Attachment 9:

Previously Submitted Assessments

List of Impaired Water Bodies

MA21-01	East Branch Housatonic River
MA41-03	Quinebaug River
MA72122	Uncas Pond
MA93-11	Essex River
MA95-72	Aucoot Creek
MA96-07	Prince Cove
MA96257	Red Lily Pond
MA96-40	Popponesset Bay
MA96-50	Ryder Cove
MA96-51	Muddy Creek
MA96-71	Namequoit River
MA96-74	Quanset Pond
MA96-75	Round Cove
MA96-77	Pleasant Bay

12/08/2014

Impaired Waters Assessment for East Branch Housatonic River (MA21-01)

Summary

Impaired Water[1]	Impairments:	Stormwater:	*Fecal Coliform*
		Non-Stormwater:[2]	*PCB in Fish Tissue*
	Category:	*5 (Waters requiring a TMDL)*	
	Final TMDLs:	*None*	
	WQ Assessment:	*Housatonic River Watershed 2002 Water Quality Assessment Report*[3]	
Location	Towns:	*Dalton, Hinsdale, Washington*	
	MassDOT Roads:	*Route 8, Route 9*	
Assessment Method(s)	7R (TMDL Method) ☐	7U (Non-TMDL Method) ☒	

Site Description

An assessment for the East Branch Housatonic River (MA21-01) was previously submitted to the EPA on March 8, 2011 under the *Impaired Waters Assessment for Impaired Waters with <9% Impervious Cover in Contributing Watershed.*[4] However, the East Branch Housatonic River is only impaired for pathogens and impairments that are unrelated to stormwater, so the water body has been reassessed herein.

The East Branch Housatonic River (MA21-01) headwaters are located at the outlet of Muddy Pond in northeastern Washington, Massachusetts. From Washington, the East Branch Housatonic River flows north through Hinsdale and terminates in central Dalton at the outlet of Center Pond, where the next segment of the East Branch Housatonic River (MA21-02) begins. Segment MA21-01 is 11.3 miles long and is classified as Class B, Cold Water Fishery. The total watershed for this river,

[1] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[2] MassDOT, December 2012. Impaired Waters Assessment for Impaired Waters with Impairments Unrelated to Stormwater. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year3/Year3_ImpairedWatersAssessment_1.pdf#page=308

[3] MassDEP, 2002. Housatonic River Watershed Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/21wqar07.pdf

[4] MassDOT, 2011. MassDOT Quarter 3 Submittal: NPDES MS4 General Permit Compliance Water Quality Impaired Waters Assessment and Mitigation Plan. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year1/ImpairedWaters_Q3.pdf

shown in Figure 1, covers 53 square miles, primarily in Hinsdale with sections in Dalton, Washington, Windsor, and Peru. The subwatershed for this river lies in Hinsdale (8.7 square miles), Washington (3.5 square miles), Dalton (2.0 square miles), and Peru (0.9 square miles), for a total of 15.1 square miles.

The *Housatonic River Watershed 2002 Water Quality Assessment Report*[3] includes the East Branch Housatonic River. At the time of publication in 2002, only the lower 3.3 miles in Dalton had been assessed for Fish Consumption use and confirmed as "impaired," with the source identified as inappropriate waste disposal from the General Electric Site. The entire East Branch Housatonic River has been designated as "impaired" for Primary Contact due to elevated fecal coliform bacteria from an unknown source. Fecal coliform levels were highest during wet weather events.

MassDOT's property in the urban area with the potential to directly contribute stormwater runoff to Segment MA21-01 is comprised of portions of Route 8 and Route 9. Refer to Figure 1 for the location of these roadways within the watershed to Segment MA21-01.

Assessment

In cases where a TMDL has been approved, MassDOT assesses the water body for the impairments covered by the TMDL under the BMP 7R methodology.[5] MassDOT separately assesses the water body for any stormwater-related impairments that are not covered by the TMDL under the BMP 7U methodology.[6] MassDOT assessed the East Branch Housatonic River (MA21-01) using the methodologies described below.

MassDOT has identified a water body impairment in the East Branch Housatonic River watershed which is not related to stormwater runoff. The specific impairment unrelated to stormwater for the East Branch Housatonic River is PCB in fish tissue. In accordance with MassDOT's Impaired Waters Assessment for Impaired Waters with Impairments Unrelated to Stormwater[2] in the December 8, 2012 EPA submittal, the non-stormwater related impairments are not specifically addressed as part of the Impaired Waters Program.

This assessment has been completed based on the Massachusetts Year 2012 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.[1] MassDEP has released a Proposed Massachusetts Year 2014 Integrated List[7] which has been reviewed for any proposed changes to the condition of the water bodies. The condition of the East Branch Housatonic River is not proposed to change.

BMP 7U for Pathogen Impairment

MassDOT assessed the indicator bacteria (fecal coliform) impairment using the approach described in BMP 7U[6] of MassDOT's Storm Water Management Plan (SWMP) which applies to impairments that have been assigned to a water body not covered by a final TMDL.

[5] MassDOT, July 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

[6] MassDOT, April 2010. BMP 7U: Water Quality Impaired Waters Assessment and Mitigation Plan. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7U_ImpairedWaterbodiesAssessment.pdf

[7] MassDOT, June 2014. Massachusetts Year 2014 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/14iwlistp.pdf

Pathogen concentrations in stormwater vary widely and concentrations can vary by an order of magnitude within a given storm event at a single location making it difficult to predict pathogen concentrations in stormwater with accuracy. MassDOT generally will not conduct site specific assessments of pathogen loading for each water body impaired for pathogens but instead developed an iterative adaptive management approach to address impaired waters and permit condition requirements and an approach to stormwater management. Greater detail of the assessment methodology is provided in MassDOT's BMP 7U Pathogen Methodology.[8]

Proposed Mitigation Plan

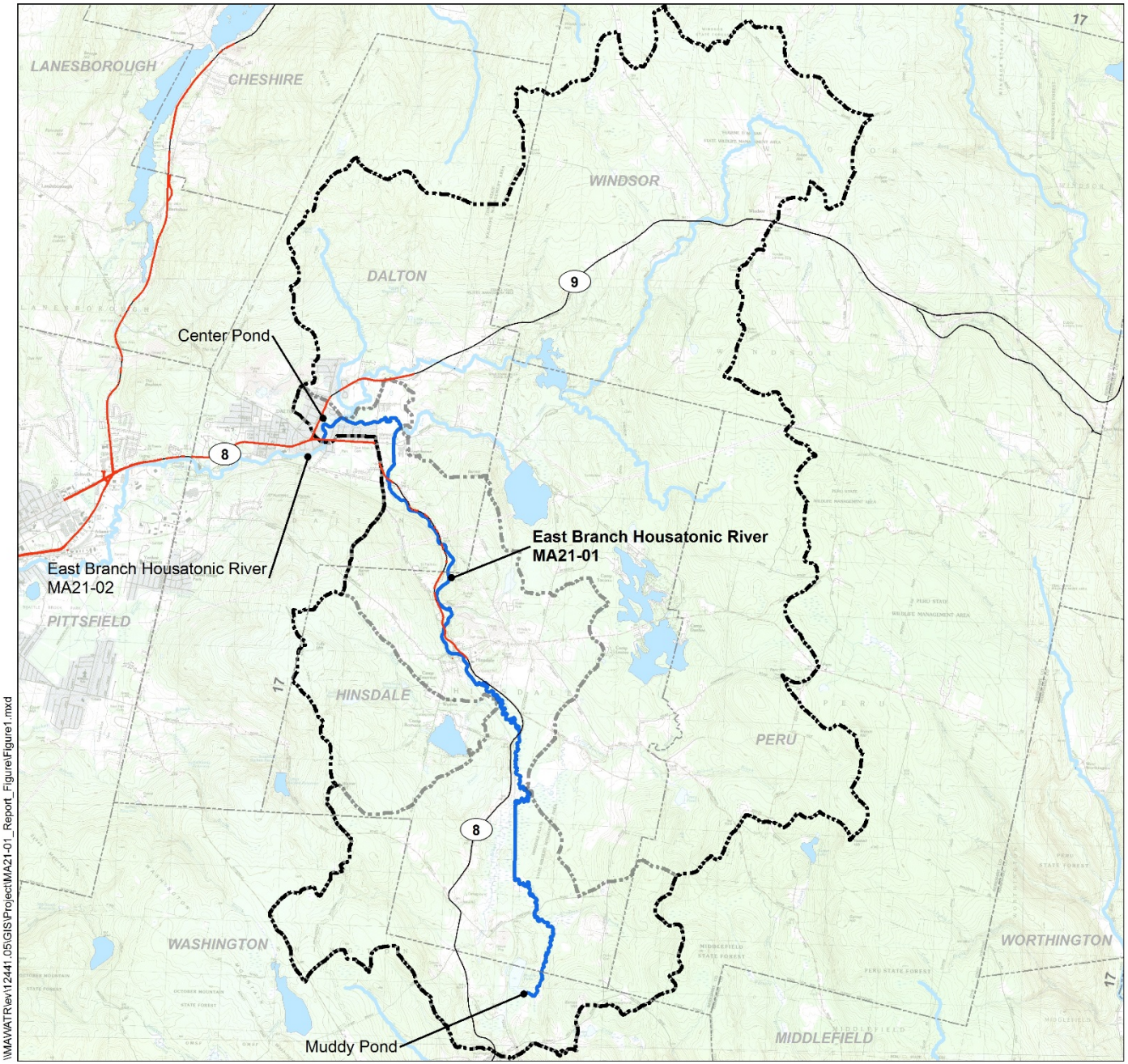
MassDOT implements a variety of non-structural BMP programs across their system in accordance with their existing Stormwater Management Plan (SWMP) including educational programs, illicit connection review and source control. As discussed in MassDOT's BMP 7U Pathogen Methodology,[8] MassDOT believes that existing efforts are consistent with the current and draft MS4 permit requirements in regard to pathogens.

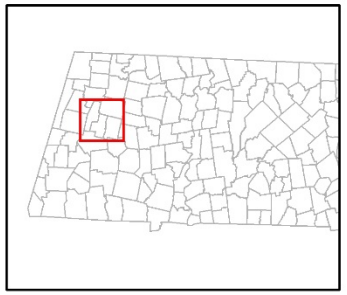
In addition, as part of its pet waste management program, MassDOT has determined that no MassDOT targeted rest stops are located within the subwatershed of this water body. MassDOT will be installing signs at rest stops within the subwatershed of impaired waterbodies. The signs will inform the public of the need to remove pet waste, which can minimize contributions of pathogens to stormwater runoff. Pet waste removal bags and disposal cans will be provided.

Furthermore, MassDOT has an ongoing inspection and monitoring program aimed at identifying and addressing illicit discharges to MassDOT's stormwater management system. MassDOT investigates any suspicious flows noted, and will work with owners of confirmed illicit discharges to remove these flows, and thereby minimize the possibility of pathogen contributions to receiving waters. At present, there are no suspected or known illicit discharges, or unauthorized drainage tie-ins, within the subwatershed of this water body that could be contributing pathogens to the impaired water body.

MassDOT has concluded that the BMPs outlined in the SWMP are consistent with its existing permit requirements for the East Branch Housatonic River (MA21-01). These measures achieve pathogen reductions (including fecal coliform) to the maximum extent practicable and are consistent with the intent of its existing stormwater permit. As stated previously, pathogen loadings are highly variable and although there is potential for stormwater runoff from MassDOT roadways to be a contributing source it is unlikely to warrant action relative to other sources of pathogens in the watershed. MassDOT will continue to ensure proper non-structural BMPs are being implemented within the watershed of the East Branch Housatonic River, including regular roadway and drainage system maintenance, erosion and sedimentation control, and outreach and education.

[8] MassDOT, December 2014. Description of MassDOT's Application of BMP 7U for Pathogen Related Impairments.





MassDOT Roadways in Urban Area

MassDOT Roadways

Total Watershed

Subwatershed

Assessed Segment

Impaired Lakes

Impaired Streams

N

0 0.75 1.5 Miles

Figure 1

East Branch Housatonic River (MA21-01) Watersheds

December 2014

massDOT Massachusetts Department of Transportation Highway Division

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12/08/2014

Impaired Waters Assessment for Quinebaug River (MA41-03)

Summary

Impaired Water[1]	Impairments:	Stormwater:	*Fecal Coliform, Other, Dissolved Oxygen, Taste and Odor*
		Non-Stormwater:[2]	*Debris/Floatables/Trash, Physical Substrate Alteration*
	Category:	*5 (Waters requiring a TMDL)*	
	Final TMDLs:	*None*	
	WQ Assessment:	*French & Quinebaug River Watershed 2004-2008 Water Quality Assessment Report* [3]	
Location	Towns:	*Dudley, Southbridge*	
	MassDOT Roads:	*Route 131*	
Assessment Method(s)	7R (TMDL Method) ☐	7U (Non-TMDL Method) ☒	

Site Description

An assessment for Quinebaug River (MA41-03) was previously submitted to the EPA on March 8, 2011 under the *Impaired Waters Assessment for Impaired Waters with <9% Impervious Cover in Contributing Watershed.*[4] However, this submittal did not address the pathogen impairment to Quinebaug River, so the water body has been reassessed herein.

Quinebaug River (MA41-03) is located within the French and Quinebaug River Watershed. The land use for the total watershed to this segment, shown in Figure 1A, consist of 72% forest, 11% residential, and 6% agricultural. Quinebaug River (MA41-03) flows for two miles beginning at the Southbridge Wastewater Treatment Plant and ending at the West Dudley Impoundment. Quinebaug River (MA41-09) flows into the assessed segment, and Quinebaug River (MA41-04)

[1] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[2] MassDOT, December 2012. Impaired Waters Assessment for Impaired Waters with Impairments Unrelated to Stormwater. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year3/Year3_ImpairedWatersAssessment_1.pdf#page=308

[3] MassDEP, 2009. French and Quinebaug River Watersheds 2004-2008 Water Quality Assessment Report. Available at: http://www.mass.gov/eea/agencies/massdep/water/watersheds/french-quinebaug-river-watersheds-2004-08.html

[4] MassDOT, 2011. MassDOT Quarter 3 Submittal: NPDES MS4 General Permit Compliance Water Quality Impaired Waters Assessment and Mitigation Plan. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year1/ImpairedWaters_Q3.pdf

flows out of the assessed segment. MassDOT owns one road, Route 131, within the subwatershed to Quinebaug River (MA41-03).

According to the *French & Quinebaug River Watershed 2004-2008 Water Quality Assessment Report,*[3] there are several NPDES permitted wastewater discharges to this segment and its tributaries. The town of Southbridge is permitted to discharge treated wastewater from the Southbridge Wastewater Treatment Plant. The Masonic Home in Charlton, Massachusetts is permitted to discharge treated domestic water to the headwaters of an unnamed tributary to this segment of Quinebaug River. Laidlaw Transit, also in Charlton, is permitted to discharge stormwater to Wabash Pond, which outlets into Quinebaug River. The Water Quality Assessment Report lists the other designated uses of this waterbody as "not assessed," and there are no sources listed as the causes of the impairments to Quinebaug River (MA41-03).

Assessment

In cases where a TMDL has been approved, MassDOT assesses the waterbody for the impairments covered by the TMDL under the BMP 7R methodology.[5] MassDOT separately assesses the waterbody for any stormwater-related impairments that are not covered by the TMDL under the BMP 7U methodology.[6] MassDOT assessed Quinebaug River (MA41-03) using the methodologies described below.

MassDOT has identified a subset of water body impairments in Quinebaug River (MA41-03) watershed which are not related to stormwater runoff. Specific impairments unrelated to stormwater for Quinebaug River (MA41-03) include debris/floatables/trash and physical substrate alteration. In accordance with MassDOT's Impaired Waters Assessment for Impaired Waters with Impairments Unrelated to Stormwater[2] in the December 8, 2012 EPA submittal, the non-stormwater related impairments are not specifically addressed as part of the Impaired Waters Program.

This assessment has been completed based on the Massachusetts Year 2012 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.[1] MassDEP has released a Proposed Massachusetts Year 2014 Integrated List[7] which has been reviewed for any proposed changes to the condition of the water bodies. The condition of Quinebaug River (MA41-03) is not proposed to change.

BMP 7U for Pathogen Impairment

MassDOT assessed the indicator bacteria (fecal coliform) impairment using the approach described in BMP 7U[6] of MassDOT's Storm Water Management Plan (SWMP) which applies to impairments that have been assigned to a water body not covered by a final TMDL.

Pathogen concentrations in stormwater vary widely and concentrations can vary by an order of magnitude within a given storm event at a single location making it difficult to predict pathogen concentrations in stormwater with accuracy. MassDOT generally will not conduct site specific

[5] MassDOT, July 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

[6] MassDOT, April 2010. BMP 7U: Water Quality Impaired Waters Assessment and Mitigation Plan. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7U_ImpairedWaterbodiesAssessment.pdf

[7] MassDOT, June 2014. Massachusetts Year 2014 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/14iwlistp.pdf

assessments of pathogen loading for each water body impaired for pathogens but instead developed an iterative adaptive management approach to address impaired waters and permit condition requirements and an approach to stormwater management. Greater detail of the assessment methodology is provided in MassDOT's BMP 7U Pathogen Methodology.[8]

BMP 7U for Impervious Cover Related Impairments

A Final TMDL is not in place to address Quinebaug River's (MA41-03) following impairments: dissolved oxygen, taste and odor, and other. Therefore, MassDOT assessed the stormwater-related impairments not addressed by a TMDL using the approach outlined in the Description of MassDOT's Application of Impervious Cover Method in BMP 7U[6] which was developed using the EPA Region I's Impervious Cover (IC) Method, described in EPA's Stormwater TMDL Implementation Support Manual.[9] 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 calculated the following values for the total contributing watershed and the subwatershed of the impaired water (Quinebaug River) to determine the IC area and set a reduction target. Watersheds are based on the USGS Dataset 451[10] and modified as necessary using topography. MassGIS's impervious surfaces data layer[11] was used to determine the IC of the watersheds. The total watershed and the subwatershed are shown in Figures 1A and 1B.

Table 1 Impaired Segment Watershed

	Total Watershed	Subwatershed
Watershed Area	94,013 acres	2,513 acres
Impervious Cover (IC) Area	4,992 acres	146 acres
Percent Impervious	5.3%	5.8%

MassDOT determined that the total watershed and the subwatershed are both less than 9% impervious, indicating that stormwater is a likely not a contributor to the impairments.

Proposed Mitigation Plan

MassDOT has concluded, using the IC Method, that there is no required reduction in impervious area for Quinebaug River 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 not covered by a TMDL. Therefore, further assessment of this waterbody for impairments not covered by a TMDL is not warranted under the Impaired Waters Program.

[8] MassDOT, December 2014. Description of MassDOT's Application of BMP 7U for Pathogen Related Impairments.

