South Belmont Main Drain

The catchment of South Belmont Main Drain consists of a network of deeply incised drains that combine to form the South Belmont Main Drain itself. The drain discharges into the Middle Swan Estuary in Belmont, opposite Clarkson Reserve.

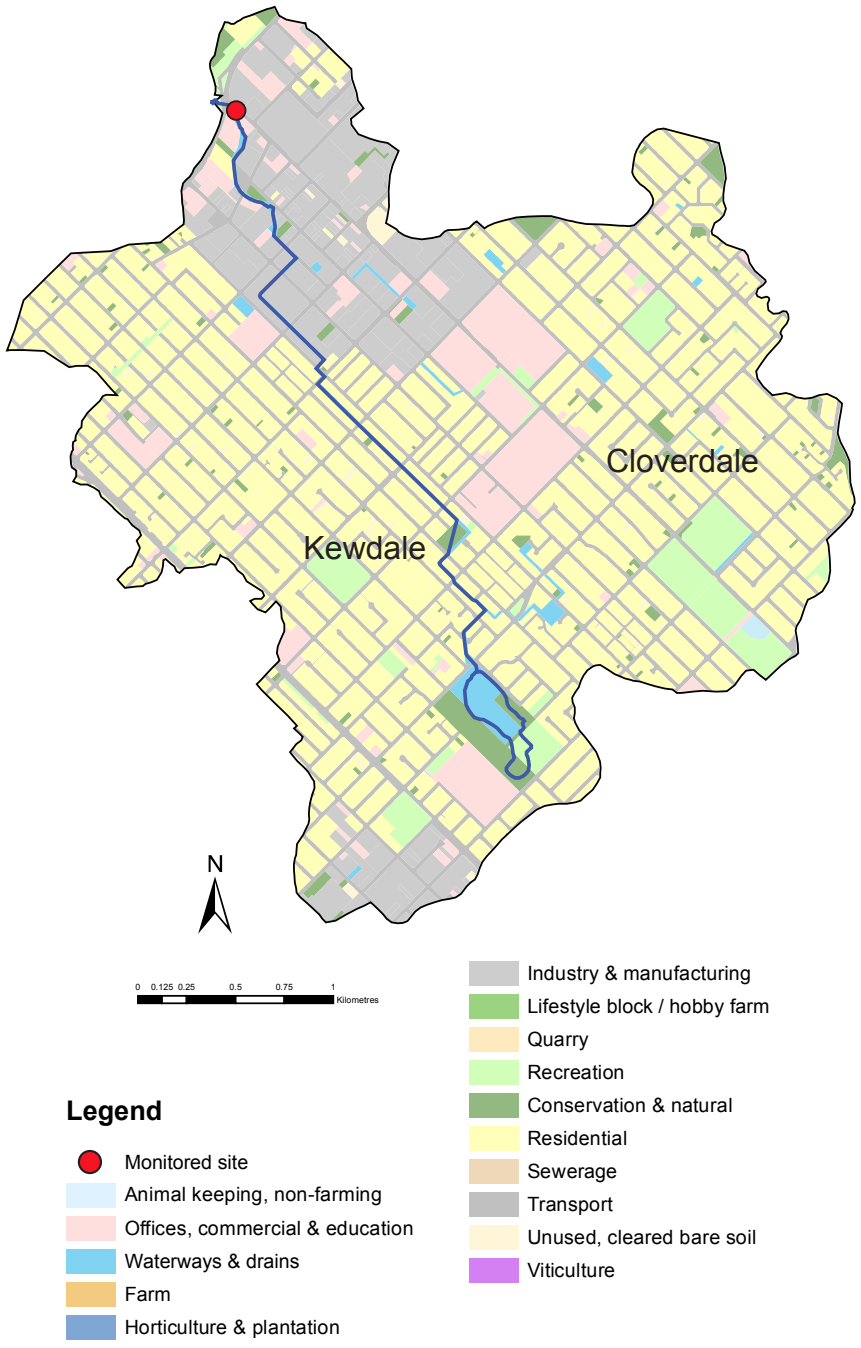
The catchment is highly modified and comprises urban uses such as light service industries and medium- to high-density residential developments. The middle and upper catchment is almost entirely residential, while the lower catchment immediately above the monitoring site is a commercial and industrial area. There are no areas of remnant vegetation in the catchment.

