

**Boston Water and
Sewer Commission**

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April 2, 2010

Ms. Janet Moonan
Region 1 (New England)
5 Post Office Square, Suite 100
Mail Code OEP06-1
Boston, MA 02109-3912

Mr. Glen Haas
Massachusetts Department of Environmental Protection
1 Winter Street
Boston, MA 02108

Massachusetts Department of Environmental Protection
Metro Boston/Northeast Regional Office
205B Lowell Street
Wilmington, MA 01887
ATTN: Mr. Richard Chaplin

RE: Annual Stormwater Management Report – Revision
MAS010001 – Boston Water and Sewer Commission

Dear Ms. Moonan and Messrs. Haas and Chaplin:

The Boston Water and Sewer Commission respectfully submits a revision to Section 4 of its Stormwater Management Report for the year 2009. The enclosed, revised Section 4 corrects and clarifies certain errors of transcription contained in the Commission's February 26, 2010 submission which suggested that historical data was current. The Commission requests that the enclosed, revised Section 4 replace that Section of the Stormwater Management Report for 2009 filed with the Environmental Protection Agency ("EPA") and Massachusetts Department of Environmental Protection ("DEP") by letter dated February 26, 2010.

The Commission's NPDES Stormwater Permit (MAS01001) was issued by the EPA and DEP on September 29, 1999, and became effective on October 29, 1999. The Commission requested reapplication for the NPDES Stormwater Permit in the 2003 Stormwater Management Report submitted on February 27, 2004.



The Commission's staff is available to meet or discuss the NPDES Stormwater Permit and Stormwater Management Programs at your convenience. If you would like to arrange a meeting or if you have any questions or comments concerning the Annual Report, please contact Ms. Amy Schofield, Project Manager at (617) 989-7432.

Yours truly,

John P. Sullivan, Jr., P.E.
Chief Engineer

JPS/jjs

Cc: D. Gray, EPA
F. Civian, DEP
C. Jewell, BWSC
J. Steinkrauss, BWSC



Municipality/Organization: Boston Water and Sewer Commission

EPA NPDES Permit Number: MAS010001

Report/Reporting Period: 2009 (January 1, 2009 – December 31, 2009)

**NPDES Phase I Permit
Annual Report**

General Information:

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Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations.

Signature:

Printed Name: John P. Sullivan, Jr., P.E.

Title: Chief Engineer

Date: March 31, 2010

4.0 REPRESENTATIVE AND RECEIVING WATER MONITORING, AND BMP DEMONSTRATION PROGRAMS

4.1 CURRENT STATUS OF MONITORING PROGRAMS

Under the permit, the Commission was required to monitor stormwater quality in areas representative of different land uses, and receiving water quality during wet weather. The Commission was also required to implement a demonstration program designed to evaluate the effectiveness of a non-structural stormwater Best Management Practice, and perform wet and dry weather screening of major storm drain outfalls.

This section provides a summary of these programs. More comprehensive reports regarding the representative land use monitoring, receiving water monitoring and BMP Evaluation are provided in Appendices B through D.

The Commission completed all of the required representative and receiving water monitoring within the first five years of the permit. In 2004, because there were funds remaining in the monitoring program contract, the Commission extended the contract duration, and an additional round of receiving water monitoring was performed in 2005. In 2006, the Commission extended the monitoring program contract again, and added \$10,039 to the contract, to allow for one more year of receiving water monitoring. In total, the Commission completed six years of receiving water monitoring.

In 2007, anticipating that the Commission's permit would soon be re-issued by EPA/DEP, the Commission sent a letter to EPA/DEP in 2007, stating that it had fulfilled all of the monitoring requirements of the existing permit, and there were no immediate plans to continue representative and receiving water monitoring. Since there was no response from EPA or DEP regarding the letter, it was concluded that it was acceptable to EPA and DEP.

4.2 NPDES MONITORING ACCOMPLISHMENTS TO DATE

The representative water monitoring program was completed in 2004 and the receiving water monitoring program was completed in 2006. The Best Management Practices demonstration programs were completed prior to 2009. Brief summaries of the programs are provided in this section and complete descriptions of the programs, along with the data collected, are provided in Appendices B through D. Please note that the Appendices results and descriptions reflect sampling data through 2004 (for representative area sampling) and 2006 (for receiving water sampling). A map showing the locations of the

representative area and receiving water sampling sites is provided at the end of this section.

