Mangosteen Drain

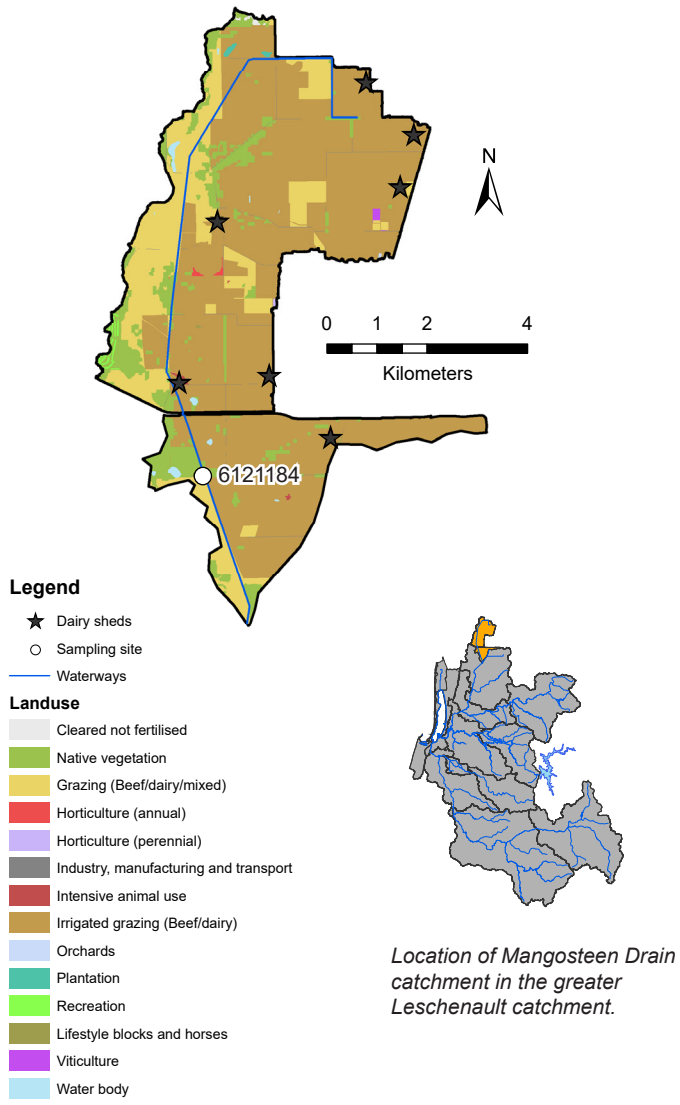
This data report provides a summary of the nutrients at the Mangosteen Drain sampling site in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. Downstream of the sampling site, the drain discharges to the Wellesley River in Wokalup. Nutrients (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

Mangosteen Drain has a catchment area of about 39 km^2, most of which has been cleared for beef and dairy cattle which covers more than 80 per cent of the catchment. There are a number of dairy sheds in the catchment. The north-eastern portion of the catchment lies in the Harvey River Irrigation District and, as such, receives water from the Harvey River. Most of the waterways in the catchment are artificial drainage channels and there is little to no fringing vegetation present.

The catchment lies entirely on the Swan Coastal Plain and has soils with a low capacity to bind phosphorus. This means that any phosphorus applied to them can be quickly washed into drains and other waterways.

Water quality is measured at site 6121184, Leitch Rd, which is near where the drain passes under Leitch Road in Wokalup, just downstream of where it passes through the Byrd Swamp nature reserve.



Location of Mangosteen Drain catchment in the greater Leschenault catchment.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the Mangosteen Drain sampling site were very high. The proportion of bioavailable phosphorus present was large. There was also a large amount of particulate matter present in the water. The highly modified nature of the catchment and waterways and the dominance of agricultural land uses all contributed to the poor water quality at this site.