The catchment of the South Belmont Main Drain is situated almost entirely over permeable Bassendean sands. The deeply incised drains intercept the groundwater in low-lying areas.

Water quality monitoring and stream gauging was once undertaken just near the end of the catchment. In 2008 the gauging station was shifted approximately 400 m upstream because it was being tidally influenced. In 2011 the water quality monitoring site was moved 100 m upstream from its original location for the same reason. This site is monitored fortnightly and is positioned to indicate the nutrients entering the estuary, and so the data do not accurately represent nutrient concentrations in upstream areas.

South Belmont MD – facts and figures

Average rainfall (2012–16)	~ 680 mm per year (Perth metro)
Catchment area	10 km^2
Per cent cleared area (2005)	97%
River flow	Permanently flowing drainage network No major water supply dams in catchment
Average annual flow	~ 1.6 GL per year (2012–16 average)
Main land uses (2005)	Residential, industry and manufacturing and associated transport (roads)



Tomato Lake, the grass along the lake has recently been sprayed, August 2017.

Adachi Park near the Swan River in the South Belmont Main Drain catchment, May 2006.

Nutrient Summary: concentrations, estimated loads and targets

Year	Site	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Annual flow (GL)	616133		1.3*	2.2*	1.6*	1.0*	1.7*	1.3*	1.6	1.9*	1.4*	1.8*
TN median (mg/L)	SWS13	0.67	0.69	0.76	0.80	0.66	0.78	0.65	0.63	0.69	0.72	0.71
TP median (mg/L)	SWS13	0.080#	0.082#	0.096	0.150#	0.130#	0.100	0.096	0.110#	0.130#	0.125#	0.120
TN load (t/yr)	SWS13		0.97*	1.54*	1.19*	0.69*	1.10*	0.93*	1.10	1.37*	1.03*	1.31*
TP load (t/yr)	SWS13		0.14*	0.22*	0.17*	0.11*	0.17*	0.13*	0.16	0.20*	0.16*	0.19*

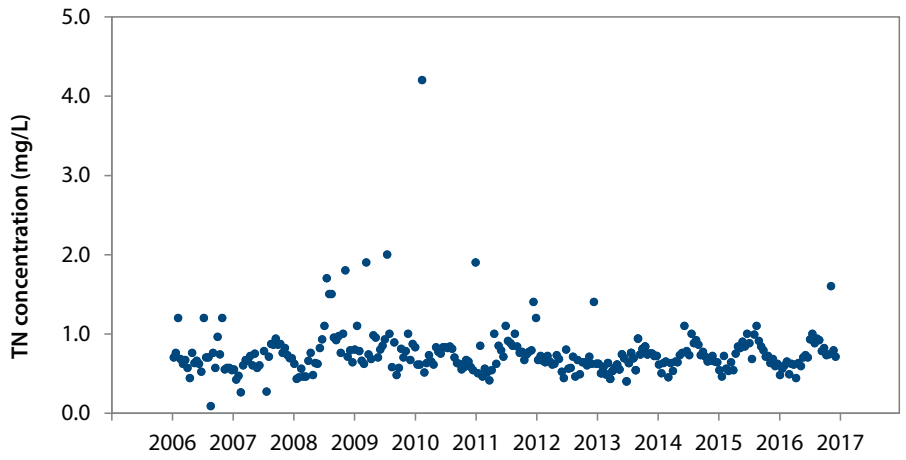
TN short term target = 2.0 mg/L TN long term target = 1.0 mg/L TP short term target = 0.2 mg/L TP long term target = 0.1 mg/L

