Chapter 4: Treatment BMPs

BMP 401: Sediment Trap

Purpose

A sediment trap is a small temporary ponding area with a gravel outlet used to collect and store sediment from sites cleared and/or graded during construction. Sediment traps, along with other perimeter controls, shall be installed before any land disturbance takes place in the drainage area. They also provide a location that allows sediment and other particles to settle out of the runoff before the water continues draining off-site.

Conditions of Use

Prior to leaving a construction site, stormwater runoff must pass through sediment pond or trap or other appropriate sediment removal best management practice. Non-engineered sediment traps may be used on-site prior to an engineered sediment trap or sediment pond to provide additional sediment removal capacity.

It is intended for use on sites where the tributary drainage area is smaller than 3.00 acres, with no unusual drainage features, and a projected build-out time of 6 months or less. The sediment trap is a temporary measure and shall be maintained until the site area is permanently protected against erosion.

Sediment traps and ponds are only effective in removing sediment down to about the medium silt size fraction. Runoff with sediment of finer grades (fine silt and clay) will pass through untreated - emphasizing the need to prevent erosion first and to control erosion overall before reaching the pond.

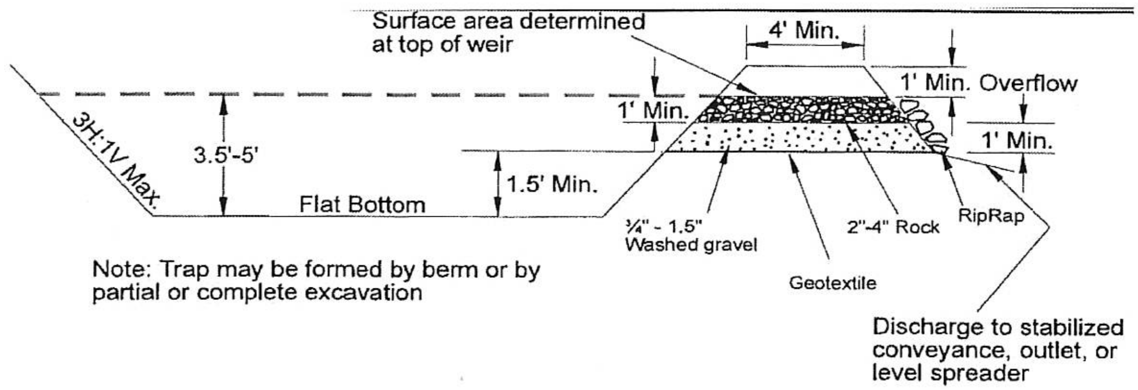
Whenever possible, sediment-laden water shall be discharged into on-site relatively level, vegetated areas (see BMP 334 – Vegetated Strip). This is the only passive way to effectively remove fine particles from runoff. Chemical treatments or filtrations can also be used to actively remove the particles, which can be particularly useful after initial treatment in a sediment trap or pond. The areas of release must be evaluated on a site-by-site basis in order to determine appropriate locations for and methods of releasing runoff. Vegetated wetlands shall not be used for this purpose. Frequently, it may be possible to pump water from the collection point at the downhill end of the site to an upslope vegetated area. Pumping shall only augment the treatment system - not replace it - due to the possibility of pump failure and/or runoff volume in excess of pump capacity.

All projects that are constructing permanent facilities for runoff quantity control should use the rough-graded or final-graded permanent facilities for traps and ponds. This includes combined facilities and infiltration facilities. When permanent facilities are used as temporary sedimentation facilities, all requirements of the more restrictive type (temporary or permanent) trap or pond must be met. If the requirements of the permanent facility are larger, the trap or pond may be initially constructed to those requirements, but shall be enlarged to comply with the permanent requirements before the project's NOT is filed for.

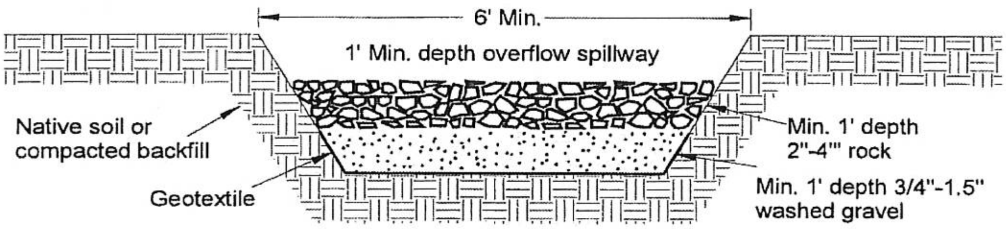
The permanent pond may be required by the local municipality to be divided into 2 cells - one for settling and the other for de-watering. Either a permanent or the temporary control structure (described in BMP 401, Temporary Sediment Pond) can be used. If a permanent control structure is used, it may be advisable to partially restrict the lower orifice with gravel or other clean large fill to increase residence time of the inflow while still allowing dewatering of the pond. A shut-off valve may be added to the control structure to allow complete retention of stormwater in emergency situations. In this case, an emergency overflow weir must be added. A skimmer may be used for the sediment trap outlet if approved, permitted, or required by the local municipality.

