MassDOT Semi Annual Submittal

(June 8, 2012 – December 7, 2012)

NPDES MS4 General Permit Compliance Water Quality Impaired Waters Assessment and Mitigation Plan

December 7, 2012

Deval L. Patrick, Governor
Timothy P. Murray, Lt. Governor
Richard A. Davey, Secretary & CEO
Frank DePaola, Administrator

massDOT
Massachusetts Department of Transportation
Highway Division

December 7, 2012

David Gray
U.S. Environmental Protection Agency, Region 1
5 Post Office Square - Suite 100, Mail Code #OEP06-1
Boston, MA 02110

Subject: Semi Annual Submittal under MassDOT's Impaired Waters Program

Dear Mr. Gray,

As part of MassDOT's Impaired Waters Program, the attached report documents MassDOT's activities between June and December of this year. MassDOT has completed assessment of many receiving waters that receive direct discharge from MassDOT roads and the design and permitting of stormwater retrofit BMPs are underway in multiple locations.

This memo outlines the progress made to date towards the MassDOT commitment to assess the 684 impaired water bodies listed in Appendix L-1 of MassDOT's June 9, 2010 and July 23, 2010 submittals to EPA. MassDOT is completing the assessments using the processes outlined in BMP 7U: Impaired Waters Assessment and Mitigation Plan and/ or BMP 7R: TMDL Watershed Review. Assessments that do not require further design of BMPs to meet the target IC or pollutant loading are finalized in a single document and are included in Table 1 below. For assessments where it is determined that further action is necessary to meet the target IC or pollutant loading reductions, MassDOT developed two steps to complete the assessment.

1. **Progress Report**: The progress report assessment includes an evaluation of the potential contribution of stormwater from MassDOT urban roads and a calculation of the targeted reduction of effective impervious area and/or pollutant loading reduction taking into account existing BMPs. At this point the assessment meets the requirement by EPA to evaluate if existing BMPs are sufficient and therefore the assessments are included in Table 2 (separately) and Table 3 (combined with final reports) below.

2. **Progress to Final Report**: There can be a lag of 6 to 18 months between assessment and completing design to allow for gathering site specific information, design and permitting of the BMPs. Once the designs have reached the point that we can calculate the pollutant or impervious cover reduction provided by the proposed BMPs, the assessments are finalized. Assessments at this second stage are identified as "progress to final" assessments, which provide a summary of the progress report assessment and the drainage design information. While previous submittals include this type of submittal, this submittal does not include any in this stage.

Table 1 below summarizes the assessments that have been finalized (either through one final document or a progress to final assessment). A complete listing of the impaired waters with final assessments included in this submittal appears in Table 6 at the end of this letter.

Table 1 Summary of Final Assessments for Water Bodies in Appendix L-1

Assessment Type	Previous Submittals (#)	December 2012 Submittal (#)	Total (#)
Impaired Water Bodies with TMDLs*			
TMDL Method	10	1	11
IC Method**	3	0	3
TMDL and IC Method	5	0	5
No Discharge	55	4	59
Other (non-stormwater)	4	17	21
Total	**77**	**22**	**99**
Impaired Water Bodies without TMDLs			
IC Method	20	9	29
<9 % IC	28	3	31
No Discharge	133	23	156
Other (non-stormwater)	1	26	27
TMDL Method***	1	0	1
TMDL and IC Method	1	0	1
Total	**184**	**61**	**245**
Impaired Water Bodies Total	**261**	**83**	**344**

* TMDL listing as included in 2010 Appendix L-1
** The TMDL for these waterbodies is for pathogens which is not applicable to MassDOT's TMDL methodology. Therefore, the IC method was used to address the other listed impairments for the water body and the assessments addressed pathogens programmatically.
*** TMDL has been finalized for the receiving water since the submittal of the 2010 Appendix L-1. Therefore, the TMDL method was used for the assessment.

Table 2 summarizes the assessments that are in the progress reports stage. A complete listing of the impaired waters with progress reports included in this submittal appears in Table 7 at the end of this letter.

Table 2 Summary of Progress Assessments for Water Bodies in Appendix L-1

Assessment Type	Previous Submittals (#)	December 2012 Submittal (#)	Total (#)
Impaired Waterbodies with TMDLs			
TMDL and IC Method	0	1	1
IC Method**	1	0	1
TMDL Method	3	0	3
Impaired Waterbodies without TMDLs			
TMDL and IC Method	0	1	1
IC Method	13	7	20
Impaired Water Bodies Total	**17**	**9**	**26**

** The TMDL for these waterbodies is for pathogens which is not applicable to MassDOT's TMDL methodology. Therefore, the IC method was used to address the other listed impairments for the water body and the assessments addressed pathogens programmatically.

The measurable goal set for BMP 7R committed MassDOT to review 20% of the 209 impaired waters with a TMDL annually. Table 3 below summarizes the progress and final reports submitted as of this report to provide a holistic view of the progress made towards performing assessments for those water bodies listed on Appendix L-1 and towards meeting the commitments in these first two and a half years of the program.

Table 3 Summary of Total (Progress & Final) Assessment Submittals for Water Bodies on Appendix L-1

Assessment Type	Previous Submittals (#)	December 2012 Submittal (#)	Total (#)	Total (%)
Impaired Water Bodies with TMDLs*				
TMDL Method	13	1	14	
IC Method**	4	0	4	
TMDL and IC Method	5	1	6	
No Discharge	55	4	59	
Other (non-stormwater)	4	17	21	
Total	**81**	**23**	**104**	**50%**
Impaired Water Bodies without TMDLs				
IC Method	33	16	49	
<9 % IC	28	3	31	
No Discharge	133	23	156	
Other (non-stormwater)	1	26	27	
TMDL Method***	1	0	1	
TMDL and IC Method	1	1	2	
Total	**197**	**69**	**266**	
Impaired Waterbodies Total	**278**	**92**	**370**	**54%**

* TMDL listing as included in 2010 Appendix L-1

** The TMDL for these waterbodies is for pathogens which is not applicable to MassDOT's TMDL methodology. Therefore, the IC method was used to address the other listed impairments for the water body and the assessments addressed pathogens programmatically.

*** TMDL has been finalized for the receiving water since the submittal of the 2010 Appendix L-1. Therefore, the TMDL method was used for the assessment.

Our submittals continue to include assessments for waterbodies that were not listed in Appendix L-1. The impaired water bodies reviewed as part of this submittal are receiving waters that are listed as impaired according to the 2010 final 303(d) list but were not listed as impaired in the 2008 final 303(d) list. While not required under the BMP 7U and 7R commitments made to EPA explicitly, MassDOT has reviewed these water bodies when identified as part of projects or when reviewing larger watershed areas. We are including the table below to keep track of these "additional" submittals separately to illustrate the breadth of the work being accomplished under the Impaired Waters Program.

Table 4 Final Assessment Submittals for Waterbodies Not Included in Appendix L-1

Assessment Type	Previous Submittals (#)	December 2012 Submittal (#)	Total (#)
TMDL Method	2	1	3
<9% IC	0	3	3
Other (non-stormwater)	2	2	4
Other	0	1	1
Impaired + TMDL Total	**4**	**7**	**11**

Table 5 Progress Assessment Submittals for Water Bodies Not Included in Appendix L-1

Assessment Type	Previous Submittals (#)	December 2012 Submittal (#)	Total (#)
TMDL Method	1	0	1

Impaired Waters Assessments -- Attachments

This submittal includes the following attachments, showing impaired waters assessments in the categories identified below:

1. **Final Impaired Waters Assessments:** Attachment 1 includes 11 completed assessments for impaired waterbodies that required a full assessment.

2. **Progress Impaired Waters Assessments**: Attachment 2 includes 9 progress reports. These progress reports include target reductions in pollutant loading and impervious cover. These assessments will now be forwarded to MassDOT design contractors for design and permitting of BMPs to meet the target reductions to the maximum extent practicable. These progress reports represent a significant amount of work towards completing the assessment.

3. **Less than 9% Impervious Cover Assessments:** Attachment 3 includes 6 assessments where desktop/GIS analysis of the subbasin indicated that the subwatershed includes less than 9% impervious cover. These water bodies' impairments are not stormwater related. No further assessment is necessary.

4. **Unrelated Impairments Assessments:** Attachment 4 includes 40 assessments where the impairment is not stormwater related and therefore according to BMP 7U and 7R no further assessment is necessary.

5. **No Discharge from MassDOT Outfalls Assessments:** Attachment 5 includes 27 assessments where desktop review or field review of the subbasin found that MassDOT urban roads do not drain directly to the receiving water in question and therefore according to BMP 7U and 7R no further assessment is necessary. Only direct discharges, and not MassDOT properties that drain to other watercourses or segments upstream of the subject water body or stream segment, are included in the assessment.

6. **Category Change Assessments and Other:** Attachment 6 includes 6 assessments where review has found that the water body is no longer listed on the 2010 final 303(d) list as Category 5 which identified them as impaired for pollutants, or the water body was formerly listed as another segment and has already been assessed.

BMP Design and Construction

MassDOT's design contractors are developing design and construction documents for BMPs proposed in previously submitted assessments and progress reports. Table 6 at the end of this letter shows a summary of the progress on design of BMPs recommended in previous submittal assessments or in this submittal.

MassDOT welcomes any input or feedback from the EPA on the assessments and documents included in this and all future progress reports. If you have any questions or concerns, or would like to meet to discuss this submittal, please feel free to contact me at (857) 368-8788.

Yours sincerely,

Henry Barbaro
Supervisor of Wetlands & Water Resources
Henry.Barbaro@state.ma.us

cc: Kathleen Woodward, Esq., EPA Region I
Alex Murray, MassDOT
Tori Kim, MA Attorney General's Office

Table 6 Final Impaired Waters Assessments

Waterbody ID	Waterbody Name	Impairment▫	TMDL Impairment**	Method Used		Load Reduction Target		Notes/ Recommendations
				TMDL	IC	TMDL (lb/yr)	IC (ac)	
Water Body Included on Appendix L-1								
MA82045	Framingham Reservoir #2	Mercury in Fish Tissue, Turbidity	-		X		0.1	Bridge site constraints prevent improvements.
MA82B-06	Assabet River	Aquatic Plants (Macrophytes) [35108], Excess Algal Growth [35108], Other, (Non-Native Aquatic Plants*), Oxygen, Dissolved [35108], Temperature, water, Taste and Odor, Phosphorus (Total) [35108], (Debris/Floatables/Trash*)	-	X		0.2		Bridge site constraints prevent improvements.
MA92-08	Martins Brook	Fecal Coliform, Fishes Bioassessments, Aquatic Macroinvertebrate Bioassessments, Oxygen, Dissolved	-		X		2.2	Limited space, wetlands, and high groundwater levels prevent improvements.
MA92-17	Howlett Brook	Fishes Bioassessments, Fecal Coliform	-		X		0.1	Limited space, wetlands, and high groundwater levels prevent improvements.
MA34-15	Wilton Brook	Aquatic Plants (Macrophytes), (Non-Native Aquatic Plants*)	-		X		0.6	Site constraints prevent improvements. Municipal land is available but no DOT land.
MA71027	Lower Mystic Lake	(Sulfide-Hydrogen Sulfide*), Oxygen, Dissolved, (Salinity*)	-		X		0.06	Bridge site constraints prevent improvements.
MA62-07	Trout Brook	Turbidity, Oxygen, Dissolved, Total Suspended Solids (TSS), Fecal coliform	-		X		3.8	Limited space, wetlands, and bridge site constraints prevent improvements.
MA36094	Mona Lake	Nutrient/Eutrophication Biological Indicators	Phosphorus	X		0.2		Bridge site constraints prevent improvements.

Waterbody ID	Waterbody Name	Impairment▫	TMDL Impairment**	Method Used		Load Reduction Target		Notes/ Recommendations
				TMDL	IC	TMDL (lb/yr)	IC (ac)	
MA82A-13	Eames Brook	(Debris/Floatables/Trash*), Taste and Odor, Excess Algal Growth, Aquatic Macroinvertebrate Bioassessments, (Non-Native Aquatic Plants*)	-		X		0.09	Bridge site constraints prevent improvements.
MA82035	Farm Pond	Turbidity, Excess Algal Growth, (Non-Native Aquatic Plants*), (Eurasian Water Milfoil, Myriophyllum spicatum*)	-		X		0.04	Bridge site constraints prevent improvements.
MA36-23	Chicopee River	-	-	-	-	-	-	No longer impaired according to 2010 Integrated List of Waters. No further action required.
MA81-08	Nashua River	-	-	-	-	-	-	No longer impaired according to 2010 Integrated List of Waters. No further action required.
MA82A-14	Pine Brook	-	-	-	-	-	-	No longer impaired according to 2010 Integrated List of Waters. No further action required.
MA41056	Wielock Pond	-	-	-	-	-	-	No longer impaired according to 2010 Integrated List of Waters. No further action required.
MA96-17	Falmouth Inner Harbor	-	-	-	-	-	-	No longer impaired according to 2010 Integrated List of Waters. No further action required.

Waterbody ID	Waterbody Name	Impairment▫	TMDL Impairment**	Method Used		Load Reduction Target		Notes/ Recommendations
				TMDL	IC	TMDL (lb/yr)	IC (ac)	
Water Body Not Included on Appendix L-1								
MA51010	Brierly Pond	Aquatic Plants (Macrophytes), (Non-Native Aquatic Plants*)	-	X		0		TP loading rate complies with the TMDL. No further action required.
MA51-20	Unnamed Tributary	Aquatic Plants (Macrophytes) [361], Sedimentation/Siltation, Non-Native Aquatic Plants, Aquatic Plants (Macrophytes) [360]	-	-	-	-	-	No longer reported as its own water body on Integrated List of Waters. Now addressed as Curtis Ponds North and South (MA51032 and MA51032), which have already been assessed and did not require further action.

▫ Impairments listed on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*.

* "TMDL not required (Non-Pollutant)" according to MassDEP's final *Massachusetts Year 2010 Integrated List of Waters,*

**Some water bodies which did not have a TMDL impairment listed on Appendix L-1 have since been included in TMDL reports published by the MassDEP. These water bodies are not part of the 209 TMDL water bodies listed on Appendix L-1 and therefore do not comply with the requirement of completion of 20% TMDL water bodies per year.

Table 7 Impaired Waters Assessments – Progress Reports

Waterbody ID	Waterbody Name	Impairment▫	TMDL Impairment on L-1 Appendix**	Method Used		Load Reduction Target		Notes/ Recommendations
				TMDL	IC	TMDL (lb/yr)	IC (ac)	
Water Body Included on Appendix L-1								
MA53-01	Runnins River	Aquatic Macroinvertebrate Bioassessments, Fecal Coliform [38903], Mercury in Fish Tissue [33880], Nutrient/Eutrophication Biological Indicators, Oil and Grease, Oxygen, Dissolved, (Debris/Floatables/Trash*)	-	X	X		25.7	Assessed in combination with Burrs Pond (MA53001) which is run of the Runnins River. Will be assigned to Design Contractor for Final Design. TMDL listed on 2010 Final 303(d) list.
MA53001***	Burrs Pond	Aquatic Macroinvertebrate Bioassessments, Fecal Coliform, Mercury in Fish Tissue, Nutrient/Eutrophication Biological Indicators, Oil and Grease, Dissolved Oxygen, (Debris/Floatables/Trash*)	Mercury	X	X		25.7	Considered run of the Runnins River (MA53-01). Assessed in combination with Runnins River. Will be assigned to Design Contractor for Final Design.
MA62-05	Salisbury Plain River	(Physical substrate habitat alterations*), Fecal Coliform, Oxygen, Dissolved, Sedimentation/Siltation	-		X		1.7	Will be assigned to Design Contractor for Final Design.
MA62-06	Salisbury Plain River	(Debris/Floatables/Trash*), Aquatic Macroinvertebrate Bioassessments, Excess Algal Growth, Fecal Coliform, Phosphorus (Total), Taste and Odor, Turbidity, Oxygen, Dissolved	-		X		0.7	Will be assigned to Design Contractor for Final Design.

Waterbody ID	Waterbody Name	Impairment▫	TMDL Impairment on L-1 Appendix**	Method Used		Load Reduction Target		Notes/ Recommendations
				TMDL	IC	TMDL (lb/yr)	IC (ac)	
MA62-32	Matfield River	Fecal Coliform, Excess Algal Growth, Phosphorus (Total), Aquatic Macroinvertebrate Bioassessments, Oxygen, Dissolved, Taste and Odor`	-		X		1.0	Will be assigned to Design Contractor for Final Design.
MA62-33	Shumatuscacant River	Sedimentation/Siltation, Fecal Coliform, (Physical substrate habitat alterations*), Oxygen, Dissolved	-		X		2.0	Will be assigned to Design Contractor for Final Design.
MA92-03	Miles River	Oxygen, Dissolved, Aquatic Macroinvertebrate Bioassessments, Fecal Coliform	-		X		0.2	Will be assigned to Design Contractor for Final Design.
MA92-06	Ipswich River	Mercury in Fish Tissue, Oxygen, Dissolved, (Low flow alterations*)	-		X		8.8	Will be assigned to Design Contractor for Final Design.
MA95-42	New Bedford Inner Harbor	(Debris/Floatables/Trash*), Polychlorinated biphenyls, PCB in Fish Tissue, Taste and Odor, Fecal Coliform [36171], Oxygen, Dissolved, Oil and Grease, Other, Nitrogen (Total)			X		23.3	BMPs proposed in assessment. Assigned to Design Contractor for Final Design.

▫ Impairments listed on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*.

* "TMDL not required (Non-Pollutant)" according to MassDEP's final *Massachusetts Year 2010 Integrated List of Waters,*

**Some water bodies which did not have a TMDL impairment listed on Appendix L-1 have since been included in TMDL reports published by the MassDEP. These water bodies are not part of the 209 TMDL water bodies listed on Appendix L-1 and therefore do not comply with the requirement of completion of 20% TMDL water bodies per year.

***Burrs Pond (MA53001) is not listed on the *Massachusetts Year 2010 Integrated List of Waters* because it is now considered run of the Runnins River (MA53-01). The impairments listed in this table are the impairments listed in the *Massachusetts Year 2010 Integrated List of Waters* for Runnins River (MA53-01).

Table 8 Status of Completed Assessments with Target Removals

Semi-Annual Submittal Date	Waterbody ID	Waterbody Name	Submitted as a Progress Report?		If Submitted as a Progress Report: Resubmitted as a Final Report?		Progress (Design, Construction or Complete)		% Design Complete	Anticipated Date of 100% Design Completion
			Yes	No	Yes	No	June 8, 2012	December 8, 2012		
6/8/2012	MA32-05	Westfield River	X			X	n/a	Design	30%	1/6/2013
6/8/2012	MA34-19	Stony Brook	X			X	n/a	Design	30%	1/13/2013
6/8/2012	MA35026	Greenwood Pond	X			X	n/a	Design	30%	12/30/2012
6/8/2012	MA51073	Indian Lake	X			X	n/a	Pre-design	n/a	2014
6/8/2012	MA51-08	Unnamed Tributary	X			X	n/a	Pre-design	n/a	2014
6/8/2012	MA62-14	Robinson Brook	X			X	n/a	Design	75%	2013
6/8/2012	MA62-39	Rumford River	X			X	n/a	Design	25%	1/4/2013
6/8/2012	MA71-02	Mystic River	X			X	n/a	Design	25%	1/25/2013
6/8/2012	MA71-03	Mystic River	X			X	n/a	Design	15%	1/25/2013
6/8/2012	MA73-01	Neponset River	X			X	n/a	Pre-design	n/a	2014
6/8/2012	MA73-02	Neponset River	X			X	n/a	Pre-design	n/a	2014
6/8/2012	MA62134	Norton Reservoir		X			Pre-Design	Design	100%	2012
6/8/2012	MA42-03	French River		X			Pre-Design	Pre-Design	--	N/A
6/8/2012	MA42058*	Texas Pond		X			Pre-Design	Pre-Design	--	N/A
6/8/2012	MA42059*	Thayers Pond		X			Pre-Design	Pre-Design	--	N/A

Semi-Annual Submittal Date	Waterbody ID	Waterbody Name	Submitted as a Progress Report?		If Submitted as a Progress Report: Resubmitted as a Final Report?		Progress (Design, Construction or Complete)		% Design Complete	Anticipated Date of 100% Design Completion
			Yes	No	Yes	No	June 8, 2012	December 8, 2012		
6/8/2012	MA41-05	Cady Brook		X			Pre-Design	Pre-Design	--	N/A
6/8/2012	MA72-07	Charles River		X			--	--	--	--
						Toll Area Project	Pre-Design	Design	25-75%	6/30/2013
						Interstate 95 North Area Project	Pre-Design	Pre-Design	--	9/30/2013
6/8/2012	MA72-25	Rosemary Brook		X			Pre-Design	Design	25%	12/28/2012
6/8/2012	MA72-29	Cheese Cake Brook		X			Pre-Design	Design	25-75%	6/30/2013
6/8/2012	MA72-31	Unnamed Tributary (Millers River)		X			Pre-Design	Pre-Design	--	2014
6/8/2012	MA95113	Noquochoke Lake		X			25% Design Complete	Construction	100%	n/a
6/8/2012	MA95170	Noquochoke Lake		X			25% Design Complete	Construction	100%	n/a
6/8/2012	MA95171	Noquochoke Lake		X			25% Design Complete	Construction	100%	n/a
6/8/2012	MA72-36	Charles River		X			Pre-Design	Design	25-75%	6/30/2013
6/8/2012	MA62-47	Wading River		X			25/75% Design Complete	Construction	100%	n/a
12/8/2011	MA71-04	Alewife Brook	X			X	Pre-Design	75% Design	25%	Unknown
12/8/2011	MA51039	Dorothy Pond		X			Pre-Design	Pre-Design	n/a	Unknown
12/8/2011	MA74-08	Monatiquot River	X			X	Pre-Design	Pre-design	n/a	6/30/2013
12/8/2011	MA71040	Spy Pond	X			X	Pre-Design	Design	25-75%	12/31/2013

Semi-Annual Submittal Date	Waterbody ID	Waterbody Name	Submitted as a Progress Report?		If Submitted as a Progress Report: Resubmitted as a Final Report?		Progress (Design, Construction or Complete)		% Design Complete	Anticipated Date of 100% Design Completion
			Yes	No	Yes	No	June 8, 2012	December 8, 2012		
12/8/2011	MA93060	Lake Quannapowitt	X		X (6/8/12)		No Design required – no space for BMPs	Complete	n/a	n/a
12/8/2011	MA72-14	Mine Brook	X			X	n/a	Pre-design	n/a	6/30/2013
12/8/2011	MA71-01	Aberjona River	X		X (6/8/12)		25% Design Complete	Construction	100%	n/a
12/8/2011	MA61-04	Cole River	X		X (6/8/12)		15% Design Complete	Design	25%	-
12/8/2011	MA51-16	Dark Brook		X			Pre-25% Design	Design	25-75%	3/31/2013
12/8/2011	MA93032	Hawkes Pond	X		X (6/8/12)		25% Design Complete	Design	100%	n/a
12/8/2011	MA51-01	Kettle Brook	X			X	Design	Design	25-75%	3/31/2013
12/8/2011	MA61-02	Lee River	X		X (6/8/12)		15% Design Complete	Design	25%	12/21/12
12/8/2011	MA51087	Leesville Pond	X			X	25/75% Design Complete	Design	25-75%	3/31/2013
12/8/2011	MA93-34	Saugus River	X		X (6/8/12)		25% Design Complete	Design	75%	-
12/8/2011	MA93-35	Saugus River	X		X (6/8/12)		25% Design Complete	Design	75%	-
6/8/2011	MA84B-02	Beaver Brook		X			25/75% Design Complete	Construction	100%	n/a
6/8/2011	MA84038	Mill Pond		X			25/75% Design Complete	Construction	100%	n/a
3/8/2011	MA36-16	Quaboag River		X			n/a	25-75% Design	n/a	3/31/2013
3/8/2011	MA42034	Lowes Pond		X			n/a	Construction	100%	n/a
12/8/2010	MA51-03	Blackstone River		X			100% Construction Complete	100% Construction Complete	100%	Complete

Semi-Annual Submittal Date	Waterbody ID	Waterbody Name	Submitted as a Progress Report?		If Submitted as a Progress Report: Resubmitted as a Final Report?		Progress (Design, Construction or Complete)		% Design Complete	Anticipated Date of 100% Design Completion
			Yes	No	Yes	No	June 8, 2012	December 8, 2012		
12/8/2010	MA51012	Burncoat Park Pond		X			100% Construction Complete	100% Construction Complete	100%	Complete

*French River (MA42-03), Thayers Pond (MA42059) and Texas Pond (MA42058) were assessed together since Thayers Pond and Texas Pond are now considered run of the French River and the IC reduction target was set collectively.

List of Attachments

Attachment 1: Impaired Waters Assessments – Final Reports

Attachment 2 Impaired Waters Assessments – Progress Reports

Attachment 3: Less than 9% Impervious Cover Assessments

Attachment 4: Unrelated Impairments Assessments

Attachment 5: No Discharges from MassDOT Outfalls Assessments

Attachment 6: Category Change Assessments and Other

Attachment 1:

Impaired Waters Assessments – Final Reports

List of Impaired Waterbodies

Waterbody ID	Waterbody Name
MA34-15	Wilton Brook
MA36094	Mona Lake
MA51010	Brierly Pond
MA62-07	Trout Brook
MA71027	Lower Mystic Lake
MA82035	Farm Pond
MA82045	Framingham Reservoir #2
MA82A-13	Eames Brook
MA82B-06	Assabet River
MA92-08	Martins Brook
MA92-17	Howlett Brook

Attachment 2:

Impaired Waters Assessments - Progress Reports

List of Impaired Waterbodies

Waterbody ID	Waterbody Name
MA53001	Burrs Pond
MA53-01	Runnins River
MA62-05	Salisbury Plain River
MA62-06	Salisbury Plain River
MA62-32	Matfield River
MA62-33	Shumatuscacant River
MA92-03	Miles River
MA92-06	Ipswich River
MA95-42	New Bedford Inner Harbor

Attachment 3:

Less than 9% Impervious Cover Assessments

List of Impaired Waterbodies

Waterbody ID	Waterbody Name	On Appendix L-1	TMDL
MA51-12	West River	Yes	No
MA81-06	Nashua River	Yes	No
MA81167	Pepperell Pond	Yes	No
MA42-13	Little River	No	No
MA81-56	Asnebumskit Brook	No	No
MA91-37	Mulpus Brook	No	No

Attachment 4:

Unrelated Impairments Assessments

Attachment 5:

No Discharges from MassDOT Outfalls Assessments

List of Impaired Waterbodies

Waterbody ID	Waterbody Name	TMDL
MA32-09	Powdermill Brook	-
MA36093	Minechoag Pond	Phosphorus (CN 118)
MA62-08	Salisbury Brook	-
MA62232	Sassaquin Pond	-
MA92038	Martins Pond	Mercury (NEHg) (CN NEIWPCC-Hg)
MA95-33	Acushnet River	-

Attachment 6:

Category Change Assessments and Other

Table 6 Final Impaired Waters Assessments

Waterbody ID	Waterbody Name	Impairment▫	TMDL Impairment**	Method Used: TMDL	Method Used: IC	Load Reduction Target: TMDL (lb/yr)	Load Reduction Target: IC (ac)	Notes/ Recommendations
Water Body Included on Appendix L-1								
MA82045	Framingham Reservoir #2	Mercury in Fish Tissue, Turbidity	-		X		0.1	Bridge site constraints prevent improvements.
MA82B-06	Assabet River	Aquatic Plants (Macrophytes) [35108], Excess Algal Growth [35108], Other, (Non-Native Aquatic Plants*), Oxygen, Dissolved [35108], Temperature, water, Taste and Odor, Phosphorus (Total) [35108], (Debris/Floatables/Trash*)	-	X		0.2		Bridge site constraints prevent improvements.
MA92-08	Martins Brook	Fecal Coliform, Fishes Bioassessments, Aquatic Macroinvertebrate Bioassessments, Oxygen, Dissolved	-		X		2.2	Limited space, wetlands, and high groundwater levels prevent improvements.
MA92-17	Howlett Brook	Fishes Bioassessments, Fecal Coliform	-		X		0.1	Limited space, wetlands, and high groundwater levels prevent improvements.
MA34-15	Wilton Brook	Aquatic Plants (Macrophytes), (Non-Native Aquatic Plants*)	-		X		0.6	Site constraints prevent improvements. Municipal land is available but no DOT land.
MA71027	Lower Mystic Lake	(Sulfide-Hydrogen Sulfide*), Oxygen, Dissolved, (Salinity*)	-		X		0.06	Bridge site constraints prevent improvements.
MA62-07	Trout Brook	Turbidity, Oxygen, Dissolved, Total Suspended Solids (TSS), Fecal coliform	-		X		3.8	Limited space, wetlands, and bridge site constraints prevent improvements.
MA36094	Mona Lake	Nutrient/Eutrophication Biological Indicators	Phosphorus	X		0.2		Bridge site constraints prevent improvements.

Waterbody ID	Waterbody Name	Impairment▫	TMDL Impairment**	Method Used		Load Reduction Target		Notes/ Recommendations
				TMDL	IC	TMDL (lb/yr)	IC (ac)	
MA82A-13	Eames Brook	(Debris/Floatables/Trash*), Taste and Odor, Excess Algal Growth, Aquatic Macroinvertebrate Bioassessments, (Non-Native Aquatic Plants*)	-		X		0.09	Bridge site constraints prevent improvements.
MA82035	Farm Pond	Turbidity, Excess Algal Growth, (Non-Native Aquatic Plants*), (Eurasian Water Milfoil, Myriophyllum spicatum*)	-		X		0.04	Bridge site constraints prevent improvements.
MA36-23	Chicopee River	-	-	-	-	-	-	No longer impaired according to 2010 Integrated List of Waters. No further action required.
MA81-08	Nashua River	-	-	-	-	-	-	No longer impaired according to 2010 Integrated List of Waters. No further action required.
MA82A-14	Pine Brook	-	-	-	-	-	-	No longer impaired according to 2010 Integrated List of Waters. No further action required.
MA41056	Wielock Pond	-	-	-	-	-	-	No longer impaired according to 2010 Integrated List of Waters. No further action required.
MA96-17	Falmouth Inner Harbor	-	-	-	-	-	-	No longer impaired according to 2010 Integrated List of Waters. No further action required.

Waterbody ID	Waterbody Name	Impairment▫	TMDL Impairment**	Method Used		Load Reduction Target		Notes/ Recommendations
				TMDL	IC	TMDL (lb/yr)	IC (ac)	
Water Body Not Included on Appendix L-1								
MA51010	Brierly Pond	Aquatic Plants (Macrophytes), (Non-Native Aquatic Plants*)	-	X		0		TP loading rate complies with the TMDL. No further action required.
MA51-20	Unnamed Tributary	Aquatic Plants (Macrophytes) [361], Sedimentation/Siltation, Non-Native Aquatic Plants, Aquatic Plants (Macrophytes) [360]	-	-	-	-	-	No longer reported as its own water body on Integrated List of Waters. Now addressed as Curtis Ponds North and South (MA51032 and MA51032), which have already been assessed and did not require further action.

▫ Impairments listed on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters.*

* "TMDL not required (Non-Pollutant)" according to MassDEP's final *Massachusetts Year 2010 Integrated List of Waters,*

**Some water bodies which did not have a TMDL impairment listed on Appendix L-1 have since been included in TMDL reports published by the MassDEP. These water bodies are not part of the 209 TMDL water bodies listed on Appendix L-1 and therefore do not comply with the requirement of completion of 20% TMDL water bodies per year.

Table 7 Impaired Waters Assessments – Progress Reports

Waterbody ID	Waterbody Name	Impairment▫	TMDL Impairment on L-1 Appendix**	Method Used		Load Reduction Target		Notes/ Recommendations
				TMDL	IC	TMDL (lb/yr)	IC (ac)	
Water Body Included on Appendix L-1								
MA53-01	Runnins River	Aquatic Macroinvertebrate Bioassessments, Fecal Coliform [38903], Mercury in Fish Tissue [33880], Nutrient/Eutrophication Biological Indicators, Oil and Grease, Oxygen, Dissolved, (Debris/Floatables/Trash*)	-	X	X		25.7	Assessed in combination with Burrs Pond (MA53001) which is run of the Runnins River. Will be assigned to Design Contractor for Final Design. TMDL listed on 2010 Final 303(d) list.
MA53001***	Burrs Pond	Aquatic Macroinvertebrate Bioassessments, Fecal Coliform, Mercury in Fish Tissue, Nutrient/Eutrophication Biological Indicators, Oil and Grease, Dissolved Oxygen, (Debris/Floatables/Trash*)	Mercury	X	X		25.7	Considered run of the Runnins River (MA53-01). Assessed in combination with Runnins River. Will be assigned to Design Contractor for Final Design.
MA62-05	Salisbury Plain River	(Physical substrate habitat alterations*), Fecal Coliform, Oxygen, Dissolved, Sedimentation/Siltation	-		X		1.7	Will be assigned to Design Contractor for Final Design.
MA62-06	Salisbury Plain River	(Debris/Floatables/Trash*), Aquatic Macroinvertebrate Bioassessments, Excess Algal Growth, Fecal Coliform, Phosphorus (Total), Taste and Odor, Turbidity, Oxygen, Dissolved	-		X		0.7	Will be assigned to Design Contractor for Final Design.

Waterbody ID	Waterbody Name	Impairment▫	TMDL Impairment on L-1 Appendix**	Method Used		Load Reduction Target		Notes/ Recommendations
				TMDL	IC	TMDL (lb/yr)	IC (ac)	
MA62-32	Matfield River	Fecal Coliform, Excess Algal Growth, Phosphorus (Total), Aquatic Macroinvertebrate Bioassessments, Oxygen, Dissolved, Taste and Odor`	-		X		1.0	Will be assigned to Design Contractor for Final Design.
MA62-33	Shumatuscacant River	Sedimentation/Siltation, Fecal Coliform, (Physical substrate habitat alterations*), Oxygen, Dissolved	-		X		2.0	Will be assigned to Design Contractor for Final Design.
MA92-03	Miles River	Oxygen, Dissolved, Aquatic Macroinvertebrate Bioassessments, Fecal Coliform	-		X		0.2	Will be assigned to Design Contractor for Final Design.
MA92-06	Ipswich River	Mercury in Fish Tissue, Oxygen, Dissolved, (Low flow alterations*)	-		X		8.8	Will be assigned to Design Contractor for Final Design.
MA95-42	New Bedford Inner Harbor	(Debris/Floatables/Trash*), Polychlorinated biphenyls, PCB in Fish Tissue, Taste and Odor, Fecal Coliform [36171], Oxygen, Dissolved, Oil and Grease, Other, Nitrogen (Total)			X		23.3	BMPs proposed in assessment. Assigned to Design Contractor for Final Design.

▫ Impairments listed on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*.

* "TMDL not required (Non-Pollutant)" according to MassDEP's final *Massachusetts Year 2010 Integrated List of Waters,*

**Some water bodies which did not have a TMDL impairment listed on Appendix L-1 have since been included in TMDL reports published by the MassDEP. These water bodies are not part of the 209 TMDL water bodies listed on Appendix L-1 and therefore do not comply with the requirement of completion of 20% TMDL water bodies per year.

***Burrs Pond (MA53001) is not listed on the *Massachusetts Year 2010 Integrated List of Waters* because it is now considered run of the Runnins River (MA53-01). The impairments listed in this table are the impairments listed in the *Massachusetts Year 2010 Integrated List of Waters* for Runnins River (MA53-01).

Table 8 Status of Completed Assessments with Target Removals

Semi-Annual Submittal Date	Waterbody ID	Waterbody Name	Submitted as a Progress Report?		If Submitted as a Progress Report: Resubmitted as a Final Report?		Progress (Design, Construction or Complete)		% Design Complete	Anticipated Date of 100% Design Completion
			Yes	No	Yes	No	June 8, 2012	December 8, 2012		
6/8/2012	MA32-05	Westfield River	X			X	n/a	Design	30%	1/6/2013
6/8/2012	MA34-19	Stony Brook	X			X	n/a	Design	30%	1/13/2013
6/8/2012	MA35026	Greenwood Pond	X			X	n/a	Design	30%	12/30/2012
6/8/2012	MA51073	Indian Lake	X			X	n/a	Pre-design	n/a	2014
6/8/2012	MA51-08	Unnamed Tributary	X			X	n/a	Pre-design	n/a	2014
6/8/2012	MA62-14	Robinson Brook	X			X	n/a	Design	75%	2013
6/8/2012	MA62-39	Rumford River	X			X	n/a	Design	25%	1/4/2013
6/8/2012	MA71-02	Mystic River	X			X	n/a	Design	25%	1/25/2013
6/8/2012	MA71-03	Mystic River	X			X	n/a	Design	15%	1/25/2013
6/8/2012	MA73-01	Neponset River	X			X	n/a	Pre-design	n/a	2014
6/8/2012	MA73-02	Neponset River	X			X	n/a	Pre-design	n/a	2014
6/8/2012	MA62134	Norton Reservoir		X			Pre-Design	Design	100%	2012
6/8/2012	MA42-03	French River		X			Pre-Design	Pre-Design	--	N/A
6/8/2012	MA42058*	Texas Pond		X			Pre-Design	Pre-Design	--	N/A
6/8/2012	MA42059*	Thayers Pond		X			Pre-Design	Pre-Design	--	N/A

Semi-Annual Submittal Date	Waterbody ID	Waterbody Name	Submitted as a Progress Report?		If Submitted as a Progress Report: Resubmitted as a Final Report?		Progress (Design, Construction or Complete)		% Design Complete	Anticipated Date of 100% Design Completion
			Yes	No	Yes	No	June 8, 2012	December 8, 2012		
6/8/2012	MA41-05	Cady Brook		X			Pre-Design	Pre-Design	--	N/A
6/8/2012	MA72-07	Charles River		X			--	--	--	--
		Toll Area Project					Pre-Design	Design	25-75%	6/30/2013
		Interstate 95 North Area Project					Pre-Design	Pre-Design	--	9/30/2013
6/8/2012	MA72-25	Rosemary Brook		X			Pre-Design	Design	25%	12/28/2012
6/8/2012	MA72-29	Cheese Cake Brook		X			Pre-Design	Design	25-75%	6/30/2013
6/8/2012	MA72-31	Unnamed Tributary (Millers River)		X			Pre-Design	Pre-Design	--	2014
6/8/2012	MA95113	Noquochoke Lake		X			25% Design Complete	Construction	100%	n/a
6/8/2012	MA95170	Noquochoke Lake		X			25% Design Complete	Construction	100%	n/a
6/8/2012	MA95171	Noquochoke Lake		X			25% Design Complete	Construction	100%	n/a
6/8/2012	MA72-36	Charles River		X			Pre-Design	Design	25-75%	6/30/2013
6/8/2012	MA62-47	Wading River		X			25/75% Design Complete	Construction	100%	n/a
12/8/2011	MA71-04	Alewife Brook	X			X	Pre-Design	75% Design	25%	Unknown
12/8/2011	MA51039	Dorothy Pond		X			Pre-Design	Pre-Design	n/a	Unknown
12/8/2011	MA74-08	Monatiquot River	X			X	Pre-Design	Pre-design	n/a	6/30/2013
12/8/2011	MA71040	Spy Pond	X			X	Pre-Design	Design	25-75%	12/31/2013

Semi-Annual Submittal Date	Waterbody ID	Waterbody Name	Submitted as a Progress Report?		If Submitted as a Progress Report: Resubmitted as a Final Report?		Progress (Design, Construction or Complete)		% Design Complete	Anticipated Date of 100% Design Completion
			Yes	No	Yes	No	June 8, 2012	December 8, 2012		
12/8/2011	MA93060	Lake Quannapowitt	X		X (6/8/12)		No Design required – no space for BMPs	Complete	n/a	n/a
12/8/2011	MA72-14	Mine Brook	X			X	n/a	Pre-design	n/a	6/30/2013
12/8/2011	MA71-01	Aberjona River	X		X (6/8/12)		25% Design Complete	Construction	100%	n/a
12/8/2011	MA61-04	Cole River	X		X (6/8/12)		15% Design Complete	Design	25%	-
12/8/2011	MA51-16	Dark Brook		X			Pre-25% Design	Design	25-75%	3/31/2013
12/8/2011	MA93032	Hawkes Pond	X		X (6/8/12)		25% Design Complete	Design	100%	n/a
12/8/2011	MA51-01	Kettle Brook	X			X	Design	Design	25-75%	3/31/2013
12/8/2011	MA61-02	Lee River	X		X (6/8/12)		15% Design Complete	Design	25%	12/21/12
12/8/2011	MA51087	Leesville Pond	X			X	25/75% Design Complete	Design	25-75%	3/31/2013
12/8/2011	MA93-34	Saugus River	X		X (6/8/12)		25% Design Complete	Design	75%	-
12/8/2011	MA93-35	Saugus River	X		X (6/8/12)		25% Design Complete	Design	75%	-
6/8/2011	MA84B-02	Beaver Brook		X			25/75% Design Complete	Construction	100%	n/a
6/8/2011	MA84038	Mill Pond		X			25/75% Design Complete	Construction	100%	n/a
3/8/2011	MA36-16	Quaboag River		X			n/a	25-75% Design	n/a	3/31/2013
3/8/2011	MA42034	Lowes Pond		X			n/a	Construction	100%	n/a
12/8/2010	MA51-03	Blackstone River		X			100% Construction Complete	100% Construction	100%	Complete

Semi-Annual Submittal Date	Waterbody ID	Waterbody Name	Submitted as a Progress Report?		If Submitted as a Progress Report: Resubmitted as a Final Report?		Progress (Design, Construction or Complete)		% Design Complete	Anticipated Date of 100% Design Completion
			Yes	No	Yes	No	June 8, 2012	December 8, 2012		
12/8/2010	MA51012	Burncoat Park Pond		X			100% Construction Complete	100% Construction Complete	100%	Complete

*French River (MA42-03), Thayers Pond (MA42059) and Texas Pond (MA42058) were assessed together since Thayers Pond and Texas Pond are now considered run of the French River and the IC reduction target was set collectively.

List of Attachments

Attachment 1: Impaired Waters Assessments – Final Reports

Attachment 2 Impaired Waters Assessments – Progress Reports

Attachment 3: Less than 9% Impervious Cover Assessments

Attachment 4: Unrelated Impairments Assessments

Attachment 5: No Discharges from MassDOT Outfalls Assessments

Attachment 6: Category Change Assessments and Other

Attachment 1:

Impaired Waters Assessments – Final Reports

List of Impaired Waterbodies

Waterbody ID	Waterbody Name
MA34-15	Wilton Brook
MA36094	Mona Lake
MA51010	Brierly Pond
MA62-07	Trout Brook
MA71027	Lower Mystic Lake
MA82035	Farm Pond
MA82045	Framingham Reservoir #2
MA82A-13	Eames Brook
MA82B-06	Assabet River
MA92-08	Martins Brook
MA92-17	Howlett Brook

Impaired Waters Assessment for Wilton Brook (MA34-15)

Impaired Water Body

Name: Wilton Brook

Location: Easthampton, MA

Water Body ID: MA34-15

Impairments

Wilton Brook (MA34-15) is listed under Category 5, "Waters Requiring a TMDL", on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. Wilton Brook is impaired for the following:

- aquatic plants (macrophytes)
- (non-native aquatic plants*)

According to MassDEP's *Connecticut River Watershed 2003 Water Quality Assessment Report* (MassDEP, 2008), Wilton Brook includes Rubber Thread Pond as a run of the river impoundment based on depth and detention time data. Rubber Thread Pond was on the 2006 Integrated List of Waters for noxious aquatic plants because of the presence of *Trapa natans,* a non-native aquatic plant.

Relevant Water Quality Standards

Water Body Classification: Class B

Applicable State Regulations:

- *314 CMR 4.05 (5) (a) Aesthetics.* All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.
- *314 CMR 4.05 (5) (c) Nutrients*. Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.

Site Description

Wilton Brook is approximately 1.1 miles long and is defined by its headwaters at South Street in Easthampton, MA to the outlet of Rubber Thread Pond in Easthampton, MA. MassDOT's property directly contributing stormwater runoff to Wilton Brook is comprised of approximately 2.0 miles of South Main Street (Route 10). Route 10 is a two lane roadway in which stormwater is collected in catch basins along the shoulder. Stormwater is piped to a trunk line which runs east to South Main Street. The trunk line ties into the municipal system on South Street which continues south where it discharges on the west side of South Street north of the bike path approximately 200 feet upstream of Wilton Brook. The pipe discharges to a vegetated area (See Photo 1) and stormwater flows through two culverts which discharge to an eroded dirt area approximately 130 feet upstream of Wilton Brook (See Photo 2). Based on the erosion at the culvert outlet, MassDOT assumed large volumes and high velocities of stormwater flow through this area and directly discharge to Wilton Brook prior to infiltrating the soils. The total watershed and subwatershed are the same for Wilton Brook and are shown in Figure 1. MassDOT property directly discharging stormwater to Wilton Brook is shown in Figure 2.

Photo 1: Municipal Stormwater Outfall

Photo 2: Erosion at Culvert Outlet

Assessment under BMP 7U

The impairments for Wilton Brook have not been addressed by a TMDL. Therefore, MassDOT assessed the impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the following impairments:

- aquatic plants (macrophytes)

According to MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*, the impairment of (non-native aquatic plants*) is not caused by pollutants (MassDEP, 2011). Therefore, this impairment is not considered further in this assessment.

MassDOT's Application of the Impervious Cover Method

MassDOT's Application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I's Impervious Cover Method described in EPA's *Stormwater TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT's program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT's Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body's entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS's impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT's target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT's properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's *Stormwater Best Management Practices (BMP) Performance Analysis* report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for Wilton Brook (MA34-15):

Table 1. Site Parameters for Wilton Brook (MA34-15)

Total and Subwatershed		
Watershed Area	801	acres
Impervious Cover (IC) Area	134	acres
Percent Impervious	16.7	%
IC Area at 9% Goal	72	acres
Target Reduction % in IC	46.3	%
Reductions Applied to DOT Direct Watershed		
MassDOT's IC Area **Directly** Contributing to Impaired Segment	1.3	acres
MassDOT's Target Reduction in Effective IC (46.3% of DOT Directly Contributing IC)	0.6	acres

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 46.3%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 0.6 acres.

<u>Existing BMPs</u>

There are no existing BMPs in the Wilton Brook directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to Wilton Brook.

Mitigation Plan

No mitigation of impervious surface is achieved by existing BMPs. Therefore, MassDOT considered the implementation of additional BMPs to reach the target reduction of 0.6 acres.

Based on the review of MassDOT's directly contributing drainage area, no potential BMPs have been identified that can be implemented on MassDOT property to address the impairments of Wilton Brook given the site constraint of limited property. Along Route 10 limited right-of-way and residential development adjacent to the road prevent implementation of stormwater infiltration BMPs. MassDOT does not own property near the municipal outlet which drains stormwater from Route 10 and therefore construction of infiltration BMPs is not feasible.

Conclusions

MassDOT used the IC Method to assess Wilton Brook for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. Results indicate that MassDOT should reduce its effective IC within its directly contributing subwatershed by 0.6 acres to achieve the targeted reduction in effective IC. MassDOT evaluated its property within the directly contributing watershed to Wilton Brook to identify existing BMPs and found that no BMPs exist. This information is summarized in Table 2 below.

Table 2. Effective IC Reductions under Existing & Proposed Conditions

IC in Directly Contributing Watershed	1.3	acres
Target Reduction in Effective IC	0.6	acres
IC Effectively Reduced by Existing BMPs	0.0	acres
IC Remaining to Mitigate with Proposed BMPs	**0.6**	**acres**

MassDOT should reduce its effective IC within the directly contributing watershed by an additional 0.6 acres to achieve the targeted reduction in IC. However, site limitations in the Wilton Brook subwatershed include limited right-of-way and residential development adjacent to MassDOT property and lack of owned property near the outlet of drainage from MassDOT's roadway which do not allow for the construction of stormwater infiltration BMPs that would provide effective treatment of the impervious area for this location. Therefore, no further action will be taken as part of the Retrofit Initiative of the MassDOT Impaired Waters program.

MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. Furthermore, MassDOT will continue to implement non-structural BMPs that reduce the impacts of stormwater.

References

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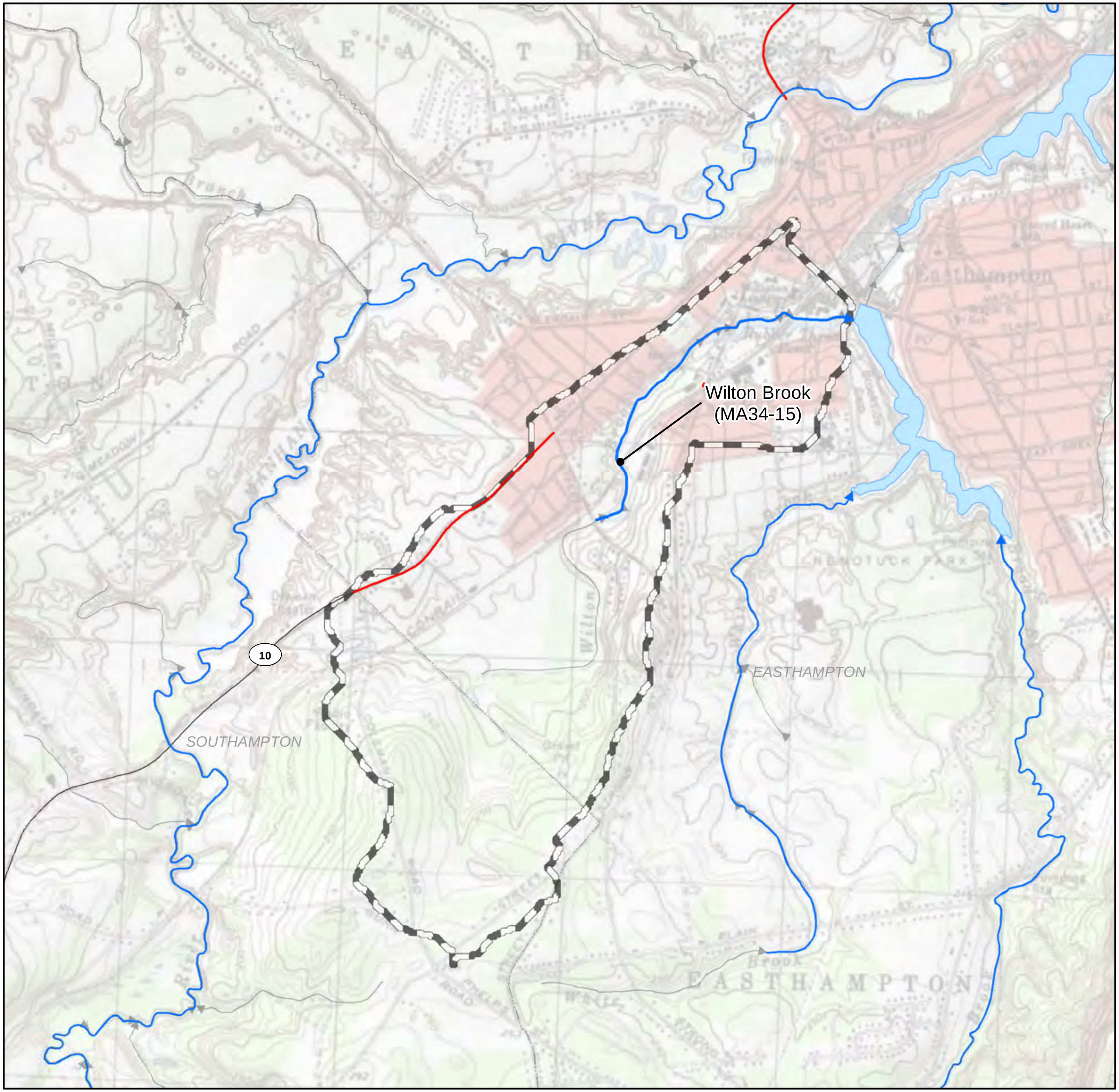

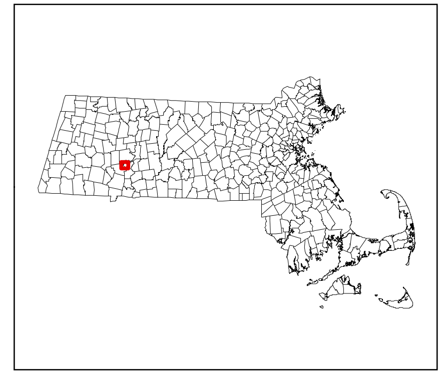

- Blackstone River
- Impaired Stream Segment
- Non-Impaired Stream Segment
- Impaired Water Bodies
- Total and Sub Watershed
- MassDOT Roads in Urban Areas
- MassDOT Roads
- Town Boundaries

N

0 1,000 2,000 3,000 4,000 Feet

1 in = 2,000 ft

Figure 1

Wilton Brook (MA34-15)
Sub and Total Watershed

December 2012

Figure 2

Wilton Brook (MA34-15)
Directly Contributing
MassDOT Watershed

December 2012

Impaired Waters Assessment for Mona Lake (MA36094)

Impaired Water Body

Name: Mona Lake

Location: Springfield, MA

Water Body ID: MA36094

Impairments

Mona Lake (MA36094) is listed as a Category 4a water body, “TMDL is completed”, on MassDEP’s final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). Mona Lake is impaired for the following:

- nutrient/eutrophication biological indicators

Relevant Water Quality Standards

Water Body Classification: Class B

- *314 CMR 4.05 (5)(a) Aesthetics*. All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.
- *314 CMR 4.05 (5) (c) Nutrients*. Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.

Site Description

Mona Lake is a waterbody located in the Chicopee River Watershed in Springfield, MA of approximately 11 acres. The lake lies between a railroad and Berkshire Ave in a high density residential area. Within the subwatershed of Mona Lake, MassDOT owns 75-ft of roadway on the Berkshire Ave Bridge which spans the railroad approximately 800 feet southwest of the lake. The sub watershed is shown in Figure 1 and MassDOT’s directly contributing watershed is shown in Figure 2.

MassDOT owns only the bridge on Berkshire Ave and minimal to no property surrounding the bridge. The approach roadways are owned and operated by the respective towns. No closed drainage systems exist on the bridge structures; however, the bridges are curbed and stormwater runoff flows off the bridge into the municipal stormwater system. Based on topography of the site, the municipal system likely drains to Mona Lake.

Assessment under BMP 7R

The TMDL for phosphorus for Mona Lake addresses the impairment of nutrient/eutrophication biological indicators. Therefore, MassDOT assessed the contribution of phosphorus from MassDOT property directly draining to this water body to address these impairments. The assessment was completed using the approach described in BMP 7R (TMDL Watershed Review).

TMDL

The Massachusetts Department of Environmental Protection's (MassDEP) TMDL report titled *Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes* [CN 118.0] (MassDEP, 2002) can be summarized as follows:

- Pollutant of Concern: Phosphorus
- Impairment for Mona Lake Addressed in TMDL: nutrient/eutrophication biological indicators
- Applicable Waste Load Allocation (WLA): See Table 2d (p. 41) and 4d (p. 48) of TMDL Report.
  - Description of Associated Land Use: Commercial/Industrial
  - Commercial/Industrial Land Use Current Load (TP): 0.0 kg/yr (0.0 lbs/yr)
  - Commercial/ Industrial Land Use Target WLA (TP): 0.0 kg/yr (0.0 lbs/yr)
  - Commercial/Industrial Area in Watershed: 0.0 ha (0.0 acres)
  - Commercial/Industrial Land Use Target Areal WLA (TP): 0.0 kg/ha/yr (0.0 lb/acre/yr)

Estimated Loading from MassDOT

The loading of total phosphorus (TP) from MassDOT property directly contributing stormwater runoff to Mona Lake was estimated using the following assumptions and calculations:

- MassDOT estimates the TP loading from its impervious areas as 1.6 lb/acre/yr. This loading rate is based on data collected in a study of stormwater runoff conducted by the United States Geological Survey (USGS) (Smith and Granato, 2010). The study analyzed stormwater samples from 12 sites located on highways operated by MassDOT across Massachusetts between September 2005 and September 2007. Samples were taken under a variety of weather conditions during this period.
- MassDOT estimates the TP loading from its pervious areas as 0.6 lb/acre/yr. This loading rate is based on the loading rate for hayland provided in the United States Environmental Protection Agency's (EPA) document EPA 440/5-80-011, "Modeling phosphorus loading and Pond response under uncertainty: a manual and compilation of export coefficients" (Reckhow, 1980). Hayland was chosen to represent the pervious right-of-way areas which are typically cleared areas that are mowed only once per year.

- MassDOT calculated its total estimated TP loading rate using the estimated loading rates listed above. MassDOT property contributing stormwater directly to Mona Lake is 0.1 acres of impervious area and 0.0 acres of pervious area. The TP loading is 0.2 lb/yr without accounting for existing BMPs or treatment throughout the watershed.
- MassDOT calculated its target TP WLA using the TMDL target areal WLA of 0.0 lb/ac/yr and the total area of MassDOT property within the TMDL watershed directly draining to Mona Lake (0.1 acres). The target TP WLA for MassDOT runoff is 0.0 lb/yr.

Assessment

MassDOT calculated its current TP loading rate (0.2 lb/yr) and its target TP WLA (0.0 lb/yr) using values provided in MassDEP's TMDL report. The difference between these two values represents the target reduction in TP that MassDOT will aim to achieve to comply with the WLA. For the watershed directly contributing to Mona Lake, this target reduction is 0.2 lb/yr, or 100%. As explained in BMP 7R, MassDOT's pollutant loading analysis provides only a preliminary estimate of the level of pollutant reductions that may be recommended. In light of the variability of data on stormwater discharges, MassDOT will rely on a variety of other factors apart from numeric guidelines, including site constraints, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT only owns the Berkshire Ave Bridge and no existing BMPs were identified in the DOT direct watershed to Mona Lake. Thus, there is currently no TP reduction being provided.

Table 1: Loading from MassDOT's Directly Contributing Property Relative to TMDL WLA

Total Area	0.1	ac
Target Areal WLA	0.0	lb/ac/yr
Total Estimated Load	0.2	lb/yr
WLA for MassDOT's Directly Contributing Property	0.0	lb/yr
MassDOT's Required Load Reduction	0.2	lb/yr

Mitigation Plan

There are no existing BMPs in the directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to Mona Lake. Because no BMPs exist to meet the target reduction of 0.2 acres, MassDOT considered the implementation of BMPs.

Based on the review of MassDOT's directly contributing drainage area, no BMPs have been identified that can be implemented on MassDOT property to address the impairments of Mona Lake due to site constraints. The Berkshire Ave Bridge is owned by MassDOT, but the roadways on either side of the bridge are not owned by MassDOT. Therefore, there is no land available to implement stormwater infiltration BMPs to mitigate the effect of the bridge stormwater runoff.

Conclusions

MassDOT used the TMDL Method to assess Mona Lake (MA36094) for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. To meet the TMDL for the phosphorus MassDOT should reduce its TP loading within the urban area directly contributing watershed by 0.2 lb/yr to achieve the targeted reduction. MassDOT evaluated its property within the directly contributing watershed to Mona Lake to identify existing BMPs and found that no BMPs exist to reduce effective IC. This information is summarized in Table 1 above.

MassDOT should reduce its TP loading to Mona Pond by an additional 0.2 lb/yr to achieve the guidelines set forth in the TMDL. However, the site constraints and limited right-of-way area indicate that the construction of stormwater infiltration BMPs along the directly contributing MassDOT roadways is infeasible. Therefore, no further action will be taken as part of the Retrofit Initiative of the MassDOT Impaired Waters program.

MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. MassDOT will also continue to implement non-structural BMPs that reduce the impacts of stormwater.

References

Massachusetts Department of Environmental Protection (MassDEP). (2011). Massachusetts Year 2010 Integrated List of Waters - Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act. Retrieved from: http://www.mass.gov/dep/water/resources/10list6.pdf

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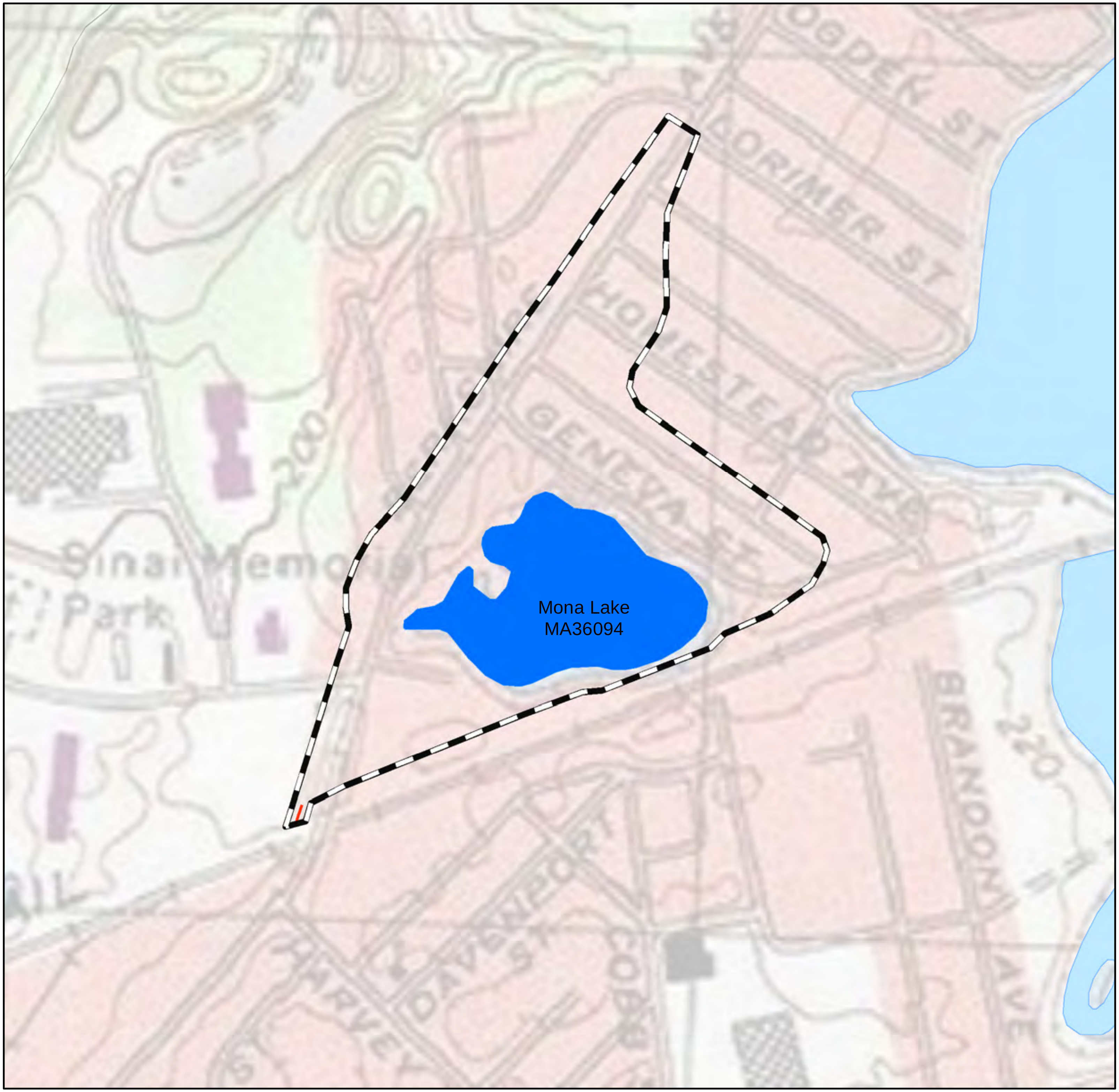
Smith, K.P., & Granato, G.E. (2010). Quality of stormwater runoff discharged from Massachusetts highways, 2005-07: U.S. Geological Survey Scientific Investigations Report 2009-5269, 198 p.



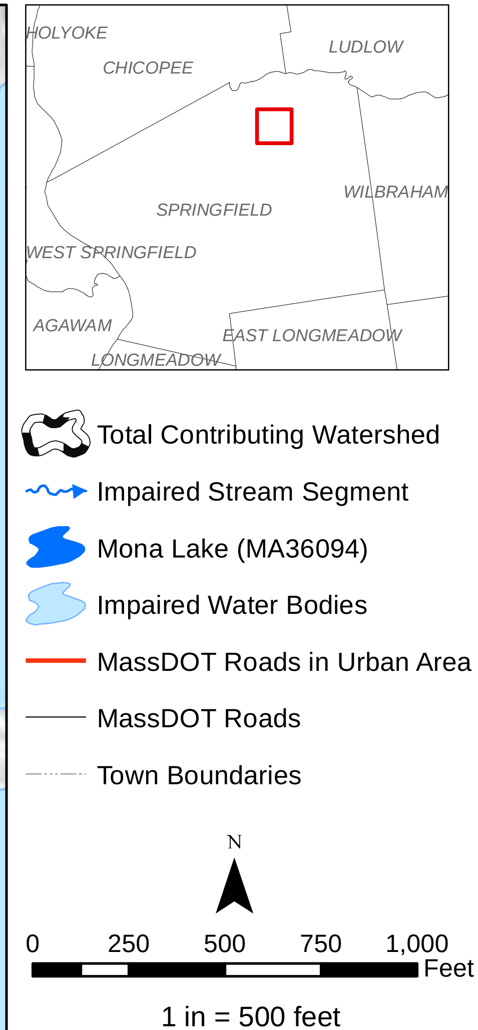


Figure 1

Mona Lake
Sub and Total Watershed
MA36094

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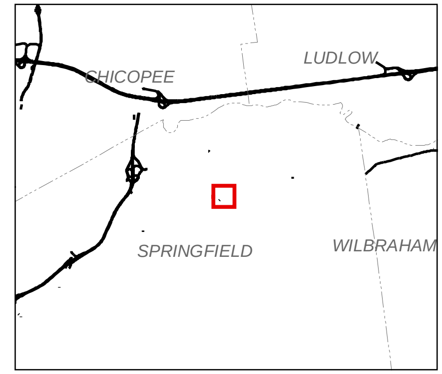

Stormwater Outfalls
MassDOT Directly Contributing Watersheds
Impaired Stream Segment
Impaired Water Bodies
Non-Impaired Stream Segment
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries

N

0 50 100 200 300 400 Feet

1 inch = 200 feet

Figure 2

Mona Lake (MA36094)
Directly Contributing
MassDOT Watershed

December 2012

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Impaired Waters Assessment for Brierly Pond (MA51010)

Impaired Water Body

Name: Brierly Pond

Location: Millbury, MA

Water Body ID: MA51010

Impairments

Brierly Pond (MA51010) is listed as a Category 4a water body, "TMDL is completed", on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). Brierly Pond is impaired for the following:

- aquatic plants (macrophytes)
- (non-native aquatic plants*)

According to MassDEP's *Blackstone River Watershed 2003-2007 Water Quality Assessment Report* (MassDEP, 2010), Brierly Pond is impaired due to an infestation with the non-native aquatic plant species *Myriophyllum heterophyllum,* which was observed by DWM biologists in July 1994. Brierly Pond is covered by a Total Maximum Daily Load (TMDL) for phosphorus according to MassDEP's *Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes* [CN 70.1] (MassDEP, 2002). According to MassDEP's 2010 Integrated List of Waters, non-native aquatic plants are listed as a non-pollutant and do not require development of a TMDL.

Relevant Water Quality Standards

Water Body Classification: Class B

Applicable State Regulations:

- *314 CMR 4.05 (5) (a) Aesthetics*. All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.
- *314 CMR 4.05 (5) (c) Nutrients*. Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of

nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.

Site Description

Brierly Pond is a water body in the Blackstone River Watershed in Millbury, MA of approximately 18 acres and depth of approximately 7 feet. The watershed is predominantly forested (50%), rural residential and agriculture (30%) and open water (15%) (MassDEP, 2002). The pond bisects Singletary Brook which runs southwest-northeast through the water body. Land directly adjacent to the pond includes forest, residential and roadway (commercial-industrial).

Brierly Pond has a total contributing watershed of approximately 2,840 acres. The total watershed is shown in Figure 1. MassDOT's property directly contributing stormwater runoff to Brierly Pond is comprised of approximately 250 feet of West Main Street, a two lane roadway that runs north-south to the east of the pond. MassDOT's directly contributing watershed is shown in Figure 2.

Assessment under BMP 7R

The TMDL for phosphorus for selected northern Blackstone lakes addresses the impairment for aquatic plants (macrophytes) for Brierly Pond. Therefore, MassDOT assessed the contribution of phosphorus from MassDOT property directly draining to this water body to address the impairment. The assessment was completed using the approach described in BMP 7R (MassDOT, 2012).

According to the final *Massachusetts Year 2010 Integrated List of Waters*, non-native aquatic plants are a non-pollutant stressor which indicates that restoration will require measures other than TMDL development and implementation. As a result, MassDOT has concluded that stormwater runoff from its roadways does not contribute to the impairments of non-native aquatic plants found in Brierly Pond.

TMDL

The Massachusetts Department of Environmental Protection's (MassDEP) TMDL report titled *Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes* [CN 70.1] (MassDEP, 2002) can be summarized as follows:

- Pollutant of Concern: Phosphorus
- Impairment for Brierly Pond Addressed in TMDL: aquatic plants (macrophytes)
- Applicable Waste Load Allocation (WLA): See Tables 2b (p. 40) and 4b (p. 58) of TMDL.
  - Description of Associated Land Use: Commercial/Industrial
  - Commercial/Industrial Land Use Current Load (TP): 11.5 kg/yr (25.4 lbs/yr)
  - Commercial/ Industrial Land Use Target WLA (TP): 9 kg/yr (19.8 lbs/yr)
  - Commercial/Industrial Area in Watershed: 5.2 ha (12.8 acres)
  - Commercial/Industrial Land Use Target Areal WLA (TP): 1.7 kg/ha/yr (1.5 lb/acre/yr)

Estimated Loading from MassDOT

The loading of total phosphorus (TP) from MassDOT property directly contributing stormwater runoff to Brierly Pond was estimated using the following assumptions and calculations:

- MassDOT estimates the TP loading from its impervious areas as 1.6 lb/acre/yr. This loading rate is based on data collected in a study of stormwater runoff conducted by the United States Geological Survey (USGS) (Smith and Granato, 2010). The study analyzed stormwater samples from 12 sites located on highways operated by MassDOT across Massachusetts between September 2005 and September 2007. Samples were taken under a variety of weather conditions during this period.
- MassDOT estimates the TP loading from its pervious areas as 0.6 lb/acre/yr. This loading rate is based on the loading rate for hayland provided in the United States Environmental Protection Agency's (EPA) document EPA 440/5-80-011, "Modeling phosphorus loading and Pond response under uncertainty: a manual and compilation of export coefficients" (Reckhow, 1980). Hayland was chosen to represent the pervious right-of-way areas which are typically cleared areas that are mowed only once per year.
- MassDOT calculated its total estimated TP loading rate using the estimated loading rates listed above. MassDOT property contributing stormwater directly to Brierly Pond is 0.17 acres of impervious area and 0.04 acres of pervious area. The TP loading is 0.3 lb/yr without accounting for existing BMPs or treatment throughout the watershed.
- MassDOT calculated its target TP WLA using the TMDL target areal WLA of 1.5 lb/ac/yr and the total area of MassDOT property within the TMDL watershed directly draining to Leesville Pond (0.2 acres). The target TP WLA for MassDOT runoff is 0.3 lb/yr.

Assessment

MassDOT calculated its current TP loading rate (0.3 lb/yr) and its target TP WLA (0.3 lb/yr) using values provided in MassDEP's TMDL report. The difference between these two values represents the required reduction in TP that MassDOT must achieve to comply with the TMDL. For the watershed directly contributing to Brierly Pond, there is no required reduction because MassDOT's current TP loading rate is equal to the target TP WLA.

Loading from MassDOT's Directly Contributing Property Relative to TMDL WLA

Total Area	0.2	ac
Target Areal WLA	1.5	lb/ac/yr
Total Estimated Load	0.3	lb/yr
WLA for MassDOT's Directly Contributing Property	0.3	lb/yr
MassDOT's Required Load Reduction	0.0	lb/yr

Conclusions

MassDOT concluded that no additional treatment is required for Brierly Pond because the total estimated TP loading rate is equal to the target areal WLA stated in the TMDL.

MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding the design progress made towards meeting the load reduction, plans for construction of the BMPs and finalized assessments. Furthermore, MassDOT will continue to implement non-structural BMPs that reduce the impacts of stormwater.

References

Massachusetts Department of Environmental Protection (MassDEP). (2002). Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes. Retrieved from: http://www.mass.gov/dep/water/resources/blaktmdl.pdf

Massachusetts Department of Environmental Protection (MassDEP). (2010). Blackstone River Watershed 2003-2007 Water Quality Assessment Report. Retrieved from: http://www.mass.gov/dep/water/resources/51wqar10.pdf

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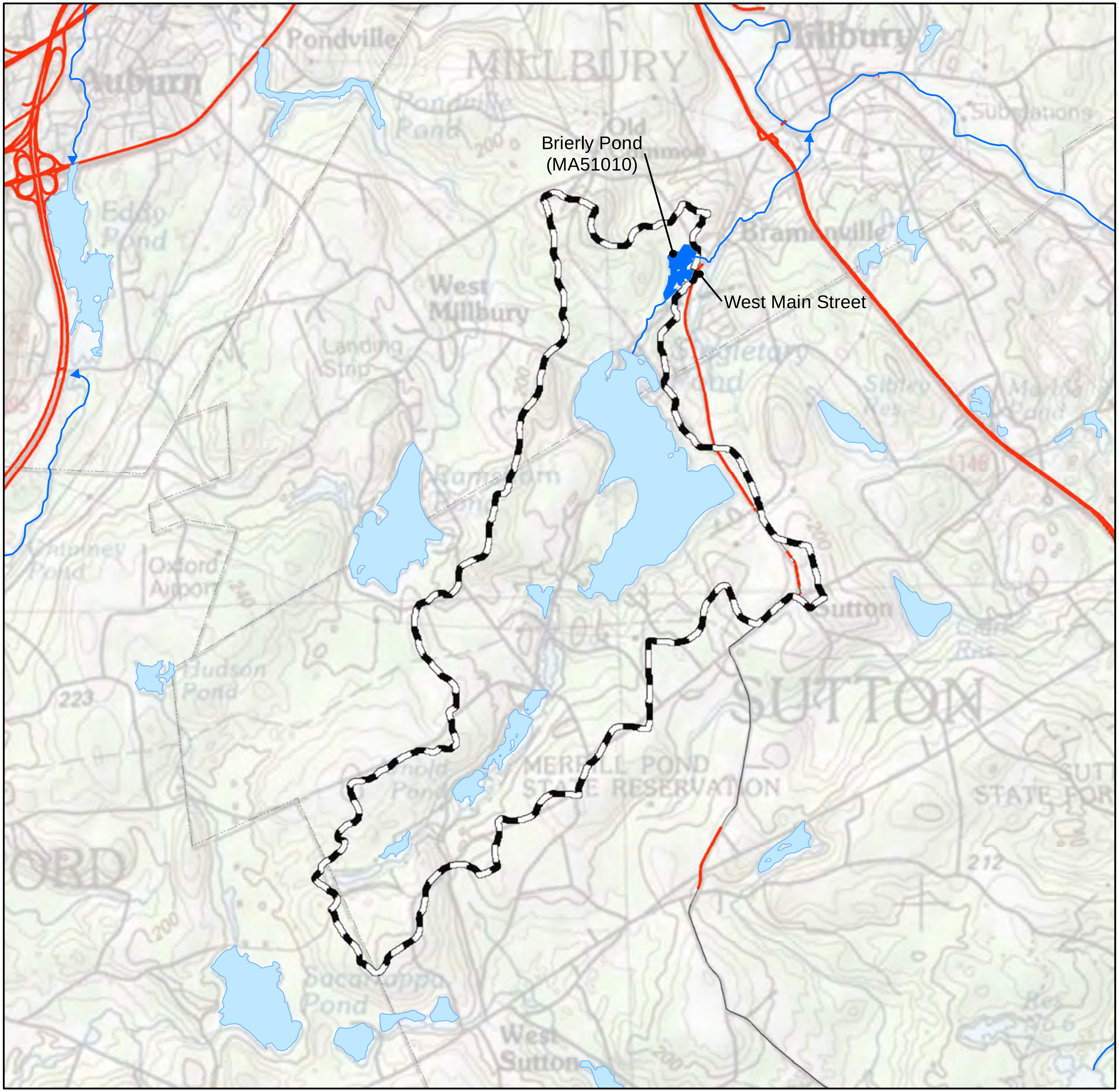
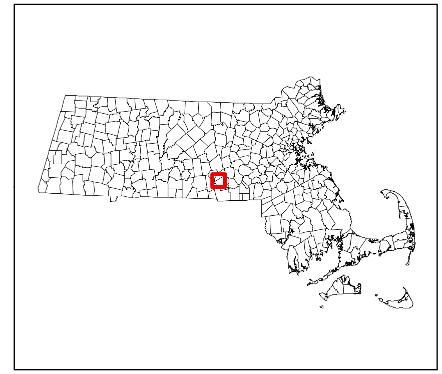
Smith, K.P., and Granato, G.E., 2010. Quality of storm water runoff discharged from Massachusetts highways, 2005-07: U.S. Geological Survey Scientific Investigations Report 2009-5269, 198 p.





Impaired Stream Segment

Brierly Pond

Impaired Water Bodies

Total Contributing Watershed

MassDOT Roads in Urban Area

MassDOT Roads

Town Boundaries

N

0 2,000 4,000 6,000 8,000 Feet

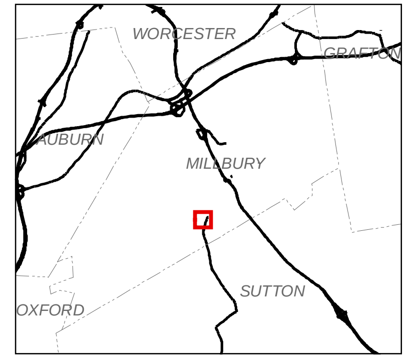
1 in = 4,000 feet

Figure 1

Brierly Pond
Total Watershed
MA51010

December 2012

massDOT Massachusetts Department of Transportation Highway Division



Stormwater Outfalls

MassDOT Directly Contributing Watersheds

Impaired Stream Segment

Impaired Water Bodies

Non-Impaired Stream Segment

NWI Wetland Areas

MassDOT Roads in Urban Areas

MassDOT Roads

Town Boundaries

N

0 100 200 300 400 Feet

1 inch = 200 feet

Figure 2

Brierly Pond (MA51010)
Directly Contributing
MassDOT Watershed

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Impaired Waters Assessment for Trout Brook (MA62-07)

Impaired Water Body

Name: Trout Brook

Location: Avon and Brockton, MA

Water Body ID: MA62-07

Impairments

Trout Brook (MA62-07) is listed under Category 5, "Waters Requiring a TMDL", on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). Trout Brook is impaired due to the following:

- turbidity
- dissolved oxygen
- total suspended solids (TSS)
- fecal coliform.

According to MassDEP's *Taunton River Watershed 2001 Water Quality Assessment Report* (MassDEP, 2009c), Trout Brook (MA62-07) is impaired for siltation, organic enrichment, low dissolved oxygen, and pathogens. The report states that suspected sources of fecal coliform are discharges from municipal separate storm sewer systems and illicit connections. The report recommends following the *Nonpoint Source Pollution Assessment Report and Management Plan* (ESS, 2003), conducting biological, habitat, and water quality monitoring, and conducting bacteria sampling.

Relevant Water Quality Standards

Water Body Classification: Class B

Applicable State Regulations:

- *314 CMR 4.05 (3)(b) 5 Solids*. These waters shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.
- *314 CMR 4.05 (3)(b) 6 Color and Turbidity.* These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this class.
- *314 CMR 4.05 (4)(a) 1 Dissolved Oxygen*. Shall not be less than 6.0 mg/l. Where natural background conditions are lower, DO shall not be less than natural background. Natural

seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.

- *314 CMR 4.05 (4)(a) 4 Bacteria*.
  - a. Waters designated for shellfishing: fecal coliform shall not exceed a geometric mean Most Probable Number (MPN) of 14 organisms per 100 ml, nor shall more than 10% of the samples exceed an MPN of 28 per 100 ml, or other values of equivalent protection based on sampling and analytical methods used by the Massachusetts Division of Marine Fisheries and approved by the National Shellfish Sanitation Program in the latest revision of the Guide For The Control of Molluscan Shellfish (more stringent regulations may apply, see 314 CMR 4.06(1)(d)(5));
  - b. at bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010, no single enterococci sample taken during the bathing season shall exceed 104 colonies per 100 ml, and the geometric mean of the five most recent samples taken within the same bathing season shall not exceed a geometric mean of 35 enterococci colonies per 100 ml. In non-bathing beach waters and bathing beach waters during the non bathing season, no single enterococci sample shall exceed 104 colonies per 100 ml and the geometric mean of all samples taken within the most recent six months typically based on a minimum of five samples shall not exceed 35 enterococci colonies per 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department.

Site Description

Trout Brook is a water body in Avon and Brockton, Massachusetts which runs approximately 3.4 miles. It extends from northeast of Argyle Avenue and west of Conrail Line in Avon to the confluence with Salisbury Brook (MA62-08) to form the Salisbury Plain River (MA62-05) in Brockton. Both Salisbury Brook and Salisbury Plain River are analyzed in separate assessments. See Figure 1 for the location of Trout Brook and its subwatershed.

The MassDOT-owned urban roadways in the subwatershed of Trout Brook are Harrison Boulevard, East Main Street, Route 28, Route 37, Route 123, Route 27, the Field Street bridge, East Battles Street bridge and Howard Street bridge (Figures 2 and 3). The drainage along each roadway is briefly described below.

<u>Harrison Boulevard</u>

Harrison Boulevard is over 2,600 feet away from Trout Brook and runs towards Brockton Reservoir. This roadway was not included as directly contributing impervious cover (IC) area in this assessment.

<u>East Main Street</u>

East Main Street is over 1,500 feet from Trout Brook. Route 28 runs between East Main Street and Trout Brook. There is an outfall on East Main Street and it is not likely that drainage from this outfall is culverted beneath Route 28 and towards the brook. Therefore, this roadway was not included as directly contributing IC area.

<u>Route 28</u>

Route 28 is a curbed roadway with a drainage system comprised of catch basins and a trunkline. A portion of Route 28 discharges stormwater to nearby wetlands which border the bank of Trout Brook. Therefore, this section of Route 28 was included as directly contributing MassDOT IC area in this assessment. Stormwater from the urban portion of Route 28 south of this is captured by a stormwater system which conveys water south along the non-urban portion of Route 28. This system likely discharges to Trout Brook, and therefore, was included as directly contributing IC area. The direct areas of Route 28 are shown in Figure 2. The urban portion of Route 28 north of the directly discharging area conveys stormwater to nearby wetlands and vegetated areas, and therefore is not considered direct IC area.

Route 37

Route 37 is over 3,000 feet away from Trout Brook and was not included as directly contributing IC area.

Route 123

The urban portion of Route 123 within the subwatershed of Trout Brook begins approximately 1,970 feet from the brook and is sloped away from Trout Brook. Therefore, Route 123 was not included as directly contributing IC area.

Route 27

The bridge on Route 27 shown in Figure 3 spans across Trout Brook appears to have originally discharged stormwater directly to Trout Brook via outfalls in the bridge headwalls. However, these outfalls have been abandoned and stormwater is now conveyed across the bridge via a trunkline which runs along Route 27 and uses a conduit pipe to cross the bridge. This trunkline is part of the Brockton municipal stormwater system which likely discharges to Trout Brook. Therefore, this bridge was included as directly contributing MassDOT IC area in this assessment.

Field Street Bridge, East Battles Street Bridge and Howard Street Bridge.

These bridges are classified as urban, however, the roadways around them are not urban. According to drainage plans, stormwater from these bridges is captured and piped into the Brockton stormwater system along Route 28, which then runs south along Route 28. It is likely that this system discharges directly to Trout Brook. Even though the stormwater from these bridges discharges to the town municipal systems first, we suspect that the drainage eventually directly drains to the impaired waters under review so the bridges were included as directly contributing MassDOT area. They are shown in Figure 2.

Assessment under BMP 7U

The following impairments for Trout Brook have not been addressed by a TMDL: turbidity, dissolved oxygen, and total suspended solids. Therefore, MassDOT assessed the impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the following impairments:

- turbidity
- dissolved oxygen
- total suspended solids

The impairment for fecal coliform is assessed separately in the section titled Assessment of Pathogen Impairment.

MassDOT's Application of the Impervious Cover Method

MassDOT's Application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I's Impervious Cover Method described in EPA's *Stormwater TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT's program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT's Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body's entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS's impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT's target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT's properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's *Stormwater Best Management Practices (BMP) Performance Analysis* report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for Trout Brook (MA62-07):

Table 1. Site Parameters for Trout Brook (MA62-07)

Total Watershed and Subwatershed		
Subwatershed Area	4,460	acres
Impervious Cover (IC) Area	1,620	acres
Percent Impervious	36.3	%
IC Area at 9% Goal	401.4	acres
Target Reduction % in IC	75	%
Reductions Applied to DOT Direct Watershed		
MassDOT's IC Area **Directly** Contributing to Impaired Segment	5.1	acres
MassDOT's Target Reduction in Effective IC (75% of DOT Directly Contributing IC)	3.8	acres

*The total watershed and subwatershed are the same in the case of Trout Brook (MA62-07)

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 75%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 3.8 acres.

Existing BMPs

There are no existing BMPs in the Trout Brook directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to Trout Brook.

Mitigation Plan

Because there are not existing BMPs mitigating impervious surface to meet the target reduction of 3.8 acres, MassDOT considered the implementation of BMPs.

Based on the review of MassDOT's directly contributing drainage area, no BMPs have been identified that can be implemented on MassDOT property to address the impairments of Trout Brook due to site constraints. The Field Street Bridge, East Battles Street Bridge, Howard Street Bridge and Route 27 Bridge are owned by MassDOT. However, the roadways on either side of the bridges are not owned by MassDOT. Therefore, there is no land available to implement BMPs to mitigate the effect of the bridge stormwater. Route 28 has a minimal right-of-way and is very developed with commercial buildings and parking lots adjacent to the road. Also, the main outfall from which stormwater from Route 28 is conveyed to Trout Brook discharges directly to wetlands.

Assessment of Pathogen Impairment

MassDOT assessed the pathogen impairment using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. Pathogen concentrations in stormwater vary widely temporally and spatially; concentrations can vary by an order of magnitude within a given storm event at a single location (MassDEP, 2009b). Therefore, it is difficult to predict pathogen concentrations in stormwater with accuracy. Due to this difficulty, MassDOT generally will not conduct site specific assessments of loading at each location impaired for pathogens. Instead these sites will be assessed collectively based on available information on pathogen loading from highways, MassDOT actions, and information available from EPA and DEP. Based on this information

MassDOT developed an approach to be consistent with relevant TMDL and permit condition requirements and an iterative adaptive management approach to stormwater management.

In addition, while there is a positive relationship between IC and pathogen loading, the relationship is not as direct as other impairments. According to the Center for Watershed Protection "…Other studies show that concentrations of bacteria are typically higher in urban areas than rural areas (USGS, 1999), but they are not always directly related to IC (CWP, 2003)." Therefore, DOT did not rely solely on the IC method to assess pathogen impairments. Instead, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

Pathogens in MassDOT Discharge

A study conducted on MassDOT's South East Expressway measured bacterial concentrations in stormwater runoff (Smith, 2002). This study found a geometric mean of 186 fecal coliforms/100 ml. Concentrations of pathogens in stormwater runoff from roadways can vary widely and pathogen concentrations in runoff across the state likely deviate significantly from this stretch of roadway's specific estimate. Event mean concentrations of fecal coliform bacteria in urban stormwater from other sources ranging between 14,000 and 17,000 fecal coliform organisms/100 mL have been reported (MassDEP, 2009b). These data suggest that pathogen loading from highways may be lower than other urban areas.

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

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

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

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

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

Assessment

Pathogen loadings are highly variable and, as a result, quantitative assessments are challenging and of little value. Therefore, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

TMDLs for pathogen impairments in Massachusetts recognize that pathogens are highly variable and difficult to address and emphasize the need for an iterative adaptive management approach to address pathogens. Examples of relevant language from these TMDLs are included below:

- "given the vast potential number of bacteria sources and the difficulty of identifying and removing them from some sources such as stormwater require an iterative process and will take some time to accomplish. While the stated goal in the TMDL is to meet the water quality standard at the point of discharge it also attempts to be clear that MassDEP's expectation is that for stormwater an iterative approach is needed…" (MassDEP, 2009a)
- "The NPDES permit does not, however, establish numeric effluent limitations for stormwater discharges. Maximum extent practicable (MEP) is the statutory standard that establishes the level of pollutant reductions that regulated municipalities must achieve. The MEP standard is a narrative effluent limitation that is satisfied through implementation of SWMPs and achievement of measurable goals."(MassDEP, 2009b)
- "Although the TMDL presents quantified WLAs for stormwater that are set equivalent to the criteria in the Massachusetts Water Quality Standards, the Phase II NPDES permits will not include numeric effluent limitations. Phase II permits are intended to be BMP based permits that will require communities to develop and implement comprehensive stormwater management programs involving the use of BMPs. Massachusetts and EPA believe that BMP based Phase II permits involving comprehensive stormwater management together with specific emphasis on pollutants contributing to existing water quality problems can be consistent with the intent of the quantitative WLAs for stormwater discharges in TMDLs." (MassDEP, no date).

This language clearly indicates that an iterative adaptive management approach is the appropriate way to address discharges to pathogen impaired waters. The recommendations in pathogen TMDLs for waters in Massachusetts generally require development and implementation of stormwater management programs, illicit discharge detection and elimination efforts, and in some cases installing BMPs to the maximum extent practicable

The draft North Coastal Watershed General MS4 permit and the draft Interstate, Merrimack, and South Coastal (IMS) watershed permits contain specific requirements for compliance with pathogen TMDLs (in Appendix G). While these permits are still in draft form, MassDOT believes they represent the best available guidance on what EPA believes is appropriate for addressing stormwater discharges to pathogen-impaired waters. Section 2.2.1(c) of the permit states "For any discharge from its MS4 to impaired waters with an approved TMDL, the permittee shall comply with the specific terms of Part 2.1 of this permit. In addition, where an approved TMDL establishes a WLA that applies to its MS4 discharges, the permittee shall implement the specific BMPs and other permit requirements identified in Appendix G to achieve consistency with the WLA." Appendix G references a number of programmatic BMPs that are necessary to address pathogen loading. These cover the following general topics:

- Residential educational program
- Illicit connection identification, tracking and removal
- Pet waste management

Mitigation Plan

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

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

In addition, the structural BMPs that will be considered to reduce the IC will also have the effect of reducing pathogen loads.

MassDOT believes the existing and proposed efforts are consistent with the current and draft MS4 permit's requirements and TMDL recommendations. MassDOT's existing stormwater management plan outlines BMPs that include education and illicit discharge detection and elimination. Although not included in this permit term, MassDOT will be implementing a pet waste management program at its rest stops that have discharges to pathogen impaired waters. In addition, MassDOT has requested coverage under an individual stormwater permit for the next permit term. This permit may contain additional programmatic BMPs to address pathogens.

Conclusions

MassDOT used the IC Method to assess Trout Brook (MA62-07) for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. Results indicate that MassDOT should reduce its effective IC within its directly contributing subwatershed by 3.8 acres to achieve the targeted reduction in effective IC. MassDOT evaluated its property within the directly contributing watershed to Trout Brook to identify existing BMPs and found that no BMPs exist to reduce effective IC. This information is summarized in Table 2 below.

Table 2. Effective IC Reductions under Existing & Proposed Conditions

IC in Directly Contributing Watershed	5.1	acres
Target Reduction in Effective IC	3.8	acres
IC Effectively Reduced by Existing BMPs	0.0	acres
IC Remaining to Mitigate with Proposed BMPs	**3.8**	**acres**

MassDOT should reduce its effective IC within the directly contributing watershed by an additional 3.8 acres to achieve the targeted reduction in IC. However, the site constraints and limited right-of-way area indicate that the construction of BMPs along the directly contributing MassDOT roadways is infeasible. Therefore, no further action will be taken as part of the Retrofit Initiative of the MassDOT Impaired Waters program.

MassDOT has concluded, based on review of the draft North Coastal Watershed General MS4 permit, the draft Interstate, Merrimack, and South Coastal watershed permits, and pathogen TMDLs for Massachusetts waters, that the BMPs outlined in the stormwater management plan and those under consideration for reducing effective IC from MassDOT areas are consistent with its existing permit requirements. MassDOT believes that these measures achieve pathogen reductions to the maximum extent practicable and are consistent with the intent of its existing stormwater permit and the applicable Pathogen TMDLs.

MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. MassDOT will also continue to implement non-structural BMPs that reduce the impacts of stormwater.

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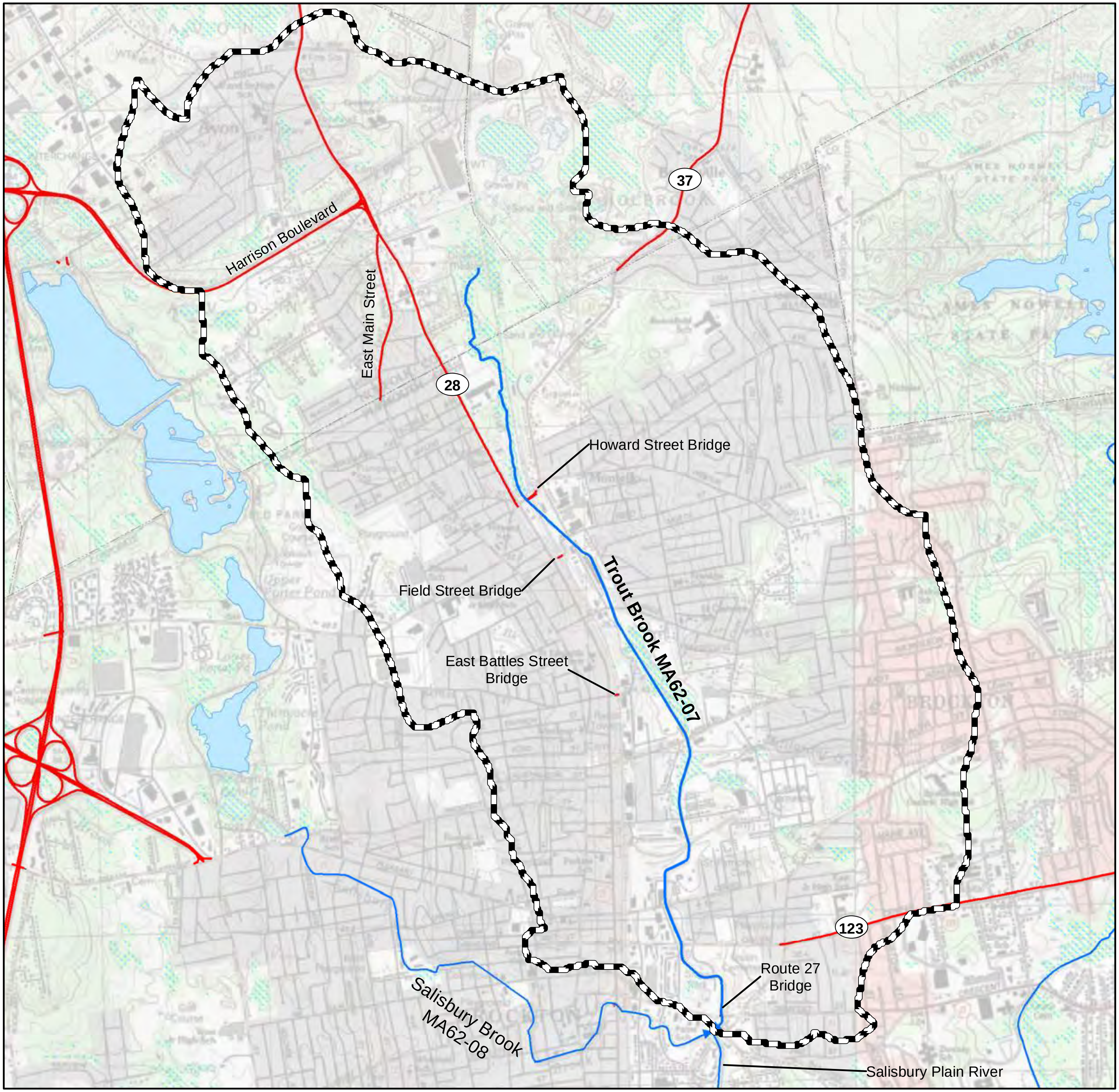
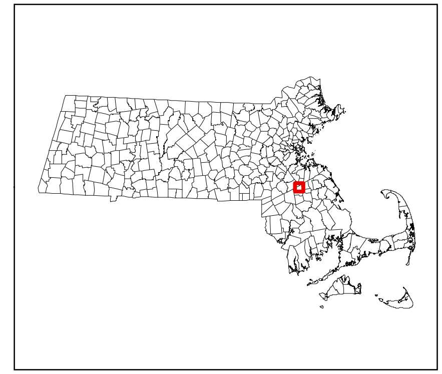




Total and Subwatershed
Trout Brook
Impaired Stream Segment
Impaired Water Bodies
NWI Wetland Areas
MassDOT Roads in UA
MassDOT Roads
Town Boundaries

N

0 0.125 0.25 0.5 0.75 1 Miles

1 in = 1 miles

Figure 1

Trout Brook
Total and Subwatershed
MA62-07

October 2012

Moving Massachusetts Forward.
massDOT

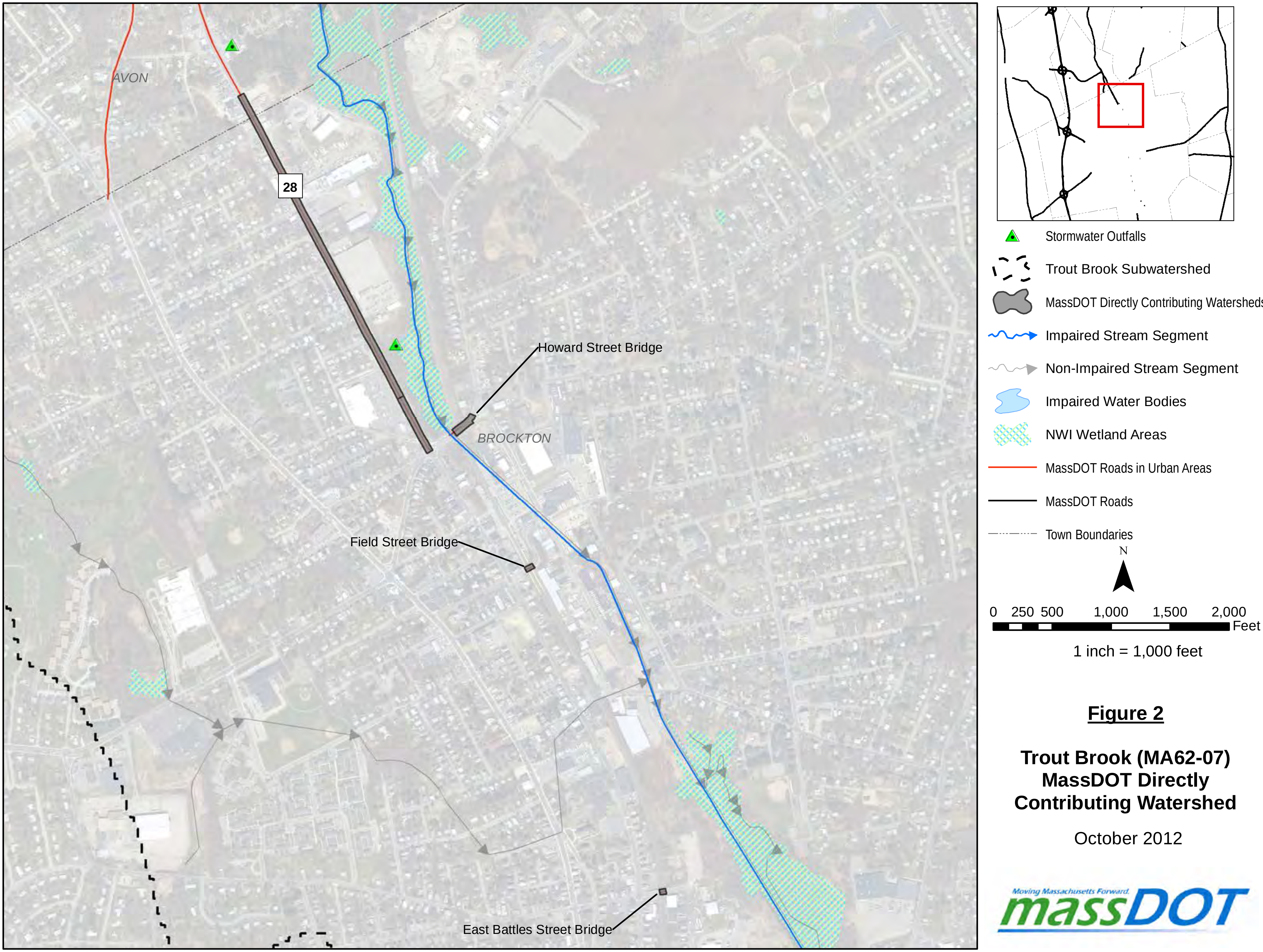
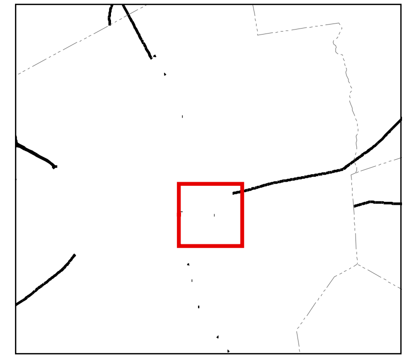


Figure 2

Trout Brook (MA62-07) MassDOT Directly Contributing Watershed

October 2012



Stormwater Outfalls
Trout Brook Subwatershed
MassDOT Directly Contributing Watersheds
Impaired Stream Segment
Non-Impaired Stream Segment
Impaired Water Bodies
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries

N

0 125 250 500 750 1,000 Feet

1 inch = 500 feet

Figure 3

Trout Brook (MA62-07)
MassDOT Directly Contributing Watershed

October 2012

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Impaired Waters Assessment for Lower Mystic Lake (MA71027)

Impaired Water Body

Name: Lower Mystic Lake

Location: Arlington and Medford, MA

Water Body ID: MA71027

Impairments

Lower Mystic Lake (MA71027) is listed under Category 5, "Waters Requiring a TMDL", on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). Lower Mystic Lake is impaired for the following:

- (sulfide-hydrogen sulfide*)
- dissolved oxygen
- (salinity*).

