Mangosteen Drain

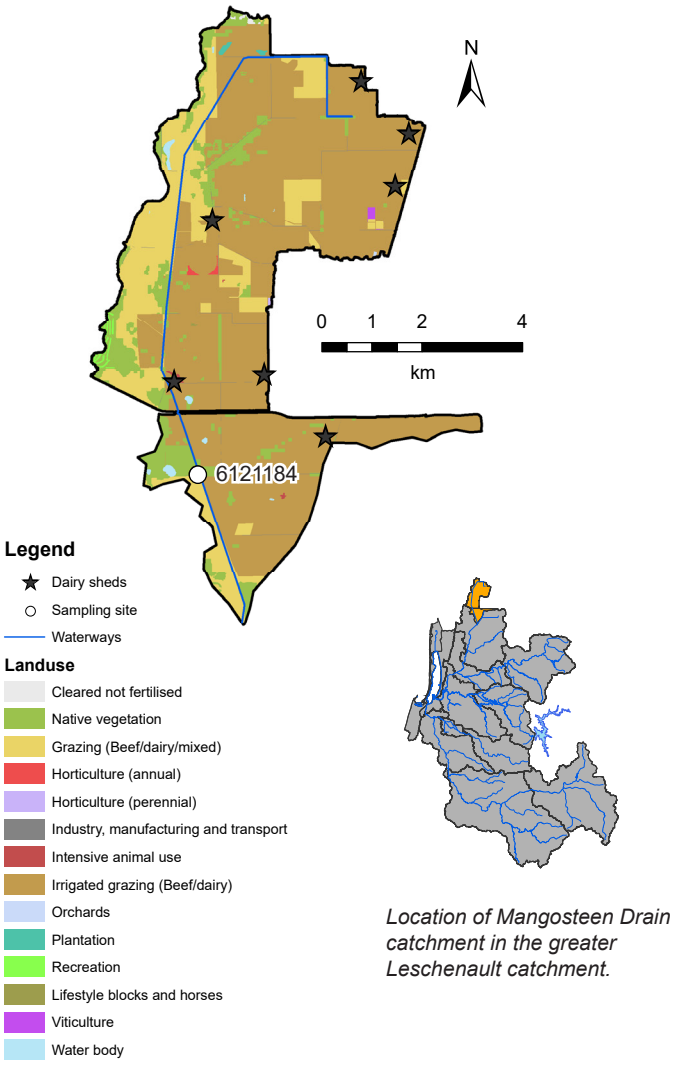
This data report provides a summary of the nutrients at the Mangosteen Drain sampling site in 2019 as well as historical data from 2005–19. This report was produced as part of Healthy Estuaries WA. Downstream of the sampling site, the drain discharges to the Wellesley River in Wokalup.

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 at the Mangosteen Drain sampling site were classified as high (total nitrogen) and very high (total phosphorus). 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 (Leitch Road)
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

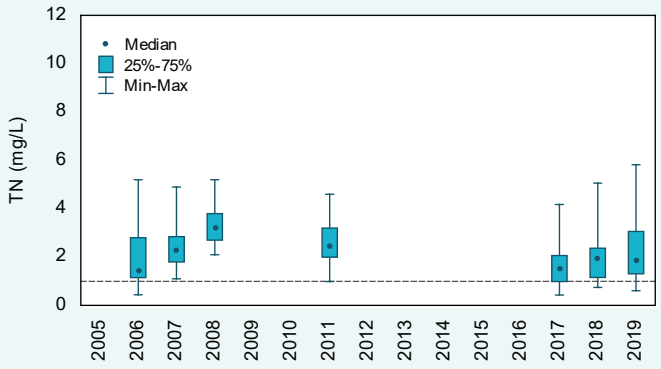
Mangosteen Drain

Nitrogen over time (2005–19)

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. Using the State Wide River Water Quality Assessment (SWRWQA) methodology, all years with sufficient data were classified as having high TN concentrations with the exception of 2008 which was classified as very high. Compared with the other sites sampled in the Leschenault catchment, TN concentrations were high, with the 2019 median (1.9 mg/L) being the highest of the 10 sites sampled. 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.