Design and Installation Specifications

- See the figure below for the cross-section of a typical trap.



- See the figure below for the outlet details of a typical trap.



- If permanent runoff control facilities are part of the project, they can be used for sediment retention. (Most municipalities prefer that they are.)
- To determine the sediment trap geometry, first calculate the design surface area (*SA*) of the trap, measured at the invert of the weir. Use the following equation:

  $SA = FS(Q_2/V_S)$ where

  Q_2 = Design inflow based on the peak discharge from the developed 2-year runoff event from the contributing drainage area as computed in the hydrologic analysis. The 10-year peak flow shall be used if the project size, expected timing and duration of construction; downstream conditions warrant a higher level of protection; or as directed by jurisdictional personnel. If no hydrologic analysis is required, the Rational Method may be used.

  V_S = The settling velocity of the soil particle of interest. The 0.02 mm (medium silt) particle with an assumed density of 2.65 g/cm^3 has been selected as the particle of interest and has a settling velocity (V_S) of 0.00096 fps

  FS = A safety factor of 2 to account for non-ideal settling.

  Therefore, the equation for computing surface area becomes: $SA = 2 \times Q_2/0.00096$ or 2080 square feet per cfs of inflow. **NOTE:** Even if permanent facilities are used, they must still have a surface area that is at least as large as that derived from the above formula. If they do not, the pond must be enlarged.
- To aid in determining sediment depth, all sediment traps shall have a staff gauge with a prominent mark 1-foot above the bottom of the trap.
- Sediment traps may not be feasible on utility projects due to the limited work space or the short-term nature of the work. Portable tanks may be used in place of sediment traps for utility projects.

Maintenance Standards

- Sediment shall be removed from the trap when it reaches 12" in depth.
- Any damage to the pond embankments or slopes shall be repaired.
- Inspect weekly and after each rain event until the site upstream has been stabilized.
- Once the site has been stabilized, inspections should occur quarterly and after each major rain event to check for erosion, sediment accumulation; mowing; trash removal; other defects and needed repairs.

BMP 402: Temporary Sediment Pond

Purpose

Sediment ponds remove sediment from runoff originating from disturbed areas of the site. Sediment ponds are typically designed to remove sediment no smaller than medium silt (0.02 mm). Consequently, they usually reduce turbidity only slightly.

Conditions of Use

Prior to leaving a construction site, stormwater runoff must pass through a sediment pond or other appropriate sediment removal best management practice.

A sediment pond shall be used where the contributing drainage area's runoff can not otherwise be 1) reduced to pre-existing conditions, or 2) sufficiently treated to remove sediment and other contaminants of the water cycle. Ponds must be used in conjunction with erosion control practices to reduce the amount of sediment flowing into the basin.

Design and Installation Specifications

- Sediment basins may 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. Also, sediment traps and ponds are attractive to children and can be very dangerous. Compliance with local ordinances regarding health and safety must be addressed. If fencing of the pond is required, the type of fence and its location shall be shown on the SWP3 plan.
- All structures are subject to the Arkansas Dam Safety Regulations.
- See the figure below for a typical pond plan view as shown on a SWP3

