Floating Silt Curtains

INSTREAM PRACTICES

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

Symbol FSC

Photo 1 – Silt curtain used as an isolation barrier

Photo 2 – Sheet piling used to form a dry work area with a floating silt curtain used as a sediment containment system

Key Principles

1. A floating silt curtain is not a filtration system or an instream sediment fence.
2. Instream sediment control is achieved by isolating sediment-laden waters from passing stream flows, thus allowing sedimentation of disturbed waters within the enclosed area.
3. The placement of silt curtains within tidal waters is complex and requires careful planning and design. Inappropriate design can result in unnecessary sediment releases.

Pre-Design Data Collection

Observations to be made during the initial site inspection include:

- Suitable anchor points for the silt curtain both instream and along the bank.
- Location of launching and retrieving points for the barrier. This may involve the use of a boat, truck, winch, launch ramp, or crane.
- Identification of the overbank catchment area likely to contribute stormwater runoff into the isolation area, and potential options for managing this lateral inflow.
- Location of 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).
- Ascertain the channel profile and water depths (if not already available from marine survey).
- Estimate channel discharge and stream velocity. Stream velocity will likely vary across the channel, so as a minimum, estimate the flow velocity at 1/4, 1/2 and 3/4 channel width.
- Ascertain typical wave heights, including waves generated by boat traffic.
- Identify any protected or ‘non-disturbance’ areas.
- Collect pre-disturbance water quality data.

Design Information

The design information provided below is a general guide. Manufacturers and distributors of silt curtains may provide their own design guidelines and specifications.

Silt curtains are normally manufactured for a specific installation, thus dimensional information (e.g. length and fall height) must be obtained prior to ordering the curtain.

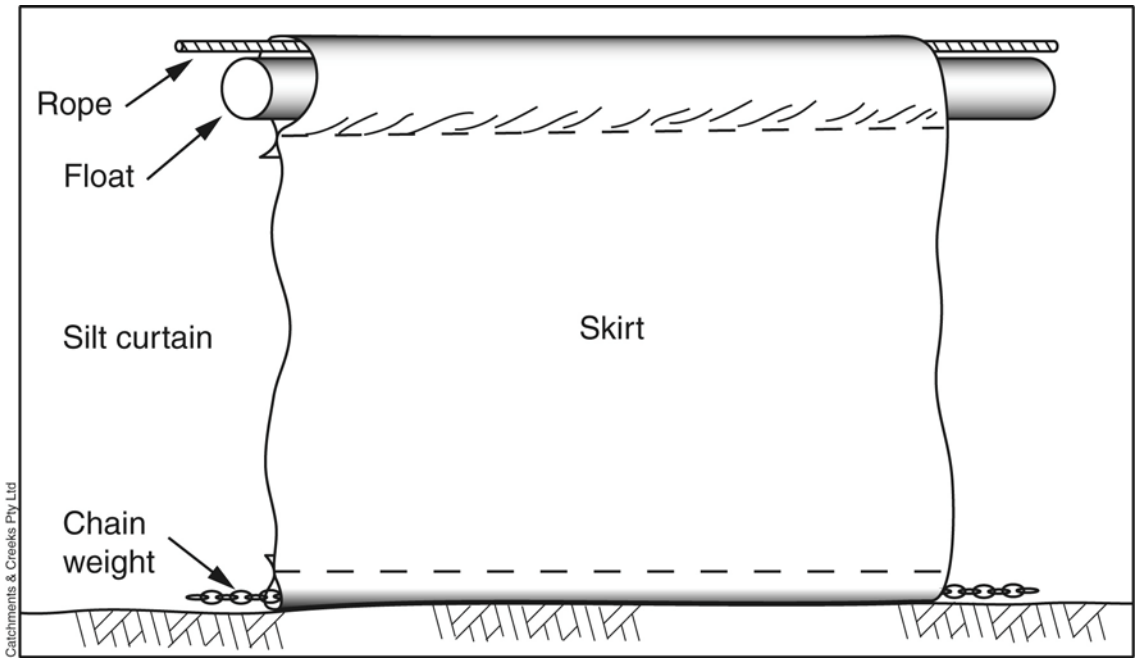

Figure 1 – Typical features of a floating silt curtain

The depth of the barrier should be approximately 10% greater than the water depth to ensure it rests on the channel bed. The barrier, however, should not be so deep as to form large pleats along the bottom of the fabric where sediment may collect causing the barrier to be pulled under the water surface.

