Instream Sediment Control Systems

INSTREAM PRACTICES

Photo 1 – Filter tube barrier

Photo 2 – Modular sediment barrier

The information contained within this series of fact sheets deals only with the design of 'temporary' instream sediment control measures. Discussion is not provided on permanent stormwater treatment systems of instream sediment collection ponds.

The sediment control measures used on most 'off-stream' construction sites are primarily based on the gravitational *settlement* of sediment-laden runoff. In most cases, the sediment-laden runoff results from either local storm runoff, or process water such as de-watering activities, equipment cleaning and material cutting operations.

Instream sediment control measures, however, primarily rely on the *filtration* of sediment from dry weather stream flows. The reasons why these treatment measures rely on filtration processes as opposed to settlement-based systems are outlined below.

- Most off-stream sediment control practices focus on the capture of the coarser sediment fraction—*Sediment Basins* being the one major exception to this rule. On the other hand, instream sediment control practices need to focus on both coarse sediment and turbidity levels.
- Most instream maintenance and construction activities are conducted during dry weather, or at least when only low-flows are expected within the watercourse.
- Thus, environmental protection normally focuses on the appropriate management and treatment of dry weather flows. This is different from traditional off-stream sediment control practices, which primarily focus on the management of wet weather events.
- Thus, instream sediment control techniques are normally required to treat much lower flow rates and volumes compared to the design flow rates for off-stream sediment control measures.
- Due to the lower flow rates experienced by instream sediment measures, sediment blockages are more easily detected and necessary maintenance can usually be carried out immediately. This is different from traditional off-stream sediment controls where sediment blockages normally occur during storm events when maintenance of the device is usually impracticable.
- Also, instream construction and maintenance activities are normally conducted over much shorter time periods compared to off-stream works; therefore, the high maintenance requirements and sediment blockage problems associated with filtration systems are less likely to seen as a significant problem to site managers.
- It is also noted that most streams flow much cleaner during periods of dry weather, thus higher treatment standards (i.e. filtration) are usually required during these periods of dry weather flow in order to minimise environmental harm.

It is rarely practical to design instream sediment controls to treat stream flows resulting from flood flows or significant freshwater events. If the contamination of flood flows is an important issue for the site, then consideration should be given to the application of an appropriate flow diversion system, such as an *Isolation Barrier*.

Any sediment runoff generated outside the main waterway channel, i.e. within the overbank areas, must be treated prior to its discharge into the watercourse. The selection and design of off-stream sediment control techniques is discussed within the various fact sheets listed under the general *'Sediment Control'* sub-heading.

The selection and design of instream sediment control technique depends on a number of variables including channel shape, flow rate, water depth, base-flow water quality, and the duration of the instream disturbance. Tables 2 to 4 provide guidance on the selection of appropriate instream sediment control techniques.

Photo 3 – Rock filter dam

Photo 4 – Sediment filter cage

Photo 5 – Sediment weir

Photo 6 – Straw bale barrier

Wherever reasonable and practicable, preference should be given to Type 1 sediment control systems, followed by Type 2, then Type 3 systems as presented in Table 1.

Table 1 – Classification of temporary instream sediment control techniques [1]

Type 1	Type 2	Type 3
• Pump sediment-laden water to an off-stream Type F or Type D sediment basin or high filtration system	• Filter tube barrier • Rock filter dam • Sediment weir	• Modular sediment barrier • Sediment filter cage • Sediment fence • Straw bale barrier

[1] Classification may vary depending on flow conditions and design details.