According to MassDEP's *Mystic River Watershed and Coastal Drainage Area 2004-2008 Water Quality Assessment Report* (MassDEP, 2010), Lower Mystic Lake is impaired for cause unknown, organic enrichment/low dissolved oxygen, salinity/total dissolved solids/chlorides.

Relevant Water Quality Standards

Water Body Classification: Class B

- *314 CMR 4.05 (3)(b)1.a Dissolved Oxygen*. Shall not be less than 6.0 mg/l in cold water fisheries and not less than 5.0 mg/l in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.

Site Description

Lower Mystic Lake spans 92.8 acres on the town line of Arlington and Medford, Massachusetts. As shown in **Figure 1** and **Figure 2**, while MassDOT urban roads are in the total and subwatershed, only one bridge potentially contributes stormwater to the Lower Mystic Lake. This directly-contributing IC area is shown in **Figure 3**.

MassDOT owns one bridge approximately 1,000 feet east of Lower Mystic Lake, shown in **Figure 3**. This bridge is the only MassDOT-owned property with potential direct stormwater discharge to this reservoir and it is part of Grove Street over a railway line. At this location, MassDOT owns only the bridge and minimal to no property surrounding the bridge. The approach roadways are owned and operated by the municipality. No closed drainage systems exist on the bridge structures; however, the bridges are curbed. Therefore, stormwater runoff flows off the bridges and into the nearest stormwater system. Based on the topography of the site, the stormwater system likely drains to Lower Mystic Lake.

Assessment under BMP 7U

None of the impairments for the Lower Mystic Lake have been addressed by a TMDL. Therefore, MassDOT assessed the impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the following impairments:

- dissolved oxygen.

According to the *Year 2010 Integrated List of Waters*, sulfide-hydrogen sulfide and salinity are considered non-pollutants and unrelated to stormwater. Therefore, MassDOT has determined that further assessment of these impairments for the water body is not required under BMP 7U.

MassDOT's Application of the Impervious Cover Method

MassDOT's Application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I's Impervious Cover Method described in EPA's *Stormwater TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT's program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT's Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body's entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS's impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT's target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT's properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's

Stormwater Best Management Practices (BMP) Performance Analysis report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for the Lower Mystic Lake (MA71027):

Table 1. Site Parameters for Lower Mystic Lake (MA71027)

Total Watershed		
Watershed Area	21,991	acres
Impervious Cover (IC) Area	7,411	acres
Percent Impervious	33.7	%
IC Area at 9% Goal	1,979	acres
Target Reduction % in IC	73.3	%
Subwatershed		
Subwatershed Area	2,348	acres
Impervious Cover (IC) Area	592	acres
Percent Impervious	25.2	%
IC Area at 9% Goal	211	acres
Target Reduction % in IC	64.4	%
Reductions Applied to DOT Direct Watershed		
MassDOT's IC Area **Directly** Contributing to Impaired Segment	0.09	acres
MassDOT's Target Reduction in Effective IC (64.4% of DOT Directly Contributing IC)	0.06	acres

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 64.4%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 0.06 acres.

Existing BMPs

There are no existing BMPs in the directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to Lower Mystic Lake.

Mitigation Plan

Because there is no mitigation of impervious surface achieved by MassDOT BMPs to meet the target reduction of 0.06 acres, MassDOT considered the implementation of BMPs.

Based on the review of MassDOT's directly contributing drainage area, no BMPs have been identified that can be implemented on MassDOT property to address the impairments of Lower Mystic Lake due to site constraints. The Grove Street bridge is owned by MassDOT, but the roadways on either side of the bridges are not owned by MassDOT. Therefore, there is no land available to implement stormwater infiltration BMPs to mitigate the effect of the bridge stormwater runoff.

Conclusions

MassDOT used the IC Method to assess Lower Mystic Lake (MA71027) for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. Results indicate that MassDOT should reduce its effective IC within its directly contributing subwatershed by 0.06 acres to achieve the targeted reduction in effective IC. MassDOT evaluated its property within the directly contributing watershed to Lower Mystic Lake to identify existing BMPs and found that no BMPs exist to reduce effective IC. This information is summarized in Table 2 below.

Table 2. Effective IC Reductions under Existing & Proposed Conditions

IC in Directly Contributing Watershed	0.09	acres
Target Reduction in Effective IC	0.06	acres
IC Effectively Reduced by Existing BMPs	0.0	acres
IC Remaining to Mitigate with Proposed BMPs	**0.06**	**acres**

MassDOT should reduce its effective IC within the directly contributing watershed by an additional 0.06 acres to achieve the targeted reduction in IC. However, the site constraints and limited right-of-way area indicate that the construction of stormwater infiltration BMPs along the directly contributing MassDOT roadways is infeasible. Therefore, no further action will be taken as part of the Retrofit Initiative of the MassDOT Impaired Waters program.

MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. MassDOT will also continue to implement non-structural BMPs that reduce the impacts of storm water.

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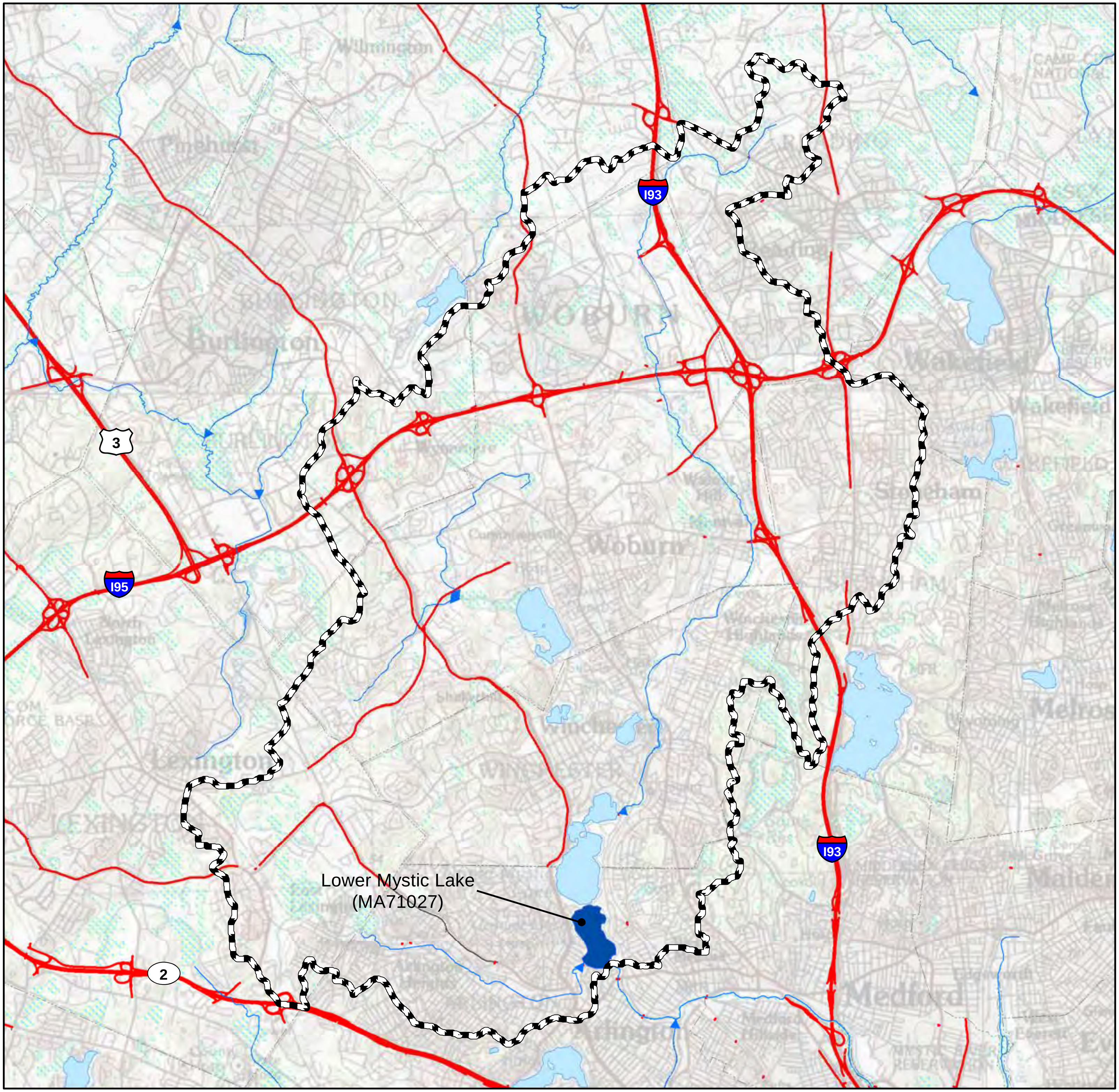
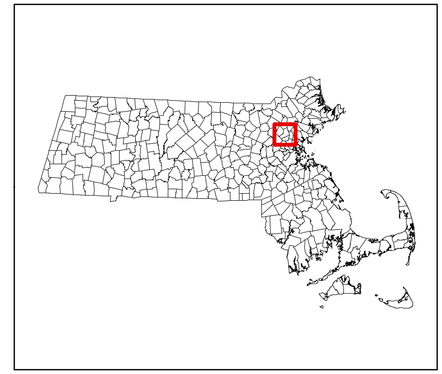




Total Watershed
Impaired Stream Segment
Lower Mystic Lake
Impaired Water Bodies
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries

N

0 0.250.5 1 1.5 2 Miles

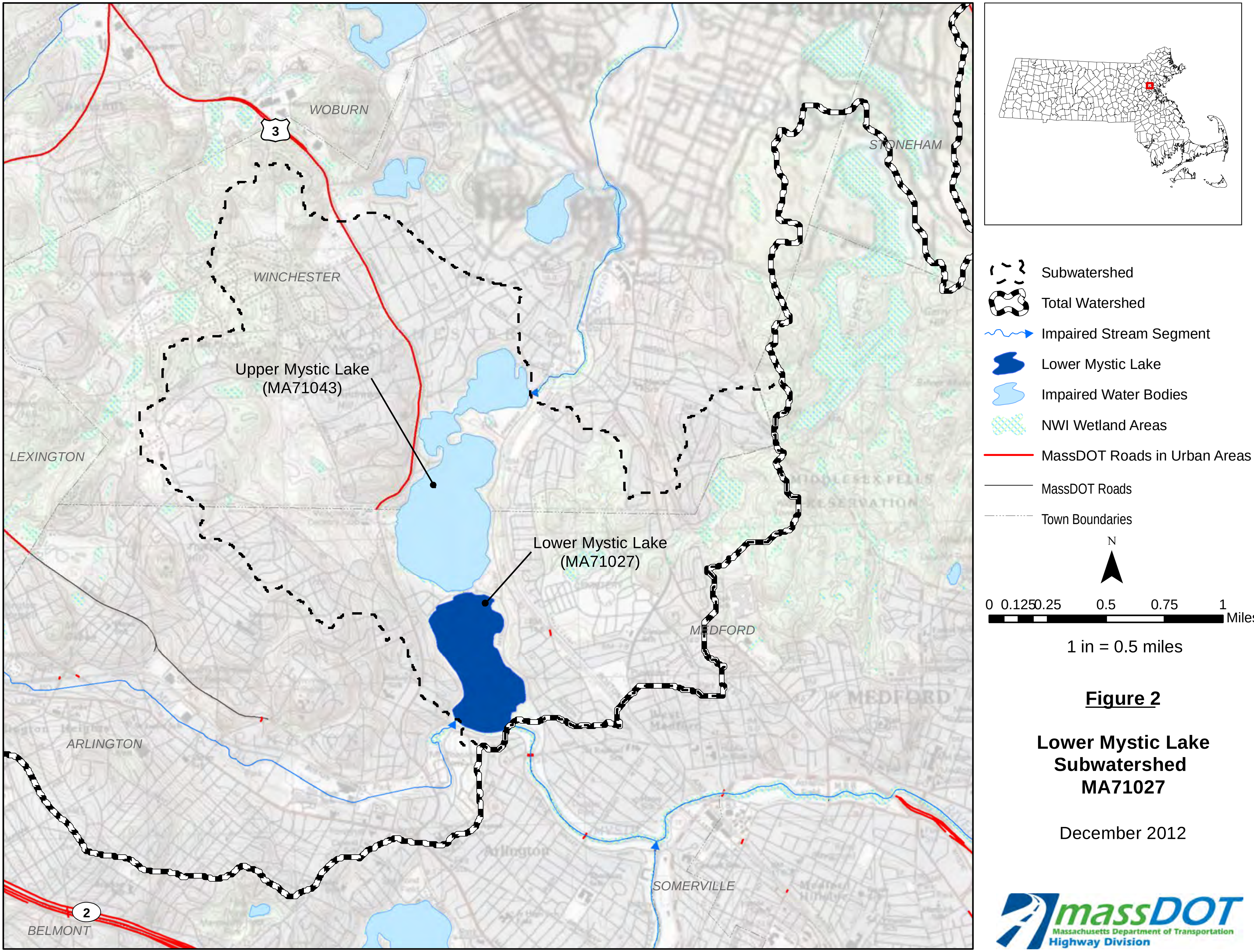
1 in = 1.25 miles

Figure 1

Lower Mystic Lake
Total Watershed
MA71027

December 2012

massDOT Massachusetts Department of Transportation Highway Division



<u>**Figure 2**</u>

Lower Mystic Lake Subwatershed MA71027

December 2012

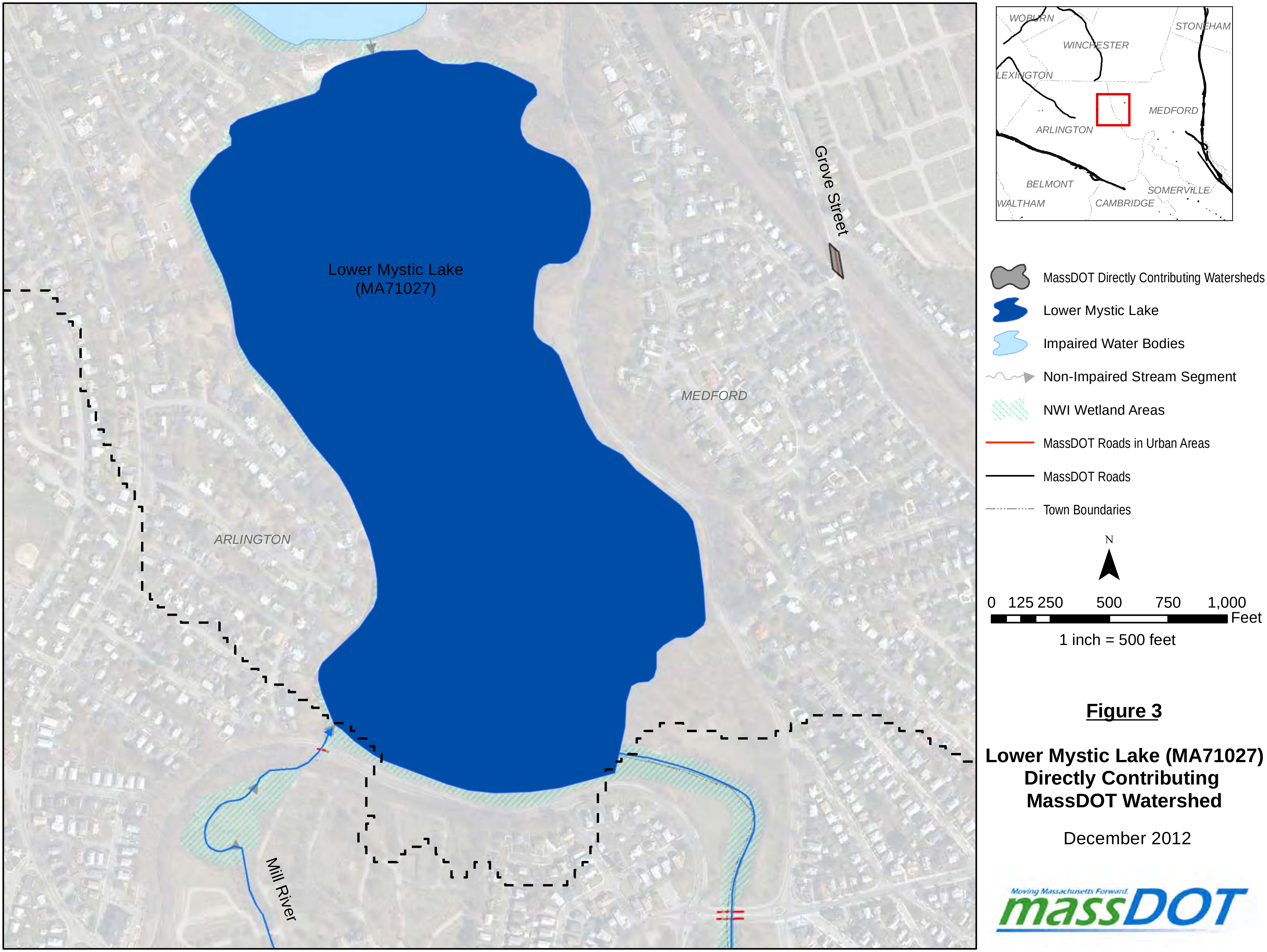


Figure 3

Lower Mystic Lake (MA71027) Directly Contributing MassDOT Watershed

December 2012

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Impaired Waters Assessment for Farm Pond (MA82035)

Impaired Water Body

Name: Farm Pond

Location: Framingham, MA

Water Body ID: MA82035

Impairments

Farm Pond (MA82035) is listed under Category 5, “Waters Requiring a TMDL”, on MassDEP’s final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). Farm Pond is impaired for the following:

- excess algal growth
- turbidity
- (non-native aquatic plants*)
- (Eurasian water milfoil, Myriophyllum spicatum*)

According to MassDEP’s *SuAsCo Watershed Year 2001 Water Quality Assessment Report* (MassDEP, 2001), Farm Pond is impaired for non-native macrophytes and excess algal growth. The report states that suspected sources of pollution include municipal urban high density areas, discharge from separate storm sewer systems, and internal nutrient recycling.

Relevant Water Quality Standards

Water Body Classification: Class B

- *314 CMR 4.05 (3)(b) 5 Solids*. These waters shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.
- *314 CMR 4.05 (5)(a) Aesthetics*. All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.
- *314 CMR 4.05 (3)(b) Color and Turbidity.* These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this class.
- *314 CMR 4.05 (5) (c) Nutrients*. Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the

Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.

Site Description

Farm Pond (MA82035) spans 140 acres in Framingham, MA. As shown in **Figure 1**, the total and subwatershed are the same. There is one bridge located within the subwatershed and two bridges just outside the subwatershed. All three bridges were visited on November 16, 2012 to determine the stormwater drainage patterns at each location. One bridge just outside the subwatershed, the Mount Wayte Ave. Bridge, is known to directly discharge into Eames Brook (MA82A-13). Another bridge just outside of the watershed, Winter Street Bridge, is assumed to drain to Framingham Reservoir #2 (MA82045) and not to Farm Pond, based on the topography of the area and proximity to the reservoir. The third bridge, Fountain Street Bridge, discharges directly to Farm Pond.

The Fountain Street Bridge is the only MassDOT-owned property discharging directly to this pond, as displayed in **Figure 2**. At this location, MassDOT owns only the bridge and minimal to no property surrounding the bridge. The approach roadways are owned and operated by the respective towns. No closed drainage system exists on the bridge structure; however, the bridge is curbed. Therefore, stormwater runoff flows off the bridge and into the municipal stormwater system. The municipal outfall could not be located but based on topography of the site, the municipal system likely drains to Farm Pond.

Assessment under BMP 7U

None of the impairments for Farm Pond have been addressed by a TMDL. Therefore, MassDOT assessed the impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the following impairments:

- excess algal growth
- turbidity
- (non-native aquatic plants*)
- (Eurasian water milfoil, Myriophyllum spicatum*)

According to MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*, the impairment of non-native aquatic plants and Eurasian water milfoil, Myriophyllum spicatum are not caused by pollutants (MassDEP, 2011). Therefore, these impairments are not considered further.

MassDOT's Application of the Impervious Cover Method

MassDOT's Application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I's Impervious Cover Method described in EPA's *Stormwater TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT's program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT's Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body's entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS's impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT's target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT's properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's *Stormwater Best Management Practices (BMP) Performance Analysis* report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for Farm Pond (MA82035):

Table 1. Site Parameters for Farm Pond (MA82035)

Total and Subwatershed		
Watershed Area	734	acres
Impervious Cover (IC) Area	253	acres
Percent Impervious	34.5	%
IC Area at 9% Goal	66.1	acres
Target Reduction % in IC	73.9	%
Reductions Applied to DOT Direct Watershed		
MassDOT's IC Area **Directly** Contributing to Impaired Segment	0.06	acres
MassDOT's Target Reduction in Effective IC (73.9% of DOT Directly Contributing IC)	0.04	acres

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 73.9%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 0.04 acres.

Existing BMPs

There are no existing BMPs in the Farm Pond directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to Farm Pond.

Mitigation Plan

Because there is no mitigation of impervious cover achieved by existing MassDOT BMPs to meet the target reduction of 0.04 acres, MassDOT considered the implementation of BMPs.

Based on the review of MassDOT's directly contributing drainage area, no BMPs have been identified that can be implemented on MassDOT property to address the impairments of Farm Pond due to site constraints. The Fountain Street Bridge is owned by MassDOT, but the roadways on either side of the bridge are not owned by MassDOT. Therefore, there is no land available to implement stormwater infiltration BMPs to mitigate the effect of the bridge stormwater runoff.

Conclusions

MassDOT used the IC Method to assess Farm Pond (MA82035) for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. Results indicate that MassDOT should reduce its effective IC within its directly contributing subwatershed by 0.04 acres to achieve the targeted reduction in effective IC. MassDOT evaluated its property within the directly contributing watershed to Farm Pond to identify existing BMPs and found that no BMPs exist to reduce effective IC. This information is summarized in Table 2 below.

Table 2. Effective IC Reductions under Existing & Proposed Conditions

IC in Directly Contributing Watershed	0.06	acres
Target Reduction in Effective IC	0.04	acres
IC Effectively Reduced by Existing BMPs	0.0	acres
IC Remaining to Mitigate with Proposed BMPs	**0.04**	**acres**

MassDOT should reduce its effective IC within the directly contributing watershed by an additional 0.04 acres to achieve the targeted reduction in IC. However, the site constraints and limited right-of-way area indicate that the construction of stormwater infiltration BMPs along the directly contributing MassDOT roadways is infeasible. Therefore, no further action will be taken as part of the Retrofit Initiative of the MassDOT Impaired Waters program.

MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. MassDOT will also continue to implement non-structural BMPs that reduce the impacts of storm water.

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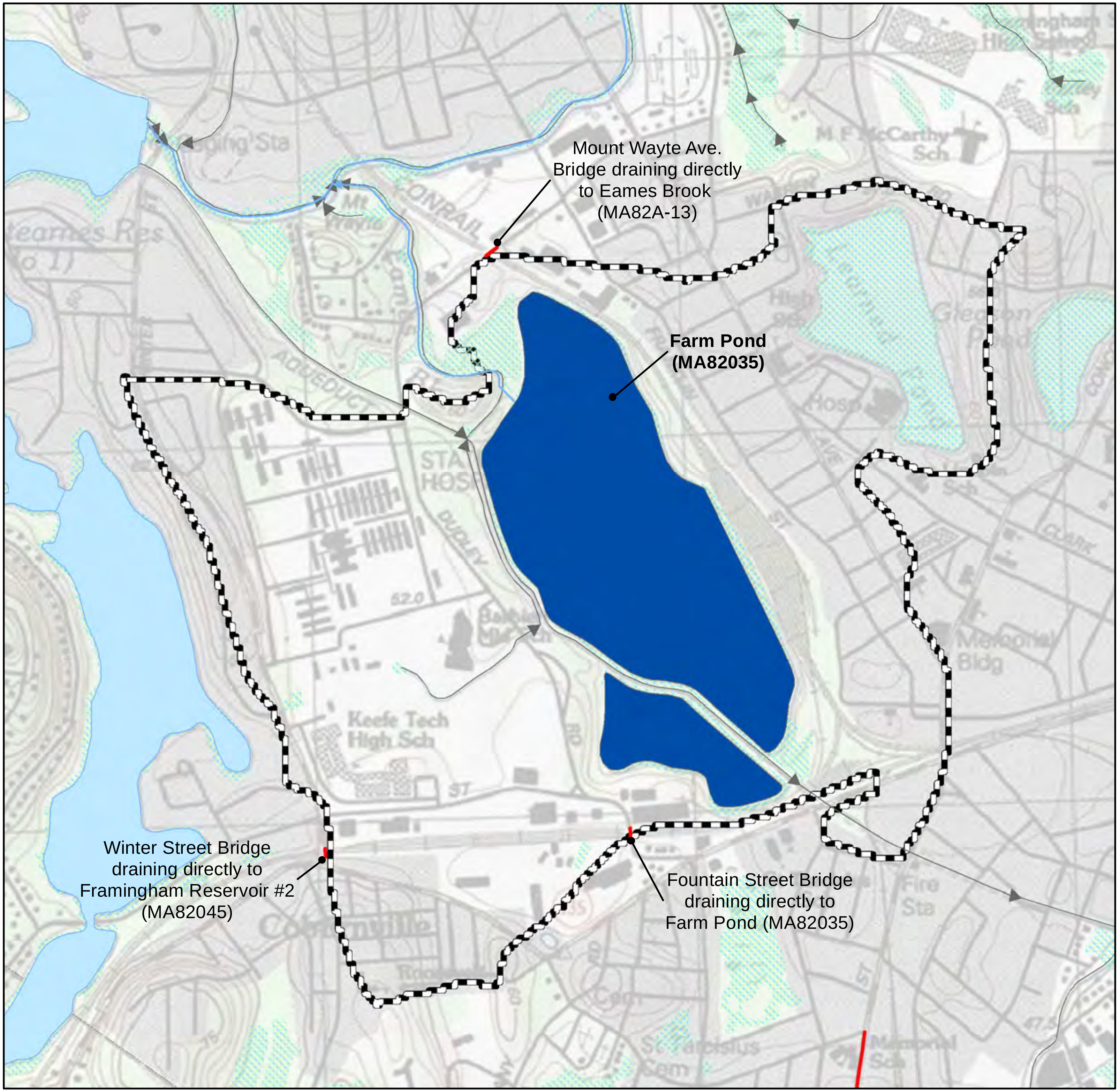

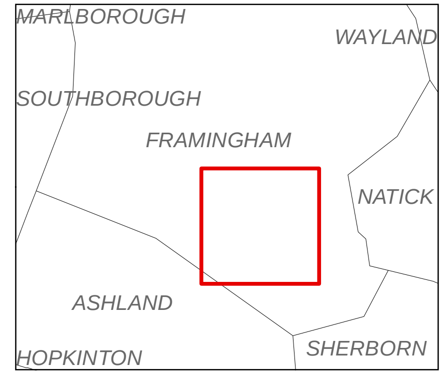

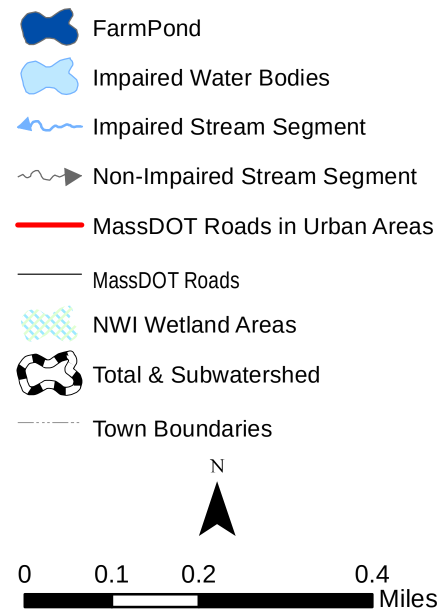

1 in = 0.22 miles

Figure 1

Farm Pond
Total & Subwatershed
MA82035

December 2012

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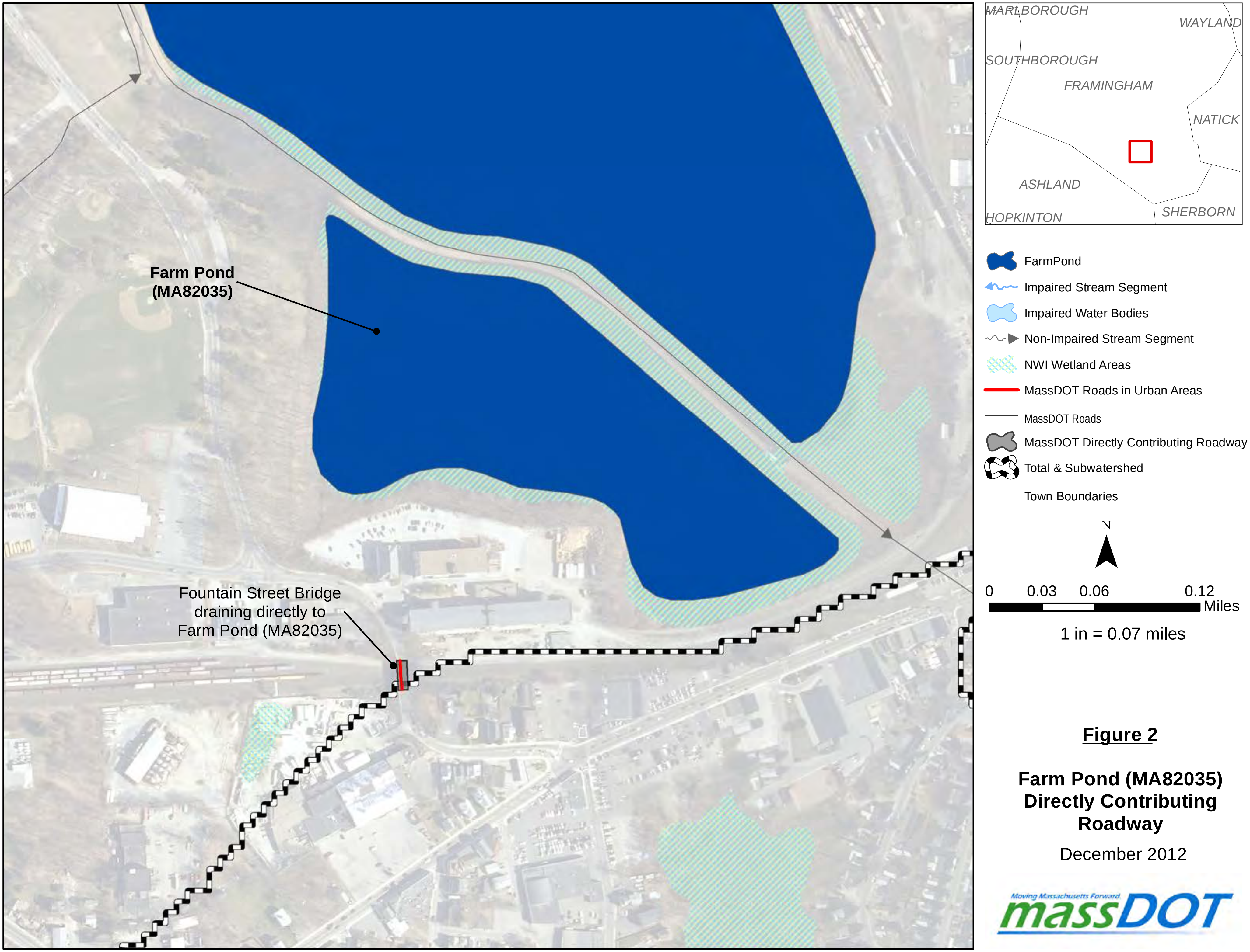

Figure 2

Farm Pond (MA82035) Directly Contributing Roadway

December 2012

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Impaired Waters Assessment for Framingham Reservoir #2 (MA82045)

Impaired Water Body

Name: Framingham Reservoir #2

Location: Framingham & Ashland, MA

Water Body ID: MA82045

Impairments

Framingham Reservoir #2 (MA82045) is listed under Category 5, “Waters Requiring a TMDL”, on MassDEP’s final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). Framingham Reservoir #2 is impaired for the following:

- mercury in fish tissue
- turbidity

According to MassDEP’s *SuAsCo Watershed Year 2001 Water Quality Assessment Report* (MassDEP, 2010), Framingham Reservoir #2 is impaired for mercury. The source of the mercury was traced to the Nyanza Superfund Site, and a fish consumption advisory was issued for the pond.

Relevant Water Quality Standards

Water Body Classification: Class B

- *314 CMR 4.05 (5)(a) Aesthetics*. All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.
- *314 CMR 4.05 (3)(b) Color and Turbidity.* These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this class.
- *314 CMR 4.05 (5)(e) Toxic Pollutants.* All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife. For pollutants not otherwise listed in 314 CMR 4.00, the National Recommended Water Quality Criteria: 2002, EPA 822R-02-047, November 2002 published by EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act, are the allowable receiving water concentrations for the affected waters, unless the Department either establishes a site specific criterion or determines that naturally occurring background concentrations are higher. Where the Department determines that naturally occurring background concentrations are higher, those concentrations shall be the allowable receiving water concentrations. The Department shall use the water quality criteria for the protection of aquatic life expressed in terms of the dissolved fraction of metals when EPA’s 304(a) recommended criteria provide for use of the dissolved fraction. The EPA recommended criteria based on total recoverable metals shall be converted to dissolved metals using

EPA's published conversion factors. Permit limits will be written in terms of total recoverable metals. Translation from dissolved metals criteria to total recoverable metals permit limits will be based on EPA's conversion factors or other methods approved by the Department. The Department may establish site specific criteria for toxic pollutants based on site specific considerations.

Site Description

Framingham Reservoir #2 spans 114 acres in Framingham and Ashland, MA. As shown in **Figure 1**, while MassDOT urban roads are in the total watershed, only three bridges are located within the subwatershed (**Figure 2**) and all three of those bridges have potential direct stormwater discharge to Framingham Reservoir #2.

MassDOT owns two bridges near the inlet of Framingham Reservoir #2, shown in **Figure 3,** and one bridge on the eastern subwatershed line, shown in **Figure 4**. These bridges are the only MassDOT-owned property with potential direct stormwater discharge to this reservoir and include:

- *Fountain Street over train tracks in Ashland*
- *Union Street over the Sudbury River in Ashland*
- *Winter Street over train tracks in Framingham*

At each of these locations, MassDOT owns only the bridge and minimal to no property surrounding the bridge. The approach roadways are owned and operated by the respective towns. No closed drainage systems exist on the bridge structures; however, the bridges are curbed. Therefore, stormwater runoff flows off the bridges and into the municipal stormwater system. Based on topography of the sites, the municipal system likely drains to Framingham Reservoir #2.

Assessment under BMP 7U

None of the impairments for the Framingham Reservoir have been addressed by a TMDL. Therefore, MassDOT assessed the impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the following impairments:

- turbidity

According to Northeast Regional Mercury TMDL (NEIWPCC, 2007), regulated stormwater is considered to be a de minimis contributor to the waste load allocation for mercury. Additionally, the primary source of mercury in stormwater in Massachusetts is atmospheric deposition, which must be controlled by targeting sources that emit into the air. Based on the TMDL, the impairment for mercury in fish tissue has been excluded from the IC Method and deemed "unrelated to stormwater," so no further action is necessary for this pollutant (NEIWPCC, 2007).

MassDOT's Application of the Impervious Cover Method

MassDOT's Application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I's Impervious Cover Method described in EPA's *Stormwater TMDL Implementation*

Support Manual (ENSR, 2006) to MassDOT's program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT's Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body's entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS's impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT's target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT's properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's *Stormwater Best Management Practices (BMP) Performance Analysis* report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for the Framingham Reservoir #2 (MA82045):

Table 1. Site Parameters for Framingham Reservoir #2 (MA82045)

Total Watershed		
Watershed Area	28,448	acres
Impervious Cover (IC) Area	3,580	acres
Percent Impervious	12.6	%
IC Area at 9% Goal	2,560	acres
Target Reduction % in IC	28.5	%
Subwatershed		
Subwatershed Area	824	acres
Impervious Cover (IC) Area	171	acres
Percent Impervious	20.7	%
IC Area at 9% Goal	74	acres
Target Reduction % in IC	56.7	%
Reductions Applied to DOT Direct Watershed		
MassDOT's IC Area **Directly** Contributing to Impaired Segment	0.19	acres
MassDOT's Target Reduction in Effective IC (56.7% of DOT Directly Contributing IC)	0.11	acres

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 56.7%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 0.11 acres.

Existing BMPs

There are no existing BMPs in the Framingham Reservoir #2 directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to Framingham Reservoir #2.

Mitigation Plan

Because there is no mitigation of impervious cover achieved by existing MassDOT BMPs to meet the target reduction of 0.11 acres, MassDOT considered the implementation of BMPs.

Conclusions

MassDOT used the IC Method to assess Framingham Reservoir #2 (MA82045) for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. Results indicate that MassDOT should reduce its effective IC within its directly contributing subwatershed by 0.11 acres to achieve the targeted reduction in effective IC. MassDOT evaluated its property within the directly contributing watershed to Framingham Reservoir #2 to identify existing BMPs and found that no BMPs exist to reduce effective IC. This information is summarized in Table 2 below.

Table 2. Effective IC Reductions under Existing & Proposed Conditions

IC in Directly Contributing Watershed	0.19	acres
Target Reduction in Effective IC	0.11	acres
Effective IC Reduced by Existing BMPs	0.0	acres
Effective IC Reduced by Proposed BMPs	0.0	acres
IC Target Remaining	**0.11**	**acres**

MassDOT should reduce its effective IC within the directly contributing watershed by 0.11 acres to achieve the targeted reduction in IC. However, the site constraints and limited right-of-way area indicate that the construction of stormwater infiltration BMPs along the directly contributing MassDOT roadways is infeasible. Therefore, no further action will be taken as part of the Retrofit Initiative of the MassDOT Impaired Waters program.

MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. MassDOT will also continue to implement non-structural BMPs that reduce the impacts of stormwater.

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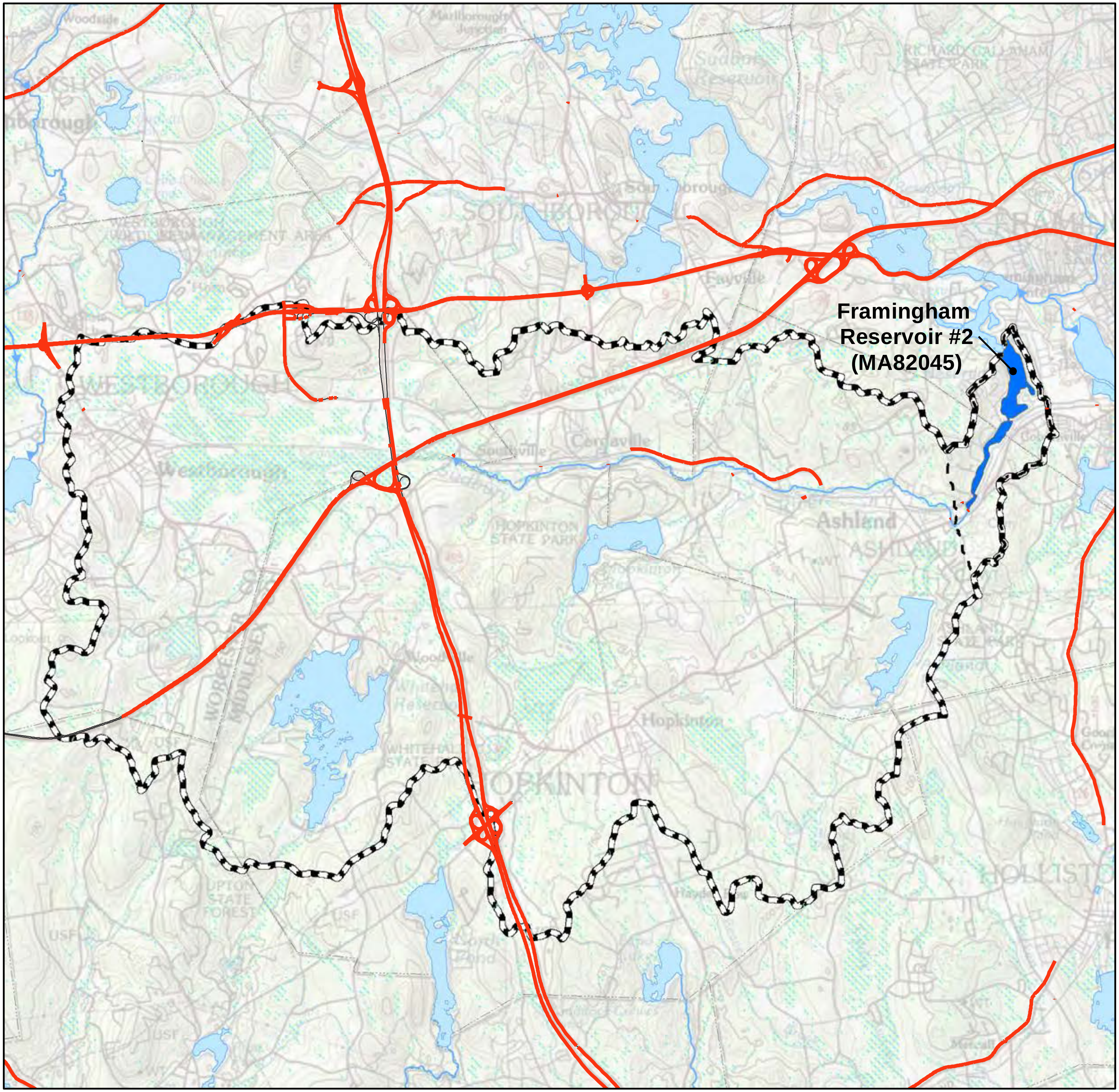

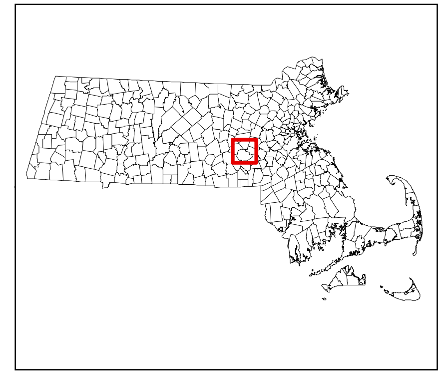

Framingham Reservoir #2

Impaired Water Bodies

Impaired Stream Segment

Non-Impaired Stream Segment

MassDOT Roads in Urban Areas

MassDOT Roads

NWI Wetland Areas

Subwatershed

Total Watershed

Town Boundaries

N

0 0.45 0.9 1.8 2.7 Miles

1 inch = 1.34 miles

Figure 1

Framingham Reservoir #2
Total Watershed
MA82045

December 2012

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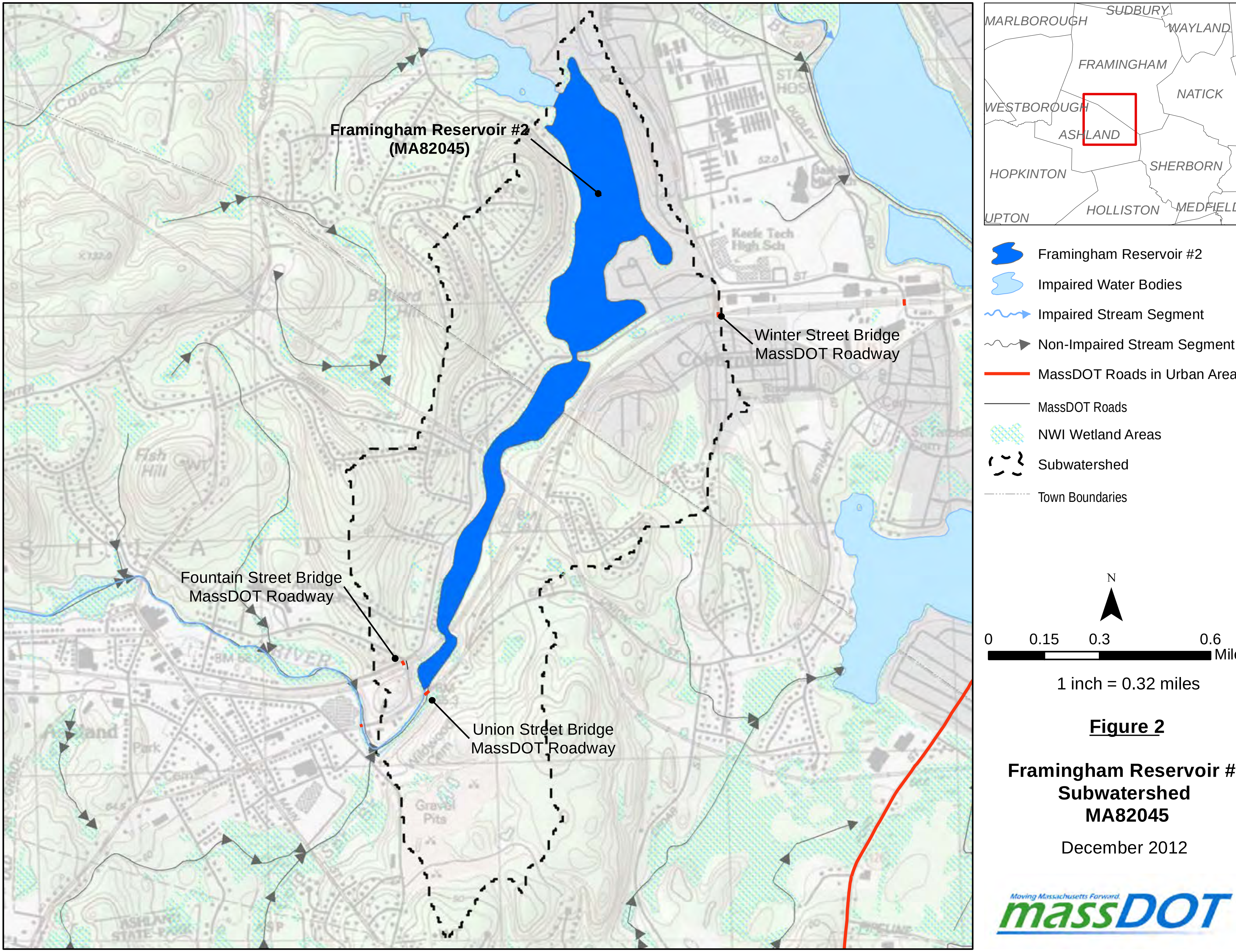

Figure 2

Framingham Reservoir #2 Subwatershed MA82045

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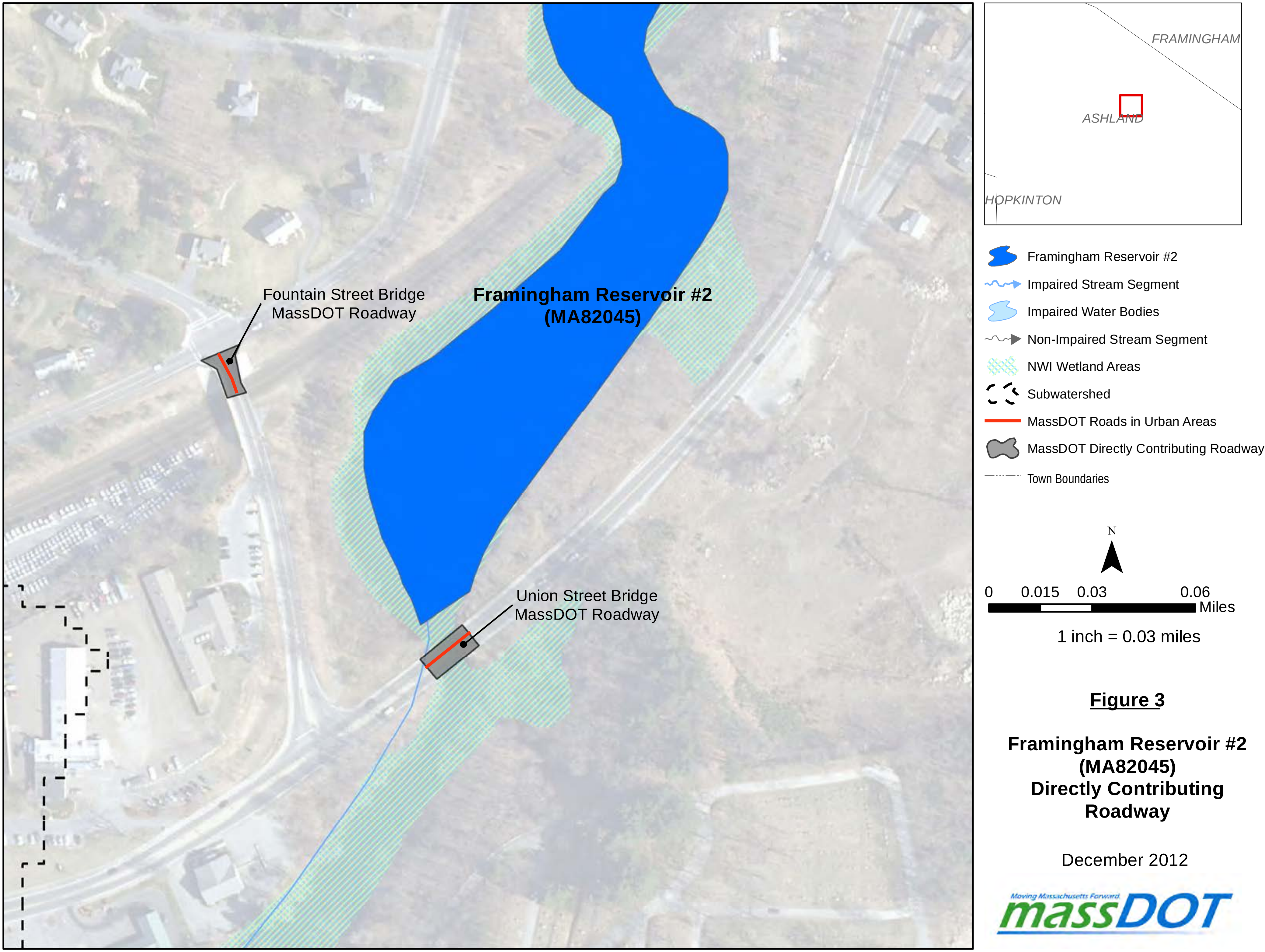

Figure 3

Framingham Reservoir #2 (MA82045) Directly Contributing Roadway

December 2012

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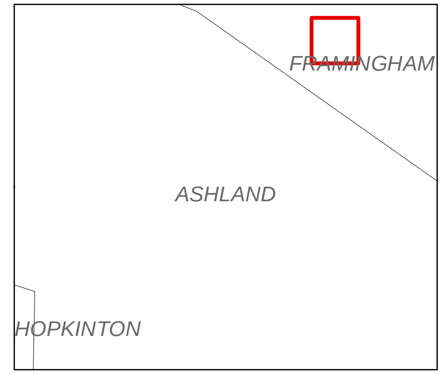

Framingham Reservoir #2
Impaired Stream Segment
Impaired Water Bodies
Non-Impaired Stream Segment
NWI Wetland Areas
Subwatershed
MassDOT Roads in Urban Areas
MassDOT Directly Contributing Roadway
Town Boundaries

N

0 0.02 0.04 0.08 Miles

1 inch = 0.04 miles

Figure 4

Framingham Reservoir #2 (MA82045) Directly Contributing Roadway

December 2012

Moving Massachusetts Forward. massDOT

Impaired Waters Assessment for Eames Brook (MA82A-13)

Impaired Water Body

Name: Eames Brook

Location: Framingham, MA

Water Body ID: MA82A-13

Impairments

Eames Brook (MA82A-13) is listed under Category 5, "Waters Requiring a TMDL" on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). Eames Brook is impaired for the following:

- taste and odor
- excess algal growth
- aquatic macroinvertebrate bioassessments
- (non-native aquatic plants*)
- (debris/floatables/trash*).

Additionally, MassDEP's *SuAsCo Watershed Year 2001 Water Quality Assessment Report* (MassDEP, 2001) states that Eames Brook is impaired due to unknown causes, noxious aquatic plants, and exotic species (non-pollutant).

Relevant Water Quality Standards

Water Body Classification: Class B

Applicable State Regulations:

- *314 CMR 4.05 (3)(b) 5 Solids*. These waters shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.
- *314 CMR 4.05 (3)(b) 6 Color and Turbidity.* These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this Class.
- *314 CMR 4.05 (3)(b) 8 Taste and Odor.* None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to this Class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.
- *314 CMR 4.05 (5) (a) Aesthetics*. All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.

- *314 CMR 4.05 (5) (b) Bottom Pollutants or Alterations*. All surface waters shall be free from pollutants in concentrations or combinations or from alterations that adversely affect the physical or chemical nature of the bottom, interfere with the propagation of fish or shellfish, or adversely affect populations of non-mobile or sessile benthic organisms.

- *314 CMR 4.05 (5) (c) Nutrients.* Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.
- *314 CMR 4.05 (5)(e) Toxic Pollutants*. All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife. For pollutants not otherwise listed in 314 CMR 4.00, the National Recommended Water Quality Criteria: 2002, EPA 822R-02-047, November 2002 published by EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act, are the allowable receiving water concentrations for the affected waters, unless the Department either establishes a site specific criterion or determines that naturally occurring background concentrations are higher. Where the Department determines that naturally occurring background concentrations are higher, those concentrations shall be the allowable receiving water concentrations. The Department shall use the water quality criteria for the protection of aquatic life expressed in terms of the dissolved fraction of metals when EPA's 304(a) recommended criteria provide for use of the dissolved fraction. The EPA recommended criteria based on total recoverable metals shall be converted to dissolved metals using EPA's published conversion factors. Permit limits will be written in terms of total recoverable metals. Translation from dissolved metals criteria to total recoverable metals permit limits will be based on EPA's conversion factors or other methods approved by the Department. The Department may establish site specific criteria for toxic pollutants based on site specific considerations.
- *314 CMR 4.05 (3)(b) 1 Dissolved Oxygen*. a. Shall not be less than 6.0 mg/l in cold water fisheries and not less than 5.0 mg/l in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.
- *314 CMR 4.05 (3)(b) 2 Temperature.* a. Shall not exceed 68°F (20°C) based on the mean of the daily maximum temperature over a seven day period in cold water fisheries, unless naturally occurring. Where a reproducing cold water aquatic community exists at a naturally occurring higher temperature, the temperature necessary to protect the community shall not be exceeded and the natural daily and seasonal temperature fluctuations necessary to protect the community shall be maintained. Temperature shall not exceed 83°F (28.3°C) in warm water fisheries. The rise in temperature due to a discharge shall not exceed 3°F (1.7°0C) in rivers and streams designated as cold water fisheries nor 5°F (2.8°C) in rivers and streams designated as warm water fisheries (based on the minimum expected flow for the month); in lakes and ponds the rise shall not exceed 3°F (1.7°0C) in the epilimnion (based on the monthly average of maximum daily temperature); b. natural seasonal and daily variations that are necessary to protect existing and designated uses shall be

maintained. There shall be no changes from natural background conditions that would impair any use assigned to this Class, including those conditions necessary to protect normal species diversity, successful migration, reproductive functions or growth of aquatic organisms.

- *314 CMR 4.05 (3)(b) 3 pH*. Shall be in the range of 6.5 through 8.3 standard units but not more than 0.5 units outside of the natural background range. There shall be no change from natural background conditions that would impair any use assigned to this Class.

Site Description

Eames Brook (MA82A-13) flows for 0.57 miles from the outlet of Farm Pond in Framingham to the confluence with the Sudbury River in Framingham. Eames Brook is surrounded mainly by wetlands. There is a MassDOT owned bridge on the upstream end of the subwatershed and a closer MassDOT owned bridge located on the border of the subwatershed. As shown in **Figure 1**, there are no other MassDOT urban roads within the subwatershed.

On November 16, 2012 a site visit was performed to determine the stormwater drainage patterns at MassDOT roadway. MassDOT owns one directly contributing bridge near Eames Brook, called Mount Wayte Ave. Bridge in **Figure 2**. At this location, MassDOT owns only the bridge and minimal to no property surrounding the bridge. The approach roadways are owned and operated by the respective towns. No closed drainage systems exist on the bridge structures; however, the bridges are curbed. Therefore, stormwater runoff flows off the bridge and into the municipal stormwater system. The municipal outfall drains to Eames Brook.

Assessment under BMP 7U

None of the impairments for Eames Brook (MA82A-13) have been addressed by a TMDL. Therefore, MassDOT assessed the impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the following impairments:

- taste and odor
- excess algal growth
- aquatic macroinvertebrate bioassessments

According to MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*, the impairments of non-native aquatic plants and debris/floatables/trash are not caused by pollutants (MassDEP, 2011). Therefore, these impairments are not considered further.

MassDOT's Application of the Impervious Cover Method

MassDOT's Application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I's Impervious Cover Method described in EPA's *Stormwater TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT's program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT's Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body's entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS's impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT's target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT's properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's *Stormwater Best Management Practices (BMP) Performance Analysis* report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for Eames Brook (MA82A-13):

Table 1. Site Parameters for Eames Brook (MA82A-13)

Total & Subwatershed		
Watershed Area	771	acres
Impervious Cover (IC) Area	266	acres
Percent Impervious	34.5	%
IC Area at 9% Goal	69.4	acres
Target Reduction % in IC	74.1	%
Reductions Applied to DOT Direct Watershed		
MassDOT's IC Area **Directly** Contributing to Impaired Segment	0.12	acres
MassDOT's Target Reduction in Effective IC (74.0% of DOT Directly Contributing IC)	0.09	acres

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 74.0%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 0.09 acres.

Existing BMPs

There are no existing BMPs in the Eames Brook directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to Eames Brook.

Mitigation Plan

Because there is no mitigation of impervious cover achieved by existing MassDOT BMPs to meet the target reduction of 0.09 acres, MassDOT considered the implementation of BMPs.

Based on the review of MassDOT's directly contributing drainage area, no BMPs have been identified that can be implemented on MassDOT property to address the impairments of Eames Brook due to site constraints. The Mount Wayte Ave. Bridge is owned by MassDOT, but the roadways on either side of the bridge are not owned by MassDOT. Therefore, there is no land available to implement stormwater infiltration BMPs to mitigate the effect of the bridge stormwater runoff.

Conclusions

MassDOT used the IC Method to assess Eames Brook (MA82A-13) for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. Results indicate that MassDOT should reduce its effective IC within its directly contributing subwatershed by 0.09 acres to achieve the targeted reduction in effective IC. MassDOT evaluated its property within the directly contributing watershed to Eames Brook to identify existing BMPs and found that no BMPs exist to reduce effective IC. This information is summarized in Table 2 below.

Table 2. Effective IC Reductions under Existing & Proposed Conditions

IC in Directly Contributing Watershed	0.12	acres
Target Reduction in Effective IC	0.09	acres
IC Effectively Reduced by Existing BMPs	0.0	acres
IC Remaining to Mitigate with Proposed BMPs	**0.09**	**acres**

MassDOT should reduce its effective IC within the directly contributing watershed by an additional 0.09 acres to achieve the targeted reduction in IC. However, the site constraints and limited right-of-way area indicate that the construction of stormwater infiltration BMPs along the directly contributing MassDOT roadways is infeasible. Therefore, no further action will be taken as part of the Retrofit Initiative of the MassDOT Impaired Waters program.

MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. MassDOT will also continue to implement non-structural BMPs that reduce the impacts of storm water.

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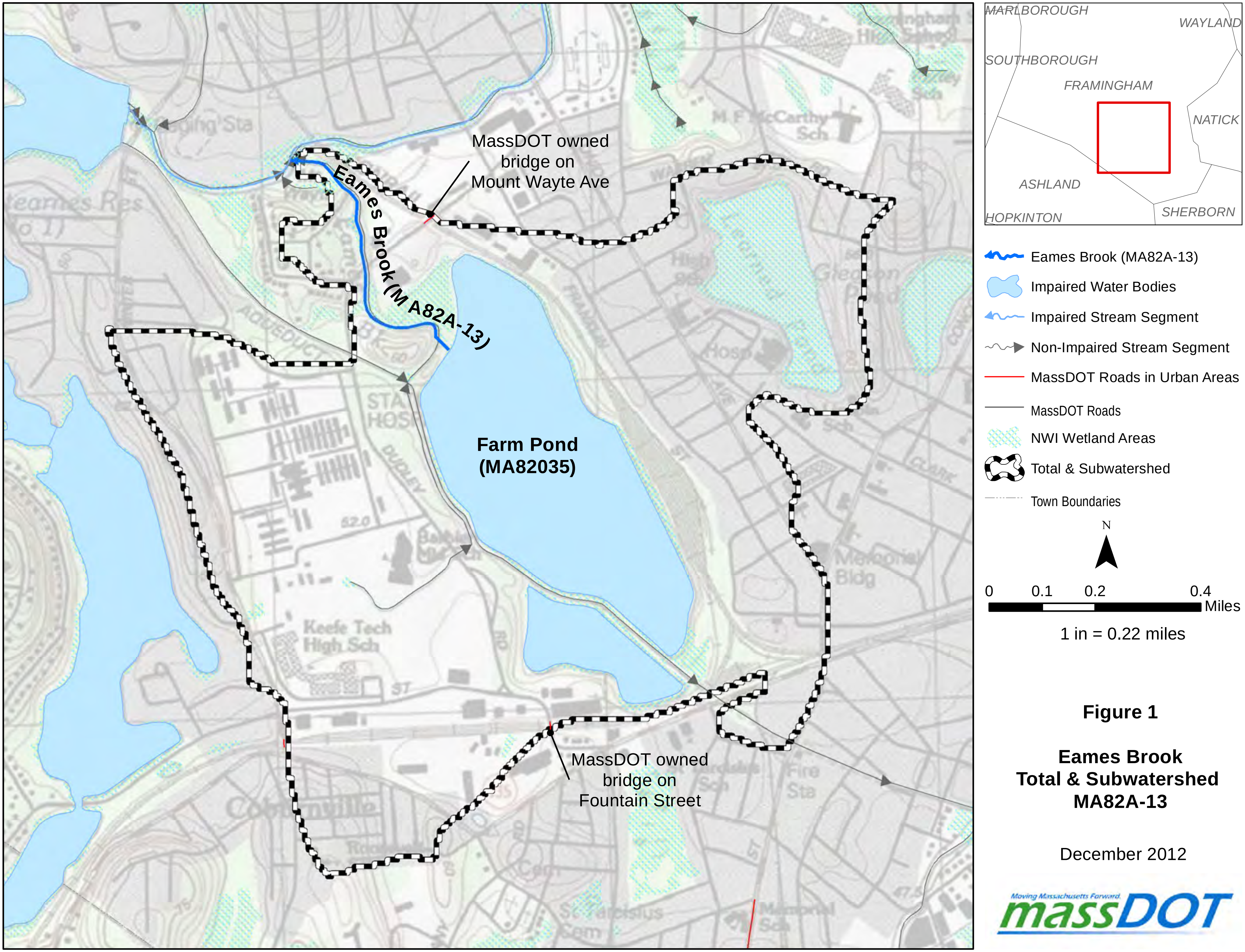

Figure 1

Eames Brook Total & Subwatershed MA82A-13

December 2012

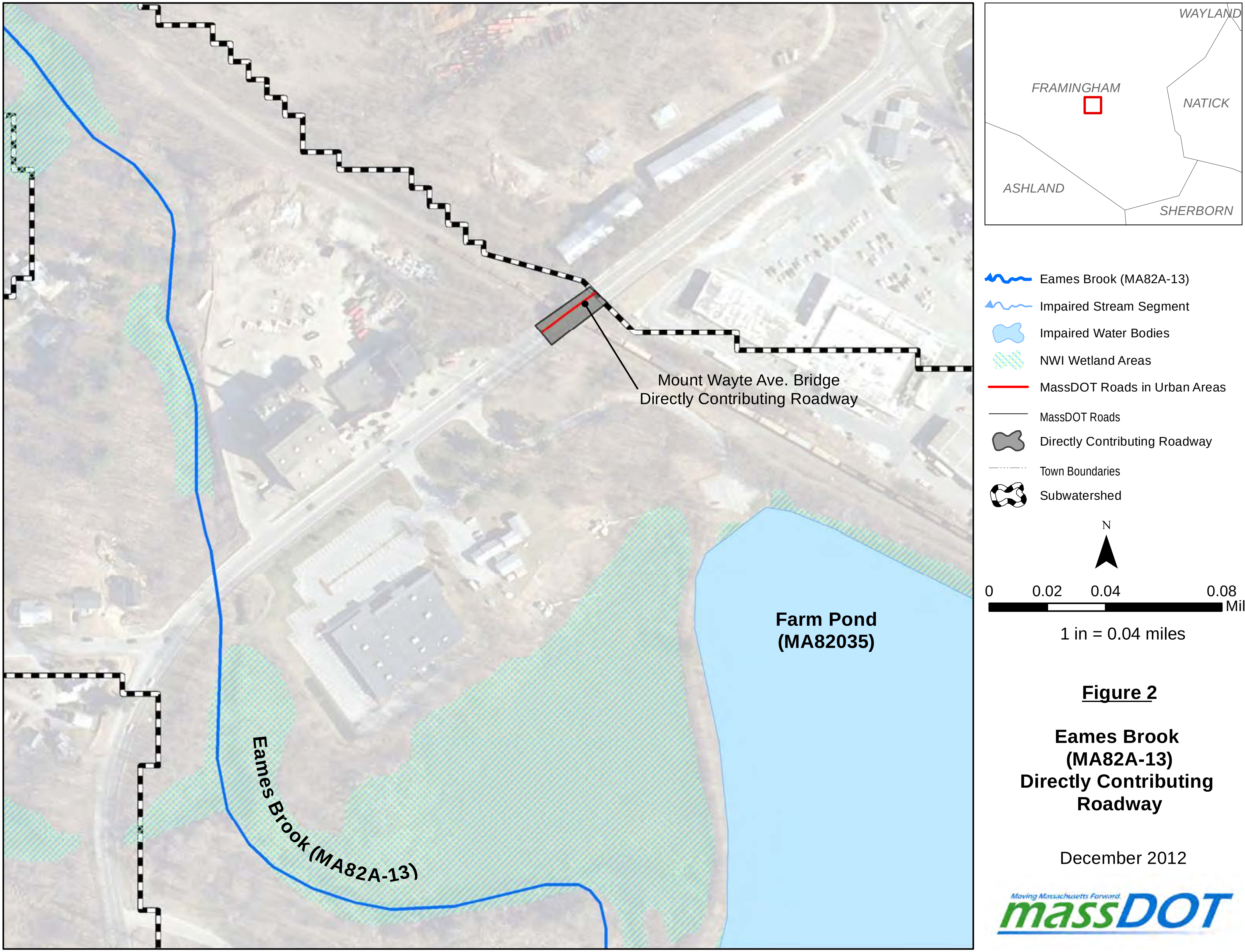

Figure 2

Eames Brook (MA82A-13) Directly Contributing Roadway

December 2012

Moving Massachusetts Forward. massDOT

Impaired Waters Assessment for Assabet River (MA82B-06)

Impaired Water Body

Name: Assabet River

Location: Maynard and Acton, MA

Water Body ID: MA82B-06

Impairments

Assabet River (MA82B-06) is listed under Category 5, "Waters Requiring a TMDL" on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). The following impairments for the Assabet River segment (MA82B-06) have not been addressed through the development of a TMDL:

- temperature
- taste and odor
- other
- (debris/floatables/trash)*
- (non-native aquatic plants)*.

The *Assabet River TMDL for Total Phosphorus (CN 201.0)* (MassDEP, 2004) was developed to address impairments related to phosphorus within the Assabet River. The following additional impairments for the Assabet River segment (MA82B-06) have been addressed through the development of a TMDL:

- total phosphorus
- excess algal growth
- dissolved oxygen
- aquatic plants (macrophytes).

Additionally, MassDEP's *SuAsCo Watershed Year 2001 Water Quality Assessment Report* (MassDEP, 2001) states that suspected sources of pollution include municipal point source discharge, sanitary sewer overflows, impacts from hydrostructure/flow regulation/modification, internal nutrient recycling, and discharge from municipal separate storm sewer systems.

Relevant Water Quality Standards

Water Body Classification: Class B, Warm Water Fishery

Applicable State Regulations:

- *314 CMR 4.05 (3)(b) 1 Dissolved Oxygen*. Shall not be less than 6.0 mg/l in cold water fisheries and not less than 5.0 mg/l in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.
- *314 CMR 4.05 (3)(b) 2 Temperature*

- a. Shall not exceed 68°F (20°C) based on the mean of the daily maximum temperature over a seven day period in cold water fisheries, unless naturally occurring. Where a reproducing cold water aquatic community exists at a naturally occurring higher temperature, the temperature necessary to protect the community shall not be exceeded and the natural daily and seasonal temperature fluctuations necessary to protect the community shall be maintained. Temperature shall not exceed 83°F (28.3°C) in warm water fisheries. The rise in temperature due to a discharge shall not exceed 3°F (1.7°0C) in rivers and streams designated as cold water fisheries nor 5°F (2.8°C) in rivers and streams designated as warm water fisheries (based on the minimum expected flow for the month); in lakes and ponds the rise shall not exceed 3°F (1.7°0C) in the epilimnion (based on the monthly average of maximum daily temperature).
- b. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained. There shall be no changes from natural background conditions that would impair any use assigned to this Class, including those conditions necessary to protect normal species diversity, successful migration, reproductive functions or growth of aquatic organisms.

- *314 CMR 4.05 (3)(b) 5 Solids.* These waters shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.
- *301 CMR 4.05 (3)(b) 6 Color and Turbidity.* These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this Class.
- *301 CMR 4.05 (3)(b) 8 Taste and Odor.* None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to this Class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.
- *314 CMR 4.05 (5)(a) Aesthetics*. All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.
- *314 CMR 4.05 (5) (c) Nutrients*. Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.

Site Description

The Assabet River Segment (MA82B-06) flows for 1.2 miles from the USGS gauge at Routes 27/62 in Maynard to the Powdermill Dam in Acton. The Assabet River is surrounded mainly by urban residential area. **Figure 1** shows the MassDOT-owned urban roadways within the total watershed. As shown in **Figure 2**, the MassDOT-owned urban roadways within the subwatershed include the Waltham Street Bridge, Main Street Bridge, and Great Road Bridge. The subwatershed includes Segment MA82B-06 (under assessment) and Segment MA82B-05.

MassDOT owns one bridge which directly contributes stormwater to the upstream end of Segment MA82B-06, called Waltham Street Bridge in **Figure 3**. The other bridges in the subwatershed drain to a different stream segment which will be assessed separately. At the Waltham Street Bridge location, MassDOT owns only the bridge and minimal to no property surrounding the bridge. The approach roadways are owned and operated by the respective towns. No closed drainage systems exist on the bridge structure; however, the bridge is curbed. Therefore, stormwater runoff flows off the bridge and into the municipal stormwater system. Based on topography of the site, the municipal system likely drains to the Assabet River Segment (MA82B-06).

Assessment under BMP 7U

Five of the impairments for Assabet River Segment (MA82B-06) have not been addressed by a TMDL. Therefore, MassDOT assessed the impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the following impairments:

- temperature
- taste and odor
- other.

According to MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*, the impairments for (debris/floatables/trash)* and (non-native aquatic plants)* are not caused by pollutants (MassDEP, 2011). Therefore, these impairments are not considered further.

MassDOT's Application of the Impervious Cover Method

MassDOT's application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I's Impervious Cover Method described in EPA's *Stormwater TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT's program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT's Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body's entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS's impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT's target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT's properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's *Stormwater Best Management Practices (BMP) Performance Analysis* report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for Assabet River (MA82B-06):

Table 1. Site Parameters for Assabet River (MA82B-06)

Total Watershed		
Watershed Area	74,924	acres
Impervious Cover (IC) Area	8,980	acres
Percent Impervious	12.0	%
IC Area at 9% Goal	6,743	acres
Target Reduction % in IC	24.9	%
Subwatershed		
Subwatershed Area	1,506	acres
Impervious Cover (IC) Area	425	acres
Percent Impervious	28.2	%
IC Area at 9% Goal	135	acres
Target Reduction % in IC	68.2	%
Reductions Applied to DOT Direct Watershed		
MassDOT's IC Area **Directly** Contributing to Impaired Segment	0.1	acres
MassDOT's Target Reduction in Effective IC (68% of DOT Directly Contributing IC)	0.1	acres

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 68%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 0.1 acres.

Assessment under BMP 7R

The *Assabet River Total Maximum Daily Load for Total Phosphorus [CN 201.0]* addresses the impairments for total phosphorus, dissolved oxygen, excess algal growth, and aquatic plants (macrophytes) for this water body. Therefore, MassDOT assessed the contribution of total phosphorus from MassDOT urban areas to this water body using the approach described in BMP 7R (TMDL Watershed Review).

TMDL

The Massachusetts Department of Environmental Protection's (MassDEP) TMDL report titled *Assabet River Total Maximum Daily Load for Total Phosphorus [CN 201.0]* can be summarized as follows:

- Pollutant of Concern: Total Phosphorus
- Impairments for Assabet River Addressed in TMDL: total phosphorus, dissolved oxygen, excess algal growth, and aquatic plants (macrophytes)
- Applicable Waste Load Allocation (WLA):
    - Description of Associated Land Use: Urban. The landuse for this TMDL was based on MassGIS data from 1990 – 1991. For the purposes of this assessment, urban landuse was used to represent roadway.
    - Urban Land Use Current Load (TP): No information provided
    - Urban Land Use Target WLA (TP): 1.0 lbs/day or 364 lb/yr. The TMDL identifies a target of 1.0 lbs/day for watershed non-point sources, specifically runoff combined with groundwater that is not from the natural background of the watershed (page 40 of TMDL). Therefore, the assumption that urban landuse has a TMDL of 1.0 lbs/day is conservative because it not only includes phosphorus sources from runoff but also from groundwater.
    - Urban Area in Watershed: 11,712 acres
    - Urban Land Use Target Areal WLA (TP): 0.0 lb/acre/yr.

Estimated Loading from MassDOT

The loading of total phosphorus (TP) from MassDOT property directly contributing stormwater runoff to Assabet River was estimated using the following assumptions and calculations:

- MassDOT estimates the TP loading from its impervious areas as 1.6 lb/acre/yr. This loading rate is based on data collected in a study of stormwater runoff conducted by the United States Geological Survey (USGS) (Smith and Granato, 2010). The study analyzed stormwater samples from 12 sites located on highways operated by MassDOT across Massachusetts between September 2005 and September 2007. Samples were taken under a variety of weather conditions during this period.
- MassDOT estimates the TP loading from its pervious areas as 0.6 lb/acre/yr. This loading rate is based on the loading rate for hayland provided in the United States Environmental Protection Agency's (EPA) document EPA 440/5-80-011, "Modeling phosphorus loading and Pond response under uncertainty: a manual and compilation of export coefficients" (Reckhow, 1980). Hayland was chosen to represent the pervious right-of-way areas which are typically cleared areas that are mowed only once per year.
- MassDOT calculated its total estimated TP loading rate using the estimated loading rates listed above. MassDOT property contributing stormwater directly to Assabet River is 0.1 acres of impervious area and 0.0 acres of pervious area. The TP loading is 0.2 lb/yr without accounting for existing BMPs or treatment throughout the watershed.
- MassDOT calculated its target TP WLA using the TMDL target areal WLA of 0.0 lb/ac/yr and the total area of MassDOT property within the TMDL watershed directly draining to Assabet River (0.1 acres). The target TP WLA for MassDOT runoff is 0.0 lb/yr.

Assessment

MassDOT calculated its current TP loading rate (0.2 lb/yr) and its target TP WLA (0.0 lb/yr) using values provided in MassDEP's TMDL report. The difference between these two values represents the target reduction in TP that MassDOT will aim to achieve to comply with the WLA. For the watershed directly contributing to Assabet River, this target reduction is 0.2 lb/yr, or 100%. As explained in BMP 7R, MassDOT's pollutant loading analysis provides only a preliminary estimate of the level of pollutant reductions that may be recommended. In light of the variability of data on stormwater discharges, MassDOT will rely on a variety of other factors apart from numeric guidelines, including site constraints, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

There are no existing BMPs in the Assabet River (MA82B-06) directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to Assabet River. Thus, there is currently no TP reduction being provided.

Table 2: Loading from MassDOT's Directly Contributing Property Relative to TMDL WLA

Total Area	0.1	ac
Target Areal WLA	0.0	lb/ac/yr
Total Estimated Load	0.2	lb/yr
WLA for MassDOT's Directly Contributing Property	0.0	lb/yr
MassDOT's Required Load Reduction	0.2	lb/yr

Mitigation Plan

Because there are no existing BMPs mitigating impervious surface or reducing total phosphorus loading, MassDOT considered the implementation of BMPs to meet the 0.1 acre target reduction in impervious cover and 0.2 lb/yr in total phosphorus loading.

Based on the review of MassDOT's directly contributing drainage area, no BMPs have been identified that can be implemented on MassDOT property to address the impairments of Assabet River (MA82B-06) due to site constraints. The Waltham Street Bridge is owned by MassDOT, but the roadways on either side of the bridge are not owned by MassDOT. Therefore, there is no land available to implement stormwater infiltration BMPs to mitigate the effect of the bridge stormwater runoff.

Conclusions

MassDOT used both the IC Method and the TMDL Method to assess Assabet River (MA82B-06) for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. To meet target reductions in impervious cover to meet the 9% goal MassDOT should reduce impervious cover within the urban area directly contributing watershed to Assabet River by 0.1 acres. To meet guidelines set forth in the TMDL for total phosphorus MassDOT should reduce its TP loading within the urban area directly contributing watershed by 0.2 lb/yr to achieve the targeted reduction. MassDOT evaluated its property within the directly contributing watershed to the Assabet River to identify existing BMPs and found that no BMPs exist to reduce effective IC and total phosphorus loading.

MassDOT should reduce impervious cover and TP loading to the Assabet River to meet target impervious cover reduction and guidelines set forth in the TMDL; however, the site constraints and limited right-of-way area indicate that the construction of stormwater infiltration BMPs along the directly contributing MassDOT roadways is infeasible. Therefore, no further action will be taken as part of the Retrofit Initiative of the MassDOT Impaired Waters program.

MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. MassDOT will also continue to implement non-structural BMPs that reduce the impacts of stormwater.

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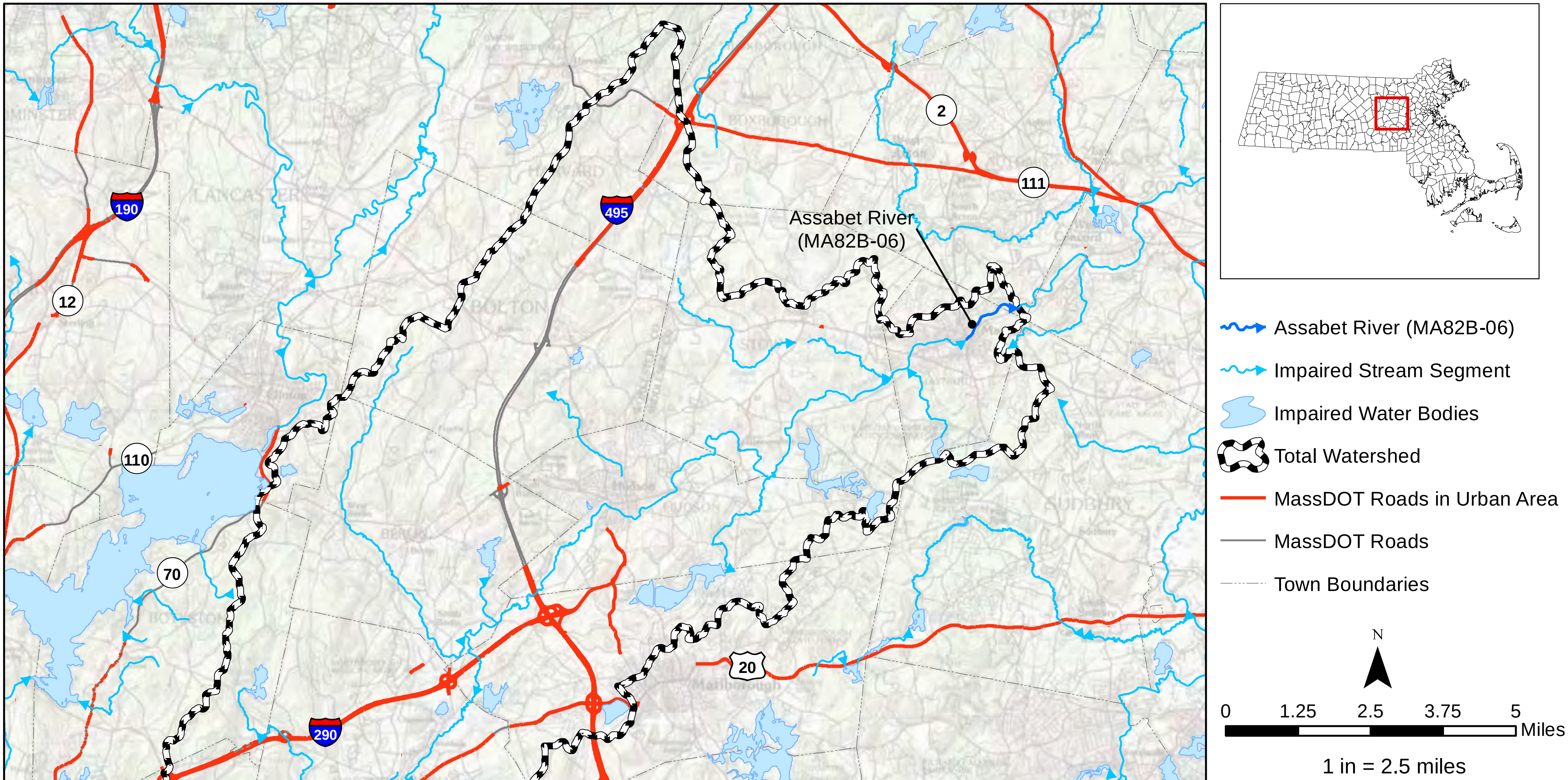

Figure 1

Assabet River Total Watershed MA82B-06

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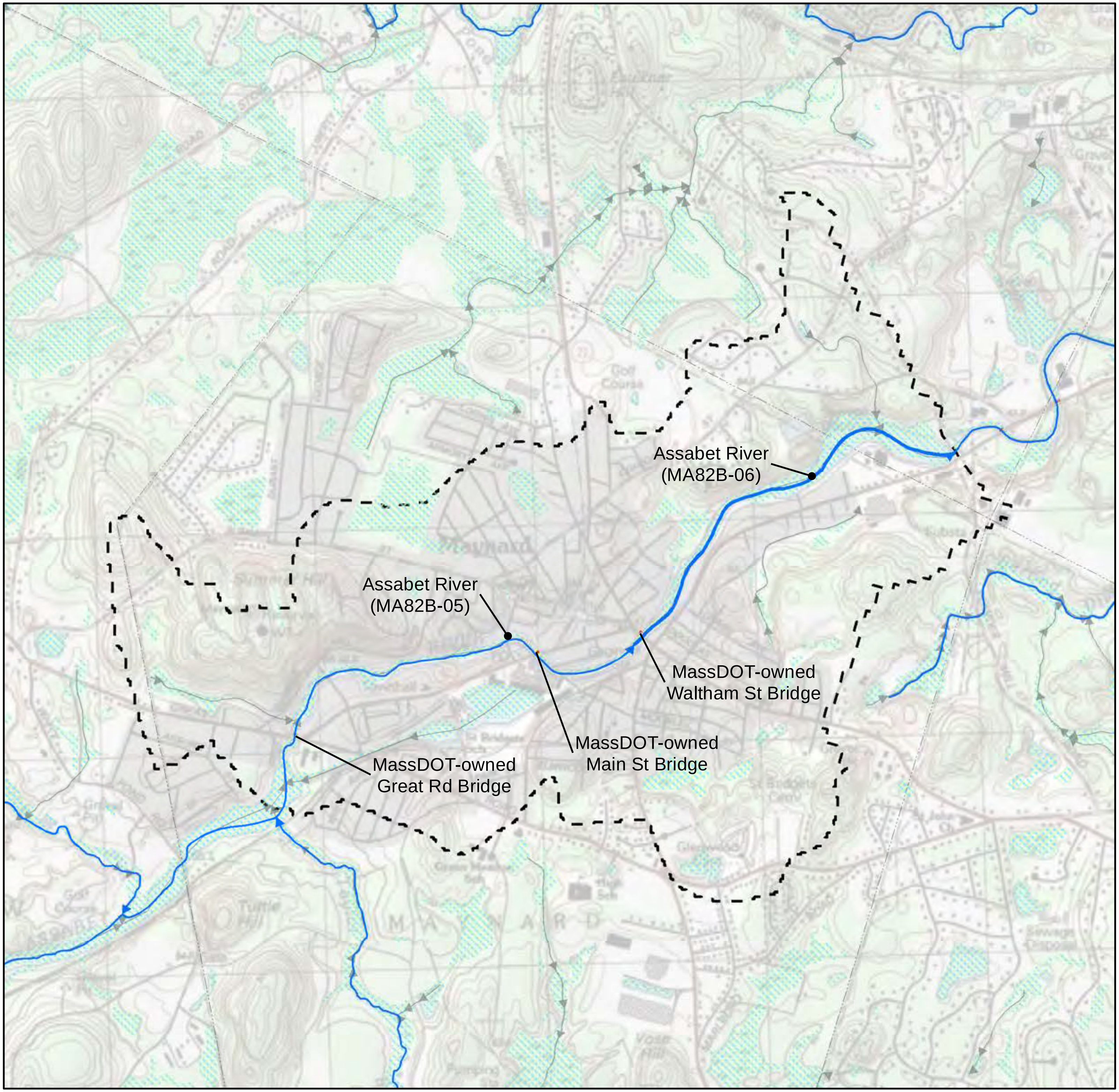
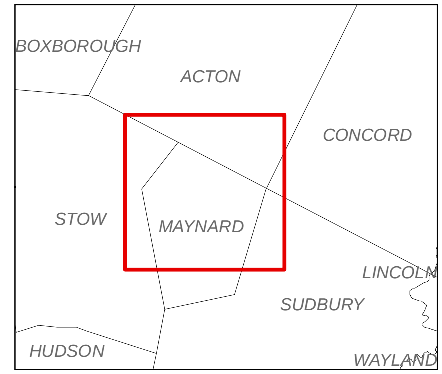




Assabet River (MA82B-06)

Impaired Stream Segment

Impaired Water Bodies

Non-Impaired Stream Segment

NWI Wetland Areas

Assabet River Subwatershed

MassDOT Roads in Urban Area

MassDOT Roads

Town Boundaries

N

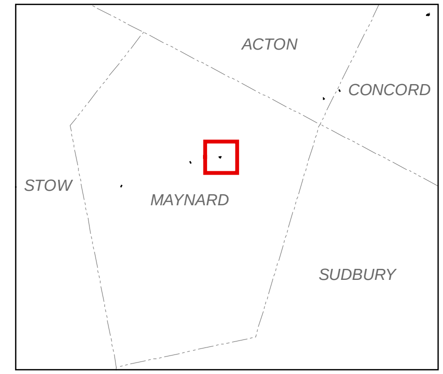
0 1,000 2,000 3,000 4,000 Feet

1 in = 2,000 feet

Figure 2

Assabet River Subwatershed MA82B-06

December 2012



MassDOT Directly Contributing Watersheds
Impaired Stream Segment
Impaired Water Bodies
Non-Impaired Stream Segment
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries

N

0 50 100 200 300 400 Feet

1 inch = 200 feet

Figure 3

Assabet River (MA82B-06) Directly Contributing MassDOT Watershed

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Impaired Waters Assessment for Martins Brook (MA92-08)

Impaired Water Body

Name: Martins Brook

Location: North Reading and Wilmington, MA

Water Body ID: MA92-08

Impairments

Martins Brook (MA92-08) is listed under Category 5, "Waters Requiring a TMDL", on the *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). The brook is impaired for the following:

- fecal coliform
- fishes bioassessments
- aquatic macroinvertebrate bioassessments
- dissolved oxygen.

According to MassDEP's *Ipswich River Watershed 2000 Water Quality Assessment Report* (MassDEP, 2004), Martins Brook is 4.6 miles long, a Class B water, and was originally assessed because it was on the 1998 303(d) List of Waters for organic enrichment, low dissolved oxygen, other habitat alterations, and pathogens. The report states, "Habitat quality degradation resulting from severe bank erosion, instream sedimentation (sand) and riparian zone disruption was noted as were low dissolved oxygen and slightly elevated total phosphorus levels. Sediment inputs probably originate from multiple sources including the large Benevento Sand & Gravel operation, point source discharge(s), road runoff, and eroding stream banks." Martins Brook is covered by the *Draft Pathogen Total Maximum Daily Load (TMDL) for the Ipswich River Watershed* report (MassDEP, 2005).

Relevant Water Quality Standards

Water Body Classification: Class B

Applicable State Regulations:

- *314 CMR 4.05 (3)(b) 5 Solids.* These waters shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.
- *314 CMR 4.05 (5) (b) Bottom Pollutants or Alterations*. All surface waters shall be free from pollutants in concentrations or combinations or from alterations that adversely affect the physical or chemical nature of the bottom, interfere with the propagation of fish or shellfish, or adversely affect populations of non-mobile or sessile benthic organisms.
- *314 CMR 4.05 (5) (c) Nutrients*. Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as

otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.

- *314 CMR 4.05 (5)(e) Toxic Pollutants*. All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife. For pollutants not otherwise listed in 314 CMR 4.00, the National Recommended Water Quality Criteria: 2002, EPA 822R-02-047, November 2002 published by EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act, are the allowable receiving water concentrations for the affected waters, unless the Department either establishes a site specific criterion or determines that naturally occurring background concentrations are higher. Where the Department determines that naturally occurring background concentrations are higher, those concentrations shall be the allowable receiving water concentrations. The Department shall use the water quality criteria for the protection of aquatic life expressed in terms of the dissolved fraction of metals when EPA's 304(a) recommended criteria provide for use of the dissolved fraction. The EPA recommended criteria based on total recoverable metals shall be converted to dissolved metals using EPA's published conversion factors. Permit limits will be written in terms of total recoverable metals. Translation from dissolved metals criteria to total recoverable metals permit limits will be based on EPA's conversion factors or other methods approved by the Department. The Department may establish site specific criteria for toxic pollutants based on site specific considerations.
- *314 CMR 4.05 (3)(b) 1 Dissolved Oxygen*. Shall not be less than 6.0 mg/l in cold water fisheries and not less than 5.0 mg/l in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.
- *314 CMR 4.05 (3)(b) 2 Temperature.*
    - a. Shall not exceed 68°F (20°C) based on the mean of the daily maximum temperature over a seven day period in cold water fisheries, unless naturally occurring. Where a reproducing cold water aquatic community exists at a naturally occurring higher temperature, the temperature necessary to protect the community shall not be exceeded and the natural daily and seasonal temperature fluctuations necessary to protect the community shall be maintained. Temperature shall not exceed 83°F (28.3°C) in warm water fisheries. The rise in temperature due to a discharge shall not exceed 3°F (1.7°0C) in rivers and streams designated as cold water fisheries nor 5°F (2.8°C) in rivers and streams designated as warm water fisheries (based on the minimum expected flow for the month); in lakes and ponds the rise shall not exceed 3°F (1.7°0C) in the epilimnion (based on the monthly average of maximum daily temperature);
    - b. natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained. There shall be no changes from natural background conditions that would impair any use assigned to this Class, including those conditions necessary to protect normal species diversity, successful migration, reproductive functions or growth of aquatic organisms.

- *314 CMR 4.05 (3)(b) 3 pH*. Shall be in the range of 6.5 through 8.3 standard units but not more than 0.5 units outside of the natural background range. There shall be no change from natural background conditions that would impair any use assigned to this Class.
- *314 CMR 4.05 (3)(b) 4 Bacteria*.
    - a. At bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: where E. coli is the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml; alternatively, where enterococci are the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies per 100 ml and no single sample taken during the bathing season shall exceed 61 colonies per 100 ml;
    - b. For other waters and, during the non bathing season, for waters at bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: the geometric mean of all E. coli samples taken within the most recent six months shall not exceed 126 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies per 100 ml; alternatively, the geometric mean of all enterococci samples taken within the most recent six months shall not exceed 33 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 61 colonies per 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department.

Site Description

Martins Brook is a water body that originates in North Reading, Massachusetts at the Martins Pond dam and flows for approximately 4.6 miles until it reaches the confluence with the Ipswich River (MA92-06). Martins Brook crosses into Wilmington for a short distance where Unnamed Tributary (MA92-26) and two unnamed streams flow into the brook. Martins Brook then crosses back into North Reading where another unnamed stream and Rapier Brook flow into it before it enters the Ipswich River. Route 28 (Main Street) in North Reading crosses the brook approximately 0.75 miles upstream from its confluence with the Ipswich River. See **Figure 1**.

The watershed of MassDOT's property directly contributing stormwater runoff to Martins Brook is comprised of three segments of Route 28 (Main Street) in North Reading. See **Figure 2**. A segment of Route 28 that crosses over Martins Brook stretches from Larch Street which is south of the brook to approximately 770 feet north of the brook. Stormwater runoff from this segment of Route 28 is collected in catch basins and drains to an outfall that directly discharges to Martins Brook. Directly north of this area is the second segment that directly drains to the brook. This segment stretches to just north of Winter Street. Stormwater runoff from this segment is collected in catch basins and piped to an outfall that drains to Rapier Brook, then flows for approximately 500 feet before entering Martins Brook. This watershed is considered direct to Martins Brook because there is minimal opportunity for stormwater runoff to infiltrate before flowing into Martins Brook. The last segment of Route 28 that drains directly to Martins Brook begins at North Street and ends just north of Pluff Ave. Runoff from this segment is collected by a system of catch basins that is piped to an outfall that drains to an unnamed stream and ultimately to Martins Brook. In addition to runoff from Route 28, a pipe coming from the direction of a parking lot east of Route 28 is connected into the system. There was heavy flow from this pipe during the field observation. The Hillview Country Club golf course is the east of the parking lot and it was assumed that flow probably comes from the golf course and drains underneath the parking lot into the system. Field observations showed little opportunity for infiltration at the outfall so it was assumed that runoff from this segment is directly draining to Martins Brook which is approximately 1100 feet away from the outfall.

