ILLINOIS URBAN MANUAL
PRACTICE STANDARD

Temporary Sediment Basin

(feet)
Code 957

Source: ODNR Rainwater and Land Development Manual

Definition

A temporary basin constructed with an engineered outlet, formed by embankment or excavation, or a combination of the two.

In this standard, basins constructed by the first method are referred to as embankment and those constructed by the second method are referred to as excavated. Basins constructed by both the embankment and the excavation methods are classified as embankment if the depth of water impounded against the embankment at the auxiliary spillway elevation is three feet or more.

Purpose

The purpose of this practice is to minimize the release of sediment from construction areas by retaining stormwater runoff and allowing sufficient retention time for settling of suspended soil particles.

Conditions Where Practice Applies

This practice applies to urban land, construction sites, agricultural lands, and other disturbed lands where the following or similar conditions exist:

1. In areas of concentrated flows or points of discharge during construction activities where physical site conditions, construction schedules, or other restrictions preclude the installation, or establishment of erosion control practices to satisfactorily reduce runoff, erosion, and sedimentation;
2. Contributing tributary and disturbed drainage areas are between 5 and 30 acres. For areas one to five acres, refer to Practice Standard TEMPORARY SEDIMENT TRAP 960;
3. The structure life is limited to three years or less;
4. Where access can be maintained for sediment removal and proper disposal and for inspection and maintenance of the outlet(s),
5. Sufficient space and appropriate topography allow for construction of a temporary impoundment and site conditions allow for runoff from disturbed areas to be directed into the basin;
6. Where structural failure of the basin will not result in loss of life, damage to homes, commercial or industrial buildings, main highways or railroads; or in the use or service of public utilities; and,
7. The practice may not apply to sites which discharge directly to an Impaired Water as identified in the Illinois Environmental Protection Agency's 303 (d) listing for suspended solids, turbidity, or siltation.

Criteria

Temporary sediment basin design and construction shall comply with all applicable federal, state and local laws and regulations. They shall be constructed according to the approved Storm Water Pollution Prevention Plan.

Basins shall be constructed prior to disturbance of up-slope tributary areas and placed so they function during all phases of construction.

Basins should be located to intercept the largest amount of runoff from the disturbed areas of the site while minimizing interference with construction activities and construction of utilities. Temporary sediment basins shall never be constructed in live streams, or in other waters of the U.S., or partially or wholly within a mapped floodplain.

Site conditions shall be such that stormwater runoff from the design storm can be safely passed through a combination of a principal spillway outlet structure and an auxiliary spillway.

Basin design shall provide for stormwater runoff storage (sediment settlement treatment) and over excavation volume (sediment deposition and removal). The volumes shall be determined based upon the entire area draining to the basin.

The available stormwater runoff storage volume shall be a minimum of 134 cubic yards per acre of land disturbed (one inch of runoff). The depth of the storage volume is defined as the distance between the crest elevation of the auxiliary spillway and surface of the over excavation volume. The lower one half of required storage volume (67 cubic yards per acre) shall be provided at a depth of three feet.

The required storage volume may be used as follows:

1. 100% detention;
2. 50% detention and 50% permanent pool;
3. 100% detention controlled by mechanical valve; or,
4. Any combination of the above that meets the purpose of this standard

The over excavation storage volume shall be a minimum of 34 cubic yards per acre (0.25 inches per acre). The depth of storage shall be a minimum of two feet. This storage volume lies immediately below the required storage and is not to be included as part of the required storage volume.

The ratio for a rectangular basin shape would be 3:1(length to width). The length to width ratio of the flow path shall be maximized with a goal of 3:1 or greater. Baffles may be utilized to enhance and lengthen the flow path (refer to considerations) or to meet the flow path ratio requirements for other basin shapes.

The side slopes of the required storage volume shall not be steeper than three horizontal to one vertical. The side slopes of the sediment storage shall not be steeper than two horizontal to one vertical.

Practices used to pump water out of the basin for purposes of sediment clean-out, basin decommissioning, etc. must follow the Practice Standard for DEWATERING 813.

