Sediment Fence Isolation Barriers

INSTREAM PRACTICES

Flow Control	✓	No Channel Flow	✓	Dry Channels	✓
Erosion Control		Low Channel Flows	✓	Shallow Water	✓
Sediment Control	[1]	High Channel Flows	✓	Deep Water	

[1] Sediment control benefits may be achieved through the use of a second, landward fence.

Symbol SFB

Photo 1 – Sediment fence isolation barrier with landward sediment fence

Photo 2 – Site (left) viewed from the right bank

Key Principles

1. A sediment fence isolation barrier may consist of a single fence, but is more commonly associated with two parallel fences, each performing a different task.
2. The landward fence forms either a wet or dry landward chamber that focuses on the capture of coarse sediment (i.e. a traditional *Sediment Fence*), thus a woven fabric may be used, but a composite non-woven fabric is preferred. This fence must be appropriately buried into the channel bank or anchored under aggregate (Figure 3).
3. The outer (riverside) fence primarily acts as the isolation barrier, thus a woven fabric is most commonly used, but a composite non-woven fabric can be used.
4. The outer 'wet' chamber formed between the parallel fences focuses on the gravity settlement of the finer sediment particles that pass through the landward fence.
5. Because the outer fence is primarily used to divert stream flows and produce a quiescent settling chamber, this fence does not necessarily need to be buried, but should rest firmly on the channel bed with the assistance of ballast (e.g. heavy chain sewn into the bottom of the fabric, Figure 4).

Pre-Design Data Collection

Observations to be made during the initial site inspection include:

- Confirm the overbank catchment area likely to contribute stormwater runoff into the isolation area, and potential options for managing this lateral inflow.
- Locate any stormwater outlets discharging near the work area. It is not recommended for flow diversion barriers to enclose stormwater outlets unless appropriate design measures are taken to account for the inflows generated by the outlets.
- Indication of tidal range (if data is not already available within tide charts).
- Estimate the total channel discharge, and stream velocity within the region where the isolation barrier is likely to be installed.

- Ascertain the channel profile and water depths within the region where the barrier is likely to be located (if not already available from marine survey or contour charts). Specifically, identify areas where the water depth is likely to exceed 0.8m.
- Ascertain typical wave heights, including waves generated by boat traffic.
- Determine the primary bed material, e.g. clay, sand, gravel.
- Identify any protected or 'non-disturbance' areas.
- Consideration should also be given to the collection of water samples for the determination of the pre-disturbance water quality.

Design Information

Recommended design information of the various components of a sediment fence isolation barrier is provided in Table 1.

Table 1 – Design information

	Landward fence	Outer (marine) fence
Fabric type	• Woven fabric or non-woven composite (preferred).	• Woven fabric.
Location	• Typically located just above normal water level.	• Maximum recommended water depth of 0.8m.
Bottom fabric anchor	• Ideally buried in 200mm deep trench or bottom 300mm of fabric covered with a continuous layer of sand or aggregate.	• Minimum 8mm ballast chain sown into bottom of fabric. • Weighted fabric allowed to rest on channel bed.
Maximum spacing of support posts	• 1 or 2m with wire mesh backing.	• 1m with or without wire mesh support.
Placement of support posts	• Down-slope of fabric (i.e. channel side of fabric).	• Downstream side of fabric (i.e. opposing the stream flow).
Use of backing mesh to support fabric	• Optional	• Use of backing mesh depends on power of stream flow and risk of stream debris.
Freeboard above stream water level	• N/A	• Freeboard depends on expected wave conditions. • Minimum 200mm.

The most effective placement methods for sediment fence isolation barriers are:

- a semicircle or U-shape configuration around the disturbance (Figure 1);
- a circle or elliptical shape encircling the disturbance (Figure 2).

Ideally avoid isolating more than 30% of the effective channel width during periods when stream flows are possible. However, if appropriate hydraulic analysis is performed on adverse effects of potential stream velocity increases, then it may be possible to isolate as much as 2/3 of the effective channel width. It is generally **not** recommended for an isolation barrier to be placed across the full width of a watercourse channel.