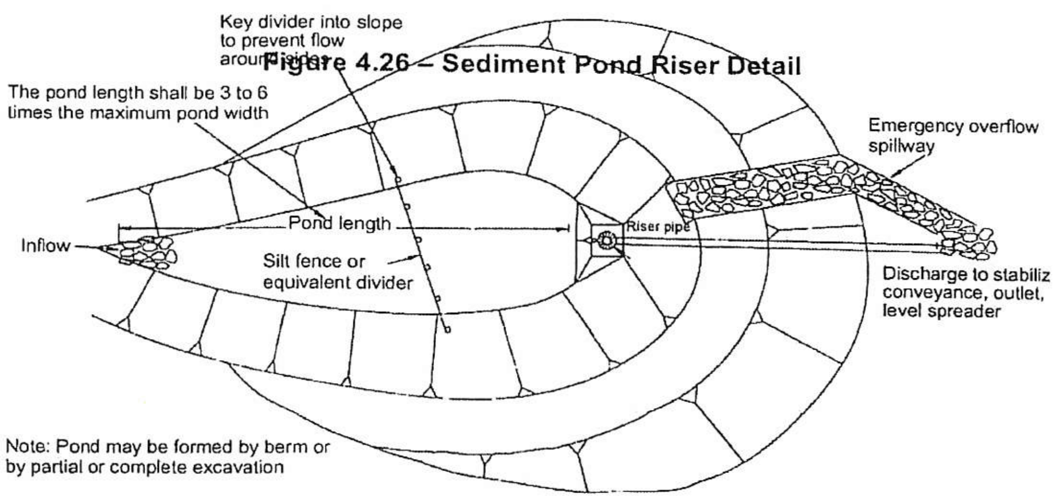
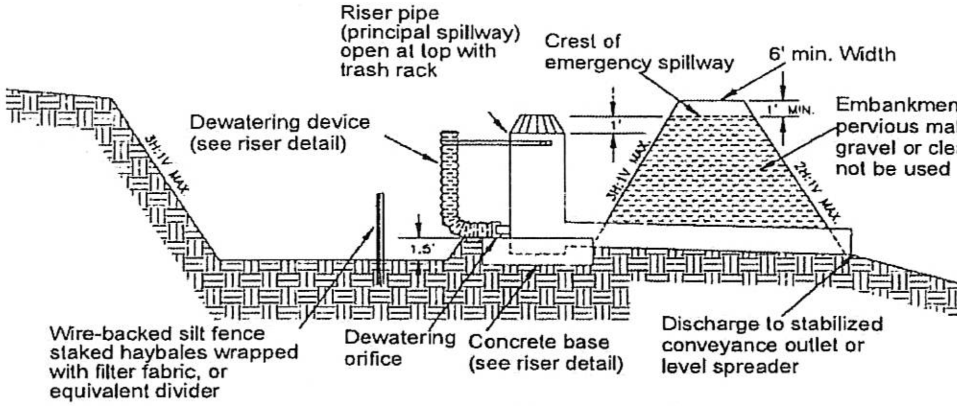


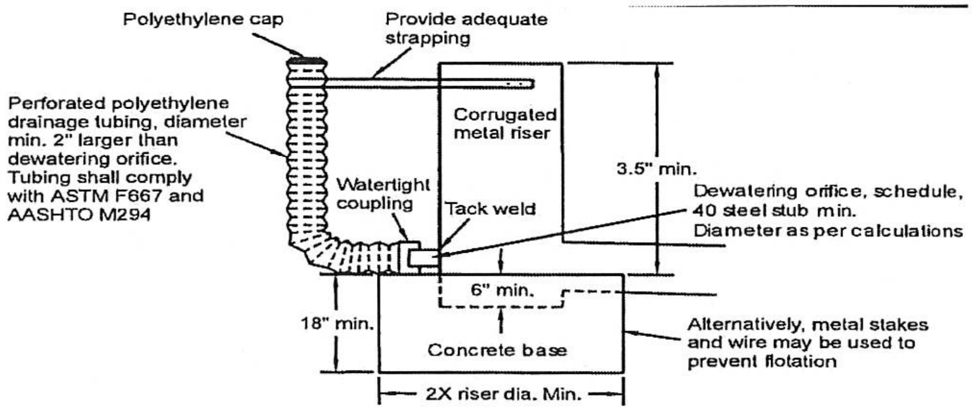
Figure 4.26 – Sediment Pond Riser Detail

- See the figure on the top of the next page for the cross-section of a pond with a riser pipe and de-watering device.
- If permanent runoff control facilities are part of the project, they can be used for temporary sediment retention. All requirements of a sediment basin must be met. This may require enlarging the temporary basin to comply with the requirements of the permanent basin. If permanent control structures are used, it may be advisable to partially restrict the lower orifice with gravel or other clean large fill to increase residence time while still allowing the basin to dewater.
- Use of infiltration facilities for sedimentation basins during construction tends to clog the soils and reduce their capacity to infiltrate. If infiltration facilities are to be used, the sides and bottom of the facility must only be rough excavated to a minimum of 24" above final grade. Final grading of the infiltration facility shall occur only when all contributing drainage areas have been fully stabilized.

An infiltration pre-treatment facility should be fully constructed and used with the sedimentation basin to help prevent clogging.