The minimum top width required for embankments is:

Total Height of Embankment (ft.)	Top Width (ft.)
Less than 10	6
10 – 14.9	8

The combined upstream and downstream side slopes of the settled embankment shall not be less than six horizontal to one vertical, and neither slope shall be steeper than three horizontal to one vertical.

A protective cover of vegetation shall be established on all exposed areas of embankments, spillways and borrow areas as climatic conditions allow, according to the guidelines in Practice Standards EROSION CONTROL BLANKET 830 and PERMANENT VEGETATION 880.

The minimum elevation of the top of the settled embankment shall be one foot above the water surface in the basin with the auxiliary spillway flowing at design depth. The minimum difference in elevation between the crest of the auxiliary spillway and the settled top of the dam shall be two feet for all embankments.

The design height of the embankment shall be increased by the amount needed to insure that after settlement the height of the embankment equals or exceeds the design height.

The temporary sediment basin shall be designed to drain within 40 hours for 100% detention facilities and within 24 hours for all other designs.

The outlet shall be designed so as to not exceed 0.04 cubic feet per second discharge rate with the design calculations determination based on the “pond full” condition (calculations based upon water level at auxiliary spillway elevation). The outlet orifice shall be located:

1. With the invert located at the top-level elevation of the over excavation volume for a 100% detention facility
2. With the invert at the top of the permanent pool level elevation for a 50% detention facility; or,
3. With the invert located at the top-level elevation of the over excavation for a 100% detention facility with a valve-controlled orifice.

The design verification requires the use of flood routing techniques performed by a trained specialist. Illinois State Water Survey Bulletin 70 Rainfall data is to be utilized with Huff rainfall distribution characteristics. Either continuous event simulation or event hydrograph methods shall be utilized to model the basins performance. HEC-1, HEC-HMS, and TR-20 are public domain industry standards that are commonly used. Various commercial

proprietary programs are available that may be more effectively utilized for analyzing detention basins.

Determination of hydraulic characteristics for the outlet shall be based upon the stormwater runoff occurring for an 80th percentile storm event. The outlet shall consist of:

1. A pipe conduit and related outlet erosion protection shall be placed under or through the embankment or boundary formed by excavation. The outlet point for the principal spillway shall be protected from erosion.
2. An orifice restrictor(s) in advance of the pipe conduit with its invert(s) set at the level(s) as determined from the hydrologic design and utilization type of the active storage volume.
3. Anti-clog device installed in advance of the orifice such as a skimmer, perforated riser and other approved devices or combinations, thereof.
4. Structures as necessary to provide for the interface and continuity between the anti-clog device, orifice restrictor and pipe conduit installations.

For the auxiliary spillway the inflow hydrograph from the tributary drainage area shall be based upon a 95th percentile storm. The storm routed through the active storage area would be the basis for determining the overflow weir design and related outlet protection. The crest of the auxiliary spillway is to be at or above the elevation required to achieve the required storage volume. The minimum capacity of a natural or constructed auxiliary spillway is to be based upon the 25-storm year frequency discharge for the critical duration storm. It shall consist of:

1. Overflow weir with the crest elevation set at the top of the required active storage volume
2. Outlet protection
3. Basin embankment top elevation set at a minimum of one foot above the design high water elevation or two foot above the weir

crest whichever is greater

The auxiliary spillway shall safely pass the peak flow, or the storm runoff shall be routed through the basin. Auxiliary spillways shall provide for passing the design flow at a safe velocity to a point downstream where the embankment will not be endangered.

Considerations

Basin type selection is based upon numerous considerations including the following:

1. Site drainage conditions such as the elevation of the principal outlet elevation
2. Extent to which the capture of the initial flush from the tributary area is desired
3. Performance for storm water runoff conditions that are of lesser volume than the design storm
4. The extent to which the basin is to provide the least discharge rate
5. Length of time that the basin will be in place
6. Acceptability of ponded water and its depth

Basin Types/Performance:

Type I(a) – 100% detention type basins begin outflow of first flush stormwater runoff as soon as the site runoff reaches the basin principal outlet. Approximately ⅓ of the runoff would exit through the principal spillway before the design storm ends.

