Helena River

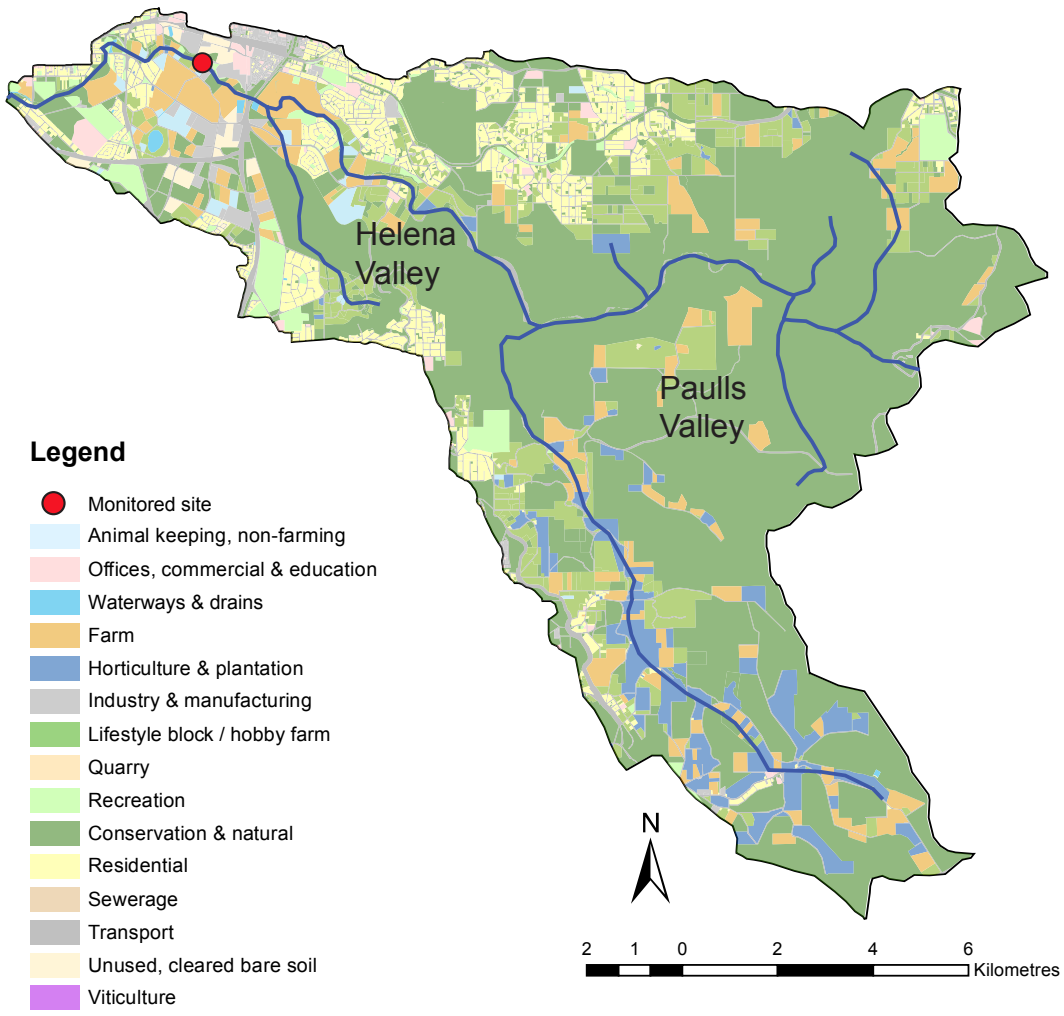
The Helena River's headwaters originate in the Darling Scarp, before traversing the coastal plain and discharging into the Upper Swan Estuary at Guildford. Piesse Gully flows through state forest and Kalamunda National Park before joining Helena River just upstream of the Lower Helena Pumpback Dam. Helena River is an ephemeral river system with a largely natural catchment comprising bushland, state forest and national parks. The river's flow regime has been altered and reduced by dams including the the Lower Helena Pumpback Dam and the Helena River Reservoir (Mundaring Weir) and associated control structures.

The area above the Lower Helena Pumpback Dam is a water supply catchment for Perth and the Goldfields region. Surface water quality is ensured with controls over access, land use practices and development in this part of the catchment.

Large tracts of state forest and bushland exist in the Helena River catchment including Greenmount, Beelu, Gooseberry Hill, Kalamunda and a small portion of John Forrest national parks. Agricultural, light industrial and residential areas make up the remaining land use in the catchment.

Soils in the catchment comprise shallow earths and sandy and lateritic gravels on the Darling Scarp; sandy, gravelly soils on the foothills to the west; and alluvial red earths close to the confluence with the Swan Estuary. Groundwater tends to make a relatively minor contribution to flow in the Helena River.

