



# SWALES & FILTER STRIPS

## Construction Guide

STORMWATER DEVICE INFORMATION SERIES

## What are swales and filter strips?

Swales, also known as bioretention, filter or infiltration strips, are broad, grass channels used to treat stormwater runoff. They direct and slow stormwater across grass or similar ground cover and through the soil. Swales also help filter sediments, nutrients and contaminants from incoming stormwater before discharging to downstream stormwater system or waterways. Some swales have liners to direct filtered runoff, or rocky linings to slow fast flows. Swales are simple to maintain and can fit well in urban design.



Fig.1 Swale in Waitakere City

# Seven key components of swales and filter strips

## 1. Inflow points

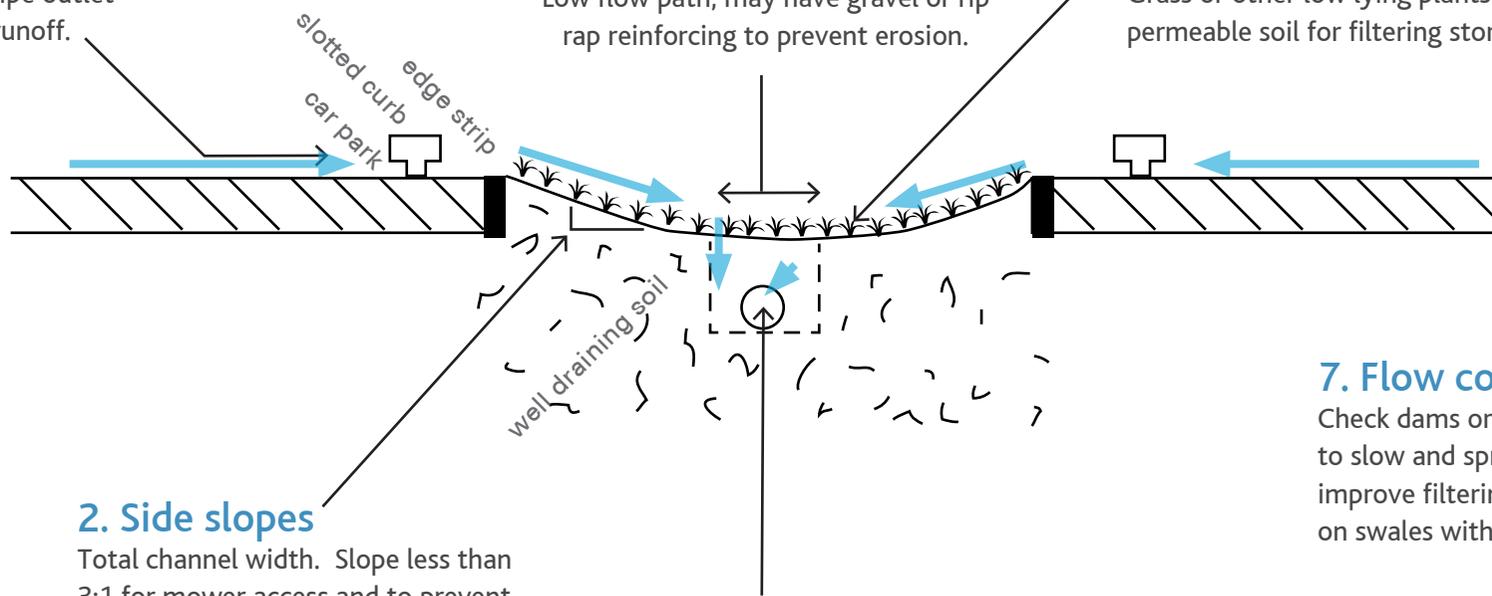
Stormwater flow entry, via pipe outlet or surface runoff.

## 3. Channel base

Low flow path, may have gravel or rip rap reinforcing to prevent erosion.

## 5. Plants and soil

Grass or other low lying plants in permeable soil for filtering stormwater.



## 2. Side slopes

Total channel width. Slope less than 3:1 for mower access and to prevent scour.

## 4. Underdrain (if present)

Usually perforated pipe, buried under channel to capture filtered flow and connected to stormwater system.

## 6. Outlet

Discharge point for filtered stormwater.

