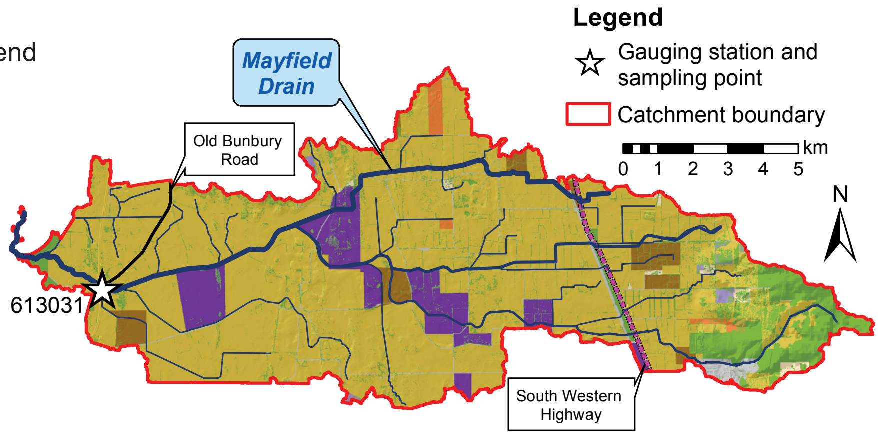
Mayfield Drain

Mayfield Drain catchment drains west from the Darling Plateau, discharging into the southern end of the Harvey Estuary. The catchment has 237 km of natural and modified waterways of which approximately half are gazetted under the Waroona Drainage District and managed by the Water Corporation.

The catchment's soils are mostly poorly drained flats and sandy soils containing either ironstone gravel or calcareous mounds. It has the smallest area of leached sands (5.3 km², 4.5%) of all the Peel-Harvey catchments. Under a third of the catchment has a high to very high risk of phosphorus loss to waterways (30%).



Mayfield Drain - July 2010

Water quality is monitored at the gauging station close to the Old Bunbury Road (613031), near the outlet of the catchment.

Flow data were collected at Mayfield Drain between 1991 and October 2007. There was a period of approximately three years when flow was not measured (March 2002 to May 2005).

During the years the gauging station was operational Mayfield Drain flowed continuously. 2001 and 2006 were extremely dry resulting in much lower flows (and loads) than other years.

Most of the catchment is used for agriculture (e.g. cattle and mixed grazing) with the largest percentage area dedicated to a single land use ('cattle for beef'). It also has the smallest area and percentage of remnant vegetation compared with the other Peel-Harvey catchments.

Land use classification (2006)		Area (km²)	Area (%)
Animal keeping – non-farming (horses)		1.0	0.80
Cattle for beef (predominantly)		87	73
Cattle for dairy		3.7	3.1
Conservation and natural		16	13
Cropping		0.03	0.02
Horticulture		0.44	0.37
Industry, manufacturing and transport		2.8	2.3
Lifestyle block		0.58	0.48
Mixed grazing		8.3	7.0
Residential		<0.01	<0.01
Total		**119**	**100**

In 2009 Mayfield Drain had the equal-lowest median TN concentration (along with the Murray River) and second-lowest median TP concentration of the 13 sites sampled in the Peel-Harvey catchment.

Nutrient summary: median concentrations, loads and status classification at 613031

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Annual flow (GL)	31	18	13	24	36	3.7					3.4			
TN median (mg/L)	0.78	0.88	0.53	0.66	0.47	0.40	0.42	0.47	0.37	0.62	0.52	1.3	0.80	0.49
TP median (mg/L)	0.10	0.06	0.03	0.03	0.02	0.025	0.03	0.025	0.025	0.05	0.06	0.17	0.05	0.03
TN load (t/year)	64	35	25	48	74	5.6					8.5			
TP load (t/year)	12	5.6	4.3	8.3	14	0.70					0.92			

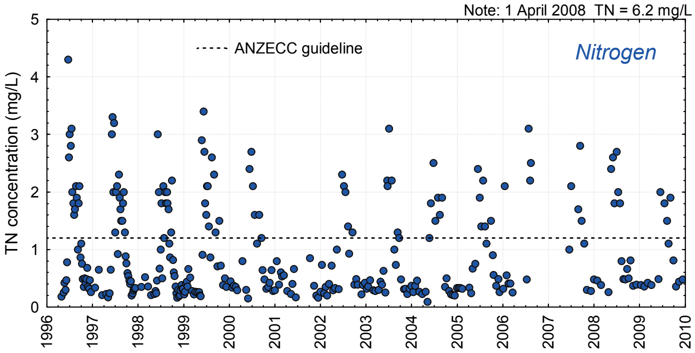
Status classification: Low, Moderate, High, Very high

