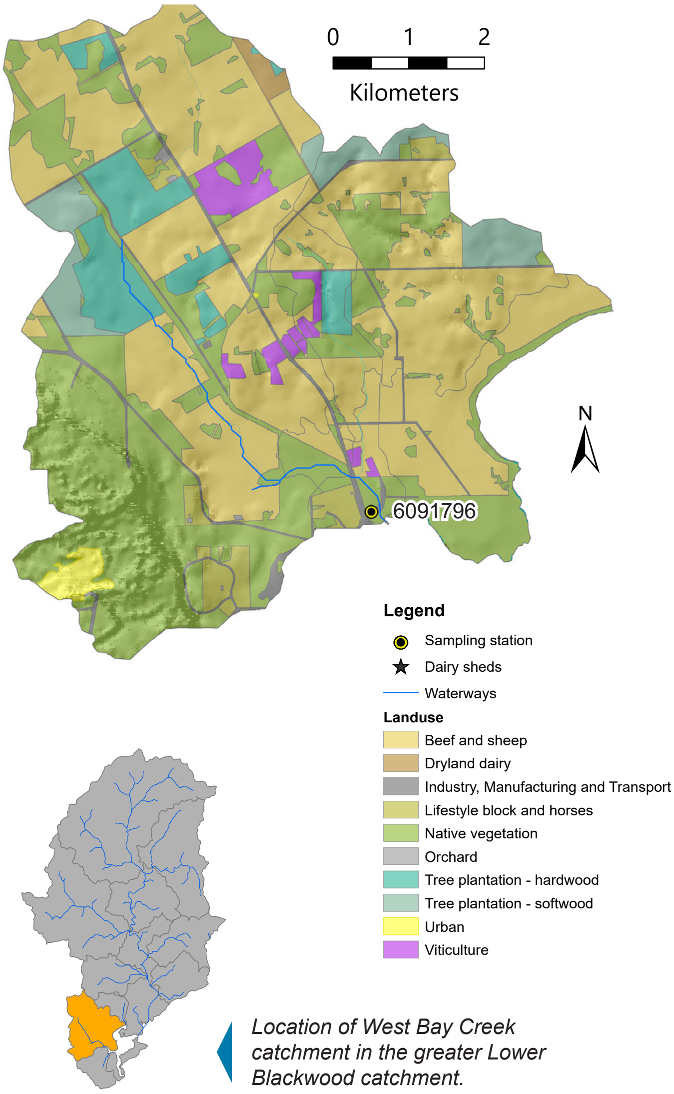
Department of Water and Environmental Regulation
Department of Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA

West Bay Creek

This data report provides a summary of the nutrients at the West Bay Creek 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 creek discharges into West Bay of 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.



Location of West Bay Creek catchment in the greater Lower Blackwood catchment.

About the catchment

West Bay Creek has a catchment area of about 42 km^2. The dominant land uses are beef and sheep grazing and native vegetation. There are a number of streams which discharge to the Hardy Inlet from this catchment; however only one, West Bay Creek which drains the western part of the catchment, is sampled. The creek has virtually no fringing vegetation remaining along much of its length.

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 entering the streams.

West Bay Creek discharges into West Bay, in the Hardy Inlet in Augusta.

Water quality is measured at site 6091796, West Bay Creek, where the creek passes under West Bay Creek Road, a few hundred meters upstream of where it discharges into the Hardy Inlet.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the West Bay Creek sampling site were low. There was a peak in nutrient and total suspended sediment concentrations in March because of a bushfire which burnt the site in mid to late January. This fire also caused the creek to cease flowing for a few weeks; normally it would flow year-round.

Facts and figures

Sampling site code	6091796
Rainfall at Alexandra Bridge (2018)	933 mm
Catchment area	42 km^2
Per cent cleared area (2001)	61 per cent
River flow	Permanent
Main land use (2001)	Beef and sheep grazing and native vegetation

West Bay Creek

Nitrogen over time (2004–18)

