# Gull Road Drain

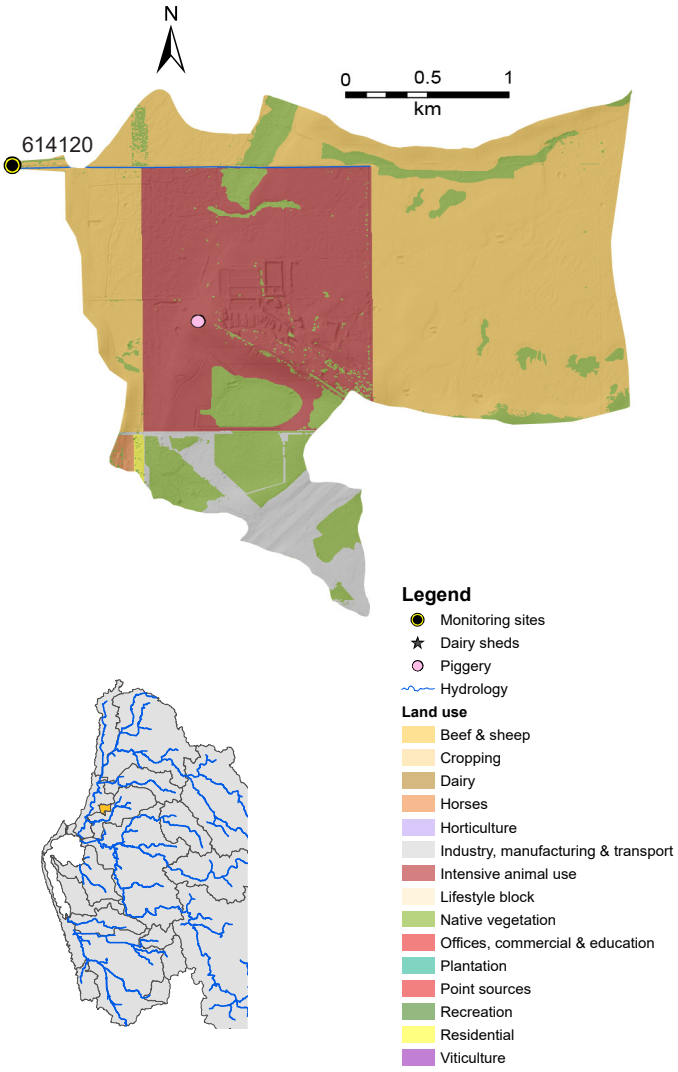
This data report provides a summary of the nutrients at the Gull Road Drain sampling site in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. This data report provides a summary of the nutrients at the sampling site in the Gull Road Drain catchment. Downstream of the site, the drain enters the Lower Serpentine River and, from there, discharges to the Peel 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

Gull Road Drain has a catchment area of about 8 km$^2$. Upstream and to the south of the sampling site is a piggery and composting facility. More than three-quarters of the catchment has been cleared for agriculture, predominantly beef cattle grazing and intensive animal use.

Most of the catchment has soils with a low capacity to bind phosphorus. This is often so poor that any phosphorus applied to them can be quickly washed into drains and other waterways.

Water quality is measured at site 614120, Gull Road, where Gull Road Drain passes under Gull Road in Keralup.




*Location of Gull Road Drain catchment in the greater Peel-Harvey catchment.*

## Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the Gull Road Drain sampling site were very high, with the median concentrations substantially higher than the other catchment sites. Nutrient loads were small because of the very small flow volumes at this site. The highly modified nature of the drainage system, including the number of drains constructed to reduce surface water ponding, along with the lack of fringing vegetation means nutrients can be washed from soils into waterways and transported downstream quickly rather than being assimilated.

## Facts and figures

| | |
|---|---|
| Sampling site code | 614120 |
| Catchment area | 8 km$^2$ |
| Per cent cleared area (2015) | 85 per cent |
| River flow | Ephemeral, dries over summer |
| Annual flow (2018) | 0.3 GL |
| Main land use (2015) | Beef cattle grazing and intensive animal use |

# Gull Road Drain

## Nitrogen over time (2004–18)

### Concentrations

Total nitrogen (TN) concentrations were very high at the Gull Road Drain sampling site, much higher than at the other 12 sites sampled in the Peel-Harvey catchment. Concentrations fluctuated over the reporting period but all samples collected were consistently much higher then the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value.

