

Upper Scott

This data report provides a summary of the nutrients at the Upper Scott 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 stream discharges to the Scott 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

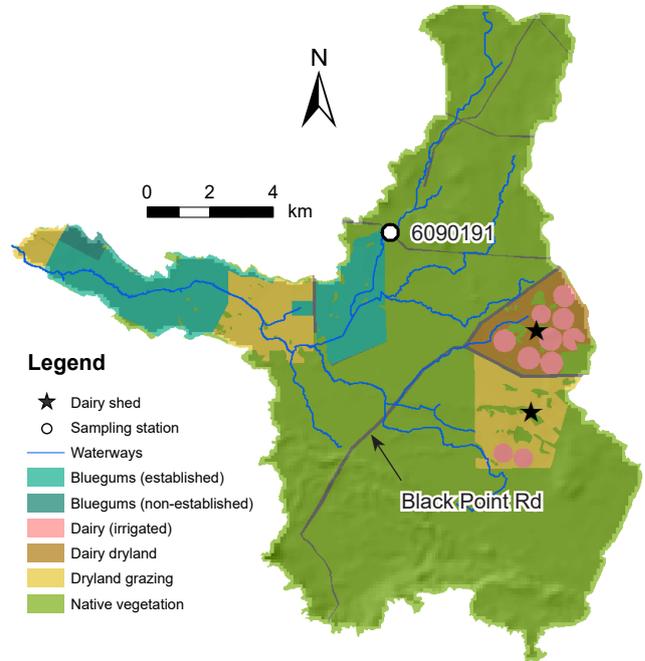
The Upper Scott catchment has an area of about 162 km², just over three-quarters of which is covered by native vegetation. There are also areas of bluegum plantations, dryland grazing and irrigated dairy. However, these are all downstream of the sampling site, or along different streams than the one the sampling site is on. The fringing vegetation is in good condition in the portions of the catchment which are still covered in native vegetation. However, it is absent or in poor condition along the streams that flow through plantations or agricultural areas.

A large portion of the catchment, especially south-east of Black Point Road, will rarely flow as most rainfall will infiltrate into the deep sands in this region.

Water quality is measured at site 6090191, Four Acres Road, where the stream passes under Four Acres Road. This site was established to quantify how much nutrients are being exported from native vegetation; upstream of the sampling site is mostly uncleared native vegetation.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the Four Acres Road sampling site in the Upper Scott catchment were low, lower than any other site in the Scott River catchment. This is because of the catchment being almost entirely uncleared upstream of the sampling site. Almost all of the nutrients present at this site are from natural sources.



Location of Upper Scott catchment in the greater Scott River catchment.

Facts and figures

Sampling site code	6090191
Rainfall at Brennans Ford (2018)	850 mm
Catchment area	162 km ²
Per cent cleared area (2009)	23 per cent
River flow	Ephemeral
Main land use (2009)	Native vegetation, bluegum plantations and dryland grazing



Nitrogen over time (2004–18)

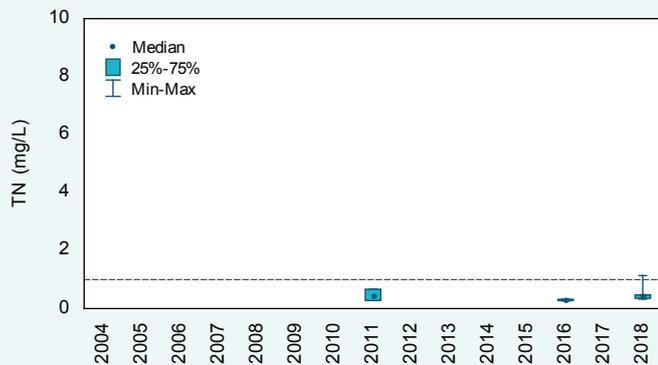
Concentrations

TN concentrations at Four Acres Road were low, with all the available data below the Water Quality Improvement Plan (WQIP) target with the exception of one sample collected in 2018. The 2018 median TN concentration at Four Acres Road was the lowest of the sites sampled in the Scott River catchment (0.40 mg/L, less than half the 2018 median of the catchment with the next lowest median, Brennans Bridge, 0.92 mg/L).

Trends

Because of the gaps in the data collected from Four Acres Road it was not possible to calculate trends in TN concentrations at this site. A minimum of five years of data are required to calculate trends.

Four Acres Road



Total nitrogen concentrations, 2004–18 at site 6090191. The dashed line is the Scott River WQIP target for median TN concentrations.



The Four Acres Road sampling site in September, shortly before the site dried for the year. The culvert where the stream passes under the road is on the right of the photograph. Note the tannin-stained water.