[9] ENSR, 2006. Stormwater TMDL Implementation Support Manual for US EPA Region 1. ENSR International & EPA Region 1, Boston, MA. Available at http://www.epa.gov/region1/eco/tmdl/regionalpgrfs.html

[10] USGS Data Series 451 Local and Cumulative Impervious Cover of Massachusetts Stream Basins Available at: http://pubs.usgs.gov/ds/451/

[11] MassGIS Impervious Surfaces datalayer taken from 2005 orthoimagery. Available at: http://www.mass.gov/mgis/impervious_surface.htm

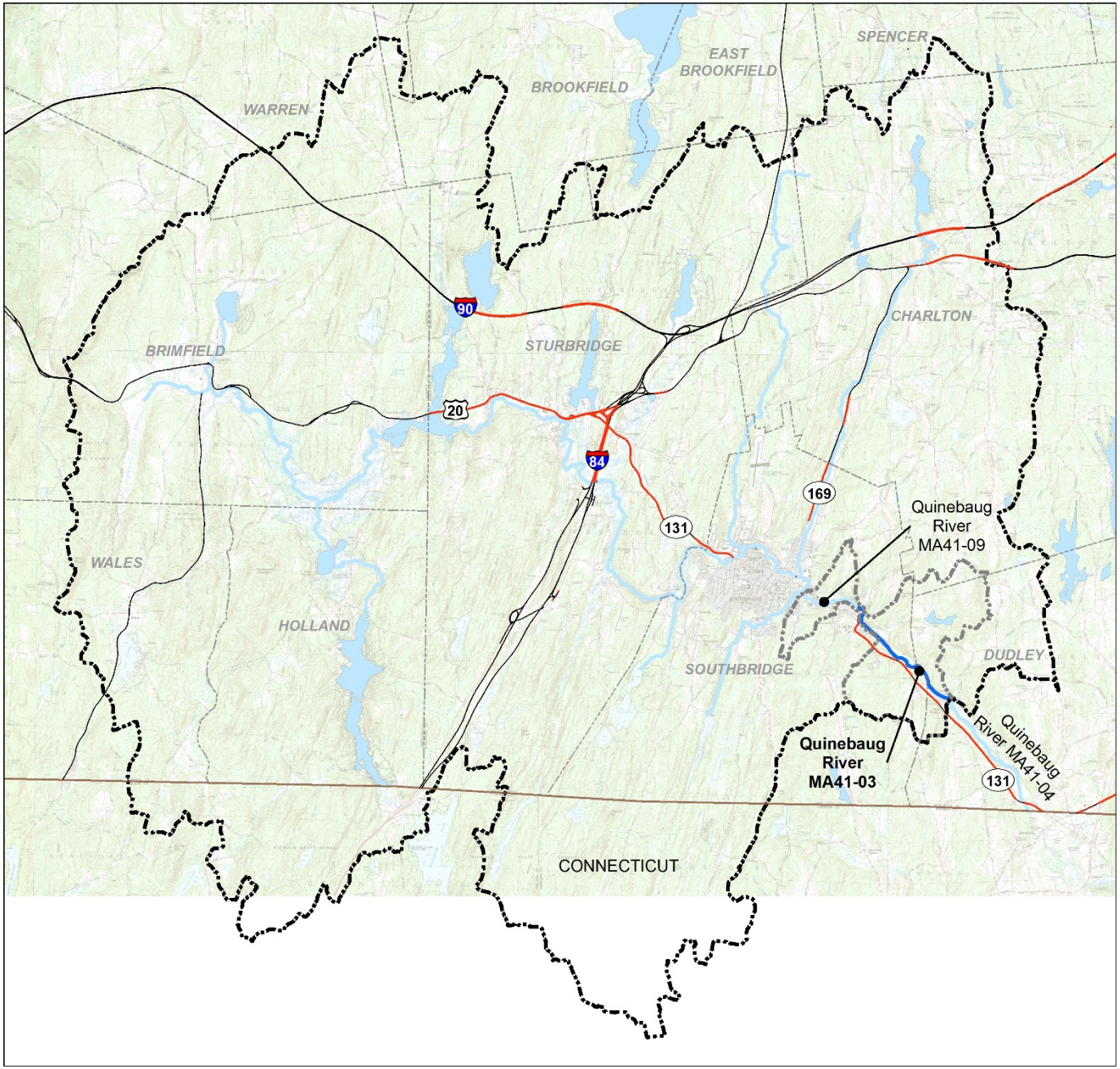
With respect to the fecal coliform impairment, MassDOT implements a variety of non-structural BMP programs across their system in accordance with their existing Stormwater Management Plan (SWMP) including educational programs, illicit connection review and source control. As discussed in MassDOT's BMP 7U Pathogen Methodology,[8] MassDOT believes that existing efforts are consistent with the current and draft MS4 permit requirements in regard to pathogens.

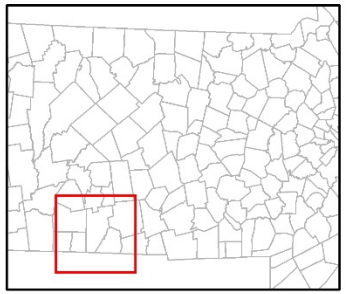
In addition, as part of its pet waste management program, MassDOT has determined that no MassDOT targeted rest stops are located within the subwatershed of this water body. MassDOT will be installing signs at rest stops within the subwatershed of impaired waterbodies. The signs will inform the public of the need to remove pet waste, which can minimize contributions of pathogens to stormwater runoff. Pet waste removal bags and disposal cans will be provided.

Furthermore, MassDOT has an ongoing inspection and monitoring program aimed at identifying and addressing illicit discharges to MassDOT's stormwater management system. MassDOT investigates any suspicious flows noted, and will work with owners of confirmed illicit discharges to remove these flows, and thereby minimize the possibility of pathogen contributions to receiving waters. At present, there are no suspected or known illicit discharges, or unauthorized drainage tie-ins, within the subwatershed of this water body that could be contributing pathogens to the impaired water body.

MassDOT has concluded that the BMPs outlined in the SWMP are consistent with its existing permit requirements for Quinebaug River. These measures achieve pathogen reductions (including fecal coliform) to the maximum extent practicable and are consistent with the intent of its existing stormwater permit. As stated previously, pathogen loadings are highly variable and although there is potential for stormwater runoff from MassDOT roadways to be a contributing source it is unlikely to warrant action relative to other sources of pathogens in the watershed.

MassDOT will continue to ensure proper non-structural BMPs are being implemented within the watershed of Quinebaug River, including regular roadway and drainage system maintenance, erosion and sedimentation control, and outreach and education. Further work by MassDOT 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 NPDES permit annual reports to EPA regarding proposed BMP design either through retrofit or programmed projects, plans for construction of BMPs, and reduction achieved by finalized BMP designs.





MassDOT Roadways in Urban Area
MassDOT Roadways
Total Watershed
Subwatershed
Assessed Segment
Impaired Lakes
Impaired Streams

N

0 1 2 Miles

Figure 1A

Quinebaug River (MA41-03) Watersheds

December 2014

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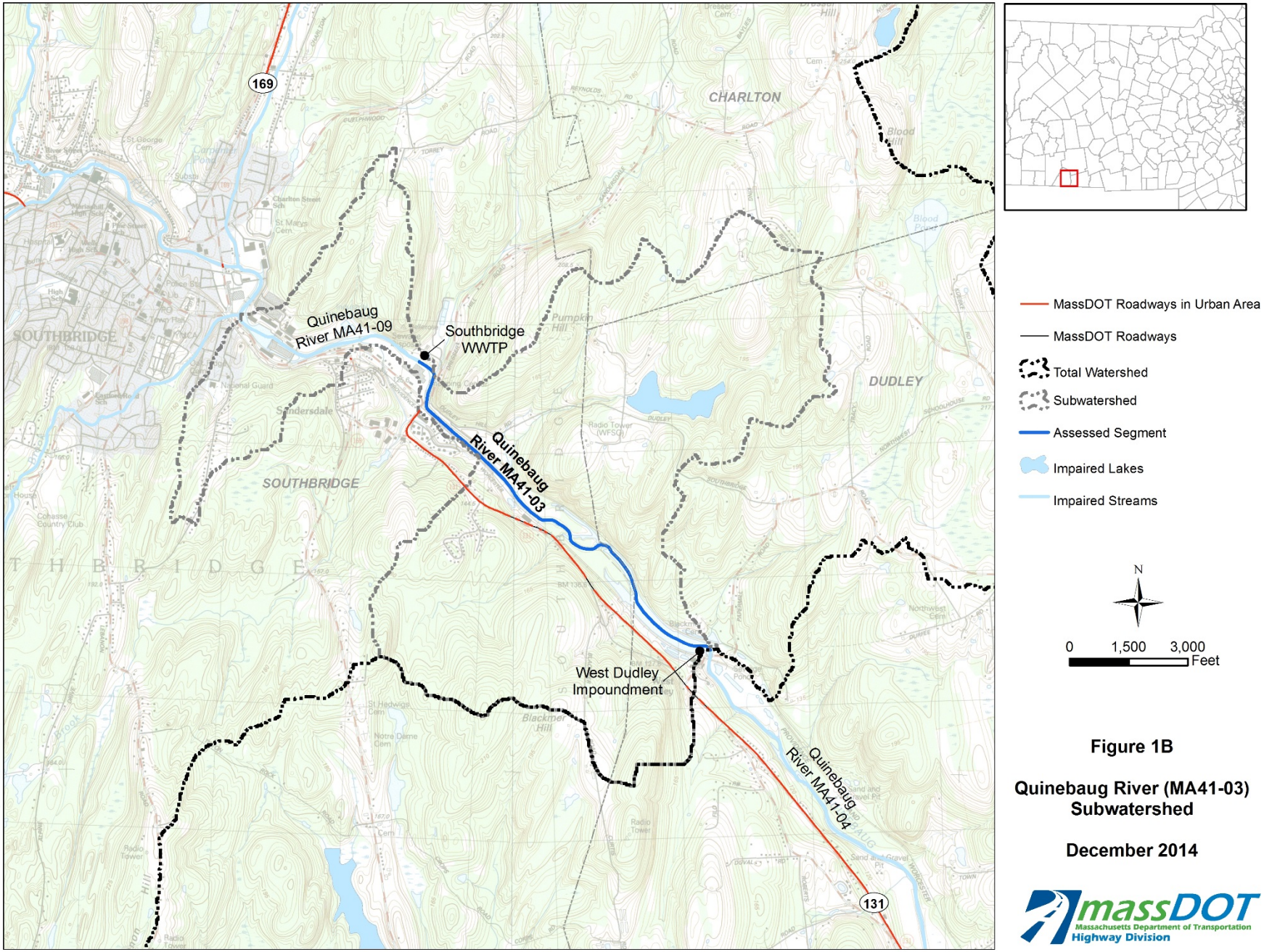

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Figure 1B

Quinebaug River (MA41-03) Subwatershed

December 2014

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Massachusetts Department of Transportation
Highway Division

Impaired Waters Assessment for Uncas Pond (MA72122)

Summary

Impaired Water[1]	Impairments:	Stormwater: *Dissolved Oxygen*
		Non-Stormwater:[2] *Non-Native Aquatic Plants*
	Category:	*4A (TMDL is complete)*
	Final TMDLs:	*Total Maximum Daily Load for Nutrients in the Upper/Middle Charles River, Massachusetts*[3]
	WQ Assessment:	*Charles River Watershed 2002-2006 Water Quality Assessment Report*[4]
Location	Towns:	*Franklin*
	MassDOT Roads:	*None*
Assessment Method(s)	7R (TMDL Method) ☒	7U (Non-TMDL Method) ☐ No Discharge ☒

Site Description

An assessment for Uncas Pond (MA72122) was previously submitted to the EPA on June 8, 2012 using the BMP 7U methodology.[5] However, Uncas Pond is covered under the *Total Maximum Daily Load for Nutrients in the Upper/Middle Charles River, Massachusetts*,[3] so it has been reassessed herein using BMP 7R methodology.[6]

[1] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[2] MassDOT, December 2012. Impaired Waters Assessment for Impaired Waters with Impairments Unrelated to Stormwater. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year3/Year3_ImpairedWatersAssessment_1.pdf#page=308

[3] MassDEP, 2011. Total Maximum Daily Load for Nutrients in the Upper/Middle Charles River, Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/ucharles.pdf

[4] MassDEP, 2008. Charles River Watershed 2002-2006 Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/72wqar07.pdf

[5] MassDOT, April 2010. BMP 7U: Water Quality Impaired Waters Assessment and Mitigation Plan. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7U_ImpairedWaterbodiesAssessment.pdf

[6] MassDOT, July 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

Uncas Pond (MA72122) is a 17-acre lake located in Franklin, Massachusetts. Flow exits Uncas Pond on its western side, forming a small, unimpaired stream. The total watershed and subwatershed for Uncas Pond are the same. The watershed, shown in Figure 1, covers approximately 200 acres, with 97% of that area in Franklin and 3% in Wrentham. Land use in the watershed consists of forested area, residential properties, golf course, wetland, and open water. Forested area accounts for approximately 50% of the land use, residential properties for 20%, golf course for 10%, and wetland/open water for the remaining 20%.

According to the *Charles River Watershed 2002-2006 Water Quality Assessment Report*,[4] Aquatic Life within Uncas Pond (MA72122) is classified as "impaired" due to non-native aquatic macrophyte and low dissolved oxygen. The source of the low dissolved oxygen is unknown, but the source of the non-native aquatic macrophyte is cited as introduction of a non-native organism. Fish Consumption and Primary Contact are classified as "not assessed." Records taken by Division of Watershed Management (DWM) staff in 2002 indicate that no objectionable conditions were present, prompting Secondary Contact and Aesthetics to be classified as "support."

This assessment has been completed based on the Massachusetts Year 2012 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.[1] MassDEP has released a Proposed Massachusetts Year 2014 Integrated List[7] which has been reviewed for any proposed changes to the condition of the water bodies. The condition of Uncas Pond is not proposed to change.

After review, it was determined that MassDOT property does not discharge to Uncas Pond because MassDOT does not own any urban property within Uncas Pond's watershed. Although I-495 runs parallel and adjacent to the southern boundary of the watershed, a site visit conducted in August 2014 and a review of MassDOT record plans concluded that runoff from the abutting section of I-495 is conveyed under the highway and discharged to the south, away from Uncas Pond.

As defined in MassDOT's assessment methodology,[6] since this portion of MassDOT's urban property does not directly contribute stormwater runoff to Uncas 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) statewide to minimize the impacts of stormwater from its property.

[7] MassDOT, June 2014. Massachusetts Year 2014 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/14iwlistp.pdf

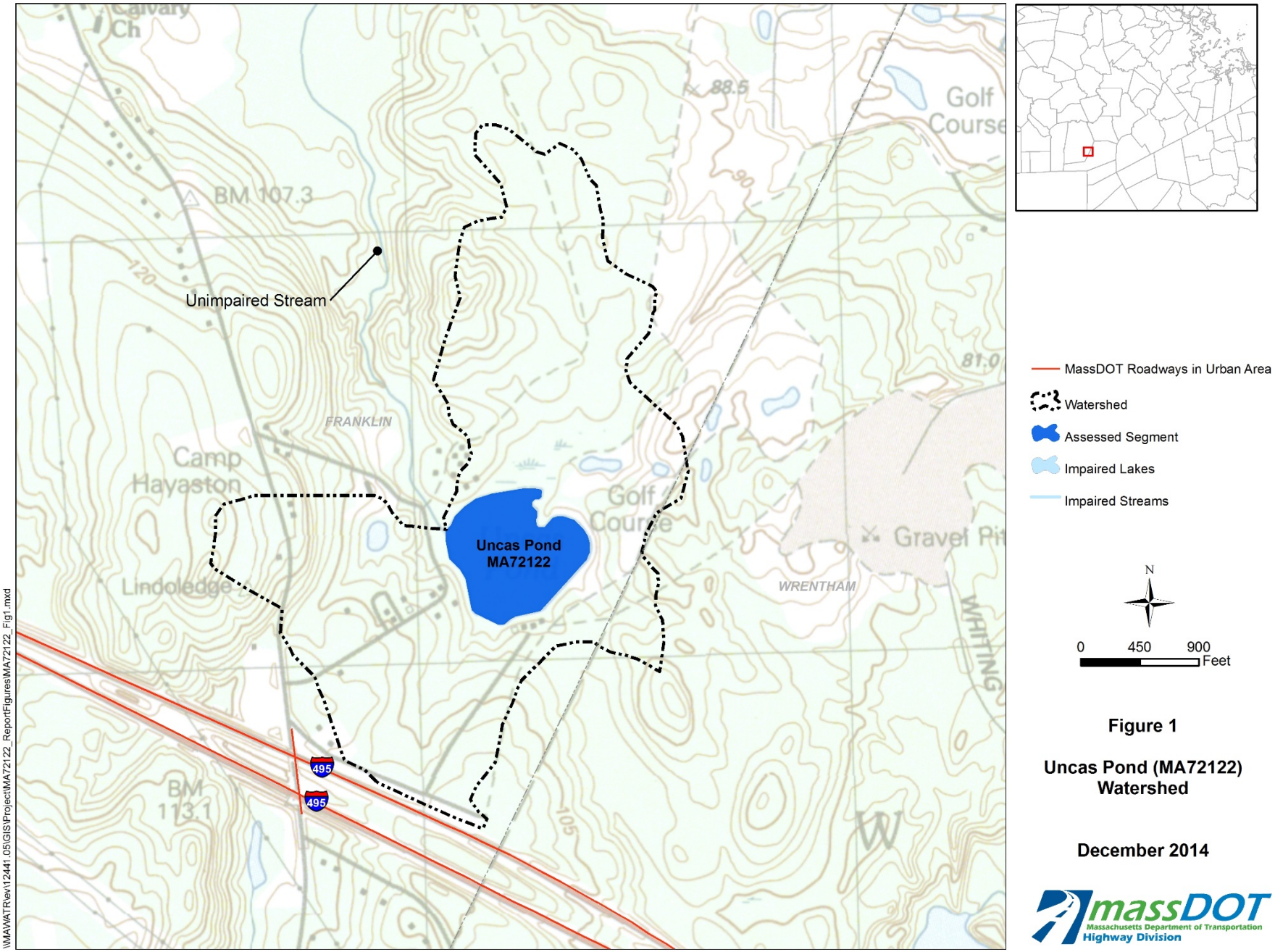

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Figure 1

Uncas Pond (MA72122) Watershed

December 2014

massDOT
Massachusetts Department of Transportation
Highway Division

Impaired Waters Assessment for Essex River (MA93-11)

Summary

Impaired Water[1]	Stormwater Impairments:	*Fecal Coliform*
Location	Category:	*5 (Waters requiring a TMDL)*
	Final TMDLs:	*Final Pathogen TMDL for the North Coastal Watershed March 2012*[2]
	WQ Assessment:	*North Shore Coastal Watersheds 2002 Water Quality Assessment Report*[3]
	Towns:	*Essex*
	MassDOT Roads:	*Route 133*
Assessment Method(s)	7R (TMDL Method) ☒	7U (IC Method) ☐
BMPs	Existing:	*None*

Site Description

Essex River (MA93-11) is a 0.5 square-mile segment located in Essex, Massachusetts. This segment of Essex River is classified as a Class SA tidal estuary and as an Area of Critical Environmental Concern (ACEC)/Outstanding Resource Water (ORW) by Executive Office of Energy and Environmental Affairs (EEA). Essex River flows north from its source east of Southern Avenue in Essex to the mouth at Essex Bay as shown in Figure 1. The total watershed and subwatershed consists of medium density residential, commercial areas and forest. MassDEP's Water Quality Assessment Report[4] lists Aesthetics and Primary and Secondary Contact uses as "support" because they meet surface water quality standards. Shellfish Harvesting is listed as "impaired" due to elevated fecal coliform bacteria. The source of the impairment is listed as

1 MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

2 MassDEP, 2012. *Final Pathogen TMDL for the North Coastal Watershed* March 2012. Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/ncoastl1.pdf

3 MassDEP, 2007. *North Shore Coastal Watersheds 2002 Water Quality Assessment Report*. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/93wqar06.pdf

4 MassDEP, 2007. *North Shore Coastal Watersheds 2002 Water Quality Assessment Report*. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/93wqar06.pdf

unknown but the suspected sources are discharges from separate storm sewer systems. Aquatic Life and Fish Consumption uses are listed as “not assessed” for this waterbody.

MassDOT-owned roadways within the subwatershed include portions of Route 133 as shown in Figure 1. Route 133 is a two-lane roadway with curbing and sidewalk on both sides. Route 133 (Main Street) crosses Essex River east of Willow Court. Route 133 (Eastern Ave) crosses Ebben Creek, a tributary to Essex River, west of Lufkin Street.

Runoff collected along the MassDOT-owned portion of Route 133 (Main Street), between Willow Court and 136 Main Street, discharges to the Essex River at two locations. Runoff is collected in catch basins along either side of the roadway and outfalls through two outlet pipes under the west side of the bridge where Route 133 (Main Street) crosses Essex River. The second discharge location is east of the bridge at a gravel boat landing. Runoff is collected in catch basins on both sides of the roadway and outfalls to Essex River at this location from a duck-bill end section. At Ebben Creek, runoff flows overland from Route 133 off the roadway and directly into the creek.

