

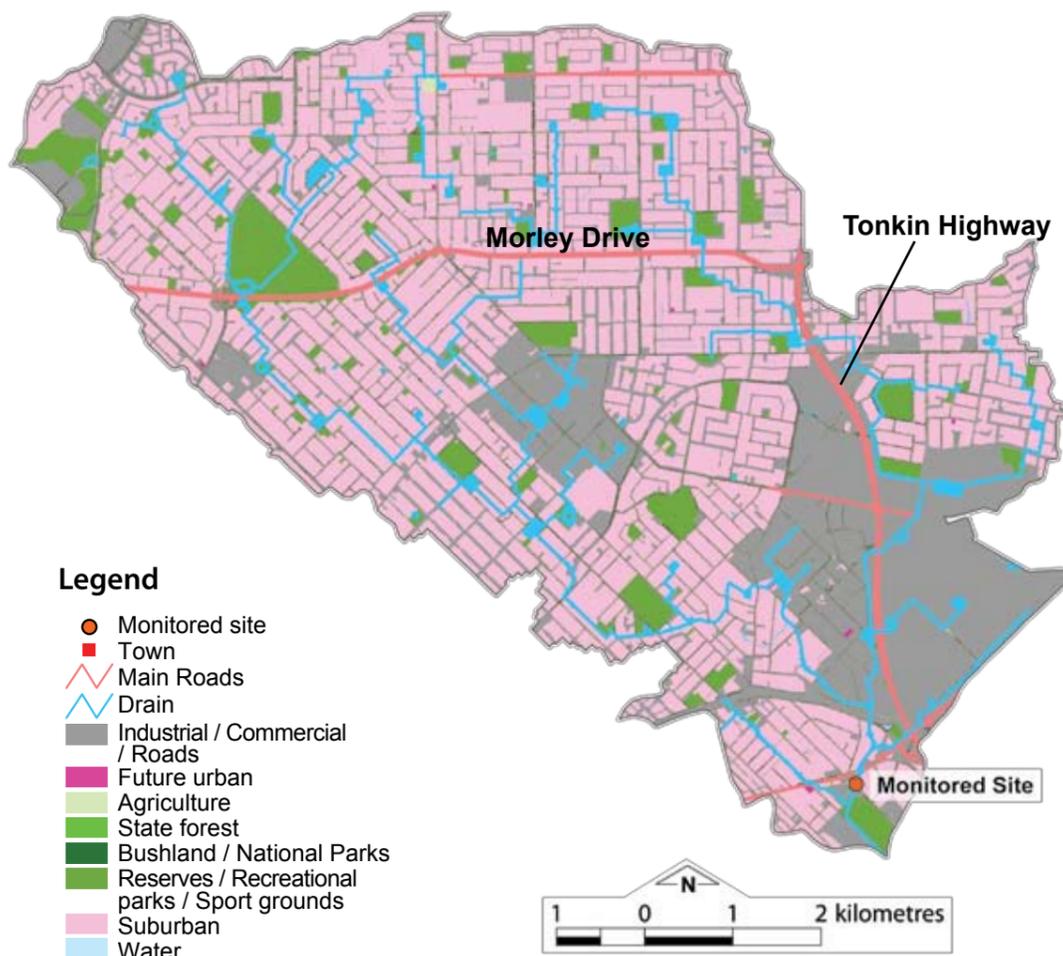
Bayswater Main Drain

Bayswater Main Drain is a permanently flowing drainage network with open and covered sections. It has the largest urbanised catchment in the Perth metropolitan area. Many of the current drains were once natural watercourses that have been modified for use as drainage to allow development. The drain discharges into the middle Swan River upstream from Garratt Road Bridge in Bayswater.

Clearing and development in the catchment began in the late 1800s and very little native vegetation now remains. This has affected water levels and flow patterns in the drains in two ways. Firstly, groundwater levels have risen, increasing the volume of groundwater entering drains and causing them to flow year-round. Secondly, the increase in the proportion of the catchment covered by hard surfaces such as roofs and roads has increased the amount of surface runoff.