Mangosteen Drain



Total nitrogen concentrations, 2005–19 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 (2019)

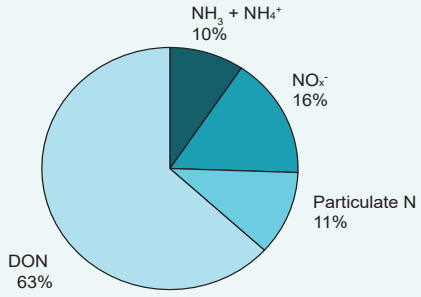
Types of nitrogen

Total N is made up of different types of N. At the Mangosteen Drain sampling site, about two-thirds of the N was present as dissolved organic N (DON) which consists mainly of degrading plant and animal matter but may also include other types. Most types of DON need to be further broken down to become available to plants and algae, though some types are readily bioavailable. The proportion of N present as highly bioavailable dissolved inorganic N (DIN – consisting of nitrate, NO_x^- and total ammonia, $NH_3 + NH_4^+$) was moderate 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.

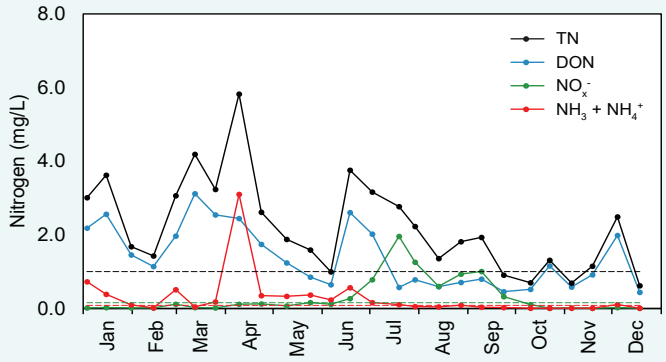
Concentrations

Total N, DON and total ammonia were all highest in the first half of the year. At this time, most of the water present in the drain was coming from groundwater, irrigation returns and potentially discharges from upstream land uses. Concentrations then decreased before peaking again in June, with nitrate peaking in July. 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.

Mangosteen Drain



2019 average nitrogen fractions at site 6121184.



2019 nitrogen concentrations at 6121184. The black dashed line is the Leschenault WQIP target for lowland rivers, the red and green are the ANZECC trigger values for total ammonia and nitrate.

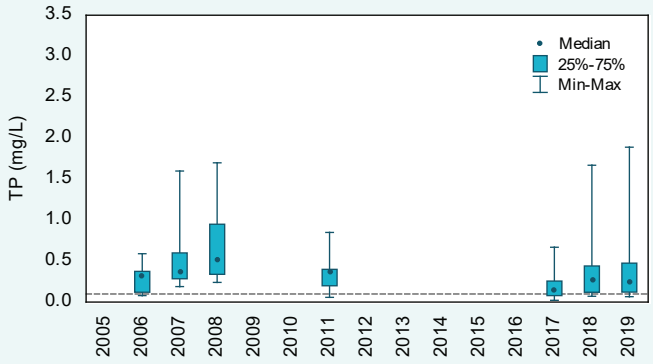
A side drain (not flowing when this picture was taken) which enters Mangosteen Drain just upstream of the sampling site at Leitch Road, December 2018.

Phosphorus over time (2005–19)

Concentrations

Using the SWRWQA methodology, all years with sufficient data were classified as having a very high TP concentration, furthermore all annual medians were above the WQIP lowland river TP target. In 2019, the median TP concentration was the second highest of the 10 sites sampled (0.243 mg/L, only Elvira Gully in the Middle Brunswick catchment had a higher median of 0.248 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.

Mangosteen Drain



Total phosphorus concentrations, 2005–19 at site 6121184. The dashed line is the Leschenault WQIP target for lowland rivers.

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

Phosphorus (2019)

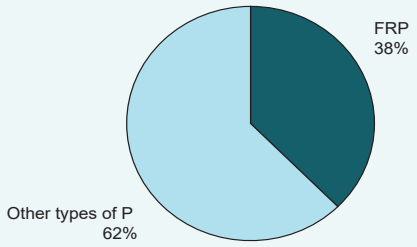
Types of phosphorus

Total P is made up of different types of P. At the Mangosteen Drain sampling site, about a third of the P was present as highly bioavailable phosphate; measured as filterable reactive P (FRP), in surface waters this is mainly present as phosphate (PO_4^{3-}) species. This type of P was likely sourced 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. The bioavailability of DOP varies and is poorly understood.

