



## Vegetated swales for the treatment of rural runoff

Swales (linear, vegetated depressions) are commonly used to control surface runoff in urban areas. But what about their application to rural properties? Two swales were monitored on behalf of Melbourne Water's Rural Land Program (RLP) to assess their effectiveness at filtering agricultural runoff.

The first swale (Figure 1) was an existing, 'natural' drainage line (118 metres long) with a dense covering of pasture grass. The second swale (Figure 2) was a purpose-built swale (trapezoidal form, 44 m x 3 m) planted with a range of native vegetation selected from the list of ephemeral plant species in the Melbourne Water Constructed Wetland Guidelines (including *Carex apressa*, *Ficinia nodosa*, *Lomandra longifolia* and *Juncus spp.*).

The surrounding land-use (primarily cherries) of both swales was intensive and involved seasonal spraying of liquid fertilizer, including into and surrounding the swales. A large infiltration and sedimentation basin was also monitored, but only for flow.

### Findings

**Treatment performance:** The two swales were moderately effective, delivering around 20% removal of suspended solids (TSS), 15% of Phosphorus (TP) and 10% of Nitrogen (TN). This performance, while not outstanding, is positive given the proximity of spraying operations (with significant overspray likely).

**Natural vs. constructed treatments:** Similar performances were measured for the natural and constructed swales. It may therefore be more cost-effective to preserve and enhance existing vegetated drainage lines (where possible) rather than construct treatment systems. Initial property assessments should consider options to enhance natural treatments, through actions like supplementary planting, protective fencing out and stock exclusion.



Figure 1. The natural, grassy swale monitored for water quality benefits.

**Complementary non-structural actions:** It is critical that even where structural measures such as swales, buffer strips or sediment basins are planned, that complementary management actions are also implemented. These should include:

- traffic and vehicle management to ensure the treatments are not damaged,
- limiting application of fertiliser to minimum rates, and
- management of vegetation within the swale to ensure it remains dense and is not affected by rutting or rilling.

**Construction and planting of vegetated swales:** Constructed swales should be designed and built to maximise filtration of flows. This can include:

- Ensuring the cross-section is shaped as a trapezoid (the base is flat, not v-shape, Figure 2) to maximise contact of flow with vegetation.
- Ensuring dense vegetation with a combination of sedges/reeds and ground-cover (grass). Sedges and reeds alone can create preferential flow paths over surrounding bare soil, undermining treatment effectiveness.
- Aiming for quick establishment of vegetation to avoid erosion.
- Ensuring frequent inspection of erosion and vegetation establishment during the first 12-24 months.

**Using infiltration as a treatment:** The large sediment basin (monitored for flows only) was capable of removing 90% of the annual flow (and thus the pollutant load) entering the property. It did so through infiltration, which was possible because of its large

storage volume and the high infiltration capacity of the surrounding soils. While this is a very effective means of reducing sediment and phosphorus (and most heavy metals), there may be some risk of contaminating groundwater with highly soluble pollutants such as some herbicides and pesticides. It is suggested that before adopting this approach, an initial screening sample from inflows be taken. Of course, the suitability of infiltration as a treatment will also depend on the landholder's intended use of the water which would otherwise flow downstream.

**Maintenance considerations:** Regular maintenance can be essential to ensuring the long term operation of treatments systems. To facilitate this:

- Maintenance requirements should be considered during the design phase.
- Treatments should be easy to access for maintenance.
- The landholder should be provided with an ongoing maintenance schedule.



Figure 2. The constructed swale during the building phase (left), showing the trapezoid design; and after construction (right) planted with sedges and reeds.