dcr
Massachusetts

May 1, 2014

Glenda Velez
U.S Environmental Protection Agency OEP06-01
5 Post Office Square – Suite 100
Boston, MA 02109-3912

RE: NPDES Phase II Small MS4 General Permit
DCR Permit Year 11 Annual Report

Dear Ms. Velez:

Please find enclosed DCR's NPDES Phase II Permit Year 11 Annual Report. The annual report summarizes DCR's activities during Permit Year 11 (April 2013-March 2014) towards meeting the measurable goals outlined in our Notice of Intent (NOI). DCR received authorization to discharge under the general permit on December 4, 2007.

Please feel free to contact me at (617) 626-1340 if you have any questions or require further information.

Sincerely,
Department of Conservation and Recreation

Robert Lowell
Environmental Section Chief

Enclosures: NPDES Phase II Small MS4 General Permit Annual Report – Year 11

CC: Fred Civian
DEP
One Winter Street
Boston, MA 02108

Municipality/Organization: Department of Conservation and Recreation

EPA NPDES Permit Number: MAR043001

MaDEP Transmittal Number:

Annual Report Number & Reporting Period: **No. 11: April 2013 – March 2014**

Department of Conservation and Recreation NPDES PII Small MS4 General Permit Annual Report

Part I. General Information

Contact Person: Robert Lowell Title: Environmental Section Chief

Telephone #: (617) 626-1340 Email: Robert.Lowell@state.ma.us

Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction orsupervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on myinquiry 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. Murray

Title: Commissioner

Date: 30 April 2014

Department of Conservation and Recreation
(DCR)

NPDES Storm Water Management Program

Permit Year 11 Annual Report

For Coverage Under
National Pollutant Discharge Elimination System (NPDES)

General Permit for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems (MS4s)

Department of Conservation and Recreation
251 Causeway Street
Suite 600
Boston, MA 02114-2104

Submittal: May 1, 2014

Municipality/Organization: Department of Conservation and Recreation

EPA NPDES Permit Number: MAR043001

MaDEP Transmittal Number:

Annual Report Number & Reporting Period: **No. 11: April 2013 – March 2014**

Department of Conservation and Recreation NPDES PII Small MS4 General Permit Annual Report

Part I. General Information

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Telephone #:	(617) 626-1340	Email:	Robert.Lowell@state.ma.us

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Signature:

Printed Name: John P. Murray

Title: Commissioner

Date:

Part II. Self-Assessment

The Department of Conservation and Recreation (DCR) has completed the required self-assessment and has determined that we are in compliance with all permit conditions, except as noted in the following tables. DCR received authorization to discharge under the general permit from EPA on November 8, 2007 and from DEP on November 21, 2007. DCR understands that coverage under the MS4 is continued until a specified time after the new permits that are currently in draft format are issued by EPA.

DCR continues to implement a comprehensive storm water program with limited fiscal and labor resources. DCR storm water management efforts are supported by operating and capital appropriations that were reduced from FY13 (July 2012 – June 2013) $3.87 million to $2.74 million in FY14 (July 2013 to June 2014). DCR expects to utilize all available funds and to implement practices to reduce pollution in runoff from parks and parkways. The Governor's FY15 budget provisions for DCR are currently proposed at $3.9 million.

Part III. Summary of Minimum Control Measures

The Department of Conservation and Recreation owns and operates many different types of facilities and parkways which are covered by the NPDES Phase II General Permit. In order to accurately reflect the programs DCR has accomplished, both state-wide and for specific facilities, this annual report has been divided into separate tables. Table 1 describes the control measures which are not site specific. Tables 2 through 7 describes site or facility type specific BMPs that are being implemented specifically at water supply/ reservoirs, state forests, state parks, beaches, construction sites or parkways.

A few of the BMPs included in DCR's Storm Water Management Plan (SWMP) are for facilities outside of the urbanized area. Therefore, the facilities addressed by these BMPs are not listed in the site specific tables. We continue to include these BMPs in Table 1 to demonstrate the many diverse programs being implemented by the DCR to raise awareness of storm water and water quality issues in the general public. We have noted these BMPs as facilities that are "outside of the urbanized area" in the table below.

Table 1: State-wide Best Management Practices (BMPs)

1. Public Education and Outreach

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
1-1	DCR Storm Water Web Page	External Affairs/IT Dept. (Conrad Crawford)	Develop web page and publish storm water related publications (inc. SWMP and NOI), information and links on web page.	*Goal Met* – The following documents were posted on DCR's web site for public access and review: ▪ Permit Year 10 Annual Report ▪ DCR Daily Street Sweeping Schedules for 2013 and 2014 has been posted on the website.	Continue to update as necessary. Post a copy of Permit Year 11 Annual Report. Post Authorization to Discharge letters from EPA and DEP.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
1-5	Mobile Water Quality Education Seminars (statewide)	Operations (Adam Parr)	Provide storm water/ water quality education educational events at a minimum of nine different locations. These events would be in addition to the facility/ program specific BMPs also listed in this SWMP.	*Goal Met* – DCR offered state-wide Public Education Events including water quality, storm water education (includes forestry practices, healthy ecosystems, water quality, children's programs) at many DCR facilities statewide at least once. • Belle Isle Marsh • Robertson State Park • Leominster State Forest • Erving State Forest • D.A.R. State Forest • Waquoit Bay NRR	Provide educational events at a minimum of nine different locations during the year. Environmental education programs planned in the North Region parks and reservations include: • DCR Coastal Awareness Environmental Education Program on DCR coastal properties; • numerous clean-up days at beaches, marshes and ponds; • canoe trips, • birding trips; • Nutrient loading studies and coastal explorations.
1-6	Charles River Conservancy Volunteer Clean Up Program	Operations (Jack Murray)	Continue to partner with Conservancy on Charles River Clean Up Program	Goal Met - DCR assisted with and coordinated support for this year's Clean Up Day held on 4/27/13. Some state wide locations include: • Boston Harbor Islands • Lake Cochituate State Park • Middlesex Fells • Moore State Park • Wollaston Beach Reservation	DCR continues to assist with this Clean Up Day, which is scheduled for April 26, 2014. Due to weather concerns on April 26, 2014 the event will be rescheduled. DCR coordinates volunteers on Park Serve Day held in April at numerous locations statewide.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
1-7	Charles River Reservation School Program	Operations (Adam Parr)	Provide 1 storm water/ water quality related educational program each year.	Environmental education through the Charles River Reservation School Program was cancelled as of June 2007 due to inadequate staffing. There has continued to be a lack of funding for staffing these programs.	No planned activities.
1-8	Camp Nihan	Operations (Adam Parr)	Provide 1 storm water/ water quality related educational program each year.	Environmental education programs at Camp Nihan were cancelled as of June 2007 due to inadequate staffing. There has continued to be a lack of funding for staffing these programs.	No planned activities.
1-9	Quabbin Educational Programs (*outside of the urbanized area*)	Water Resources (Ann Carroll)	Continue to provide multi-session watershed related education programs on an annual basis to two schools in the Quabbin Reservoir watershed.	Interpretive Services staff conducted educational programs for student and adult participants. In addition, tours were led for a number of local, regional, and even international groups on a variety of watershed-related topics. Staff also served on the Steering Committee for the Massachusetts Envirothon, and as DCR liaison with the Swift River Valley Historical Society, Friends of Quabbin, Valley Environmental Education Collaborative and the Student Conservation Association.	Continue activities.
1-10	Wachusett Educational Programs (*outside of the urbanized area*)	Water Resources (Ann Carroll)	Continue to provide multi-session watershed related education programs on an annual basis to two schools in the Wachusett Reservoir watershed.	Staff continued to implement the Wachusett Watershed Education Program in five communities: Holden, Boylston, West Boylston, Princeton, and Rutland, with the expansion to additional schools in Holden and Rutland.	Continue activities.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
1-11	Project WET	Water Resources (Ann Carroll)	Maintain sponsorship of state water education for teachers program.	Program WET was cancelled as of summer 2007. DCR staff assist with educational opportunities in watershed municipalities under STEAM, Science Technology, Engineering, Art and Math programs.	No planned WET activities.
1-12	"DownStream" Newsletter	Water Resources (Ann Carroll)	Continue to develop and disseminate newsletter regarding issues relevant to Wachusett Reservoir/ Quabbin Reservoir watersheds twice a year.	*Goal Met* - DCR published and circulated this newsletter. The Spring 2013 issue included discussions on Environmental Education and Mass Envirothon and impacts of Emerald Ash Borer on commonwealth forests. The Fall 2013 issue focuses on Quabbin Reservoir and its islands and native bat conservation efforts. Copies of the newsletters can be found at http://www.mass.gov/dcr/water Supply/watershed/dwmfactsheets.htm and as Appendix A of this report. The newsletter is sent to members of the Friends of the Watershed (Wachusett, Quabbin and Ware River) Group.	Publish newsletters in May and November 2013. Place newsletters on web page.
1-13	Massachusetts Drinking Water Education Partnership (MADWEP)	Recreation (Gary Briere)	Maintain membership.	*Goal Met* – DCR is an active member of MADWEP.	Maintain membership.
1-14	Low Impact Development Project	Water Resources (Anne Carroll)	Pursue the inclusion of public education component within the planning, permitting and implementation of one LID project a year.	DCR vacuum swept permeable pavements at Herter Lot #1 and Walden Pond parking lots. Geotechnical studies were conducted at Dedham Parkway and Soldiers Field Road to determine suitability for infiltration.	Construction of rain gardens at Regatta Point Park, Worcester. Project would reduce direct stormwater discharge to Lake Quinsigamond.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
1-15	DCR Storm Water Training Workshop	Engineering (Mike Misslin)	Provide ½ day training program to address storm water management regulation, policies and procedures relevant to DCR staff.	*Measurable Goal Previously Completed.*	Working to add Storm Water Handbook Training to PACE training program.
1-16	Ipswich River Demonstration Projects	Director of Water Resources (Anne Carroll)	Continue to include public education and outreach in the projects funded through the EPA Watershed Grant, as appropriate.	*Goal Met* – The **Whipple Annex Green Roof** results report was published and posted to the website along with a fact sheet, and DCR held a formal presentation to review the results. **Weather Based Irrigation Demonstration project** - Analysis of savings and a report was produced April 2, 2009, and has been posted to the website.	DCR and the USGS have published a pre- and post-construction groundwater data assessment report for the **Silver Lake Permeable Pavement** and the **Silver Lake Rain gardens** Demonstration Projects. The report, a circular, and a fact sheet have been posted on the DCR website. Aside from system maintenance, no further work is proposed.
1-17	Partner with Center for Urban Environmental Studies	Chief Engineer (Michael Misslin)	Partner with Northeastern University to assist development of new pollution control methods for storm water.	*Goal Partially Met* – DCR developed Notice to Partner with Northeastern and National Science Foundation in Permit Year 5. No additional work occurred during this permit year.	No activities are planned.

Additional Practices:

- The Stillwater Farm Educational Site continues regularly scheduled open hours seasonally. The building is open to the public four days a week from Memorial Day through Labor Day.

2. Public Involvement and Participation

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
2-1	Formalize Partnerships with CLF and CRWA	General Counsel (Douglas Rice)	Continue to work with CLF and CRWA and abide by Memo of Understanding (MOU)	*Goal Met* - DCR provided CLF/ CRWA with the final report summarizing the actions taken to meet the criteria outlined in the MOU.	No activities are planned.
2-2	UMass/DCR Program to monitor WQ in target areas of Wachusett Reservoir (*outside of the urbanized area*)	Water Resources (Ann Carroll)	Continue program with UMass.	*Goal Met* - Program is ongoing. Current focus is development of hydro-dynamic model of Stillwater Basin section of reservoir and invasive species.	Subject will be developed for summer 201 study.
2-3	Public NPDES Meetings to Discuss Annual Report	Engineering (Mike Misslin)	Hold one meeting at three locations each year for internal staff, interested parties and public. Track and record comments received.	*Goal Met* – DCR held two public meetings to present and discuss Annual Report.	Once the new MS4 watershed based permits are issued DCR will follow public meeting requirements outlined in those permits.
2-4	Partnership and Friends Database	External Affairs (Conrad Crawford)	Send an annual letter regarding storm water/ NPDES issues to the watershed advocacy groups included in their Partnership and Friends database.	*Goal Met* - Database has over 346 contacts. Use database to send notification of annual report review.	Send annual email regarding storm water/ NPDES issues once issued. Maintain database. Send email regarding new MS4 permits once issued.
2-5	Storm Water Related Concerns/ Feedback Reported on DCR Web Site	External Affairs (Conrad Crawford)	Continue to maintain staffing to forward concerns/ feedback to appropriate department and track response to concerns submitted by the public via DCR's web site.	*Goal Met* - Web site is active. DCR Commissioner has implemented concern/feedback letter tracking and response system.	Continue program.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
2-6	DCR Stewardship Council	External Affairs (Conrad Crawford)	Continue to participate. Raise storm water issues, as appropriate. Present summary of annual report to council.	*Goal Met* - DCR attends monthly and is an active participant.	Continue participation. Present summary of Annual Report for Permit Year 11.
2-7	Massachusetts Water Resource Commission (MWRC)	Water Resources (Ann Carroll)	Continue to be involved in program and provide technical and staff support to MWRC.	*Goal Met* - DCR attends monthly and is an active participant.	Continue participation.
2-8	Lakes and Ponds Program	Water Resources (Ann Carroll)	Continue to sponsor program.	*Goal Met* - DCR continues to sponsor this program. Examples of LID installations and demonstration projects for the Ipswich River watershed are available through http://www.mass.gov/dcr/waterSupply/lakepond/lakepond.htm	Continue sponsorship.
2-9	Think Blue Campaign	Engineering (Mike Misslin)	Explore a partnership with Think Blue. Provide update on program and schedule in annual reports.	*Goal Not Met* – Think Blue public messaging is in conflict with DCR public messaging.	Discontinue partnership.
2-10	Partnership with MyRWA	Engineering (Mike Misslin)	Explore a partnership with MyRWA. Include a summary of collaborative activities in annual reports.	*Goal Met* – DCR staff has volunteered to be on MyRWA Science sub-committee and shared drainage information with MyRWA.	Further define partnerships and implement water quality monitoring program.

3. Illicit Discharge Detection and Elimination

BMP ID #	BMP Description	Responsible Dept./ Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
3-1	Drainage Outfall Inventory	Engineering (Mike Misslin)	Locate all known outfalls owned and operated by DCR within urbanized areas. Explore possibility of providing inventory for public review and include "Contact Us" Link.	*Goal Met* - DCR located all known outfalls owned and operated by DCR within urbanized areas by the end of Permit Year 5. The drainage outfall information was gathered from either scanned construction drawings or field surveys. During this past permit year, DCR has continued to add to and update the stormwater infrastructure database by verifying and updating the database during illicit discharge detection field work and catch basin cleaning and maintenance efforts. DCR has used the database to support maintenance activities, quickly understand the scope of potential drainage failures, and facilitate work related to adjacent municipalities. DCR has shared drainage information on infrastructure that was handed over to MassDOT.	DCR will continue to verify the location and condition of outfalls located from paper maps during illicit discharge detection field tasks. DCR will continue to use the "Contact Us" link as the primary method for the public to request drainage system mapping information. The information will be provided to the public in a timely fashion.

BMP ID #	BMP Description	Responsible Dept./ Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
3-2	Drainage Inventory Specification	Chief Engineer (Michael Misslin/AECOM)	DCR will develop and implement a Drainage Inventory Specification which will require submission of drainage infrastructure information from construction and redevelopment projects to add to the infrastructure database.	*Goal Met* - Drainage specifications have been included in revised contract language and standard contract documents for newly issued contracts.	All new construction projects will continue to include the Drainage Inventory Specification. Incorporate as-built information from current construction into drainage mapping.
3-3	Illicit Drainage Connection Policy	General Counsel (Douglas Rice)	DCR is preparing a policy prohibiting illicit discharges to the DCR storm water system. The Policy will be finalized and issued during Fall 2006. Develop formal agreement with Attorney General's office.	*Goal Partially Met* - DCR has executed a drainage connection policy and MOU with Boston Water and Sewer Commission. .	Receive approval for proposed drainage connection policy state-wide.

BMP ID #	BMP Description	Responsible Dept./ Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
3-4	Drainage Infrastructure Inventory	Chief Engineer (Michael Misslin)	Identify DCR's roadway, parkway and boulevard drainage infrastructure and add to GIS Drainage Outfall Inventory/ database.	Goal Met - At the end of 2008, DCR's consultant had mapped drainage information for each of the urbanized area DCR properties. The drainage information was gathered from either scanned construction drawings or field surveys. DCR has continued to update the drainage inventory during its catch basin cleaning, maintenance, and illicit discharge detection efforts this permit year.	The infrastructure database is a dynamic work in progress. Updates are made to the database when new construction takes place. Corrections to the database will be made as areas are visited during the illicit discharge investigation and during catch basin cleaning and maintenance efforts. DCR's infrastructure database is now linked to inspection, maintenance and illicit discharge investigation records, providing consolidated records of the features and all work performed on the feature over the years. In addition, DCR will add features identified during maintenance work that were missed from the infrastructure database. DCR will update the database when construction activities alter drainage infrastructure.

BMP ID #	BMP Description	Responsible Dept./ Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
3-5	Illicit Connection Sampling Program	Engineering (Mike Misslin)	Continue to prioritize and review known potential illicit connections. Once DCR, or its consultant, completes large portions of the drainage infrastructure inventory (BMP 3-4), DCR will develop a priority area list and focus on those systems. DCR will summarize the systems reviewed, the outcome of the reviews and any proposed follow up work in each annual report. The annual report will also include the priority areas list for the next permit year.	*Goal Met* - DCR's consultant performed the third year of a five-year rotating illicit discharge inspection program. The urban stormwater system was split spatially into five regions to facilitate inspections. All regions contain approximately 20% of DCR's system and all contain areas of special concern including public beaches impaired waters, etc. Over this past permit year, areas that primarily drained to the Merrimack and Mystic Rivers were inspected for illicit discharges. This region encompasses several state parks that drain to Merrimack River and major roads such as Revere Beach Parkway and Mystic Valley Parkway. On-site sample analysis was employed to get real-time results to help identify potential sources of illicit flows. *(continued on next page)*	DCR will inspect 20% of their stormwater system within the urbanized area during the summer and fall of 2014. DCR will continue to update the drainage inventory and identify needs for maintenance and cleaning as part of this field effort. DCR will follow up on 7 cases of suspect illicit connections from Permit Year 10 inventory.

BMP ID #	BMP Description	Responsible Dept./ Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
3-5 (cont'd)				Over Permit Year 10, stormwater features were inspected on DCR property. Five cases of dry weather flow were investigated with suspected illicit connections. Water samples from coastal beaches were tested for pathogens by independent laboratories. Beach advisories were posted daily in accordance with Dept of Public Safety recommendations. Where water samples showed repeated exceedances the drainage inventory was used to systematically locate and trace possible sources of contamination.	
3-6	Drainage Tie-In Policy	General Counsel/ Chief Engineer (Douglas Rice / Michael Misslin)	Develop a SOP regarding drainage tie-ins from private entities to DCR's MS4.	*Goal Met* – DCR utilizes their access permit program to "permit" drainage tie-ins when requested or when un-permitted connections are identified in the field. Eight (8) connections were permitted in Permit Year 11. See Appendix C.	Continue to review requested drainage connections through access permit program.

BMP ID #	BMP Description	Responsible Dept./ Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
3-7	Develop Storm Water Control Agreements with Other MS4s	General Counsel (Douglas Rice)	DCR will implement a program to work cooperatively with operators of interconnected MS4s in the instance where storm water discharges impact either system. DCR will develop control agreements with the discharging municipality.	*Goal Partially Met* –DCR has identified interconnections with municipal systems during the infrastructure mapping. MOU in place with Boston Water & Sewer Commission.	If interconnections with town MS4s are identified related to illicit discharges, DCR will work collaboratively with the town to identify a solution and remove the discharge. Unauthorized drainage connection from Boston at Castleton Road and Jamaicaway to be resolved.
3-8	Illegal Dumping	Operations (Adam Parr)	Continue training of rangers regarding illegal dumping and work with law enforcement when necessary.	*Goal Met* – DCR picks up and appropriately disposed of waste abandoned on the side of road on an on-going basis. DCR also properly disposed of materials from maintenance yards in Stoneham, Cambridge, and Milton. Solid waste clean-ups completed at Bradley Palmer State Forest and Hop Brook Flood Control facility in Northborough.	Clean Muddy River water sheet at Charlesgate

Additional practices outside the urbanized area:

- Water Supply Protection Environmental Quality staff continued with wet weather sampling efforts to characterize storm events. Staff completed a report of options for addressing or eliminating the 50 direct discharges to the Wachusett Reservoir.

4. Construction Site Stormwater Runoff Control

BMP ID #	BMP Description	Responsible Dept./Person	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
4-2	E&S/ NPDES Contract Bid Item and Special Provisions	Engineering (Mike Misslin)	Prepare contract bid item and special provisions. Include in all new contracts which disturb more than one acre. Bid item will include erosion control specifications.	*Goal Met* - Erosion and sedimentation control specifications are included in revised contract language and standard contract documents.	Continue to include Erosion and Sediment Control Specification in all new construction projects.
4-3	Construction SWPPP Template	Engineering (Mike Misslin)	DCR will develop a SWPPP Template for use by Contractors on DCR projects. Template will be placed on DCR website for download by contractors.	DCR is currently instructing consultants and in-house staff to use EPA's template for appropriate projects.	DCR will continue using EPA's template.
4-5	On-going Construction Projects Web Page	External Affairs/ IT Dept. (Conrad Crawford)	DCR will maintain the construction related web page that includes information regarding on-going DCR construction projects.	*Goal Partially Met* – The front page of DCR's web site highlights on-going design and construction projects. Information regarding projects that are subject to the Construction GP was not added.	DCR will add a link to EPA's eNOI web site for the public to use in accessing a list of DCR construction sites that exceed 1 acre disturbance.
4-6	Annual Erosion Prevention/ Sediment Control Training	Engineering (Mike Misslin)	Provide annual training to DCR construction management staff. Report number of attendees, topics covered and dates of training in annual report.	*Goal Not Met* – Training was not performed this year due to staff shortage and agency priorities.	Engineering consultant to provide erosion control training as part of work site job coordination and safety discussions.

BMP ID #	BMP Description	Responsible Dept./Person	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
4-7	Technical Assistance to Conservation Commissions	Water Resources (Ann Carroll)	Continue to provide technical assistance and the staffing level necessary to provide timely responses.	*Goal Met* - Technical assistance was provided to twelve (12) Conservation Commissions regarding projects within the Quabbin and Wachusett Reservoirs. *Wachusett:* EQ continued to attend meetings of local boards and commissions and provide assistance to the volunteer boards. *Quabbin:* Staff continued to provide direct technical assistance to a number of watershed communities on zoning, planning and technical engineering issues. In addition, they continued work on development of model wetland bylaws, a permit checklist, and a USFS-funded guidebook on watershed forest management.	Continue to provide assistance as requested by Conservation Commissions.
4-8	Contract Bid Item and Special Provisions Enforceability	Engineering (Mike Misslin)	Include notice, which defines the procedure to address storm water related problems identified at construction sites, in all new contracts.	*Goal Met* – Continued to require development of SWPPP and filing of NOI for construction sites which disturb more than one acre.	Continue to implement in all new projects which disturb more than one acre. Coordinate on contracts transferred to MassDOT, such as bridge work.
4-9	Construction Runoff Enforcement from DCR and/or Offsite Construction Pollution	General Counsel (Douglas Rice)	Refer offsite/ non-DCR construction projects that are causing construction related pollution on DCR property to Attorney General's office as necessary. Refer to EPA is appropriate.	*Goal Met* – No construction related pollution action in urbanized areas was necessary this year.	Refer problems identified to AG or EPA. Document in annual report.