The length of the barrier should be 10-20% longer than the measured length of the proposed enclosure to reduce the stresses on the barrier and allow for necessary adjustments during its installation.

Curtain fabric:

Silt curtains are **not** manufactured from sediment fence fabric. Instead the material consists of a woven geotextile, canvas/tarp material, or a commercially available silt curtain such as nylon reinforced polyvinyl chloride (PVC) or equivalent.

Table 1 provides the suggested material properties for a floating silt curtain.

Ballast chain:

Sew or heat-seal a galvanised chain into the base of the curtain. Alternatively, attach weights to the bottom edge of the curtain at a maximum spacing of 1.5m. The individual weights must provide at least the equivalent total weight per unit length as specified for a ballast chain.

Specifications for the ballast chain/weights are provided in Table 1

Load line (tie rope):

In still water, no load line other than the fabric itself will be necessary. Place a rope in the sleeve with the flotation units and attach the anchors to it. Do not directly attach an anchor to the fabric.

Specifications for the ballast chain/weights are provided in Table 1

Table 1 – Suggested material property for floating silt curtain

Material property	Test method	Typical value	Units
Skirt fabric:			
Grab tensile strength		900	N
Pore size (EOS) (O_{95})	AS 3706.7	0.21	mm
UV resistance	AS 3706.11	Required	
Panel lengths		30m for depths less than 4m	m
		15m for depths greater than 4m	m
Ballast chain:			
Galvanised		Yes	
Typical size	velocity < 0.15m/s	10	mm
	velocity > 0.15m/s	13	mm
Required weight	velocity < 0.15m/s	1.9	kg/m
	velocity > 0.15m/s	3.3	kg/m
Land anchor:			
Timber post (min)	diameter	100	mm
Marine anchors:			
Firm mud bed	Mushroom anchor	34	kg
	Danforth anchor	5	kg
Sandy bed	Danforth anchor	5	kg
Tie rope	velocity < 0.15m/s	10	mm
	velocity > 0.15m/s	13	mm
Connecting chain	length	3	m
	size	8	mm

Location:

The most effective placement methods for a floating silt curtain are:

- a semicircle or U-shape configuration around the disturbance (Figure 2);
- a circle or elliptical shape encircling the disturbance (Figure 3).

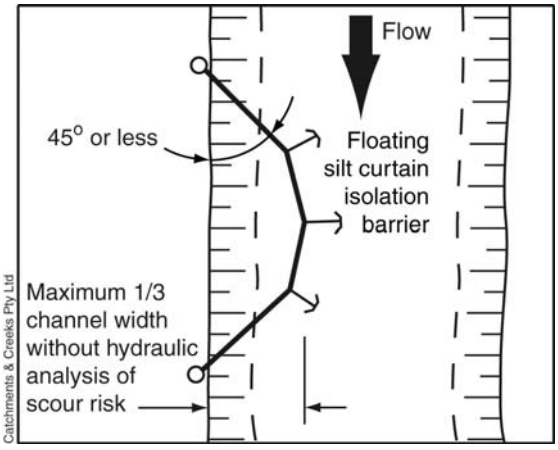

Figure 2 – Installation of a silt curtain around a bank disturbance

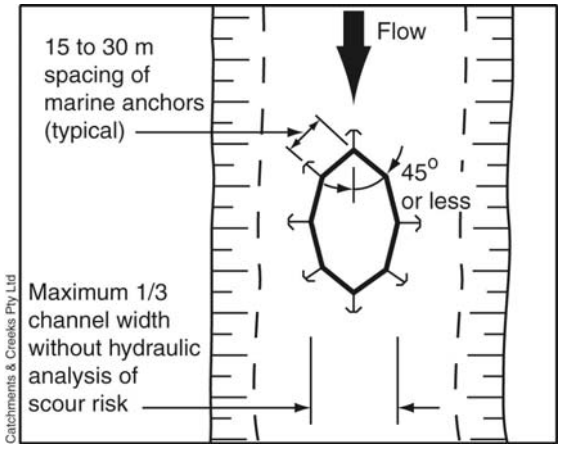

Figure 3 – Installation of a silt curtain around a mid-channel disturbance

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 the adverse effects of potential stream velocity increases, then it may be possible to isolate a larger proportion of the channel width.