The 'effective' stream width does not include backwater areas, i.e. those areas that do not significantly contribute to the conveyance of stream or flood flows.

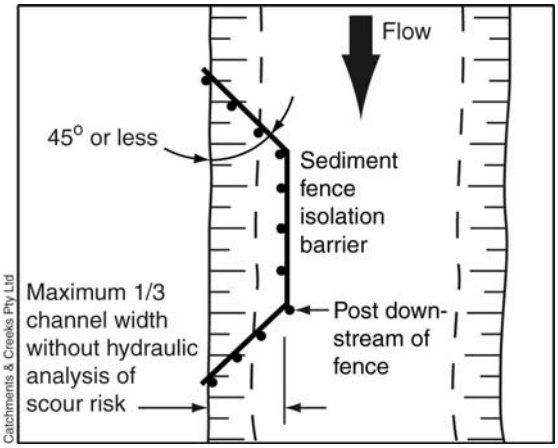

Figure 1 – Isolation of bank disturbance

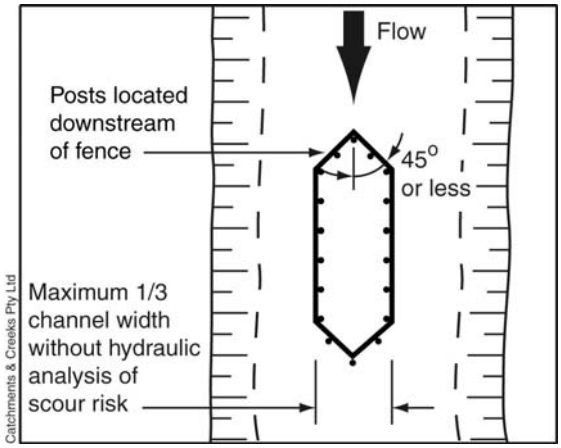

Figure 2 – Isolation of mid-channel disturbance

The landward sediment fence should be anchored in either a 200mm trench, or under a continuous layer of sand or aggregate (Figure 3), but **not** earth.

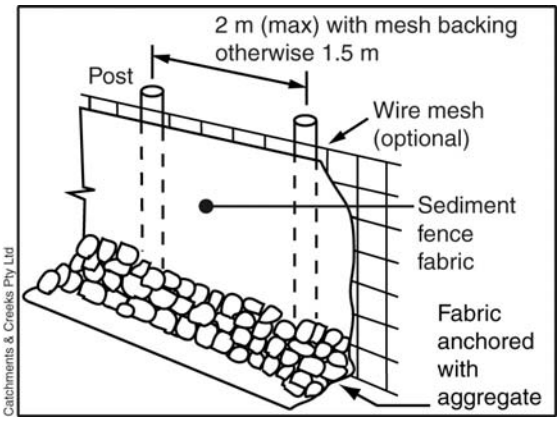

Figure 3 – Anchorage of landward sediment fence using aggregate

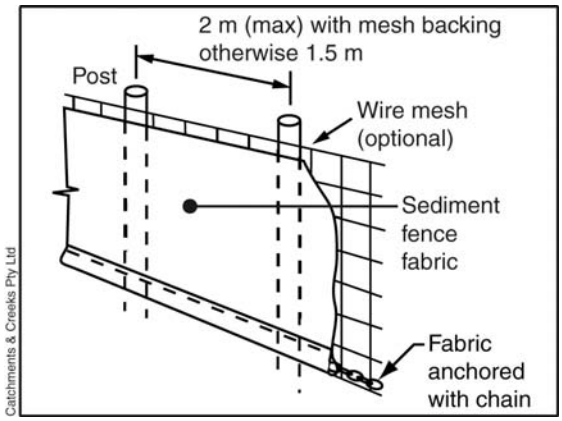

Figure 4 – Anchorage of riverside isolation barrier using chain ballast

Wire mesh backing used if the flow velocity exceeds 0.25m/s. If the stream flow adjacent the fence exceeds a depth*velocity product (d*V) of 0.25, then additional lateral support may be required to hold the outer barrier support posts in place.

