Portable Sedimentation Tanks

DE-WATERING SEDIMENT CONTROL TECHNIQUE

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

[1] These systems may or may not incorporate the process of 'filtration'. Treatment standard varies with the type of unit, but is likely to be 'equivalent' to low filtration for site-modified systems, medium level filtration for commercial settling tanks, and high level filtration for some lamella settling tanks.

[2] Specifically designed commercial units are likely to be required for clayey soils, unless the discharge can be released onto a substantial *Grass Filter Bed*.

Symbol

Photo 1 – Lamella settling tank

Photo 2 – Site-modified mini skip

Key Principles

1. The primary treatment process is likely to be 'filtration' for site-modified units, and gravity-induced settlement for commercial units. The settlement process within commercial units is likely to be assisted by either chemical coagulation or the development of low-turbulent laminar flow conditions within the tank.
2. The critical design parameter for most commercial units is the design flow rate. Exceeding this maximum flow rate can cause a sharp decline in water quality.

Design Information

Depending on the particulate make-up of the sediment-laden water (i.e. micron size), commercial settling tanks can be expected to achieve a turbidity level of around 80 NTU (nephelometric turbidity units). Further treatment can then be achieved by passing the effluent through an appropriate sand or cartridge filter, or releasing the water onto a substantial *Grass Filter Bed*.

Some commercial tanks allow batch treatment only, while others may allow continuous or batch flow. Batch treatment systems are the most efficient, however, they usually require either the use of an upstream storage tank of sufficient size to contain all inflows during one complete batch cycle, or two or more parallel treatment units.

Typical batch treatment cycles incorporate approximately 1-hour of coagulation followed by 2-hours of settling.

Site-modified sedimentation tanks:

Site-modified settling tanks are most commonly based around the use of mini skips (Figures 2 to 4). These systems are mostly continuous flow systems that have a low to medium filtration capability that normally requires a secondary (polishing) treatment process. The secondary treatment process may consist of a sand or cartridge filter (both requiring a second pump phase), or releasing the water onto a substantial *Grass Filter Bed*.

Care must be taken when designing site-modified units to control inlet and outlet flow velocities to minimise the re-suspension of settled sediment.

The following components may need to be incorporated into the treatment system:

- chemical (coagulant) injection process (optional depending on the clay properties);
- secondary containment for acid, caustic, buffering compound and treatment chemical;
- settling chamber;
- high flow bypass (optional depending on operational conditions).