Water quality is monitored fortnightly at the Department of Water and Environmental Regulation gauging station located near the catchment's lower end, shortly before the river flows into the Upper Swan Estuary near the Westrail workshops at Bellevue. The site has been positioned to give an indication of the nutrients leaving the catchment and may not represent upstream areas. From 2016, there were no flow data available.



Helena River – facts and figures

Average rainfall (2012–16)	~ 680 mm per year (Perth metro)
Catchment area	175 km^2
Per cent cleared area (2005)	36%
River flow	Ephemeral (flows June to January) Two water supply dams are present in the catchment
Average annual flow	~ 5.1 GL per year (2012–15 average)
Main land uses (2005)	Conservation and natural, residential and farms.


Photo: Water Science Branch

Nutrient Summary: concentrations, estimated loads and targets

Year	Site	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Annual flow (GL)	616086	0.9*	8.8*	13.5*	14.2*	1.7*	10.8*	3.9*	10.8	4.0*	1.5*	
TN median (mg/L)	SWN10	1.04#	0.94	0.66	0.72	0.61	1.00	0.61	0.92	0.89	0.89	0.80
TP median (mg/L)	SWN10	0.041	0.013	0.016	0.018	0.015	0.016	0.012	0.013	0.021	0.021	0.022
TN load (t/yr)	SWN10	0.85*	9.46*	17.61*	16.84*	1.48*	11.83*	3.24*	12.05	3.77*	1.31*	
TP load (t/yr)	SWN10	0.02*	0.20*	0.36*	0.34*	0.03*	0.24*	0.07*	0.24	0.08*	0.03*	

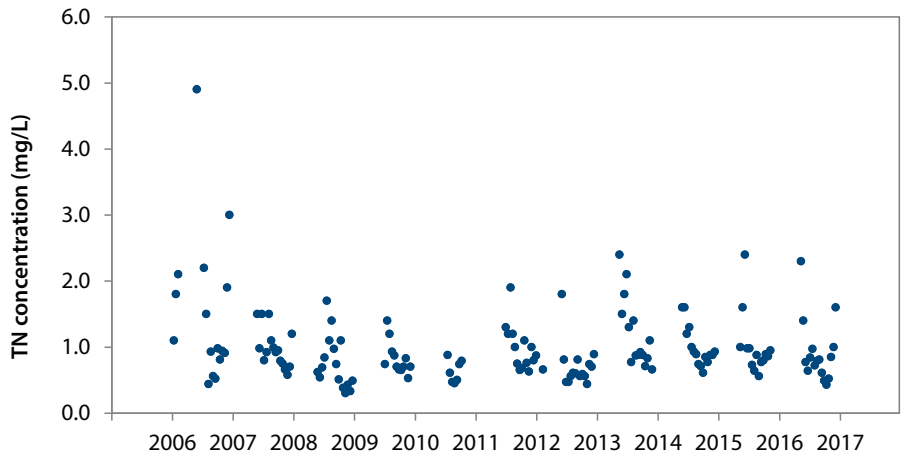
TN short term target = 2.0 mg/L TN long term target = 1.0 mg/L TP short term target = 0.2 mg/L TP long term target = 0.1 mg/L

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

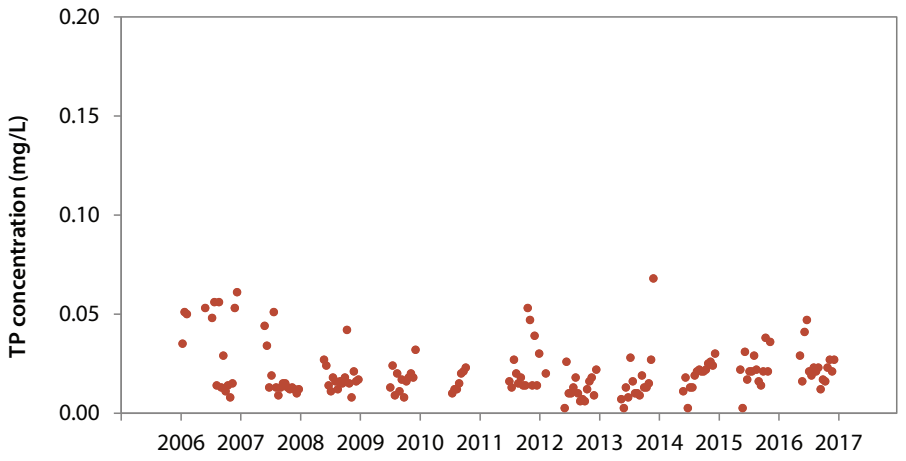
* Best estimate using available data. # Statistical tests that account for the number of samples and large data variability are used for testing against targets on three years of winter data. Thus the annual median value can be above the target even when the site passes the target (or below the target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

Changes in nutrient concentrations over time in the Helena River

Total nitrogen concentrations over the 2006 to 2016 monitoring period



Total phosphorus concentrations over the 2006 to 2016 monitoring period



Trend

Total nitrogen (TN) concentrations fluctuated over the reporting period. No trends were detected over either the short- (2012–16) or long-term (2007–16).

