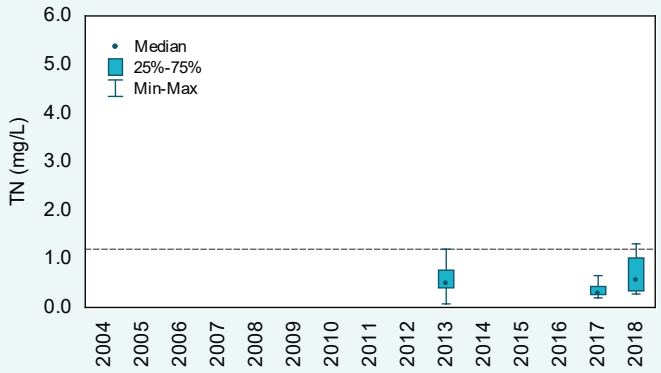
As Chapman Brook was only sampled sporadically over the past 15 years, it was not possible to calculate trends in TN concentrations at this site. A minimum of five years of data are required to test for trends.

Estimated loads

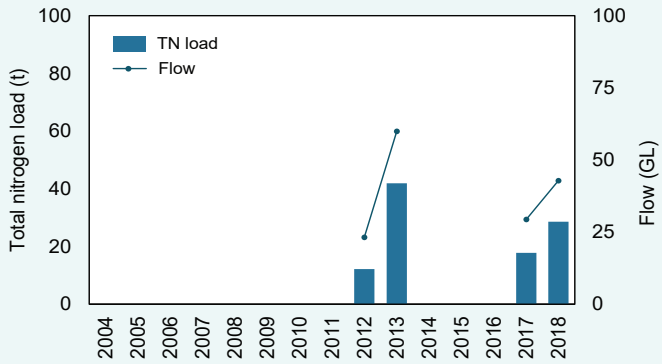
In 2018, the estimated TN load at the Chapman Brook sampling site was 28 t, and the load per unit area was 153 kg/km^2. Chapman Brook was one of only two sites in the Lower Blackwood catchment with flow data, the other being at Hut Pool, which is on the Blackwood River itself. No comparisons have been made between the two sites because of the very different size and nature of their two catchments.

Annual TN loads were closely related to flow volumes; years with large annual flow volumes had large TN loads and vice versa.

Chapman Brook



Total nitrogen concentrations, 2004–18 at site 609022. The dashed line is the ANZECC trigger value for lowland rivers.



Total nitrogen loads and annual flow, 2004–18 at site 609022.

Chapman Brook near the sampling site. Note the natural fringing vegetation along the banks, February 2019.

Chapman Brook

Nitrogen (2018)

Types of nitrogen

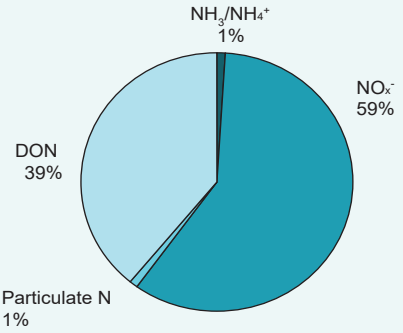
Total N is made up of many different types of N. In Chapman Brook, nearly two-thirds of the N was present as oxides of nitrogen (NO_x^-) which is sourced mainly from animal wastes and fertilisers. This form of N is readily bioavailable for plants and algae to use to fuel rapid growth. High proportions of NO_x^- are commonly seen in agricultural catchments. The other form of N that was present in a high percentage was dissolved organic N (DON). This type of N consists mainly of 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

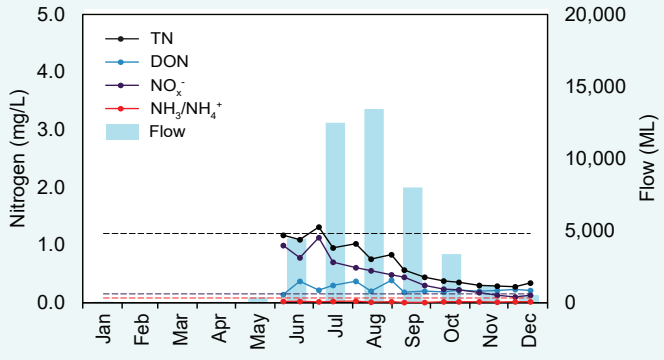
Total N, NO_x^- and, to a lesser extent, DON all showed a first-flush response where N was mobilised following heavy rainfall. Much of this N was probably the results of mineralisation of organic N in soils and streams over the summer period, and runoff of high-concentration water from agricultural land, which builds up with fertilisers and animal waste (in grazing areas) over the summer. While TN concentrations were generally low, NO_x^- concentrations were high. Only three of the 15 samples had a NO_x^- value below the ANZECC trigger value, all collected near the end of the year.