Essex River (MA93-11) was previously assessed as a less than 9% Impervious Cover watershed, and the assessment report was included in the March 8, 2011 submission.

Existing BMPs

MassDOT did not identify any existing BMPs in place to treat roadway runoff from the directly discharging area before reaching the impaired water segment.

Assessment

In cases where a TMDL has been approved, MassDOT assesses the waterbody for the impairments covered by the TMDL under the BMP 7R methodology.[5] MassDOT separately assesses the waterbody for any stormwater-related impairments that are not covered by the TMDL under the BMP 7U methodology.[6] MassDOT assessed Essex River (MA93-11) using the methodologies described below.

This assessment has been completed based on the Massachusetts Year 2012 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.[7] MassDEP has released a Proposed Massachusetts Year 2014 Integrated List[8] which has been reviewed for any proposed changes to the condition of the water bodies. The condition of Essex River is proposed to change from a Category 5 (Waters requiring a TMDL) to a Category 4A (TMDL is completed) on the Massachusetts Year 2014 Integrated List.

[5] Massachusetts Department of Transportation (MassDOT), July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

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

[7] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[8] MassDOT, June 2014. Massachusetts Year 2014 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. Massachusetts. Available at http://www.mass.gov/eea/docs/dep/water/resources/07v5/14iwlistp.pdf

BMP 7R for Pathogen TMDL (CN 155.0)

MassDOT assessed the indicator bacteria (fecal coliform) impairment using the approach described in BMP 7R of MassDOT's Storm Water Management Plan (SWMP)[9] which applies to impairments that have been assigned to a water body covered by a final TMDL. Essex River (MA93-11) is covered by the *Final Pathogen TMDL for the North Coastal Watershed*.[10]

Pathogen concentrations in stormwater vary widely and concentrations can vary by an order of magnitude within a given storm event at a single location making it difficult to predict pathogen concentrations in stormwater with accuracy. MassDOT generally will not conduct site specific assessments of pathogen loading for each water body impaired for pathogens but instead developed an iterative adaptive management approach to be consistent with relevant TMDLs and permit condition requirements and an approach to stormwater management. Greater detail of the assessment methodology is provided in MassDOT's BMP 7R Pathogen Methodology.[11]

According to Section 5.0 on Page 67 of the Final TMDL, "sources of indicator bacteria in the North Coastal watershed are many and varied". Indicator bacteria is found in the North Coastal watershed during dry and wet weather conditions. Suspected and known dry weather sources in the watershed include:

- leaking sewer pipes;
- stormwater drainage systems (illicit connections of sanitary sewers to storm drains);
- failing septic systems;
- recreational activities;
- wildlife including birds; and
- discharges of inadequately treated boat waste.

Some suspected and known wet weather sources include:

- wildlife and domesticated animals (including pets);
- stormwater runoff including municipal separate storm sewer systems (MS4);
- combined sewer overflows (CSOs); and
- sanitary sewer overflows (SSOs).

In addition to the generic recommendations provided in the draft NPDES MS4 permits for Massachusetts and discussed in the MassDOT Pathogen Methodology, the TMDL states that implementation to achieve the TMDL goals should be an iterative process by first prioritizing areas based on available data while considering their impact to down gradient resources. Recommended TMDL implementation measures include identification and elimination of prohibited sources such as leaky or illicitly connected sanitary sewer flows, and best management practices to mitigate stormwater runoff volume. The town of Essex has entered into a consent agreement, with MassDEP to address the discharge of pollutants into the town's storm drainage facilities. They expect to improve water quality by removing failing septic systems and subsequently connecting a

[9] Massachusetts Department of Transportation (MassDOT), July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

[10] MassDEP, 2012. *Final Pathogen TMDL for the North Coastal Watershed* March 2012. Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/ncoastl1.pdf

[11] MassDOT, December 2014. Description of MassDOT's Application of BMP 7R for Pathogen Related Impairments.

substantial number of homes and businesses into the Gloucester sewage collection and wastewater treatment facility.

Proposed Mitigation Plan

As stated earlier, Essex River (MA93-11) was previously assessed as a less than 9% Impervious Cover watershed, and the assessment report was included in the March 8, 2011 submission. MassDOT has concluded, using the IC Method, that there is no required reduction in impervious area for Essex River 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 not covered by a TMDL. Therefore, further assessment of this waterbody for impairments not covered by a TMDL is not warranted under the Impaired Waters Program because the impervious cover is less than the 9% maximum IC target. The March 8, 2011 assessment report did not address any pathogen impairments to Essex River, which includes the fecal coliform impairment. Essex River has been reassessed to address this impairment.

With respect to the fecal coliform impairment, 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. As discussed in MassDOT's BMP 7R Pathogen Methodology,[12] MassDOT believes that existing efforts are consistent with the current and draft MS4 permit requirements and TMDL recommendations in regard to pathogens.

In accordance with the BMPs identified in the TMDL report as planned measures to reach compliance with the North Coastal pathogen TMDL report, MassDOT has documented the locations of its stormwater outfalls. In addition, as part of its pet waste management program, MassDOT has determined that no MassDOT targeted rest stops are located within the subwatershed of this water body. At rest stops that have been identified as being within subwatersheds of water bodies impaired for pathogens, MassDOT will be installing signs at rest stops within the subwatershed of impaired waterbodies. The signs will inform the public of the need to remove pet waste, which can minimize contributions of pathogens to stormwater runoff. Pet waste removal bags and disposal cans will be provided.

Although the TMDL report also identifies the benefits of stormwater structural BMPs to address runoff from impervious areas in some instances, MassDOT feels that it is not a beneficial approach to implement these BMPs in advance of other ongoing BMP efforts identified in the watershed, given the documented variability of pathogen concentrations in highway runoff, and the low probability of achieving substantial gains towards meeting the TMDL with solely implementing IC reductions and controls.

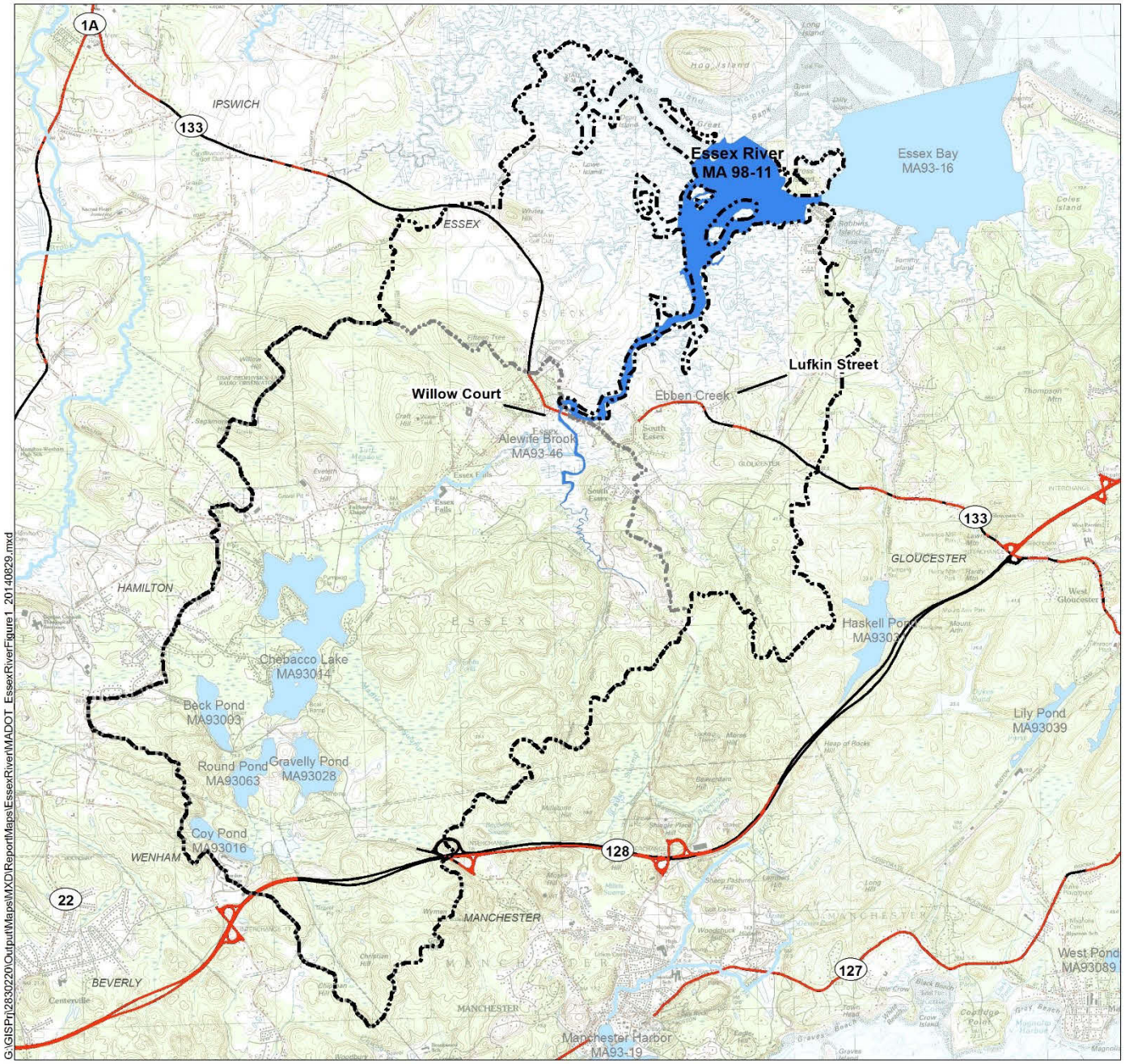
Furthermore, MassDOT has an ongoing inspection and monitoring program aimed at identifying and addressing illicit discharges to MassDOT's stormwater management system. MassDOT investigates any suspicious flows noted, and will work with owners of confirmed illicit discharges to remove these flows, and thereby minimize the possibility of pathogen contributions to receiving waters. At present, there are no suspected or known illicit discharges, or unauthorized drainage tie-ins, within the subwatershed of this water body that could be contributing pathogens to the impaired water body.

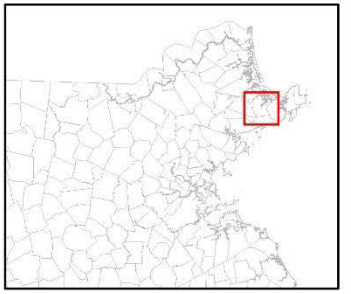
MassDOT has concluded that the BMPs outlined in the SWMP are consistent with its existing permit requirements for Essex River. These measures achieve pathogen reductions (including fecal

[12] MassDOT, December 2014. Description of MassDOT's Application of BMP 7U for Pathogen Related Impairments.

coliform) to the maximum extent practicable and are consistent with the intent of its existing stormwater permit. As stated previously, pathogen loadings are highly variable and although there is potential for stormwater runoff from MassDOT roadways to be a contributing source it is unlikely to warrant action relative to other sources of pathogens in the watershed.

MassDOT will continue to ensure proper non-structural BMPs are being implemented within the watershed of Essex River, including regular roadway and drainage system maintenance, erosion and sedimentation control, and outreach and education. Further work by MassDOT 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 NPDES permit annual reports to EPA regarding proposed BMP design either through retrofit or programmed projects, plans for construction of BMPs, reduction achieved by finalized BMP designs and progress made towards meeting target pathogen load reductions.





MassDOT Roadways

MassDOT Roadways in Urban Area

Total Watershed

Subwatershed

Assessed Segment

Impaired Lakes

Impaired Streams

N

0 2,250 4,500 Feet

Figure 1

Essex River (MA93-11) Watersheds

December 2014

massDOT
Massachusetts Department of Transportation
Highway Division

Impaired Waters Assessment for Aucoot Creek (MA95-72)

Summary

Impaired Waters[1]	Stormwater Impairments:	*Fecal Coliform, Nitrogen (Total), Nutrient/Eutrophication Biological Indicators, and Dissolved Oxygen*
	Category:	*5 (Waters requiring a TMDL)*
	Final TMDLs:	*None*
	WQ Assessment:	*None*
Location	Towns:	*Marion*
	MassDOT Roads:	*Route 6*
Assessment Methods(s)	7R (TMDL Method) ☐	7U (Non-TMDL Method) ☒

Site Description

An assessment for Aucoot Creek (MA95-72) was previously submitted to the EPA on June 8, 2011 using the BMP 7U[2] methodology as a less than 9% assessment. However, Aucoot Creek is now being reassessed herein to include the BMP 7U Pathogen Methodology.[3] Although pathogens impairments are covered in the Buzzards Bay Watershed by the *Final Pathogen TMDL for the Buzzards Bay Watershed,*[4] the TMDL does not specifically discuss Aucoot Creek (MA95-72).

Aucoot Creek (MA95-72) consists of the estuarine portion east of Route 6 in Marion to the confluence with Aucoot Cove in Marion, Massachusetts (Figure 1). Aucoot Cove (MA95-71) extends from the confluence of Aucoot Creek (MA95-72) to the boundary of the Division of Marine Fisheries (DMF) designated shellfishing area BB31.1, north and southwest from Haskell Island in Marion. Aucoot Cove (MA95-71) was formerly part of Aucoot Cove (MA95-09), which now extends from the boundary of the DMF designated shellfishing area BB31.1 to the mouth of the Buzzards Bay. MA95-09 is discussed in the *Buzzards Bay Watershed 2000 Water Quality Assessment Report*;[5] however, Aucoot Creek is not included in the Water Quality Assessment Report. The

[1] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

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

[3] MassDOT. December 2014. Description of MassDOT's Application of BMP 7U for Pathogen Related Impairments.

[4] MassDEP, March 2009. Final Pathogen TMDL for the Buzzards Bay Watershed (CN251.1). Available at: http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/buzzbay1.pdf

[5] MassDEP, November 2003. Buzzards Bay Watershed 2000 Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/95wqar1.pdf

closest MassDOT-owned urban roadway, Route 6, is approximately 670 feet away from the Aucoot Creek. This roadway is a two-lane highway with no median that drains to a non-impaired stream prior to discharging to Aucoot Creek MA95-72.

Assessment

In cases where a TMDL has been approved, MassDOT assesses the water body for the impairments covered by the TMDL under the BMP 7R methodology.[6] MassDOT separately assesses the water body for any stormwater-related impairments that are not covered by the TMDL under the BMP 7U methodology.[7] MassDOT assessed Aucoot Creek (MA95-72) using the methodologies described below.

This assessment has been completed based on the Massachusetts Year 2012 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.[8] MassDEP has released a Proposed Massachusetts Year 2014 Integrated List[9] which has been reviewed for any proposed changes to the condition of the water bodies. The condition of Aucoot Creek is not proposed to change.

BMP 7U for Pathogen Impairment

MassDOT assessed the indicator bacteria (fecal coliform) impairment using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (SWMP).[10]

Pathogen concentrations in stormwater vary widely and concentrations can vary by an order of magnitude within a given storm event at a single location making it difficult to predict pathogen concentrations in stormwater with accuracy. MassDOT generally will not conduct site specific assessments of pathogen loading for each water body impaired for pathogens but instead developed an iterative adaptive management approach to address impaired waters and permit condition requirements and an approach to stormwater management. Greater detail of the assessment methodology is provided in MassDOT's BMP 7U Pathogen Methodology.[11]

BMP 7U for Impervious Cover Related Impairments

A Final TMDL is not in place to address Aucoot Creek's (MA95-72) following impairments: nitrogen (total), nutrient/eutrophication biological indicators, and dissolved oxygen. Therefore, MassDOT assessed the stormwater-related impairments not addressed by a TMDL using the approach

[6] Massachusetts Department of Transportation (MassDOT), July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

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

[8] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[9] MassDEP, June 2014. Massachusetts Year 2014 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/14iwlistp.pdf

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

[11] MassDOT. December 2014. Description of MassDOT's Application of BMP 7U for Pathogen Related Impairments.

outlined in the Description of MassDOT's Application of Impervious Cover Method in BMP 7U[12] which was developed using the EPA Region I's Impervious Cover (IC) Method, described in EPA's Stormwater TMDL Implementation Support Manual.[13] 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 calculated the following values for the total contributing watershed of the impaired water (Aucoot Creek) to determine the IC area and set a reduction target. Watersheds are based on the USGS Dataset 451 and modified as necessary using topography.[14] MassGIS's impervious surfaces data layer was used to determine the IC of the watersheds.[15] The watershed is shown in Figure 1.

Table 1 Impaired Segment Watershed

	Total Watershed
Watershed Area	2,332 acres
Impervious Cover (IC) Area	89 acres
Percent Impervious	3.8%

MassDOT calculated the watershed is less than 9% impervious indicating that stormwater is likely not a contributor to the impairments.

Proposed Mitigation Plan

MassDOT has concluded, using the IC Method, that there is no required reduction in impervious area for Aucoot Creek 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 not covered by a TMDL. Therefore, further assessment of this water body for impairments not covered by a TMDL is not warranted under the Impaired Waters Program.

With respect to the fecal coliform impairment, 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. As discussed in MassDOT's BMP 7U Pathogen Methodology,[16] MassDOT believes that existing efforts are consistent with the current and draft MS4 permit requirements in regard to pathogens.

In addition, as part of its pet waste management program, MassDOT has determined that no MassDOT targeted rest stops are located within the watershed of this water body. MassDOT will be installing signs at rest stops within the subwatershed of impaired water bodies. The signs will

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

[13] ENSR 2006. Stormwater TMDL Implementation Support Manual for US EPA Region 1. ENSR International & EPA Region 1, Boston, MA. Available at http://www.epa.gov/region1/eco/tmdl/regionalpgrfs.html

[14] USGS Data Series 451 Local and Cumulative Impervious Cover of Massachusetts Stream Basins Available at: http://pubs.usgs.gov/ds/451/

[15] MassGIS Impervious Surfaces datalayer taken from 2005 orthoimagery. Available at: http://www.mass.gov/mgis/impervious_surface.htm

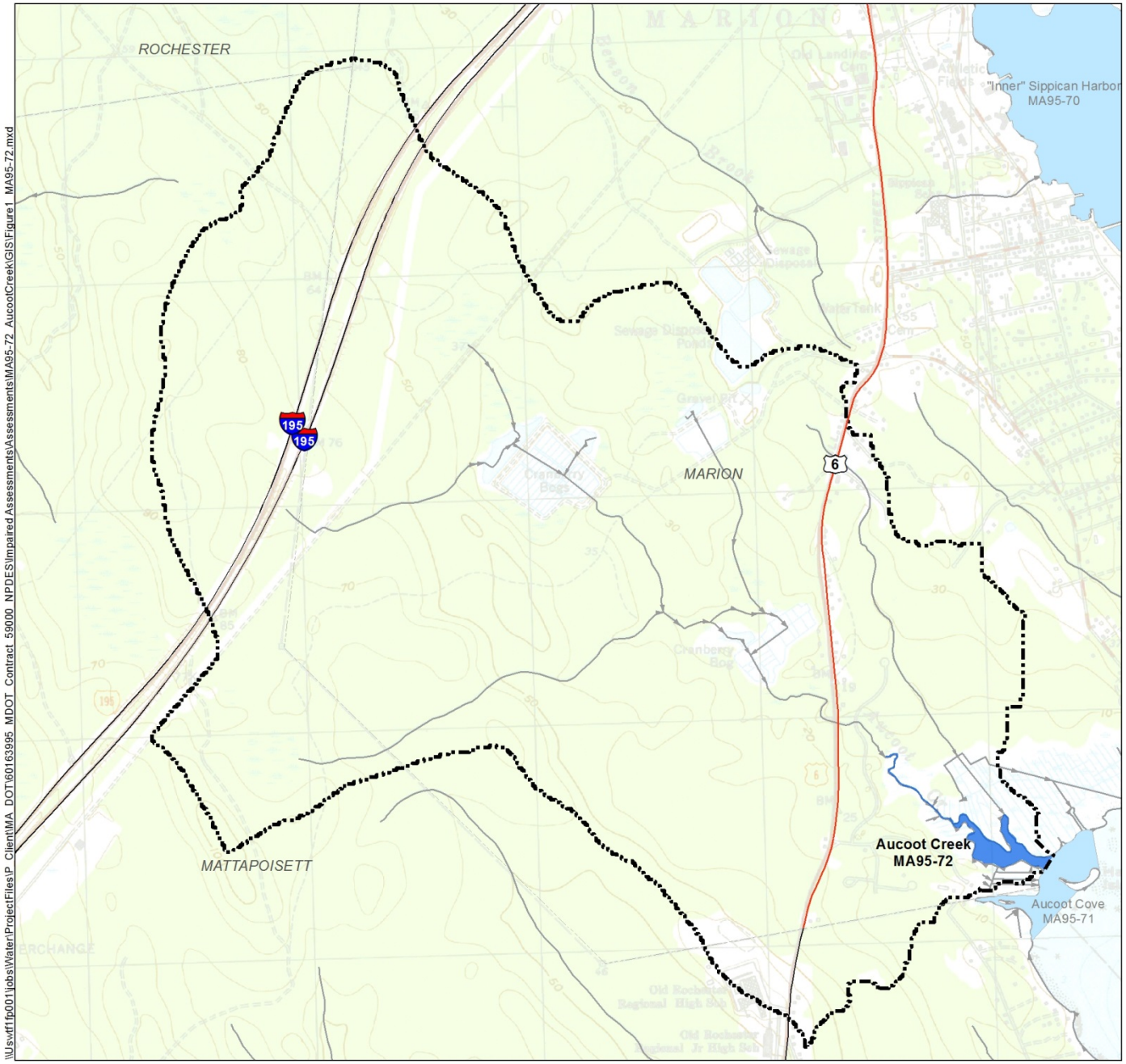
[16] MassDOT. December 2014. Description of MassDOT's Application of BMP 7U for Pathogen Related Impairments.