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 South Belmont Main Drain

Total nitrogen concentrations over the 2006 to 2016 monitoring period



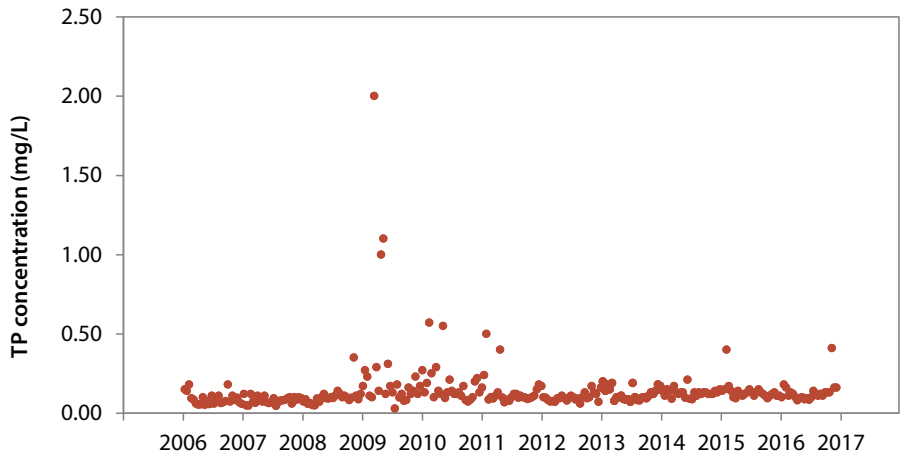
Trend

Total nitrogen (TN) concentrations appear fairly stable over the reporting period. This was verified by statistical analysis which detected no trends.

Target

South Belmont Main Drain has been passing the short- and long-term TN targets for the entire reporting period.

Total phosphorus concentrations over the 2006 to 2016 monitoring period



Trend

The range in total phosphorus (TP) concentrations appears to have decreased, with a much larger range present in 2009–10 than in subsequent years. A small emerging increasing trend of 0.005 mg/L/yr was detected over the 2012–16 period.

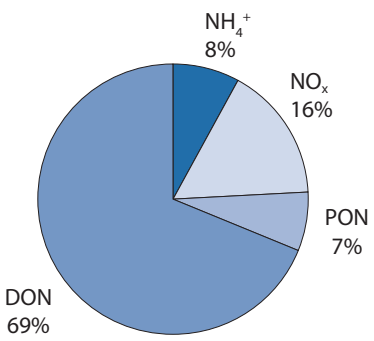
Target

Prior to 2008 the drain was passing the short- but failing the long-term TP target. In 2008–15 both targets were being passed. In 2016, TP concentrations increased to the point that the drain is no longer passing the long-term target.

A boardwalk at Tomato Lake, August 2017. Photo: Emma van Looij.

Nutrient fractions and estimated loads in South Belmont Main Drain

Average composition of nitrogen (N) in South Belmont Main Drain over the 2012 to 2016 monitoring period

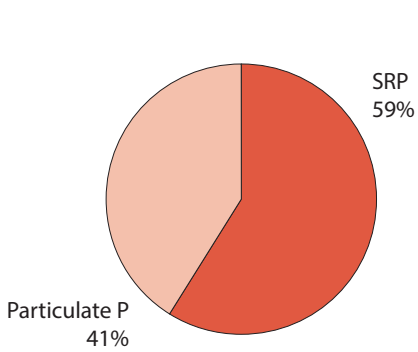


Nitrogen

Organic nitrogen (N) was the dominant form of N present in South Belmont Main Drain. This form of N is made up of dissolved organic N (DON) and particulate N (PON). DON largely comprises organic compounds leached from peaty subsoils 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. The remaining N was present as dissolved inorganic N (DIN, ammonium – NH_4^+ and N oxides – NO_x). These forms of N are probably derived from fertilisers, septic tank leachate and industry discharge and are readily available for plant and algal uptake.