Bassendean sands are the most common soil type in the catchment. This soil type is characterised by its poor nutrient retention capabilities. Any nutrients applied to the surface will rapidly leach through into groundwater after the application of water. Before development, a number of peaty swamps were present, the majority of which have now been in-filled, leaving a peaty layer of soil in some areas.

The Swan River Trust monitors a site at the lower end of the catchment for nutrients and flow, shortly before the drain flows into the King William Street Main Drain and the Swan River. This allows the Trust to monitor nutrients leaving the catchment and flowing into the Swan River.



Facts and figures

Length	~ 6 km (Bayswater Main Drain) ~ 44 km (total Water Corporation drains)
Average rainfall	~ 800 mm per year
Gauging station in proximity to monitored site	Site number 616082
Catchment area	27 km ² (total) 26 km ² (monitored)
River flow	Permanent No major water supply dams in catchment
Average annual flow	~ 7.0 GL per year
Percentage of average inflow to Swan River	~ 2.9% of total inflow per year
Main land uses	High density residential, commercial areas and light to medium industry. Historically agriculture in the form of market gardens was also common.



Bayswater Main Drain at the gauging station, January 2003

Nutrient summary: concentrations, loads and targets

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Annual flow (GL)	3.9*	5.2*	6.6*	6.4*	2.9*	7.0*	8.8*	3.3*	5.1	7.7	5.8	15.3	3.2
TN median (mg/L)	1.7	1.7	1.7	1.75	1.65	1.75	1.6	1.2	1.25	1.3	1.2	1.4	1.1
TP median (mg/L)	0.21	0.087	0.084	0.099	0.092	0.095	0.1	0.054	0.071	0.051	0.05	0.052	0.068
TN load (t/year)	6.6	9.3	11.8	11.2	5.25	12.0	16.1	4.3	6.4	9.3	7.1	20.9	3.7
TP load (t/year)	1.0	0.9	0.7	1.0	0.4	0.8	1.1	0.2	0.5	0.4	0.3	1.0	0.3

* best estimate using available data 1 GL = 1 gegalitre = 1,000,000,000 litres 1 mg/L = 1 milligram per litre = 0.001 grams per litre t/yr = tonnes per year

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

Changes in nutrient concentrations over time in Bayswater Main Drain

Nitrogen

Trend:

Total nitrogen (TN) concentrations appear to have decreased in the Bayswater Main Drain since 1994. This change has been detected as a downward trend of 0.075 mg/L/year in the long-term (1997-2006) and an emerging decreasing trend of 0.028 mg/L/year in the short-term (2002-06). There are not yet enough independent samples collected to confirm the short-term trend.

Target:

Bayswater Main Drain has been passing the short-term

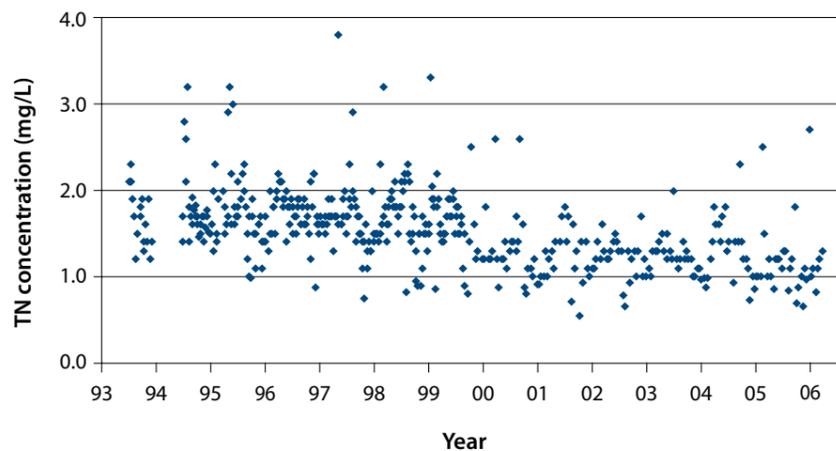


Looking down the drain towards the sampling site. Almost the entire length of the drain has wooden boards lining the sides. Photo: Dieter Tracey

target since 1987. As noted above, TN concentrations have been trending downwards however this has

not yet been a large enough decrease for the catchment to start passing the long-term TN target.