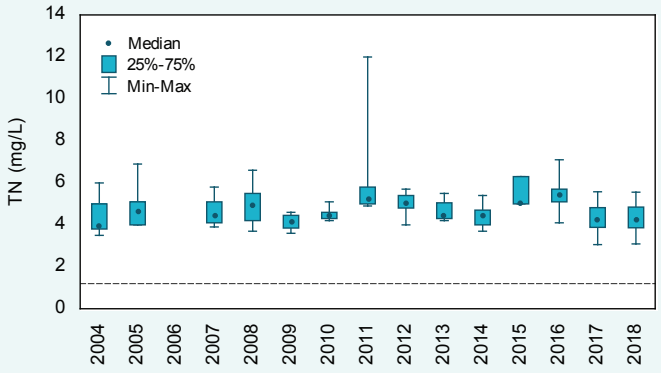
### Trends

There was no trend in TN concentrations at Gull Road Drain over either the short- (2014–18) or long-term (2004–18).

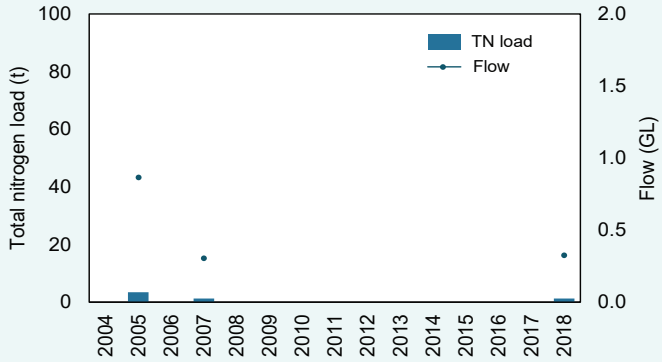
### Estimated loads

Estimated TN loads at the Gull Road Drain sampling site were small compared with the other sites in the Peel-Harvey catchment. In 2018, Gull Road Drain had an estimated TN load of 1 t, the smallest of the 10 sites where it was possible to calculate loads. The 2018 load per unit area was moderate at 163 kg/km$^2$. The reason for the small load at this site was the relatively small flow volumes as TN concentrations were very high. Gull Road had by far the smallest annual flow in 2018, 0.3 GL (the next smallest annual flow was at Meredith Drain which had 4.3 GL). Only three years had sufficient flow data to be able to calculate loads. TN loads were closely related to flow volume; years with high annual flow had large TN loads and vice versa.

## Gull Road Drain




*Total nitrogen concentrations, 2004–18 at site 614120. The dashed line is the ANZECC trigger value for lowland rivers.*




*Total nitrogen loads and annual flow, 2004–18 at site 614120.*

*The weir at the Gull Road Drain sampling site, July 2018.*

# Gull Road Drain

## Nitrogen (2018)

### Types of nitrogen

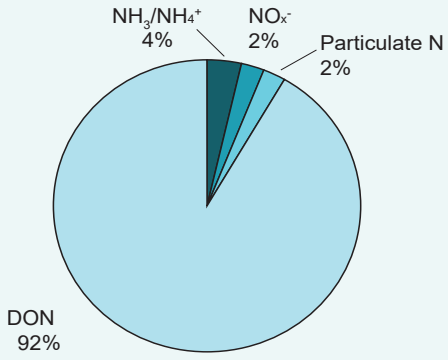
Total N is made up of many different types of N. In Gull Road Drain, more than 90 per cent of the N was present as dissolved organic N (DON). This type of N consists of plant and animal matter as well as other forms. DON varies in its bioavailability; plant and animal matter usually needs to be further broken down before becoming available whereas other forms of DON are readily bioavailable. The proportion of N present as dissolved inorganic N (DIN—consisting of oxides of N, $NO_x^-$ and ammonia N, $NH_3/NH_4^+$) was low. These forms of N are readily bioavailable and are sourced from animal waste and fertilisers.