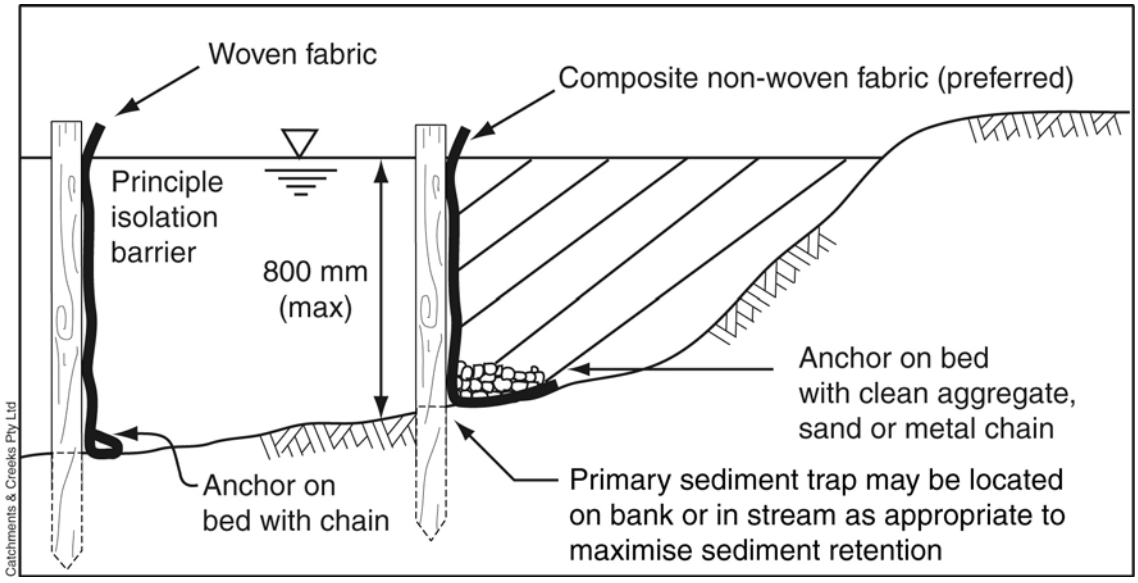

Figure 5 – Typical installation of sediment fence isolation barrier

Table 2 provides the recommended material properties for the outer isolation barrier. Table 3 provides the recommended material properties for the landward sediment fence.

Table 2 – Recommended material property for the outer (riverside) sediment fence isolation barrier

Material property	Test method	Typical value	Units
Flow rate	AS 3706.9	15	$L/s/m^2$ (under 100 mm head)
Wide strip tensile strength	AS 3706.2	10 both directions	kN/m
Pore size (EOS) (O_{95})	AS 3706.7	0.21	mm
Mass per unit area	AS 3706.1	90	gsm
UV resistance	AS 3706.11	required	
Width	–	730–910	mm
Grab tensile strength		900	N
Support frame:			
Wooden posts	Diameter	65	mm
Wooden stakes	Size	50 X 50	mm
Wire mesh	Gauge	14	
	Opening	150	mm
Anchor chain	Size	8	mm

Table 3 – Recommended material property for the landward sediment fence

Material property	Test method	Typical value	Units
Flow rate	AS 3706.9	145	$L/s/m^2$ (under 100 mm head)
Wide strip tensile strength	AS 3706.2	17 both directions	kN/m
Pore size (EOS) (O_{95})	AS 3706.7	110	mm x 10^{-3}
Mass per unit area	AS 3706.1	225	gsm
UV resistance	AS 3706.11	required	
Width	–	730–910	mm

