Attachment 5:

BMP 7U Pathogen Methodology

Description of MassDOT's Application of BMP 7U for Pathogen Related Impairments

Introduction

The Massachusetts Department of Transportation (MassDOT) owns and operates stormwater collection systems along its roadways throughout Massachusetts. In urbanized areas, discharges from these stormwater collection systems are regulated under a Municipal Separate Storm Sewer Systems (MS4) National Pollutant Discharge Elimination System (NPDES) general permit issued by the United States Environmental Protection Agency (USEPA). This permit requires that MassDOT assess their potential impact to impaired water bodies.

MassDOT has developed a NPDES Storm Water Management Plan[1] (SWMP) pursuant to the requirements of its NPDES general permit. The SWMP includes BMP 7U,[2] the assessment method used to address pollutant loading from MassDOT's stormwater discharges to the State's impaired water bodies not covered by a TMDL. MassDOT assesses impaired waters across the state to ensure that stormwater discharges from MassDOT's urbanized roadways do not cause instream exceedances of water quality standards. For simplicity, MassDOT is developing this standalone methodology to accompany the Impaired Waters Program assessments for pathogen related impairments not addressed by a TMDL.

Pathogens in MassDOT Stormwater Runoff

Pathogen concentrations in stormwater vary widely temporally and spatially; concentrations can vary by an order of magnitude within a given storm event at a single location.[3] Therefore, it is difficult to predict pathogen concentrations in stormwater with accuracy. Due to this difficulty, MassDOT generally will not conduct site specific assessments of pathogen loading for each water body impaired for pathogens. Instead, MassDOT-owned property which discharges to pathogen impaired waters are assessed based on available information on pathogen loading from highways, MassDOT actions, and information available from EPA and MassDEP. Based on this information MassDOT developed an approach to be consistent with relevant TMDLs and permit condition requirements and an iterative adaptive management approach to stormwater management.

In addition, while there is a positive relationship between impervious cover (IC) and pathogen loading, the relationship is not as direct as other impairments. According to the Center for Watershed Protection "…Other studies show that concentrations of bacteria are typically higher in urban areas than rural areas[4] but they are not always directly related to IC."[5] Therefore, MassDOT did not rely on BMP 7U to assess pathogen impairments as it has for other

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[1] MassHighway, 2009. NPDES Storm Water Management Plan for MassHighway Owned and Operated Highways. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/SWMP20091223.pdf

[2] MassDOT, 6 April, 2011. Description of MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT Application of IC Method). http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7U_ImpairedWaterbodiesAssessment.pdf

[3] MassDEP. (2009). Final Pathogen TMDL for the Cape Cod Watershed. Available at: MassDEP 2009b Final Pathogen TMDL for the Cape Cod Watershed Area

[4] U.S. Geological Survey (USGS). (1999). Pesticides and Bacteria in an Urban Stream – Gills Creek. USGS Fact Sheet FS-131-98. Columbia, South Carolina.

[5] Center for Watershed Protection (CWP). (2003). Impacts of Impervious Cover on Aquatic Systems. Watershed Protection Research Monograph No. 1. Ellicott City, MD.

impairments not addressed by a TMDL. Instead, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements.

A study conducted on MassDOT's South East Expressway measured bacterial concentrations in stormwater runoff.[6] This study found a geometric mean of 186 fecal coliforms/100 mL. Concentrations of pathogens in stormwater runoff from roadways can vary widely and pathogen concentrations in runoff across the state likely deviate significantly from this stretch of roadway's specific estimate. Event mean concentrations of fecal coliform bacteria in urban stormwater from other sources ranging between 14,000 and 17,000 fecal coliform organisms/100 mL have been reported.[7] These data suggest that pathogen loading from highways may be lower than other urban areas.

Consideration of the potential sources of pathogens supports the idea that pathogens are present in lower concentrations in highway runoff since potential pathogen sources are likely to be less prevalent in the highway environment than along other urban roadways. Potential sources of pathogens and their relationship to the highway setting include:

- Illicit discharges: Due to the typical setback of highways from residential and commercial developments and the stand alone nature of the drainage system, the potential for illicit discharges (e.g. sewer connections, laundry tie-ins) is much lower than in other stormwater systems. This has been confirmed by MassDOT's illicit discharge detection on many miles of urban roadways within a broad range of areas across Massachusetts. After assessment of almost 140 miles and investigation of more than 2,500 stormwater features, MassDOT's consultant performing the broad scope reviews has found no confirmed illicit discharges.
- Limited Sewer Utilities in Road Rights-of-Way: Since MassDOT does not provide sewer services, many MassDOT roads do not have sewer utilities within the road's right-of-way; thereby eliminating the chance of cross-connections or leaking pipes as a source of pathogens into the stormwater system.
- Pet waste: Pets are only present on highways in rare instances. In urban residential areas pets and their associated waste are much more common. MassDOT is aware that pet waste at road side rest stops may represent a potential source of pathogens to stormwater in certain situations, and has a pet waste management program underway to address this source where necessary.
- Wildlife: Highways are not generally an attractive place for wildlife. Wildlife generally avoids highways and only occasionally crosses them.