Table 4 – 1 presents the schedule under which the representative stormwater monitoring, receiving water monitoring, and BMP demonstration programs were completed. They are summarized as follows:

- Between 2001 and 2004, completed representative monitoring in a high density residential area, an open space area, and a mixed use area. Representative monitoring in a low-density residential and a commercial area were completed prior to 2001, and the data is provided in separate reports.
- Performed wet and dry weather water quality sampling at five (5) receiving water locations in 2001, 2002, 2003, 2004, 2005 and 2006. Since receiving water quality monitoring could not be performed by the Commission in 2000 as required under the permit, an additional round (three storms) of wet weather receiving water quality monitoring was performed in 2004.
- Evaluated the effectiveness of a non-structural stormwater Best Management Practice (the Pet Waste Management Demonstration Project).
- Although not required under the Permit, completed the Catch Basin Effectiveness Demonstration Project.

Table 4 – 1 Monitoring Program Implementation Schedule

	High Density Residential	Open Space	Mixed Use	Catch Basin Effectiveness	Pet Waste Management	Receiving Waters
Spring 2001	3 Storms			3 Storms		2 Storms/1 Dry
Fall 2001		1 Storm			Baseline Monitoring	1 Storm
Spring 2002	3 Storms	2 Storms		3 Storms	BMP Program Implementation	3 Storms/1 Dry
Fall 2002		3 Storms		Sediment Measurements	Post BMP Monitoring	
Spring 2003			3 Storms	Sediment Measurements		2 Storms/1 Dry
Fall 2003				Sediment Measurements		1 Storm
Spring 2004			3 Storms	Sediment Measurements		3 Storms/1 Dry
Fall 2004						3 Storms
2005						3 Storms/1 Dry
2006						3 Storms/1 Dry

4.3 REPRESENTATIVE STORMWATER MONITORING

Under the Commission's original SQMP submitted to EPA, the Commission proposed to monitor stormwater quality in drainage areas representative of high-density residential, transportation and industrial land uses. Each of these areas would be monitored during three storm events per year, for two years. Since the Commission had just recently completed one full year of monitoring in a low-density residential area, and one full year of monitoring in a commercial area, the Commission proposed to monitor stormwater in these land use areas during three storm events for one year only. The Commission's Stormwater Quality Monitoring Plan (SQMP) was approved by EPA in February 2000.

Subsequent to submitting the SQMP, the Commission re-evaluated data collected from the previously completed low-density residential and commercial area stormwater monitoring programs. The Residential Stormwater Monitoring Program (West Roxbury) conducted between April, 1997 and June 1997, captured 11 storm events and the Commercial Area Stormwater Monitoring Program (Dorchester Lower Mills) conducted between April 1999 and March 2000 captured 13 storm events. The Commission concluded that these programs had produced sufficient data to evaluate the quality of stormwater discharges from those land use types. Therefore, the Commission modified its monitoring program in 2001 to include monitoring of only the high density, open space and mixed land use types. The modification was reported to EPA/DEP in the Commission's annual Stormwater Management Report for 2000. In a memorandum faxed to the Commission by EPA on April 29, 2003, it was stated that the proposed revisions to the representative monitoring program were "acceptable to EPA". A letter from DEP to the Commission dated May 13, 2003, also stated that the proposed modifications were "reasonable and appropriate".

At the time the Residential and Commercial Area stormwater monitoring programs were being evaluated, the Commission also performed an evaluation of land uses in the areas of Boston served by separated storm drains. Based on Mass GIS data and information provided in the Commission's Geographic Information System, it was determined that transportation and industrial land uses accounted for less than eight (8) percent of the land use in the separated areas of Boston. Major land use types in the areas of the city served by separate storm drains were residential (60 percent), followed by open space or water (13 percent) and commercial/institutional (19 percent). The evaluation further indicated that the most of the drainage areas in Boston were comprised of a mixture of land uses, as opposed to any single land use type. In response to this finding, the Commission modified its NPDES Stormwater Monitoring Program in 2001, to include monitoring of open space and mixed use areas, as opposed to transportation and industrial land use areas. The Commission reported the modification to the EPA/DEP in the annual Stormwater Management Report for 2000. In a memorandum faxed by EPA to the Commission on April 29, 2003, EPA stated that the proposed modifications to the

representative monitoring program were “reasonable and appropriate”. DEP also sent a letter to the Commission dated May 13, 2003, stating that the modifications were “reasonable and appropriate”.

