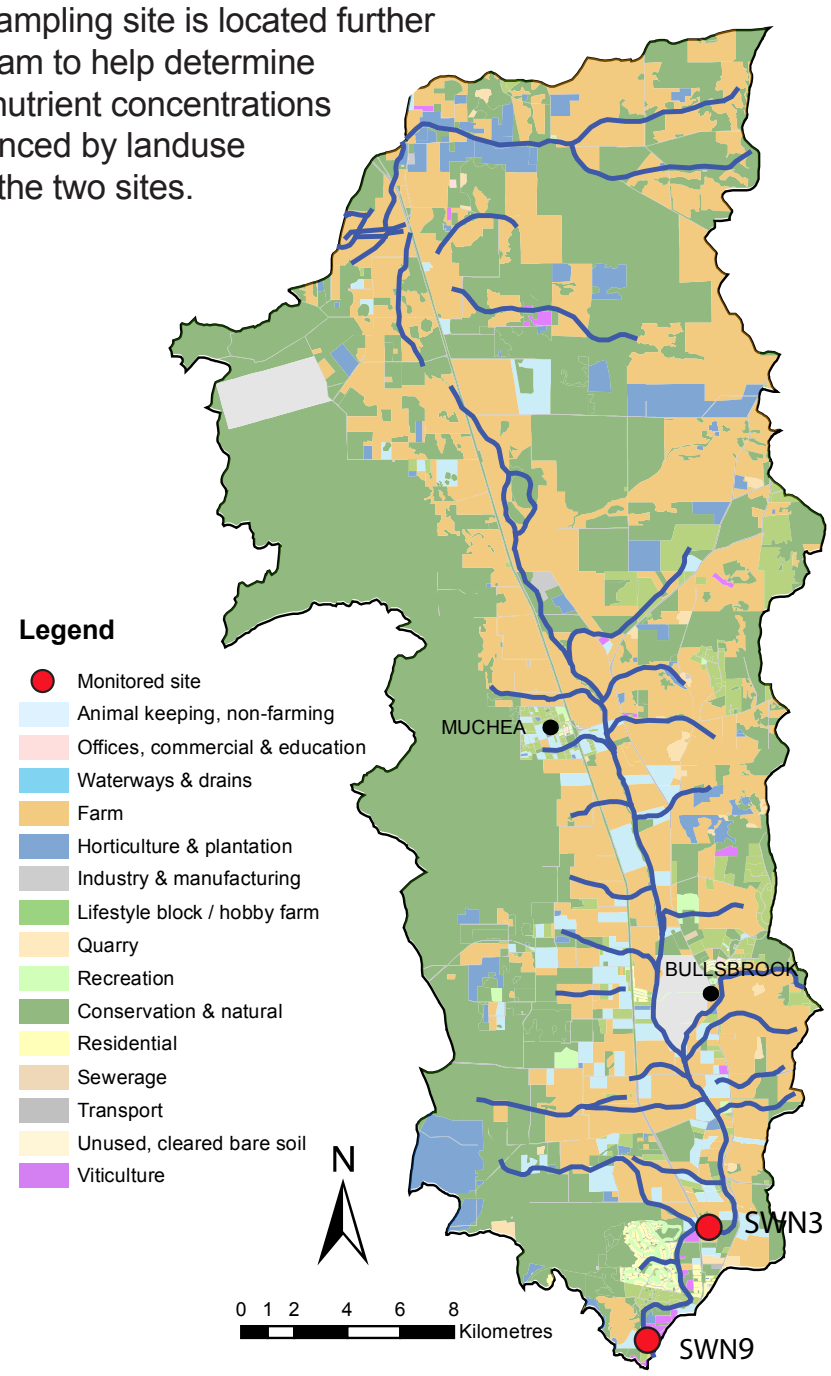
Ellen Brook

Ellen Brook is a natural, ephemeral waterway and has the largest catchment area of all the Swan Canning subcatchments on the Swan Coastal Plain. It discharges into the Upper Swan Estuary near West Swan Road in Belhus.

Much of the Ellen Brook catchment has been cleared for agriculture. Some of the remaining areas of vegetation have a high conservation value, containing rare and endangered flora and fauna such as the western swamp tortoise.

Soils in the Ellen Brook catchment consist mainly of Bassendean sands in the west, Guildford clays along the Ellen Brook valley, and red earth soils to the east. Shallow lenses of sandy-clay and loamy-clay duplexes are also common in valley areas, giving rise to perched wetlands during wet periods. Groundwater flows towards Ellen Brook from the Gnangara Mound in the west and from aquifers on the Dandaragan Plateau to the east. Natural springs are present in some areas.