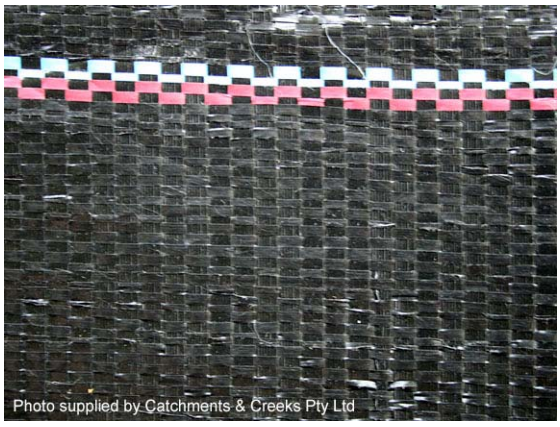

Photo 3 – Traditional woven sediment fence fabric

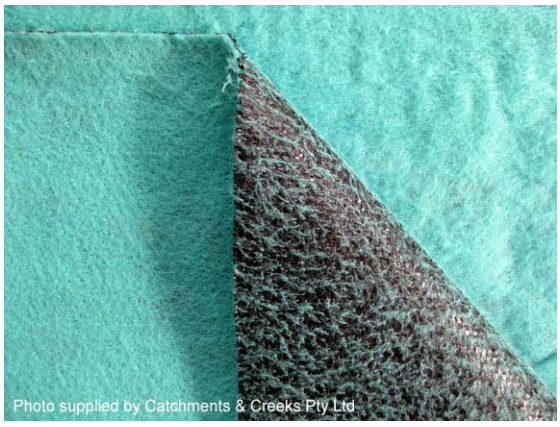

Photo 4 – Composite fabric with the woven (black) backing being the down-slope face of the sediment fence

In ‘dry’ streams during periods when:

- stream flows are only expected as a result of local storms; and
- flood flows are extremely unlikely (i.e. the dry season);

a sediment fence isolation barrier can be used to isolate large sections of the channel to allow instream disturbances such as de-silting operations (Figure 6).

The intention here is for minor intermittent stream flows (generated by local storms) to be diverted around the isolation barrier in a manner that does not cause channel erosion. However, flood flows, if they where to occur, are allowed to pass over the isolation barrier such that upstream flooding is not adversely affected, and channel velocities are not increased.

Following any stream flows, all sediment-laden water collected within the isolation area must be pumped to an off-stream sediment control system, that should ideally be located at least 50m from the stream.

If it is necessary to maintain the work area dry, then an impervious barrier will be required.

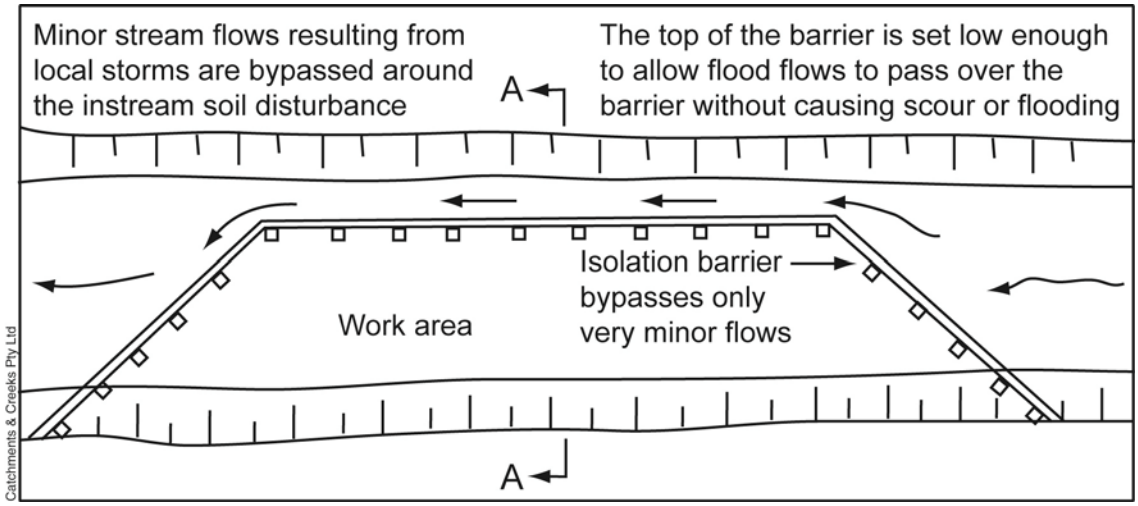

Figure 6 – Sediment fence isolation barrier used to divert intermittent stream flows

