Mobile Treatment Units

DE-WATERING SEDIMENT CONTROL TECHNIQUE

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

[1] Some treatment systems can treat and/or capture water contaminants other than sediment.

Photo 1 – Truck-mounted vacuum unit

Photo 2 – Trailer-mounted units

Design Information

Mobile treatment systems include:

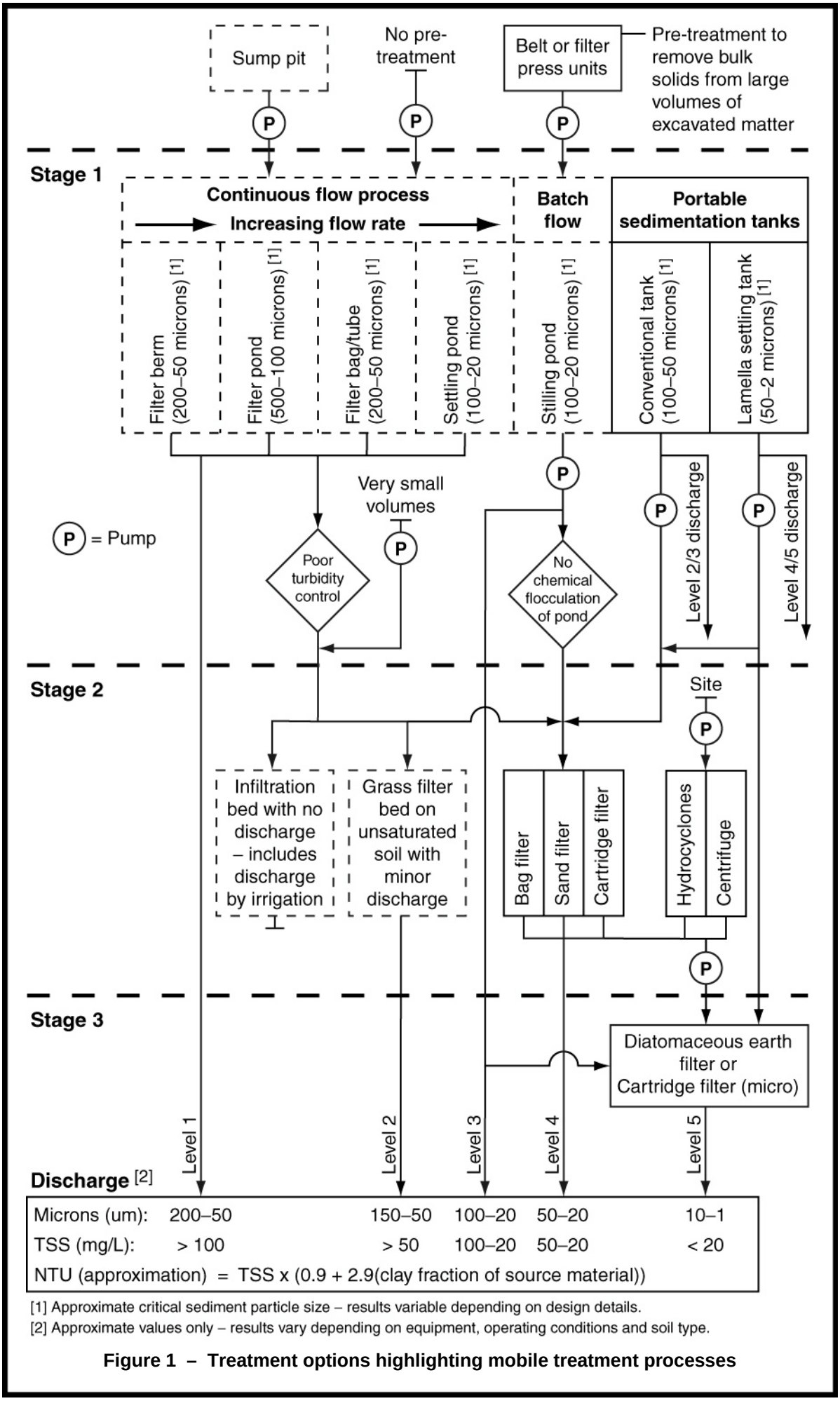
- vacuum units that collect and transport sediment-laden water for off-site treatment and disposal (Photo 1);
- truck-mounted treatment units, such as hydrocyclones, centrifuge units, belt presses (Photos 3 and 4) and filter presses (Photo 5);
- trailer-mounted units, such as pressurises bag, diatomaceous earth (DE), cartridge and sand filters (Photo 2);
- skid-mounted treatment systems;
- portable sedimentation tanks (refer to separate fact sheet).

Figure 1 provides an indication of the 'potential' outcomes of various treatment options highlighting those processes that can be adapted to mobile units. Actual outcomes can be highly variable based on the soil properties, the choice of equipment, and the operational flow rate relative to the equipment's maximum flow rate.

Most construction site de-watering projects can be dealt with in a few days at a modest flow rate. On such sites the costs are heavily influenced by the ease of equipment set-up and decommissioning, which is where truck- and skid-mounted equipment has the advantage.

On large construction sites and mining operations there is the need to manage large volumes of water that generate large quantities of sediment. Such cases often justify the use of specialised equipment and techniques not normally recommended on typical construction sites. This equipment includes, vacuum drum filters, filter-presses, belt-presses, centrifuges and banks of hydrocyclones.

High-tech water treatment systems are generally only efficient at separating solids that fall within a narrow set of properties, thus on large de-watering facilities it is normally beneficial to segregate particles into several targeted streams such as shown in Figure 1.