Water quality is monitored fortnightly at the Department of Water and Environmental Regulation gauging station near the lower end of the brook, close to Great Northern Highway. This site is useful to estimate what nutrients are leaving the catchment, but not nutrient concentrations in upstream tributaries. A second sampling site is located further downstream to help determine whether nutrient concentrations are influenced by landuse between the two sites.



Ellen Brook – facts and figures

Average rainfall (2012–16)	~ 680 mm per year (Perth metro)
Catchment area	715 km^2
Per cent cleared area (2005)	54%
River flow	Ephemeral (May to December) No major water supply dams in catchment
Average annual flow	~ 10.7 GL per year (2012–16 average)
Main land uses (2005)	Conservation and natural, farms.

A riffle installed in Ellen Brook, October 2016.

High water levels at West Swan Road after heavy summer rainfall, February 2017.

Nutrient Summary: concentrations, estimated loads and targets

Year	Site	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Annual flow (GL)	616189	7.5	13.6	12.9	19.1	2.3	9.2	3.1	18.3	9.7*	4.1*	18.4*
TN median (mg/L)	SWN3	1.30	2.50#	2.00#	2.40	2.00#	2.20	1.80#	2.50	2.20	2.30	2.50
TP median (mg/L)	SWN3	0.350	0.430	0.390	0.440	0.270	0.430	0.280	0.495	0.440	0.310	0.440
TN load (t/yr)	SWN3	16.37	32.30	29.68	46.10	4.38	20.88	5.88	45.21	22.19*	8.77*	46.93*
TP load (t/yr)	SWN3	3.17	6.22	5.81	9.09	0.82	3.94	1.10	9.46	4.13*	1.58*	8.81*
TN median (mg/L)	SWN9					0.78	1.45	0.98#	0.97#	1.25	1.30	1.80
TP median (mg/L)	SWN9					0.115	0.185	0.150	0.130	0.135	0.105	0.210

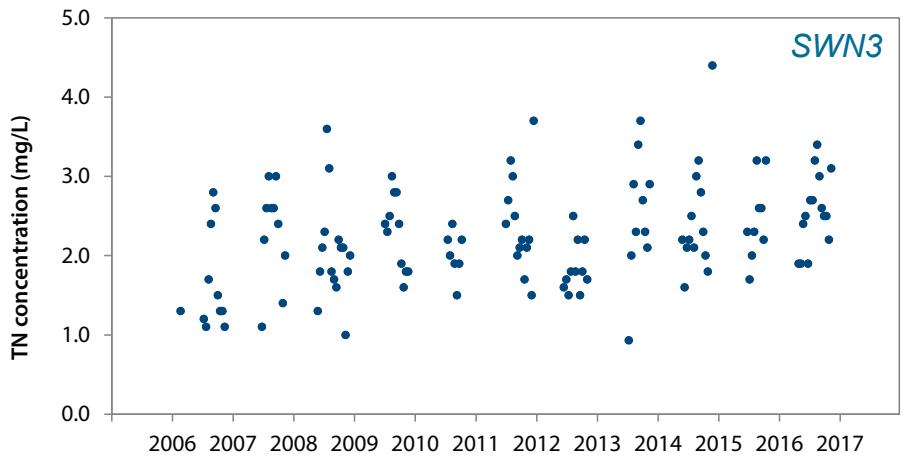
TN short term target = 2.0 mg/L TN long term target = 1.0 mg/L TP short term target = 0.2 mg/L TP long term target = 0.1 mg/L