Nitrogen (2018)

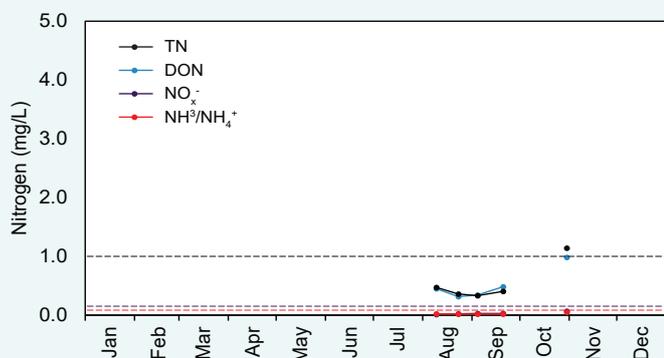
Concentrations

N concentrations were low at Four Acres Road, with all samples collected below their respective WQIP target or Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value. The exception was the last sample collected in late October, when TN was just above the target. There was a reverse seasonal pattern present, with concentrations of TN and dissolved organic N (DON) slightly higher at the beginning of the year and peaking at the end of the year. The site was not flowing between late September and early October. Given the relatively undisturbed state of the catchment, most of the N came from nitrogen fixation carried out by native vegetation and decaying plant material, which breaks down to become DON. The N concentrations seen at this site are typical for streams with an undisturbed catchment covered in native vegetation.

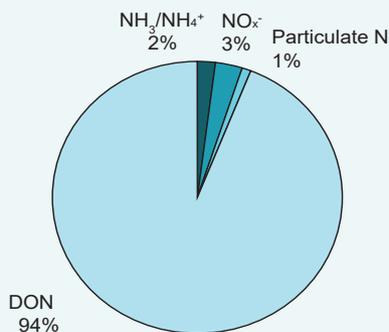
Types of nitrogen

Total N is made up of many different types of N. At Four Acres Road, most of the N was present as DON, which consists mainly of degrading plant and animal matter. Only a very small proportion of N was present as dissolved inorganic N (oxides of nitrogen; NO_x^- and ammonia N; $\text{NH}_3/\text{NH}_4^+$); the smallest of all the sites sampled in the Scott River catchment. The proportions of N at this site were typical of a largely undisturbed, forested catchment where most of the N is being sourced from nitrogen fixation by native vegetation. This accounts for the high proportion of N present as DON.

Four Acres Road



2018 nitrogen concentrations at 6090191. The black dashed line is the Scott River WQIP target for TN, the red and purple lines are the ANZECC trigger values for lowland rivers for $\text{NH}_3/\text{NH}_4^+$ and NO_x^- .



2018 average nitrogen fractions at site 6090191.



The Four Acres Road sampling site in June. Rain has created a muddy puddle but the site did not start flowing until August.

Phosphorus over time (2004–18)

Concentrations

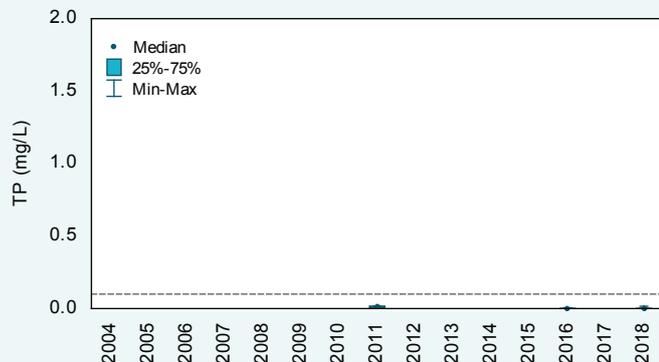
Total phosphorus (TP) concentrations were very low at the Four Acres Road site. All samples collected were well below the WQIP target. The 2018 median was the lowest of the sites sampled in the Scott River catchment (0.003 mg/L, the next lowest was 20 times higher, at Governor Broome Road, with a median of 0.062 mg/L).

The P concentrations seen at this site are typical for streams with an undisturbed catchment covered in native vegetation.

Trends

Because of the gaps in the data collected from Four Acres Road it was not possible to calculate trends in TP concentrations at this site. A minimum of five years of data are required to calculate trends.

Four Acres Road



Total phosphorus concentrations, 2004–18 at site 6090191. The dashed line is the Scott River WQIP target for median TP concentrations.



Four Acres Road in September, note the dense fringing vegetation at this largely natural site.