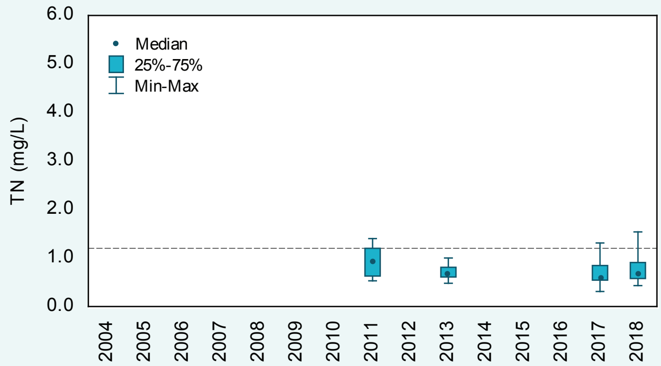
Concentrations

The median total nitrogen (TN) concentrations were below the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value every year that had sufficient data to graph. TN fluctuated over the reporting period, with all years having some samples over the ANZECC trigger value with the exception of 2013.

Trends

As West Bay Creek 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.

West Bay Creek



Total nitrogen concentrations, 2004–18 at site 6091796. The dashed line is the ANZECC trigger value for lowland rivers.

West Bay Creek sampling site during high flows, August 2018.

West Bay Creek

Nitrogen (2018)

Types of nitrogen

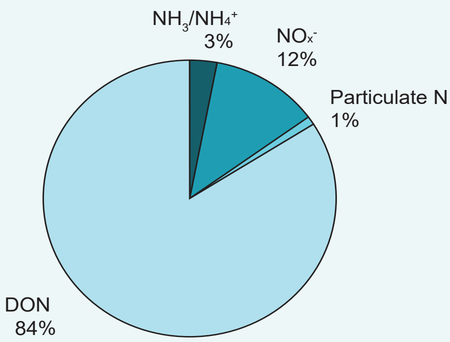
Total N is made up for many different types of N. Dissolved organic N (DON) contributed the largest proportion of the N present. DON is mostly sourced from degrading plant and animal matter which generally needs to be further broken down to become available to plants and algae but may also be present in other forms, which are bioavailable. Generally, agricultural catchments have a larger portion of N present as dissolved inorganic N (DIN), consisting of oxides of N (NO_x^-) and ammonia N (NH_3/NH_4^+), than observed at West Bay Creek. Both NO_x^- and NH_3/NH_4^+ generally come from fertilisers and animal wastes and are readily bioavailable to plants and algae.

Concentrations

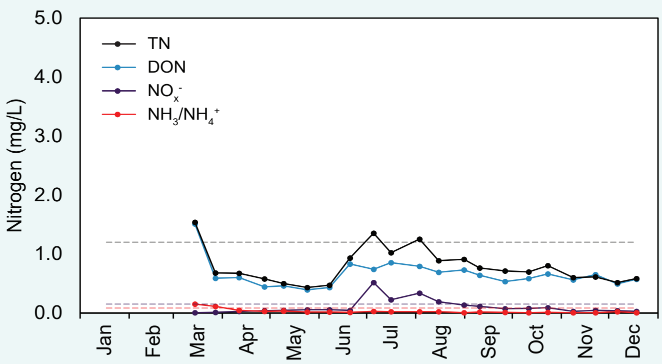
Total N, NO_x^- and DON all showed a seasonal response, increasing in June when rainfall increased and then decreasing again later in the year. The peak in June is likely because of a first-flush effect where N was mobilised following the onset of winter rains. Much of this N was probably the result of mineralisation of organic N in soils and streams over the summer period, and runoff of high concentration waters from agricultural land which builds up with fertiliser and animal waste over summer. The peak in March was because of a bushfire which occurred in mid to late January at the site. This caused the creek to cease flowing and, when it recommenced, ash and debris from the bushfire entered the creek, causing the spike in TN and DON observed in the graph.

Where there are no data on the graph the creek was either not flowing because of the January bushfire, or had very low water levels and no sample was collected.

West Bay Creek



2018 average nitrogen fractions at site 6091796.



2018 nitrogen concentrations at 6091796. The dashed lines are the ANZECC trigger values for lowland rivers for the different N species.

West Bay Creek sampling site during low flows, December 2018.