Facts and figures

Sampling site code	6121184
Catchment area	39 km^2
Per cent cleared area (2018)	88%
River flow	Permanent, though dried over summer previously
Main land use (2018)	Irrigated beef and dairy cattle

Mangosteen Drain

Nitrogen over time (2004–18)

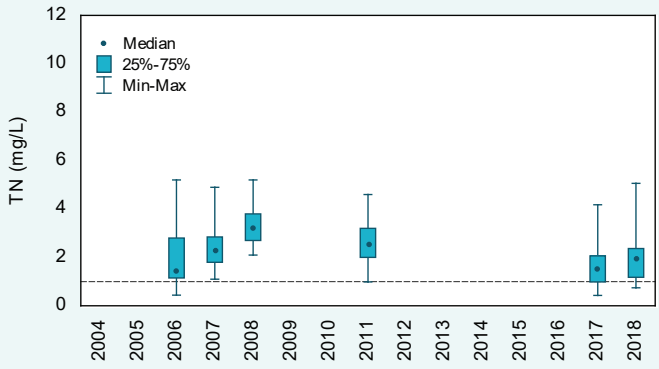
Concentrations

Total nitrogen (TN) concentrations at the Mangosteen Drain sampling site fluctuated over the reporting period. The annual median concentrations were above the Leschenault Water Quality Improvement Plan (WQIP) lowland river TN target every year where there were sufficient data to graph. TN concentrations were high compared with the other sites sampled in the Leschenault catchment with the 2018 median (1.9 mg/L) being the second highest of the 10 sites sampled. Only the site on the Wellesley Diversion Drain had a higher median concentration (2.2 mg/L). The high TN concentrations in Mangosteen Drain can be attributed to the agricultural land use in the catchment, the modification of natural stream lines to drains and the construction of artificial drains, which move water through the landscape rapidly.

Trends

As the Mangosteen Drain 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.

Mangosteen Drain



Total nitrogen concentrations, 2004–18 at site 6121184, The dashed line is the Leschenault WQIP target for lowland rivers.

Looking downstream along Mangosteen Drain at the Leitch Road sampling site. Note the lack of fringing vegetation and straightened channel form of the Drain, January 2019.

Mangosteen Drain

Nitrogen (2018)

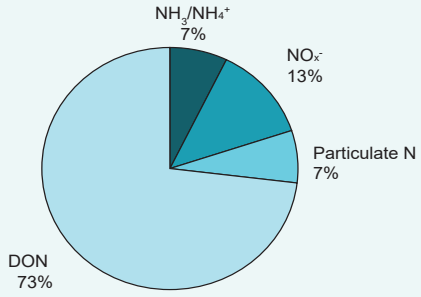
Types of nitrogen

Total N is made up of many different forms of N. At the Mangosteen Drain sampling site, nearly three-quarters 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 highly bioavailable dissolved inorganic N (DIN – consisting of oxides of N, NO_x^- and ammonia N, NH_3/NH_4^+) was low compared with the other Leschenault catchment sites but still typical of a site in an agricultural area. Likely sources for this kind of N include fertilisers and animal wastes, with natural sources contributing less.

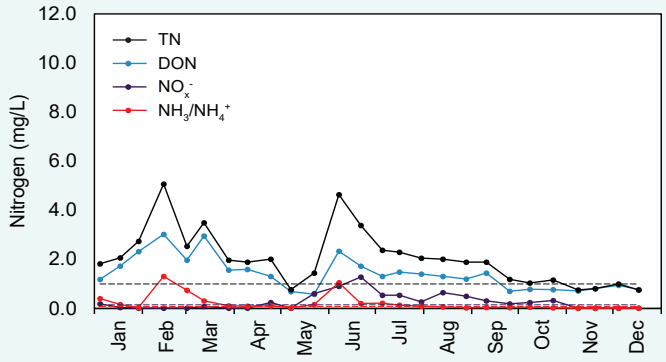
Concentrations

All forms of N showed a seasonal response to increased rainfall and flow, with a peak in June. This is indicative of a first-flush effect 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 irrigated agriculture where fertiliser and animal wastes build up over summer, as well as organic N washed from soils and remnant wetlands. A second large peak was present in TN, DON and NH_3/NH_4^+ concentrations in February. The exact reason for this peak is unknown, though it may be from discharge from an upstream land use or irrigation returns. This peak correlates with a peak in phosphorus concentrations but does not coincide with rainfall so it is not because of rainfall washing nutrients into the drain.

Mangosteen Drain



2018 average nitrogen fractions at site 6121184.



2018 nitrogen concentrations at 6121184. The black dashed line is the Leschenault WQIP target for lowland rivers, the red and purple are the ANZECC trigger values for lowland rivers.

A side drain (not flowing when this picture was taken) which enters Mangosteen Drain just upstream of the sampling site at Leitch Road, December 2018.