- See the figure below for a typical pond riser detail



- Determining Pond Geometry:

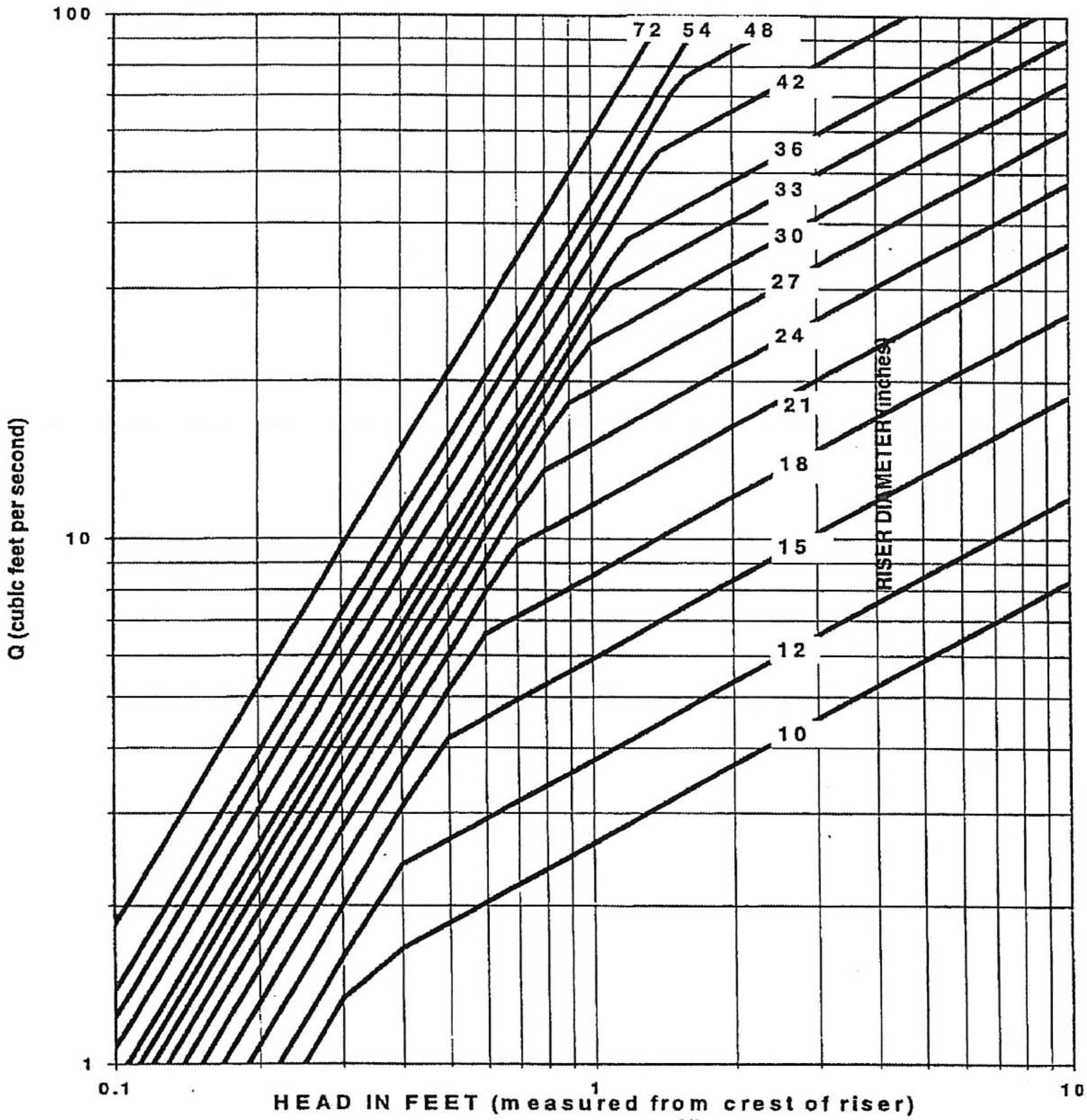
The basic geometry of the pond can now be determined using the following design criteria:

- o Required surface area (see BMP 401)
- o Minimum 42" depth from top of riser to bottom of pond
- o Maximum 3:1 interior side slopes and maximum 2:1 exterior slopes. The interior slopes can be increased to a maximum of 2:1 if fencing is provided at or above the maximum water surface.
- o 12" of freeboard between the top of the riser and the crest of the emergency spillway
- o Flat bottom
- o Minimum 12" deep spillway
- o Length-to-width ratio should be between 2:1 and 6:1
- o Sizing of Discharge Mechanisms

The outlet for the basin consists of a combination of principal and emergency spillways. These outlets must pass the peak runoff expected from the contributing drainage area for a 100-year storm. If, due to site conditions and basin geometry, a separate emergency spill-way is not feasible, the principal spillway must pass the entire peak runoff expected from the 100-year storm. However, an attempt to provide a separate emergency spillway should always be made. Available spillway storage must begin at the principal spillway riser crest.