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

Furthermore, MassDOT has an ongoing inspection and monitoring program aimed at identifying and addressing illicit discharges to MassDOT's stormwater management system. MassDOT investigates any suspicious flows noted, and will work with owners of confirmed illicit discharges to remove these flows, and thereby minimize the possibility of pathogen contributions to receiving waters. At present, there are no suspected or known illicit discharges, or unauthorized drainage tie-ins, within the watershed of this water body that could be contributing pathogens to the impaired water body.

MassDOT has concluded that the BMPs outlined in the SWMP are consistent with its existing permit requirements for the MA95-72 Aucoot Creek. These measures achieve pathogen reductions (including fecal coliform) to the maximum extent practicable and are consistent with the intent of its existing stormwater permit. As stated previously, pathogen loadings are highly variable and although there is potential for stormwater runoff from MassDOT roadways to be a contributing source it is unlikely to warrant action relative to other sources of pathogens in the watershed.

MassDOT will continue to ensure proper non-structural BMPs are being implemented within the watershed of Aucoot Creek, including regular roadway and drainage system maintenance, erosion and sedimentation control, and outreach and education. Further work by MassDOT 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 NPDES permit annual reports to EPA regarding proposed BMP design either through retrofit or programmed projects, plans for construction of BMPs, reduction achieved by finalized BMP designs and progress made towards meeting target reductions.



MassDOT Roadways in Urban Area

MassDOT Roadways

Total and Subwatershed

Assessed Segment

Impaired Lakes

Impaired Streams

Non-Impaired Streams

N

0 1,250 2,500 Feet

Figure 1

Aucoot Creek (MA95-72) Watersheds

December 2014

massDOT
Massachusetts Department of Transportation
Highway Division

Impaired Waters Assessment for Prince Cove (MA96-07)

Summary

Impaired Water[1]	Stormwater Impairments:	*Estuarine Bioassessments; Fecal Coliform*
	Category:	*4A (TMDL is completed)*
	Final TMDLs:	*Three Bays System Total Maximum Daily Loads for Total Nitrogen (CN 242.0)*[2]
		Final Pathogen TMDL for Three Bays Watershed, Barnstable, MA (CN 309.0)[3]
	WQ Assessment:	*Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[4]
Location	Towns:	*Barnstable*
	MassDOT Roads:	*Route 28*
Assessment Method(s)	7R (TMDL Method) ☒	7U (Non-TMDL Method) ☐
BMPs	Existing:	*None*
MassDOT Area and Targets		Nitrogen
	Estimated MassDOT Load:	*65.4 lbs/yr*
	Existing Load to Water Body:	*29,781 lbs/yr*
	MassDOT Contribution to Existing Load	*0.22 %*

[1] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[2] Mass DEP, 2007. Final Three Bays System, Total Maximum Daily Load for Total Nitrogen, Massachusetts (CN 242.0). Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/threebay.pdf

[3] Mass DEP, 2009. Final Pathogen TMDL for Three Bays Watershed, Barnstable, MA (CN 309.0). Available at: http://www.mass.gov/eea/docs/dep/water/resources/3baapp/3bays.pdf

[4] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

Site Description

An assessment for Prince Cove (MA96-07) was previously submitted to the EPA on June 8, 2014 as a BMP 7R assessment. [5] However, due to update groundwatershed delineations, the assessment is being resubmitted.

Prince Cove (MA96-07) is a 0.14-square mile water body located north of North Bay (MA96-66) in Barnstable, Massachusetts. Figure 1 illustrates the groundwatershed for Prince Cove (MA96-07). The groundwatershed for this impaired segment is based on technical reports[6] developed by the Massachusetts Estuaries Project (MEP) which serve as the basis for the development of Total Maximum Daily Loads. The MEP team includes technical staff from USGS and the Cape Cod Commission and works collaboratively with MassDEP and the University of Massachusetts Dartmouth School of Marine Science and Technology (SMAST). For groundwatershed assessments, if a discharge occurs inside the groundwatershed boundary, it is considered to be a discharge that contributes to the impaired segment. If the discharge point is outside of the groundwatershed boundary, it is not considered to contribute to the impaired segment. The Prince Cove groundwatershed is located in Barnstable along the Marston Mills River and includes residential areas, wetlands, ponds, and a MassDOT road (Route 28).

Prince Cove receives inflow from Marston Mills River (an unimpaired river), an unnamed (and unimpaired) tributary and groundwater flow. The Marston Mills River flows south from Middle Pond through Mill Pond into Prince Cove (Figure 2). Prince Cove discharges to North Bay (MA96-66). MassDEP's Water Quality Assessment Report titled *Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[7] identifies the Aquatic Life Use as "impaired" for Prince Cove due to the loss of eelgrass bed habitat caused by total nitrogen loading from septic systems and fertilizers. The report identified the Shellfish Harvesting Use as "impaired" due to fecal coliform bacteria. The report identifies Primary Contact and Secondary Contact Uses as "support". The Aesthetics and Fish Consumption Uses were not assessed.

Figure 2 illustrates the MassDOT roads within the groundwatershed that contribute runoff to Prince Cove, which drains to North Bay. A total of approximately 10 acres of impervious area and 1.4 acres of pervious area within the right-of-way of Route 28 contributes runoff to Prince Cove either by catch basin and pipe systems or runoff and infiltration to groundwater.

Runoff from the center portion of Route 28, beginning from approximately 350 feet west of Staysail Circle and extending 2,150 feet east of Staysail Circle (2,500 linear feet total), flows via catch basins and pipes to a subsurface leaching bed located at a low point adjacent to Marston Mills River. The ground surface at the bypass outfall for the leaching bed has become a deeply eroded channel that directs stormwater to the adjacent low-lying area that flows directly to Marston Mills River. On the east and west ends of the section of roadway directing runoff to the leaching bed, runoff from additional sections of Route 28 is directed to catch basins and pipes that drain through outfalls shown on Figure 2 or by sheet flow to adjacent pervious areas. The additional sections include the roadway from approximately 250 feet west of Putnam Ave to 350 feet west of Staysail Circle and the area 1,500 feet west of South County Road to approximately 150 feet east of the intersection of

[5] MassDOT. March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at:

[6] University of Massachusetts Dartmouth and MassDEP, 2006. Massachusetts Estuaries Project Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Three Bays, Barnstable, Massachusetts. Available at: http://www.oceanscience.net/estuaries/report/3Bays/3Bays_MEP_Final.pdf

[7] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

Route 28 and Osterville West Barnstable Road. The drainage from these sections infiltrates into the ground and is considered contributing through groundwater.

Portions of Route 28 near the east and west boundary of the Prince Cove groundwatershed are not shown to directly contribute to Prince Cove as they drain to areas outside of the boundary. These areas contribute to the North Bay groundwatershed and are described in the Impaired Waters Assessment for North Bay (MA96-66).

Existing BMPs

MassDOT estimated the pollutant load reduction provided by existing BMPs by applying treatment reductions to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from different sources depending on the BMP and engineering judgment as described in the *Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds.*[8]

MassDOT identified one existing BMP in place with the potential to treat roadway runoff from the discharging area before reaching the impaired water segment. This existing BMP is a subsurface leaching bed located at a low point adjacent to Marston Mills River. Per the methodology, the subsurface leaching beds do not receive a nitrogen removal credit as they do not provide storage or advanced water quality treatment.

Assessment

In cases where a TMDL has been approved, MassDOT assesses the water body for the impairments covered by the TMDL under the BMP 7R methodology.[9] MassDOT separately assesses the water body for any stormwater-related impairments that are not covered by the TMDL under the BMP 7U methodology.[10] MassDOT assessed Prince Cove (MA96-07) using the methodologies described below.

This assessment has been completed based on the *Massachusetts Year 2012 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*.[11] MassDEP has released a Proposed Massachusetts Year 2014 Integrated List[12] which has been reviewed for any proposed changes to the condition of the water bodies. The condition of Prince Cove (MA96-07) is not proposed to change.

[8] Massachusetts Department of Transportation (MassDOT), March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[9] Massachusetts Department of Transportation (MassDOT), July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

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

[11] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[12] MassDOT, June 2014. Massachusetts Year 2014 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. Massachusetts. Available at http://www.mass.gov/eea/docs/dep/water/resources/07v5/14iwlistp.pdf

BMP 7R for Nitrogen TMDL (CN 242.0)

The Total Maximum Daily Load (TMDL) for Total Nitrogen in the Three Bays System, Massachusetts (CN 242.0)[13] identifies the total existing groundwatershed nitrogen load for this water body and attributes the estuarine bioassessments impairment to excess nitrogen loading from the groundwatershed. Therefore, MassDOT considers the following impairments to Prince Cove (MA96-07) to be linked to elevated nitrogen: estuarine bioassessments. MassDOT assessed the contribution of nitrogen from MassDOT properties to this water body using the approach described in BMP 7R[14] of MassDOT's Storm Water Management Plan (Water Quality Impaired Waters Assessment and Mitigation Plan), which applies to impairments that have been addressed by a TMDL, and MassDOT's application of BMP 7R to nitrogen in groundwater-controlled watersheds.[8]

For the nitrogen assessment under BMP 7R, MassDOT used USGS modeling[15] to estimate annual pollutant loads from its property. Based on the USGS SELDM model, which was run using precipitation data from the Hyannis site and an average of water quality data from Harwich and Marion, MassDOT estimates the nitrogen loading from impervious areas as 6.2 lbs/acre/yr and from pervious areas as 2.5 lbs/acre/yr.[16] The nitrogen loading for MassDOT property in the contributing area is summarized below:

- MassDOT Impervious Area: 10.0 acres
- MassDOT Pervious Area: 1.4 acres
- Estimated Existing MassDOT Load: 65.4 lbs/yr
- Total Existing Groundwatershed Nitrogen Load: 29,781 lbs/yr
- MassDOT Existing Load as a Percentage of Total Groundwatershed Nitrogen Load: 0.22%

The MassDOT existing load compared to the total groundwatershed nitrogen load is very small and considered negligible based on MassDOT's Nitrogen TMDL Method because it is less than 3.5% of the total nitrogen groundwatershed load.[14] In general, in areas where the MassDOT load is determined to be negligible, MassDOT does not implement BMPs because of their minimal impact on the overall groundwatershed load.

BMP 7R for Pathogen TMDL (CN 309.0)

MassDOT assessed the indicator bacteria (fecal coliform) impairment using the approach described in BMP 7R of MassDOT's Storm Water Management Plan (SWMP)[17] which applies to impairments

[13] Mass DEP.2007. Final Three Bays System, Total Maximum Daily Load for Total Nitrogen, Massachusetts (CN 242.0). Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/threebay.pdf

[14] MassDOT, July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

[15] Granato, G.E., 2013, Stochastic empirical loading and dilution model (SELDM) version 1.0.0: U.S. Geological Survey Techniques and Methods, book 4, chap. C3, 112 p. Available at: http://pubs.usgs.gov/tm/04/c03

[16] MassDOT, March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[17] MassDOT, July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

that have been assigned to a water body covered by a final TMDL. Prince Cove (MA96-07) is covered by the *Final Pathogen TMDL for the Three Bays Watershed.*[18]

Pathogen concentrations in stormwater vary widely and concentrations can vary by an order of magnitude within a given storm event at a single location making it difficult to predict pathogen concentrations in stormwater with accuracy. MassDOT generally will not conduct site specific assessments of pathogen loading for each water body impaired for pathogens but instead developed an iterative adaptive management approach to address impaired waters and permit condition requirements and an approach to stormwater management. Greater detail of the assessment methodology is provided in MassDOT's BMP 7R Pathogen Methodology.[19]

According to the Final TMDLs, sources of indicator bacteria in the Three Bays groundwatersheds are believed to be primarily from boat discharges, waterfowl/wildlife, transport of fecal coliform via the Marston Mills River via tidal exchange and stormwater inflows from paved areas. It should be noted that bacteria from wildlife would be considered a natural condition unless some form of human inducement, such as feeding, is causing congregation of wild birds or animals. Additionally, the Three Bays TMDL states that the first priority should be given to all sources that result in water quality standards violations during dry weather conditions, such as illicit sewer connections, failed Title 5 systems and/or sanitary sources. Recommended TMDL implementation measures include identification and elimination of these sources.

The Three Bays TMDL states that several impaired segments carry a higher priority due to their location, use, and risk to human health. Prince Cove (MA96-07) is included as a priority ranking as a component of the Massachusetts Estuary Project.[20] The Three Bays TMDL states that the two predominant types of land use in the Three Bays watershed are forestland and residential. The land area surrounding Prince Cove is the most heavily developed.[19]

In addition to the generic recommendations provided in the draft MS4 permits for Massachusetts, the Three Bays Watershed TMDL report (Section 6.0)[19] recommends the following specific BMPs to address elevated fecal coliform levels in the watershed:

- Identification and elimination of prohibited sources such as leaky or improperly connected sanitary sewer flows
- BMPs to mitigate stormwater runoff volume
- Enforcement of the "No Discharge Zone" which makes direct discharge of wastewater from boats illegal.

Proposed Mitigation Plan

As described above, MassDOT's nitrogen contribution to the receiving water is negligible. Therefore, MassDOT has no plans to implement structural BMPs to control nitrogen in stormwater runoff from their property.

[18] Mass DEP.2009. Final Pathogen TMDL for Three Bays Watershed, Barnstable, MA (CN 309.0). Available at: http://www.mass.gov/eea/docs/dep/water/resources/3baapp/3bays.pdf

[19] MassDOT, December 2014. Description of MassDOT's Application of BMP 7R for Pathogen Related Impairments.

[20] Mass DEP, 2009. Final Pathogen TMDL for Three Bays Watershed, Barnstable, MA (CN 309.0). Available at: http://www.mass.gov/eea/docs/dep/water/resources/3baapp/3bays.pdf

With respect to the fecal coliform impairment, 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. As discussed in MassDOT's BMP 7R Pathogen Methodology, MassDOT believes that existing efforts are consistent with the current and draft MS4 permit requirements and TMDL recommendations in regard to pathogens.

In accordance with the BMPs identified in the TMDL report as planned measures to reach compliance with the Cape Cod Pathogen TMDL and the Three Bays Watershed TMDL reports, MassDOT has documented the locations of its stormwater outfalls. In addition, as part of its pet waste management program, MassDOT has determined that no MassDOT targeted rest stops are located within the groundwatershed of this water body. MassDOT will be installing signs at rest stops within the subwatershed of impaired water bodies. The signs will inform the public of the need to remove pet waste, which can minimize contributions of pathogens to stormwater runoff. Pet waste removal bags and disposal cans will be provided

Although the TMDL reports also identifies the benefits of structural BMPs to address pathogens in runoff from impervious areas in some instances, MassDOT feels that it is not a beneficial approach to implement these BMPs in advance of other ongoing BMP efforts identified in the groundwatershed, given the documented variability of pathogen concentrations in highway runoff, and the low probability of achieving substantial gains towards meeting the TMDL with solely implementing impervious cover reductions and controls.

Furthermore, MassDOT has an ongoing inspection and monitoring program aimed at identifying and addressing illicit discharges to MassDOT's stormwater management system. MassDOT investigates any suspicious flows noted, and will work with owners of confirmed illicit discharges to remove these flows, and thereby minimize the possibility of pathogen contributions to receiving waters. At present, there are no suspected or known illicit discharges, or unauthorized drainage tie-ins, within the groundwatershed of this water body that could be contributing pathogens to the impaired water body.

MassDOT has concluded that the BMPs outlined in the SWMP are consistent with its existing permit requirements for Prince Cove. These measures achieve pathogen reductions (including fecal coliform) to the maximum extent practicable and are consistent with the intent of its existing stormwater permit. As stated previously, pathogen loadings are highly variable and although there is potential for stormwater runoff from MassDOT roadways to be a contributing source it is unlikely to warrant action relative to other sources of pathogens in the watershed.

MassDOT will continue to ensure proper non-structural BMPs are being implemented within the groundwatershed of Prince Cove, including regular roadway and drainage system maintenance, erosion and sedimentation control, and outreach and education. As described in MassDOT's Stormwater Handbook,[21] MassDOT does not use nitrogen based fertilizers as part of normal operations and maintenance procedures. In the rare circumstance where fertilizers are used, it is for the occasional vegetation establishment associated with recent ground disturbance. Further work by MassDOT 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 NPDES permit annual reports to EPA regarding proposed BMP design either

[21] MassDOT, May 2004. The MassHighway Storm Water Handbook for Highways and Bridges. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/wetlands/Stormwater_Handbook.pdf

through retrofit or programmed projects, plans for construction of BMPs, reduction achieved by finalized BMP designs and progress made towards meeting target reductions.