Changes in TN concentrations over the 1994-2006 monitoring period



Phosphorus

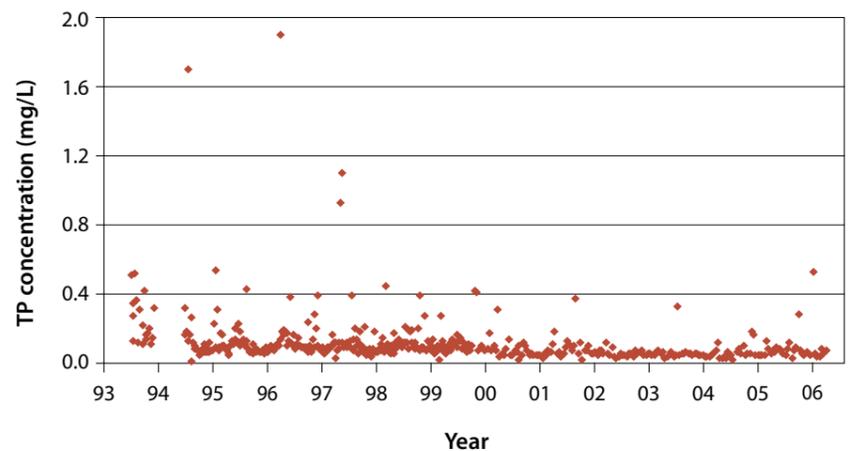
Trend:

From the graph, total phosphorus (TP) concentrations appear to have declined slightly during the 1994-2002 period. There was an emerging decreasing trend of 0.006 mg/L/year during the ten-year period 1997-2006.

Target:

From 1994-96 Bayswater Main Drain passed the short-term but failed the long-term TP target. Since 1997 it has passed the long-term target.

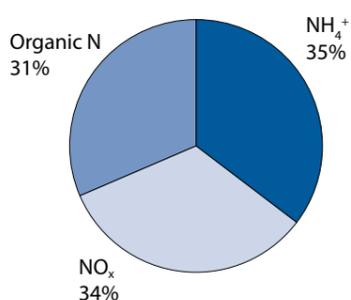
Changes in TP concentrations over the 1994-2006 monitoring period



Nutrient fractions and loads in Bayswater Main Drain

Nitrogen

About two-thirds of the nitrogen (N) present is in the form of dissolved inorganic N (DIN) (consisting of ammonium – NH₄⁺ and N oxides – NO_x), which is readily available for plant and algal uptake. These forms of N are probably derived from fertilisers used on parks and gardens, industrial runoff, septic tank leachate



Average composition of nitrogen (N) in Bayswater Main Drain over the 2002-06 monitoring period

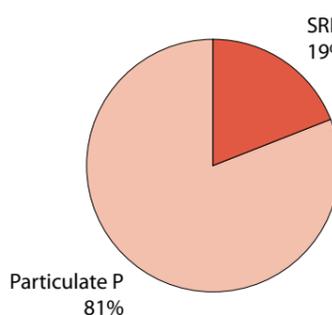
from those areas that are not sewered and have a high groundwater level, and animal waste. Organic N makes up the remainder of the N present. It consists of dissolved and particulate fractions. Dissolved organic N (DON) consists largely of organic compounds leached from peaty sub-soils and degrading plant and animal matter. It is available for uptake by plants, algae and bacteria. Particulate N is composed of plant and animal debris and needs to be further broken down to become available to plants and algae.

