Recommended Best Management Practices for

Total Suspended Solids (Includes Sediment and Siltation)

Total Maximum Daily Load Fact Sheet

About Total Suspended Solids

Total Suspended Solids (TSS) are solids in water that can be trapped by a filter. The term TSS should not be confused with the term "total solids", which refers to the amount of matter suspended and dissolved in water or wastewater, and is related to both specific conductance and turbidity. Total Solids includes both total suspended solids (TSS): the portion of total solids retained by a filter; and total dissolved solids: the portion that passes through a filter. TSS can include a wide variety of material, such as silt, decaying plant and animal matter, industrial wastes, and sewage.

High concentrations of suspended solids causes many problems for stream health and aquatic life. High TSS can block light from reaching submerged vegetation. As the amount of light passing through the water is reduced, photosynthesis slows down. Reduced rates of photosynthesis causes less dissolved oxygen (DO) to be released into the water by plants. If light is completely blocked from bottom dwelling plants, the plants will stop producing oxygen and will die. Bacteria use up most of the remaining oxygen during plant decomposition, causing low levels of DO in the water. Low DO can lead to fish kills. High TSS can also cause an increase in surface water temperature, because the suspended particles absorb heat from sunlight. This can cause DO levels to fall even further (warmer waters naturally hold less DO), and can harm aquatic life in many other ways, as discussed in the temperature section.

Decreases in water clarity caused by TSS can affect the ability of fish to see and catch food. Suspended sediment can also clog fish gills, reduce growth rates, decrease resistance to disease, and prevent egg and larval development. When suspended solids settle to the bottom of a water body, they can smother the eggs of fish and aquatic insects, as well as suffocate newly hatched insect larvae. Settling sediments can fill in spaces between rocks which could have been used by aquatic organisms for homes.

High TSS in a water body can often mean higher concentrations of bacteria, nutrients, pesticides, and metals in the water. These pollutants may attach to sediment particles on the land and be carried into water bodies with storm water. In the water, the pollutants may be released from the sediment or travel farther downstream. Furthermore, High TSS can cause problems for industrial use, because the solids may clog or scour pipes and machinery.

Sources of Total Suspended Solids

TSS can come from a wide variety of sources, such as sediment conveyed by storm water runoff, streambank and streambed erosion, decaying plant and animal matter, industrial wastes, and sewage. The primary sources of TSS pollution include:

- **High Flow Rates**
  The flow rate of the watercourse is a primary factor in TSS concentrations. Fast running water is more erosive and can carry more particles and larger-sized sediment. Heavy rains can pick up sand, silt, clay, and organic particles (such as leaves, soil, tire particles, etc.) from the land and carry it to surface water. A change in flow rate can also affect TSS; if the speed or direction of the water current increases, particulate matter from bottom sediments may be re-suspended in the water column, and streambank or streambed erosion may accelerate.

- **Soil Erosion and Disturbance**
  Soil erosion is caused by disturbance of a land surface. Soil erosion can be caused by building and road construction, farming and agricultural activities, streambank hydromodification, logging, and mining. The eroded soil particles can be carried by storm water to surface water and will increase the TSS of the adjacent water body. In-stream soil disturbance from bottom-feeding fish or dredging activities can also contribute to TSS.

- **Storm Water Runoff**
  During storm events, soil particles and debris from streets and industrial, commercial, agricultural and residential areas can be washed into streams. Large amounts of pavement in urban areas increases storm water runoff volume and velocity and decreases opportunities for infiltration as natural settling areas are removed. Sediment is carried through storm drains directly to creeks and rivers.

- **Wastewater and Septic System Effluent**
  The effluent from Wastewater Treatment Plants (WWTPs) can add suspended solids to a stream. The wastewater from our houses contains food residue, human waste, and other solid material that we put down our drains. Most of the solids are removed from the water at the WWTP before being discharged to the stream, but treatment can't eliminate everything.

- **Organic Materials and Excess Nutrients**
  As plants and animals decay within the water column, suspended organic particles are released and can contribute to the TSS concentration. Excess nutrients can result in increased algae and vegetation within water columns that will ultimately decay and contribute to TSS.

Best Management Practices that Address Total Suspended Solid TMDLs

The following summarizes BMPs your community will be required to include in your revised Storm Water Management Program (SWMP) to meet the minimum performance standards of NPDES Permit #OHQ000003. Furthermore, it suggests means by which a community can tailor their SWMP to specifically address the TSS TMDL.

MCM 1: Public Education and Outreach BMPs

Your program must reach at least 50% of your population. To do so, your community is required to implement more than one mechanism and target at least 5 different storm water themes or messages over the permit term, at least one of which must be targeted to the development community.

To address TSS, choose at least one of the following themes:
• Protection and maintenance of natural vegetative buffers along waterways

- Management of manure and pet wastes
- Reduction and management of residential and agricultural fertilizers
- Reduction of soil erosion on residential and agricultural land uses
- Reduction of impervious surfaces and the increase of on-site infiltration
- Composting and management of grass clippings and yard wastes
- Operation & Maintenance of on-site sewage treatments systems
- Construction site erosion and sediment control practices

MCM 2: Public Participation and Involvement
Your program shall include a minimum of five public involvement activities over the permit term.