Phosphorus (2018)

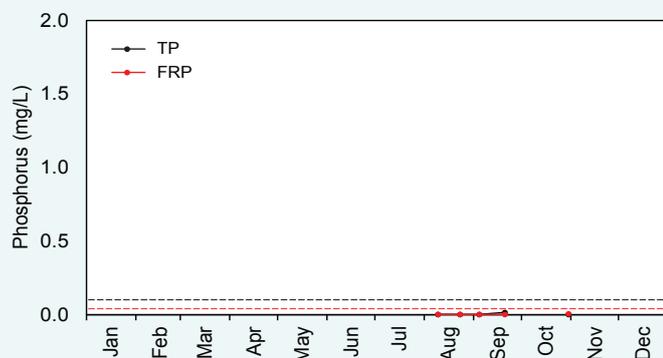
Concentrations

In 2018, phosphorus concentrations were very low at Four Acres Road with no evidence of a seasonal pattern. All TP samples were below the WQIP target and all filterable reactive phosphorus (FRP) samples below the ANZECC trigger value for lowland rivers. In fact, concentrations were so low that of the five samples collected in 2018, four were below the laboratory limit of reporting for both TP and FRP. This is indicative of the heavily vegetated catchment present upstream of this site.

Types of phosphorus

As four of the five samples collected in 2018 were below the laboratory limit of reporting for both TP and FRP, it was not possible to construct pie charts showing the relative proportion of the different forms of P.

Four Acres Road



2018 phosphorus concentrations at 6090191. The black dashed line is the Scott River WQIP target for TP, the red is the ANZECC trigger values for lowland river for FRP.



A dry creek bed in December in the Upper Scott catchment. The streams in this catchment dry over the summer months, only starting to flow again following the onset of winter rain.

Total suspended solids over time (2004–18)

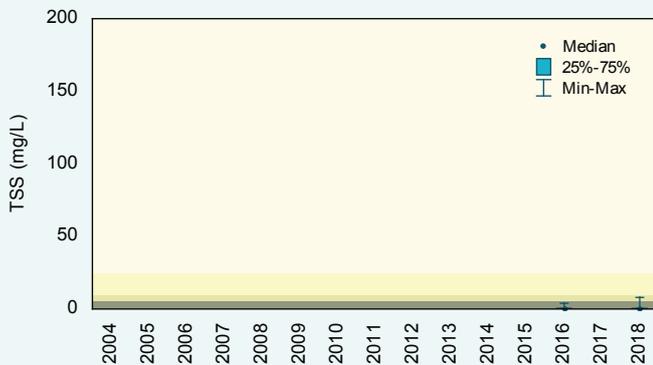
Concentrations

Total suspended solids (TSS) concentrations at Four Acres Road were low. The median concentration was low using the Statewide River Water Quality Assessment (SWRWQA) classification bands for both years for which there were data.

Trends

Because of the gaps in the data collected from Four Acres Road it was not possible to calculate trends in TSS concentrations at this site. A minimum of five years of data are required to calculate trends.

Four Acres Road



Total suspended solids concentrations, 2004–18 at site 6090191. The shading refers to the SWRWQA classification bands.

very high high moderate low



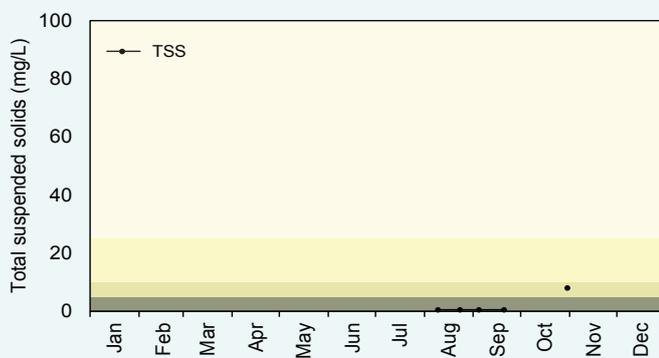
Natural vegetation along a stream in the Upper Scott catchment. There are large areas of undisturbed vegetation in this catchment.

Total suspended solids (2018)

Concentrations

In 2018, all of the samples except one were classified as low using the SWRWQA classification bands. The sample collected late in October was classified as moderate. This sample was also the only one which was above the laboratory limit of reporting. The reason for the higher TSS concentration on this sampling occasion is unclear. It may have been because of the stream starting to flow again following heavy rainfall, or the sampler inadvertently disturbing the riverbed or aquatic vegetation while taking the sample.

Four Acres Road



2018 total suspended solids concentrations at 6090191. The shading refers to the SWRWQA classification bands.

very high high moderate low



Native bushland in the Upper Scott catchment, February 2020.

Upper Scott

pH over time (2004–18)

pH values

pH fluctuated at Four Acres Road. The annual median pH was between the upper and lower ANZECC trigger values for all years for which there were data. In 2016 and 2018 there were some samples which were below the lower ANZECC trigger value.

