SEDIMENT CONTROL PONDS

(a.k.a. Sediment basins, detention ponds or basins)

A sediment control pond is a large excavated area used to detain construction site runoff and promote settling of suspended sediment particles. They are wet ponds, which means they are designed to hold a permanent pool of water and provide additional storage – known as active storage – for detaining incoming flows. As such they are very similar to stormwater management wet ponds that are built as permanent detention facilities to treat runoff from developed areas.

Figure B2-19: Sediment control ponds

In addition to removing suspended sediment, sediment control ponds prevent downstream erosion by releasing water through an outlet structure at a fixed rate over an extended period of time. This protects downstream features from the erosive impact of storm event peak flows.

Several aspects of sediment pond design determine their capacity to improve water quality and reduce peak flows. These include permanent pool storage volume, active storage volume, length-to-width ratio, presence of a forebay or cells, and the location of the inlet and outlet

Sediment ponds are 'end-of-pipe' practices that are typically the final BMP through which stormwater flows before it is discharged offsite. They receive flows from all the other ESC measures installed in the contributing drainage area as well as overland flow, often from stripped land areas. As such they are particularly important components of ESC plans, providing the last line of defense against the release of excess sediment to natural water features.

Application

- Treatment of runoff from any construction site drainage areas > 2 ha.
- Applied as an end-of-pipe control.

Design and installation

- Sediment ponds must be constructed prior to any construction activities except for topsoil stripping and grading associated with the construction of the pond.
- Once excavation and grading is complete, pond banks must be compacted and stabilized with vegetation. An

Thinking beyond ponds

Studies has shown that while properly designed ponds have good removal efficiencies, high incoming runoff volumes and sediment concentrations often result in effluent sediment concentrations that exceed thresholds for the protection of aquatic organisms and their habitats.

Apply a ***multi-barrier approach*** and focus on ***stabilizing the site*** in order to keep sediment out of the stream.

RECP may also be needed until vegetation is well established and effectively preventing erosion.

- The maximum recommended contributing drainage area for a sediment pond is 10 ha.
- Consider whether there is a need to construct the pond with a liner to prevent interaction with groundwater. This is particularly important if there is a downward gradient and hydraulic conductivity of soils is greater than 10^{-7} m/s, or if the pond is to be located in a vulnerable area, which may include: (i) highly vulnerable aquifers, (ii) significant groundwater recharge areas, (iii) wellhead protection area A or (iv) wellhead protection area B (if the area has a vulnerability score ≥ 8).

Siting

- Install the sediment basin based on topography and in a low area allows the maximum control of sediment laden runoff from the disturbed areas.
- Consult with local CA if proposed location is the also the location of the ultimate (post-construction) stormwater management pond.

Pond and forebay design

The following design specifications should be applied in the design and sizing of sediment control ponds and their forebay areas:

Design component	Specifications	Notes
Forebay / berms	At least one forebay designed as follows: • ≥ 1 metre deep • Sized to ensure non-erosive velocities leaving forebay • ≤ 33% of permanent pool ***AND*** A submerged berm or turbidity curtain	Submerged berm/turbidity curtain applied across the width of the pond, half way between the initial forebay berm and the outlet structure.
Permanent pool volume	≥ 125 m^3 per hectare contributing drainage area	• 185 m^3/ha provided if length-to-width ratio or drawdown requirements are not met • Confirm volume with local CA
Active storage volume	≥ 125 m^3 per ha drainage area	
Drawdown time	≥ 48 hours	
Length-to-width ratio	≥ 4:1	A baffle may be required to increase length of the flow path and prevent short circuiting
Permanent pool depth	1 – 3 metres	• Refers to maximum depth (deepest point) • Minimum depth is applied to avoid re-suspension of previously settled sediment • Maximum depth is a safety precaution
Slope grades	• Interior side slopes graded no steeper than 4H:1V • Exterior side slopes graded no steeper than 2H:1V	

Inlet design

- For swale inlets typically in place before site servicing is complete, ensure structural stability and the application of erosion controls. Options include embedded stone, well established vegetation installed with turf reinforcement matting, or other hard or soft armoring techniques.
- Ensure stabilization selected will withstand erosive forces of the runoff flowing through the channel inlet.
- Install flow interruption devices in the swale upstream of the pond in order to dissipate the energy in the runoff and reduce its erosivity.
- A slope drain or similar structure is recommended to allow runoff to be conveyed down into the pond with minimal erosion risk.

