

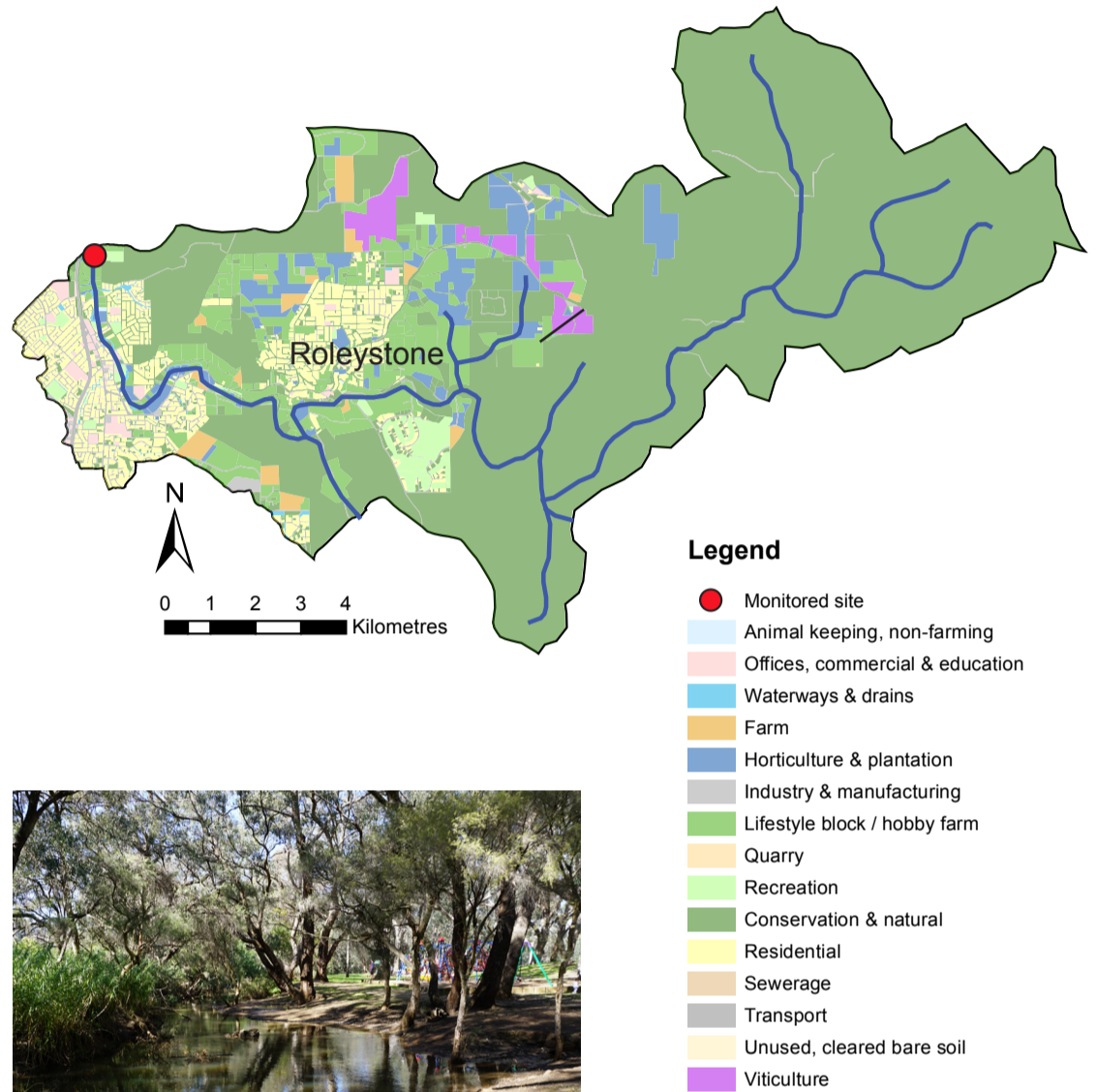
Upper Canning River

The Upper Canning River is a permanent, natural river system that only ceases to flow after a series of low rainfall years. The river is dammed on the Darling Scarp and this has produced an artificial flow regime. The Upper Canning catchment drains the area below the Canning Reservoir wall to the junction with Southern River in Gosnells. It contributes the second-largest inflow to the Canning Estuary.