### Concentrations

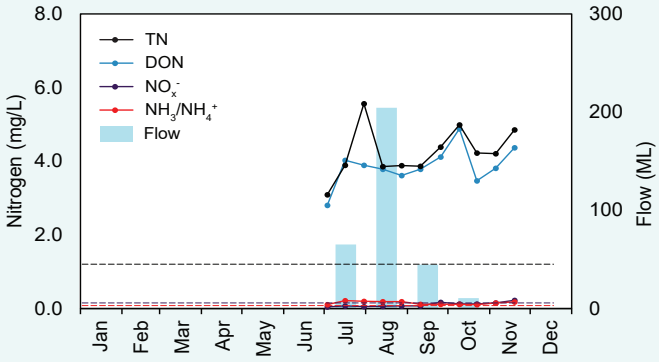
In 2018, there was no clear seasonal pattern in N concentrations at the Gull Road Drain sampling site, with the exception of $NH_3/NH_4^+$ which increased when the drain started flowing, being at its highest from about July to August and then decreasing again. The lack of a distinct seasonal pattern suggests that most forms of N were entering the drain via both surface and groundwater flows.

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

## Gull Road Drain




*2018 average nitrogen fractions at site 614120.*




*2018 nitrogen concentrations and monthly flow at 614120. The dashed lines are the ANZECC trigger values for lowland rivers for the different N species.*

*Algal growth in the upper part of Gull Road Drain. High nutrient concentrations contribute to excess algal growth such as this, November 2017.*

# Gull Road Drain

## Phosphorus over time (2004–18)

### Concentrations

Total phosphorus (TP) concentrations have declined significantly over the reporting period at the Gull Road Drain sampling site. They are, however, still very high with Gull Road Drain having the highest median TP concentration of the 13 sites in the Peel-Harvey catchment. In 2018, the median TP concentration was 0.74 mg/L, much higher than the next highest median at Nambeelup Brook of 0.415 mg/L. All samples were well over the Peel-Harvey Water Quality Improvement Plan (WQIP) target.

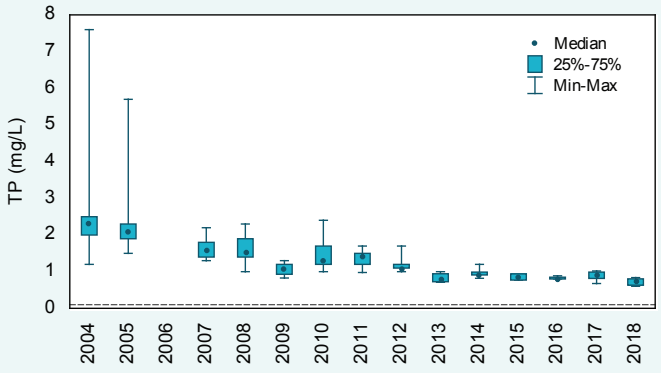
### Trends

There was a short-term (2014–18) decreasing trend present in TP concentrations of 0.055 mg/L/yr, as well as a long-term (2004–18) decreasing trend of 0.096 mg/L. These trends are likely because of Wandalup Farms (upstream of the sampling site) installing a waste treatment facility and developing the ability to manufacture compost and blend soil in 2003. This reduced the amount of waste escaping the facility and entering the drain.

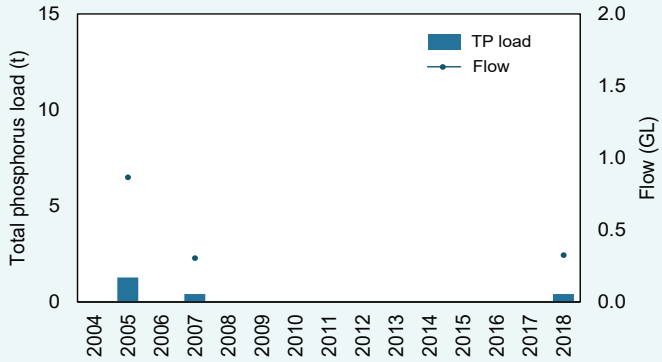
### Estimated loads

Estimated TP loads at the Gull Road Drain sampling site were small compared with the other sites in the Peel-Harvey catchment. In 2018, the site had an estimated TP load of 0.42 t, the smallest TP load of the 10 sites in the Peel-Harvey catchment where it was possible to calculate loads. The load per unit area of 52.1 kg/km$^2$ was moderate. As with TN, the reason for the small TP loads is the small flow volumes as TP concentrations were very high. Only three years had sufficient flow data to be able to calculate loads. TP loads were closely related to flow volume; years with high annual flow had large TP loads and vice versa.