West Bay Creek

Phosphorus over time (2004–18)

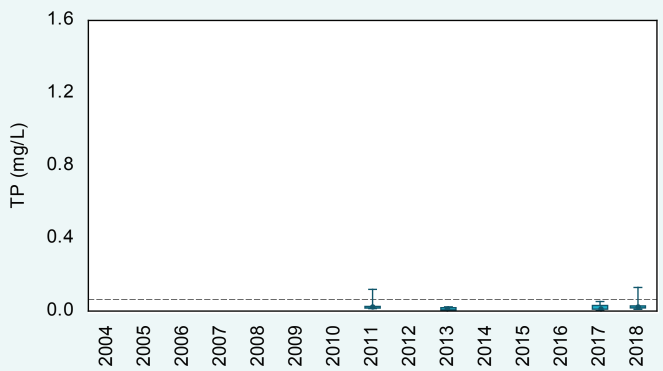
Concentrations

The median total phosphorus (TP) concentration was below the ANZECC trigger value for each of the years where there were sufficient data to graph. Both 2011 and 2018 had some samples above the ANZECC trigger value. While TP concentrations were moderate in West Bay Creek compared with the other sites sampled in the Blackwood catchment, they were still low overall.

Trends

As West Bay Creek 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.

West Bay Creek



Total phosphorus concentrations, 2004–18 at site 6091796. The dashed line is the ANZECC trigger value for lowland rivers.

Triglochin growing in West Bay Creek at the sampling site, October 2018.

Phosphorus (2018)

Types of phosphorus

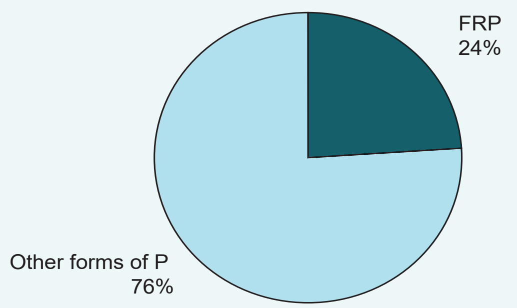
Total P is made up of different types of P. In West Bay Creek, just under a quarter of the P was present as filterable reactive P (FRP) which is readily bioavailable to plants and algae to use to fuel rapid growth. Likely sources of FRP in an agricultural catchment like this one include fertilisers and 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

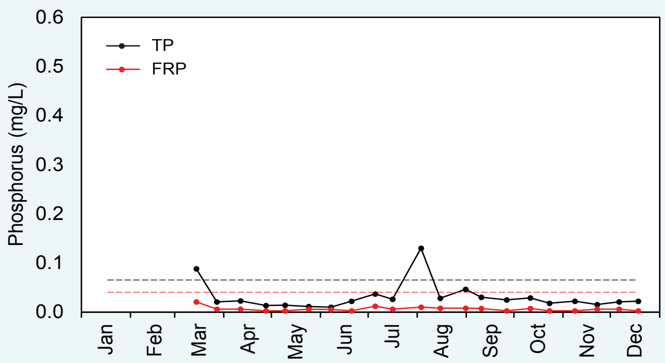
Total P concentrations showed a seasonal response, increasing slightly in June before decreasing again later in the year. The increase in June is likely because of a first-flush effect where heavy rainfall washed P into the stream from upstream agricultural land use. The peak in March was because of a bushfire which occurred in mid to late January at the site. This caused the creek to cease flowing and, when it recommenced, ash and debris from the bushfire entered the creek, causing the spike in TP and FRP observed in the graph. The reason for the comparatively high peak in TP in early August is unknown.

Where there are no data on the graph the creek was either not flowing because of the January bushfire, or had very low water levels and no sample was collected.

West Bay Creek



2018 average phosphorus fractions at site 6091796.



2018 phosphorus concentrations at 6091796. The dashed lines are the ANZECC trigger values for lowland rivers for the different P species.

Looking downstream along West Bay Creek from underneath the West Bay Creek Road bridge, June 2019.

West Bay Creek

Total suspended solids over time (2004–18)

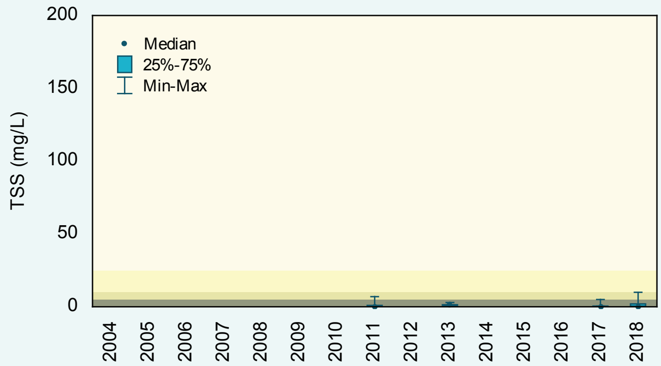
Concentrations

Using the Statewide River Water Quality Assessment bands, the median total suspended solids (TSS) concentration was classified as low in each of the four years where there were enough data to graph. The 2018 median TSS concentration was the equal lowest of the nine sites sampled in the Blackwood River catchment, with two-thirds of the samples having a concentration that was lower than the laboratory limit of reporting (LOR) of 1 mg/L.