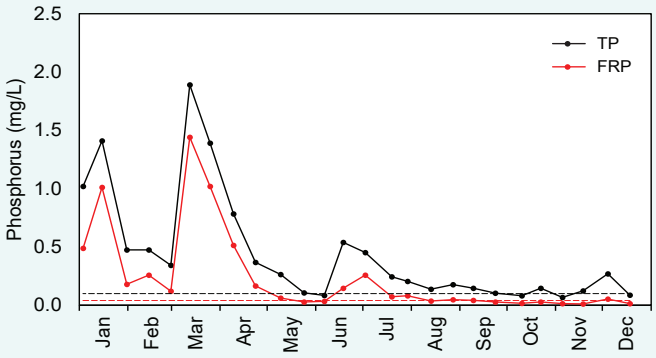
Concentrations

Phosphorus concentrations showed a similar pattern to N concentrations in 2019; however the peaks early in the year did not exactly coincide with the peaks in N. At this time, most of the water present in the drain was coming from groundwater, irrigation returns and potentially discharges from upstream land uses. There was also a smaller peak in June (TP) and July (phosphate) likely because of a first-flush effect where increases in rainfall and flow washed nutrients into the drain via surface flows.

Mangosteen Drain



2019 average phosphorus fractions at site 6121184.



2019 phosphorus concentrations at 6121184. The black dashed line is the Leschenault WQIP target for lowland rivers, the red is the ANZECC trigger value for phosphate.

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

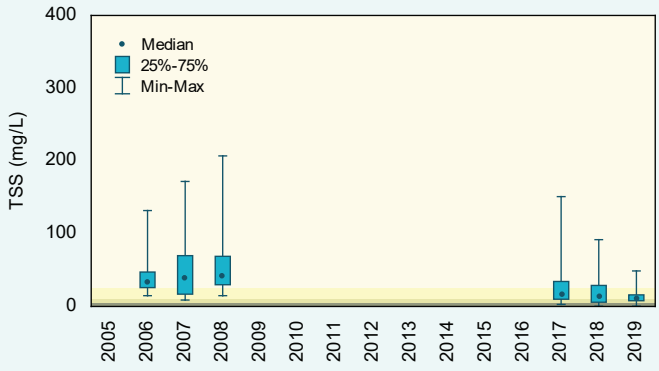
Mangosteen Drain

Total suspended solids over time (2005–19)

Concentrations

Total suspended solids (TSS) concentrations at the Mangosteen Drain sampling site were generally high. Using the SWRWQA methodology, TSS concentrations were classified as very high before the break in monitoring and high since then. In 2019, the annual median (11mg/L) was the highest of the 10 sites sampled, similar to Wellesley Diversion Drain which had an annual median of 10 mg/L.

Mangosteen Drain



Total suspended solids concentrations, 2005–19 at site 6121184. The shading refers to the SWRWQA classification bands.

low moderate high very high

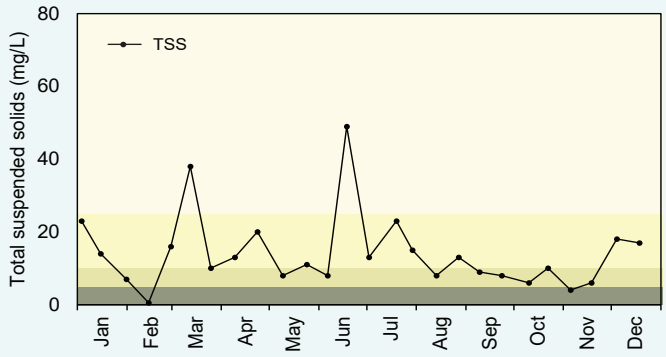
A roadside drain. These drains help to quickly transport water from the road to larger drains, November 2020.

Total suspended solids (2019)

Concentrations

Unlike in 2018, when TSS concentrations were generally higher in the first part of the year, TSS fluctuated during 2019, though the highest peaks did occur in the first half of the year. The two largest peaks in March and June, coincided with peaks in TP and TN, with phosphate also peaking in March. Possible sources of particulate matter at this site include 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, as well as surface water runoff.