## Gull Road Drain




*Total phosphorus concentrations, 2004–18 at site 614120. The dashed line is the Peel-Harvey WQIP target for winter median TP concentrations.*




*Total phosphorus loads and annual flow, 2004–18 at site 614120.*


*Installing treatment beds in Gull Road Drain that use a high phosphorus-adsorbing material to remove some of the phosphorus from the water, August 2017.*

## Phosphorus (2018)

### Types of phosphorus

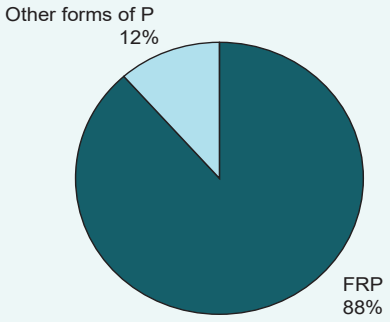
Total P is made up of different types of P. At Gull Road Drain, 88 per cent of the P was present as filterable reactive P (FRP), the highest proportion of the 13 sites sampled in the Peel-Harvey catchment (Peel Main Drain had the next highest percentage of 63 per cent). This form of P is readily bioavailable and was probably derived from animal waste and fertilisers with a small amount coming from natural sources. The remainder of the 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

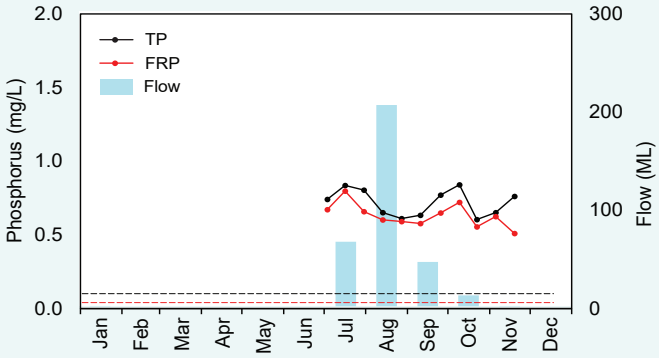
Both TP and FRP concentrations showed a small peak in July, shortly after the drain started to flow for the year. This peak may have been because of a first-flush effect where heavy rainfall flushed P into the drain from surrounding land use as well as mobilising any that was left in the drain after it dried the previous summer. FRP concentrations then declined over the rest of the year, though there was a peak observed in late September to early October and then again in early November. The reason for these peaks is unknown. TP concentrations followed a similar pattern except for the peak in late November; the reason for this is also unknown.

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

## Gull Road Drain




*2018 average phosphorus fractions at site 614120.*




*2018 phosphorus concentrations and monthly flow at 614120. The dashed black line is the Peel-Harvey WQIP target, the red line is the ANZECC trigger values for lowland rivers.*

*A drain upstream of the Gull Road Drain sampling site. Note the waterlogging and surface runoff from the paddock in the background, August 2017.*

# Gull Road Drain

## Dissolved organic carbon over time (2004–18)

### Concentrations

There were only three years with sufficient data to graph at the Gull Road Drain sampling site. All annual medians were classified as very high using the Statewide River Water Quality Assessment (SWRWQA) classification bands. While DOC concentrations appear to have decreased between 2016–18, there are not yet enough data to test for trends (see Trends section, below). Compared with the other sites in the Peel-Harvey catchment, DOC concentrations were very high with the Gull Road Drain having the largest median in 2018 (112 mg/L, the Nambeelup Brook site had the next largest median of 49 mg/L). The annual range in concentrations was also large.