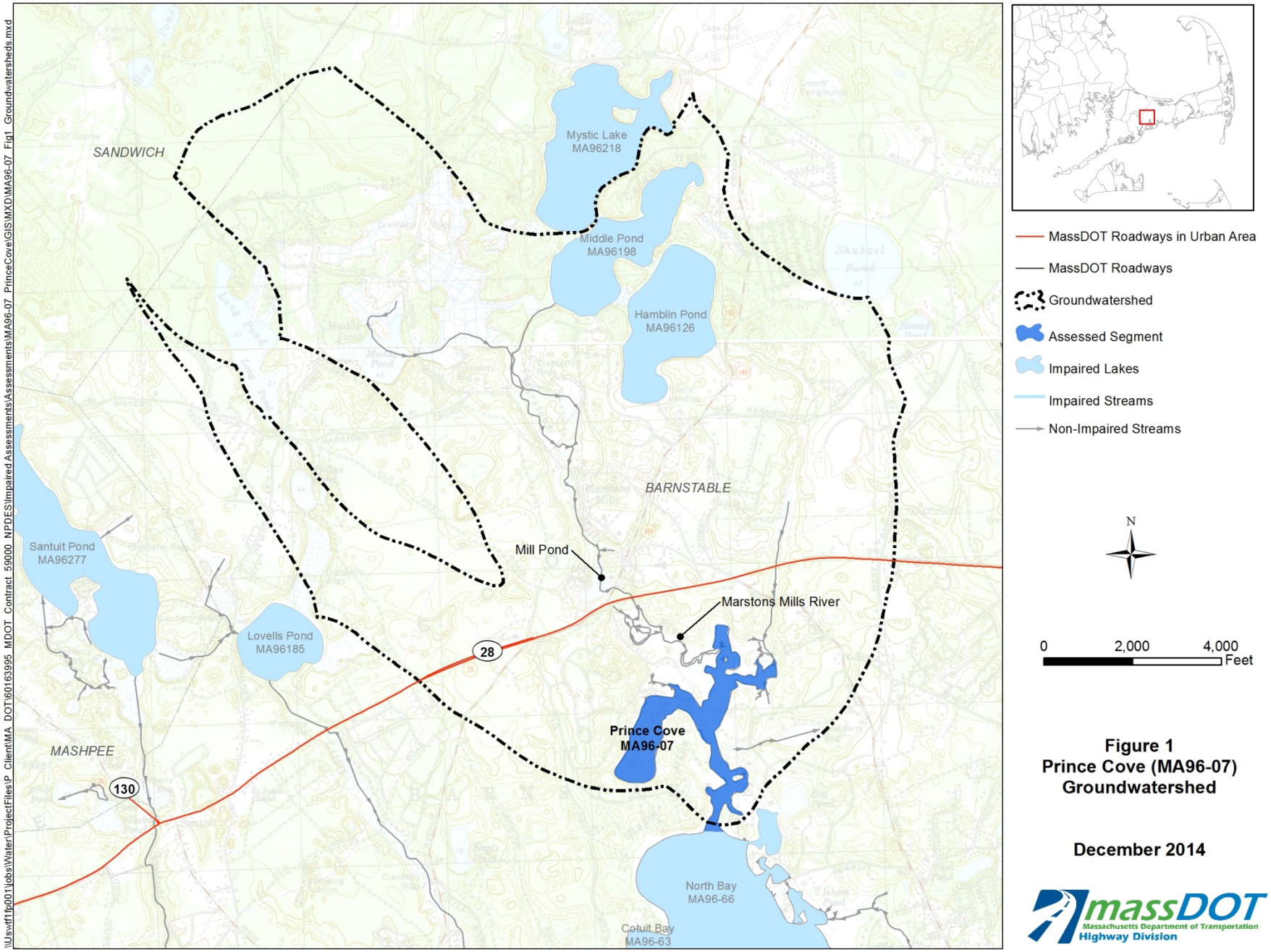


Figure 1
Prince Cove (MA96-07)
Groundwatershed

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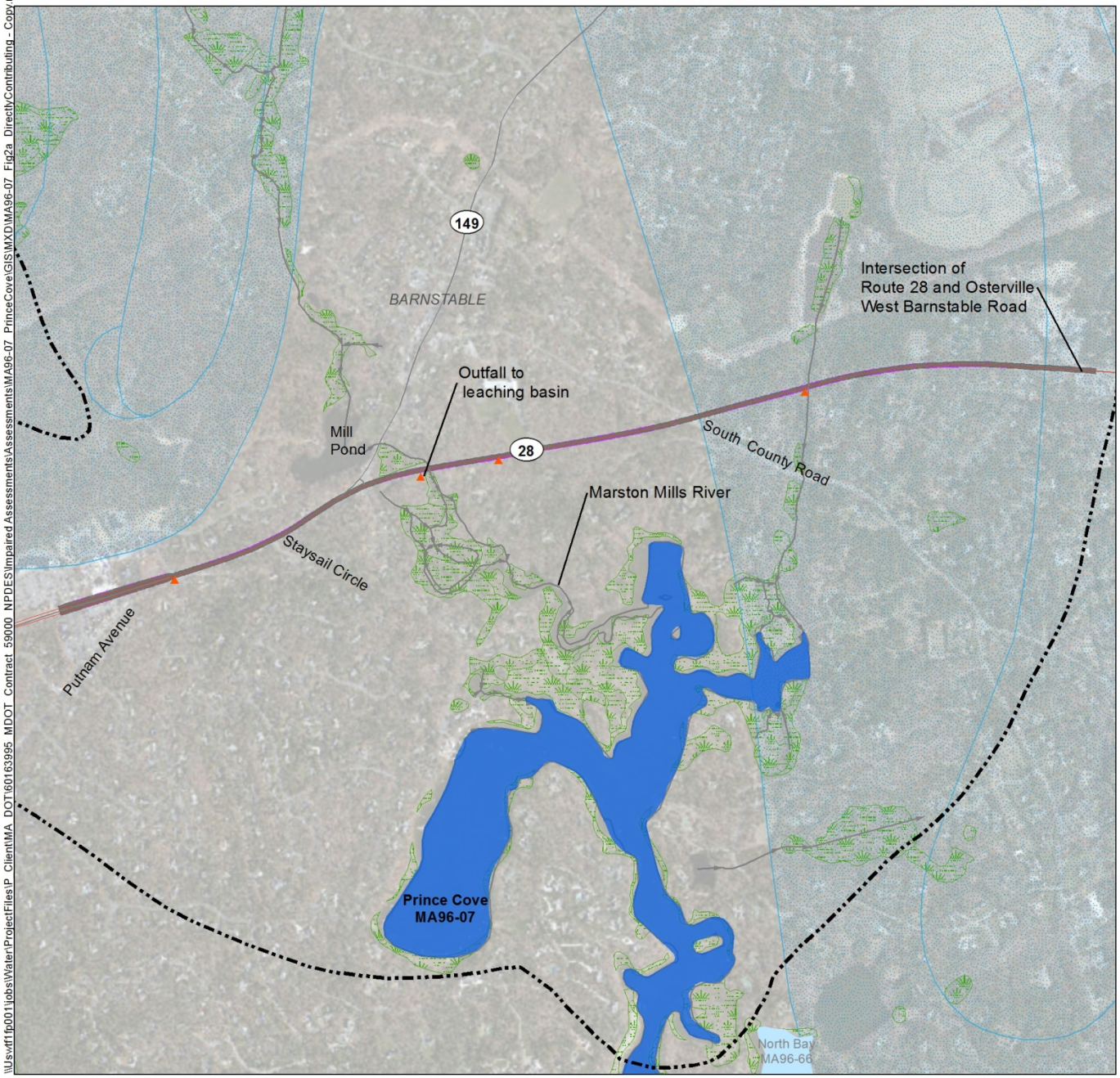

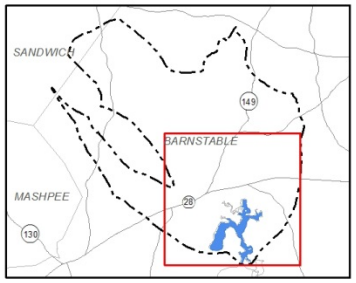

- MassDOT Outfalls
- Groundwatershed
- Assessed Segment
- Impaired Lakes
- Impaired Streams
- MassDOT Pervious Area
- MassDOT Impervious Area
- Zone II Wellhead Protection Areas
- DEP Wetlands
- Non-Impaired Streams

N

0 600 1,200 Feet

Figure 2

Prince Cove (MA96-07)
MassDOT Contributing Area

December 2014

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12/08/2014

Impaired Waters Assessment for Red Lily Pond (MA96257)

Summary

Impaired Water[1]	Stormwater Impairments:	*Fecal Coliform; Nutrient/Eutrophication Biological Indicators*
	Category:	*5 (Waters requiring a TMDL)*
	Final TMDLs:	*None*
	WQ Assessment:	*Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[2]
Location	Towns:	*Barnstable*
	MassDOT Roads:	*Route 28*
Assessment Method(s)	7R (TMDL Method) ☐	7U (Non-TMDL Method) ☒
BMPs	Existing:	*None*
MassDOT Area and Targets		Nitrogen
	Estimated MassDOT Load:	*5.4 lbs/yr*
	Existing Load to Water Body:	*1,830 lbs/yr*
	MassDOT Contribution to Existing Load:	*0.30 %*

Site Description

An assessment for Red Lily Pond (MA96257) was previously submitted to the EPA on June 8, 2011 as a no discharge assessment. However, Red Lily Pond is now being evaluated on a groundwatershed delineation, so it has been reassessed herein using BMP 7U Nitrogen[3] methodology.

[1] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[2] MassDEP, 2011.Cape Cod Coastal Drainage Areas 2004-2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

[3] MassDOT, 2014. *Application of BMP 7U to Nitrogen in Groundwater-Controlled Massachusetts Watersheds*.

Red Lily Pond is a 4-acre pond that is connected to Lake Elizabeth by a corrugated metal culvert located in Barnstable, Massachusetts. Figure 1 illustrates the groundwatershed for Red Lily Pond (MA96257). The groundwatershed for this impaired segment is based on technical reports[2] developed by the Massachusetts Estuaries Project (MEP) which serve as the basis for the development of Total Maximum Daily Loads. The MEP team includes technical staff from USGS and the Cape Cod Commission and works collaboratively with MassDEP and the University of Massachusetts Dartmouth School of Marine Science and Technology (SMAST). For groundwatershed assessments, if a discharge occurs inside the groundwatershed boundary, it is considered to be a discharge that contributes to the impaired segment. If the discharge point is outside of the groundwatershed boundary, it is not considered to contribute to the impaired segment. MassDOT property that contributes runoff or infiltration within the groundwatershed area is considered in this assessment as contributing to Red Lily Pond (MA96257).
MassDEP's Water Quality Assessment Report titled *Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[4] identifies the Aquatic Life, Primary Contact, Secondary Contact and Aesthetic Uses are designated as "impaired" for Red Lily Pond (MA96257). These uses are impaired due to excessive aquatic macrophyte growth within the Pond. The Fish Consumption use was not assessed.

Figure 2 illustrates the MassDOT road within the groundwatershed that contributes runoff to the water body. Route 28 traverses the groundwatershed boundary north of Red Lily Pond. Approximately 0.7 acres of impervious roadway drains to the groundwatershed via overland flow, infiltration or catchbasins and pipes; therefore, the section of roadway is considered discharging to Red Lily Pond (MA96257). Approximately 0.5 acres of pervious surface adjacent to the roadways is considered contributing to the water body as runoff via overland flow infiltrates into the ground within the boundaries of the groundwatershed.

Existing BMPs

MassDOT did not identify any existing BMPs in place to treat roadway runoff from the discharging area before reaching the impaired water segment.

Assessment

In cases where a TMDL has been approved, MassDOT assesses the water body for the impairments covered by the TMDL under the BMP 7R methodology.[5] MassDOT separately assesses the water body for any stormwater-related impairments that are not covered by the TMDL under the BMP 7U methodology.[6] MassDOT assessed Red Lily Pond (MA96257) using the methodologies described below.

This assessment has been completed based on the Massachusetts Year 2012 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.[7] MassDEP has released a Proposed Massachusetts Year 2014

[4] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

[5] Massachusetts Department of Transportation (MassDOT), July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

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

[7] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

Integrated List[8] which has been reviewed for any proposed changes to the condition of the water bodies. The condition of Red Lily Pond is not proposed to change.

BMP 7U for Nitrogen

MassDOT assessed the contribution of nitrogen from MassDOT properties to this water body using the approach described in BMP 7U[9] of MassDOT's Storm Water Management Plan (Water Quality Impaired Waters Assessment and Mitigation Plan), which applies to impairments that have not been addressed by a TMDL, and MassDOT's application of BMP 7U to nitrogen in groundwater-controlled watersheds.[10] The MEP technical report identifies the total existing groundwatershed nitrogen loading from the groundwatershed for this water body, and identifies that estuarine degradation is a result of excess nitrogen loading to the groundwatershed. Therefore, MassDOT considers the following impairments to Red Lily Pond (MA96257) to be linked to elevated nitrogen: nutrient/eutrophication biological indicators.

For the nitrogen assessment under BMP 7U, MassDOT used USGS modeling[11] to estimate annual pollutant loads from its property. Based on the USGS SELDM model, which was run using precipitation data from the Hyannis site and an average of water quality data from Harwich and Marion, MassDOT estimates the nitrogen loading from impervious areas as 6.2 lbs/acre/yr and from pervious areas as 2.5 lbs/acre/yr.[10] The nitrogen loading for MassDOT property in the contributing area is summarized below:

- MassDOT Impervious Area: 0.7 acres
- MassDOT Pervious Area: 0.5 acres
- Estimated Existing MassDOT Load: 5.4 lb/yr
- Total Existing Groundwatershed Nitrogen Load: 1,830 lb/yr
- MassDOT Existing Load as a Percentage of Total Groundwatershed Nitrogen Load: 0.30%

The MassDOT existing load compared to the total groundwatershed nitrogen load is very small and considered negligible based on MassDOT's Nitrogen TMDL Method because it is less than 3.5% of the total nitrogen groundwatershed load.[9] In general, in areas where the MassDOT load is determined to be negligible, MassDOT does not implement BMPs because of their minimal impact on the overall groundwatershed load.

BMP 7U for Pathogen Impairment

MassDOT assessed the indicator bacteria (fecal coliform) impairment using the approach described in BMP 7U of MassDOT's Storm Water Management Plan (SWMP).

Pathogen concentrations in stormwater vary widely and concentrations can vary by an order of magnitude within a given storm event at a single location making it difficult to predict pathogen

[8] MassDOT, June 2014. Massachusetts Year 2014 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. Massachusetts. Available at http://www.mass.gov/eea/docs/dep/water/resources/07v5/14iwlistp.pdf

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

[10] MassDOT, 2014. *Application of BMP 7U to Nitrogen in Groundwater-Controlled Massachusetts Watersheds*.

[11] Granato, G.E., 2013, Stochastic empirical loading and dilution model (SELDM) version 1.0.0: U.S. Geological Survey Techniques and Methods, book 4, chap. C3, 112 p. Available at: http://pubs.usgs.gov/tm/04/c03

concentrations in stormwater with accuracy. MassDOT generally will not conduct site specific assessments of pathogen loading for each water body impaired for pathogens but instead developed an iterative adaptive management approach to address impaired waters and permit condition requirements and an approach to stormwater management. Greater detail of the assessment methodology is provided in MassDOT's BMP 7U Pathogen Methodology.[12]

Proposed Mitigation Plan

As described above, MassDOT's nitrogen contribution to the receiving water is negligible. Therefore, MassDOT has no plans to implement structural BMPs to control nitrogen in stormwater runoff from their property.

With respect to the fecal coliform impairment, 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. As discussed in MassDOT's BMP 7UPathogen Methodology, [11] MassDOT believes that existing efforts are consistent with the current and draft MS4 permit requirements in regard to pathogens.

In addition, as part of its pet waste management program, MassDOT has determined that no MassDOT targeted rest stops are located within the groundwatershed of this water body. MassDOT will be installing signs at rest stops within the groundwatershed of impaired water bodies. The signs will inform the public of the need to remove pet waste, which can minimize contributions of pathogens to stormwater runoff. Pet waste removal bags and disposal cans will be provided

Furthermore, MassDOT has an ongoing inspection and monitoring program aimed at identifying and addressing illicit discharges to MassDOT's stormwater management system. MassDOT investigates any suspicious flows noted, and will work with owners of confirmed illicit discharges to remove these flows, and thereby minimize the possibility of pathogen contributions to receiving waters. At present, there are no suspected or known illicit discharges, or unauthorized drainage tie-ins, within the groundwatershed of this water body that could be contributing pathogens to the impaired water body.

MassDOT has concluded that the BMPs outlined in the SWMP are consistent with its existing permit requirements for the Red Lily Pond. These measures achieve pathogen reductions (including fecal coliform) to the maximum extent practicable and are consistent with the intent of its existing stormwater permit. As stated previously, pathogen loadings are highly variable and although there is potential for stormwater runoff from MassDOT roadways to be a contributing source it is unlikely to warrant action relative to other sources of pathogens in the groundwatershed.

MassDOT will continue to ensure proper non-structural BMPs are being implemented within the groundwatershed of Red Lily Pond, including regular roadway and drainage system maintenance, erosion and sedimentation control, and outreach and education. As described in MassDOT's Stormwater Handbook,[13] MassDOT does not use nitrogen based fertilizers as part of normal operations and maintenance procedures. In the rare circumstance where fertilizers are used, it is for the occasional vegetation establishment associated with recent ground disturbance. Further work by MassDOT 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

[12] MassDOT. December 2014. Description of MassDOT's Application of BMP 7U for Pathogen Related Impairments.

[13] MassDOT, May 2004. The MassHighway Storm Water Handbook for Highways and Bridges. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/wetlands/Stormwater_Handbook.pdf

include an update in NPDES permit annual reports to EPA regarding proposed BMP design either through retrofit or programmed projects, plans for construction of BMPs, reduction achieved by finalized BMP designs and progress made towards meeting target reductions.

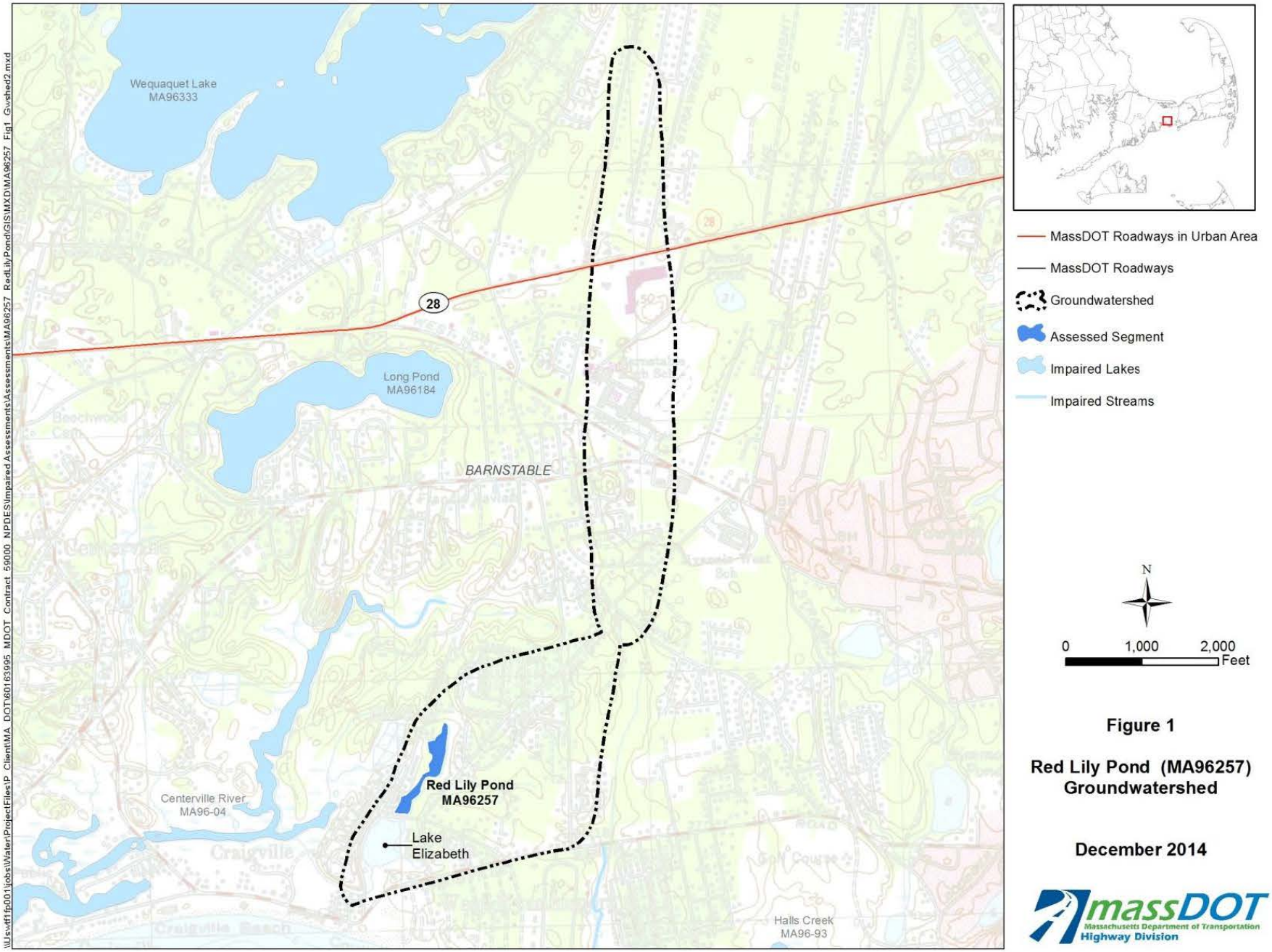

Figure 1

Red Lily Pond (MA96257)
Groundwatershed

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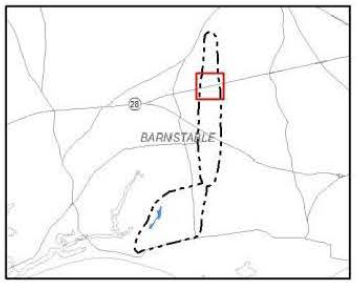

- MassDOT Outfalls
- MassDOT Roadways in Urban Area
- Groundwatershed
- MassDOT Impervious Area
- MassDOT Pervious Area

N

0 100 200 Feet

Figure 2

Red Lily Pond (MA96257)
MassDOT Contributing Area

December 2014

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Highway Division

Impaired Waters Assessment for Popponesset Bay (MA96-40)

Summary

Impaired Water[1]	Stormwater Impairments:	*Estuarine Bioassessments*
	Category:	*4A (TMDL is completed)*
	Final TMDLs:	*Final Popponesset Bay Total Maximum Daily Loads for Total Nitrogen (CN 217.0)* [2]
	WQ Assessment:	*Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[3]
Location	Towns:	*Barnstable and Mashpee*
	MassDOT Roads:	*Route 28 and Route 130*
Assessment Method(s)	7R (TMDL Method) ☒	7U (Non-TMDL Method) ☐
BMPs	Existing:	*Infiltration Basin*
MassDOT Area and Targets		Nitrogen
	Estimated MassDOT Load:	*179.3 lbs/yr*
	Existing Load to Water Body:	*74,076 lbs/yr*
	Reduction provided by Existing BMPs:	*10.5 lbs/yr*
	MassDOT Contribution to Existing Load:	*0.23%*

Site Description

An assessment for Popponesset Bay (MA96-40) was previously submitted to the EPA on June 8, 2011 as a no discharge assessment. However, Popponesset is now being evaluated on a

[1] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[2] Mass DEP, 2006. Final Popponesset Bay Total Maximum Daily Loads for Total Nitrogen, Massachusetts (CN 217). Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/popptmdl.pdf

[3] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

groundwatershed delineation, so it has been reassessed herein using BMP 7R Nitrogen[4] methodology.