Target

Helena River has been passing the short- and long-term TN targets for the reporting period.

Helena River Pumpback Dam, August 2017. Photo: Emma van Looij

Trend

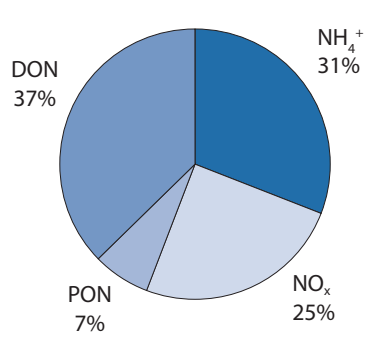
Visually, total phosphorus (TP) concentrations have been relatively stable over the reporting period. However, statistical analysis detected a small increasing trend over the short-term (2012–16) of 0.003 mg/L/yr.

Target

Helena River has been passing the short- and long-term TP targets for the reporting period.

Nutrient fractions and estimated loads in the Helena River

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

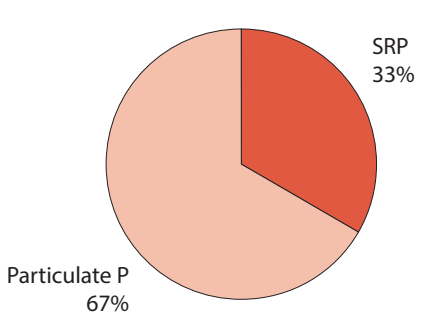


Nitrogen

Just over half the nitrogen (N) present in Helena River was dissolved inorganic N (DIN, comprising ammonium – NH_4^+ and nitrogen oxides – NO_x). These forms of N are readily available for uptake by plants and algae and are derived from fertilisers, animal waste, industrial sources and septic tank leachate. Organic N made up the remainder of the N and consists of both dissolved (DON) and particulate (PON) fractions. DON is mostly organic compounds leached from peaty subsoils and degrading plant and animal matter and is available for uptake by plants, algae and bacteria. PON is plant and animal debris and needs to be further broken down to become available to plants and algae.

As Helena River did not have flow (and therefore load) information available for the last five years (2012–16) it was not possible to compare its loads with the other subcatchments.

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



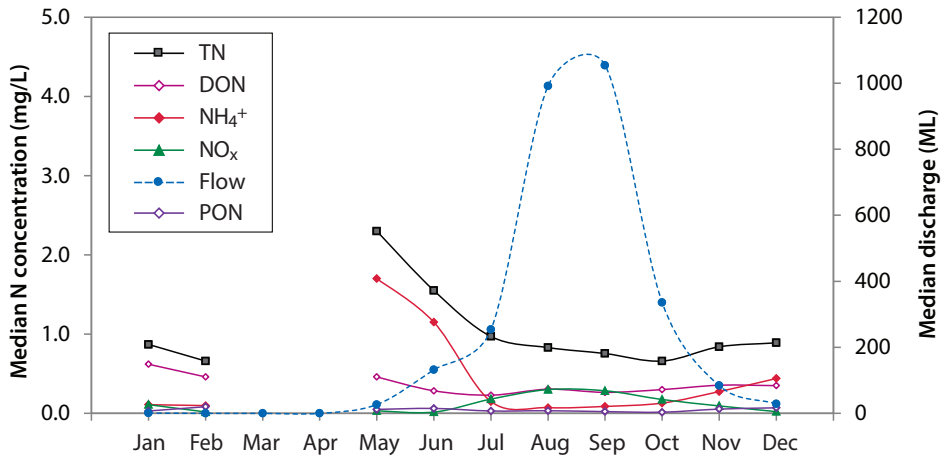
Phosphorus

Approximately two-thirds of the phosphorus (P) in Helena River was particulate P which is commonly associated with soil erosion and suspended sediments in the water column. This form of P is not readily bioavailable, but may become so as particles decompose and bound phosphate is released. The remainder of the P was present as soluble reactive phosphorus (SRP). Animal waste, fertilisers and septic tank leachate are common sources of SRP in rural catchments. This form of P is readily available for plant and algal growth.