Mangosteen Drain

Phosphorus over time (2004–18)

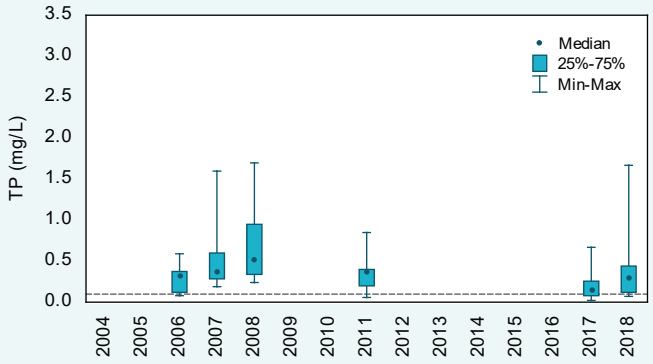
Concentrations

Total phosphorus (TP) concentrations were very high at the Mangosteen Drain sampling site with all annual medians above the WQIP lowland river TP target. In 2018, the annual median at this site (0.27 mg/L) was the highest of the 10 sites sampled in the Leschenault catchment. The site on the Wellesley River had the next highest median of 0.18 mg/L. The combination of agricultural land use, highly modified drainage systems, irrigation and soils with a poor phosphorus binding capacity all contribute to the very high TP concentrations seen at this site.

Trends

As the Mangosteen Drain 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.

Mangosteen Drain



Total phosphorus concentrations, 2004–18 at site 6121184. The dashed line is the Leschenault WQIP target for upland rivers.

An agricultural drain with aquatic plants and algae present, November 2020.

Phosphorus (2018)

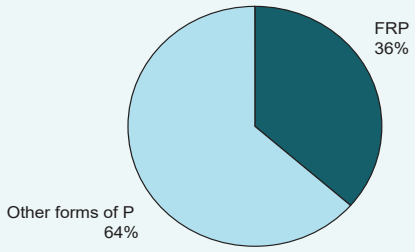
Types of phosphorus

Total P is made up of different forms of P. At the Mangosteen 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 from fertilisers and animal waste 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 plants and algae. The bioavailability of DOP varies and is poorly understood.

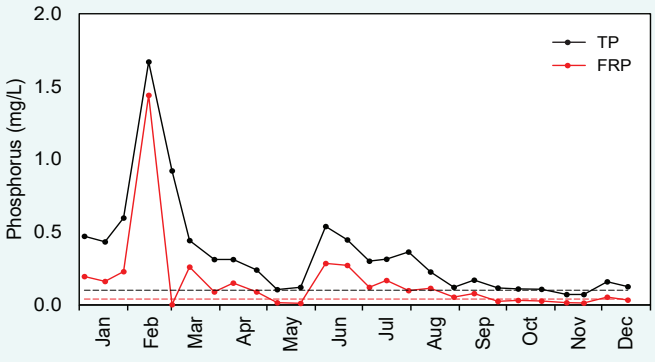
Concentrations

Phosphorus concentrations showed a very similar pattern to N concentrations in 2018. The peak in June was likely because of a first-flush effect where increases in rainfall and flow washed nutrients into the drain via surface flows. Both TP and FRP concentrations were also high in January and peaked in February. As for N, the exact reason for this peak is unknown, though it may be from discharge from an upstream land use or irrigation returns. It is not correlated with rainfall.

Mangosteen Drain



2018 average phosphorus fractions at site 6121184.



2018 phosphorus concentrations at 6121184. The black dashed line is the Leschenault WQIP target for lowland rivers, the red is the ANZECC trigger value for lowland rivers.

A paddock drain. Drains like this are used to help prevent water ponding in paddocks, November 2020.