## 7. Flow controls

Check dams or spreaders, used to slow and spread flows to improve filtering. Often used on swales with slopes over 5%.



**Fig.2** Waitakere City Hospital car park swale

- Slotted kerbs not too close to edge of swale.
- Sign post in centre of swale are compromising underdrain.



**Fig.3** Henderson Valley Road – newly constructed road side swales

- Geotextile used to protect catchpit (swale outlet) during construction.
- Dish channels for each driveway controls flows and allow high flows to pass above.



**Fig.4** Manawa Wetland vegetated swale

- Native vegetated swale following contours and overland flow paths.
- Check dams used to slow flow and allow for filtration.

# Construction Sequence

Swale design will usually be specifically detailed in construction plans. The following outlines the general swales construction sequence.

## 1. Excavate

- Remove material to form channel.
- Form to levels on construction plans with excavator and blade. Side slopes not to exceed 3:1 horizontal to vertical slope. Base of channel usually minimum 600mm to allow mower access, or maximum 2m wide.
- Do not compact ground at base of channel, as it acts as filter for flows.



Fig.5 Excavation, preparation of side slopes to form channel



Fig.6 Construction of inlets with erosion protection

## 2. Check fall

Use laser, survey or spirit level to check slope of swale length is not greater than 3:1, or as detailed in construction plans.

## 3. Connect

- Construct flow collection inlets (may be catchpits, manholes) and connect to stormwater system.
- Construct outlets (may be concrete or rock sill, catchpit or vertical riser pipe with grate or scruffy dome) and connect to specified stormwater system. (see Figure 6)
- Set sills at elevation specified on plans to prevent flooding.
- Cover all collection points until swale construction is complete.

## 4. Install underdrain (if present)

- Excavate trench for underdrain in base of channel.
- If specified, lay liner or geotextile around trench and pin in place.
- Lay gravel bed (minimum 50mm).
- Lay underdrain pipe, (usually perforated such as Novaflow) covered with geotextile barrier or filter sock.
- Connect underdrain to outlets as detailed on construction plans, making a water tight seal.
- Fill underdrain trench with gravel bedding to bottom of channel, place geotextile overtop of metal and then cover with topsoil.

## Construction Sequence Cont...

### 5. Install flow controls

- If slope of swale length is steeper than 5% gradient, flow controls are required, for instance, rocks and check dams. (See Figure 3 dish channel driveway built as check dams)
- Check construction plans for details of what controls should be fitted and where.

### 6. Sow and plant

- Place 100mm minimum topsoil across swale length and channel width.
- Topsoil must be free of clay to allow free draining.
- Sow grass densely (and plant native plants, if specified) as detailed in construction plans. Sow to cover entire swale length and width.
- If specified, plant native plants in positions detailed on plans.
- Fence off until grass established, and water regularly early on to establish dense grass growth.

### 7. Remove sediment controls and restore

- Once planting completed, remove sediment/dewatering controls.
- Restore surrounding areas to original condition, removing excess materials and regrassing.
- Establish and uncover collection inlets.



Fig.7 Preparation of top soil layer (minimum 100mm) for planting



Fig.8 Constructed swale. Picture shows curb cuts as inlets, established dense grass and plants (North Harbour Stadium)



Fig.9 Dewatering control measures (also helps to control sediments) at the outlets during construction

## Quick checks

- ✓ Plant grass densely to give complete coverage without bare patches. Confirm design specification before construction. Changes during site development may mean levels and locations need revision.
- ✓ Construct swale banks at slope less than 3H:1V. Check fall along length of swale before installing underdrain.
- ✓ Install flow controls if slope of swale length is more than 5% gradient.
- ✓ Make sure kerbs and other street edge features allow for sheet flow across and into swale.
- ✓ Keep collection points covered until grass is established.
- ✓ Block or divert any new or existing inlets and outlets from swale during construction.

## Avoid

- ✗ Do not overcompact soil during construction – soil needs to be free-draining.
- ✗ Do not construct swale when ground is wet, especially on clay sites.
- ✗ Do not mix clay into topsoil mix.
- ✗ Do not block inflows with woody or large plants.
- ✗ Do not drive over swale during construction to avoid soil compaction, fence off if necessary.

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