BMP ID #	BMP Description	Responsible Dept./Person	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
4-10	Utility/ Drainage Tie-In Permit	Permitting (Nancy Thornton/Christian Delaney)	Continue to require all offsite projects which need to tie into a DCR MS4 to receive a permit under this program.	*Goal Met* – Offsite projects are required to receive this permit before tying into a DCR MS4. Eight (8) drainage connection or maintenance permits were issued in Permit Year 11. See Appendix C.	Require tie-ins to apply for a permit.

5. Post-Construction Stormwater Management in New Development and Redevelopment

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
5-1	Compliance with MA DEP Stormwater Management Policy	Engineering (Mike Misslin)	Apply Stormwater Management Policy Guidelines to all development/ redevelopment projects.	*Goal Met* - All new/ redevelopment projects were designed to incorporate the current stormwater best management practices.	All new/ redevelopment projects will be designed to incorporate the most current stormwater best management practices. Storm water discharges to tributaries to the Quabbin or Wachusett watersheds will be reviewed for applicable storm water policy and standards.
5-2	DCR Storm Water Handbook	Engineering (Mike Misslin)	Develop Handbook and issue department-wide and to Contractors. New projects will be designed in accordance with the Handbook.	*Goal Partially Met* - Storm Water Handbook has been updated to be consistent with the 2008 Massachusetts DEP Stormwater Policy. The Handbook is completed and was distributed to engineering and planning staff.	Conduct appropriate Handbook training sessions.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
5-3	Storm Water Handbook Training	Director of Human Resources (Penny O'Reilly)	Provide 2 seminars within 6 months of issuing handbook to train internal personnel and consultants. Provide annual seminars thereafter. Record # of attendees and dates of training.	*Goal Met* – No formal state-wide training session conducted.	Provide training on Stormwater Handbook at DCR Supervisors Academy to be held April 2014.
5-4	BMP Long-Term Operation and Maintenance	Operations / Engineering (Kevin Whalen/ Mike Misslin)	DCR has committed $2 million dollars annually to provide long-term maintenance of BMPs on the schedule indicated in the Maintenance Activity Schedule of the SWMP.	*Goal Met* - Long-term operation and maintenance was accomplished using contracts established for pavement resurfacing and deferred maintenance. DCR's storm water management efforts are supported by operating and capital appropriations that totaled approximately $3.9 million in FY13 and expects to utilize all available funds to provide an appropriate level of service and to identify better practices to reduce pollution in runoff from roads and parkways.	DCR has requested $4.1 million for long-term operation and maintenance of BMPs in FY15. Budget process/ deliberations are still in process.
5-5	Low Impact Development Projects	Water Resources (Anne Carroll)	Actively work on the planning, permitting and implementation of one Low Impact Development (LID) project each year.	Design LID project with MassDOT in Cambridge and Boston for drainage from reconstructed Longfellow Bridge. Conduct sampling and analyze phosphorous concentrations in stormwater.	Design and permit an LID project with MassDOT in Cambridge and Boston for drainage from reconstructed Longfellow Bridge. Design and install rain garden(s) at Regatta Point State Park to reduce run-off to Lake Quinsigamond.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
5-6	Walden Pond Stormwater Improvements *(outside of urbanized area)*	Engineering (Mike Misslin)	Complete design of storm water improvements and install.	*Goal Met* – Project complete in Permit Year 5. Parking lot with pervious pavement was vacuum swept to maintain infiltration.	Parking lots with pervious pavement will be cleaned using vacuum sweeping equipment.
5-7	Post Construction Runoff Enforcement from Offsite Pollution	Engineering (Mike Misslin)	Refer off site projects that runoff to DCR property to Attorney General's office as necessary.	*Goal Met* – No post construction runoff enforcement actions necessary this permit year.	Refer problems identified to AG or EPA. Document in annual report.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
5-8	Ipswich River EPA Targeted Watershed Grant – Low Impact Development (LID) Subdivision Demonstration Project	Water Resources (Anne Carroll)	The DCR received a $1.04 million grant from the Environmental Protection Agency's Targeted Watershed program to demonstrate an integrated approach to addressing the problems facing the Ipswich River. This approach encompasses two strategies: • Low-Impact Development (LID) – landscaping and design techniques that capture stormwater and recharge it to groundwater • Water Conservation – education strategies and technologies that reduce demand on water supplies, and associated groundwater pumping.	On June 9, 2009, more than 100 people participated in a full-day presentation and tour of the LID Subdivision (Project #1), the Green Roof (Project #2), and the Silver Lake LID parking lot and neighborhood demonstration projects (Projects #3 and 4). On November 4, 2009, DCR and the Ipswich River Watershed Association hosted a forum for Massachusetts legislators and staff to inform and educate them about the grant-funded projects, to share results from the five years of studies funded by the grant, and to stimulate discussion about issues affecting Massachusetts watersheds.	For up-to-date planned activities for all Ipswich River Targeted Watershed Grant projects, please visit http://www.mass.gov/dcr/ waterSupply/ipswichRiver /index.htm

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
5-8a	Ipswich River EPA Targeted Watershed Grant - Green Roof Demonstration Project	Water Resources (Anne Carroll)	Monitor quality and quantity of runoff from the green roof at Whipple Annex and conventional roof at Ipswich Town Hall. Summarize results and include in annual report.	The green roof demonstration site, Whipple Annex, is being redeveloped as affordable housing for seniors. Water quality samples collected from the green roof by USGS in 2008 were analyzed for a range of parameters, including conductivity, pH, nitrogen, phosphorus, metals, and total petroleum hydrocarbons. DCR presented the results to a legislative forum on November 4, 2009. The report has been prepared and a link to it can be found here http://pubs.usgs.gov/sir/2010/5007/.	No additional activities planned.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
5-8b	Ipswich River EPA Targeted Watershed Grant - Permeable Paving Demonstration Project	Water Resources (Anne Carroll)	Continue groundwater quality sampling for one year upon completion of project construction. Summarize results in annual report.	This project incorporated three LID practices (permeable paving materials, bioretention cells, and vegetated water quality swales) designed to reduce runoff volume, improve water quality, and enhance groundwater recharge. There have been no beach closures, due to fecal bacteria, starting in 2006 and continuing until 2009. However, there was one closure due to a cyanobacteria bloom. USGS installed seven wells in the parking lot to provide data on groundwater levels and groundwater quality. USGS monitored preconstruction conditions quarterly and after a few large storms. Following construction, USGS began monitoring groundwater levels and collecting samples monthly. Sampling is designed to detect any changes in groundwater quality associated with recharge from the parking lot.	USGS has published a report of pre- and post-construction groundwater data, and a link to the report is posted on their website at http://www.mass.gov/dcr/watersupply/ipswichriver/progress.htm

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
5-8c	Ipswich River EPA Targeted Watershed Grant - LID at Silver Lake	Water Resources (Anne Carroll)	Perform sampling of stormwater volumes and water quality for one year upon completion of project construction. Summarize results versus pre-construction in Year 5 annual report.	This project incorporates several LID techniques to replace the conventional stormwater collection system in two streets draining to Silver Lake. Stormwater flow paths were disconnected from the piped drainage system by directing stormwater to rain gardens and porous pavers. Eleven rain gardens are located in the roadway rights-of-way. The roadway edges in three areas along Silver Lake Avenue were resurfaced with porous pavers with underlying infiltration beds. Sampling for changes in water quality and discharge quantity continued for 15 months, post-construction, concluding in October 2007.	USGS has published a report of pre- and post-construction groundwater data, and a link to the report is posted on their website at http://www.mass.gov/dcr/watersupply/ipswichriver/progress.htm

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
5-8d	Ipswich River EPA Targeted Watershed Grant - Rainwater Harvesting	Water Resources (Anne Carroll)	Continue data collection of outdoor water use or each participating household with rainwater harvesting systems through the irrigation seasons of 2007 and 2008. Compare use with historic records and summarize in annual report. Install large underground system.	This project funded installation of roughly 40 rainwater harvesting systems in residential settings. The systems consist of a storage tank, a pressure pump to aid in water distribution, a spigot for a hose, and a water meter to measure flow. Three sizes of storage tanks were installed. A large-capacity (8,000-gallon) underground storage vault was installed at the Boutwell Elementary School in Wilmington in April 2007, to supply water for irrigating the adjacent ball field. The water meter attached to each rainwater harvesting system provided data on the volume of rainwater pumped from the storage tanks for outdoor use. In addition, Wilmington Water Department records on each residential participant's domestic water use were analyzed to compare domestic water demand before and after installation of the rainwater harvesting system. *(continued on next page)*	Additionally, a paper has been accepted but not yet published by the Journal of American Water Resources Association.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
5-8d (cont'd)				Rainwater was used for outdoor purposes by all participants. Survey results indicate that, in general, the rainwater that participants used replaced the use of domestic water. Results presented by DCR and Tufts University at the WaterEC, the International Water Efficiency Conference on April 1, 2009.	
5-8e	Ipswich River EPA Targeted Watershed Grant - LID Ball Field	Water Resources (Anne Carroll)	Begin data collection of water use and continuous soil moisture retention on field in 2007 and continue through summer of 2008.	A portion of a municipal athletic field complex, located adjacent to the river at Ipswich River Park and totaling eight acres, was redeveloped to maximize infiltration and minimize irrigation requirements and application of fertilizer and pesticides. The town monitored the soil moisture of the amended field and the control fields; and the volumes of water used on each of the four fields in the complex. The watering needs of the amended field were much less compared to the conventionally treated fields. Results presented by DCR and Tufts University at the WaterEC, the International Water Efficiency Conference on April 1, 2009.	A paper has been accepted but not yet published by the Journal of American Water Resources Association.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
5-8f	Ipswich River EPA Targeted Watershed Grant - Weather Based Irrigation	Water Resources (Anne Carroll)	Compile and analyze post-installation water use records for the 25 weather-based irrigation controllers through summer 2008. Summarize in annual report.	During Permit Year 5 a total of 25 weather-based irrigation controller switches were installed on both residential properties and municipal athletic fields in five communities. These devices contain devices used to deliver the optimum amount of water needed by the landscape. Data on water use was recorded using readings from individual water meters dedicated to the irrigation system. These readings were compared to water use at control sites using conventional irrigation technologies and to records on pre-installation water use of project participants. Results presented by DCR and Tufts University at the WaterEC, the International Water Efficiency Conference on April 1, 2009.	Additionally, a paper has been accepted but not yet published by the Journal of American Water Resources Association.

5. Additional

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
	Breakheart Reservation Pond Improvements Project	Planning & Engineering (Mike Misslin)		DCR's consultant performed site visits, survey and hydrologic analysis of the Breakheart Reservation's pond system (two ponds). During the analysis, DCR discovered that the two ponds are held by poor condition dams. DCR stormwater personnel met with DCR dam personnel to discuss the issues at both ponds and possible improvements.	DCR will continue discussions with DCR dam personnel to fund and implement necessary action at the Breakheart Reservation dams/pond to reduce beach erosion and improve the condition of the dams. It is on a priority list and will be addressed as the priority is reached. They are not high hazard dams.
	Mt. Greylock	Engineering (Mike Misslin)		DCR is in the process of designing a lodge/conference center and campground at Mt. Greylock. 220 catch basins were installed in compliance with historic parkway guidelines. As-built plans were provided to DCR and included in the drainage infrastructure database.	Inspect all catch basins and cross culverts on mountain road and clean as needed.
	Mt. Wachusett (out of UA)	Engineering (Mike Misslin) Environmental Quality staff		DCR used construction controls during utility installation at this facility. DCR swept the Summit Road and removed sediments from vernal pool and stormwater structures on Administration Road, Mt. Wachusett	DCR will monitor Administration Road for erosion and BMP maintenance after rain events that exceed 0.5 inches in 24-hours.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
	Improvements to drainage system.			Plans for a new stormwater treatment system for the area in front of the Quabbin administration building were largely completed. Staff worked closely with local and state officials in monitoring and enforcing stormwater regulations and design requirements in Quabbin and Wachusett watersheds and worked with DEP in reviewing several NPDES General Construction Permit applications.	Continue coordination with DEP.

6. Pollution Prevention and Good Housekeeping

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
6-1	Vehicle Washing Policy	Operations (Jack Murray/Kevin Whalen)	Maintain practice of washing vehicles at off-site locations into state-wide written policy and implement. Identify off-site commercial (snow plow equipment) vehicle washing facility.	*Goal Met* - Policy implemented in Winter 06-07 for smaller cars and trucks. Pursued locating off-site commercial (snow plow equipment) vehicle washing facility but were not successful.	DCR is still working with MassDOT to identify off-site commercial (snow plow equipment) vehicle washing facility/vendor.
6-2	Floor Drain Policy	Engineering (Mike Misslin)	Maintain plan for floor drain use and servicing.	*Goal Met* - Plan is maintained, staffed and funded under Clean State Initiative.	Maintain plan.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
6-3	CB Cleaning Policy	Chief Engineer/ Operations (Michael Misslin/Kevin Whalen)	DCR will develop a written plan for regular catch basin cleaning to be implemented in DCR's fiscal year 2006 and thereafter.	*Goal Met* - Policy finalized and implemented statewide.	Continue to implement policy.
6-4	CB Inspection/ Repair Policy	Stormwater (Rob Lowell)	DCR will develop an agency wide policy for implementing a schedule for inspecting catch basins and prioritizing repairs of catch basins and implement.	*Goal Met* – Policy finalized. Priority catch basins identified for repair were repaired within two weeks. Repair group was moved to the Stormwater in DCR for faster repair tied to reporting. April 2013 through March 2014 4,000 ft. of drainage pipe and 320 catch basins repaired.	Continue to implement policy.
6-5	Street Sweeping Policy	Operations (Kevin Whalen)	Create and implement agency-wide policy on all roads, parkways and parking lots.	*Goal Met* – Policy has been finalized and implemented. From September through November DCR and contractors swept Mass Parks and parkways monthly in accordance with DCR's Maintenance Activity Schedule. DCR added parking lots along the Charles and Mystic Rivers. A total of approximately 3,343 tons of street sweeping were removed from DCR roads and parkways in 2013.	Continue to implement policy. DCR;s sweeping contractor – National Watermain Cleaning Company - uses high performance regenerative sweepers.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
6-6	IPM Policy	Water Resources (Ann Carroll)	Create and implement agency-wide policy.	*Goal Partially Met* - Create draft plan for internal review. Test studies being performed.	Continue to develop policy.
6-7	VMP Training	Engineering (Mike Misslin)	Provide training on DCR Vegetation Management Plan (VMP) to internal maintenance staff once every two years. Provide training, if required, for seasonal workers without prior experience on off years.	*Goal Met* – DCR follows VMPs provided by municipalities to the extent possible.	Continue to provide training for seasonal workers. Training will include review of VMPs prior to seasonal brush cutting.
6-9	EMS	Engineering (Mike Misslin)	Continue to provide first response for emergency management situations such as spills and/ or coordinate with Mass. State Police, as appropriate. Continue to provide annual training in spill response coordinated with DEP, MWRA, emergency responders and other local responders.	*Goal Met* - DCR coordinates responses with Mass State Police, Coast Guard and DEP as necessary.	Continue to coordinate responses and provide annual training.
6-10	Waste Disposal	Engineering / Operations (Mike Misslin/ Kevin Whalen)	DCR will continue to properly dispose of waste.	*Goal Met* - DCR has budgeted for disposal of catch basin and street sweeping wastes. Spent $248K on waste disposal.	Continue to properly dispose of waste and include in budgets.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
6-11	Beneficial Use Determination (BUD)	Engineering (Mike Misslin)	DCR will work to determine a beneficial use determination (BUD) for catch basin residuals.	*Goal Partially Met* – DCR is seeking a contractor to manage DCR compost and street sweepings. DCR will issue an RFR for site services with BUD for street sweeping management.	Continue to use facility with BUD for street sweepings.
6-14	CB Repair/ Discharge Pipe Cleaning Needs Assessment	Engineering (Mike Misslin)	Perform an annual state wide assessment of the condition and cleaning requirements of visible proximate DCR lateral piping and catch basin repair needs. Pilot project in 2005. Agency wide program in 2006. Annual reports will summarize piping requiring cleaning and catch basin to be repaired and report on progress.	*Goal Met* - Over the spring and summer, DCR continued to systematically clean catch basins and water jet the associated outlet drain pipes using private contractors overseen daily by DCR staff. From September through December, 3,395 catch basins were cleaned and water jetted and their locations recorded using GPS. (See individual tables for locations) DCR spent $0.57 M to clean and $0.8M to repair catch basins.	DCR will continue to systematically clean catch basins and water jet the associated outlet drain pipes, as determined necessary, using private contractors overseen daily by DCR staff. DCR anticipates dedicating more budget ($1.6 M) and level of effort this year for catch basin cleaning and repair. DCR will investigate additional areas where drainage infrastructure has been identified as obstructed or broken during statewide CB cleaning activities. Use CCTV and/ or magnetic probes to identify necessary repairs or remedy. Areas will include: ▪ Storrow Drive/ Esplanade ▪ Charlesgate ▪ Truman Highway ▪ Riverway ▪ Mystic Valley Parkway ▪ Jamaicaway ▪ West Roxbury Parkway ▪ Morrissey Boulevard ▪ Blue Hills Parkway

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
6-14 (cont'd)				DCR repaired catch basins at numerous locations that include: ▪ Morrissey Boulevard ▪ Day Boulevard ▪ McGrath Highway ▪ Embankment Road ▪ Memorial Drive ▪ Soldiers Field Road ▪ Storrow Drive	
6-17	Maintenance Tracking System	Engineering/ Operations (Mike Misslin/ Kevin Whalen)	Develop a maintenance tracking system. Add storm water infrastructure information inventoried in BMP 3-4. Include inspection/ maintenance schedule and create reports of BMPs that are "scheduled" for cleaning.	DCR's consultant has developed a global positioning system (GPS) program to work with DCR's GPS operating systems and the existing geospatial stormwater infrastructure database to record maintenance activities. DCR employees have been trained in recording and processing data using the new system. The consultant has organized previous DCR maintenance records into a database linked to the stormwater infrastructure database.	DCR's consultant will continue to work with DCR's maintenance team to track maintenance needs and actions. DCR plans on updating their data collection equipment to better work with the growing infrastructure and tracking database and continue to use the GPS program to efficiently track inspections and activities.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
6-18	Maintenance Activity Schedule	Operations (Kevin Whalen)	Maintain infrastructure and roadways in compliance with maintenance activity schedule.	*Goal Met* – **Street Sweeping**: To insure adequate street sweeping frequency, DCR entered into a renewable contract in 2014 with a street sweeping contractor to clean certain DCR parkways and roads. The contract provides for sweeping roadways that discharge to impaired receiving waters using mechanical and vacuum sweeping equipment at least four times per year, and monthly in areas where cars are allowed to park. Car parking in these areas has restricted access to the curb line thereby reducing the effectiveness of street cleaning. The program is outlined on DCR's web site at http://www.mass.gov/dcr/sweep.htm The DCR street sweeper fleet (six sweeper units) received maintenance periodically during the year and were operated as necessary by DCR to keep parking lots and roadways parkways as clean and trash free as possible. *(continued on next page)*	Continue to comply with maintenance activity schedule. **Street Sweeping**: Continue to provide and fund contract for sweeping roadways that discharge to impaired receiving waters using mechanical and vacuum sweeping equipment at least four times per year, and monthly in areas where cars are allowed to park. DCR requires high performance regeneration air sweepers for 2013-2014 sweeping services.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
6-18 (cont'd)	Maintenance Activity Schedule			Beach sand screener/sanitizers were operated on a daily basis at Revere Beach, Nantasket Beach, Wollaston Beach, Nahant Beach and other high use beach areas to reduce contaminants in the beach sand (cigarette butts, plastic bottles, etc.) that threaten surface water quality and to improve beach experiences for visitors. These beach maintenance services are performed by staff that also operates street sweepers when not operating beach sanitizers. DUPR district managers have the responsibility to prioritize and schedule these tasks. DCR also composted algae pulled from select beaches this last year. *(continued on next page)*	

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
6-18 (cont'd)	Maintenance Activity Schedule			**Leaf Removal:** To improve seasonal leaf removal DCR purchased three (3) high efficiency leaf loader machines to assist removal of leaves and debris from urban parkways. This new equipment enables DCR to better clean those roads lined with oaks and other trees that drop their leaves late in the season and often cannot be removed effectively before winter conditions prevent their removal. DCR removed leaves ahead of streets being swept. **Catch Basins**: DCR continued to systematically clean catch basins and water jet the associated outlet drain pipes using private contractors and DCR equipment overseen daily by DCR staff. DCR repaired its vacuum truck and used it to service catch basins with private contractors supplementing those services. Cleaning and maintenance of catch basins is recorded using portable GPS-enabled computers.	**Leaf Removal:** DCR will continue to remove leaves ahead of streets being swept. **Catch Basins**: DCR will continue to systematically clean catch basins and water jet the associated outlet drain pipes, as determined necessary, using private contractors overseen daily by DCR staff. DCR anticipates a greater budget commitment ($800K) and level of effort FY14 when compared to FY13.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
6-18 (cont'd)	Maintenance Activity Schedule			**Material Storage Yard Maintenance**: MassDOT has taken over the deicing and snow operations for all DCR roads. Four urban parks do store street sweeping and catch basin cleaning on-site. The accumulation areas are marked off for collection to reduce illegal dumping. **Fleet Maintenance**: DCR fleet manager (Joe Suppa) oversees the compliance with fleet maintenance. Individual facilities are reviewed in Table 2-7 of this report.	**Material Storage Yard Maintenance:** Not applicable. **Fleet Maintenance:** Fleet manager will review fleet maintenance schedule.
6-19	Winter Storm Plan	Operations (Kevin Whalen)	Continue to maintain a responsible winter storm program and provide sufficient funding.	*Goal Met* – DCR continued to maintain a winter storm program, where DCR retains responsibility (e.g. sidewalks, parking lots, certain bike paths, etc.). MassDOT has responsibility for snow and ice control on most other DCR roads and parkways.	Continue to maintain winter storm program where DCR retains responsibility.
6-20	Pet Waste Management	Operations (Kevin Whalen)	Continue pet waste management program. Continue to train DCR park rangers to monitor this program. Coordinate with law enforcement if necessary.	*Goal Met* – " Mutt Mitt" Dog Waste Collection Stations were maintained at locations including: ▪ Charles Reservation DCR revised the pet waste management map.	Maintain pet waste management program. Install additional new collection station at Blair Pond.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
6-21	Pool Discharge SOP	Engineering (Mike Misslin)	Update and re-issue SOP. Provide training to pool staff.	*Goal Met* – DCR updated and re-issued SOP including de-chlorinating procedures.	Provide training to pool staff, as necessary.