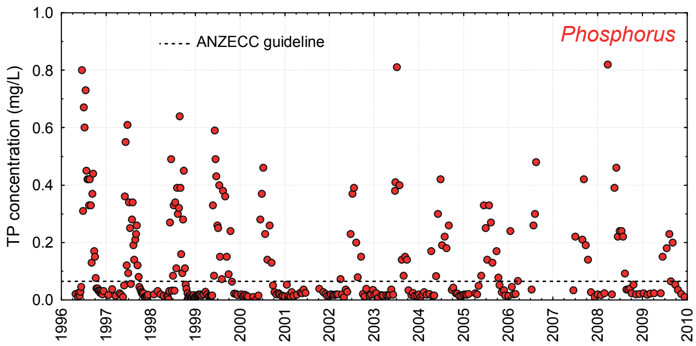
Status reported for three-year period end (i.e. 1996–98 reported in 1998)

* best estimate using available data

TN = total nitrogen TP = total phosphorus

Total nitrogen (TN) and total phosphorus (TP) concentrations (1996–2009)





TN concentration:

The annual percentage of TN samples that exceeded the ANZECC[1] guideline for lowland rivers (1.2 mg/L) ranged between 0% in 2001 and 50% in 2007.

Between 1996 and 2004, 30% of samples exceeded the guideline. This value increased to 35% for the period between 2005 and 2009.

TN trend:

Trend analysis was undertaken using data from 2005 to 2009 inclusive.

Once the data were adjusted for flow and seasonality, an emerging increasing trend (0.13 mg/L/year) was detected.

TP concentration:

The annual percentage of TP samples that exceeded the ANZECC[1] guideline for lowland rivers (0.065 mg/L) ranged between 0% in 2001 and 63% in 2007.

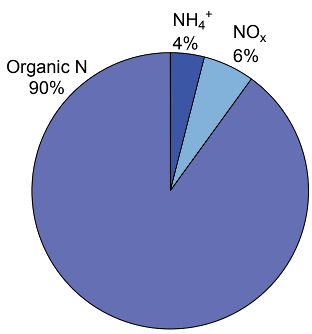
Between 1996 and 2004, 39% of samples exceeded the guideline. This value increased to 44% for the period between 2005 and 2009.

TP trend:

Trend analysis was undertaken using data from 2005 to 2009 inclusive.

Once the data were adjusted for flow and seasonality, an emerging increasing trend (0.014 mg/L/year) was detected.

Nutrient fractions (2005–09)



Nitrogen:

Most of the nitrogen (N) present was organic in nature. Organic N consists of both dissolved organic and particulate nitrogen. It is derived from degrading plant and animal matter and fertilisers. It often needs to be further broken down before it can be used by plants and algae.

The remaining N was dissolved inorganic N (DIN) such as ammonium (NH_4^+) and N oxides (NO_x).

DIN is also derived from animal wastes and fertilisers but is readily available to plants and algae.

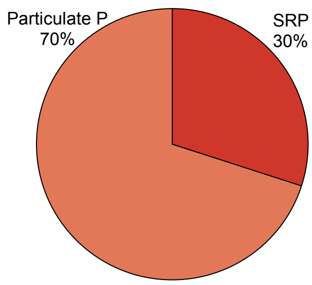
Mayfield Drain had the second-lowest percentage of DIN of the catchments draining to the Harvey Estuary (10%). It was one of five sites within the Peel-Harvey catchment where 90% or more of the N present was organic.

Upstream - April 2010

Phosphorus:

Approximately two-thirds of the phosphorus (P) was present as particulate P, which consists of sediment-bound forms of P and organic waste materials.

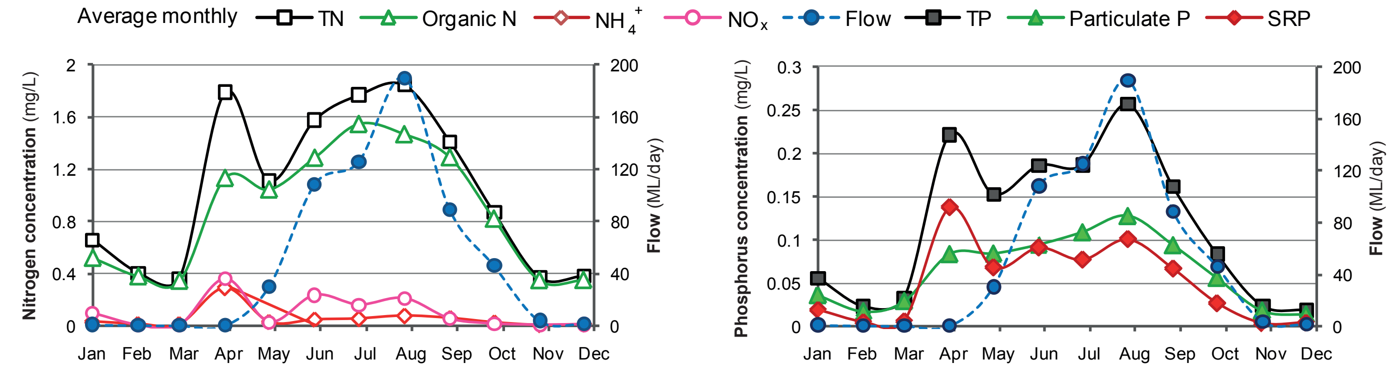
Particulate P is not readily available for uptake by plants and algae, but may become available over time as organic matter decomposes or soil particles release bound phosphorus.