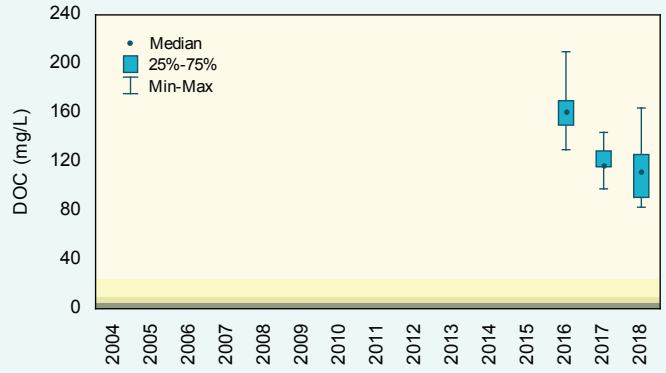
### Trends

It was not possible to calculate trends in DOC concentrations at the Gull Road Drain site as there were only three years of data present. A minimum of five years of data is required to test for trends.

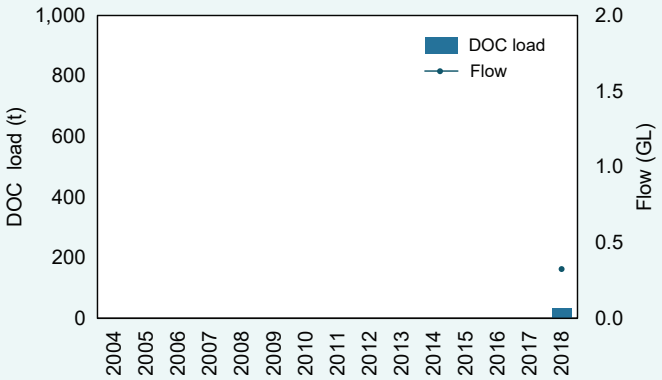
### Estimated loads

Estimated DOC loads at the Gull Road Drain sampling site were small compared with the other sites in the Peel-Harvey catchment. In 2018, the estimated DOC load was 35 t, much smaller than the other 10 sites in the Peel-Harvey catchment where it was possible to calculate loads (the next smallest load of 153 t was recorded at Coolup South Main Drain). The load per unit area of 4,357 kg/km$^2$ was moderate to large compared with the other Peel-Harvey sites. As for TN and TP, the reason for the small DOC loads was the small flow volume. DOC concentrations were very high. DOC loads were closely related to flow volume; years with high annual flow had large DOC loads and vice versa.

## Gull Road Drain




*Dissolved organic carbon concentrations, 2004–18 at site 614120. The shading refers to the SWRWQA classification bands.*




*Dissolved organic carbon loads and annual flow, 2004–18 at site 614120.*

very high high moderate low

*The Lower Serpentine River at one of the river health assessment sampling site. Gull Road Drain discharges into the Lower Serpentine River downstream of this location, December 2017.*

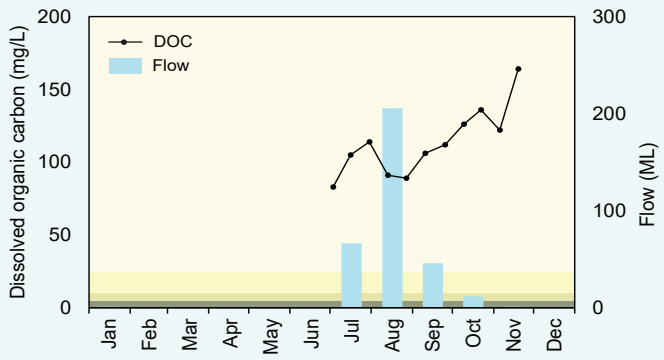
## Dissolved organic carbon (2018)

### Concentrations

In 2018, all DOC samples collected were classified as very high using the SWRWQA. There was an initial peak in DOC in late July, suggesting that early rainfall and flow flushed DOC into the drain from surrounding land use as well as mobilising DOC already present in the dry drain. Concentrations then fell before increasing again from September to the end of the flow year.
Most of the DOC at this site was entering the drain via groundwater. DOC is sourced mainly from degrading plant and animal matter, including natural organic matter in soils and wetlands, with many wetlands on deep sands typically generating high DOC concentrations. It varies widely in its bioavailability.