The principal spillway designed may result in some reduction in the peak rate of runoff. However, if the basin for a permanent stormwater detention pond is used for a temporary sedimentation basin, the control structure for the permanent pond can be used to maintain pre-development discharge limitations. The size of the basin; the expected life of the construction project; the anticipated downstream effects;

and the anticipated weather conditions during construction should be considered to determine the need of additional discharge control.



$Q_{weir} = 9.739\ DH^{3/2}$

$Q_{orifice} = 3.782\ D^2H^{1/2}$

Q in cfs, D and H in feet

Slope change occurs at weir-orifice transition

Principal Spillway: Determine the required diameter for the principal spillway (riser pipe). The diameter shall be the minimum necessary to pass the pre-developed 10-year peak flow (Q_{10}). **Note:** A permanent control structure may be used instead of a temporary riser.

Emergency Overflow Spillway: Determine the required size and design of the emergency overflow spillway for the developed 100-year peak flow.

Dewatering Orifice: Determine the size of the dewatering orifice(s) (minimum 1" diameter) using a modified version of the discharge equation for a vertical orifice and a basic equation for the area of a circular orifice. Determine the required area of the orifice.

The vertical, perforated tubing connected to the dewatering orifice must be at least 2" larger in diameter than the orifice to improve flow characteristics. The size and number of perforations in the tubing should be large enough so that the tubing does not restrict flow. The orifice should control the flow rate.

- Additional Design Specifications

The pond preferably would be divided into two roughly equal volume cells by a permeable divider that will reduce turbulence while allowing movement of water between cells. The divider shall be at least 50% the height of the riser and a minimum of 12" below the top of the riser.

Wire-backed, 24" to 36" high, extra strength filter fabric supported by treated 4"x4"s can be used as a divider. Alternatively, staked straw bales wrapped with filter fabric (geo-textile) may be used. If the pond is more than 6'-0" deep, a different mechanism must be proposed. A native stone embankment is one acceptable method of separation for deeper ponds. Other designs that satisfy the intent of this provision are allowed as long as the divider is permeable, structurally sound, and designed to prevent erosion under or around the barrier.

To aid in determining sediment depth, 12" intervals shall be prominently marked on the riser. If an embankment of more than 6'-0" is proposed, the pond must comply with the criteria regarding dam safety for detention BMPs.

- The most common structural failure of sedimentation basins is caused by piping. Piping refers to two phenomena:
  1. Water seeping through fine-grained soil, eroding the soil grain by grain and forming pipes or tunnels; and,
  2. Water under pressure flowing upward through a granular soil with a head of sufficient magnitude to cause soil grains to lose contact with each other and their capability for supporting those grains above them.

The most critical construction sequences to prevent piping will be:

a. Tight connections between riser and barrel and other pipe connections;
b. Adequate anchoring of riser;
c. Proper soil compaction of the embankment and riser footing; and
d. Proper construction of anti-seep devices

Maintenance Standards

- Sediment shall be removed from the pond when it reaches 12" in depth.
- Any damage to the pond embankments or slopes shall be repaired.

BMP 410: Retention vs. Detention Ponds

Purpose

Retention ponds hold water back. They typically hold water until it infiltrates into the ground or evaporates. Detention ponds temporarily contain water, or slow release it into drainage ways.

Conditions of Use

Retention ponds should be used in areas where it can more easily be infiltrated into the ground or held at a constant elevation without the need for pumping in "new" water from ground sources, adjacent surface waters, or municipal water supplies.

Detention ponds should be used in locations where their discharge will not exacerbate downstream conditions.

Design and Installation Specifications

Retention ponds should be sized to hold the entire design storm of the municipality that they are located in, or in more karstic areas, whatever the ground infiltration rate will support.

Detention ponds should also be designed to the standards of the municipality that they are located in as well as being sized in consideration of how upstream storm event flows will meet their discharges during the same storm event.

Maintenance Standards

If retention ponds have dry periods, they should be cleaned and mowed, if necessary, during their dry periods. If they do not have dry periods, they may require having the water level drawn down every few years so that the removal of accumulations from within the pond itself can occur. Accumulations may include gross solids, invasive or excessive vegetation, or natural or man-made items that could disrupt the effectiveness of the pond.

Detention ponds also will need to be mowed or brush-hogged at least once a year to maintain the vegetation in and around it. Accumulations of gross solids, invasive or excessive vegetation, or natural or man-made items that could disrupt the effectiveness of the pond should be removed in similar time frames as those of retention ponds.

BMP 420: De-watering

Purpose

De-watering a pond or similar feature is a way of separating water from the potential pollutants it contains.

Conditions of Use

If water can not be passively treated to remove its pollutants, it may need to go through a de-watering process before being released to a natural or man-made drainage way.