Where there are no data shown on the graph, the brook was not flowing.

Chapman Brook



2018 average nitrogen fractions at site 609022.



2018 nitrogen concentrations and monthly flow at 609022. The dashed lines are the ANZECC trigger values for lowland rivers for the different N species.

Fishing for marron is a popular recreation activity near the Chapman Brook sampling site, January 2018.

Chapman Brook

Phosphorus over time (2004–18)

Concentrations

Total phosphorus (TP) concentrations in Chapman Brook were low compared with the other sites in the Blackwood River catchment. All samples collected were below the ANZECC trigger value. The site had one of the lowest 2018 median TP concentration of the nine sites monitored in the Blackwood River catchment. The high P-binding capacity of the soils in the catchment contribute to the lower P concentrations as they tend to bind P, reducing the amount that enters the waterways.

Trends

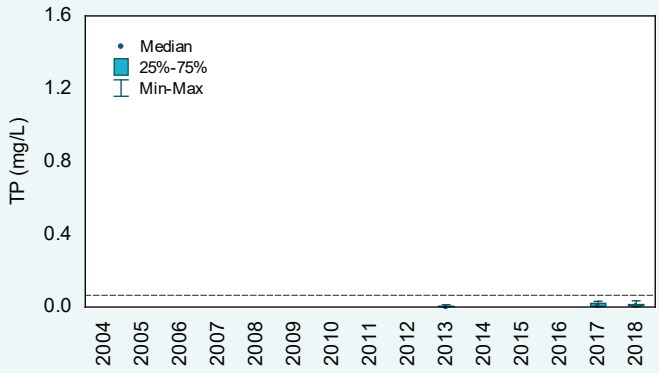
As Chapman Brook was only sampled sporadically over the past 15 years, it was not possible to calculate trends in TP concentrations at this site. A minimum of five years of data are required to test for trends.

Estimated loads

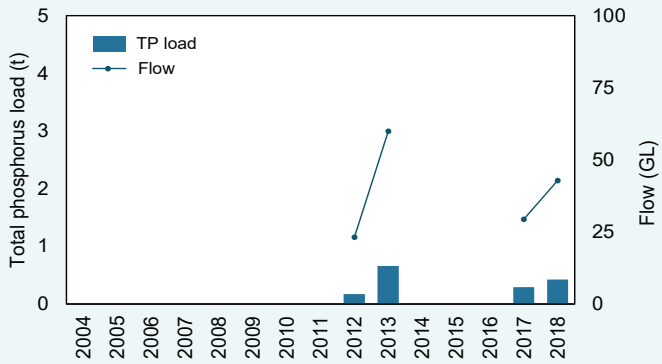
In 2018, the estimated TP load at the Chapman Brook sampling site was 0.42 t and the load per unit area was 2.3 kg/km^2. Chapman Brook was one of only two sites in the Lower Blackwood catchment with flow data, the other being at Hut Pool, which is on the Blackwood River itself. No comparisons have been made between the two sites because of the very different size and nature of their two catchments.

Annual TP loads were closely related to flow volumes; years with large annual flow volumes had large TP loads and vice versa.

Chapman Brook



Total phosphorus concentrations, 2004–18 at site 609022. The dashed line is the ANZECC trigger value for lowland rivers.



Total phosphorus loads and annual flow, 2004–18 at site 609022.

Dense fringing vegetation at the Chapman Brook sampling site, December 2018.