Bayswater Main Drain has the fourth highest TN load (2002-06) of the eleven monitored Swan Canning catchments for which there

is flow data. It is the third highest contributor of TN load to the Swan River.

Phosphorus

Most of the phosphorus (P) present is in the form of particulate P which is not readily available to plants and algae. This form of P consists of sediment-bound forms of P and organic



Average composition of phosphorus (P) in Bayswater Main Drain over the 2002-06 monitoring period

waste materials as well as algae and bacteria. Soluble reactive P (SRP), which is readily available for plant and algal growth, is only present in comparatively small quantities. The proportion of SRP to particulate P is very low compared to other catchments (in fact it has the lowest percentage of SRP of the 15 priority catchments) with predominantly leached sandy soils. It is likely that physical and chemical conditions cause most SRP that enters the drain to form insoluble particles by binding with metals such as iron and aluminium.

Bayswater Main Drain has the third highest TP load (2002-06) of the seven Swan River catchments for which there is flow data.

Seasonal variation in nutrient levels in Bayswater Main Drain

Nitrogen

There was no seasonal pattern in N. Concentrations remained fairly constant throughout the year. As N concentrations did not change after the onset of winter rains it is reasonable to conclude that very little N is entering the drain by surface water runoff, but is predominantly coming from sub-surface and groundwater sources. Large-scale clearing in the catchment has raised groundwater levels, bringing them closer to the surface and increasing their relative contribution to stream flow.



Photo: Emma van Looij

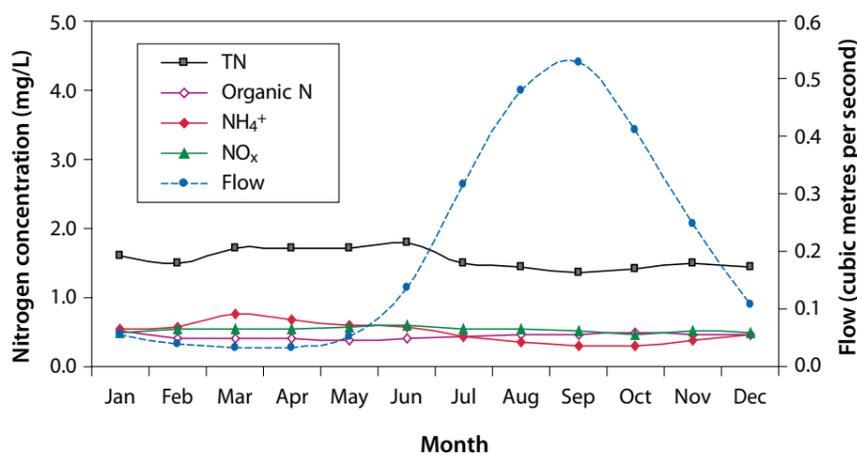
The porous soils found in the catchment allow any N being applied to the surface, such as fertilisers, or leaching from septic tanks to flush through and rapidly enter the drain either through sub-surface flow or via groundwater.

Phosphorus

P concentrations did not show a seasonal pattern. Levels remained fairly constant throughout the year, which indicates that they are not influenced by season (or

rainfall). It is likely that the majority of P is entering the drain as SRP through sub-surface and groundwater flows and once in the drain is forming insoluble particles by binding with metals such as iron and aluminium. Particulate P may also be present as algae, bacteria, and plant and animal debris. SRP concentrations are at, or below, the lower detectable limit for much of the year.