Design and Installation Specifications

The conditions of a receiving water will determine how treated a runoff must be before its release to drainage ways. If a receiving water has a TMDL or other maximum loading requirement placed on it, additional treatment - such as de-watering - may be required to remove more pollutants than most BMPs can provide.

One example of de-watering BMP is manufactured enclosed filter bag that water is pumped into from a sediment pond or trap. The bag's construction is finely controlled to maintain the very small openings in the bag's fabric weave. The water slowly soaks through the bag. Once the water has all passed through the bag, it can be sliced open so the solids inside can be collected for replacement on-site or for being mixed in with other decaying organic materials to make mulch or other soil amendments.

Maintenance Standards

Follow manufacturer's specifications.

BMP 421: Turbidity Removal

Purpose

When the amount of turbidity is pertinent to the receiving water of a construction site.

Conditions of Use

Should be used in a pond or trap or other water body treatment facility. Temperature can affect the way water reacts with the items within it so can also affect how turbid water can appear. If the water body that the turbidity is trying to be removed from is large enough to go through water turn-over or has sufficient amount of animal life within its borders, treatment may be more difficult.

Design and Installation Specifications

Installations should take into account not only the amount of turbidity that needs to be removed, but also the properties of the water body itself. If the water body is expected to even partially freeze, the turbidity removal process or device will need to allow room for the expansion of the water without destroying or damaging the device(s) or its parts.

Maintenance Standards

Follow manufacturer's specifications.

BMP 430: Chemical Treatments

Purpose

Turbidity is difficult to control once fine particles are suspended in stormwater runoff from a construction site. Sedimentation ponds are effective at removing larger particulate matter by gravity settling, but are ineffective at removing smaller particulates such as clays and fine silts. Sediment ponds are typically designed to remove sediment no smaller than medium silt (0.02 mm). Chemical treatments may be used to reduce the turbidity of stormwater runoff.

Conditions of Use

Chemical treatment can reliably provide exceptional reductions of turbidity and associated pollutants. Very high turbidities can be reduced to levels comparable to what is found in streams during dry weather. Traditional BMPs used to control soil erosion and sediment loss from sites under development may not be adequate to ensure compliance with the water quality standard for turbidity in the receiving water. Chemical treatment may be required to protect streams from the impact of turbid stormwater discharges, especially when construction is to proceed through the wet season.

Formal written approval from the State and Local Permitting Authorities is required for the use of chemical treatment regardless of the site's size. The intention to use Chemical Treatment shall be indicated on the NOI for coverage under the General Construction Permit. Chemical treatment systems should be designed as part of the Construction SWPPP, not after the fact. Chemical treatment may be used to correct problem sites in limited circumstances with formal written approval from Permitting Authority.

The municipality's review authority must be notified at the application phase of the project review (or the time that the determination on the project is performed) that chemical treatment is proposed. If it is added after this stage, an addendum will be necessary and may result in a delay of the project's approval.

Design and Installation Specifications

See Appendix D for background information on chemical treatment.

Criteria for Chemical Treatment Product Use: Chemically treated stormwater discharged from construction sites must be non-toxic to aquatic organisms. The following protocol shall be used to evaluate chemicals proposed for stormwater treatment at construction sites. Authorization to use a chemical in the field based on this protocol does not relieve the applicant from responsibility for meeting all discharge and receiving water criteria applicable to a site.

- Treatment chemicals must be approved by EPA for potable water use.
- Petroleum-based polymers are prohibited.
- Prior to authorization for field use, jar tests shall be conducted to demonstrate that turbidity reduction necessary to meet the receiving water criteria can be achieved. Test conditions, including but not limited to raw water quality and jar test procedures, should be indicative of field conditions.

Although these small-scale tests cannot be expected to reproduce performance under field conditions, they are indicative of treatment capability.

- Prior to authorization for field use, the chemically treated stormwater shall be tested for aquatic toxicity. Applicable procedures shall be used. Testing shall use stormwater from the construction site at which the treatment chemical is proposed for use or a water solution using soil from the proposed site.
- The proposed maximum dosage shall be at least a factor of 5 lower than the NOEC.
- The approval of a proposed treatment chemical is conditional AND subject to full-scale bio-assay monitoring of treated stormwater at the construction site where the proposed treatment chemical is to be used.
- Treatment chemicals that have already passed the above testing protocol do not need to be re-evaluated. Contact ADEQ office for a list of treatment chemicals that have been evaluated and are currently approved for use within the State of Arkansas.