7. BMPs for Meeting Total Maximum Daily Load (TMDL) Waste Load Allocations (WLA)

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
7-1	Wetland Protection Act Compliance	Operations/ Engineering (Kevin Whalen / Mike Misslin)	Continue compliance with WPA.	*Goal Met* - Wetlands Protection Act is actively enforced at all DCR properties including those not located within urbanized areas. DCR has staff specifically dedicated to WPA compliance in Wachusett and Quabbin Reservoir watersheds. DCR received multiple Orders of Condition in Boston, Cambridge, Newton, Milton and Somerville for work within wetland resources.	Continue compliance. DCR will be filing for Order of Conditions for work within wetland resources in: • Boston • Milton • Somerville
7-2	401 Water Quality Certification	Operations/ Engineering (Kevin Whalen / Mike Misslin)	Continue compliance with 401 WQ Certification.	*Goal Met*	Continue compliance.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
7-3	Cultural Resources Review	Chief Archeologist (Ellen Berkland)	Continue to review potential impact to historic properties during conceptual design stage.	*Goal Met* - DCR reviews all projects for potential impact to historic properties during design phase.	Continue reviews and use subcontractors as necessary.
7-4	Chicopee Basin, French Basin, Mill River Basin, Northern Blackstone and Connecticut River TMDLs	Water Resources/ Chief Forester (Ann Carroll/ Peter Church)	These TMDL Reports recommended that during timber harvesting practices DCR shall check that an approved forest cutting plan and BMPs for erosion are followed. DCR will provide a summary table of timber harvesting activities, the date forest cutting plan was approved and proposed BMPs in each annual report.	*Goal Partially Met* – No timber sales were conducted in the Northern Blackstone Basin.	Provide summary report in annual report.
7-5	Connecticut Basin TMDL - Train Conservation Commission on Timber Harvest BMPs	Chief Forester (Peter Church)	Present short seminar for each Conservation Commission.	*Goal Met* – No timber sales were conducted in the Connecticut River basin.	Provide summary report in annual report.
7-6	Permit Year TMDL Summary	Engineering (Mike Misslin)	Include summary of TMDL reports approved by EPA during the previous permit year which include recommendations for actions by DCR in annual report.	*Goal Met* – Section 7b of this annual report includes a summary of the current Final TMDLs and those that include implementation recommendations which impact DCR (Table 8).	Continue to be involved in the development of draft TMDLs and implement recommendations summarized in Table 8.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
7-7	Priority Resource Area Review Program	Planning (Joe Orfant)	Implement a program to review the outfalls identified in the outfall inventory which discharge to one or more of the resources outlined in Part V and IX of the permit.	*Goal Partially Met* – DCR has updated the receiving water body table (Appendix C of the March 2008 SWMP) to reflect the outfalls identified in the drainage inventory. The table summarizes the number of outfalls by sub-basin number and identifies the impaired waterbody included in the sub-basin. This analysis showed priority areas distributed throughout the state. From this list, DCR has developed a 5-year illicit discharge inspections rotation that groups areas spatially for ease of program operations. DCR focused its illicit discharge program this year on areas adjacent to the Charles River which is impaired with a TMDL. **Blair Pond Improvements** -DCR identified the need for improvements to Blair Pond to improve hydrologic function and aesthetics of the pond. Blair Pond receives water from Clay Pit Pond in Belmont which is listed on the Massachusetts 303d list as Category 5 for Pesticides and discharges to Alewife Brook which is Category 5 Impaired. DCR completed dredging and disposal of contaminated sediments and constructed a new	DCR will continue the illicit discharge inspection program performing inspections on the third one-fifth of the system. This upcoming program will include systems that discharge to several impaired waters including the Charles River. DCR will continue to address failing stormwater systems and outfalls to reduce flooding, erosion, rutting and sedimentation. When possible, DCR will include structural stormwater Best Management Practices (BMPs) to improve the quality of water being discharged. **Blair Pond Improvements** – DCR will bid and the project with anticipated construction date of Fall 2011.

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 11	Planned Activities – April 2014 to March 2015
7-7 (cont'd)	Priority Resource Area Review Program			pond lobe to serve as a fore-bay to collect sediments in incoming water. These improvements increased water depths in the pond, improved water quality, and will enable DCR to more easily maintain and remove future sediment deposits.	

Table 2: Parkway Best Management Practices

Table 3: State Park Facilities Best Management Practices

Table 4: Beach Facilities Best Management Practices

Table 5: Water Supply/ Reservoir Facilities Best Management Practices

Table 6: State Forest Facilities Best Management Practices

Table 7: Construction Sites Best Management Practices

7b. WLA Assessment

TMDL reports were reviewed for discussion of implementation activities which may impact or directly mention DCR's facility or roadways and are summarized in Table 8. DCR will continue to review compliance with these recommended activities. Table 8 summarizes the final TMDLs approved as of March 31, 2011 and the implementation recommendations which impact DCR facilities.

Table 8: TMDL Summary

Part IV. Summary of Information Collected and Analyzed

No additional information collected and/or analyzed.

Part V. Program Outputs & Accomplishments

All programs and accomplishments are summarized in the appropriate tables.

Appendix A:

Down Stream Newsletters

Appendix B:

Potential Illicit Discharge Detection and Elimination Report

Appendix C:

Utility/ Drainage Tie-In Permits

NUMBER 29
Spring 2013

Massachusetts Department
of Conservation and Recreation
Division of Water Supply Protection
www.mass.gov/dcr/watersupply.htm

Mass ENVIROTHON

25 Years of Hands-On Environmental Education

by Clif Read, Director, DCR Quabbin Visitors Center

The Mass Envirothon is a statewide, natural resource-based environmental education program. It was founded in 1988 as the fourth Envirothon program in North America, thus the 2013 tournament marked its 25th anniversary. Over the years, the Evnirothon has grown in quality and quantity; over 40 teams now participate.

The group picture is a highlight of every Mass Envirothon. Many of the students from the 40 teams participating in the 2013 Envirothon pose in front of the Ames Mansion at Borderland State Park. There are lots of big smiles after a morning of challenging questions about water, forestry, soils, and wildlife, as well as environmental issue presentations.

The Envirothon is available to high school aged students and offers them unique learning opportunities. The Mass Envirothon program challenges students to:

- Get outdoors and explore, gaining hands-on knowledge and experience of Massachusetts ecosystems.
- Engage with their communities, developing skills for investigating local environmental issues and participating in community decisions and actions.
- Test their environmental knowledge and skills in a challenging competition.
- Grow in their commitment to stewardship of the environment and natural resources.
- Cultivate curiosity and a love of learning in science.
- Increase their awareness of career opportunities in the environmental field.

Envirothon teams representing schools and community organizations prepare the entire scholastic year for a statewide event in May that tests their knowledge of forest, wildlife, water, and soil resources, as well as current environmental issues. The program stresses the inter-dependence of human and natural systems, emphasizes hands-on, team-oriented problem solving, and highlights the value of community involvement.

There are opportunities to learn about these topics throughout the school year, including resource materials for use in the classroom, workshops geared to both teachers and students, and the opportunity to encounter environmental professionals in action. The winning team is entitled to compete in the North American Envirothon, a week long event that joins the top teams from the 50 states and 9 Canadian Provinces that run Envirothon programs.

One unique aspect of the Mass Envirothon is the selected Environmental Issue. This portion of the event, intro-

Continued on Page 4

Stone Walls Reveal the Past

Have you ever wondered about them?

By Jim Lafley, DCR/DWSP Education Coordinator

Stone walls are everywhere in the Quabbin, Ware River and Wachusett watershed landscape; they even remain under the reservoir surface! Stone walls aren't generally found in other parts of the country, and certainly not in the numbers of central Massachusetts. Stone walls come in different shapes, sizes, and configurations.

Many of the stones now seen as walls were buried by soil that had been created from forest litter after the last ice age. As European settlers removed trees, cultivated land, and grazed livestock, soil was compacted and eroded. These actions allowed winter frost to penetrate deeper into the ground, bringing stones to the surface, where they became a nuisance.

This picture is an example of a "dumped wall," where early settlers merely dumped unwanted stones in linear fashion along the edge of an agricultural field.

Most early walls were simply linear landfills created to clear the field for plowing and harvesting. These simple walls were little more than a line of stones dumped along the edge of the fields. These dumped walls could be a single stone wide, a double row or occasionally several stones wide.

Later, walls were used to delineate property boundaries, so they were typically stacked more neatly. Stacked walls could also be single, double, or multiple stones wide, if the land yielded a lot of stone over time. This style of wall is the most common in the watersheds and throughout New England. Effort was clearly made to have these walls retain their shape, as the stones were placed more carefully than dumped walls.

Well designed stone walls appeared more recently – about 150 years ago – as property owners had more time to spend on walls and fencing materials became more difficult to find. Fences were originally made of wood, stumps, and other forest debris, but as wood became scarce stone walls were used as fences. Built walls are usually at least double stone walls, but sometimes it is possible to find a single built wall of flat rocks.

The most effort in creating built walls is the fitting necessary to incorporate naturally occurring stones into the design. Many dumped and stacked walls were rebuilt, especially along the front of properties, when owners had more time or needed a higher wall to act as a fence.

Broad walls are the most interesting to me when I come across one in the woods. Some of these very wide walls were built as "walking walls," like sidewalks for people to get from the house to the barn, mill or workshop in winter or mud season.

Another style of broad wall consists of two single or double walls separated by several feet. The section between the walls was filled in with rubble taken from the fields. These walls indicate an incredible supply of stone in the ground that needed to be removed.

Walls had many functions over time, many of which can be seen across the

Continued on Page 6

The more carefully constructed "stacked wall" was built to endure the ravages if time, and very likely used to de-mark a property boundary.

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Beware the Emerald Ash Borer

Latest Threat to Massachusetts Forests

Compiled by Jim Taylor, DCR/DWSP Planner from DCR press release

The Emerald Ash Borer (EAB), *Agrilus planipennis*, was first detected in Dalton, MA in August 2012. Massachusetts is the 18th state discovered to have EAB within its borders. Upon detection of this invasive species, DCR began work with the Massachusetts Department of Agricultural Resources (DAR), the United States Forest Service (USFS), and the United State Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) to formulate a plan for dealing with the invasive insect.

DCR set up more than 700 EAB traps across the Commonwealth. With funding from the USFS, DCR girdled 26 trees, a process known as 'delimiting' that stresses individual trees in an effort to attract and sequester any EAB in the area. After the delimiting survey was completed around the Dalton/Pittsfield area, five trees were found to have EAB larvae present -all located within a 1.5 mile radius of the trap where the first EAB beetle was detected.

DCR also engaged in a public outreach campaign, including meetings, allowing the public to express their opinions and concerns on the topic of a quarantine. Though most public comments posted in the aftermath of these meetings called for a quarantine as small as scientifically possible, studies concluded that a county-wide quarantine would work best.

The Emerald Ash Borer, shown slighlty larger than actual size, is identified by its golden green or brassy color body with darker, metallic emerald green wing covers. The mature adult measures 3/8 - 5/8 inches (8.5 - 13 mm) in length, with the female slighlty larger than the male.

The quarantine order means that certain products will be kept from moving outside the regulated area, including all hardwood firewood (any piece of wood smaller than 48"), all ash nursery stock, and any ash lumber that has not been treated. Proper wood treatments include the removal of bark and half an inch of wood, dry kiln sterilization, fumigation, and heat treatments.

The state of New York recently added 22 new counties to their EAB quarantine, including counties that abut the Berkshire County border. This will allow wood to move from quarantined county to quarantined county, including moving regulated wood from Massachusetts to the mills that are just over the border in New York, relieving some of the financial pressure on the wood industry in Berkshire County.

Plans for future surveys are currently being discussed and EAB traps will be utilized again this summer in Massachusetts, as well as the girdling of approximately 100 ash trees to continue to help narrow the infestation.

Continued on Page 6

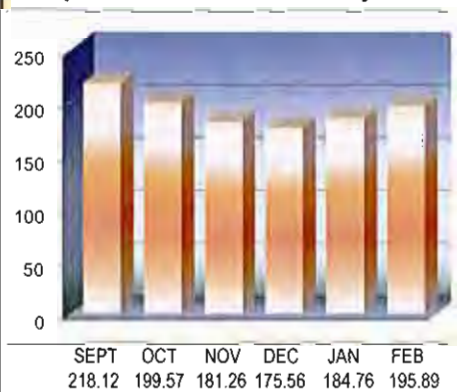
This picture details the bark damage caused by feeding EAB larvae. Note the 'D'-shaped exit hole made by the mature EAB, which kills upper branches of the tree and leaves it vulnerable to disease.

Reservoir Watch

Reservoir levels and 6-month precipitation

Reservoir	Quabbin	Wachusett
Minimum	522.57'	389.71'
% Full	86.3%	89.5%
Date	12/14/12	10/29/12
Maximum*	524.89'	391.52'
% Full*	90.5%	93.1%
Date	9/1/12	12/10/12
Precipitation	18.87"	20.87"
Seasonal Avg	23.06"	22.28"

System-wide 6-month Water Usage
(in million gallons per day)
September 2012 to February 2013



Envirothon

From Page 1

duced in 1991, challenges teams to conduct research in their community, interacting with resource professionals, town officials and local citizens in an effort to address a real-life problem. The team then presents their research, findings and proposals to a volunteer panel of environmental professionals, who serve as judges to select the best proposal at the Envirothon competition.

The 2013 Current Issue was Trees, Forests, and Sustainability. Previous years topics have included: Sustainable Stormwater Management; Wetland Protection; Groundwater Protection; Renewable Energy: Getting it Right, Ecologically & Economically; Outdoor Recreation and the Environment; Energy Conservation and Renewable Energy; Acting Locally for Climate Protection: Protecting Cultural Landscapes; Natural Resource Management in the Urban Environment; Strengthening Local Food Systems; Introduced Species and Biodiversity Conservation; Open Space Planning; Watershed Management; Pest Management; Community Wastewater Treatment and Disposal.

Envirothon participants rely on teamwork to study, discuss, and learn at the soil pit.

The learning is always mixed with fun at the Envirothon. Participants during the 2003 event at Heifer International's Overlook Farm in Rutland take a break to enjoy a hayride.

The Department of Conservation and Recreation has been actively involved with the planning and implementation of the Mass Envirothon program dating back to the first years of the program. The Envirothon

25 Years of Massachusetts Envirothon History

Year	Focus	Location	Winning Team
2013	Trees, Forests, & Sustainability	Borderland SP	Newton North HS
2012	Stormwater Management	Blackstone River SP	Newton Community Farm
2011	Wetland Protection	Great Brook Farm SP	Lexington HS
2010	Groundwater Protection	Otter River SP	Lexington HS
2009	Renewable Energy	Doyle Conservation Ctr	Tantasqua Regional HS
2008	Recreation & Environment	Hopkinton SP	Lexington HS
2007	Energy Conservation	Mount Wachusett CC	Bristol County 4H
2006	Local Climate Protection	Blackstone River SP	Bristol County 4H
2005	Cultural Landscapes	Essex Aggie	Bristol County 4H
2004	Nat. Resource Protection	Cochituate SP	Acton Boxborough HS
2003	Local Food System	Overlook Farm	Bristol County 4H
2002	Biodiversity	Borderland SP	Needham Area Home Sch
2001	Stormwater Management	Mass. Electric	Needham Area Home Sch
2000	Wetland Conservation	Gore Place	Needham Area Home Sch
1999	Open Space Planning	Hampshire College	Barnstable HS
1998	Watershed Management	Mount Wachusett CC	Lawrence Academy
1997	Pest Management	Borderland SP	Patriot Trail Girl Scouts
1996	Wastewater Treatment	Quabbin Visitors Ctr	Pittsfield HS
1995	Groundwater	Great Brook farm SP	Pittsfield HS
1994	Acid Rain	Buck Hill Cons Area	Lunenburg HS
1993	Non-Point Source Pollution	Buck Hill Cons Area	Lunenburg HS
1992	Wetlands Protection	Buck Hill Cons Area	Lunenburg HS
1991	Water Resources	Buck Hill Cons Area	Lunenburg HS
1990	None Specific	Buck Hill Cons Area	Lunenburg HS
1989	None Specific	Buck Hill Cons Area	Lunenburg HS
1988	None Specific	Buck Hill Cons Area	Lunenburg HS

A Barred Owl looks on as participants scramble to answer the challenge at the Envirothon's wildlife station.

competition was held at Quabbin Reservoir in 1996; since then the State Parks Division has hosted the event at various facilities, including Borderland State Park, Lake Cochituate State Park, Great Brook Farm, Otter Brook BP, Blackstone Heritage State Park and Hopkinton State Park.

The connection between DCR – as well as its sister agencies within the Executive Office of Energy and Environmental Affairs – and the Mass Envirothon is a natural link. The program encourages environmental stewardship and protection while supporting community service among our youth. Everyone who participates in the Mass Envirothon comes out a winner!

Proud champions: the team from Newton North High School was the overall winner of the 2013 Mass Envirothon.

Thoughts from the new Envirothon Water Station Coordinator

by Kelley Freda, DCR/DWSP Environmental Analyst

I took over the water portion of the Mass Envirothon for 2013 and introduced new topics related to the ever evolving field. I wanted students to be aware that water quality and watershed management are dynamic, and that scientists don't always have all the answers. Regardless of whether they win or lose the competition, they need to be aware of the issues that they will be facing in their world for years to come.

New topics that were inserted into the Envirothon water curriculum include: pharmaceuticals and personal care products (PPCPs), stormwater pollution, watershed forest management, and climate change. Students will now learn how these different issues are interdependent, all playing an important part in water quality. Federal and state laws that work to ensure water quality are also now part of the Envirothon's water station. These new issues have already raised the kids' understanding of water quality.

Many students were shocked to learn what is, and is not, removed during the water treatment process. They found out about PPCPs and how they persist in the environment once they are flushed down the drain. Some of these chemicals end up in our streams and rivers, affecting everything from drinking water to aquatic life.

Clockwise from above: Students collect and identify benthic macroinvertebrates with Kelley Freda. Dan Giza from Alden Labs works with students to analyze data. Students collect water quality data with a digital meter.

Climate change is a hot topic (pardon the pun). Students now have the opportunity to focus on how this major issue in their lives impacts water resources. They are able to discuss how climate change is causing more frequent and intense storms, changing water quality, diminishing fresh water supplies, drying up streams, and adding pollutants into our drinking waters.

These new topics enhance the existing information on the hydrologic cycle. The revamped water station provides a wide perspective that will help Envirothon participants become good stewards of water quality.

Stonewalls - continued from Page 2

DCR watershed system. Retaining walls keep property or roads in place. Boundary walls indicate the edges of an owner's property. Estate walls are more impressive built walls, usually created by a stone mason to enhance a property. Cattle guides were used to keep animals moving in the right direction and pens were created to contain animals. Foundation walls and cellar walls were built to support a house, barn or other building. Walking walls made shoveling snow in winter and moving around during mud season easier.

Check out the variety of stone walls as you drive or walk around the watershed, or any portion of rural New England, and contemplate the effort that went into creating these historical landmarks. As a bonus, see if you can determine the purpose of the wall.

Above is an ideal example of a "filled wall." Two outer walls retain space in between which is filled with stones and debris that erupted from the soil over successive years of use.

This nicely constructed estate wall, below, shows how a skilled mason took the time to give careful attention to form and fit of the stones as a statement to the landowner's prosperity

Emerald Ash Borer - continued from Page 3

First found in the Chicago area in the 1990s, EAB inhabits only White ash (*Fraxinus americana*), black ash (*F. nigra*), red ash (*F. pennslyvanica*), green ash (*F. pennsylvanica var. subintegerrima*) and several horticultural varieties of ash. This tree type is a vital part of the New England forestscape.

EAB is identified by its golden green or brassy color body with darker, metallic emerald green wing covers. The adults measure 3/8" - 5/8" (8.5 - 13 mm) in length, with females being larger than males. Adults are present from mid-May to late July. They feed on leaves, leaving irregularly shaped patches with jagged edges. Larvae are flattened in appearance, consisting of 10 cream-colored, bell-shaped segments with a pair of brown pinchers at one end and measure about 1- 1¼" (26 - 32 mm) in length when fully developed.

This picture shows bark damage to an Ash tree that has been seriously harmed by the Emerald Ash Borer. The tree will now become weakened, misshapen and vulnerable to fatal disease.

The damage EAB inflicts includes distinct 'S'-shaped tunnels formed beneath the bark from larval feeding, with vertical splits in the bark caused by callus tissue forming in response to larval feeding. Adult emergence leaves 'D'-shaped exit holes (3-4 mm in diameter) in the bark. Eventually, the upper third of the tree dies back and numerous shoots arise below the dead portion of the trunk, leaving the tree misshapen, weak, and vulnerable to disease and other natural challenges.

If you think you have seen EAB or its tell-tale damage, you are urged to contact the agencies listed on page 7.

Kids Corner

Try The Water Supply Jumble

Unscramble the jumbled water-related words and make use of the circled letters to solve the riddle at right. The answers are below...but no peeking!

ROMTS ○○_ _ _ _

NADTWEL ○_ _ _ _ _○

ILALNFAR _○_ _ _ _ _ _

IVERSERRO _○○_ _ _ _ _

RYOLDYHOG ○_○_ _ _ _ _

"This radio is soaked." *"Mine too!"*

Where do the Wachusett Reservoir rangers keep their equipment?...

In the _ _ _ _ _ _ _ _ _ _ !

And another thing...

by J. Taylor

"Hey! Did you read this? They're talking about me!"

WBZ-TV's weekend morning AccuWeather Meteorologist Joe Joyce's dog, Luna, had her picture taken by DCR's Kelley Freda at an Earth Day event. Luna seemed particularly interested in the importance of picking up after ones pet!

For more information about...

The Mass Envirothon:
Massachusetts Envirothon Website
www.maenvirothon.org
North America Envirothon
www.envirothon.org

Stonewalls:
The Stonewall Initiative
www.stonewall.uconn.edu
***Exploring Stone Walls,* by Robert M. Thompson. Walker & Sons, New York. 2005.**

Emerald Ash Borer:
MA Dept of Conservation and Recreation
www.mass.gov/dcr
US Forest Service
http://na.fs.fed.us/fhp/eab/
USDA Animal and Plant Health Inspection Service
www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/
EAB Coalition
www.emeraldashborer.info

Jumble Answers:

Storm, Wetland, Rainfall, Reservoir, Hydrology, Watershed

The Braccianti Built the Dam

By Rebecca Boronoski, DCR Wachusett Ranger

The Wachusett Reservoir and Dam remain a historic feat of hard work and engineering. These structures are known today as two of the largest hand built water facilities in the world.

This amazing source of drinking water was constructed by hundreds of men who labored for ten years, relying mainly on simple hand tools and horses. The project's time frame, 1896-1906, came just before the availability of gasoline powered hydraulic engines. Only the heaviest work utilized steam powered machines, which still required labor for shoveling coal.

"The Braccianti" take time to pose at the top of the Wachusett Dam while still under construction, around 1905.

About two thirds of the workforce were Italian immigrants, many of whom did not speak English, that came to America in search of work. They were known as "braccianti" — unskilled labor. However, they displayed their craftsmanship in building the 415 foot high dam while moving over 6.9 million cubic yards of soil, 380 houses, schools, churches, and mills, and several miles of roads and railways.

Many of the Italian laborers settled in the area after the project was finished. As a result, many Italian Americans who live in the region today can proudly say that their ancestors helped build the Wachusett Reservoir and Dam.

downstream

Department of Conservation and Recreation
Division of Water Supply Protection
Office of Watershed Management
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Downstream is produced twice a year by the Massachusetts Department of Conservation and Recreation, Division of Water Supply Protection. It includes articles of interest to the Watershed System communities. Our goal is to inform the public about watershed protection issues and activities, provide a conduit for public input and promote environmentally responsible land management practices.

Governor: Deval L. Patrick
EOEEA Secretary: Richard K. Sullivan Jr.
DCR Commissioner: Edward M. Lambert Jr.
DWSP Director: Jonathan L. Yeo
Downstream Editor: James E. Taylor

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Massachusetts Department
of Conservation and Recreation
Division of Water Supply Protection
www.mass.gov/dcr/watershed

Quabbin Islands

The High Grounds of the Swift River Valley

Clif Read, Director, DCR Quabbin Visitors Center

Baffle Dams connect the 40 acre Walker Island, in the foreground, and Mount Zion, Quabbin Reservoir's largest island at 1,410 acres. The baffle dams and islands redirect the flow of Ware River water brought by viaduct so that it takes up to five years before it is used for drinking water.

The most striking physical feature of the Quabbin Reservoir when seen from the air is its sheer size. The 25,000 acres of reservoir surface stretches 18 miles from its southern most point at Winsor Dam in Belchertown to the northern end in New Salem. At its widest point, Quabbin Reservoir spans six miles east to west, from Gate 43 in Hardwick to the shores of its West Arm in Pelham.