Chapman Brook

Phosphorus (2018)

Types of phosphorus

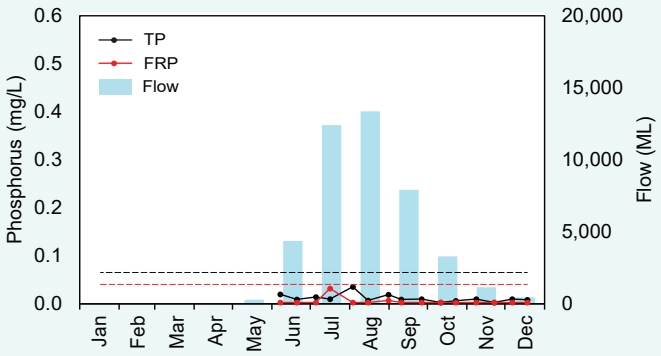
Total P is made up of different types of P. Because a large number of samples were below the laboratory limit of reporting in 2018, phosphorus fraction pie charts were not generated for the Chapman Brook site. At this site, two of the 15 TP samples and 13 of the 15 filterable reactive phosphorus (FRP) samples were below their limit of reporting (0.005 mg/L in each case). The high P-binding capacity of the soils present in this catchment contributed to the low P concentrations.

Concentrations

Total P and FRP both showed a slight seasonal response, being marginally higher during the middle of the year when rainfall and flow were highest. This suggests most of the P was entering Chapman Brook from surface flows as well as in-stream sources such as erosion, with groundwater contributing proportionally less P. However, concentrations were low year-round, with all samples below their respective ANZECC trigger values.

Where there are no data shown on the graph, the brook was not flowing.

Chapman Brook



2018 phosphorus concentrations and monthly flow at 609022. The dashed lines are the ANZECC trigger values for lowland rivers for the different P species.

Collecting a water quality sample at the Chapman Brook sampling site, September 2018.

Chapman Brook

Total suspended solids over time (2004–18)

Concentrations

Compared with the other sites sampled in the Blackwood River catchment, TSS concentrations were low in Chapman Brook. Using the Statewide River Water Quality Assessment (SWRWQA) bands, most of the samples collected in the three years in which there were sufficient data to graph were classified as low. In 2018, the median was 0.5 mg/L, the equal lowest with West Bay and McLeod creeks.

Trends

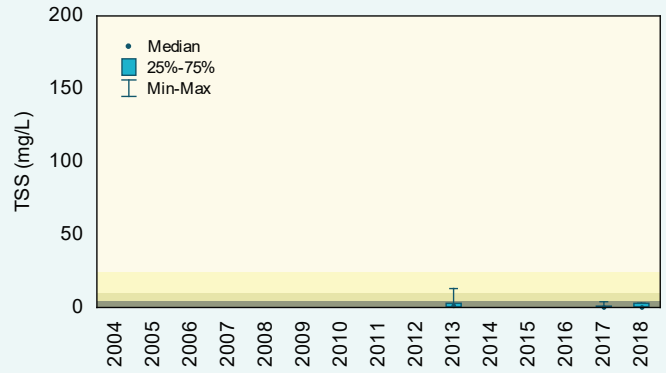
As Chapman Brook was only sampled sporadically over the past 15 years, it was not possible to calculate trends in TSS concentrations at this site. A minimum of five years of data are required to test for trends.

Estimated loads

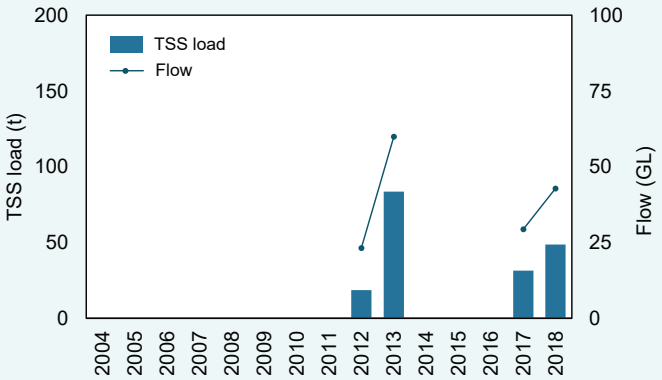
In 2018, the estimated TSS loads at the Chapman Brook sampling site was 49 t and the load per unit area was 260 kg/km^2. Chapman Brook was one of only two sites in the Lower Blackwood catchment with flow data, the other being at Hut Pool, which is on the Blackwood River itself. No comparisons have been made between the two sites because of the very different size and nature of their two catchments.

Annual TSS loads were closely related to flow volumes; years with higher annual flow had larger TSS loads and vice versa.

Chapman Brook



Total suspended solids concentrations, 2004–18 at site 609022. The shading refers to the SWRWQA classification bands.



