The Upper Swan catchment consists of a number of creeks and drains which discharge into the Swan River at various points. Drainage is highly modified in the southern and central portions of the catchment but remains more natural in the northern section.

Archaeological evidence shows that the Upper Swan River and surrounding areas were important to the local Nyungar people. After the foundation of the Swan River Colony the fertile alluvial flats along both sides of the river were used as agricultural land. Over time, landuse has changed in the southern portion of the catchment to urban and industrial uses while the northern section retains many vineyards. Caversham Airbase is located in the upper part of the Wandoo Creek subcatchment.

The western edge of the catchment is characterised by leached, highly permeable, Bassendean sands which have poor nutrient retention capabilities. The remainder of the catchment has neutral red and yellow earths which tend to be more fertile and viticulture is the dominant landuse.

Two sites are monitored for water quality. One, on Wandoo Creek (WNDCK) and one on Chapman Street Drain (CSMDREID). These two waterways have very different landuses in their catchments. The sampling sites give an indication of the nutrient concentrations leaving the two subcatchments and entering the Upper Swan River. They do not represent nutrient concentrations in upstream areas, nor do they give an indication of the water quality in the remaining subcatchments.

### Upper Swan – facts and figures

<table>
<thead>
<tr>
<th>Average rainfall (2010–14)</th>
<th>~ 686 mm per year (Perth metro)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catchment area</td>
<td>39.4 km² (total catchment)</td>
</tr>
<tr>
<td>Per cent cleared area</td>
<td>83% (total catchment)</td>
</tr>
<tr>
<td>River flow</td>
<td>CSMDREID flows year round whilst WNDCK dries for at least six months every year</td>
</tr>
<tr>
<td>Main land uses (2005)</td>
<td>Viticulture and farms (total catchment)</td>
</tr>
</tbody>
</table>

### Nutrient Summary: concentrations, rainfall and targets

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual rainfall (mm)</th>
<th>Site</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
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<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CSMDREID</td>
<td>1.40</td>
<td>1.40</td>
<td>1.20</td>
<td>1.20</td>
<td>1.00</td>
<td>1.10</td>
<td>1.30</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>WNDCK</td>
<td>2.80</td>
<td>3.00</td>
<td>2.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>WNDCK</td>
<td>0.340</td>
<td>0.440</td>
<td>0.335</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CSMDREID</td>
<td>0.066</td>
<td>0.110</td>
<td>0.120</td>
<td>0.120</td>
<td>0.150</td>
<td>0.160</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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 Upper Swan

**Total nitrogen concentrations over the 2007 to 2014 monitoring period**

**Total phosphorus concentrations over the 2007 to 2014 monitoring period**

**Trend:**
Total nitrogen (TN) concentrations appear stable at CSMDREID and look like they may be decreasing at WNDCK. No trend was detected at CSMDREID and there were insufficient data with which to test for trends at WNDCK.

**Target:**
CSMDREID is passing the short- but failing the long-term target. WNDCK, with its higher TN concentrations, is currently failing both the short- and the long-term TN targets.

Nutrient fractions in Upper Swan

**Average composition of nitrogen (N) in Upper Swan over the 2010 to 2014 (CSMDREID) and 2011 to 2014 (WNDCK) monitoring period**

**Average composition of phosphorus (P) in Upper Swan over the 2010 to 2014 (CSMDREID) and 2011 to 2014 (WNDCK) monitoring period**

**Nutrient fractions in Upper Swan**

**CSMDREID**

Nitrogen (N) composition varied between the sites, especially NO\(_3\) and DON. Organic N comprises both dissolved (DON) and particulate (PON) fractions. DON consists of organic compounds leached from peaty subsoils and degrading plant and animal matter. It 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. Dissolved inorganic N (DIN, consisting of ammonium — NH\(_4\)\(^+\) and N oxides — NO\(_3\)) is derived from fertilisers, animal wastes, septic tank leachate and possibly industrial landuse and is readily available for plant and algal uptake.

