SEDIMENT BASIN
From Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas
http://www.mass.gov/dep/water/laws/policies.htm#storm

Definition:
A sediment basin is a settling pond with a controlled storm water release structure used to collect and store sediment produced by construction activities. A sediment basin can be constructed by excavation or by placing an earthen embankment across a low area or drainage swale. Sediment basins can be designed to maintain a permanent pool or to drain completely dry. The basin detains sediment-laden runoff long enough to allow most of the sediment to settle out.

Purpose
- To collect and store sediment from sites cleared and/or graded during construction or for extended periods of time before reestablishment of permanent vegetation or construction of structures.
- To retain sediment on the construction site and prevent off-site sedimentation.

Where Practice Applies
- Sediment basins are needed where other erosion control measures are not adequate to prevent offsite sedimentation.
- A sediment basin should be used only where is sufficient space and appropriate topography. The basin should be made large enough to handle the maximum expected amount of site drainage.
- Fencing around the basin may be necessary for safety or vandalism reasons.
- A sediment basin used in combination with other control measures, such as seeding or mulching, is especially effective for removing sediments.
- Dam Safety Regulations (302 CMR 10) must be followed where applicable. Contact the Department of Conservation and recreation for more information.
Advantages

- Protects downstream areas from clogging or damage due to sediment deposits generated during construction activities.

- Because of additional detention time, sediment ponds may be capable of trapping smaller-sized sediment particles than other practices. They are most effective, however, when used in conjunction with other practices such as seeding or mulching.

Disadvantages/Problems

- Ponds may become an “attractive nuisance” and a safety hazard.

- Sediment ponds are only effective in removing sediment down to about the medium silt size fraction. Sediment-laden runoff with smaller-size fractions (fine silt and clay) will pass through untreated; emphasizing the need control erosion to the maximum extent first.

Planning Considerations

- Sediment basins are usually constructed by building a low earthen dam across a drainageway to form a temporary sediment storage pool. A properly designed spillway outlet with adequate freeboard is essential.

- A sediment basin may be created by excavation, construction of a compacted embankment, or a combination of both. It may have one or more inflow points carrying polluted runoff.

- Basins should be installed before clearing and grading begin.

- To improve trap efficiency the basin should have the maximum surface area possible, and sediment should enter the basin as far from the outlet as possible.

- Sediment basin life should be limited to 3 years, unless it is designed as a permanent structure.

Effectiveness

Sediment basins are at best only 70-80 percent effective in trapping sediment which flows into them. Therefore, they should be used in conjunction with erosion control practices such as temporary seeding, mulching, diversion dikes, etc. to reduce the amount of sediment flowing into the basin. Sediment basins are most effective when designed with a series of chambers.
Location

- Locate sediment basins only in upland areas, not wetlands.

- Ensure that basin location provides a convenient concentration point for sediment laden flows from the area served.

- To improve the effectiveness of the basin, it should be located so as to intercept the largest possible amount of runoff from the disturbed area. The best locations are generally on relatively flat terrain downstream from disturbed areas.

- Drainage into the basin can be improved by the use of diversion dikes and ditches.

- The basin must not be located in a stream but should be located to trap sediment-laden runoff before it enters the stream.

- The basin should not be located where its failure would result in the loss of life or interruption of the use or service of public utilities or roads.

Diversions

- Divert sediment-laden water to upper end of sediment pool to improve trap effectiveness. Bring all water into the basin at low velocity to prevent erosion.

- Divert runoff from undisturbed areas away from basin.

Multiple Use

Sediment basins may be designed as permanent structures to remain in place after construction is completed for use as stormwater detention ponds. Sediment must be removed from the pond when construction is complete to prepare the pond for permanent use.

Design Recommendations

Drainage area - Not more than 100 acres.

Sediment storage - The sediment basin should have a minimum volume based on 1/2 inch of storage for each acre of drainage area. This volume equates to 1800 cubic feet of storage or 67 cubic yards for each acre of drainage area.

Trap efficiency - Length-to-width ratio should be 2:1 or greater; divert inflow to upper end of basin to avoid short-circuiting flow. Length is defined as the average distance from the inlet to the outlet of the trap. Baffles to spread the flow throughout the basin should be included.

Dewatering - Perforate riser and cover holes with gravel.

Total spillway capacity - 10-year peak flow with 1 foot freeboard.
Principal Spillway

Riser and barrel - Usually vertical pipe riser with horizontal pipe barrel; must withstand the maximum external loading without yielding, buckling, or cracking. Pipe connections must be watertight. Capacity Minimum of 0.2 cfs/acre of drainage.