Type I(b) – 100% temporary pool type basin does not discharge through the orifice until the control valve is opened. This design maximizes the stormwater runoff storage time. The basin performance is dependent upon the timing of the valve opening and closing. Approximately ⅓ of the runoff would exit through the auxiliary spillway before the design storm ends and ⅔ of the runoff would exit via the principal spillway once the valve is open.

Type II – 50% detention type basins function similar to 100% type; however, the first flush must pass through the permanent pool (the orifice capacity is approximately double that of the 100% detention type). Approximately1/6 of the runoff would exit through the principal spillway before the design storm ends and 1/3 of the storm would exit via the principal spillway while 1/2 of the runoff would exit via the auxiliary spillway.

Stormwater runoff from undisturbed areas on the subject site or from off-site shall be safely routed around the subject site. If stormwater runoff from areas other than the disturbed area of the subject site must be routed through the temporary sediment basin, the basin must be sized based on the entire drainage area.

Effectiveness of a sediment basin depends primarily on the sediment particle size and the ratio of the basin surface area to the inflow rate (Smolen et al 1988/USEPA NPDES, Sediment Basins and Rock Dams). Consequently, achieving the storage volume criteria by increasing the basin depth is expected to reduce the basins effectiveness in removing silt.

In the event that the orifice size is subject to clogging (less than 4” in diameter has been an acceptable “standard”). The following devices (amongst many others) may be appropriate to alleviate clogging (the following devices should be placed in advance of the principal spillway control orifice and not replace it):

1. A riser constructed out of PVC with holes or slots equivalent to a recommended 3X the maximum orifice discharge rate. The pipe will be wrapped with wire mesh that sits one to two inches away from the pipe. The pipe will be wrapped in a non-woven geo-textile for large, medium or fine materials, or a woven monofilament for smaller sizes. The wire and fabric wrap shall be replaced when the fabric becomes blinded with sediment. Wire will be placed over the top of the pipe to act as a trash guard to

prevent clogging of the pipe. The pipe shall be a minimum of six inches and a maximum of 12 inches in diameter and extend to a height equal to the top of the dry storage. Slots shall be cut cleanly and de-burred. At least three rows of ¾-inch slots shall be provided.

2. A skimmer is a floating siphon that rests on the surface of the water in the basin. The skimmer is made of PVC pipe equipped with a float and attached with a coupling to an outlet at the base of the riser. Because the skimmer floats, it rises and falls with the level of the water in the basin and drains only the cleanest top layer of runoff. Sediment removal rates from basins equipped with skimmers have been shown to be significantly more effective than the removal rates incorporating a perforated riser or orifice. Skimmers are not generally recommended for the removal of colloidal clay sediment particles. The clay particles tend to disburse and suspend throughout the water column in the basin.

A properly designed and maintained sediment basin is expected to allow settling of 70-80% of the coarser sediment (sand, heavy silts) from suspension. While some fine silt and clay soil particles will drop from suspension, the standard basin design will need to be supplemented with other practices if the goal is to remove fine particle sizes from suspension. In order to remove fine silts and clay particles from the water column, the following supplemental practices may be used:

1. Forebays can extend the useful life of the main sediment storage area by trapping the majority of sediment in the forebay area. Site runoff enters a forebay prior to entering the larger portion of the basin itself. Sediment forebays function to reduce incoming water velocities and to trap and localize incoming sediments, thereby reducing basin maintenance. Separation of the forebay from the rest of the basin requires construction of a submerged shelf or a stone or stabilized earthen embankment. The forebay should have a minimum surface area to adequately treat

expected runoff volumes. Sediment forebays also extend the flow path of stormwater, increasing its residence time. Earth embankments constructed to separate the main basin from the forebay must be stabilized. Flocculants can be used to mix with runoff entering the forebay to increase the amount of sediment deposition in the fore bay. A forebay can be used as an outlet point for construction site dewatering.