Assessment under BMP 7U

None of the following impairments for Martins Brook (MA92-08) have been addressed by a TMDL except for fecal coliform which is covered by a draft TMDL. Therefore, MassDOT assessed the impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the following impairments:

- fishes bioassessments
- aquatic macroinvertebrate bioassessments
- dissolved oxygen.

The impairment for fecal coliform is assessed separately in the section titled Assessment of Pathogen Impairment.

MassDOT's Application of the Impervious Cover Method

MassDOT's Application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I's Impervious Cover Method described in EPA's *Stormwater TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT's program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT's Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body's entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS's impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT's target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT's properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's *Stormwater Best Management Practices (BMP) Performance Analysis* report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for Martins Brook (MA92-08):

Table 1. Site Parameters for Martins Brook (MA92-08)

Total and Subwatershed		
Watershed Area	8,459	acres
Impervious Cover (IC) Area	1,262	acres
Percent Impervious	14.9	%
IC Area at 9% Goal	762	acres
Target Reduction % in IC	39.7	%
Reductions Applied to DOT Direct Watershed		
MassDOT's IC Area **Directly** Contributing to Impaired Segment	5.5	acres
MassDOT's Target Reduction in Effective IC (39.7% of DOT Directly Contributing IC)	2.2	acres

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 39.7%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 2.2 acres.

Existing BMPs

There are no existing BMPs in the Martins Brook directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to Martins Brook.

Mitigation Plan

Because there is no existing mitigation of impervious surface achieved by MassDOT BMPs, MassDOT considered the design and implementation of BMPs. Site limitations in the Martins Brook subwatershed include limited right-of-way owned by MassDOT and the presence of wetlands and high groundwater levels. Route 28 is surrounded by commercial development on both sides of the road so there is limited land available to implement stormwater infiltration BMPs. At the stormwater outfalls, wetlands and/or high groundwater levels were evident which would impede any infiltration from occurring at these locations. See the pictures below for further support.


Stormwater outfall near Martins Brook that drains to wetland.


Route 28 facing north. Commercial development lines the road on both sides.

Stormwater outfall draining to unnamed stream that drains to Martins Brook.
High groundwater levels were evident.

Based on the review of MassDOT's directly contributing drainage area, the site constraints described do not allow for the construction have additional BMPs.

Assessment of Pathogen Impairment

MassDOT assessed the pathogen impairment using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. Pathogen concentrations in stormwater vary widely temporally and spatially; concentrations can vary by an order of magnitude within a given storm event at a single location (MassDEP, 2009b). Therefore, it is difficult to predict pathogen concentrations in stormwater with accuracy. Due to this difficulty, MassDOT generally will not conduct site specific assessments of loading at each location impaired for pathogens. Instead these sites will be assessed collectively based on available information on pathogen loading from highways, MassDOT actions, and information available from EPA and DEP. Based on this information MassDOT developed an approach to be consistent with relevant TMDL and permit condition requirements and an iterative adaptive management approach to stormwater management.

In addition, while there is a positive relationship between IC and pathogen loading, the relationship is not as direct as other impairments. According to the Center for Watershed Protection "…Other studies show that concentrations of bacteria are typically higher in urban areas than rural areas (USGS, 1999), but they are not always directly related to IC (CWP, 2003)." Therefore, DOT did not rely solely on the IC method to assess pathogen impairments. Instead, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

Pathogens in MassDOT Discharge

A study conducted on MassDOT's South East Expressway measured bacterial concentrations in stormwater runoff (Smith, 2002). This study found a geometric mean of 186 fecal coliforms/100 ml. Concentrations of pathogens in stormwater runoff from roadways can vary widely and pathogen concentrations in runoff across the state likely deviate significantly from this stretch of roadway's specific estimate. Event mean concentrations of fecal coliform bacteria in urban stormwater from other sources ranging between 14,000 and 17,000 fecal coliform organisms/100 mL have been reported (MassDEP, 2009b). These data suggest that pathogen loading from highways may be lower than other urban areas.

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

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

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

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

Assessment

Pathogen loadings are highly variable and, as a result, quantitative assessments are challenging and of little value. Therefore, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

TMDLs for pathogen impairments in Massachusetts recognize that pathogens are highly variable and difficult to address and emphasize the need for an iterative adaptive management approach to address pathogens. Examples of relevant language from these TMDLs are included below:

- "given the vast potential number of bacteria sources and the difficulty of identifying and removing them from some sources such as stormwater require an iterative process and will take some time to accomplish. While the stated goal in the TMDL is to meet the water quality standard at the point of discharge it also attempts to be clear that MassDEP's expectation is that for stormwater an iterative approach is needed…" (MassDEP, 2009a)
- "The NPDES permit does not, however, establish numeric effluent limitations for stormwater discharges. Maximum extent practicable (MEP) is the statutory standard that establishes the level of pollutant reductions that regulated municipalities must achieve. The MEP standard is a narrative effluent limitation that is satisfied through implementation of SWMPs and achievement of measurable goals."(MassDEP, 2009b)
- "Although the TMDL presents quantified WLAs for stormwater that are set equivalent to the criteria in the Massachusetts Water Quality Standards, the Phase II NPDES permits will not include numeric effluent limitations. Phase II permits are intended to be BMP based permits that will require communities to develop and implement comprehensive stormwater management programs involving the use of BMPs. Massachusetts and EPA believe that BMP based Phase II permits involving comprehensive stormwater management together with specific emphasis on pollutants contributing to existing water quality problems can be consistent with the intent of the quantitative WLAs for stormwater discharges in TMDLs." (MassDEP, no date).

This language clearly indicates that an iterative adaptive management approach is the appropriate way to address discharges to pathogen impaired waters. The recommendations in pathogen TMDLs for waters in Massachusetts generally require development and implementation of stormwater management programs, illicit discharge detection and elimination efforts, and in some cases installing BMPs to the maximum extent practicable

The draft North Coastal Watershed General MS4 permit and the draft Interstate, Merrimack, and South Coastal (IMS) watershed permits contain specific requirements for compliance with pathogen TMDLs (in Appendix G). While these permits are still in draft form, MassDOT believes they represent the best available guidance on what EPA believes is appropriate for addressing stormwater discharges to pathogen-impaired waters. Section 2.2.1(c) of the permit states "For any discharge from its MS4 to impaired waters with an approved TMDL, the permittee shall comply with the specific terms of Part 2.1 of this permit. In addition, where an approved TMDL establishes a WLA that applies to its MS4 discharges, the permittee shall implement the specific BMPs and other permit requirements identified in Appendix G to achieve consistency with the WLA." Appendix G references a number of programmatic BMPs that are necessary to address pathogen loading. These cover the following general topics:

- Residential educational program
- Illicit connection identification, tracking and removal
- Pet waste management.

Mitigation Plan

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

- BMP 3C-1: Drainage Connection Policy
- BMP 3C-2: Drainage Tie-In Standard Operating Procedure
- BMP 3D: Illicit Discharge Detection Review

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

In addition, the structural BMPs that will be considered to reduce the IC will also have the effect of reducing pathogen loads.

MassDOT believes the existing and proposed efforts are consistent with the current and draft MS4 permit's requirements and TMDL recommendations. MassDOT's existing stormwater management plan outlines BMPs that include education and illicit discharge detection and elimination. Although not included in this permit term, MassDOT will be implementing a pet waste management program at its rest stops that have discharges to pathogen impaired waters. In addition, MassDOT has requested coverage under an individual stormwater permit for the next permit term. This permit may contain additional programmatic BMPs to address pathogens.

Conclusions

MassDOT used the IC Method to assess Martins Brook (MA92-08) for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. Results indicate that MassDOT should reduce its effective IC within its directly contributing subwatershed by 2.2 acres to achieve the targeted reduction in effective IC. MassDOT evaluated its property within the directly contributing watershed to Martins Brook to identify existing BMPs and found that no BMPs exist to reduce effective IC. Site limitations in the Martins Brook subwatershed include limited right-of-way owned by MassDOT and the presence of wetlands and high groundwater levels which do not allow for the construction of stormwater infiltration BMPs that would provide effective treatment of the impervious area for this location. Therefore, no further action will be taken as part of the Retrofit Initiative of the MassDOT Impaired Waters program. This information is summarized in Table 2 below.

Table 2. Effective IC Reductions under Existing & Proposed Conditions

IC in Directly Contributing Watershed	5.5	acres
Target Reduction in Effective IC	2.2	acres
Effective IC Reduced by Existing BMPs	0.0	acres
Effective IC Reduced by Proposed BMPs	0.0	acres
IC Target Remaining	**2.2**	**acres**

MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. MassDOT will also continue to implement non-structural BMPs that reduce the impacts of stormwater.

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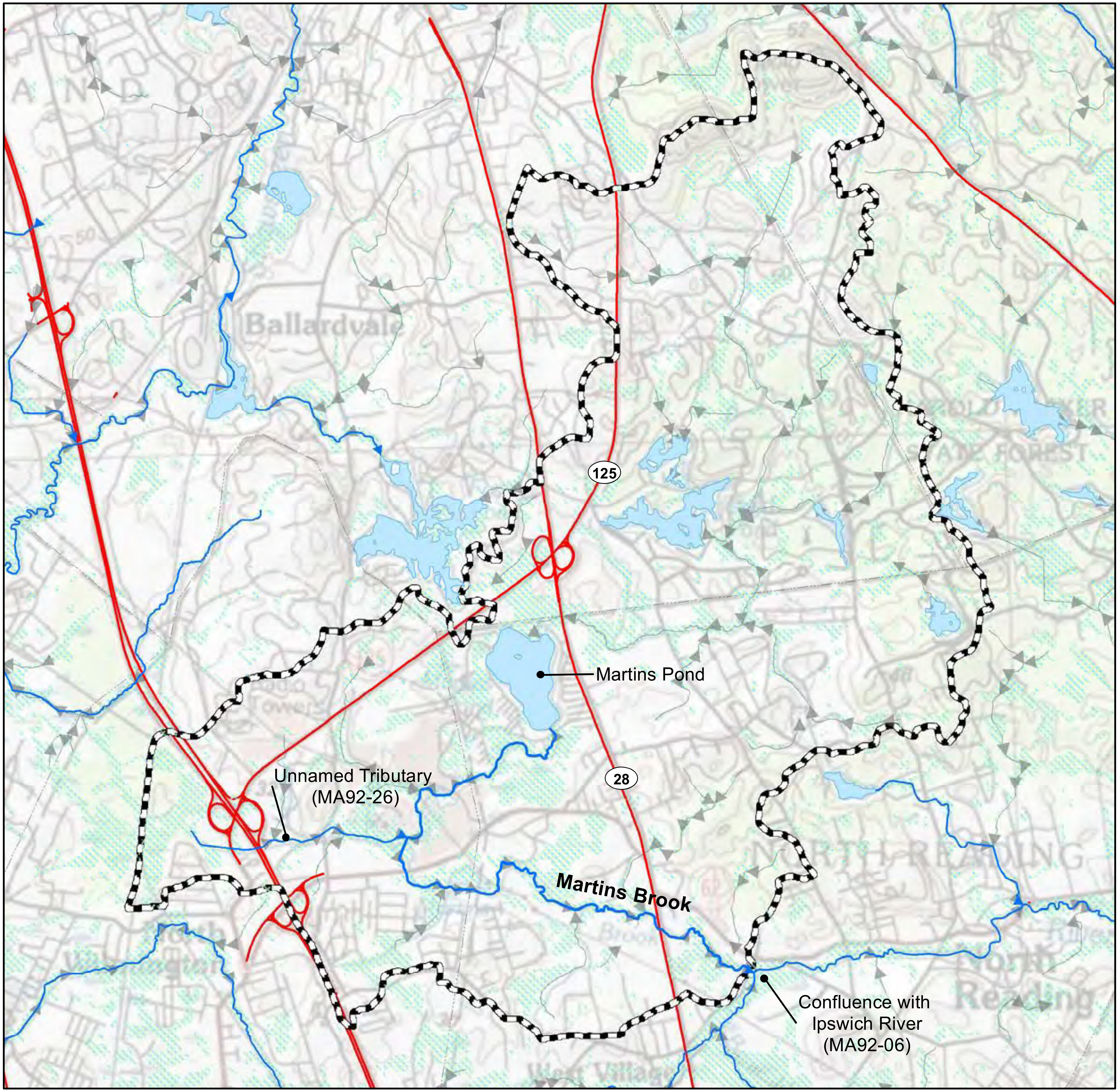

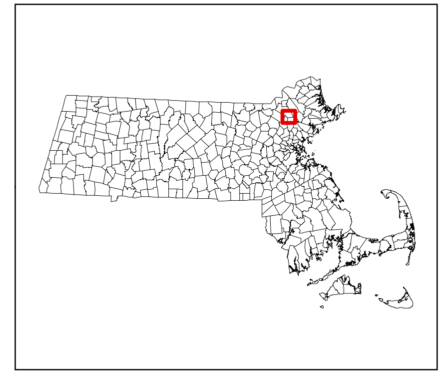

Impaired Stream Segment
Impaired Stream Segment
Impaired Water Bodies
Non-Impaired Stream Segment
NWI Wetland Areas
Total and Subwatershed
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries

N

0 0.150.3 0.6 0.9 1.2 Miles

1 in = 1 miles

Figure 1

Martins Brook
Total and Subwatershed
MA92-08

September 2012

massDOT
Massachusetts Department of Transportation
Highway Division

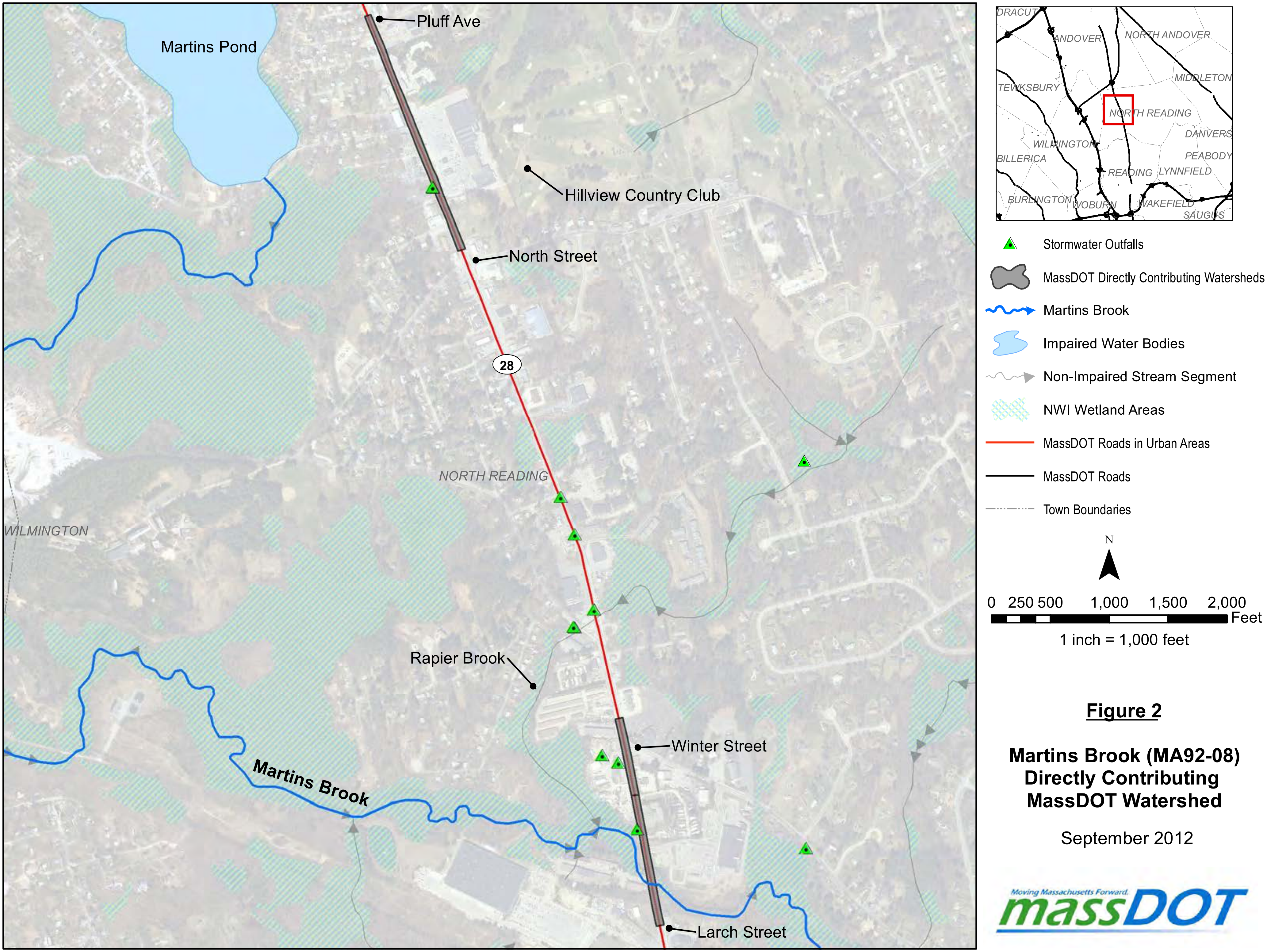

Figure 2

Martins Brook (MA92-08) Directly Contributing MassDOT Watershed

September 2012

Moving Massachusetts Forward. massDOT

Impaired Waters Assessment for Howlett Brook (MA92-17)

Impaired Water Body

Name: Howlett Brook

Location: Topsfield, MA

Water Body ID: MA92-17

Impairments

Howlett Brook (MA92-17) is listed under Category 5, “Waters Requiring a TMDL”, on the *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). The brook is impaired for:

- fecal coliform
- fishes bioassessments.

According to MassDEP’s *Ipswich River Watershed 2000 Water Quality Assessment Report* (MassDEP, 2004), Howlett Brook is 2.5 miles long, a Class B water, and was originally assessed because it was on the 1998 303(d) List of Waters for pathogens. The report states, “The Aquatic Life Use is assessed as impaired for Howlett Brook based primarily on the fish community data and professional judgment. Although the course(s) of impairment are largely unknown the presence of numerous impoundments in the subwatershed may contribute to the dominance of macrohabitat generalists.” Howlett Brook is covered by the *Draft Pathogen Total Maximum Daily Load (TMDL) for the Ipswich River Watershed* report (MassDEP, 2005).

Relevant Water Quality Standards

Water Body Classification: Class B

Applicable State Regulations:

- *314 CMR 4.05 (3)(b) 5 Solids.* These waters shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.
- *314 CMR 4.05 (5) (b) Bottom Pollutants or Alterations*. All surface waters shall be free from pollutants in concentrations or combinations or from alterations that adversely affect the physical or chemical nature of the bottom, interfere with the propagation of fish or shellfish, or adversely affect populations of non-mobile or sessile benthic organisms.
- *314 CMR 4.05 (5) (c) Nutrients*. Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for

POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.

- *314 CMR 4.05 (5)(e) Toxic Pollutants*. All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife. For pollutants not otherwise listed in 314 CMR 4.00, the National Recommended Water Quality Criteria: 2002, EPA 822R-02-047, November 2002 published by EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act, are the allowable receiving water concentrations for the affected waters, unless the Department either establishes a site specific criterion or determines that naturally occurring background concentrations are higher. Where the Department determines that naturally occurring background concentrations are higher, those concentrations shall be the allowable receiving water concentrations. The Department shall use the water quality criteria for the protection of aquatic life expressed in terms of the dissolved fraction of metals when EPA's 304(a) recommended criteria provide for use of the dissolved fraction. The EPA recommended criteria based on total recoverable metals shall be converted to dissolved metals using EPA's published conversion factors. Permit limits will be written in terms of total recoverable metals. Translation from dissolved metals criteria to total recoverable metals permit limits will be based on EPA's conversion factors or other methods approved by the Department. The Department may establish site specific criteria for toxic pollutants based on site specific considerations.
- *314 CMR 4.05 (3)(b) 1 Dissolved Oxygen*. Shall not be less than 6.0 mg/l in cold water fisheries and not less than 5.0 mg/l in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.
- *314 CMR 4.05 (3)(b) 2 Temperature.*
  - a. Shall not exceed 68°F (20°C) based on the mean of the daily maximum temperature over a seven day period in cold water fisheries, unless naturally occurring. Where a reproducing cold water aquatic community exists at a naturally occurring higher temperature, the temperature necessary to protect the community shall not be exceeded and the natural daily and seasonal temperature fluctuations necessary to protect the community shall be maintained. Temperature shall not exceed 83°F (28.3°C) in warm water fisheries. The rise in temperature due to a discharge shall not exceed 3°F (1.7°0C) in rivers and streams designated as cold water fisheries nor 5°F (2.8°C) in rivers and streams designated as warm water fisheries (based on the minimum expected flow for the month); in lakes and ponds the rise shall not exceed 3°F (1.7°0C) in the epilimnion (based on the monthly average of maximum daily temperature);
  - b. natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained. There shall be no changes from natural background conditions that would impair any use assigned to this Class, including those conditions necessary to protect normal species diversity, successful migration, reproductive functions or growth of aquatic organisms.
- *314 CMR 4.05 (3)(b) 3 pH*. Shall be in the range of 6.5 through 8.3 standard units but not more than 0.5 units outside of the natural background range. There shall be no change from natural background conditions that would impair any use assigned to this Class.
- *314 CMR 4.05 (3)(b) 4 Bacteria*.

- a. At bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: where E. coli is the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml; alternatively, where enterococci are the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies per 100 ml and no single sample taken during the bathing season shall exceed 61 colonies per 100 ml;
- b. For other waters and, during the non bathing season, for waters at bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: the geometric mean of all E. coli samples taken within the most recent six months shall not exceed 126 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies per 100 ml; alternatively, the geometric mean of all enterococci samples taken within the most recent six months shall not exceed 33 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 61 colonies per 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department.

Site Description

Howlett Brook is a water body that originates from Great Hill in Topsfield near the intersection of Ipswich Road and Newburyport Turnpike and flows northwesterly to its confluence with Pye Brook. From there Howlett Brook turns northeasterly and meanders to its confluence with Ipswich River (MA92-15) in Topsfield. After the confluence with Pye Brook, five unnamed, non-impaired streams flow into Howlett Brook which is 2.5 miles long. The total watershed and subwatershed to Howlett Brook are shown in Figure 1 and Figure 2, respectively.

On September 6, 2012 a site visit was performed to determine stormwater drainage patterns at MassDOT roadway. The watershed of MassDOT's property directly contributing stormwater runoff to Howlett Brook is at the Newburyport Bridge crossing with Howlett Brook between approximately Camp Meeting Road and Wildes Street. This section of the roadway is two lanes with a right-of-way width of approximately 50 feet. Based on field observation, stormwater runs off the road as sheet flow into adjacent grassy areas and continues down grade towards Howlett Brook. No existing infiltration BMP was identified within MassDOT-owned properties in this area.

Assessment under BMP 7U

None of the following impairments for the Howlett Brook (MA92-17) have been addressed by a TMDL, except for fecal coliform which is covered by a draft TMDL. Therefore, MassDOT assessed the impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the impairment for fishes bioassessments. The impairment for fecal coliform is assessed separately in the section titled Assessment of Pathogen Impairment.

MassDOT's Application of the Impervious Cover Method

MassDOT's Application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I's Impervious Cover Method described in EPA's *Stormwater TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT's program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT's Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body's entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS's impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT's target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT's properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's *Stormwater Best Management Practices (BMP) Performance Analysis* report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for Howlett Brook (MA92-17):

Table 1. Site Parameters for Howlett Brook (MA92-17)

Total Watershed		
Watershed Area	6,292	acres
Impervious Cover (IC) Area	476	acres
Percent Impervious	7.6	%
IC Area at 9% Goal	566	acres
Target Reduction % in IC	0	%
Subwatershed		
Subwatershed Area	1,610	acres
Impervious Cover (IC) Area	149	acres
Percent Impervious	9.3	%
IC Area at 9% Goal	145	acres
Target Reduction % in IC	2.7	%
Reductions Applied to DOT Direct Watershed		
MassDOT's IC Area **Directly** Contributing to Impaired Segment	2.2	acres
MassDOT's Target Reduction in Effective IC (2.7% of DOT Directly Contributing IC)	0.1	acres

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 2.7%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 0.1 acres.

Existing BMPs

There are no existing BMPs in the Howlett Brook directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to Howlett Brook.

Mitigation Plan

Because there are no existing BMPS to provide mitigation of impervious surface and meet the reduction requirement of 0.1 acres, MassDOT considered the implementation of BMPs.

Review of MassDOT's directly contributing drainage area and identification of site constraints such as limited right-of-way owned by MassDOT, the presence of wetlands and high groundwater levels, indicate that an appropriate area for a BMP to address the impairments of Howlett Brook cannot be identified. Newburyport Turnpike in the DOT direct discharge area is bounded by residential and commercial properties, and no space is available within MassDOT's right-of-way for new BMP construction. Figure 3 shows the MassDOT direct discharge area to Howlett Brook.

Newburyport Turnpike Bridge at Howlett Brook, Topsfield

Howlett Brook at Newburyport Turnpike, Topsfield.

Assessment of Pathogen Impairment

MassDOT assessed the pathogen impairment using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. Pathogen concentrations in stormwater vary widely temporally and spatially; concentrations can vary by an order of magnitude within a given storm event at a single location (MassDEP, 2009b). Therefore, it is difficult to predict pathogen concentrations in stormwater with accuracy. Due to this difficulty, MassDOT generally will not conduct site specific assessments of loading at each location impaired for pathogens. Instead these sites will be assessed collectively based on available information on pathogen loading from highways, MassDOT actions, and information available from EPA and DEP. Based on this information MassDOT developed an approach to be consistent with relevant TMDL and permit condition requirements and an iterative adaptive management approach to stormwater management.

In addition, while there is a positive relationship between IC and pathogen loading, the relationship is not as direct as other impairments. According to the Center for Watershed Protection "…Other studies show that concentrations of bacteria are typically higher in urban areas than rural areas (USGS, 1999), but they are not always directly related to IC (CWP, 2003)." Therefore, DOT did not rely solely on the IC method to assess pathogen impairments. Instead, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

Pathogens in MassDOT Discharge

A study conducted on MassDOT's South East Expressway measured bacterial concentrations in stormwater runoff (Smith, 2002). This study found a geometric mean of 186 fecal coliforms/100 ml. Concentrations of pathogens in stormwater runoff from roadways can vary widely and pathogen concentrations in runoff across the state likely deviate significantly from this stretch of roadway's specific estimate. Event mean concentrations of fecal coliform bacteria in urban stormwater from other sources ranging between 14,000 and 17,000 fecal coliform organisms/100 mL have been reported (MassDEP, 2009b). These data suggest that pathogen loading from highways may be lower than other urban areas.

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

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

- Wildlife: Highways are not generally an attractive place for wildlife. Wildlife generally avoids highways and only occasionally crosses them.

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

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

Assessment

Pathogen loadings are highly variable and, as a result, quantitative assessments are challenging and of little value. Therefore, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

TMDLs for pathogen impairments in Massachusetts recognize that pathogens are highly variable and difficult to address and emphasize the need for an iterative adaptive management approach to address pathogens. Examples of relevant language from these TMDLs are included below:

- "given the vast potential number of bacteria sources and the difficulty of identifying and removing them from some sources such as stormwater require an iterative process and will take some time to accomplish. While the stated goal in the TMDL is to meet the water quality standard at the point of discharge it also attempts to be clear that MassDEP's expectation is that for stormwater an iterative approach is needed…" (MassDEP, 2009a)
- "The NPDES permit does not, however, establish numeric effluent limitations for stormwater discharges. Maximum extent practicable (MEP) is the statutory standard that establishes the level of pollutant reductions that regulated municipalities must achieve. The MEP standard is a narrative effluent limitation that is satisfied through implementation of SWMPs and achievement of measurable goals."(MassDEP, 2009b)
- "Although the TMDL presents quantified WLAs for stormwater that are set equivalent to the criteria in the Massachusetts Water Quality Standards, the Phase II NPDES permits will not include numeric effluent limitations. Phase II permits are intended to be BMP based permits that will require communities to develop and implement comprehensive stormwater management programs involving the use of BMPs. Massachusetts and EPA believe that BMP based Phase II permits involving comprehensive stormwater management together with specific emphasis on pollutants contributing to existing water quality problems can be consistent with the intent of the quantitative WLAs for stormwater discharges in TMDLs." (MassDEP, no date).

This language clearly indicates that an iterative adaptive management approach is the appropriate way to address discharges to pathogen impaired waters. The recommendations in pathogen TMDLs for waters in Massachusetts generally require development and implementation of stormwater management programs, illicit discharge detection and elimination efforts, and in some cases installing BMPs to the maximum extent practicable

The draft North Coastal Watershed General MS4 permit and the draft Interstate, Merrimack, and South Coastal (IMS) watershed permits contain specific requirements for compliance with pathogen TMDLs (in Appendix G). While these permits are still in draft form, MassDOT believes they represent the best available guidance on what EPA believes is appropriate for addressing stormwater discharges to pathogen-impaired waters. Section 2.2.1(c) of the permit states "For any discharge from its MS4 to impaired waters with an approved TMDL, the permittee shall comply with the specific terms of Part 2.1 of this permit. In addition, where an approved TMDL establishes a WLA that applies to its MS4 discharges, the permittee shall implement the specific BMPs and other permit requirements identified in Appendix G to achieve consistency with the WLA." Appendix G references a number of programmatic BMPs that are necessary to address pathogen loading. These cover the following general topics:

- Residential educational program
- Illicit connection identification, tracking and removal
- Pet waste management

Mitigation Plan

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

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

In addition, the structural BMPs that will be considered to reduce the IC will also have the effect of reducing pathogen loads.

MassDOT believes the existing and proposed efforts are consistent with the current and draft MS4 permit's requirements and TMDL recommendations. MassDOT's existing stormwater management plan outlines BMPs that include education and illicit discharge detection and elimination. Although not included in this permit term, MassDOT will be implementing a pet waste management program at its rest stops that have discharges to pathogen impaired waters. In addition, MassDOT has requested coverage under an individual stormwater permit for the next permit term. This permit may contain additional programmatic BMPs to address pathogens.

Conclusions

MassDOT used the IC Method to assess Howlett Brook (MA92-17) for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. Results indicate that MassDOT should reduce its effective IC within its directly contributing subwatershed by 0.1 acres to achieve the targeted reduction in effective IC. MassDOT evaluated its property within the directly contributing watershed to Howlett Brook to identify existing BMPs and found that no BMPs exist to reduce effective IC. This information is summarized in Table 2 below.

Table 2. Effective IC Reductions under Existing & Proposed Conditions

IC in Directly Contributing Watershed	2.2	acres
Target Reduction in Effective IC	0.1	acres
IC Effectively Reduced by Existing BMPs	0.0	acres
IC Remaining to Mitigate with Proposed BMPs	**0.1**	**acres**

MassDOT should reduce its effective IC within the directly contributing watershed by an additional 0.1 acres to achieve the targeted reduction in IC. However, site limitations in the Howlett Brook subwatershed include limited right-of-way owned by MassDOT and the presence of wetlands and high groundwater levels. Based on this review, it was determined that stormwater infiltration BMPs are not appropriate for this location and that there is not room available.

MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. MassDOT will also continue to implement non-structural BMPs that reduce the impacts of stormwater.

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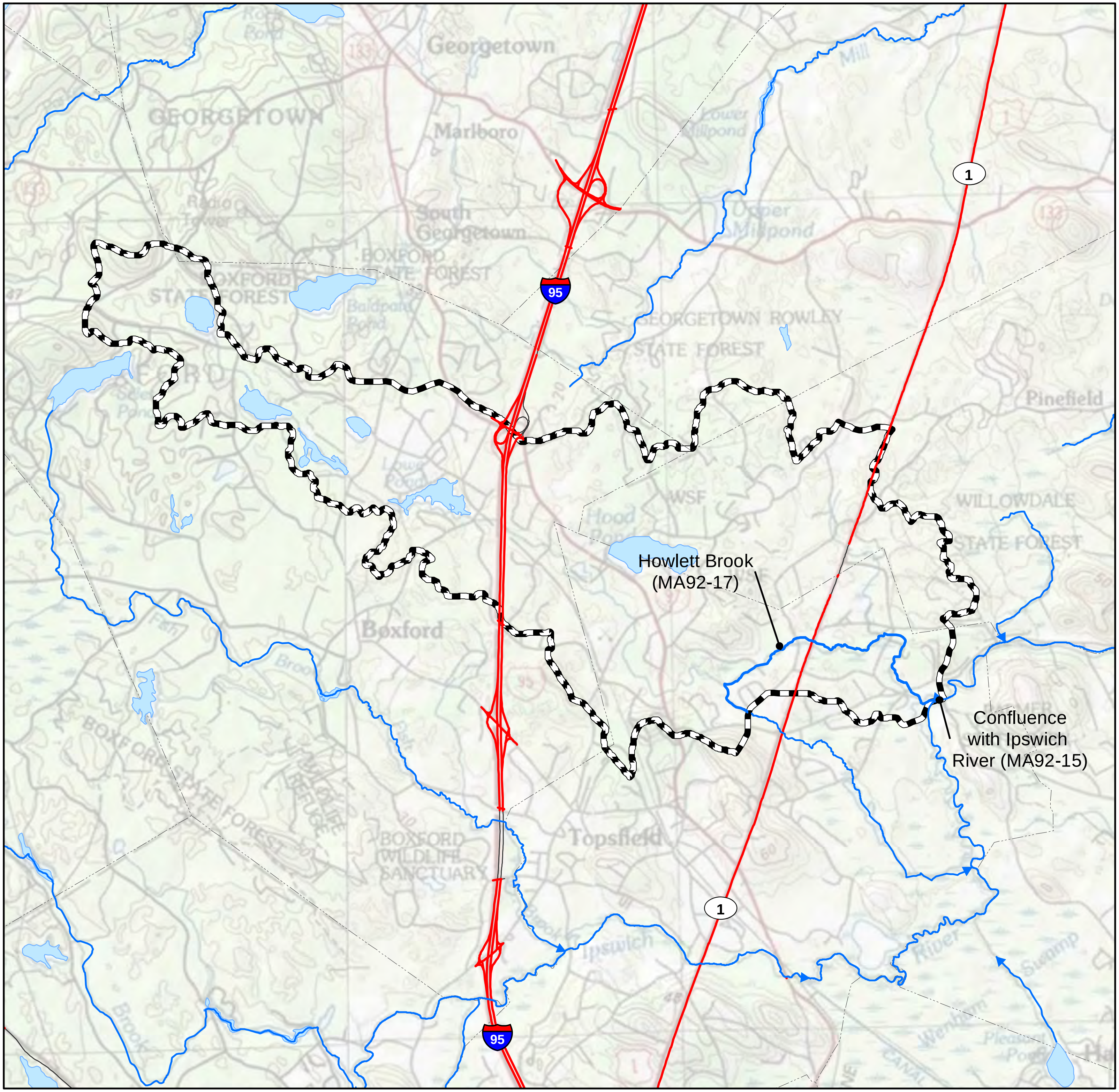

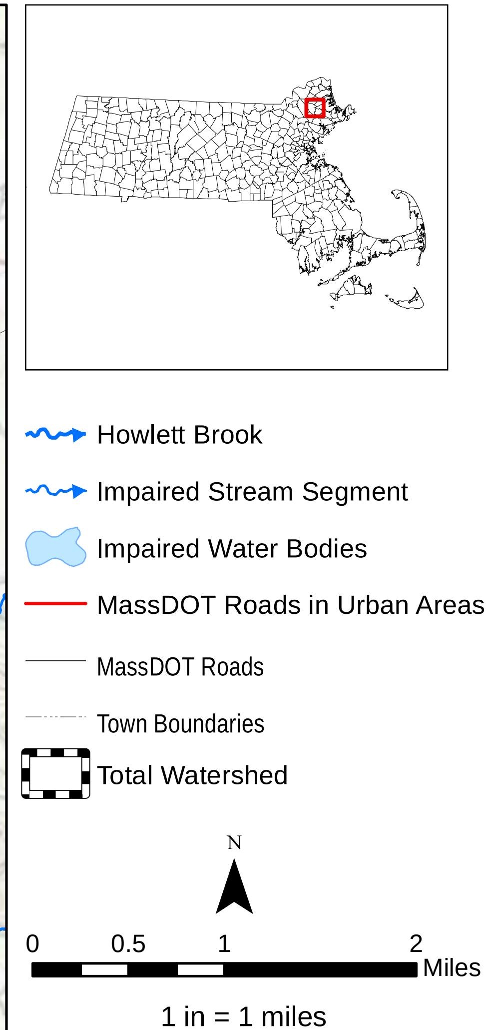

Figure 1

Howlett Brook
Total Watershed
MA92-17

October 2012

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Massachusetts Department of Transportation
Highway Division

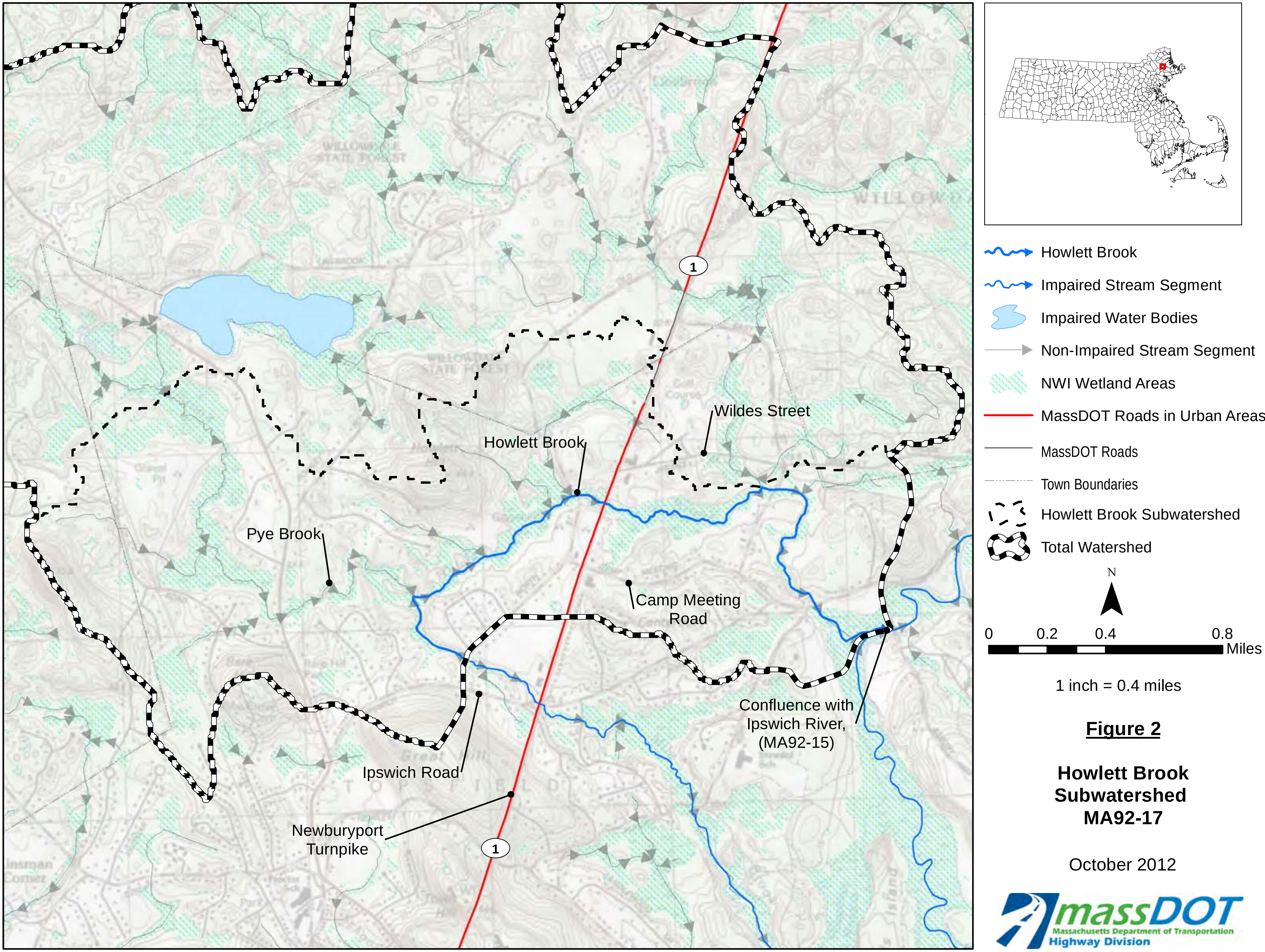

Figure 2

Howlett Brook Subwatershed MA92-17

October 2012

massDOT Massachusetts Department of Transportation Highway Division

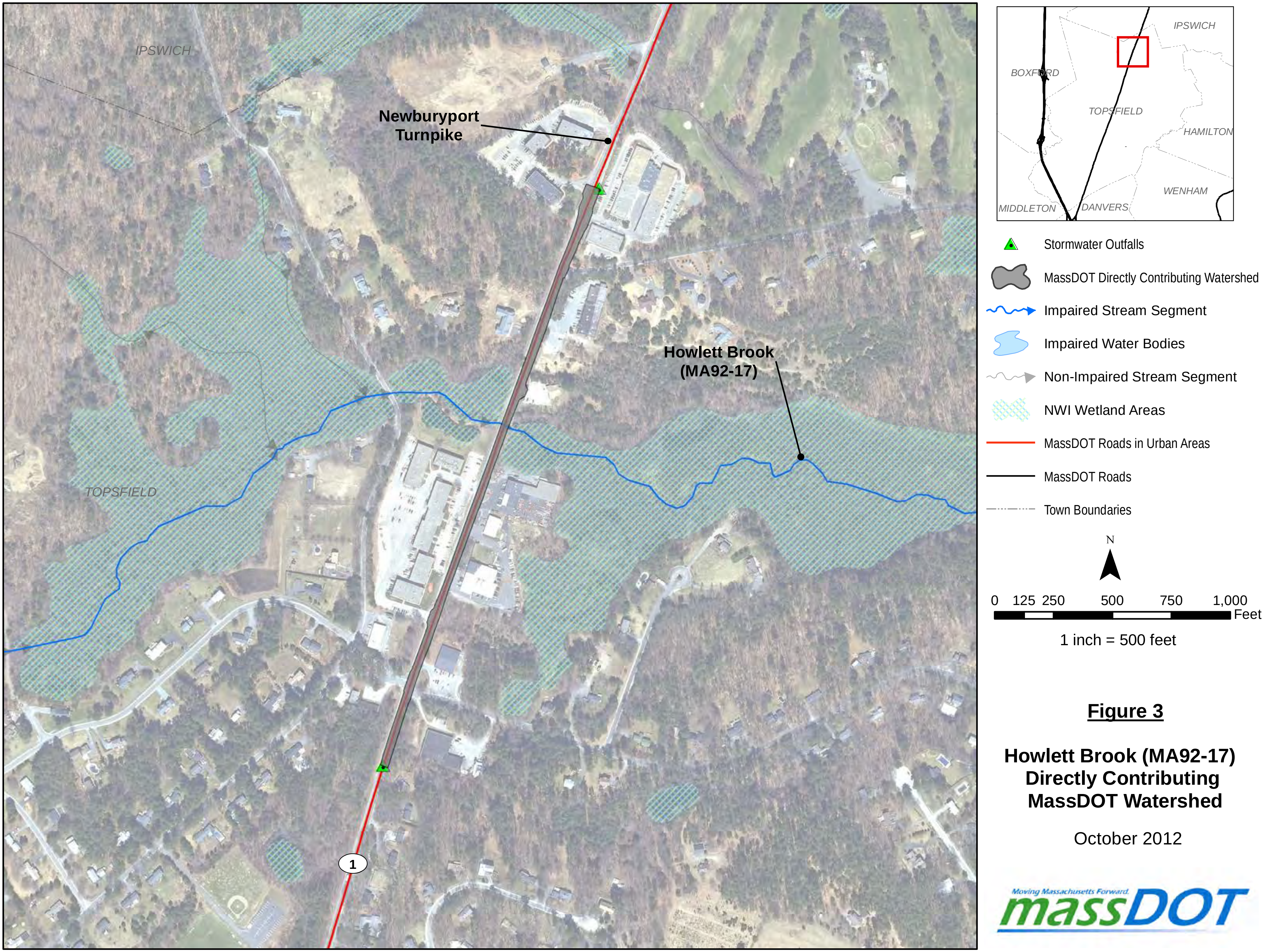

Figure 3

Howlett Brook (MA92-17) Directly Contributing MassDOT Watershed

October 2012

Moving Massachusetts Forward. massDOT

Attachment 2:

Impaired Waters Assessments - Progress Reports

List of Impaired Waterbodies

Waterbody ID	Waterbody Name
MA53001	Burrs Pond
MA53-01	Runnins River
MA62-05	Salisbury Plain River
MA62-06	Salisbury Plain River
MA62-32	Matfield River
MA62-33	Shumatuscacant River
MA92-03	Miles River
MA92-06	Ipswich River
MA95-42	New Bedford Inner Harbor

Impaired Waters Assessment for Runnins River (MA53-01) and Burrs Pond (MA53001) – Progress Report

Impaired Waterbody

Name: Runnins River

Location: Seekonk, MA

Water Body ID: MA53-01

Impairments

Runnins River (MA53-01) is listed under Category 5, "Waters Requiring a TMDL", on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). Runnins River is impaired for the following:

- aquatic macroinvertebrate bioassessments
- fecal coliform
- mercury in fish tissue
- nutrient/eutrophication biological indicators
- oil and grease
- oxygen, dissolved
- (debris/floatables/trash*)

According to MassDEP's *Narragansett and Mount Hope Bay Watersheds 2004-2008 Water Quality Assessment Report* (MassDEP, 2009c), Burrs Pond (MA53001) is now considered a run-of-the-river impoundment of Runnins River and therefore is included in this assessment. The report identifies the 0.2 mile reach of Runnins River through Burrs Pond as impaired for mercury in fish tissue due to atmospheric deposition and recommends fish toxics monitoring and water quality monitoring. Runnins River is covered by the *Final Pathogen TMDL for the Narragansett/Mt. Hope Bay Watershed* (MassDEP, 2010) and Burrs Pond is covered by the *Northeast Regional Mercury TMDL* (NEIWPCC, 2007). The TMDL for Runnins River has been added since the original MassDOT impaired waters list (Appendix L-1 list) was developed.

Relevant Water Quality Standards

Water Body Classification: Class B

Applicable State Regulations:

- *314 CMR 4.05 (3)(b) 1 Dissolved Oxygen*. Shall not be less than 6.0 mg/l in cold water fisheries and not less than 5.0 mg/l in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.

- *314 CMR 4.05 (3)(b) 4 Bacteria*.
    - a. At bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: where E. coli is the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml; alternatively, where enterococci are the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies per 100 ml and no single sample taken during the bathing season shall exceed 61 colonies per 100 ml;
    - b. For other waters and, during the non bathing season, for waters at bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: the geometric mean of all E. coli samples taken within the most recent six months shall not exceed 126 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies per 100 ml; alternatively, the geometric mean of all enterococci samples taken within the most recent six months shall not exceed 33 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 61 colonies per 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department;
- *314 CMR 4.05 (3)(b) 5 Solids*. These waters shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.
- *314 CMR 4.05 (3)(b) 7 Oil and Grease.* These waters shall be free from oil, grease and petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course, or are deleterious or become toxic to aquatic life.
- *314 CMR 4.05 (5)(b) Bottom Pollutants or Alterations*. All surface waters shall be free from pollutants in concentrations or combinations or from alterations that adversely affect the physical or chemical nature of the bottom, interfere with the propagation of fish or shellfish, or adversely affect populations of non-mobile or sessile benthic organisms.
- *314 CMR 4.05 (5)(a) Aesthetics*. All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.
- *314 CMR 4.05 (5)(c) Nutrients*. Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.
- *314 CMR 4.05 (5)(e) Toxic Pollutants*. All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife. For

pollutants not otherwise listed in 314 CMR 4.00, the National Recommended Water Quality Criteria: 2002, EPA 822R-02-047, November 2002 published by EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act, are the allowable receiving water concentrations for the affected waters, unless the Department either establishes a site specific criterion or determines that naturally occurring background concentrations are higher. Where the Department determines that naturally occurring background concentrations are higher, those concentrations shall be the allowable receiving water concentrations. The Department shall use the water quality criteria for the protection of aquatic life expressed in terms of the dissolved fraction of metals when EPA's 304(a) recommended criteria provide for use of the dissolved fraction. The EPA recommended criteria based on total recoverable metals shall be converted to dissolved metals using EPA's published conversion factors. Permit limits will be written in terms of total recoverable metals. Translation from dissolved metals criteria to total recoverable metals permit limits will be based on EPA's conversion factors or other methods approved by the Department. The Department may establish site specific criteria for toxic pollutants based on site specific considerations.

Site Description

Segment MA53-01 of Runnins River begins at Route 44 (Taunton Avenue) in Seekonk, MA and flows south through Old Grist Mill Pond and Burrs Pond (MA53001) before ultimately reaching Mobil Dam at the MA/RI border. South of the Mobil Dam, Runnins River becomes the Barrington River and is subject to tidal influence. The total length of Segment MA53-01 of Runnins River is 3.7 miles.

The watershed to Segment MA53-01 of Runnins River is highly urbanized, particularly towards the middle and southern portions of the reach where it crosses beneath Interstate 195 (I-195), Route 6 (Highland Avenue/Fall River Avenue), Mink Street, and School Street. A number of commercial properties in these locations are located within 1,000 feet of the river, with a majority along the river's eastern bank located less than 500 feet away. According to MassDEP's Final Pathogen TMDL for the Narragansett/Mt. Hope Bay Watershed (MassDEP, 2010), several of the businesses in the portion of the reach south of the Route 6 crossing have had known failures of on-site wastewater disposal systems. Refer to Figure 1 for the total watershed and Figure 2 for the subwatershed to Segment MA53-01 of Runnins River.

MassDOT's property directly contributing stormwater runoff to Segment MA53-01 of Runnins River is comprised of portions of the following roadways:

- Route 44 (Taunton Avenue)
- Route 114A (Fall River Avenue)
- I-195
- Route 6 (Highland Avenue/Fall River Avenue)
- Mink Street
- School Street

Refer to Figure 2 for the location of these roadways within the subwatershed to Segment MA53-01 of Runnins River.

Assessment under BMP 7U

Of the impairments listed for Segment MA53-012 of Runnins River, four are potentially linked to stormwater runoff and have not been addressed by a TMDL. Therefore, MassDOT assessed these impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the following impairments:

- aquatic macroinvertebrate bioassessments
- nutrient/eutrophication biological indicators
- oil and grease
- oxygen, dissolved

The impairment for fecal coliform has been addressed by the *Final Pathogen TMDL for the Narragansett/Mt. Hope Bay Watershed* (MassDEP, 2010). Likewise, the impairment for mercury in fish tissue has been addressed by the *Northeast Regional Mercury TMDL* (NEIWPCC, 2007). MassDOT has assessed its contribution to these impairment and compliance with the corresponding TMDLs separately in the section titled "Assessment under BMP 7R."

According to the MassDEP2010 Integrated Waters List), the impairment for debris/floatables/trash is a non-pollutant stressor linked to the presence of pollution (trash, debris, habitat alterations, etc.) rather than a specific pollutant such as nutrients, metals, pesticides, etc. typically found in stormwater runoff. Restoration of waters impaired by non-pollutant stressors will require measures other than TMDL development and implementation (MassDEP, 2011). Accordingly, MassDOT has concluded that stormwater runoff from its roadways does not contribute to the impairment of debris/floatables/trash found in Segment MA53-01 of Runnins River.

The following sections describe the methodology used by MassDOT to assess the four impairments potentially linked to stormwater that have not been addressed by a TMDL.

MassDOT's Application of the Impervious Cover Method

MassDOT's Application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I's Impervious Cover Method described in EPA's *Stormwater TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT's program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT's Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body's entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS's impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT's target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT's properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's *Stormwater Best Management Practices (BMP) Performance Analysis* report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for Segment MA53-01 of Runnins River:

Table 1. Site Parameters for Runnins River (MA53-01)

Total Watershed		
Watershed Area	6,248	acres
Impervious Cover (IC) Area	1,393	acres
Percent Impervious	22.3	%
IC Area at 9% Goal	562	acres
Target Reduction % in IC	59.7	%
Subwatershed		
Subwatershed Area	3,772	acres
Impervious Cover (IC) Area	1,203	acres
Percent Impervious	31.9	%
IC Area at 9% Goal	339	acres
Target Reduction % in IC	71.8	%
Reductions Applied to DOT Direct Watershed		
MassDOT's IC Area **Directly** Contributing to Impaired Segment	35.8	acres
MassDOT's Target Reduction in Effective IC (71.8% of DOT Directly Contributing IC)	25.7	acres

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 71.8%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 25.7 acres.

Existing BMPs

MassDOT has five leaching catch basins along School Street within the directly contributing watershed to Runnins River. Although these leaching catch basins intercept and infiltrate stormwater that would otherwise flow directly into Runnins River, they do not fully meet the design criteria to be considered infiltration basins. Furthermore, the leaching catch basins have no form of pretreatment and appeared to be clogged with sediment and debris when observed in the field. During large storms, the potential exists for these basins to overflow into Runnins River.

For these reasons, no IC effective reduction credits have been assigned to these leaching catch basins. Further action to reduce effective IC within the directly contributing watershed to Runnins River may include rehabilitation of these structures to restore their original design functionality.

Mitigation Plan

Because the total mitigation of impervious surface achieved by MassDOT's existing BMPs is less than the target reduction of 25.7 acres, MassDOT will consider the implementation of additional BMPs.

Assessment under BMP 7R

Mercury in Fish Tissue Impairment

The impairment for mercury in fish tissue is due to the presence of elevated mercury levels in largemouth bass discovered during fish sampling performed at Burrs Pond. The remainder of Segment MA53-01 of Runnins River upstream and downstream of Burrs Pond has not been assessed for mercury (MassDEP, 2009c). This impairment has been addressed by the *Northeast Regional Mercury TMDL*, which indicates that stormwater is a *de minimis* source of mercury contamination. According to the TMDL, the majority of mercury in stormwater comes from atmospheric deposition, and therefore the most effective reductions in mercury loading can be achieved through controls on atmospheric deposition (NEIWPCC, 2007). Accordingly, MassDOT has concluded that stormwater runoff from its roadways is a *de minimis* contributor to this impairment.

Fecal Coliform Impairment

MassDOT assessed the pathogen (fecal coliform) impairment using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. Pathogen concentrations in stormwater vary widely temporally and spatially; concentrations can vary by an order of magnitude within a given storm event at a single location (MassDEP, 2009b). Therefore, it is difficult to predict pathogen concentrations in stormwater with accuracy. Due to this difficulty, MassDOT generally will not conduct site specific assessments of loading at each location impaired for pathogens. Instead these sites will be assessed collectively based on available information on pathogen loading from highways, MassDOT actions, and information available from EPA and DEP. Based on this information MassDOT developed an approach to be consistent with relevant TMDL and permit condition requirements and an iterative adaptive management approach to stormwater management.

In addition, while there is a positive relationship between IC and pathogen loading, the relationship is not as direct as other impairments. According to the Center for Watershed

Protection "…Other studies show that concentrations of bacteria are typically higher in urban areas than rural areas (USGS, 1999), but they are not always directly related to IC (CWP, 2003)." Therefore, DOT did not rely solely on the IC method to assess pathogen impairments. Instead, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

Pathogens in MassDOT Discharge

A study conducted on MassDOT's South East Expressway measured bacterial concentrations in stormwater runoff (Smith, 2002). This study found a geometric mean of 186 fecal coliforms/100 ml. Concentrations of pathogens in stormwater runoff from roadways can vary widely and pathogen concentrations in runoff across the state likely deviate significantly from this stretch of roadway's specific estimate. Event mean concentrations of fecal coliform bacteria in urban stormwater from other sources ranging between 14,000 and 17,000 fecal coliform organisms/100 mL have been reported (MassDEP, 2009b). These data suggest that pathogen loading from highways may be lower than other urban areas.

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

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

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

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

Assessment

Pathogen loadings are highly variable and, as a result, quantitative assessments are challenging and of little value. Therefore, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

TMDLs for pathogen impairments in Massachusetts recognize that pathogens are highly variable and difficult to address and emphasize the need for an iterative adaptive management approach to address pathogens. Examples of relevant language from these TMDLs are included below:

- "given the vast potential number of bacteria sources and the difficulty of identifying and removing them from some sources such as stormwater require an iterative process and will take some time to accomplish. While the stated goal in the TMDL is to meet the water quality standard at the point of discharge it also attempts to be clear that MassDEP's expectation is that for stormwater an iterative approach is needed…" (MassDEP, 2009a)
- "The NPDES permit does not, however, establish numeric effluent limitations for stormwater discharges. Maximum extent practicable (MEP) is the statutory standard that establishes the level of pollutant reductions that regulated municipalities must achieve. The MEP standard is a narrative effluent limitation that is satisfied through implementation of SWMPs and achievement of measurable goals."(MassDEP, 2009b)
- "Although the TMDL presents quantified WLAs for stormwater that are set equivalent to the criteria in the Massachusetts Water Quality Standards, the Phase II NPDES permits will not include numeric effluent limitations. Phase II permits are intended to be BMP based permits that will require communities to develop and implement comprehensive stormwater management programs involving the use of BMPs. Massachusetts and EPA believe that BMP based Phase II permits involving comprehensive stormwater management together with specific emphasis on pollutants contributing to existing water quality problems can be consistent with the intent of the quantitative WLAs for stormwater discharges in TMDLs." (MassDEP, no date).

This language clearly indicates that an iterative adaptive management approach is the appropriate way to address discharges to pathogen impaired waters. The recommendations in pathogen TMDLs for waters in Massachusetts generally require development and implementation of stormwater management programs, illicit discharge detection and elimination efforts, and in some cases installing BMPs to the maximum extent practicable

The draft North Coastal Watershed General MS4 permit and the draft Interstate, Merrimack, and South Coastal (IMS) watershed permits contain specific requirements for compliance with pathogen TMDLs (in Appendix G). While these permits are still in draft form, MassDOT believes they represent the best available guidance on what EPA believes is appropriate for addressing stormwater discharges to pathogen-impaired waters. Section 2.2.1(c) of the permit states "For any discharge from its MS4 to impaired waters with an approved TMDL, the permittee shall comply with the specific terms of Part 2.1 of this permit. In addition, where an approved TMDL establishes a WLA that applies to its MS4 discharges, the permittee shall implement the specific BMPs and other permit requirements identified in Appendix G to achieve consistency with the WLA." Appendix G references a number of programmatic BMPs that are necessary to address pathogen loading. These cover the following general topics:

- Residential educational program
- Illicit connection identification, tracking and removal
- Pet waste management

Mitigation Plan

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

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

In addition, the structural BMPs that will be considered to reduce the IC will also have the effect of reducing pathogen loads.

MassDOT believes the existing and proposed efforts are consistent with the current and draft MS4 permit's requirements and TMDL recommendations. MassDOT's existing stormwater management plan outlines BMPs that include education and illicit discharge detection and elimination. Although not included in this permit term, MassDOT will be implementing a pet waste management program at its rest stops that have discharges to pathogen impaired waters. In addition, MassDOT has requested coverage under an individual stormwater permit for the next permit term. This permit may contain additional programmatic BMPs to address pathogens.

Conclusions

MassDOT used the IC Method to assess Segment MA53-01 of Runnins River and Burrs Pond (MA53001) for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* that are potentially linked to stormwater runoff and for which no TMDL exists. Results indicate that MassDOT should reduce its effective IC within its directly contributing watershed by 25.7 acres to achieve the targeted reduction in effective IC. MassDOT evaluated its property within the directly contributing watershed to Runnins River to identify existing BMPs and found that existing BMPs provide 0% of the target reduction in effective IC. This information is summarized in Table 2 below.

Table 2. Effective IC Reductions under Existing & Proposed Conditions

IC in Directly Contributing Watershed	35.8	acres
Target Reduction in Effective IC	25.7	acres
IC Effectively Reduced by Existing BMPs	0.0	acres
IC Remaining to Mitigate with Proposed BMPs	**25.7**	**acres**

MassDOT will now work with its design consultants to identify locations suitable for construction of additional BMPs to treat directly contributing IC as part of MassDOT's Impaired Waters Retrofit Initiative. The design consultants will develop construction plans for BMPs that will aim to provide the target IC reduction or treatment to the maximum extent practicable.

MassDOT has concluded based on review of the *Northeast Regional Mercury TMDL*, that stormwater is a *de minimis* source of mercury contamination. MassDOT has furthermore concluded based on review of the draft North Coastal Watershed General MS4 permit, the draft Interstate, Merrimack, and South Coastal watershed permits, and pathogen TMDLs for Massachusetts waters, that the BMPs outlined in the stormwater management plan and those under consideration for reducing effective IC from MassDOT areas are consistent with its existing permit requirements. MassDOT believes that these measures achieve pathogen reductions (including fecal coliform) to the maximum extent practicable and are consistent with the intent of its existing stormwater permit and the applicable Pathogen TMDLs.

MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. Furthermore, MassDOT will continue to implement non-structural BMPs that reduce the impacts of stormwater.

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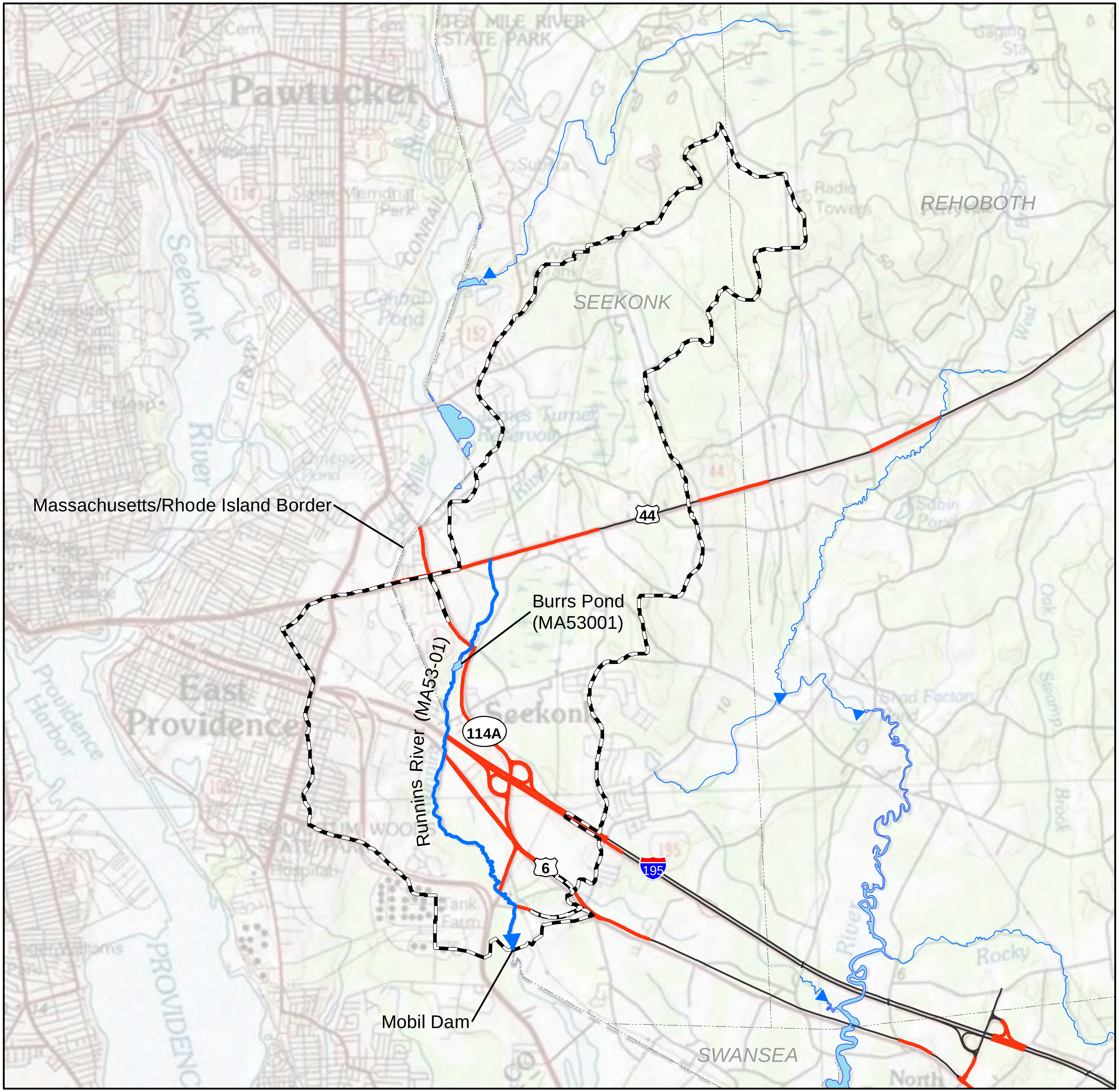
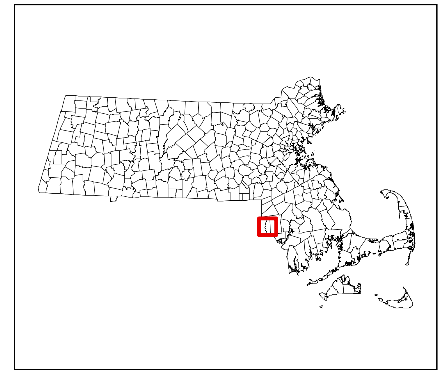




Impaired Stream Segment

Runnins River (MA53-01)

Impaired Water Body

Total Watershed

MassDOT Roads in Urban Areas

MassDOT Roads

Town Boundaries

N

0 0.5 1 2

Miles

1 in = 1 miles

Figure 1

Runnins River
Total Watershed
MA53-01

December 2012

massDOT Massachusetts Department of Transportation Highway Division

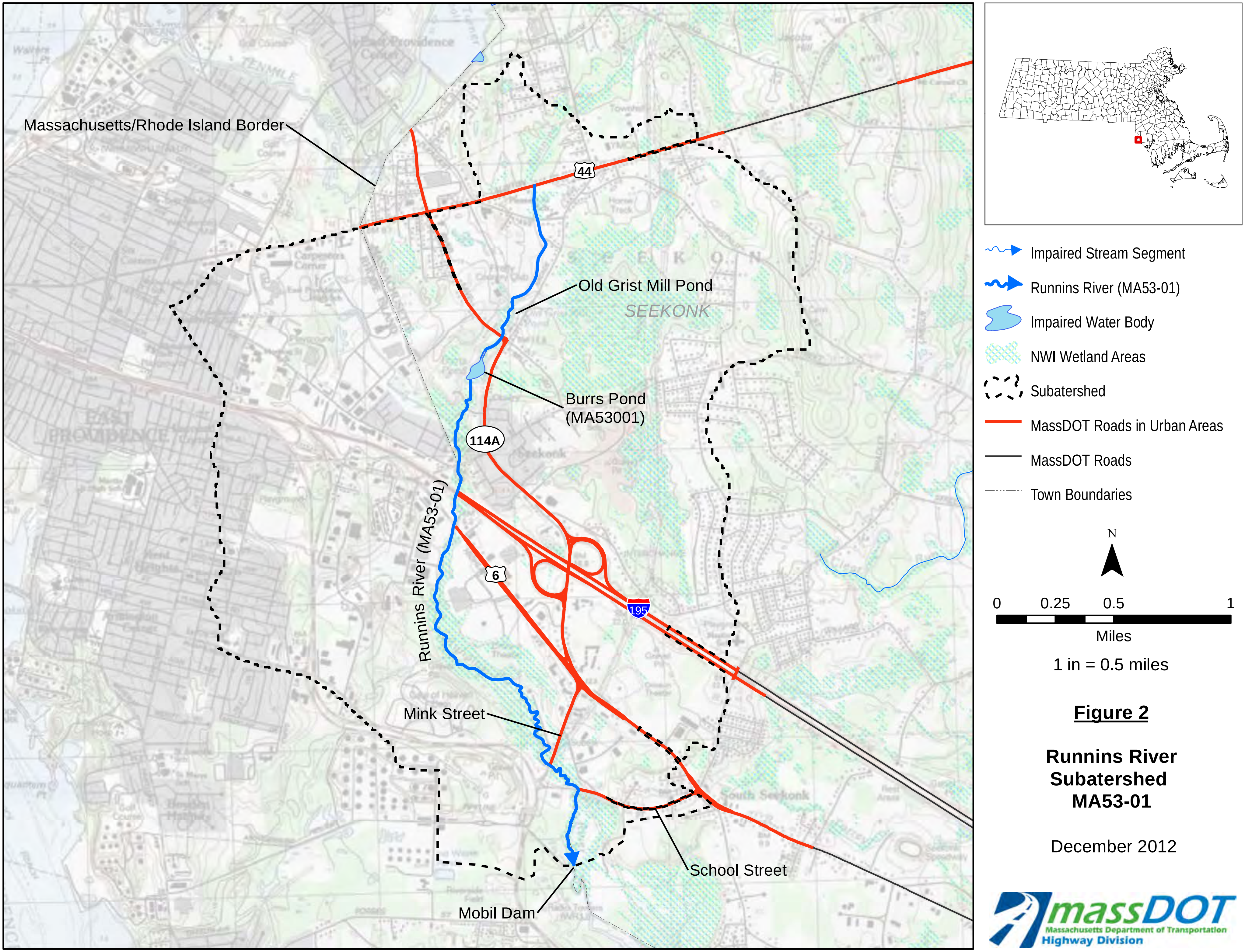


Figure 2

Runnins River Subatershed MA53-01

December 2012

massDOT Massachusetts Department of Transportation Highway Division

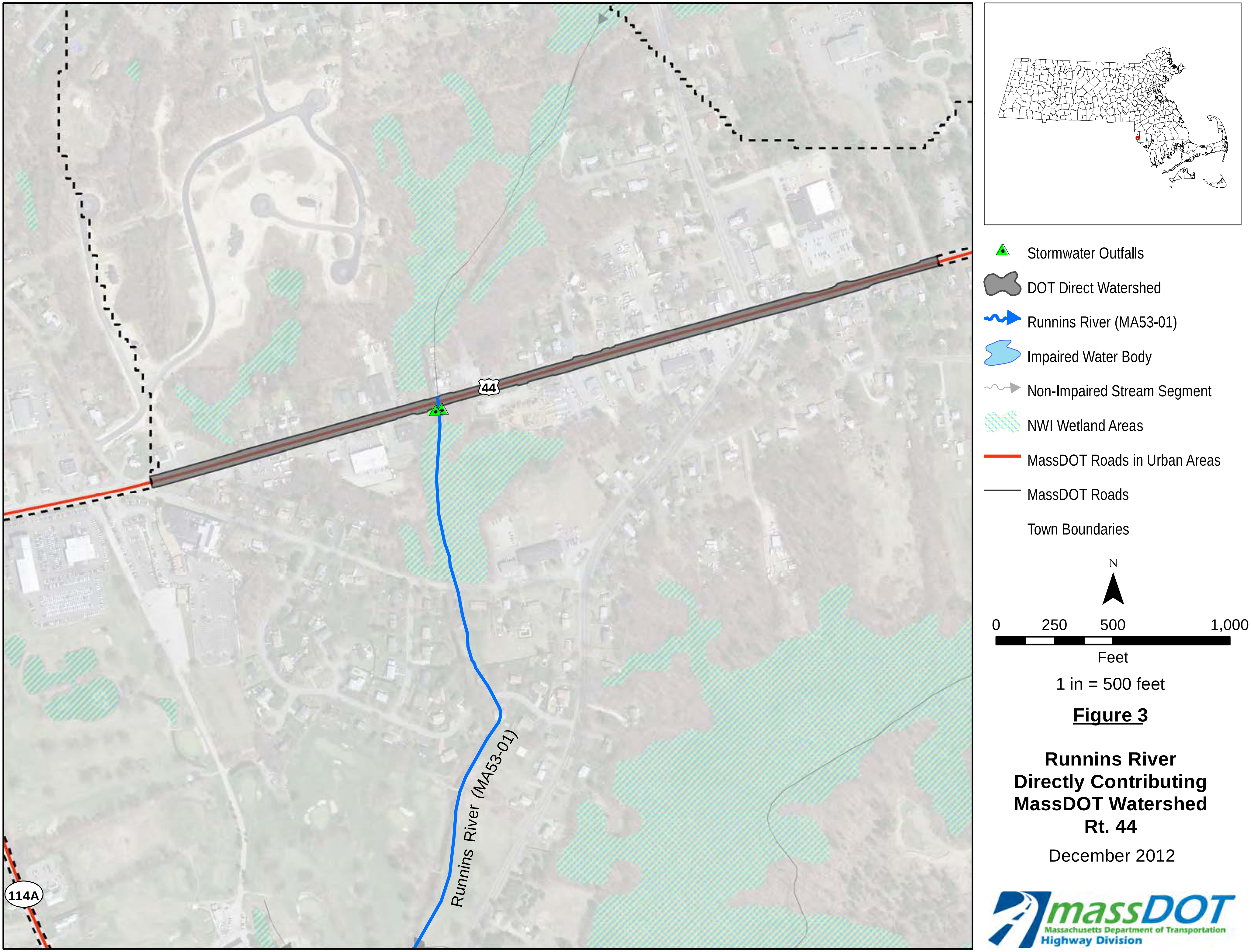
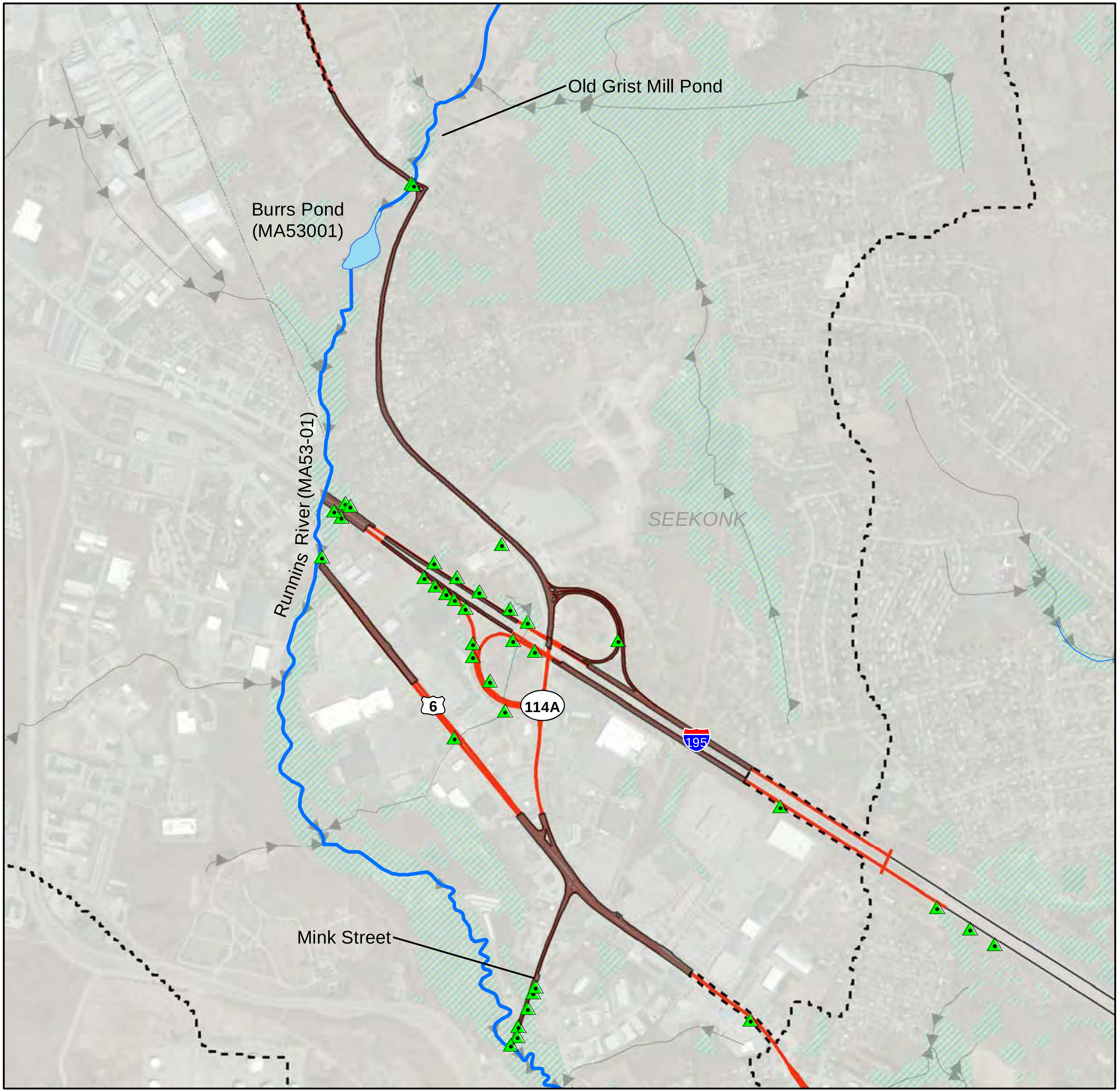


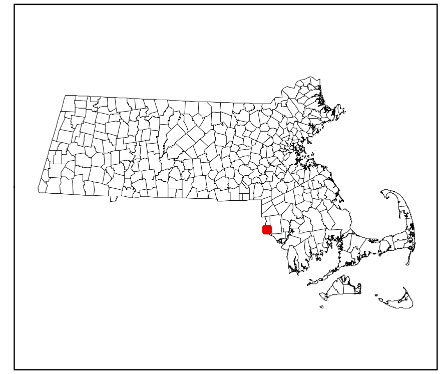
Figure 3

Runnins River Directly Contributing MassDOT Watershed Rt. 44

December 2012

massDOT Massachusetts Department of Transportation Highway Division





Stormwater Outfalls
DOT Direct Watershed
Runnins River (MA53-01)
Impaired Water Body
Non-Impaired Stream Segment
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries

N

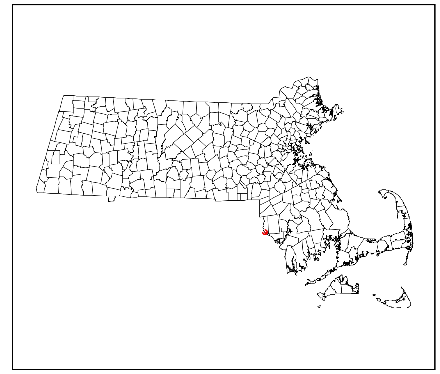
0 750 1,500 3,000
Feet
1 in = 500 feet

Figure 4

Runnins River Directly Contributing MassDOT Watershed Rt. 114A, Rt. 6, Mink Street, I-195

December 2012

massDOT
Massachusetts Department of Transportation
Highway Division



Stormwater Outfalls
Leaching Catch Basins
DOT Direct Watershed
Runnins River (MA53-01)
Impaired Water Body
Non-Impaired Stream Segment
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries

N

0 50 100 200

Feet

1 in = 100 feet

Figure 5

Runnins River Directly Contributing MassDOT Watershed School Street

December 2012

massDOT Massachusetts Department of Transportation Highway Division

Impaired Waters Assessment for Salisbury Plain River (MA62-05) – Progress Report

Impaired Water Body

Name: Salisbury Plain River

Location: Brockton, MA

Water Body ID: MA62-05

Impairments

The Salisbury Plain River (MA62-05) is listed under Category 5, "Waters Requiring a TMDL", on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011a). The Salisbury Plain River is impaired for the following:

- fecal coliform
- dissolved oxygen
- sedimentation/siltation
- (physical substrate habitat alterations*).

According to MassDEP's *Taunton River Watershed 2001 Water Quality Assessment Report* (MassDEP, 2005), while the aesthetics of the stream were not assessed, the primary and secondary contact recreational use of the Salisbury Plain River (MA62-06) are impaired due to elevated bacteria counts. The stream is directly upstream of the Brockton Advanced Water Reclamation Facility and suspected sources include discharges from municipal separate storm sewer systems (MassDEP, 2005). Salisbury Plain River (MA62-05) is covered by the *Final Pathogen TMDL for the Taunton River Watershed* (MassDEP, 2011b). This TMDL has been added since the original MassDOT impaired waters list (Appendix L-1 list) was developed.

Relevant Water Quality Standards

Water Body Classification: Class B

Applicable State Regulations:

- *314 CMR 4.05 (3)(b) 5 Solids*. These waters shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.
- *314 CMR 4.05 (5) (b) Bottom Pollutants or Alterations*. All surface waters shall be free from pollutants in concentrations or combinations or from alterations that adversely affect the physical or chemical nature of the bottom, interfere with the propagation of fish or shellfish, or adversely affect populations of non-mobile or sessile benthic organisms.

- *CMR 4.05 (3)(b) 1 Dissolved Oxygen*. Shall not be less than 6.0 mg/l in cold water fisheries and not less than 5.0 mg/l in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.
- *314 CMR 4.05 (5) (a) Aesthetics*. All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.
- *314 CMR 4.05 (3)(b) 4 Bacteria*.
  - a. At bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: where E. coli is the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml; alternatively, where enterococci are the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies per 100 ml and no single sample taken during the bathing season shall exceed 61 colonies per 100 ml;
  - b. For other waters and, during the non bathing season, for waters at bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: the geometric mean of all E. coli samples taken within the most recent six months shall not exceed 126 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies per 100 ml; alternatively, the geometric mean of all enterococci samples taken within the most recent six months shall not exceed 33 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 61 colonies per 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department.

Site Description

The upstream segment of the Salisbury Plain River is 2.44 miles long and is defined as the stretch of river from the confluence of Trout Brook and Salisbury Brook in Brockton to Brockton Advanced Water Reclamation Facility (AWRF), as displayed in **Figure 2**.

The Salisbury Plain River's total watershed is shown in **Figure 1** and the subwatershed is displayed in **Figure 2**. MassDOT's property directly contributing stormwater runoff to the Salisbury Plain River MA62-05 segment is comprised of approximately 0.5 miles of Main Street (Route 28). As shown in **Figure 3**, this section of Route 28 is surrounded by expansive parking lots. There is no curb or berm along this stretch of road, which allows stormwater from the east side of the road to run off as sheet flow into the parking lots. The parking lots on the east side of the road are sloped toward the river so stormwater drains directly into the Salisbury Plain River (MA62-05). Stormwater from a majority of the west side of the road also runs off as sheet flow into adjacent parking lots. The surrounding topography and large pipe outlets indicate that the water from these parking lots likely drains to a vegetated stream channel within the parking lots on the west side of the road, which drains water into a culvert under Route 28 toward the Salisbury Plain River (MA62-05), as noted in **Figure 3**. While the field staff could not confirm the culvert outlet, the culvert likely drains into the Salisbury Plain River (MA62-05).

Assessment under BMP 7U

Of the impairments listed for the Salisbury Plain River (MA62-05), two are potentially linked to stormwater runoff and have not been addressed by a TMDL. Therefore, MassDOT assessed the impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the following impairments:

- dissolved oxygen
- sedimentation/siltation

The impairment for fecal coliform has been addressed by the *Final Pathogen TMDL for the Taunton River Watershed* (MassDEP, 2011b). MassDOT has assessed its contribution to the impairment and compliance with the TMDL separately in the section titled "Assessment of Pathogen Impairment."

According to MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*, the impairment of physical substrate habitat alterations is not caused by pollutants (MassDEP, 2011a). Therefore, this impairment is not considered further.

The following sections describe the methodology used by MassDOT to assess the impairments potentially linked to stormwater that have not been addressed by a TMDL.

MassDOT's Application of the Impervious Cover Method

MassDOT's Application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I's Impervious Cover Method described in EPA's *Stormwater TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT's program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT's Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body's entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS's impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT's target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT's properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's *Stormwater Best Management Practices (BMP) Performance Analysis* report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for the Salisbury Plain River (MA62-05):

Table 1. Site Parameters for Salisbury Plain River (MA62-05)

Total Watershed		
Watershed Area	11,575	acres
Impervious Cover (IC) Area	4,186	acres
Percent Impervious	36.2	%
IC Area at 9% Goal	1,042	acres
Target Reduction % in IC	75.1	%
Subwatershed		
Subwatershed Area	1,836	acres
Impervious Cover (IC) Area	822	acres
Percent Impervious	44.8	%
IC Area at 9% Goal	165	acres
Target Reduction % in IC	79.9	%
Reductions Applied to DOT Direct Watershed		
MassDOT's IC Area **Directly** Contributing to Impaired Segment	2.2	acres
MassDOT's Target Reduction in Effective IC (79.9% of DOT Directly Contributing IC)	1.7	acres

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 79.9%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 1.7 acres.

Existing BMPs

There are no existing BMPs in the Salisbury Plain River directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to the Salisbury Plain River.

Mitigation Plan

Because there is no mitigation of impervious surface achieved by MassDOT BMPs to meet the reduction requirement of 1.7 acres, MassDOT will consider the implementation of BMPs.

Assessment of Pathogen Impairment

MassDOT assessed the pathogen (fecal coliform) impairment using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. Pathogen concentrations in stormwater vary widely temporally and spatially; concentrations can vary by an order of magnitude within a given storm event at a single location (MassDEP, 2009b). Therefore, it is difficult to predict pathogen concentrations in stormwater with accuracy. Due to this difficulty, MassDOT generally will not conduct site specific assessments of loading at each location impaired for pathogens. Instead these sites will be assessed collectively based on available information on pathogen loading from highways, MassDOT actions, and information available from EPA and DEP. Based on this information MassDOT developed an approach to be consistent with relevant TMDL and permit condition requirements and an iterative adaptive management approach to stormwater management.

In addition, while there is a positive relationship between IC and pathogen loading, the relationship is not as direct as other impairments. According to the Center for Watershed Protection "…Other studies show that concentrations of bacteria are typically higher in urban areas than rural areas (USGS, 1999), but they are not always directly related to IC (CWP, 2003)." Therefore, DOT did not rely solely on the IC method to assess pathogen impairments. Instead, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

Pathogens in MassDOT Discharge

A study conducted on MassDOT's South East Expressway measured bacterial concentrations in stormwater runoff (Smith, 2002). This study found a geometric mean of 186 fecal coliforms/100 ml. Concentrations of pathogens in stormwater runoff from roadways can vary widely and pathogen concentrations in runoff across the state likely deviate significantly from this stretch of roadway's specific estimate. Event mean concentrations of fecal coliform bacteria in urban stormwater from other sources ranging between 14,000 and 17,000 fecal coliform organisms/100 mL have been reported (MassDEP, 2009b). These data suggest that pathogen loading from highways may be lower than other urban areas.

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

- <u>Illicit discharges:</u> Due to the typical setback of highways from residential and commercial developments and the stand alone nature of the drainage system, the potential for illicit discharges (e.g. sewer connections, laundry tie-ins) is much lower than in other stormwater systems. This has been confirmed by MassDOT's illicit discharge detection on many miles of urban roadways within a broad range of areas across Massachusetts. After assessment of almost 140 miles, and investigation of more than 2,500 stormwater features, MassDOT's consultant performing the broad scope reviews has found no confirmed illicit discharges.
- <u>Limited Sewer Utilities in Road Right of Ways:</u> Since DOT does not provide sewer services, many MassDOT roads do not have sewer utilities within the road's right of way;

thereby eliminating the chance of cross-connections or leaking pipes as a source of pathogens into the stormwater system.

- Pet waste: Pets are only present on highways in rare instances. In urban residential areas pets and their associated waste are much more common. MassDOT is aware that pet waste at road side rest stops may represent a potential source of pathogens to stormwater in certain situations.
- Wildlife: Highways are not generally an attractive place for wildlife. Wildlife generally avoids highways and only occasionally crosses them.

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

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

Assessment

Pathogen loadings are highly variable and, as a result, quantitative assessments are challenging and of little value. Therefore, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

TMDLs for pathogen impairments in Massachusetts recognize that pathogens are highly variable and difficult to address and emphasize the need for an iterative adaptive management approach to address pathogens. Examples of relevant language from these TMDLs are included below:

- "given the vast potential number of bacteria sources and the difficulty of identifying and removing them from some sources such as stormwater require an iterative process and will take some time to accomplish. While the stated goal in the TMDL is to meet the water quality standard at the point of discharge it also attempts to be clear that MassDEP's expectation is that for stormwater an iterative approach is needed…" (MassDEP, 2009a)
- "The NPDES permit does not, however, establish numeric effluent limitations for stormwater discharges. Maximum extent practicable (MEP) is the statutory standard that establishes the level of pollutant reductions that regulated municipalities must achieve. The MEP standard is a narrative effluent limitation that is satisfied through implementation of SWMPs and achievement of measurable goals."(MassDEP, 2009b)
- "Although the TMDL presents quantified WLAs for stormwater that are set equivalent to the criteria in the Massachusetts Water Quality Standards, the Phase II NPDES permits will not include numeric effluent limitations. Phase II permits are intended to be BMP based permits that will require communities to develop and implement comprehensive stormwater management programs involving the use of BMPs. Massachusetts and EPA believe that BMP based Phase II permits involving comprehensive stormwater management together with specific emphasis on pollutants contributing to existing water quality problems can be consistent with the intent of the quantitative WLAs for stormwater discharges in TMDLs." (MassDEP, no date).

This language clearly indicates that an iterative adaptive management approach is the appropriate way to address discharges to pathogen impaired waters. The recommendations in pathogen

TMDLs for waters in Massachusetts generally require development and implementation of stormwater management programs, illicit discharge detection and elimination efforts, and in some cases installing BMPs to the maximum extent practicable

The draft North Coastal Watershed General MS4 permit and the draft Interstate, Merrimack, and South Coastal (IMS) watershed permits contain specific requirements for compliance with pathogen TMDLs (in Appendix G). While these permits are still in draft form, MassDOT believes they represent the best available guidance on what EPA believes is appropriate for addressing stormwater discharges to pathogen-impaired waters. Section 2.2.1(c) of the permit states “For any discharge from its MS4 to impaired waters with an approved TMDL, the permittee shall comply with the specific terms of Part 2.1 of this permit. In addition, where an approved TMDL establishes a WLA that applies to its MS4 discharges, the permittee shall implement the specific BMPs and other permit requirements identified in Appendix G to achieve consistency with the WLA.” Appendix G references a number of programmatic BMPs that are necessary to address pathogen loading. These cover the following general topics:

- Residential educational program
- Illicit connection identification, tracking and removal
- Pet waste management

Mitigation Plan

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

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

In addition, the structural BMPs that will be considered to reduce the IC will also have the effect of reducing pathogen loads.

MassDOT believes the existing and proposed efforts are consistent with the current and draft MS4 permit’s requirements and TMDL recommendations. MassDOT’s existing stormwater management plan outlines BMPs that include education and illicit discharge detection and elimination. Although not included in this permit term, MassDOT will be implementing a pet waste management program at its rest stops that have discharges to pathogen impaired waters. In addition, MassDOT has requested coverage under an individual stormwater permit for the next permit term. This permit may contain additional programmatic BMPs to address pathogens.

Conclusions

MassDOT used the IC Method to assess the Salisbury Plain River (MA62-05) for the impairments identified in MassDEP's final Massachusetts Year 2010 Integrated List of Waters. Results indicate that MassDOT should reduce its effective IC within its directly contributing subwatershed by 1.7 acres to achieve the targeted reduction in effective IC. MassDOT evaluated its property within the directly contributing watershed to the Salisbury Plain River (MA62-05) to identify existing BMPs and found that no BMPs exist to reduce effective IC. This information is summarized in Table 2 below.

Table 2. Effective IC Reductions under Existing & Proposed Conditions

IC in Directly Contributing Watershed	2.2	acres
Target Reduction in Effective IC	1.7	acres
IC Effectively Reduced by Existing BMPs	0.0	acres
IC Remaining to Mitigate with Proposed BMPs	**1.7**	**acres**

MassDOT should reduce its effective IC within the directly contributing watershed by an additional 1.7 acres to achieve the targeted reduction in IC. MassDOT will now work with its design consultants to identify locations suitable for construction of additional BMPs to treat directly contributing IC as part of MassDOT's Impaired Waters Retrofit Initiative. The design consultants will develop construction plans for BMPs that will aim to provide the target IC reduction or treatment to the maximum extent practicable.

Furthermore, MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. MassDOT will also continue to implement non-structural BMPs that reduce the impacts of stormwater.

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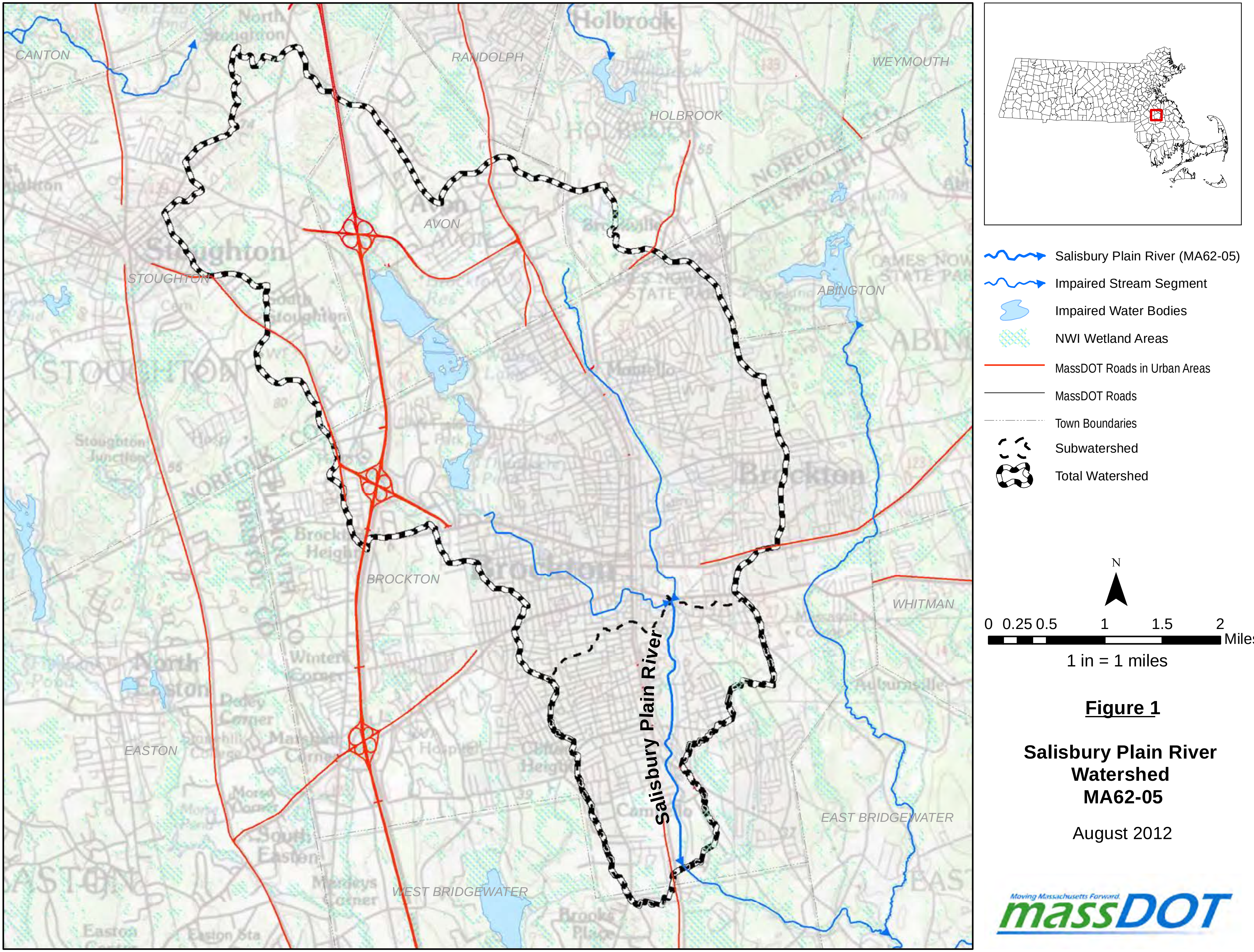

Figure 1

Salisbury Plain River Watershed MA62-05

August 2012

massDOT
Moving Massachusetts Forward.