Much of the catchment remains uncleared and is classified as state forest. The catchment's western portion has been cleared for urban and agricultural use with many orchards present. Significant urban expansion is set to occur along the river in areas that are presently rural. Foreshore vegetation includes extensive areas of remnant vegetation including wetlands and woodlands, narrow riverine fringes of vegetation, and areas modified for public access that are mostly grassed.

The Upper Canning is mostly a hills catchment. From the base of the reservoir, the river flows west for about 10 km through a deep valley in the Darling Scarp. The Upper Canning River flows through Helena and then Dwellingup soils as it passes over the scarp. It then passes through a small portion of Southern River sands and Forrestfield soils before it becomes the Lower Canning River. Most of the flow in the Upper Canning results from surface water rather than groundwater.

Water quality is monitored fortnightly at the Seaforth gauging station near the lower end of the Upper Canning River. This site was chosen to estimate the nutrient concentrations leaving the catchment, so the data may not accurately represent nutrient concentrations in upstream tributaries.



The Canning River in Kelmscott, August 2016.



The spillway at Churchman Brook dam which is just upstream of the Upper Canning catchment, August 2017.

Upper Canning River – facts and figures

Average rainfall (2012–16)	~ 680 mm per year (Perth metro)
Catchment area	147 km ²
Per cent cleared area (2005)	25%
River flow	Permanent, only ceases to flow after a series of low rainfall years Canning Dam is located on the Canning River
Average annual flow	~ 7.1 GL per year (2012–15 average)
Main land uses (2005)	Conservation and natural, farms and rural residential (bush blocks)

Nutrient Summary: concentrations, estimated loads and targets

Year	Site	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Annual flow (GL)	616027	4.6	9.8*	10.0*	10.5*	3.2	8.4*	5.5	8.8	9.1*	5.1*	
TN median (mg/L)	616027	0.29	0.50	0.36	0.38	0.30	0.46	0.33	0.38	0.31	0.32	0.51
TP median (mg/L)	616027	0.013	0.013	0.017	0.016	0.017	0.021	0.012	0.012	0.013	0.012	0.017
TN load (t/yr)	616027	2.57	8.37*	8.36*	9.24*	1.65	7.14*	3.09	7.70	7.21*	3.26*	
TP load (t/yr)	616027	0.08	0.27*	0.26*	0.31*	0.05	0.24*	0.10	0.26	0.22*	0.10*	

TN short term target = 2.0 mg/L

TN long term target = 1.0 mg/L

TP short term target = 0.2 mg/L

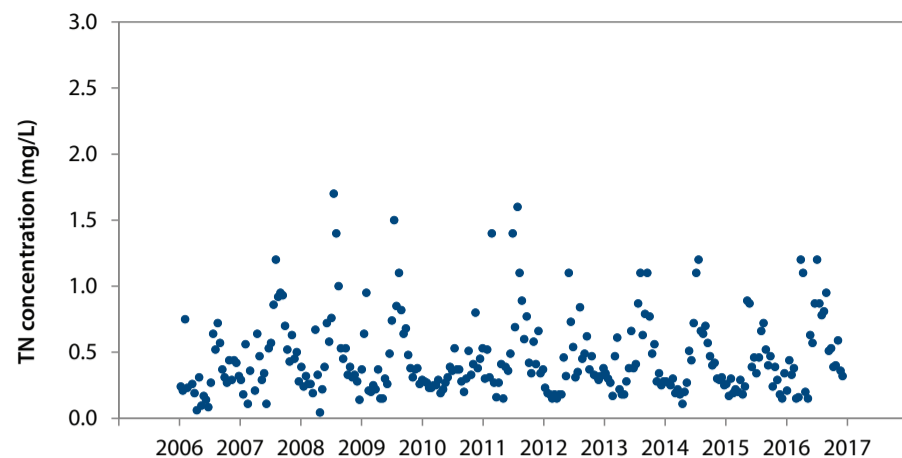
TP long term target = 0.1 mg/L

insufficient data to test target
 failing both short and long-term target
 passing short but failing long-term target
 passing both short and long-term target

* Best estimate using available data. # Statistical tests that account for the number of samples and large data variability are used for testing against targets on three years of winter data. Thus the annual median value can be above the target even when the site passes the target (or below the target when the site fails).

Changes in nutrient concentrations over time in the Upper Canning River

Total nitrogen concentrations over the 2006 to 2016 monitoring period



Trend

Visually little change in total nitrogen (TN) concentrations has occurred over the reporting period. This was verified by statistical analysis, which detected no trends. Both 2006 and 2010 were extremely dry years and this is shown by the absence of high values for these two years.