Popponesset Bay (MA96-40) is a water body in Barnstable and Mashpee, Massachusetts that covers approximately 0.68 square miles. The water body extends from its sources at the Mashpee River (MA96-24) and Shoestring Bay (MA96-08) and flows southeast to the inlet of Nantucket Sound, including Ockway Bay and Pinquickset Cove (Figure 1). Figure 1 illustrates the groundwatershed for Popponesset Bay (MA96-40). The groundwatershed for this impaired segment is based on technical reports[5] developed by the Massachusetts Estuaries Project (MEP) which serve as the basis for the development of Total Maximum Daily Loads. The MEP team includes technical staff from USGS and the Cape Cod Commission and works collaboratively with MassDEP and the University of Massachusetts Dartmouth School of Marine Science and Technology (SMAST). For groundwatershed assessments, if a discharge occurs inside the groundwatershed boundary, it is considered to be a discharge that contributes to the impaired segment. If the discharge point is outside of the groundwatershed boundary, it is not considered to contribute to the impaired segment. MassDOT property that contributes runoff or infiltration within the groundwatershed area is considered in this assessment as contributing to Popponesset Bay (MA96-40).

Land use in the Popponesset Bay (MA96-40) groundwatershed is primarily residential and recreational in the vicinity of the coast and residential and forested in the northern portion of the groundwatershed. Popponesset Bay groundwatershed has seen rapid and extensive development of single family homes, which has transformed forest to suburban use and increased prevalence of on-site wastewater treatment systems. The Town of Mashpee has a NPDES permit to discharge to Popponesset Bay (MAR041129).[6]

MassDEP's Water Quality Assessment Report titled *Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[6] identifies the Aquatic Life Use as "impaired" for Popponesset Bay (MA96-40). The "impaired" status for the Aquatic Life Use is reported to be caused by loss of eelgrass habitat (estuarine bioassessment) and the source is subsurface wastewater disposal (septic) systems, stormwater runoff (unspecified urban stormwater and discharges from municipal separate storm sewer systems) and fertilizers (yard maintenance, agriculture, golf courses). The Shellfish Harvesting and Primary and Secondary Contact Recreational Uses are identified as "support". The Fish Consumption and Aesthetics Uses were not assessed.

Figures 2a, 2b, and 2c illustrate the MassDOT-owned urban road within the groundwatershed that contributes runoff to the water body. Route 28 traverses the groundwatershed boundary north of Popponesset Bay (MA96-40). Route 130 intersects with Route 28 near the eastern boundary of the groundwatershed. All of Route 28 and the MassDOT urban portion of Route 130 within the groundwatershed discharge to the Popponesset Bay (MA96-40) groundwatershed (Figure 2c and 3). In general, catch basins collect flow along both roads and connect to trunk lines located along Route 28 that discharge to the shoulders of Route 28 via several outfalls. Drainage along Route 28 is described in more detail below.

[4]MassDOT, March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[5] University of Massachusetts Dartmouth and MassDEP, September 2004. Massachusetts Estuaries Project Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for the Popponesset Bay, Mashpee and Barnstable, Massachusetts. Available at: http://www.oceanscience.net/estuaries/report/Popponesset/PopponessetMEPrpt_final.pdf

[6] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

The majority of the urban road is curbed with asphalt berm. The northbound lane of Route 28 occasionally has raised granite curbing. Some sheet flow likely drains overland to the shoulder of the roadway in areas where there are no berms and curbs. Route 28 is primarily a two lane road, with the exception of major intersections where the road widens for turning lanes (including the intersections of Shellback Way and Charles Street, and Donnas Lane and Jobs Fishing Road). Sidewalks are located on both sides of the road in the vicinity of these intersections (Figure 2a).

Based on a field visit, runoff from an additional 2,500 feet southwest (to the intersection with Dover Road) and 350 feet northeast (to the intersection with Anchor Lane) along Route 28, located beyond the groundwatershed boundaries, flows back into the groundwatershed (via catch basins that collect flow and connect to the trunk lines located within Route 28 mentioned above) and is considered “Supplemental DOT Contributing Areas”. Any impervious area located outside the groundwatershed boundary that flows back into the groundwatershed via sheet flow, drainage pipes, or other means is considered “Supplemental”. These portions of roadway are shown in Figure 2a.

Runoff is also collected via trunk line and carried to an existing infiltration basin from a high point located approximately 1,000 feet southwest of the basin (in the vicinity of Quippish Road) (Figure2c) (details regarding this infiltration basin are included in the “Existing BMPs” section below). This infiltration basin has no visible outlet control structure. Runoff from the other side of this high point flows southwest to a cluster of leaching catch basins located in the vicinity of Cape Drive. Runoff from a high point located southwest of Cape Drive also flows to this infiltration basin. Runoff to the southwest of this high point is collected in catch basins connected to a trunk line that continues to a culvert where a non-impaired stream (Quaker Run) crosses under Route 28 (Figure 2b). Runoff also flows from a high point at Orchard Road northeast to Quaker Run via trunk line. From the high point at Orchard Road, runoff flows southwest via trunk line to a series of catch basins and an outfall on the northbound side of the road located at a large culvert where a non-impaired section of the Mashpee River crosses under the road. Runoff also flows from a high point immediately northeast of the rotary via trunk line to the non-impaired segment of the Mashpee River. Runoff from within the rotary to the watershed boundary is collected in catch basins and carried via trunk line to an outfall located adjacent to the electric easement that crosses Route 28 southwest of Charles Street (Figure 2a).

From the eastern boundary of the groundwatershed, runoff is collected in catch basins that drain via trunk line to an outfall located west (and offset from the roadway) of the southbound lane, southwest of Santuit Newton Road. Runoff also flows to this outfall from a high point located approximately 300 feet northeast of Sandalwood Drive (Figure 2c). Runoff flows southwest from this high point approximately 1,300 feet (past the intersection with Route 130 and over the non-impaired section of the Santuit River) via trunk line to an existing infiltration basin (approximately 115 feet long by 25 feet wide and 4 feet deep) located adjacent to the northbound lane (details regarding this infiltration basin are included in the “Existing BMPs” section below).

Existing BMPs

As previously mentioned, an existing infiltration basin is located approximately 350 feet southwest of the intersection of Route 130 and Route 28, approximately 20 feet south of the northbound lane of Route 28 (Figure 3). The existing infiltration basin (as shown in Photo 1) is approximately 115 feet long by 25 feet wide by 4 feet deep (estimated), with two inlets (as described above and as shown on Figure 3) and no visible outlet.

Photo 1. Infiltration basin adjacent to Route 28.

The infiltration basin receives drainage from Route 130 and Route 28 in this area (from a highpoint on Route 28 located 300 feet northeast of Sandalwood Drive to the high point located in the vicinity of Quippish Road, as described above, including the entire urban portion of Route 130 within the groundwatershed).

MassDOT estimated the pollutant load reduction provided by existing BMPs by applying treatment reductions to existing BMPs based on their size, function and contributing watershed. BMP performances were derived from EPA Region 1's BMP performance analysis report[7] and engineering judgment. The table below shows the existing BMP, the MassDOT drainage areas and the pollutant load reductions.

The following table shows how the TMDL WLA applies to the MassDOT directly discharging area.

Table 1 Annual MassDOT Groundwatershed Nitrogen Loading under Existing Conditions

Groundwatershed/ BMP ID	Contributing Groundwatershed Size (acres)	Pre-BMP Annual Load (lbs/yr)	BMP Pollutant Load Reduction (lbs/yr)	Post-BMP Annual Load (lbs/yr)	Estimated Annual Removal Efficiency
Existing BMP 1	3.3	18.8	10.5	8.3	56%

[7] United States Environmental Protection Agency (USEPA), March 2010. Stormwater Best Management Practices (BMP) Performance Analysis. Available at: http://www.epa.gov/region1/npdes/stormwater/assets/pdfs/BMP-Performance-Analysis-Report.pdf

Assessment

In cases where a TMDL has been approved, MassDOT assesses the water body for the impairments covered by the TMDL under the BMP 7R methodology.[8] MassDOT separately assesses the water body for any stormwater-related impairments that are not covered by the TMDL under the BMP 7U methodology.[9] MassDOT assessed Popponesset Bay (MA96-40) using the methodologies described below.

This assessment has been completed based on the Massachusetts Year 2012 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.[10] MassDEP has released a Proposed Massachusetts Year 2014 Integrated List[11] which has been reviewed for any proposed changes to the condition of the water bodies. The condition of Popponesset Bay is not proposed to change.

BMP 7R for Nitrogen TMDL (CN 217.0)

The *Total Maximum Daily Load (TMDL) for Total Nitrogen in the Popponesset Bay (CN 217)*[12] identifies the total existing groundwatershed nitrogen load for this water body and attributes Estuarine Bioassessments to excess nitrogen loading from the groundwatershed. Therefore, MassDOT assessed the contribution of nitrogen from MassDOT properties to this water body using the approach described in BMP 7R[13] of MassDOT's Storm Water Management Plan (Water Quality Impaired Waters Assessment and Mitigation Plan), which applies to impairments that have been addressed by a TMDL, and MassDOT's application of BMP 7R to nitrogen in groundwater-controlled watersheds.[14]

For the nitrogen assessment under BMP 7R, MassDOT used USGS modeling[15] to estimate annual pollutant loads from its property. Based on the USGS SELDM model, which was run using precipitation data from the Hyannis site and an average of water quality data from Harwich and Marion, MassDOT estimates the nitrogen loading from impervious areas as 6.2 lbs/acre/yr and from pervious areas as 2.5 lbs/acre/yr.[14] The nitrogen loading for MassDOT property in the contributing area is summarized below:

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[8] Massachusetts Department of Transportation (MassDOT), July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

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

[10] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[11] MassDEP, June 2014. Massachusetts Year 2014 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/14iwlistp.pdf

[12] Mass DEP.2006. Final Popponesset Bay Total Maximum Daily Loads for Total Nitrogen, Massachusetts (CN 217). Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/popptmdl.pdf

[13] MassDOT, July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

[14] MassDOT, March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[15] Granato, G.E., 2013, Stochastic empirical loading and dilution model (SELDM) version 1.0.0: U.S. Geological Survey Techniques and Methods, book 4, chap. C3, 112 p. Available at: http://pubs.usgs.gov/tm/04/c03

- MassDOT Impervious Area: 25.0 acres
- MassDOT Pervious Area: 9.8 acres
- Estimated Existing MassDOT Load: 179.3 lbs/yr
- Total Existing Groundwatershed Nitrogen Load: 74,076 lbs/yr
- Reduction provided by Existing BMPs: 10.5 lbs/yr
- Total MassDOT Load: 168.8 lbs/yr
- MassDOT Existing Load as a Percentage of Total Groundwatershed Nitrogen Load: 0.23 %

The MassDOT existing load compared to the total groundwatershed nitrogen load is very small and considered negligible based on MassDOT's Nitrogen TMDL Method because it is less than 3.5% of the total nitrogen groundwatershed load.[16] In general, in areas where the MassDOT load is determined to be negligible, MassDOT does not implement BMPs because of their minimal impact on the overall groundwatershed load.

Proposed Mitigation Plan

As described above, MassDOT's Nitrogen contribution to the receiving water is negligible. Therefore, MassDOT has no plans to implement structural BMPs to control nitrogen in stormwater runoff from their property.

MassDOT will continue to ensure proper non-structural BMPs are being implemented within the groundwatershed of the water body, including regular roadway and drainage system maintenance, erosion and sedimentation control, street sweeping, and outreach and education. As described in MassDOT's Stormwater Handbook,[17] MassDOT does not use nitrogen based fertilizers as part of normal operations and maintenance procedures. In the rare circumstance where fertilizers are used, it is for the occasional vegetation establishment associated with recent ground disturbance. Further work by MassDOT 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 NPDES permit annual reports to EPA regarding proposed BMP design either through retrofit or programmed projects, plans for construction of BMPs, reduction achieved by finalized BMP designs and progress made towards meeting target reductions.

[16] MassDOT, March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[17] MassDOT, May 2004. The MassHighway Storm Water Handbook for Highways and Bridges. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/wetlands/Stormwater_Handbook.pdf

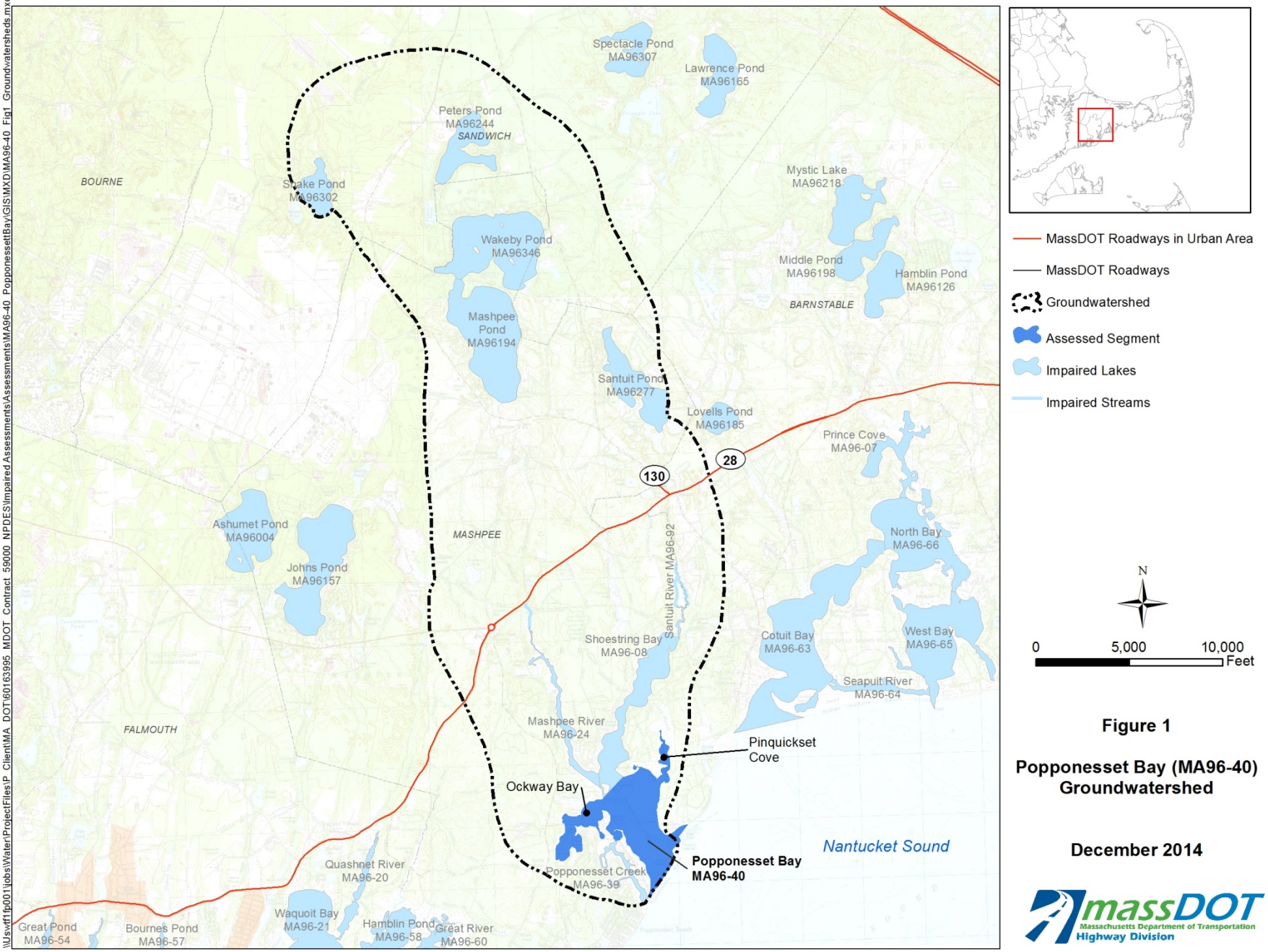
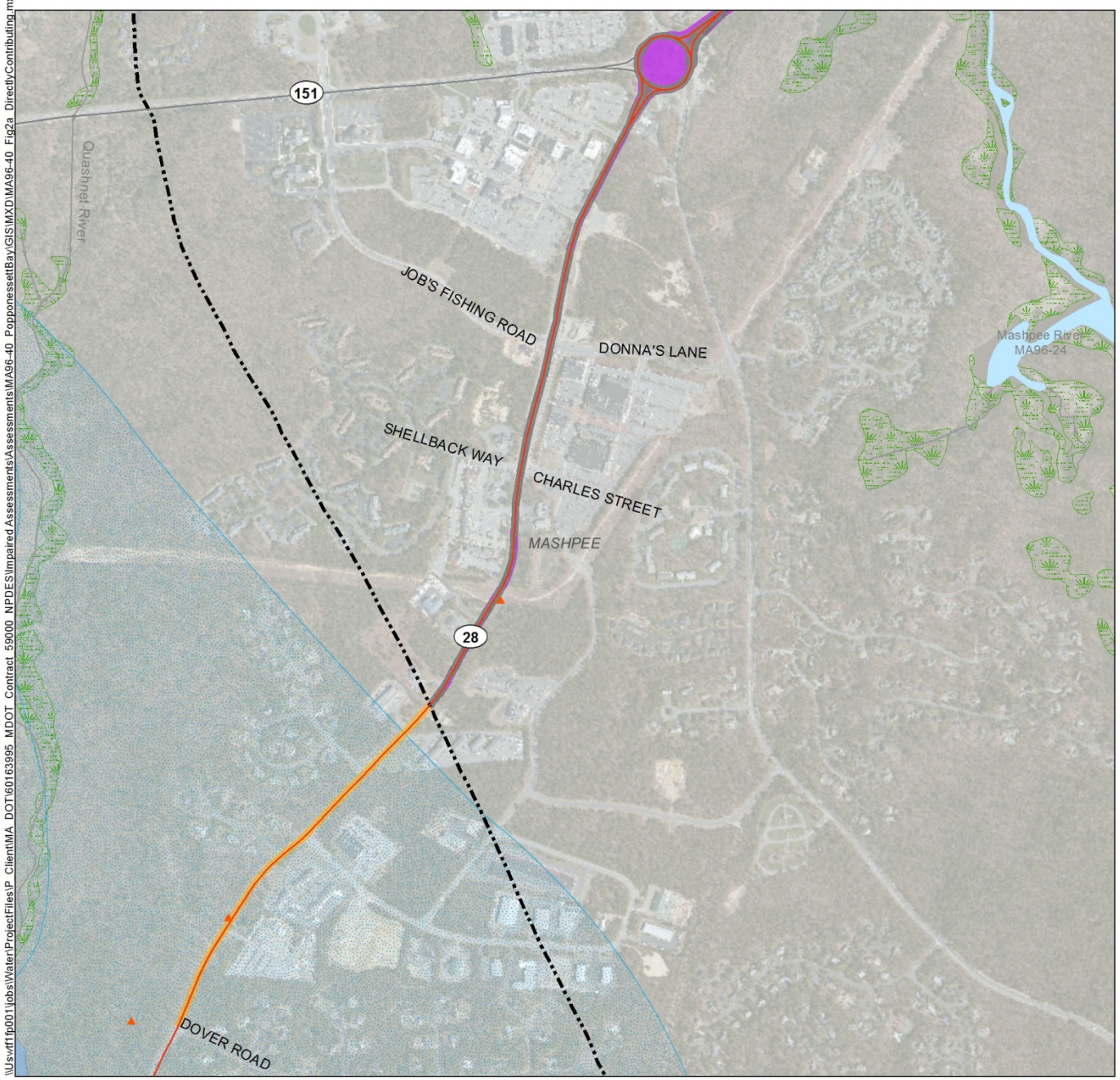
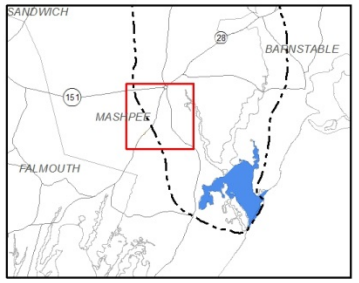