It is generally **not** recommended for a silt curtain to be placed across the full width of a watercourse channel. The full-width installation shown in Photo 2 is only possible because this particular channel reach is located near the upstream limit of the tidal channel, thus only minor channel flows are expected.

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.

Mooring:

All silt curtains should be adequately anchored to prevent their displacement by stream flow.

The landward anchor may consist of a secure post, buried anchor, large diameter tree, or other immovable object (Figure 4).

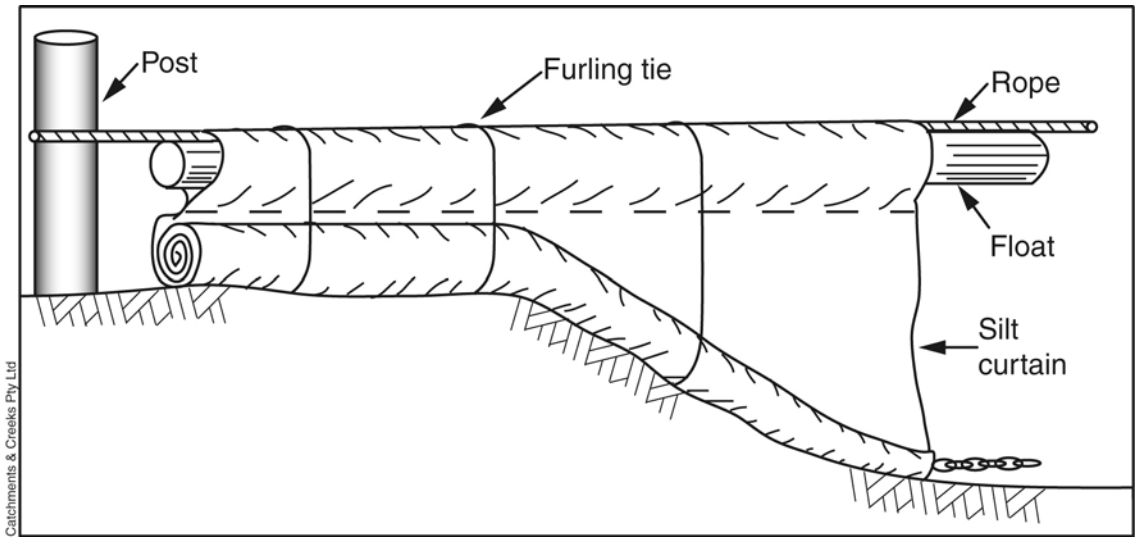

Figure 4 – Mooring of Silt Curtain to anchor post on stream bank

Secure the rest of the silt curtain to marine piles or marine anchors consisting of an anchor, chain, anchor rope, mooring and identification buoy (Figure 5). An alternative to a marine anchor is to drive piles into the channel bed; however, this anchoring method should be considered only as a last resort.