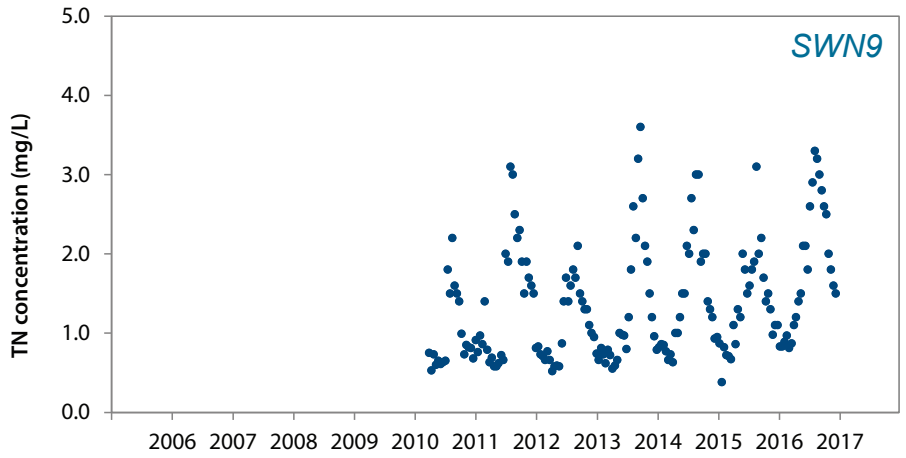
insufficient data to test target failing both short and long-term target passing short but failing long-term target passing both short and long-term target

* 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 Ellen Brook

Total nitrogen concentrations over the 2006 to 2016 monitoring period





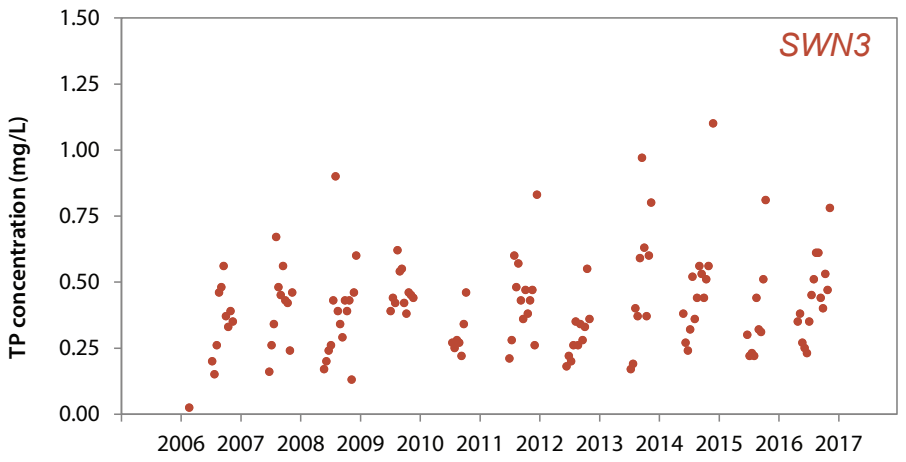
Trend

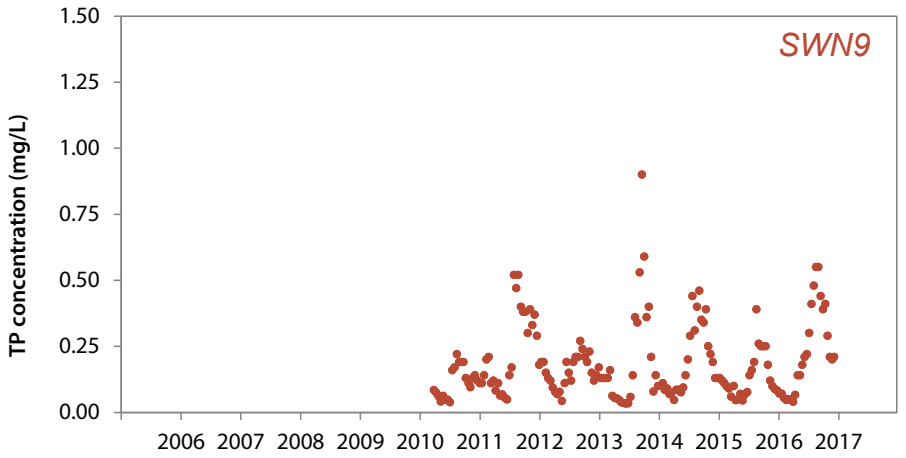
Visually, total nitrogen (TN) increased over the monitoring period at both sites and both had emerging increasing trends of 0.1 mg/L/yr over the 2012–16 period. TN concentrations were very similar at the two sites during winter.

Target

The upstream site, SWN3 is currently failing both the short- and long-term TN targets. SWN9, which is further down in the catchment is passing the short- but failing the long-term TN target.

Total phosphorous concentrations over the 2006 to 2016 monitoring period





Trend

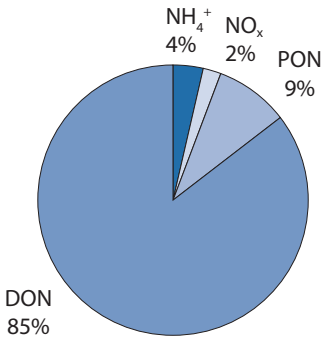
Total phosphorus (TP) concentrations appear stable at both sites. No TP trends were detected at either site. TP concentrations were very similar at the two sites during the winter months.