A closer examination reveals 66 islands dotting the landscape, ranging in size from Mount Zion at 1,410 acres to a number of small unnamed islands less than an acre in size. The total area for all the islands is 3,672 acres, which also adds 63 miles to the reservoir shoreline. Following Mt. Zion, the islands larger than 100 acres in size in descending order are: Mount L, Little Quabbin, Pomeroy, Leveau, Moore, Russ, Curtis, and Liz.

These islands are fascinating features of the former Swift River Valley and carry with them an interesting history. Before the valley was flooded to create the Quabbin Reservoir, the area was characterized by low, flat plains cut by three different branches of the Swift River. Rising up from the valley floor were the north/south oriented ridges which define the western and eastern edges of the watershed, and the Prescott ridge in the middle of the valley.

There were isolated hills such as Mt. Liz, Mt. Pomeroy, and Curtis Hill; impressive monoliths anchored to the valley floor. Historic photos show these imposing landmarks that oriented both Native Americans and the colonists who followed into the valley.

Quabbin began to fill in 1939, but it took seven years to complete the inundation of the valley. As rising waters crept slowly over the landscape, smaller hills were covered entirely, while the bases of taller peaks were flooded and islands were created. The topographic features we see today are the proverbial tip of the iceberg.

The name Quabbin is a Native American word that was used to describe the Swift River Valley region. Roughly

Continued on Page 4

Water of Champions is Champion of Water

DCR and MWRA water wins regional award

By Joel Zimmerman, DCR Regional Planner

Many people may fondly recall the iconic moment in 2011 when the Boston Bruins' injured forward Nathan Horton poured a squeeze bottle of Boston water onto the ice of Vancouver's Rogers Center, helping the team skate to a Stanley Cup championship. Did you know that not only are Boston's sports team championship caliber but so is its drinking water, as it has twice been named "New England's Best."

The New England Water Works Association holds a drinking water contest at its annual conference. Samples from competing New England water utilities were tasted at room temperature by an impartial panel of judges and scored on a 1-10 scale. The winner of the annual contest, now in its fourth year, receives bragging rights, a large trophy, and the opportunity to enter the national water taste test in June 2014. This year, for the second time, the source water from the Quabbin and Wachusett Reservoirs, managed by the Department of Conservation and Recreation that is then treated and distributed by the Massachusetts Water Resources Authority, took home the 2013 award for "New England's Best" drinking water.

DCR and MWRA staff at Quabbin Reservoir proudly display the New England's Best Drinking Water trophy.

DCR and MWRA take their championship trophy on a tour, just like the Stanley Cup. The trophy travels to the drinking water supply systems' offices and field locations, visiting all the staff that ensure the quality of this superior drinking water for 2.5 million people.

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The QuabCam

Reservoir view on demand

By Rita Convery, MWRA Communications Director

The Massachusetts Water Resources Authority (MWRA) installed a web cam on the windowsill of DCR's Quabbin Visitor Center in 2007 to stream real-time photos of the reservoir from its website, www.mwra.com/qcam.html.

Fred Laskey, MWRA's Executive Director, came up with the idea when the agency was upgrading some if its security cameras. "It's such a magnificent place, but too far away to visit very often," he said. "So, now you can take a virtual visit whenever you want. I knew we had the technology and thought people would like it."

And like it they do. QuabCam has a fan base that captures still photos and sends in comments. James S., a QuabCam fan and amateur entomolo-

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A sampling of images from the QuabCam

DCR Going Batty

Water Supply Protection Efforts Help Restore the Wachusett Bat Population

By Jillian Pereira, DCR Wildlife Technician, and Allan Rantala, DCR Environmental Analyst

A Little Brown Bat rests on the glove of a DCR Forester, awaiting return to the wild.

Halloween is fading away, but we can still hold faint thoughts of spiders, witches, and, of course, vampire bats! While many people are terrified of bats due to their portrayal as vicious, disease carrying blood suckers, the truth is they are not that scary and actually play a vital role in the local ecosystem.

All bats found in Massachusetts are insectivores, feeding primarily on mosquitoes, moths, and other night-flying insects. They can consume thousands each night and, like most wildlife, they seldom show aggression unless threatened or sick. In addition to eating tons of insects, bats are an important food source to raptors, skunks and raccoons.

Little Brown and Big Brown Bats, two of the most common Massachusetts species, form large nursery colonies during the late spring and summer months. Females roost in dark, hot places such as attics, barns, and other outbuildings to give birth and raise their young. Males, often solitary or in groups less than a dozen in the summer, roost in cooler spots behind window shutters and awnings and under the bark of trees. The bats emerge from their roost sites at sunset to search for food throughout the night.

Bats have excellent eyesight but because they are nocturnal and hunt in the dark, they use echolocation to detect their prey by emitting high frequency sound that bounces back to their ears and enables them to locate their food and other objects.

Most bats in the northeast hibernate using caves and old mines as their hibernacula (winter shelter), mainly in western Massachusetts, upstate New York, and Vermont. Bats that hibernate in caves face the danger of contracting White-nose Syndrome (WNS), a mysterious disease that is devastating bat populations in the Northeast and other parts of the U.S.. Since the discovery of WNS in 2006, the bat population has dwindled 90-100% in some Northeast hibernacula.

Though scientists still do not know the cause of WNS, signs point to a cold-loving fungus called *Geomyces destructans* that gets in the bats' skin. Bats with the disease are often marked with a white powder that covers the nose and other parts of the body. They also exhibit abnormal behavior, such as flying during the day or in the winter when they should be hibernating. The four species in Massachusetts that use hibernacula are the Little Brown Bat, the Northern Long-eared Bat, Small-footed Bat, and Tri-colored Bat. The Little Brown Bat was once the most abundant species in the state and is now listed as endangered.

In the early spring of 2013, DCR Water Supply Protection staff constructed and installed two designs of bat houses to help the population rebound. Five houses were deployed in three locations around the Wachusett Reservoir. These houses will likely be used by females for rearing pups but may also be used by the males.

In late July, DCR staff surveyed the houses and found that bats were using

Continued on Page 6

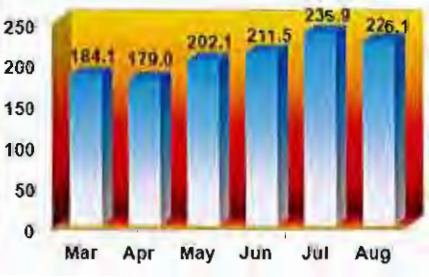
This picture looks up into the open bottom of a popular bat house similar to the ones recently constructed by DCR.

- Reservoir Watch -

Reservoir levels and 6-month precipitation

Reservoir	Quabbin	Wachusett
Minimum	523.5'	389.5'
% Full	87.9%	89.1%
Date	3/1/13	3/28/13
Maximum	528.2'	393.2'
% Full	96.5%	96.3%
Date	7/9/13	6/16/13
Precipitation	29.2"	21.8"
Seasonal Avg	25.2"	23.4"

System-wide 6-month Water Usage (in million gallons per day) March 2013 to August 2013



Data courtesy of MWRA

Islands of the Quabbin

From Page 1

translated as "the meeting of many waters" or "a well watered place," Quabbin was an apt descriptor of the valley, as water was in abundance throughout the area due to the Swift River and numerous ponds, lakes, and streams.

While most of the Native American names for hills were lost over the years, two large hills in what became Greenwich and Enfield were called Big and Little Quabbin. Today, Little Quabbin is an island which covers 397 acres visible from the Enfield Lookout on the north side of Big Quabbin.

The next island to the north is called Mt. Liz, named for Elizabeth Rowlandson, the daughter of a minister who apparently was captured and killed by Native Americans.

A little further north lies Mt. Pomeroy with it graceful bowl shaped peak at the island's south end and gently sloping northern face. There seems to be less agreement on the origin of the Pomeroy name. One story refers to a great hunter of the region, famous for the large number of bears he killed each year. A competing story has it named for a man burned at the stake by Native Americans.

Other hills were named for local land owners (Chapman, Curtis, and Walker), shapes such as an "L" contour, or natural features (Den).

In addition to serving as landmarks, some of the hills were the focal point for activities for valley residents. For

A historic photograph shows the 1930 motorcycle hill climb held at Little Quabbin Mountain.

many years Little Quabbin Mountain was the site for the annual Motorcycle Hill Climb, attracting hundreds of spectators and participants from miles around. Riders would start from the flat valley bottom just east of the mountain and race their motorcycles up the steep hillside to the top, gaining nearly 500 feet during their ascent.

Curtis Island is the site of the former Dugmar Golf Course, a 1920s speculative land venture by two gentlemen from Springfield. When Thomas Mahar and John Duggan bought the 147 acres of land in Greenwich in 1924, the Swift River Act had not yet passed the Massachusetts Legislature, however it was a foregone conclusion that the Quabbin Project would move forward. They constructed a nine hole golf course in the valley, an area now covered by water. They also built a club house on Curtis Hill, just above the reservoir flow line at its capacity. Were Mahar and Duggan shrewd speculators or lucky businessmen who parlayed a land purchase into a windfall when they were finally bought out by the state in the 1930s? No matter your opinion, the foundation of the club house is still visible above the water line, evidence of a by-gone era.

The reservoir's largest island, Mt. Zion, and the smaller Walker Island immediately to the south, are technically not islands due to the baffle dams that create a land bridge to the mainland. From the south end of Mt. Zion, the North Baffle Dam extends 1,615 feet to Walker Island, and then the South Baffle Dam connects to the mainland from the south end of Walker Island.

These two islands and the two baffle dams form a diversion barrier for water entering the reservoir from the Swift River East Branch and from the Ware River. Due to Ware River water's higher sediment load, nutrient and organic content, the retention time is increased in Quabbin by redirecting the water northward in a counterclockwise direction around Mt. Zion. This additional distance increases the residence time in Quabbin by nearly five years, allowing greater natural purification and an improvement in water quality.

Den Hill, a moderately sized island of 50 acres, is located just east of the baffle dams. When Quabbin was built

This view from the Enfield lookout is a popular spot with visitors to the Quabbin Reservoir. The main body of land across the water to the far left is the Prescott Peninsula (1) which is connected to land at its far northern end. The islands visible in this view include Mt. Liz (2), Mt. Zion (3), Parker Island (4), and Little Quabbin (5).

part of the western face of Den Hill was excavated, providing rock used on the facing of the baffle dams. The large scar from this excavation is still visible today, rising up from the water line.

The Quabbin's islands have remained undisturbed since they were formed in the 1940s. Public access is prohibited on all the islands. Forest management has not occurred with the exception of a few operations during periods of low water decades ago. Over the years there have been a few natural resource inventories and research projects conducted on these lands.

A quiet moment on the shores of Russ Mountain, a 141 acres island in Quabbin Reservoir.

Eagles and loons utilize different islands for nest sites, deer and moose swim back and forth to islands, and winter ice provides a bridge for larger wildlife to access the islands, so there is some animal movement from surrounding land. Nevertheless, the islands of Quabbin Reservoir are entities onto themselves, each with their own fascinating history, ecology, and place in the water supply system landscape.

Environmental Reference Points on the Quabbin Islands

by Thom Snowman, DCR Natural Resource Specialist

Natural resource studies frequently make use of "reference" or "control" conditions in places isolated from daily human activities and subjected primarily to natural processes. This data provides important comparisons to conditions brought about by areas more directly affected by human interaction. While no natural area is completely free of human influence, the Quabbin islands are largely inaccessible and have generally been left on their own to cope with natural disturbances, as well as grow without the influence of active forest management. As a result, they are of interest for comparisons to areas more affected by human impacts.

Since 1960, Division of Water Supply Protection (DWSP) Forestry and Natural Resources staff have tracked changes on all watershed forestlands through a Continuous Forest Inventory (CFI). The study established over 350 evenly spaced one-fifth acre inventory plots across the DWSP watershed properties, including 20 plots spread over 10 islands.

Reassessed every 5-10 years, every tree greater than 5.5" diameter is identified, numbered, measured and its progress tracked. This uncommon dataset provides excellent background information on growth and change within our forests.

Forest types on the islands include hardy ridgeline stands of oak, mature northern hardwoods (Ash and Sugar Maple), and tall mature pines on the western and northwestern faces, in particular on Mt. Zion, that escaped the devastating 1938 hurricane. Agricultural practices at the height of farming in New England (mid-1800s) brought the vast majority of watershed properties, including what are now islands, into service as tillage, pasture, or woodlot, so that no true "old growth" has been found.

In addition to tracking broad changes in the forests, DWSP also monitors several small populations of rare and endangered plants that have been discovered on the islands. Rare plants have persisted on the islands primarily on very steep or rocky slopes that were not disturbed by early agriculture or logging.

While these populations are now well-protected, even on the islands they are coming under the threat of expanding populations of non-native, invasive species, including Japanese barberry, Asiatic bittersweet, and common reed. Seed from these species is spread by birds and other wildlife and these invasives, once established, readily occupy areas that are disturbed by natural occurrences such as tree-toppling winds or snow and ice damage.

DCR staff on the beach of Mt. L preparing to asses CFI plots in the 2010 survey. Mt. L is the reservoirs second largest island at 543 acres. It has two CFI plots.

The QuabCam - continued from Page 2

gist from North Carolina, collects stills of the spiders that set up shop in front of the lens – and their victims. Florida retiree 'Ford21' writes in from time to time to share cam stills of especially pretty sunsets. He says that he likes to keep the QuabCam on to watch for passing boats, which remind him of his younger days spent fishing in New England.

Kristin MacDougall, who answers 'Ask MWRA' questions noted, "For some of our viewers, the sight of boats on the QuabCam can be a cause for suspicion. Over the years, I have received several emails from concerned citizens asking if boats were searching for a body in the reservoir!" She added, "They are always relieved to learn that they are just part of the DCR and MWRA sampling or bird harassment programs. It is good to know that people across the country are keeping their eyes open."

The camera takes a live photo every 20 seconds, automatically refreshing in between shots. The footage is not saved, but MWRA posts stills on its Flickr page from time to time. If you have a favorite, send it along to ria.convery@mwra.state.ma.us.

Downspout on the Water

DCR staff member captures rarity

By Joel Zimmerman, DCR/DWSP Regional Planner

The tornado downspout over Quabbin Reservoir captured by DCR's Joe Stafford on 9/1/13.

While the QuabCam automatically captures the view looking north from the Quabbin Administration Building in Belchertown, the reservoir is so vast that it still takes the human touch sometimes to see a singular event.

That is what happened on Labor Day weekend, when DCR's Joe Stafford was in the right place at the right time to snap an extraordinary picture. Joe noticed from his vantage point at the Gate 8 Boat Launch Area what appeared to be the tail of a funnel about half way down from the cloud base, and could see the dam and the boat house on the other side.

Once the tail touched down it whipped up enough water that he could no longer see much on the other side. He grabbed a couple of quick pictures and wondered whether he had just witnessed a tornado.

Joe's pictures were sent along to some weather enthusiasts, who then passed the information to the National Weather Service. Less than a week later, it was confirmed that there was indeed a tornado over Quabbin Reservoir! Meteorologists noted that it is rare to have only one person observe a waterspout and an even more unique feat to have that person take a photo of it, but that is what happened in this case. Fortunately no damage was done by this tornado, but thanks to Joe and his quick actions, we can all see this phenomenon.

Going Batty

- continued from Page 3

each one! It was very encouraging to see them put to use in their first year.

Bat Facts:

- It is estimated that an individual bat can eat 600 insects per hour.
- No U.S. species drinks blood.
- Some bats have existed in their present form for at least 50 million years.
- Bats usually give birth to a single annual litter of one or two that may weigh up 20% to 30% of the mother's weight. This is comparable to a 100 pound human female giving birth to a 20 to 30 pound baby!

This bat house, installed on DCR property, has a two-sided design offering the choice of sunny or shaded sides for roosting and is painted black to ensure maximum heat gain.

How to help the bat population:

- Stay out of caves and mines where bats are known to use and abide by cave restrictions and/or closings.
- Report unusual bat behavior to the Massachusetts Department of Fisheries and Wildlife.
- Provide a chemical-free, natural habitat around your home.
- Construct a bat house.

Kids Corner

What's in middle of the Res.?

Fill in the blanks below to complete the list of things found around the edges of the Quabbin Reservoir, Then read the new letters down and find out what is in the reservoir.

Por__upine
Spi__lway
Tr__es
R__ngers
Shoreli__e
Stone__alls
E__gles
We__lands
Str__ams
Dee__

And another thing...

by J. Taylor

The QuabCam captures another tourist visiting the tranquil Quabbin Reservoir, known far and wide for its out of this world drinking water.

For more information about...

Quabbin Reservoir Islands and History
Swift River Valley Historical Society
http://swiftrivermuseum.org/
Friends of Quabbin
www.foquabbin.org/

New England's Best Drinking Water
Massachusetts Water Resources Authority
www.mwra.com
New England Water Works Association
www.newwa.org
American Water Works Association
www.awwa.org

Bats
White Nose Syndrome: North America's Response to the Devastating Bat Disease
http://whitenosesyndrome.org/
Bat Boxes
www.batconservation.org/bat-houses/build-your-own-bat-house

Then and Now

Filling Quabbin Reservoir

Clif Read, Director, DCR Quabbin Visitors Center

The flooding of the Swift River Valley to create the Quabbin Reservoir commenced on August 14, 1939 and took seven years before the reservoir reached capacity. Two massive impoundment structures hold back the 412 billion gallons of water of the reservoir: the Winsor Dam blocks the flow of the Swift River and the slightly smaller Goodnough Dike several miles to the east holds back water from the Beaver Brook drainage.

The top view was taken on November 4, 1939, just above the rotary on the west end of the Goodnough Dike. Looking north over the low, flat valley and the former land area of Enfield and Greenwich, the image shows a pool of water forming behind the dike, the cleared valley floor and the future islands of Mt. Liz and Mt. Pomeroy. The contemporary photograph shows a full reservoir from the same photo point.

downstream

Department of Conservation and Recreation
Division of Water Supply Protection
Office of Watershed Management
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Downstream is produced twice a year by the Massachusetts Department of Conservation and Recreation, Division of Water Supply Protection. It includes articles of interest to the Watershed System communities. Our goal is to inform the public about watershed protection issues and activities, provide a conduit for public input, and promote environmentally responsible land management practices.

Governor: Deval L. Patrick
EOEEA Secretary: Richard K. Sullivan Jr.
DCR Commissioner: John P. Murray
DWSP Director: Jonathan L. Yeo
Downstream Editor: James E. Taylor

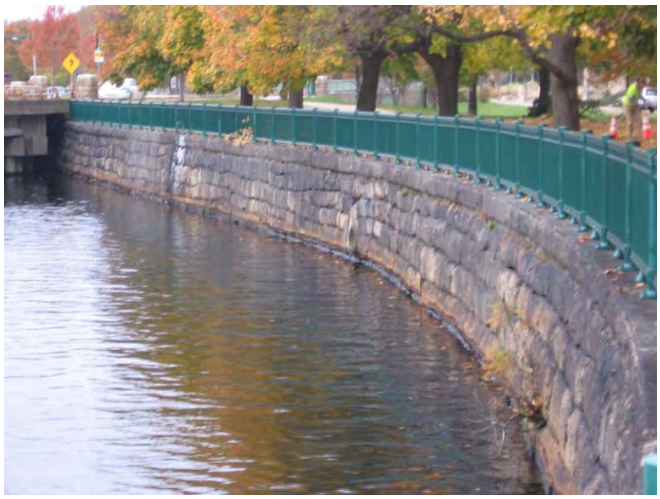
Environment

Prepared for:
Department of Conservation and Recreation
Boston, Massachusetts

Submitted by:
AECOM
Chelmsford, MA
May 2013

Illicit Discharge Detection Report

Permit Year 10 - 2012



AECOM

dcr

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Aaron Hopkins

Prepared By

Kate Sylvest

Reviewed By

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1.0 Introduction

At the request of the Massachusetts Department of Conservation and Recreation (DCR), AECOM Environment (AECOM) developed and performed an illicit discharge detection (IDD) program to identify possible illicit discharge sources in urbanized portions of the DCR's stormwater collection system. This project supports the provisions of Minimum Control Measure No. 3 of DCR's NPDES Small MS4 General Permit. This provision mandates the development and implementation of an illicit discharge detection and elimination plan to identify potentially hazardous releases into the stormwater system and establish the means to eliminate these discharges.

The U.S. Environmental Protection Agency (EPA) defines illicit discharges as any non-permitted discharge to a storm sewer system that is not composed entirely of stormwater. Sources for these flows include direct connections to a sanitary sewer line, piped floor drains from garages or basements, and illegally dumped fluids like motor oil and paint. These discharges can result in serious consequences for the ultimate receiving waterbody, including decreased water quality, the destruction of wildlife habitat, and a decrease in the aesthetic value of the waterbody. Illicit discharges are of particular concern in urbanized areas because of the high concentration of development and industrial and commercial facilities. However, non-permitted discharges that do not carry pollutants are not considered illicit including culverted streams, groundwater seepage, and potable water (Brown, Caraco & Pitt 2004).

Since this program began in 2008, AECOM has performed the following tasks to assess DCR's stormwater systems for illicit discharges:

- Program Year One - 2008
  - Produced a five year inspection schedule and rotation
  - Developed an illicit discharge identification and testing protocol
  - Performed illicit discharge inspections on approximately 20% of the DCR's stormwater systems in urban areas
- Program Year Two – 2009
  - Modified the IDD protocol to reflect improvements identified in Program Year One
  - Performed illicit discharge inspections on approximately 20% of the DCR's stormwater systems in urban areas
- Program Year Three – 2010
  - Modified the IDD protocol to reflect changes to field testing procedure
  - Modified the IDD rotation to reflect new priority areas
  - Performed illicit discharge inspections on approximately 20% of the DCR's stormwater systems in urban areas

- Program Year Four – 2011
  - Modified the IDD protocol to reflect changes to field documentation procedure
  - Performed illicit discharge inspections on approximately 20% of the DCR's stormwater systems in urban areas

The next sections detail the procedure and summarize the results from year five of the IDD Program.

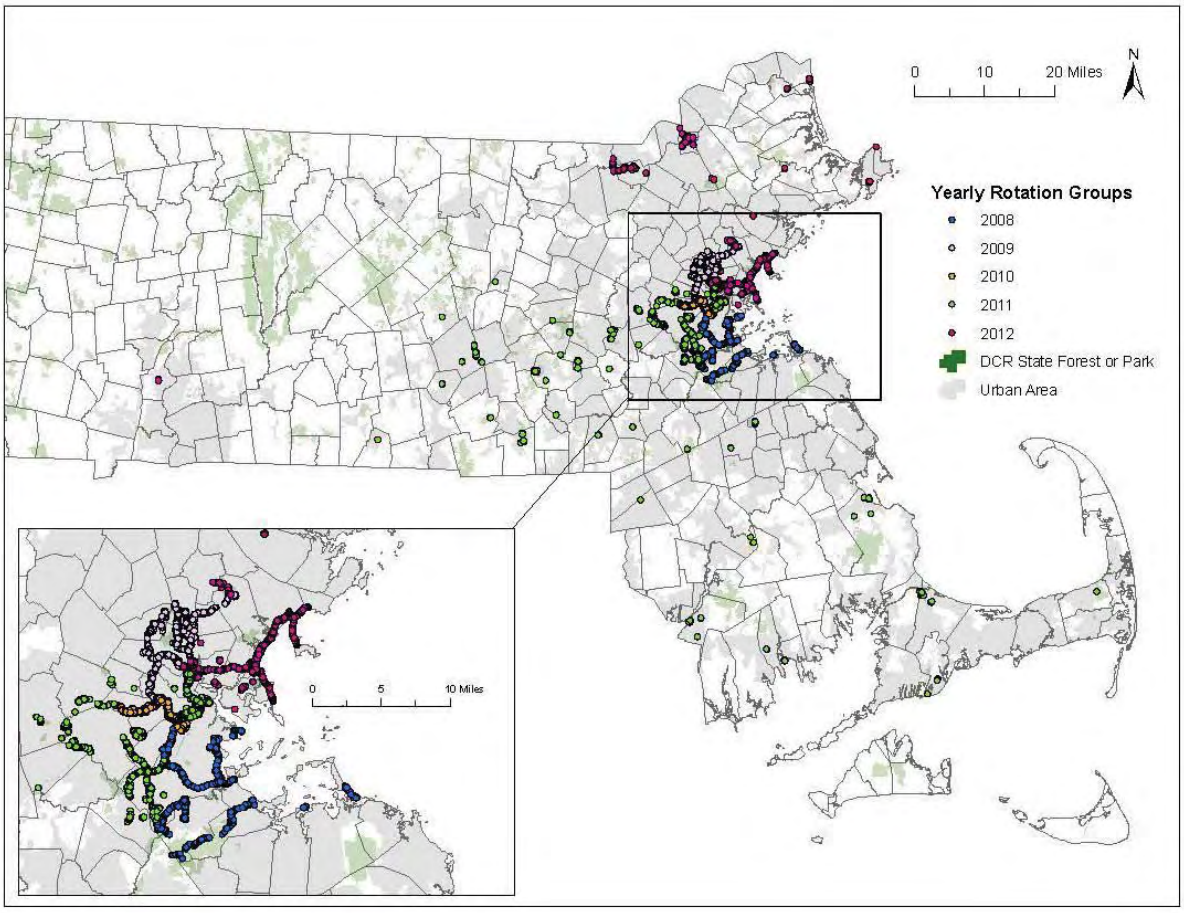
2.0 Methods

This section presents the methods AECOM used to develop and implement an IDD program for the DCR. In Program Year One (2008), AECOM divided the DCR's urban stormwater systems into five inspection zones, as presented in Section 2.1 and Figure 2-1. The IDD protocol developed in Program Year One was updated in the second, third, and fourth year of the program to reflect improvements and modifications as explained in Section 2.2. Section 3.0 describes AECOM's results for Program Year Five.