Treatment System Design Considerations: The design and operation of a chemical treatment system should take into consideration the factors that determine optimum, cost-effective performance. It may not be possible to fully incorporate all of the classic concepts into the design because of practical limitations at construction sites. Nonetheless, it is important to recognize the following:

- The right chemical must be used at the right dosage. A dosage that is either too low or too high will not produce the lowest turbidity. There is always an optimum dosage rate. This is a situation where the adage "adding more is always better" is not the case.
- The coagulant must be mixed rapidly into the water to insure proper dispersion.
- A flocculation step is important to increase the rate of settling; to produce the lowest turbidity; and to keep the dosage rate as low as possible.
- Too little energy input into the water during the flocculation phase results in flocs that are too small and/or insufficiently dense. Too much energy can rapidly destroy floc as it is formed.
- Since the volume of the basin is a determinant in the amount of energy per unit volume, the size of the energy input system can be too small relative to the volume of the basin.
- Care must be taken in the design of the withdrawal system to minimize outflow velocities and to prevent floc discharge. The discharge should be directed through a physical filter such as a vegetated swale that would catch any unintended floc discharge.

Treatment System Design: Chemical treatment systems shall be designed as batch treatment systems using either ponds or portable trailer mounted tanks. Flow-through continuous treatment systems are not allowed at this time. A chemical treatment system consists of the stormwater collection system (either temporary diversion or the permanent site drainage system); a storage pond; pumps; a chemical feed system; treatment cells; and inter-connecting piping.

The treatment system shall use a minimum of 2 lined treatment cells. Multiple treatment cells allow for clarification of treated water while other cells are being filled or emptied. Treatment cells may be ponds or (portable or permanent) tanks. Ponds with constructed earthen embankments taller than 6'-0" high require special engineering analysis.

The following equipment should be located in an operational shed:

- the chemical injector;
- secondary containment for acid, caustic, buffering compound, and/or treatment chemicals;
- emergency shower and eyewash, and
- monitoring equipment which consists at least one pH meter and one turbidity meter.

Sizing Criteria: The combination of the storage pond or other holding area and treatment capacity should be large enough to treat stormwater from events lasting multiple days. It is recommended that at a minimum the storage pond or other holding area should be sized to hold 1.5 times the runoff volume of the 10-year, 24-hour storm event. Bypass should be provided around the chemical treatment system to accommodate extreme storm events, and runoff volume shall be calculated. If no hydrologic analysis is required for the site, the Rational Method may be used.

Primary settling should be encouraged in a storage pond. A fore-bay with access for maintenance may be beneficial.

There are 2 opposing considerations in sizing the treatment cells. A larger cell is able to treat a larger volume of water each time a batch is processed. However, the larger the cell, the longer the time required to empty the cell. A larger cell may also be less effective at flocculation and therefore require a longer settling time. The simplest approach to sizing the treatment cell is to multiply the allowable discharge flow rate times the desired drawdown time. Typically, a 4-hour drawdown time allows one batch per cell per 8-hour work period, given 1 hour of flocculation followed by 2 hours of settling.

The permissible discharge rate governed by potential downstream effect can be used to calculate the recommended size of the treatment cells. The following discharge flow rate limits shall apply:

- If the discharge is directly or indirectly to a stream, the discharge flow rate shall not exceed 50% of the peak flow rate of the 2-year, 24-hour event for all storm events up to the 10-year, 24-hour event.
- If discharge is occurring during a storm event equal to or greater than the 10-year, 24-hour event, the allowable discharge rate is the peak flow rate of the 10-year, 24-hour event.
- Discharge to a stream should not increase the stream flow rate by more than 10%.
- If the discharge is directly to a lake, major receiving water or an infiltration system, there is no discharge flow limit.
- If the discharge is to a municipal storm drainage system, the allowable discharge rate may be limited by the capacity of the public system. It may be necessary to clean the municipal storm drainage system prior to the start of the discharge to prevent scouring solids from within the drainage system.
- Runoff rates shall be calculated using the methods for the pre-developed condition. If no hydrologic analysis is required for the site, the Rational Method may be used.

Maintenance Standards

Monitoring:

The following monitoring shall be conducted. Test results shall be recorded on a daily log kept on-site:

Operational Monitoring

- pH, conductivity (as a surrogate for alkalinity), turbidity and temperature of the untreated stormwater
- Total volume treated and discharged
- Discharge time and flow rate
- Type and amount of chemical used for pH adjustment
- Amount of polymer used for treatment
- Settling time

Compliance Monitoring

- pH and turbidity of the treated stormwater
- pH and turbidity of the receiving water

Bio-monitoring

Treated stormwater shall be tested for acute (lethal) toxicity. Bio-assays shall be conducted by a laboratory accredited by the State, unless otherwise approved by ADEQ. **The performance standard for acute toxicity is no-statistically-significant-difference in survival between the control and 100% chemically treated stormwater.**

All toxicity tests shall meet quality assurance criteria and test conditions in the most recent versions of the EPA test method and Ecology Publication WQ-R-95-80, Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria.