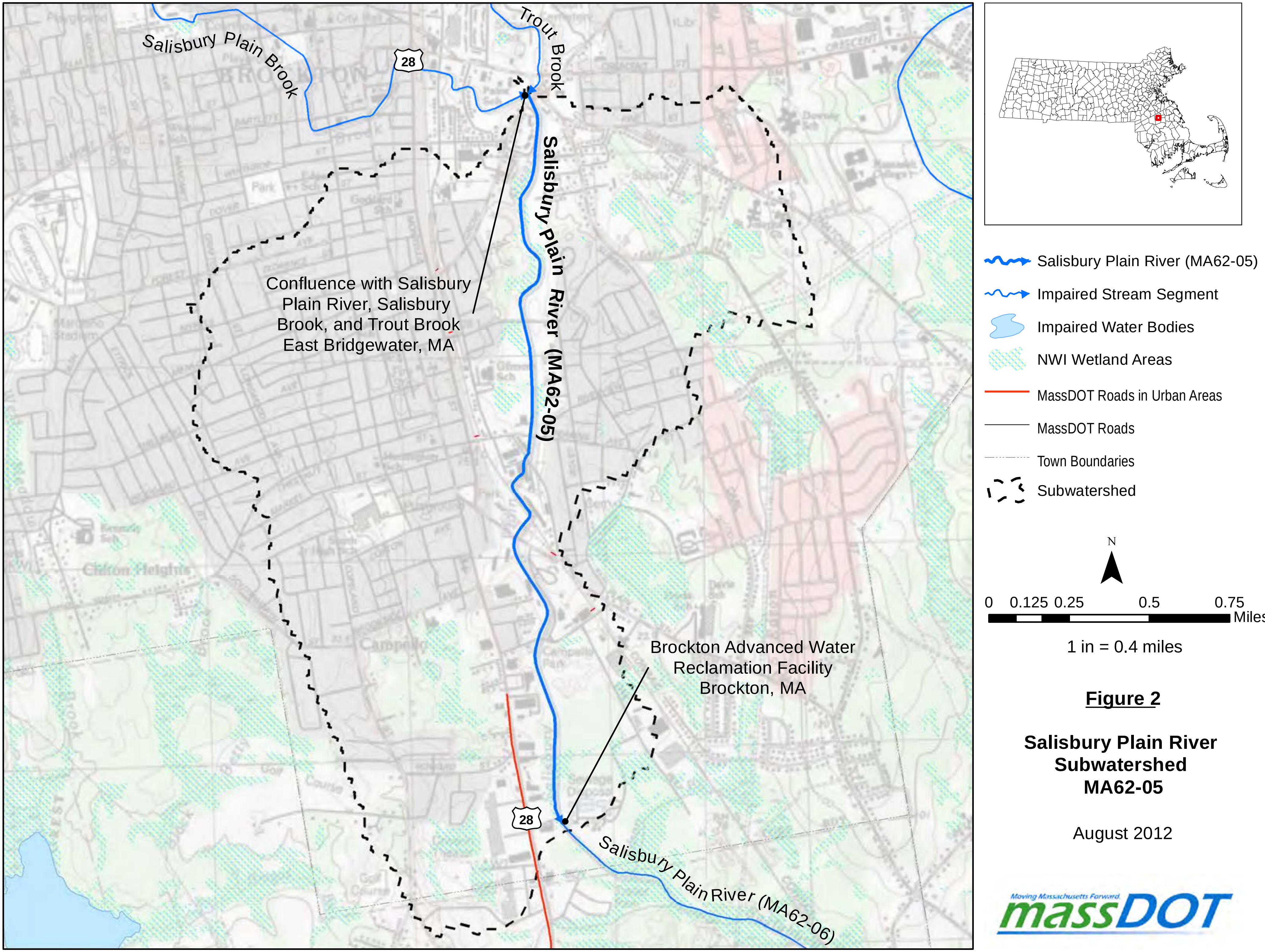

Figure 2

Salisbury Plain River Subwatershed MA62-05

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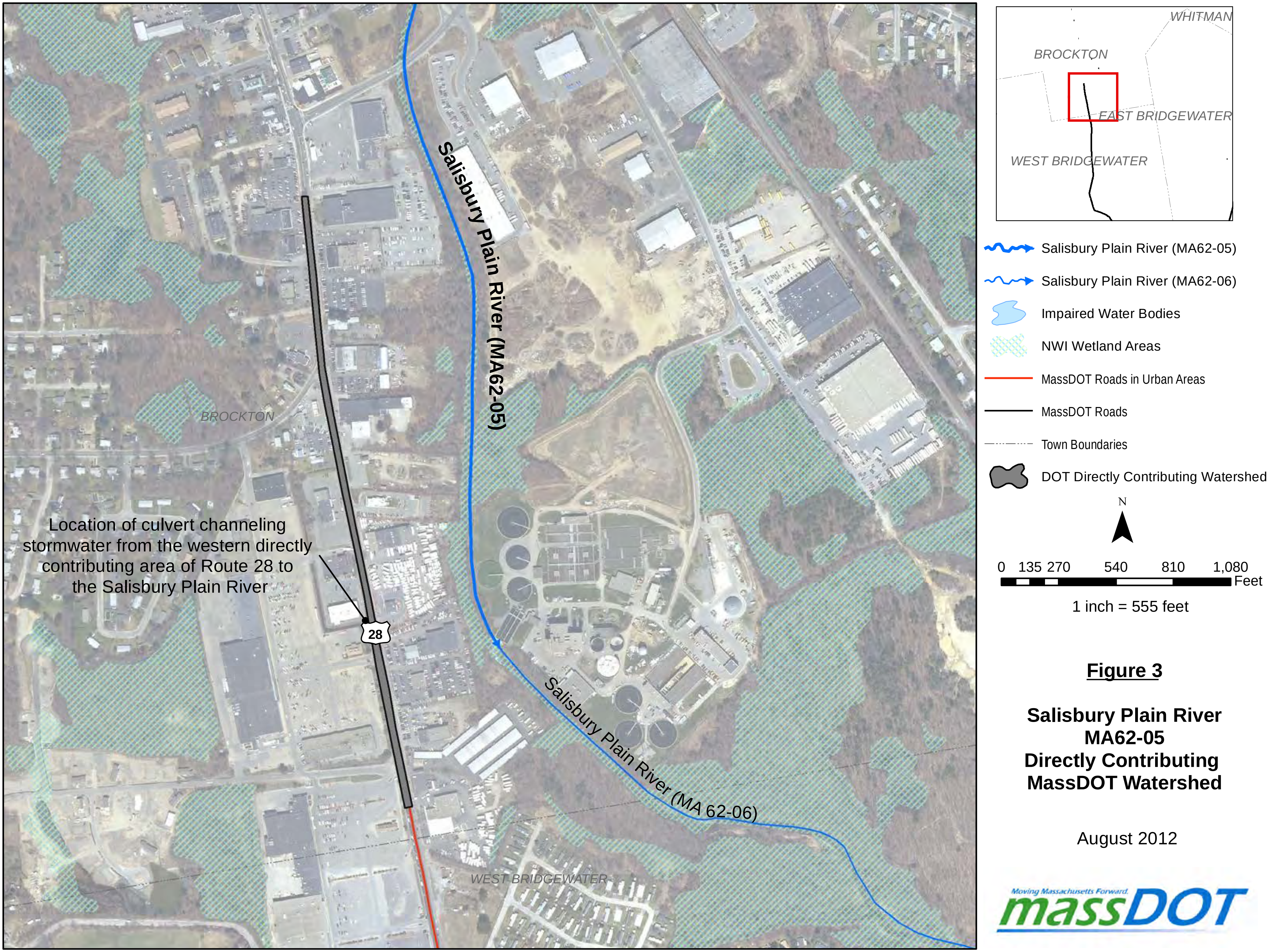

Figure 3

Salisbury Plain River
MA62-05
Directly Contributing
MassDOT Watershed

August 2012

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Impaired Waters Assessment for Salisbury Plain River (MA62-06) – Progress Report

Impaired Water Body

Name: Salisbury Plain River

Location: West Bridgewater & Brockton, MA

Water Body ID: MA62-06

Impairments

The Salisbury Plain River (MA62-06) is listed under Category 5, "Waters Requiring a TMDL", on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011a). The Salisbury Plain River is impaired for the following:

- fecal coliform
- dissolved oxygen
- aquatic macroinvertebrate bioassessments
- excess algal growth
- taste and odor
- total phosphorus
- turbidity
- (debris/floatables/trash*).

According to MassDEP's *Taunton River Watershed 2001 Water Quality Assessment Report* (MassDEP, 2005), the primary and secondary contact recreational use as well as the aesthetics of the Salisbury Plain River (MA62-06) are impaired due to elevated bacteria counts and objectionable conditions (i.e. odors, turbidity, filamentous green algae, and trash and debris). The report states that the degradations likely result from the Brockton Advanced Water Reclamation Facility and suspected sources also include discharges from municipal separate storm sewer systems (MassDEP, 2005). Salisbury Plain River (MA62-06) is covered by the *Final Pathogen TMDL for the Taunton River Watershed* (MassDEP, 2011b). This TMDL has been added since the original MassDOT impaired waters list (Appendix L-1 list) was developed.

Relevant Water Quality Standards

Water Body Classification: Class B, Warm Water Fishery

Applicable State Regulations:

- *314 CMR 4.05 (3)(b) 5 Solids*. These waters shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.

- *314 CMR 4.05 (5) (b) Bottom Pollutants or Alterations*. All surface waters shall be free from pollutants in concentrations or combinations or from alterations that adversely affect the physical or chemical nature of the bottom, interfere with the propagation of fish or shellfish, or adversely affect populations of non-mobile or sessile benthic organisms.
- *314 CMR 4.05 (5) (c) Nutrients*. Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.
- *314 CMR 4.05 (5) (a) Aesthetics*. All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.
- *301 CMR 4.05 (3)(b) 6 Color and Turbidity.* These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this Class.
- *301 CMR 4.05 (3)(b) 8 Taste and Odor.* None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to this Class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.
- *314 CMR 4.05 (5)(e) Toxic Pollutants*. All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife. For pollutants not otherwise listed in 314 CMR 4.00, the National Recommended Water Quality Criteria: 2002, EPA 822R-02-047, November 2002 published by EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act, are the allowable receiving water concentrations for the affected waters, unless the Department either establishes a site specific criterion or determines that naturally occurring background concentrations are higher. Where the Department determines that naturally occurring background concentrations are higher, those concentrations shall be the allowable receiving water concentrations. The Department shall use the water quality criteria for the protection of aquatic life expressed in terms of the dissolved fraction of metals when EPA's 304(a) recommended criteria provide for use of the dissolved fraction. The EPA recommended criteria based on total recoverable metals shall be converted to dissolved metals using EPA's published conversion factors. Permit limits will be written in terms of total recoverable metals. Translation from dissolved metals criteria to total recoverable metals permit limits will be based on EPA's conversion factors or other methods approved by the Department. The Department may establish site specific criteria for toxic pollutants based on site specific considerations.
- *CMR 4.05 (3)(b) 1 Dissolved Oxygen*. Shall not be less than 6.0 mg/l in cold water fisheries and not less than 5.0 mg/l in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and

daily variations that are necessary to protect existing and designated uses shall be maintained.

- *314 CMR 4.05 (3)(b) 4 Bacteria*.
  - a. At bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: where E. coli is the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml; alternatively, where enterococci are the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies per 100 ml and no single sample taken during the bathing season shall exceed 61 colonies per 100 ml;
  - b. For other waters and, during the non bathing season, for waters at bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: the geometric mean of all E. coli samples taken within the most recent six months shall not exceed 126 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies per 100 ml; alternatively, the geometric mean of all enterococci samples taken within the most recent six months shall not exceed 33 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 61 colonies per 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department.

Site Description

The final segment of the Salisbury Plain River is 2.26 miles long and is defined as the stretch of river from the Brockton Advanced Water Reclamation Facility (AWRF) discharge in Brockton to the confluence with Beaver Brook forming the Matfield River in East Bridgewater, as displayed in **Figure 2**.

The Salisbury Plain River's total watershed is shown in **Figure 1** and the subwatershed is displayed in **Figure 2**. MassDOT's property directly contributing stormwater runoff to the Salisbury Plain River MA62-06 segment is comprised of approximately 0.25 miles of Main Street (Route 28). As shown in **Figure 3**, this section of Route 28 is a two lane roadway with a single catch basin and outfall system directing water from the roadway into the intersecting stream that flows for 0.4 miles before reaching the Salisbury Plain River (MA62-06). Because this unimpaired stream segment is unnamed and flows for a short distance before joining the Salisbury Plain River (MA62-06), it was assumed that stormwater draining into this stream has little opportunity for infiltration and directly drains to the Salisbury Plain River.

Assessment under BMP 7U

Of the impairments listed for the Salisbury Plain River (MA62-06), six are potentially linked to stormwater runoff and have not been addressed by a TMDL. Therefore, MassDOT assessed the impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the following impairments:

- dissolved oxygen
- aquatic macroinvertebrate bioassessments

- excess algal growth
- taste and odor
- total phosphorus
- turbidity.

The impairment for fecal coliform has been addressed by the *Final Pathogen TMDL for the Taunton River Watershed* (MassDEP, 2011b). MassDOT has assessed its contribution to the impairment and compliance with the TMDL separately in the section titled “Assessment of Pathogen Impairment.”

According to MassDEP’s final *Massachusetts Year 2010 Integrated List of Waters*, the impairment of debris/floatables/trash is not caused by pollutants (MassDEP, 2011a). Therefore, this impairment is not considered further.

The following sections describe the methodology used by MassDOT to assess the impairments potentially linked to stormwater that have not been addressed by a TMDL.

MassDOT’s Application of the Impervious Cover Method

MassDOT’s Application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I’s Impervious Cover Method described in EPA’s *Storm Water TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT’s program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT’s Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body’s entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS’s impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT’s target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT’s properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's *Storm Water Best Management Practices (BMP) Performance Analysis* report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for the Salisbury Plain River (MA62-06):

Table 1. Site Parameters for Salisbury Plain River (MA62-06)

Total Watershed		
Watershed Area	13,610	acres
Impervious Cover (IC) Area	4,538	acres
Percent Impervious	33.3	%
IC Area at 9% Goal	1,225	acres
Target Reduction % in IC	73.0	%
Subwatershed		
Subwatershed Area	3,871	acres
Impervious Cover (IC) Area	1,174	acres
Percent Impervious	30.3	%
IC Area at 9% Goal	348	acres
Target Reduction % in IC	70.4	%
Reductions Applied to DOT Direct Watershed		
MassDOT's IC Area **Directly** Contributing to Impaired Segment	1.0	acres
MassDOT's Target Reduction in Effective IC (70.4% of DOT Directly Contributing IC)	0.7	acres

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 70.4%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 0.7 acres.

Existing BMPs

There are no existing BMPs in the Salisbury Plain River directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to the Salisbury Plain River.

Mitigation Plan

Because there is no mitigation of impervious surface achieved by MassDOT BMPs to meet the reduction requirement of 0.7 acres, MassDOT will consider the implementation of BMPs.

Assessment of Pathogen Impairment

MassDOT assessed the pathogen (fecal coliform) impairment using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. Pathogen concentrations in stormwater vary widely temporally and spatially; concentrations can vary by an order of magnitude within a given storm event at a single location (MassDEP, 2009b). Therefore, it is difficult to predict pathogen concentrations in stormwater with accuracy. Due to this difficulty, MassDOT generally will not conduct site specific assessments of loading at each location impaired for pathogens. Instead these sites will be assessed collectively based on available information on pathogen loading from highways, MassDOT actions, and information available from EPA and DEP. Based on this information MassDOT developed an approach to be consistent with relevant TMDL and permit condition requirements and an iterative adaptive management approach to stormwater management.

In addition, while there is a positive relationship between IC and pathogen loading, the relationship is not as direct as other impairments. According to the Center for Watershed Protection "…Other studies show that concentrations of bacteria are typically higher in urban areas than rural areas (USGS, 1999), but they are not always directly related to IC (CWP, 2003)." Therefore, DOT did not rely solely on the IC method to assess pathogen impairments. Instead, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

Pathogens in MassDOT Discharge

A study conducted on MassDOT's South East Expressway measured bacterial concentrations in stormwater runoff (Smith, 2002). This study found a geometric mean of 186 fecal coliforms/100 ml. Concentrations of pathogens in stormwater runoff from roadways can vary widely and pathogen concentrations in runoff across the state likely deviate significantly from this stretch of roadway's specific estimate. Event mean concentrations of fecal coliform bacteria in urban stormwater from other sources ranging between 14,000 and 17,000 fecal coliform organisms/100 mL have been reported (MassDEP, 2009b). These data suggest that pathogen loading from highways may be lower than other urban areas.

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

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

waste at road side rest stops may represent a potential source of pathogens to stormwater in certain situations.

- Wildlife: Highways are not generally an attractive place for wildlife. Wildlife generally avoids highways and only occasionally crosses them.

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

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

Assessment

Pathogen loadings are highly variable and, as a result, quantitative assessments are challenging and of little value. Therefore, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

TMDLs for pathogen impairments in Massachusetts recognize that pathogens are highly variable and difficult to address and emphasize the need for an iterative adaptive management approach to address pathogens. Examples of relevant language from these TMDLs are included below:

- "given the vast potential number of bacteria sources and the difficulty of identifying and removing them from some sources such as stormwater require an iterative process and will take some time to accomplish. While the stated goal in the TMDL is to meet the water quality standard at the point of discharge it also attempts to be clear that MassDEP's expectation is that for stormwater an iterative approach is needed…" (MassDEP, 2009a)
- "The NPDES permit does not, however, establish numeric effluent limitations for stormwater discharges. Maximum extent practicable (MEP) is the statutory standard that establishes the level of pollutant reductions that regulated municipalities must achieve. The MEP standard is a narrative effluent limitation that is satisfied through implementation of SWMPs and achievement of measurable goals."(MassDEP, 2009b)
- "Although the TMDL presents quantified WLAs for stormwater that are set equivalent to the criteria in the Massachusetts Water Quality Standards, the Phase II NPDES permits will not include numeric effluent limitations. Phase II permits are intended to be BMP based permits that will require communities to develop and implement comprehensive stormwater management programs involving the use of BMPs. Massachusetts and EPA believe that BMP based Phase II permits involving comprehensive stormwater management together with specific emphasis on pollutants contributing to existing water quality problems can be consistent with the intent of the quantitative WLAs for stormwater discharges in TMDLs." (MassDEP, no date).

This language clearly indicates that an iterative adaptive management approach is the appropriate way to address discharges to pathogen impaired waters. The recommendations in pathogen TMDLs for waters in Massachusetts generally require development and implementation of stormwater management programs, illicit discharge detection and elimination efforts, and in some cases installing BMPs to the maximum extent practicable

The draft North Coastal Watershed General MS4 permit and the draft Interstate, Merrimack, and South Coastal (IMS) watershed permits contain specific requirements for compliance with pathogen TMDLs (in Appendix G). While these permits are still in draft form, MassDOT believes they represent the best available guidance on what EPA believes is appropriate for addressing stormwater discharges to pathogen-impaired waters. Section 2.2.1(c) of the permit states "For any discharge from its MS4 to impaired waters with an approved TMDL, the permittee shall comply with the specific terms of Part 2.1 of this permit. In addition, where an approved TMDL establishes a WLA that applies to its MS4 discharges, the permittee shall implement the specific BMPs and other permit requirements identified in Appendix G to achieve consistency with the WLA." Appendix G references a number of programmatic BMPs that are necessary to address pathogen loading. These cover the following general topics:

- Residential educational program
- Illicit connection identification, tracking and removal
- Pet waste management

Mitigation Plan

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

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

In addition, the structural BMPs that will be considered to reduce the IC will also have the effect of reducing pathogen loads.

MassDOT believes the existing and proposed efforts are consistent with the current and draft MS4 permit's requirements and TMDL recommendations. MassDOT's existing stormwater management plan outlines BMPs that include education and illicit discharge detection and elimination. Although not included in this permit term, MassDOT will be implementing a pet waste management program at its rest stops that have discharges to pathogen impaired waters. In addition, MassDOT has requested coverage under an individual stormwater permit for the next permit term. This permit may contain additional programmatic BMPs to address pathogens.

Conclusions

MassDOT used the IC Method to assess the Salisbury Plain River (MA62-06) for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. Results indicate that MassDOT should reduce its effective IC within its directly contributing subwatershed by 0.7 acres to achieve the targeted reduction in effective IC. MassDOT evaluated its property within the directly contributing watershed to the Salisbury Plain River (MA62-06) to identify existing BMPs and found that no BMPs exist to reduce effective IC. This information is summarized in Table 3 below.

Table 2. Effective IC Reductions under Existing & Proposed Conditions

IC in Directly Contributing Watershed	1.0	acres
Target Reduction in Effective IC	0.7	acres
IC Effectively Reduced by Existing BMPs	0.0	acres
IC Remaining to Mitigate with Proposed BMPs	**0.7**	**acres**

MassDOT should reduce its effective IC within the directly contributing watershed by an additional 0.7 acres to achieve the targeted reduction in IC. MassDOT will now work with its design consultants to identify locations suitable for construction of additional BMPs to treat directly contributing IC as part of MassDOT's Impaired Waters Retrofit Initiative. The design consultants will develop construction plans for BMPs that will aim to provide the target IC reduction or treatment to the maximum extent practicable.

Furthermore, MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. MassDOT will also continue to implement non-structural BMPs that reduce the impacts of stormwater.

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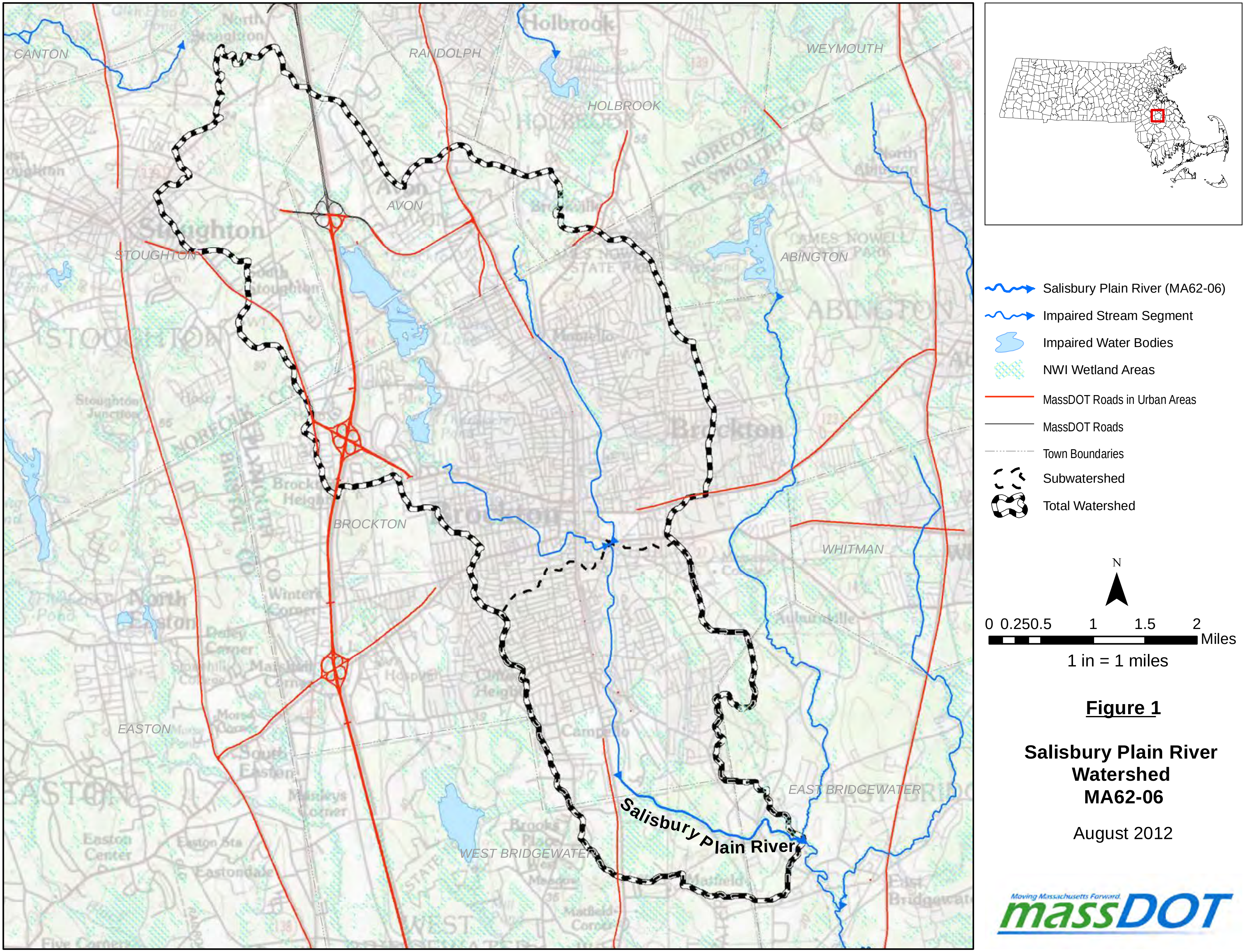

Figure 1

Salisbury Plain River Watershed MA62-06

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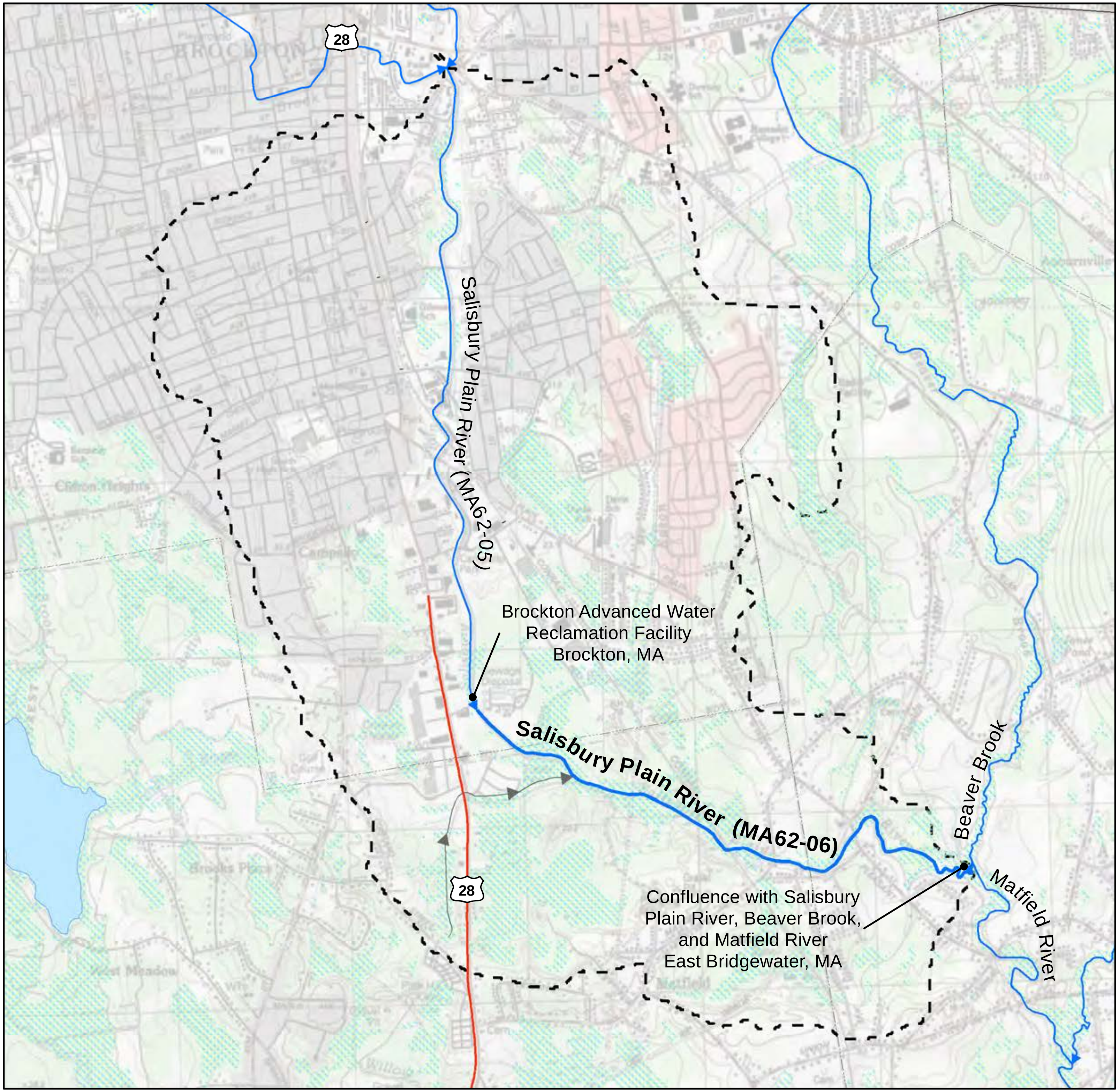

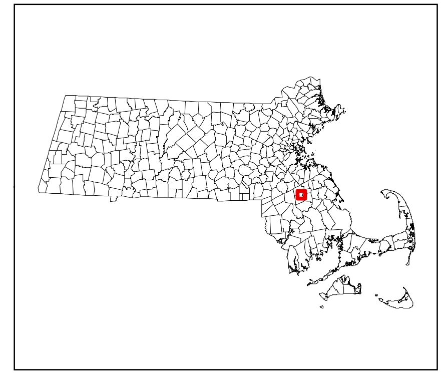

Salisbury Plain River (MA62-06)
Impaired Stream Segment
Impaired Water Bodies
Non-Impaired Stream Segment
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries
Subwatershed

N

0 0.1 0.2 0.4 0.6 0.8 Miles

1 in = 0.5 miles

Figure 2

Salisbury Plain River Subwatershed MA62-06

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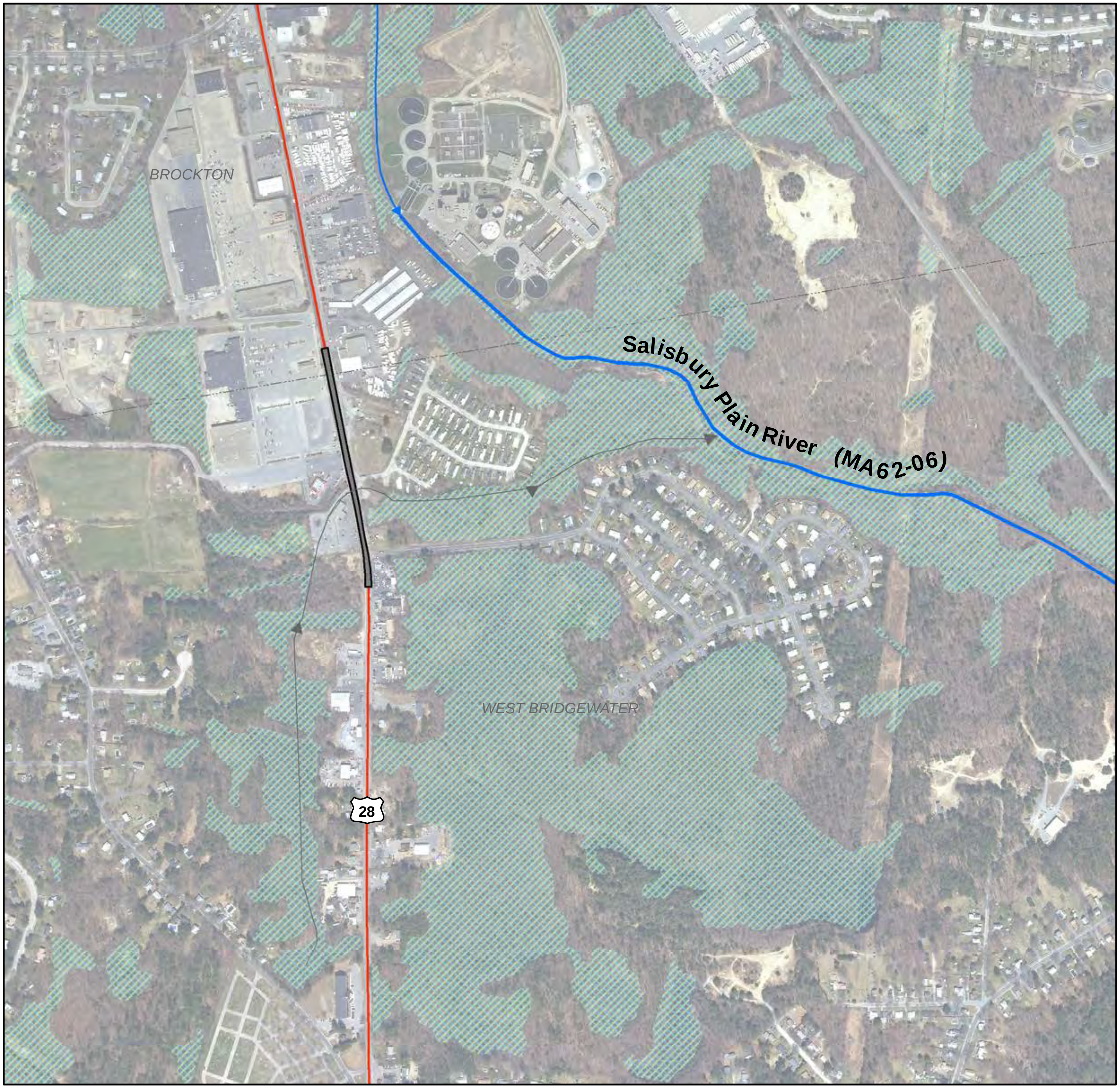

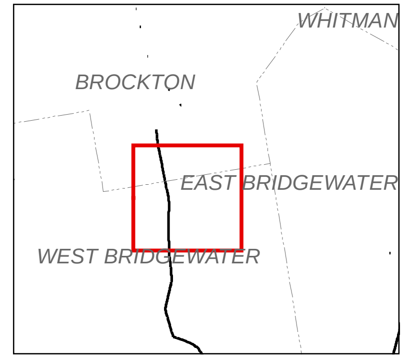

Impaired Stream Segment
Impaired Water Bodies
Directly Contributing Stream Channel
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries
DOT Directly Contributing Watershed

N

0 185 370 740 1,110 1,480 Feet

1 inch = 763 feet

Figure 3

Salisbury Plain River MA62-06 Directly Contributing MassDOT Watershed

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Impaired Waters Assessment for Matfield River (MA62-32) – Progress Report

Impaired Water Body

Name: Matfield River

Location: East Bridgewater and Bridgewater, MA

Water Body ID: MA62-32

Impairments

The Matfield River (MA62-32) is listed under Category 5, "Waters Requiring a TMDL", on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011a). The Matfield River is impaired for the following:

- fecal coliform
- dissolved oxygen
- excess algal growth
- total phosphorus
- taste and odor
- aquatic macroinvertebrate bioassessments.

According to MassDEP's *Taunton River Watershed 2001 Water Quality Assessment Report* (MassDEP, 2005), the aquatic life use of the Matfield River is impaired, and although instream biological data were not available, conditions (i.e., low dissolved oxygen/saturation and elevated total phosphorus concentrations) were similar to those documented in the Salisbury Plain River which was found to be impacted by the Brockton Advanced Water Reclamation Facility discharge and nonpoint source pollution (MassDEP, 2005). The primary contact, secondary contact, and aesthetics uses of the Matfield River are also impaired. The report identifies the degradations likely result from the Brockton Advanced Water Reclamation Facility and suspected sources also include discharges from municipal separate storm sewer systems (MassDEP, 2005). Matfield River is covered by the *Final Pathogen TMDL for the Taunton River Watershed* (MassDEP, 2011b). This TMDL has been added since the original MassDOT impaired waters list (Appendix L-1 list) was developed.

Relevant Water Quality Standards

Water Body Classification: Class B, Warm Water Fishery

Applicable State Regulations:

- *314 CMR 4.05 (5) (c) Nutrients*. Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.

- *CMR 4.05 (3)(b) 1 Dissolved Oxygen*. Shall not be less than 6.0 mg/l in cold water fisheries and not less than 5.0 mg/l in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.
- *314 CMR 4.05 (5) (a) Aesthetics*. All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.
- *314 CMR 4.05 (5)(e) Toxic Pollutants*. All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife. For pollutants not otherwise listed in 314 CMR 4.00, the National Recommended Water Quality Criteria: 2002, EPA 822R-02-047, November 2002 published by EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act, are the allowable receiving water concentrations for the affected waters, unless the Department either establishes a site specific criterion or determines that naturally occurring background concentrations are higher. Where the Department determines that naturally occurring background concentrations are higher, those concentrations shall be the allowable receiving water concentrations. The Department shall use the water quality criteria for the protection of aquatic life expressed in terms of the dissolved fraction of metals when EPA's 304(a) recommended criteria provide for use of the dissolved fraction. The EPA recommended criteria based on total recoverable metals shall be converted to dissolved metals using EPA's published conversion factors. Permit limits will be written in terms of total recoverable metals. Translation from dissolved metals criteria to total recoverable metals permit limits will be based on EPA's conversion factors or other methods approved by the Department. The Department may establish site specific criteria for toxic pollutants based on site specific considerations.
- *301 CMR 4.05 (3)(b) 8 Taste and Odor.* None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to this Class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.
- *314 CMR 4.05 (3)(b) 4 Bacteria*.
    - a. At bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: where E. coli is the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml; alternatively, where enterococci are the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies per 100 ml and no single sample taken during the bathing season shall exceed 61 colonies per 100 ml;
    - b. For other waters and, during the non bathing season, for waters at bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010:

the geometric mean of all E. coli samples taken within the most recent six months shall not exceed 126 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies per 100 ml; alternatively, the geometric mean of all enterococci samples taken within the most recent six months shall not exceed 33 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 61 colonies per 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department.

Site Description

The 6.7 mile length of the Matfield River begins at the confluence of Beaver Brook and the Salisbury Plain River within East Bridgewater. After 1.2 miles the river is joined by Meadow Brook and continues for 5.5 miles before merging with the Town River to form the Taunton River in Bridgewater, as displayed in **Figure 2**. Beaver Brook, the Salisbury Plain River, and Meadow Brook all drain into the Matfield River and are classified as impaired in the *Massachusetts Year 2010 Integrated List of Waters*. Beaver Brook and Meadow Brook are both listed as impaired for pathogens and the Salisbury Plain River is listed as impaired for nutrients, organic enrichment/low DO, pathogens, taste, odor, color, noxious aquatic plants, turbidity, and objectionable deposits.

The Matfield River's total watershed is shown in **Figure 1** and contains all tributaries within the Northeast section of the Taunton River basin. The Matfield River subwatershed is displayed in **Figure 2**. MassDOT's property directly contributing stormwater runoff to the Matfield River is comprised of approximately 0.77 miles of Bedford Street (Route 18). This section of Route 18 is a two lane roadway, shown in **Figure 3**, in which stormwater is collected in catch basins along both shoulders. One section of the roadway allows stormwater to drain into a localized catch basin and outfall system. For a majority of the directly contributing roadway, however, stormwater is piped to a trunk line that discharges stormwater directly to the Matfield River at the roadway culvert.

Assessment under BMP 7U

Of the impairments listed for the Matfield River (MA62-32), five are potentially linked to stormwater runoff and have not been addressed by a TMDL. Therefore, MassDOT assessed the impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the following impairments:

- dissolved oxygen
- excess algal growth
- total phosphorus
- taste and odor
- aquatic macroinvertebrate bioassessments.

The impairment for fecal coliform has been addressed by the *Final Pathogen TMDL for the Taunton River Watershed* (MassDEP, 2011b). MassDOT has assessed its contribution to the impairment and compliance with the TMDL separately in the section titled "Assessment of Pathogen Impairment."

The following sections describe the methodology used by MassDOT to assess the impairments potentially linked to stormwater that have not been addressed by a TMDL.

MassDOT's Application of the Impervious Cover Method

MassDOT's Application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I's Impervious Cover Method described in EPA's *Stormwater TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT's program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT's Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body's entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS's impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT's target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT's properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's *Stormwater Best Management Practices (BMP) Performance Analysis* report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for the Matfield River (MA62-32):

Table 1. Site Parameters for Matfield River (MA62-32)

Total Watershed		
Watershed Area	49,152	acres
Impervious Cover (IC) Area	9,128	acres
Percent Impervious	18.6	%
IC Area at 9% Goal	4,424	acres
Target Reduction % in IC	51.5	%
Subwatershed		
Subwatershed Area	2,540	acres
Impervious Cover (IC) Area	315	acres
Percent Impervious	12.4	%
IC Area at 9% Goal	227	acres
Target Reduction % in IC	27.3	%
Reductions Applied to DOT Direct Watershed		
MassDOT's IC Area **Directly** Contributing to Impaired Segment	3.8	acres
MassDOT's Target Reduction in Effective IC (27.3% of DOT Directly Contributing IC)	1.0	acres

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 27.3%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 1.0 acres.

Existing BMPs

There are no existing BMPs in the Matfield River directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to the Matfield River.

Mitigation Plan

Because there is no mitigation of impervious surface achieved by MassDOT BMPs to meet the reduction requirement of 1.0 acres, MassDOT will consider the implementation of BMPs.

Assessment of Pathogen Impairment

MassDOT assessed the pathogen (fecal coliform) impairment using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. Pathogen concentrations in stormwater vary widely temporally and spatially; concentrations can vary by an order of magnitude within a given storm event at a single location (MassDEP, 2009b). Therefore, it is difficult to predict pathogen concentrations in stormwater with accuracy. Due to this difficulty, MassDOT generally will not conduct site specific assessments of loading at each location impaired for pathogens. Instead these sites will be assessed collectively based on available information on pathogen loading from highways, MassDOT actions, and information available from EPA and DEP. Based on this information

MassDOT developed an approach to be consistent with relevant TMDL and permit condition requirements and an iterative adaptive management approach to stormwater management.

In addition, while there is a positive relationship between IC and pathogen loading, the relationship is not as direct as other impairments. According to the Center for Watershed Protection "…Other studies show that concentrations of bacteria are typically higher in urban areas than rural areas (USGS, 1999), but they are not always directly related to IC (CWP, 2003)." Therefore, DOT did not rely solely on the IC method to assess pathogen impairments. Instead, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

Pathogens in MassDOT Discharge

A study conducted on MassDOT's South East Expressway measured bacterial concentrations in stormwater runoff (Smith, 2002). This study found a geometric mean of 186 fecal coliforms/100 ml. Concentrations of pathogens in stormwater runoff from roadways can vary widely and pathogen concentrations in runoff across the state likely deviate significantly from this stretch of roadway's specific estimate. Event mean concentrations of fecal coliform bacteria in urban stormwater from other sources ranging between 14,000 and 17,000 fecal coliform organisms/100 mL have been reported (MassDEP, 2009b). These data suggest that pathogen loading from highways may be lower than other urban areas.

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

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

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

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

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

Assessment

Pathogen loadings are highly variable and, as a result, quantitative assessments are challenging and of little value. Therefore, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

TMDLs for pathogen impairments in Massachusetts recognize that pathogens are highly variable and difficult to address and emphasize the need for an iterative adaptive management approach to address pathogens. Examples of relevant language from these TMDLs are included below:

- "given the vast potential number of bacteria sources and the difficulty of identifying and removing them from some sources such as stormwater require an iterative process and will take some time to accomplish. While the stated goal in the TMDL is to meet the water quality standard at the point of discharge it also attempts to be clear that MassDEP's expectation is that for stormwater an iterative approach is needed…" (MassDEP, 2009a)
- "The NPDES permit does not, however, establish numeric effluent limitations for stormwater discharges. Maximum extent practicable (MEP) is the statutory standard that establishes the level of pollutant reductions that regulated municipalities must achieve. The MEP standard is a narrative effluent limitation that is satisfied through implementation of SWMPs and achievement of measurable goals."(MassDEP, 2009b)
- "Although the TMDL presents quantified WLAs for stormwater that are set equivalent to the criteria in the Massachusetts Water Quality Standards, the Phase II NPDES permits will not include numeric effluent limitations. Phase II permits are intended to be BMP based permits that will require communities to develop and implement comprehensive stormwater management programs involving the use of BMPs. Massachusetts and EPA believe that BMP based Phase II permits involving comprehensive stormwater management together with specific emphasis on pollutants contributing to existing water quality problems can be consistent with the intent of the quantitative WLAs for stormwater discharges in TMDLs." (MassDEP, no date).

This language clearly indicates that an iterative adaptive management approach is the appropriate way to address discharges to pathogen impaired waters. The recommendations in pathogen TMDLs for waters in Massachusetts generally require development and implementation of stormwater management programs, illicit discharge detection and elimination efforts, and in some cases installing BMPs to the maximum extent practicable

The draft North Coastal Watershed General MS4 permit and the draft Interstate, Merrimack, and South Coastal (IMS) watershed permits contain specific requirements for compliance with pathogen TMDLs (in Appendix G). While these permits are still in draft form, MassDOT believes they represent the best available guidance on what EPA believes is appropriate for addressing stormwater discharges to pathogen-impaired waters. Section 2.2.1(c) of the permit states "For any discharge from its MS4 to impaired waters with an approved TMDL, the permittee shall comply with the specific terms of Part 2.1 of this permit. In addition, where an approved TMDL establishes a WLA that applies to its MS4 discharges, the permittee shall implement the specific BMPs and other permit requirements identified in Appendix G to achieve consistency with the WLA." Appendix G references a number of programmatic BMPs that are necessary to address pathogen loading. These cover the following general topics:

- Residential educational program
- Illicit connection identification, tracking and removal
- Pet waste management

Mitigation Plan

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

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

In addition, the structural BMPs that will be considered to reduce the IC will also have the effect of reducing pathogen loads.

MassDOT believes the existing and proposed efforts are consistent with the current and draft MS4 permit's requirements and TMDL recommendations. MassDOT's existing stormwater management plan outlines BMPs that include education and illicit discharge detection and elimination. Although not included in this permit term, MassDOT will be implementing a pet waste management program at its rest stops that have discharges to pathogen impaired waters. In addition, MassDOT has requested coverage under an individual stormwater permit for the next permit term. This permit may contain additional programmatic BMPs to address pathogens.

Conclusions

MassDOT used the IC Method to assess the Matfield River for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. Results indicate that MassDOT should reduce its effective IC within its directly contributing subwatershed by 1.0 acres to achieve the targeted reduction in effective IC. MassDOT evaluated its property within the directly contributing watershed to the Matfield River to identify existing BMPs and found that no BMPs exist to reduce effective IC. This information is summarized in Table 2 below.

Table 2. Effective IC Reductions under Existing & Proposed Conditions

IC in Directly Contributing Watershed	3.8	acres
Target Reduction in Effective IC	1.0	acres
IC Effectively Reduced by Existing BMPs	0.0	acres
IC Remaining to Mitigate with Proposed BMPs	**1.0**	**acres**

MassDOT should reduce its effective IC within the directly contributing watershed by an additional 1.0 acres to achieve the targeted reduction in IC. MassDOT will now work with its design consultants to identify locations suitable for construction of additional BMPs to treat directly contributing IC as part of MassDOT's Impaired Waters Retrofit Initiative. The design consultants will develop construction plans for BMPs that will aim to provide the target IC reduction or treatment to the maximum extent practicable.

Furthermore, MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. MassDOT will also continue to implement non-structural BMPs that reduce the impacts of stormwater.

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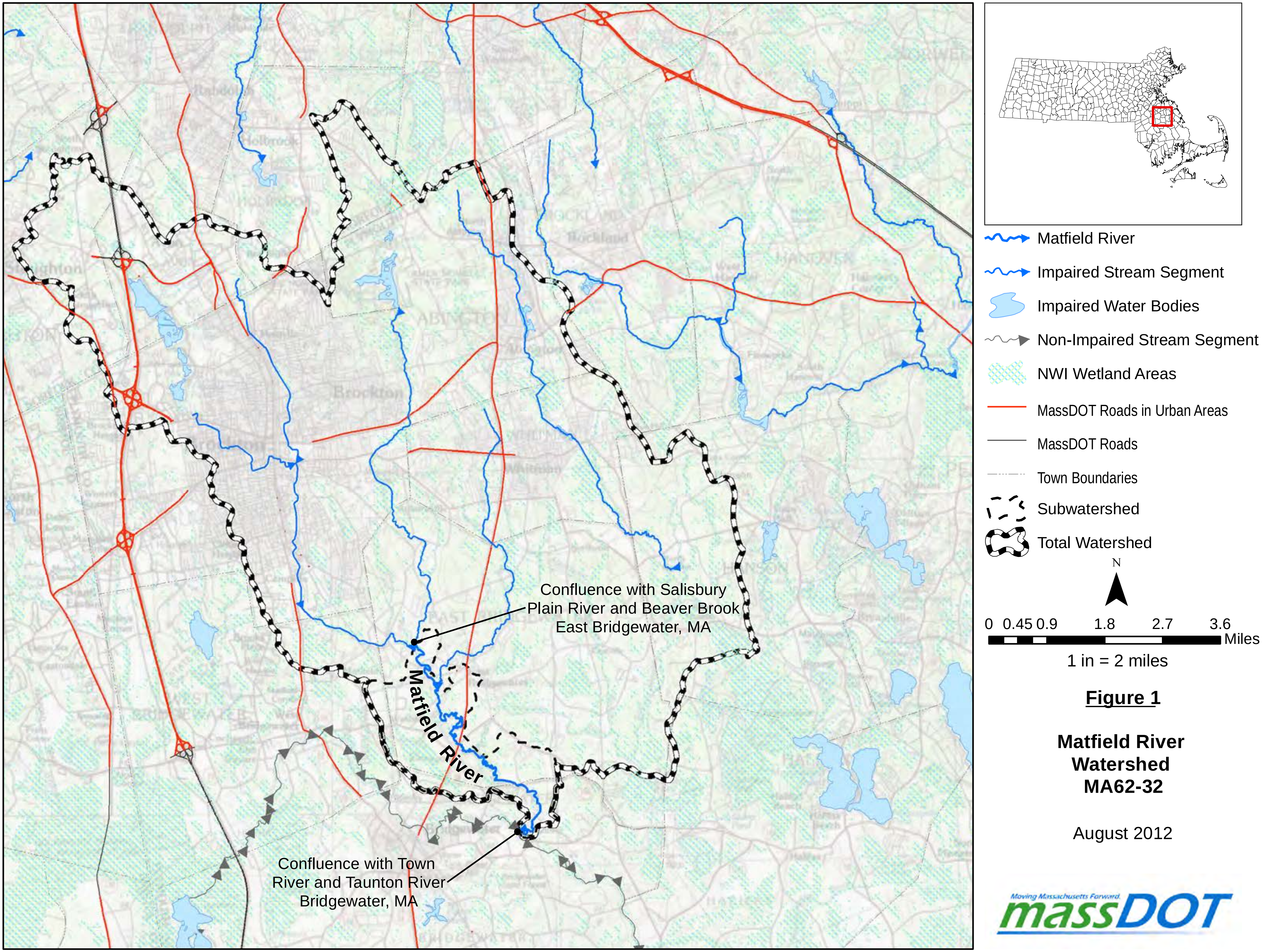

Figure 1

Matfield River Watershed MA62-32

August 2012

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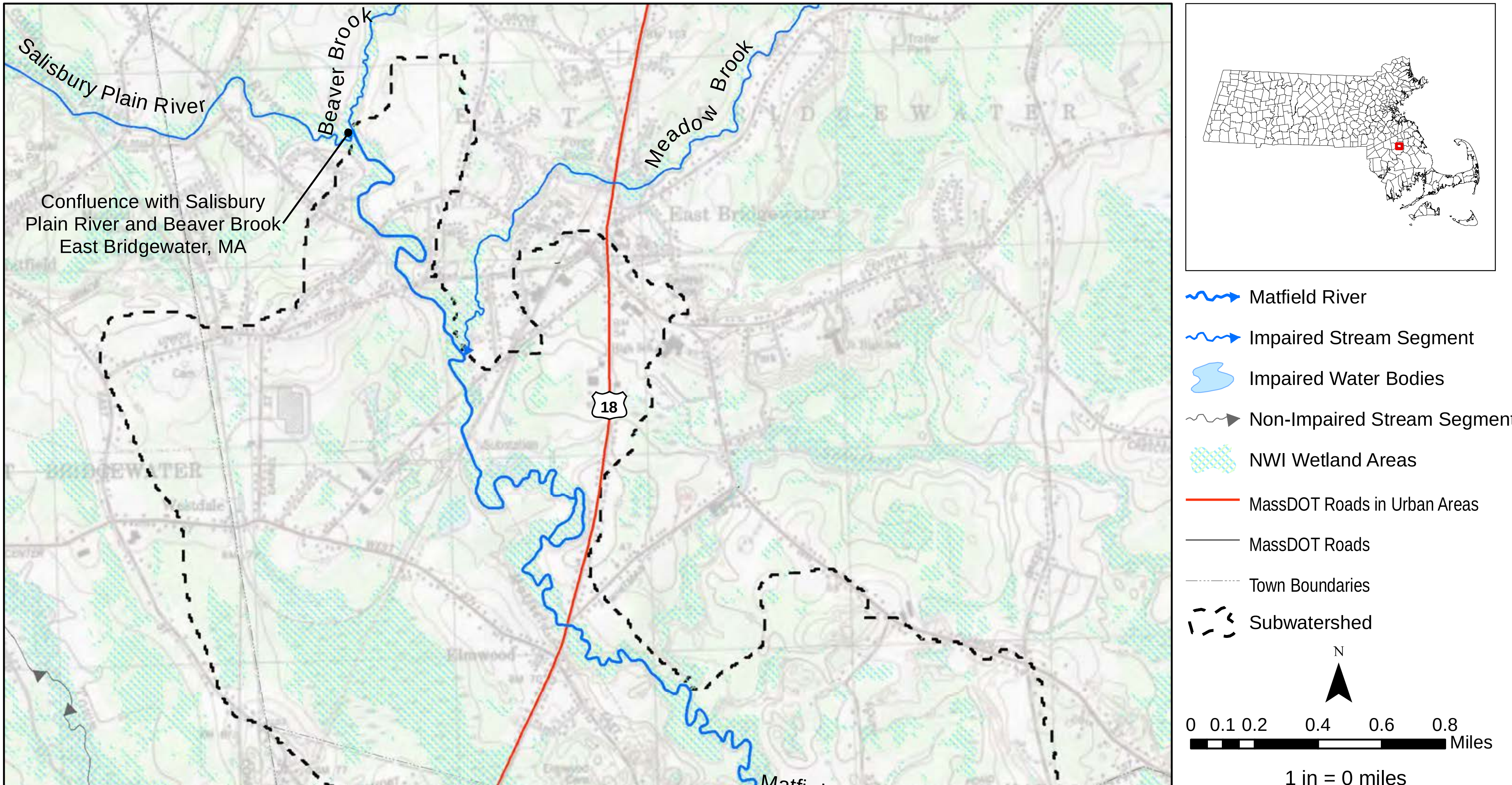

Figure 2

Matfield River Subwatershed MA62-32

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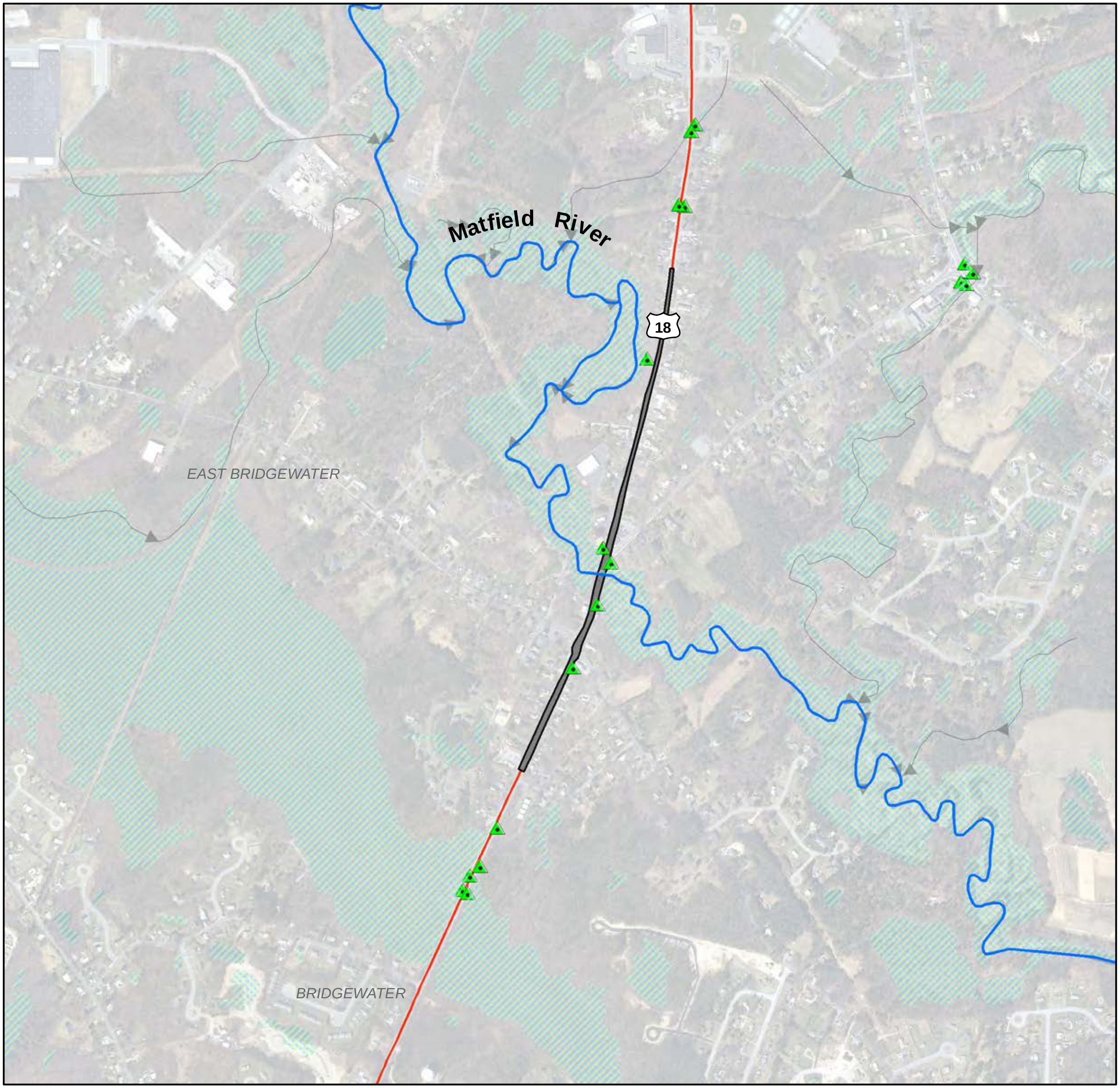

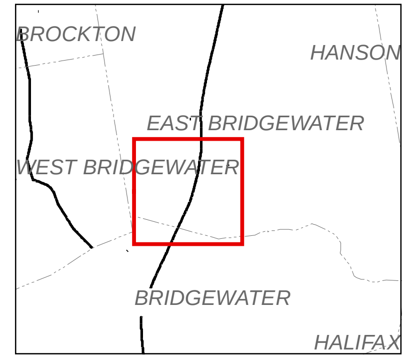

Stormwater Outfalls

Impaired Stream Segment

Impaired Water Bodies

Non-Impaired Stream Segment

NWI Wetland Areas

MassDOT Roads in Urban Areas

MassDOT Roads

Town Boundaries

DOT Directly Contributing Watershed

N

0 255 510 1,020 1,530 2,040 Feet

1 inch = 1,047 feet

<u>Figure 3</u>

Matfield River
MA62-32
Directly Contributing
MassDOT Watershed

August 2012

Moving Massachusetts Forward. massDOT

Impaired Waters Assessment for Shumatuscacant River (MA62-33) – Progress Report

Impaired Water Body

Name: Shumatuscacant River

Location: Abington, Whitman, and Hanson, MA

Water Body ID: MA62-33

Impairments

The Shumatuscacant River (MA62-33) is listed under Category 5, "Waters Requiring a TMDL", on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011a). The Shumatuscacant River is impaired for the following:

- fecal coliform
- dissolved oxygen
- sedimentation/siltation
- (physical substrate habitat alterations*).

Shumatuscacant River is covered by the *Final Pathogen TMDL for the Taunton River Watershed* (MassDEP, 2011b). This TMDL has been added since the original MassDOT impaired waters list (Appendix L-1 list) was developed.

Relevant Water Quality Standards

Water Body Classification: Class B

Applicable State Regulations:

- *314 CMR 4.05 (3)(b) 5 Solids*. These waters shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.
- *314 CMR 4.05 (5) (b) Bottom Pollutants or Alterations*. All surface waters shall be free from pollutants in concentrations or combinations or from alterations that adversely affect the physical or chemical nature of the bottom, interfere with the propagation of fish or shellfish, or adversely affect populations of non-mobile or sessile benthic organisms.
- *CMR 4.05 (3)(b) 1 Dissolved Oxygen*. Shall not be less than 6.0 mg/l in cold water fisheries and not less than 5.0 mg/l in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.
- *314 CMR 4.05 (3)(b) 4 Bacteria*.

- a. At bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: where E. coli is the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml; alternatively, where enterococci are the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies per 100 ml and no single sample taken during the bathing season shall exceed 61 colonies per 100 ml;
- b. For other waters and, during the non bathing season, for waters at bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: the geometric mean of all E. coli samples taken within the most recent six months shall not exceed 126 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies per 100 ml; alternatively, the geometric mean of all enterococci samples taken within the most recent six months shall not exceed 33 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 61 colonies per 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department.

Site Description

The 8.5 mile long Shumatuscacant River begins within a wetland west of Vineyard Road in Abington and flows for 2.5 miles to Island Grove Pond (MA62094). The river continues for 1.8 miles before entering Hobart Pond (MA62090) in Whitman and then merges with Poor Meadow Brook (MA62-34) in Hanson after 3.4 miles, as displayed in **Figure 1**. The 0.5 mile reach of the Shumatuscacant River through Island Grove Pond is classified as impaired for non-native aquatic plants, excess algal growth, and turbidity and the 0.3 mile reach through Hobart Pond is classified as impaired for non-native aquatic plants and turbidity according to the *Massachusetts Year 2010 Integrated List of Waters*. Island Grove Pond and Hobart Pond receive no direct discharges from MassDOT roadways and were included as "no discharge" assessments in the 6/8/2012 submittal to EPA.

MassDOT's property that directly contributes stormwater runoff to the Shumatuscacant River is comprised of approximately 0.66 miles of Bedford Street (Route 18) and is shown in **Figure 2**. Route 18 is a two lane roadway in which stormwater is collected in catch basins along both shoulders. Stormwater is piped to a trunk line extending 0.29 miles north and 0.37 miles south of where the river intersects with Route 18. The trunk line discharges stormwater directly to the Shumatuscacant River at the roadway culvert. Route 123 does not directly contribute stormwater runoff to the Shumatuscacant River. The total watershed and subwatershed are the same for Shumatuscacant River and are shown in **Figure 1**.

Assessment under BMP 7U

Of the impairments listed for the Shumatuscacant River (MA62-33), two are potentially linked to stormwater runoff and have not been addressed by a TMDL. Therefore, MassDOT assessed the impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the following impairments:

- dissolved oxygen
- sedimentation/siltation.

The impairment for fecal coliform has been addressed by the *Final Pathogen TMDL for the Taunton River Watershed* (MassDEP, 2011b). MassDOT has assessed its contribution to the impairment and compliance with the TMDL separately in the section titled "Assessment of Pathogen Impairment."

According to MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*, the impairment of physical substrate habitat alterations is not caused by pollutants (MassDEP, 2011). Therefore, this impairment is not considered further.

The following sections describe the methodology used by MassDOT to assess the impairments potentially linked to stormwater that have not been addressed by a TMDL.

MassDOT's Application of the Impervious Cover Method

MassDOT's Application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I's Impervious Cover Method described in EPA's *Stormwater TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT's program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT's Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body's entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS's impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT's target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT's properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's *Stormwater Best Management Practices (BMP) Performance Analysis* report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for the Shumatuscacant River (MA62-33):

Table 1. Site Parameters for Shumatuscacant River (MA62-33)

Total Watershed and Subwatershed		
Watershed Area	6,845	acres
Impervious Cover (IC) Area	1,250	acres
Percent Impervious	18.3	%
IC Area at 9% Goal	616	acres
Target Reduction % in IC	50.7	%
Reductions Applied to DOT Direct Watershed		
MassDOT's IC Area **Directly** Contributing to Impaired Segment	4.0	acres
MassDOT's Target Reduction in Effective IC (50.7% of DOT Directly Contributing IC)	2.0	acres

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 50.7%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 2.0 acres.

Existing BMPs

There are no existing BMPs in the Shumatuscacant River directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to the Shumatuscacant River.

Mitigation Plan

Because the total mitigation of impervious surface achieved by MassDOT's existing BMPs is less than the target reduction of 2.0 acres, MassDOT will consider the implementation of additional BMPs.

Assessment of Pathogen Impairment

MassDOT assessed the pathogen (fecal coliform) impairment using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. Pathogen concentrations in stormwater vary widely temporally and spatially; concentrations can vary by an order of magnitude within a given storm event at a single location (MassDEP, 2009b). Therefore, it is difficult to predict pathogen concentrations in stormwater with accuracy. Due to this difficulty, MassDOT generally will not conduct site specific assessments of loading at each location impaired for pathogens. Instead these sites will be assessed collectively based on available information on pathogen loading from highways, MassDOT actions, and information available from EPA and DEP. Based on this information

MassDOT developed an approach to be consistent with relevant TMDL and permit condition requirements and an iterative adaptive management approach to stormwater management.

In addition, while there is a positive relationship between IC and pathogen loading, the relationship is not as direct as other impairments. According to the Center for Watershed Protection "…Other studies show that concentrations of bacteria are typically higher in urban areas than rural areas (USGS, 1999), but they are not always directly related to IC (CWP, 2003)." Therefore, DOT did not rely solely on the IC method to assess pathogen impairments. Instead, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

Pathogens in MassDOT Discharge

A study conducted on MassDOT's South East Expressway measured bacterial concentrations in stormwater runoff (Smith, 2002). This study found a geometric mean of 186 fecal coliforms/100 ml. Concentrations of pathogens in stormwater runoff from roadways can vary widely and pathogen concentrations in runoff across the state likely deviate significantly from this stretch of roadway's specific estimate. Event mean concentrations of fecal coliform bacteria in urban stormwater from other sources ranging between 14,000 and 17,000 fecal coliform organisms/100 mL have been reported (MassDEP, 2009b). These data suggest that pathogen loading from highways may be lower than other urban areas.

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

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

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

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

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

Assessment

Pathogen loadings are highly variable and, as a result, quantitative assessments are challenging and of little value. Therefore, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

TMDLs for pathogen impairments in Massachusetts recognize that pathogens are highly variable and difficult to address and emphasize the need for an iterative adaptive management approach to address pathogens. Examples of relevant language from these TMDLs are included below:

- "given the vast potential number of bacteria sources and the difficulty of identifying and removing them from some sources such as stormwater require an iterative process and will take some time to accomplish. While the stated goal in the TMDL is to meet the water quality standard at the point of discharge it also attempts to be clear that MassDEP's expectation is that for stormwater an iterative approach is needed…" (MassDEP, 2009a)
- "The NPDES permit does not, however, establish numeric effluent limitations for stormwater discharges. Maximum extent practicable (MEP) is the statutory standard that establishes the level of pollutant reductions that regulated municipalities must achieve. The MEP standard is a narrative effluent limitation that is satisfied through implementation of SWMPs and achievement of measurable goals."(MassDEP, 2009b)
- "Although the TMDL presents quantified WLAs for stormwater that are set equivalent to the criteria in the Massachusetts Water Quality Standards, the Phase II NPDES permits will not include numeric effluent limitations. Phase II permits are intended to be BMP based permits that will require communities to develop and implement comprehensive stormwater management programs involving the use of BMPs. Massachusetts and EPA believe that BMP based Phase II permits involving comprehensive stormwater management together with specific emphasis on pollutants contributing to existing water quality problems can be consistent with the intent of the quantitative WLAs for stormwater discharges in TMDLs." (MassDEP, no date).

This language clearly indicates that an iterative adaptive management approach is the appropriate way to address discharges to pathogen impaired waters. The recommendations in pathogen TMDLs for waters in Massachusetts generally require development and implementation of stormwater management programs, illicit discharge detection and elimination efforts, and in some cases installing BMPs to the maximum extent practicable

The draft North Coastal Watershed General MS4 permit and the draft Interstate, Merrimack, and South Coastal (IMS) watershed permits contain specific requirements for compliance with pathogen TMDLs (in Appendix G). While these permits are still in draft form, MassDOT believes they represent the best available guidance on what EPA believes is appropriate for addressing stormwater discharges to pathogen-impaired waters. Section 2.2.1(c) of the permit states "For any discharge from its MS4 to impaired waters with an approved TMDL, the permittee shall comply with the specific terms of Part 2.1 of this permit. In addition, where an approved TMDL establishes a WLA that applies to its MS4 discharges, the permittee shall implement the specific BMPs and other permit requirements identified in Appendix G to achieve consistency with the WLA." Appendix G references a number of programmatic BMPs that are necessary to address pathogen loading. These cover the following general topics:

- Residential educational program
- Illicit connection identification, tracking and removal
- Pet waste management

Mitigation Plan

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

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

In addition, the structural BMPs that will be considered to reduce the IC will also have the effect of reducing pathogen loads.

MassDOT believes the existing and proposed efforts are consistent with the current and draft MS4 permit's requirements and TMDL recommendations. MassDOT's existing stormwater management plan outlines BMPs that include education and illicit discharge detection and elimination. Although not included in this permit term, MassDOT will be implementing a pet waste management program at its rest stops that have discharges to pathogen impaired waters. In addition, MassDOT has requested coverage under an individual stormwater permit for the next permit term. This permit may contain additional programmatic BMPs to address pathogens.

Conclusions

MassDOT used the IC Method to assess the Shumatuscacant River for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. Results indicate that MassDOT should reduce its effective IC within its directly contributing subwatershed by 2.2 acres to achieve the targeted reduction in effective IC. MassDOT evaluated its property within the directly contributing watershed to the Shumatuscacant River to identify existing BMPs and found that no BMPs exist to reduce effective IC. This information is summarized in Table 2 below.

Table 2. Effective IC Reductions under Existing & Proposed Conditions

IC in Directly Contributing Watershed	4.0	acres
Target Reduction in Effective IC	2.0	acres
IC Effectively Reduced by Existing BMPs	0.0	acres
IC Remaining to Mitigate with Proposed BMPs	**2.0**	**acres**

MassDOT should reduce its effective IC within the directly contributing watershed by an additional 2.0 acres to achieve the targeted reduction in IC. MassDOT will now work with its design consultants to identify locations suitable for construction of additional BMPs to treat directly contributing IC as part of MassDOT's Impaired Waters Retrofit Initiative. The design consultants will develop construction plans for BMPs that will aim to provide the target IC reduction or treatment to the maximum extent practicable.

The area where the Shumatuscacant River intersects Route 18 currently contains an area used to prevent erosion from stormwater at the two outfalls (**Photo 1**). This area has the potential to be used for a BMP, as displayed in **Photos 2-3.** The photos show the well vegetated area between the two stormwater outfalls and the Shumatuscacant River flow path.

Photo 1. Stormwater outfall near Shumatuscacant River (MA62-33)

Photo 2. First potential site for BMP near Shumatuscacant River (MA62-33)

Photo 3. Second Potential site for BMP near Shumatuscacant River (MA62-33)

Furthermore, MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. Furthermore, MassDOT will continue to implement non-structural BMPs that reduce the impacts of stormwater.

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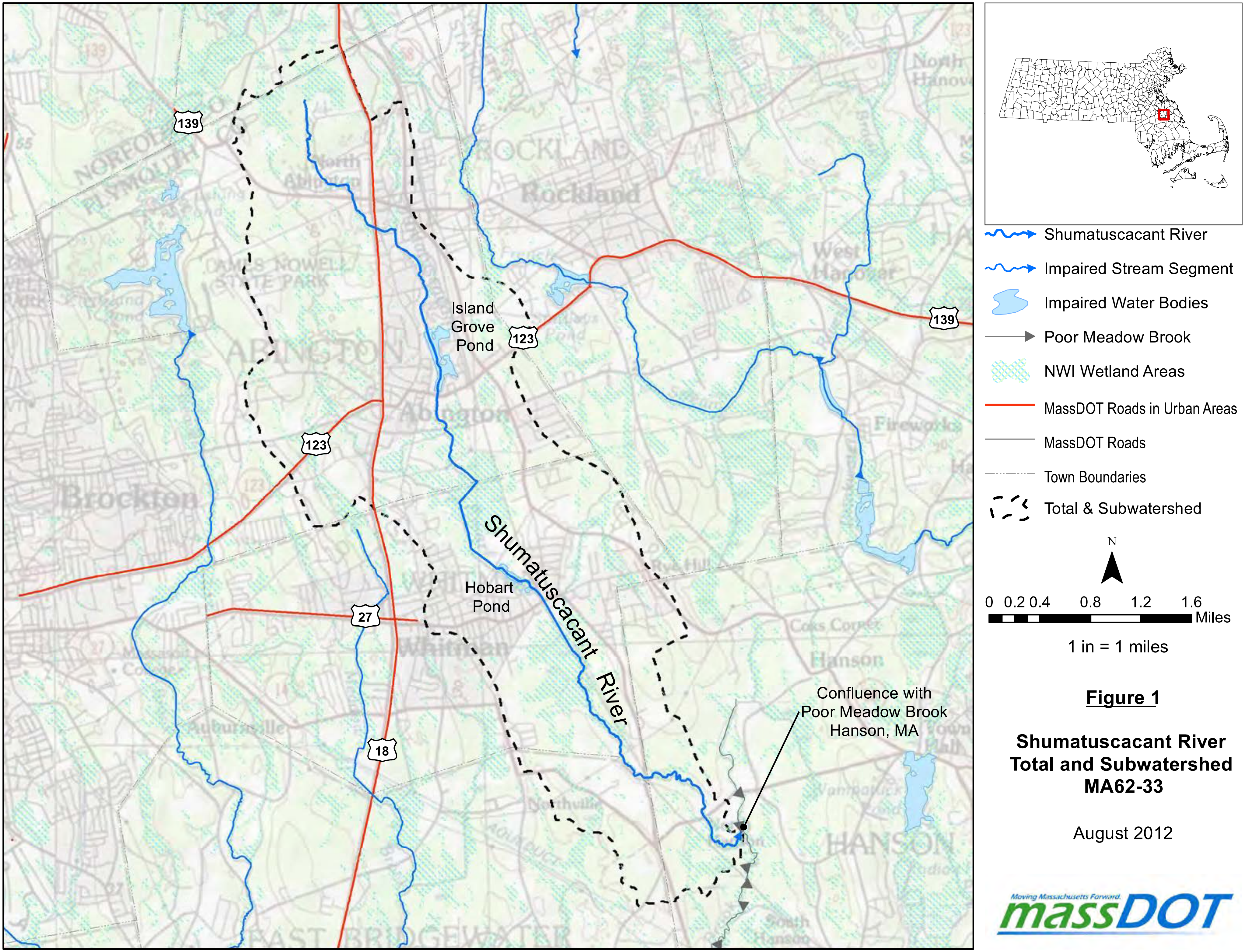

Figure 1

Shumatuscacant River Total and Subwatershed MA62-33

August 2012

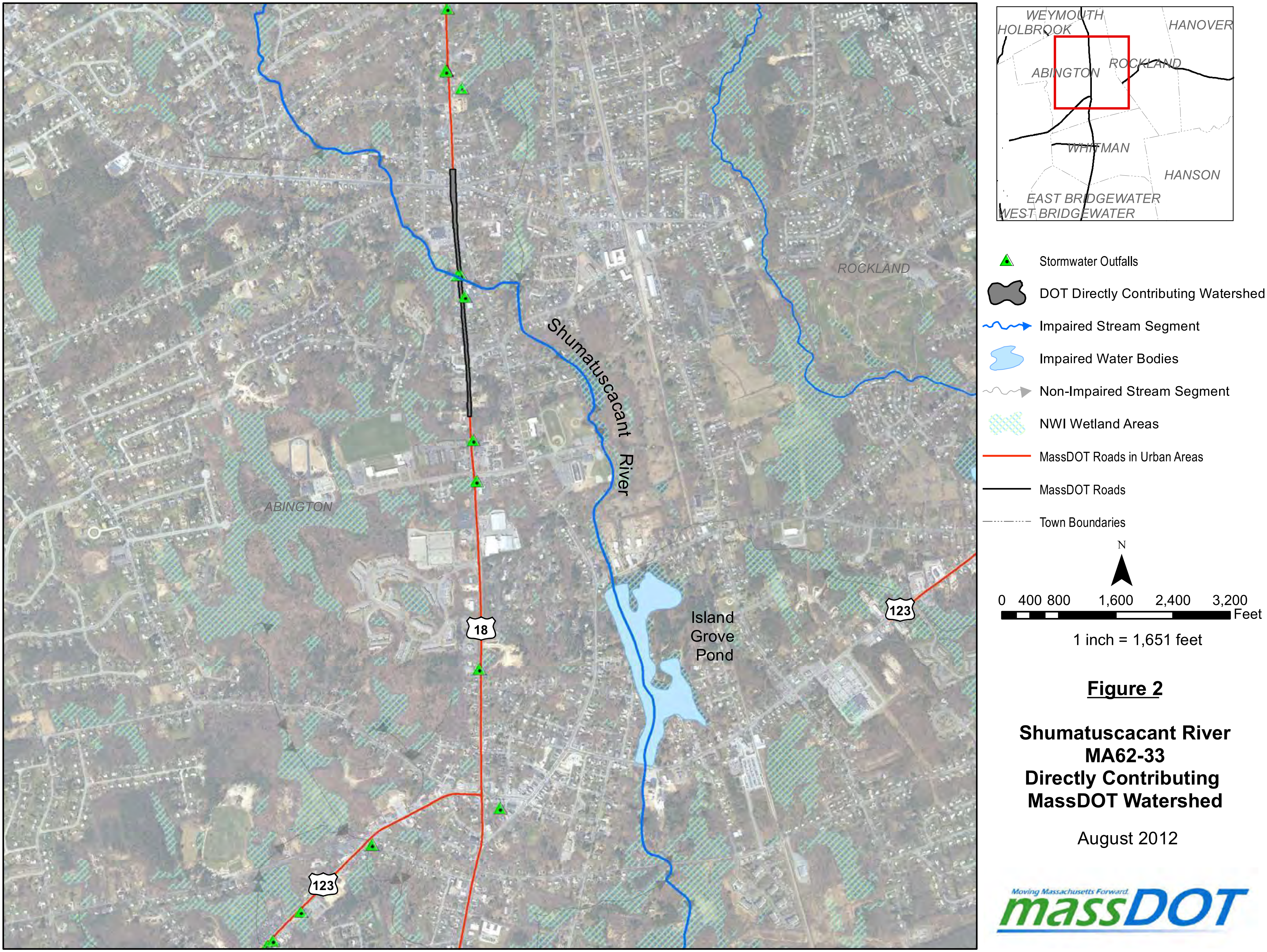

Figure 2

Shumatuscacant River
MA62-33
Directly Contributing
MassDOT Watershed

August 2012

Moving Massachusetts Forward.
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Impaired Waters Assessment for Miles River (MA92-03) – Progress Report

Impaired Waterbody

Name: Miles River

Location: Beverly, Wenham, Hamilton, and Ipswich, MA

Water Body ID: MA92-03

Impairments

The Miles River (MA92-03) is listed under Category 5, "Waters Requiring a TMDL", on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. The Miles River is impaired for the following:

- aquatic macroinvertebrate bioassessments
- dissolved oxygen
- fecal coliform.

According to MassDEP's *Ipswich River Watershed 2000 Water Quality Assessment Report* (MassDEP, 2004), Miles River is impaired for benthic macroinvertebrate bioassessment and the suspected causes are DO, nutrient enrichment, and low flow alterations. The report also suspects flow alterations from water diversions, golf courses, and grazing in riparian zone affect the water body, but it is unclear what the impacts are on the Miles River. The *Draft Pathogen TMDL for the Ipswich River Watershed* (MassDEP, no date) documents bacteria concentrations between 20 – 740 cfu/100mL in samples taken from the Miles River.

Relevant Water Quality Standards

Water Body Classification: Class B

Applicable State Regulations:

- *314 CMR 4.05 (3)(b) 5 Solids*. These waters shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.

- *CMR 4.05 (3)(b) Dissolved Oxygen*. Shall not be less than 6.0 mg/l in cold water fisheries and not less than 5.0 mg/l in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.

- *314 CMR 4.05 (5) (a) Aesthetics*. All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.

- *314 CMR 4.05 (5) (b) Bottom Pollutants or Alterations*. All surface waters shall be free from pollutants in concentrations or combinations or from alterations that adversely affect the physical or chemical nature of the bottom, interfere with the propagation of fish or shellfish, or adversely affect populations of non-mobile or sessile benthic organisms.

- *314 CMR 4.05 (5)(c) Nutrients*. Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.
- *314 CMR 4.05 (5)(e) Toxic Pollutants*. All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife. For pollutants not otherwise listed in 314 CMR 4.00, the National Recommended Water Quality Criteria: 2002, EPA 822R-02-047, November 2002 published by EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act, are the allowable receiving water concentrations for the affected waters, unless the Department either establishes a site specific criterion or determines that naturally occurring background concentrations are higher. Where the Department determines that naturally occurring background concentrations are higher, those concentrations shall be the allowable receiving water concentrations. The Department shall use the water quality criteria for the protection of aquatic life expressed in terms of the dissolved fraction of metals when EPA's 304(a) recommended criteria provide for use of the dissolved fraction. The EPA recommended criteria based on total recoverable metals shall be converted to dissolved metals using EPA's published conversion factors. Permit limits will be written in terms of total recoverable metals. Translation from dissolved metals criteria to total recoverable metals permit limits will be based on EPA's conversion factors or other methods approved by the Department. The Department may establish site specific criteria for toxic pollutants based on site specific considerations.
- *314 CMR 4.05 (3)(b) 2 Temperature.* a. Shall not exceed 68°F (20°C) based on the mean of the daily maximum temperature over a seven day period in cold water fisheries, unless naturally occurring. Where a reproducing cold water aquatic community exists at a naturally occurring higher temperature, the temperature necessary to protect the community shall not be exceeded and the natural daily and seasonal temperature fluctuations necessary to protect the community shall be maintained. Temperature shall not exceed 83°F (28.3°C) in warm water fisheries. The rise in temperature due to a discharge shall not exceed 3°F (1.7°0C) in rivers and streams designated as cold water fisheries nor 5°F (2.8°C) in rivers and streams designated as warm water fisheries (based on the minimum expected flow for the month); in lakes and ponds the rise shall not exceed 3°F (1.7°0C) in the epilimnion (based on the monthly average of maximum daily temperature); b. natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained. There shall be no changes from natural background conditions that would impair any use assigned to this Class, including those conditions necessary to protect normal species diversity, successful migration, reproductive functions or growth of aquatic organisms.

- *314 CMR 4.05 (3)(b) 3 pH*. Shall be in the range of 6.5 through 8.3 standard units but not more than 0.5 units outside of the natural background range. There shall be no change from natural background conditions that would impair any use assigned to this Class.
- *314 CMR 4.05 (3)(b) Bacteria*.
    - a. At bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: where E. coli is the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml; alternatively, where enterococci are the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies per 100 ml and no single sample taken during the bathing season shall exceed 61 colonies per 100 ml;
    - b. For other waters and, during the non bathing season, for waters at bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: the geometric mean of all E. coli samples taken within the most recent six months shall not exceed 126 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies per 100 ml; alternatively, the geometric mean of all enterococci samples taken within the most recent six months shall not exceed 33 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 61 colonies per 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department.

Site Description

The Miles River (MA92-03) flows for 8.9 miles from the outlet of Longham Reservoir in Beverly to the confluence with the Ipswich River in Ipswich. The impaired stream segment Long Causeway Brook (MA92-20) flows into Miles River at the Ipswich/Hamilton townline. As displayed in **Figure 1**, the Miles River total and subwatershed are the same.

AECOM performed a field assessment of the Miles River subwatershed on September 6, 2012. The focus of the field assessment was on the MassDOT-owned urban road sections that directly discharge stormwater runoff to the impaired water body.

At the crossing of Route 1A (County Road) with Long Causeway Brook stormwater runoff from Route 1A discharges directly into the tributary. This section of Long Causeway Brook is a Category 3 stream based on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* and is approximately 1,300 ft from the Miles River. According to field observation, the stream has a narrow cross section with wide floodplain/wetlands area outside channel banks; therefore since runoff from this road discharges to the tributary, this road section was not characterized to discharge direct stormwater runoff to Miles River.

MassDOT's property that directly contributes stormwater runoff to the Miles River is comprised of approximately 1.57 acres of Route 1A and is shown in **Figure 2**. The directly contributing roadway is near where the Miles River culvert under Route 1A is located. The two-lane Route 1A bridge is about 24 feet wide with a 45-feet wide right-of-way. Based on field observation, stormwater runoff from the road is captured by catch basins and subsequently discharged into the Miles River. Because road curbing only exists along the west side of Route 1A, some of the stormwater runoff can bypass the catch basins and flow overland before entering Miles River.

Southwest of the bridge and south of the Miles River there is a two-lane road/drive way that is separated from Route 1A by a grassy area. A drop inlet in the middle of the grassy area appears to capture runoff from the unnamed road and is piped to Miles River. Research of the MassHighway Layout Plans database reveals that the road was once the approach section to the County Road bridge over Miles River before Route 1A was realigned to its current bridge crossing location in the 1950s. Further communication with MassDOT confirms that MassDOT owns both the grassy area and the no-name road.

Based on field observations on September 6, 2012, there is opportunity to install an infiltration BMP adjacent to Route 1A Bridge over Miles River that would treat a portion of the MassDOT directly contributing watershed. The location of the potential BMP is shown in **Figure 3**. There is space within a grassy land area to retain and treat some of the direct runoff from Route 1A roadway. An infiltration basin could be designed to treat runoff for the reduction target of 0.2 acres of impervious road surfaces owned by MassDOT. The existing drop inlet and the connecting pipe could be retrofitted to form the overflow control structure for the infiltration BMP. The feasibility of a BMP at this location should be investigated as well as final verification of the land ownership and potential conflict with the fire hydrant/water line.

Assessment under BMP 7U

None of the following impairments for the Miles River have been addressed by a final TMDL. Therefore, MassDOT assessed the impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the following impairments:

- aquatic macroinvertebrate bioassessments
- dissolved oxygen.

The impairment for fecal coliform is assessed separately in the section titled Assessment of Pathogen Impairment.

MassDOT's Application of the Impervious Cover Method

MassDOT's Application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I's Impervious Cover Method described in EPA's *Stormwater TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT's program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT's Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body's entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS's impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT's target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT's properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's *Stormwater Best Management Practices (BMP) Performance Analysis* report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for the Miles River (MA92-03):

Table 1. Site Parameters for Miles River (MA92-03)

Total Watershed and Subwatershed		
Watershed Area	10,963	acres
Impervious Cover (IC) Area	1,106	acres
Percent Impervious	10.1	%
IC Area at 9% Goal	986	acres
Target Reduction % in IC	10.8	%
Reductions Applied to DOT Direct Watershed		
MassDOT's IC Area **Directly** Contributing to Impaired Segment	1.6	acres
MassDOT's Target Reduction in Effective IC (10.8% of DOT Directly Contributing IC)	0.2	acres

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 10.8%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 0.2 acres.

Existing BMPs

There are no existing BMPs in the Miles River directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to the Miles River.

Mitigation Plan

Because the total mitigation of impervious surface achieved by MassDOT's existing BMPs is less than the target reduction of 0.2 acres, MassDOT will consider the implementation of additional BMPs.

Assessment of Pathogen Impairment

MassDOT assessed the pathogen (fecal coliform) impairment using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. Pathogen concentrations in stormwater vary widely temporally and spatially; concentrations can vary by an order of magnitude within a given storm event at a single location (MassDEP, 2009b). Therefore, it is difficult to predict pathogen concentrations in stormwater with accuracy. Due to this difficulty, MassDOT generally will not conduct site specific assessments of loading at each location impaired for pathogens. Instead these sites will be assessed collectively based on available information on pathogen loading from highways, MassDOT actions, and information available from EPA and DEP. Based on this information MassDOT developed an approach to be consistent with relevant TMDL and permit condition requirements and an iterative adaptive management approach to stormwater management.

In addition, while there is a positive relationship between IC and pathogen loading, the relationship is not as direct as other impairments. According to the Center for Watershed Protection "…Other studies show that concentrations of bacteria are typically higher in urban areas than rural areas (USGS, 1999), but they are not always directly related to IC (CWP, 2003)." Therefore, DOT did not rely solely on the IC method to assess pathogen impairments. Instead, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

Pathogens in MassDOT Discharge

A study conducted on MassDOT's South East Expressway measured bacterial concentrations in stormwater runoff (Smith, 2002). This study found a geometric mean of 186 fecal coliforms/100 ml. Concentrations of pathogens in stormwater runoff from roadways can vary widely and pathogen concentrations in runoff across the state likely deviate significantly from this stretch of roadway's specific estimate. Event mean concentrations of fecal coliform bacteria in urban stormwater from other sources ranging between 14,000 and 17,000 fecal coliform organisms/100 mL have been reported (MassDEP, 2009b). These data suggest that pathogen loading from highways may be lower than other urban areas.

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

- Illicit discharges: Due to the typical setback of highways from residential and commercial developments and the stand alone nature of the drainage system, the potential for illicit discharges (e.g. sewer connections, laundry tie-ins) is much lower than in other stormwater systems. This has been confirmed by MassDOT's illicit discharge detection on many miles of urban roadways within a broad range of areas across Massachusetts. After assessment of almost 140 miles, and investigation of more than 2,500 stormwater features, MassDOT's consultant performing the broad scope reviews has found no confirmed illicit discharges.

- Limited Sewer Utilities in Road Right of Ways: Since DOT does not provide sewer services, many MassDOT roads do not have sewer utilities within the road's right of way; thereby eliminating the chance of cross-connections or leaking pipes as a source of pathogens into the stormwater system.
- Pet waste: Pets are only present on highways in rare instances. In urban residential areas pets and their associated waste are much more common. MassDOT is aware that pet waste at road side rest stops may represent a potential source of pathogens to stormwater in certain situations.
- Wildlife: Highways are not generally an attractive place for wildlife. Wildlife generally avoids highways and only occasionally crosses them.

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

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

Assessment

Pathogen loadings are highly variable and, as a result, quantitative assessments are challenging and of little value. Therefore, MassDOT reviewed its existing programs and their consistency with EPA NPDES MS4 general permit requirements and Pathogen TMDL recommendations.

TMDLs for pathogen impairments in Massachusetts recognize that pathogens are highly variable and difficult to address and emphasize the need for an iterative adaptive management approach to address pathogens. Examples of relevant language from these TMDLs are included below:

- "given the vast potential number of bacteria sources and the difficulty of identifying and removing them from some sources such as stormwater require an iterative process and will take some time to accomplish. While the stated goal in the TMDL is to meet the water quality standard at the point of discharge it also attempts to be clear that MassDEP's expectation is that for stormwater an iterative approach is needed…" (MassDEP, 2009a)
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This language clearly indicates that an iterative adaptive management approach is the appropriate way to address discharges to pathogen impaired waters. The recommendations in pathogen TMDLs for waters in Massachusetts generally require development and implementation of stormwater management programs, illicit discharge detection and elimination efforts, and in some cases installing BMPs to the maximum extent practicable.

The draft North Coastal Watershed General MS4 permit and the draft Interstate, Merrimack, and South Coastal (IMS) watershed permits contain specific requirements for compliance with pathogen TMDLs (in Appendix G). While these permits are still in draft form, MassDOT believes they represent the best available guidance on what EPA believes is appropriate for addressing stormwater discharges to pathogen-impaired waters. Section 2.2.1(c) of the permit states "For any discharge from its MS4 to impaired waters with an approved TMDL, the permittee shall comply with the specific terms of Part 2.1 of this permit. In addition, where an approved TMDL establishes a WLA that applies to its MS4 discharges, the permittee shall implement the specific BMPs and other permit requirements identified in Appendix G to achieve consistency with the WLA." Appendix G references a number of programmatic BMPs that are necessary to address pathogen loading. These cover the following general topics:

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- Illicit connection identification, tracking and removal
- Pet waste management

Mitigation Plan

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

- BMP 3C-1: Drainage Connection Policy
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- BMP 6A-1: Source Control – 511 Program
- BMP 6A-2: Source Control – Adopt-A-Highway Program
- BMP 6C-1: Maintenance Program

In addition, the structural BMPs that will be considered to reduce the IC will also have the effect of reducing pathogen loads.

MassDOT believes the existing and proposed efforts are consistent with the current and draft MS4 permit's requirements and TMDL recommendations. MassDOT's existing stormwater management plan outlines BMPs that include education and illicit discharge detection and elimination. Although not included in this permit term, MassDOT will be implementing a pet waste management program at its rest stops that have discharges to pathogen impaired waters. In addition, MassDOT has requested coverage under an individual stormwater permit for the next permit term. This permit may contain additional programmatic BMPs to address pathogens.

Conclusions

MassDOT used the IC Method to assess the Miles River for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. Results indicate that MassDOT should reduce its effective IC within its directly contributing subwatershed by 0.2 acres to achieve the targeted reduction in effective IC. MassDOT evaluated its property within the directly contributing watershed to the Miles River to identify existing BMPs and found that no BMPs exist to reduce effective IC. This information is summarized in Table 2 below.

Table 2. Effective IC Reductions under Existing & Proposed Conditions

IC in Directly Contributing Watershed	1.6	acres
Target Reduction in Effective IC	0.2	acres
IC Effectively Reduced by Existing BMPs	0.0	acres
IC Remaining to Mitigate with Proposed BMPs	**0.2**	**acres**

MassDOT should reduce its effective IC within the directly contributing watershed by an additional 0.2 acres to achieve the targeted reduction in IC. MassDOT will now work with its design consultants to identify locations suitable for construction of additional BMPs to treat directly contributing IC as part of MassDOT's Impaired Waters Retrofit Initiative. The design consultants will develop construction plans for BMPs that will aim to provide the target IC reduction or treatment to the maximum extent practicable.

The grassy area adjacent to the Route 1A Bridge over Miles River is a potential location to implement an infiltration BMP. This area should be investigated further for feasibility.

Furthermore, MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. Furthermore, MassDOT will continue to implement non-structural BMPs that reduce the impacts of stormwater.