Trends

As West Bay Creek 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.

West Bay Creek



Total suspended solids concentrations, 2004–18 at site 6091796. The shading refers to the SWRWQA classification bands.

very high | high | moderate | low

White-faced heron at West Bay Creek sampling site, May 2019.

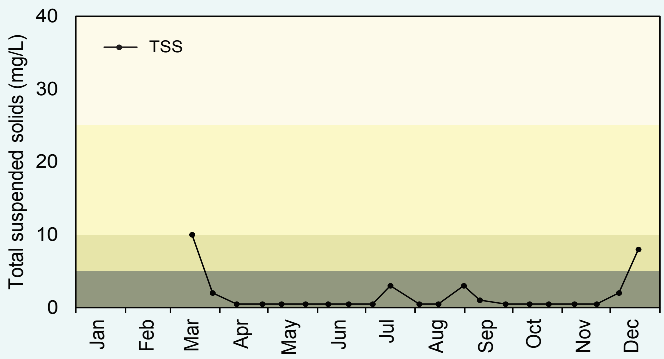
Total suspended solids (2018)

Concentrations

In 2018, most of the TSS samples collected were classified as low using the SWRWQA bands. There was a peak in TSS at the beginning and end of the year. The peak at the beginning of the year was because of ash and other particulate matter caused by the bushfire that burnt at this site in mid to late January being washed into the creek following rainfall. It is unclear what caused the peak in December.

Where there are no data on the graph the creek was either not flowing because of the January bushfire, or had very low water levels and no sample was collected.

West Bay Creek



2018 total suspended solids concentrations at 6091796. The shading refers to the SWRWQA classification bands.

very high | high | moderate | low

Collecting a water quality sample at West Bay Creek, September 2019.

West Bay Creek

pH over time (2004–18)

pH values

pH at West Bay Creek fluctuated slightly over the years for which there were sufficient data to graph. All samples (and therefore medians) were within the upper and lower ANZECC trigger values.

Trends

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

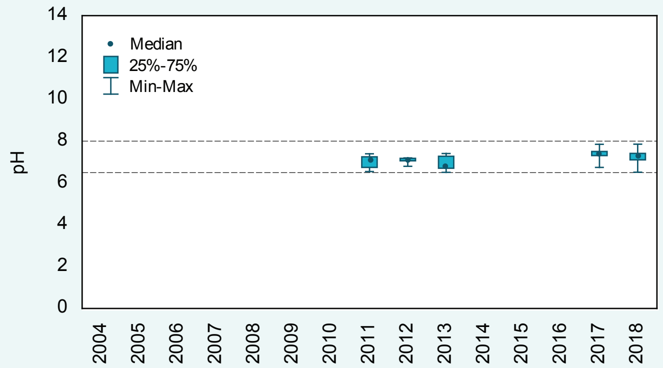
pH (2018)

pH values

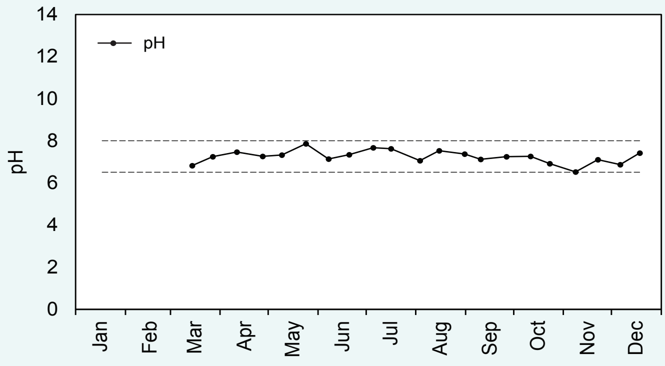
There was no evidence of a seasonal pattern in pH at West Bay Creek, with values fluctuating throughout the year. All samples collected in 2018 fell within the upper and lower ANZECC trigger values.