Total suspended solids loads and annual flow, 2004–18 at site 609022.

very high high moderate low

Canoeing on the Blackwood River, close to the Warner Glen campsite, September 2019.

Chapman Brook

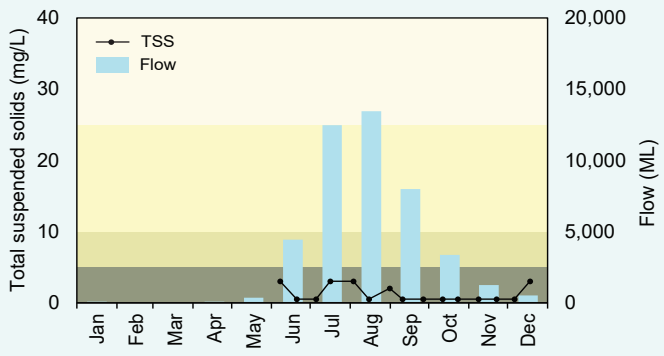
Total suspended solids (2018)

Concentrations

In 2018, all TSS samples were classified as low using the SWRWQA bands. There was no evidence of a seasonal pattern in TSS, with concentrations fluctuating through the year. Ten of the 15 samples collected were below the laboratory limit of reporting (1 mg/L).

Where there are no data shown on the graph, the brook was not flowing.

Chapman Brook



2018 total suspended solids concentrations and monthly flow at 609022. The shading refers to the SWRWQA classification bands.

very high high moderate low

Collecting water quality samples at the Chapman Brook sampling site, May 2019.

Chapman Brook

pH over time (2004–18)

pH values

In Chapman Brook, pH values were slightly alkaline, with some samples over the upper ANZECC trigger value each year for which there were sufficient data to graph. In 2018, the median pH was above the upper ANZECC trigger value and was the highest of the nine sites sampled in the Blackwood River catchment. It is unclear whether the higher pH in 2018 was because of an increase in pH at the site or just part of natural fluctuations. Future monitoring will help determine this.

Trends

As Chapman Brook was only sampled sporadically over the past 15 years, it was not possible to calculate trends in pH at this site. A minimum of five years of data are required to test for trends.

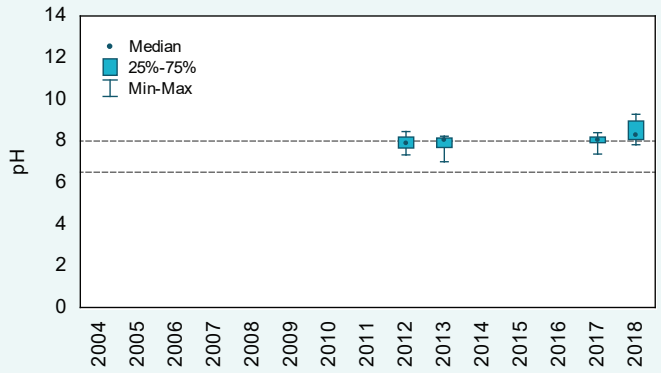
pH (2018)

pH values

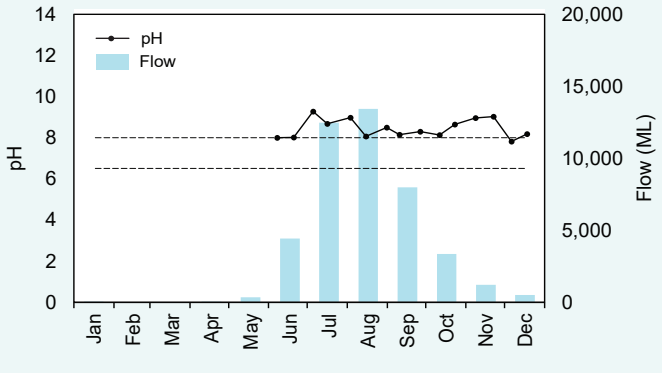
pH levels fluctuated over the year in Chapman Brook with no clear seasonal pattern. pH was above the upper ANZECC guideline on 13 of the 15 sampling occasions.

Where there are no data shown on the graph, the brook was not flowing.

Chapman Brook



pH levels, 2004–18 at site 609022. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels and monthly flow at 609022. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Sampling at the Chapman Brook sampling site, June 2019.

