# Grass Filter Beds

## DE-WATERING SEDIMENT CONTROL TECHNIQUE

| | | | | | |
|---|---|---|---|---|---|
| Low Flow Rates | ✓ | Low Filtration | ✓ | Sandy Soils | ✓ |
| Medium Flow Rates | | Medium Filtration | [1] | Clayey Soils | [2] |
| High Flow Rates | | High Filtration | [1] | Polluted Soils | [3] |

[1] The degree of filtration varies with increasing infiltration into the soil. High filtration is achieved with 100% infiltration. The level of filtration decreases rapidly once the soil becomes saturated.

[2] Clay-sized particles can be captured so long as the soil remained unsaturated.

[3] Grassed filter beds are commonly used in stormwater management to treat contaminated runoff, but the treatment efficiency can be highly variable.

**Symbol**

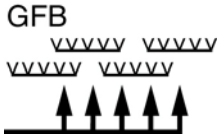



**Photo 1 – A sediment fence can be used to spread inflows evenly across the full width of the grassed filter bed**


**Photo 2 – Pumped inflow should <u>not</u> be released as concentrated flow onto a grass filter bed**

### Key Principles

1. Sediment trapping within grassed filter beds is primarily achieved through low-velocity sedimentation that occurs as the flow passes through thick grass, plus the filtration of fine sediments as the flow infiltrates the soil. Thus, the sediment trapping ability of a buffer zone increases with the increasing infiltration capacity of the soil.
2. The sediment trapping efficiency of the grassed filter bed is significantly reduced once the soil becomes saturated. The key to high treatment efficiency is maintaining the soil in an unsaturated condition. This means matching the flow rate per unit width to the infiltration capacity of the soil.
3. Critical design parameters are the flow per unit length (perpendicular to flow), and the width of the buffer (in the direction of flow).
4. Critical performance parameters include:
    - the retention of 'sheet' flow conditions through the grass (i.e. an even grass cover, with no drainage depression or wheel tracks); and
    - the non reliance on grassed filter beds as an effective sediment trap immediately following heavy rainfall that results in soil saturation (e.g. when de-watering after heavy rainfall).

**Design Information**

The 'design' depth of sheet flow should be limited to the height of the grass, but typically not exceeding 50mm. Maximum slope grade limited to approximately 10%.

Wherever practicable, the minimum width (in direction of flow) is 15m or five times the percentage slope of the grass (i.e. 50m width for a 10% slope). Table 1 provides minimum recommended widths, and maximum allowable unit flow rates for various land slopes.

**Table 1 – Minimum buffer width (in direction of flow)**

| **Land slope (%)** | **1%** | **2%** | **3%** | **4%** | **5%** | **6%** | **8%** | **10%** |
|---|---|---|---|---|---|---|---|---|
| **Minimum width (m)** [1] | 15 | 15 | 15 | 20 | 25 | 30 | 40 | 50 |
| **Max. unit flow (L/s/m)** [2,3] | 4.5 | 6.4 | 7.8 | 9.0 | 10.1 | 11.1 | 12.8 | 14.3 |

[1] Width of grassed buffer zone measured in the direction of sheet flow.

[2] Maximum flow rate is based on a maximum flow depth of 50mm and assumed Manning's n = 0.15.

[3] The inflow rate can be increased by the numerical value of buffer zone's infiltration capacity. It is noted that once the soil is saturated, the infiltration rate across the buffer zone will be negligible.

The sediment trapping ability of a grassed filter bed can be improved through the incorporation of a *Sediment Fence* up-slope of the grassed area. The *Sediment Fence* can also be used to help distribute the inflow evenly across the filter bed.

Natural bushland should **not** be used as a grassed filter bed. Even through the bushland can act as an effective sediment trap, the adverse environmental effects resulting from the trapping of sediments within bushland can be significant, including weed infestation.

It is also noted that bushland is usually less effective at trapping sediment than grassed buffers due to its inability to maintain ideal 'sheet' flow conditions over an extended flow length.