Table 2 – Recommended site conditions of use for various temporary instream sediment control measures

Instream sediment trap	Typical site conditions
Filter Tube Barrier	• Channels with 'clear' base flow. • Channels with poor settling (i.e. clayey) sediment. • Suitable for medium (< 5 days) and long-term (> 5 days) works.
Modular Sediment Barrier [1]	• Concrete-lined channels and overland flow paths. • Areas with poor access for heavy machinery. • Short-term (<2 days) works where the units can be reused.
Rock Filter Dam [1]	• Long-term works (i.e. more than 5 days). • Dry weather conditions when over-topping flows are not expected. • Constructed or heavily modified drainage channels only. • Channels with turbid or slightly turbid base flow.
Sediment Filter Cage [1]	• Short-term works (i.e. less than 2 days). • Channels with turbid or slightly turbid low-flow. • Channel containing good settling sediments. • Narrow, flat, sandy bed channels.
Sediment Weir [1]	• Medium to long-term works (i.e. more than 2 days). • Channels with turbid or slightly turbid base flows. • Sites with poor machinery access. • Channels with an irregular bed shape. • Wide channels.
Sediment Fence	• Dry channels/drains when channel flow is highly unlikely. • Only suitable for trapping sediment displaced by bed/bank works.
Straw Bale Barrier	• Strictly short-term (< 1 day) usage only. • Best used as a **temporary** sediment trap while installing the primary instream sediment control device.

[1] These techniques can be supplemented with the use of one or more filter tubes.

Table 3 – Selection of preferred instream sediment control technique [1]

Site Condition	Technique [2]	Comments
Short-term works (< 2 days)	Various	Preferred choice of sediment control device depends on site conditions and knowledge gained from past practices.
Default device for medium to long-term works (> 2 days)	Filter tubes	The filter tubes may be used in association with an earth embankment, *Rock Filter Dam, Sediment Weir,* or *Modular Sediment Barrier* depending on the expected base flow rate and environmental sensitivity of the watercourse.
Deep water drain or waterway	Floating silt curtain	Typically used in water depths greater than 0.8m as an isolation barrier, rather than as a sediment trap.
	Isolation barrier	If significant channel flows exist, then preference should be given to the use of an isolation barrier.
No machinery access	Filter tube barrier	Used on medium to long-term works (> 2 days). Needs suitable site conditions so the filter tubes (when full) can be winched from the channel. The filter tubes need to be incorporated into an earth embankment, *Rock Filter Dam*, *Modular Sediment Barrier, Sediment Weir*.
	Modular sediment barrier	All components are light and easy to transport. Can be used in association with filter tubes to increase allowable flow rate and/or increase service life.
	Sediment weir	Possible use of straw bales as the filter media within the sediment weir, otherwise use modular units.
	Sediment fence	Use in minor stormwater drains during construction and maintenance. Only suitable if channel flows are highly unlikely. Suitable for trapping minor sediment displaced during the watering of bed and bank vegetation.
Small, constructed drain	Filter tube barrier	The filter tubes need to be incorporated into an earth embankment, *Rock Filter Dam*, *Modular Sediment Barrier, Sediment Weir*.
	Rock filter dam	Can be used in association with filter tubes to increase allowable flow rate and/or increase service life.
	Modular sediment barrier	Can be used in association with filter tubes to increase allowable flow rate and/or increase service life.
Low-flow concrete drain or rocky channel	Off-stream de-watering techniques	Consider the feasibility of pumping contaminated water to a suitable off-stream de-watering sediment control system.
	Modular sediment barrier	Modular units must be wrapped in filter cloth and anchored to the channel bed. Can be used in association with filter tubes to increase allowable flow rate and/or increase service life.
	Filter tube barrier	Filter tubes incorporated into modular filter units or an impermeable weir securely anchored to the channel bed.

[1] Instream sediment traps should only be used when the use of an *Isolation Barrier* is not practical.

[2] Techniques listed in general order of preference.