The dearth of pathogen sources on highways and the relatively low concentrations of pathogens measured in the South East Expressway study together suggest that pathogen loading from stormwater runoff from highways is lower than other urban sources.

Furthermore, in almost all cases the contribution of pathogens from MassDOT to a specific water body is likely to be very small relative to other sources of pathogens in the watershed. Since MassDOT urban roadways are linear and usually cross watersheds, they represent a small fraction of the receiving water body's watershed. The water quality within these water bodies is dependent

[6] Smith. (2002). Effectiveness of Three Best Management Practices for Highway Runoff Quality along the Southeast Expressway. USGS Water Resources Investigations Report 02-4059. Boston, Massachusetts.

[7] MassDEP. (2009). Final Pathogen TMDL for the Cape Cod Watershed. Available at: http://www.mass.gov/dep/water/resources/capecod1.pdf

on discharge from various sources, including discharges from other stormwater systems and a large number of other factors.

Assessment

In general, pathogen loadings are highly variable and, as a result, quantitative assessments are challenging and of little value. Therefore, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements. [8,] The draft Massachusetts General MS4 permit contains specific requirements for discharges to water bodies with pathogen related impairments without a TMDL (in Appendix H).[9] While this MS4 permit is still in draft form and MassDOT anticipates receiving its own individual permit coverage under the finalized Massachusetts general MS4 permit, the draft permit represents the best available guidance from EPA regarding appropriate measures for addressing stormwater discharges to pathogen-impaired waters in Massachusetts. Section 2.2.2.c.ii of the permit states "The permittees subject to Part 2.2.2.c.i. shall meet all requirements of Appendix H Part III with respect to reduction of bacteria or pathogens discharges from the MS4." Appendix H references a number of programmatic BMPs that are necessary to address pathogen loading. These cover the following general topics:

- Residential educational program focused on pet waste management
- Prioritized illicit connection identification, tracking and removal.

Proposed Mitigation Plan

MassDOT implements a variety of non-structural BMP programs across their system in accordance with their existing SWMP including educational programs, illicit connection review, and source control. The specific BMPs that can help reduce potential pathogen loading in the current SWMP include:

- BMP 3C-1: Drainage Connection Policy
- BMP 3C-2: Drainage Tie-In Standard Operating Procedure
- BMP 3D: Illicit Discharge Detection Review
- BMP 5H-1: Post Construction Runoff Enforcement – Illicit Discharge Prohibition
- BMP 5H-2: Post Construction Runoff Enforcement – Drainage Tie-In
- BMP 5H-3: Post Construction Runoff Enforcement – Offsite Pollution to MassHighway Drainage System
- BMP 6A-1: Source Control – 511 Program
- BMP 6A-2: Source Control – Adopt-A-Highway Program
- BMP 6C-1: Maintenance Program

MassDOT is also developing a pet waste management program at MassDOT rest areas within pathogen impaired watersheds. MassDOT will be installing signs at rest stops within the subwatershed of impaired waterbodies. The signs will inform the public of the need to remove

[8] US EPA, 2010a. Draft Massachusetts North Coastal Small MS4 General Permit. February. Available at: http://www.epa.gov/region1/npdes/stormwater/MS4_MA.html

[9] US EPA, September 2014. Appendix F of Draft General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts. Available at: http://www.epa.gov/region1/npdes/stormwater/MS4_MA.html

pet waste, which can minimize contributions of pathogens to stormwater runoff. Pet waste removal bags and disposal cans will be provided.

Furthermore, MassDOT has an ongoing inspection and monitoring program aimed at identifying and addressing illicit discharges to MassDOT's stormwater management system. Any illicit discharges to MassDOT's system could contribute pathogens to impaired waters, however, MassDOT's existing Illicit Discharge Detection and Elimination (IDDE) program is aimed at identifying and addressing these contributions. District maintenance staff are trained to conduct regular inspections of MassDOT infrastructure and note any signs of potential illicit discharges, such as dry weather flow and notable odors or sheens. Similarly, resident engineers overseeing construction projects also receive training to note any suspicious connections or flows, and report these for follow-up investigation and action as appropriate. MassDOT will continue to implement this IDDE training, and District staff will continue to report any suspicious flows requiring further investigation. MassDOT investigates any suspicious flows noted, and will work with owners of confirmed illicit discharges to remove these flows, and thereby minimize the possibility of pathogen contributions to receiving waters.

Summary

As part of its NPDES MS4 stormwater permit, MassDOT is required to address the discharge of pollutants from its stormwater systems to impaired water bodies identified in MassDEP's *Final Massachusetts Integrated List of Waters*. MassDOT's SWMP identifies the methodology for addressing its stormwater discharges to impaired water bodies not covered by a TMDL.

MassDOT has concluded that the BMPs outlined in the SWMP are consistent with its existing permit requirements. These measures achieve pathogen reductions (including fecal coliform) to the maximum extent practicable and are consistent with the intent of its existing stormwater permit. As stated previously, pathogen loadings are highly variable and although there is potential for stormwater runoff from MassDOT roadways to be a contributing source it is unlikely to warrant action relative to other sources of pathogens in the watershed. MassDOT will continue to ensure proper non-structural BMPs are being implemented, including regular roadway and drainage system maintenance, erosion and sedimentation control, and outreach and education.