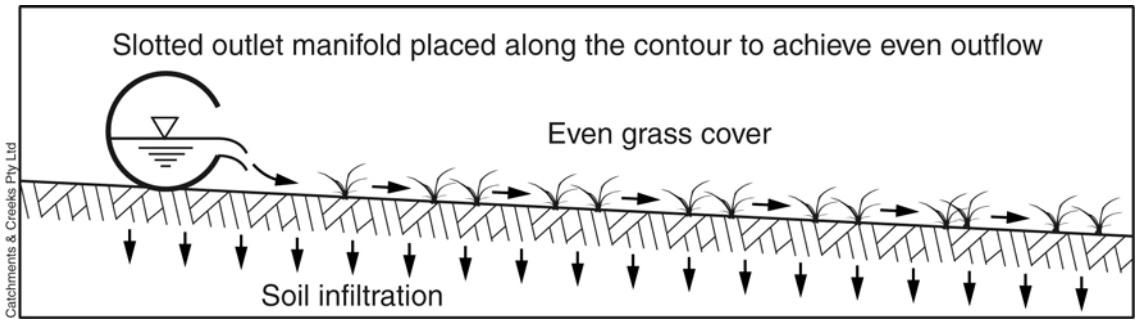


**Figure 1 – Ideal flow conditions for a grass filter bed with slotted pipe inflow**

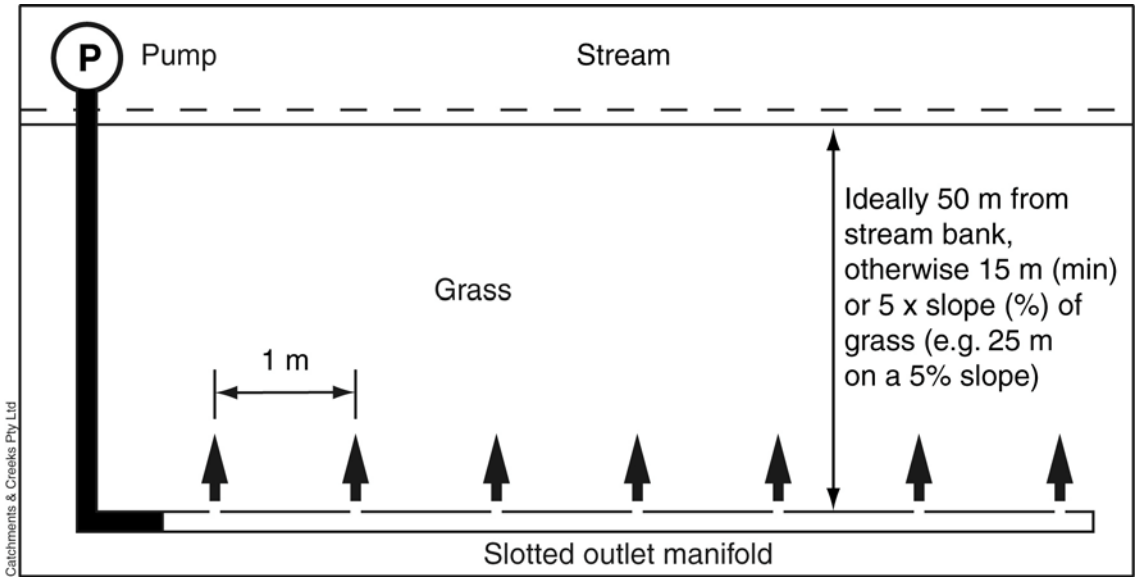


**Figure 2 – Typical layout of grass filter bed adjacent a watercourse**

**Description**

Large areas of grass used to infiltrate and filter water pumped from de-watering operations.

In the erosion and sediment control industry, a grass filter bed is effectively the same as a 'buffer zone'.

**Purpose**

Grass filter beds are used to infiltrate and/or filter water draining from the de-watering of stockpiles or water pumped from de-watering operations.

**Limitations**

Needs dry weather over previous three days to avoid the initial saturation of the soil.

Filter beds are less effective in clayey soil areas compared to sandy soils.

If the water contains a large quantity of clay-sized particles, then the water needs to infiltrate into the soil, otherwise the clay will readily pass through the grass filter.

Grass filter beds established on clayey soils are generally only suitable for filtering coarse sediments.

Only suitable for the treatment of sheet flow where the flow depth is less than the height of the grass.

Suitable for grassed slopes up to 10%.

**Advantages**

Typically little or no establishment cost.

**Disadvantages**

Excessive quantities of sediment can damage the grass.

Usually only suitable for the de-watering of small volumes.

Generally ineffective during periods of heavy or extended rainfall.

Generally requires large areas of land.

**Common Problems**

Wheel track marks within the grassed buffer zone can destroy the ideal 'sheet' flow conditions and thus significantly limit the sediment retention benefits of the buffer zone.

**Special Requirements**

The grass filter bed must have a uniform grade that promotes 'sheet flow' without rills or drainage depressions.

Water must enter the filter bed evenly across its full width. This may be achieved by discharge the water through:

- slotted outlet manifold
- *Sediment Fence*
- *Level Spreader*

Grass blade length needs to be higher than the depth of the flowing water.

Requires a well-draining sandy soil.

To be effective, the soil needs to be highly porous and there needs to be significant (75%) grass cover.

Any existing drainage depressions, such as swales, rills or wheel tracks, must be filled in to allow uniform sheet flow conditions to exist throughout the buffer.

The grassed filter bed must be treated as a non-trafficable area.

**Site Inspection**

Check that all visible sediment is trapped within the first quarter of the grass filter bed.

Check that the grass filter bed is free of drainage depressions and wheel tracks that might allow the concentration of flow.

Check for excessive sediment deposition that is affecting the health of the grass.

**Preparation**

1. Refer to approved plans for location, extent, and dimensional details. If there are questions or problems with the location, or extent, contact the engineer or responsible on-site officer for assistance.
2. Take all necessary steps to ensure disturbance to the grass filter bed is minimised throughout the time it is used as a sediment trap.
3. To the maximum degree practical, ensure flow passing through the grass filter bed is not allowed to concentrate within drainage depressions, swales, rills or wheel tracks.
4. Ensure flow enters the grass filter bed in an even manner as 'sheet flow'.
5. To assist in achieving an even spread of flow across the grass, the flow may need to be discharged:

- via a suitable outlet manifold (e.g. slotted or perforated pipe);
- through a sediment fence constructed up-slope of the filter bed—the sediment fence must be constructed along a line of constant elevation with a maximum support post spacing of 2m;
- via a *Level Spreader*—minor flows only.

**Maintenance**

1. Inspect the grass filter bed regularly and at least daily during de-watering operations.
2. Check for evidence of concentrated flow or flow bypassing. Make repairs as needed to the flow entry/distribution system to re-establish sheet flow conditions.
3. Remove excessive accumulations of sediment that may cause the concentration of flow.
4. Excessive sediment may be defined as:
    - any clearly visual sediment that covers a portion of the grassed surface; or
    - sediment deposition such that the grass strand height above the sediment is less than 50mm; or
    - a deposition of sediment in excess of 750 grams per square metre (approximately the equivalent of three 70mm diameter balls of dry soil).
5. Take appropriate steps to maintain at least 75% grass cover over the grass filter bed.
6. Where practical, maintain the grass at a height greater than the expected depth of water flow, and at least 50mm.