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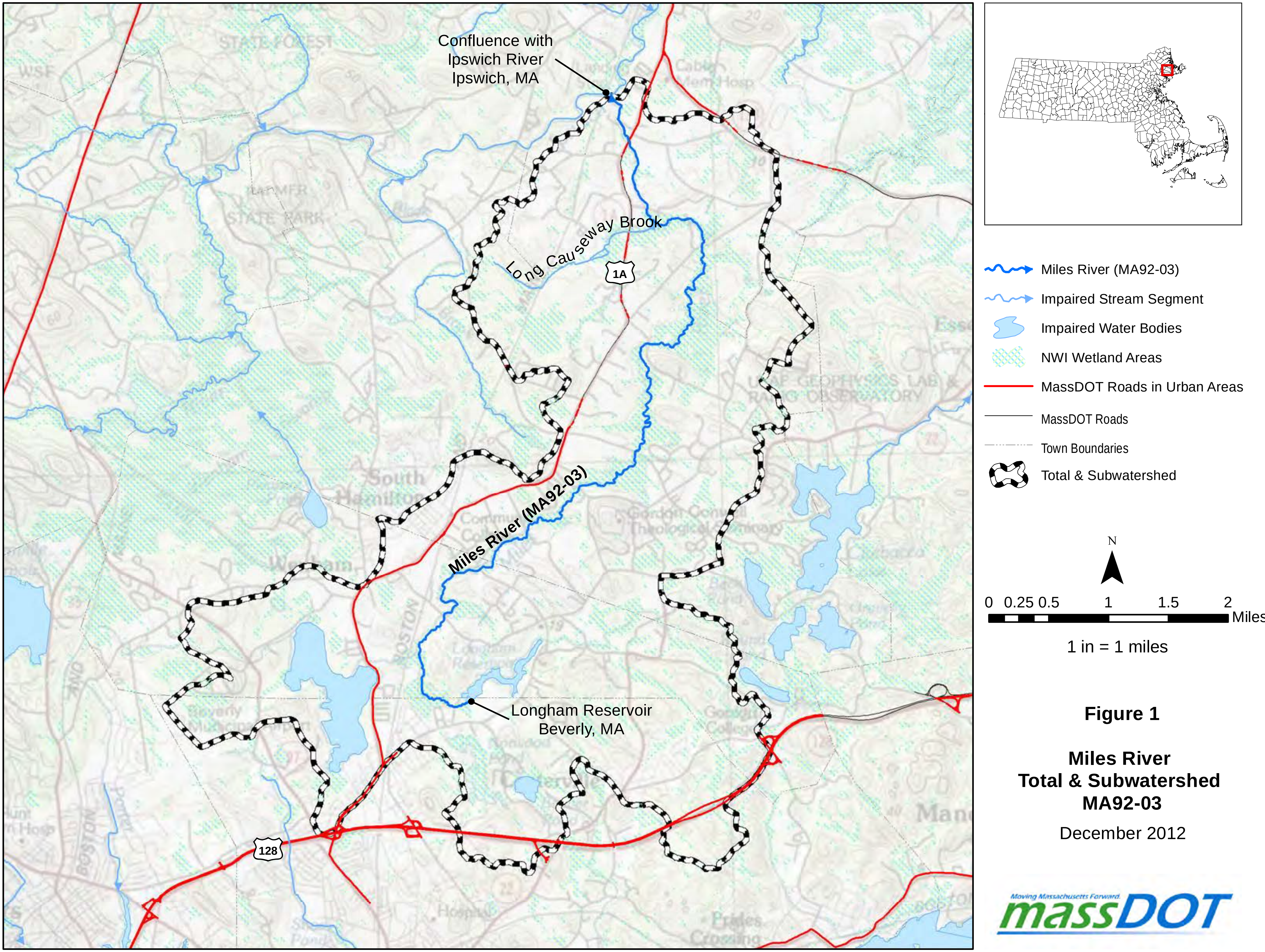

Figure 1

Miles River
Total & Subwatershed
MA92-03

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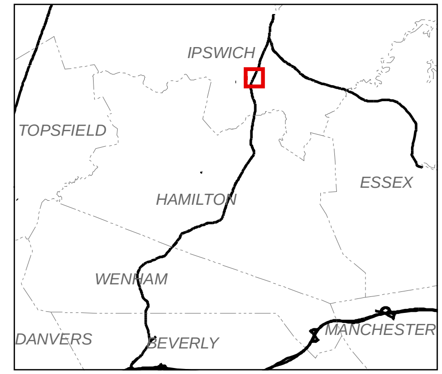

Stormwater Outfalls

Impaired Stream Segment

Impaired Water Bodies

Non-Impaired Stream Segment

NWI Wetland Areas

Directly Contributing Watershed

MassDOT Roads in Urban Areas

MassDOT Roads

Town Boundaries

N

0 50 100 200 300 400 Feet

1 inch = 220 feet

Figure 2

Miles River (MA92-03)
Directly Contributing
MassDOT Watershed

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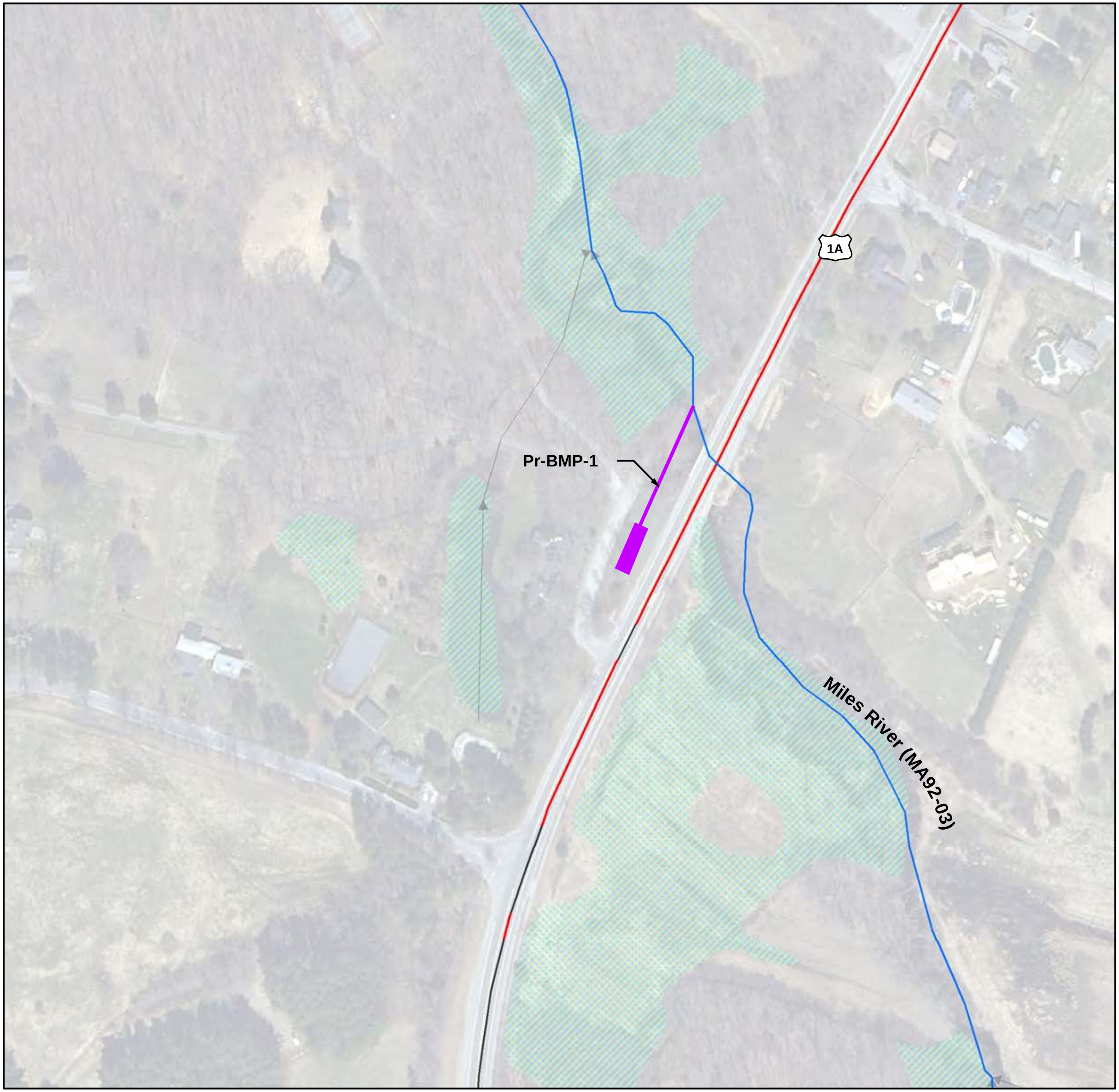

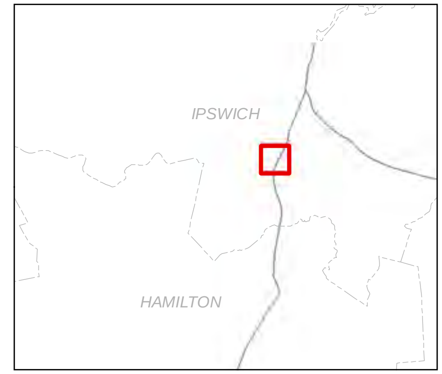

- Proposed BMP - Pipe
- Proposed BMP - Basin
- Miles River (MA92-03)
- Impaired Stream Segment
- Impaired Water Bodies
- Non-Impaired Stream Segment
- NWI Wetland Areas
- MassDOT Roads in Urban Area
- MassDOT Roads
- Town Boundaries

N

0 62.5 125 250 375 Feet

1 in = 200 feet

Figure 3

Miles River (MA92-03)
Proposed BMP

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Impaired Waters Assessment for Ipswich River (MA92-06) – Progress Report

Impaired Waterbody

Name: Ipswich River

Location: Wilmington, Reading, North Reading, Lynnfield, Middleton, Peabody, Danvers, Boxford and Topsfield, MA

Water Body ID: MA92-06

Impairments

The Ipswich River (MA92-06) is listed under Category 5, "Waters Requiring a TMDL", on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. The Ipswich River is impaired for the following:

- Mercury in Fish Tissue
- Dissolved Oxygen
- (Low flow alterations*).

Relevant Water Quality Standards

Water Body Classification: Class B

Applicable State Regulations:

- *314 CMR 4.05 (5)(e) Toxic Pollutants*. All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife. For pollutants not otherwise listed in 314 CMR 4.00, the National Recommended Water Quality Criteria: 2002, EPA 822R-02-047, November 2002 published by EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act, are the allowable receiving water concentrations for the affected waters, unless the Department either establishes a site specific criterion or determines that naturally occurring background concentrations are higher. Where the Department determines that naturally occurring background concentrations are higher, those concentrations shall be the allowable receiving water concentrations. The Department shall use the water quality criteria for the protection of aquatic life expressed in terms of the dissolved fraction of metals when EPA's 304(a) recommended criteria provide for use of the dissolved fraction. The EPA recommended criteria based on total recoverable metals shall be converted to dissolved metals using EPA's published conversion factors. Permit limits will be written in terms of total recoverable metals. Translation from dissolved metals criteria to total recoverable metals permit limits will be based on EPA's conversion factors or other methods approved by the Department. The Department may establish site specific criteria for toxic pollutants based on site specific considerations.

- *314 CMR 4.05 (3)(b) 1 Dissolved Oxygen*. Shall not be less than 6.0 mg/l in cold water fisheries and not less than 5.0 mg/l in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.

Site Description

Segment MA92-06 of the Ipswich River is 20.4 miles long and crosses through the towns of Wilmington, Reading, North Reading, Lynnfield, Middleton, Peabody, Danvers, Boxford, and Topsfield.

Based on a preliminary desktop analysis, the total watershed to Segment MA92-06 is approximately 64,304 acres in size, and the subwatershed (discharging directly to this segment) is approximately 19,662 acres in size. The total watershed is shown in Figure 1 and the subwatershed is shown in Figure 2. MassDOT roadways within the subwatershed include I-93 (including entry/exit ramps and portions of Concord Street and Rt. 129 where they cross I-93), Rt. 28, Washington Street Bridge in North Reading, Rt. 114, Rt. 62 near where it crosses Rt. 1, Rt. 1 (including entry/exit ramps for I-95), I-95 (including entry/exit ramps for Rt. 1) and High Street Bridge in Topsfield. According to the 2000 United States Census, the majority of MassDOT's roadways within the Segment MA92-06 subwatershed are considered urban except for a portion of I-95 in Middleton, Topsfield, and Boxford, and a portion Rt. 1 in Topsfield. Based on the 2010 United States Census, however, all of the MassDOT-owned roadways in the subwatershed to Segment MA92-06 are within urban areas. AECOM will use the 2010 data for further analysis of this watershed, and as such all of the roadways within the subwatershed to Segment MA92-06 will be considered urban and included in this assessment.

MassDOT's property that directly contributes stormwater runoff to Segment MA92-06 of the Ipswich River is comprised of I-93, Route 28, the Washington Street bridge, Route 114, Route 1, I-95 and the High Street bridge. The drainage along each roadway is briefly described below. The directly contributing MassDOT IC area is shown in Figures 3 through 8.

I-93

AECOM recently submitted a memorandum to MassDOT outlining recommendations for stormwater improvements to be performed during an upcoming FY13 resurfacing project planned for I-93. As part of this memorandum, AECOM identified one existing BMP treating runoff from MassDOT's impervious area and identified locations for five additional BMPs to treat runoff from MassDOT's impervious road. Although these BMPs mostly treat indirect discharges to Segment MA92-06 of the Ipswich River, one of the proposed BMPs has the potential to provide treatment for up to 1.12 acres of effective IC within MassDOT's directly contributing watershed. Once design and permitting is complete, treatment provided by proposed BMPs will be considered in AECOM's final assessment of Segment MA92-06.

Rt. 28

Rt. 28 is a 44-foot wide, four lane secondary roadway with a 55-foot right-of-way. Sidewalks line the shoulder of the southbound travel lane and a portion of the shoulder of the northbound travel lane. The roadway spans the towns of Reading and North Reading and crosses over Segment MA92-06 of the Ipswich River at the boundary between the two towns. AECOM observed one direct discharge to the river from MassDOT's stormwater system along this portion of the roadway consisting of one 24-inch concrete pipe integrated into a stone rubble masonry headwall draining approximately 2.2 acres of roadway. Rt. 28 is bounded by residential and commercial properties within the subwatershed to Segment MA92-06, and no space is available within MassDOT's right-of-way for the construction of treatment BMPs.

Washington Street Bridge

The Washington Street Bridge in North Reading consists of a 28-foot wide two lane roadway with a 36-foot right-of-way. The bridge is approximately 45 feet in length and contributes storm water directly to the Ipswich River. Residential properties border the roadway immediately to the north of the bridge and wetlands border the roadway immediately to the south of the bridge. Also, MassDOT does not own the roadway on either side of the bridge. Due to these space constraints, it is not feasible to install treatment BMPs for this portion of MassDOT's directly contributing impervious cover.

Rt. 114

Rt. 114 varies from a 36-foot wide two-lane road with a center turning lane to a 66-foot wide four lane road with a center turning lane. Sidewalks line a small stretch of the roadway, and MassDOT's right-of-way is 55 feet. Rt. 114 spans the towns of Danvers and Middleton and crosses over Segment MA92-06 of the Ipswich at the boundary between the two towns. AECOM observed no piped discharges to the river in this location; however, topography suggests that runoff from approximately 7.9 acres of roadway enters the river directly via overland flow. Rt. 114 is bounded by residential and commercial properties within the subwatershed to Segment MA92-06, and no space is available within MassDOT's right-of-way for the construction of treatment BMPs.

Rt. 62

Only a small portion of Rt. 62 in Danvers within the Segment MA92-06 subwatershed is owned by MassDOT. It consists of four lanes (two in either direction) separated by a large median. Pavement width for each travel direction is 22 feet and the median width is approximately 13 feet. MassDOT's right-of-way along this stretch of Rt. 62 is 100 feet wide. There are no direct stormwater discharges from this stretch of Rt. 62 to Segment MA92-06 of the Ipswich River.

Rt. 1

Rt. 1 varies from a two lane roadway with a surface width of 24 feet to a four lane roadway with a turning lane and a surface width of 36 feet. MassDOT's right-of-way along Rt. 1 within the Segment MA92-06 subwatershed is 50 feet in most locations. The roadway spans the towns of Topsfield and Danvers and crosses over Segment MA92-06 of the Ipswich River in Topsfield. AECOM observed several direct discharges to Segment MA92-06 of the Ipswich River from MassDOT's stormwater systems.

Two of the discharges consist of one 24-inch concrete pipe and one 18-inch concrete pipe, both projecting from the toe of slope adjacent to the bridge abutment at the river crossing. These pipes drain approximately 2.97 acres of MassDOT roadway. Due to steep slopes along the edge of the roadway, a limited right-of-way, and the presence of wetlands in this location, however, construction of treatment BMPs for these discharges is not feasible.

Just north of where Rt. 1 crosses Segment MA92-06, sheet flow from approximately 0.19 acres of MassDOT's roadway flows into an existing grass ditch. The ditch discharges directly to Segment MA92-06 via a drop inlet structure and a pipe. Assuming suitable soil conditions, this grass ditch may be retrofitted with appropriate material, stone check dams, and a proper outlet control structure to provide treatment for a small amount of MassDOT's directly contributing IC.

In general, the remainder of Rt. 1 within the subwatershed to Segment MA92-06 drains to abutting wetland areas that are not hydraulically connected to Segment MA92-06 and are therefore considered indirect discharges. A large portion of Rt. 1 at the interchange with I-95 drains to Nichols Brook (MA92-25), which is a tributary to Segment MA92-06. There is a large amount of space available for the installation of treatment BMPs within the cloverleaf areas. However, runoff from this portion of Rt. 1 is considered indirect.

I-95

I-95 is a major highway with four travel lanes in either direction separated by a grassed median. Pavement width for each travel direction is approximately 62 feet and the median width is approximately 80 feet. MassDOT's right-of-way is approximately 260 feet wide along this stretch of I-95. The roadway spans the towns of Boxford, Middleton, Topsfield, and Danvers and crosses over Segment MA92-06 of the Ipswich River at the Boxford/Middleton boundary.

The majority of the stormwater runoff from this portion of I-95 is discharged via small collection systems to abutting wetlands and to Nichols Brook (MA92-25), which is a tributary to Segment MA92-06 of the Ipswich River. Significant potential exists to reconfigure the existing stormwater systems along I-95 to discharge to the grassed median, which may potentially be retrofitted with two infiltration-style swale complete with check dams and outlet control structures. The locations of the proposed swales are shown in Figure 10. There are drop inlets at the ends of each of the swales drawn in Figure 10. The drop inlet at the end of the northern swale discharges to the river, and the drop inlet at the end of the southern swale discharges to a ditch which then conveys stormwater to the river. These drop inlets could be converted to outlet control structures which would allow the swales to treat direct discharges to Segment MA92-06.

High Street Bridge

The High Street Bridge in Topsfield consists of a 30-foot wide two lane roadway with a 60-foot right-of-way. The bridge is approximately 47 feet in length. Wetlands border the roadway immediately to the north of the bridge and residential properties border the roadway immediately to the south of the bridge. Also, MassDOT does not own the roadway on either side of the bridge. Due to these space constraints, it is not feasible to install treatment BMPs for this portion of MassDOT's directly contributing impervious cover.

Assessment under BMP 7U

None of the following impairments for Segment MA92-06 the Ipswich River have been addressed by a TMDL: low flow alterations and dissolved oxygen. Therefore, MassDOT assessed the impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (*Water Quality Impaired Waters Assessment and Mitigation Plan*), which applies to impairments that have been assigned to a water body prior to completion of a TMDL. As described in MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT, 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments. For this water body, MassDOT used the IC method to assess the following impairments:

- Dissolved Oxygen.

According to MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*, the impairment of low flow alterations is not caused by pollutants (MassDEP, 2011). Therefore, this impairment is not considered further.

The impairment of mercury in fish tissue is covered by the Final Northeast Regional Mercury TMDL (October 2007) which indicates that the mercury source was from atmospheric deposition and is not stormwater related (MassDEP, 2007). Therefore, this impairment also is not considered further in this assessment.

MassDOT's Application of the Impervious Cover Method

MassDOT's Application of Impervious Cover Method in BMP 7U applies many aspects of USEPA Region I's Impervious Cover Method described in EPA's *Stormwater TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT's program. This method assesses potential stormwater impacts on the impaired water and evaluates the IC reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of EPA and others, when a watershed has less than 9% IC, MassDOT concludes that stormwater is not the likely cause of the impairment. Additional information regarding this method is provided in MassDOT's Application of IC Method document.

Assessment

First, MassDOT calculated the percent IC of the water body's entire contributing watershed (total watershed upstream of the downstream end of an impaired segment) and that of the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body. The total watershed and subwatershed to the impaired water body were delineated using the USGS Data Series 451. When USGS Data Series watersheds did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified by delineating to the water body based on USGS topography to add specificity. IC data was available as part of the USGS data layers Data Series 451 and MassGIS's impervious surfaces data layer. In cases where it was determined that stormwater was a potential cause of the impairment, MassDOT calculated the degree to which IC would need to be reduced in the subwatershed to meet the 9% IC target. This reduction was then applied proportionally to the area of MassDOT roadways/properties directly discharging to the water body segment to identify MassDOT's target IC reduction. The 9% IC reduction serves only as a recommended target and is not meant to imply that failing to meet the target would cause an exceedance in water quality standards. As explained in BMP 7U, MassDOT will consider a variety of factors apart from numeric guidelines, including site constraints and the magnitude of any potential exceedances in water quality standards, to determine the precise nature and extent of additional BMPs recommended for particular locations. This approach is consistent with the iterative, adaptive management BMP approach set forth in EPA guidelines.

MassDOT calculated the effective IC reduction afforded by the existing structural BMPs currently incorporated into the stormwater infrastructure of MassDOT's properties. This effective IC reduction was calculated by applying effective IC reduction rates to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's *Stormwater Best Management Practices (BMP) Performance Analysis* report (EPA, 2010) and engineering judgment. More information on the approach used to calculate the effective IC reductions is described in BMP 7U. When the reduction in effective IC achieved by the existing BMPs was equal to or greater than the target reduction, no further measures were proposed. When this was not the case, MassDOT considered additional BMPs in order to meet the targeted reduction.

Using this approach, MassDOT derived the following site parameters for the Segment MA92-06 of the Ipswich River (MA62-33):

Table 1. Site Parameters for Ipswich River (MA92-06)

Watershed		
Watershed Area	64,304	acres
Impervious Cover (IC) Area	8,340	acres
Percent Impervious	13	%
IC Area at 9% Goal	5,787	acres
Necessary Reduction % in IC	30.6	%
Subwatershed		
Subwatershed Area	19,662	acres
Impervious Cover (IC) Area	2,864	acres
Percent Impervious	15	%
IC Area at 9% Goal	1,770	acres
Necessary Reduction % in IC	38.2	%
MassDOT Directly Contributing Watershed		
MassDOT Directly Contributing IC	23.0	acres
MassDOT Target Reduction in Effective IC (38.2% of MassDOT Directly Contributing IC)	8.8	acres

The subwatershed is greater than 9% impervious cover, indicating that stormwater likely contributes to the impairments assessed under this methodology. In order to reach the 9% target, effective IC within the subwatershed should be reduced by 38.2%. Therefore, MassDOT's target is to reduce effective IC within its own directly contributing watershed by the same percentage, or 8.8 acres.

Existing BMPs

There are no existing BMPs in the Ipswich River directly contributing watershed that are mitigating potential stormwater quality impacts prior to discharge to segment MA92-06 of the Ipswich River.

Mitigation Plan

Because there are currently no existing BMPs mitigating directly-contributing IC area, MassDOT will consider the implementation of additional BMPs.

Conclusions

MassDOT used the IC Method to assess the Ipswich River for the impairments identified in MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. Results indicate that MassDOT should reduce its effective IC within its directly contributing subwatershed by 8.8 acres to achieve the targeted reduction in effective IC. MassDOT evaluated its property within the directly contributing watershed to the Ipswich River to identify existing BMPs and found that no BMPs exist to reduce effective IC. This information is summarized in Table 2 below.

Table 2. Effective IC Reductions under Existing & Proposed Conditions

IC in Directly Contributing Watershed	23.0	acres
Target Reduction in Effective IC	8.8	acres
IC Effectively Reduced by Existing BMPs	0.0	acres
IC Remaining to Mitigate with Proposed BMPs	**8.8**	**acres**

MassDOT should reduce its effective IC within the directly contributing watershed by 8.8 acres to achieve the targeted reduction in IC. MassDOT will now work with its design consultants to identify locations suitable for construction of additional BMPs to treat directly contributing IC as part of MassDOT's Impaired Waters Retrofit Initiative. The design consultants will develop construction plans for BMPs that will aim to provide the target IC reduction or treatment to the maximum extent practicable.

AECOM recently submitted a memorandum to MassDOT outlining recommendations for stormwater improvements to be performed during an upcoming FY13 resurfacing project planned for I-93. As part of this memorandum, AECOM identified one existing BMP treating runoff from MassDOT's impervious area and identified locations for five additional BMPs to treat runoff from MassDOT's impervious road. Although these BMPs mostly treat indirect discharges to Segment MA92-06 of the Ipswich River, one of the proposed BMPs has the potential to provide treatment for up to 1.12 acres of effective IC within MassDOT's directly contributing watershed. Once design and permitting is complete, treatment provided by proposed BMPs The treatment provided by this BMP will be considered in AECOM's final assessment of Segment MA92-06.

As described above, MassDOT identified additional areas where BMPs could be implemented. Just north of where Rt. 1 crosses the river, sheet flow from approximately 0.19 acres of MassDOT's roadway flows into an existing grass ditch and then enters Segment MA92-06. Assuming suitable soil conditions, this grass ditch may be retrofitted with appropriate material, stone check dams, and a proper outlet control structure to provide treatment for a small amount of MassDOT's directly contributing IC. The location of this ditch is shown in Figure 9.

Similarly, significant potential exists to reconfigure the existing stormwater systems along I-95 to discharge to the grassed median, which may potentially be retrofitted with an infiltration-style swale complete with check dams and outlet control structures. The locations of the proposed swales are shown in Figure 10. There are drop inlets at the ends of each of the swales drawn in Figure 10. The drop inlet at the end of the northern swale discharges to the river, and the drop inlet at the end of the southern swale discharges to a ditch which then conveys stormwater to the river. These drop inlets could be converted to outlet control structures which would allow the swales to treat direct discharges to Segment MA92-06.

Furthermore, MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. Furthermore, MassDOT will continue to implement non-structural BMPs that reduce the impacts of stormwater.

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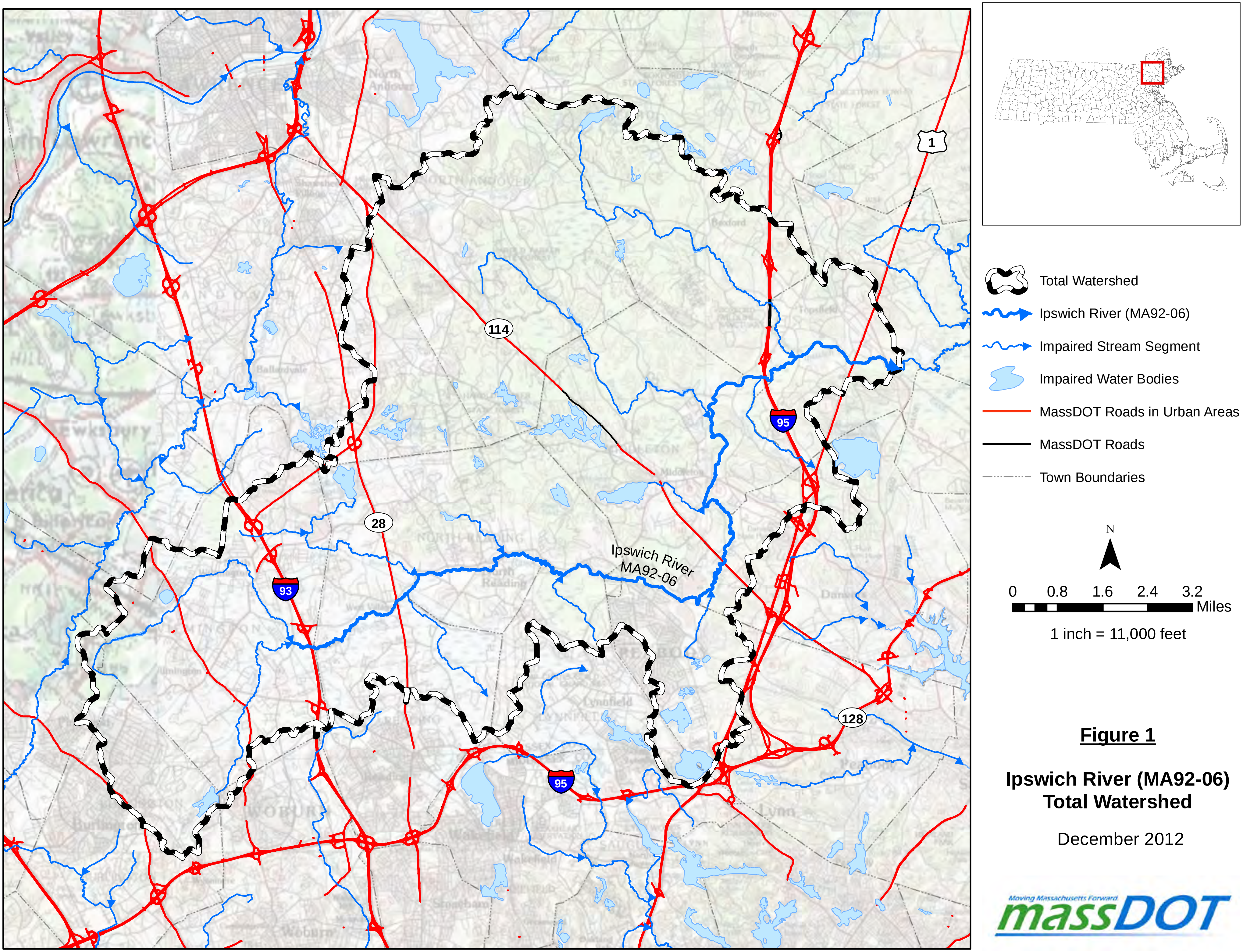
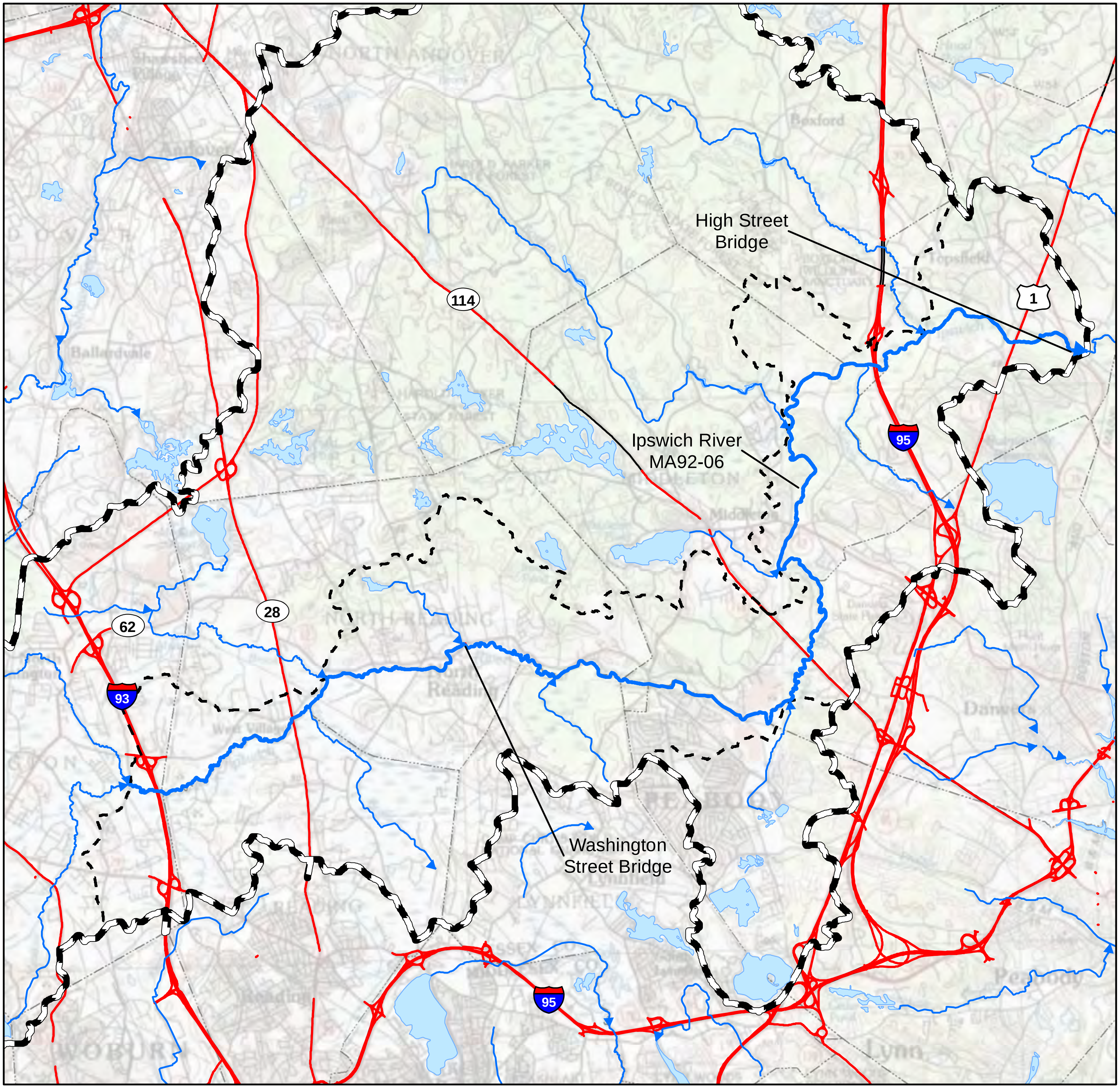


Figure 1

**Ipswich River (MA92-06)
Total Watershed**

December 2012



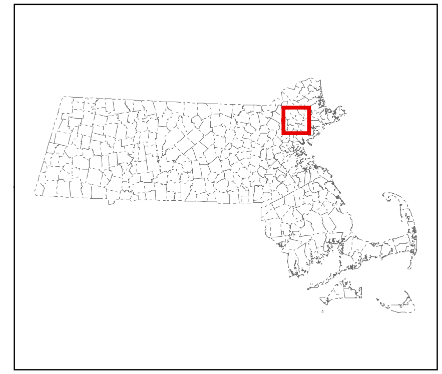


Figure 2

Ipswich River (MA92-06) Subwatershed

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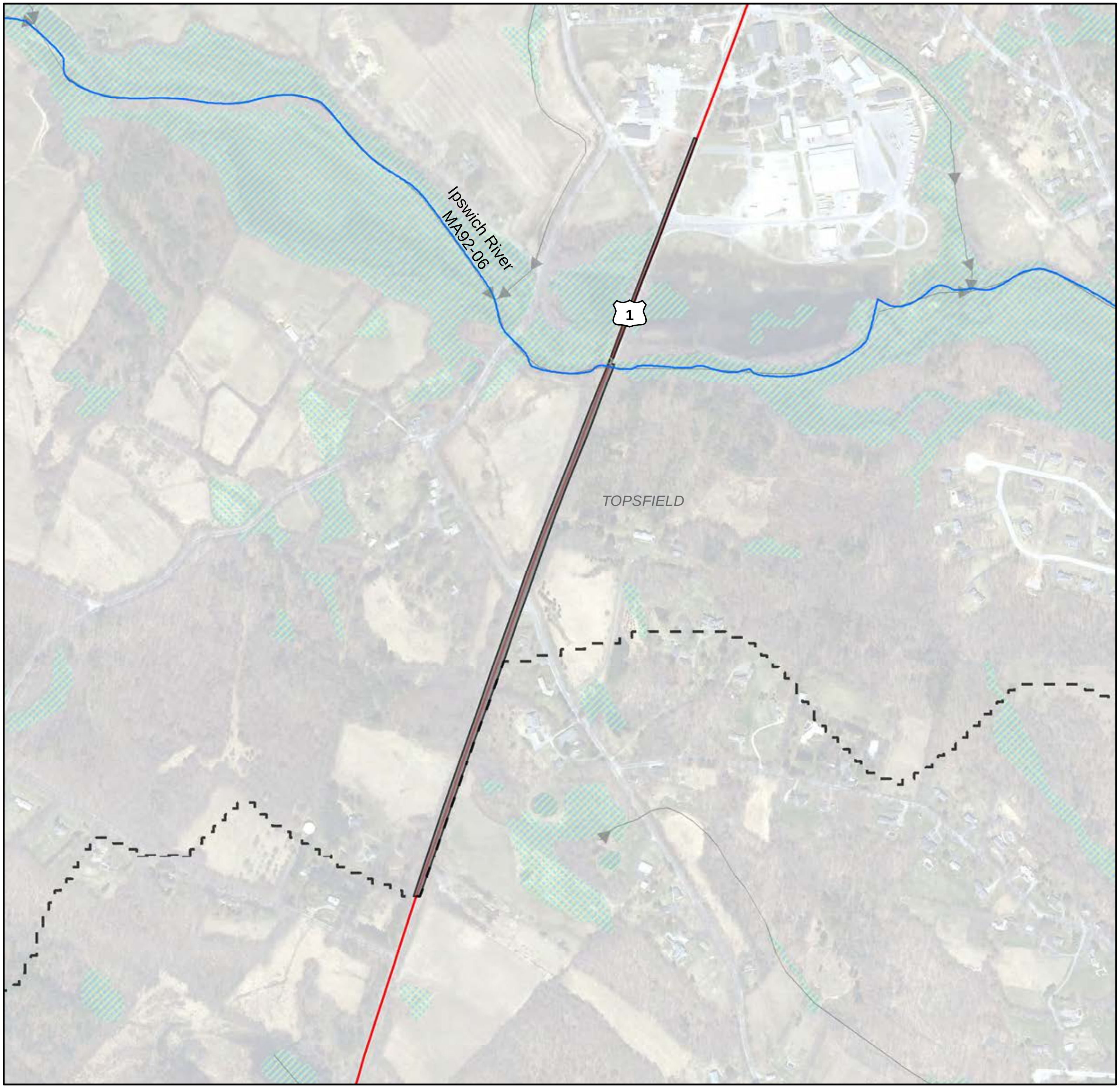

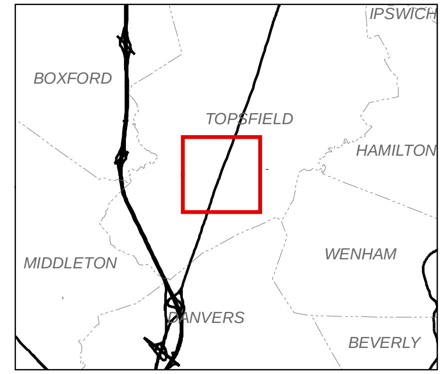

Subwatershed
MassDOT Directly Contributing Watershed
Stormwater Outfalls
Impaired Stream Segment
Impaired Water Bodies
Non-Impaired Stream Segment
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries

N

0 250 500 750 1,000 Feet

1 inch = 750 feet

Figure 3

Ipswich River (MA92-06) Directly Contributing MassDOT Watershed

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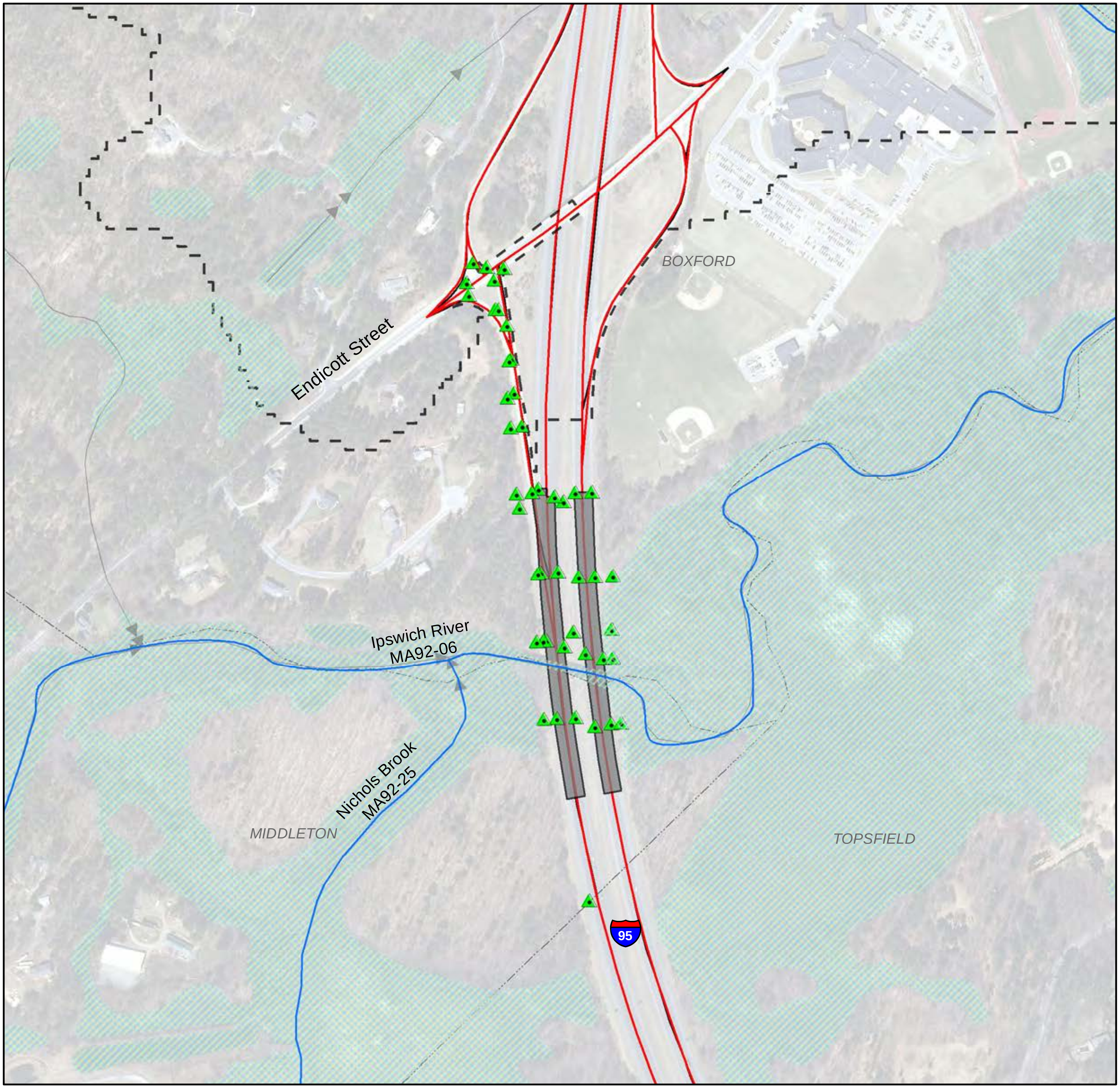

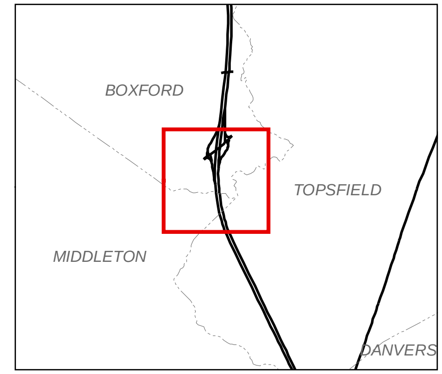

Subwatershed

MassDOT Directly Contributing Watershed

Stormwater Outfalls

Impaired Stream Segment

Impaired Water Bodies

Non-Impaired Stream Segment

NWI Wetland Areas

MassDOT Roads in Urban Areas

MassDOT Roads

Town Boundaries

N

0 200 400 600 800 Feet

1 inch = 500 feet

Figure 4

Ipswich River (MA92-06) Directly Contributing MassDOT Watershed

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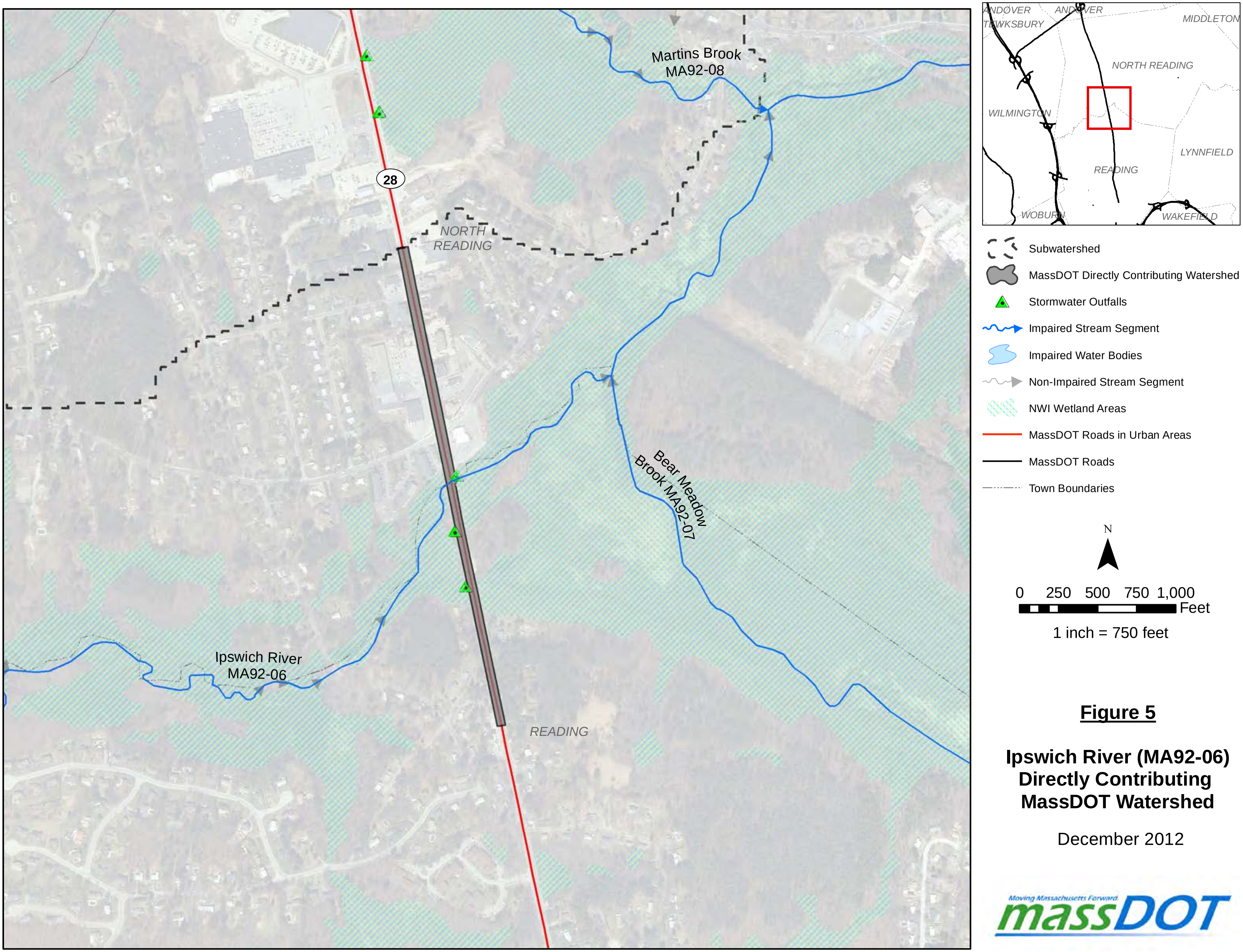

Figure 5

Ipswich River (MA92-06) Directly Contributing MassDOT Watershed

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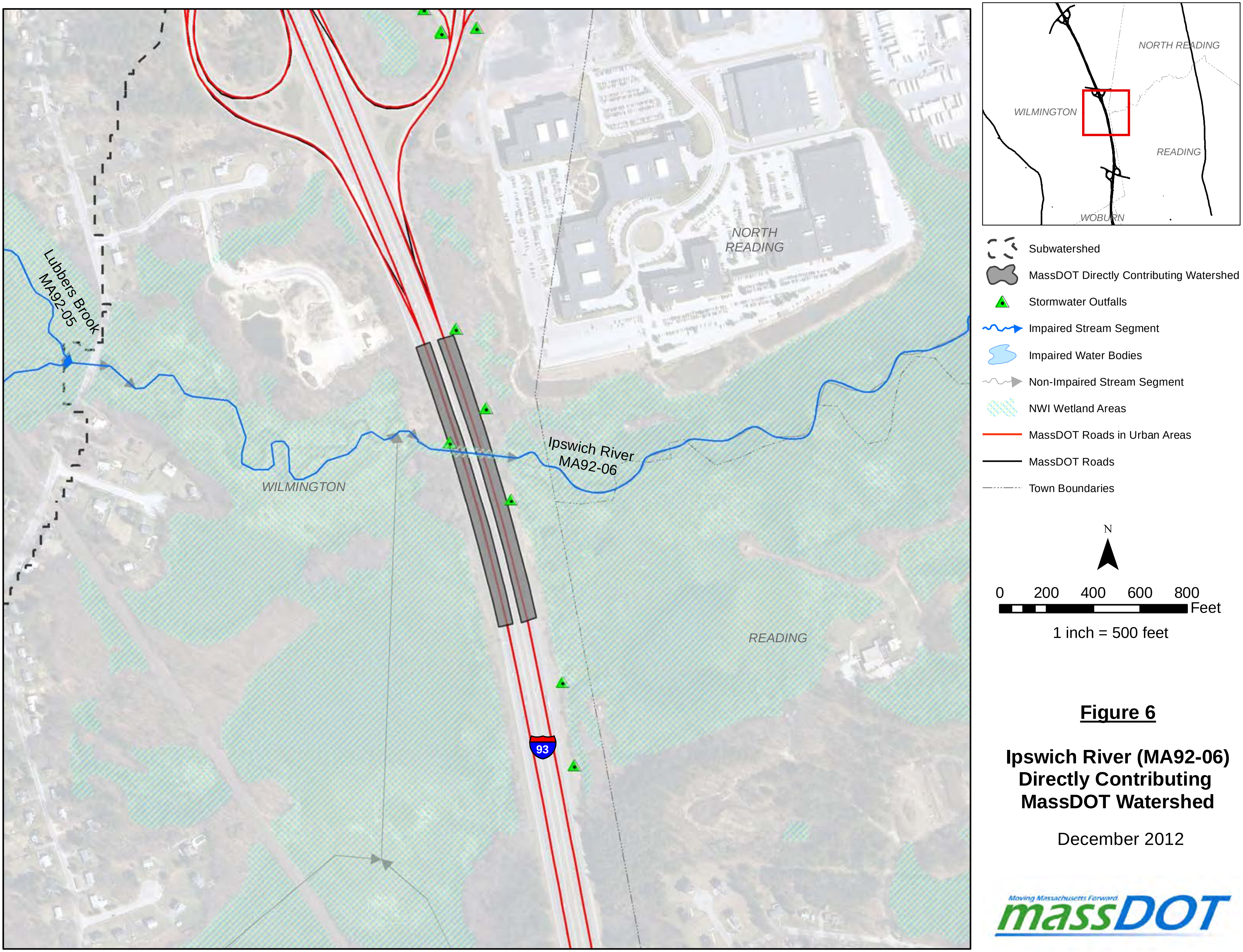

Figure 6

Ipswich River (MA92-06) Directly Contributing MassDOT Watershed

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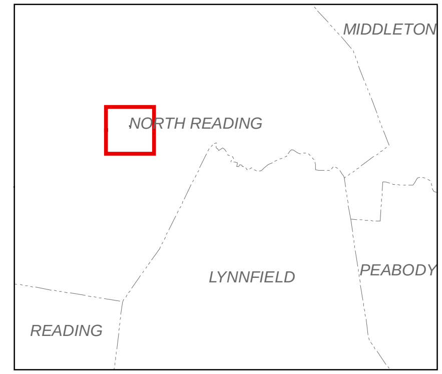

Subwatershed
MassDOT Directly Contributing Watershed
Stormwater Outfalls
Impaired Stream Segment
Impaired Water Bodies
Non-Impaired Stream Segment
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries

N

0 100 200 300 400 Feet

1 inch = 250 feet

Figure 7

Ipswich River (MA92-06) Directly Contributing MassDOT Watershed

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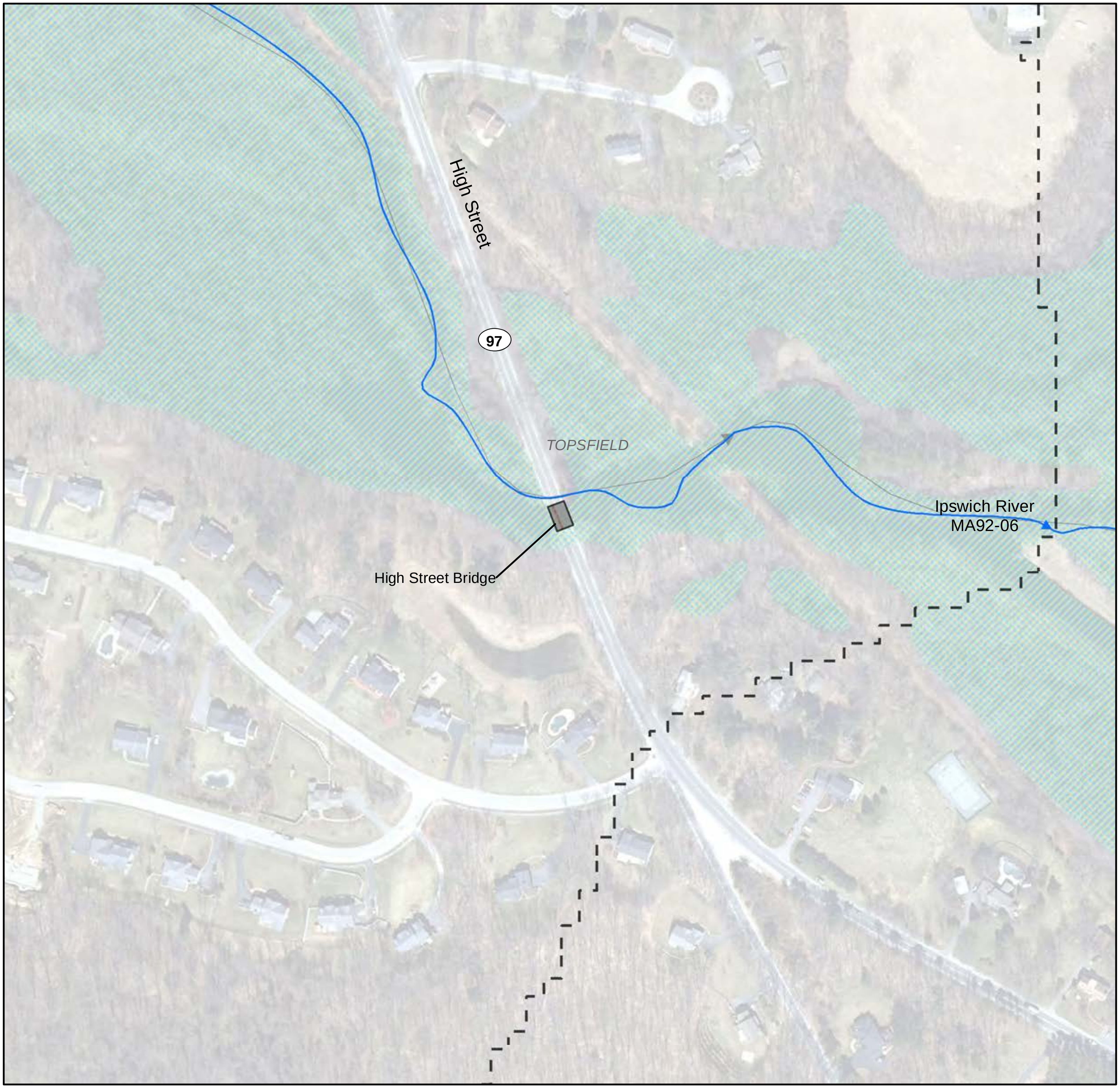

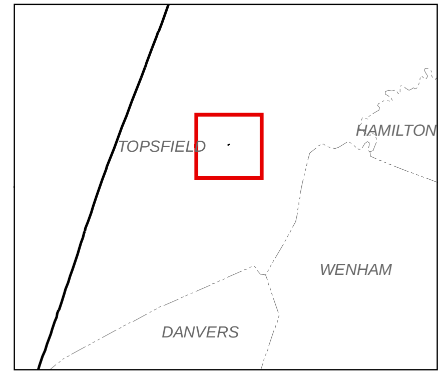

Subwatershed

MassDOT Directly Contributing Watershed

Stormwater Outfalls

Impaired Stream Segment

Impaired Water Bodies

Non-Impaired Stream Segment

NWI Wetland Areas

MassDOT Roads in Urban Areas

MassDOT Roads

Town Boundaries

N

0 100 200 300 400 Feet

1 inch = 250 feet

Figure 8

Ipswich River (MA92-06) Directly Contributing MassDOT Watershed

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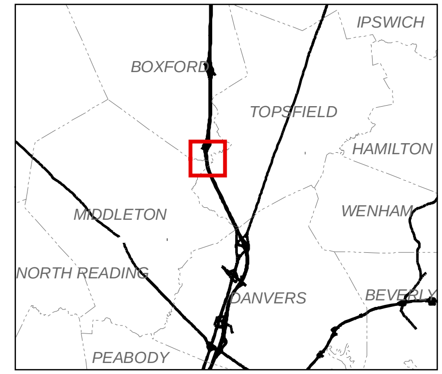

Conceptual BMPs

Total Watershed

Subwatershed

Impaired Stream Segment

Impaired Water Bodies

Non-Impaired Stream Segment

NWI Wetland Areas

MassDOT Roads

Town Boundaries

N

0 0.04 0.08 0.12 0.16 Miles

1 inch = 500 feet

Figure 9

Ipswich River (MA92-06)
Potential Locations
for BMPs
Sheet 1 of 2

December 2012

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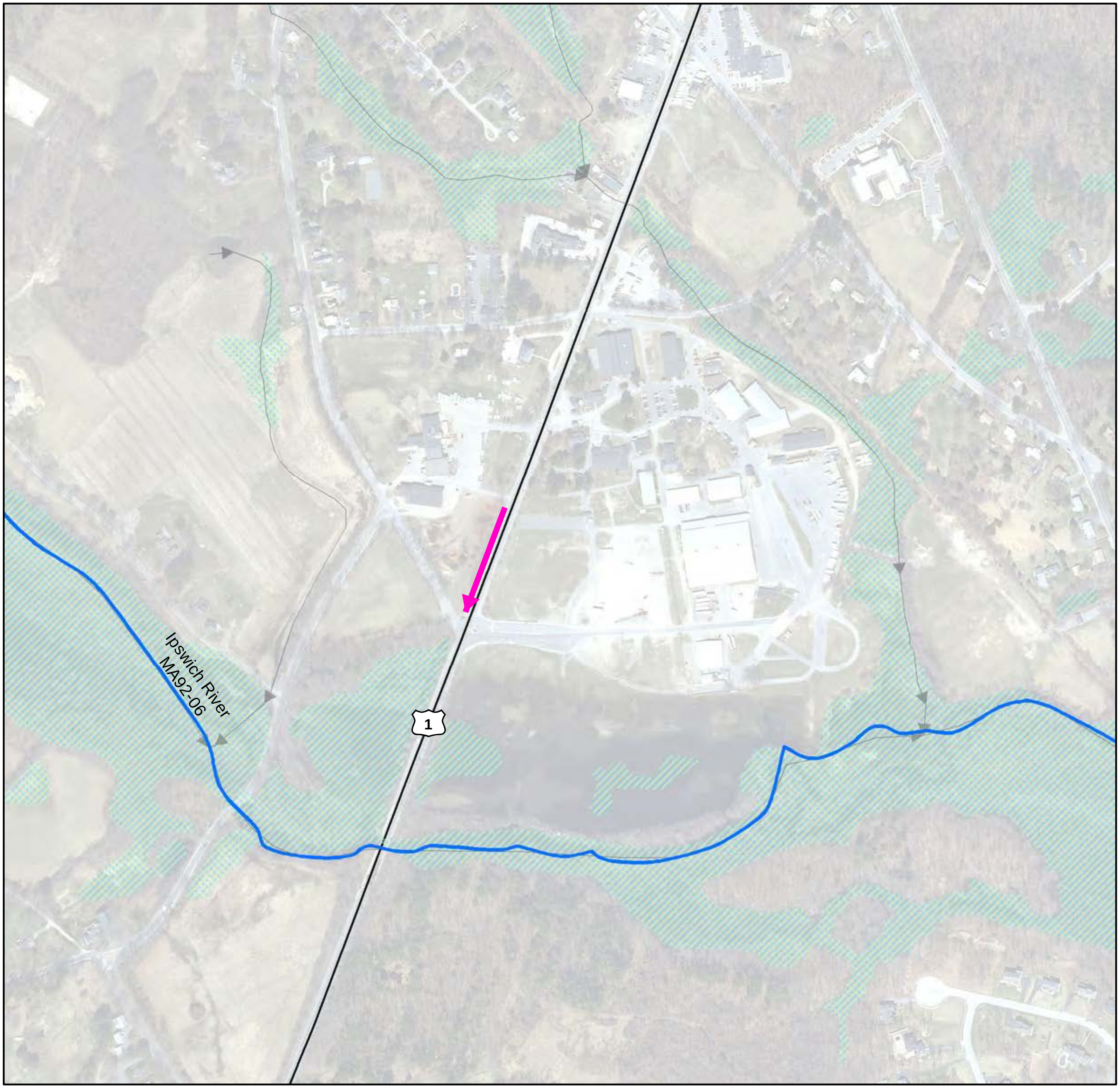

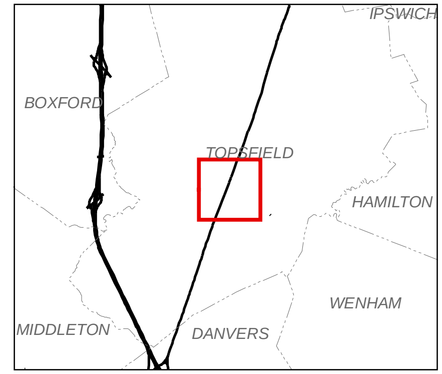

Conceptual BMPs
Total Watershed
Subwatershed
Impaired Stream Segment
Impaired Water Bodies
Non-Impaired Stream Segment
NWI Wetland Areas
MassDOT Roads
Town Boundaries

N

0 250 500 750 1,000 Feet

1 inch = 500 feet

Figure 10

Ipswich River (MA92-06)
Potential Locations for BMPs
Sheet 2 of 2

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Impaired Waters Assessment for New Bedford Inner Harbor (MA95-42)

Impaired Waterbody

Name: New Bedford Inner Harbor

Location: Fairhaven and New Bedford, Massachusetts

Water Body ID: MA95-42

Impairments

According to the MassDEP Final Year 2010 Integrated List of Waters, this segment is listed under Category 5 as impaired for: debris/floatables/trash, polychlorinated biphenyls, PCB in fish tissue, taste and odor, fecal coliform, dissolved oxygen, oil and grease, total nitrogen, and other.

The *Final Pathogen TMDL for the Buzzards Bay Watershed (CN 251.1)* includes this segment and addresses the pathogen impairment.

The *Buzzards Bay Watershed 2000 Water Quality Assessment Report* lists textile manufacturing, electronics production, and fishing trades among the main sources of impairments to this segment. Other sources of impairments in the subwatershed include salt marsh destruction and combined sewage overflows (CSOs).

Relevant Water Quality Standards

- Water Body Classification: SB
- 301 CMR § 4.05 (4)(b) – *Class SB. These waters are designated as a habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. In certain waters, habitat for fish, other aquatic life and wildlife may include, but is not limited to, seagrass. Where designated in the tables to 314 CMR 4.00 for shellfishing, these waters shall be suitable for shellfish harvesting with depuration (Restricted and Conditionally Restricted Shellfish Areas). These waters shall have consistently good aesthetic value.*

  In the case of a water intake structure (IS) at a desalination facility, the Department has the authority under 33 U.S.C. § 1251 (FWPCA § 401), M.G.L. c. 21, §§ 26 through 53 and 314 CMR 3.00 to condition the IS to assure compliance of the withdrawal activity with 314 CMR 4.00, including, but not limited to, compliance with the narrative and numerical criteria and protection of existing and designated uses.
- 314 CMR § 4.05 (4)(b)(1) –*Dissolved Oxygen. Shall not be less than 5.0 mg/l. Seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.*
- 314 CMR § 4.05 (4)(b)(4) – *Bacteria.*

  a. Waters designated for shellfishing shall not exceed a fecal coliform median or geometric mean MPN of 88 organisms per 100 ml, nor shall more than 10% of the samples exceed an MPN of 260 per 100 ml or other values of equivalent protection based on sampling and *analytical methods used by the Massachusetts Division of Marine Fisheries and approved by the National Shellfish Sanitation Program in the latest revision of the Guide For The Control of Molluscan Shellfish (more stringent regulations may apply, see 314 CMR 4.06(1)(d)(5));*

b. at bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010, no single enterococci sample taken during the bathing season shall exceed 104 colonies per 100 ml and the geometric mean of the five most recent samples taken within the same bathing season shall not exceed 35 enterococci colonies per 100 ml. In non bathing beach waters and bathing beach waters during the non bathing season, no single enterococci sample shall exceed 104 colonies per 100 ml and the geometric mean of all of the samples taken during the most recent six months typically based on a minimum of five samples shall not exceed 35 enterococci colonies per 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department;

- 314 CMR 4.05 (4)(b) 7 –*Oil and Grease. These waters shall be free from oil and grease, petrochemicals and other volatile or synthetic organic pollutants.*
- *314 CMR 4.05 (4)(b) 8 – Taste and Odor - None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to this class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.*
- 314 CMR § 4.05 (5)(a) – *Aesthetics. All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.*
- 314 CMR § 4.05 (5)(b) – *Bottom Pollutants or Alterations. All surface waters shall be free from pollutants in concentrations or combinations or from alterations that adversely affect the physical or chemical nature of the bottom, interfere with the propagation of fish or shellfish, or adversely affect populations of non-mobile or sessile benthic organisms.*
- 314 CMR § 4.05 (5)(c) – *Nutrients. Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.*
- 314 CMR § 4.05 (5)(e) - *Toxic Pollutants. All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife. For pollutants not otherwise listed in 314 CMR 4.00, the National Recommended Water Quality Criteria: 2002, EPA 822R-02-047, November 2002 published by EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act, are the allowable receiving water concentrations for the affected waters, unless the Department either establishes a site specific criterion or determines that naturally occurring background concentrations are higher. Where the Department determines that naturally occurring background concentrations are higher, those concentrations shall be the allowable receiving water concentrations. The Department shall use the water quality criteria for the protection of aquatic life expressed in terms of the dissolved fraction of metals when EPA's 304(a) recommended criteria provide for use of the dissolved fraction. The EPA recommended*

criteria based on total recoverable metals shall be converted to dissolved metals using EPA's published conversion factors. Permit limits will be written in terms of total recoverable metals. Translation from dissolved metals criteria to total recoverable metals permit limits will be based on EPA's conversion factors or other methods approved by the Department. The Department may establish site specific criteria for toxic pollutants based on site specific considerations.

Summary

MassDOT has assessed stormwater impacts from MassDOT properties discharging to the New Bedford Inner Harbor using BMP 7R to address the Pathogen TMDL and BMP 7U to address impairments not covered by a TMDL. The following sections describe the methodology for these assessments. Based on this assessment, MassDOT determined that a 32-acre reduction in effective impervious cover (IC) would be needed to meet the targets for this watershed.

MassDOT has concluded that its existing stormwater best management practices (BMPs) provide approximately 0.2 acres of effective IC reduction. To further reduce MassDOT's contribution to impairments within the New Bedford Inner Harbor watershed, MassDOT proposes 19 BMPs. These BMPs will provide an additional 8.0 acres of effective IC reduction.

See the **Proposed Mitigation Plan** section of this assessment for more information.

Reductions Applied to MassDOT Direct Watershed

	Effective IC (Acres)
MassDOT's Area Directly Contributing to Impaired Segment	37
Target Reduction	32
Reduction Achieved by Existing BMPs	0.2
Reduction Provided in Proposed Conditions	8.0
Remaining Reduction to meet Target	23.3

Site Description

The 1.2 square mile New Bedford Inner Harbor extends from the Coggeshall Street Bridge to the Hurricane Barrier in New Bedford and Fairhaven, Massachusetts (see Figure 1). According to the *Buzzards Bay 2000 Water Quality Assessment Report*, the primary land uses of the watershed include forest (39%), residential (28%), and open land (13%).

The total 17,920 acre watershed draining to the New Bedford Inner Harbor extends north to include portions of Lakeville, Freetown, Rochester, and Acushnet. The total watershed includes the New Bedford Reservoir and the Acushnet River. As shown in Figure 1, the 5,930 acre New Bedford Inner Harbor subwatershed extends to the north of the Acushnet River Segment MA95-33, which can be better seen in Figure 2, and includes much of the urbanized areas of New Bedford and Fairhaven.

MassDOT property within an urban area directly contributing to New Bedford Inner Harbor includes Interstate 195 (I-195), Route 18, and Route 6 (see Figures 2-4). The total area directly draining to the New Bedford Inner Harbor is 61 acres.

I-195 runs perpendicular to New Bedford Inner Harbor and crosses the northern-most portion of the segment via a 200-foot long bridge, as seen in Figure 2. I-195 is a two lane highway in each direction with a grass median separating the eastbound and westbound roadways. To the east of the bridge, stormwater flows either into catch basins in the roadway or into the median where it is collected by drop inlets. From there the stormwater is directly discharged into New Bedford Inner Harbor. As part of MassDOT Bridge Replacement Project #606139, infiltration basins with check dams will be installed in the median to encourage stormwater to infiltrate before reaching the drop inlets. Currently, the closed drainage system from a point immediately east of Adams Street to the bridge discharges stormwater into a concrete lined swale which flows directly into the New Bedford Inner Harbor. On the west side of the Inner Harbor Bridge, the I-195 median is paved. Stormwater from I-195 drains via catch basins along the roadway either to ditches leading to the waterbody or to the municipal combined sewer system.

Route 18 is a principal arterial carrying three lanes of travel in each direction (Figure 3). Route 18 runs north –south, on the west side and parallel to the New Bedford Inner Harbor in New Bedford. MassDOT owns Route 18 from the I-195 interchange to the Route 6 interchange. Stormwater from Route 18 and its ramps drain via catch basins into a closed drainage system that ultimately discharges to the New Bedford Inner Harbor.

Route 6 (Huttleson Avenue in Fairhaven) is a principal arterial as it crosses the New Bedford Inner Harbor from New Bedford to Fairhaven (Figure 4). The Route 6 bridge over New Bedford Inner Harbor carries two travel lanes in each direction. The bridge drains stormwater via scuppers directly to the New Bedford Inner Harbor. In Fairhaven, stormwater from Route 6 between the Adams Street intersection and the bridge drains into a culverted stream and discharges directly to the New Bedford Inner Harbor just north of the Route 6 bridge.

The MassDOT directly contributing watershed presently includes one existing BMP, a water quality swale, shown on Figure 5 labeled Ex-01. The water quality swale is shown on highway drainage plans as a man-made constructed swale.

Assessment under BMP 7R for Pathogens

The *Pathogen Total Maximum Daily Load (TMDL) for the Buzzards Bay Watershed (CN 0156.0)* covers the New Bedford Inner Harbor. The TMDL states that sources of indicator bacteria in the Buzzards Bay Watershed were found to be many and varied. The TMDL lists sources as including illicit discharges, leaky sewer pipes, sanitary sewer overflows, failing septic systems, and stormwater runoff.

In addition, as stated on page 58 of the TMDL, *Storm water runoff is another significant contributor to pathogen pollution. During rain events fecal matter from domestic animals and wildlife are readily transported to surface waters via the storm water drainage systems and/or overland flow. The natural filtering capacity provided by vegetative cover and soils is dramatically reduced as urbanization occurs because of the increase in impervious areas (i.e., streets, parking lots, etc.) and stream channelization in the watershed.*

Pathogen concentrations in stormwater vary widely temporally and spatially; concentrations can vary by orders of magnitude within a given storm event (MassDEP, 2009). Therefore, it is difficult to predict stormwater pathogen concentrations with accuracy. Due to this difficulty, MassDOT is not conducting site specific assessments of loading at each location impaired for pathogens as part of this Retrofit Program. However, MassDOT recognizes that its roadways, especially in urbanized areas, contribute to the pathogen impairment of the Buzzards Bay Watershed and has performed a general assessment and developed a mitigation plan as described below.

BMP 7R Pathogens Assessment

Pathogen loadings are highly variable and, as a result, quantitative assessments are challenging and of little value. Therefore, MassDOT has reviewed its existing programs and their consistency with the Pathogen TMDL for the Buzzards Bay Watershed recommendations as well as the draft EPA National Pollution Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit requirements for the South Coastal Watershed.

The Pathogen TMDL for the Buzzards Bay Watershed recognizes that mitigation for pathogen impairments is difficult to address and emphasizes the need for an iterative adaptive management approach. The page xvi of the TMDL states:

Since accurate estimates of existing sources are generally widely variable and unavailable, it is difficult to estimate the pollutant reductions for specific sources. TMDL implementation to achieve these goals should be an iterative process by prioritizing areas based on available data and downstream resources affected, identification of specific sources and in particular the removal of illicit connections contributing to both dry and wet weather violations. Once illicit connections are removed then prioritization should be given to identifying and implementing best management practices to mitigate stormwater runoff volume.

The existing NPDES MS4 permit that covers MassDOT stormwater discharges does not provide guidance on what measures are necessary to comply with the Pathogen TMDL for the Buzzards Bay Watershed. The fact sheet for the draft permit for MS4 stormwater discharges for the South Coastal Watershed does not contain specific guidance on what measures EPA has determined necessary to be consistent with the Pathogen TMDL for the Buzzards Bay Watershed. The fact sheet focuses on sources such as failing septic systems, pet waste, and illicit discharges.

As discussed above, both the Pathogen TMDL for the Buzzards Bay Watershed and the draft South Coastal Watershed MS4 permit state that identification of illicit discharges and addressing stormwater volumes and pollutants, such as phosphorus, are the best approaches to mitigate the pathogen impairments. MassDOT has developed a mitigation plan, described below, to address the pathogen impairments using guidance from these two documents.

BMP 7R Pathogens Mitigation Plan

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

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

Although not included in this permit term, MassDOT will be implementing a pet waste management program at its rest stops, including those that have discharges to pathogen impaired waters. In addition, MassDOT has requested to be covered under an Individual MS4 permit for the next permit term. A future individual permit may contain additional programmatic BMPs to address pathogens.

The structural BMPs that will be considered to reduce the effects of IC would also reduce pathogen loads. See the Proposed Mitigation Plan section of this assessment for more information on specific BMPs proposed as part of this assessment. MassDOT believes the existing and proposed efforts are consistent with the current and draft MS4 permit's requirements and TMDL recommendations.

Assessment under BMP 7U

The New Bedford Inner Harbor pathogen TMDL does not address all of the New Bedford Inner Harbor's impairments including debris/floatables/trash, polychlorinated biphenyls, PCB in fish tissue, taste and odor, dissolved oxygen, oil and grease, total nitrogen, and other. MassDOT concluded that the impairments for polychlorinated biphenyls (PCB) and PCB in fish tissue are unrelated to stormwater runoff. The Nationwide Urban Runoff Program (NURP) conducted by the EPA found that PCB was detected in less than 1% of stormwater samples collected (EPA, 1983). Therefore, MassDOT concluded that stormwater runoff from its roadways does not contribute to the impairments of PCB in fish tissue.

Therefore, MassDOT assessed the stormwater-related impairments not addressed by a TMDL using the approach described in BMP 7U of MassDOT's Stormwater Management Plan (Water Quality Impaired Waters Assessment and Mitigation Plan), which applies to stormwater-related impairments that have not been addressed by a TMDL.

For the stormwater-related impairments for this water body not covered by a TMDL, MassDOT used an application of EPA Region I's Impervious Cover (IC) Method described in EPA's Stormwater TMDL Implementation Support Manual (ENSR, 2006). MassDOT used this method to assess potential stormwater impacts on the impaired water and develop the target effective IC to ensure that stormwater is not the cause of the impairments. The IC Method relates an aquatic system's health (i.e., state of impairment) to the percentage of IC in its contributing watershed. This method is largely based on the work of the Center for Watershed Protection, which has compiled and evaluated extensive data relating watershed IC to the hydrologic, physical, water quality, and biological conditions of aquatic systems (Schueler, 2003). Water quality in tributary streams, rivers, lakes and ponds is a direct reflection of loading from the watershed (Wetzel, 2001); therefore, the IC method can be used as a surrogate for pollutant loading when evaluating water quality impairments and their causes. Consistent with the findings of EPA and others, MassDOT concluded that when a watershed had less than 9% IC, stormwater was not the likely cause of the impairment.

MassDOT developed the target IC reduction using the approach outlined in *Description of MassDOT's Application of Impervious Cover Method in BMP 7U* (MassDOT, 2011). Since the development of the MassDOT Application of IC Method, MassDOT has further refined its approach to evaluate MassDOT's effective IC and BMP performance. For the New Bedford Inner Harbor, MassDOT used a long-term continuous simulation model (the assessment model) to estimate effective IC.

MassDOT estimated the effective IC of its contributing drainage area with existing and proposed stormwater BMPs by comparing the runoff and pollutant response of its drainage area to the response of simulated watersheds with equivalent area, but varying IC from 0 to 100% (benchmark watersheds). The IC percentage of the watershed that produces a similar response to MassDOT's watershed was determined to be the effective IC of MassDOT's watershed. For a more detailed description of this approach, see the Long-Term Continuous Simulation for Pollutant Loading and Treatment for MassDOT Impaired Waters Program.

The MassDOT IC method for the impaired waters of the New Bedford Inner Harbor includes the following steps:

1. Calculate the percent IC of the water body's entire contributing watershed (total watershed to downstream end of impaired segment) and that of the local watershed contributing directly to the impaired segment (referred to as the subwatershed in this analysis) to determine whether stormwater has a potential to cause the impairments of the receiving water body.
2. For subwatersheds with greater than 9% IC, calculate the amount of IC reduction needed to achieve 9%. For subwatersheds with less and 9% IC, perform no further analysis under BMP 7U.
3. Calculate percentage of IC in the MassDOT directly contributing drainage area.
4. Apply reduction of IC necessary for the subwatershed to achieve 9% to the MassDOT contributing drainage area as a target to address the stormwater impairments. Calculate resulting target IC for the MassDOT drainage area.
5. Run the assessment model with specific MassDOT drainage areas and BMPs to estimate:
    a. Flow and pollutant statistics for MassDOT's current drainage area including treatment though existing BMPs.
    b. Flow and pollutant statistics for target watershed (watershed with target percent IC) and benchmark watersheds.
6. Compare MassDOT runoff and pollutant annual loading and flow statistics with target and benchmark watersheds.
7. Locate additional stormwater BMPs to maximum extent practicable and run long-term simulation to quantify their performance.

BMP 7U Assessment

Using the approach described above, MassDOT calculated the following values for the total contributing watershed and the subwatershed of the impaired water (New Bedford Inner Harbor) to determine the IC target (see Figure 1).

Watershed Impervious Cover

	Total Watershed	Subwatershed
Watershed Area	17,938 acres	5,928 acres
Impervious Cover (IC) Area	4,466 acres	4,258 acres
Percent Impervious	25%	72%
IC Area at 8% Goal	1,614 acres	533 acres
Target Reduction % in IC	64 %	87 %

The total watershed and the subwatershed are greater than 9% impervious indicating that stormwater is a likely contributor to the impairment. To meet the 9% effective IC target, the effective IC within the subwatershed would need to be reduced by 87%. Therefore, the effective IC of MassDOT's directly contributing area should also be reduced by the same percentage to meet the target. The following table shows the resulting targets for MassDOT's directly contributing property.

Reductions Applied to MassDOT Direct Watershed

MassDOT Area Directly Contributing to Impaired Segment	61 acres
MassDOT's IC Area Directly Contributing to Impaired Segment	37 acres
MassDOT's Percent Impervious	61 %
MassDOT's Target Reduction in Effective IC (87% of DOT Directly Contributing IC)	32 acres
Target Effective IC	8%

MassDOT's directly contributing area includes 37 acres of IC (61% of the total contributing area). To meet the target reduction of effective IC, MassDOT should mitigate 32 acres of effective IC. Equivalently, MassDOT's contributing drainage area should act as a watershed of 8% IC.

Existing BMPs

One existing swale is identified in the project area. The vegetative swale (Ex 01), as seen on Figure 5, is located along I-195 east in New Bedford, west of the I-195 bridge over the New Bedford Inner Harbor at interchange 16. This BMP was constructed as a ditch for stormwater conveyance and has developed wetland vegetation. Stormwater is collected from four catch basins lining the edge of the highway which outlet into a grassy area before draining into the low lying swale. The swale carries the stormwater directly to the New Bedford Inner Harbor. The presence of wetland vegetation and probable close proximity to groundwater table indicates that stormwater is not easily infiltrated. MassDOT proposes to retrofit this existing BMP as described in the Proposed Mitigation Plan section.

The existing conditions assessment model was created to estimate existing potential contributing drainage areas and exiting BMPs. The existing swale was modeled as a basin without infiltration. The table below shows the existing BMP, its MassDOT drainage area and effective IC reduction. The output from the assessment model showing effective IC analysis for the existing BMP is attached. The assessment model identifies BMPs by unique ID, included in the table below.

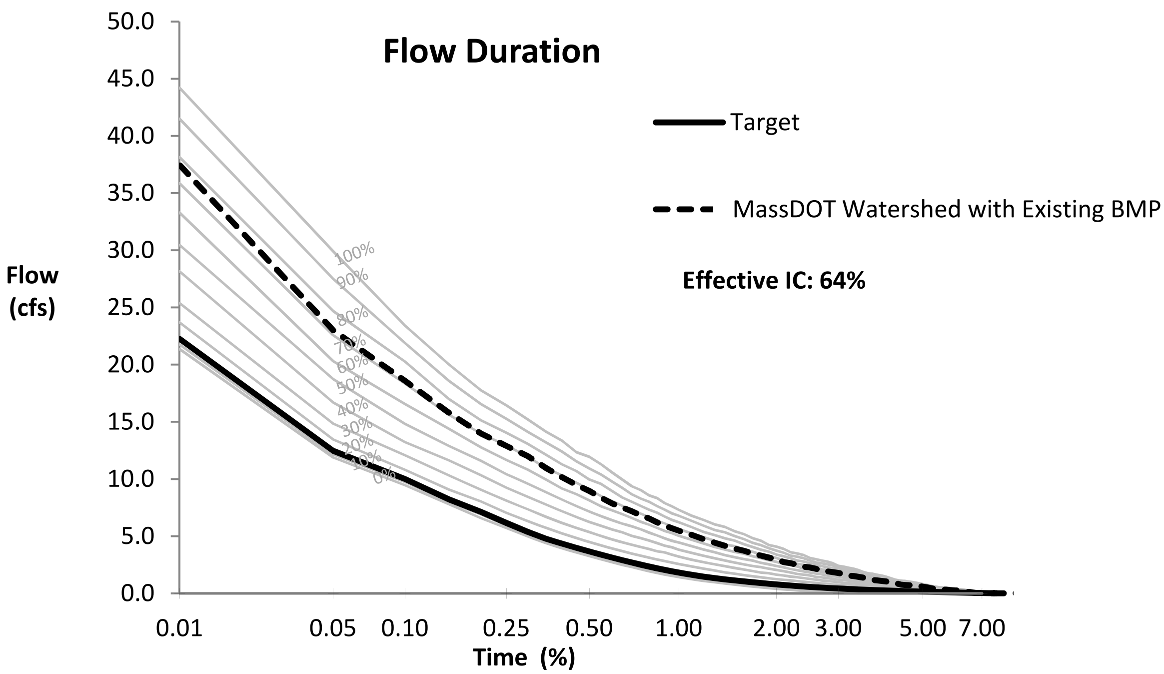
Summary of Existing BMPs

BMP Name / (BMP ID)	BMP Type	Contributing Watershed IC Area (ac.)	Resulting % Removal of Contributing Watershed IC	Effective IC Area Reduction (ac.)
Ex 01 (88.2)	Water Quality Swale	1.8	57%	1.0
Total*				**0.2**

* Total Effective IC reduction based on the assessment model results for the total MassDOT directly discharging drainage area to the receiving water (not sum of individual BMP reductions).

Existing Median Annual Load Comparisons

Simulated IC Watersheds		Runoff (ac-ft)	P (lb.)	TSS (lb.)
	0% IC	44.5	3.2	217
	5% IC	52.5	5.2	1,068
Target	**8% IC**	**58.5**	**6.9**	**1,971**
	10% IC	60.3	7.5	2,257
	20% IC	75.8	15.5	6,257
	30% IC	91.1	27.5	12,768
	40% IC	106.5	43.4	21,552
	50% IC	121.3	62.3	32,288
	60% IC	136.1	82.6	44,028
	70% IC	150.9	103.6	55,884
	80% IC	165.8	124.6	67,703
	90% IC	180.9	144.9	79,227
	100% IC	195.8	165.7	90,949
	Existing Conditions	149.65	108.5	58,786
	Proposed Conditions	148.2	102.5	55,270
	Reduction %	**2%**	**3%**	**4%**
	Effective IC	**67%**	**71%**	**71%**



Effective IC Results

Existing Estimated Effective IC	41.2 ac
Proposed Estimated Effective IC	32.7 ac
IC Reduction % with Proposed BMPs	20%
Estimated Effective IC*	47%

*Average of estimated Effective IC for annual median runoff volume, phosphorus and TSS loads, and flow duration

BMP 7U Mitigation Plan

Under existing conditions, MassDOT's estimated effective IC exceeds the target as described above. To mitigate the effects of IC, MassDOT will implement stormwater BMPs to the maximum extent practical given site constraints.

This assessment has identified locations for potential stormwater BMPs and estimated the effective IC accounting for their treatment. The Proposed Mitigation Plan section describes the BMPs and their IC reduction performance.

Proposed Mitigation Plan to Address Impervious Cover

In this assessment, MassDOT has identified 19 stormwater BMPs that may be constructed on MassDOT property to mitigate effective IC and to address the New Bedford Inner Harbor impairments. These BMPs include infiltration basins, swales, plunge pools, and created wetlands and are displayed with their estimated contributing drainage areas in Figures 5, 6, and 7. Soils in the area are characterized as Hydrologic Soil Group (HSG) C, indicating sandy clay loam with some infiltration capacity. The BMP locations were chosen based on a preliminary review of the drainage systems, topography, property lines, and other site constraints. Detailed survey, complete utility information, official property ownership, and soils information will influence the final selection and design of BMPs. Below is a description of these potential proposed BMPs.

Proposed BMPs

Pr-BMP 2

MassDOT proposes to construct an infiltration swale in the existing low lying section of grassy area alongside the I-195 entrance ramp from Coggeshell Street, as shown in Figure 5. Currently, roadway runoff is collected in catch basins along the roadway and discharged to the grassed area along the shoulder of the I-195 entrance ramp. A drop inlet collects the stormwater and discharges it directly to New Bedford Inner Harbor. This location can be regraded to create an infiltration swale. The curb on the ramp can be removed to allow roadway runoff to sheet flow from the roadway across the grass, providing some treatment of the stormwater before it enters the swale. The existing drop inlet can be raised to increase the storage of stormwater in the swale and allow for greater infiltration.

Pr-BMP 3

Proposed BMP 3 is an infiltration swale which would be constructed in the low lying grassy area along the off-ramp of I-195 to Washburn Street, seen in Figure 5. Stormwater currently discharges from two catch basins off I-195 directly into a grassy area, where it flows into a drop inlet and is drained into the sewer system along Washburn Street. MassDOT proposes to reduce the amount of stormwater draining to the sewer system by increasing infiltration in the proposed swale. This would be achieved by regarding the current landscape to create a ditch for the swale. Check dams would be placed in the swale to allow more time for the stormwater to infiltrate. MassDOT also proposes to raise the existing drop inlet to increase storage.

Pr-BMP 4

MassDOT proposes to construct a created wetland in the wooded area off I-195 east just east of River Avenue, as shown in Figure 6. Currently, stormwater along I-195 east is collected in a drainage mainline and discharged to a concrete lined swale, which is in the proposed area for the created wetland and drains directly to New Bedford Inner Harbor. The concrete swale has a significant amount of water flowing through it which flows to an existing wetland system downstream, making this a viable area for a created wetland. The wetland can be created by removing the concrete swale, creating a depression, and enhancing the vegetated area. The created wetland will aid in treatment of stormwater before it is drained into the surrounding natural systems. Proposed BMPs 9-16 consisting of check dams and infiltration basins, discussed below, will increase the pollutant removal before the stormwater reaches the proposed wetland.

Pr-BMP 5

MassDOT proposes to construct an infiltration basin in the vegetated island between the on-ramp and off-ramp from I-195 to Coggeshell Street, just west of the New Bedford Inner Harbor, as seen in Figure 5. Currently, no stormwater runoff flows to this location, therefore MassDOT proposes to remove the curbing along I-195 adjacent to this roadway island and re-direct drainage infrastructure along the ramp system, which currently drains directly to the waterbody, to this vegetated area. The area would be regraded to create a basin and increase the storage capacity for stormwater.

Pr-BMP 6

MassDOT proposes to construct an infiltration basin between Route 6 east and the highway ramp from Route 18 south to Route 6 east, shown in Figure 7. A concrete swale currently collects water from both pervious and impervious area, which flows to a drop inlet within a grassy area. The drop inlet connects to a drain line on Route 18 and is then drained to the New Bedford Inner Harbor. The grassy area proposed for the infiltration basin would be regraded to create a basin, and the existing drop inlet raised to increase storage. The closed drainage system in this area has several catch basins and manholes which MassDOT proposes to intercept and divert to the infiltration basin. This would allow for the BMP to collect stormwater from Route 6 as well as Route 18.

Pr-BMP 7

The proposed infiltration basin, shown in Figure 7, would be located along the south side of Route 6 east before the Route 6 bridge over Route 18. Currently, a concrete swale collects from a pervious area only. However, stormwater from the adjacent road, Route 6, jumps the curb and flows between the concrete swale and Route 6 and has caused significant erosion along Route 6. MassDOT proposes to completely remove the curb and place pavers along the stretch of removed curb to slow runoff, reduced erosion, and help divert water into the concrete swale. The proposed basin will be placed at the bottom of the slope to collect the stormwater from the concrete swale. In order to construct the basin, a section of the concrete swale can be removed and graded to create a basin.

Pr-BMP 8

MassDOT proposes an infiltration basin along Route 18 south before the Route 6 bridge over Route18, as seen in Figure 7. The location for the infiltration basin is a low lying grassy area that currently does not receive stormwater from impervious surfaces. The proposed area for the infiltration basin is close in proximity to a manhole that collects stormwater from Route 6 and Route 18 that currently drains into the main storm drain along Route 18 and discharges to the New Bedford Inner Harbor. MassDOT proposes to reroute drainage to the infiltration basin by installing a new pipe from the manhole to the basin. The proposed area for the infiltration basin would be regraded to form a basin.

Pr-BMP 9-16

MassDOT would construct a series of infiltration basins by grading depressions and placing check dams just upstream of existing drop inlets within the median of I-195 from just east of the I-195 bridge over the New Bedford Inner Harbor east to just west of the crossing of Main Street over I-195 as part of MassDOT Project #606139, as shown in Figure 6. Currently, stormwater from I-195 directly discharges to New Bedford Inner Harbor via a closed drainage system.

Pr-BMP 17-20 (Retrofit to Ex-BMP 1)

MassDOT proposes to leave the existing swale (Ex 01) as is and improve the treatment of stormwater entering the existing BMP. Plunge pools would be constructed at each of the four catch basin outfalls as shown in Figure 5. The small pools will help decrease the velocity of stormwater and allow sediment removal as well as providing an opportunity for infiltration. The plunge pools would serve as a method of pretreatment before the stormwater is discharged into the existing BMP.

The existing conditions assessment model was modified to develop a proposed conditions simulation including proposed BMPs, estimated potential contributing drainage areas and rough sizing of the proposed BMPs. The proposed swales and plunge pools were modeled as basins capable of infiltration.The table below provides information on the proposed BMPs, their MassDOT drainage areas and effective IC reductions. Attached to this report are the outputs from the assessment model showing effective IC analysis for each BMP. Several of the BMPs will completely infiltrate runoff on an annual average basis if, based on field conditions, it is possible to size them as estimated in this assessment. The assessment model identifies each BMP by unique ID, which is included in the table below.

Summary of Proposed Conditions

BMP Name / (BMP ID)	BMP Type	Estimated Watershed Load Pre-BMP Effective IC Acres	Estimated Percent Reduction Effective IC**	Estimated Load Reduction Effective IC Acres
EX 01 (88.2)	Water Quality Swale	1.2	57%	1.0
PR 02 (5.6)	Water Quality Swale	1.0	107%	1.0
PR 03 (3.6)	Water Quality Swale	1.0	43%	0.4
PR 04 (52.7)	Infiltration Basin	2.0	190%	3.7
PR 05 (48.7)	Infiltration Basin	0.8	176%	1.4
PR 06 (50.7)	Infiltration Basin	0.2	95%	0.2
PR 07 (51.7)	Infiltration Basin	0.6	60%	0.4
PR 08 (49.7)	Infiltration Basin	0.7	64%	0.5
PR 08 (49.7)	Infiltration Basin	0.7	64%	0.5
PR 09 (46.7)	Infiltration Basin	0.3	177%	0.5
PR 10 45.7)	Infiltration Basin	0.1	174%	0.2
PR 11 (44.7)	Infiltration Basin	0.3	153%	0.5
PR 12 (43.7)	Infiltration Basin	0.2	133%	0.3
PR 13 (42.7)	Infiltration Basin	0.3	161%	0.3
PR 14 (41.7)	Infiltration Basin	0.2	160%	0.3
PR 15 (40.7)	Infiltration Basin	0.4	125%	0.5

Summary of Proposed Conditions (Continued)

BMP Name	BMP Type	Estimated Watershed Load Pre-BMP Effective IC Acres	Estimated Percent Reduction Effective IC**	Estimated Load Reduction Effective IC Acres
PR 16 (39.7)	Infiltration Basin	0.2	101%	0.2
PR 17 (53.7)	Plunge Pool	0.1	68%	0.1
PR 18 (54.7)	Plunge Pool	0.5	17%	0.1
PR 19 (55.7)	Plunge Pool	0.4	20%	0.1
PR 20 (56.7)	Plunge Pool	0.7	16%	0.1
Total*				**8.0**

* Total Effective IC reduction based on the assessment model results for the total MassDOT directly discharging drainage area to the receiving water (not sum of individual BMP reductions).

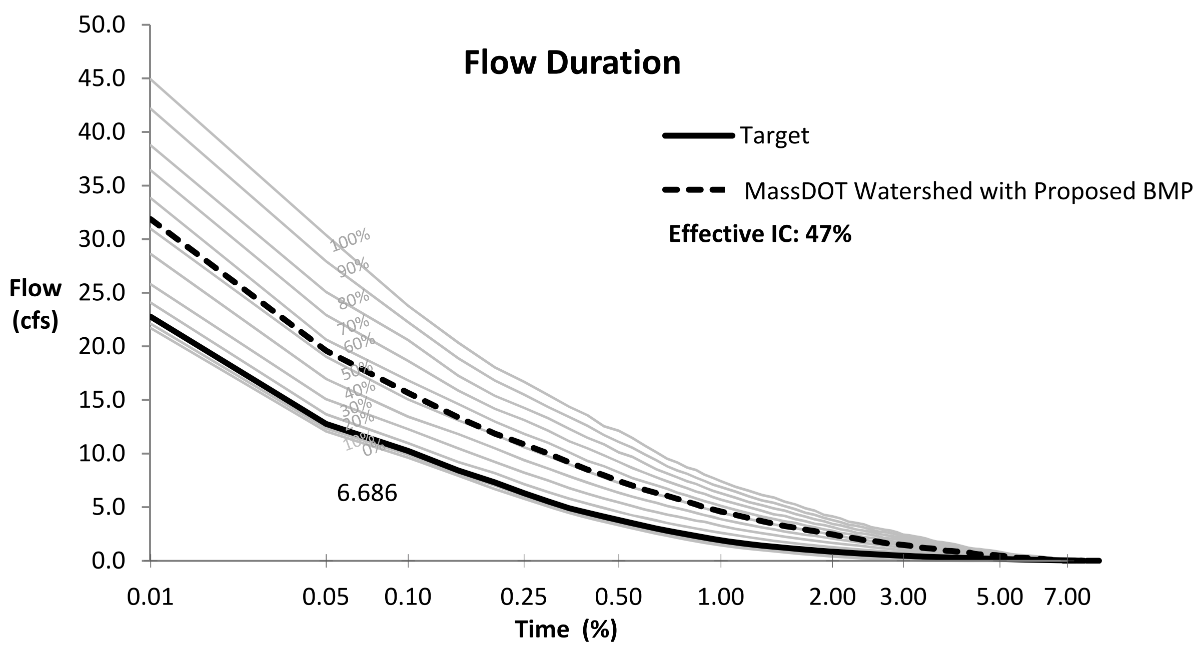
** The predicted effective IC is determined by comparing the BMPs calculated median annual discharge volume, runoff flow/duration relationship, median annual phosphorus load and median annual total suspended solids load to predicted discharge values for benchmark watersheds with the same size and varying percent IC. In cases where analysis predicts that BMPs would discharges less runoff volume and pollutant mass than those predicted for a 0% IC (pervious, woods in good condition) benchmark watershed, then the predicted effective IC removal would be greater than 100% and reduction of effective IC area will be greater than the BMP contributing IC area.

Proposed Mitigation

MassDOT used the assessment model to simulate the MassDOT directly contributing watershed and proposed BMPs for New Bedford Inner Harbor. The assessment model also simulated watersheds with the same area as the MassDOT watershed but with varying percentages of IC from 0 to 100% (benchmark watersheds). The results of the benchmark watersheds are used as “benchmarks” to determine effective IC of the MassDOT directly contributing watershed. The annual median runoff volume, phosphorus and total suspended solids (TSS) loads, and flow duration for the MassDOT watershed were compared to those results for the benchmark watersheds to determine (based on similar runoff and load responses) the equivalent or effective impervious cover of the MassDOT watershed with BMPs treating a portion of the runoff. The graph and table below summarize assessment model results for the MassDOT directly contributing drainage area including the impacts of the proposed BMPs, along with the benchmark watersheds.

Proposed Median Annual Load Comparisons

Simulated IC Watersheds		Runoff (ac-ft)	P (lb.)	TSS (lb.)
	0% IC	45.3	3.3	220
	5% IC	53.4	5.2	1,085
Target	**8% IC**	**58.9**	**6.9**	**1,930**
	10% IC	61.3	7.7	2,301
	20% IC	77.0	15.8	6,358
	30% IC	92.6	27.9	12,974
	40% IC	108.2	44.1	21,900
	50% IC	123.3	63.3	32,808
	60% IC	138.3	84.0	44,738
	70% IC	153.3	105.3	56,785
	80% IC	168.4	126.6	68,794
	90% IC	183.8	147.2	80,505
	100% IC	199.0	168.3	92,415
	Existing Conditions	142.6	108.8	59,074
	Proposed Conditions	148.2	102.5	55,270
	Reduction %	**15%**	**16%**	**17%**
	Effective IC	**52%**	**61%**	**61%**



Effective IC Results

Existing Estimated Effective IC	38 ac
Proposed Estimated Effective IC	32.7 ac
IC Reduction % with Proposed BMPs	20%
Estimated Effective IC*	47%

*Average of estimated Effective IC for annual median runoff volume, phosphorus and TSS loads, and flow duration

MassDOT estimated the effective IC under proposed conditions as 47% by comparing the annual median runoff volume, phosphorus and TSS loads, and flow distribution statistics (flow duration) from MassDOT drainage area with proposed BMPs to the receiving water to those results for benchmark watersheds. The existing BMP mitigates an estimated 0.2 acres of IC and with the proposed BMPs mitigate an estimated 8.0 acres of IC, resulting in 23.3 acres of effective IC for the MassDOT direct watershed under proposed conditions.

It is important to note that although the proposed BMPs do not reach the target reduction of 32 acres, the BMPs will have a notable benefit to the water quality of New Bedford Inner Harbor. The retrofits to Ex BMP 1 (Pr BMPs 17-20) can provide up to 90% reduction of TSS for each plunge pool. There are two instances where stormwater is currently discharged into the combined sewer system. The proposed BMPs, Pr BMP 2 and Pr BMP 3, will help prevent stormwater, on annual average conditions, from discharging to the sewer system and reduce the instances of sewage overflows.

MassDOT will continue to ensure proper non-structural BMPs are being implemented within the watershed of the New Bedford Inner Harbor, including regular roadway and drainage system maintenance, erosion and sedimentation control, and outreach and education.

In addition, BMP implementation through MassDOT's programmed projects are carefully evaluated and implemented where practicable, and documented through the MassDOT Water Quality Data Form. The potential for BMPs outside of MassDOT property will be reviewed during the design phase of these projects and through ongoing partnerships with other state and local entities.

Conclusions

MassDOT has assessed stormwater impacts from MassDOT properties directly discharging to the New Bedford Inner Harbor using BMP 7R to address the Pathogen TMDL and BMP 7U to address impairments not covered by a TMDL. This assessment found that one existing BMP treats stormwater discharges from MassDOT properties. MassDOT proposes to install 19 BMPs to reduce MassDOT's contribution to impairments within the New Bedford Inner Harbor watershed.

The following table summarizes the effective IC reductions proposed in the New Bedford Inner Harbor's watershed.

Reductions Applied to MassDOT Direct Watershed

	Effective IC (Acres)
MassDOT's Area Directly Contributing to Impaired Segment	37
Target Reduction	32
Reduction Achieved by Existing BMPs	0.2
Reduction Provided in Proposed Conditions	8.0
Remaining Reduction to meet Target	23.3

The existing BMP reduces the effective IC of the watershed by 0.2 acres. The proposed BMPs will reduce the effective IC of the watershed by 8.0 acres, which is less than the target reduction of 32 acres.

MassDOT will proceed to the design phase to develop construction plans for the proposed BMPs as part of the MassDOT Impaired Waters Program. The project designer will gather additional information in this phase, such as soil data and site survey, to further refine the proposed BMPs. Once the design of the proposed BMPs is finalized, MassDOT will provide an update with additional information and summarize the final effective IC reduction based on the as-built condition. MassDOT will continue to implement non-structural BMPs that reduce potential pollutant loading.