Mangosteen Drain



2019 total suspended solids concentrations at 6121184. The shading refers to the SWRWQA classification bands.

low moderate high very high

Paddock in Mangosteen Drain catchment, November 2020.

Mangosteen Drain

pH over time (2005–19)

pH values

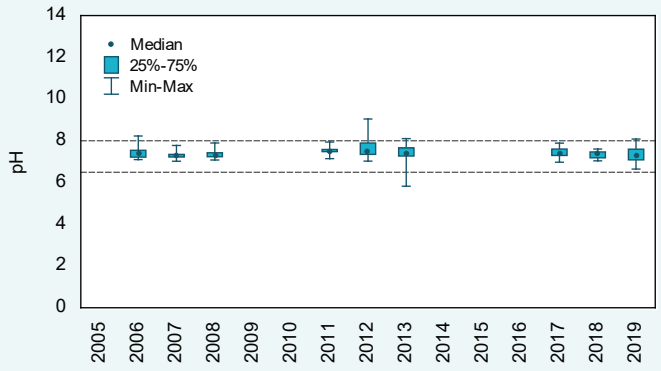
pH at the Mangosteen Drain sampling site fluctuated slightly over the years where there were sufficient data to graph. All annual medians and most samples fell within the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger values.

pH (2019)

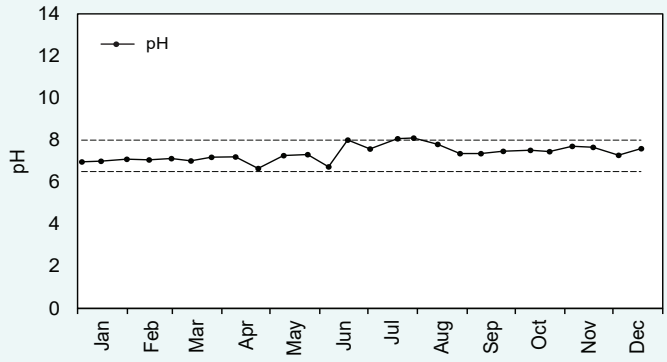
pH values

Most samples collected in 2019 fell within the upper and lower ANZECC trigger values, with the exception of two samples, collected in July, which were just more than the upper ANZECC trigger value. pH was generally higher from June onwards. This pattern was not evident in 2018 when pH remained fairly steady throughout the year. Why the pattern in 2019 would be slightly different to 2018 is unknown.

Mangosteen Drain



pH levels, 2005–19 at site 6121184. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels at 6121184. The dashed lines are the upper and lower ANZECC trigger values.

Hay bales in a paddock, November 2020.

Mangosteen Drain

Salinity over time (2005–19)

Concentrations

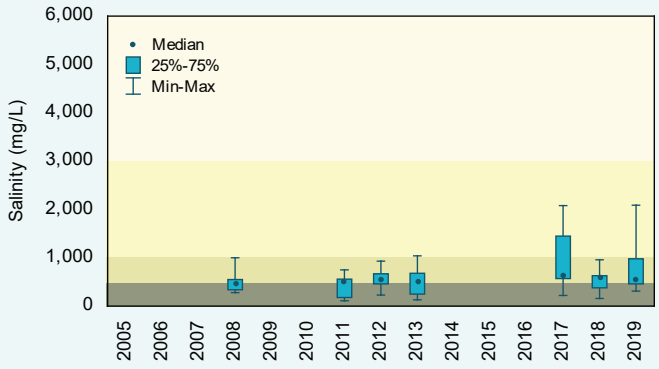
Salinity fluctuated over the reporting period. Using the Water Resources Inventory 2014 salinity ranges, all years with enough data were classified as marginal (note, the 2018 nutrient reports used the SWRWQA bands). Salinity was much higher in 2017 and 2019 than other years, though the reason for this is unclear. In 2019, the annual median (555 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 2019 medians (430 mg/L and 505 mg/L respectively).