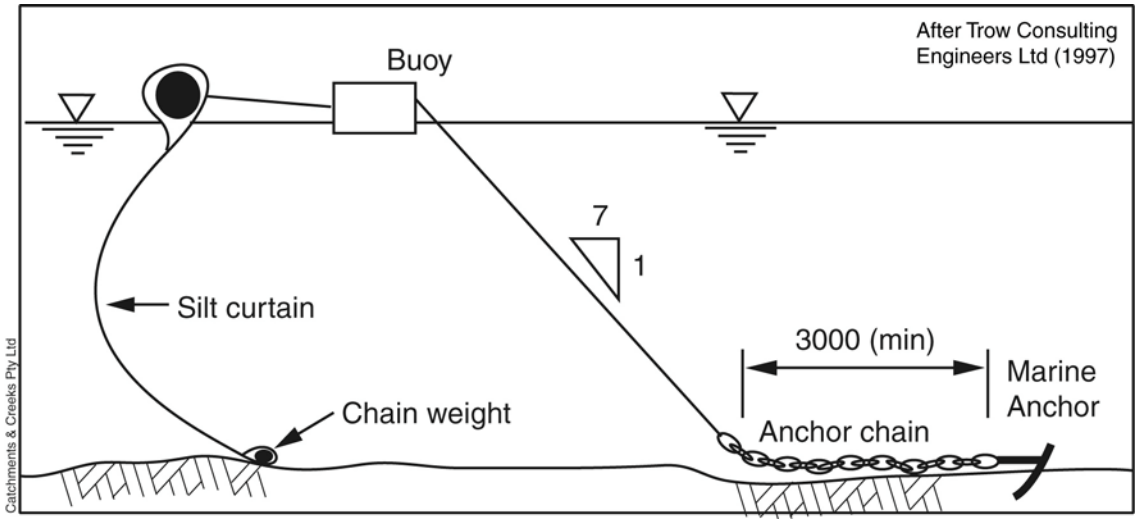

Figure 5 – Typical marine anchorage system

The silt curtain should be anchored at the junction of each panel section, but at least every 30m for depths up to 4m, and every 15m for depths exceeding 4m.

To reduce pressure on the curtain, slant the silt curtain at an angle to the stream flow. If the curtain will be exposed to reversing currents (tidal areas), anchor it on both sides.

The chain attached between the end of the anchor line and the anchor has three purposes:

- to prevent fouling (damage) of the anchor line or rope;
- to lower the angle of pull at the anchor;
- to act as a shock absorber.

In trafficable waterways, the anchor should be accompanied with a buoy—generally 300mm diameter—to warn daytime boat traffic. The enclosure should also be marked with warning lights or navigational markers if there is expected to be night time boat traffic.

If piles are used, then do not attach the floating barrier directly to the piles as this may cause chafing of the barrier against the supports.

Deployment of a floating silt curtain:

Prior to deploying the silty curtain, gather up the fabric and tie it with lightweight straps or rope every 1 to 1.5m (Figure 6). This will enable the curtain to be set in place easily without the weights being dragged along the channel bed.

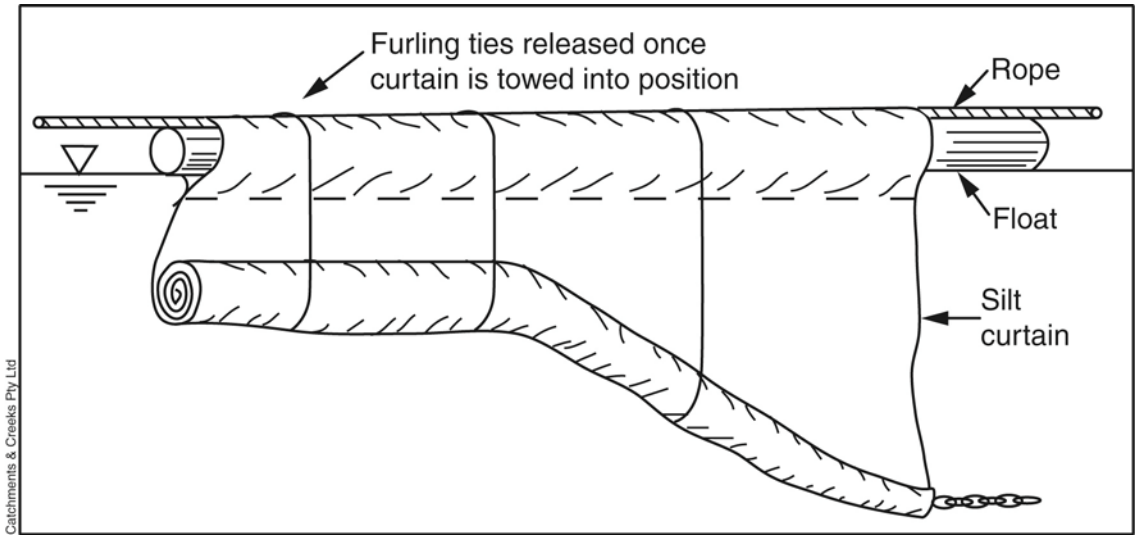

Figure 6 – Furling of skirt for deployment and/or recovery of silt curtain

Installation within tidal waters:

Critical to the design of silt curtain installations within tidal waters is the determination of the ideal location of the curtain. If located too close to the shoreline, sediment-laden waters will spill out of the enclosure during the falling tide. If located too far from the shoreline, the size and thus cost of the curtain can be excessive.

First priority should be to design of the installation such that the enclosed water volume at high tide is equal to the enclosed volume at low tide. If this can be achieved, then sediment-laden waters can remain trapped inside the enclosure until a suitable water quality is achieved that would allow removal of the curtain.