As an overall program, MassDOT will re-evaluate the potential need for structural BMPs to address pollutant loading when roadwork is conducted as programmed projects for the area. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to address impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of proposed BMPs and finalized assessments including reduction achieved by finalized BMP designs. Furthermore, MassDOT will continue to implement non-structural BMPs that reduce the impacts of stormwater.

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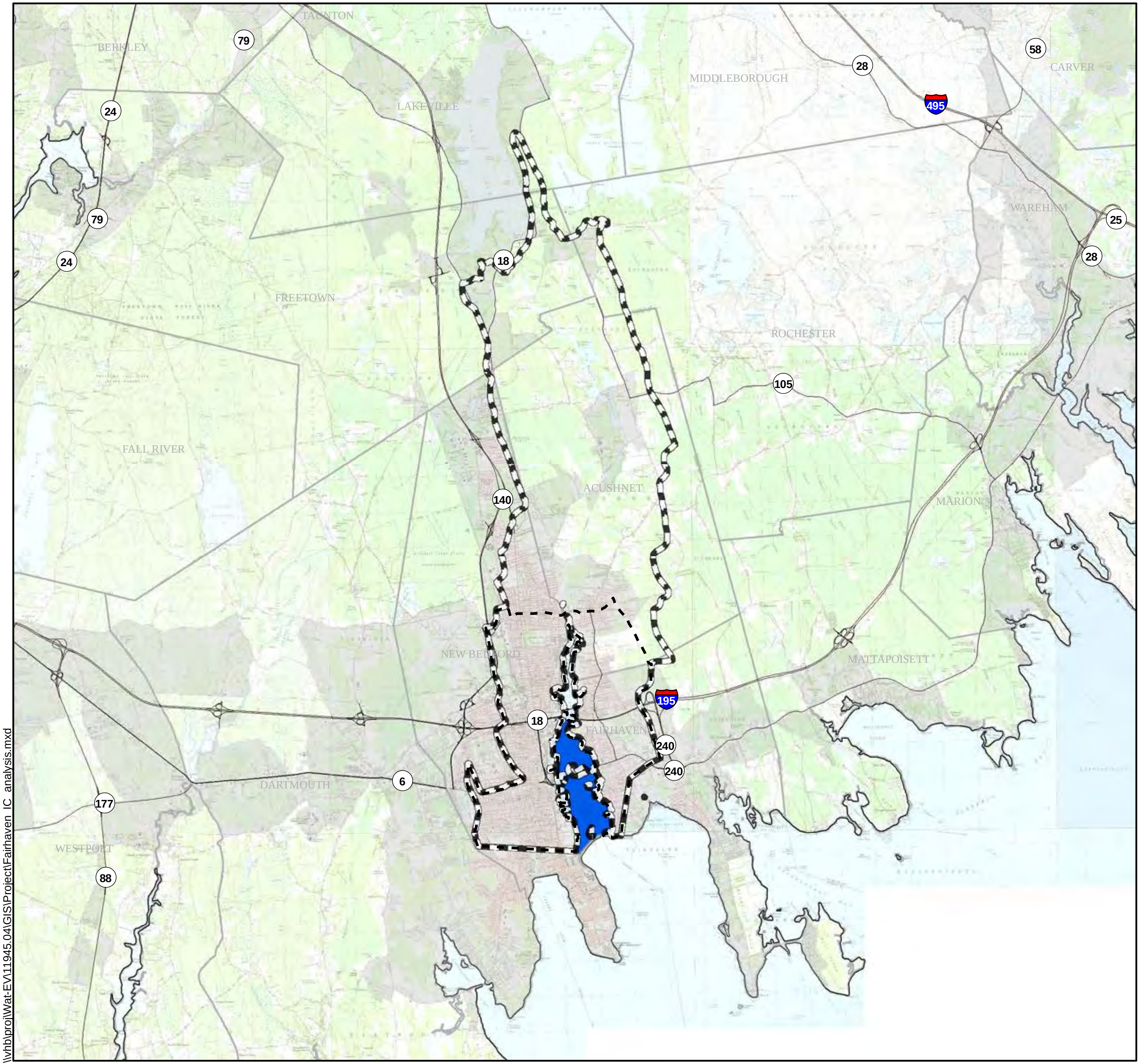

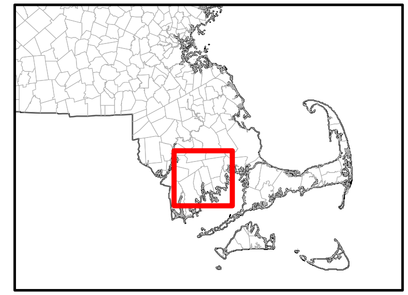

Legend

Subwatershed

Total Watershed

MassDOT Roadways

2010 Urban Area

Assessed Segment

N

0 1.5 3 Miles

Figure 1

New Bedford Inner Harbor
MA95-42
Watersheds

December 2012

massDOT Massachusetts Department of Transportation Highway Division

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Legend

- MassDOT Roadways in Urban Area
- Impaired Waters
- MassDOT Directly Discharging Watershed

N

0 375 750 1,500 Feet

Figure 2

New Bedford Inner Harbor
MA95-42
Directly Contributing
MassDOT Watershed

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Highway Division

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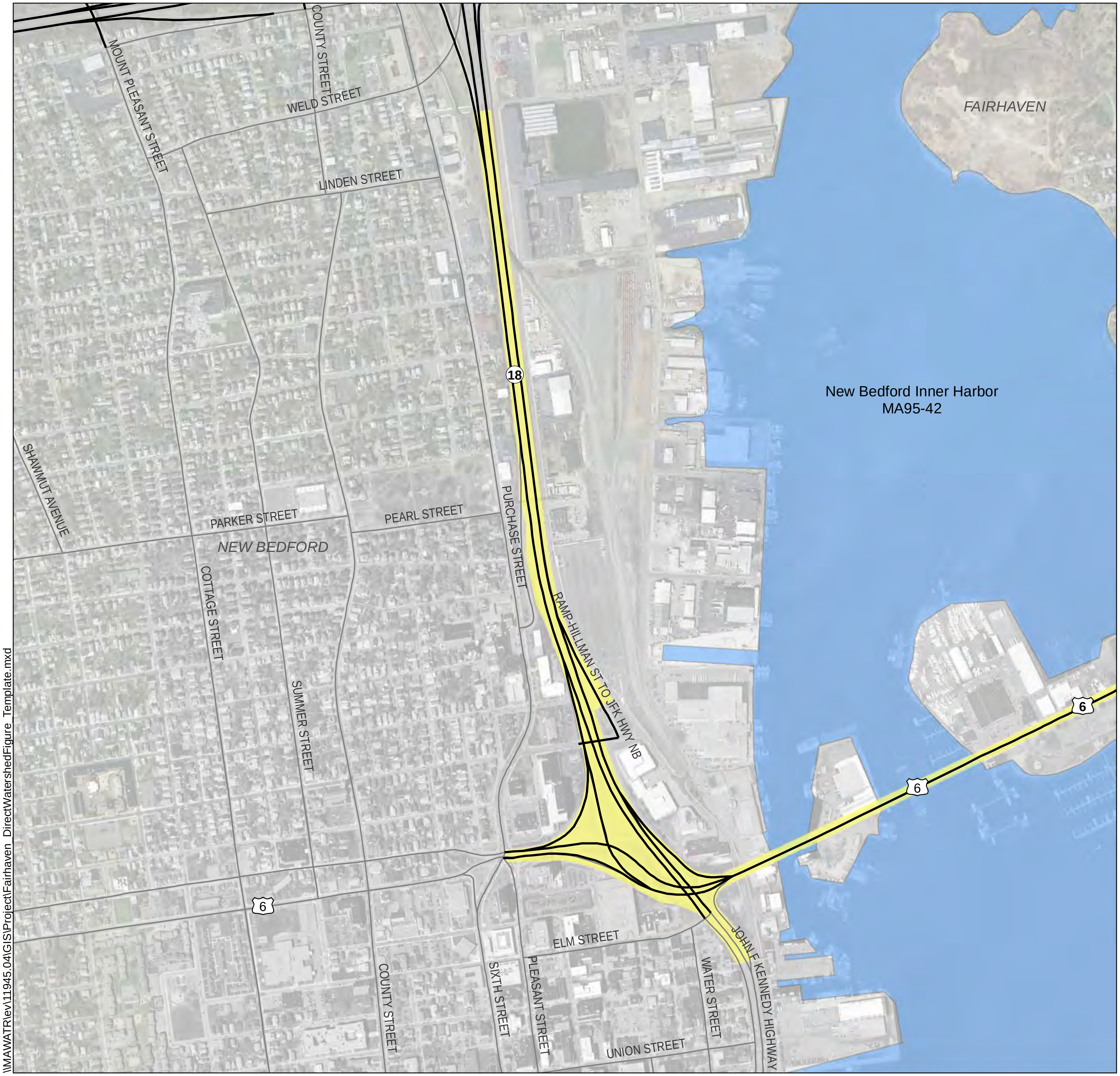

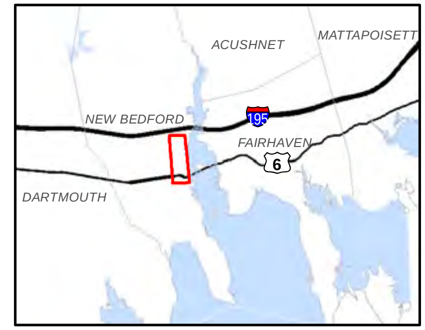

Legend

- MassDOT Roadways in Urban Area
- Impaired Waters
- MassDOT Directly Discharging Watershed

N

0 375 750 1,500 Feet

Figure 3

New Bedford Inner Harbor MA95-42 Directly Contributing MassDOT Watershed

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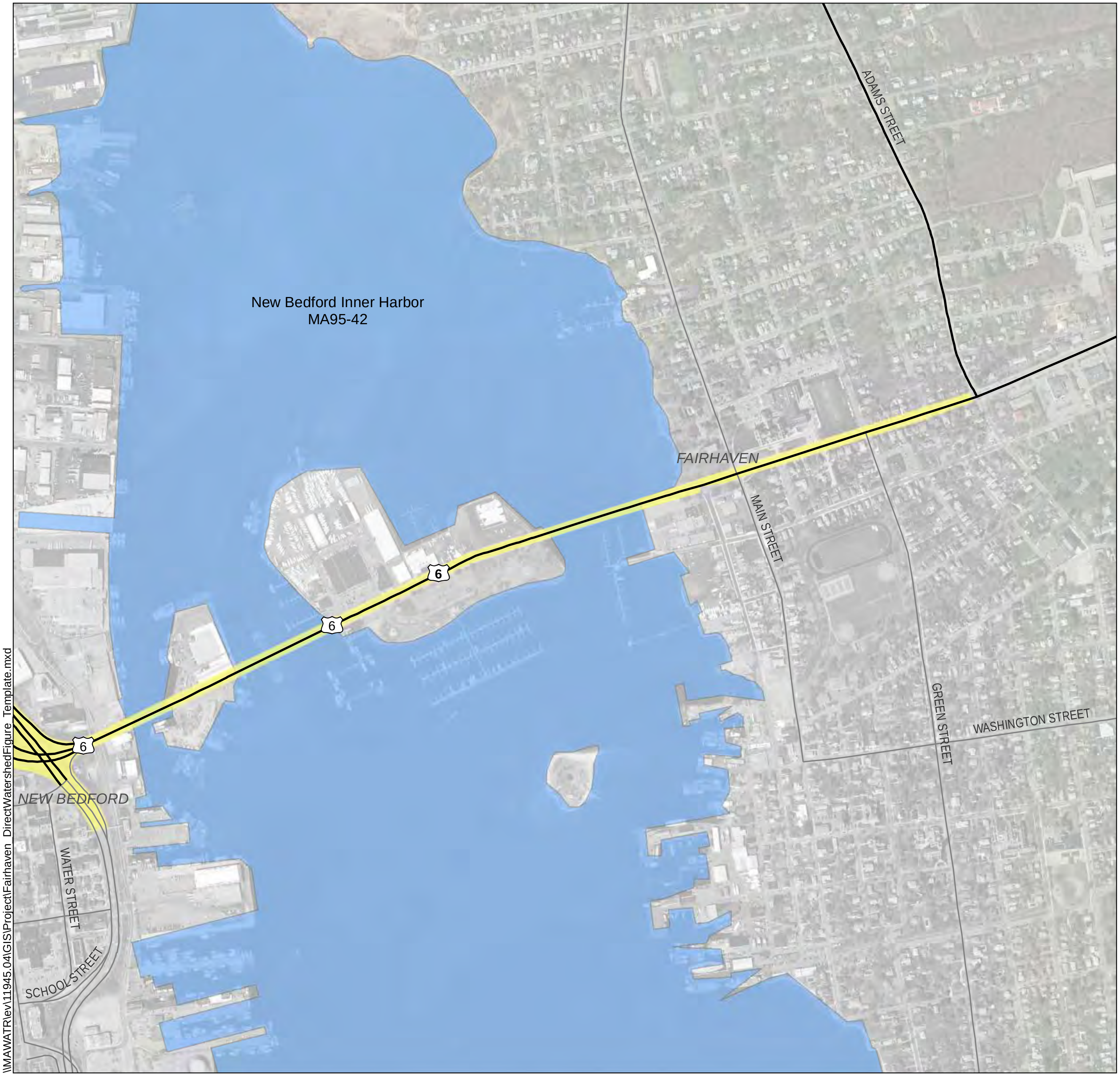

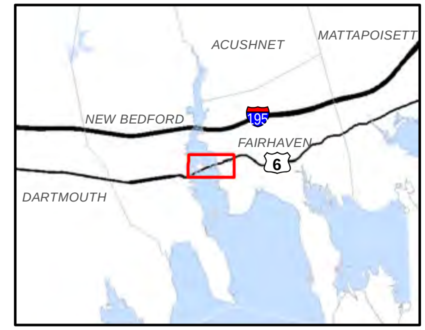

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MassDOT Roadways in Urban Area

Impaired Waters

MassDOT Directly Discharging Watershed

N

0 375 750 1,500 Feet

Figure 4

New Bedford Inner Harbor MA95-42 Directly Contributing MassDOT Watershed

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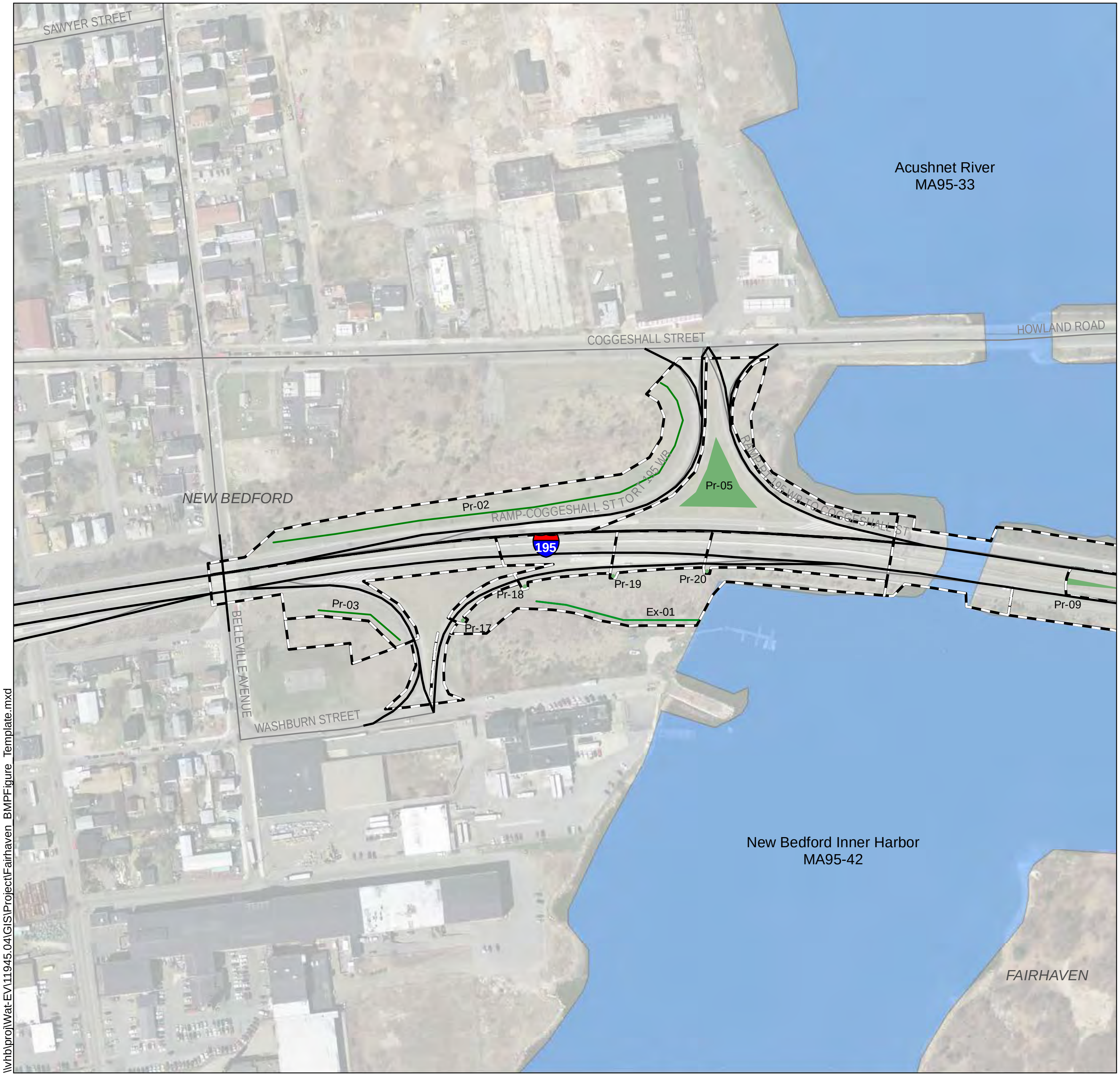

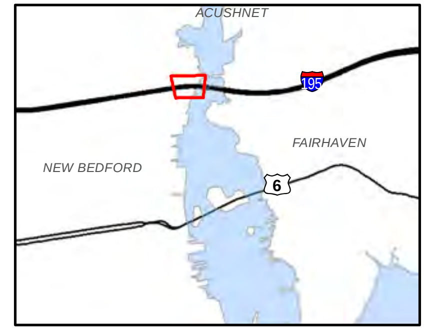

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MassDOT Roadways in Urban Area

BMPs

BMP Watersheds

Impaired Waters

0 125 250 500 Feet

Figure 5

New Bedford Inner Harbor
MA95-42
Stormwater BMPs

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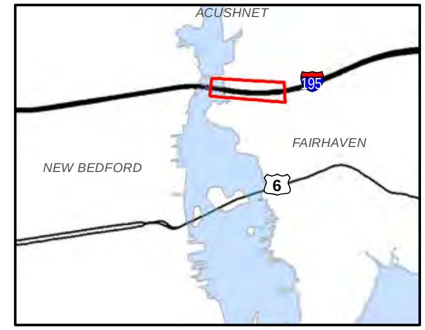
Highway Division



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MassDOT Roadways in Urban Area

BMPs

BMP Watersheds

Impaired Waters

0 200 400 800 Feet

Figure 6

New Bedford Inner Harbor
MA95-42
Stormwater BMPs

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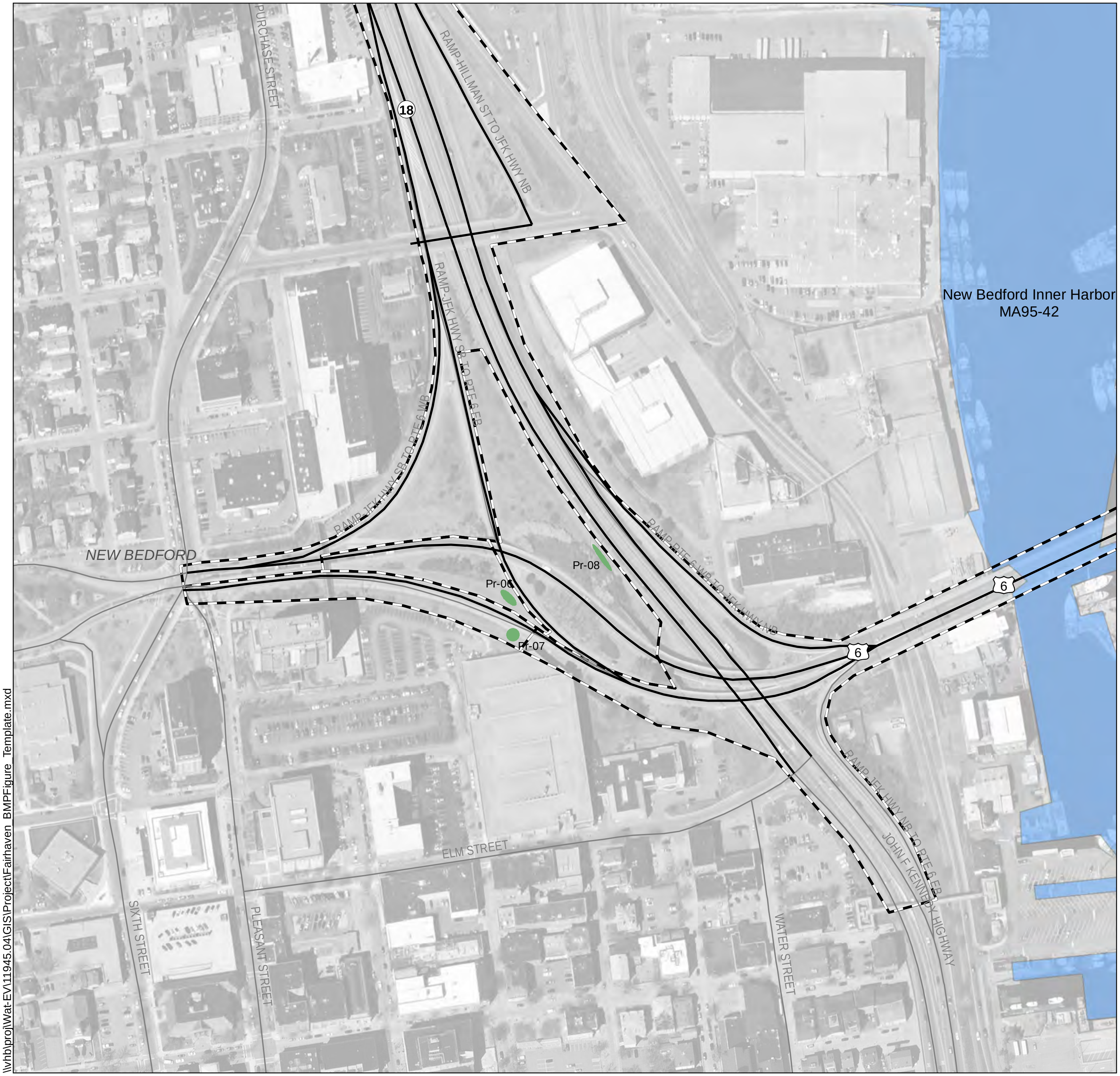

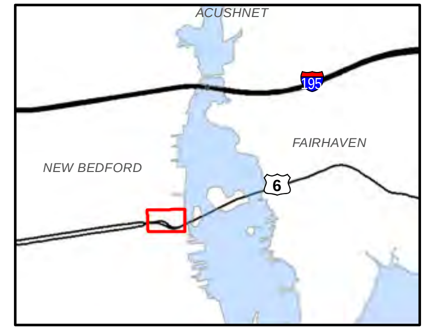

Legend

- MassDOT Roadways in Urban Area
- BMPs
- BMP Watersheds
- Impaired Waters

0 125 250 500 Feet

Figure 7

New Bedford Inner Harbor
MA95-42
Stormwater BMPs

December 2012

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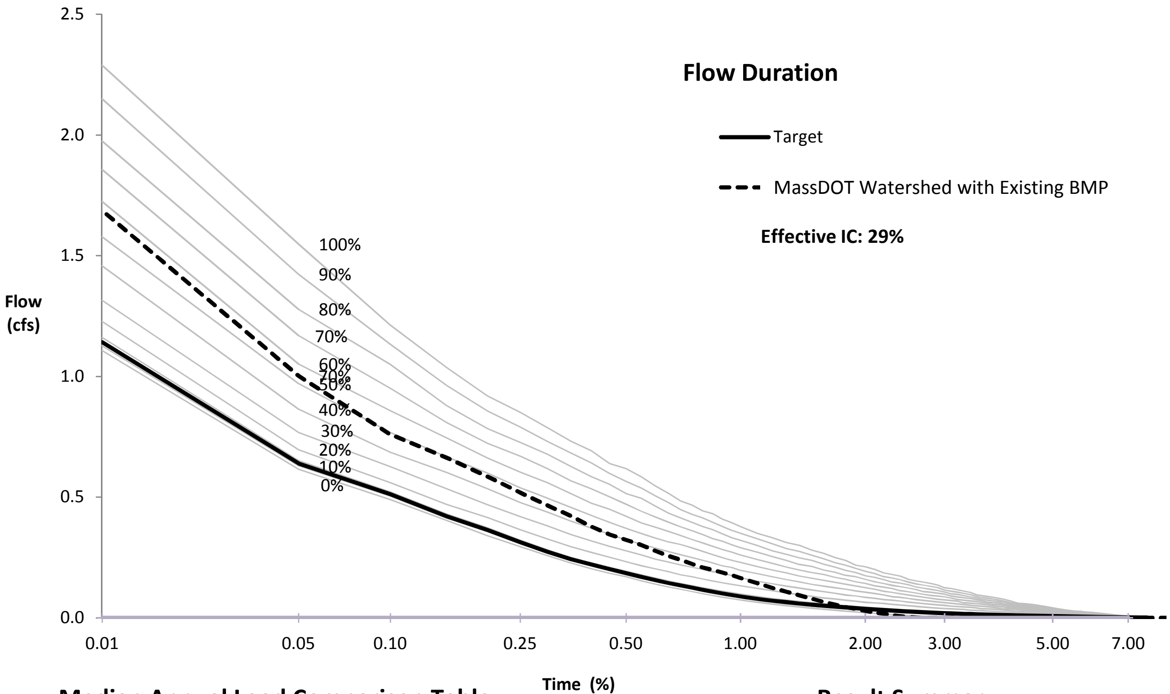
MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 88.2



Median Annual Load Comparison Table

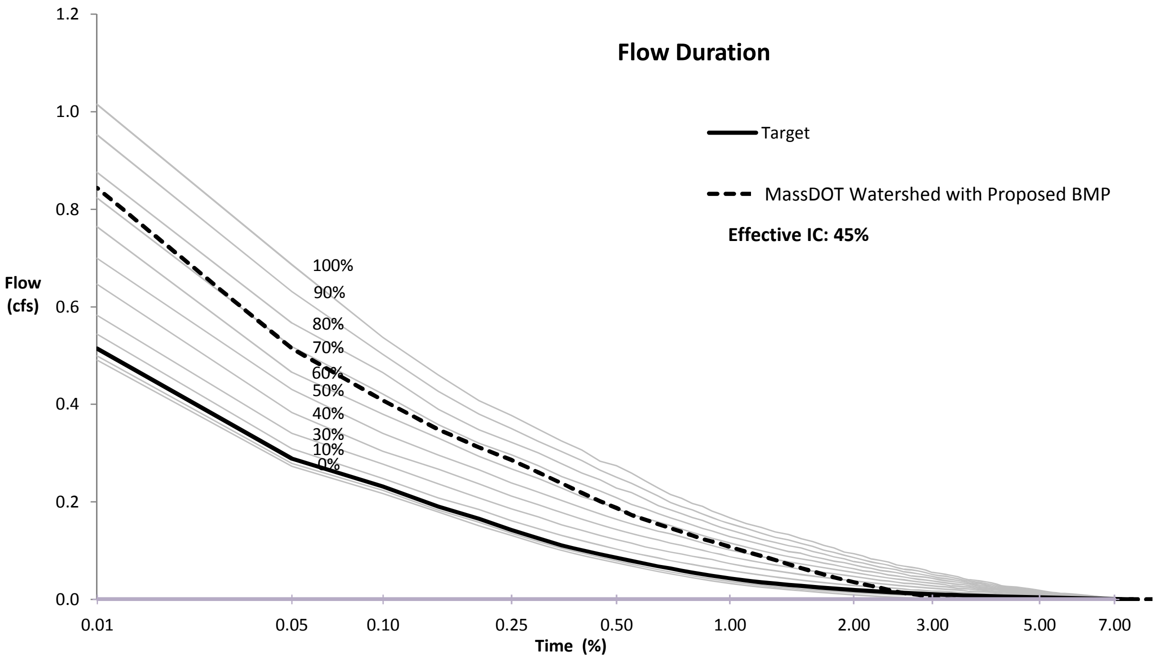
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	2.3	0.2	11
5%IC	2.7	0.3	55
10% IC	3.1	0.4	117
20% IC	3.9	0.8	324
30% IC	4.7	1.4	661
40% IC	5.5	2.2	1,116
50% IC	6.3	3.2	1,672
60% IC	7.0	4.3	2,280
70% IC	7.8	5.4	2,894
80% IC	8.6	6.4	3,506
90% IC	9.4	7.5	4,103
100% IC	10.1	8.6	4,710
Watershed Load	6.68	4.70	2,541
BMP Output	3.86	0.96	308
Target	2.90	0.32	82
Reduction %	**42%**	**80%**	**88%**
Effective IC	**19%**	**23%**	**19%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		3.2
Watershed IC (no BMP)	55%	1.8
Target IC reduction	87%	1.5
Effective IC w/BMP	24%	0.8
Difference from Target		(0.8)
IC Reduction	57%	1.0

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 3.6



Median Annual Load Comparison Table

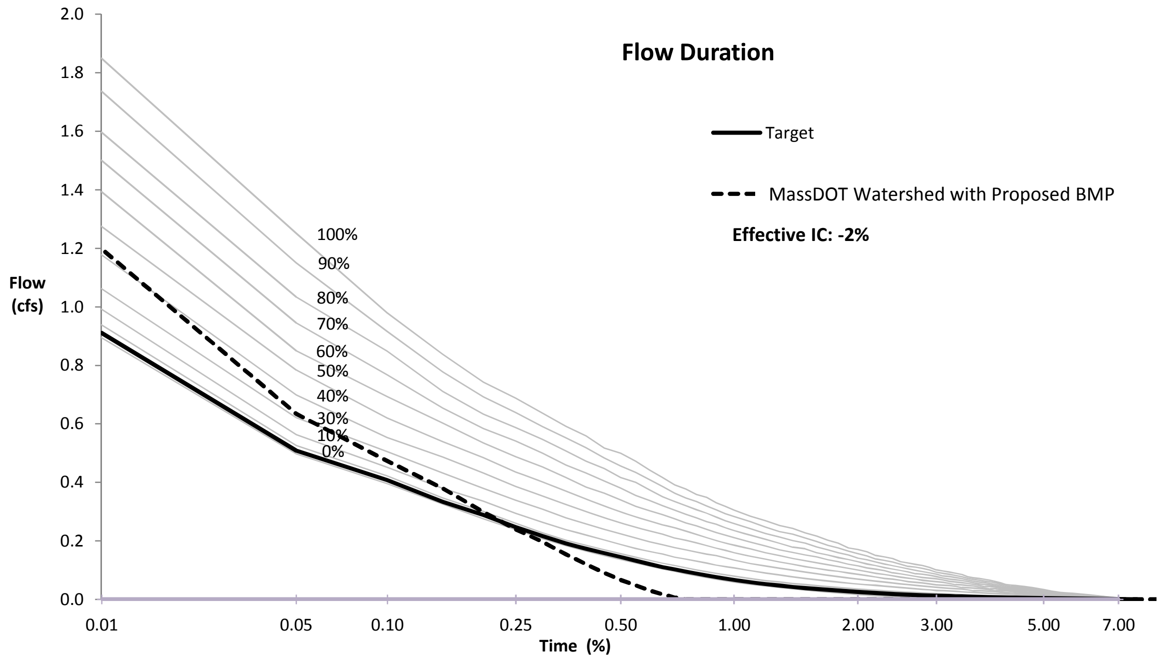
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	1.0	0.1	5
5%IC	1.2	0.1	25
10% IC	1.4	0.2	52
20% IC	1.7	0.4	144
30% IC	2.1	0.6	293
40% IC	2.4	1.0	495
50% IC	2.8	1.4	741
60% IC	3.1	1.9	1,011
70% IC	3.5	2.4	1,283
80% IC	3.8	2.9	1,554
90% IC	4.2	3.3	1,819
100% IC	4.5	3.8	2,088
Watershed Load	3.50	2.68	1,457
BMP Output	2.35	0.96	347
Target	0.79	0.10	30
Reduction %	**33%**	**64%**	**76%**
Effective IC	**37%**	**39%**	**33%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		1.4
Watershed IC (no BMP)	70%	1.0
Target IC reduction	87%	0.9
Effective IC w/BMP	40%	0.6
Difference from Target		(0.3)
IC Reduction	43%	0.4

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 5.6



Median Annual Load Comparison Table

Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	1.9	0.1	9
5%IC	2.2	0.2	45
10% IC	2.5	0.3	95
20% IC	3.2	0.6	262
30% IC	3.8	1.2	534
40% IC	4.5	1.8	902
50% IC	5.1	2.6	1,351
60% IC	5.7	3.5	1,843
70% IC	6.3	4.3	2,339
80% IC	6.9	5.2	2,833
90% IC	7.6	6.1	3,316
100% IC	8.2	6.9	3,806
Watershed Load	4.39	2.65	1,406
BMP Output	1.30	0.13	23
Target	2.20	0.21	44
Reduction %	**70%**	**95%**	**98%**
Effective IC	**-8%**	**0%**	**8%**

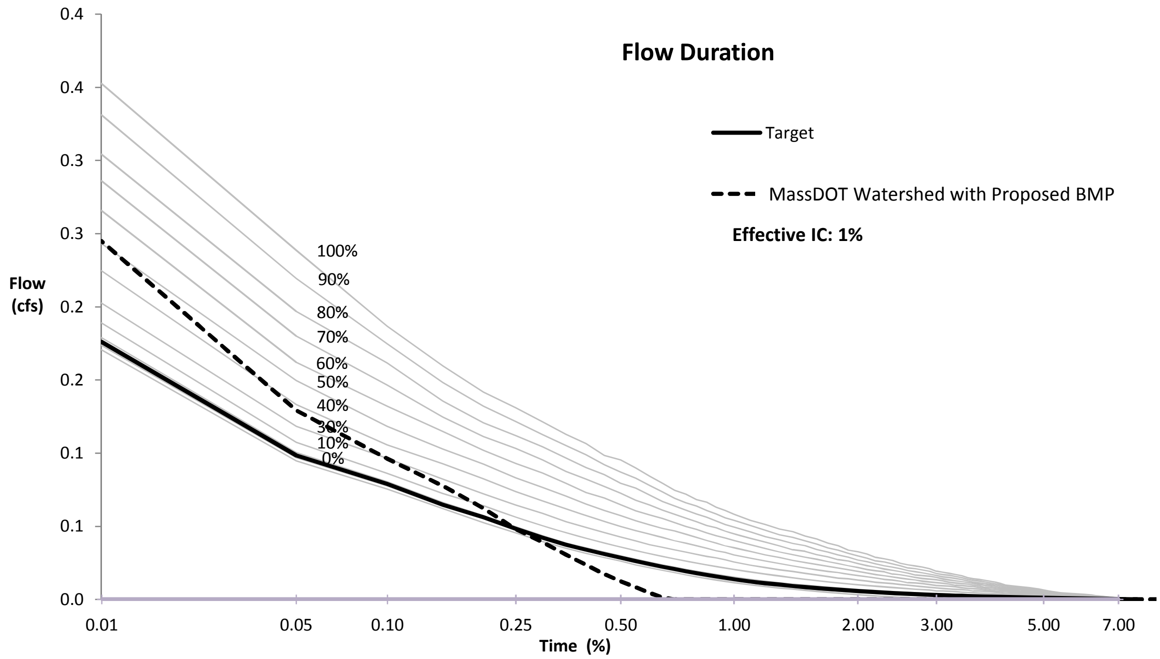
Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		2.6
Watershed IC (no BMP)	38%	1.0
Target IC reduction	87%	0.9
Effective IC w/BMP	-1%	(0.0)
Difference from Target		(0.9)
IC Reduction	102%	1.0

* Effective IC calculated as follows:

1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 39.7



Median Annual Load Comparison Table

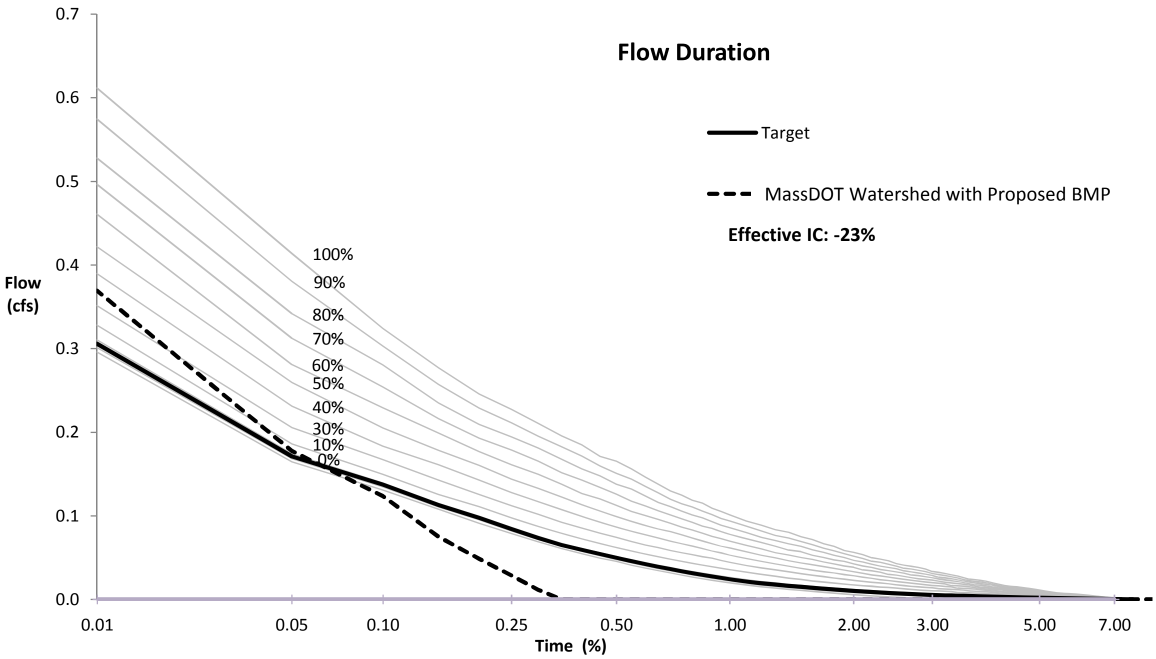
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	0.4	0.0	2
5%IC	0.4	0.0	9
10% IC	0.5	0.1	18
20% IC	0.6	0.1	50
30% IC	0.7	0.2	102
40% IC	0.8	0.3	172
50% IC	1.0	0.5	258
60% IC	1.1	0.7	351
70% IC	1.2	0.8	446
80% IC	1.3	1.0	540
90% IC	1.4	1.2	632
100% IC	1.6	1.3	726
Watershed Load	0.97	0.49	254
BMP Output	0.26	0.04	9
Target	0.22	0.02	5
Reduction %	**73%**	**92%**	**97%**
Effective IC	**-7%**	**9%**	**9%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		0.5
Watershed IC (no BMP)	49%	0.2
Target IC reduction	87%	0.2
Effective IC w/BMP	1%	0.0
Difference from Target		(0.2)
IC Reduction	98%	0.2

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 40.7



Median Annual Load Comparison Table

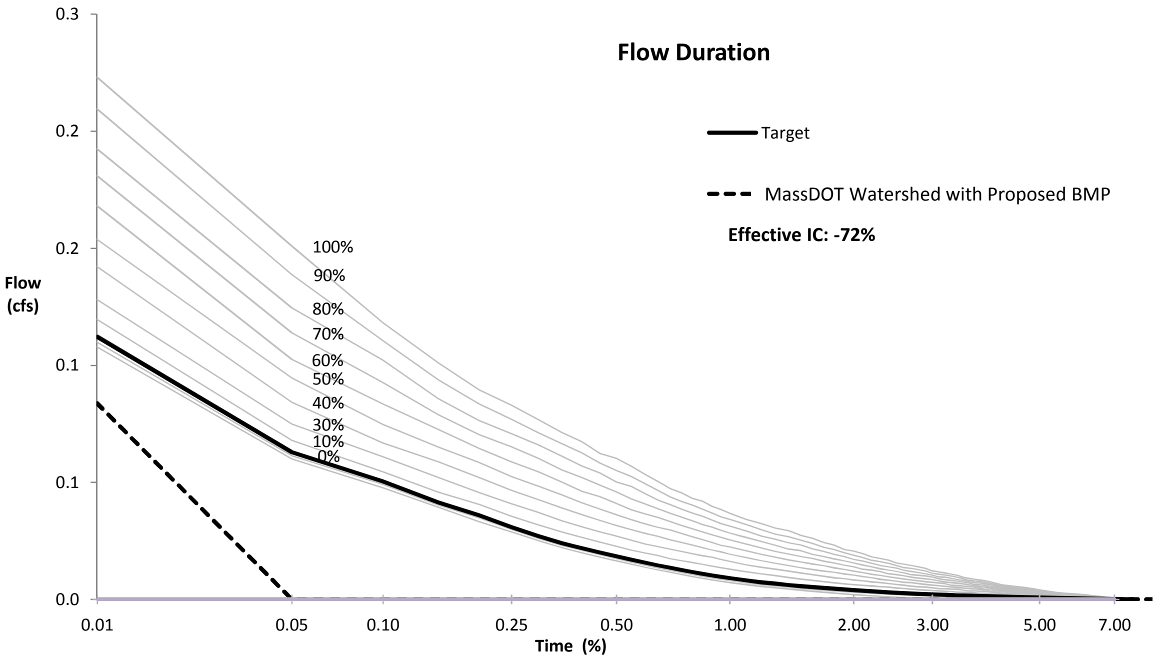
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	0.6	0.0	3
5%IC	0.7	0.1	15
10% IC	0.8	0.1	31
20% IC	1.0	0.2	87
30% IC	1.3	0.4	177
40% IC	1.5	0.6	298
50% IC	1.7	0.9	447
60% IC	1.9	1.1	609
70% IC	2.1	1.4	774
80% IC	2.3	1.7	937
90% IC	2.5	2.0	1,097
100% IC	2.7	2.3	1,259
Watershed Load	1.71	0.89	465
BMP Output	0.25	0.03	6
Target	0.34	0.03	7
Reduction %	**85%**	**97%**	**99%**
Effective IC	**-16%**	**-3%**	**8%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		0.9
Watershed IC (no BMP)	51%	0.4
Target IC reduction	87%	0.4
Effective IC w/BMP	-10%	(0.1)
Difference from Target		(0.5)
IC Reduction	120%	0.5

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 41.7



Median Annual Load Comparison Table

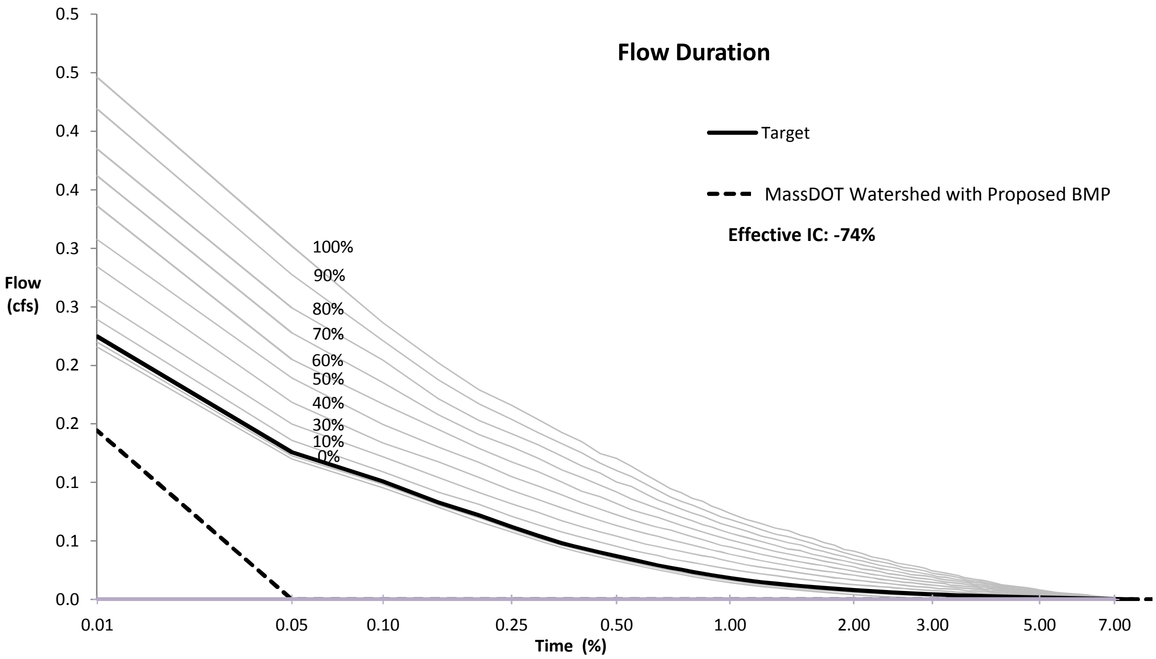
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	0.2	0.0	1
5%IC	0.3	0.0	5
10% IC	0.3	0.0	11
20% IC	0.4	0.1	32
30% IC	0.5	0.1	64
40% IC	0.5	0.2	109
50% IC	0.6	0.3	163
60% IC	0.7	0.4	222
70% IC	0.8	0.5	282
80% IC	0.8	0.6	342
90% IC	0.9	0.7	400
100% IC	1.0	0.8	459
Watershed Load	0.65	0.37	196
BMP Output	0.01	0.00	0
Target	0.08	0.01	2
Reduction %	**99%**	**100%**	**100%**
Effective IC	**-27%**	**-8%**	**-1%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		0.3
Watershed IC (no BMP)	55%	0.2
Target IC reduction	87%	0.1
Effective IC w/BMP	-33%	(0.1)
Difference from Target		(0.3)
IC Reduction	160%	0.3

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
    a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
    b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 42.7



Median Annual Load Comparison Table

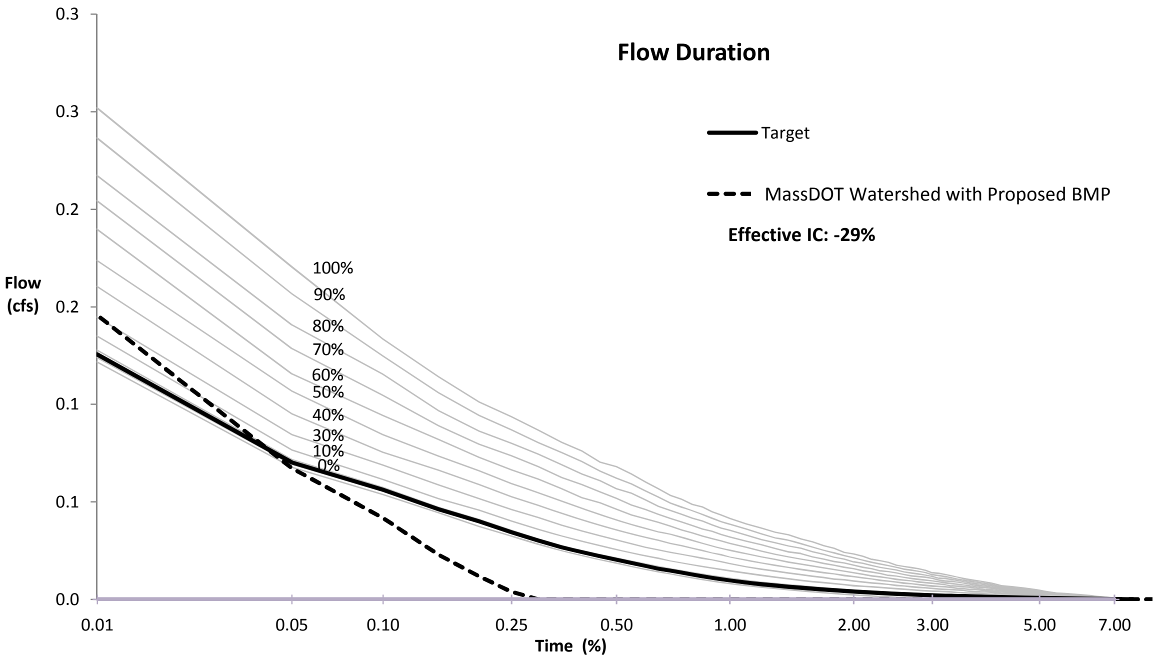
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	0.4	0.0	2
5%IC	0.5	0.1	11
10% IC	0.6	0.1	23
20% IC	0.8	0.2	63
30% IC	0.9	0.3	129
40% IC	1.1	0.4	218
50% IC	1.2	0.6	326
60% IC	1.4	0.8	445
70% IC	1.5	1.0	564
80% IC	1.7	1.3	684
90% IC	1.8	1.5	800
100% IC	2.0	1.7	918
Watershed Load	1.33	0.76	403
BMP Output	0.01	0.00	0
Target	0.13	0.01	3
Reduction %	**99%**	**100%**	**100%**
Effective IC	**-27%**	**-8%**	**-1%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		0.6
Watershed IC (no BMP)	56%	0.3
Target IC reduction	87%	0.3
Effective IC w/BMP	-34%	(0.2)
Difference from Target		(0.5)
IC Reduction	161%	0.6

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 43.7



Median Annual Load Comparison Table

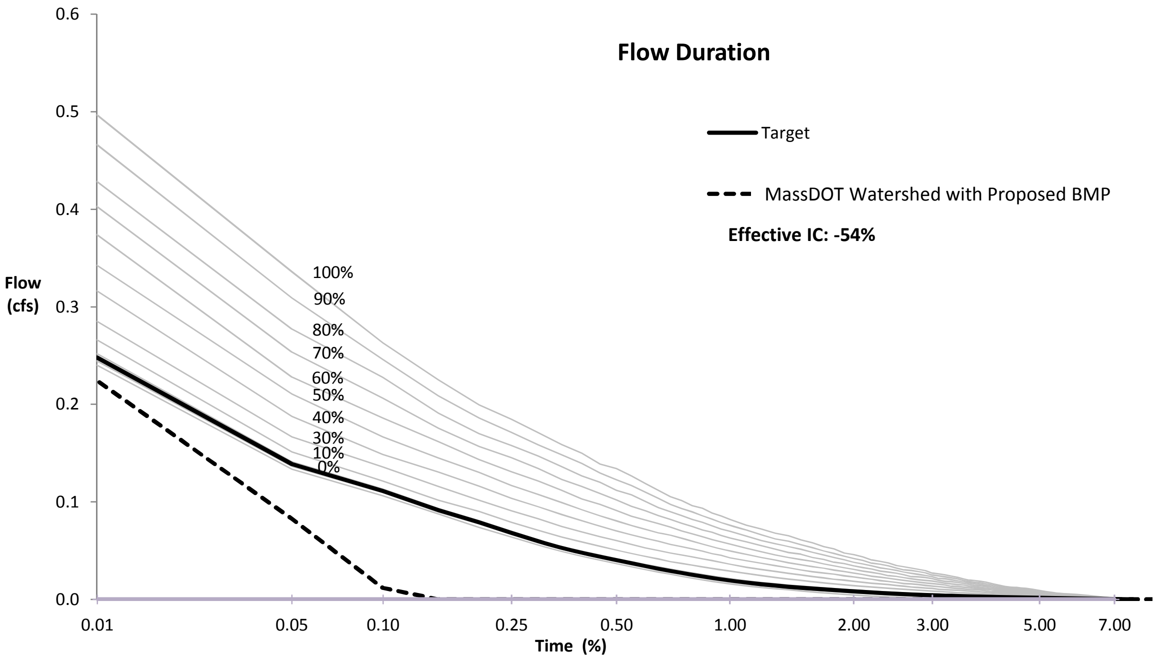
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	0.3	0.0	1
5%IC	0.3	0.0	6
10% IC	0.3	0.0	13
20% IC	0.4	0.1	36
30% IC	0.5	0.2	73
40% IC	0.6	0.2	123
50% IC	0.7	0.4	184
60% IC	0.8	0.5	251
70% IC	0.9	0.6	319
80% IC	0.9	0.7	386
90% IC	1.0	0.8	452
100% IC	1.1	0.9	518
Watershed Load	0.68	0.34	174
BMP Output	0.08	0.01	1
Target	0.18	0.02	4
Reduction %	**88%**	**98%**	**99%**
Effective IC	**-19%**	**-5%**	**0%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		0.4
Watershed IC (no BMP)	48%	0.2
Target IC reduction	87%	0.1
Effective IC w/BMP	-16%	(0.1)
Difference from Target		(0.2)
IC Reduction	133%	0.2

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 44.7



Median Annual Load Comparison Table

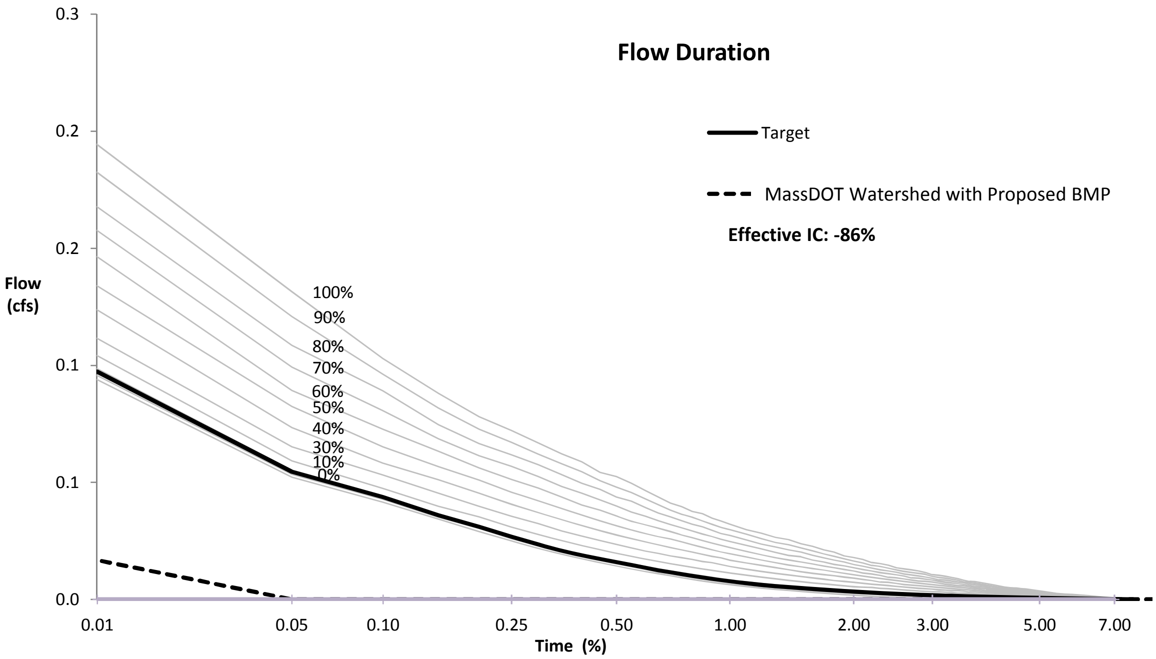
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	0.5	0.0	2
5%IC	0.6	0.1	12
10% IC	0.7	0.1	25
20% IC	0.9	0.2	70
30% IC	1.0	0.3	143
40% IC	1.2	0.5	242
50% IC	1.4	0.7	363
60% IC	1.5	0.9	495
70% IC	1.7	1.2	628
80% IC	1.9	1.4	761
90% IC	2.0	1.6	890
100% IC	2.2	1.9	1,022
Watershed Load	1.37	0.70	365
BMP Output	0.07	0.01	1
Target	0.30	0.03	6
Reduction %	**95%**	**99%**	**100%**
Effective IC	**-24%**	**-7%**	**-1%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		0.7
Watershed IC (no BMP)	50%	0.3
Target IC reduction	87%	0.3
Effective IC w/BMP	-26%	(0.2)
Difference from Target		(0.5)
IC Reduction	153%	0.5

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
    a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
    b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 45.7



Median Annual Load Comparison Table

Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	0.2	0.0	1
5%IC	0.2	0.0	5
10% IC	0.3	0.0	10
20% IC	0.3	0.1	28
30% IC	0.4	0.1	56
40% IC	0.5	0.2	95
50% IC	0.5	0.3	142
60% IC	0.6	0.4	194
70% IC	0.7	0.5	246
80% IC	0.7	0.5	298
90% IC	0.8	0.6	348
100% IC	0.9	0.7	400
Watershed Load	0.55	0.30	155
BMP Output	0.00	0.00	0
Target	0.09	0.01	2
Reduction %	**100%**	**100%**	**100%**
Effective IC	**-28%**	**-8%**	**-1%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		0.3
Watershed IC (no BMP)	52%	0.1
Target IC reduction	87%	0.1
Effective IC w/BMP	-38%	(0.1)
Difference from Target		(0.2)
IC Reduction	174%	0.2

* Effective IC calculated as follows:

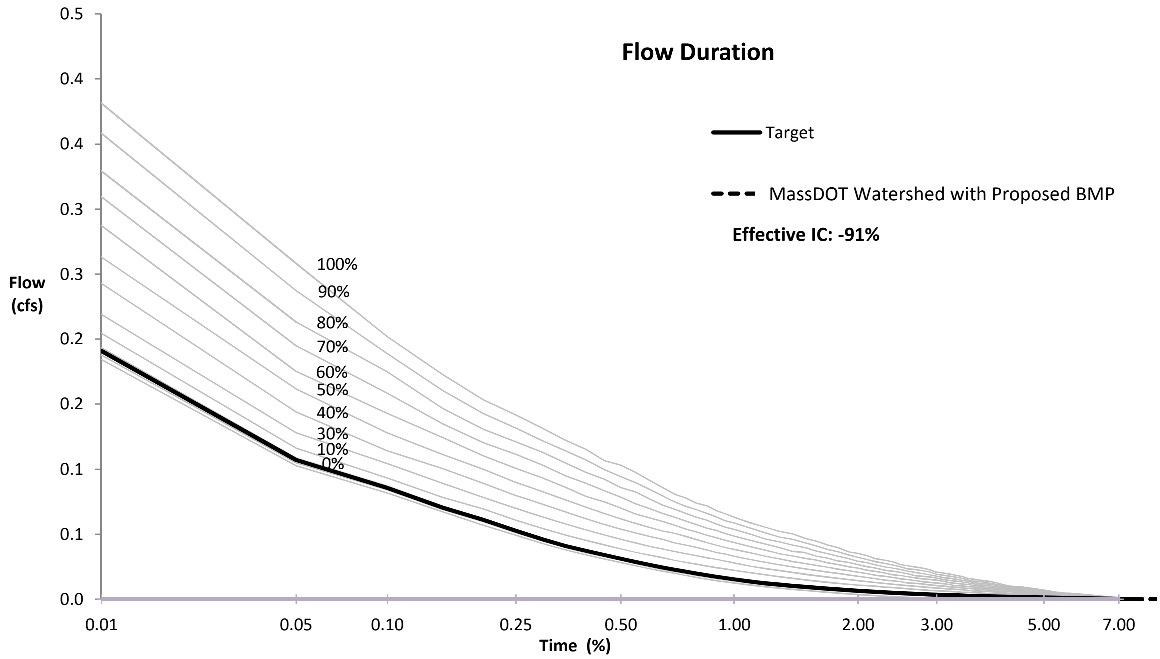
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves

   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues

   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)

2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 46.7



Median Annual Load Comparison Table

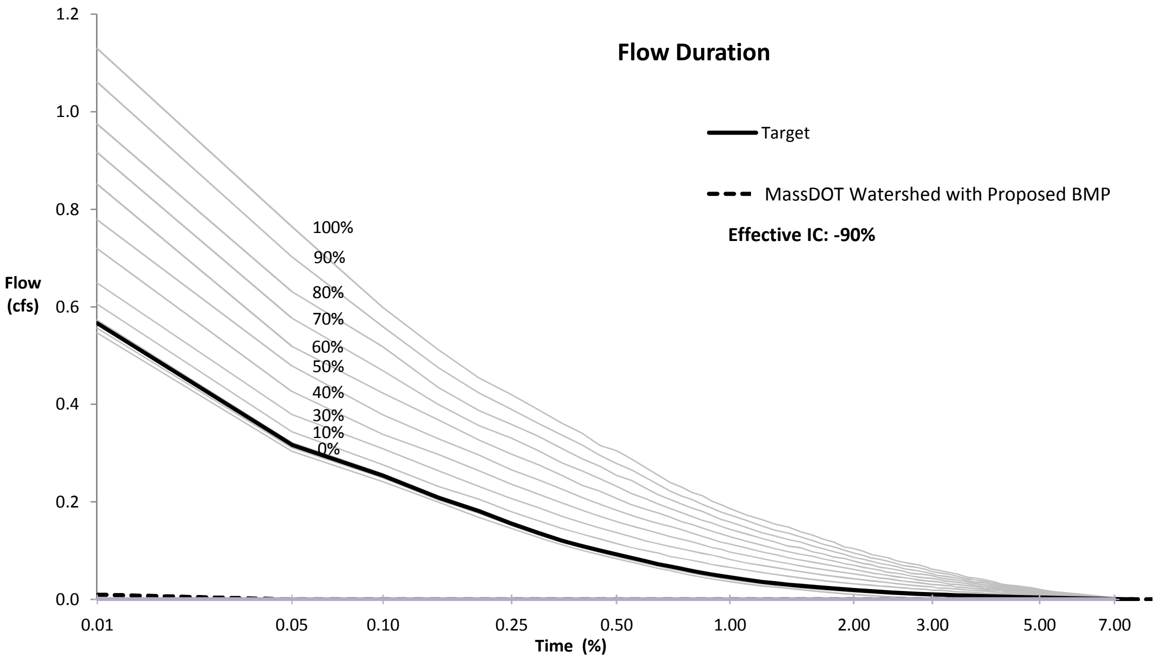
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	0.4	0.0	2
5%IC	0.5	0.0	9
10% IC	0.5	0.1	20
20% IC	0.7	0.1	54
30% IC	0.8	0.2	110
40% IC	0.9	0.4	186
50% IC	1.0	0.5	279
60% IC	1.2	0.7	380
70% IC	1.3	0.9	482
80% IC	1.4	1.1	584
90% IC	1.6	1.3	684
100% IC	1.7	1.4	785
Watershed Load	1.08	0.57	300
BMP Output	-	-	-
Target	0.19	0.02	4
Reduction %	**100%**	**100%**	**100%**
Effective IC	**-28%**	**-8%**	**-1%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		0.5
Watershed IC (no BMP)	52%	0.3
Target IC reduction	87%	0.2
Effective IC w/BMP	-40%	(0.2)
Difference from Target		(0.5)
IC Reduction	177%	0.5

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 48.7



Median Annual Load Comparison Table

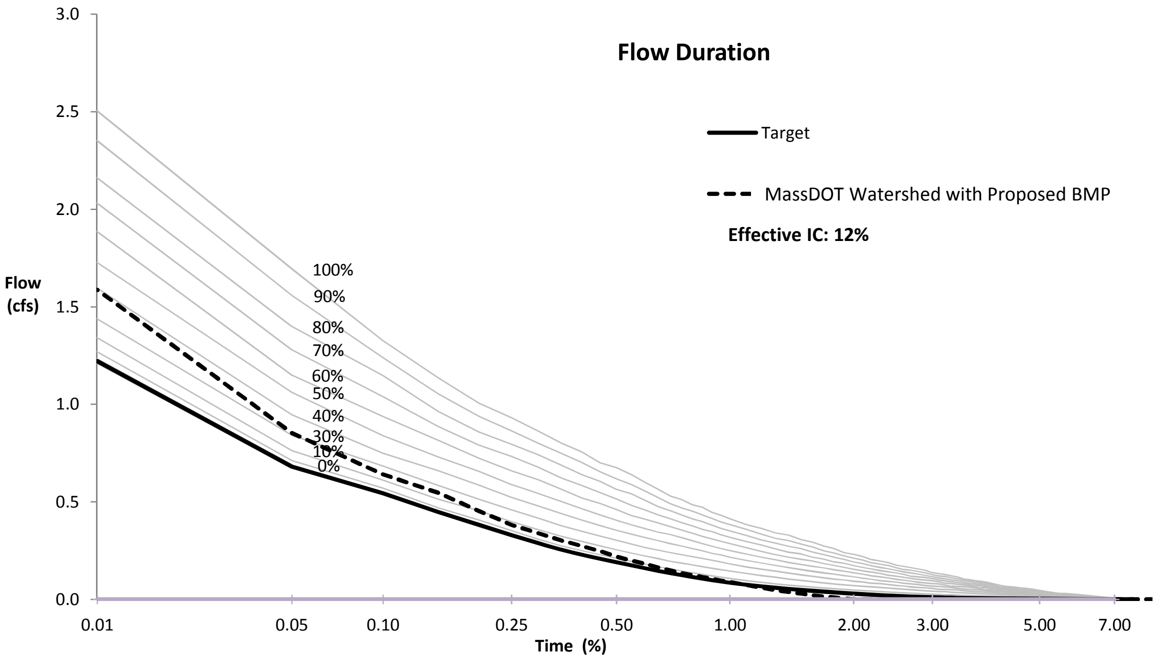
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	1.1	0.1	6
5%IC	1.3	0.1	27
10% IC	1.5	0.2	58
20% IC	1.9	0.4	160
30% IC	2.3	0.7	326
40% IC	2.7	1.1	551
50% IC	3.1	1.6	825
60% IC	3.5	2.1	1,126
70% IC	3.9	2.6	1,429
80% IC	4.2	3.2	1,731
90% IC	4.6	3.7	2,026
100% IC	5.0	4.2	2,325
Watershed Load	3.14	2.00	1,073
BMP Output	-	-	-
Target	0.54	0.05	11
Reduction %	**100%**	**100%**	**100%**
Effective IC	**-28%**	**-8%**	**-1%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		1.6
Watershed IC (no BMP)	52%	0.8
Target IC reduction	87%	0.7
Effective IC w/BMP	-40%	(0.6)
Difference from Target		(1.3)
IC Reduction	176%	1.4

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 49.7



Median Annual Load Comparison Table

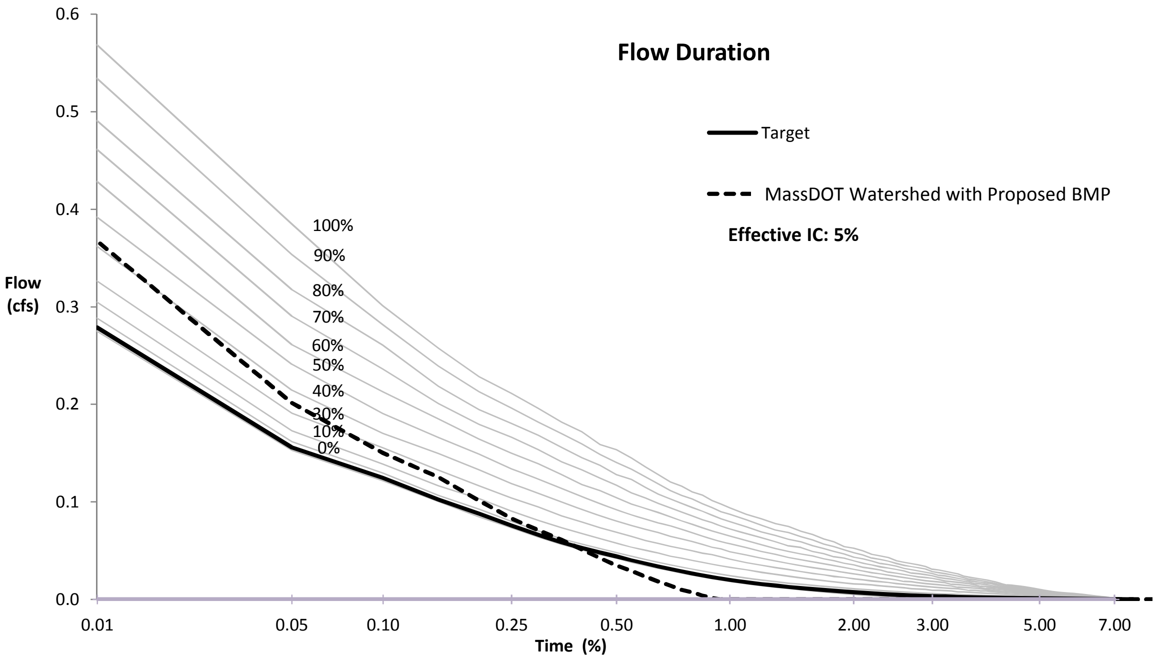
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	2.5	0.2	12
5%IC	3.0	0.3	61
10% IC	3.4	0.4	128
20% IC	4.3	0.9	355
30% IC	5.2	1.6	724
40% IC	6.0	2.5	1,221
50% IC	6.9	3.5	1,830
60% IC	7.7	4.7	2,495
70% IC	8.6	5.9	3,167
80% IC	9.4	7.1	3,837
90% IC	10.3	8.2	4,490
100% IC	11.1	9.4	5,154
Watershed Load	4.45	1.00	430
BMP Output	2.72	0.37	97
Target	2.77	0.24	38
Reduction %	**39%**	**63%**	**77%**
Effective IC	**10%**	**10%**	**10%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		3.5
Watershed IC (no BMP)	21%	0.7
Target IC reduction	87%	0.6
Effective IC w/BMP	10%	0.4
Difference from Target		(0.3)
IC Reduction	49%	0.4

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 50.7



Median Annual Load Comparison Table

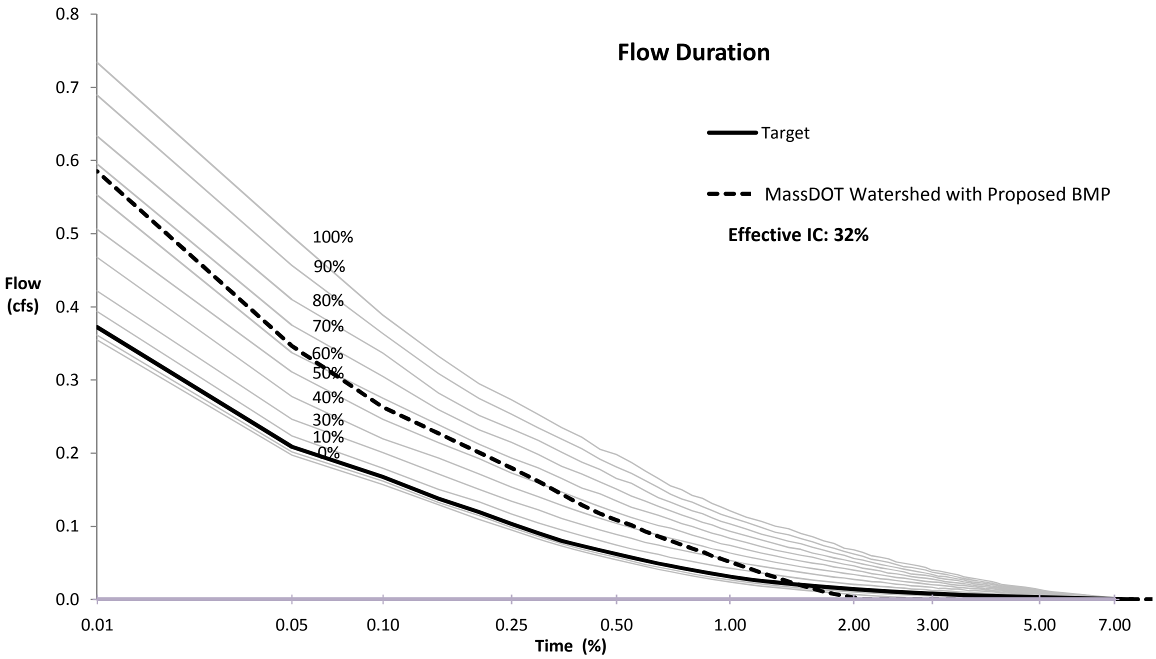
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	0.6	0.0	3
5%IC	0.7	0.1	14
10% IC	0.8	0.1	29
20% IC	1.0	0.2	80
30% IC	1.2	0.4	164
40% IC	1.4	0.6	277
50% IC	1.6	0.8	415
60% IC	1.8	1.1	566
70% IC	1.9	1.3	719
80% IC	2.1	1.6	871
90% IC	2.3	1.9	1,019
100% IC	2.5	2.1	1,170
Watershed Load	1.22	0.39	182
BMP Output	0.47	0.06	14
Target	0.66	0.06	12
Reduction %	**62%**	**85%**	**92%**
Effective IC	**-5%**	**9%**	**9%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		0.8
Watershed IC (no BMP)	31%	0.2
Target IC reduction	87%	0.2
Effective IC w/BMP	3%	0.0
Difference from Target		(0.2)
IC Reduction	91%	0.2

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
    a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
    b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 51.7



Median Annual Load Comparison Table

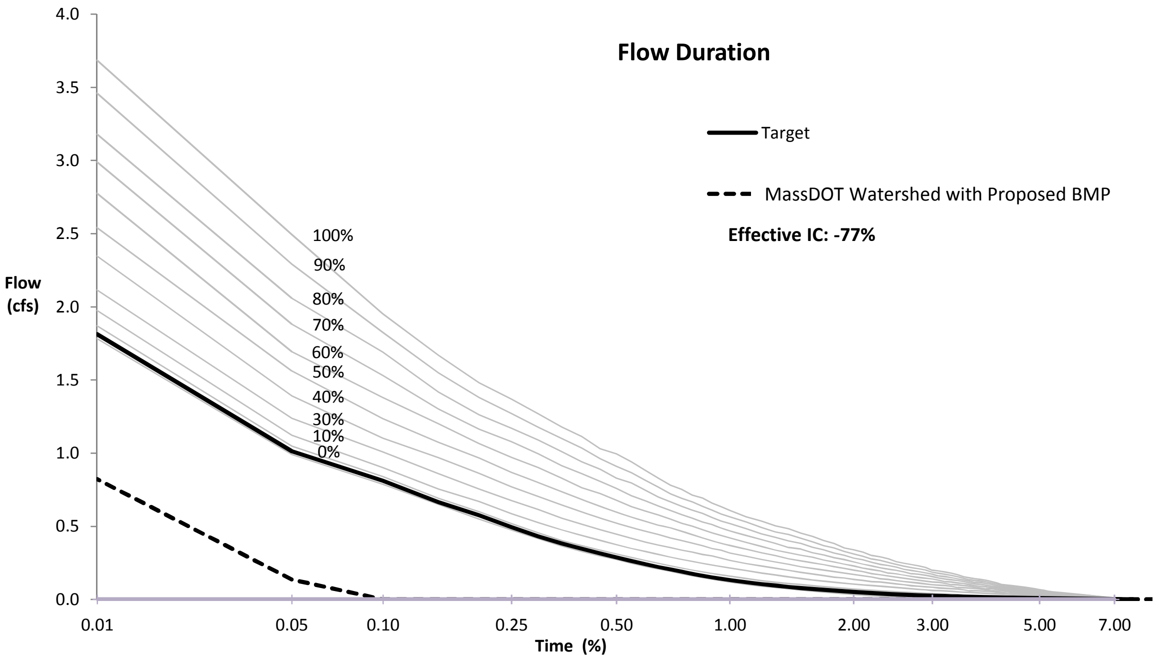
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	0.7	0.1	4
5%IC	0.9	0.1	18
10% IC	1.0	0.1	38
20% IC	1.3	0.3	104
30% IC	1.5	0.5	212
40% IC	1.8	0.7	358
50% IC	2.0	1.0	536
60% IC	2.3	1.4	731
70% IC	2.5	1.7	928
80% IC	2.8	2.1	1,125
90% IC	3.0	2.4	1,316
100% IC	3.3	2.8	1,511
Watershed Load	2.34	1.48	793
BMP Output	1.23	0.34	114
Target	0.07	0.01	2
Reduction %	**47%**	**77%**	**86%**
Effective IC	**19%**	**24%**	**21%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		1.0
Watershed IC (no BMP)	63%	0.6
Target IC reduction	87%	0.6
Effective IC w/BMP	25%	0.3
Difference from Target		(0.3)
IC Reduction	60%	0.4

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 52.7



Median Annual Load Comparison Table

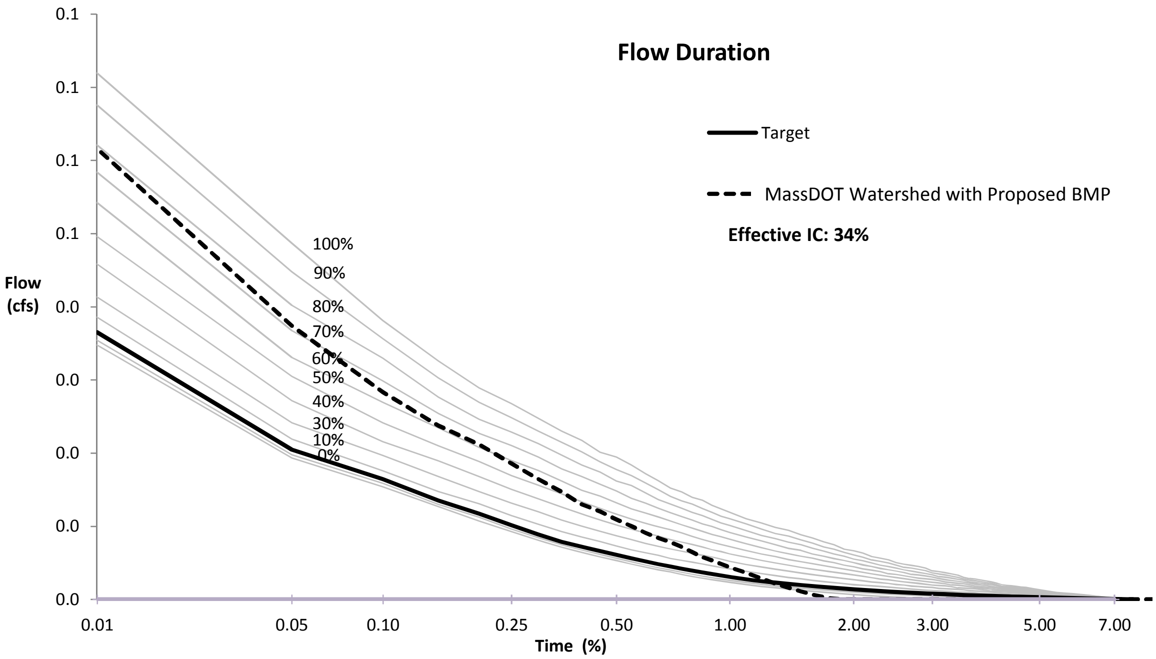
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	3.7	0.3	18
5%IC	4.4	0.4	89
10% IC	5.0	0.6	189
20% IC	6.3	1.3	522
30% IC	7.6	2.3	1,065
40% IC	8.9	3.6	1,797
50% IC	10.1	5.2	2,692
60% IC	11.3	6.9	3,671
70% IC	12.6	8.6	4,659
80% IC	13.8	10.4	5,645
90% IC	15.1	12.1	6,605
100% IC	16.3	13.8	7,583
Watershed Load	8.76	3.48	1,722
BMP Output	0.20	0.01	1
Target	4.38	0.43	89
Reduction %	**98%**	**100%**	**100%**
Effective IC	**-26%**	**-8%**	**-1%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		5.1
Watershed IC (no BMP)	38%	2.0
Target IC reduction	87%	1.7
Effective IC w/BMP	-35%	(1.8)
Difference from Target		(3.5)
IC Reduction	190%	3.7

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 53.7



Median Annual Load Comparison Table

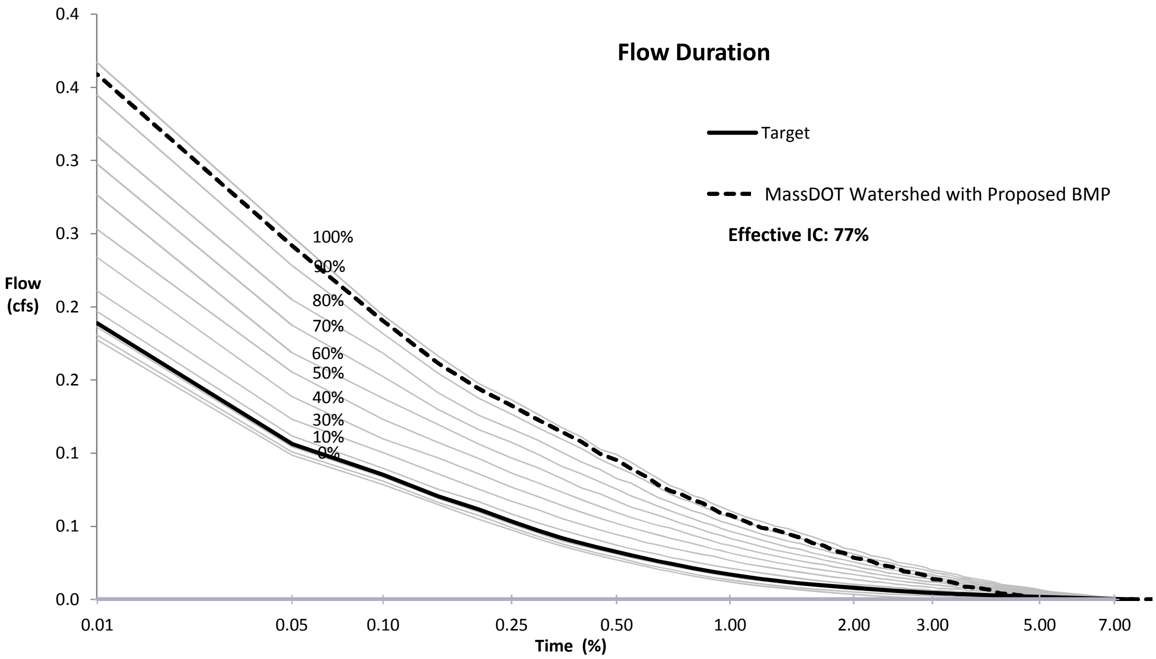
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	0.1	0.0	0
5%IC	0.1	0.0	2
10% IC	0.1	0.0	4
20% IC	0.1	0.0	10
30% IC	0.1	0.0	21
40% IC	0.2	0.1	35
50% IC	0.2	0.1	53
60% IC	0.2	0.1	72
70% IC	0.2	0.2	91
80% IC	0.3	0.2	110
90% IC	0.3	0.2	129
100% IC	0.3	0.3	148
Watershed Load	0.27	0.20	109
BMP Output	0.12	0.03	11
Target	0.10	0.01	4
Reduction %	**56%**	**84%**	**90%**
Effective IC	**17%**	**24%**	**20%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		0.1
Watershed IC (no BMP)	78%	0.1
Target IC reduction	87%	0.1
Effective IC w/BMP	25%	0.0
Difference from Target		(0.0)
IC Reduction	68%	0.1

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
    a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
    b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 54.7



Median Annual Load Comparison Table

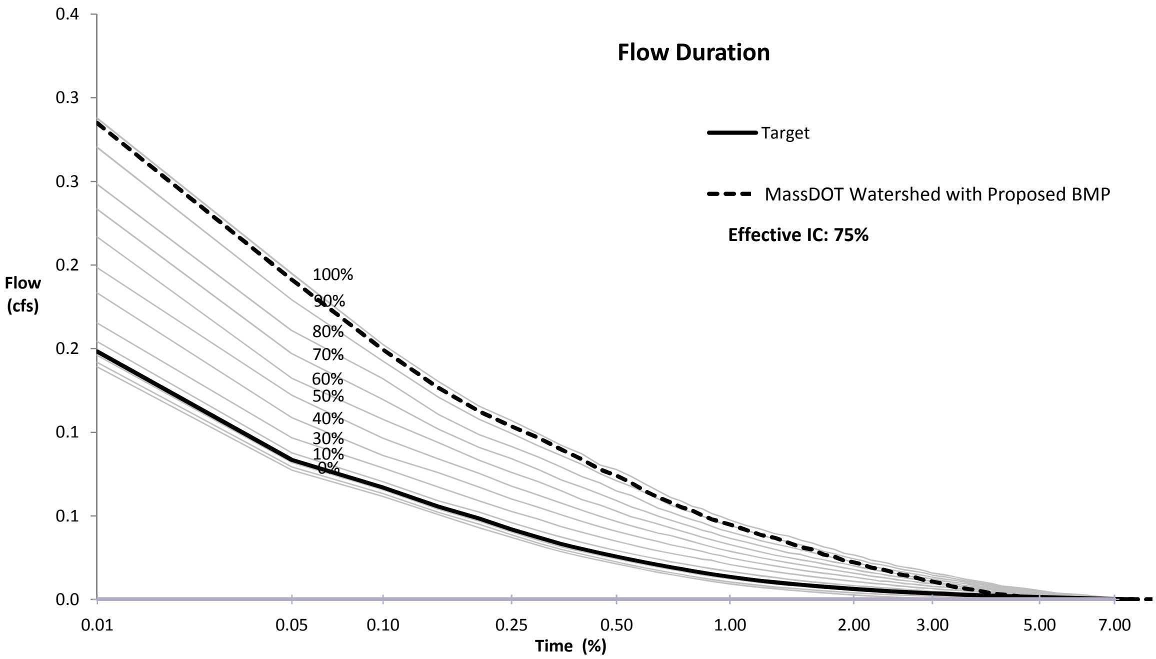
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	0.4	0.0	2
5%IC	0.4	0.0	9
10% IC	0.5	0.1	19
20% IC	0.6	0.1	52
30% IC	0.8	0.2	106
40% IC	0.9	0.4	179
50% IC	1.0	0.5	268
60% IC	1.1	0.7	366
70% IC	1.3	0.9	464
80% IC	1.4	1.0	562
90% IC	1.5	1.2	658
100% IC	1.6	1.4	755
Watershed Load	1.59	1.33	730
BMP Output	1.39	0.89	371
Target	0.53	0.08	27
Reduction %	**12%**	**33%**	**49%**
Effective IC	**81%**	**72%**	**61%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		0.5
Watershed IC (no BMP)	96%	0.5
Target IC reduction	87%	0.4
Effective IC w/BMP	77%	0.4
Difference from Target		(0.0)
IC Reduction	20%	0.1

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 55.7



Median Annual Load Comparison Table

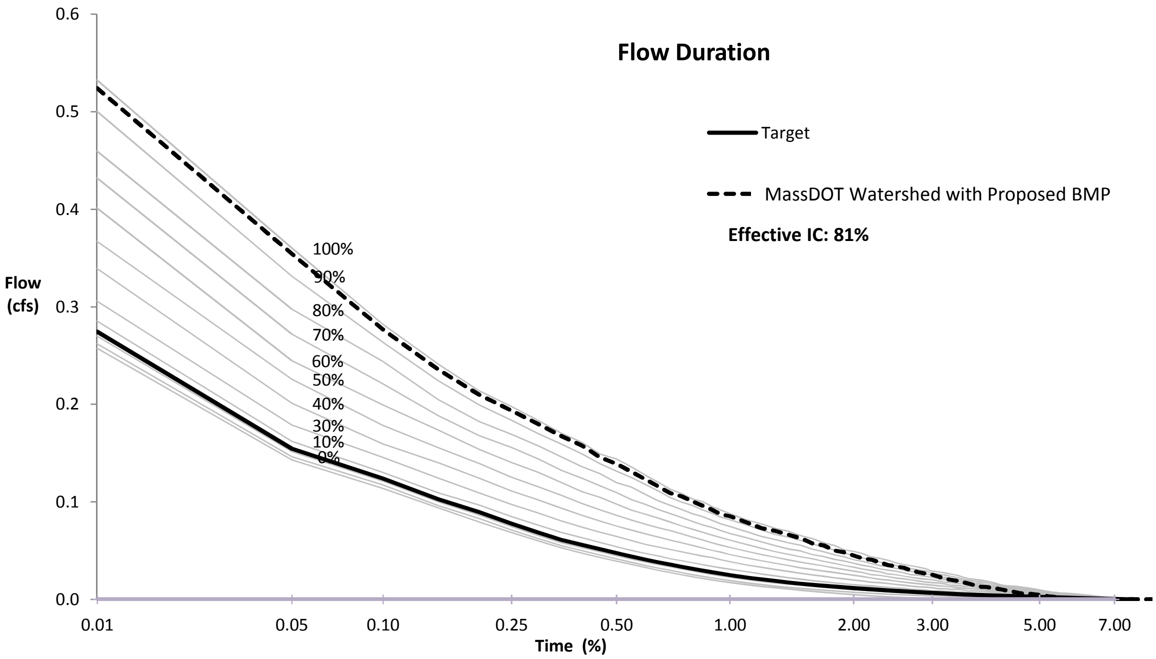
Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	0.3	0.0	1
5%IC	0.3	0.0	7
10% IC	0.4	0.0	15
20% IC	0.5	0.1	41
30% IC	0.6	0.2	83
40% IC	0.7	0.3	140
50% IC	0.8	0.4	210
60% IC	0.9	0.5	287
70% IC	1.0	0.7	364
80% IC	1.1	0.8	441
90% IC	1.2	0.9	516
100% IC	1.3	1.1	592
Watershed Load	1.26	1.06	580
BMP Output	1.07	0.67	270
Target	0.42	0.06	22
Reduction %	**15%**	**37%**	**53%**
Effective IC	**79%**	**69%**	**58%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		0.4
Watershed IC (no BMP)	99%	0.4
Target IC reduction	87%	0.3
Effective IC w/BMP	74%	0.3
Difference from Target		(0.0)
IC Reduction	24%	0.1

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

MA 95-42 Assessment Model Result Summary for Impervious Cover
BMP ID 56.7



Median Annual Load Comparison Table

Condition	Runoff (ac-ft)	Phos. (lb.)	TSS (lb.)
0%IC	0.5	0.0	3
5%IC	0.6	0.1	13
10% IC	0.7	0.1	27
20% IC	0.9	0.2	75
30% IC	1.1	0.3	154
40% IC	1.3	0.5	260
50% IC	1.5	0.8	389
60% IC	1.6	1.0	531
70% IC	1.8	1.2	673
80% IC	2.0	1.5	816
90% IC	2.2	1.7	955
100% IC	2.4	2.0	1,096
Watershed Load	2.33	1.95	1,070
BMP Output	2.13	1.50	653
Target	0.78	0.12	41
Reduction %	**9%**	**23%**	**39%**
Effective IC	**87%**	**80%**	**69%**

Result Summary

Metric	Area (%)	Area (acres)
Watershed Area		0.7
Watershed IC (no BMP)	99%	0.7
Target IC reduction	87%	0.6
Effective IC w/BMP	83%	0.6
Difference from Target		(0.0)
IC Reduction	16%	0.1

* Effective IC calculated as follows:
1. Interpolate effective IC separeately for each metric via interpolation of reference tables/curves
   a. For TSS, P and Flow volume, calculate effetive percentage % by using linear interpolation of percentage to closest load/volumevalues
   b. For flow duration, calculate average of individually interpolat4ed values taken at equal probablity interbals (based on Normal distribution)
2. Determine the maximum IC indicator for the flow metrics (TSS load and TP load)
3. Take the average of the three IC indicators (runoff volume, maximum of TSS and TP load, flow duration) as the representative effective IC for the watershed

Attachment 3:

Less than 9% Impervious Cover Assessments

List of Impaired Waterbodies

Waterbody ID	Waterbody Name	On Appendix L-1	TMDL
MA51-12	West River	Yes	No
MA81-06	Nashua River	Yes	No
MA81167	Pepperell Pond	Yes	No
MA42-13	Little River	No	No
MA81-56	Asnebumskit Brook	No	No
MA91-37	Mulpus Brook	No	No

Impaired Waters Assessment for Impaired Waters with <9% Impervious Cover in Contributing Watershed

Impaired Water Bodies

The list of impaired water bodies covered by this assessment is included in Table 1.

Impairments

Impairments included under this assessment methodology include those typically associated with stormwater runoff from impervious cover. Impairments for specific water bodies are listed in Table 1 for each water body as listed on MassDEP's *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011).

Relevant Water Quality Standards

This assessment covers a wide range of impairments related to a variety of water quality standards. Relevant Water Quality Standards can be found on MassDEP's website: http://www.mass.gov/dep/service/regulations/314cmr04.pdf

Site Description

This assessment applies to the water bodies listed in Table 1. These water bodies are located across the state and have various impairments that could potentially be related to stormwater. They potentially receive direct discharge from MassDOT urban roadways.

Assessment under BMP 7U

A Total Maximum Daily Load (TMDL) has not been developed for the impairments for the water bodies listed in Table 1. Therefore, MassDOT assessed these impairments using the approach described in BMP 7U of MassDOT's Storm Water Management Plan. As described in BMP 7U's *Description of MassDOT's Application of Impervious Cover Method* (MassDOT Application of IC Method, MassDOT 2011), impervious cover (IC) provides a measure of the potential impact of stormwater on many impairments.

MassDOT's Application of the Impervious Cover Method

MassDOT's IC Method applies many aspects of USEPA Region I's Impervious Cover Method described in USEPA's *Stormwater TMDL Implementation Support Manual* (ENSR, 2006) to MassDOT's Impaired Waters Assessment Program. The MassDOT IC method assesses potential stormwater impacts on the impaired water and evaluates the impervious cover reduction required to ensure that stormwater is not the cause of the impairments. Consistent with findings of USEPA and others, when the impervious cover for a watershed exceeds 10% a decline in stream quality occurs and that severe impairment can be expected when the IC exceeds 25%. Alternatively, the Center for Watershed Protection states that the influence of IC on the receiving waters when the watershed is in the range of 1-10 percent impervious “is relatively weak compared to other potential watershed factors”. Therefore USEPA chose a 9% target (1 point less than 10%) as the value at which stormwater impairments are no longer a significant source of pollutants (CWP, 2003). MassDOT also chose to use the 9% impervious cover target for its IC Method analysis. Additional information regarding this method is provided in MassDOT’s Application of IC Method document (MassDOT, 2011).

To be conservative, MassDOT did not rule out water bodies based on the IC value of the total watershed and instead based Table 1 on those water bodies where the local watershed contributing to the impaired segment (referred to as the subwatershed in this analysis) is equal to or less than the 9% target.

The subwatershed to the impaired water body was delineated using the USGS Data Series 451. When USGS Data Series did not delineate the subwatershed of the water body under review, the GIS shapefiles were modified based on USGS topography to add specificity. Impervious cover data was available as part of the USGS data layers Data Series 451 and MassGIS’s impervious surfaces data layer. For the water bodies listed in Table 1, MassDOT calculated that each subwatershed had less than 9% impervious cover. Therefore, as described in the MassDOT IC Method stormwater is not a likely cause of the impairments to these water bodies.

Conclusions

MassDOT has concluded, using the IC Method, that there is no required reduction in impervious area for the water bodies listed in Table 1 because the percent of impervious cover within the subwatershed is equal to or less than the 9% maximum IC target. This indicates that stormwater from this watershed is not likely the cause of the impairments. Therefore, further assessment of these water bodies is not warranted under the Impaired Waters Program.

MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT’s Programmed Projects Initiative portion of the Impaired Waters Program. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to address impairments. Furthermore, MassDOT will continue to implement the measures outlined in its Storm Water Management Plan (SWMP) to minimize the impacts of stormwater from its property.

References

Center for Watershed Protection (CWP). 2003. Impact of Impervious Cover on Aquatic Systems. Watershed Protection Research Monograph No. 1. Ellicot, MD.