Chapman Brook

Salinity over time (2004–18)

Concentrations

Salinity was low in Chapman Brook compared with the other sites sampled in the Blackwood River catchment. Using the SWRWQA bands, the annual median was classified as low in each year where there were data.

Trends

As Chapman Brook was only sampled sporadically over the past 15 years, it was not possible to calculate trends in salinity concentrations at this site. A minimum of five years of data are required to test for trends.

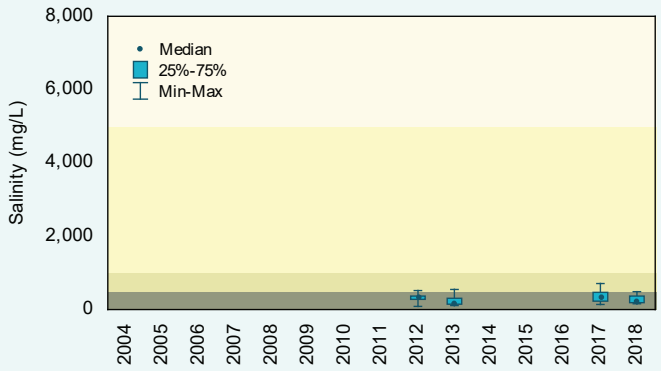
Salinity (2018)

Concentrations

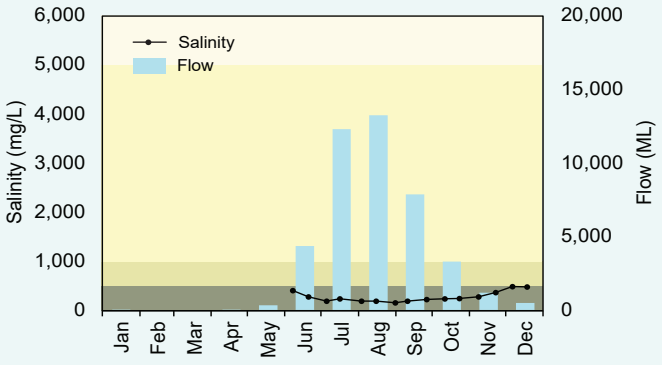
Salinity showed a slight inverse relationship with flow in Chapman Brook. Concentrations were marginally higher at the start and end of the flow year when water levels were lower and the proportion of groundwater in the brook was higher. All 2018 samples fell into the low band of the SWRWQA.

Where there are no data shown on the graph, the brook was not flowing.

Chapman Brook



Salinity concentrations, 2004–18 at site 609022. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations and monthly flow at 609022. The shading refers to the SWRWQA classification bands.

saline brackish marginal fresh

Black bream at the Chapman Brook sampling site, April 2019. At this time, the water at the site is from the Blackwood River. Chapman Brook stops flowing over summer.

Chapman Brook

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 Hardy Inlet at estuaries.dwer.wa.gov.au/estuary/hardy-inlet/

The Regional Estuaries Initiative partners with the Lower Blackwood Land Conservation District Committee (Lower Blackwood LCDC) 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 Lower Blackwood LCDC go to lowerblackwood.com.au
- To find out more about the health of the rivers in the Hardy Inlet catchment go to rivers.dwer.wa.gov.au/assessments/results

Methods

Where possible, 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 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.

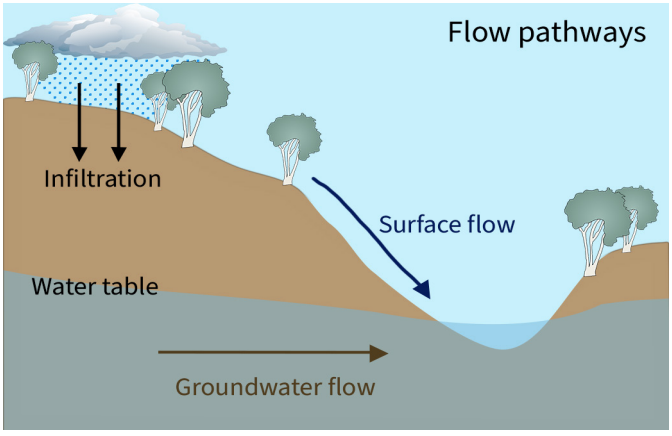
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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.



Chapman Brook Issue 1
Publication date: May 2021
ISSN: 2209–6779 (online only)