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

## Gull Road Drain




*2018 Dissolved organic carbon concentrations and monthly flow at 614120. The shading refers to the SWRWQA classification bands.*

very high high moderate low

*A drain running through a paddock in the Gull Road Drain catchment. This kind of drain will rapidly transport water, April 2002.*

# Gull Road Drain

## Total suspended solids over time (2004–18)

### Concentrations

Total suspended solids (TSS) concentrations at the Gull Road Drain sampling site were low with almost all samples collected being classified as low using the SWRWQA classification bands. In 2018, the site also had the lowest median TSS concentration of the 13 sites sampled in the Peel-Harvey catchment.

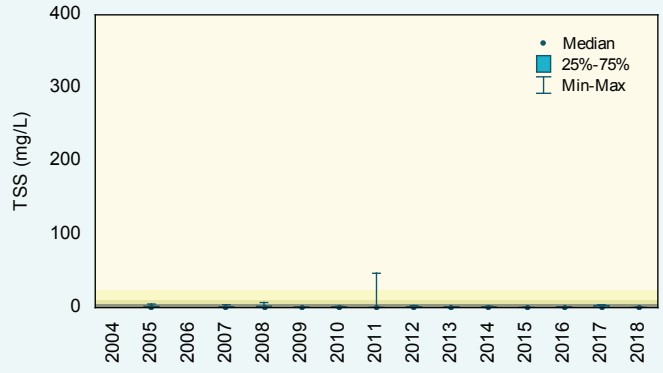
### Trends

There was no trend in TSS concentrations at Gull Road Drain over either the short- (2014–18) or long-term (2006–18).

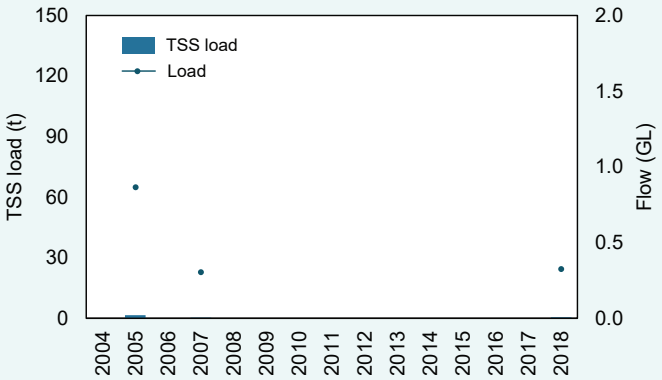
### Estimated loads

Estimated TSS loads at the Gull Road Drain sampling site were small to moderate compared with the other sites in the Peel-Harvey catchment. In 2018, the estimated TSS load at this site was 1 t, the smallest of the 10 sites in the Peel-Harvey catchment where it was possible to calculate loads. The load per unit area of 68 kg/km$^2$ was small compared with the other Peel-Harvey catchment sites, much smaller than Meredith Drain, which had the next smallest load of 254 kg/km$^2$. TSS loads were closely related to flow volume; years with high annual flow had large TSS loads and vice versa.

## Gull Road Drain




*Total suspended solids concentrations, 2004–18 at site 614120. The shading refers to the SWRWQA classification bands.*




*Total suspended solids loads and annual flow, 2004–18 at site 614120.*

very high high moderate low

*A drain in the Gull Road Drain catchment with revegetation along its left bank. The drain itself is choked with exotic grasses which thrive in high nutrient conditions, September 2004.*

# Gull Road Drain

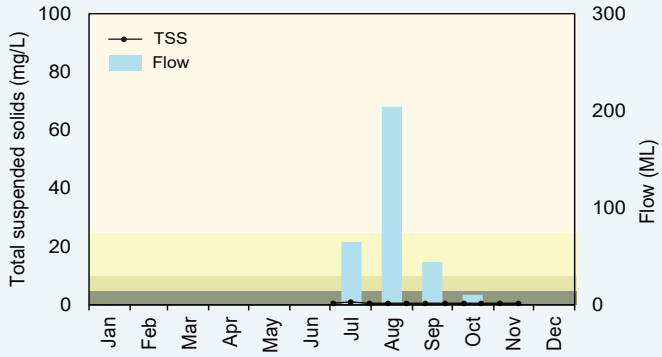
## Total suspended solids (2018)

### Concentrations

In 2018 TSS concentrations were consistently very low at the Gull Road Drain sampling site. Of the 11 samples collected in 2018, only one was above the laboratory limit of reporting (LOR), and that one was equal to the LOR (1 mg/L), so was very low.