[1] Approximate critical sediment particle size – results variable depending on design details.

[2] Approximate values only – results vary depending on equipment, operating conditions and soil type.

Figure 1 – Treatment options highlighting mobile treatment processes

Belt presses can be used as a pre-treatment process during the de-watering of bulk sediment removed from sediment basins and bogs to reduce the volume of water requiring secondary treatment.

Photo 3 – Belt-press unit in operation

Photo 4 – De-watered sludge output from the de-watering of a sludge lagoon within a wastewater treatment plant

A variety of treatment systems can be bolted to skids and trailers to allow ease of transportation from site to site. For small jobs, various industrial and domestic (Photos 6 and 7) filters can be assembled into a mobile, staged treatment system for the de-watering of excavations.

Photo 5 – Mobile filter press

Some cartridge filters (Photo 7) can also be placed on-line prior to discharging water from small roadside excavations onto a grassed verge.

Photo 6 – Domestic sand filter

Photo 7 – Domestic cartridge filter

Overview of treatment processes:

(a) Bag filters (micro filtration):

Process:
- Filtration through small filter bags with a fine micron rating.

Examples:
- Commercial pressure filters containing one or more small, fine-micron filter bags.
- A *bag filter* is **not** the same as a *filter bag*.

Performance:
- Typically a medium treatment efficiency. The filter bags normally need to operate in association with a pre-treatment process, typically a sedimentation tank. Critical particle size of around 0.001 to 0.1mm (1 to 100 microns), but typically in the range of 60 to 100 microns.
- Initial discharge can be poor until a sediment build-up occurs on the surface of the filter.
- Flow rates of around 23m^3/hr per (175 x 750mm) bag, with a full capacity of around 3kg of sediment.
- Significant more capture volume compared to cartridge filters.

Costs:
- Medium cost

(b) Belt Press and Filter Press:

Process:
- Filtration through geotextile belt/filter.

Examples:
- Truck-mounted belt press.
- Fixed or truck-mounted filter press units.

Performance:
- Performance similar to filter bags.
- Belt press can be used as a pre-treatment process within very large de-watering projects to reduce the volume of water requiring treatment.
- Filter press units can be used for high quality treatment of small volumes.

Costs:
- Typically operated on a rental basis.

(c) Cartridge filters:

Process:
- Filtration through commercial cartridge filters.

Examples:
- Commercial treatment units with replaceable filter cartridges.

Performance:
- Typically a high to very high treatment efficiency. Critical particle size of around 0.0005 to 0.1mm (0.5 to 100 microns). Cartridge filters used in domestic pool filters capture particles generally in the range of 20 to 100 microns.
- Industrial cartridge filters are generally able to remove finer particles than sand or bag filters.
- Flow rate of around 2 to 3m^3/hr per 1m long cartridge for a nominated 10 micron critical particle size.

Costs
- High capital and operational (cartridge replacement) costs.
- Best used for small jobs, otherwise consider a DE Filter.

(d) Centrifuge:

Process:
- Settlement through induced artificial gravity.

Examples:
- Range from small truck-mounted units to large fixed industrial units.

Performance:
- Flow rates of around 3 to 60m^3/hr of transportable units, up to 1500m^3/hr for industrial units.
- Used for the de-watering of bulk sediment removed from sediment basins, and the de-watering of material removed from sludge lagoons and bogs.

Costs:
- May require high amp, 3-phase power supply.
- High wear rates when treating abrasive-grit-laden water.

(e) Diatomaceous earth (DE) filters:

Process:
- Filtration through diatomaceous earth.

Examples:
- Portable skid-mounted pressure chamber units.

Performance:
- Typically a high to very high treatment efficiency. Critical particle size of around 0.001mm (1 micron).
- One of the few filter-based systems capable of removing clay-sized particles, and thus reducing turbidity levels.
- Flow rate of around 6m^3/hr per kg of diatomaceous earth (single use).
- Disposal of the used diatomaceous earth can be problematic.

Costs:
- Similar cost to sand filters.

(f) Hydrocyclones:

Process:
- Settlement through induced artificial gravity with banks of conical tubes (similar to modern bag-less vacuum cleaners).

Examples:
- Fixed or truck-mounted units

Performance:
- Hydrocyclones can be used to concentrate the sediment, thus reducing the volume of water requiring secondary (polishing) treatment.
- Used for the de-watering of bulk sediment removed from sediment basins, and the de-watering of material removed from sludge lagoons and bogs.
- These systems generally require pre-treatment for the removal of coarse sediments to improve their operational efficiency.
- Flow rates of 0.1 to 1m^3/hr for a mean particle size of 0.002 (2 microns).
- Flow rates of around 12m^3/hr for a mean particle size of 0.01 (10 microns).
- Flow rates of around 25m^3/hr for a particle size of 0.015 (15 microns).

Costs:
- High purchase cost

(g) Sand filters:

Process:
- Filtration through fine granular material.

Examples:
- Commercial sand filters (similar to the systems used on residential swimming pools.
- In-situ sand filters similar to those used for urban stormwater treatment.

Performance:
- Generally not recommended for turbidity control due to poor capture of clay-sized particles.
- Most commercial sand filters provide medium treatment efficiency. Critical particle size of around 0.02 to 0.05mm (20 to 50 microns).
- Most in-situ sand filters provide high treatment efficiency because the effluent is further treated by allowing infiltration into the ground.
- Flow rates of around 7 to 14m^3/hr per 100kg of sand.

Costs:
- High purchase or construction costs, with high maintenance costs.