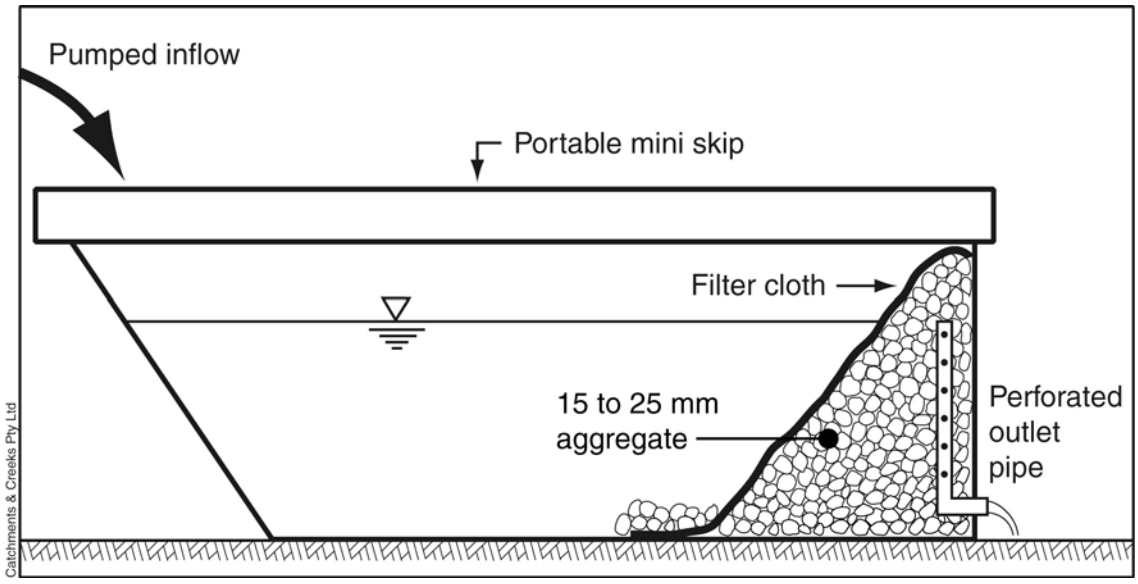

Figure 1 – Example of a modified mini skip sediment tank

When using a modified mini skip as a filtration system it is important to avoid direct contact between the filter cloth and the sidewalls of the skip as this will prevent flow through the fabric. To avoid such problems, side-flow drainage panels (normally used to provide stormwater drainage adjacent buried walls) can be used to line the walls of the mini skip, as in Figure 2.

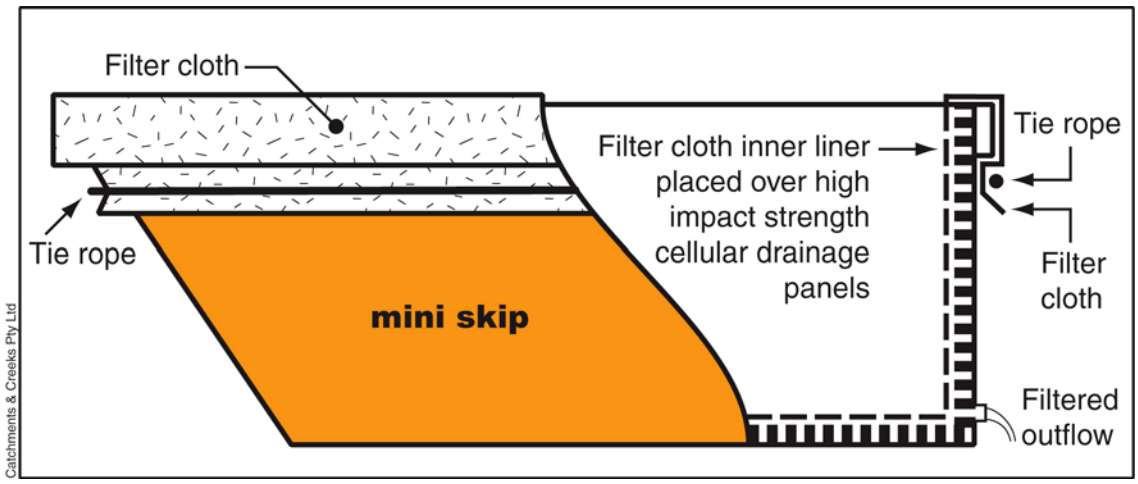

Figure 2 – Modified mini skip with high flow (cellular) drainage panels attached to the mini skip panels then covered with a replaceable filter cloth blanket

Elaborate site-modified treatment units can be developed for use in confined spaces.