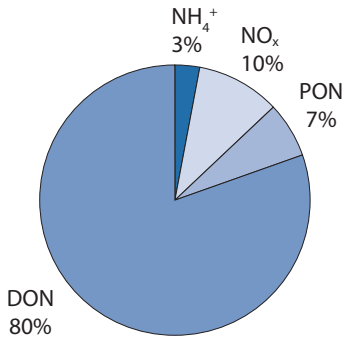
Target

Site SWN3 has been failing both the short- and long-term TP targets since 1987. SWN9 is currently failing both the short- and long-term TP targets. Prior to 2016 it was passing the short- but failing the long-term target.

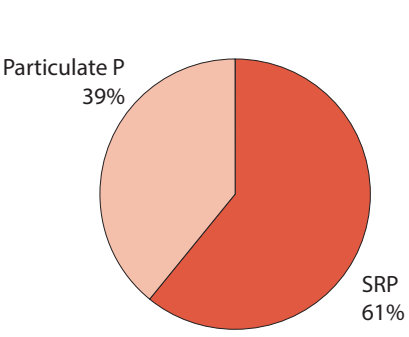
Nutrient fractions and estimated loads in Ellen Brook

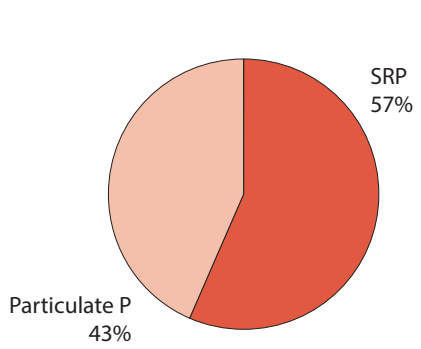
Average composition of nitrogen (N) in Ellen Brook over the 2012 to 2016 monitoring period





Average composition of phosphorus (P) in Ellen Brook over the 2012 to 2016 monitoring period





SWN3

Almost all of the nitrogen (N) at both sites was organic N which consists of dissolved (DON) and particulate (PON) fractions. DON is mostly organic compounds leached from peaty subsoils, degrading plant and animal matter, and synthetic compounds such as urea (used in fertilisers). PON is composed of plant and animal detritus and needs to be further broken down to become available to plants and algae. Dissolved inorganic N (DIN, ammonium – NH_4^+ and N oxides – NO_x) made up the remaining N.

SWN9

Ellen Brook had the second-largest average TN load (2012–16) but the fourth-smallest load per unit area (0.04 t/km^2/yr) of the nine subcatchments with flow data.