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

## Gull Road Drain




*2018 total suspended solids concentrations and monthly flow at 614120. The shading refers to the SWRWQA classification bands.*

very high | high | moderate | low

*A drain in the Gull Road Drain catchment. Note the sandy banks which will easily erode if stock walk along it or water levels are high, April 2002.*

# Gull Road Drain

## pH over time (2004–18)

### pH values

In Gull Road Drain, pH was low, with most samples collected being below the lower ANZECC trigger value. pH reduced over the reporting period, being higher at the start of the period. In 2018, the median pH (4.9) was lower in Gull Road Drain than the other 12 sampling sites in the Peel-Harvey catchment. The catchment with the next lowest median was Meredith Drain (6.9).

### Trends

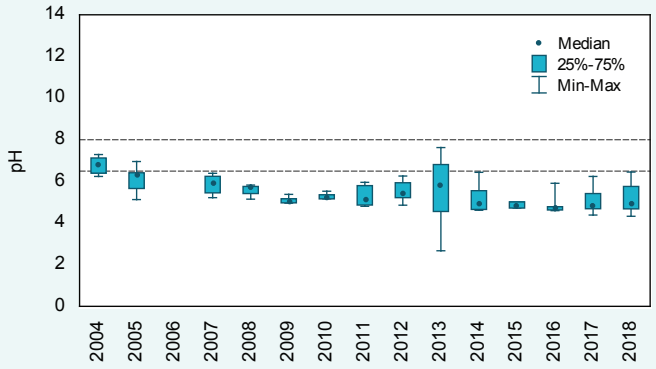
There was a long-term (2004–18) decreasing trend in pH of 0.1 units per year. There was no short-term (2014–18) trend. It appears that after the initial decrease in pH in the first part of the monitoring period, pH levels have stabilised at this site.

## pH (2018)

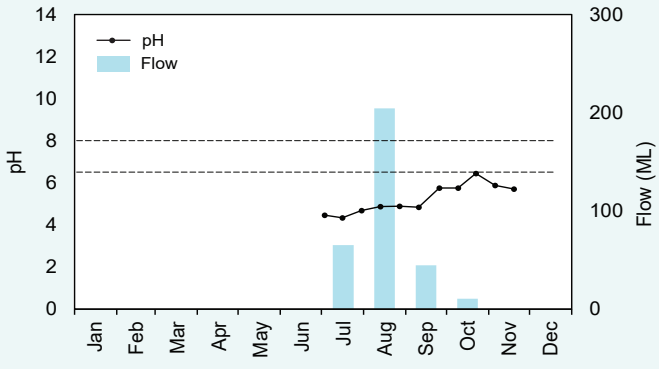
### pH values

In 2018, pH slowly increased through the year, though all samples were below the lower ANZECC trigger value. It is unclear why the pH at this site is low. It is possible that the groundwater has a higher pH than the surface water, which would help explain why the samples collected later in the year were higher than early in the year.

## Gull Road Drain




*pH levels, 2004–18 at site 614120. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.*




*2018 pH levels and monthly flow at 614120. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.*

*Looking downstream at the weir at the Gull Road Drain sampling site when it is dry, March 2019.*

# Gull Road Drain

## Salinity over time (2004–18)

### Concentrations

Salinity fluctuated over the reporting period at the Gull Road Drain sampling site. All samples collected were classified as low using the SWRWQA bands, with the exception of three samples in 2011 and one in 2015 which were classified as marginal.

### Trends

There was no trend in salinity at Gull Road Drain over either the short- (2014–18) or long-term (2006–18).