Bio-assays shall be performed on the first 5 batches and on every 10th batch thereafter; or as otherwise approved by the municipality or ADEQ. Failure to meet the performance standard shall be immediately reported to the municipality or ADEQ.

Discharge Compliance:

Prior to discharge, each batch of treated stormwater must be sampled and tested for compliance with pH and turbidity limits. These limits may be established by the water quality standards or a site-specific discharge permit.

Sampling and testing for other pollutants may also be necessary at some sites. Turbidity must be within 5 NTUs of the background turbidity. Background is measured in the receiving water, upstream from the treatment process discharge point. pH must be fall between 6.5 and 8.5 standard units and not cause a change in the pH of the receiving water larger than 0.2 standard units. It is often possible to discharge treated stormwater that has a lower turbidity than the receiving water and that matches the pH.

Treated stormwater samples and measurements shall be taken from the discharge pipe or another location representative of the nature of the treated stormwater discharge. Samples used for determining compliance with the water quality standards in the receiving water shall not be taken from the treatment pond prior to decanting. Compliance with the water quality standards is determined in the receiving water.

Operator Training: Each contractor who intends to use chemical treatment shall be trained by an experienced contractor on an active site for at least 40 hours.

Standard BMPs: Surface stabilization BMPs should be implemented on site to prevent significant erosion. All sites shall use a truck wheel wash to prevent tracking of sediment off-site.

Sediment Removal and Disposal:

- Sediment shall be removed from the storage or treatment cells as necessary. Typically, sediment removal is required at least once during a wet season and at the decommissioning of the cells. Sediment remaining in the cells between batches may enhance the settling process and reduce the required chemical dosage.
- Sediment may be incorporated into the site away from drainages.

BMP440: Filtration

Purpose

Filtration removes sediment from runoff originating from disturbed areas on-site.

Conditions of Use

Traditional BMPs used to control soil erosion and sediment loss from sites under development may not be adequate to ensure compliance with the water quality standard for turbidity in the receiving water. Filtration may be used in conjunction with gravity settling to remove sediment as small as fine silt (0.5 µm). The reduction in turbidity will be dependent on the particle size distribution of the sediment in the stormwater. In some circumstances, sedimentation and filtration may achieve compliance with the water quality standard for turbidity. Unlike chemical treatment, the use of construction stormwater filtration does not require approval from ADEQ. Filtration may also be used in conjunction with polymer treatment in a portable system to assure capture of the flocculated solids.

Filtration with sand media has been used for more than 100 years to treat water and wastewater.

Design and Installation Specifications

Background Information: The use of sand filtration for treatment of stormwater has developed recently - generally to treat runoff from streets, parking lots, and residential areas. The application of filtration to construction stormwater treatment is currently under development.

2 types of filtration systems may be applied to construction stormwater treatment: rapid and slow. Rapid sand filters are the typical system used for water and wastewater treatment. They can achieve relatively high hydraulic flow rates (on the order of 2 to 20 gpm/sf), because they have automatic backwash systems to remove accumulated solids. In contrast, slow sand filters have very low hydraulic rates (on the order of 0.02 gpm/sf), because they do not have backwash systems. To date, slow sand filtration has generally been used to treat stormwater. Slow sand filtration is mechanically simple in comparison to rapid sand filtration but requires a much larger filter area.

Filtration Equipment Sand media filters are available with automatic backwashing features that can filter to 50 µm particle size. Screen or bag filters can filter down to 5 µm. Fiber wound filters can remove particles down to 0.5 µm. Filters should be sequenced from the largest to the smallest pore opening. Sediment removal efficiency will be related to particle size distribution in the stormwater.

Treatment Process Description Stormwater is collected at interception point(s) on-site to be diverted to a sediment pond or tank for storage and removal of large sediment from the stormwater before being treated by the filtration system. The stormwater is pumped from the trap, pond, or tank through the filtration system in a rapid sand filtration system. Slow sand filtration systems are designed as flow through systems using gravity. If large volumes of concrete are being poured, pH adjustment may be necessary.

Maintenance Standards

- Rapid sand filters typically have automatic backwash systems that are triggered by a pre-set pressure drop across the filter. If the backwash water volume is not large or substantially more turbid than the stormwater stored in the holding pond or tank, backwash return to the pond or tank may be appropriate. However, land application or another means of treatment and disposal may be necessary.
- Screens, bags, and fiber filters must be cleaned and/or replaced when they become clogged.
- Sediment shall be removed from the storage and/or treatment ponds as necessary. Typically, sediment removal is required once or twice during a wet season and at the decommissioning of the ponds.