South Belmont Main Drain had the smallest average TN load (2012–16) but the third-largest load per unit area (0.12 t/km^2/yr) of the nine subcatchments with flow data.

Average composition of phosphorus (P) in South Belmont Main Drain over the 2012 to 2016 monitoring period



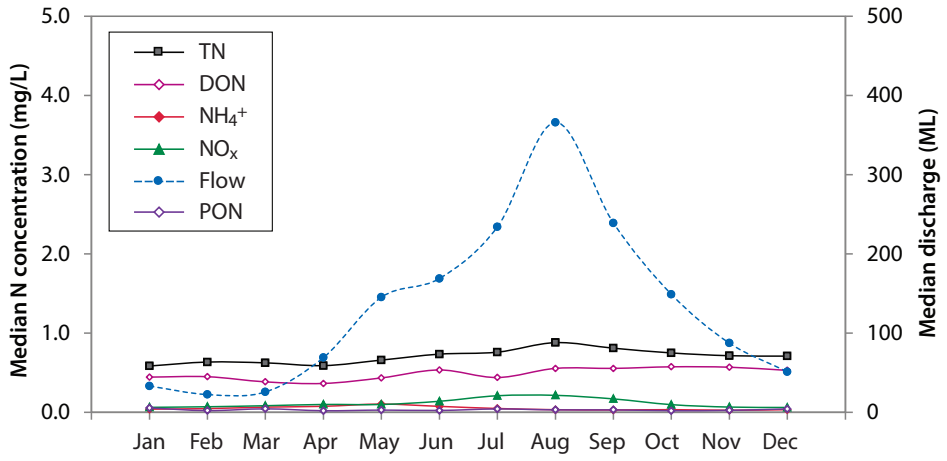
Phosphorus

Particulate phosphorus (P) made up just under half of the P present in South Belmont Main Drain. Particulate P is commonly derived from eroding soils and suspended sediments. It is not readily available for use by plants and algae though some may become available as particles decompose and bound phosphate is released. Soluble reactive phosphorus (SRP) – which in urban-residential catchments is usually derived from fertilisers, septic tanks and industry discharge – made up the remainder of the P. SRP is readily available for plant and algal growth.

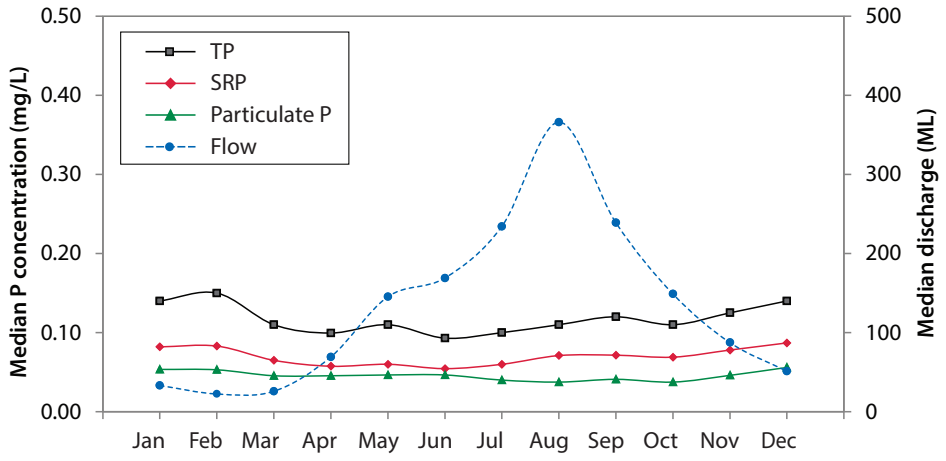
South Belmont Main Drain had the fourth-smallest average TP load (2012–16) but the second-largest load per unit area (0.02 t/km^2/yr) of the nine subcatchments with flow data.