Figure 1

Popponesset Bay (MA96-40) Groundwatershed

December 2014





- MassDOT Roadways in Urban Area
- Assessed Segment
- Impaired Lakes
- Impaired Streams
- MassDOT Supplemental Contributing Area
- MassDOT Impervious Area
- MassDOT Pervious Area
- Zone II Wellhead Protection Areas
- DEP Wetlands

N

0 500 1,000 Feet

Figure 2a

Popponesset Bay (MA96-40)
MassDOT Contributing Area

December 2014

massDOT
Massachusetts Department of Transportation
Highway Division

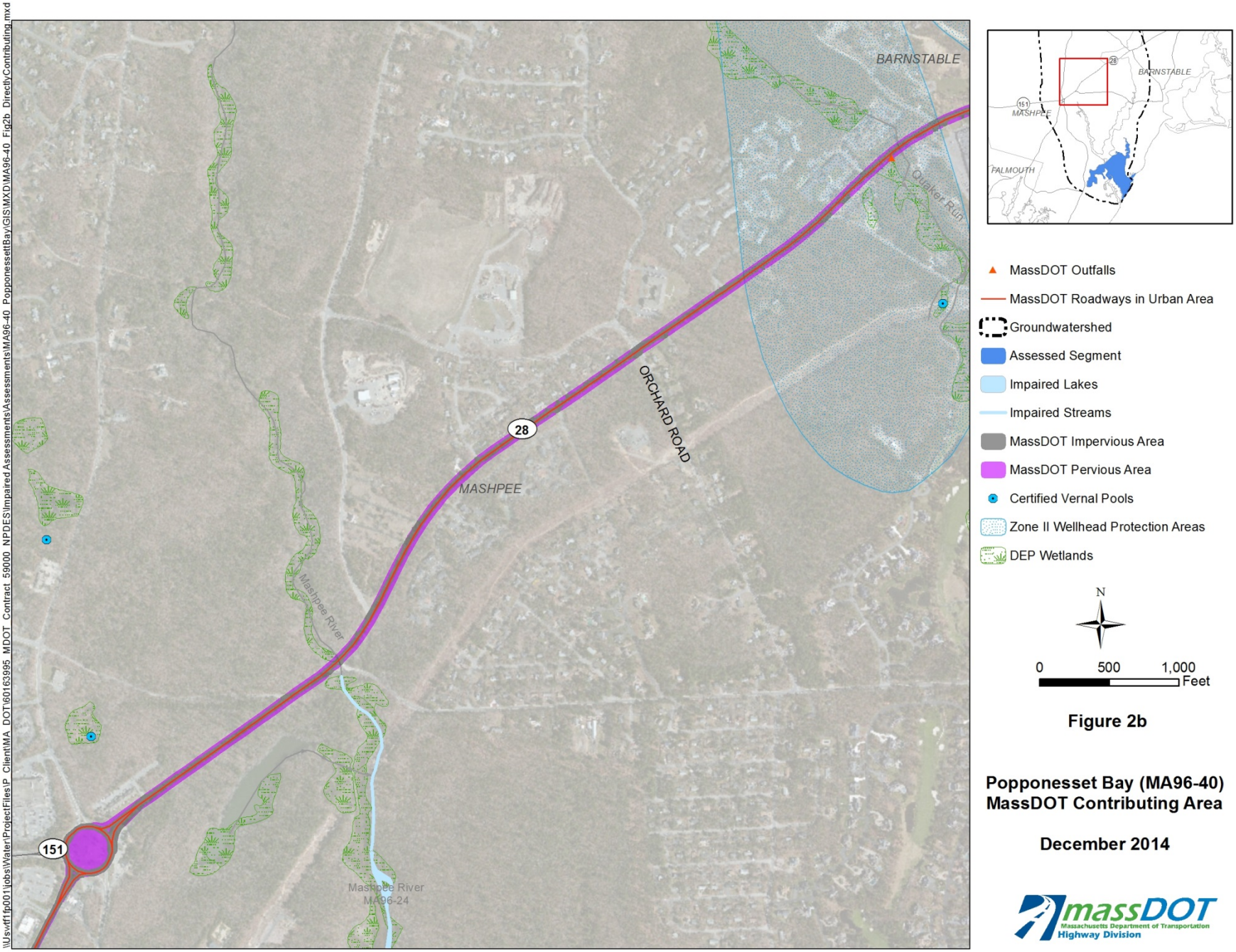


Figure 2b

Popponesset Bay (MA96-40)
MassDOT Contributing Area

December 2014

massDOT
Massachusetts Department of Transportation
Highway Division

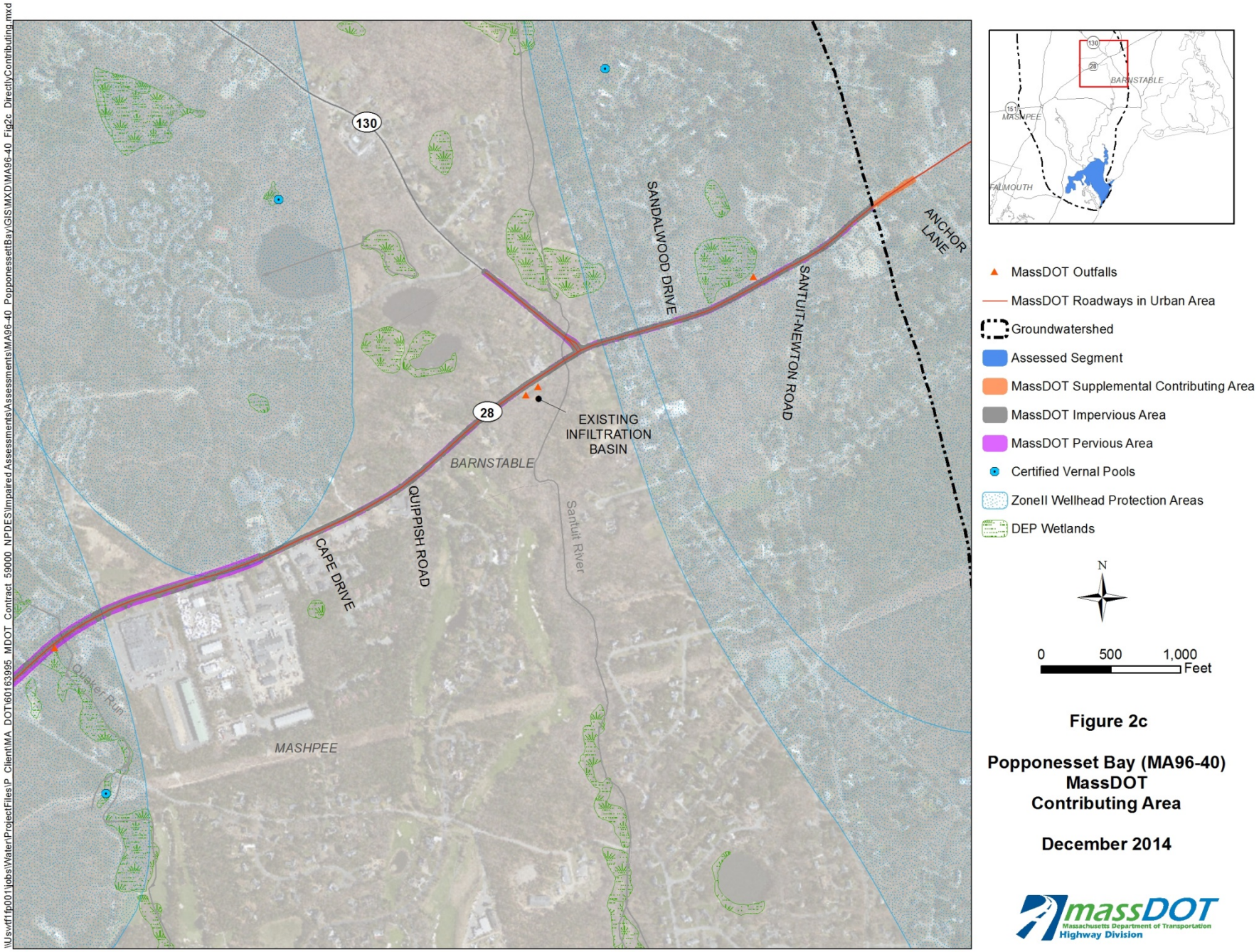
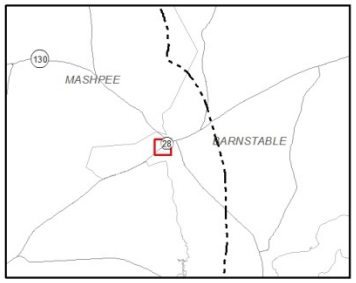


Figure 2c

Popponesset Bay (MA96-40)
MassDOT
Contributing Area

December 2014

massDOT
Massachusetts Department of Transportation
Highway Division



- MassDOT Outfalls
- MassDOT Roadways in Urban Area
- MassDOT Roadways
- Proposed/Existing BMPs
- MassDOT Impervious Area
- MassDOT Pervious Area
- Non-Impaired Streams

N

0 50 100 Feet

Figure 3

Popponesset Bay (MA96-40)
Existing BMPs

December 2014

massDOT
Massachusetts Department of Transportation
Highway Division

12/08/2014

Impaired Waters Assessment for Ryder Cove (MA96-50)

Summary

Impaired Water[1]	Stormwater Impairments:	*Estuarine Bioassessments, Fecal Coliform, Nitrogen (Total)*
	Category:	*4A (TMDL is completed)*
	Final TMDLs:	*Final Pleasant Bay System TMDL for Total Nitrogen*[2]
		Final Pathogen TMDL for the Cape Cod Watershed[3]
	WQ Assessment:	*Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[4]
Location	Towns:	*Chatham*
	MassDOT Roads:	*Route 28*
Assessment Method(s)	7R (TMDL Method) ☒	7U (Non-TMDL Method) ☐
BMPs	Existing:	*None*
MassDOT Area and Targets		Nitrogen
	Estimated MassDOT Load:	*34.4 lbs/yr*
	Existing Load to Water Body:	*18,897 lbs/yr*
	MassDOT Contribution to Existing Load:	*0.18 %*

Site Description

An assessment for Ryder Cove (MA96-50) was previously submitted to the EPA on June 8, 2011

[1] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[2] MassDEP. 2007. Final Pleasant Bay System TMDL for Total Nitrogen. Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/pbtmdl.pdf

[3] MassDEP. 2009. Final Pathogen TMDL for the Cape Cod Watershed. Available at: http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/capecod1.pdf

[4] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

using the BMP 7R[5] methodology However, Ryder Cove is now being evaluated on a groundwatershed delineation, so it has been reassessed herein using BMP 7R Nitrogen[6] methodology.

Ryder Cove is a 0.19 square mile water body located north of Route 28 in Chatham, Massachusetts. Figure 1 illustrates the groundwatershed for Ryder Cove (MA96-50). The groundwatershed for this impaired segment is based on technical reports[7] developed by the Massachusetts Estuaries Project (MEP) which serve as the basis for the development of Total Maximum Daily Loads. The MEP team includes technical staff from USGS and the Cape Cod Commission and works collaboratively with MassDEP and the University of Massachusetts Dartmouth School of Marine Science and Technology (SMAST). For groundwatershed assessments, if a discharge occurs inside the groundwatershed boundary, it is considered to be a discharge that contributes to the impaired segment. If the discharge point is outside of the groundwatershed boundary, it is not considered to contribute to the impaired segment. MassDOT property that contributes runoff or infiltration within the groundwatershed area is considered in this assessment as contributing to Ryder Cove (MA96-50).

MassDEP's Water Quality Assessment Report titled *Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[8] identifies the Aquatic Life Use as "impaired" and 0.02 square miles of the groundwatershed as "impaired" for the Shellfish Harvesting Use in Ryder Cove (MA96-50). The Aquatic Life Use "impaired" status is reported to be caused by on-site subsurface wastewater disposal (septic) systems, stormwater runoff (unspecified urban stormwater and discharges from municipal separate storm sewer systems) and fertilizers (yard maintenance). The Shellfish Harvesting Use "impaired" status is reported to be due to marina/boating pump-out releases and upstream sources. The other uses were not assessed. In addition, the MEP technical report[5] identifies the total nitrogen loading from the groundwatershed for this water body, and identifies that estuarine degradation is a result of excess nitrogen loading to the groundwatershed.

Figures 2a and 2b illustrate the MassDOT road within the groundwatershed that contributes runoff to the water body. Ryder Cove is located within the Pleasant Bay Area of Critical Environmental Concern (ACEC). Route 28 bisects the groundwatershed south of Ryders Cove. Approximately 4.6 acres of impervious roadway area and 2.3 acres of pervious area within the right-of-way drains to the groundwatershed via overland flow, curb cuts, infiltration or catchbasins and pipes; therefore, the section of roadway is considered discharging to Ryder Cove (MA96-50). Most outfalls are either small, localized systems with one or two catchbasins and an outfall or curb cuts at a low point in the roadway where sheet flow is allowed to drain overland to the shoulder of the roadway. Impervious area located outside the groundwatershed boundary that flows back into the groundwatershed via sheet flow, drainage pipes, or other means is considered "Supplemental Contributing Area". Due to a high point observed during a site visit, approximately 40 feet north of the groundwatershed boundary, 0.03 acres of impervious from outside of the groundwatershed sheet flows south into the ground watershed and discharges at a low point within the groundwatershed. This area is shown Figures 2a and 2b.

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[5] MassDOT, July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

[6] MassDOT. March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[7] University of Massachusetts Dartmouth and MassDEP, 2006. Massachusetts Estuaries Project Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Oyster Pond System, Falmouth, Massachusetts. Available at: http://www.oceanscience.net/estuaries/OysterPond.htm

[8] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

Existing BMPs

MassDOT did not identify any existing BMPs in place to treat roadway runoff from the directly discharging area before reaching the impaired water segment.

Assessment

In cases where a TMDL has been approved, MassDOT assessed the water body for the impairments covered by the TMDL under the BMP 7R methodology. MassDOT separately assesses the water body for any stormwater-related impairments that are not covered by the TMDL under the BMP 7U methodology. MassDOT assessed Ryder Cove (MA96-50) using the methodologies described below.

This assessment has been completed based on the Massachusetts Year 2012 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.[9] MassDEP has released a Proposed Massachusetts Year 2014 Integrated List[10] which has been reviewed for any proposed changes to the condition of the water bodies. The condition of MA96-50 is not proposed to change.

BMP 7R for Nitrogen TMDL (CN 244.0)

The *Total Maximum Daily Load (TMDL) for Total Nitrogen in the Pleasant Bay System, Massachusetts (CN 244.0)* [11] identifies the total existing groundwatershed nitrogen load for this water body and attributes estuarine degradation to excess nitrogen loading from the groundwatershed. Therefore, MassDOT considers the following impairments to Ryder Cove (MA96-50) to be linked to elevated nitrogen: nitrogen (total) and estuarine bioassessments. MassDOT assessed the contribution of nitrogen from MassDOT properties to this water body using the approach described in BMP 7R[12] of MassDOT's Storm Water Management Plan (Water Quality Impaired Waters Assessment and Mitigation Plan), which applies to impairments that have been addressed by a TMDL, and MassDOT's application of BMP 7R to nitrogen in groundwater-controlled watersheds.[13]

For the nitrogen assessment under BMP 7R, MassDOT used USGS modeling[14] to estimate annual pollutant loads from its property. Based on the USGS SELDM model, which was run using precipitation data from the Hyannis site and an average of water quality data from Harwich and Marion, MassDOT estimates the nitrogen loading from impervious areas as 6.2 lbs/acre/yr and from

[9] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[10] MassDEP, June 2014. Massachusetts Year 2014 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/14iwlistp.pdf

[11] MassDEP. 2007. Final Pleasant Bay System TMDL for Total Nitrogen. Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/pbtmdl.pdf

[12] MassDOT. July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

[13] MassDOT. March 7, 2014. *Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds*. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[14] Granato, G.E., 2013, Stochastic empirical loading and dilution model (SELDM) version 1.0.0: U.S. Geological Survey Techniques and Methods, book 4, chap. C3, 112 p. Available at: http://pubs.usgs.gov/tm/04/c03

pervious areas as 2.5 lbs/acre/yr.[13] The nitrogen loading for MassDOT property in the contributing area is summarized below:

- MassDOT Impervious Area: 4.6 acres
- MassDOT Pervious Area: 2.3 acres
- Estimated Existing MassDOT Load: 34.4 lb/yr
- Total Existing Groundwatershed Nitrogen Load: 18,897 lb/yr
- MassDOT Existing Load as a Percentage of Total Groundwatershed Nitrogen Load: 0.18%

The MassDOT existing load compared to the total groundwatershed nitrogen load is very small and considered negligible based on MassDOT's Nitrogen TMDL Method because it is less than 3.5% of the total nitrogen groundwatershed load.[15] In general, in areas where the MassDOT load is determined to be negligible, MassDOT does not implement BMPs because of their minimal impact on the overall groundwatershed load.