The remaining P was present as soluble reactive phosphorus (SRP), which is derived from fertilisers and animal wastes. SRP is readily available for uptake by plants and algae.

Mayfield Drain had one of the lowest percentages of SRP within the Peel-Harvey catchment. Only two other sites were lower: Waroona Drain (28%), which flows to the Harvey River, and South Dandalup River (25%), which flows to the Murray River.

Seasonal variation in nutrient concentrations and riverine flow (2005–09)



Nitrogen:

Average monthly nitrogen concentrations were greatest during autumn and winter, increasing with the first flush in April and ongoing winter flows. The decrease in concentrations in May was possibly caused by dilution or uptake by in-stream or fringing vegetation.

Slight increases in monthly averages during January may have been due to nutrient-rich groundwater intrusion, evapo-concentration, algal activity or plant decay.

All average monthly nitrogen concentrations exceeded ANZECC[1] guidelines during April. Average monthly TN and NO_x concentrations also exceeded guidelines during winter.

In-stream vegetation downstream - June 2010

Phosphorus:

Average monthly phosphorus concentrations increased in April with the first flush. This was the only month when the SRP concentration was greater than the particulate P concentration.

Concentrations decreased as flows declined in spring. Slight increases in average monthly concentrations were also noted in January, possibly due to evapo-concentration, nutrient-rich groundwater seepage, algal activity or plant decay.

Average monthly TP and SRP concentrations exceeded ANZECC[1] guideline values for at least half the year.

	ANZECC 2000	Months exceeded
TN	1.2 mg/L	Apr, Jun – Sept
NH_4^+	0.08 mg/L	Apr
NO_x	0.15 mg/L	Apr, Jun – Aug
TP	0.065 mg/L	Apr – Oct
SRP	0.04 mg/L	Apr – Sept

Catchment modification

Construction of the Perth to Bunbury highway occurred immediately downstream of the Mayfield Drain gauging station. Between May 2007 and August 2009 extensive earthworks occurred adjacent to the sampling site. Temporary diversion of the drain resulted in a dam effect and localised back-flooding in 2007. Increases in median concentrations of both TN and TP were observed in 2007; however these were not extreme when compared with historical data.

When the highway was finished stabilisation works were undertaken to address erosion, which was causing bank undercutting between the highway and the gauging station (see photographs below).

Before diversion - 5 July 2007

During diversion - 10 July 2007

Before bank stabilisation - March 2009

After bank stabilisation - June 2009

Ongoing issues

Although the nutrient status improved in 2000 (TN: low) and 1999 (TP: moderate), emerging increasing trends in both TN and TP concentrations occurred (2005–09). The emerging trends do not appear to be caused solely by disturbance from the highway development.

Excessive algal growth and in-stream vegetation suggests that nutrient reduction strategies are required.

Adoption of the fertiliser industry's Fertcare[2] program could help identify fertiliser requirements and reduce nutrient losses to the waterways.

Efforts to fence properties to exclude stock access should also continue.

Macroalgae - March 2009

Erosion along the drain is widespread due to large fluctuations in river height (up to 2.5 m) and flow (up to 31 m^3/s) within the drain mobilising sandy soils underlying limestone.

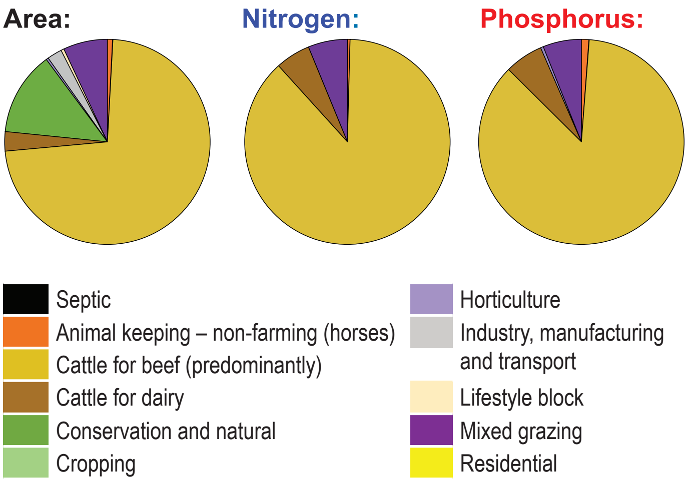
Erosion and bank undercutting - May 2009

Modelled results (1997–2007)[3]

This page reports results from the Streamflow Quality Affecting Rivers and Estuaries (SQUARE) model. It estimated flow, nitrogen and phosphorus loads from the 13 subcatchments of the Peel-Harvey estuary.