Trends

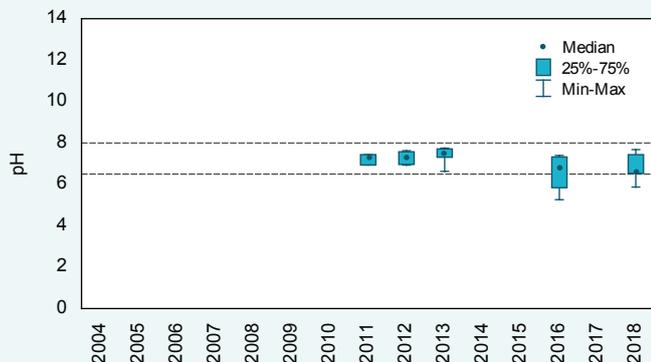
Because of the gaps in the data collected from Four Acres Road it was not possible to calculate trends in pH at this site. A minimum of five years of data are required to calculate trends.

pH (2018)

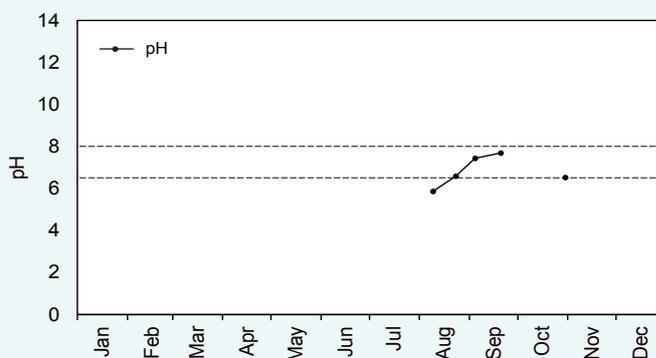
pH values

There was evidence of a seasonal pattern in pH at the Four Acres Road site. pH was lowest at the beginning and the end of the time when the watercourse was flowing. The relatively low pH at this site may be because of the presence of humic substances in the streams coming from the forest and soils upstream of the site.

Four Acres Road



pH levels, 2004–18 at site 6090191. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels at 6090191. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



Four Acres Road, close to the Upper Scott sampling site. Much of the vegetation around the sampling site is undisturbed, like this, February 2020.

Salinity over time (2004–18)

Concentrations

Four Acres Road was fresh, with all samples collected classified as fresh using the SWRWQA classification bands. While there was some slight fluctuation from year to year, salinity was stable overall.

Trends

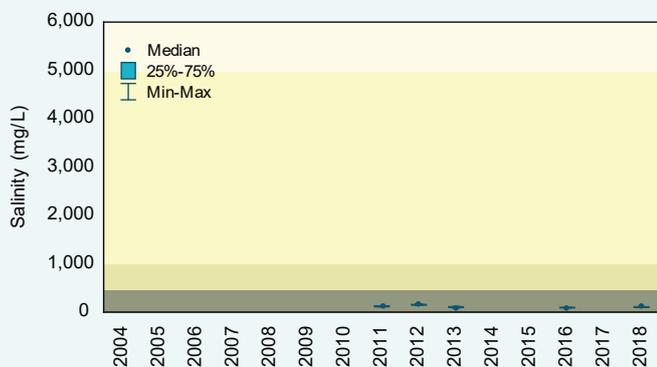
Because of the gaps in the data collected from Four Acres Road it was not possible to calculate trends in salinity at this site. A minimum of five years of data are required to calculate trends.

Salinity (2018)

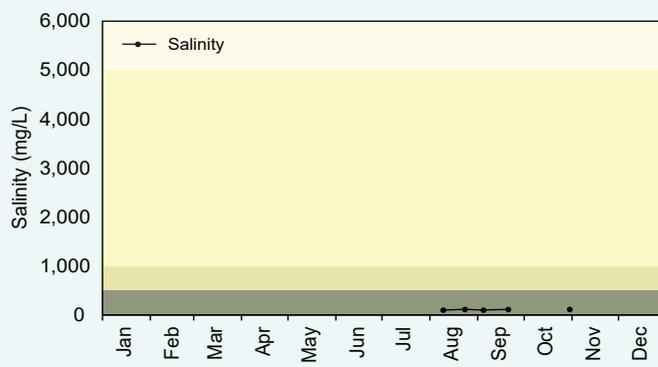
Concentrations

There was no evidence of a seasonal pattern in salinity at Four Acres Road. In fact, salinity was low year-round with all samples collected classified as fresh using the SWRWQA classification bands. This is representative of the relatively undisturbed catchment upstream of this sampling site.

Four Acres Road



Salinity concentrations, 2004–18 at site 6090191. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at 6090191. The shading refers to the SWRWQA classification bands.

saline
 brackish
 marginal
 fresh



Natural bushland in the Upper Scott catchment, February 2020.

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 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

Total nitrogen and TP concentrations were compared with the Scott River WQIP targets. These targets represent the historical median winter concentration where *Lyngbya* blooms were not observed in the upper Hardy Inlet. They were developed for use at Brennans Ford but have been used at all Scott River sites to allow for comparisons between sites. 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 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 concentrations 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.