There are two design options for a ‘no release’ enclosure. Firstly the silt curtain can be sized such that it is near vertical during the highest expected tide (Figure 7). As per normal design requirements, the specified ‘fall’ of the skirt should be at least 10% greater than the maximum water depth at the chosen location of the curtain. The key design task is to locate the curtain such that the curtain can contain the same volume of water at low and high tide (Figure 8). This design option should result in the smallest curtain size, and therefore the cheapest curtain; however, in reality this design option is often the most difficult to achieve.

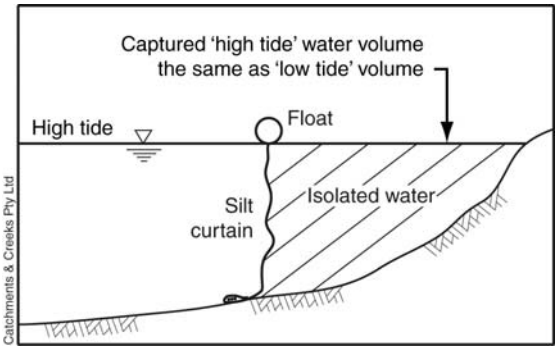

Figure 7 – Near vertical curtain at high tide

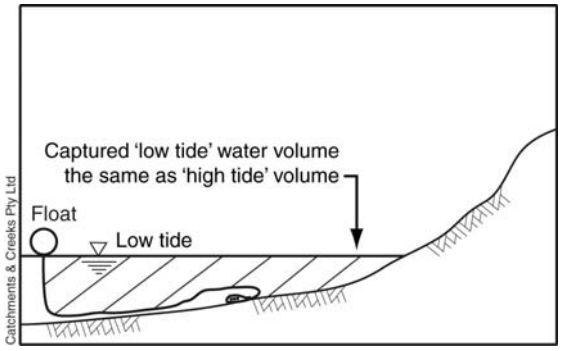

Figure 8 – Same curtain (left) at low tide

The second design option for a 'no release' enclosure is to allow the curtain to pull towards the shoreline at high tide (Figure 9). Again, the specified 'fall' of the skirt should be at least 10% greater than the maximum skirt length (measured in the vertical plane). The curtain must be located such that there will be no movement of the weighted bottom of the skirt throughout the tidal cycle.

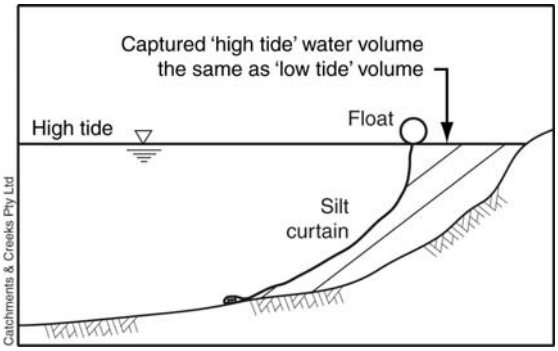

Figure 9 – Second design option at high tide

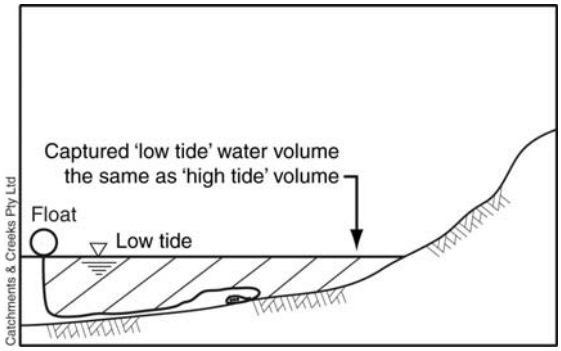

Figure 10 – Same curtain (left) at low tide

If it is not practicable to locate the silt curtain such that there will be no exchange of water during the tidal cycle, then various alternative (less desirable) design option exist. These design options include 'short' silt curtains that are elevated above the riverbed (Figures 11 & 12), and the manufacture of silt curtains with flow exchange windows or flaps. The latter option allows the use of flexible, one-way flow control flaps that encourage inflow into the enclosure towards the top of the curtain (i.e. during the flood tide), and the release of sediment-laden water through separate flaps located closer to the riverbed.