Barrel diameter - 8-inch corrugated pipe minimum, or 6-inch smooth-wall pipe minimum. Riser cross-sectional area - 1.5 x barrel area, minimum.

Dewatering - Perforate lower half of riser in each outside valley with 1/2-inch holes spaced approximately 3 inches. If corrugated pipe is used, locate holes along each outside valley. Cover with 2 ft of 1/2-to 3/4-inch aggregate.

Crest of principal spillway - One foot minimum below elevation of emergency spillway crest. Seepage prevention - At least one watertight antiseep collar with a minimum projection of 2 feet is required around barrel of pipes 8 inches in diameter or larger. The antiseep collar(s) shall increase by 15 percent the seepage path along the pipe from the riser to downstream toe of dam.

Anti-flotation block - Riser must be held in place with an anchor having buoyant weight greater than 1.1 times the weight of water displaced by riser and any exposed portion of barrel.

Trash guard - Required at top of riser.

Outlet - Must be stable for design pipe discharge. Install riprap outlet apron unless foundation is rock.

Emergency Spillway

Capacity - 10-year peak flow, minus flow in principal spillway.

Location - Construct in undisturbed soil - not fill.

Cross section - Trapezoidal with side slopes 3:1 or flatter. Control section - Level and straight, at least 20 feet long. Outlet section must be straight.

Embankment - Top width 8 feet minimum for dam height less than 10 feet. 10 feet minimum for dam height of 10 to 15 feet.

Side slopes - 2.5:1 or flatter.

Settlement allowance - 10% of design height.

Cutoff trench - Required under centerline of dam, depth 2 feet minimum into undisturbed firm mineral soil. Extend trench up each abutment to elevation of emergency spillway crest. The bottom width should be wide enough to permit operation of excavation and compaction equipment, but not less than 4 feet wide. Side slopes should be no steeper than 1:1.
Fill material - The fill material should be clean mineral soil free of roots, woody vegetation, oversized stones, rocks, or other objectionable material. Relatively pervious materials such as sand or gravel (Unified Soil Classification GW, GP, SW, and SP) should not be used in the fill.

Freeboard - “Freeboard” is the difference between the design flow elevation in the emergency spillway and the top elevation of the embankment. Minimum freeboard should be one foot.

Principal Spillway

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Anti-flotation block - Riser must be held in place with an anchor having buoyant weight greater than 1.1 times the weight of water displaced by riser and any exposed portion of barrel.

Trash guard - Required at top of riser.

Outlet - Must be stable for design pipe discharge. Install riprap outlet apron unless foundation is rock.

Construction Recommendations

Site Preparation

- The sediment basin should be as close to the sediment source as site conditions allow considering soils, pool area, dam length, and spillway conditions. Delay clearing pool until dam is complete to reduce erosion and off-site sedimentation.

- Clear, grub, and strip dam location. Excavate area for the outlet apron.
• Remove surface soil containing high amounts of organic matter and stockpile for later use. Clear sediment pool to facilitate sediment cleanout.

• Dispose of trees, limbs, logs, and other debris in designated disposal areas.

Cutoff Trench

• Excavate cutoff trench along dam centerline extending up both abutments to elevation of principal spillway crest.

• Cut trench into stable soil material, at least 2 ft wide and at least 2 ft deep with side slopes 1H:1V or flatter.

• Backfill with clayey soil if available. Compaction requirements: same as those for embankment. The trench should be de-watered during the backfilling and compaction operations.

Principal Spillway

• Use only approved watertight assemblies as shown in the plans for all pipe connections. Rod and lug connector bands with gaskets are recommended for corrugated pipe. Do not use dimple (universal) connector bands. Connection between pipe and anti-seep collar must be watertight.

• Place barrel and riser on firm, even foundation. Install anti-seep collar(s) slightly downstream of dam centerline.

• Place moist, clayey, workable soil around pipe and anti-seep collars. Do not use pervious material such as sand, gravel, or silt. Compact 4-inch layers of soil, by hand, under and around pipe and collars to at least the density of foundation soil. Avoid raising pipe from firm contact with foundation while compacting material under pipe haunches.

• Cover pipe to a depth of 2 feet minimum of hand-compacted backfill before crossing it with construction equipment.

• Anchor riser in place with concrete to prevent flotation. Embed riser at least 6 inches into concrete.