SWN3

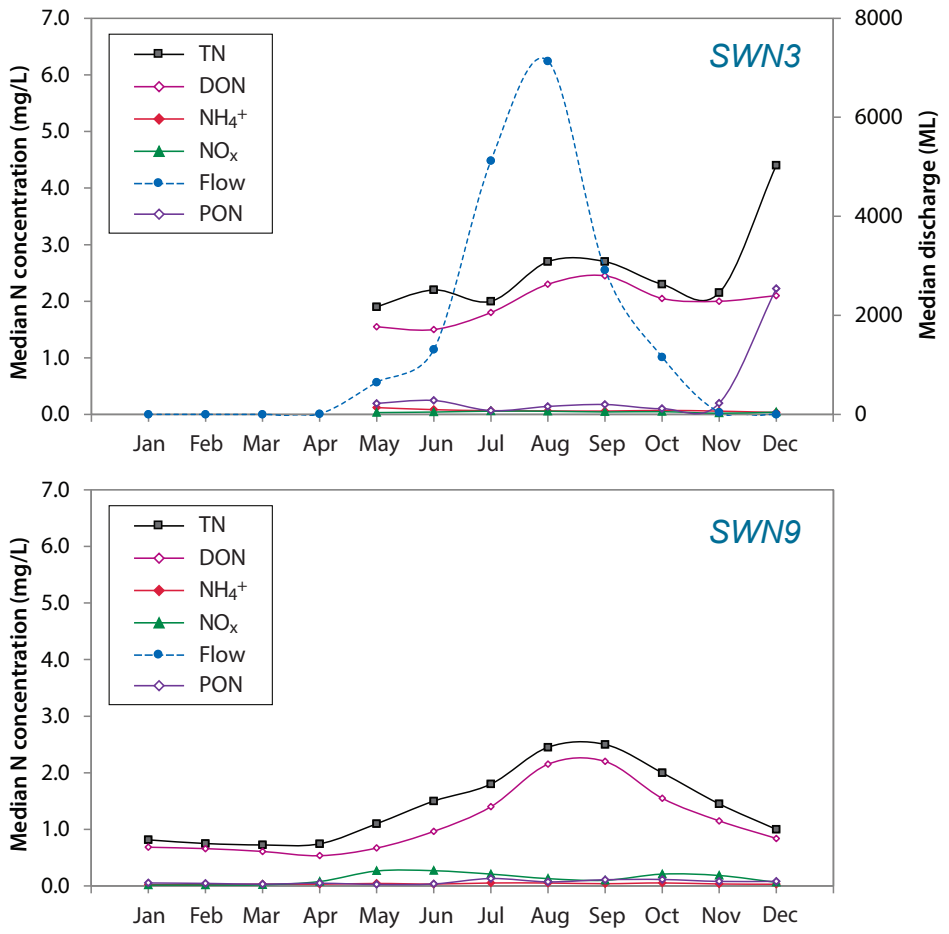
More than half of the phosphorus (P) present at both sites was soluble reactive phosphorus (SRP). This form of P is readily available for plant and algal uptake and is probably derived from animal waste and fertilisers. The remaining P was particulate P, which is not immediately available for plant and algal uptake. Likely sources for this kind of P include organic waste material and sediment-bound forms of P.

SWN9

Ellen Brook had the largest average TP load (2012–16) of the nine subcatchments with flow data. Southern River (which had a similar average discharge volume) only contributed 1.9 t compared to Ellen Brook's 5.0 t.

Seasonal variation in nutrient concentrations in Ellen Brook

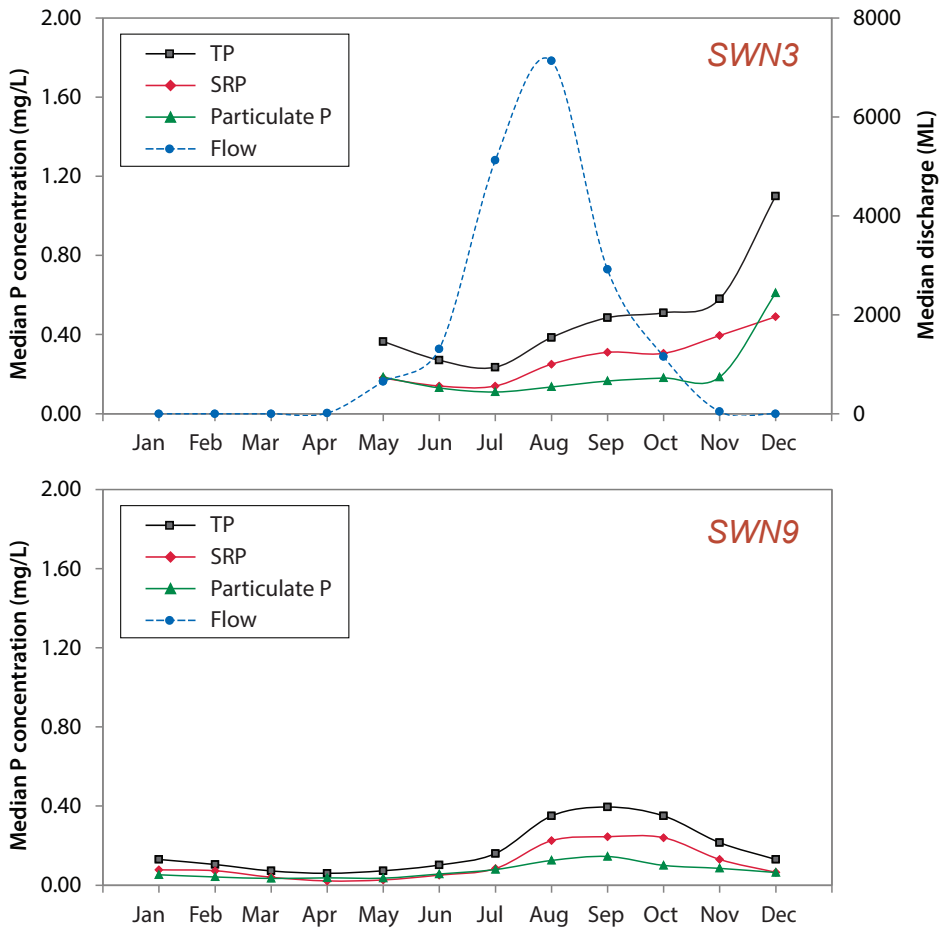
Nitrogen seasonal variation over the 2012 to 2016 monitoring period