2.1 Five Year Inspection Rotation

In support of NPDES requirements, AECOM designed a rotating schedule to ensure that urban portions of DCR's stormwater systems will be investigated once every five years. AECOM previously mapped DCR's stormwater infrastructure in urban areas using digitized, scanned drainage plans, and field recorded global positioning system (GPS) data. Several aspects of these data were analyzed to establish five comparable IDD zones, shown in Figure 2-1, including: spatial continuity, number of stormwater features, total road miles, and proportion of data from drainage plans versus GPS surveys.

Figure 2-1. Yearly Rotation Groups



Prior to developing an inspection rotation, AECOM examined priority areas listed in the Stormwater Management Plan including suspected illicit connections based on previous site visits and direct discharges to impaired waterbodies. With the DCR, AECOM determined that these priority areas have a state-wide spatial distribution that would hinder IDD program implementation. Therefore, each rotation zone contains stormwater features and road miles grouped by spatial location. Approximately 50 percent of the infrastructure data for each zone are from scanned plan data and therefore had not been field verified prior to AECOM's IDD investigations.

2.2 Illicit Discharge Detection Procedure

AECOM performed illicit discharge detection investigations according to the protocol developed with the DCR in 2008, and revised in subsequent years of the program (see Appendix A), based on the Charles River Illicit Discharge Detection and Elimination Protocol, adopted from BWSC (2004) and Pitt (2004). The protocol relies primarily on visual observations and the use of field sampling and analysis using portable instrumentation during dry weather to complete a preliminary inspection and analysis of stormwater systems. AECOM compiled a field analytical kit designed to isolate the general source of a discharge based on its chemical characteristics. This process of testing samples and reviewing results in real-time provides a significant advantage in allowing field crews to perform further field reconnaissance and potentially identify the source of flow as a sanitary sewer, industrial discharge, natural source, or domestic water.

The AECOM team attempted to schedule field investigation activities to occur at times with less than a tenth of an inch of rain in the preceding 48 hours to ensure observed flows were the result of non-stormwater discharges. However, in cases when surveys took place within 48 hours of a rain event, field teams noted any observed flows and flagged those stormwater systems for a future visit during dry weather conditions. Using the stormwater system spatial database as a guide, field crews visited each accessible manhole or catch basin in a stormwater system, removed their covers and performed a thorough visual inspection. Notable visual indicators of illicit discharges consisted of dry weather flow, suspicious pipes, or any evidence to suggest potential contamination from intermittent sources. Signs of potential contamination included odors, staining, floatables, and foaming which could indicate the presence of sewage or wash water. Non-debris floatables could also indicate the presence of sanitary sewer water. Flows that field crews determined to be culverted streams or groundwater (by visual observation) were not noted as potentially illicit.

The field crew recorded illicit discharge observations and updates to the stormwater system spatial database in real-time on a hand-held field computer (Panasonic CF-U1 Toughbook). Field crews used a Trimble Pro XT external GPS receiver with sub-meter accuracy connected via Bluetooth technology to the handheld computer to record locations and data. Field crews recorded IDD program data in AECOM-designed data entry forms and associated data tables on the handheld computer using ESRI ArcPad version 10.0. The field computer contained aerial photographs, road maps, and the existing stormwater system data for reference and editing purposes. In areas where the stormwater system had been previously field surveyed, the field crew only recorded IDD program specific observations. When stormwater data originated from scanned design plans, the field crew took GPS coordinates and updated attributes for features within that system. Following field inspections, illicit discharge records and revised infrastructure data were then downloaded into Geographic Information System (GIS) software to update the DCR's stormwater database.

Improvements to the IDD Protocol made prior to the Program Year Two field season included use of the Toughbook hand-held computer, implementing advanced feature symbology, and enhancing data validation tools. These modifications led to the field inspection of nearly 100% of the stormwater

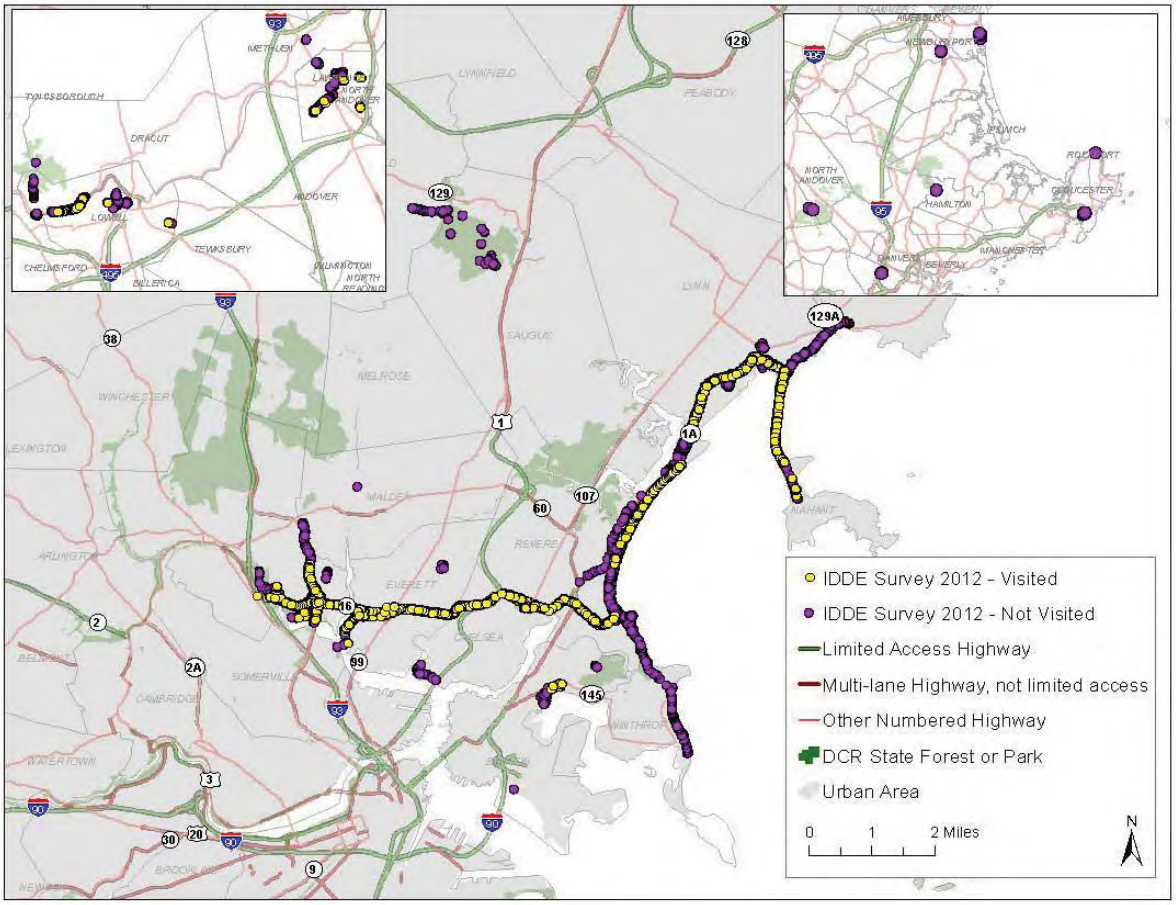
features in the investigation areas. A further modification made prior to Program Year Three was to replace the previously used boron test with an anionic surfactant test to identify non-borate based detergent contamination in analyzed flows. An improvement made prior to Program Year Four was to require field crews to fill out a summary form at all features where flows were observed to enhance the documentation process (Appendix B). Another improvement made prior to Program Year Four was the introduction of a GPS-equipped camera. The GPS camera, when paired with GIS, linked photographs taken in the field to features mapped in GIS and streamlined desktop analysis of illicit flows.

AECOM notified the DCR of observations and sampling results that indicated the presence of an illicit discharge. Evidence of intermittent illicit discharges, including staining and odors, noted during the field effort are recorded in DCR's stormwater database and will be available to future field and maintenance crews to help identify potential problem areas.

3.0 Program Year Five Results

AECOM implemented the IDD protocol outlined in Appendix A, commencing the fifth year of field investigations of the DCR's stormwater systems on August 23, 2012. The effort focused on the DCR parks and parkways just north of the Charles River including the Mystic River Reservation, the Revere Beach Parkway, and the Lynn Shore Reservation (Figure 3-1). Due to the complexity of the roadway layout and associated stormwater systems; the Year Five survey area was not completely investigated during the 2012 field season. In particular, the majority of the Revere Beach Parkway was intersected by numerous frontage roads, parking lots, and side streets with old and overlapping stormwater systems. The additional traffic management and complicated stormwater mapping that was required reduced the survey rate of the field teams. The portions of the survey area that were not visited in 2012 (Figure 3-1) will be visited in 2013 prior to the start of the Year Six rotation.

Figure 3-1. Program Year Five Survey Area



3.1 Sample Location Statistics

During the 2012 field season, AECOM field crews investigated 1,704 stormwater features for signs of illicit connections. Work was conducted in 15 cities and towns on 23 miles of roadway and included features in several DCR parks (Table 3-1).

Table 3-1. Summary of Work by Town

Town	Features	Roads (Miles)	Parks
Boston	31	0.2	Neponset River Reservation, Constitution Beach, Charles River Reservation
Brookline	2	*	Hammond Pond Parkway
Cambridge	4	*	Charles River Reservation
Chelsea	63	0.4	-
Everett	296	4.9	Revere Beach Parkway, Mystic River Reservation
Lawrence	53	*	Lt Col E.J. Higgins Mem Pool, Lawrence Riverfront S.P., Lawrence Heritage S.P., Geisler Memorial Pool
Lowell	73	*	Raymond J. Lord Memorial Pool, Lowell Heritage State Park, John J. Janas Memorial Rink
Lynn	239	4.2	Lynn Shore Reservation, Lynn Heritage State Park, Carroll Parkway
Medford	449	5.2	Mystic River Reservation
Milton	1	*	-
Nahant	117	1.5	Nahant Beach, Lynn Shore Reservation
Revere	371	6.7	Revere Beach Reservation, Revere Beach Parkway
Somerville	2	*	Mystic River Reservation
Ware	1	*	Quabbin Reservoir
Watertown	2	*	Charles River Reservation
Total	1704	23.2	-

*Features in parks only

Table 3-2 shows the breakdown of stormwater features by type. The stormwater systems were comprised primarily of catch basins, manholes, and outlets but also included other features such as yard drains, drywells, and oil/grit separators.

Table 3-2. Summary of Features Investigated in Program Year Five

Feature	Total
Catch basin	1,009
Manhole	517
Outlet	125
Other	53
Total	1,704

3.2 Sampled Flow Results

Field crews collected samples from 16 features with flow and field tested the discharge for a series of analytes according to the IDD protocol, described briefly in Section 2.2 and outlined in Appendix A. Based upon field analytical test results and field observations, AECOM crews categorized flows as either possibly illicit or not likely illicit. Figure 3-2 shows the procedure used to characterize flow samples from chemical analysis results based on the Charles River Illicit Discharge Detection and Elimination Protocol. In general, high surfactant levels indicate a wastewater source (sanitary sewer or washwater contamination, depending on ammonia to potassium ratio); low surfactant and high fluoride levels indicate a tap or irrigation source; and low surfactant and fluoride levels indicate a natural water source. Field tested temperature and pH, as well as visual inspection of the flow and stormwater system, also contributed to flow characterization. Table 3-3 details the visual observations, analytical results, and recommendations for each flow.

Figure 3-2. Field Analysis Flow Chart

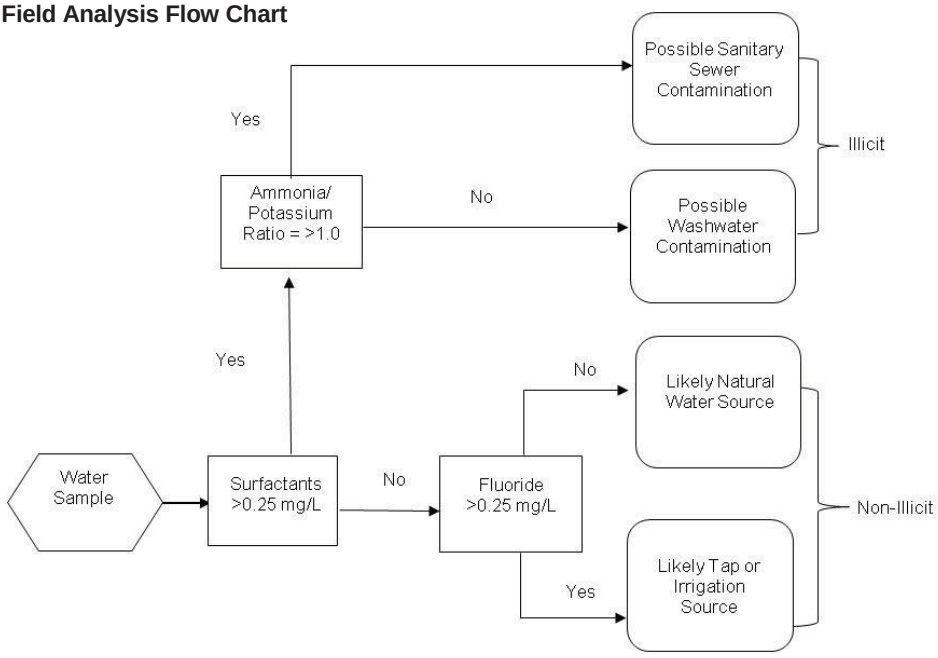


Table 3-3. Summary of Program Year Five IDD Analytical Results

Figure	Feature ID	Flow	Turbidity	Floatables	pH	Temp (°F)	Surfactants (mg/L)	NH_3 (mg/L)	K^+ (mg/L)	NH_3/K^+ Ratio	Fluoride (mg/L)	Potential Source	Justification	Recommended Action
Not Likely Illicit														
	4600	Trickle	None	None	8.4	59.5	0.25	0.00	3.00	0.00	0.28	Natural, Tap or Irrigation	Borderline surfactant, borderline fluoride, no suds observed	No action necessary
	13005	1/4 Full	None	None	8.1	60.4	0.25	NT	NT	NT	0.00	Natural Source	Low surfactant, low fluoride	No action necessary
	14399	Trickle	None	None	6.6	67.5	0.25	NT	NT	NT	0.12	Natural Source	Low surfactant, low fluoride	No action necessary
	14724	1/4 Full	None	None	8.1	74.6	0.25	NT	NT	NT	1.39	Tap or Irrigation	Borderline surfactant, high fluoride, no suds observed	No action necessary
	14984	1/4 Full	None	None	7.5	68.2	0.25	5.00	6.00	0.83	0.26	Natural, Tap or Irrigation	High surfactants, low NH_3/K^+ ratio	No action necessary
	19302	Trickle	None	Oil Sheen	7.4	62.2	0.38	0.00	0.00	NT	0.63	Natural, Tap or Irrigation	High surfactants, low NH_3/K^+ ratio	No action necessary
	25154	Trickle	None	Oil Sheen	6.2	73.0	0.10	2.00	0.00	NT	0.98	Tap or Irrigation	Low surfactant, high fluoride	No action necessary. Likely a tie-in from the adjacent municipal water line.
	25601	Trickle	None	None	8.4	59.5	0.10	NT	NT	NT	1.07	Tap or Irrigation	Low surfactant, high fluoride	No action necessary
	36054.2	Trickle	None	None	7.9	66.2	0.25	1.00	0.00	NT	0.97	Tap or Irrigation	High surfactants, low NH_3/K^+ ratio	No action necessary
Possibly Illicit														
3-3	467	Trickle	None	None	8.8	65.8	0.25	NT	NT	NT	0.81	Tap or Irrigation	Low surfactant, high fluoride	Visited within 48 hours of rain, revisit during dry weather
3-4	4498	Full	None	None	6.8	65.1	1.50	6.00	54.00	0.11	0.72	Washwater	High surfactants, low NH_3/K^+ ratio	Follow up site visit to confirm that flow is groundwater or that hoses have been removed.
3-5	12111	Trickle	None	None	7.2	75.6	0.25	10.00	11.00	0.91	0.25	Washwater	High surfactants, borderline NH_3/K^+ ratio	Visited within 48 hours of rain, revisit during dry weather
3-6	12649	1/2 Full	None	None	9.8	73.0	0.25	0.00	1.00	0.00	NT	Washwater	High surfactants, low NH_3/K^+ ratio	Visited within 48 hours of rain, revisit during dry weather
3-7	12660	Trickle	None	None	8.7	59.0	1.00	0.00	4.00	0.00	NT	Washwater	High surfactants, low NH_3/K^+ ratio	Revisit to collect representative flow sample.
3-8	23515	1/4 Full	None	None	8.2	60.4	0.50	15.00	16.00	0.94	0.00	Washwater	High surfactants, low NH_3/K^+ ratio	Visited within 48 hours of rain, revisit during dry weather
3-9	36092.1	Trickle	None	None	7.6	50.2	2.20	4.00	215.00	0.02	NT	Washwater	High surfactants, low NH_3/K^+ ratio	Revisit to determine the source of the flow, investigate areas where auto body shops are located.

NT = Not Tested

3.3 Summary of Suspected Illicit Discharges

Nine of the 16 sampled flows were determined to not be illicit based on findings from the field investigations and are not discussed further in this report. The following figures summarize the results of the analytical tests and field observations for the seven discharges determined by the field crew to be possibly illicit. The summaries include:

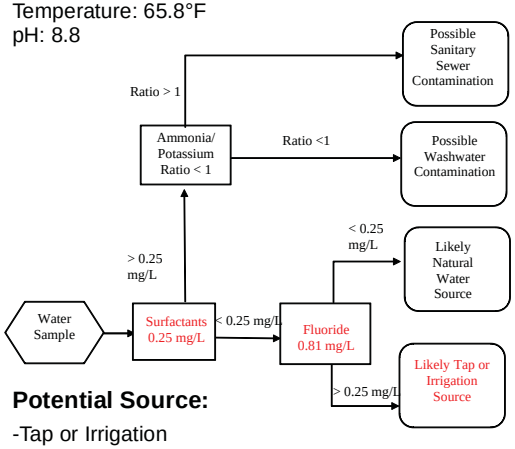
- Feature location
- Associated stormwater system
- Descriptions of the discharge
- Suspected source
- Photograph of feature
- Recommended actions

Figure 3-3
Summary for Feature 467
Fellsway, Everett, MA
Inspection Date: 09/21/12

Flow was observed in a manhole located on the Fellsway in Everett. The flow was traced upstream to a catch basin located in a residential area. A sample was collected and analytical testing results indicate that the flow is from a tap or irriagtion source. Rain occured during the 48 hours prior to the collection of the sample, therefore a revisit should be conducted to verify results.

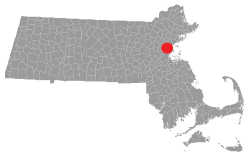
IDD Test Results:

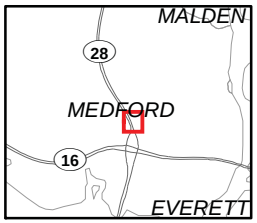
Days since last rain event: 2 (0.61" on 09/19/12)
Temperature: 65.8°F
pH: 8.8



Potential Source:

-Tap or Irrigation





- Catchbasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- Retention/Detention Feature
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary

Note: Red features represent observed dry weather flow path

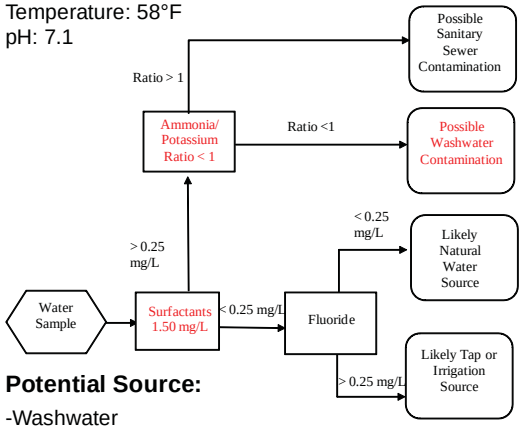
dcr AECOM

Figure 3-4
Summary for Feature 4498
Lynnway Road, Revere, MA
Inspection Date: 9/11/12

Colorless flow with a moderate sewage smell was observed draining from a hose into catchbasin 4498. The catchbasin was located near an active construction site at a pump house. Two hoses originating from the construction site were placed in the catchbasin. Water was observed dripping out of one hose and there was no flow in the other hose. According to contractors on site the hoses contained groundwater that was being pumped out of the construction site. While sampling the slow trickle from the hose, flow increased to a moderate trickle. Analytical test results suggest that the flow is washwater, not groundwater. There was standing water in catchbasin 4498 and flow was not observed in downstream features.

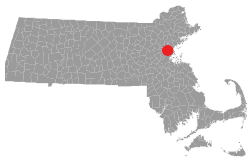
IDD Test Results:

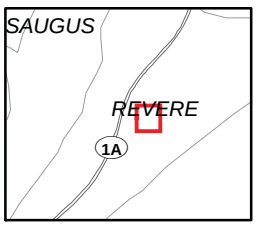
Days since last rain event: 4 (0.43" on 9/7/12)
Temperature: 58°F
pH: 7.1



Potential Source:

-Washwater





- Catchbasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- Retention/Detention Feature
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary

Note: Red features represent observed dry weather flow path

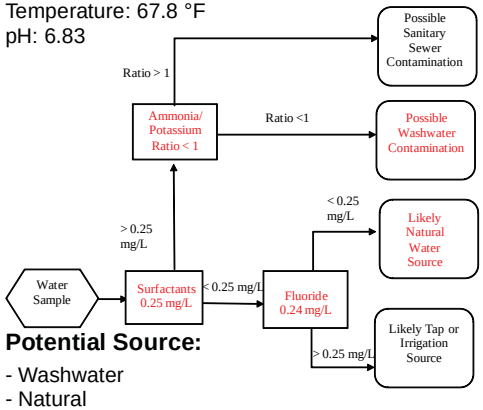
dcr AECOM

Catchbasin 4498

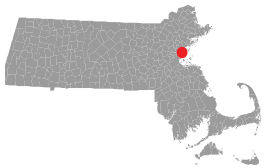
Figure 3-5
Summary for Feature 12111
Revere Beach Pkwy, Revere, MA
Inspection Date: 9/21/12

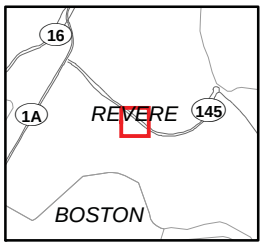
A steady flow with a sour odor was observed draining through manhole 12111. Manholes upstream of the manhole were off property and could not be checked. The manhole drained to an outfall near a culverted stream that connects to the Belle Isle inlet. Water surrounding the outfall outlet appeared cloudy. The connecting manholes were on the Suffolk Downs horse race track's property and likely receive surface runoff from the track and stable areas. Analytical testing produced inconclusive results. This feature was also visited within 48 hours of a rain event and should be revisited. Upon revisiting this feature, bacteria sampling should be conducted to test for run off containing fecal contamination from Suffolk Downs.