To address TSS, implement at least one of the following activities:
• Streamside plantings and cleanups • Storm drain stenciling • Construct a rain garden with assistance from the public • Allow residents to provide input on new proposed ordinances that reduce TSS (i.e., downspout disconnection, conservation development, riparian and wetland setbacks, etc.) • Conduct a charity car wash that implements best management practices and promotes environmental responsibility • Establish public reporting mechanism (complaint hotline, webpage, etc.) to identify non-compliance from construction sites,

MCM 3: Illicit Discharge Detection and Elimination (IDDE)
All communities should have an applicable IDDE code in place and have developed an MS4 map, as required by previous generations of the MS4 permit.

Required BMPs that directly address TSS:
• Maintain and continue updating the MS4 map on an annual basis (i.e., outfalls, names and locations of surface waters that receive discharges from those outfalls, catch basins, pipes, ditches, flood control facilities (retention/detention ponds), post-construction water quality BMPs and private post-construction water quality BMPs which have been installed to satisfy Ohio EPA's NPDES Construction Storm Water general permit and/or your local storm water management code requirements)
• Develop and maintain a list and map of Sewage Treatment Systems[1] that discharge to your MS4; work with the local health department to identify and prioritize solutions to failing STS
• Based upon data collected from previous screenings, establish a prioritization schedule for ongoing dry-weather screening of outfalls
• Develop an IDDE plan that clearly defines the department(s) and/or agency(s) responsible for investigating and resolving confirmed sources of illicit discharges
• Develop an enforcement escalation plan that outlines how your community will address illicit discharges o Clearly define escalation enforcement roles between affected agencies o Work with local health department to identify and eliminate failing sewage treatment systems o Establish timeframes for investigation and elimination
• Document in the SWMP how community emergency spill response and cleanup plans are communicated and coordinated between applicable agencies and/or departments
• Train street, service, public works, building, and parks and recreation staff to identify sources of illicit discharge

BMPs that will enhance your community's ability to address TSS:
• Establish an IDDE surveillance plan focused on sources of TSS such as: o Sewage treatment systems o Construction sites o Animal wastes (agricultural and pets) o Grass clippings and yard wastes
• Establish a schedule for regular meetings or other communications between third-party service providers (e.g., health department, SWCD, etc.) and the MS4 manager

1 - STS also includes home sewage treatment systems (HSTS) as referenced by the MS4 NPDES OHQ000003.

MCM 4: Construction Site Runoff

All communities should have an applicable construction runoff control code in place as required by previous generations of the MS4 permit.

Required BMPs that directly address TSS:
• Update your existing construction runoff control code to meet or exceed the requirements of the NPDES Construction General Permit (OHC000004), including the federal effluent limitations in Part II
• Ensure the most current erosion, sediment and non-sediment control BMP standards are required to be utilized (e.g., Rainwater & Land Development)
• Complete Storm Water Pollution Prevention Plan (SWP3) reviews and approvals prior to construction commencement
• Conduct monthly site inspections throughout construction, as well as a final site inspection to ensure correct implementation of erosion, sediment and non-sediment control BMPs in the approved SWP3
• Develop an enforcement escalation plan that outlines how and when your community will address noncompliance with approved erosion, sediment and non-sediment control plans
• Establish a standard operating procedure to respond to complaints
BMPs that will enhance your community's ability to address TSS:
• Include the following in your code: o Require on-site protected areas (i.e., wetlands, riparian areas, other valuable resources) to be physically marked in the field prior to commencement of earth disturbing activities o Require 50-ft natural vegetative buffers to be maintained between the limits of disturbance and water resources
• Require MS4 compliance inspectors to provide a written report of findings to construction site operators for every site inspection; the report would summarize compliance and non-compliance matters and establish deadlines for corrective action
• Maintain a map of active construction sites to more easily identify watersheds being impacted by construction site runoff and prioritize sites in those watersheds for inspections more frequently than once per month
• Establish a Sediment and Erosion Control bond equivalent to the cost to stabilize (vegetate) disturbed areas of the sites in cases of nonperformance (i.e. developer foreclosure/bankruptcy)

MCM 5: Post-Construction Runoff Control

All communities should have an applicable storm water management code in place as required by previous generations of the MS4 permit.