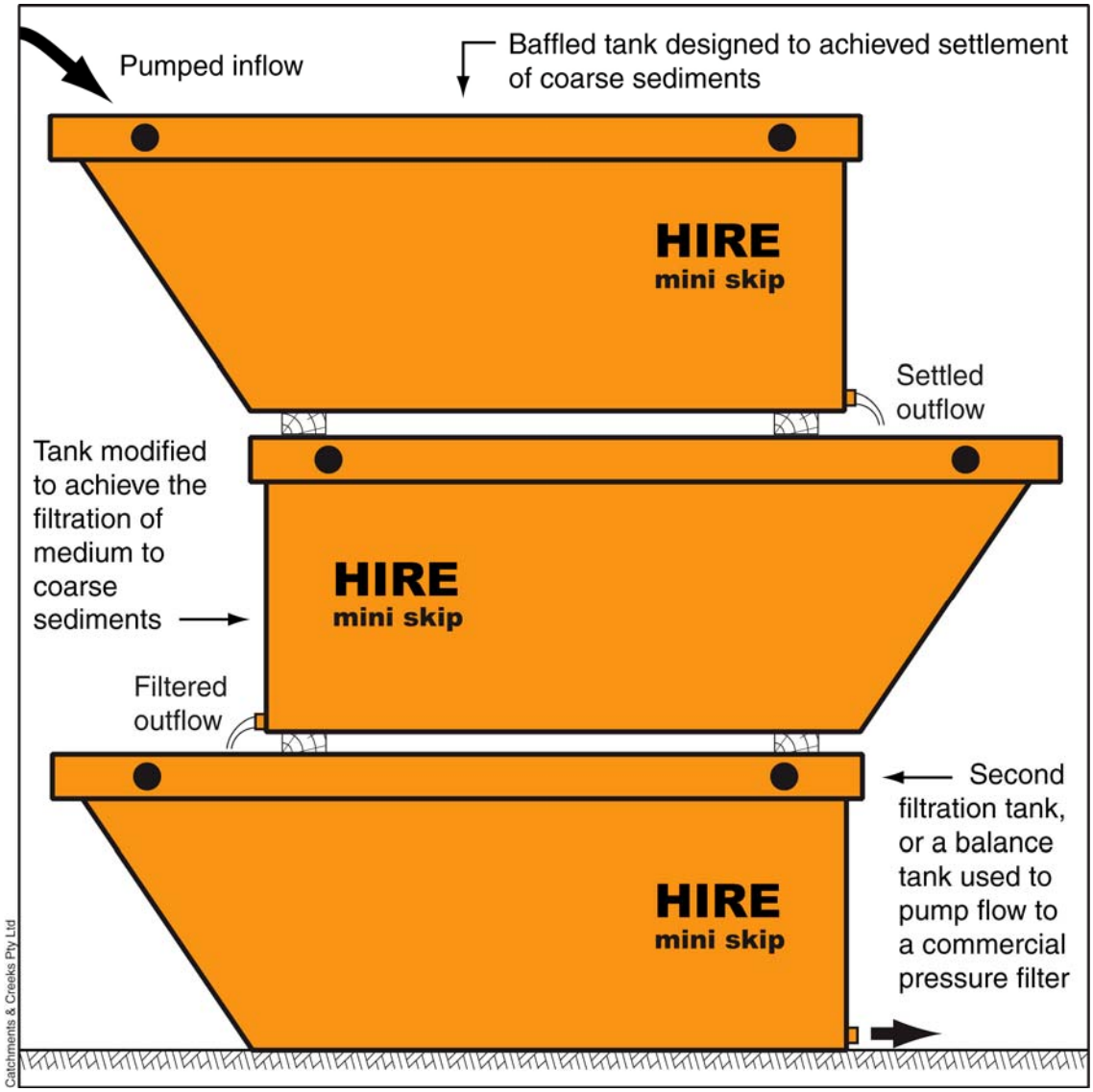

Figure 3 – Conceptual design of a stacked sedimentation and filtration tanks

Wherever practical, the sedimentation tanks should be located up-slope of a significant grassed filter bed, or at least 50m from a watercourse (Figure 4).