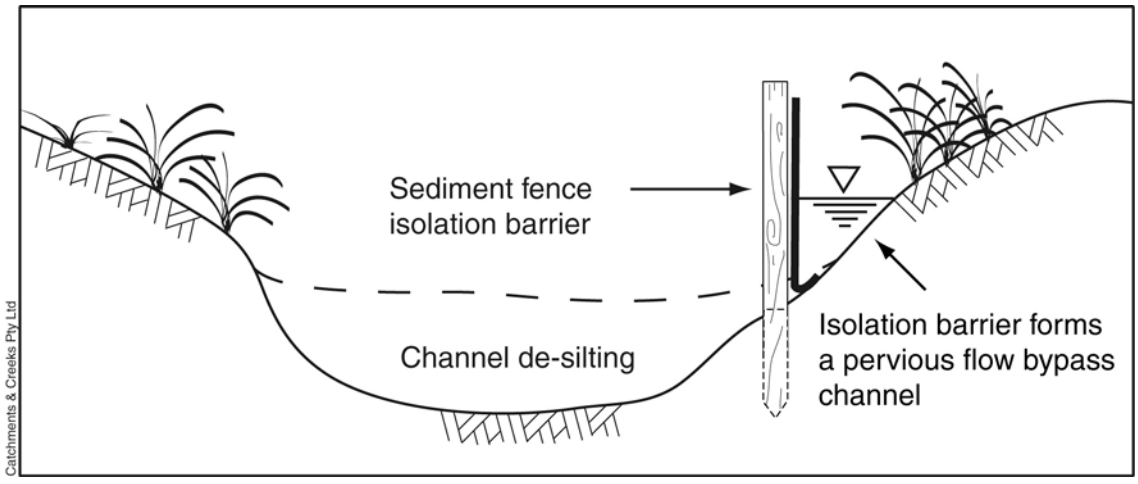

Figure 7 – Cross-section A-A from Figure 6 (above)

Description

Typically two parallel sediment fences staked around a proposed instream work site or bank disturbance in a streamlined manner that forms a quiescent water chamber suitable for the settlement of fine sediment particles.

This technique is also known as a 'staked silt barrier'.

Purpose

Used to isolate a section of enclosed 'still' water from passing stream flows, thus allowing sediment-laden water generated from construction activities to be isolated from the main channel.

Typically used as an instream isolation barrier in shallow drainage channels and streams when flows are only very minor and have a low velocity.

May also be used to isolate construction works from rivers and other large water bodies when the channel disturbance is expected to be limited to the channel banks and shallow waters along the water's edge.

Limitations

Only suitable for streams with low flow velocities adjacent to the banks.

Limited control of water turbidity.

Suitable for water depth up to 0.8m.

Advantages

Quick to install.

Requires no heavy machinery.

Disadvantages

Can be difficult to trench the fabric in a rocky or stony channel bed.

Can be damaged by floating debris or vandalism.

Special Requirements

Choice of fabric may need to vary between the outer and landward fences.

The isolation barrier should not fully block or cross the channel.

Site Inspection

Check for leakage of sediment-laden waters around the ends of the fences.

Check freeboard of fence over water levels.

Materials

- Fabric: polypropylene, polyamide, nylon, polyester, or polyethylene woven or non-woven fabric, at least 700mm in width and a minimum unit weight of 140gsm. All fabrics to contain ultraviolet inhibitors and stabilisers to provide a minimum of 6 months of useable construction life (ultraviolet stability exceeding 70%).
- Fabric reinforcement: wire or steel mesh minimum 14-gauge with a maximum mesh spacing of 200mm.
- Support posts/stakes: 1500mm^2 (min) hardwood, 2500mm^2 (min) softwood, or 1.5kg/m (min) steel star pickets suitable for attaching fabric.
- Ballast (outer barrier): minimum 8mm chain or equivalent, or minimum 50mm aggregate.
- Staples: heavy duty wire staples at least 25mm long, or wire ties.