Nitrogen seasonal variation over the 1994-2006 monitoring period



Phosphorus seasonal variation over the 1994-2006 monitoring period

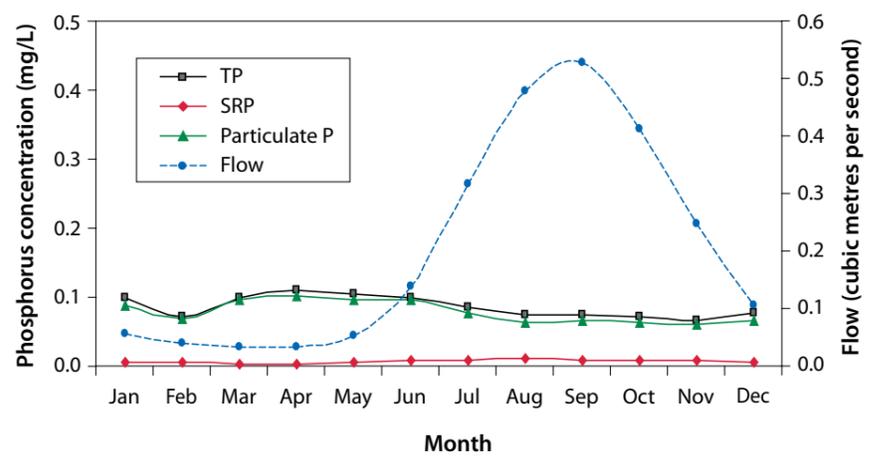


Photo: Dieter Tracey



Photo: Dieter Tracey



Photo: Emma van Looij

Photographs of Bayswater Main Drain: (Top left) A small section of the drain which is not lined. Exotic weeds dominate the riparian vegetation. (Bottom left) Bayswater Main Drain as it enters the Swan River opposite Ascot racecourse; Eric Singleton Bird Sanctuary is in the bottom right corner. (Right) The drain just before it flows past the Eric Singleton Bird Sanctuary.

Local nutrient reduction strategies

The **North Metro Conservation Group** (formerly the North Metro Catchment Group) has been involved in numerous projects throughout the Bayswater Main Drain Catchment including:

- Coordinating revegetation activities – planting more than 10,000 plants with more than 3,000 volunteer hours.
- Developing a catchment-scale water quality monitoring program.
- Providing support to education days – including Dog Swamp and Riverside Gardens education days, with more than 400 students attending.
- Adult education programs, including displays at public events, articles in local newspapers, workshops and talks on local plants and frogs.
- Development and implementation of the Sustainable Landscaping Strategy – promoting local plants to councils and local residents.

In April 2008 the North Metro Conservation Group ceased operations. Projects still occur throughout the Bayswater Main Drain Catchment and the Trust will continue to contribute to those initiatives that align with the Healthy Rivers Program. An example of this is the development of a local Water Quality Improvement Plan (WQIP) for the Bayswater Main Drain (renamed Bayswater Brook in March 2008).



The Healthy Rivers Program

The Healthy Rivers Program aims to protect the environmental health and community benefit of the Swan Canning river system by improving water quality. This is achieved through a 'catchment to coast' approach.

The Coastal Catchments Initiative

In June 2006 the Swan Canning river system was identified as a hotspot for water quality issues as part of the Coastal Catchments Initiative (CCI). The CCI seeks to significantly reduce pollutant discharge in agreed hotspots, specifically reducing the N and P inputs to the river system.

Through the CCI, the Trust is responsible for coordinating the Swan Canning Coastal Catchment Initiative and preparing a Water Quality Improvement Plan (WQIP) for the Swan Canning river system.

The WQIP aims to guide investment to reduce nutrient input during the next seven years using a comprehensive decision-making framework. The WQIP will complement other Trust initiatives, such as the Healthy Rivers Program.



Summary

Positive signs

TN levels in Bayswater Main Drain have been falling during the ten-year period 1997-2006 and there is also an emerging decreasing trend in TP concentrations. Very little of the P is present in the highly bioavailable SRP form.

Concerns

Bayswater Main Drain still has high N levels and of the 15 priority catchments has the highest percentage of N present in the form of dissolved inorganic N, which is readily available for plant and algal uptake. Bayswater Main Drain contributes the third highest TN and TP loads to the Swan River of the eight catchments that have flow data.