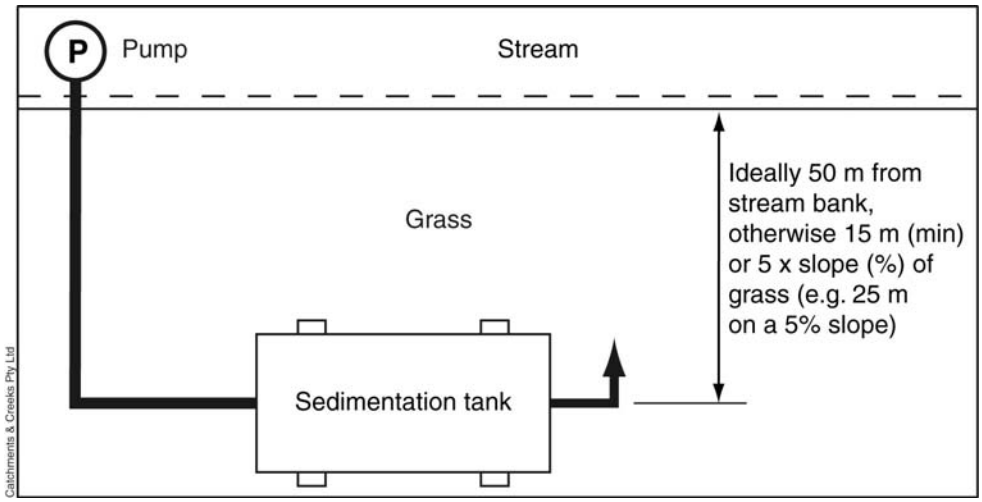

Figure 4 – Separation of sedimentation tanks from streams

Lamella settling tanks:

Also known as 'lamella plate separators', 'lamella clarifiers', 'lamella settling tanks', and lamellar settler tanks'.

Lamella tanks incorporate several parallel thin-plate baffles, set at about a 60-degree angle, to induce a stable laminar boundary layer adjacent the plate to capture and settle fine suspended particles that would normally pass through a conventional sedimentation tank (Figure 5). The tanks operate under a continuous flow process.

By inducing a laminar boundary layer, any particles that settle into the boundary layer cannot be re-suspended by the passing flow. These particles continue to settle, trapped within the laminar boundary layer, even if the dominant flow direction between the plates is upwards (i.e. against the direction of settlement).

The induced laminar boundary layer is easily disturbed if the flow rate exceeds its maximum design flow rate, thus the treatment efficiency can rapidly decline as the flow rate approaches and exceeds the maximum allowable flow rate. The rate of decline in performance will vary from unit to unit.

Lamella tanks operating under appropriate flow rates with chemical flocculation are reported to capture particles down to 0.002mm (2 microns).

Lamella tanks occupy about 10% of the footprint of a conventional settling tank of the same performance.

Prefabricated tanks come in a range of sizes that can handle flow rates around 1 to 50m^3/hr. On some tanks the hydraulic capacity may be increased to around 100m^3/hr, but declining performance should be expected.