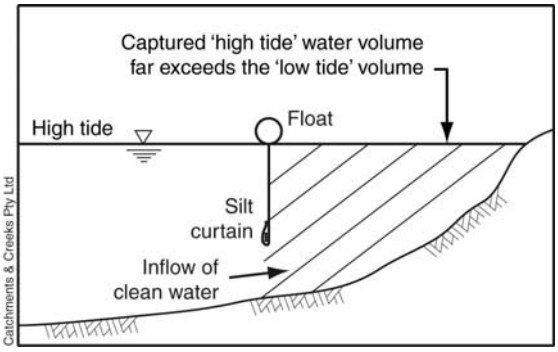

Figure 11 – 'Short' curtain at high tide

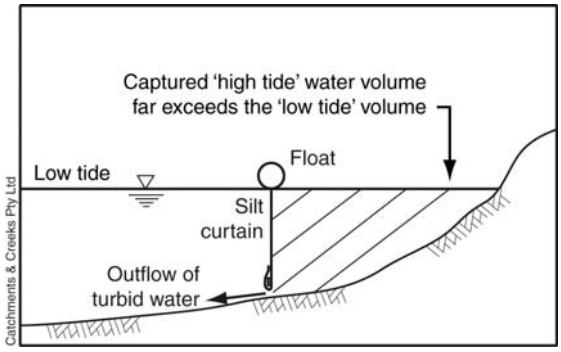

Figure 12 – Same curtain (left) at low tide

The principle reference document for this fact sheet is:

Trow Consulting Engineers Ltd, 1997. *Instream sediment control techniques field implementation manual.* Ontario Ministry of Natural Resources, Northeast Sciences & Technology. Nest Field Guide FG-007, Ontario, Canada, ISBN 0-7778-4772-8

Description

A geotextile fabric of low permeability suspended vertically from the top of the water surface and used to separate areas of contaminated and uncontaminated water.

Floating silt curtains normally consists of the following components:

- geotextile filter fabric
- flotation units secured along the top
- anchor weights secured along the bottom
- load lines secured along the top
- anchor or mooring cables

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.

Usually used in waters at least 0.8m deep such as a stream, river, lake or estuary.

Typical uses include flow isolation during the installation and maintenance of boat ramps and stormwater outlets, and the construction of waterway crossings.

Limitations

Specialist advice is required if placed in waters with a flow velocity exceeding 0.15m/s.

Water depth at least 0.8m.

Typically limited to a wave height less than 150mm, or greater than 150mm but less than 5% of water depth.

In all but exceptional circumstances, silt curtains should not be placed across the full width of a flowing stream, channel or waterway.

Avoid blocking more than 50% of a channel width at any given point in time.

Advantages

Can be effective in controlling turbidity in saline waters.

Generally the most effective sediment barrier in deepwater environments.

Disadvantages

Sediment that has settled on the bed of the isolation area can be resuspended and enter the water column once the silt curtain is removed.

Can be damaged by waves and fast flowing water.

Time consuming to install and remove.

Easily vandalised.

May cause a hazard to watercraft.

Special Requirements

Wherever practicable, the bottom of the silt curtain must be anchored to the bed of the water body to prevent sediment-laden water passing under the fabric.

Generally anchored in a U-shape around the channel disturbance.

Location

Generally used as an isolation barrier running mostly parallel to the stream flow.

The curtain should **not** be located across the full width of a flowing stream.

Site Inspection

Check for turbid plumes outside the silt curtain.

Check for damage to the anchorage system.

Materials

- Silt curtain fabric: manufactured from a woven geotextile, canvas/tarp material, or a commercially available silt curtain such as nylon reinforced polyvinyl chloride (PVC) or equivalent.
- Ballast chain: 10 to 13mm galvanised chain with minimum 1.9 to 3.3kg/m weight.
- Land anchor: minimum 100mm diameter timber post (or equivalent).
- Marine anchor: minimum 5kg lightweight (Danforth) type anchor with 10 to 13mm nylon tie rope and minimum 3m length of 8mm galvanised connecting chain.

Installation

Installation procedures should be provided by the product manufacturer or distributor. A typical installation procedure is described below, but should be confirmed with the product manufacturer or distributor.