**WNDCK**

**CSMDREID**

Phosphorus (P) composition was similar at both sites with about half of the P present as particulate P which consists of sediment-bound forms of P and organic material. Particulate P is not readily available for plant and algal uptake, but may become available over time as particles decompose or release bound phosphate.

Soluble reactive phosphorus (SRP) is derived from fertilisers and animal waste and is readily available for plant and algal uptake. It makes up the remaining P.

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**Upper Swan: Nutrient report 2014**
Seasonal variation in nutrient concentrations in Upper Swan

**Nitrogen**

N concentrations showed a seasonal pattern, particularly NO, at CSMDREID and DON at WNDCK. Surface and subsurface flows will be the dominant transport mechanism for these forms of N. PON at WNDCK is probably sourced mostly from algae growing instream which tends to increase as the weather gets warmer and flows decrease.

**Phosphorus**

P did not show a strong seasonal response at CSMDREID. The spike in particulate P concentrations in April is most likely due to the first flush washing P into the creek. It is likely that P is entering the waterways via surface and subsurface runoff as well as groundwater.
Local nutrient reduction strategies for Upper Swan

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

- Horse industry workshops which have been run by Perth Region NRM and the WA Horse Council in an attempt to improve management practices in horse properties to reduce nutrients entering the Swan Canning river system.
- New requirements for residents with aerobic treatment units to submit three, six or 12 monthly reports depending on the unit type.
- The Town of Bassendean is implementing works to improve the water quality in the catchment including applying soil amendments, replacing exotic and largely deciduous vegetation with indigenous species, conducting community education and restoring Pickering Park Foreshore and Drainage Outflow.
- Annual water quality monitoring has been conducted by the Town of Bassendean since 2010.
- Riverbank has funded numerous projects across four key foreshore sites in the Upper Swan catchment. Projects have included significant erosion control treatments such as construction of rock revetment and bioengineering as well as restoration techniques using weed control and revegetation. Examples include projects at Success Hill, Lilac Hill and Claughton Reserve.
- The 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 a ‘catchment to coast’ approach and by engaging in partnerships that focus the effort of local governments, sub-regional groups, the community and other organisations in water quality improvement activities.
- Ongoing sub-regional projects. Coordination and support of community led projects to reduce nutrient inputs into the Swan River in the north sub-region led by the Cities of Swan and Bayswater and funded by the Department of Parks and Wildlife.
- Phosphorus Awareness Project which aims to assist the community in reducing their nutrient outputs through education, promotion and behaviour change programs.

Swan Canning water quality improvement plan

The Swan Canning water quality improvement plan (SCWQIP) complements the delivery of other major programs and presents a roadmap for reducing nutrient inputs into the 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 Upper Swan

<table>
<thead>
<tr>
<th></th>
<th>Max. acceptable load (t/yr)</th>
<th>Concentration target (mg/L)</th>
<th>% reduction required</th>
</tr>
</thead>
<tbody>
<tr>
<td>TN</td>
<td>6.7</td>
<td>0.75</td>
<td>23%</td>
</tr>
<tr>
<td>TP</td>
<td>2.01</td>
<td>0.075</td>
<td>0%</td>
</tr>
</tbody>
</table>

For further information on the SCWQIP contact: rivers.info@dpaw.wa.gov.au

Summary: Upper Swan

- The site on Chapman Street Drain (CSMDREID) is passing the short- but failing the long-term TN and TP targets.
- The site on Wandoo Creek (WNDCK) is failing both the short- and long-term TN and TP targets.
- An emerging increasing TP trend of 0.015 mg/l/yr was detected at CSMDREID.
- The site at WNDCK had the second highest median TN concentration and the highest median TP concentration of the 12 catchments in this series of nutrient reports.
- The site at WNDCK had the lowest percentage of N present as bioavailable DIN of the 12 catchments in this series of nutrient reports.