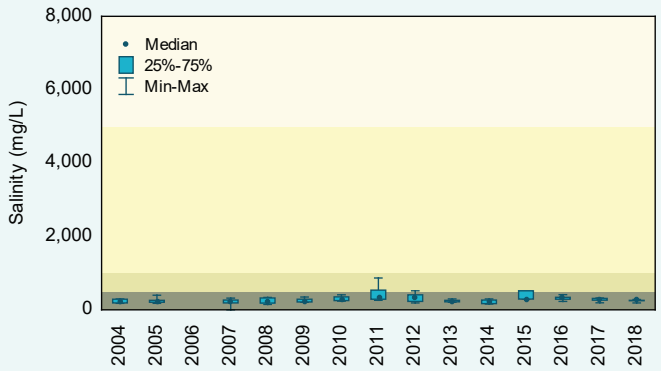
## Salinity (2018)

### Concentrations

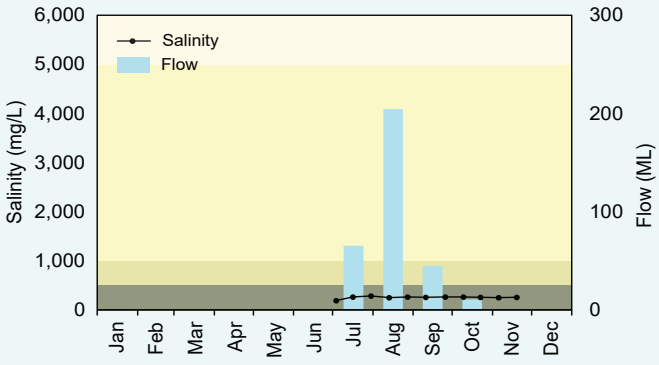
Salinity at Gull Road Drain in 2018 was consistently low and there was no evidence of a seasonal pattern, with very little variation in salinity during the year.

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

## Gull Road Drain




*Salinity concentrations, 2004–18 at site 614120. The shading refers to the SWRWQA classification bands.*




*2018 salinity concentrations and monthly flow at 614120. The shading refers to the SWRWQA classification bands.*

saline brackish marginal fresh

*Beef cattle grazing is one of the main land uses in the Gull Road Drain catchment, May 2018.*

# Gull Road 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 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 Peel-Harvey estuary at estuaries.dwer.wa.gov.au/estuary/peel-harvey-estuary/

The Regional Estuaries Initiative partners with the Peel-Harvey Catchment Council 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 Peel-Harvey Catchment Council go to peel-harvey.org.au
- To find out more about the health of the rivers in the Peel-Harvey Catchment go to rivers.dwer.wa.gov.au/assessments/results

## Methods

Total phosphorus concentrations were compared with the Peel-Harvey WQIP target. This target represents the median winter concentration that is required for each of the subcatchments to meet their load reduction 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 represent the acceptable pH range. Where there were no ANZECC trigger values available (for DOC, 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.

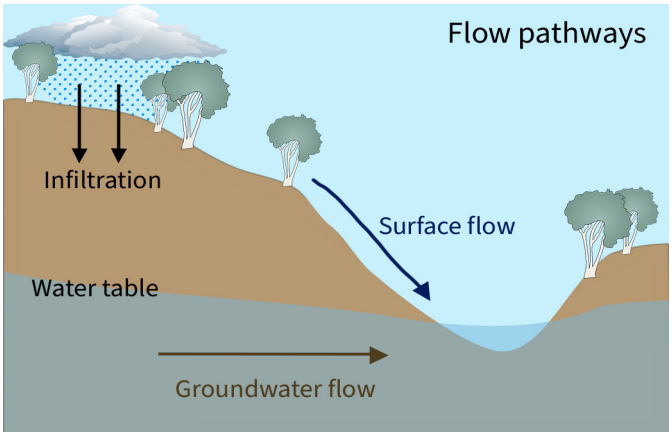
**Evapoconcentration**: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

**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.





Gull Road Drain Issue 1
Publication date: May 2021
ISSN: 2209–6779 (online only)