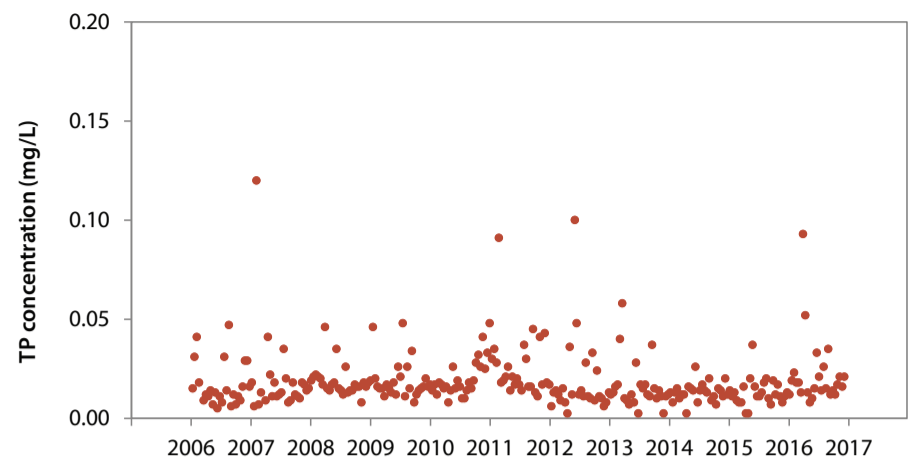
Target

The Upper Canning River has been passing the short- and long-term TN targets for the entire reporting period.



Staff gauges at the Upper Canning sampling site following heavy rainfall, August 2017. Photo: Dominic Heald

Total phosphorus concentrations over the 2006 to 2016 monitoring period



Trend

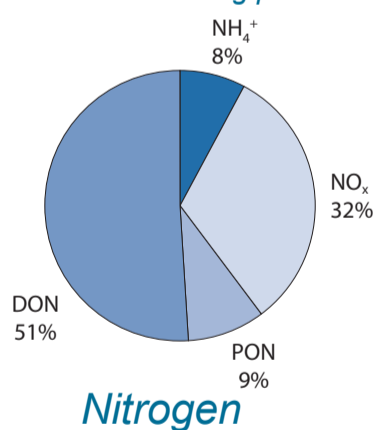
Total phosphorus (TP) concentrations remained steady during the reporting period, except for the peak from late 2010 to early 2011. The reason for this peak is unknown. Statistical analysis found no trends in the data.

Target

The Upper Canning River has been passing the short- and long-term TP targets for the entire reporting period.

Nutrient fractions and estimated loads in the Upper Canning River

Average composition of nitrogen (N) in Upper Canning River over the 2012 to 2016 monitoring period

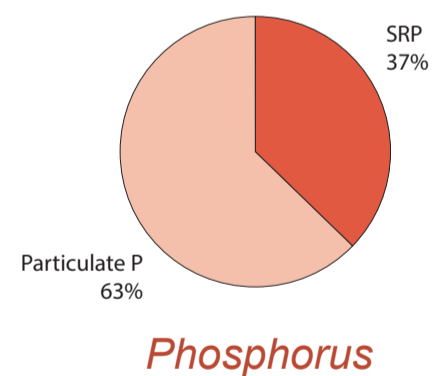


Just over one-third of the nitrogen (N) in the Upper Canning River was present as dissolved inorganic N (DIN, consisting of ammonium – NH_4^+ and N oxides – NO_x). This form of N is readily available for plant and algal uptake and is most likely sourced from fertilisers used in agricultural and urban areas, septic tank leachate and animal waste. The remaining N was present

as organic N which consists of both dissolved (DON) and particulate (PON) fractions. DON largely comprises organic compounds leached from peaty soils and degrading plant and animal matter and is available for uptake by plants, algae and bacteria. PON is composed of plant and animal debris and needs to be further broken down to become available to plants and algae.

As the Upper Canning River did not have flow (and therefore load) information available for each of the last five years (2012–16, 2016 had no flow data) it was not possible to compare its loads with the other subcatchments.