Nutrient sources

The catchment's main land use was 'cattle for beef'. This was also the dominant source of both the nitrogen (88%) and phosphorus (86%) loads. The remaining load was mostly associated with 'cattle for dairy' and 'mixed grazing' (~12% combined).



Annual exports to the Harvey Estuary

The Mayfield Drain catchment is 12% of the area that drains to the Harvey Estuary. On average it contributed to the Harvey Estuary:

- 10% of the flow (19 GL/year)
- 10% of the nitrogen load (33 tonnes/year)
- 10% of the phosphorus load (7.1 tonnes/year).

Remediation priority

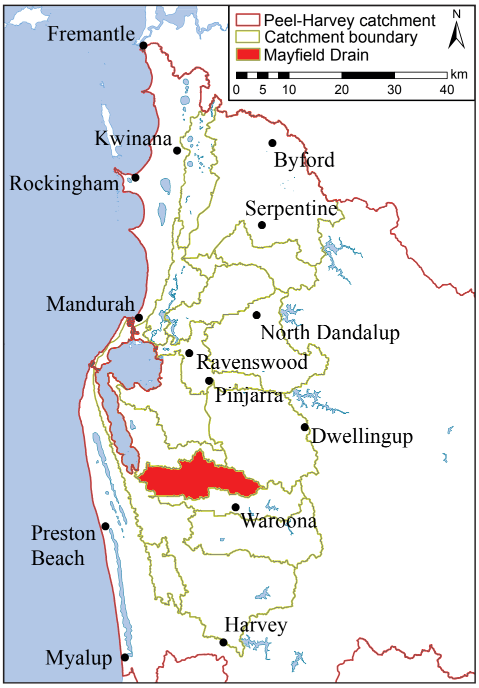
The SQUARE-modelled data indicated that based on nutrient loads per cleared area (kg/ha/year):

- The Mayfield Drain catchment requires medium-priority nitrogen and phosphorus remediation action.

Mayfield Drain has the smallest area and percentage of remnant vegetation of all the Peel-Harvey catchments.

Despite supporting intensive land use the catchment had relatively low nutrient concentrations and loads. This may be because it has the smallest percentage of leached sands and a relatively low risk of phosphorus loss to waterways compared with the other Peel-Harvey catchments.

How Mayfield Drain fits within the Peel-Harvey catchment: location and statistics



Catchment draining to estuary	Area (km²)	Flow (GL)	TN load (tonnes/year)	TN load per cleared area (kg/ha)	TP load (tonnes/year)	TP load per cleared area (kg/ha)
Peel Main Drain	120	11	26	3.0	4.5	0.52
Upper Serpentine	502	55	106	3.8	21	0.75
Dirk Brook – Punrak Drain	134	18	51	7.5	5.6	0.82
Nambeelup	143	19	44	3.6	10.5	0.86
Lower Serpentine	94	6.2	9.7	1.6	2.9	0.49
Mandurah	24	3.0	7.9	5.0	1.3	0.84
Upper Murray	6 752	286	204	0.51	4.9	0.01
Lower Murray, mid Murray and Dandalup	638	74	198	6.4	4.9	0.16
Coolup (Peel)	151	23	42	3.2	15	1.2
Subtotal Peel Inlet	**8 558**	**496**	**701**	**1.4**	**73**	**0.14**
Coolup (Harvey)	113	16	26	3.3	14	1.8
Mayfield Drain	**119**	**19**	**33**	**3.1**	**7.1**	**0.67**
Harvey	710	142	259	6.9	39	1.0
Meredith Drain	56	11	16	4.3	8.3	2.2
Subtotal Harvey Estuary	**998**	**188**	**334**	**5.6**	**69**	**1.2**
Total Peel-Harvey estuary	**9 556**	**684**	**1 035**	**1.8**	**142**	**0.25**

References

[1] ANZECC & ARMCANZ 2000, *Australian guidelines for water quality monitoring and reporting,* National Water Quality Management Strategy, Paper no. 7, Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

[2] Fertiliser Industry Federation of Australia Inc. *Fertcare* <www.fifa.asn.au>.

[3] Kelsey, P, Hall, J, Kretschmer, P, Quinton, B & Shakya D 2010, *Hydrological and nutrient modelling of the Peel-Harvey catchment*, Water Science Technical Series, Report no. 33, Department of Water, Western Australia.

www.water.wa.gov.au

For further information please contact the Water Science Branch, Department of Water
catchmentnutrients@water.wa.gov.au

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