Outlet design

- Include a perforated riser pipe outlet or approved equivalent to release effluent at a controlled rate. The riser pipe outlet should be covered with a layer of small clear stone (25 mm – 50 mm) over a layer of larger (150 mm - 200 mm).
- The orifice in the outlet structure should have a diameter ≥ 75 mm to prevent clogging.
- A vegetated filter strip (10 metres length recommended) should be planted at the sediment control pond outfall.
- The outfall should be constructed with an animal protection grate and a flow dispersion measure to prevent erosion.

Emergency spillway design

- Ensure that a stable, open channel emergency spillway is constructed to prevent overtopping or structural failure during high flows. Installation should adhere to all specifications provided by the ESC plan designer.
- The spillway must be designed to safely pass the 100 year design storm.
- Stabilize the spillway. Options include embedded stone, well established vegetation installed with turf reinforcement matting, or other hard or soft armoring techniques.
- Install erosion protection immediately downstream of the spillway, including both ground stabilization and energy dissipation measures as needed.

Calculations required

The following calculations should be submitted with associated ESC plan drawings and reports:

- Velocity calculations demonstrating that settling velocities can be achieved based on the proposed design
- Determination of permanent pool and active storage volumes
- Drawdown calculations

Inspection and maintenance

- Inspect weekly, and before and after significant rainfall (see definition in Section 10.1.2) or snowmelt events, and keep a record of the inspection.
- Ensure pond has been constructed prior to any construction activities except for activities associated with the construction of the pond, such as topsoil stripping and grading.
- Verify that pond and its specific components (i.e. inlet, forebay, berms, outlet, emergency spillway) appear to be constructed as per detailed drawings in ESC plan.
- Verify stabilization of pond banks and inlet and look for any evidence of erosion. Repair or augment stabilization measures as needed, i.e. fill rills, re-seed and apply RECP.
- Inspect inlet for signs of excess sediment accumulation and/or large debris. Remove sediment accumulation in the forebay before it reaches 50% of the forebay storage capacity.
- Measure sediment accumulation in the pond at least once every six months. Guidance on proper sediment depth measurement is available in Section 6.1 of the *Inspection and Maintenance Guide for Stormwater Management Ponds and Constructed Wetlands* (TRCA and CH2M, 2016).
- Remove sediment accumulation in the pond when it reaches approximately 30% of the permanent pool storage volume.

Figure B2-20: Sediment removal from a pond

- Observe and/or analyze pond effluent suspended sediment and/or turbidity levels to assess performance. This should be done before and after significant rainfall and snowmelt events or more frequently as needed. See Chapter 10.0 for addition guidance ESC performance monitoring.
- Where effluent turbidity is elevated, consider potential reasons for under-performance including:
  - Water short circuiting flow path due error in design or implementation
  - Erosion from banks or swale inlet
  - High sediment loads entering the pond due to inadequate ESC in the contributing drainage area.
  - Excessive sediment accumulation in the pond
- Address deficiencies and carry out follow up monitoring to assess whether actions taken have resulting in pond performance improvement.
- Ensure spillway remains structurally sound and repair as needed when damage occurs. Replace and regrade the stone as required to maintain its shape.
- For more detailed guidance on pond maintenance, refer to the *Inspection and Maintenance Guide for Stormwater Management Ponds and Constructed Wetlands* (TRCA and CH2M, 2016).
- Any repair or maintenance needs identified should be repaired within 48 hours or sooner if natural receptors are at imminent and foreseeable risk of adverse impact.

Decommissioning

- In the case where the sediment control pond is in the location of the ultimate (post-construction) pond, and construction is complete, accumulated sediment must be removed (and appropriately disposed of) and the permanent pool storage must be restored to the design level.
- Water pumped out of ponds that are being decommissioned should be treated with a sediment control measure prior to release to the receiving water system. Appropriate sediment removal BMPs for application during pond dewatering include sediment bags, weir tanks, or treatment trains that may incorporate these measures. See dewatering protocols (Section 6.4) and BMP details on p. B2-25 and B2-45 for guidance.
- Sediment and liner materials should be removed from the bottom of the pond and properly disposed of based on sediment quality. Refer to the *Inspection and Maintenance Guide for Stormwater Management Ponds and Constructed Wetlands* (TRCA and CH2M, 2016) for best practices related to pond sediment disposal / reuse.