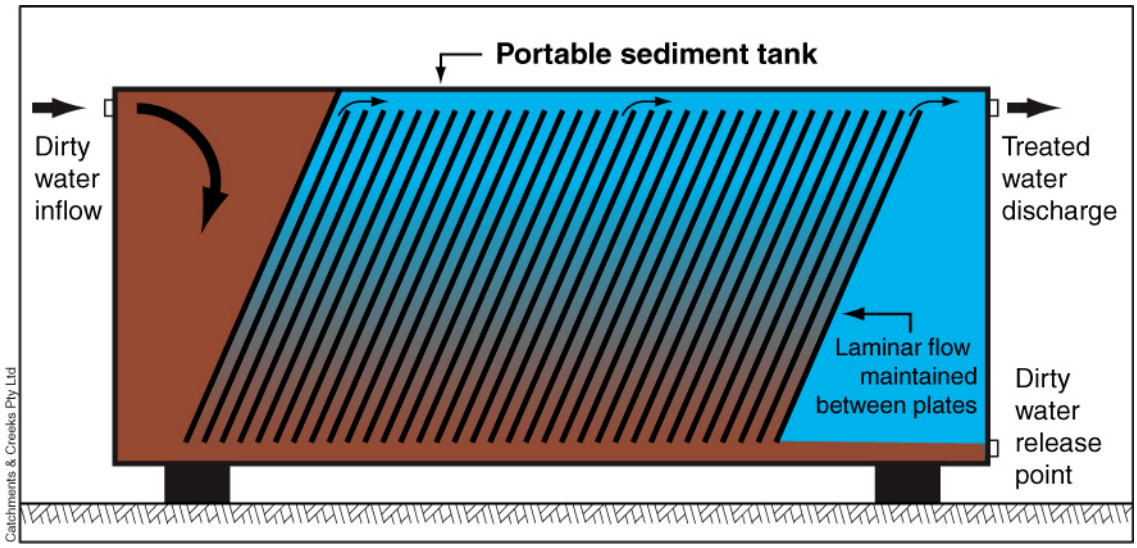

Figure 5 – Typical layout of a lamella sedimentation tank (design and operation vary widely from manufacturer to manufacturer)

In order to allow sufficient time for chemical coagulation, the coagulant may need to be injected into the inflow pipe some distance upstream of the treatment unit. Essential on-site equipment for chemical dosing may include emergency shower, eyewash, and water quality monitoring equipment including pH meter and turbidimeter.

Description

A prefabricated tank usually containing one or more compartments that trap sediment and allow chemical dosing.

Also known as *Settling Tanks* and *Portable Sediment Tanks.*

Purpose

Used to remove sediment from water pumped from excavations, tunnels and other confined spaces where a traditional *Sediment Basin* or *Stilling Pond* would be impractical. Treatment of the sediment-laden water may involve chemical coagulation to control turbidity levels.

Limitations

Only suitable for low to medium flow rates.

Control over silt and turbidity vary from unit to unit, and may require chemical dosing.

Some authorities may place restrictions on the use of certain coagulants.

Petroleum based polymers should not be used.

Advantages

Suitable for use in confined spaces.

Tanks are reusable.

Suitable for batch and continuous flow.

One of the few treatment systems that can be used for turbidity control.

Disadvantages

Can be more expensive than a one-off *Sediment Basin*, but can be cost effective if reused on several sites.

Can be difficult to clean out.

Can be a labour intensive operation.

Special Requirements

Portable sediment tanks should be located so that trapped sediments can be readily removed without interference to construction activities.

Water quality monitoring is usually required.

Use of chemical coagulants requires expert advice and formal operational procedures.

Chemically treated tank effluent must be non-toxic to aquatic organisms. Samples of treated water should be tested for acute (lethal) toxicity.

A pH adjustment may be required prior to discharge of the treated water.

Operation

1. Refer to approved plans and associated environmental management plans for operational details. If there are questions or problems with the method of installation or operation, contact the product supplier and/or responsible on-site officer for assistance.
2. Prior to use, conduct flocculation tests to demonstrate suitability of treatment additive and approximate dosage rate.
3. Use of chemical additives must be within limits specified by relevant authorities, including State agencies.
4. Chemical flocculant/coagulants must be allowed to mix rapidly with the waters to insure proper dispersion.
5. Ensure the tank operates in a manner that prevents the re-suspension and discharge of the settled sediment.
6. Maintain a daily log of batch rates (volume and time), type and amount of chemical usage (including pH adjustments if any), and water quality monitoring.

Maintenance

1. Inspect the sedimentation tank regularly and at least daily during de-watering operations.
2. Make repairs/adjustments as needed to maintain the required treatment standard.
3. De-silt the tank and maintain all replaceable components (such as filters) in accordance with supplied operational instructions. Unique site-modified units should be de-silted once settled sediment exceeds one third of the storage volume.
4. Dispose of all sediment in a manner that will not create an erosion or pollution hazard.

Removal

1. Disassemble and remove all components of the sedimentation tank and remove from the site.
2. Dispose of the consumables and sediment in a manner that will not create further erosion, sedimentation or environmental problems.
3. Rehabilitate all disturbed ground as necessary to minimise the erosion hazard.