Average composition of phosphorus (P) in Upper Canning River over the 2012 to 2016 monitoring period



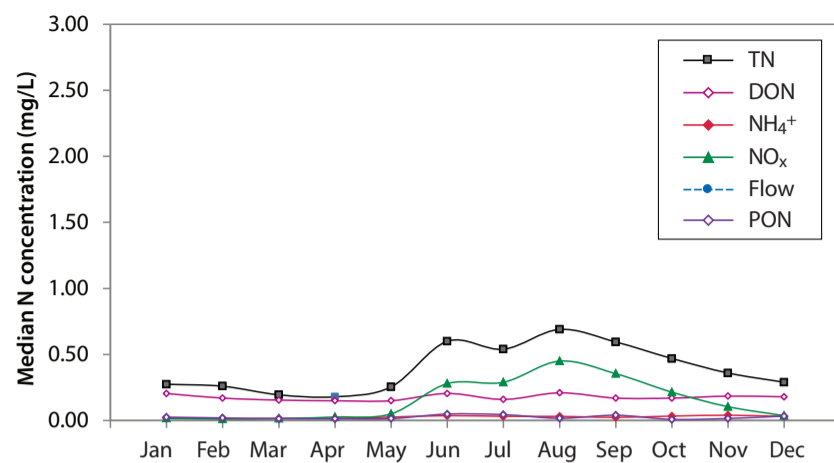
Almost two-thirds of the phosphorus (P) in the Upper Canning River was in the form of particulate P, which includes sediment-bound forms of P and degrading plant and animal matter. This form of P is not readily available for plant and algal uptake, but some may become available as particles decompose and bound phosphate is released. The remainder of the P was present as soluble reactive phosphorus (SRP) which is derived from fertilisers used in the catchment, animal waste and septic tank leachate. SRP is readily available for plant and algal uptake.

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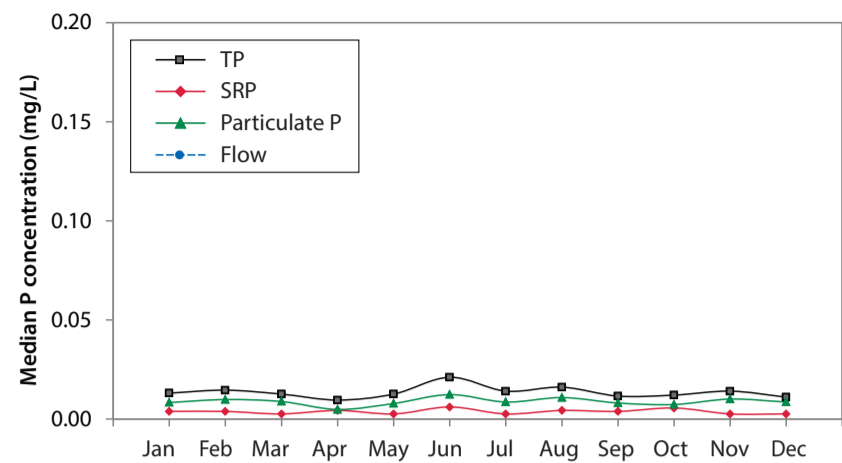


Seasonal variation in nutrient concentrations in the Upper Canning River

Nitrogen seasonal variation over the 2012 to 2016 monitoring period



Phosphorus seasonal variation over the 2012 to 2016 monitoring period



Nitrogen

NO_x concentrations in the Upper Canning River were closely linked to flow. With the onset of winter rains, surface flows mobilised NO_x derived from fertilisers and other sources that had accumulated in the catchment since the previous spring. This then entered the river via surface and subsurface flows. As rainfall eased and the amount of water moving down the river decreased, NO_x concentrations declined.

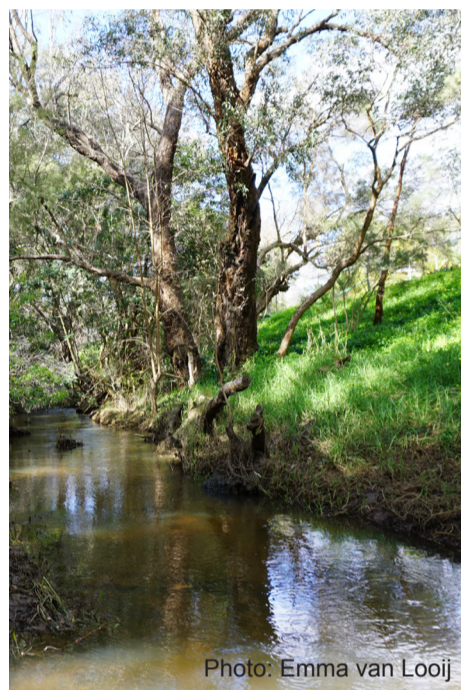


Photo: Emma van Looij

Phosphorus

Phosphorus concentrations did not show a noticeable flow response, remaining fairly constant year-round. It is likely P was entering the river year-round via groundwater, instream sources and surface and subsurface flows.