IDD Test Results:
Days since last rain event: 2 (0.61" on 9/19/12)
Temperature: 67.8 °F
pH: 6.83



Potential Source:
- Washwater
- Natural





- Catchbasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- Retention/Detention Feature
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary

Note: Red features represent observed dry weather flow path

dcr AECOM

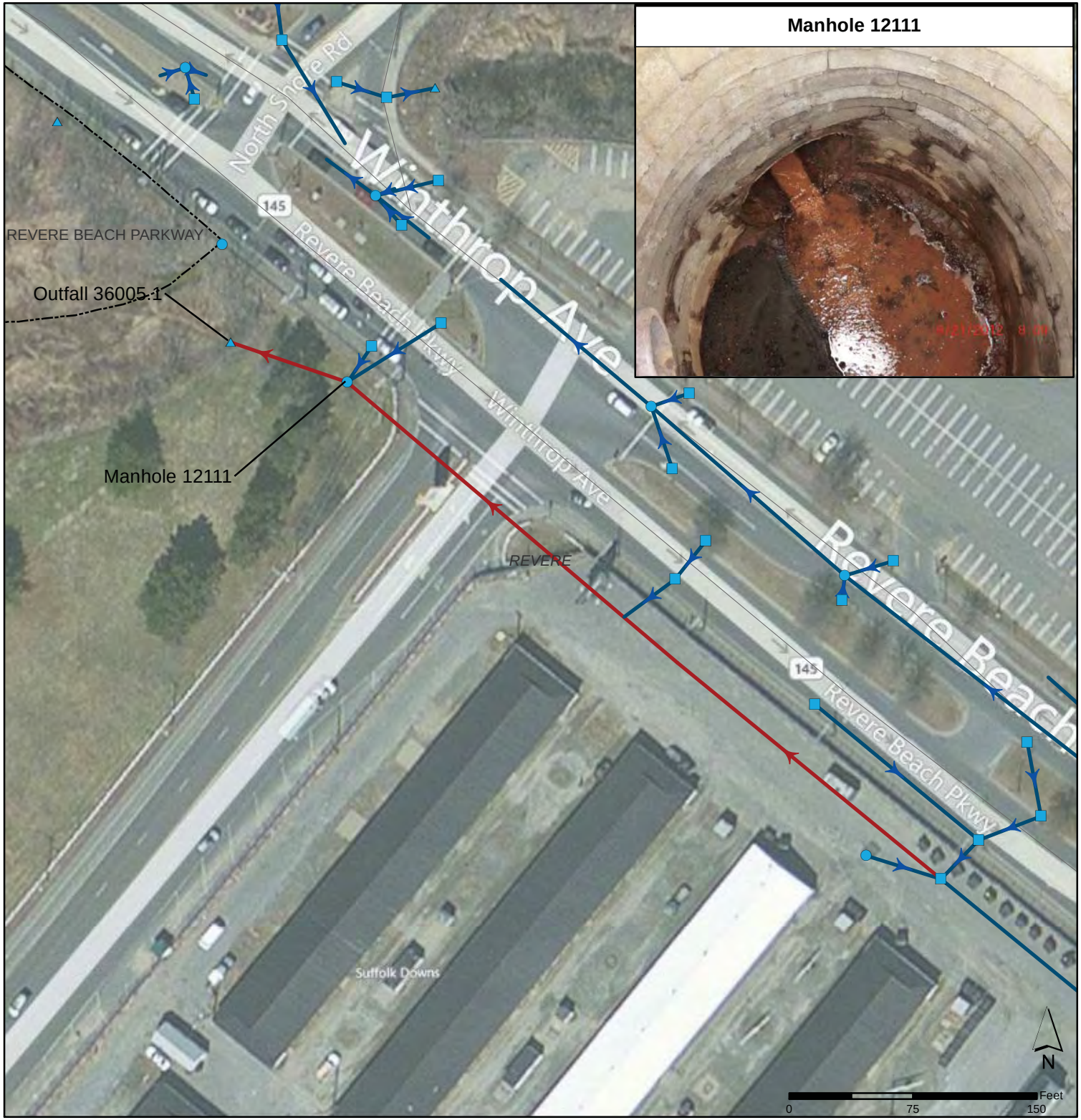
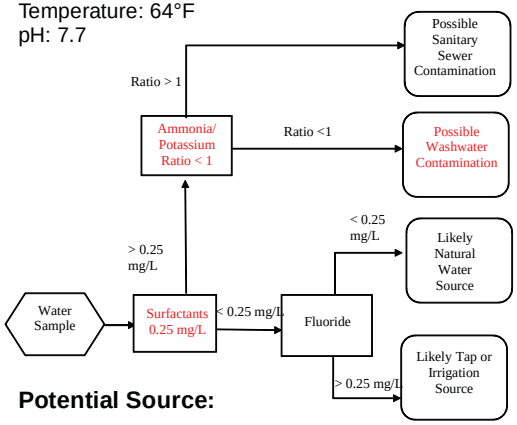


Figure 3-6
Summary for Feature 12649
Lynnway, Lynn, MA
Inspection Date: 10/10/12

Flow was observed coming from an 18" pipe off of DCR property on the Lynnway in Lynn. The flow was coming from the direction of a business parking lot off of the Lynnway. There was a period of rain during the sample window that may have contributed to the flow. Test results indicate that the flow had chemical characteristics similar to washwater.

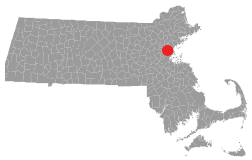
IDD Test Results:

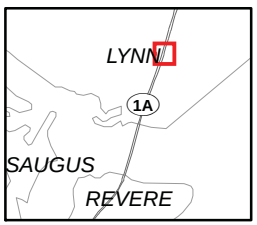
Days since last rain event: 0 (0.14" on 10/10/12)
Temperature: 64°F
pH: 7.7



Potential Source:

-Washwater





- Catchbasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- Retention/Detention Feature
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary

Note: Red features represent observed dry weather flow path

dcr AECOM

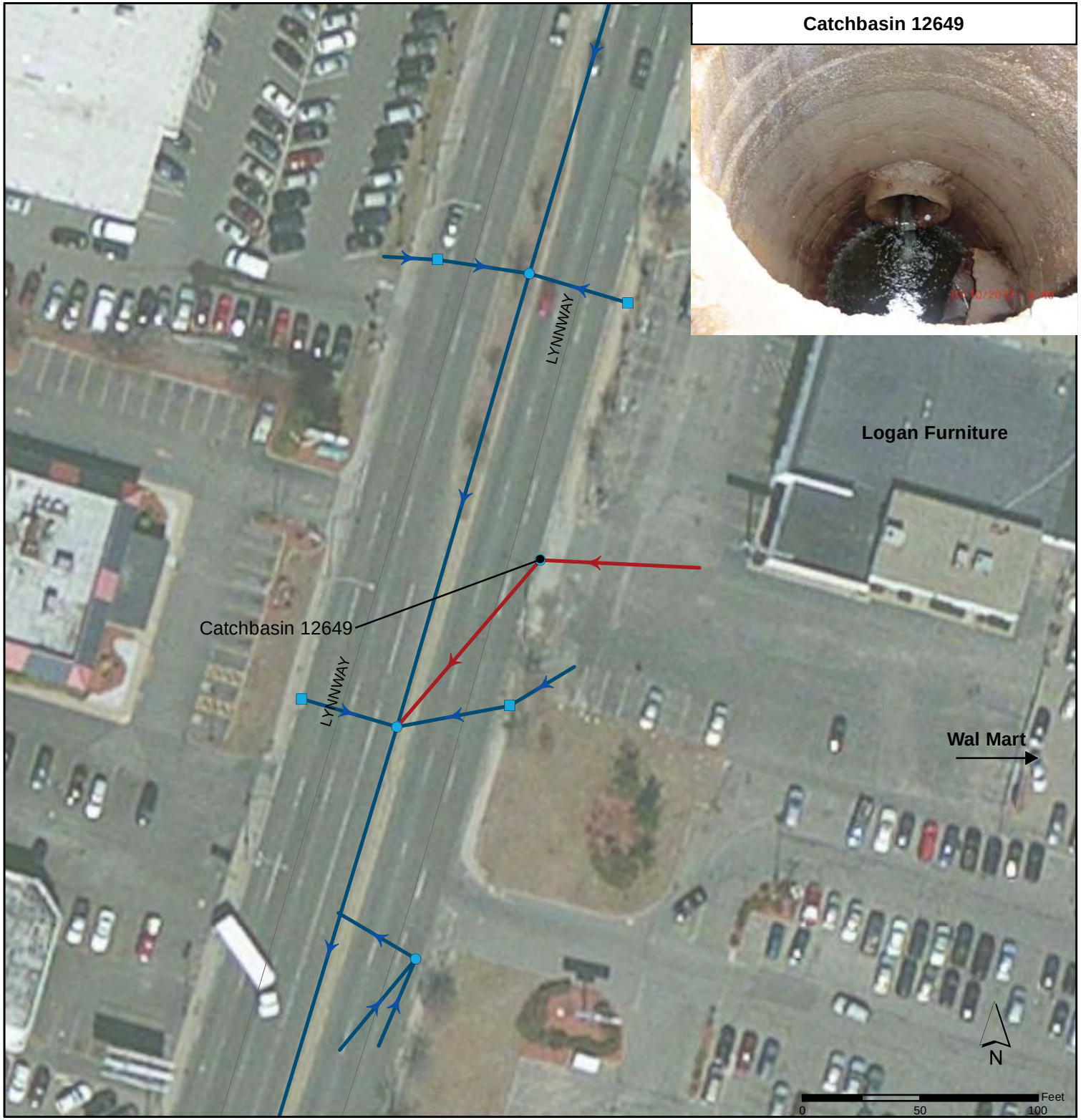
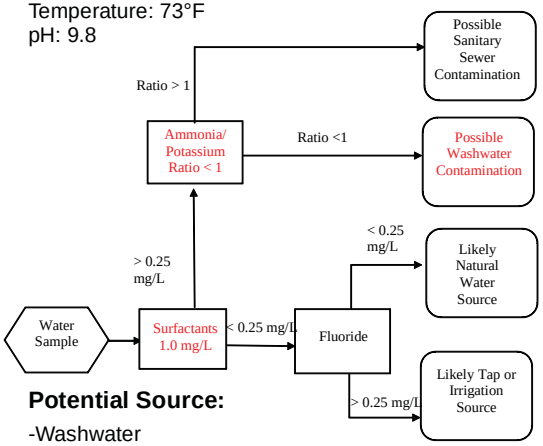


Figure 3-7
Summary for Feature 12660
Lynnway, Lynn, MA
Inspection Date: 10/12/12

Flow from an 18" pipe was observed in a manhole located on the Lynnway in Lynn. There was standing water in the manhole and the water line was near the flowing pipe. The sample that was collected contained standing water as well as the flow entering the manhole. A follow up visit should be conducted to determine whether the analytical results are representative of the flow or of the standing water.

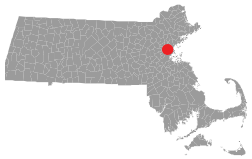
IDD Test Results:

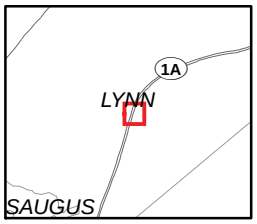
Days since last rain event: 2 (0.14" on 10/10/12)
Temperature: 73°F
pH: 9.8



Potential Source:

-Washwater





- Catchbasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- Retention/Detention Feature
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary

Note: Red features represent observed dry weather flow path

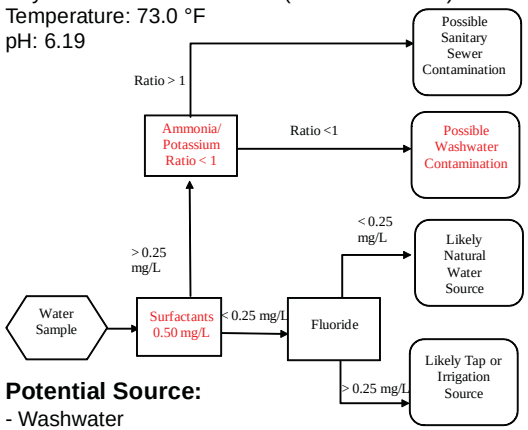
dcr AECOM

Figure 3-8
Summary for Feature 23515
Mystic View Road, Everett, MA
Inspection Date: 8/30/12

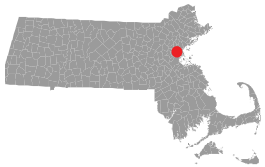
A trickling, oily flow with a strong petroleum odor was observed draining through a series of manholes beginning with manhole 23515. No flow was observed in the connecting catchbasins. The flow continued through the manhole system until reaching an underground detention tank or oil/grit separator. The tank outfalls into the nearby Mystic River, however, no flow was observed at the outfall. The manholes were located near a large stripmall, and Target was the closest potential source. This flow was observed within 48 hours of a rain event and will require a follow up visit.

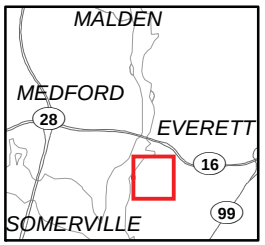
IDD Test Results:

Days since last rain event: 2 (0.15" on 8/28/12)
Temperature: 73.0 °F
pH: 6.19



Potential Source:
- Washwater





- Catchbasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- Retention/Detention Feature
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary

Note: Red features represent observed dry weather flow path

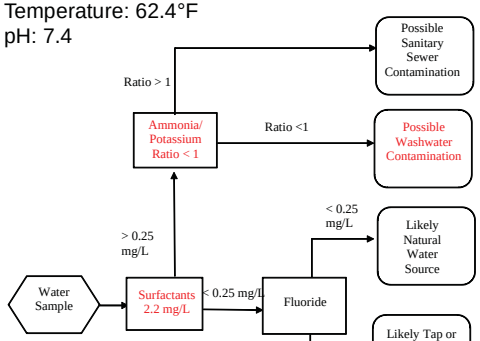
dcr AECOM

Manhole 23515

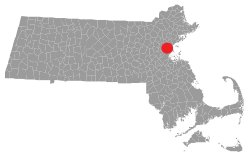
Figure 3-7
Summary for Feature 36092.1
Lynnway, Lynn, MA
Inspection Date: 10/23/2012

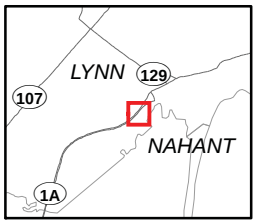
Flow was observed in a series of manholes that make up a trunk line along the Lynnway in Lynn. A trickle flow was observed in two manholes upstream of manhole 36092.1 and the field team observed the flow picking up slightly to a steady trickle in manhole 36092.1. A sample was collected and a cloudy color was observed as well as a wastewater odor. The flow was also observed in a downstream manhole but the odor and cloudy color were more apparent at manhole 36092.1. The field team noted that the area is densely settled with commercial businesses including auto body shops that may be contributing washwater to the system. Field investigation produced inconclusive results and this flow will require a follow up visit.

IDD Test Results:
Days since last rain event: 3 (0.16" on 10/20/12)
Temperature: 62.4°F
pH: 7.4



Potential Source:
-Washwater
-Nearby Laundromat





- Catchbasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- Retention/Detention Feature
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary

Note: Red features represent observed dry weather flow path

dcr AECOM

4.0 Discussion and Conclusions

4.1 Program Year Five

The AECOM field team collected samples from 16 dry weather flows within the 2012 survey area. Field testing and source determination for nine of the observed flows suggest that they were not likely illicit connections. AECOM recommends further investigation of the other seven potentially illicit discharges, including additional follow up visits and extended surveys of the stormwater system in conjunction with adjacent property owners to identify, characterize, and eliminate the potentially illicit flows. In cases where flows originated from or continued onto property not owned by DCR, DCR will need to work with local municipalities or private landowners to address the suspected flows.

Features 467, 12111, 12649, and 23515 were visited within 48 hours of minor rain events. Since the observed flows may have been the result of the precipitation, or the rain may have diluted the chemical signature of an illicit discharge, these features will be revisited in 2013 under dry weather conditions. This follow up visit will confirm the presence or absence of a dry weather flow and provide representative water quality data for the discharge.

Feature 12660 also requires a follow up visit to obtain a representative sample for source determination. This flow was not inspected after a rain event but the discharging pipe was partially submerged in standing water in manhole. The confirmatory investigation should be conducted after an extended period of dry weather when the water level in the manhole is likely to be lower.

The hose that discharged to feature 4498 was from a temporary construction site at a municipal pump station. The operator of the site reported that the flow was groundwater but test results indicated the presence of surfactants and suggested potential washwater contamination. The site should be revisited to determine if the hose has been removed or confirm that the flow is completely groundwater.

Results from testing the flow at feature 36092.1 suggested potential washwater contamination. The area was densely settled and there were many commercial businesses in the vicinity of the dry weather flow including many auto body shops. A direct connection to any of the businesses in the area could not be determined in the field. Based on inconclusive source determination, and the presence of surfactants (detergents) in the sample, AECOM recommends that a follow-up visit be conducted on this system to further delineate the flow.

4.2 Illicit Discharge Detection Program Review

The Illicit Discharge Detection Program developed in 2008 and improved upon over several field seasons, allowed AECOM field crews to efficiently and safely investigate 1,704 features on 23 miles of highly urbanized roadway during Program Year Five. Technicians identified potentially illicit flows at seven out of the 1,704 features, or 0.28%. This occurrence of illicit discharges is similar to the low rates observed in Program Year One (0.19%), Program Year Two (0.63%), Program Year Three (0.43%), and Program Year Four (0.28%) and suggests that the study area, which included the aging and complex stormwater systems around the Revere Beach Parkway, is not more likely to have illicit connections than other portions of DCR's property.

Over the course of this five year program, DCR and AECOM investigated 10,949 individual stormwater features for signs of illicit discharges, or approximately 70% of DCR's mapped stormwater conveyance system in urban areas (Figure 4-1). An estimated 1,500 features that were scheduled to be surveyed as part of Program Year Five will be inspected in 2013 before the commencement of Program Year Six activities. The remaining 20% of the system represents areas that were not accessible during field surveys due to active construction work or traffic safety concerns and may be inspected during subsequent years of the IDD program.

Figure 4-1. Inspection Activities over the Five Year IDD Program

This effort identified 96 dry weather flows, of which nearly half (47) were determined to be non-illicit based on analytical results and field observations. The remaining 49 discharges had chemical or physical characteristics that indicated potentially illicit connections. This is an overall occurrence rate of only 0.45% and suggests that illicit connections to DCR's stormwater system in urban areas are rare.

5.0 References

Boston Water & Sewer Commission, 2004. *A Systematic Methodology for the Identification and Remediation of Illegal Connections.* 2003 Stormwater Management Report, chap 2.1.

Brown. E., D. Caraco, and R. Pitt. 2004. *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments.* Center for Watershed Protection, Elliott City, MD. http://www.epa.gov/npdes/pubs/idde_tableofcontents.pdf

Pitt, R. 2004 Methods for Detection of Inappropriate Discharge to Storm Drain Systems. *Internal Project Files.* Tuscaloosa, AL, *in* The Center for Watershed Protection and Pitt, R,, Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and *Technical Assessments:* Cooperative Agreement X82907801-0, U.S. Environmental Protection Agency, variously pages. Available at: http://www.cwp.org.

Datasheet for Trimble GPS Pathfinder ProXH Reciever. Trimble Navigation Limited, Westminster, CO. available at http://www.trimble.com/pathfinderproxh.shtml

Datasheet for Panasonic CF-U1 Toughbook, Panasonic Corporation of America, available at http://catalog2.panasonic.com/ webapp/wcs/stores/servlet/ModelDetail?storeId=11201&catalogId=13051&modelNo=Toughbook-U1

Edwards, P. 2007. HACH DR/890 Colorimeter Procedures Manual, 8th edition, HACH Company, Loveland, CO.

Appendix A

Standard Operating Procedures

DCR Illicit Discharge Detection

Field Investigation

Standard Operating Procedure

Summer 2012

1.0 Site Characterization Notes

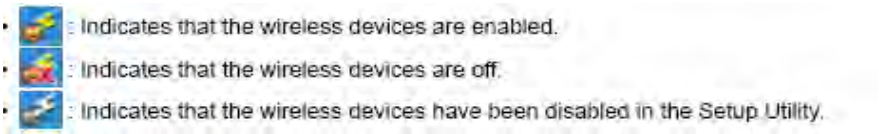
- Review stormwater infrastructure map of area and determine most effective approach for IDD survey.
- Establish safe working area using traffic control contractor and state police detail.
- Open stormwater feature and confirm/update attributes in database for both points and lines. If from plans you will be prompted to collect a GPS location for the feature.
- If change point location, then also need to move line endpoints.
- Deleted features Points: Delete box set to yes, feature should disappear once map is refreshed
- Deleted features Lines: actually delete features by selecting and deleting
- Duplicate points: Choose which one is “more right” and update that feature. Set the duplicate feature to Delete “yes” and in the Notes include the ENSR_ID of the “right” feature we are keeping.
- If a feature does not appear on the GPS unit, create a new feature and enter attributes. A GPS point will automatically be collected for point features.

2.0 GPS Notes

- To open program, either choose Button 1 or click on IDDE shortcut folder and choose the map file.
- Bluetooth trouble shooting: The GPS should automatically connect. Note that it may take a few minutes. Try the following actions:

  On Computer:

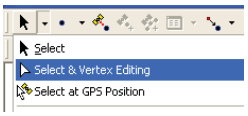
  - Check GPS Preferences:
    - Protocol-- NMEA 0183
    - Port-- COM Port 40
    - Baud Rate-- 4800
  - Check to see if the Wireless Switch is turned on



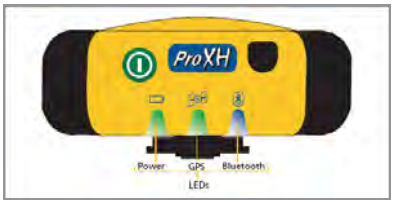
On GPS Reciever:

- Make sure GPS receiver is on and Bluetooth is activated (blue light slowly flashes) If not, press and hold power button for >5 seconds to turn on Bluetooth

- Camera instructions: Choose Button 2 or Start>Programs>AMCap
  - Will save picture to folder with shortcut on desktop
- Must be in editor mode to change point/record data and must click “OK” to save GPS form.



- To edit pipes, choose the vertex editor. Digitize pipes from upstream to downstream.
- The GPS unit must be turned off during lunch and at the end of the day to save battery.
- The GPS unit needs to be charged every night; either in the office or at home (make sure you have the charger).