Salinity (2019)

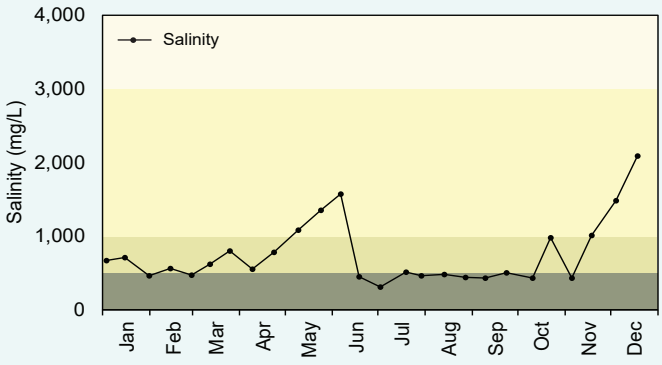
Concentrations

There was no clear pattern in salinity at the Mangosteen Drain sampling site in 2019, though concentrations were slightly lower from late June to early October when rainfall and flow were highest. The peak in early June coincided with low concentration of N and P and occurred after more than two weeks of no rainfall. This suggests a number of possible reasons including water entering the drain from a different part of the catchment, a larger proportion of water at the time coming from groundwater rather than surface flow, or evapoconcentration of salts in the drain. The peak in October was likely the result of evapoconcentration and increased groundwater contribution. Salinity was lower again in early November, as about 25 mm of rain fell a few days before this sample was collected, before rising sharply as water levels dropped once more.

Mangosteen Drain



Salinity concentrations, 2005–19 at site 6121184. The shading refers to the Water Resources Inventory 2014 salinity ranges.



2019 salinity concentrations at site 6121184. The shading refers to the Water Resources Inventory 2014 salinity ranges.

fresh marginal brackish saline

Land use in the Mangosteen Drain catchment, November 2020.

Mangosteen Drain

Background

Healthy Estuaries WA is a State Government program launched in 2020 and builds 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.

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 the water and harm fish and other species. Total suspended solids, pH and salinity data are also presented as these help us better understand the processes occurring in the catchment.

You can find information on the condition of the Leschenault Estuary at estuaries.dwer.wa.gov.au/estuary/leschenault-estuary

Healthy Estuaries WA partners with the Leschenault Catchment Council to fund best-practice management of fertiliser, dairy effluent and watercourses 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 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

Variables were compared with the Leschenault Estuary water quality improvement plan concentration targets or ANZECC trigger values where available, or the SWRWQA bands or the 2014 Water Resources Inventory ranges. They were classified using the SWRWQA methodology. Standard statistical tests were used to calculate trends and loads. For further information on the methods visit estuaries.dwer.wa.gov.au/nutrient-reports/data-analysis

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 per volume of water.

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

First flush: material washed into a waterway by the first rainfall after an extended dry period. The first flush is often associated with high concentrations of nutrients and particulate matter.

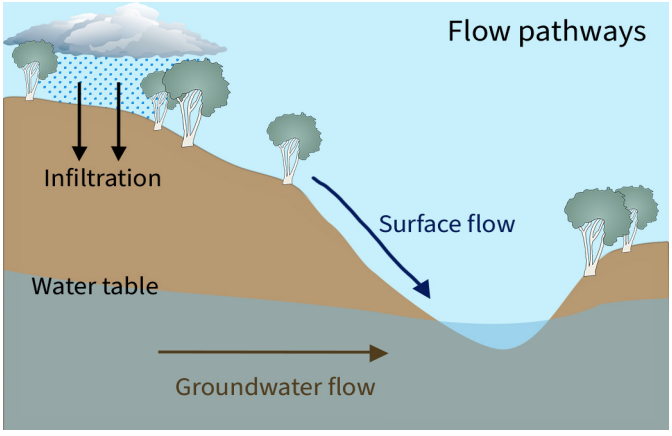
Laboratory limit of reporting: (LOR) this is the lowest concentration of an analyte that can be reported by a laboratory.

Load: the total mass of a substance passing a certain point.

Load per square kilometre: the load at the sampling site divided by the entire catchment area upstream of the sampling site.

Nitrate: The measurement for the nutrient nitrate actually measures both nitrate (NO_3^-) and nitrite (NO_2^-), which is reported as NO_x^-. We still refer to this as nitrate as in most surface waters nitrite is present in very low concentrations.

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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