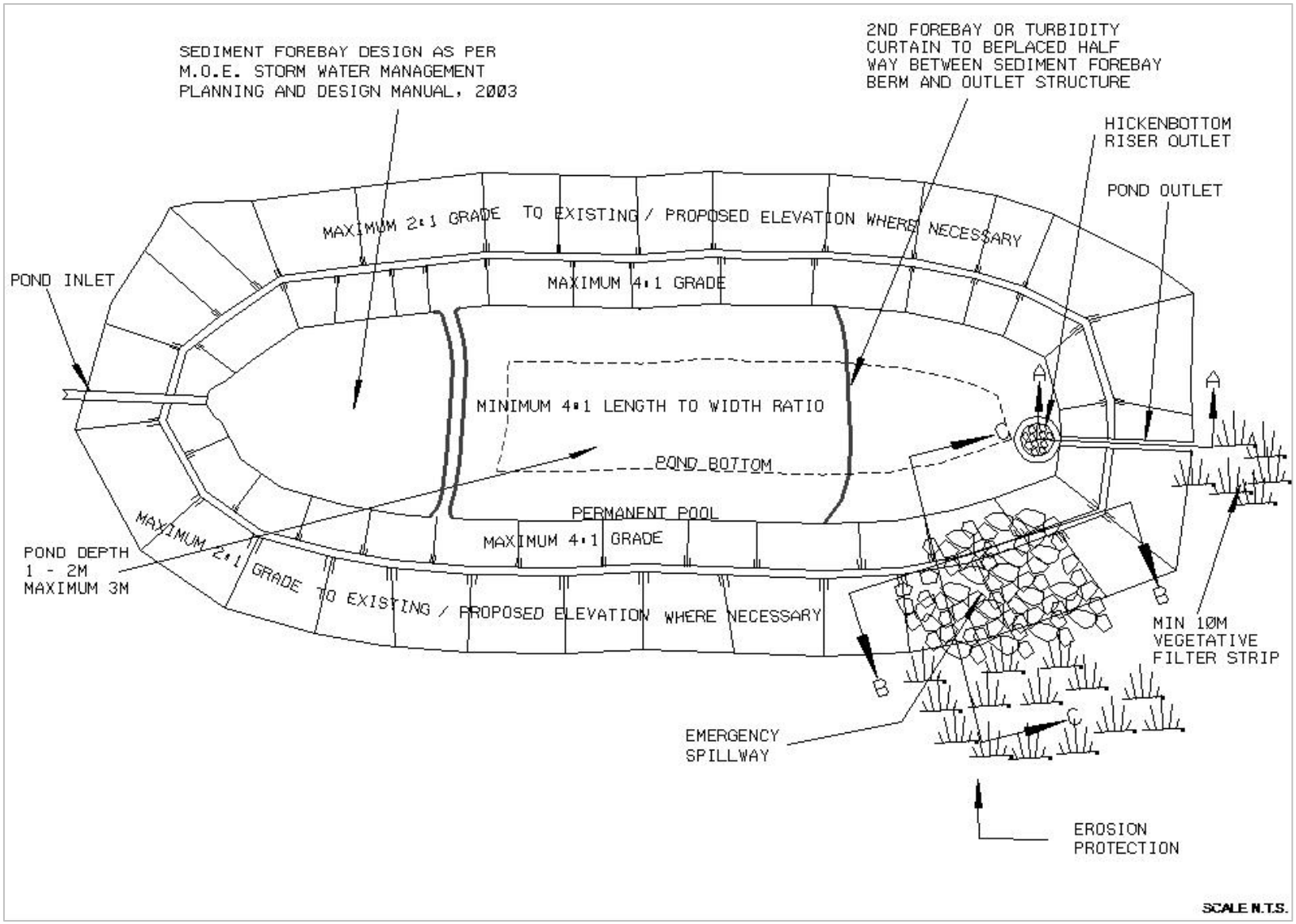

Figure B2-21: Plan view depiction of sediment control pond design specifications