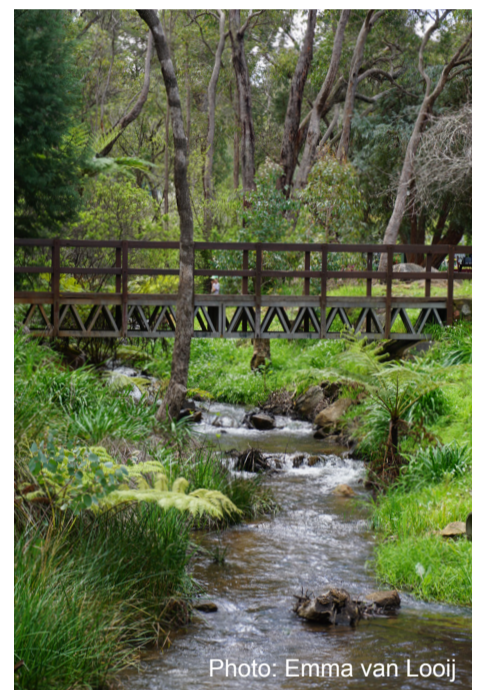


Photo: Emma van Looij



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Photographs of Upper Canning River: (Top left) Churchman Brook dam, this is just upstream of the Upper Canning River catchment and dams Churchman Brook, August 2017. (Bottom left) Dam on a tributary of the Canning River at Stinton Cascades, August 2017. (Right) The Upper Canning River at Roley Pool in Roleystone, August 2017.

Local nutrient reduction strategies for the Upper Canning River

Nutrient reduction strategies being undertaken or recently completed in the Upper Canning River catchment include but are not limited to:

- The Sediment and Erosion Control Project which is a detailed investigation into the planning, statutory and policy mechanisms for controlling and enforcing the management of erosion and sedimentation within the cities of Armadale and Gosnells.
- A study of sedimentation in Canning River pools where pools are being identified and prioritised to assess the impact of sedimentation.
- The City of Armadale Streamcare Project, which began in 2002 and has helped hundreds of landowners take care of their local riverside environments. Any resident in the City of Armadale with a waterway flowing through their property is eligible to participate in the program and receive technical advice about weed control, herbicides, property planning and revegetation. They may also be eligible for free native plants to revegetate their waterway.
- The Armadale Gosnells Landcare Group coordinating landcare planning, community action and awareness programs. This is a community group comprising elected and senior staff representatives of the cities of Armadale and Gosnells, government agencies, community members and landholders.
- Ongoing subregional projects. These are partnership projects whereby the South East

Regional Centre for Urban Landcare works together with the Department of Biodiversity, Conservation and Attractions (DBCA), local governments and community to deliver water quality and community capacity-building outcomes.

- The Phosphorus Awareness Project which aims to assist the community in reducing their nutrient outputs through education, promotion and behaviour change programs.
- The DBCA's Healthy Catchments Program aims to protect the environmental health and community benefit of the Swan Canning river system by improving water quality in the catchments. This is achieved through engaging partners and focusing the effort of local governments, sub-regional groups, the community and other organisations in water quality improvement activities.

Swan Canning water quality improvement plan

The Swan Canning water quality improvement plan (SCWQIP) complements the River Protection Strategy (RPS) and presents a roadmap for reducing nutrient inputs into the Swan Canning river systems. It uses sophisticated modelling to identify nutrient sources and provides nutrient-reduction targets for each of the subcatchments.

SCWQIP load and concentration targets for Upper Canning River

	Max. load (t/yr)	Conc. target (mg/L)	% reduction
TN	7.5	1.00	0%
TP	0.42	0.100	0%

For further information on the RPS and the SCWQIP contact rivers.info@dbca.wa.gov.au

Summary: Upper Canning River

- The Upper Canning River is passing both the short- and long-term TN and TP targets.
- Of the 33 sites sampled, it has one of the lowest median TN and TP concentrations.
- Since the last nutrient reports were published in 2012 (presenting data up-to and including 2011) the proportion of P present as bioavailable SRP has increased from 27 to 37%.
- Nutrient concentrations are currently considered acceptable and no decrease is required for the Upper Canning River to meet its SCWQIP targets.