Required BMPs that directly address TSS:
• Update your existing storm water management code to meet or exceed the requirements of NPDES OHC000004, including the federal effluent limitations in Part II
• Ensure the most current post-construction BMP standards are required to be utilized (e.g., Rainwater & Land Development)
• Complete Storm Water Pollution Prevention Plan (SWP3) reviews and approvals prior to construction commencement o Ensure SWP3 includes an executed Maintenance Agreement and Long-Term Maintenance Plan for post-construction BMPs o Review 100% of SWP3s where the larger common plan of development/sale disturbs one or more acres.
• Conduct monthly site inspections throughout construction, as well as a final site inspection to ensure correct implementation of post-construction BMPs in the approved SWP3
• Establish a program to ensure long-term maintenance of post-construction BMPs, including a protocol for enforcement escalation of your storm water management code
• Prior to commencing earth disturbing activities, ensure 100% of applicable sites have a fully executed Maintenance Agreement for the site, including an approved Maintenance Plan for each post-construction BMP
BMPs that will enhance your community's ability to address TSS:
• Update the design specification for bioretention to require internal water storage whenever feasible (as recommended by ODNR's Rainwater Manual)
• Include at least one of the following in your storm water management code: o Require on-site protected areas (i.e., wetlands, riparian areas, other valuable resources) to be physically marked in the field prior to commencement of earth disturbing activities o Prioritize and incentivize the following types of post-construction BMPs: ▪ Wet extended detention basins ▪ Dry extended detention basins with forebays and micropools ▪ Infiltration basins and trenches with appropriate pretreatment, e.g. vegetated swales, filter strips, etc. ▪ Bioretention areas ▪ Constructed wetlands that provide extended detention of the water quality volume (WQv) ▪ Permeable pavement ▪ Tree box filters
• Require MS4 compliance inspectors to provide a written report of findings to construction site operators for every site inspection; the report would summarize compliance and non-compliance matters and establish a deadline for corrective action
• Establish a performance bond for post-construction BMPs and require the community engineer to generate documentation of acceptance before releasing bond
• Establish a Sediment and Erosion Control bond equivalent to the cost to stabilize (vegetate) disturbed areas of sites in cases of non-performance
• Require submittal of as-built drawings for post-construction BMPs to ensure installation and/or conduct a physical inspection of BMPs at least once during the NPDES permit term
• Adopt at least one of the following planning and development codes: o Conservation development o Riparian and wetland setbacks o Downspout disconnections (redirect flow to rain gardens, rain barrel systems, open vegetated

channels and/or filter strips) o Revised parking codes (e.g., decrease overall number of spaces, allow alternative pervious materials, shared parking, etc.)
• Incentivize the following within existing developed areas: o Retrofitting of storm water management control systems to treat the WQv and/or increase infiltration o Encourage commercial, industrial and institutional land owners to reduce impervious surfaces and replace them with storm water practices that infiltrate, capture and reuse, or otherwise reduce storm water runoff such as permeable pavement, cisterns, infiltration basins and trenches, bioretention with internal water storage, open channel swales, etc.
• Require an applicable community department (e.g., service, engineering) to annually inspect public and private post-construction BMPs, or require private property owners to submit an annual maintenance report. Ensure corrective actions are performed as needed by the applicable party.

MCM 6: Pollution Prevention/Good Housekeeping

As required by previous generations of the MS4 permit, all applicable community-operated facilities should have an SWPPP developed in accordance with the requirements of Ohio EPA's Industrial Storm Water General Permit.

Required BMPs that directly address TSS:
• Update and implement facility SWPPPs to reflect minimum requirements of the Ohio EPA General NPDES Permit for Storm Water Associated with Industrial Activities (OHR000005) o Perform inspection requirements ▪ quarterly routine facility inspections, quarterly visual assessment of storm water discharges, and an annual comprehensive site inspection with annual report
• Complete an annual training for applicable employees on any combination of the topics listed below
• Your community is required to implement Pollution Prevention & Good Housekeeping practices at the following municipally-operated facilities: o Streets, roads and highways o Municipal parking lots o Maintenance and storage yards, including, but not limited to, municipal composting facilities and leaf collection yards o Golf courses, parks, and related maintenance facilities o Waste transfer stations, compost facilities, solid waste facilities (e.g. municipal solid waste (MSW) landfills, and construction and demolition (C&D) landfills) o Marinas o Fleet and/or maintenance shops o Salt/sand storage locations o Snow disposal areas
BMPs that will enhance your community's ability to address TSS:
• Programs which can be implemented to address TSS from the above sources include: o Street and parking lot sweeping o Catch basin cleaning o Ditch cleaning or trash collection program for open channel MS4s o Timely stabilization of disturbed soils and soil stockpiles at the service yard, landfills and on municipal construction activity o Protection of catch basins and other appropriate sediment controls when conducting road repairs, waterline repairs and other maintenance activities of the Service Department or Department of Public Works

o BMPs for granular fertilizer storage and application o Establish wash stations directed to sanitary sewers or utilize dry cleanup methods for lawn care equipment, golf carts, boats, and other municipal vehicles and equipment used in parks and golf course maintenance o Locate snow disposal areas where there are wide vegetative buffers or within berms
• At community-owned and operated facilities (maintenance garages, golf courses, parks, community gardens, cemeteries, etc.) maintain, protect and restore permanent natural vegetative buffers between developed areas and water resources
• Relocate stockpiles of waste materials and erodible materials away from stream banks and steep slopes and/or install appropriate sediment controls around such materials
• Install green infrastructure such as bioretention, permeable pavement, cisterns, green roofs, and infiltration trenches or basins at municipal facilities and/or retrofit existing storm water management ponds to treat the WQv
• Vegetate open areas at maintenance and storage yards to reduce TSS production