Where there are no data on the graph the creek was either not flowing because of the January bushfire, or had very low water levels and no sample was collected.

West Bay Creek



pH levels, 2004–18 at site 6091796. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels at 6091796 The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

West Bay Creek Road, September 2018. The vegetation is starting to regenerate following the January 2018 fire.

West Bay Creek

Salinity over time (2004–18)

Concentrations

Salinity fluctuated over the five years that had sufficient data to graph. The median salinity fell in either the low or marginal SWRWQA bands. Salinity appeared to be higher in 2018 than previous years but there is not enough data yet to conclude if this is part of the natural fluctuations at this site or evidence salinity is increasing. Ongoing monitoring will help determine this. The 2018 median salinity was the second highest of the nine sites sampled in the Blackwood River catchment (580 mg/L; only Hut Pool had a higher median salinity of 2630 mg/L).

Trends

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

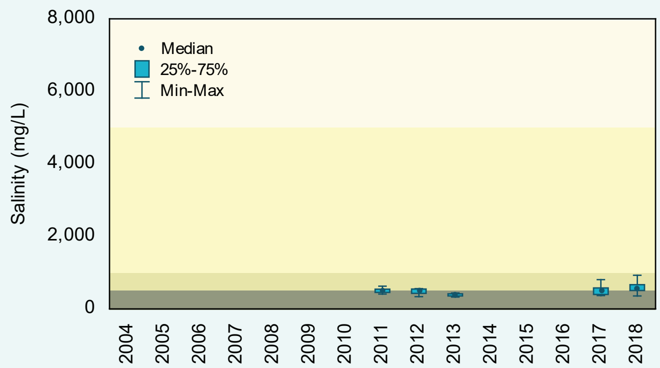
Salinity (2018)

Concentrations

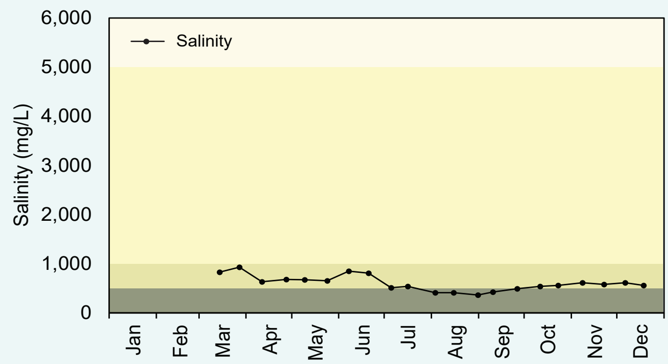
Salinity was slightly higher at the start of the year, falling into the marginal band on each sampling occasion until July when it become fresh. Later in the year, in October, it increased again and became marginal once more. This suggests salts are entering the creek year-round via surface flow as well as from groundwater. The higher salinity present in the drier months may be because of evapoconcentration where salts are left behind as the creek water dries up or because the groundwater in the area is more saline than the surface water, or both.

Where there are no data on the graph the creek was either not flowing because of the January bushfire, or had very low water levels and no sample was collected.

West Bay Creek



Salinity concentrations, 2004–18 at site 6091796. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at 6091796. The shading refers to the SWRWQA classification bands.

saline　brackish　marginal　fresh

Low water levels in West Bay Creek where it flows under West Bay Creek Road, July 2019.

West Bay Creek

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.

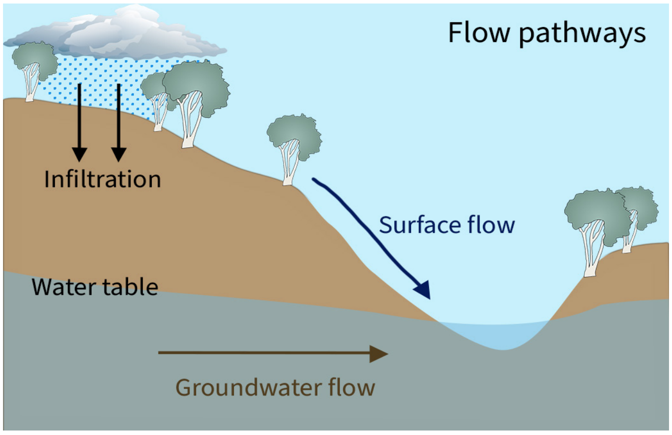
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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.



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