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. Prior to the installation, check weather reports for a suitable windless, calm day. Do not proceed with the installation unless safe to do so.
3. 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.
4. Clear the immediate launching area of rock and debris. Avoid disturbing groundcover vegetation.
5. Layout a plastic launching pad (spillway) at right angles to the watercourse bank and peg or anchor it down. This is to protect the curtain and reduce friction when launching.
6. Unfold the curtain in an open area prior to its installation. Ensure the barrier is fabricated with sufficient dimensions to be in good contact with the bottom of the channel. The depth of the barrier should be approximately 10% greater than the water depth to ensure it rests on the bed.
7. Ideally, the length of the barrier is 10 to 20% longer than the measured length of the proposed enclosure.
8. Unfold the first curtain panel on the slipway.
9. Insert the floats both ends for ease of installation.
10. Pull through the steel chain in the bottom sleeve using the draw cord.
11. Pull through the rope using the draw cord.
12. Prior to deploying the barrier, gather up the curtain and tie the curtain with lightweight straps or rope every 1 to 1.5m. The aim of this is to enable the curtain to be set in place in the water easily without the curtain being dragged along the channel bed.
13. Set the upstream bank anchor point and tie off one end of the barrier, ensuring no water will be able to flow into the upstream end.
14. Deploy the barrier from the end of a boat. Fasten the free end of the barrier to the downstream anchor point, then anchor the barrier at intermediate points.
15. Taper the ends of the barrier to the shape of the shoreline, otherwise tie the ends of the barrier with furling straps so the depth of the barrier can be adjusted to the shape of the bank.
16. After the barrier has been anchored, check to see that the skirt is not twisted around the flotation units. When the barrier is properly deployed, cut the tie ropes and let the ballast weights sink to the bed.
17. Ensure the skirt (at maximum water level) is free of large pleats that may collect sediment causing the barrier to be pulled under the water surface.

Alternative land-based installation procedure:

1. Unfold the first curtain panel on the slipway.
2. Insert the floats both ends for ease of installation.
3. Pull through the steel chain in the bottom sleeve using the draw cord.
4. Pull through the rope using the draw cord.
5. Prior to deploying the barrier, gather up the curtain and tie the curtain with lightweight straps or rope every 1 to 1.5m. The aim of this is to enable the curtain to be set in place in the water easily without the weights being dragged along the bottom.
6. Set the upstream bank anchor point and tie off one end of the barrier, ensuring no water will be able to flow into the upstream end.
7. Install an extra length of rope or cable in the final curtain position in the water.

8. Tie the end of the curtain rope to the extra length already in position and pull the curtain into the water stopping when the end of the first section of curtain is still on the bank.
9. Unfold the second section of curtain on the slipway making sure the curtain is correctly orientated with the first section of curtain
10. Insert the floats, chain and rope as before.
11. Using the draw cord from the first section, tie up the ends using the eyelets already in the curtain.
12. Gather up the curtain and tie together with twine or thin rope.
13. Launch as before.
14. Continue until the entire curtain is installed.
15. Anchor well to shore anchors.
16. Using a suitable boat, move along the curtain and cut the ties holding the chain and curtain and allow the weighted end to sink.
17. Ensure the skirt (at maximum water level) is free of large pleats that may collect sediment causing the barrier to be pulled under the water surface.

Maintenance

1. Inspect the silt curtain daily for damage.
2. Ensure the top of the barrier remains above the water surface, and the curtain is free of tears or gaps.
3. Ensure the barrier remains in the specified location.
4. Check for turbidity leaks.
5. Check all anchor points.
6. Repair or replace any torn segments.
7. Check for sediment build-up on the bottom of the skirt that may begin to pull the curtain under the water.
8. Dispose of any excessive sediment or debris deposits in a manner that will not create an erosion or pollution hazard.
9. Repair any places in the isolation barrier that have weakened or that have been subjected to damage from inflows or overtopping water.

Removal

1. The silt curtain 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 the channel water contained within the enclosure has achieved a suitable water quality before removing the silt curtain.
4. Ensure the release of sediment and the damage to the channel's bed and banks is minimised during removal of the silt curtain.
5. 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.
6. Remove all construction materials, excessive sediment deposits and debris and dispose of in a suitable manner that will not cause an erosion or pollution hazard.
7. Restore the watercourse channel to its original cross-section, and smooth and appropriately stabilise and/or revegetate all disturbed areas.