During operation, the LEDs provide the following status information:

LED	Color	Mode	Status
Power	Green	Solid	Good
	Red	Short flash[1]	Low
	Amber	Short flash	Charging
	Amber	Solid	Fully charged and on external power
GPS	Green	Long flash[2]	Generating positions
	Green	Rapid flash[3]	Too few satellites or poor geometry
Bluetooth	Blue	Waiting heartbeat flash[4]	Activated and waiting
	Blue	Long flash	Activated and connected
	Blue	Off	Bluetooth has not been activated or has been turned off
	Blue	Toggle flash[5]	Bluetooth toggled on and off event

[1] Short flash - one flash ever three seconds
[2] Long flash - one flash per second
[3] Rapid flash - two flashes per second
[4] Waiting heartbeat flash - one flash every three seconds
[5] Toggle flash - five short flashes over two seconds

3.0 Illicit Discharge Detection Steps

1. Examine stormwater feature for dry weather flow.
2. If no flow is present look for signs of potential contamination from intermittent sources (staining, floatables, foam etc.), input observations on the IDD page of the GPS form and photograph the evidence (noting the photo filename in the IDD record).
3. If dry weather flow present don latex gloves and safety glasses and collect a water sample using the remote collection device. Use caution to only sample the dry weather flow and avoid sampling water from the sump.
4. Immediately measure pH and temperature using the YSI pH10. Record the results, along with physical observations of the flow, on the GPS form.
5. Cap, label with feature ENSR ID and store the sample jar. Note on the maps and in the field book the location of any samples taken.
6. Photograph the discharge and note the photo name any additional relevant information on the GPS form. Save the GPS data by clicking “OK”.
7. Continue to survey the remaining features of the system. Trace the dry weather flow upstream until the source is discovered, the drainage comes from off DCR property, or the flow disappears.
8. Collect, label and retain the most upstream water sample of the dry weather flow. The previous downstream flow samples are not required and can be emptied into the stormdrain.
9. Once the most upstream location of the discharge has been identified, edit the feature point which will create another IDD record for that feature, perform chemical analysis on this sample and enter the new temperature and sample analysis results in the GPS form. Complete flow summary form.

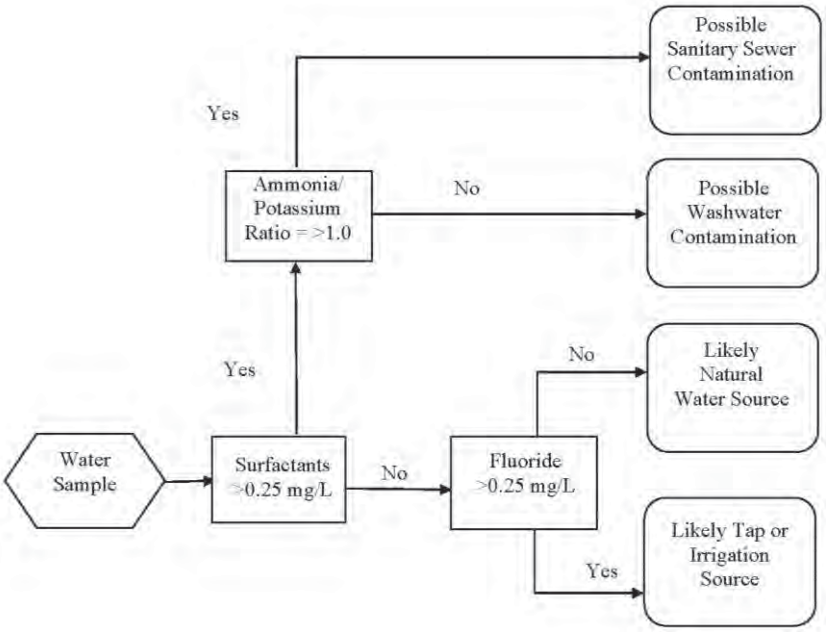
4.0 Calibration of Equipment

- Rachel MacPhee will calibrate the YSI pH10 weekly and record the calibration results in the field notebook.
- The Horiba Compact Ion meter must be calibrated using the 1-point calibration before use (max once per day) and record the calibration results in the field notebook.
- The 2-point calibration for the Horiba Compact Ion meter should be preformed once a month and record the calibration results in the field notebook.

5.0 Chemical Analysis Steps

1. Temperature and pH of the sample is taken a second time preceding the testing.
2. For Ammonia and Fluoride, test using the DR/890 Colorimeter and follow the appropriate HACH procedures included in the field kit. For Potassium, test using the Horiba Compact Ion Meter. For Surfactants use the Detergents detection kit and follow appropriate procedures in the field binder.
3. Press the “Ratio” button the GPS form to calculate the NH_3/K Ratio for comparison with the benchmark.

4. Visually inspect surroundings and note the land use, buildings and utilities in the area. Also note any non-stormwater surface water; landscaping, irrigation, streams, etc.
5. If possible, determine the likely source of the discharge using the chemical results, physical conditions, visual observations and the information on Tables 1 and 2.
6. Notify Aaron Hopkins or Kaitlin Sylvester about the location, characteristics and likely source of any illicit discharges encountered during the survey.



6.0 Contaminated Equipment and Disposal

- All samples and liquids exposed to testing chemicals must be stored in an appropriate waste holding container for proper disposal and ***not*** discharged back into the stormdrain.
- Any remaining sample which has not been tested can be placed back into the stormdrain.
- Contaminated testing supplies should be rinsed once with tap water and separated from the remaining equipment. Place the rinse water in the waste container for proper disposal.
- Residuals from the Surfactants analysis must be placed in a Ziploc bag, and secondly contained in a plastic Nalgene container labeled “surfactants waste”. This waste will be transferred in Westford to a holding container and contained in a chemical waste cabinet to later be disposed of appropriately.
- Supplies which need to be used multiple times per field day must be thoroughly cleaned. Wash twice with tap water then a third time using deionized water.
- At the end of the day, properly dispose all chemicals down a sink drain with running water to dilute. If appropriate, the waste container can be emptied directly into a sewer main in the field.

- Before reuse, all used equipment should be thoroughly washed with Liquinox detergent in the office, rinsed three times and allowed to air dry.

Appendix B

Illicit Flow Form

Potential Illicit Flow Details

Date/Time: _____ Sampler initials: _____ Feature # (AECOM ID): _____

Field Logbook #: _____

Responsible person for follow-up documentation: _____

Location: _____

Potential Source according to flow chart (see back page):

☐ Sanitary Sewer Contamination ☐ Natural Water

☐ Washwater Contamination ☐ Tap or Irrigation

☐ Re-test same sample for any parameters on border of values on flow chart. Document both results.

☐ Sample any potential source discharge if possible and if unclear if actual source (ie. water bubbler overflowing)

☐ Add a note in the upstream structure when observered. Even if no flow is seen upstream, please note. Make note to future crews if not able to get to structure that day

☐ Make notes on surroundings (building types, landscaping with irrigation, etc)

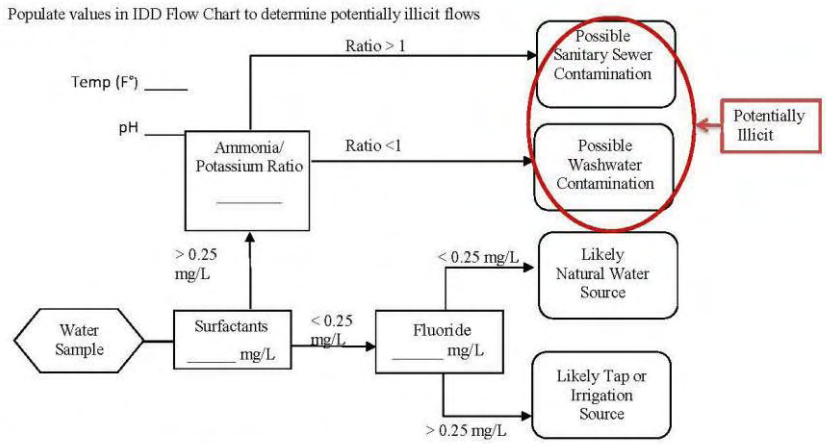
☐ Photograph surroundings and flow

☐ Call office and discuss observations.

Detailed Site Drawing

Be sure to: label the features where flow was observed, label other mapped features, label pipes according to flow direction, potential sources, and include other pertinent information. ***Document entire flow path (source to outfall). Note where flow begins and ends.***

REMEMBER TO TAKE A PHOTO!



Use this space for additional notes and/or site sketches

AECOM
250 Apollo Drive
Chelmsford, MA 01824

978.905.2100 tel
978.905.2101 fax

Memorandum

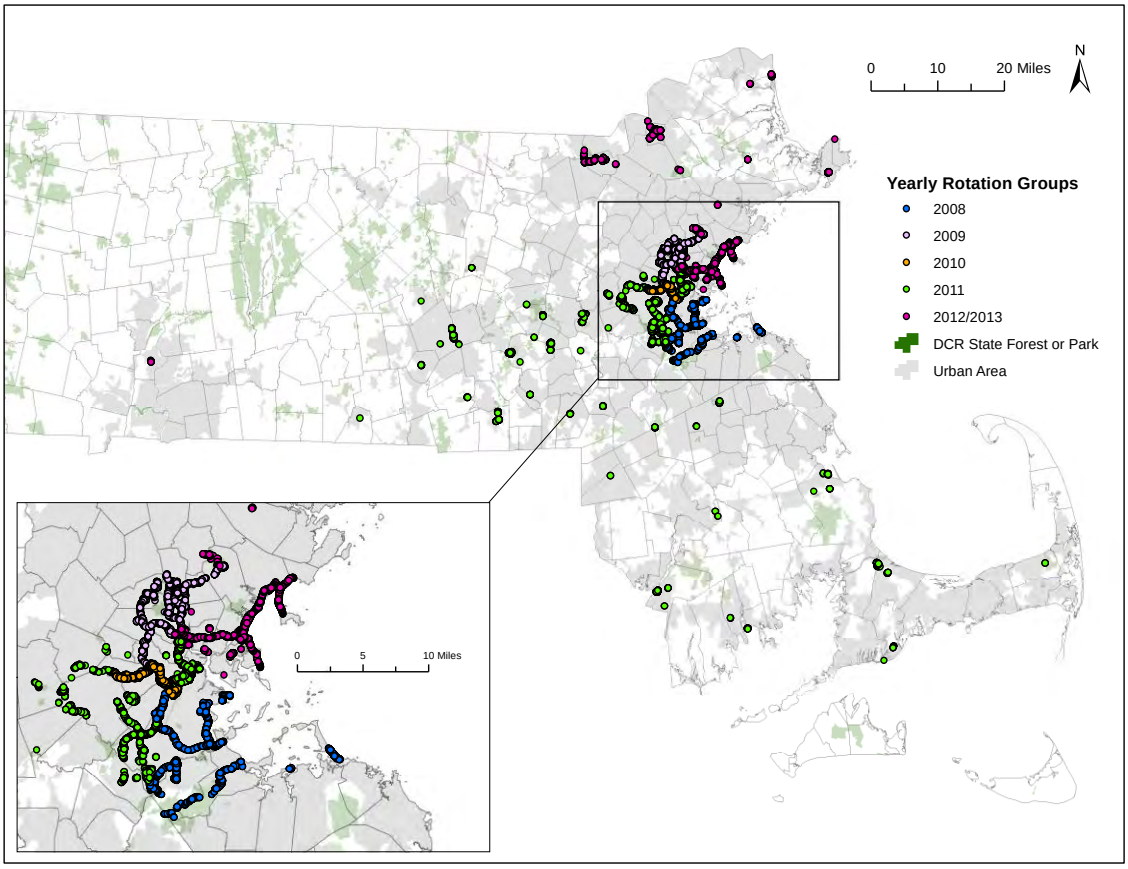
To	Mr. Robert Lowell – MA Department of Conservation and Recreation	Page 1
CC		
Subject	2013 Illicit Discharge Report Addendum	
From	AECOM Environment	
Date	December 16, 2013	

This memorandum provides an addendum to the Illicit Discharge Detection Report, 2012 (IDD Report, 2012) submitted to the Massachusetts Department of Conservation and Recreation (DCR) on May 3, 2013. During 2013 AECOM completed the rotation initiated in Program Year 5 (2012), results from the 2013 portion of the Program Year 5 surveys are outlined herein.

Illicit Discharge Detection Program Year 5 Addendum

AECOM Environment (AECOM) completed the Program Year 5 rotation for DCR in 2013 in support of the Illicit Discharge Detection (IDD) program. The previously established 5 year rotation (Figure 1) was developed in support of DCR's Minimum Control Measure No. 3 of NPDES Small MS4 General Permit. The 5 year rotation ensures that all of DCR's urban stormwater features will be visited at least once every 5 years.

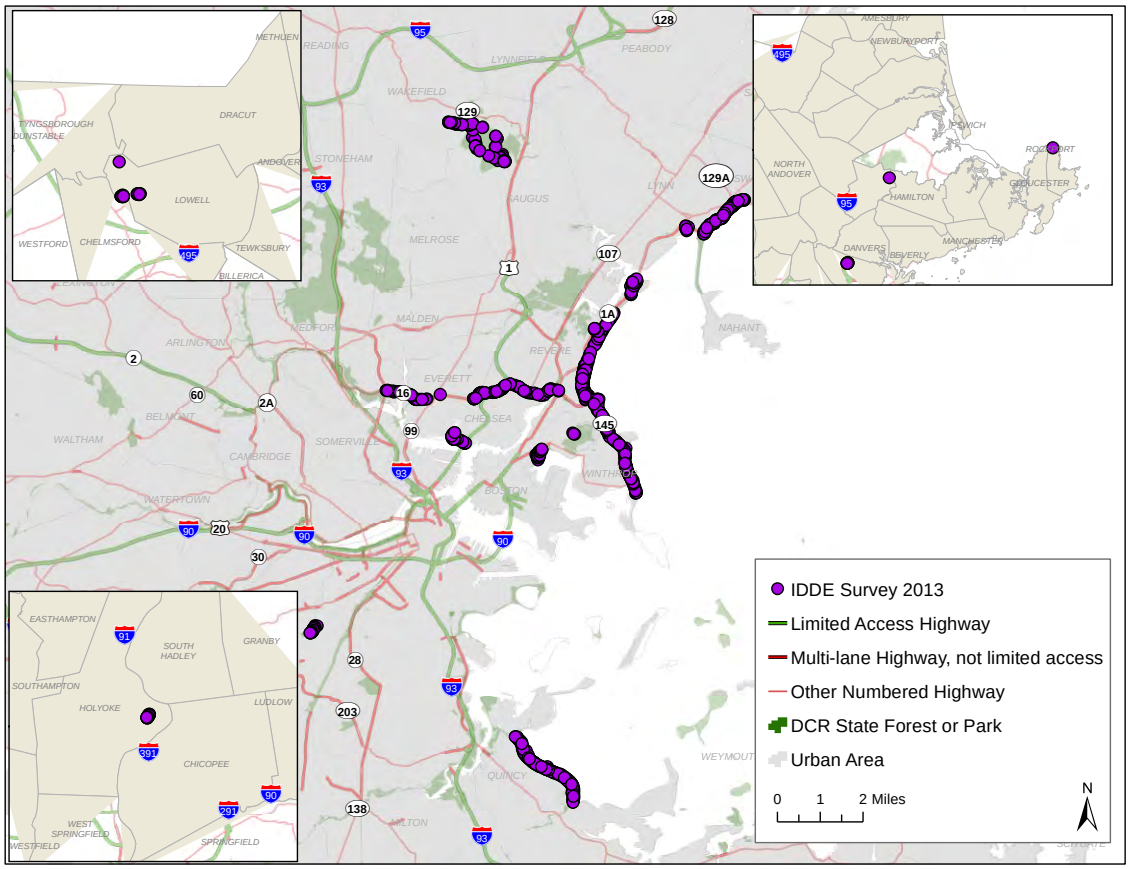
Figure 1 – Yearly Rotation Groups



The abbreviated 2013 field season commenced on April 10, 2013 and continued through the late summer. AECOM performed the 2013 illicit discharge detection investigations according to the methods outlined in the IDD Report, 2012.

Due to the complexity of the roadways assigned to the Program Year 5 rotation the survey area was split into 2 field seasons, 2012 and 2013. During the 2013 field season AECOM completed all areas remaining from 2012. The majority of the survey areas completed in 2013 were located along Revere Beach Parkway, Revere Beach Blvd, Lynn Shore Drive, Winthrop Parkway, Winthrop Shore Drive, and a subset of features within DCR parks in Ashland, Boston, Chelsea, Holyoke, Lowell, Lawrence, Natick, Rockport, Saugus, Topsfield, and Weston. The 2013 survey also included Quincy Shore Drive which has been under construction in previous years (Figure 2).

Figure 2 – Program Year 5 (2013) Survey Area



During the 2013 field season, AECOM field crews investigated 1,316 stormwater features for signs of illicit connections. The survey covered 17 miles of DCR roadway within 24 towns. Table 1 shows the breakdown of stormwater features by type. The stormwater systems were primarily comprised of catch basins, manholes, and outlets but also included other features such as yard drains, drywells, and oil/grit separators.

Table 1 – Summary of Features Investigated in Program Year Five

Feature	Total
Catch basin	746
Manhole	330
Outlet	177
Inlet	32
Other	31
Total	1,316

The AECOM field crews collected stormwater samples from 6 features with dry weather flow and field tested the discharges for a series of analytes according to the IDD protocol, described in the IDD Report, 2012. Of the six samples collected none were considered to be illicit based on field testing results and source determination.

With the completion of Program Year 5 AECOM safely and efficiently completed DCR's 5 year illicit discharge rotation, and investigated a total of 12,985 stormwater features along 220 miles of roadway. The occurrence of illicit discharges was consistently low; Table 2 outlines the low rates seen throughout each program year and the overall rate of occurrence throughout the 5 year program.

Table 2 – Illicit Discharge Occurrence by Program Year

Program Year	Illicit Discharge Occurrence
1	0.19%
2	0.63%
3	0.43%
4	0.28%
5	0.23%
Program Total	0.34%

The IDD protocol developed for this program allowed for GPS data to be collected for the majority of DCR's urban stormwater features throughout Massachusetts. This effort lead to the creation of a comprehensive GIS database with field verified mapping and inspection information for nearly 13,000 stormwater structures, 53 miles of stormwater piping, and 47 detention and retention features. DCR's IDD program is flexible and can be adapted in response to NPDES permit changes to ensure DCR's compliance with future program requirements.

Sincerely,

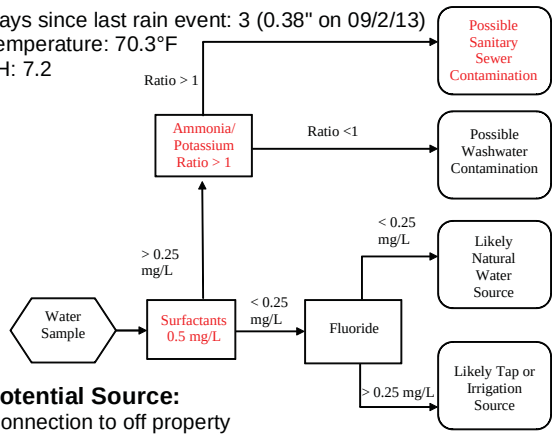
Kaitlin Sylvester
Kaitlin.Sylvester@aecom.com

Spring Pond
Jamaicaway, Boston, MA
Inspection Date: 09/05/2013

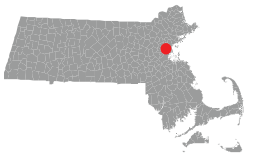
Dry weather flow was investigated in manhole 37205 on Jamaicaway in Boston. A trickle from a 12" clay pipe that runs underneath the property at 242 Jamaicaway was observed as well as a more significant flow from an 18" cast iron pipe appearing to originate from the direction of Castleton Street. Further investigation of two manholes on Castleton Street found that the manholes had been sealed under their metal covers with asphalt and were unable to be investigated. The sealed manholes are off of DCR property and were marked with "sewer" covers. Survey results indicated that one or both of the manholes located on Castleton Street may be contributing to the flow observed in manhole 37205 that then flows downstream to raised manhole 12956. This raised manhole has been outfitted with a hinged cover that overflows during some rain events and contributes to erosion and sedimentation issues around Spring Pond. The overflow was documented during a rain event four days before this IDDE survey through photos forwarded to DCR from Mass Fish and Wildlife. Test results performed on the flow from Castleton Street yielded results that indicate possible sanitary sewer contamination. A desktop review of video footage taken in this system displayed results consistent with the findings of this survey.

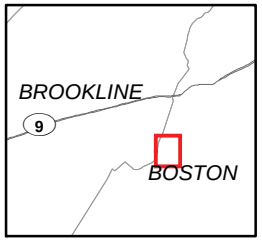
IDD Test Results Manhole 37205:

Days since last rain event: 3 (0.38" on 09/2/13)
Temperature: 70.3°F
pH: 7.2



Potential Source:
-Connection to off property Sewer

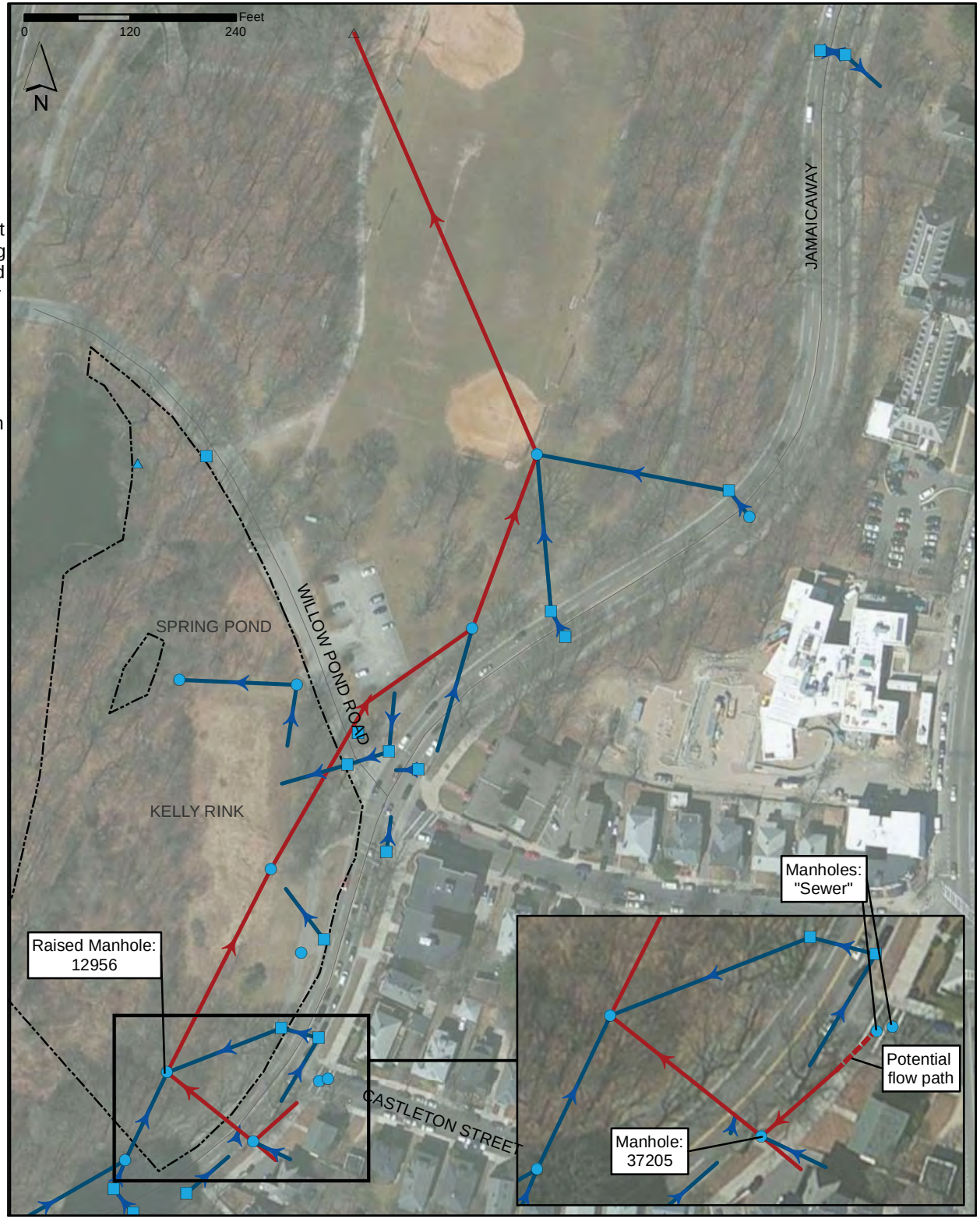




dcr AECOM

- Catchbasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- Retention/Detention Feature
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary

Note: Red features represent observed dry weather flow path



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Memorandum

To	Robert Lowell	Page 1
CC	Kaitlin Sylvester	
Subject	Wet Weather Monitoring	

From	Aaron Hopkins
Date	08/19/2013

DCR Wet Weather Monitoring

In an effort to generate baseline data on phosphorus and bacterial inputs from stormwater runoff to the Lower Charles River, the Department of Conservation and Recreation (DCR) and AECOM developed and implemented a wet weather monitoring program. This pilot program was intended to test the proposed protocol and collect loading data for a few selected catchments.