Mangosteen Drain

Total suspended solids over time (2004–18)

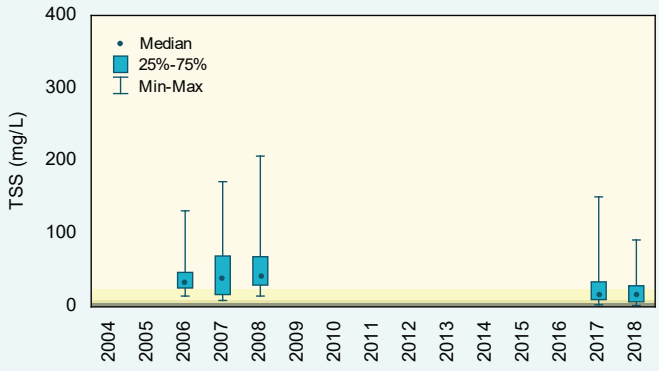
Concentrations

Total suspended solids (TSS) concentrations at the Mangosteen Drain sampling site were generally high. Using the Statewide River Water Quality Assessment (SWRWQA) classification bands, the annual medians from 2006–08 were classified as very high and the medians from 2017–18 were classified as high. In 2018, the annual median (16 mg/L) was the highest of the 11 sites sampled in the Leschenault catchment.

Trends

As the Mangosteen Drain site was not sampled between 2009–16 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.

Mangosteen Drain



Total suspended solids concentrations, 2004–18 at site 6121184. The shading refers to the SWRWQA classification bands.

very high high moderate low

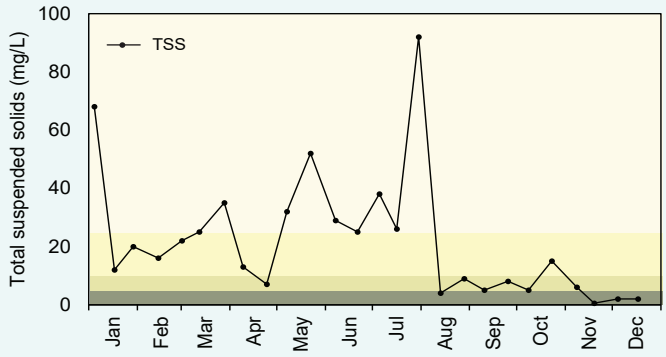
A roadside drain. These drains help to quickly transport water from the road to larger drains, November 2020.

Total suspended solids (2018)

Concentrations

In 2018, TSS concentrations were generally higher in the first part of the year, with most samples collected from August onwards falling into either the low or moderate bands. There were a number of peaks in TSS concentrations in the first part of the year, even when there was little or no rainfall. Possible sources of particulate matter in the early part of the year are some form of runoff from an upstream land use, irrigation returns, disturbance of the bed or banks of the drain upstream of the sampling site, or particulate matter that is being disturbed during sampling, perhaps attached to in-stream vegetation.

Mangosteen Drain



2018 total suspended solids concentrations at 6121184. The shading refers to the SWRWQA classification bands.

very high high moderate low

Paddock in Mangosteen Drain catchment, November 2020.

Mangosteen Drain

pH over time (2004–18)

pH values

pH at the Mangosteen Drain sampling site fluctuated slightly over the years where there were sufficient data to graph. All annual medians and most samples fell within the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger values.

Trends

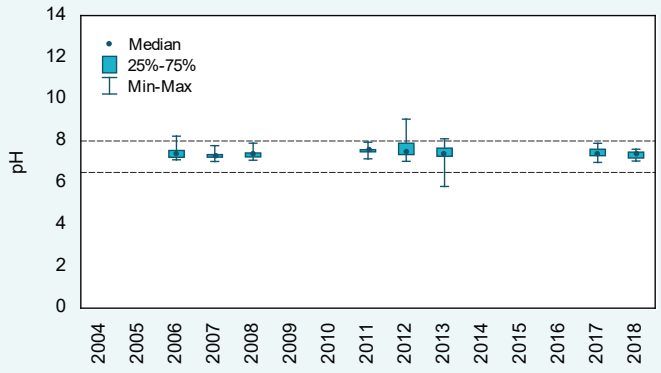
As the Mangosteen Drain site was not sampled between 2014–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

pH (2018)

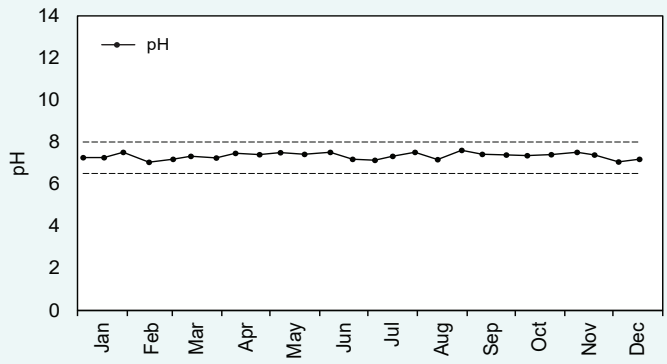
pH values

All samples collected in 2018 fell within the ANZECC trigger values. There was no evidence of a seasonal pattern, with values fluctuating slightly during the year.