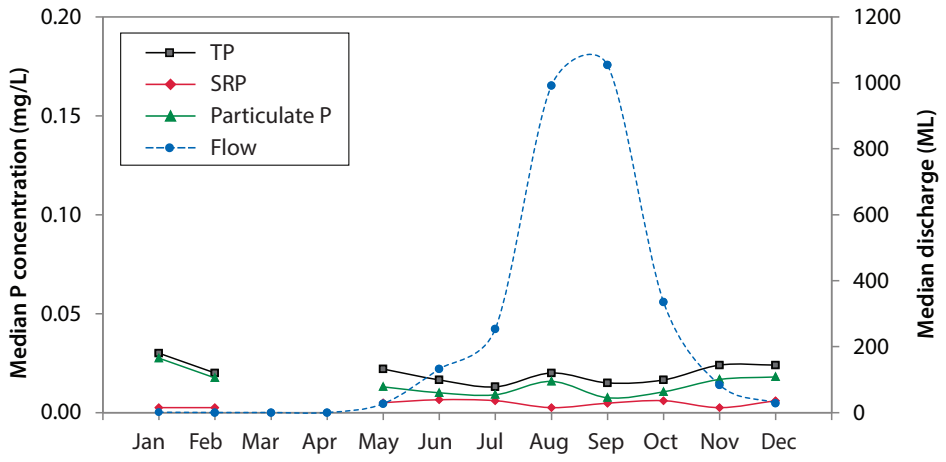
As Helena River did not have flow (and therefore load) information available for the last five years (2012–16) it was not possible to compare its loads with the other subcatchments.

Seasonal variation in nutrient concentrations in the Helena River

Nitrogen seasonal variation over the 2012 to 2016 monitoring period



Phosphorus seasonal variation over the 2012 to 2016 monitoring period



Nitrogen

A seasonal pattern in NO_x concentration was observed: maximum NO_x concentrations occurred in August/September corresponding with the peak in flow. NH_4^+ concentrations peaked in May and June then decreased rapidly. This indicates that NH_4^+ was being exported for a short period at the onset of winter rains, perhaps from a localised point source. The maximum concentrations of organic N also occurred in May then decreased gradually through winter. The data shown in January and February are from single sampling events in 2012. The river was flowing at a time it is normally dry.

Photo: Emma van Looij

Phosphorus

There was no evidence of a clear seasonal pattern for P concentrations in the Helena River, with concentrations remaining low and relatively stable throughout the year. The peak in particulate and total P in January was due to a single sampling event in 2012. It is worth noting that the P concentrations at this site were all very low, the long term TP target is 0.1 mg/L, all the data is well below this.

Photo: Emma van Looij

Photo: Dominic Heald

Photo: Emma van Looij

Photo: Emma van Looij

Photographs of Helena River: (Top left) High flow at the sampling site following heavy rains, August 2017. (Bottom left) A small, infrequently flowing tributary to the Helena River, flowing after heavy winter rains, August 2017. (Right) Piesse Brook at Rocky Pool, August 2017.

Local nutrient reduction strategies for Helena River

Nutrient reduction strategies being conducted or recently completed in the Helena River catchment include but are not limited to:

- The Eastern Regional Catchment Management Program is a partnership project whereby the Eastern Metropolitan Regional Council is working together with the Department of Biodiversity Conservation and Wildlife (DBCA), local governments and community groups to deliver water quality and community capacity building outcomes.
- From 2004 to 2014, weeding and planting by the Helena River Catchment Group linked private property owners along the Helena River to control major weed invasions as part of the iconic Helena River rehabilitation project. The project has received funding from State NRM for consolidation and follow up works over 2017–18.
- A follow up assessment of the Helena River foreshore condition and pressures was completed by the DBCA in 2016–17, the report provides recommendations for prioritising future restoration activities along the river.
- The Eastern Catchment Management Plan 2012–2022 was developed to address catchment management including water quality in a coordinated approach.
- The Phosphorus Awareness Project which assists 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 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 Helena River

	Max. load (t/yr)	Conc. target (mg/L)	% reduction
TN	3.6	1.00	38%
TP	0.23	0.100	0%

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

Photo: Emma van Looij

Summary: Helena River

- The Helena River is currently passing both the short- and long-term TN and TP targets.
- Of the 33 sites sampled, it has the second-lowest median TN concentration and the lowest median TP concentration.
- The proportion of P present as bioavailable SRP is one of the lowest.
- Since the last nutrient reports were published in 2012 (presenting data up-to and including 2011) the proportion of N present as NH_4^+, (a bioavailable form of N) has increased from 16 to 31%.
- Of the 33 sites sampled, the proportion of N present as DIN (a bioavailable form of N) is the third-highest.
- Since the last nutrient reports were published the proportion of N present as NO_x (oxidised N, a bioavailable form of N) has reduced from 38 to 25%.
- A small increasing short-term TP trend was detected.

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