Copies of the final reports for the Residential Stormwater Monitoring Program (RSM) and the Commercial Area Stormwater Monitoring (CSM) were submitted to the EPA/DEP at the conclusion of the programs. The reports are also included on the CD provided with this report. A summary of conclusions made based on the representative stormwater monitoring program is provided below. A more detailed discussion of the program is provided in Appendix B.

Based on the data generated under the representative stormwater monitoring program, which were collected through 2004, the following general conclusions can be made:

- Certain of the data identified bacterial levels in stormwater that exceeded applicable water quality standards, particularly those based on fecal coliform concentration, even in areas known to have no illegal sanitary connections. Levels measured in the Commission’s NPDES monitoring programs were very comparable to those reported in the NSQD database. Ambient temperature was clearly a factor impacting bacterial concentrations but, due to the characteristically high degree of variability in bacterial data, it was difficult to assess other trends. It was clear that these bacterial parameters were not reliable indicators of sewage contamination.
- Certain of the data identified levels of copper and zinc in runoff from the Boston area that exceeded applicable water quality criteria, particularly in dissolved form. The fact that the metals occurred primarily in dissolved form, suggests that conventional BMPs aimed at solids control were ineffective at addressing metals toxicity. Data from the mixed use area indicated higher metals concentrations and higher proportions of dissolved metal in runoff than were reported in the national database, however, that trend may not persist as the NSQD database continues to be populated.
- Drainage areas with more pavement and associated automobile traffic (e.g. the commercial, high-density residential and mixed use areas) generally had higher levels of solids, heavy metals, oil & grease, and/or TPH. It was not clear why the mixed use area had significantly higher levels of O&G and TPH than most areas, yet had lower levels of heavy metals, which would also be associated with automobile traffic.
- Certain of the data indicated that surfactants were present at low levels in many of the stormwater samples, but there were no other indications of wastewater contamination. While it may be a useful tool in dry weather screening, additional wet weather testing of surfactants was not warranted.

4.4 RECEIVING WATER MONITORING – BUSSEY BROOK, CHANDLER POND, CANTERBURY BROOK

The permit stated that the Commission was required to monitor a minimum of four receiving waters three times a year throughout the permit term. The purpose of the receiving water monitoring was to characterize the water quality impacts of stormwater discharges from the Commission's drainage system.

The word "receiving waters" as stated in the permit were somewhat ambiguous. The fact sheet provided with the draft permit when it was issued stated that the (draft) permit was conditioned to include four "sampling stations", or four "locations". After careful consideration of receiving water monitoring locations, the Commission set forth a program designed to result in a better understanding of the overall impact stormwater discharges have on receiving water quality. It consisted of collecting wet weather samples from five sampling "stations", located within three receiving water "bodies". Two of the water bodies (Bussey Brook and Canterbury Brook) were sampled at stations located upstream and downstream of Commission owned storm drain outfalls. One body (Chandler Pond) was sampled at one station near its outlet to the Commission's drainage system. In addition, although not required under the permit, samples were collected from each of the five sample stations during dry weather; this was to get an overall idea of the quality of the receiving waters without the influence of wet weather discharges.

The Commission's receiving water monitoring program was described briefly in the Commission's Stormwater Management Report for 2000, and elaborated upon in the annual reports for subsequent years. The receiving water issue was specifically brought to EPA's attention in the Commission Stormwater Management Report for 2001. In a memorandum faxed to the Commission on April 29, 2003, EPA stated that the proposed revisions to the receiving water monitoring program were "acceptable." A letter dated May 13, 2003, was also sent by DEP to the Commission stating that the revisions were "reasonable and appropriate."

Wet and dry weather water quality samples were collected from the five receiving water stations in 2001, 2002, 2003, 2004, 2005 and 2006. Since the Commission was unable to perform receiving water quality monitoring in 2000, an additional round (three storms) of wet weather receiving water quality monitoring was performed in 2004.