ENSR. (2006). Stormwater TMDL Implementation Support Manual for US Environmental Protection Agency Region 1. ENSR International & USEPA Region 1, Boston, MA. Project No.: 10598-001-500. Retrieved from: http://www.epa.gov/region1/eco/tmdl/pdfs/Stormwater-TMDL-Implementation-Support-Manual.pdf

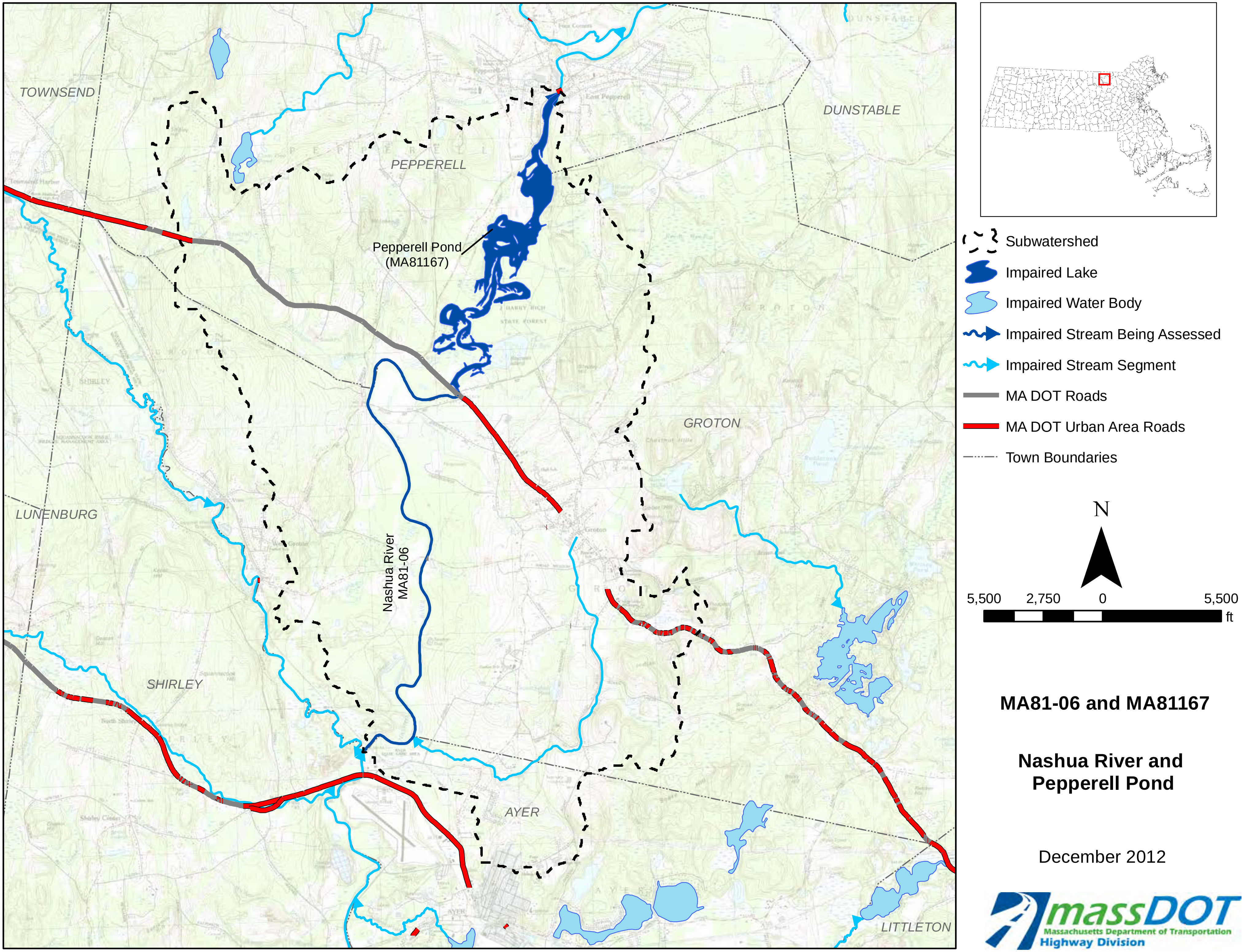
Massachusetts Department of Environmental Protection (MassDEP). (2011). Massachusetts Year 2010 Integrated List of Waters - Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act. Retrieved from: http://www.mass.gov/dep/water/resources/10list6.pdf

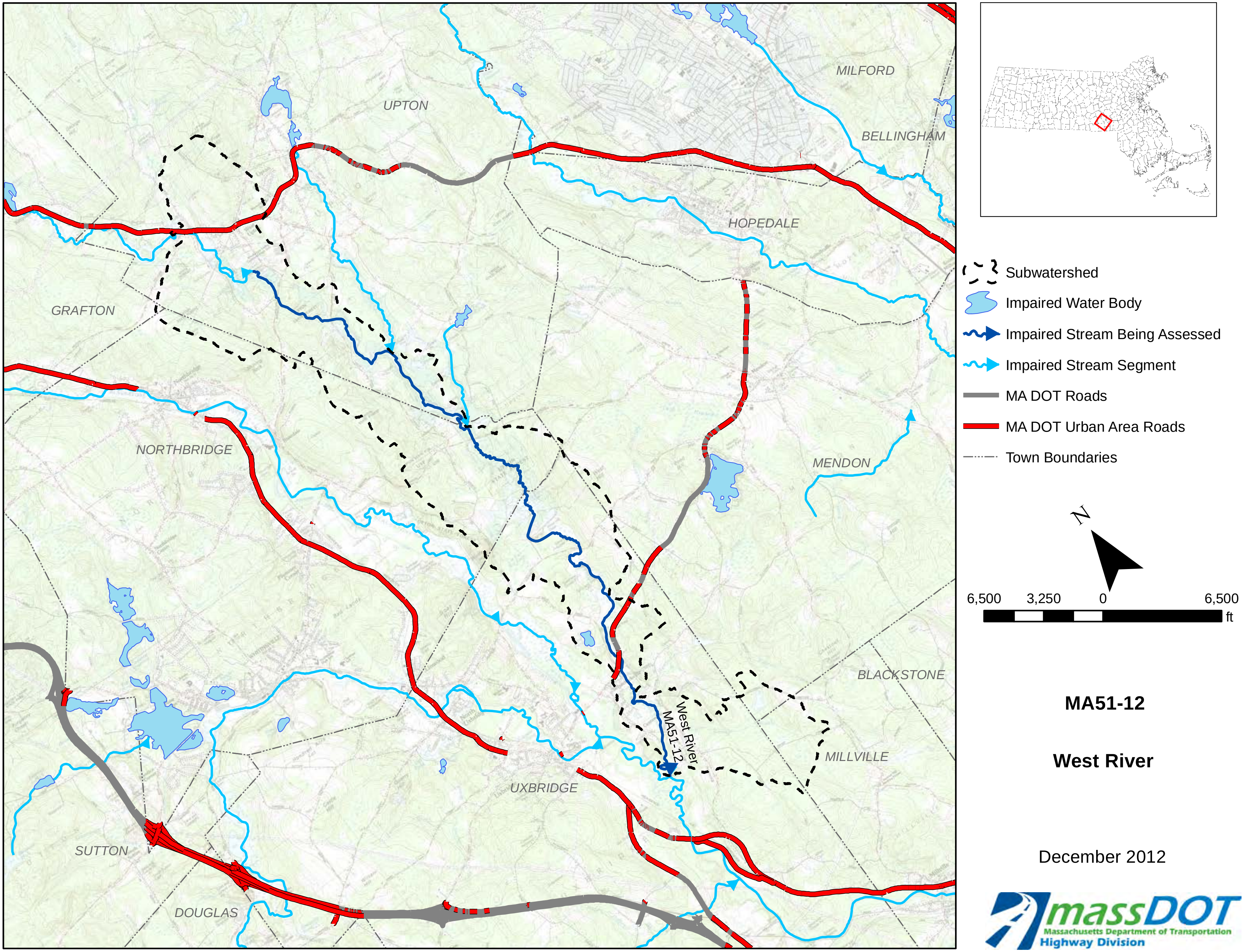
Massachusetts Department of Transportation (MassDOT). (2011). Description of MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT Application of IC Method).

Table 1. Impaired Waters Addressed by IC Method with <9% IC in Watershed

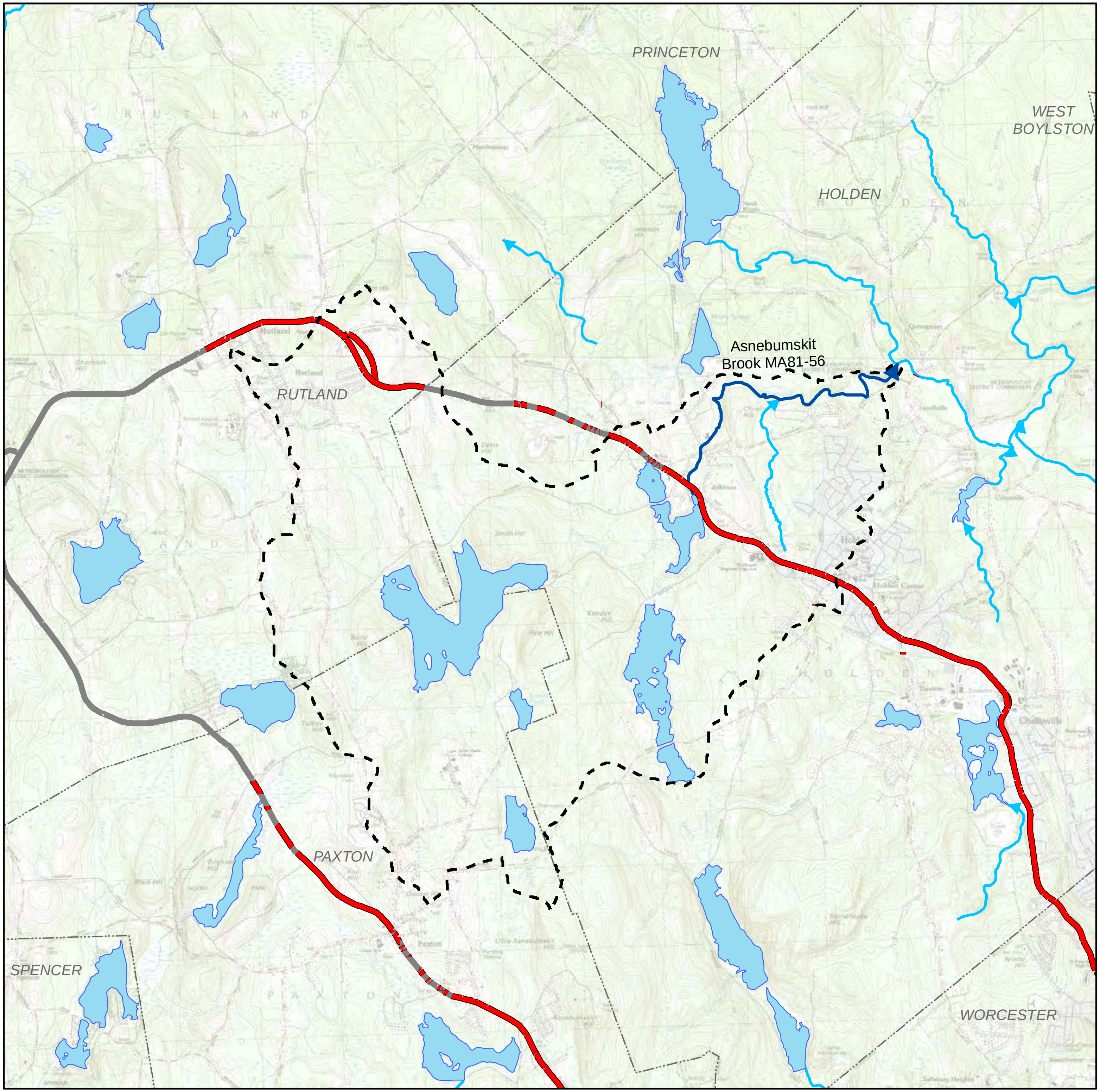
Water Body ID	Water Body Name	Impairments of Concern (2010)**	% IC in Subwatershed
Water Bodies Included in L-1 Appendix			
MA51-12	West River	(Non-Native Aquatic Plants*), pH, Low, Nutrient/Eutrophication Biological Indicators, Lead, Copper, Aquatic Plants (Macrophytes), (Chloride*), Cadmium	8.1%
MA81-06	Nashua River	Nutrient/Eutrophication Biological Indicators, Aquatic Macroinvertebrate Bioassessments, Mercury in Fish Tissue, Non-Native Aquatic Plants	6.6%
MA81167***	Pepperell Pond	Nutrient/Eutrophication Biological Indicators, Aquatic Macroinvertebrate Bioassessments, Mercury in Fish Tissue, Non-Native Aquatic Plants	6.6%
Water Bodies Not Included in L-1 Appendix			
MA42-13	Little River	Oxygen, Dissolved, Aquatic Macroinvertebrate Bioassessments	6.2%
MA81-56	Asnebumskit Brook	Ambient Bioassays --Chronic Aquatic Toxicity	6.4%
MA81-37	Mulpus Brook	Lack of a coldwater assemblage	6.1%

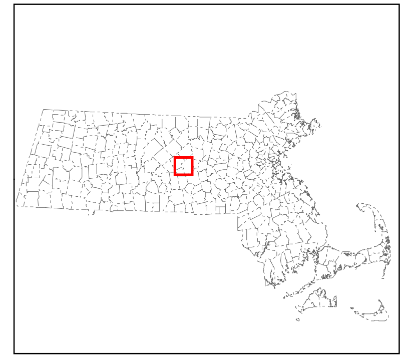
*Non-pollutant according to MA DEP 303d Year 2010 Integrated List of Waters
**Impairments listed on the MA DEP 303d Year 2010 Integrated List of Waters
***Pepperell Pond, formerly segment MA81167, is now considered run-of-the-river with Nashua River (MA81-06) according to the *MA DEP 303d Year 2010 Integrated List of Waters (ILW)*. Pepperell Pond is included in Appendix L-1 based on the *MA DEP 303d Year 2008 ILW* but is no longer listed separately on the *MA DEP 303d Year 2010 ILW*. Because Pepperell Pond is now considered part of Nashua River (MA81-06) which has 8.9% IC in its subwatershed, Pepperell Pond is reported as having 8.9% IC in its subwatershed as well.


TOWNSEND
PEPPERELL
DUNSTABLE
Pepperell Pond
(MA81167)
GROTON
LUNENBURG
Nashua River
MA81-06
SHIRLEY
AYER
LITTLETON
Subwatershed
Impaired Lake
Impaired Water Body
Impaired Stream Being Assessed
Impaired Stream Segment
MA DOT Roads
MA DOT Urban Area Roads
Town Boundaries
N
5,500
2,750
0
5,500
ft
MA81-06 and MA81167
Nashua River and
Pepperell Pond
December 2012
massDOT
Massachusetts Department of Transportation
Highway Division



MILFORD
UPTON
BELLINGHAM
HOPEDALE
GRAFTON
NORTHBRIDGE
MENDON
BLACKSTONE
MILLVILLE
UXBRIDGE
SUTTON
DOUGLAS
West River
MA51-12
Subwatershed
Impaired Water Body
Impaired Stream Being Assessed
Impaired Stream Segment
MA DOT Roads
MA DOT Urban Area Roads
Town Boundaries
N
6,500
3,250
0
6,500
ft
MA51-12
West River
December 2012
massDOT
Massachusetts Department of Transportation
Highway Division





Subwatershed
Impaired Lake
Impaired Water Body
Impaired Stream Being Assessed
Impaired Stream Segment
MA DOT Roads
MA DOT Urban Area Roads
Town Boundaries

N

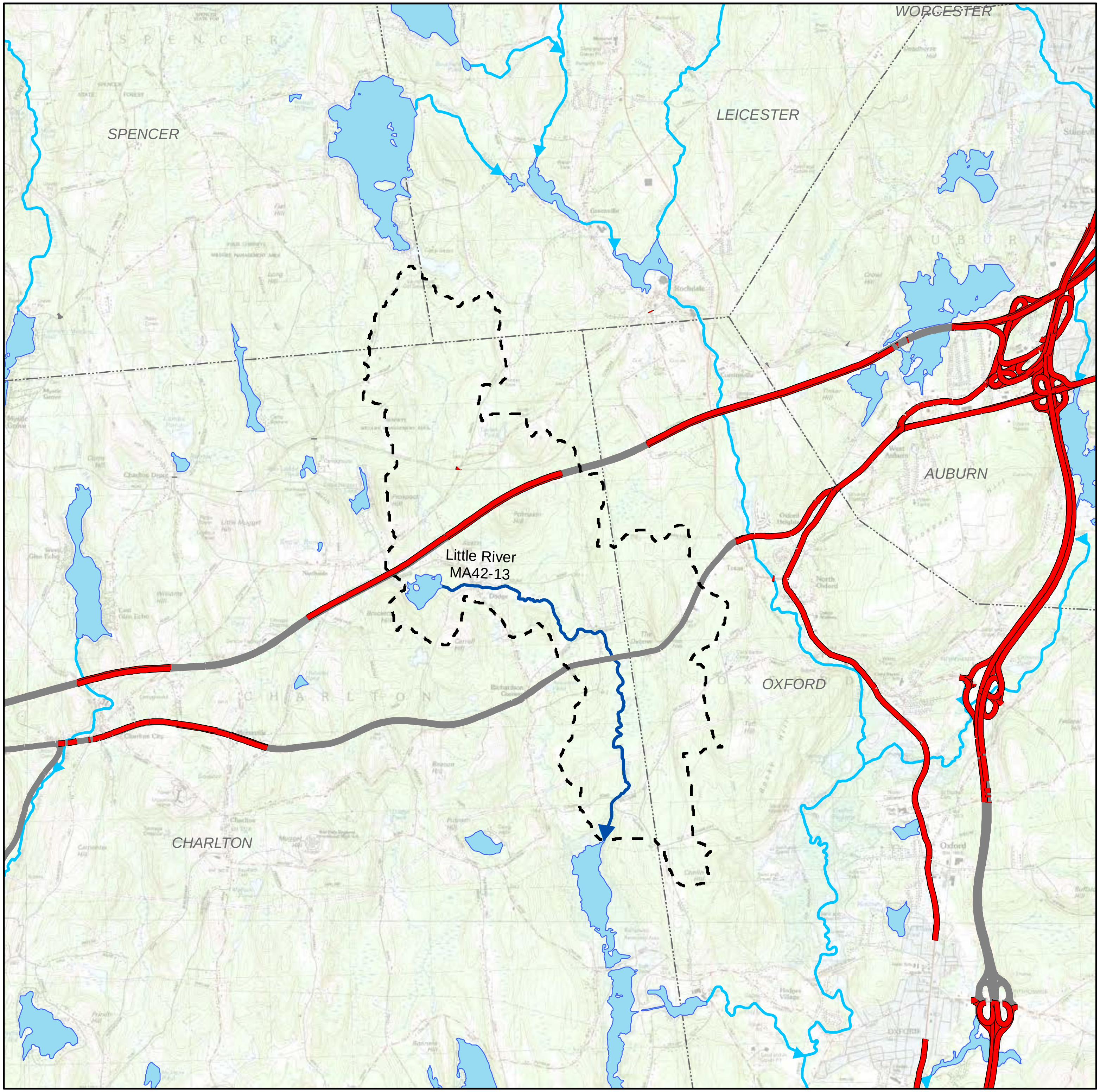
5,500 2,750 0 5,500 ft

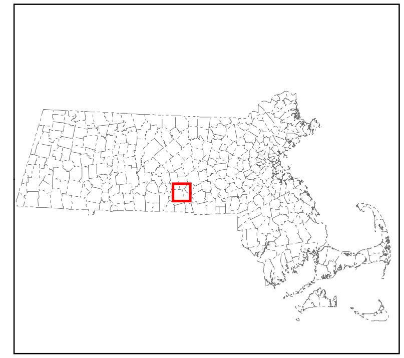
MA81-56

Asnebumskit Brook

December 2012

massDOT
Massachusetts Department of Transportation
Highway Division





Subwatershed
Impaired Lake
Impaired Water Body
Impaired Stream Being Assessed
Impaired Stream Segment
MA DOT Roads
MA DOT Urban Area Roads
Town Boundaries

N

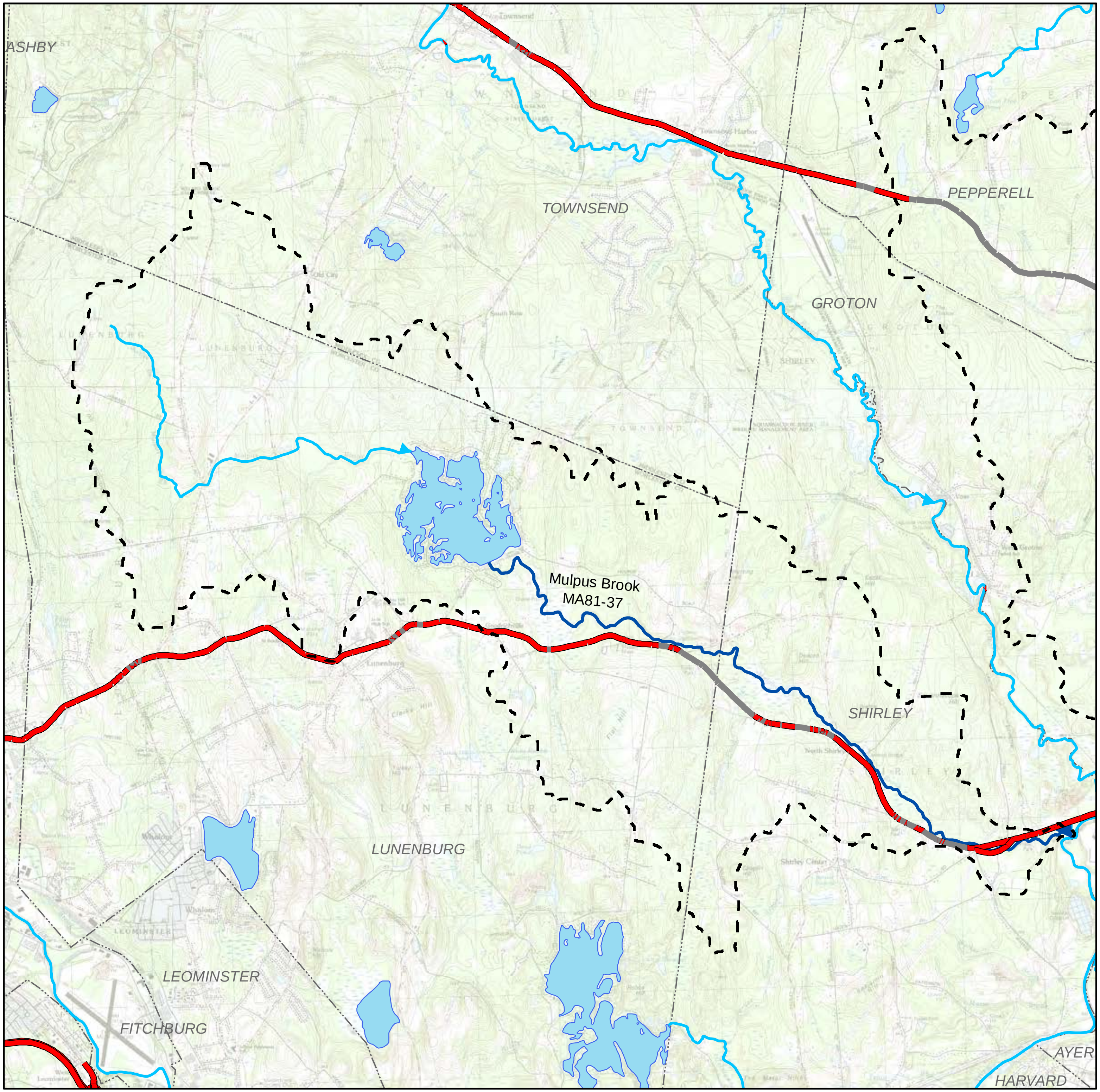
5,500 2,750 0 5,500 ft

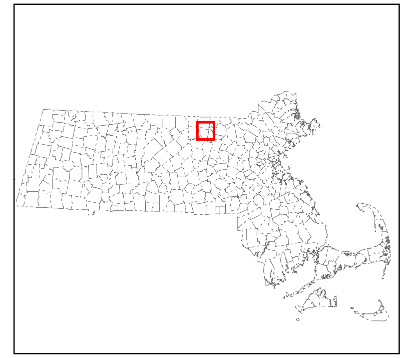
MA42-13

Little River

December 2012

massDOT Massachusetts Department of Transportation Highway Division





MA81-37

Mulpus brook

December 2012

massDOT
Massachusetts Department of Transportation
Highway Division

Attachment 4:

Unrelated Impairments Assessments

Impaired Waters Assessment for

Impaired Waters with Impairments Unrelated to Stormwater

Impaired Water Bodies

As part of the Impaired Waters Program, MassDOT has been reviewing those impaired water bodies identified as potentially receiving MassDOT urban area road runoff (Appendix L-1 list) to determine the appropriate assessment methodology. During our review, we determined that a number of water bodies were included in the appendix with impairments unrelated to stormwater. This assessment completes the assessment for 40 of these water bodies (Table 1 and 2).

Impairments

This assessment addresses the impairments listed below.

- Chlordane
- DDT
- PCB in Fish Tissue
- Mercury in Fish Tissue
- Non-pollutants

Table 1 and 2 includes the receiving water impairment as listed on MassDEP's *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). Other water bodies may include these impairments but are also listed for pollutants that are potentially related to stormwater. Those receiving waters will be addressed in specific assessments for the water bodies to which they apply.

Relevant Water Quality Standards

This assessment covers a wide range of impairments related to a variety of water quality standards. Relevant Water Quality Standards can be found on MassDEP's website: http://www.mass.gov/dep/service/regulations/314cmr04.pdf

Assessment under BMP 7U

A Total Maximum Daily Load (TMDL) has not been developed for chlordane, DDT, or PCB in fish tissue for the water bodies listed in Table 1 and 2. Therefore, MassDOT began to assess these impairments using the impervious cover (IC) method, described in BMP 7U of MassDOT's Storm Water Management Plan (MassDOT, 2011). Step 1 of BMP 7U requires the reviewer to identify if the impairment is related to highway stormwater runoff. MassDOT determined that these impairments are not related to stormwater and has thus concluded that stormwater runoff from its roadways does not contribute to the impairments. The paragraphs below discuss each impairment in more detail.

Chlordane: Chlordane is a pesticide that was in use in the United States between 1948 and 1988. Chlordane has a low potential to move through soils, and it is not readily degraded by water or light. Its half-life is estimated to be 350 days, which means that it is degraded by approximately 97% after 5 years in the environment (NPIC, 2001). According to section BMP6A-5 of the Storm Water Management Plan (SWMP) prepared for MassHighway in 2008, pesticide use on MassDOT property is regulated by the Rights of Way Management Regulations (33 CMR 11.00). In response to the regulations, MassDOT prepared a 5-year Vegetation Management Plan and a Yearly Operational Plan, both which aim to minimize the use of chemical controls (MassHighway, 2008) in general. MassDOT does not currently use chlordane on its roadways. Based on this information, MassDOT concluded that these impairments are not related to stormwater runoff from MassDOT roads.

DDT: DDT is an organochlorine insecticide that was in use in the United States until 1972. DDT is not readily degraded in the environment; it has a half life of 2-15 years in soil and 150 years in aquatic ecosystems (NPIC, 1999). The Nationwide Urban Runoff Program (NURP) conducted by the EPA found that DDT was detected in less than 1% of 121 samples collected and that it "should be considered to pose a minimal threat to the quality of surface waters from runoff contamination" (EPA, 1983). MassDOT does not currently use DDT on its roadways. Therefore, MassDOT concluded that stormwater runoff from its roadways does not contribute to the impairment for DDT.

PCB in Fish Tissue: Polychlorinated Biphenyls (PCBs) refer to a range of man-made organic chemicals that were manufactured in the United States between 1929 and 1979. They had a variety of industrial applications and are extremely persistent in the environment. The Nationwide Urban Runoff Program (NURP) conducted by the EPA found that PCBs were detected in less than 1% of 121 samples collected (EPA, 1983). Therefore, MassDOT concluded that stormwater runoff from its roadways does not contribute to the impairment for PCBs in fish tissue.

Assessment under BMP 7R

A Total Maximum Daily Load (TMDL) has been developed for **mercury in fish tissue**. Therefore, MassDOT began to assess these impairments using the TMDL method, described in BMP 7R of MassDOT's Storm Water Management Plan (MassDOT, 2011). In reviewing the water bodies addressed by the *Northeast Regional Mercury TMDL (*NEIWPCC, 2007)*,* the TMDL indicated that this impairment is not stormwater related. According to the TMDL, regulated stormwater is considered to be a *de minimis* contributor to the waste load allocation for mercury. Additionally, the primary source of mercury in stormwater in Massachusetts is atmospheric deposition, which must be controlled by targeting sources that emit into the air. Based on the TMDL, the impairment for mercury in fish tissue has been excluded from the IC Method and deemed "unrelated to stormwater," so no further action is necessary for this pollutant (NEIWPCC, 2007). This was documented in Step 4 of BMP 7R.

Table 1 also lists "**non-pollutants**" for impaired water bodies which are listed in the format (___*), such as (Non-Native Aquatic Plants*). These impairments are considered non-pollutants according to the *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). The demarcation indicates that amelioration of the stressor will require measures other than TMDL development and implementation. Water bodies with impairments that are exclusively non-pollutants were assigned to category 4c in 2010. This was a change from the 2008 list from which the original list of water bodies to assess was based on. The Impaired Waters Program does not include category 4c water bodies in its scope because non-pollutant impairments are considered to be "unrelated to stormwater." (MassDEP, 2011)

Conclusions

MassDOT has concluded, in accordance with the IC Method and/ or TMDL method, that there is no required reduction in impervious area/ pollutant loading for the water bodies listed in Table 1 and 2 because their impairments are not related to stormwater runoff from MassDOT property. As such, further assessment of these water bodies is not warranted under the Impaired Waters Program.

References

Environmental Protection Agency (EPA). (1983). Results of the Nationwide Urban Runoff Program: Volume I – Final Report. Retrieved from: http://www4.ncsu.edu/~rcborden/CE383/Stormwater_Refs/NURP_Results_Vol_1.pdf

Massachusetts Department of Environmental Protection (MassDEP). (2011). Massachusetts Year 2010 Integrated List of Waters - Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act. Retrieved from: http://www.mass.gov/dep/water/resources/10list6.pdf

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National Pesticide Information Center (NPIC). (2001). Chlordane General Fact Sheet. Retrieved from: http://npic.orst.edu/factsheets/chlordanegen.pdf

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New England Interstate Water Pollution Control Commission (NEIWPCC). (2007). Northeast Regional Mercury Total Maximum Daily Load. Retrieved from: http://www.epa.gov/region1/eco/tmdl/pdfs/ne/tmdl-Hg-approval-doc.pdf

Table 1. Appendix L-1 Impaired Waters with Impairments that are Unrelated to Storm Water

Waterbody ID	Waterbody Name	Impairments of Concern (According to 2010 303d List)	TMDL Impairment on Appendix L-1*
MA21071	Morewood Lake	PCB in Fish Tissue	
MA42-04	French River	Mercury in Fish Tissue	
MA51170	Waite Pond	Mercury in Fish Tissue	12/20/2007-NEHg TMDL
MA52042	Whiting Pond	Mercury in Fish Tissue	12/20/2007-NEHg TMDL
MA61004	North Watuppa Pond	Mercury in Fish Tissue	12/20/2007-NEHg TMDL
MA62174	Somerset Reservoir	Mercury in Fish Tissue	12/20/2007-NEHg TMDL
MA71011	Clay Pit Pond	Chlordane	
MA72035	Echo Lake	Mercury in Fish Tissue	12/20/2007-NEHg TMDL
MA74021	Sylvan Lake	Chlordane, DDT	
MA74025	Whitmans Pond	DDT	
MA74028	Ice House Pond	Chlordane, DDT	
MA81147	Wachusett Reservoir	(Eurasian Water Milfoil, Myriophyllum spicatum*), (Non-Native Aquatic Plants*), Mercury in Fish Tissue	12/20/2007-NEHg TMDL
MA82044	Framingham Reservoir #1	Mercury in Fish Tissue, (Non-Native Aquatic Plants*), (Eurasian Water Milfoil, Myriophyllum spicatum*)	
MA82106	Sudbury Reservoir	Mercury in Fish Tissue	12/20/2007-NEHg TMDL
MA82109	Walden Pond	Mercury in Fish Tissue	12/20/2007-NEHg TMDL
MA82124	Nutting Lake	Mercury in Fish Tissue	12/20/2007-NEHg TMDL
MA82126	Lake Cochituate	(Eurasian Water Milfoil, Myriophyllum spicatum*), (Non-Native Aquatic Plants*), PCB in Fish Tissue	
MA82A-03	Sudbury River	Mercury in Fish Tissue	
MA82A-04	Sudbury River	Mercury in Fish Tissue, (Non-Native Aquatic Plants*)	
MA82A-25	Sudbury River	Mercury in Fish Tissue	
MA83001	Ames Pond	Mercury in Fish Tissue	
MA84002	Lake Attitash	Mercury in Fish Tissue	
MA84008	Lake Cochichewick	Mercury in Fish Tissue	
MA84015	Forge Pond	Mercury in Fish Tissue	12/20/2007-NEHg TMDL
MA84022	Haggetts Pond	Mercury in Fish Tissue	
MA84028	Kenoza Lake	Mercury in Fish Tissue	
MA84064	Stevens Pond	Mercury in Fish Tissue	
MA92034	Lowe Pond	Mercury in Fish Tissue, (Non-Native Aquatic Plants*)	
MA92041	Mill Pond	Mercury in Fish Tissue	12/20/2007-NEHg TMDL
MA92059	Silver Lake	DDT, Mercury in Fish Tissue [33880]	12/20/2007-NEHg TMDL
MA92073	Wenham Lake	DDT, Mercury in Fish Tissue [33880]	12/20/2007-NEHg TMDL
MA93026	Foster Pond	DDT	
MA94050	Great Herring Pond	Mercury in Fish Tissue	12/20/2007-NEHg TMDL

Waterbody ID	Waterbody Name	Impairments of Concern (According to 2010 303d List)	TMDL Impairment on Appendix L-1*
MA94054	Great South Pond	Mercury in Fish Tissue	12/20/2007-NEHg TMDL
MA94-22	Indian Head River	Mercury in Fish Tissue	
MA95125	Sampson Pond	Mercury in Fish Tissue, DDT, (Non-Native Aquatic Plants*)	
MA95151	Turner Pond	Mercury in Fish Tissue	12/20/2007-NEHg TMDL
MA96008	Baker Pond	Mercury in Fish Tissue	12/20/2007-NEHg TMDL

* TMDL impairment listed on Appendix L-1 based on 2008 Integrated List of Waters. Some water bodies may have TMDLs finalized on the 2010 list.

Table 2. Impaired Waters with Impairments that are Unrelated to Storm Water not on Appendix L-1

Waterbody ID	Waterbody Name	Impairments of Concern (According to 2010 303d List)	TMDL Impairment on Appendix L-1*
MA21042	Goodrich Pond	PCB in Fish Tissue	
MA73002	Bird Pond	PCB in Fish Tissue	

* TMDL impairment listed on Appendix L-1 based on 2008 Integrated List of Waters. Some water bodies may have TMDLs finalized on the 2010 list.

Attachment 5:

No Discharges from MassDOT Outfalls Assessments

List of Impaired Waterbodies

Waterbody ID	Waterbody Name	TMDL
MA32-09	Powdermill Brook	-
MA36093	Minechoag Pond	Phosphorus (CN 118)
MA62-08	Salisbury Brook	-
MA62232	Sassaquin Pond	-
MA92038	Martins Pond	Mercury (NEHg) (CN NEIWPCC-Hg)
MA95-33	Acushnet River	-

Impaired Waters Assessment for Powdermill Brook (MA32-09)

Impaired Water Body

Name: Powdermill Brook

Location: Westfield, MA

Water Body ID: MA32-09

Impairments

Final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011):

- Turbidity
- Sedimentation/siltation
- Excess algal growth

Powdermill Brook (MA32-09) is listed under Category 5, “Waters Requiring a TMDL”, on MassDEP’s final *Massachusetts Year 2010 Integrated List of Waters*. According to MassDEP’s *Westfield River Watershed 2001 Water Quality Assessment Report* (MassDEP, 2005), Powdermill Brook is listed as Category 5 for several pollutants and will require TMDLs for these pollutants. The Massachusetts Division of Fisheries and Wildlife (MDFW) proposed that Powdermill Brook be listed in the Surface Water Quality Standards (SWQS) as a cold water fishery.

Relevant Water Quality Standards

Water Body Classification: Class B

Applicable State Regulations:

- *314 CMR 4.05 (3)(b) 6 Color and Turbidity*. These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this class.
- *314 CMR 4.05 (3)(b) 5 Solids*. These waters shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.
- *314 CMR 4.05 (5) (a) Aesthetics*. All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.

Site Description

Powdermill Brook begins north of Ball Mountain, east of Pitcher Road in Montgomery, MA and flows southeast to its confluence with the Westfield River, Westfield, MA. The brook is approximately 9.5 miles long with a drainage area of approximately 19 square miles. The drainage area is comprised mostly of forest (81%), residential (7%) and agriculture (6%) land cover. The impervious cover for the sub basin of this segment is approximately 2.7%, thereby classifying the subwatershed as a low threat to water quality from impervious surface water runoff (MassDEP, 2005). Figure 1 and Figure 2 shows the location of Powdermill Brook and nearby MassDOT owned urban roadway.

Assessment under BMP 7U for No Discharge Determination

In compliance with the assessment protocol outlined in BMP 7U (MassDOT, 2011), MassDOT proceeded with Step 1 to determine whether or not stormwater runoff could potentially be linked to the impairment for this water body. Even though the subwatershed of Powdermill Brook is less than 9% impervious, the brook was evaluated further because the total watershed is greater than 9%. A desktop analysis was performed, and from this it was determined that MassDOT does not directly contribute runoff to Powdermill Brook (MA32-09). It was confirmed during a site visit on June 21, 2012 that MassDOT owned urban roadway does not directly drain to Powdermill Brook. Stormwater from I-90 west of Montgomery Road sheet flows to the roadway shoulder where it infiltrates. The shoulder consists of well maintained grass areas and adjacent forest areas. Stormwater from I-90 and Route 10 near the I-90 / Route 10 interchange is collected in catch basins which discharge to drainage channels which flow to the non-impaired Arm Brook, a tributary of Powdermill Brook.

Conclusions

Because MassDOT property does not directly contribute stormwater runoff to Powdermill Brook, further assessment of this water body is not warranted under the Impaired Waters program.

MassDOT will continue to implement the measures outlined in its Stormwater Management Plan (SWMP) to minimize the impacts of stormwater from its property.

References

Massachusetts Department of Environmental Protection (MassDEP). (2005). Westfield River 2001 Water Quality Assessment Report. Retrieved from: http://www.mass.gov/dep/water/resources/32wqar.pdf.

Massachusetts Department of Environmental Protection (MassDEP). (2008). Massachusetts Year 2008 Integrated List of Waters - Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 303(d) and 305(b) of the Clean Water Act. Retrieved from: http://www.mass.gov/dep/water/resources/08list2.pdf

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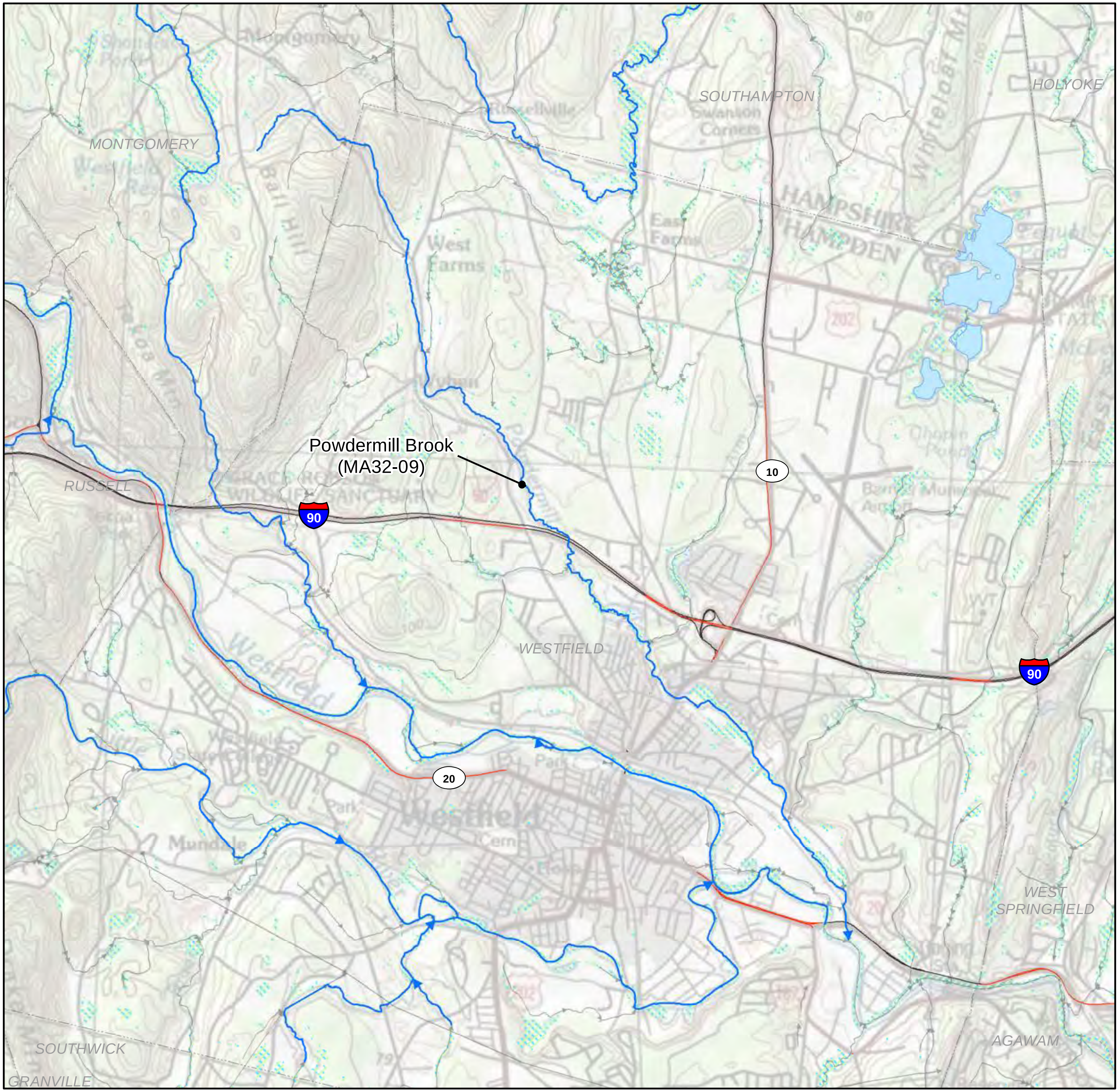

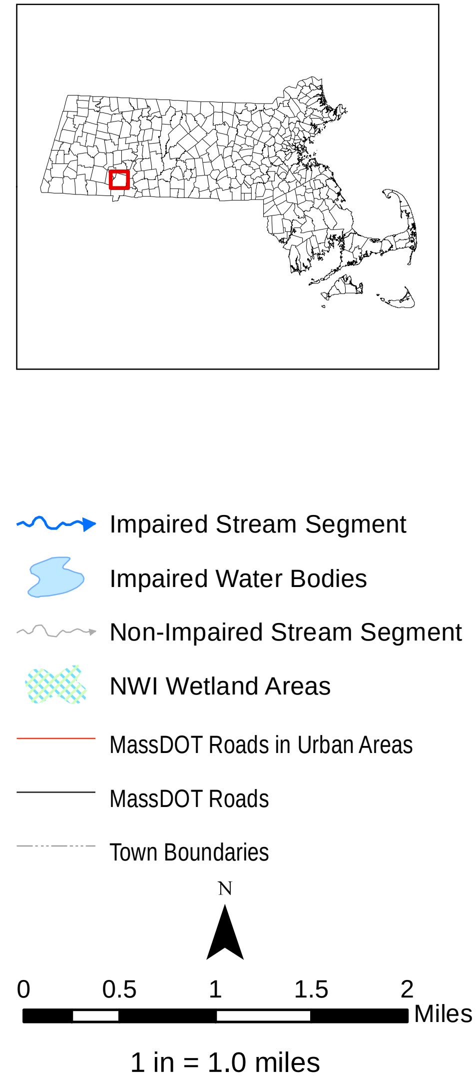

Figure 1

Powdermill Brook
MA32-09
No Discharge

December 2012

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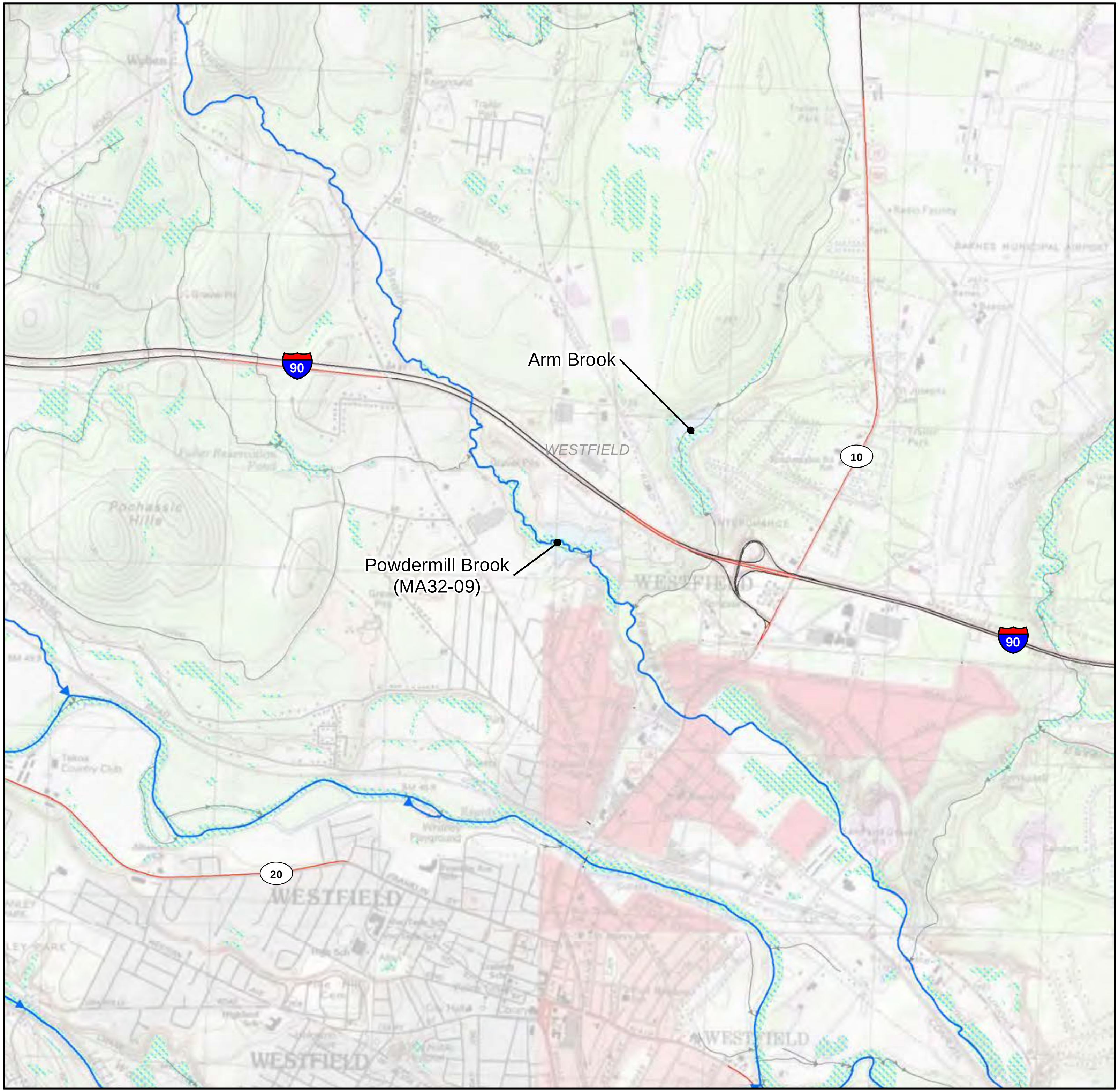
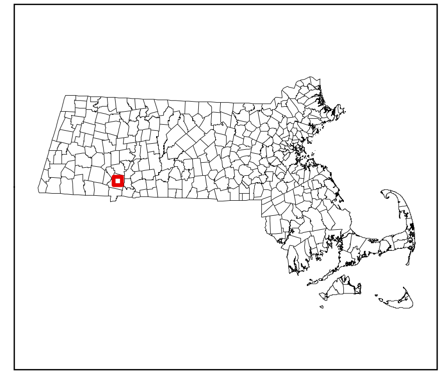
Moving Massachusetts Forward.





Impaired Stream Segment

Impaired Water Bodies

Non-Impaired Stream Segment

NWI Wetland Areas

MassDOT Roads in Urban Areas

MassDOT Roads

Town Boundaries

N

0 0.25 0.5 0.75 1 Miles

1 in = 0.5 miles

Figure 2

Powdermill Brook
MA32-09
No Discharge

December 2012

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Impaired Waters Assessment for Minechoag Pond (MA36093)

Impaired Waterbody

Name: Minechoag Pond

Location: Ludlow, MA

Water Body ID: MA36093

Impairments

Minechoag Pond (MA36093) is listed as a Category 4a water body, "TMDL is completed", on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). Minechoag Pond is impaired for the following:

- nutrient/eutrophication biological indicators

The *Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes (CN 118.0)* (MassDEP, 2002) was developed to address the impairment related to phosphorus for Minechoag Pond.

Relevant Water Quality Standards

Water Body Classification: Unknown

Applicable State Regulations:

- *314 CMR 4.05 (5) (a) Aesthetics.* All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.

Site Description

Minechoag Pond is a water body located in the Chicopee River Watershed in Ludlow, MA of approximately 21 acres. The pond is surrounded by high-density residential areas to the north and east and a golf course to the south and west. The sub and total contributing watershed is approximately 400 acres and is shown in Figure 1. MassDOT owned roadway within the Minechoag Pond subwatershed includes portions of Interstate-90 (I-90) and portions of the eastbound exit 7 on/off ramps.

Assessment under BMP 7R for No Discharge Determination

Based on desktop analysis, it was determined that MassDOT property does not directly contribute runoff to Minechoag Pond (MA36093). Drainage from MassDOT-owned roadway I-90 discharges to the shoulders where it is conveyed through drainage swales to adjacent wetlands. None of the stormwater is piped and discharged directly to Minechoag Pond. This conclusion was based on a review of MassDOT drainage plans for Contract No. 51-193 dated May 1955. MassDOT drainage sheets 046, 048, 049, 051, 052 and 055 shows drainage from I-90 within Minechoag Pond's subwatershed does not flow directly to the waterbody. The locations of drainage swales and wetlands were confirmed using aerial imagery.

Conclusions

Because MassDOT property does not directly contribute storm water runoff to Minechoag Pond further assessment of this water body is not warranted under the Impaired Waters program.

MassDOT will continue to implement the measures outlined in its Stormwater Management Plan (SWMP) to minimize the impacts of storm water from its property.

References

Massachusetts Department of Environmental Protection (MassDEP). (2002). Total Maximum Daily Loads of Phosphorus for Selected Chicopee Basin Lakes. CN 118.0. Retrieved from: http://www.mass.gov/dep/water/resources/chicopee.pdf

Massachusetts Department of Environmental Protection (MassDEP). (2011). Massachusetts Year 2010 Integrated List of Waters - Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act. Retrieved from: http://www.mass.gov/dep/water/resources/10list6.pdf

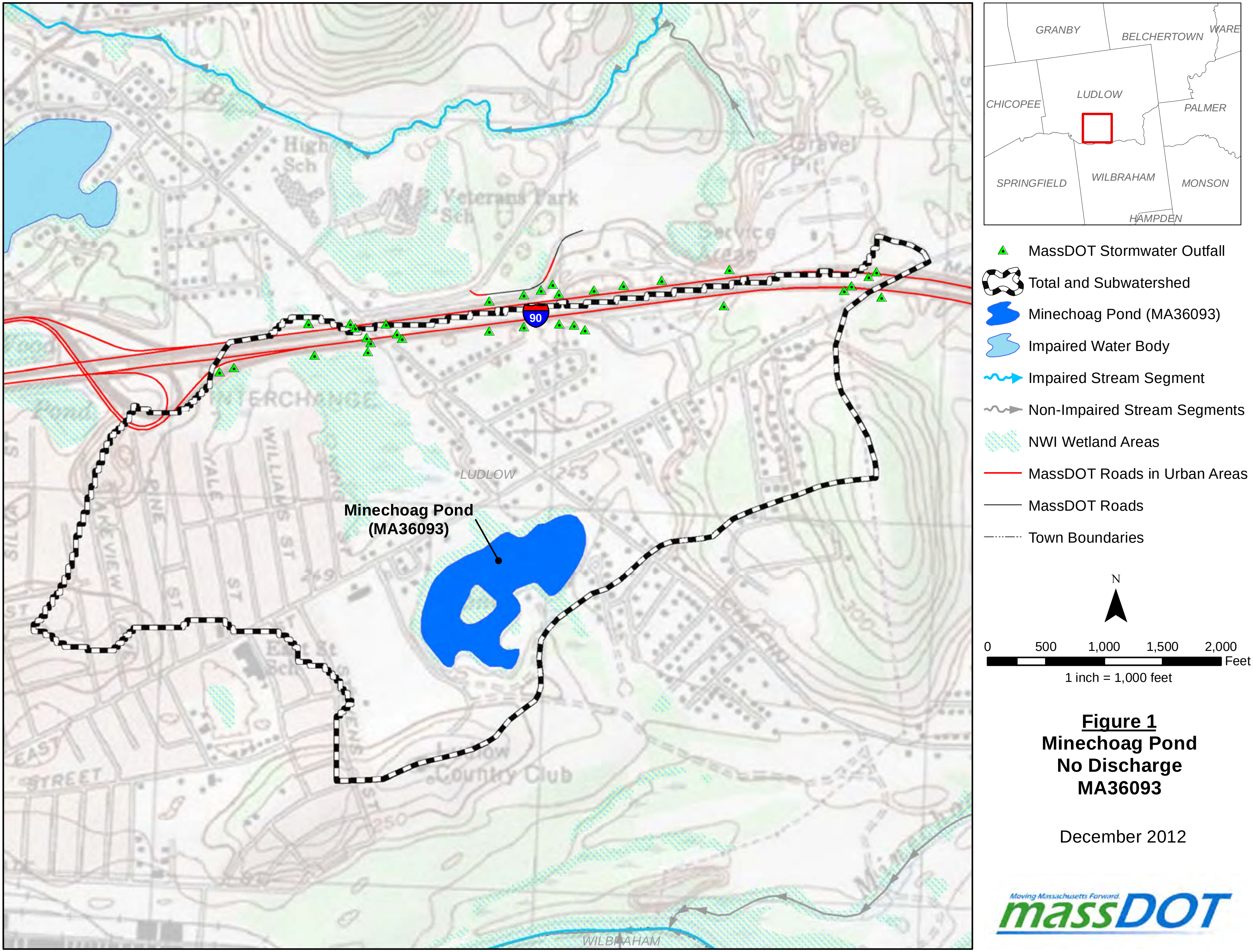

Figure 1
Minechoag Pond
No Discharge
MA36093

December 2012

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Impaired Waters Assessment for Salisbury Brook (MA62-08)

Impaired Water Body

Name: Salisbury Brook

Location: Brockton, MA

Water Body ID: MA62-08

Impairments

Salisbury Brook (MA62-08) is listed under Category 5, "Waters Requiring a TMDL", on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters*. Salisbury Brook is impaired for the following:

- fecal coliform
- sedimentation/siltation
- physical substrate habitat alterations.

According to MassDEP's *Taunton River Watershed 2001 Water Quality Assessment Report* (MassDEP, 2005), the 2.5-mile reach of Salisbury Brook is impaired due to siltation and pathogens. The report states that a 0.4 mile reach of Salisbury Brook is impaired because of physical alteration (culverted underground) that results in a reduction of habitat available for aquatic life, and that suspected sources of fecal coliform are discharges from municipal separate storm sewer systems and illicit connections. The report recommends following the *Nonpoint Source Pollution Assessment Report and Management Plan* (ESS, 2003), conducting biological, habitat, and water quality monitoring, and conducting bacteria sampling.

Relevant Water Quality Standards

Water Body Classification: Class B

Applicable State Regulations:

- *314 CMR 4.05 (3)(b) 5 Solids*. These waters shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.
- *314 CMR 4.05 (4)(a) 4 Bacteria*.
    - a. Waters designated for shellfishing: fecal coliform shall not exceed a geometric mean Most Probable Number (MPN) of 14 organisms per 100 ml, nor shall more than 10% of the samples exceed an MPN of 28 per 100 ml, or other values of equivalent protection based on sampling and analytical methods used by the Massachusetts Division of Marine Fisheries and approved by the National Shellfish Sanitation Program in the

latest revision of the Guide For The Control of Molluscan Shellfish (more stringent regulations may apply, see 314 CMR 4.06(1)(d)(5));

- b. at bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010, no single enterococci sample taken during the bathing season shall exceed 104 colonies per 100 ml, and the geometric mean of the five most recent samples taken within the same bathing season shall not exceed a geometric mean of 35 enterococci colonies per 100 ml. In non bathing beach waters and bathing beach waters during the non bathing season, no single enterococci sample shall exceed 104 colonies per 100 ml and the geometric mean of all samples taken within the most recent six months typically based on a minimum of five samples shall not exceed 35 enterococci colonies per 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department.

Site Description

Salisbury Brook is a water body in Brockton, Massachusetts which runs approximately 2.5 miles from Cross Pond (MA62052) to the confluence with the Trout Brook (MA62-07). Both Trout Brook and Salisbury Plain River are analyzed in separate impaired waters assessments. See Figure 1 for the location of Salisbury Brook and its subwatershed.

Assessment under BMP 7U for No Discharge Determination

Based on site visits on August 30, 2012, it was determined that MassDOT does not directly contribute runoff to Salisbury Brook (MA62-08). The nearest MassDOT-owned urban roadways are Route 27 and a bridge on Route 28. Route 27 discharges stormwater into nearby wetlands and into Lovett Brook which is not impaired. After stormwater runoff flows through Lovett Brook, it flows through a non-impaired segment of Salisbury Brook, then flows through Cross Pond before flowing into the impaired segment of Salisbury Brook. Therefore, discharges from DOT roadway are considered indirect for the impaired segment of Salisbury Brook. The bridge on Route 28 that crosses over Salisbury Brook has been retrofitted so that the drainage no longer flows into the brook but drains into the municipal stormwater system. It is unknown where the municipal stormwater system outfalls.

Conclusions

Because MassDOT urban property does not directly contribute stormwater runoff to Salisbury Brook, further assessment of this water body is not warranted under the Impaired Waters program.

MassDOT will continue to identify opportunities to implement additional structural BMPs to address pollutant loading when road work is conducted under MassDOT's programmed projects initiative. Work on programmed projects, which often include broader scale road layout changes, may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments. MassDOT will include an update in annual reports and biannual submittals to EPA regarding progress made towards meeting target IC reductions, plans for construction of additional BMPs, and finalized assessments including reductions achieved by finalized BMP designs. Furthermore, MassDOT will continue to implement non-structural BMPs that reduce the impacts of stormwater.

References

ESS Group. Inc. (2003). Matfield and Salisbury Plain River Watersheds Nonpoint Source Pollution Assessment Report and Management Plan. Prepared for MassDEP/DWM. Wellesley, MA. Retried from: http://www.glooskapandthefrog.org/Matfield%20text.pdf

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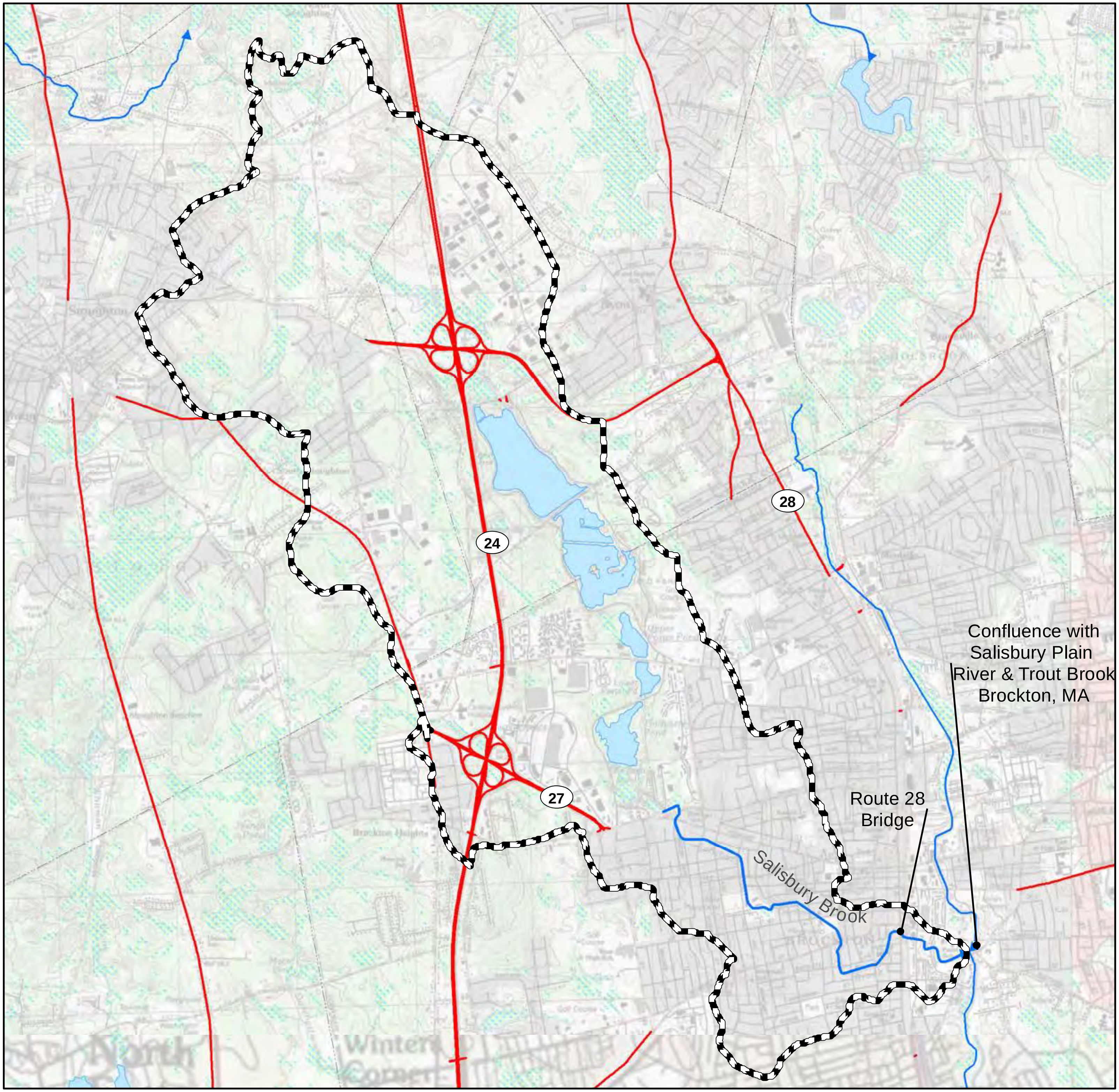

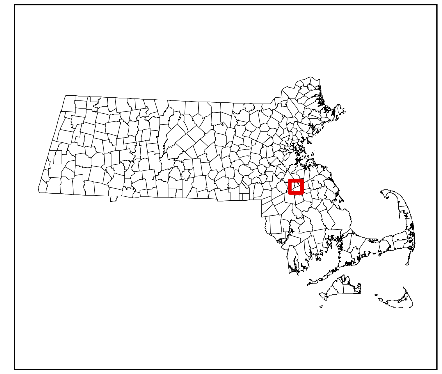

Total and Subwatershed

Salisbury Brook

Impaired Stream Segment

Impaired Water Bodies

NWI Wetland Areas

MassDOT Roads in UA

MassDOT Roads

Town Boundaries

N

0 0.150.3 0.6 0.9 1.2 Miles

1 in = 1 miles

Figure 1

Salisbury Brook
Total and Subwatershed
MA62-08

September 2012

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Impaired Waters Assessment for Sassaquin Pond (MA62232)

Impaired Water Body

Name: Sassaquin Pond

Location: New Bedford, MA

Water Body ID: MA62232

Impairments

The Sassaquin Pond (MA62232), formerly reported as MA95129, is listed under Category 5, “Waters Requiring a TMDL”, on MassDEP’s final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). The Sassaquin Pond is impaired for the following:

- fecal coliform
- excess algal growth
- taste and odor.

According to MassDEP’s *Taunton River Watershed 2001 Water Quality Assessment Report* (MassDEP, 2005), the Sassaquin Pond is impaired for enterococci and fecal coliform bacteria, excess algal growth and odor. Suspected sources were identified in the report as the municipal separate storm sewer systems, stormwater, and septic systems.

Relevant Water Quality Standards

Water Body Classification: Class B

Applicable State Regulations:

- *314 CMR 4.05 (5) (c) Nutrients*. Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.
- *314 CMR 4.05 (5) (a) Aesthetics*. All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris,

scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.

- *301 CMR 4.05 (3)(b) 8 Taste and Odor.* None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to this Class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.
- *314 CMR 4.05 (3)(b) 4 Bacteria*.
  - a. At bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: where E. coli is the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml; alternatively, where enterococci are the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies per 100 ml and no single sample taken during the bathing season shall exceed 61 colonies per 100 ml;
  - b. For other waters and, during the non bathing season, for waters at bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: the geometric mean of all E. coli samples taken within the most recent six months shall not exceed 126 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies per 100 ml; alternatively, the geometric mean of all enterococci samples taken within the most recent six months shall not exceed 33 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 61 colonies per 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department.

Site Description

Sassaquin Pond is a water body in New Bedford spreading 35.8 acres. The pond has no major inlet or outlet and is surrounded by urban neighborhoods. Route 140 runs near the southwest corner of the pond, as shown in **Figure 1**.

Assessment under BMP 7U for No Discharge Determination

Based on the topography surrounding Sassaquin Pond, it was determined that MassDOT does not directly contribute runoff from Route 140. The delineation of the subwatershed to Sassaquin Pond shows that no MassDOT roads are within the subwatershed (**Figure 1**). An unimpaired stream outside of the subwatershed starts south of Sassaquin Pond, crosses under Route 140, and continues to flow north to the Bolton Cedar Swamp. The unimpaired stream likely collects a majority of Route 140 stormwater runoff near Sassaquin Pond.

Conclusions

Because MassDOT urban property does not directly contribute stormwater runoff to Sassaquin Pond, further assessment of this water body is not warranted under the Impaired Waters program.

MassDOT will continue to implement the measures outlined in its Stormwater Management Plan (SWMP) to minimize the impacts of stormwater from its property.

References

Massachusetts Department of Environmental Protection (MassDEP). (2005). Taunton River Watershed 2001 Water Quality Assessment Report. Retrieved from: http://www.mass.gov/dep/water/resources/62wqar1.pdf

Massachusetts Department of Environmental Protection (MassDEP). (2011). Final Pathogen Total Maximum Daily Loads for the Taunton River Watershed. Retrieved from: http://www.mass.gov/dep/water/resources/taunton1.pdf

Massachusetts Department of Environmental Protection (MassDEP). (2012). Massachusetts Year 2012 Integrated List of Waters - Proposed Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act. Retrieved from: http://www.mass.gov/dep/water/resources/12list2.pdf

Massachusetts Department of Environmental Protection (MassDEP). (2011). Massachusetts Year 2010 Integrated List of Waters - Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act. Retrieved from: http://www.mass.gov/dep/water/resources/10list6.pdf

Figure 1

Sassaquin Pond
Total & Subwatershed
MA62232

September 2012

Impaired Waters Assessment for Martins Pond (MA92038)

Impaired Water Body

Name: Martins Pond

Location: North Reading, Massachusetts

Water Body ID: MA92038

Impairments

Martins Pond (MA92038) is listed under Category 5, "Waters Requiring a TMDL", on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011). Martins Pond is impaired due to the following:

- mercury in fish tissue
- excess algal growth
- turbidity
- non-native aquatic plants.

According to MassDEP's *Ipswich River Watershed 2000 Water Quality Assessment Report* (MassDEP, 2004), the non-native aquatic plant species *Cabomba Carolinian* (fanwort) and the non-native wetland plant *Lythrum salicaria* were identified in Martins Pond. A low frequency occurrence of *Najas minor* was also observed. In 1995, fish toxics monitoring was conducted by MassDEP's Division of Watershed Management in Martins Pond which identified elevated mercury concentrations in three species of fish so the Massachusetts Department of Public Health issued a site-specific fish consumption advisory for largemouth bass, black crappie, and yellow perch. Martins Pond is covered by the *Draft Pathogen Total Maximum Daily Load (TMDL) for the Ipswich River Watershed* report (MassDEP, 2005) and the Northeast Regional Mercury TMDL (NEIWPCC. (2007).

Relevant Water Quality Standards

Water Body Classification: Class B

Applicable State Regulations:

- *314 CMR 4.05 (3)(b) 6 Color and Turbidity*. These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this class.
- *314 CMR 4.05 (5) (c) Nutrients*. Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to

cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.

- *314 CMR 4.05 (5)(e) Toxic Pollutants*. All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife. For pollutants not otherwise listed in 314 CMR 4.00, the National Recommended Water Quality Criteria: 2002, EPA 822R-02-047, November 2002 published by EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act, are the allowable receiving water concentrations for the affected waters, unless the Department either establishes a site specific criterion or determines that naturally occurring background concentrations are higher. Where the Department determines that naturally occurring background concentrations are higher, those concentrations shall be the allowable receiving water concentrations. The Department shall use the water quality criteria for the protection of aquatic life expressed in terms of the dissolved fraction of metals when EPA's 304(a) recommended criteria provide for use of the dissolved fraction. The EPA recommended criteria based on total recoverable metals shall be converted to dissolved metals using EPA's published conversion factors. Permit limits will be written in terms of total recoverable metals. Translation from dissolved metals criteria to total recoverable metals permit limits will be based on EPA's conversion factors or other methods approved by the Department. The Department may establish site specific criteria for toxic pollutants based on site specific considerations.

Site Description

Martins Pond (MA92038) is a water body in North Reading, Massachusetts that covers approximately 89 acres. The pond has one primary inlet, the Skug River, and one primary outlet, Martins Brook. The closest MassDOT roadways are Route 125 which runs northwest of the pond and Route 28 (Main Street) which runs east of the pond. See Figure 1.

Assessment under BMP 7U for No Discharge Determination

Based on a site visit on July 27th, 2012, it was determined that MassDOT does not directly contribute runoff to Martins Pond (MA92038). The nearest MassDOT-owned urban roadways are Route 125 in Andover and Route 28 (Main Street) in North Reading. Runoff from Route 125 flows off the roadway into well-vegetated woods where it infiltrates. Runoff from Route 28 is collected in catch basins and piped to Skug River which is not impaired. Runoff that drains to Skug River is considered indirect drainage to Martins Pond.

Conclusions

Because MassDOT urban property does not directly contribute stormwater runoff to Martins Pond, further assessment of this water body is not warranted under the Impaired Waters program.

MassDOT will continue to implement the measures outlined in its Stormwater Management Plan (SWMP) to minimize the impacts of stormwater from its property.

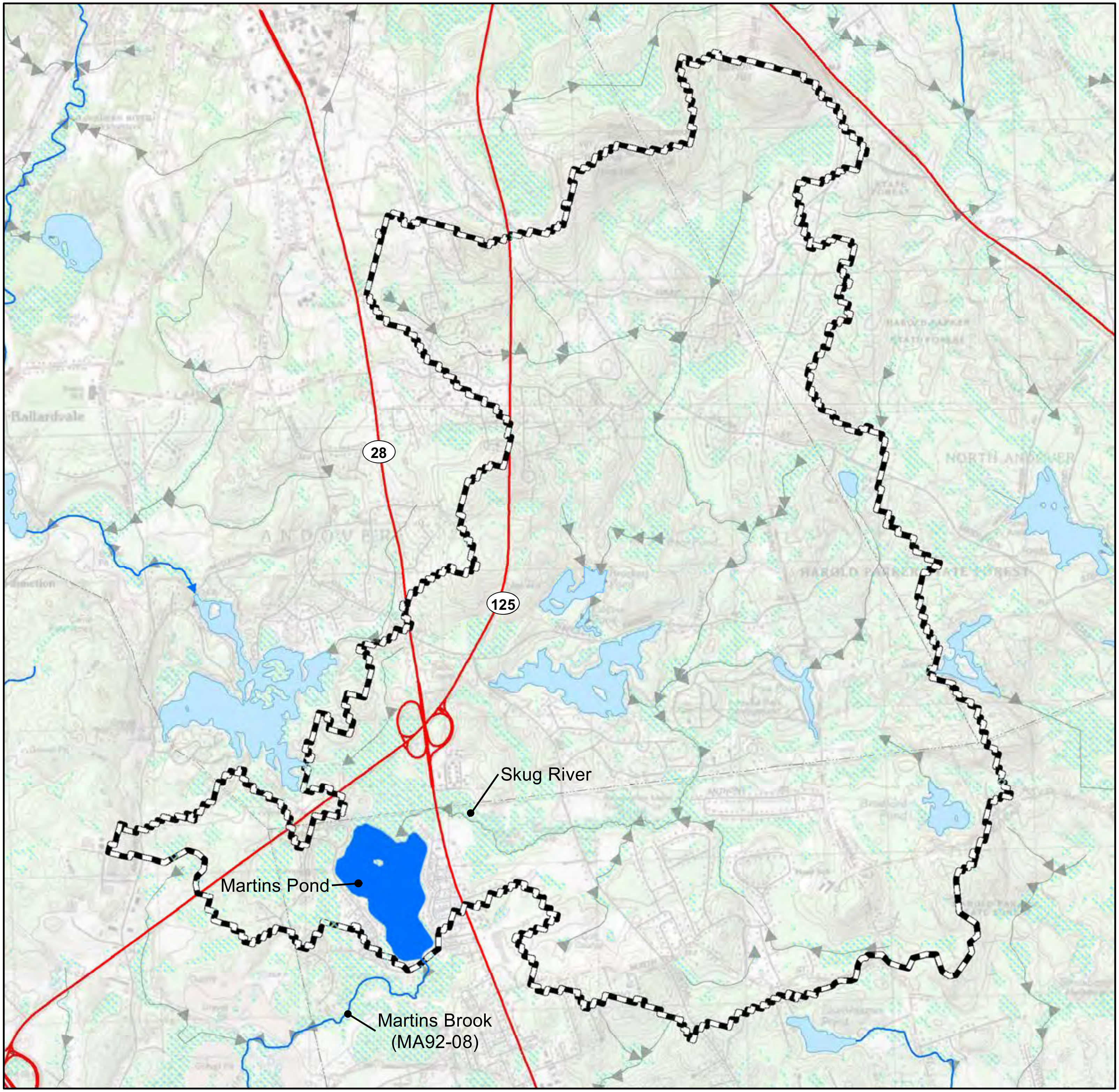
References

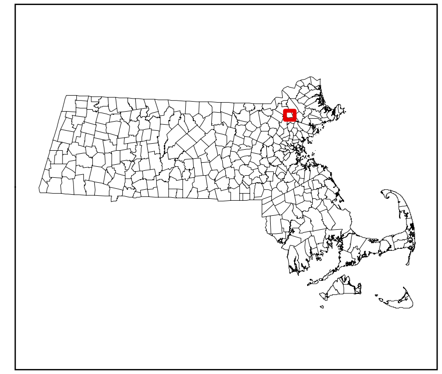
Massachusetts Department of Environmental Protection (MassDEP). (2004). Ipswich River Watershed 2000 Water Quality Assessment Report. Retrieved from: www.mass.gov/dep/water/resources/92wqar.pdf

Massachusetts Department of Environmental Protection (MassDEP). (2005). Draft Pathogen TMDL for the Ipswich River Watershed. Retrieved from: http://www.mass.gov/dep/water/resources/ipswich1.pdf

Massachusetts Department of Environmental Protection (MassDEP). (2011). Massachusetts Year 2010 Integrated List of Waters - Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act. Retrieved from: http://www.mass.gov/dep/water/resources/10list6.pdf

NEIWPCC. (2007). Northeast Regional Mercury Total Maximum Daily Load. Retrieved from: http://www.neiwpcc.org/mercury/mercurydocs/Final%20Northeast%20Regional%20Mercury%20TMDL.pdf.





Impaired Stream Segment

Martins Pond

Impaired Water Bodies

Non-Impaired Stream Segment

NWI Wetland Areas

Total and Subwatershed

MassDOT Roads in Urban Areas

MassDOT Roads

Town Boundaries

N

0 0.125 0.25 0.5 0.75 1 Miles

1 in = 1 miles

Figure 1

Martins Pond
Total and Subwatershed
MA92038

September 2012

massDOT
Massachusetts Department of Transportation
Highway Division

Impaired Waters Assessment for Acushnet River (MA95-33)

Impaired Waterbody

Name: Acushnet River

Location: New Bedford and Fairhaven, Massachusetts

Water Body ID: MA95-33

Impairments

According to the MassDEP Final Year 2010 Integrated List of Waters, this segment is listed under Category 4c as impaired for: oil and grease, color, fecal coliform, taste and odor, polychlorinated biphenyls, dissolved oxygen, other, nitrogen (total).

The *Final Pathogen TMDL for the Buzzards Bay Watershed (CN 251.1)* includes this segment and addresses fecal coliform impairment.

The *Buzzards Bay Watershed 2000 Water Quality Assessment Report* lists manufacturing facilities and combined sewer overflows (CSOs) among the main sources of impairments to this segment.

Relevant Water Quality Standards

Water Body Classification: SB

- 301 CMR § 4.05 (3)(b) – Class SB. *These waters are designated as a habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. In certain waters, habitat for fish, other aquatic life and wildlife may include, but is not limited to, seagrass. Where designated in the tables to 314 CMR 4.00 for shellfishing, these waters shall be suitable for shellfish harvesting with depuration (Restricted and Conditionally Restricted Shellfish Areas). These waters shall have consistently good aesthetic value. In the case of a water intake structure (IS) at a desalination facility, the Department has the authority under 33 U.S.C. § 1251 (FWPCA § 401), M.G.L. c. 21, §§ 26 through 53 and 314 CMR 3.00 to condition the IS to assure compliance of the withdrawal activity with 314 CMR 4.00, including, but not limited to, compliance with the narrative and numerical criteria and protection of existing and designated uses.314 CMR § 4.05 (3)(b)(1) – Dissolved Oxygen. Dissolved Oxygen. Shall not be less than 5.0 mg/l. Seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained. Where natural background conditions are lower, DO shall not be less than natural background.*
- 314 CMR § 4.05 (3)(b)(7*) –Oil and Grease. These waters shall be free from oil and grease, petrochemicals and other volatile or synthetic organic pollutants.*
- 314 CMR § 4.05 (4)(b)(4) – *Bacteria.*

  a. Waters designated for shellfishing shall not exceed a fecal coliform median or geometric mean MPN of 88 organisms per 100 ml, nor shall more than 10% of the samples exceed an MPN of 260 per 100 ml or other values of equivalent protection based on sampling and analytical methods used by the Massachusetts Division of Marine Fisheries and approved *by the National Shellfish Sanitation Program in the latest revision of the Guide For The Control of Molluscan Shellfish (more stringent regulations may apply, see 314 CMR 4.06(1)(d)(5));*

b. at bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010, no single enterococci sample taken during the bathing season shall exceed 104 colonies per 100 ml and the geometric mean of the five most recent samples taken within the same bathing season shall not exceed 35 enterococci colonies per 100 ml. In non bathing beach waters and bathing beach waters during the non bathing season, no single enterococci sample shall exceed 104 colonies per 100 ml and the geometric mean of all of the samples taken during the most recent six months typically based on a minimum of five samples shall not exceed 35 enterococci colonies per 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department;314 CMR § 4.05 (4)(b)(6) – Color and Turbidity. These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this class.

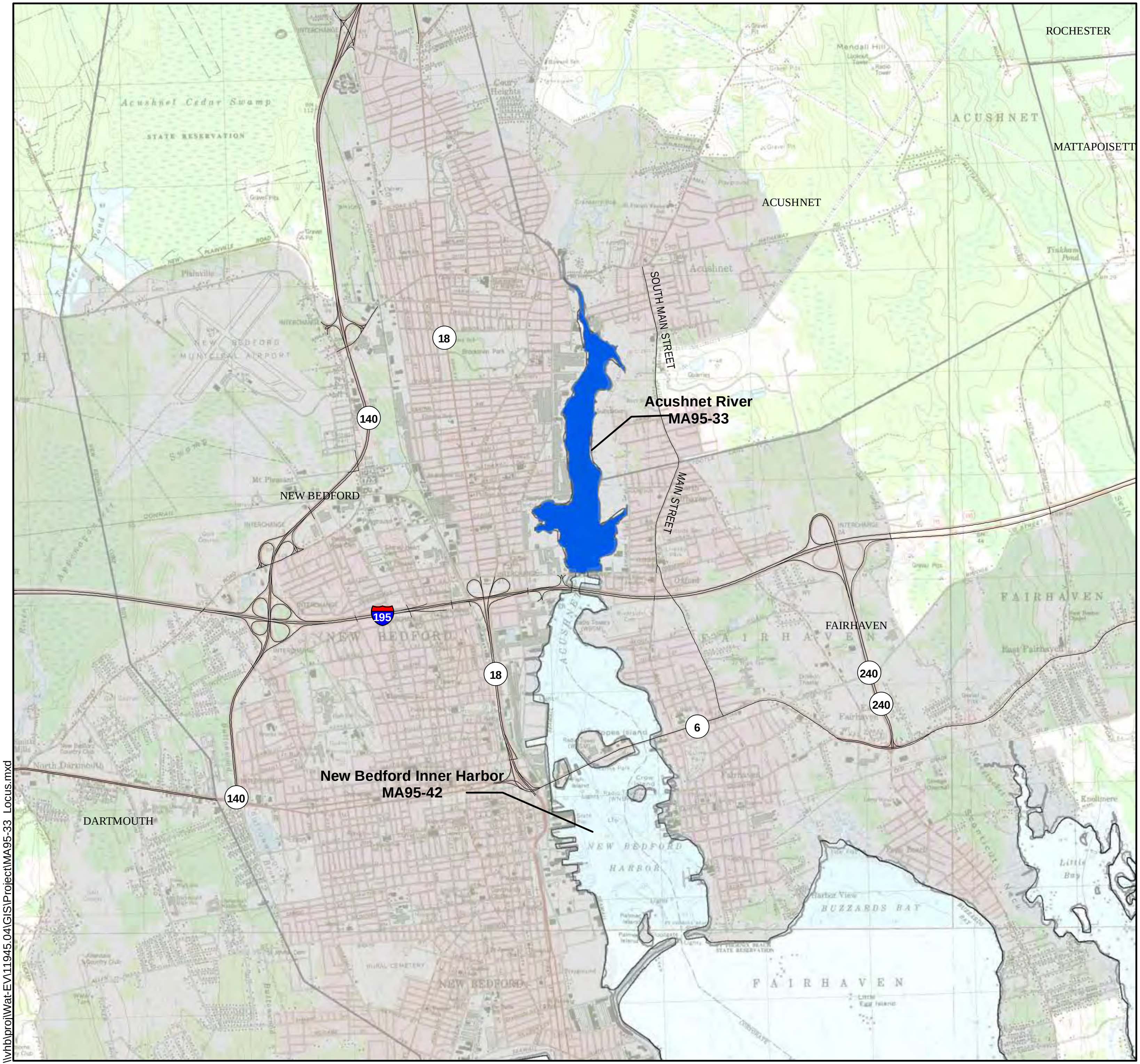
- 314 CMR § 4.05 (5)(a) – *Aesthetics. All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.*
- 314 CMR § 4.05 (5)(c) – *Nutrients. Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.*
- 314 CMR § 4.05 (5)(e) - *Toxic Pollutants. All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife. For pollutants not otherwise listed in 314 CMR 4.00, the National Recommended Water Quality Criteria: 2002, EPA 822R-02-047, November 2002 published by EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act, are the allowable receiving water concentrations for the affected waters, unless the Department either establishes a site specific criterion or determines that naturally occurring background concentrations are higher. Where the Department determines that naturally occurring background concentrations are higher, those concentrations shall be the allowable receiving water concentrations. The Department shall use the water quality criteria for the protection of aquatic life expressed in terms of the dissolved fraction of metals when EPA's 304(a) recommended criteria provide for use of the dissolved fraction. The EPA recommended criteria based on total recoverable metals shall be converted to dissolved metals using EPA's published conversion factors. Permit limits will be written in terms of total recoverable metals. Translation from dissolved metals criteria to total recoverable metals permit limits will be based on EPA's conversion factors or other methods approved by the Department. The Department may establish site specific criteria for toxic pollutants based on site specific considerations.*

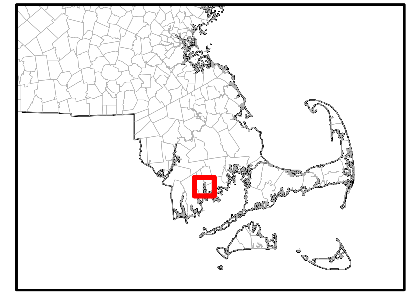
- 314 CMR § 4.05 (4)(b)(8) – *Taste and Odor. None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to this class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.*

Site Description

Acushnet River (MA95-33) total segment area covers 0.31 square miles and extends from outlet Main Street culvert in Acushnet to the Coggeshall Street Bridge connecting New Bedford and Fairhaven. According to the *Buzzards Bay Watershed 2000 Water Quality Assessment Report,* the primary land uses of the 21.7 square mile subwatershed are forest (45%), residential (25%) and open land (13%).

MassDOT property does not discharge directly to Acushnet River. The nearest MassDOT properties are South Main Street in Acushnet, MA and Main Street in Fairhaven, approximately 0.45 miles east of Acushnet River. Stormwater from South Main Street and Main Street discharge into unnamed brooks which travel for a significant distance before reaching the Acushnet River. Interstate 195, located downstream beyond the southern extent of the segment, discharges to the New Bedford Inner Harbor (MA95-42).





Legend

MassDOT Roadways

2010 Urban Area

Assessed Segment

N

0 0.5 1 Miles

Figure 1

Acushnet River MA95-33

December 2012

massDOT Massachusetts Department of Transportation Highway Division

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No MassDOT Discharge Review Under Step 2 of BMP 7U

Under Step 2 of BMP 7U, MassDOT committed to map the locations of MassDOT urban outfalls relative to 303(d) waters. This step included "*performing a desktop review of the sub-basin of the 303(d) water body to determine the specific locations of MassDOT outfalls and their receiving waters. This procedure will help determine whether MassDOT's outfalls in fact are potentially discharging in to the water body at issue, and will identify the number of outfalls that may need to be addressed through a mitigation plan. If MassDOT concludes based on its mapping that MassDOT's outfalls clearly are not discharging to the 303(d) water, it will document the basis for the conclusion and will conduct no further assessment of the water body at issue*." Step 2 of BMP 7R includes a similar desktop review.

Appendix L-1 of the June 8, 2010 submittal to the court, as part of the CLF vs. MassDOT lawsuit, identified waterbodies that potentially receive runoff from MassDOT urban roads and included Category 4a and 5 impaired waterbodies. In 2009, USGS published a new GIS datalayer of nested sub-basins[1]. These new more detailed sub-basins allowed AECOM to, in most cases, define the specific watershed to an individual impaired segment when developing Appendix L-1. In some cases the sub-basin continued to include more than one impaired waterbody (and other non-impaired waterbodies) and, therefore, AECOM has been reviewing these sub-basins to identify which of the sub-basin's receiving waters do potentially receive MassDOT discharge from *urban area roads* and which do not. AECOM reviewed each sub-basin in detail and identified waters that do not receive direct discharge from MassDOT. These were identified based on a visual examination of the location of the discharge and the location of the receiving water body. Note that in some cases these water bodies receive discharge from non-urban highways. MassDOT's NPDES storm water permit and MassDOT's impaired waters program covers urban areas. Storm water from non-urban areas is addressed under MassDOT's Programmed Project Initiative.

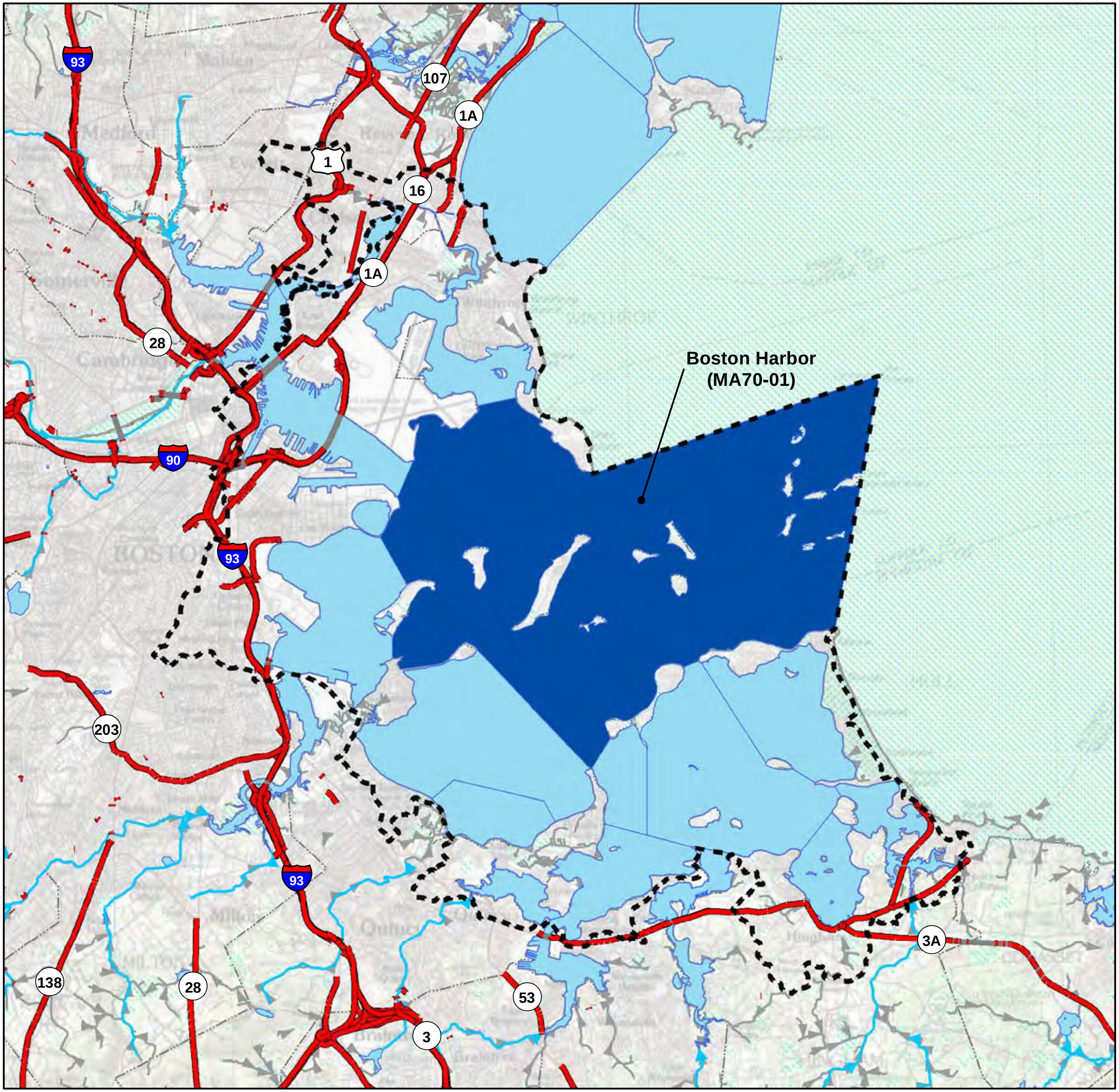
The figures in this section summarize the desktop review and those receiving waters that have been identified as not directly receiving MassDOT discharges during this more detailed review. The figures show the impaired waterbody segment being assessed in dark blue. The other impaired waterbody segments within the sub-basin are in bright blue. MassDOT urban area roads are indicated in red with the outfalls identified as green circles. The gray portions of MassDOT roadways are outside of urban areas and therefore not covered by the existing NPDES permit. These areas are not considered in this assessment.

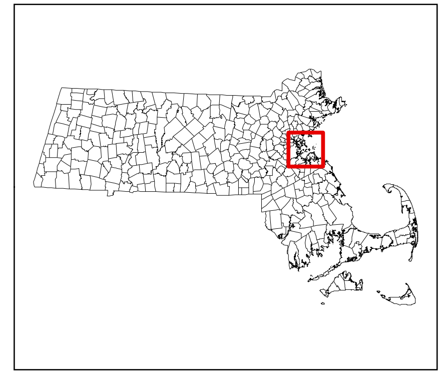
The water bodies MassDOT has identified that do not receive discharge from MassDOT are listed in the table below and shown in the attached figures.

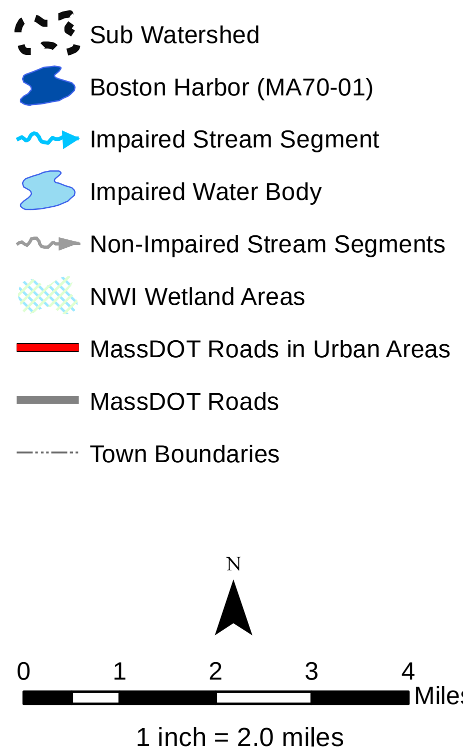
[1] MassGIS states the purpose of the datalayer as follows: "This data layer was created in cooperation with the Environmental Protection Agency (EPA) to assist local communities in environmental planning and stormwater runoff studies. The purpose of this data layer is to provide basin boundaries and impervious surface data at a more discretized scale than is available with current Watershed Boundary Dataset (WBD) subdivisions." The GIS layer is available at http://water.usgs.gov/GIS/metadata/usgswrd/XML/ds451_subbasins.xml.