2. Flocculent and coagulant aids can be used on sites with particularly fine- grained and erodible soil (i.e. fine silt or clays). The introduction of this treatment practice could occur at various locations such as: upslope treatment channels, forebays, in-basin baffles, or below (downstream) of the outlet. The means of delivery for these chemicals and their application rates will be provided by the engineer in the form of appropriate standard detail drawings and specifications.
3. Baffles can improve the sediment trapping performance of the basin by preventing short-circuiting of the basin (extend travel time) and through enhanced sediment trapping and settling efficiency. Baffles help reduce water turbulence in the basin. Baffles can be used in combination with flocculants to increase the amount of sediment deposition in the basin. Baffles may be constructed with a permeable material such as jute or filter fabric.
4. The drainage area above the temporary sediment basin should be protected against erosion to the extent practicable so that expected sediment accumulation will not shorten the planned effective life of the structure.
5. A treatment train is a design concept that incorporates a combination of erosion control and sediment trapping practices on a construction site to reduce the overall sediment load that enters the sediment basin. Using a treatment train approach can extend the life of a sediment basin and greatly reduce the need for basin maintenance (sediment removal) as well as improve the water quality that leaves the site.

Provisions for safety may be mandatory based on local ordinance and should be considered regardless of requirements. A minimum six-foot-wide submerged safety ledge should be constructed along the edge of the basin. A perimeter fence may be required based on local ordinance or specific site conditions.

For any site which discharges directly to an impaired water identified in the Illinois Environmental Protection Agency's 303 (d) listing for suspended solids, turbidity, or siltation the stormwater pollution prevention plan shall be designed for a storm event equal to or greater than a 90th percentile storm event. If required by federal regulation or the IEPA's Illinois Urban Manual, the storm water pollution prevention plan shall adhere to a more restrictive design criteria.

Plans and Specifications

Plans and specifications for installing a bioretention facility shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. At a minimum include the following items:

1. Construction sediment and erosion control plan
2. Facility location and alignment
3. Size and dimensions including width, length, depth, and side slopes
4. Facility cross section
5. Location and design of outlet(s)
6. Control structure detail and layout
7. Sizing of sediment storage area
8. Dewatering plan for pumping operations
9. Material specifications
10. Facility maintenance plan

All plans shall include the installation, inspection, and maintenance schedules with the responsible party identified.

The Standard Drawing for TEMPORARY SEDIMENT BASIN 957 may be used as the plan sheet.

Operation and Maintenance

An operation and maintenance plan shall be developed that indicates individual responsible for operation and maintenance.

Sediment should be removed when it exceeds the volume provided in the two foot over excavated area.

The fabric on the riser should be checked and replaced if clogged or blinded with sediment.

Trash and debris should be removed from the riser.

The embankment should be inspected for signs of seepage, settlement or slumping. These problems should be repaired immediately.

Provisions for proper disposal of sediment removed shall be made.

References

Indiana Department of Environmental Management. Planning and Specification Guide for Effective Erosion and Sediment Control and Post- Construction Water Quality. Chapter 7 – Storm Water Quality Measures: Construction & Land-Disturbing Activities. Indianapolis, Indiana. October 2007.

Kentucky Department for Environmental Protection, Division of Water. Kentucky Erosion Prevention and Sediment Control Field Guide. Section 9 – Installing Sediment Traps and Basins. Frankfort, Kentucky. 2009.

Missouri Department of Natural Resources. Protecting Water Quality: A Field Guide to Erosion, Sediment and Stormwater Best Management Practices for Development Sites in Missouri and Kansas. Section 4 – Runoff Control- Sediment Controls. Jefferson City, Missouri. January 2011.

Ohio Department of Natural Resources, Division of Soil and Water Conservation. Rainwater and Land Development: Ohio's Standards for Stormwater Management, Land Development and Urban Stream Protection. Chapter 6 – Sediment Control. Columbus, Ohio. December 2006.

Tennessee Department of Environmental Conservation, Division of Water Resources. Erosion & Sediment Control Handbook. Chapter 7 – Management Practices. Knoxville, Tennessee. August 2012.

University of Kentucky, Kentucky Transportation Center. Best Management Practices (BMPs) for Controlling Erosion, Sediment, and Pollutant Runoff from Construction Sites. Chapter 4 – Technical Specifications for BMPs. Lexington, Kentucky. October 2009.