A brief summary of the conclusions made based on the receiving water monitoring is provided below. A more detailed discussion of the program is provided in Appendix C.

Based on the receiving water monitoring data generated by the program, which were collected through 2006, the following general conclusions can be made:

- Certain of the data identified wet weather concentrations of dissolved copper and zinc that exceeded water quality criteria in the two brooks monitored. Certain of the wet weather dissolved zinc concentrations in Chandler Pond also exceeded the criteria. Frequent dry weather exceedances of both metals in the brooks suggest that concentrations of these metals in excess of the applicable water quality standards may be typical in urban Massachusetts's waters.

- Certain of the data identified bacterial concentrations that exceeded water quality criteria in the receiving waters during wet weather, particularly in the two brook locations. While dry weather exceedances were also relatively frequent, the concentrations were generally lower.
- Through the use of paired sampling to isolate storm drain discharges and dry weather sampling to assess “background” conditions, it was clearly demonstrated that sources other than the Commission’s storm drains are the primary cause of metals and bacterial pollution in the brooks. Chandler Pond does not have many other sources of pollution and is generally cleaner than the brooks.
- There was no indication that stormwater had a significant impact on any of the other pollutants monitored in the receiving waters.
- Certain of the data indicated that surfactants were present at low levels in many of the receiving water samples, but there were no other indications of wastewater contamination. While it may be a useful tool in dry weather screening, additional wet weather testing of surfactants was not warranted.

4.5 PINE NECK CREEK WATER QUALITY ASSESSMENT

In 2006, the Commission completed a water quality assessment of the Pine Neck Creek (PNC) storm drain system. The system discharges at outfall 12L092, which is located just south of Tenean Beach in the Dorchester neighborhood of Boston. The assessment was performed by the Commission to determine if the PNC storm drain system was contributing to the elevated levels of bacterial at Tenean Beach. Project components included: investigation of the PNC tributary area using the sandbag method of investigation; a sanitary survey of the PNC watershed to identify all possible sources of bacterial contamination to Pine Neck Creek and Tenean Beach; wet and dry weather receiving water quality sampling of Pine Neck Creek and near Tenean Beach; and dye tracing of discharges from the PNC outfall and nearby CSO outfall 090.

Through a review of existing information and statistical analysis, it was concluded that:

Activation at CSO 090 correlated with high bacteria counts at Tenean Beach

Elevated bacteria levels at Tenean Beach correlated with rain events, which occurred within 24 hours of sampling. Other beaches in the area, such as Malibu Beach, presented similarly. The conclusions for this project were as follows:

- No illegal tie-ins or other illicit discharges to the PNC storm drainage system were found.
- The PNC outfall did not have a significant potential to cause dry weather closures at Tenean Beach. Enterococcus levels measured at the outfall, prior to any mixing, during two 24-hour dry weather sampling events were well below the 104

CFU/100ml beach closure standard. Only one sample had a level above this standard; the level measured was 140 CFU/100 ml. The mean concentration for both of these events was 15 CFU/100 ml. Dye testing also indicated that dilution will cause a 3 to 4-log reduction from the levels of bacteria measured at the outfall to the levels measured at the beach sampling stations.

- Two significant dry weather sources of bacteria were identified; a 64-inch outfall and outfall CSO 090, which is located to the north of the 64-inch outfall¹. Both had levels of bacteria during a dry weather event that were more than an order-of-magnitude greater than levels at the PNC outfall.
- Beach closures tended to occur 24 – 48 hours after rain events and activation of CSO 090. Statistically, this could explain approximately 86% of beach closures. Dry-weather dye tracing showed that tidal influence transports flow from the mouth of CSO 090 to Tenean Beach within 24 hours.
- There were numerous other wet-weather sources of bacteria in the Tenean Beach area. These include four major sources and nine smaller sources, all of which were outfalls.
- Dye tracing indicated that CSO 090 has the potential to influence bacterial levels at the beach.

The Pine Neck Creek Water Quality Assessment was completed in 2007.

4.6 BMP DEMONSTRATION PROJECTS

a. Catch Basin Effectiveness Demonstration Project

Wet weather monitoring of solids loading into and out of two catch basins located in the high-density residential area on Mount Vernon Street in Charlestown was conducted during three spring storm events in 2001 and 2002. The data was used to assess the capture efficiencies of the catch basins. Solids accumulation in the catch basin sumps was also tracked.