Installation

1. Prior to commencing any works, obtain all necessary approvals and permits required to conduct the necessary works including permits for the disturbance of riparian and aquatic vegetation, and the construction of all permanent or temporary instream barriers and instream sediment control measures.
2. Refer to approved plans for location and dimensional details. If there are questions or problems with the location, dimensions or method of installation contact the engineer or responsible on-site officer for assistance.
3. Confirm if a single or double fence is required.
4. If there is flow within the watercourse or drainage channel at the time of installation of the isolation barrier, then take appropriate measures to minimise the release of sediment during its installation. Such measures should only installed if considered appropriate for the local conditions, and only if their installation is judged to provide a net overall environmental benefit.
5. To the maximum degree practicable, construction activities and equipment should not operate within open flowing waters.

6. Identify the appropriate location of the outer isolation barrier. For reasons of safety, the outer barrier should not be placed in water depths exceeding 1.2m.
7. If placed in large open waters, install the isolation barriers such that the top of each fence is at least 300mm above the waterline to prevent over-topping by waves or fluctuations in water level.
8. Place the support posts (outer barrier) at a maximum spacing of 2m with wire mesh backing, or 1.5m without wire mesh backing. Drive the posts 600mm into the channel bed or until the post are secure. If the support post cannot be driven 600mm into the bed, then additional bracing may be required.
9. Attach any fence reinforcement (wire mesh) as specified in the approved plans or as directed.
10. Prior to installing the fabric, secure (sew) a ballast chain into the bottom of the fabric.
11. Attach the specified fabric to the channel side of the posts. Where possible, used a continuous roll of fabric. If this is not possible, construct suitable leak-proof joints in the fabric.
12. Fasten the fabric securely using heavy-duty staples or nails (with a washer) at a maximum spacing of 50mm. Use wire ties to securely attach the fabric to the wire mesh (if used).
13. If it is not practicable to attach a ballast to the bottom of the fabric, then secure the bottom 300mm of fabric to the channel bed using a continuous placement (minimum 50mm) of large aggregate or clean rock fill.
14. After installing the outer isolation barrier, install the second landward barrier (if required). The landward barrier is usually located just above the normal water line, but should be located so as not to interfere with adjacent construction activities.
15. Ensure the top of the fabric of the outer barrier is at least 200mm above the maximum expected, dry weather (i.e. non-flood flow) water level.
16. Install the landward sediment fence in accordance with the normal installation procedures for a sediment fence, except the maximum spacing of support posts is 2m with or without a wire mesh backing. Ensure the fabric is attached to the landward side of the posts.

Maintenance

1. Inspect the isolation barrier daily and after any significant change in stream flow. Make necessary repairs immediately.
2. Inspect the barrier for turbidity leaks that might be caused by holes in the barrier or damage to the fabric-streambed contact.
3. Repair any torn sections with a continuous piece of fabric from post to post.
4. When making repairs, always restore the system to its original configuration unless an amended layout is required or specified.

Removal

1. All components of the sediment fence isolation barrier should be removed as soon as possible after it is no longer needed.
2. If excessive sediment or debris has collected around the barrier, then remove such material before the barrier is removed and dispose of such material properly.
3. Ensure any channel water contained within the enclosed channel area is suitably treated before either the water is discharged from the enclosure or the isolation barrier is removed.
4. If it is not feasible to wait for adequate settlement of suspended sediments, then where practicable, pump the sediment-laden water to an off-stream de-watering sediment control system for treatment. This treatment area should ideally be located at least 50m from the channel.
5. Starting from the upstream end, remove all materials used to form the isolation barrier and dispose of in a suitable manner that will not cause an erosion or pollution hazard.
6. Restore the watercourse channel to its original cross-section, and smooth and appropriately stabilise and/or revegetate all disturbed areas.