Mangosteen Drain



pH levels, 2004–18 at site 6121184. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels at 6121184. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Hay bales in a paddock, November 2020.

Mangosteen Drain

Salinity over time (2004–18)

Concentrations

Salinity fluctuated over the reporting period. All annual medians were classified as marginal using the SWRWQA bands with the exception of 2008, which was classified as fresh. Salinity was much higher in 2017 than other years, though the reason for this is unclear. In 2018, the annual median (575 mg/L) was the third lowest of the 10 sites sampled in the Leschenault catchment. Only the two sites in the Middle and Upper Preston River catchments had lower 2018 medians (420 mg/L and 430 mg/L respectively).

Trends

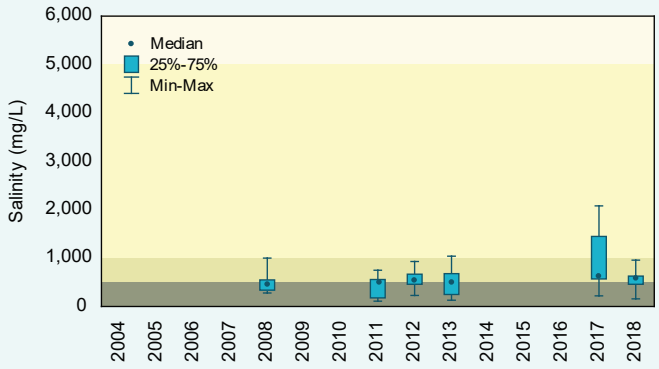
As the Mangosteen Drain site was not sampled between 2014–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

Salinity (2018)

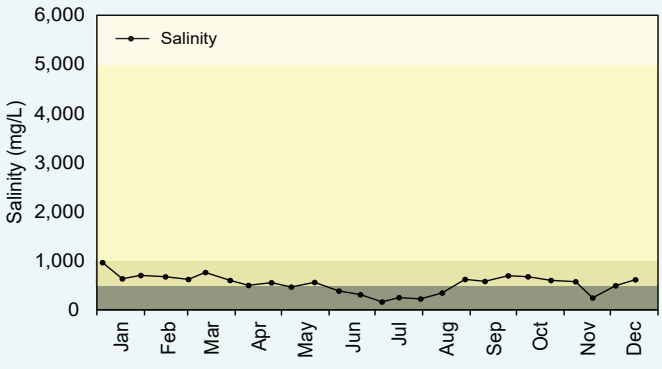
Concentrations

There was no clear pattern in salinity at the Mangosteen Drain sampling site in 2018. Most of the samples collected fell into the marginal band of the SWRWQA, though a few in the wettest part of the year were classified as fresh. Whether this was because of an increase in surface water runoff at this time or not is unclear as the pattern is not evident in every year of data (other years not presented here).

Mangosteen Drain



Salinity concentrations, 2004–18 at site 6121184. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at site 6121184. The shading refers to the SWRWQA classification bands.

saline brackish marginal fresh

Land use in the Mangosteen Drain catchment, November 2020.

Mangosteen Drain

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.

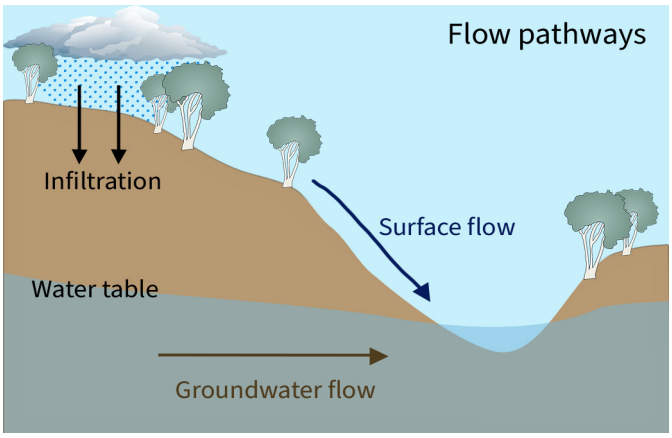
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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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