AECOM conducted wet weather monitoring at and around the Elliot and Longfellow Bridges in Boston and Cambridge on June 7th, 2013 according to DCR's wet weather protocol (Appendix A). These catchments were selected due to interest in potential stormwater inputs to the Charles River from local bridges. The last rain event in the area was on June 3rd, approximately 72 hours before monitoring. The targeted storm resulted in 3.6 inches of rain in the 24 hour period that began with the sampling event.

METHODS

Less than 0.05 inches of rain fell in the overnight hours (1:00 AM – 2:00 AM) and AECOM technicians were onsite to capture the first measurable flush of the storm at 7:50 AM (Figure 1).

Grab samples were first collected from the sheet flow running from the Elliot Bridge crown towards the east, this location captured runoff from the bridge deck and eastern approach of the two inbound lanes (Figure 2). The field team then setup on the Longfellow Bridge and collected grab samples from two separate locations on the bridge. Runoff on the Longfellow Bridge deck is captured by regularly spaced scuppers along the curb, the Cambridge sampling location captured sheet flow between two scuppers on the western approach of the two inbound lanes, and the Boston sampling location captured sheet flow between two scuppers on the eastern approach of the two inbound lanes (Figure 3). A nearby stormwater outfall to the Charles River was also sampled (Figure 3). The team then returned to the Elliot Bridge and collected another sheet flow grab sample from the first location approximately two hours after the initial sample to gage changes in stormwater concentrations after the first flush of the storm.

Each grab sample was divided into bottles for nutrient and bacteria analysis and placed on ice. The samples were transported to the Alpha Analytical Laboratory in Westborough, Massachusetts and analyzed for Fecal coliform, *E. coli*, and Total Phosphorus (TP).

RESULTS

The sampling protocol for the pilot program was practical, safe, and efficient for collecting wet weather flow samples. Rapid field mobilization and continual forecast updates were critical for capturing first flush samples. The locations for the pilot study were specifically chosen to minimize traffic safety issues, future locations with accessibility or traffic issues should be addressed individually to ensure safe and efficient sampling of targeted precipitation events.

Bacteria levels, as *E. coli*, in all first flush samples exceeded the Massachusetts Department of Public Health standard from 105 CMR 445.010 of 235 colonies per 100 ml (Table 1). These levels would limit primary contact recreation in the receiving water and indicate bacterial contamination in the catchment. Likely sources of bacteria in the drainage areas of these bridges include dogs and wildlife; it is unlikely that sewer or illicit discharges contribute to the stormwater runoff from either the Elliot or Longfellow Bridges although they are possible in the outfall drainage system.

Table 1. *E. coli* Levels from the June 7-8 Storm

Location	E. coli (MPN/100 ml)	Sample Type
ELLIOT	20,000	First Flush
LONGFELLOW-CAM	1,700	First Flush
LONGFELLOW-BOS	2,500	First Flush
OUTFALL	5,200	First Flush
ELLIOT - 2	5,200	Two Hours into Storm

The second sample collected from the Elliot Bridge, two hours into the storm, showed a substantial decrease in *E. coli* levels, suggesting that the first flush sample may be a worst case scenario and that bacterial input to the receiving waters likely decreases over the course of a rain event.

Total Phosphorus concentrations in the first flush samples were also expected to be elevated over the event mean concentration (EMC). The first flush phenomenon is exaggerated in smaller watersheds with a high percentage of impervious surface (Pitt et al 2004). The drainage areas for the Elliot Bridge and the two Longfellow Bridge samples were very small (700 m^2 and 150 m^2 respectively; Figures 2 and 3) and 100% impervious. The potential for the first flush phenomenon within these catchments is highlighted by the 77% drop in TP concentration at the Elliot Bridge from 0.843 mg/l at first flush to 0.197 mg/l two hours into the storm (Table 2).

Table 2. Total Phosphorus Concentrations from the June 7-8 Storm

Location	TP (mg/l)	Sample Type
ELLIOT	0.843	First Flush
LONGFELLOW-CAM	0.319	First Flush
LONGFELLOW-BOS	0.209	First Flush
OUTFALL	0.196	First Flush
ELLIOT - 2	0.197	Two Hours into Storm

A review of more than 400 paired samples from the National Stormwater Quality Database yielded a ratio to relate first flush concentrations to EMCs for certain compounds (Maestre et al 2004). The ratio calculated for Total Phosphorus concentrations in commercial land use areas (1.44) allowed for the estimation of EMCs from the first flush data collected during this study (Table 3). The estimated EMCs were then used to calculate phosphorus loading from these watersheds for comparison to the Lower Charles River Total Maximum Daily Load (TMDL).

Table 3. Total Phosphorus Concentrations and Estimated Total Phosphorus EMCs from the Sheet Flow Samples Collected During the June 7-8 Storm First Flush

Location	First Flush (mg/l)	Estimated EMC (mg/l)	Watershed Area (m^2)	Annual Load (kg/year)
ELLIOT	0.843	0.585	700	0.43
LONGFELLOW-CAM	0.319	0.222	150	0.03
LONGFELLOW-BOS	0.209	0.145	150	0.02

Note: Annual loads were based on annual precipitation from the TMDL (41.5 inches) converted to 41.25 inches of runoff based the impervious area curve number and runoff calculations for small urban watersheds (USDA 1986).

These estimates for annual loading represent substantial exceedances over the TMDL recommendations but are in line with the 1998-2002 water quality data from commercial land use areas that were used to generate the TMDL. The Elliot Bridge sheet flow would require a 90% reduction in TP to attain the TMDL loading rates while the Longfellow Bridge sheet flow would require a 75% reduction on the Cambridge side and a 60% reduction on the Boston side.

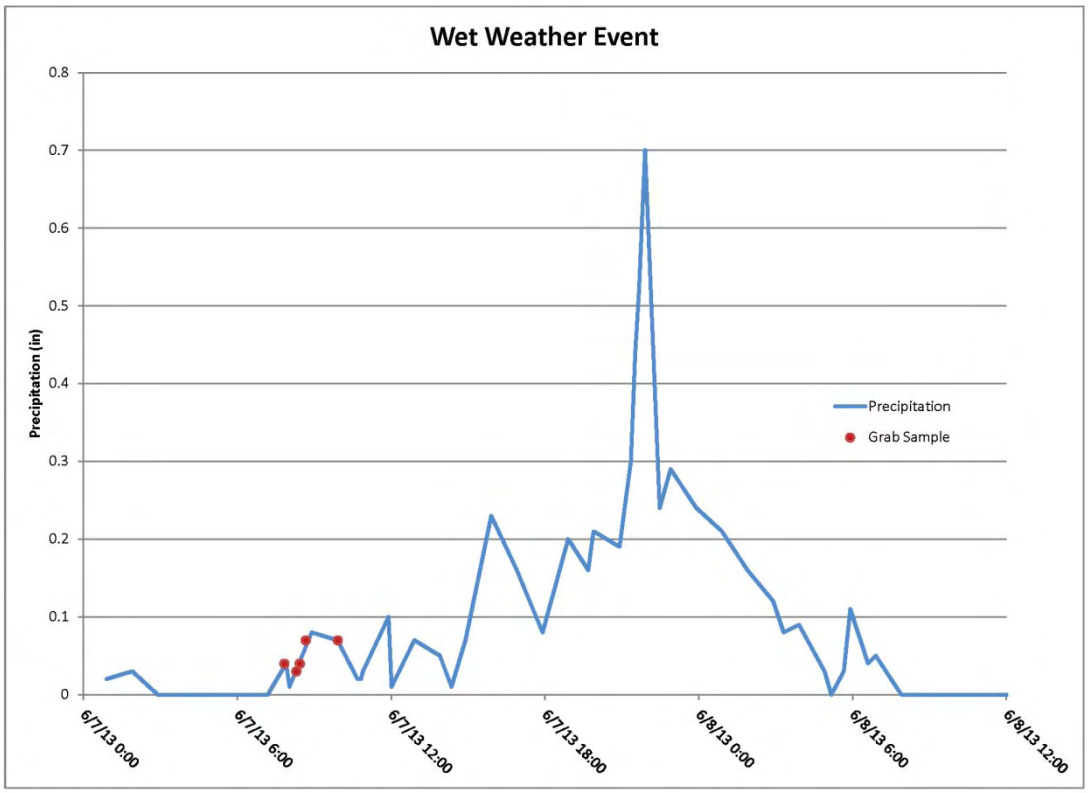
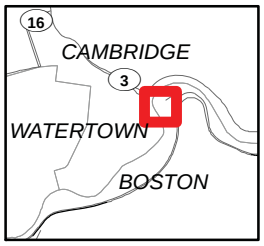


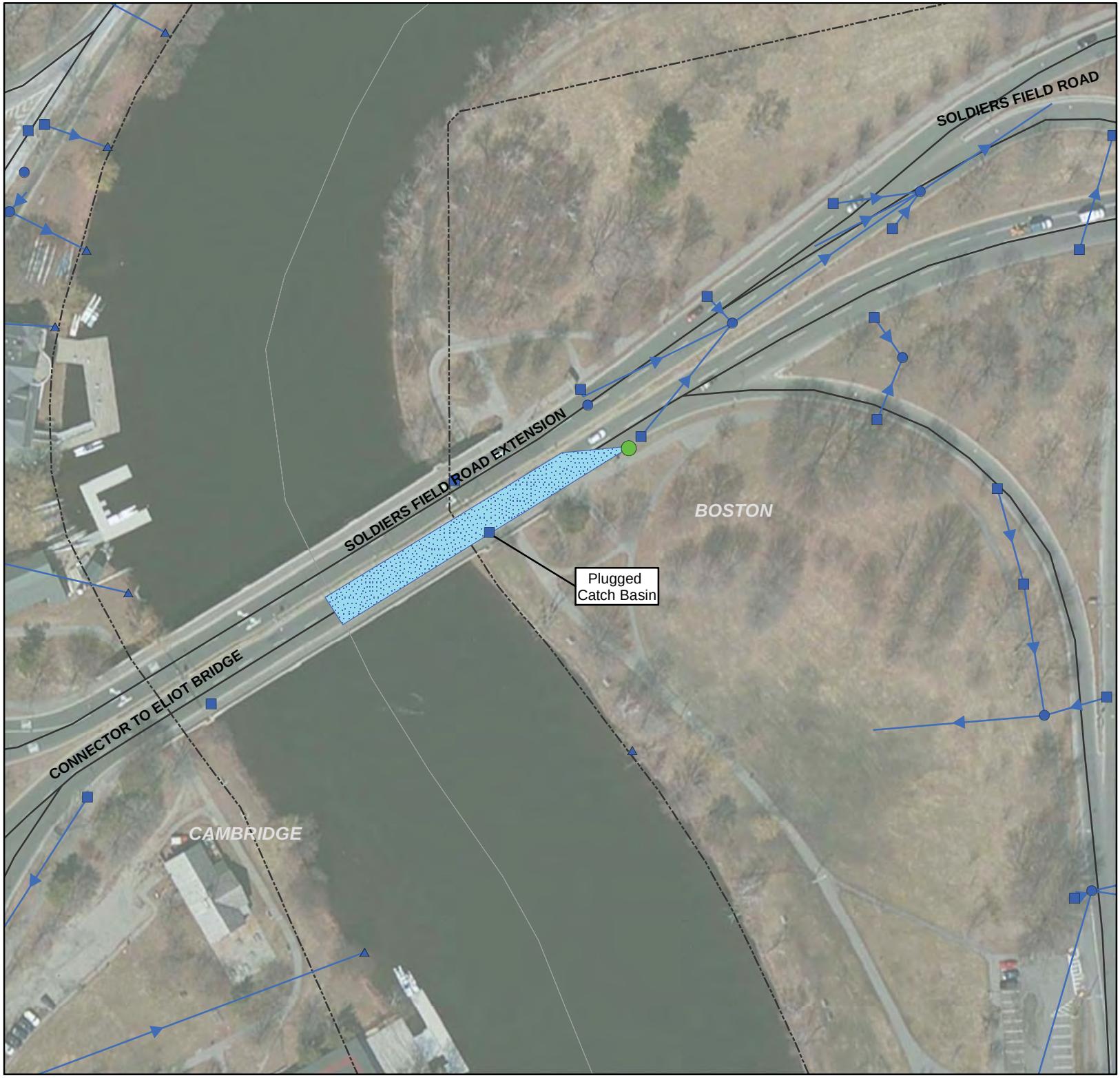
Figure 1. Precipitation and wet weather sample times for the June 7-8 storm. Precipitation data from weather station KBOS at Logan Airport (www.wunderground.com).

Figure 2
Wet Weather Monitoring
2013
Elliot Bridge

System 1:
Sheet flow collected from the Elliot Bridge during the first flush and rising limb of the storm on June 7, 2013.

- Sample Collection Location
- Estimated Sheet Flow
- CatchBasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary





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AECOM

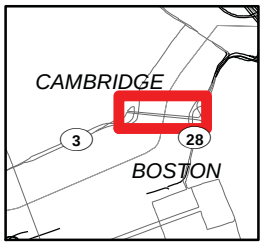
N

0 50 100 200 Feet

Figure 3
Wet Weather Monitoring
2013
Longfellow Bridge

System 2:
Sheet flow was collected from the Longfellow Bridge on both the Cambridge and Boston approaches. A stormwater outfall that contributes to the Charles River was also sampled on June 7, 2013.

- Sample Collection Location
- Estimated Sheet Flow
- CatchBasin
- Manhole
- Inlet
- Outlet
- Other
- Conveyance (Pipe)
- DCR Parkway in Urban Area
- DCR Property in Urban Area
- Town Boundary



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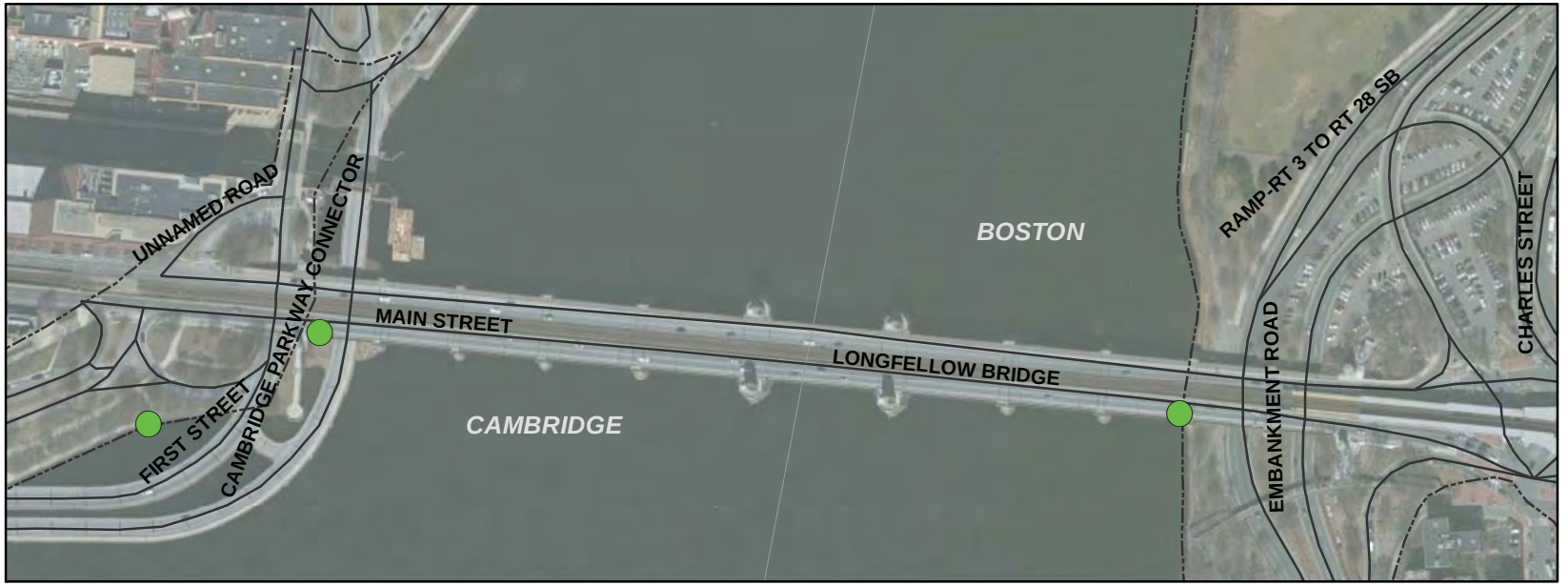
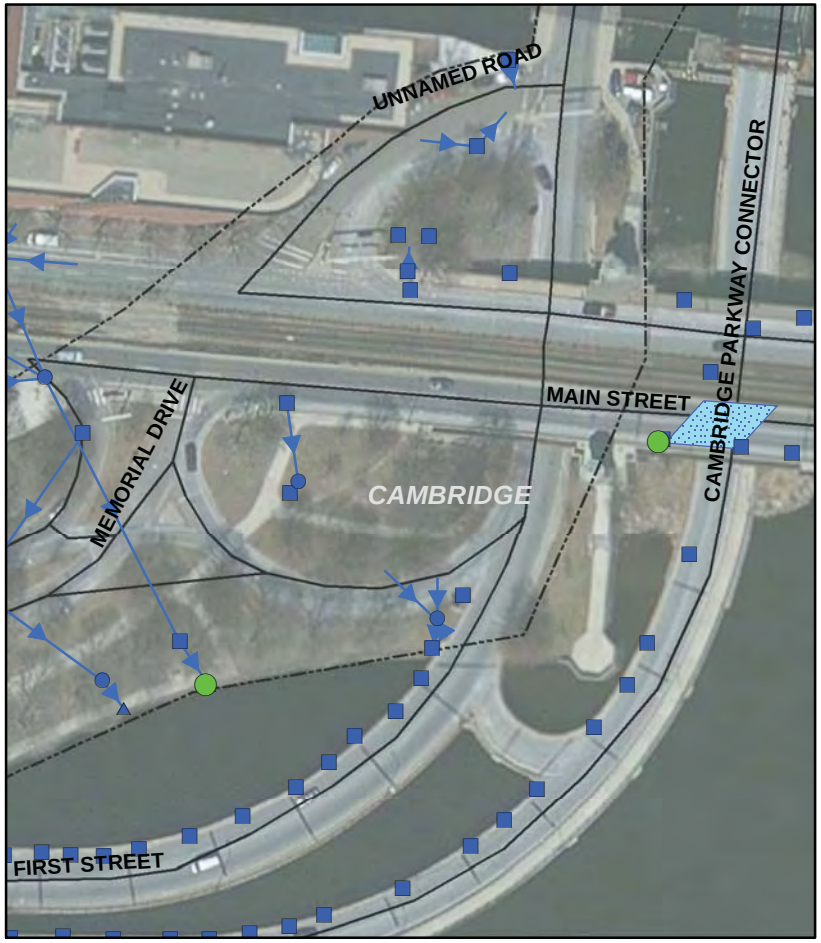
Feet
0 50 100 200





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Maestre A., Pitt R., and Williamson D. Nonparametric Statistical Tests Comparing the First Flush and Composite Samples from the National Stormwater Quality Database. Stormwater and Urban Water System Modeling in Models and Applications to Urban Water Systems, Vol. 12 (edited by W. James). CHI. Guelph, Ontario, pp. 317-338. 2004.

Massachusetts Department of Environmental Protection and US Environmental Protection Agency, New England Region (MassDEP and USEPA) 2007. TMDL for Nutrients in the Lower Charles River Basin, Massachusetts. Worcester and Boston, MA.

Pitt, R., Maestre, A., and Morquecho, R. Stormwater Characteristics as Contained in the Nationwide MS4 Stormwater Phase 1 Database. Critical Transitions in Water and Environmental Resources Management: pp. 1-9. 2004.

USDA. Natural Resources Conservation Service, Conservation Engineering Division. Urban Hydrology for Small Urban Watersheds. Technical Release 55. June 1986.

Appendix A

Wet Weather Protocol

DCR 2013

AECOM will perform monitoring of selected stormwater systems during rain events as part of a pilot wet weather monitoring program. The program will focus on discharges to the Lower Charles River in support of the phosphorus TMDL for that reach of the river (see attached maps). Monitoring will include systems that only receive runoff from DCR properties, roadways, or bridges as well as a system that receives runoff from non-DCR sources.

Targeted storm events will include a forecast of at least 0.5 inches of rain in an eight hour period preceded by at least 48 hours of dry weather (less than 0.1 inches of rain) during the Spring (March to June) of 2013.

The stormwater monitoring event will include a single grab sample at the 3 previously identified locations. Sampling will occur during the rising limb of the storm event and, if possible, will capture the first flush (initial 30 minutes of precipitation) of the event.

Specific monitoring procedures are outlined below:

Monitoring Procedure

1. Setup at the pre-selected monitoring location at least 30 minutes before the forecasted beginning of the rain event.
2. Record the time that precipitation begins.
3. Collect one liter of water within 30 minutes of the first steady rainfall (rising limb and/or first flush) and record the time. For discharges from outfalls or within catchbasins and manholes collect samples directly from pipes with a remote sampling device. Use a pole mounted sample cup with squared edges to collect sheet flow from roadways and bridges.
4. Divide the sample into bottles for bacteria and total phosphorus and place the bottles on ice.
5. Photograph the flow and note the major sources of runoff.
6. Deliver all samples to the laboratory for bacteria and total phosphorus analysis.
7. Compare sampling times with hydrograph recorded at a local weather station.

Method adapted from:

NPDES Storm Water Sampling Guidance Document. US Environmental Protection Agency. EPA 833-8-92-001. July 1992.

EPA NH Draft NPDES Permit, http://www.epa.gov/region1/npdes/stormwater/nh/2013/NHMS4-NewDraftPermit-2013.pdf

dcr
Massachusetts

DCR Drainage Connection and Permits 2013
Permit Year 11

Permit No.	Location	Source
#24951	Pleasant St., Watertown	Criterion Development Partners
#24958	Rt. 16 Near Rt. 99 Everett	Columbia Design Group
#24982	Robinson State Park Westfield	City of Westfield
#24992	25 Morrissey Blvd. Dorchester	Morrissey Blvd. Holdings / Dalton / Finegold
#25001	Revere Beach Pkwy/State Road	SPS/MASSDOT
#25034	Jamaicaway, 161 Huntington Ave.	Howard Stein/Hudson Associates
#25073	Blvd. Rd. Wellesley	Lesanto Development Corp.
#25098	18 Jackson St. Malden / Spot Pond Brook Flood Control Conduit	Combined Properties

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Deval L. Patrick
Governor

Richard K. Sullivan Jr., Secretary
Executive Office of Energy & Environmental Affairs

John P. Murray, Commissioner
Department of Conservation & Recreation