Seasonal variation in nutrient concentrations in South Belmont Main Drain

Nitrogen seasonal variation over the 2012 to 2016 monitoring period



Phosphorus seasonal variation over the 2012 to 2016 monitoring period



Nitrogen

NO_x concentrations exhibited a very slight seasonal pattern. The maximum concentrations of TN and NO_x occurred in winter, coinciding with winter rains and increased flow. This suggests that there are multiple sources or transport pathways for NO_x and DON, especially surface and subsurface flow after rain as well as groundwater. NH_4^+ and organic N concentrations were not seasonal, remaining relatively constant throughout the year.


Photo: Emma van Looij

Phosphorus

Particulate P and SRP concentrations showed little variation throughout the year. A small increase in phosphorus concentrations in summer may be associated with increased algal growth and a relative increase in groundwater flow compared with surface flow.


Photo: Emma van Looij


Photo: Emma van Looij


Photo: Emma van Looij


Photo: Emma van Looij

Photographs of South Belmont MD: (Top left) Algal mats in an ornamental lake in Faulkner Park, Belmont. October 2017. (Bottom left) South Belmont Main Drain just upstream of the sampling site, October 2017. (Right) Tomato Lake in the South Belmont Main Drain catchment, August 2017.

Local nutrient reduction strategies for South Belmont Main Drain

Nutrient reduction strategies being undertaken or recently completed in the South Belmont Main Drain catchment include but are not limited to:

- The 2015–17 Light Industry Program, a project delivered by the Department of Water and Environmental Regulation in partnership with the Department of Biodiversity, Conservation and Attractions (DBCA) and seven local governments in the Swan Canning catchment, including the City of Belmont. Businesses were audited and provided with recommendations or requirements to reduce the risk of releasing nutrient and non-nutrient contaminants into waterways and groundwater systems. The City of Belmont has a dedicated Light Industry Officer to audit and educate business owners and operators in the light industrial precincts.
- A report for the selection of drainage improvement sites and nutrient interventions in the catchment was finalised in 2008 and prioritised locations and nutrient interventions at nine sites in the catchment. The appropriate nutrient interventions at each site were identified from a range of standard (i.e. stormwater best management practices) and other available nutrient intervention technologies and structures.
- The restoration of Tomato Lake, which has been ongoing since 1998. These activities have seen the lake further deepened to ensure permanent water over summer. A revegetation program to re-establish a buffer zone along the lake bank, providing habitat for fauna and improving water quality has also begun. To help prevent algal blooms, aerators have been installed in the lake to improve oxygen levels and a bacterial enzyme is added as a preventative measure to reduce nutrient availability. Longer-term actions involve attempting to reduce nutrients (from fertilisers) entering the lake through the stormwater system.
- The Phosphorus Awareness Project which aims to assist the community in reducing their nutrient outputs through education, promotion and behaviour change programs.

Photo: Lynette Galvin

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 system. It uses sophisticated modelling to identify nutrient sources and provides nutrient-reduction targets for each of the subcatchments.

SCWQIP load and concentration targets for Sth Belmont Main Drain

	Max. load (t/yr)	Conc. target (mg/L)	% reduction
TN	1.0	0.50	41%
TP	0.13	0.050	46%

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

Summary: South Belmont Main Drain

- South Belmont Main Drain was passing both the short- and the long-term TN and TP targets however, in 2016 it no longer passed the long-term TP target.
- A small emerging increasing short-term trend in TP concentrations was detected.
- Of the 33 sites sampled, it has one of the lowest median TN concentrations.
- Of the nine catchments with flow data, it has the smallest average overall TN load and the second-smallest TP load per unit area. It has the third-largest TN load per unit area.
- Of the 33 sites sampled, it has one of the highest proportions of P present as bioavailable SRP.
- Overall, a 41% reduction in TN and a 46% reduction in TP is required for this catchment to meet its SCWQIP targets.

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For further information please contact the
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