Whereas the catch basin efficiencies measured in the two catch basins during 2001 ranged from 10 to 33 percent, the three storm events monitored in 2002 all indicated negative solids capture efficiencies, as the solids accumulation in the catch basin sumps was approaching half of the sump depths. This suggested that the catch basins become less effective at removing total solids as the depth of sediment in the sump approaches 50 percent. These findings were consistent with the conclusions of other studies reported in the literature.

¹ Since the Pine Neck Creek Water Quality Assessment was completed, the area tributary to CSO 090 was separated. The 090 area, as well as the area tributary to the 64-inch storm drain referred to, are both currently under investigation for illegal connections.

The Catch Basin Effectiveness Demonstration Project was completed in 2002. However, the Commission continued to monitor the depth of sediment in the two catch basin sumps on a quarterly basis throughout 2004 to determine if any additional solids capture occurred. Sediment depths in both catch basins continued to increase through May 2003, but began to level off and even decline in subsequent months. This supports the suggestion that the catch basins may have achieved their maximum effectiveness.

A more detailed discussion of the Commission's Catch Basin Effectiveness Demonstration Project is provided in D.

b. Pet Waste Management Demonstration Project

The Pet Waste Management Demonstration project conducted in Wesley G. Ross Playground in Hyde Park was completed in 2002. The project included characterizing existing conditions in 2001 by conducting a visual survey of the playground, and interviewing dog owners in the area and playground users. A pet waste education program was implemented in the spring and summer of 2002 to increase public awareness of the impact of pet waste on water quality. This was primarily accomplished through interviews with nearby residents and park users, and the distribution of multicolored, bilingual "Scoop the Poop" flyers distributed at the conclusion of the interviews. These flyers were also mailed to 172 residents in the vicinity of Ross Playground and an advertisement in French Creole, promoting the "Scoop the Poop" message was placed in a newspaper serving Boston's Haitian population.

The Boston Office of Animal Control also conducted one of their free rabies vaccinations clinics in the area on May 11, 2002, at which the flyers and sample pooper scooper bags were distributed to participants. In addition, Commission staff met with a representative of the Boston Parks Department to suggest ways in which that department could enhance pet waste management, including improved signage and year-round availability of trash receptacles.

To evaluate the success of the pet waste education project, a follow up visual survey and interviews with the dog owners and park users were completed after implementation. For the Pet Waste Management Demonstration Project, it was not possible to draw definitive conclusions regarding the effect of the education program on reducing bacterial contamination of stormwater. In general, the Pet Waste Management Program was well received by park users and area residents, and seemed to raise the awareness of dog-owners with respect to the potential impact of dog waste on water quality. It also appeared to have had an impact on the level of pet waste cleanup in the park, as indicated by the approximately 50 percent average reductions in the density of pet waste deposits after the program was put in place. This result is a clear aesthetic benefit. Whether it is a result of the environmental issues raised, or secondary "peer pressure" induced by the program is unclear, as is the question of whether the improvement in cleanup efforts will be long lasting. Less clear is the net impact on stormwater quality, since levels of bacteria in the runoff are so variable and affected by so many factors.

A more detailed discussion of the Commission's Pet Waste Management Demonstration Project is provided in Appendix D.

c. Catch Basin Maintenance and Cleaning

Under the Commission's Catch Basin Preventive Maintenance Program, the sediment depths in one hundred catch basins were monitored between January 2002 and April 2003 to determine the factors that effect how quickly catch basins become full. Variables considered in selecting the catch basins to be monitored included slope, land use, the size of the tributary area, the type of road (high traveled road vs. back road) and tree cover. The selected catch basins were inspected four times each on a quarterly basis and the depth of sediment measured.

No statistically significant correlation between land use and accumulation rates was observed. Similarly, no correlation was observed based on slope, drainage area, or neighborhood characteristics. Some correlation with tree cover was observed, with the catch basins located in areas of denser tree coverage demonstrating as much as 50 percent higher accumulation rates as compared to basins with little or no tree cover. The data also exhibited a seasonal correlation, with the winter months demonstrating the highest accumulation rates.