Table 4 – Selection of preferred instream sediment control technique [1]

Site Condition	Technique [2]	Comments
Significant sediment flows (in volume) are expected such as in a sandy bed channel	Sediment cage	Used in narrow, flat-bed channels or during low flow.
	Sediment weir	A sediment weir is a possible option if a *Sediment Filter Cage* could not be suitably installed.
	Filter tubes	The preferred option if high turbidity levels are expected.
	Rock filter dam	Not suitable if there is a high risk of failure caused by high stream flows. Generally only suitable for constructed or modified channels where heavy machinery access exists.
Channels with existing turbid low-flows	Sediment cage	Used on narrow, flat, sandy bed or during low flow.
	Sediment weir	Possible option if no heavy machinery access exists.
	Rock filter dam	Suitable for constructed or modified channels where heavy machinery access exists. May not be suitable if significant stream flows are likely.
Coarse gravel bed channels	Filter tube barrier	The preferred option if the filter tubes can be installed without causing irreversible or unacceptable bed damage.
	Rock filter dam	May require the use of a thick filter cloth to separate the gravel bed and *Rock Filter Dam*. May not be suitable if significant stream flows are likely.
Natural dry-bed waterway where stream flows are most unlikely	No instream controls	Site conditions may allow instream works to occur without the need for instream sediment controls if the risk of stream flow is sufficiently low.
	Modular barrier	Most components can be reusable from site to site.
	Sediment weir	Use of straw bales as the filter media may allow the bales to be reused if flow does not occur.
Natural dry-bed waterway where stream flows are possible	Isolation barrier	Stage disturbance across the channel to allow the free, uncontaminated bypass of likely stream flows or lateral inflows resulting from local storms.
	Sediment weir	Use of straw bales as the filter media may allow the bales to be reused if flow does not occur; otherwise consider the use of a *Modular Sediment Barrier*.
Natural waterway with minor base flow	Delay works	1st option: delay works until a suitable low-flow period.
	Isolation barrier	Stage disturbance across the channel to allow the free, uncontaminated bypass of stream flows with minimal impact on aquatic passage.
	Filter tube barrier	The filter tubes need to be incorporated into an in-situ *Modular Sediment Barrier,* or *Sediment Weir*.
Narrow channels with significant base flow	Delay works	1st option: delay works until a suitable low flow period.
	Isolation barrier	Stage channel disturbance wherever practical.
	Cofferdam	Cofferdam with gravity base-flow bypass pipe.
Wide channels with significant base flow	Delay works	1st option: delay works until a suitable low flow period.
	Isolation barrier	Stage disturbance across the channel and isolated from the main channel flow.

[1] Instream sediment traps should only be used when the use of an *Isolation Barrier* is not practical.

[2] Techniques listed in general order of preference.

Table 5 provides a summary of the attributes of various temporary instream sediment control techniques.

Table 5 – Attributes of various temporary instream sediment control techniques [1]

	Filter tube barrier	Isolation barrier with off-stream trap	Modular sediment barrier	Rock filter dam	Sediment filter cage	Sediment weir	Sediment fence	Straw bale barrier
Standard drawing code	FTB	IB	MSB	RFD	SFC	SW	SF	SBB
Typical treatment standard [1]	2	N/A	3	2	3	2	3	N/A
Turbidity control	M	H	L	M	L	M	L	L
Type of channel:								
Concrete drains	✓		✓					
Constructed channels		✓		✓	✓			
Natural watercourse	✓	✓				✓		
Soil type (within disturbance area):								
Sandy soil		✓	✓	✓	✓	✓		
Good-settling loam or clay	✓	✓	✓	✓		✓		
Poor-settling loam or clay	✓	✓		✓		✓		
Dispersive clay	✓	✓		✓		✓		
Stream flow conditions:								
No stream flows expected							✓	
No base flow, but possible storm/flood flows	✓	✓	✓	✓	✓	✓		
Minor base flows	✓	✓	✓	✓	✓	✓		
Significant base flows		✓						
Significant risk of flow flows		✓				✓		
Duration of instream works:								
< 1 day								✓
1 to 2 days	✓	✓	✓	?	✓	?		
< 5 days	✓	✓	✓	✓	✓	✓		
> 5 days	?	✓	✓	✓		✓		