Impaired Segments Where Assessment Identified No Discharges from MassDOT Outfalls to Water Body

Waterbody ID	Waterbody Name	Watershed Name	TMDL
MA70-01	Boston Harbor	Boston Harbor	-
MA70-04	Quincy Bay	Boston Harbor	-
MA70-07	Hingham Bay	Boston Harbor	-
MA70-09	Hull Bay	Boston Harbor	-
MA72045	Hardys Pond	Charles	-
MA82060	Hocomonco Pond	Concord	-
MA91-14	Egypt River	Parker	-
MA93-08	Bass River	North Coastal	-
MA93-21	Salem Harbor	North Coastal	-
MA93-24	Nahant Bay	North Coastal	-
MA93-43	Saugus River	North Coastal	-
MA93-49	Shute Brook	North Coastal	-
MA94-11	Green Harbor	South Coastal	-
MA94-19	The Gulf	South Coastal	-
MA95-34	Slocums River	Buzzards Bay	-
MA95-38	Clarks Cove	Buzzards Bay	-
MA95-39	Apponagansett Bay	Buzzards Bay	-
MA95-62	Buzzards Bay	Buzzards Bay	-
MA95-65	Nasketucket Bay	Buzzards Bay	Pathogens (CN 251.1)
MA95-69	Sippican Harbor	Buzzards Bay	Pathogens (CN 251.1)
MA95-71	Aucoot Cove	Buzzards Bay	-

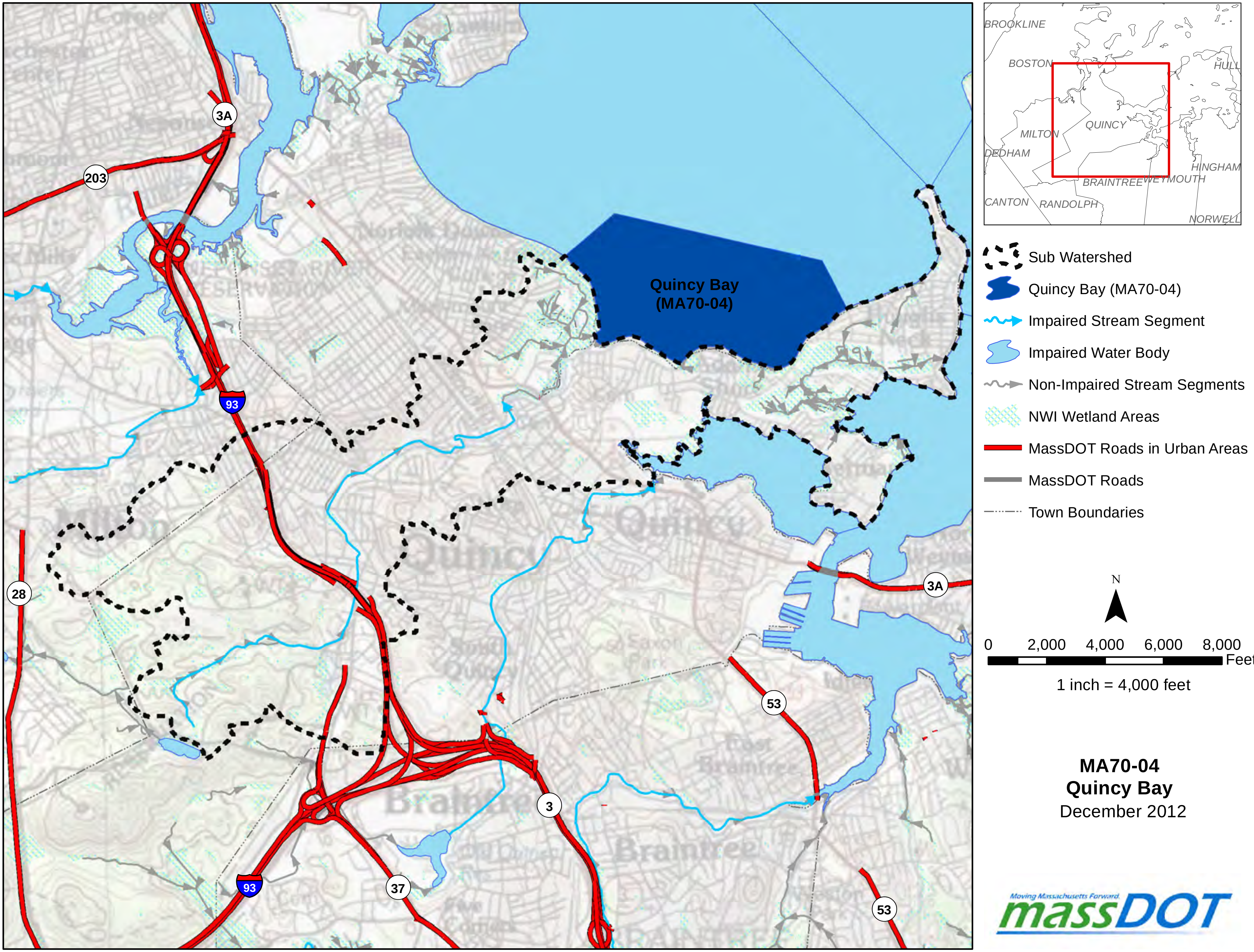






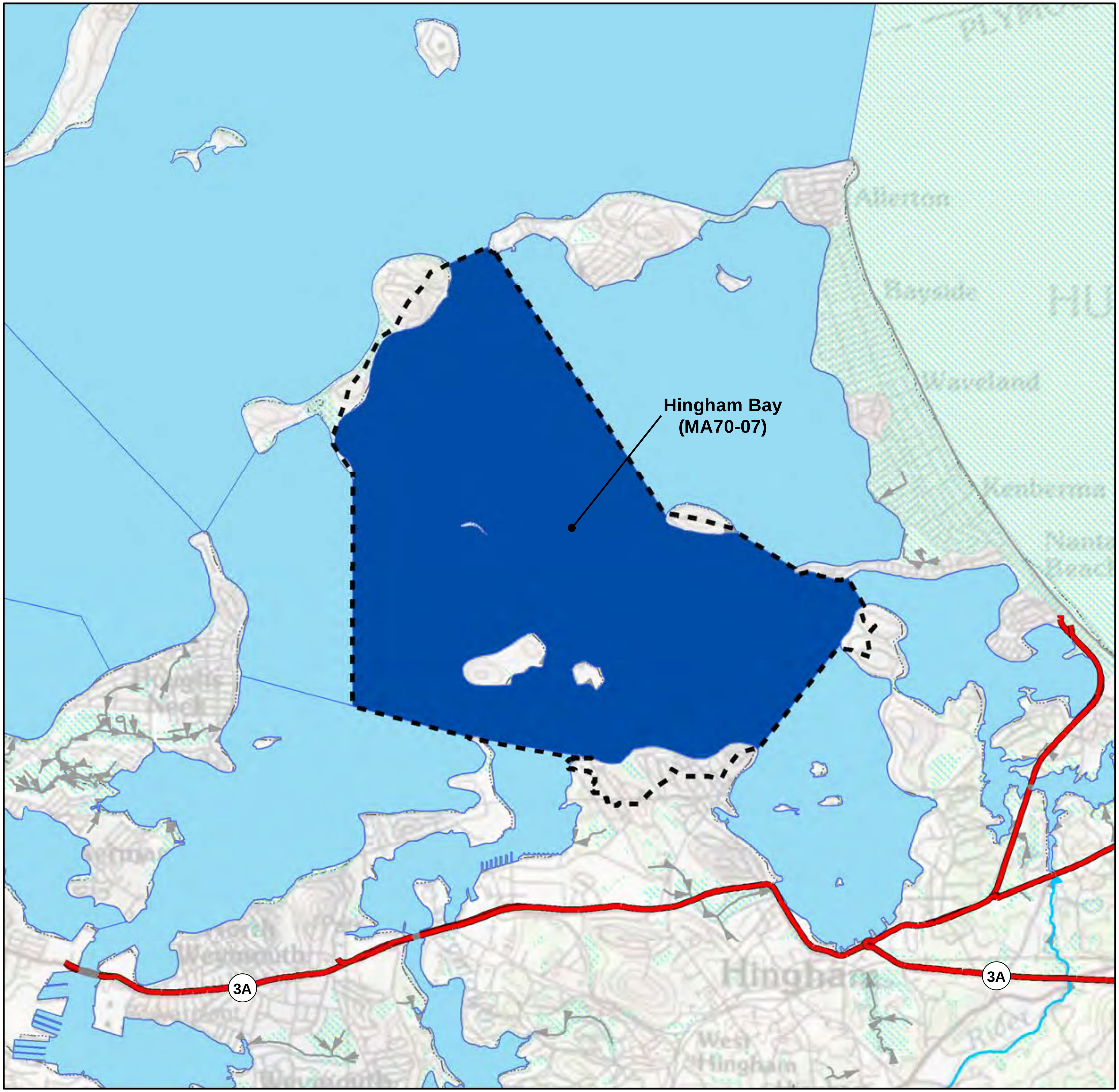
MA70-01
Boston Harbor
December 2012

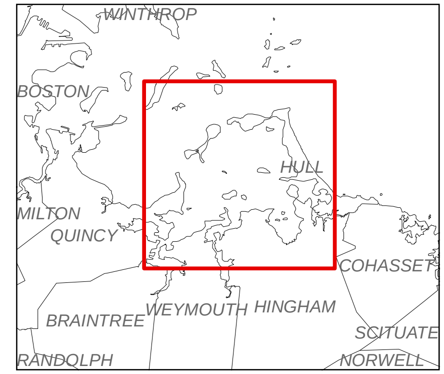
Moving Massachusetts Forward.
massDOT



MA70-04
Quincy Bay
December 2012

Moving Massachusetts Forward.
massDOT





Sub Watershed
Hingham Bay (MA70-07)
Impaired Stream Segment
Impaired Water Body
Non-Impaired Stream Segments
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries

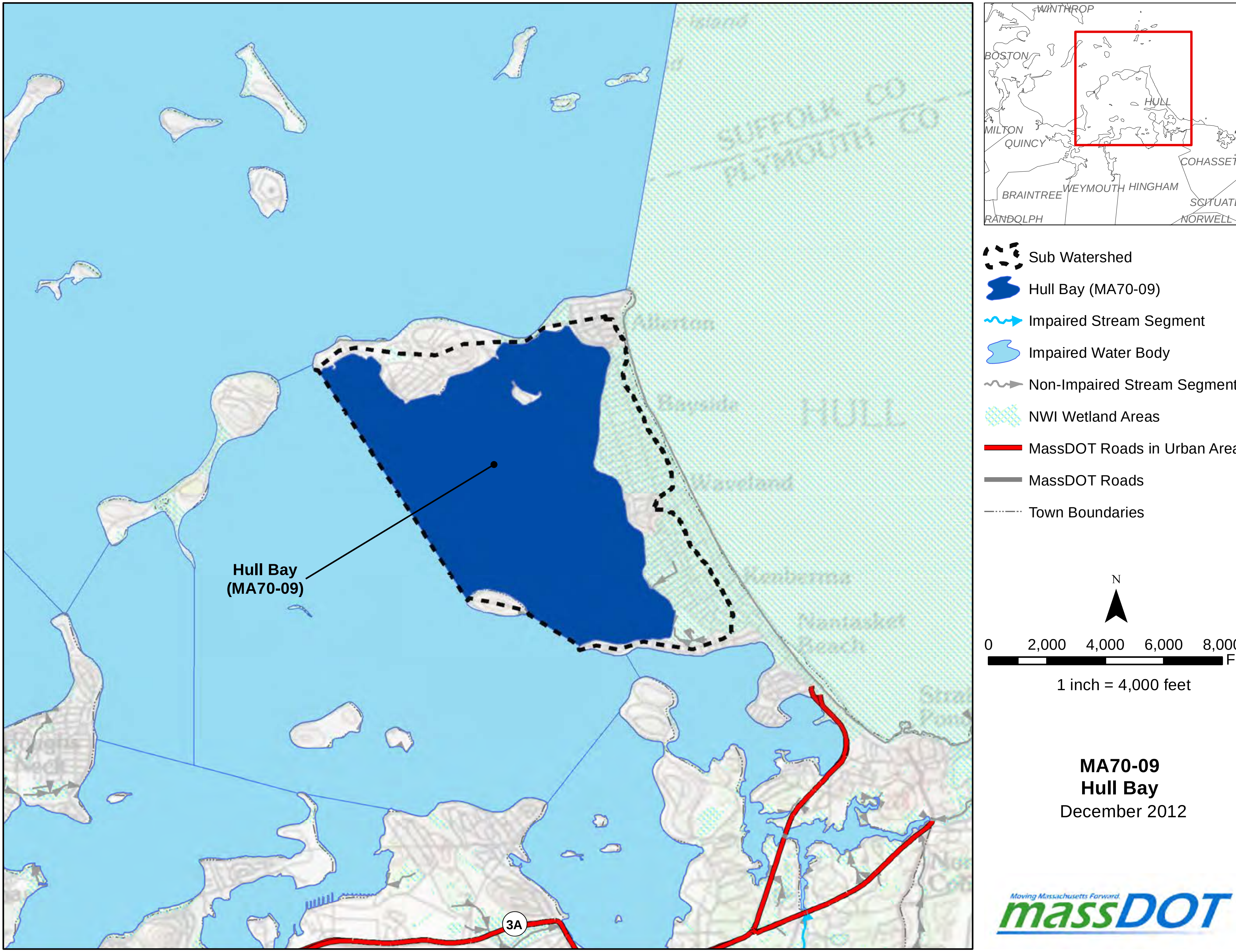
N

0 2,000 4,000 6,000 8,000 Feet

1 inch = 4,000 feet

MA70-07
Hingham Bay
December 2012

Moving Massachusetts Forward.
massDOT



MA70-09
Hull Bay
December 2012

Moving Massachusetts Forward.
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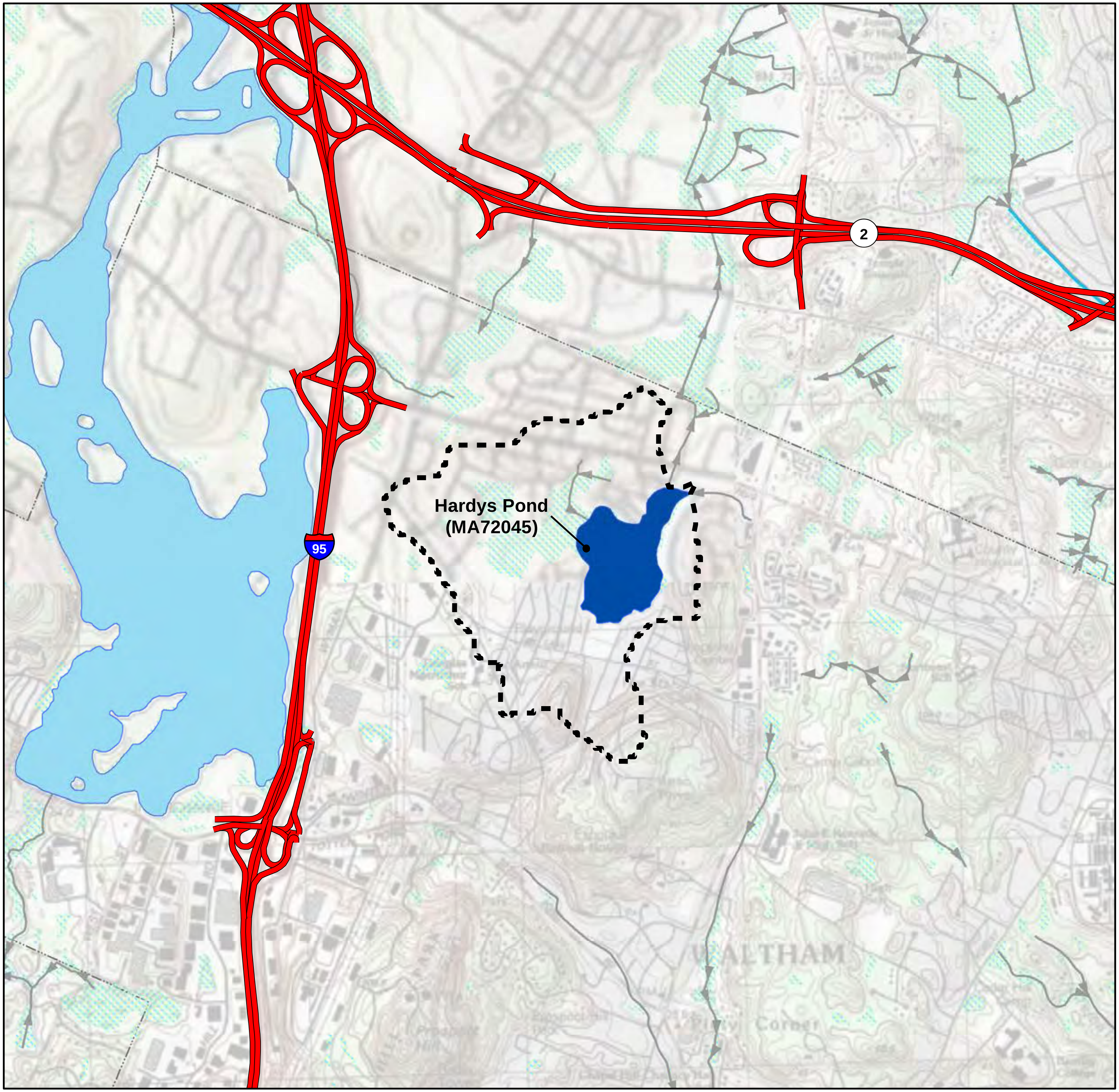
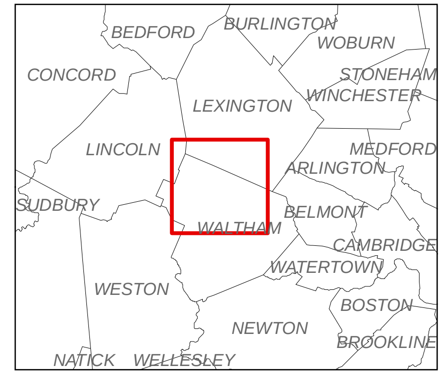




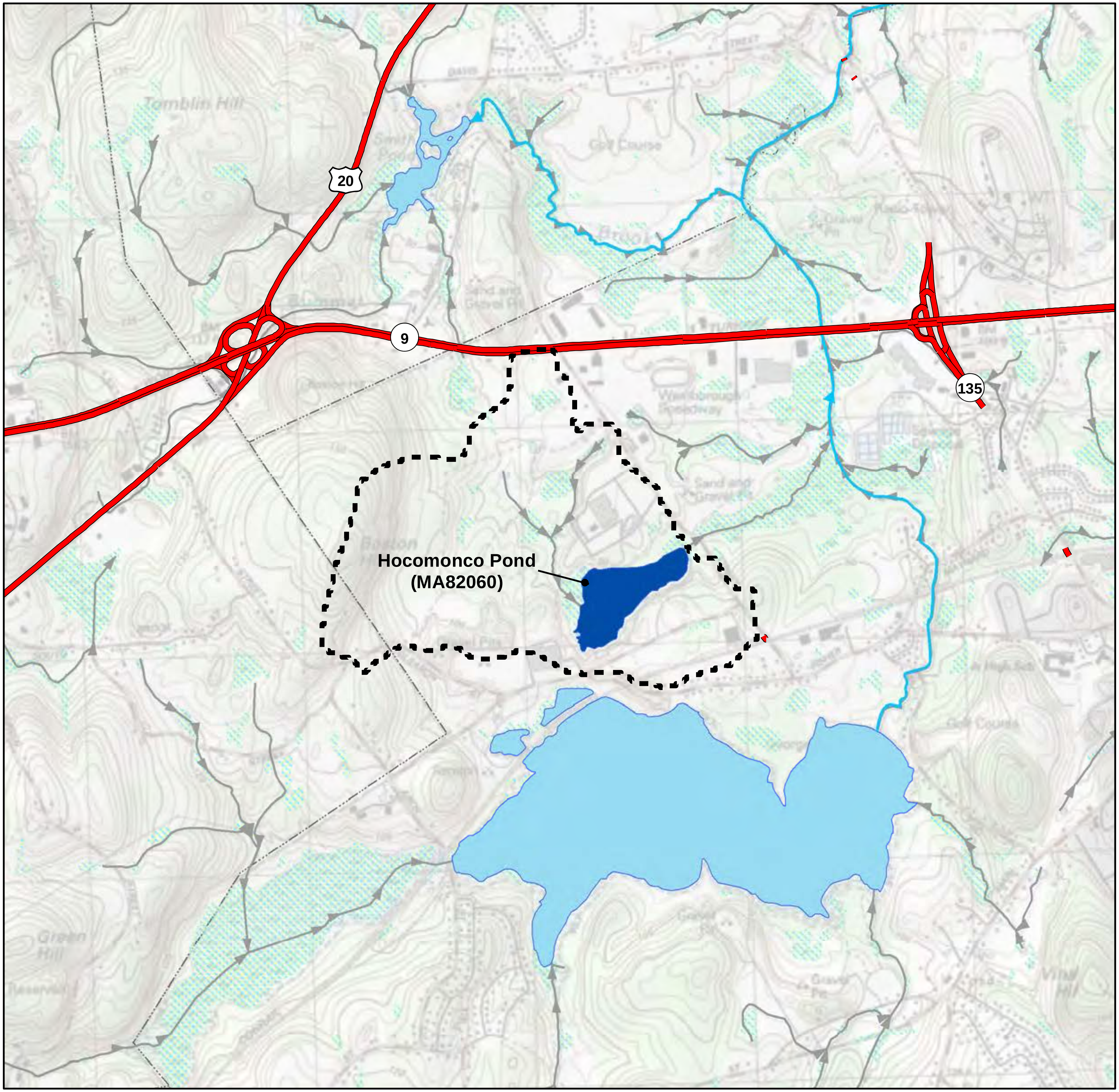
Sub Watershed
Hardys Pond (MA72045)
Impaired Stream Segment
Impaired Water Body
Non-Impaired Stream Segments
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries

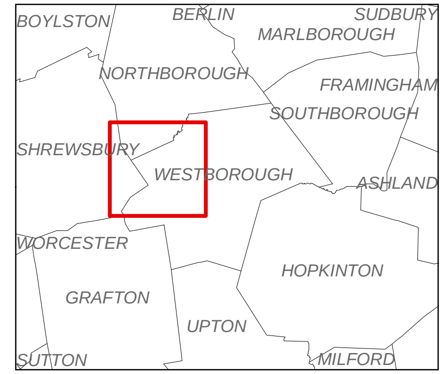
N

0 1,000 2,000 4,000 Feet

1 inch = 2,000 feet

MA72045
Hardys Pond
December 2012





Sub Watershed
Hocomonco Pond (MA82060)
Impaired Stream Segment
Impaired Water Body
Non-Impaired Stream Segments
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries

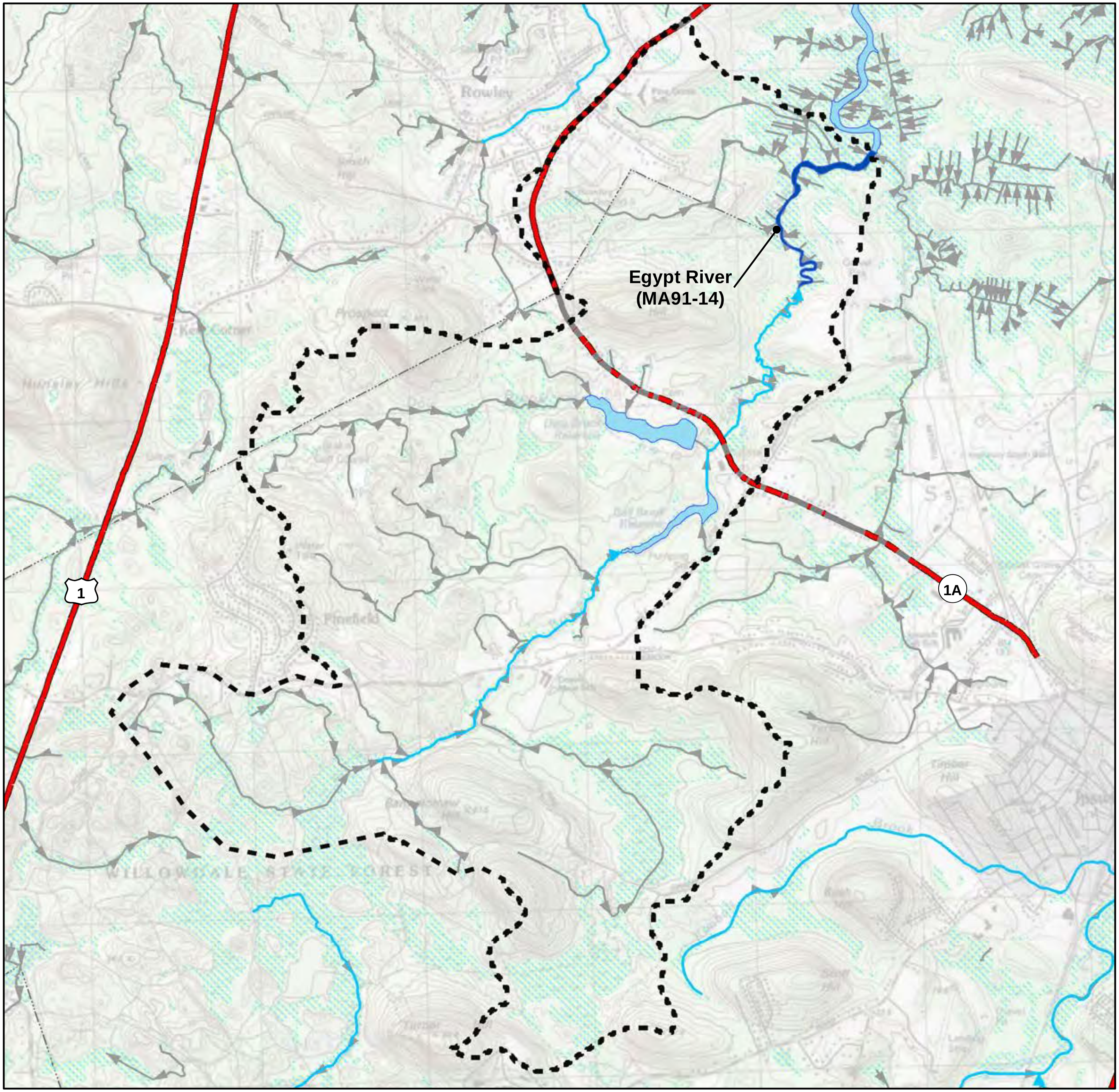
N

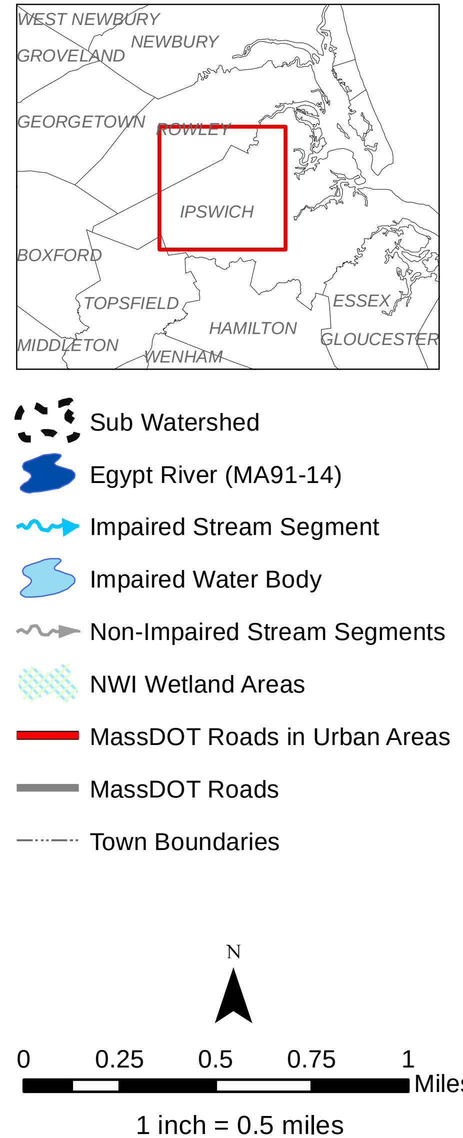
0 2,000 4,000 Feet

1 inch = 2,000 feet

MA82060
Hocomonco Pond
December 2012

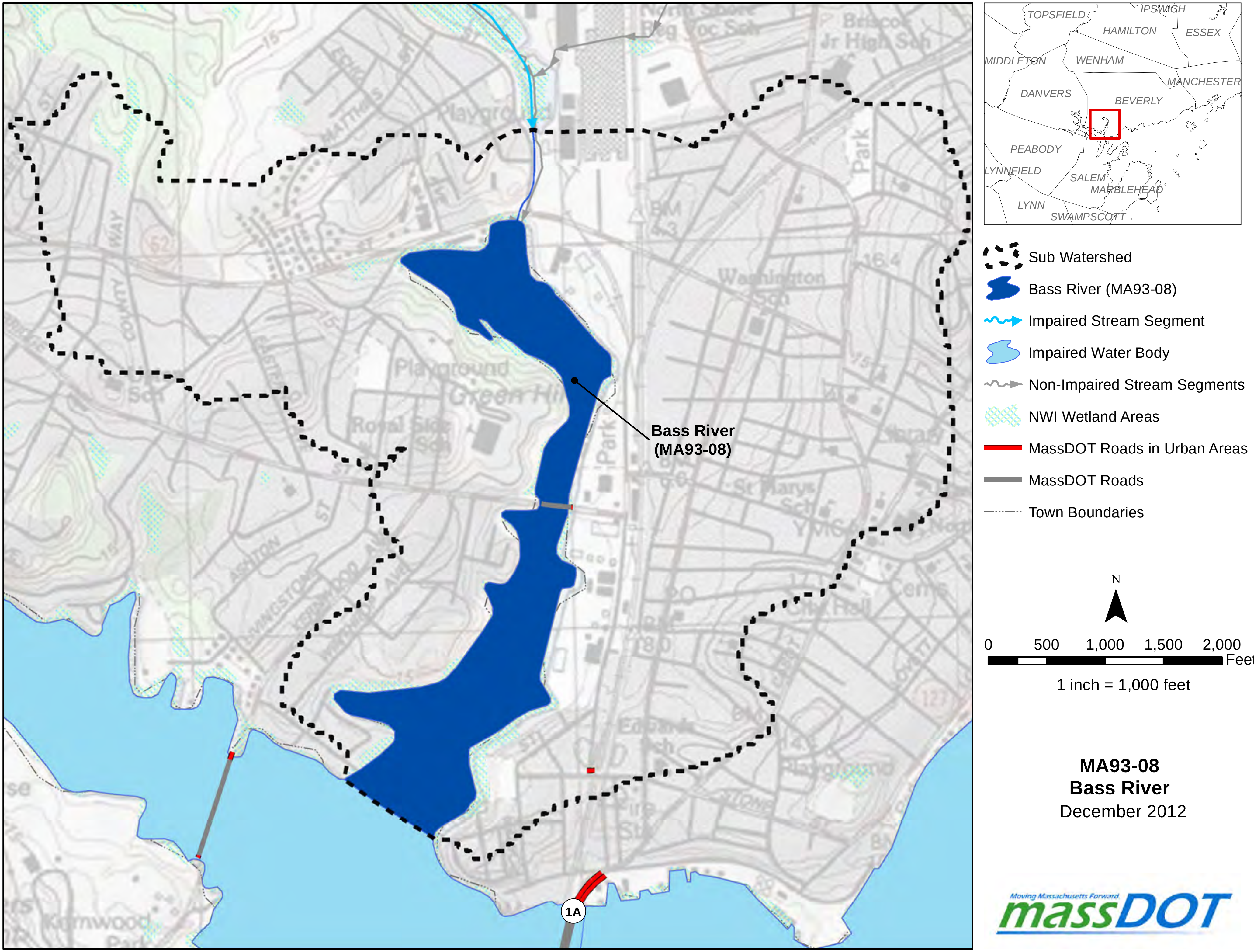
Moving Massachusetts Forward.
massDOT



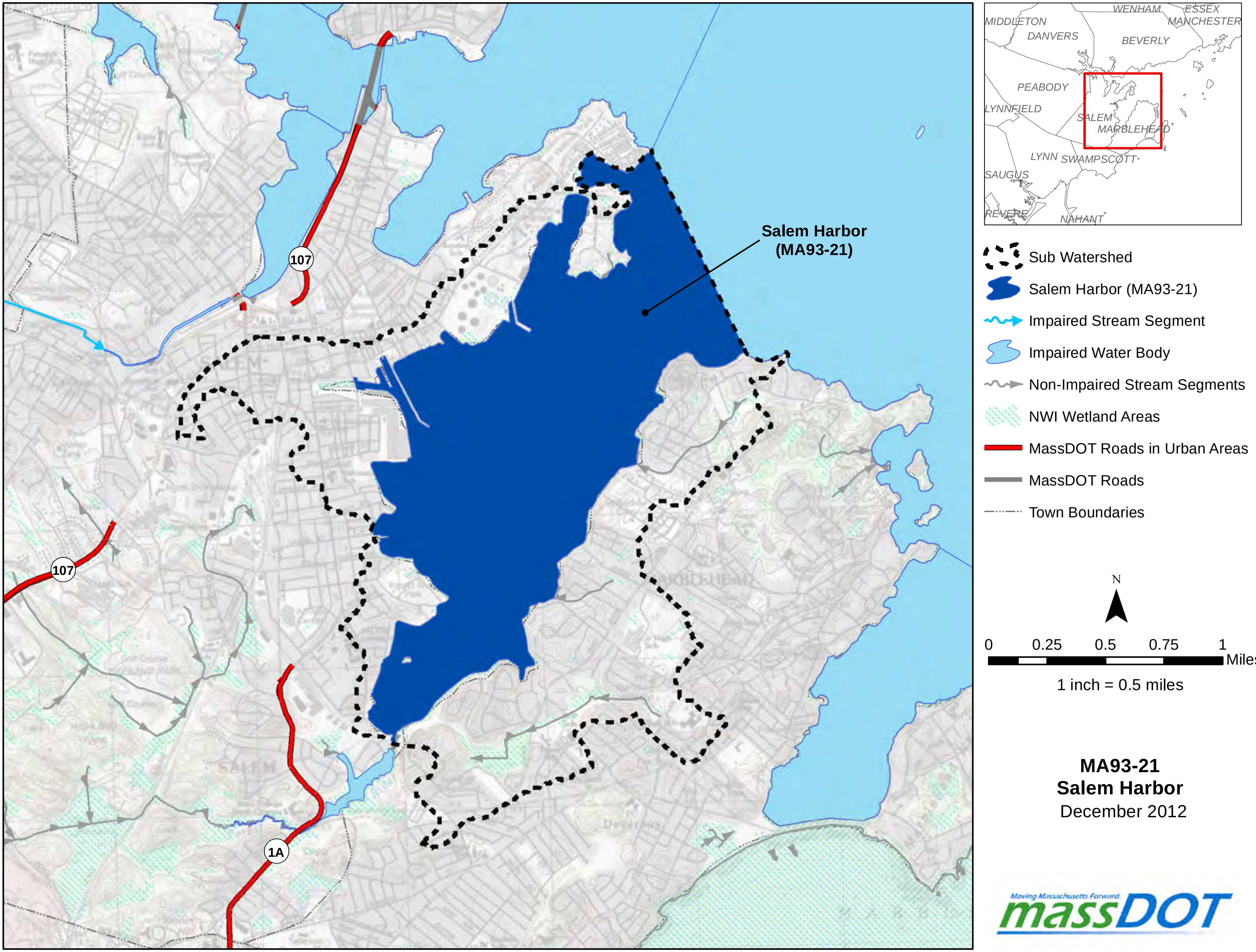


MA91-14
Egypt River
December 2012

Moving Massachusetts Forward.
massDOT

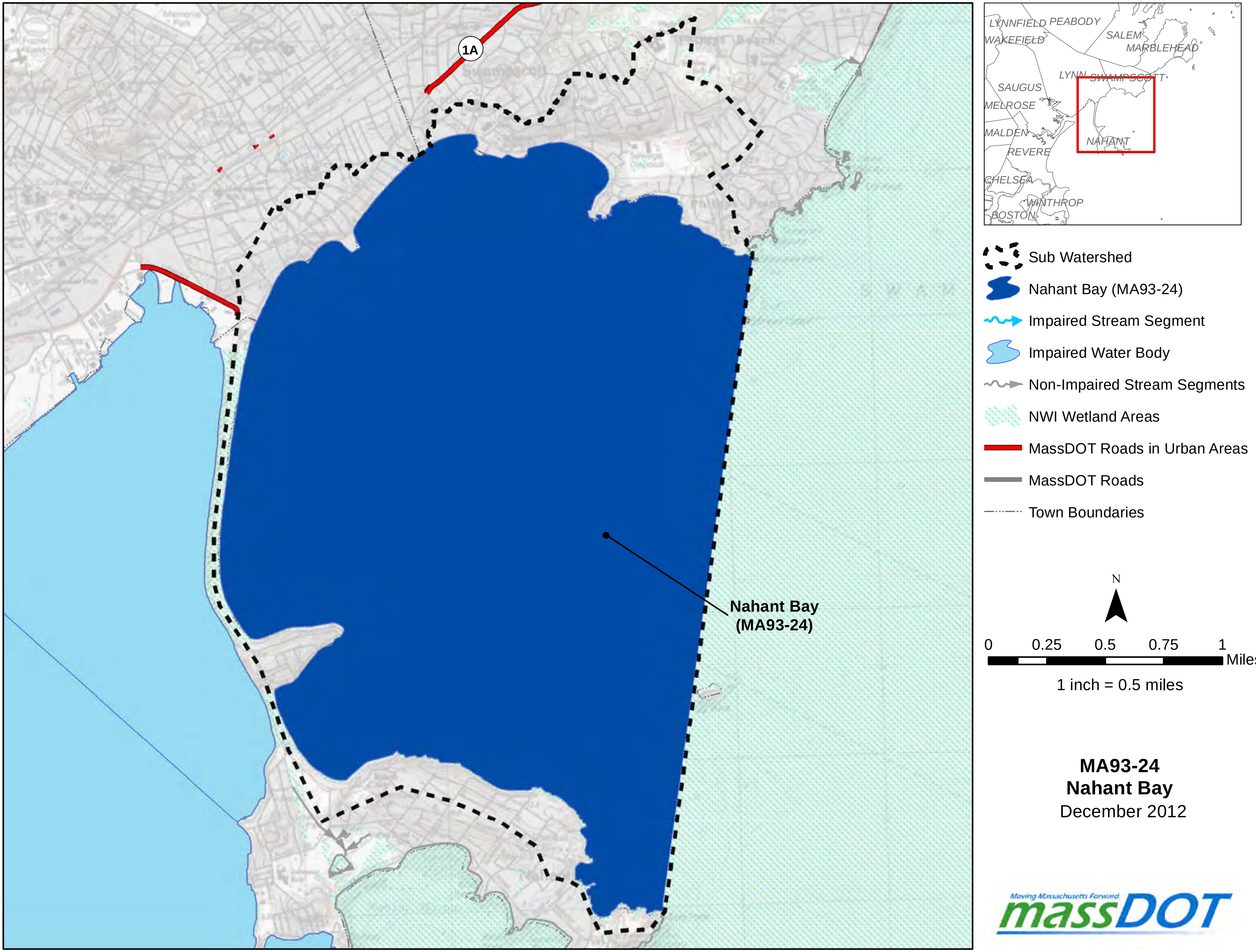


Bass River
(MA93-08)
1A
TOPSFIELD
IPSWICH
HAMILTON
ESSEX
MIDDLETON
WENHAM
MANCHESTER
DANVERS
BEVERLY
PEABODY
LYNNFIELD
SALEM
MARBLEHEAD
LYNN
SWAMPSCOTT
Sub Watershed
Bass River (MA93-08)
Impaired Stream Segment
Impaired Water Body
Non-Impaired Stream Segments
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries
N
0
500
1,000
1,500
2,000
Feet
1 inch = 1,000 feet
MA93-08
Bass River
December 2012
Moving Massachusetts Forward.
massDOT

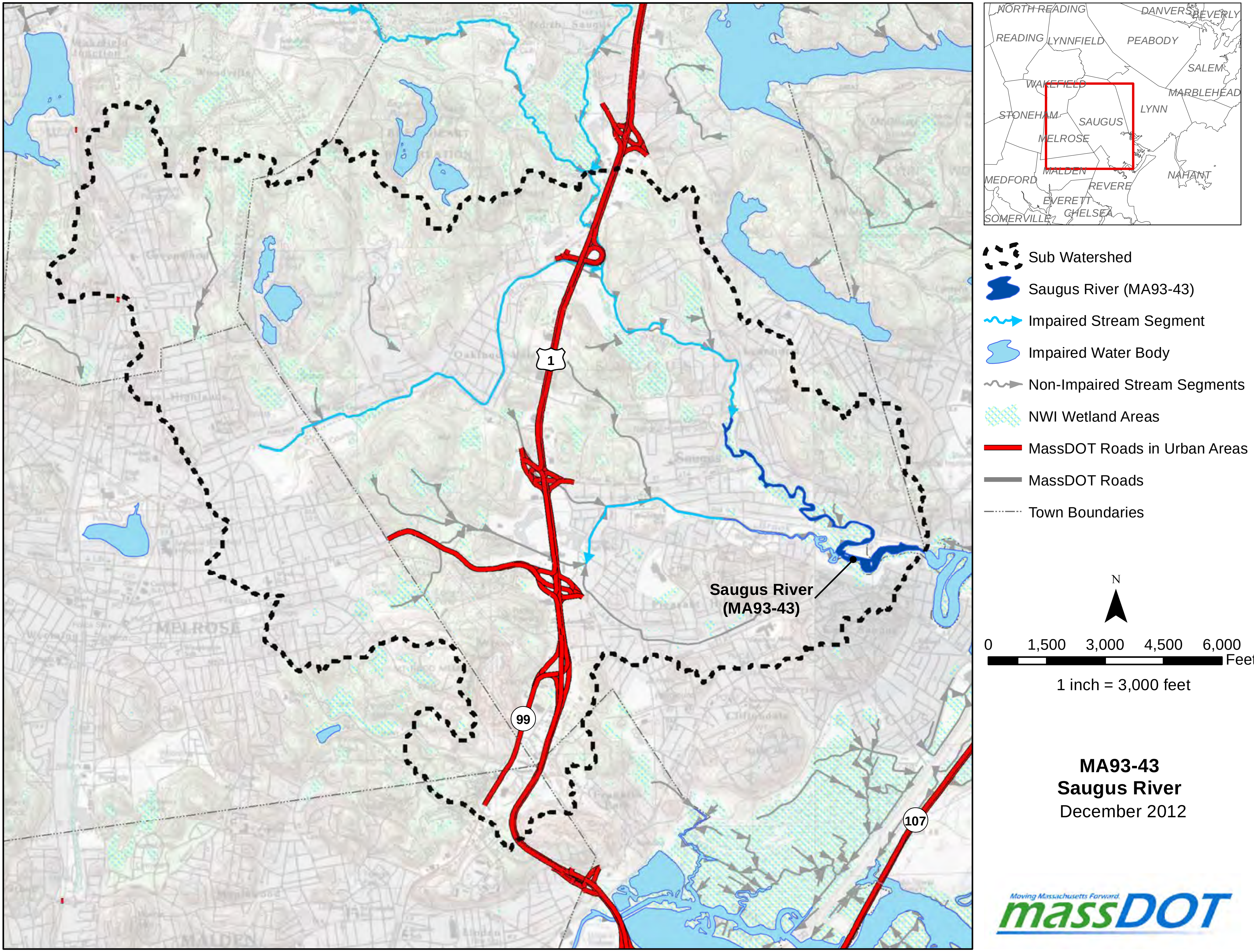


MA93-21
Salem Harbor
December 2012

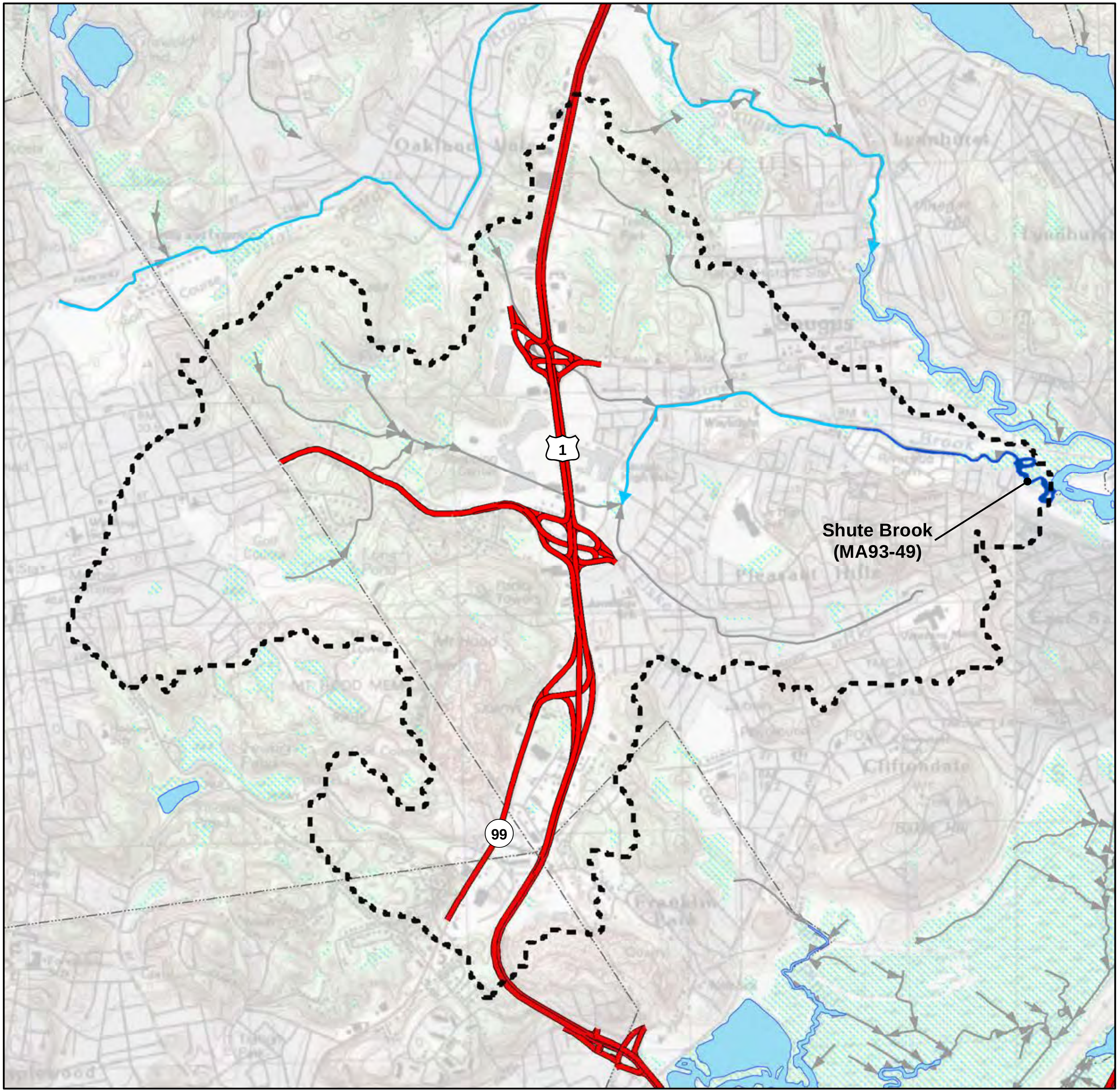
Moving Massachusetts Forward.
massDOT

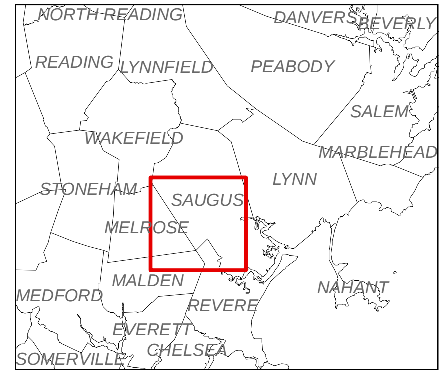


MA93-24
Nahant Bay
December 2012



NORTH READING
DANVERS
BEVERLY
READING
LYNNFIELD
PEABODY
SALEM
WAKEFIELD
MARBLEHEAD
STONEHAM
SAUGUS
LYNN
MELROSE
MALDEN
NAHANT
MEDFORD
REVERE
EVERETT
CHELSEA
SOMERVILLE
Sub Watershed
Saugus River (MA93-43)
Impaired Stream Segment
Impaired Water Body
Non-Impaired Stream Segments
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries
1
99
107
Saugus River (MA93-43)
N
0 1,500 3,000 4,500 6,000 Feet
1 inch = 3,000 feet
MA93-43
Saugus River
December 2012
Moving Massachusetts Forward.
massDOT





Sub Watershed

Shute Brook (MA93-49)

Impaired Stream Segment

Impaired Water Body

Non-Impaired Stream Segments

NWI Wetland Areas

MassDOT Roads in Urban Areas

MassDOT Roads

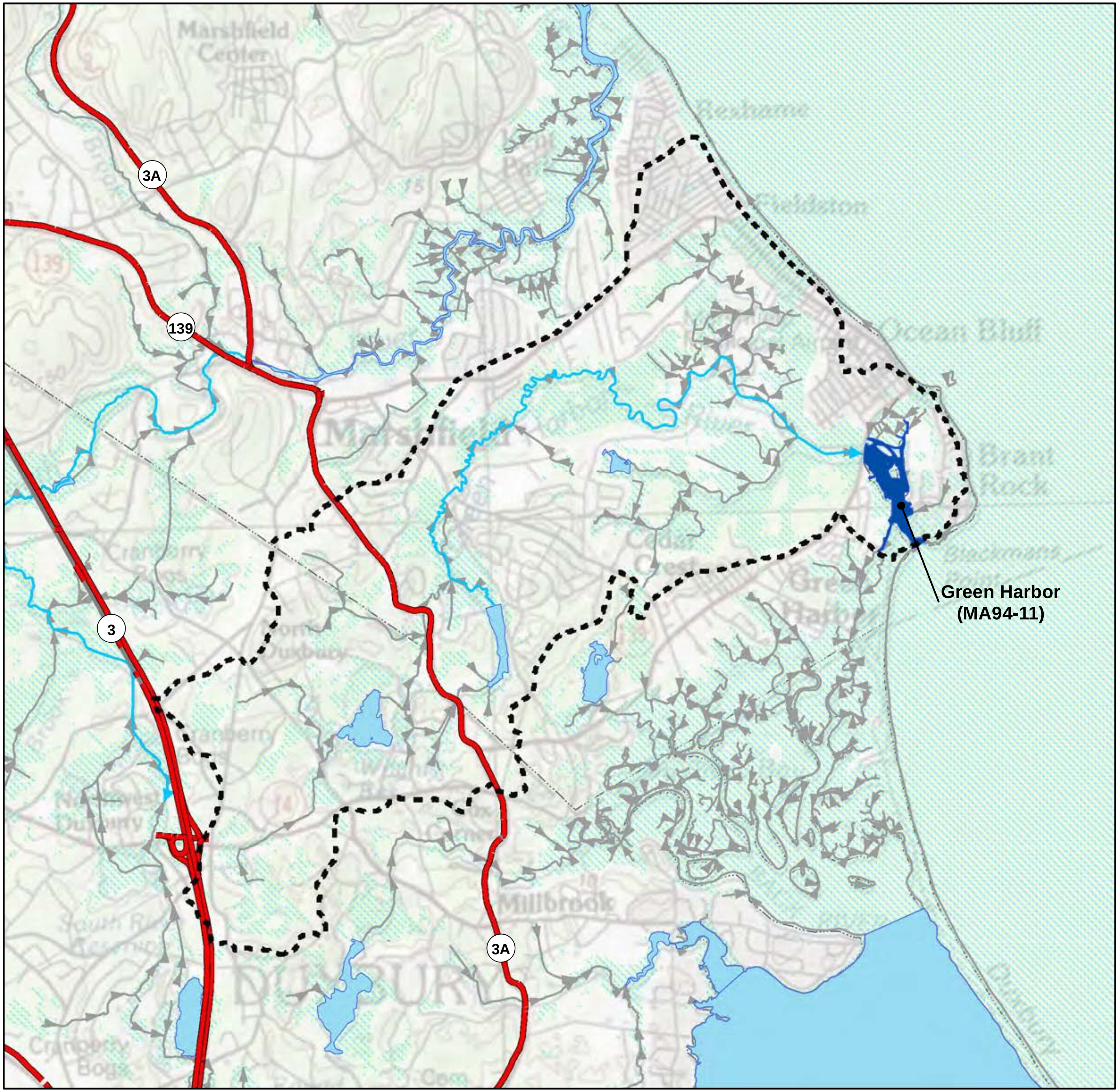
Town Boundaries

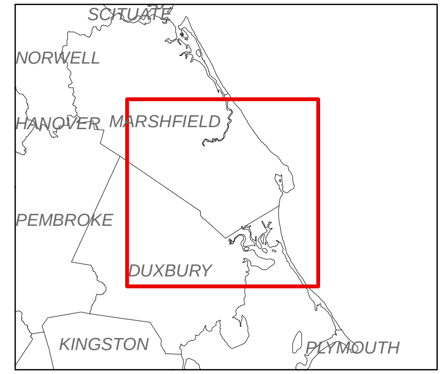
N

0 1,000 2,000 3,000 4,000 Feet

1 inch = 2,000 feet

MA93-49
Shute Brook
December 2012





Sub Watershed

Green Harbor (MA94-11)

Impaired Stream Segment

Impaired Water Body

Non-Impaired Stream Segments

NWI Wetland Areas

MassDOT Roads in Urban Areas

MassDOT Roads

Town Boundaries

N

0 2,000 4,000 6,000 8,000 Feet

1 inch = 4,000 feet

MA94-11
Green Harbor
December 2012

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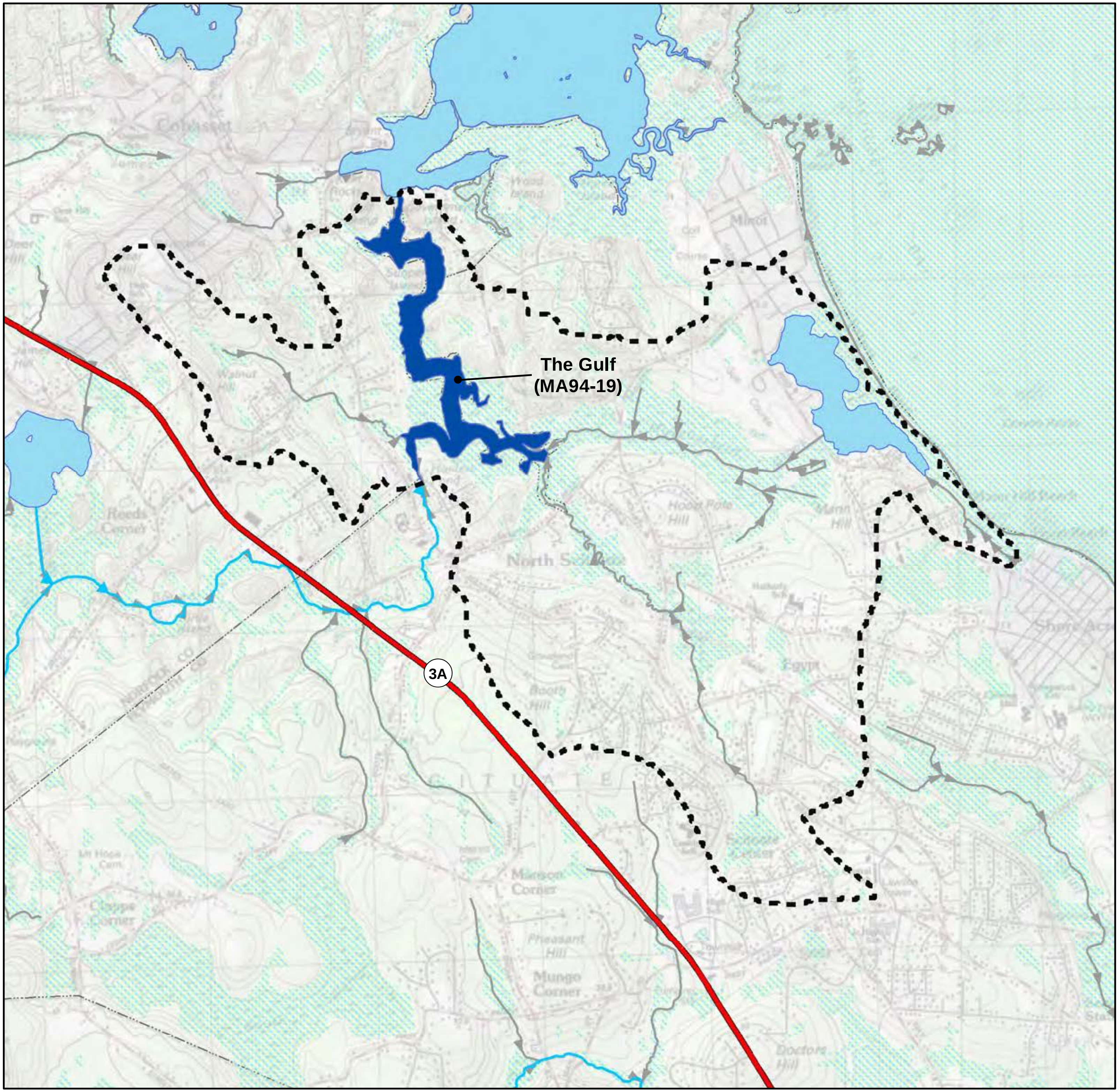
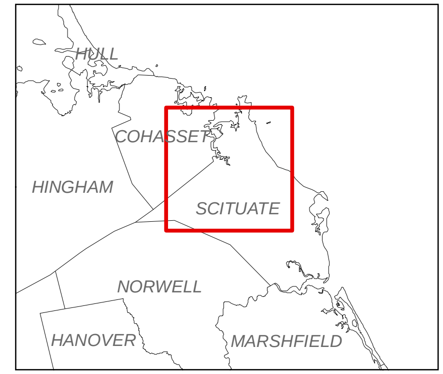




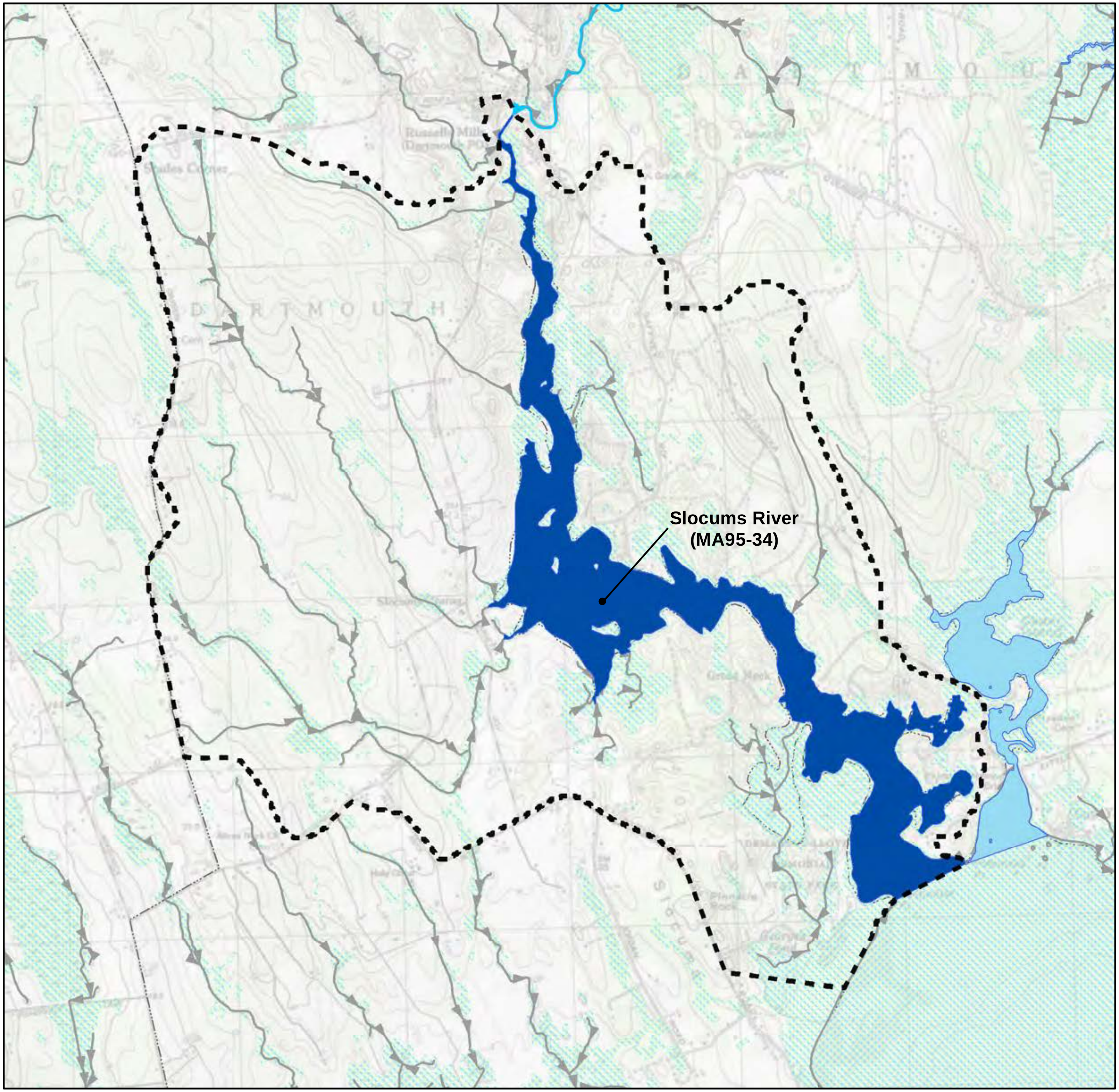
- Sub Watershed
- The Gulf (MA94-19)
- Impaired Stream Segment
- Impaired Water Body
- Non-Impaired Stream Segments
- NWI Wetland Areas
- MassDOT Roads in Urban Areas
- MassDOT Roads
- Town Boundaries

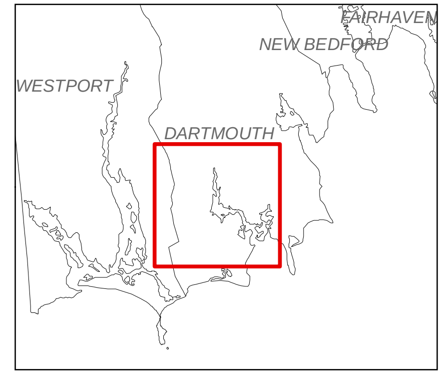
N

0 0.25 0.5 0.75 1 Miles

1 inch = 0.5 miles

MA94-19
The Gulf
December 2012





Sub and Total Watershed
Slocums River (MA95-34)
Impaired Stream Segment
Impaired Water Body
Non-Impaired Stream Segments
NWI Wetland Areas
MassDOT Roads in Urban Areas
MassDOT Roads
Town Boundaries

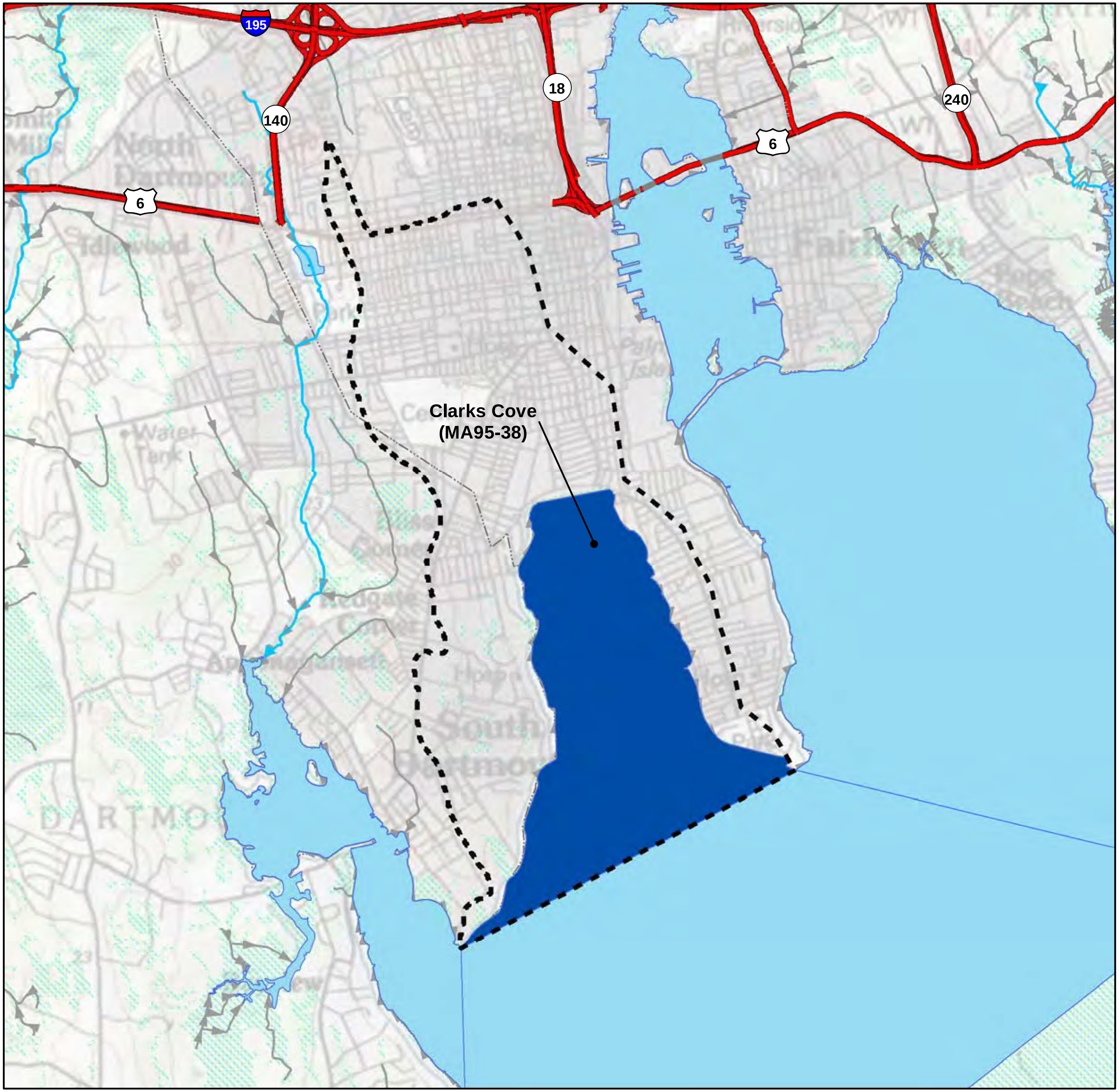
N

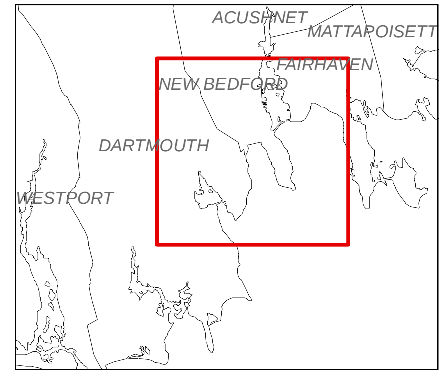
0 0.125 0.25 0.5 0.75 1 Miles

1 inch = 0.5 miles

MA95-34
Slocums River
December 2012

Moving Massachusetts Forward.
massDOT





Sub Watershed

Clarks Cove (MA95-38)

Impaired Stream Segment

Impaired Water Body

Non-Impaired Stream Segments

NWI Wetland Areas

MassDOT Roads in Urban Areas

MassDOT Roads

Town Boundaries

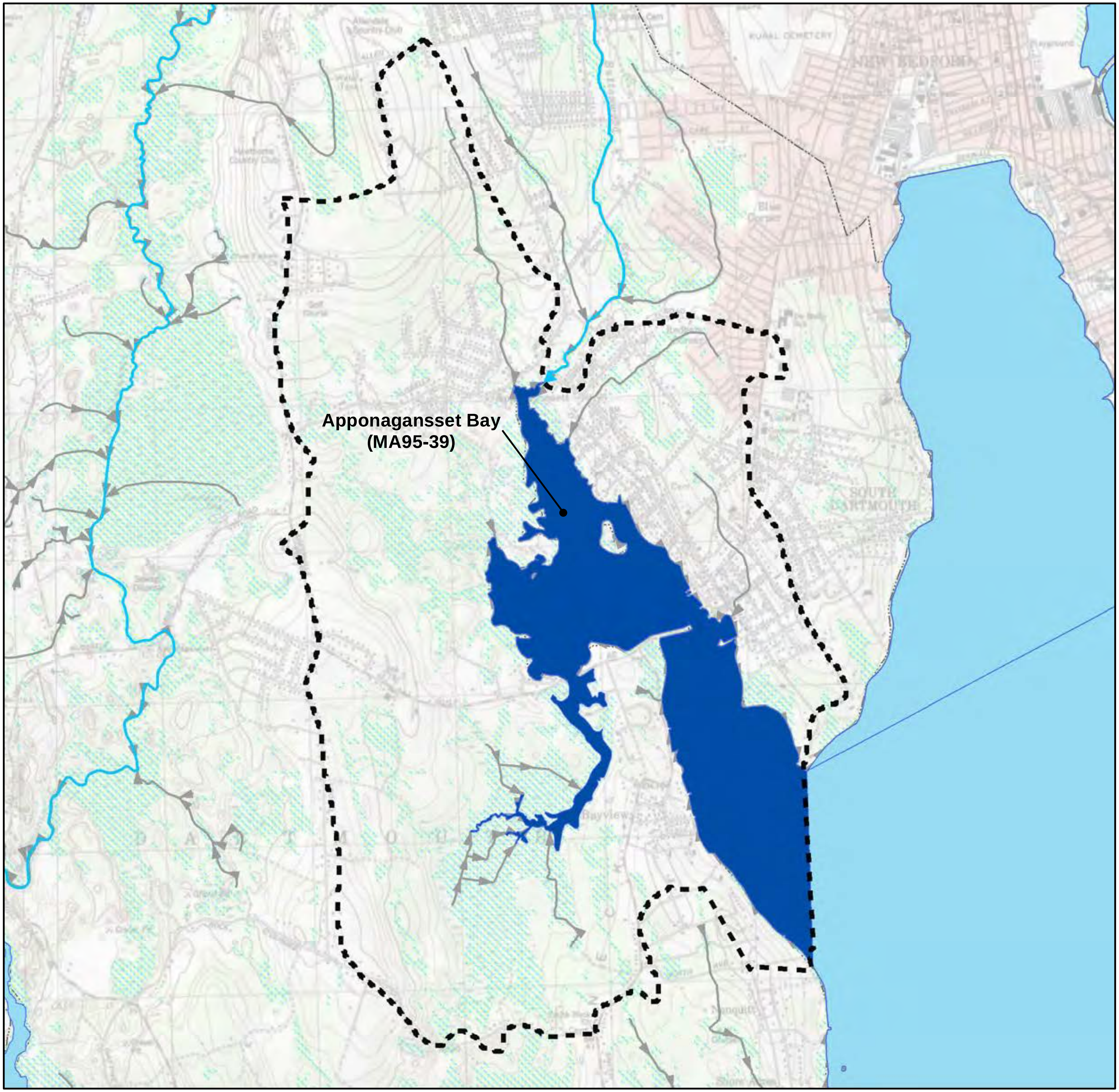
N

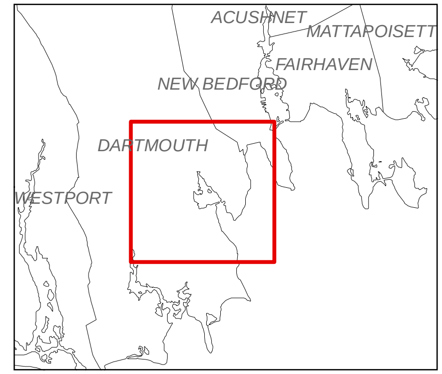
0 2,000 4,000 6,000 8,000 Feet

1 inch = 4,000 feet

MA95-38
Clarks Cove
December 2012

Moving Massachusetts Forward.
massDOT





Sub Watershed

Apponagansset Bay (MA95-39)

Impaired Stream Segment

Impaired Water Body

Non-Impaired Stream Segments

NWI Wetland Areas

MassDOT Roads in Urban Areas

MassDOT Roads

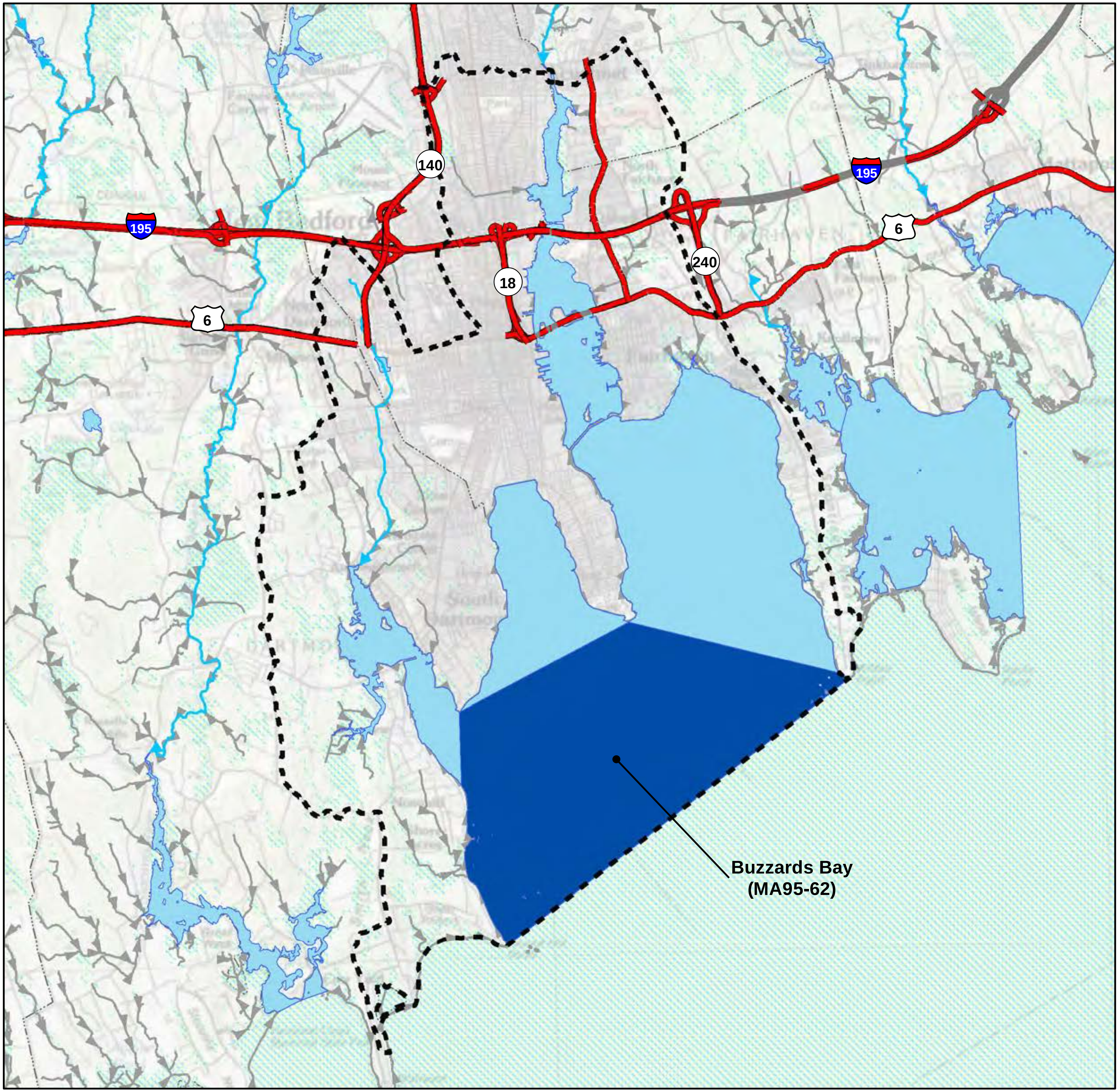
Town Boundaries

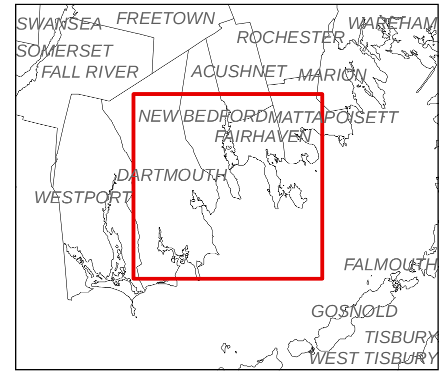
N

0 1,500 3,000 4,500 6,000 Feet

1 inch = 3,000 feet

MA95-39
Apponagansset Bay
December 2012





Sub Watershed

Buzzards Bay (MA95-62)

Impaired Stream Segment

Impaired Water Body

Non-Impaired Stream Segments

NWI Wetland Areas

MassDOT Roads in Urban Areas

MassDOT Roads

Town Boundaries

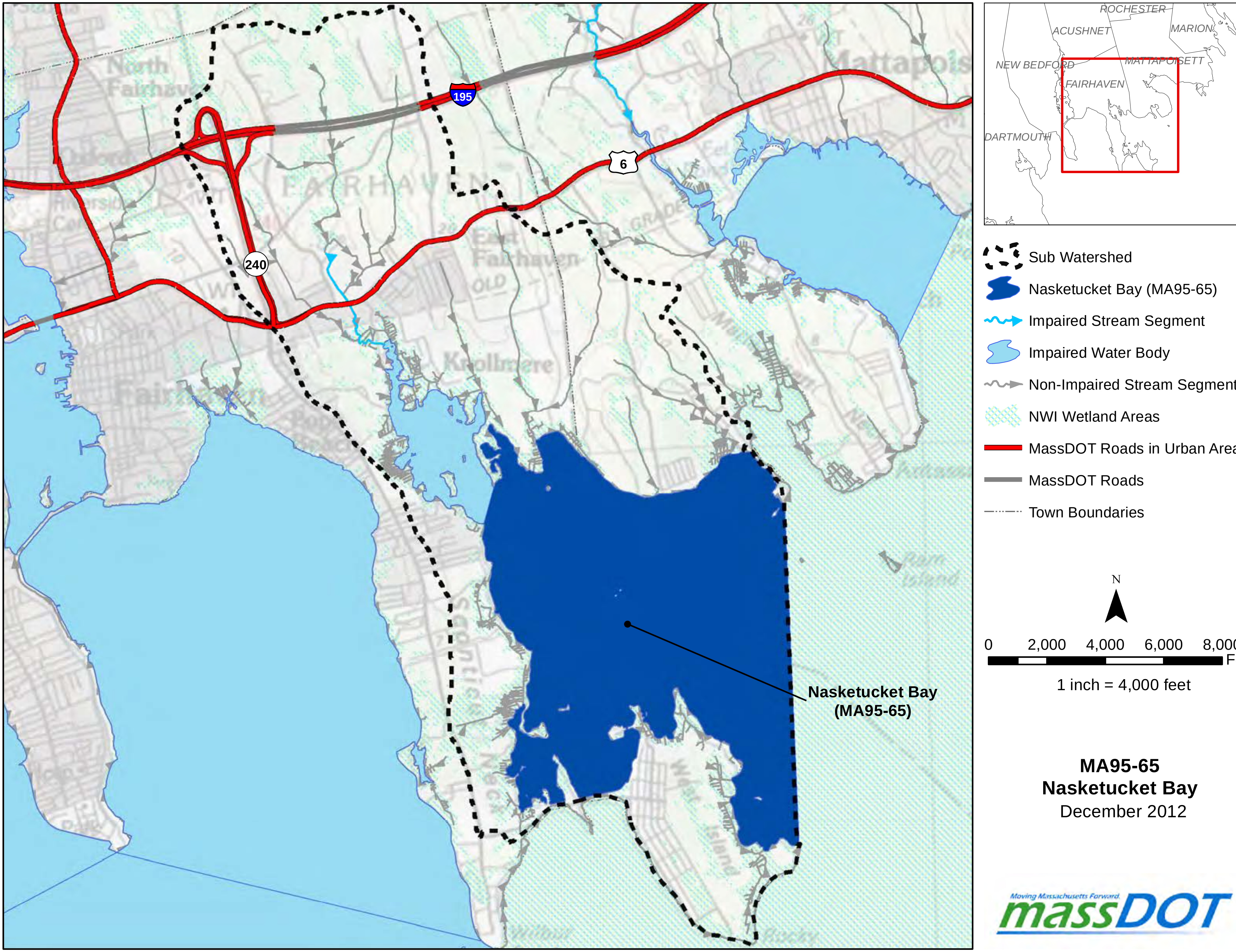
N

0 0.75 1.5 2.25 3 Miles

1 inch = 1.5 miles

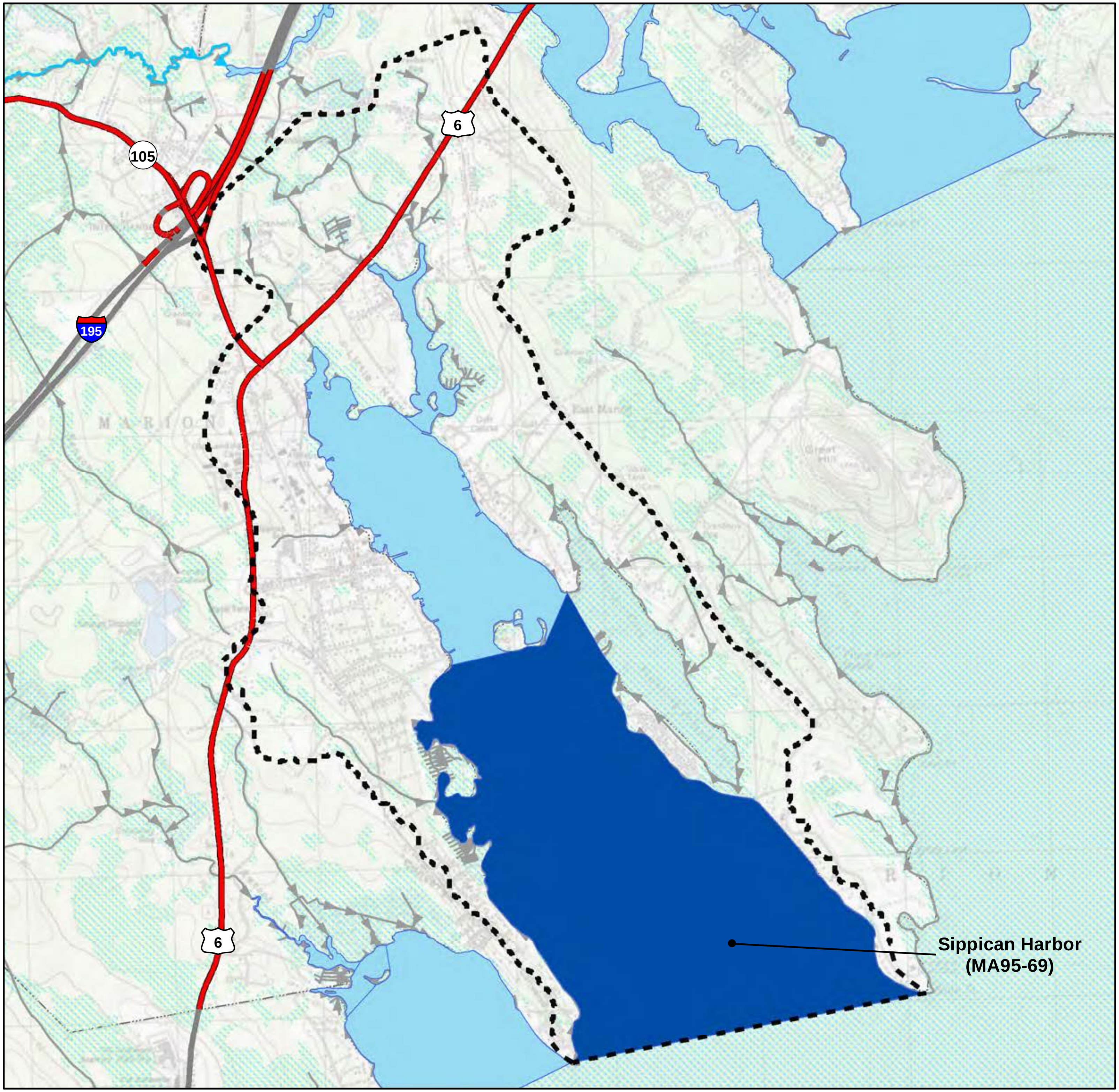
MA95-62
Buzzards Bay
December 2012

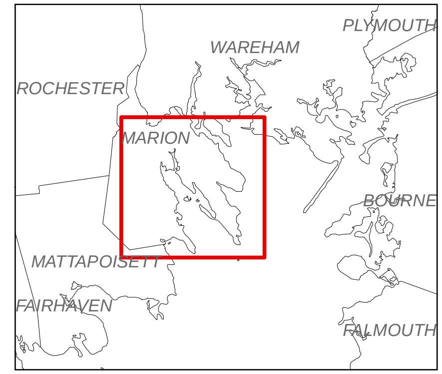
Moving Massachusetts Forward.
massDOT



MA95-65
Nasketucket Bay
December 2012

Moving Massachusetts Forward.
massDOT





Sub Watershed

Sippican Harbor (MA95-69)

Impaired Stream Segment

Impaired Water Body

Non-Impaired Stream Segments

NWI Wetland Areas

MassDOT Roads in Urban Areas

MassDOT Roads

Town Boundaries

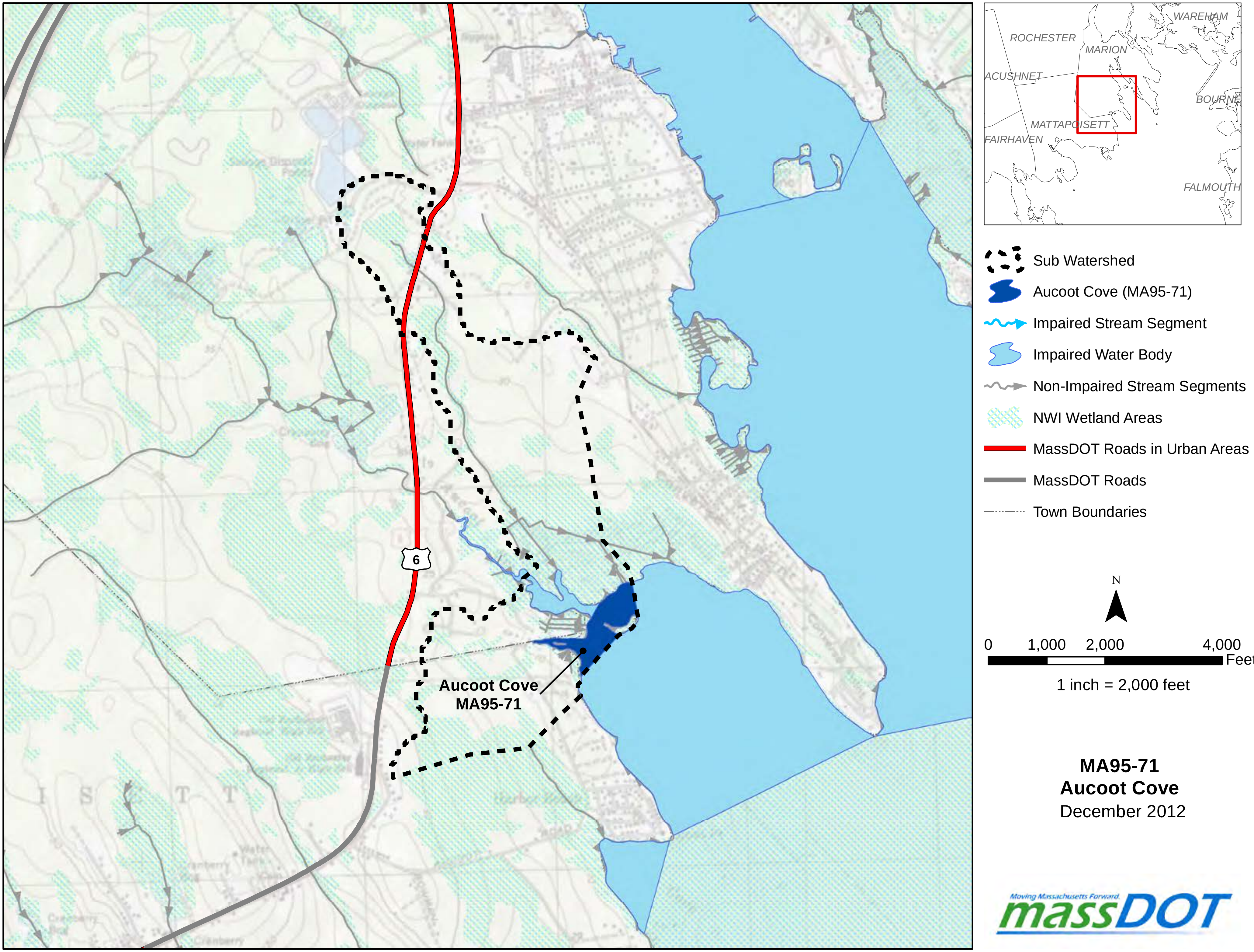
N

0 1,500 3,000 4,500 6,000 Feet

1 inch = 3,000 feet

MA95-69
Sippican Harbor
December 2012

Moving Massachusetts Forward.
massDOT



MA95-71
Aucoot Cove
December 2012

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Attachment 6:

Category Change Assessments and Other

Impaired Waters Assessment for
2008 to 2010 303d List Category Change Water Bodies

Introduction

MassDEP updates the Integrated List of Waters ("303(d) list") every two years to reflect changes to the water quality of Massachusetts' streams and lakes. The Final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2011) was finalized on November 16, 2011 and replaces the Final *Massachusetts Year 2008 Integrated List of Waters* (MassDEP, 2008). Five water bodies that were previously included for assessment under the MassDOT Impaired Water Program, due to their listed impairment on the 2008 list were removed from Category 5, "Waters requiring a TMDL", and moved to Category 2, "Attaining some uses; other uses not assessed", on the 2010 list. Additional assessment determined that these five water bodies are no longer impaired, and thus, do not require development of TMDLs. Table 1 provides the five water bodies and associated impairments as listed on the 303(d) list.

Table 1: MassDOT Impaired Waters Program Water Bodies Re-categorized from Category 5 in 2008 to Category 2 in 2010

Water Body ID	Water Body Name	2008 303(d) List: Impairments of Concern	2010 303(d) List: Impairments of Concern
MA36-23	Chicopee River	Pathogens	NA
MA41056	Wielock Pond	Turbidity	NA
MA81-08	Nashua River	Cause Unknown, Unknown toxicity, Pathogens	NA
MA82A-14	Pine Brook	Cause Unknown	NA
MA96-17	Falmouth Inner Harbor	Pathogens	NA

Site Description

This assessment applies to the impaired water bodies listed in Table 1. These water bodies are located throughout the state: Chicopee River is located in Hampden County; Wielock Pond and Nashua River are located in Worcester County; Pine Brook is located in Middlesex County; and Falmouth Inner Harbor is located in Barnstable County. These waters may receive direct discharge from MassDOT urban roadways; however, they are no longer listed as impaired according to the 2010 303(d) list.

Assessment under BMP 7U

Since these water bodies did not have a Total Maximum Daily Loads (TMDLs) developed, MassDOT planned to complete the assessment using the Impervious Cover Method, described in BMP 7U of MassDOT's Storm Water Management Plan (MassDOT, 2011). These water bodies are no longer listed as Category 5 which identified them as "impaired (i.e., not supporting one or more intended use), the impairment was related to the presence of one or more 'pollutants', and the source of those pollutants was not considered to be natural" (MassDEP, 2008). They are now listed as Category 2 which identifies them as "supporting the uses for which they were assessed, but other uses were unassessed" (MassDEP, 2008).

As a result, MassDOT has concluded no additional efforts need to be conducted to reduce effective IC within these water bodies' watersheds. The paragraphs below discuss each water body in more detail.

Chicopee River (MA36-23): According to the 2008 303(d) list, the Chicopee River was impaired for pathogens which required the development of a TMDL. The impairment related to pathogens was removed from the 2010 list based on a new assessment of the water body. Aquatic life, primary and secondary contact recreation and aesthetic uses were all met.

Wielock Pond (MA41056): According to the 2008 303(d) list, Wielock Pond was impaired for turbidity which required the development of a TMDL. The impairment related to turbidity was removed from the 2010 list based on a new assessment of the water body. Secondary contact recreation and aesthetic uses were met.

Nashua River (MA81-08): According to the 2008 303(d) list, Nashua River was impaired for the following impairments: cause unknown, unknown toxicity and pathogens. The impairment related to cause unknown was removed from the 2010 list because the previous listing in Category 5 was inconsistent with assessment methodology. Impairments for unknown toxicity and pathogens were removed based on a new assessment. Aquatic life, primary and secondary contact recreation and aesthetic uses were met.

Pine Brook (MA82A-14): According to the 2008 303(d) list, Pine Brook was impaired for cause unknown which required the development of a TMDL. The impairment related to cause unknown was removed from the 2010 list because the previous listing in Category 5 was inconsistent with assessment methodology. Aquatic life and aesthetic uses were met.

Falmouth Inner Harbor (MA96-17): According to the 2008 303(d) list, Falmouth Inner Harbor was impaired for pathogens and the development of a TMDL was required. The impairment related to pathogens was removed from the 2010 list based on a new assessment of the water body. Shellfish use was supported in the latest assessment.

Conclusions

MassDOT has concluded, in accordance with BMP 7U, that there is no required reduction in impervious area for the water bodies listed in Table 1 because they are no longer listed as impaired according to the 2010 303(d) list. As such, further assessment of these water bodies is not warranted under the Impaired Waters Program.

References

Massachusetts Department of Environmental Protection (MassDEP). (2008). Massachusetts Year 2008 Integrated List of Waters - Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 303(d) and 305(b) of the Clean Water Act. Retrieved from: http://www.mass.gov/dep/water/resources/08list2.pdf

Massachusetts Department of Environmental Protection (MassDEP). (2011). Massachusetts Year 2010 Integrated List of Waters - Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act. Retrieved from: http://www.mass.gov/dep/water/resources/10list6.pdf

Massachusetts Department of Transportation (MassDOT). (2011). Description of MassDOT's Application of Impervious Cover Method in BMP 7U (MassDOT Application of IC Method).

Impaired Waters Assessment for Unnamed Tributary (MA51-20), formerly listed as Curtis Pond South (MA51033) and Curtis Pond North (MA51032)

Impaired Water Body

Name: Unnamed Tributary

Location: Worcester, MA

Water Body ID: MA51-20

Impairments and Background

The Unnamed Tributary (MA51-20) is listed under Category 5, "Waters Requiring a TMDL" on MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2010). Unnamed Tributary (MA51-20) is impaired for the following:

- Sedimentation/Siltation
- (Non-Native Aquatic Plants*)
- Aquatic Plants (Macrophytes).

The proposed *Massachusetts Year 2012 Integrated List of Waters* (MassDEP, 2012) lists Unnamed Tributary as impaired for the three impairments listed above as well as these additional impairments:

- Debris/Floatables/Trash
- Fecal Coliform
- Low flow alterations
- Nutrient/Eutrophication Biological Indicators

Unnamed Tributary was formerly listed as Curtis Pond South (MA51033) and Curtis Pond North (MA51032) according to the final *Massachusetts Year 2008 Integrated List of Waters* (MassDEP, 2008) but now these ponds are considered part of Unnamed Tributary. Both ponds have already been assessed by MassDOT and were submitted to EPA on December 8th, 2011 in a report titled, *MassDOT Semi Annual Submittal (June 8, 2011 – December 7, 2011).* Please refer to this report for the full assessment of the ponds. Below is a summary of their findings.

Site Description

Unnamed Tributary (MA51-20) flows for 1.4 miles from the outlet of Leesville Pond, Worcester to the confluence with the Middle River, Worcester. The tributary is considered a run-of-the-river impoundment due to the low retention time within the pond areas (MassDEP, 2010) and, therefore, includes the ponds formerly known as Curtis Ponds (MA51033 and MA51032). See Figure 1 for their locations.

Curtis Pond South

Curtis Pond South (MA51033) is a water body in Worcester, MA of approximately 14 acres with a watershed area of approximately 20,300 acres (MassDEP, 2002). Curtis Ponds North (MA51032) and South (MA51033) are divided by the Conrail track. Kettle Brook (MA51-01) flows through Curtis Pond South and ends at Curtis Pond North.

The nearest MassDOT-owned roads are I-290 and the Heard Street Bridge over the railroad. During site visits on August 30 and 31, 2011, it was determined that stormwater from I-290 discharges to Leesville Pond (MA51087) and Kettle Brook (MA51-01) and not to Curtis Pond South. There are no drainage features on the Heard Street bridge and runoff from the bridge roadway flows off the bridge and along Heard Street. While it is uncertain whether this runoff enters the Worcester MS4 drainage systems along Heard Street and is then conveyed to Curtis Pond South, MassDOT performed the assessment as a potential direct discharge to determine if any action by MassDOT would be necessary. Figure 1 shows the surface area of the Heard Street Bridge which has potential to contribute direct runoff to Curtis Pond South.

Curtis Pond North

Curtis Pond North (MA51032) is a water body in Worcester, MA of approximately 31 acres with a contributing watershed area of approximately 20,900 acres (MassDEP, 2002). Kettle Brook (MA51-01) flows through Curtis Pond South and ends at Curtis Pond North which flows into Middle River (MA51-02). Curtis Ponds North (MA51032) and South (MA51033) are divided by the Conrail track. MassDOT roadways in urban areas within the watershed are limited to two bridges illustrated in Figure 1.

Assessment under BMP 7R for Phosphorus for Curtis Pond South

The TMDL for phosphorus for Selected Northern Blackstone Lakes addresses the impairment for Noxious Aquatic Plants for Curtis Pond South. Therefore, MassDOT assessed the contribution of phosphorus from MassDOT urban areas to this water body to address this impairment. The assessment was completed using the approach described in BMP 7R (TMDL Watershed Review).

TMDL

The Massachusetts Department of Environmental Protection's (MassDEP) TMDL report titled *Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes* [CN 70.1] (MassDEP, 2002) can be summarized as follows in reference to Curtis Pond South:

- Pollutant of Concern: Phosphorus
- Impairment for Curtis Pond South Addressed in TMDL: Noxious aquatic plants
- Applicable Waste Load Allocation (WLA): See Tables 2d (p. 42) and 4d (p. 59) of TMDL.
    - Description of Associated Land Use: Commercial/Industrial
    - Commercial/Industrial Land Use Current Load (TP): 188.8 kg/yr (416.2 lb/yr)
    - Commercial/ Industrial Land Use Target WLA (TP): 175 kg/yr (385.8 lb/yr)
    - Commercial/Industrial Area in Watershed: 552.8 ha (1366.0 acres)
    - Commercial/Industrial Land Use Target Areal WLA (TP): 0.32 kg/ha/yr (0.28 lb/acre/yr)

- Applicable Recommendations: "Public Education, NPS Survey, Lake Management Plan, Residential BMPs, Urban BMPs, Highway BMPs, In-Lake Management" (Table 7, page 66).

Estimated Loading from MassDOT

The loading of total phosphorus (TP) from MassDOT property contributing stormwater runoff to Curtis Pond South was estimated using the following assumptions and calculations:

- MassDOT estimates the TP loading from its impervious areas as 1.60 lb/acre/yr. This loading rate is based on data collected in a study of stormwater runoff conducted by the United States Geological Survey (USGS) (Smith and Granato, 2010). The study analyzed stormwater samples from 12 sites located on highways operated by MassDOT across Massachusetts between September 2005 and September 2007. Samples were taken under a variety of weather conditions during this period.
- No pervious areas existed in the MassDOT directly contributing property to Curtis Pond South so no calculations were done for pervious area.
- MassDOT calculated the total estimated TP loading from MassDOT urban area using the estimated loading rate (1.60 lb/ac/yr) and area of the Heard Street Bridge (0.07 acres) to be 0.11 lb/yr. This loading estimate does not account for any existing BMPs or attenuation before the runoff reaches the pond.
- MassDOT calculated the target TP WLA for its stormwater runoff to Curtis Pond South using the target areal WLA of 0.28 lb/ac/yr included in the TMDL report and the area of the Heard Street Bridge (0.07 acres). This target TP WLA for MassDOT urban runoff is 0.02 lb/yr.

Assessment and Mitigation Plan

MassDOT's estimated TP loading (0.11 lb/yr) is insignificant (0.003%) compared to the overall load to the pond (1,607.6 kg/ yr or 3,544.2 lb/yr) (MassDEP, 2002). Therefore, the pollutant load from this bridge is *de minimis*.

Assessment under BMP 7U for No Discharge Determination for Curtis Pond North

Based on a site visit on August 31, 2011, it was determined that runoff from MassDOT urban areas does not directly contribute runoff to Curtis Pond North. The nearest MassDOT-owned urban roadways are the Webster Street and Mill Street bridges over Middle River. Figure 1 shows Curtis Pond North and the bridges. During the site visit it was determined that the Mill Street bridge does not have any drainage features, and that stormwater runoff flows south off of the bridge and along Mill Street. Similarly, there is no drainage system on the Webster Street bridge. Runoff from this bridge flows northeast off of the bridge and along Webster Street. It appeared during the site visit that the runoff from the bridges flows into the Worcester MS4 drainage systems along their respective streets and discharges to Middle River which was not included in this Impaired Assessment. Therefore, MassDOT has determined that the runoff from these bridges does not directly discharge to Curtis Pond North.

Conclusions

According to MassDEP's final *Massachusetts Year 2010 Integrated List of Waters* (MassDEP, 2010), Curtis Pond South (MA51033) and Curtis Pond North (MA51032) are now considered Unnamed Tributary (MA51-20). Both ponds were already assessed by MassDOT and submitted to EPA in the report titled, *MassDOT Semi Annual Submittal (June 8, 2011 – December 7, 2011).* This assessment for Unnamed Tributary (MA51-20) summarizes the findings of the Curtis Ponds assessments. Below are the conclusions of the Curtis Pond South and Curtis Pond North assessments.

Curtis Pond South

The area owned by MassDOT represents a diminutive fraction of the TP loading of Curtis Pond South (0.003%). Therefore, MassDOT concludes that it represents a *de minimis* source of phosphorus to the pond. Therefore, no further measures are warranted.

As an overall program, MassDOT will identify opportunities for structural BMPs to address pollutant loading when road work is conducted as programmed projects for this area. Work on programmed projects which often include broader scale road layout changes may provide additional opportunities for construction of new treatment BMPs. This is consistent with an iterative adaptive management approach to addressing impairments.

Curtis Pond North

MassDOT property does not directly contribute stormwater runoff to Curtis Pond North. Therefore, further assessment of this water body is not warranted under the Impaired Waters program.

MassDOT will continue to implement the good housekeeping measures outlined in its Storm Water Management Plan (SWMP).

References

Massachusetts Department of Environmental Protection (MassDEP). (2002). Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes. CN 70.1. Retrieved from: http://www.mass.gov/dep/water/resources/blaktmdl.pdf

Massachusetts Department of Environmental Protection (MassDEP). (2010). Blackstone River Watershed 2003 - 2007 Water Quality Assessment Report. Retrieved from: http://www.mass.gov/dep/water/resources/51wqar10.pdf

Massachusetts Department of Environmental Protection (MassDEP). (2011). Massachusetts Year 2010 Integrated List of Waters - Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act. Retrieved from: http://www.mass.gov/dep/water/resources/10list6.pdf