Nitrogen

Generally, N concentrations behaved similarly at both sites, though only SWN9 flows year-round. TN and DON were seasonal, being highest in winter. This coincides with flushing of DON from surface soils and the surface transport of particulate material (containing PON). Groundwater also rises and contributes more N in winter. The high concentrations in December were from a single sampling event following unseasonal rainfall in 2014.

Phosphorus seasonal variation over the 2012 to 2016 monitoring period



Phosphorus

Like N, P concentrations behaved similarly at both sites. All forms of P varied seasonally, increasing in response to winter rains (and rising groundwater levels) and falling again as rainfall eased. SRP is transported to the brook by groundwater discharge and subsurface and surface runoff. As with N, the high concentrations in December were from a single sampling event in 2014.

Photo: Dieter Tracey

Department of Biodiveristy, Conservation and Attractions

Photo: Kelli O'Neill

Photographs of Ellen Brook: (Top left) The gauging station weir where water samples are collected, September 2005. (Above left) Monitoring water quality in one of the Ellen Brook constructed wetlands, November 2016. (Right) Ellen Brook just downstream of Brand Highway, November 2012.

Local nutrient reduction strategies for Ellen Brook

Nutrient reduction strategies being undertaken or recently completed in the Ellen Brook catchment include but are not limited to:

- A riparian fencing and revegetation program, which has seen designated areas along Ellen Brook fenced off and planted with native species.
- The Department of Biodiversity, Conservation and Attractions (DBCA) Drainage and Nutrient Intervention Program trialling a number of different approaches to water quality improvement at different scales in the Ellen Brook Catchment including a nutrient filter at Brand Highway on the Ellen Brook, a wetland and nutrient filter on a minor tributary to Ellen Brook and a wetland on Bingham Road creek.
- 50 tonnes of Phoslock® was applied to the Ellen Brook in 2013 to reduce soluble phosphorus loads entering the Swan River.
- The first stage of a seven wetland project was constructed in 2014. The first stage of the Ellen Brook wetland project uses IronMan Gypsum, a mining by-product, to enhance phosphorus removal.
- Immediately upstream of the Ellen Brook Wetland, is the Belhus Reserve which has been modified with restoration being undertaken to reduce sediment delivered from this drainage line to the Ellen Brook. Riffles and a sedimentation area have been installed and weed control and revegetation are being undertaken.
- A four-year soil amendment trial has been completed. This investigated three different by-products to increase phosphorus retention of the sandy soils in rural Ellen Brook.
- Nutrient waste and property management workshops were and continue to be delivered to the horse industry in the Swan-Canning catchment by the Ellen Brockman Integrated Catchment Group.
- Ongoing subregional partnership projects whereby the Ellen Brockman Integrated Catchment Group is working together with DBCA, local governments and community groups 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.

The Ellen Brook catchment has a local WQIP that draws together activities for improving water quality in the catchment and helps to target future investment for better water quality outcomes.

SCWQIP load and concentration targets for Ellen Brook

	Max. load (t/yr)	Conc. target (mg/L)	% reduction
TN	22.1	1.00	69%
TP	2.13	0.100	79%

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

Summary: Ellen Brook

- At SWN3, the proportion of N present as highly bioavailable DIN is equal lowest of all the sites sampled.
- Of the 33 sites sampled, Ellen Brook sites have the third- and second-highest median TN concentrations and the highest and third-highest median TP concentrations.
- Of the nine sites with flow data, Ellen Brook has the second-largest average TN load and the largest average TP load.
- Of the 33 sites sampled, SWN9 has the third highest proportion of P present as bioavailable SRP. SWN3 also had a large proportion of P present as SRP.
- Currently SWN3 is failing both the short- and long-term TN and TP targets. SWN9 is failing the short- but passing the long-term TN target and is failing both TP targets.
- Emerging increasing short-term TN trends were present at both sites.
- Overall, a 69% reduction in TN and a 79% reduction in TP is required for this catchment to meet its SCWQIP targets.

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