• Install trash guard with bars spaced 2-3 inches apart.

• Install riprap apron at pipe outlet, width 5 ft minimum. Extend apron to stable grade (length 10 ft minimum). Use well-graded stone with “d50” of 9 inches minimum.
**Embarkment**

- Scarify base of dam before placing fill.

- Fill material should be placed in 6-to 8-inch continuous layers over the entire length of the fill and compacted. Save the least permeable soil for center portion of dam. Place the most permeable soil in downstream toe.

- Compaction may be obtained by routing the hauling equipment over the fill so that the entire surface of each layer of the fill is traversed by at least one wheel or tread track of the equipment. If compaction is obtained with hauling equipment, an elevation 10 percent higher than the design height is required to allow for settlement. If compactors are used for compaction, the overbuild may be reduced to not less than 5 percent.

- Fill material must contain sufficient moisture that it can be formed by hand into a ball without crumbling. If water can be squeezed out of the ball, it is too wet for proper compaction.

- Construct dam to lines and grades shown in plan. Side slopes must be 2.5:1 or flatter.

- Compact fill material in 6-to 8-inch continuous layers over length of dam. Compaction may be obtained by routing construction equipment over fill so that the entire surface of each layer is traversed by at least one wheel of compacting equipment. Protect spillway barrel with 2 ft of hand-compacted fill before traversing with equipment.

- Construct embankment 10%higher than design height to allow for settlement.

**Emergency Spillway**

- Cut emergency spillway in undisturbed soil to lines and grade shown in the approved plan. Side slopes must be 3:1 or flatter.

- Control section must be level and straight, 20 ft long minimum. Exit section must be straight.

- Vegetate spillway as soon as grading is complete, following all requirements in vegetation plan. Anchor mulch in spillway with netting.

- Install paving material to finished grade if spillway is not to be vegetated.

**Cleanout**

Place reference stake at sediment cleanout elevation (50%of design volume).
Erosion Control

- Minimize the area disturbed and time of exposure.
- Excavate the outlet apron area first, to use as a sediment trap during construction of dam.
- Use temporary diversions to prevent surface water from running onto disturbed areas.
- Construct embankment before clearing the sediment pool.
- Stabilize all disturbed areas except lower one-half of sediment basin immediately after construction.

Safety

- Sediment basins should be installed only on sites where failure of the structure would not result in loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities.
- Sediment basins are attractive to children and can be very dangerous.
- Keep sediment pool dewatered between storms.
- Construct side slopes 2:1 or flatter in pool area.
- Fence area if trespassing is likely. Post signs warning the public of hazards of soft sediment and floodwater.
- Follow all state and local requirements.

Common Trouble Points

Piping failure along conduit- Due to lack of proper compaction, omission of anti-seep collar, or leaking pipe joints.

Erosion of spillway or embankment slopes- Due to inadequate vegetation or improper grading and sloping.

Slumping and/or settling of embankment - Due to inadequate compaction and/or use of poor-quality fill material.

Slumping failure - Due to steep side slopes.

Erosion and caving below pipe - Due to inadequate outlet protection.

Basin not located properly for access - Makes maintenance difficult and costly.
**Sediment not properly removed** - Leaves inadequate storage capacity.

**Lack of anti-flotation pipe** - Damage from uplift.

**Lack of trash rack** - Barrel and riser blocked with debris.

**Elevations of principal spillway and emergency spillway too high relative to top of dam** - Potential failure from overtopping.

**Maintenance**

- Sediment basins should be readily accessible for maintenance and sediment removal. The sediment basin should remain in operation and be properly maintained until the site area is permanently stabilized by vegetation and/or when permanent structures are in place.

- Inspect sediment basins after each significant rainfall.

- Remove and properly dispose of sediment when it accumulates to one-half design volume (level marked by reference stake). The effectiveness of a sediment pond is based less on its size than on regular sediment removal.

- Check embankment, emergency spillway, and outlet for erosion damage.

- Check embankment for: settlement, seepage, or slumping along the toe or around pipe. Look for signs of piping. Repair immediately. Remove trash and other debris from principal spillway, emergency spillway, and pool area.

- Clean or replace gravel when sediment pool does not drain properly.

- Remove basin after drainage area has been permanently stabilized, inspected, and approved. Before removing dam, drain water and remove sediment; place waste material in designated disposal areas. Smooth site to blend with surrounding area and stabilize.

**Additional References**