BMP 7R for Pathogen TMDL (CN 252.0)

MassDOT assessed the indicator bacteria (fecal coliform) impairment using the approach described in BMP 7R of MassDOT's Storm Water Management Plan (SWMP).[16] Ryder Cove (MA96-50) is covered by the Final Pathogen TMDL for the Cape Cod Watershed.[17]

Pathogen concentrations in stormwater vary widely and concentrations can vary by an order of magnitude within a given storm event at a single location making it difficult to predict pathogen concentrations in stormwater with accuracy. MassDOT generally will not conduct site specific assessments of pathogen loading for each water body impaired for pathogens but instead developed an iterative adaptive management approach to address impaired waters and permit condition requirements and an approach to stormwater management. Greater detail of the assessment methodology is provided in MassDOT's BMP 7R Pathogen Methodology.[18]

According to the Final TMDL, sources of indicator bacteria in the Cape Cod watershed are believed to be primarily from boat wastes; failing septic systems; pets, wildlife, and birds; and stormwater. It should be noted that bacteria from wildlife would be considered a natural condition unless some form of human inducement, such as feeding, is causing congregation of wild birds or animals. Additionally, the TMDL states that implementation to achieve the TMDL goals should be an iterative process with selection and implementation of mitigation measures followed by monitoring to determine the extent of water quality improvement realized. Recommended TMDL implementation measures include identification and elimination of prohibited sources such as leaky or improperly connected sanitary sewer flows and best management practices to mitigate stormwater runoff volume.[19]

[15] Massachusetts Department of Transportation (MassDOT), March 7, 2014. *Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds*. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[16] MassDOT. July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.mhd.state.ma.us/downloads/projDev/BMP_7R_TMDL_WatershedReview.pdf

[17] MassDEP. 2009. Final Pathogen TMDL for the Cape Cod Watershed. Available at: http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/capecod1.pdf

[18] MassDOT. December 2014. Description of MassDOT's Application of BMP 7R for Pathogen Related Impairments.

[19] MassDEP. 2009. Final Pathogen TMDL for the Cape Cod Watershed. Available at: http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/capecod1.pdf

The TMDL states that several impaired segments carry a higher priority due to their location, use, and risk to human health. The higher priority areas in the Cape Cod watershed stand out as likely priority areas to address bacteria pollution sources. These segments tend to be located nearest to sensitive areas such as Outstanding Resource Waters (ORW) or designated uses that require higher water quality standards than Class B. Ryder Cove (MA96-50) is listed as a low priority although it is designated as an ORW, Class SA, ACEC, and includes a shellfishing use.[19]

In addition to the generic recommendations provided in the draft MS4 permits for Massachusetts, the Cape Cod Watershed TMDL report (Section 8.0) recommends the following specific BMPs to address elevated fecal coliform levels in the watershed:

- Correction of failing septic systems
- Public education regarding illicit sewer connection and failing infrastructure, as well as stormwater runoff and boat wastes
- Identification and elimination of prohibited sources such as leaky or improperly connected sanitary sewer flows
- Best management practices to mitigate stormwater runoff volume

The TMDL report also indicates that structural BMPs may be appropriate if less costly non-structural BMPs are not effective. Many non-structural BMPs are in place, including public education and outreach, street sweeping, and catch basin cleanouts. In addition to practices like these, many communities have formed advisory committees to help resolve existing stormwater issues. Many of the communities on Cape Cod practice their own stormwater BMPs. Additionally, the TMDL states that implementation to achieve the TMDL goals should be an iterative process with selection and implementation of mitigation measures followed by monitoring to determine the extent of water quality improvement realized.

The following BMPs are specifically identified within the TMDL as being ongoing and/or planned in order to meet the bacteria TMDL for the Cape Cod Watershed:

- Septic tank controls
- Documentation of storm drain outfall locations
- Resident education
- Additional water quality monitoring
- Designation of “No Discharge” areas in high priority coastal waters
- Street sweeping and catch basin cleaning

Proposed Mitigation Plan

As described above, MassDOT’s nitrogen contribution to the receiving water is negligible. Therefore, MassDOT has no plans to implement structural BMPs to control nitrogen in stormwater runoff from their property.

With respect to the fecal coliform impairment, 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. As discussed in MassDOT’s BMP 7R Pathogen Methodology, MassDOT believes that existing efforts are

consistent with the current and draft MS4 permit requirements and TMDL recommendations in regard to pathogens.

In accordance with the BMPs identified in the TMDL report as planned measures to reach compliance with the Cape Cod Pathogen TMDL report, MassDOT has documented the locations of its stormwater outfalls. In addition, as part of its pet waste management program, MassDOT has determined that no MassDOT targeted rest stops are located within the groundwatershed of this water body. MassDOT will be installing signs at rest stops within the groundwatershed of impaired water bodies. The signs will inform the public of the need to remove pet waste, which can minimize contributions of pathogens to stormwater runoff. Pet waste removal bags and disposal cans will be provided.

Although the TMDL report also identifies the benefits of riparian restoration and structural BMPs to address pathogens in runoff from impervious areas in some instances, MassDOT feels that it is not a beneficial approach to implement these BMPs in advance of other ongoing BMP efforts identified in the groundwatershed, given the documented variability of pathogen concentrations in highway runoff, and the low probability of achieving substantial gains towards meeting the TMDL with solely implementing IC reductions and controls.

Furthermore, MassDOT has an ongoing inspection and monitoring program aimed at identifying and addressing illicit discharges to MassDOT's stormwater management system. MassDOT investigates any suspicious flows noted, and will work with owners of confirmed illicit discharges to remove these flows, and thereby minimize the possibility of pathogen contributions to receiving waters. At present, there are no suspected or known illicit discharges, or unauthorized drainage tie-ins, within the groundwatershed of this water body that could be contributing pathogens to the impaired water body.

MassDOT has concluded that the BMPs outlined in the SWMP are consistent with its existing permit requirements for the Ryder Cove. These measures achieve pathogen reductions (including fecal coliform) to the maximum extent practicable and are consistent with the intent of its existing stormwater permit. As stated previously, pathogen loadings are highly variable and although there is potential for stormwater runoff from MassDOT roadways to be a contributing source it is unlikely to warrant action relative to other sources of pathogens in the watershed.

MassDOT will continue to ensure proper non-structural BMPs are being implemented within the groundwatershed of Ryder Cove, including regular roadway and drainage system maintenance, erosion and sedimentation control, and outreach and education. As described in MassDOT's Stormwater Handbook,[20] MassDOT does not use nitrogen based fertilizers as part of normal operations and maintenance procedures. In the rare circumstance where fertilizers are used, it is for the occasional vegetation establishment associated with recent ground disturbance. Further work by MassDOT 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 NPDES permit annual reports to EPA regarding proposed BMP design either through retrofit or programmed projects, plans for construction of BMPs, reduction achieved by finalized BMP designs and progress made towards meeting target reductions.

[20] MassDOT, May 2004. The MassHighway Storm Water Handbook for Highways and Bridges. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/wetlands/Stormwater_Handbook.pdf

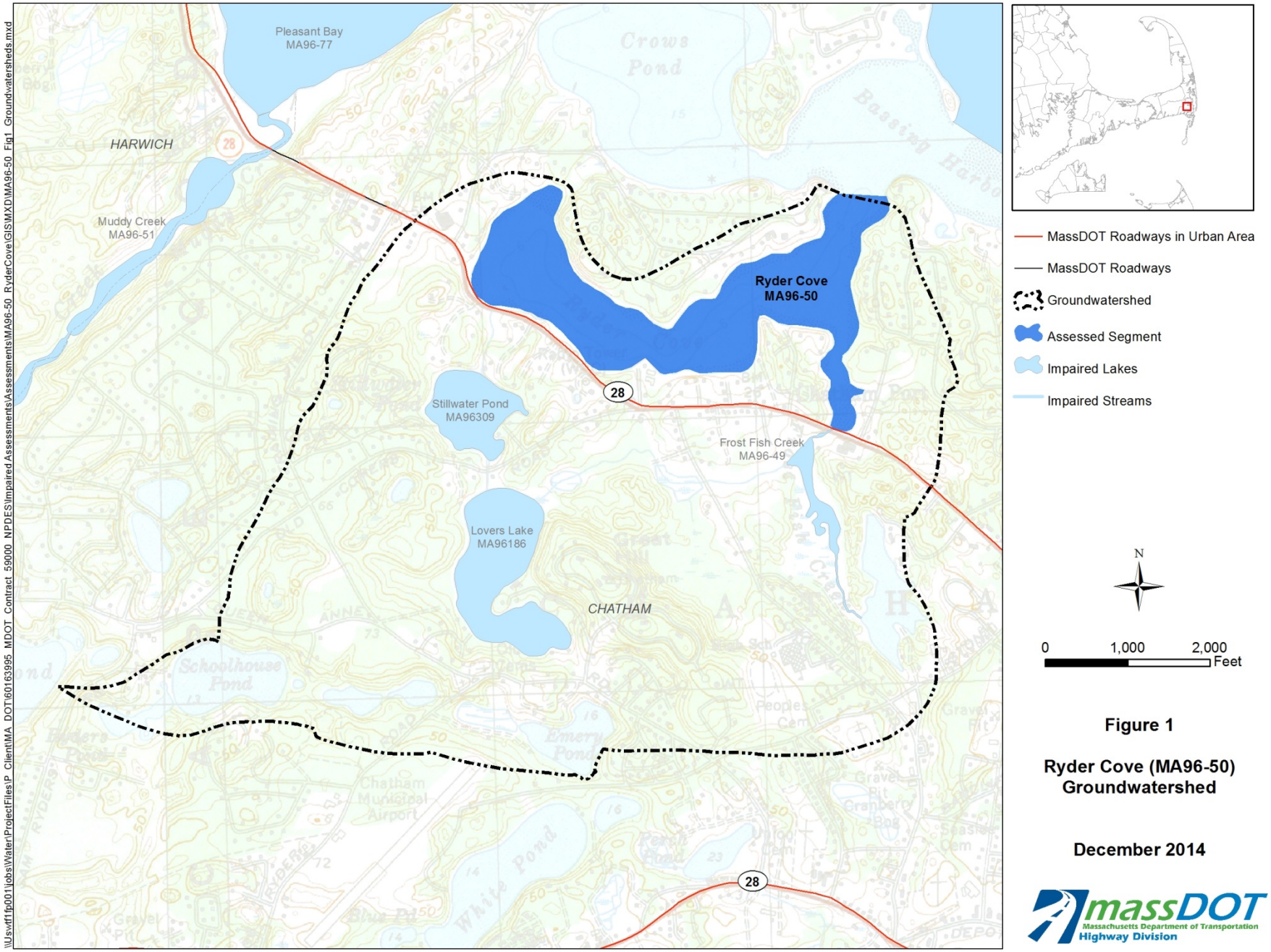

Figure 1

Ryder Cove (MA96-50) Groundwatershed

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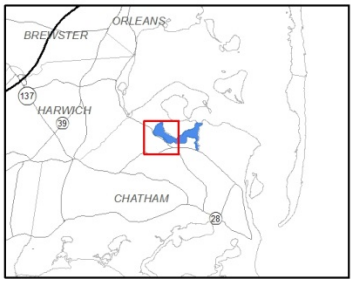


- MassDOT Outfalls
- MassDOT Roadways in Urban Area
- Groundwatershed
- MassDOT Impervious Area
- MassDOT Pervious Area
- MassDOT Supplemental Contributing Area
- Assessed Segment
- Impaired Lakes
- Outstanding Resource Waters
- Areas of Critical Environmental Concern
- Zone II Wellhead Protection Areas
- DEP Wetlands

N

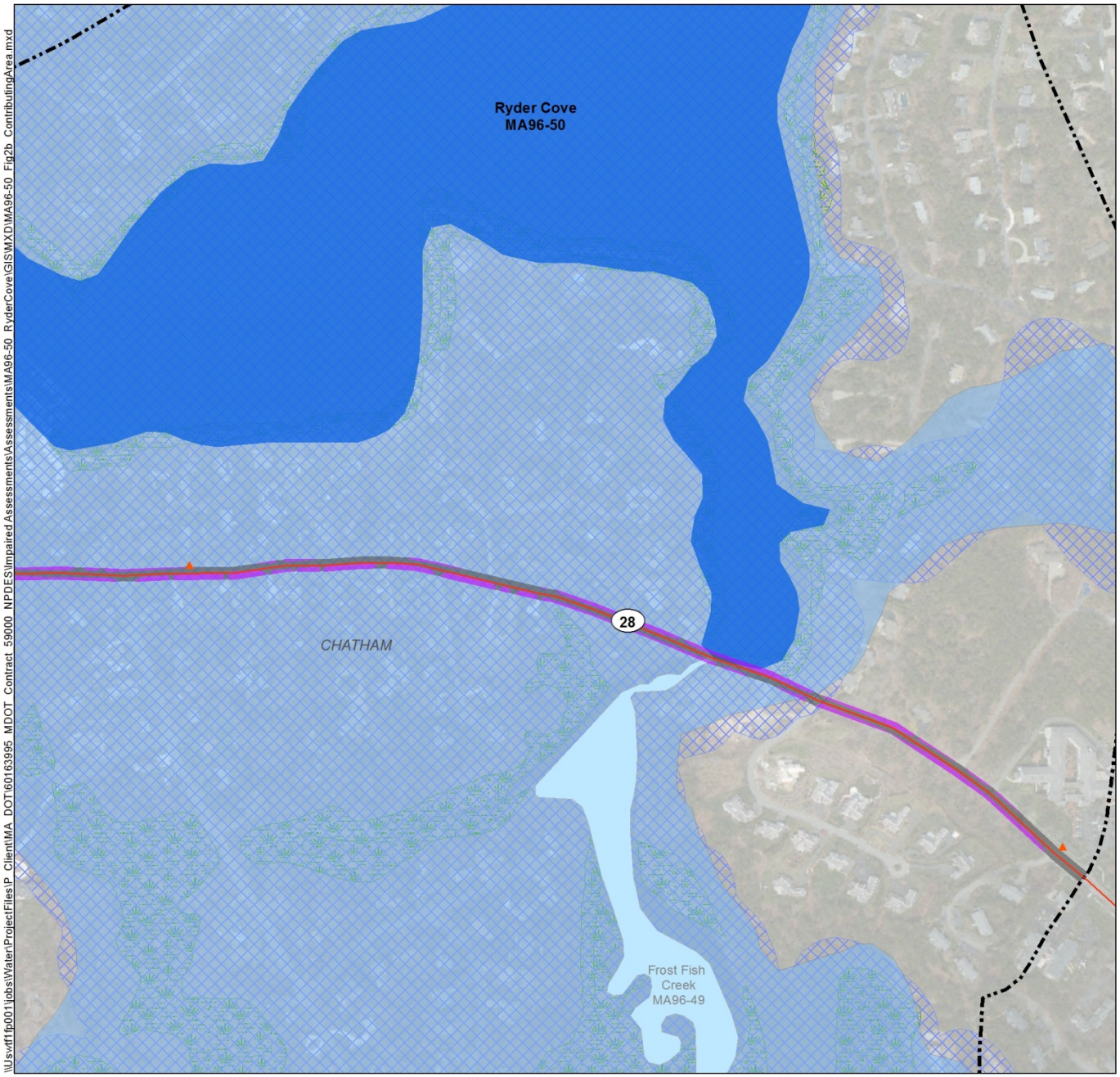
0 300 600 Feet

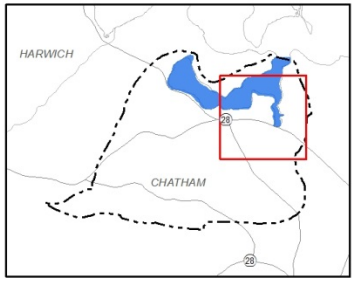
Figure 2a

Ryder Cove (MA96-50)
MassDOT Contributing Area

December 2014

massDOT
Massachusetts Department of Transportation
Highway Division





- MassDOT Outfalls
- MassDOT Roadways in Urban Area
- Groundwatershed
- Assessed Segment
- Impaired Lakes
- MassDOT Impervious Area
- MassDOT Pervious Area
- Areas of Critical Environmental Concern
- DEP Wetlands
- Outstanding Resource Waters

N

0 300 600 Feet

Figure 2b

Ryder Cove (MA96-50)
MassDOT Contributing Area

December 2014

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Highway Division

12/08/2014

Impaired Waters Assessment for Muddy Creek (MA96-51)

Summary

Impaired Water[1]	Stormwater Impairments:	*Fecal Coliform, Nitrogen (Total)*
	Category:	*4A (TMDL is completed)*
	Final TMDLs:	*Final Pleasant Bay System TMDL for Total Nitrogen (CN 244.0)*[2]
		Bacteria TMDL for Muddy Creek[3]
	WQ Assessment:	*Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[4]
Location	Towns:	*Harwich, Chatham*
	MassDOT Roads:	*Route 6, Route 28, Route 137*
Assessment Method(s)	7R (TMDL Method) ☒	7U (Non-TMDL Method) ☐
BMPs	Existing:	*None*
MassDOT Area and Targets		Nitrogen
	Estimated MassDOT Load:	*26.9 lbs/yr*
	Existing Load to Water Body:	*18,833 lbs/yr*
	MassDOT Contribution to Existing Load:	*0.14 %*

1 MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[2] MassDEP, 2007. Final Pleasant Bay System TMDL for Total Nitrogen. Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/pbtmdl.pdf

[3] MassDEP, 2005. Bacteria TMDL for Muddy Creek. Available at: http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/muddycrk.pdf

[4] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

Site Description

An assessment for Muddy Creek (MA96-51) was previously submitted to the EPA on June 8, 2011 using the BMP 7R[5] methodology. However, Muddy Creek is now being evaluated on a groundwatershed delineation, so it has been reassessed herein using BMP 7R Nitrogen[6] methodology.

Muddy Creek is a 0.5 square mile water body located southwest of Pleasant Bay in Chatham and Harwich Massachusetts. Figure 1 illustrates the groundwatershed for Muddy Creek (MA96-51). The groundwatersheds are based on technical reports[6] developed by the Massachusetts Estuaries Project (MEP) which serve as the basis for the development of Total Maximum Daily Loads. The MEP team includes technical staff from USGS and the Cape Cod Commission and works collaboratively with MassDEP and the University of Massachusetts Dartmouth School of Marine Science and Technology (SMAST). For groundwatershed assessments, if a discharge occurs inside the groundwatershed boundary, it is considered to be a discharge that contributes to the impaired segment. If the discharge point is outside of the groundwatershed boundary, it is not considered to contribute to the impaired segment. MassDOT property that contributes runoff or infiltration within the groundwatershed area is considered in this assessment as contributing to Muddy Creek (MA96-51).

MassDEP's Water Quality Assessment Report titled *Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[4] identifies the Aquatic Life Use and Shellfishing Harvesting Use as "impaired" for Muddy Creek (MA96-51). The "impaired" status for the Aquatic Life Use is reported to be caused by total nitrogen from subsurface wastewater disposal (septic) systems, stormwater runoff (unspecified urban stormwater and discharges from municipal separate storm sewer systems) and fertilizers. The Shellfish Harvesting Use is reported to be "impaired" due to elevated fecal coliform bacteria from waterfowl, waste from pets, on-site septic system discharges and discharges from municipal separate storm sewer systems. The other uses were not assessed.

Figures 2a and 2b illustrate the MassDOT roads in and adjacent to the groundwatershed that contribute runoff to the water body. Muddy Creek is located within the Pleasant Bay Area of Critical Environmental Concern (ACEC). Route 6 crosses through the Muddy Creek groundwatershed south of Long Pond and the interchange with Route 137. At the Route 137/ Route 6 interchange a small section of Route 137 and the ramp connecting Route 137 northbound to Route 6 eastbound contributes runoff within the Muddy Creek groundwatershed via overland flow, infiltration or catchbasins and pipes. MassDOT roadway on Route 6 collects stormwater from the interchange with Route 137 via curb and gutter to a high point approximately 325 feet north of the southern groundwatershed boundary close to Hawksnest Pond; the roadway south of this area is collected in pipes and conveyed to the south where the runoff discharges outside of the groundwatershed.

Route 28 traverses the groundwatershed in the northeast corner; however, as observed during a site visit, a 600-foot section of roadway east of the groundwatershed boundary is considered "Supplemental Contributing Area". Any impervious area located outside the groundwatershed boundary that flows back into the groundwatershed via sheet flow, drainage pipes, or other means

[5] *MassDOT, July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf*

[6] *MassDOT, March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf*

[7] University of Massachusetts Dartmouth and MassDEP, 2006. Massachusetts Estuaries Project Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Oyster Pond System, Falmouth, Massachusetts. Available at: http://www.oceanscience.net/estuaries/OysterPond.htm

is considered "Supplemental". Flow from Route 28 is collected along the roadway and drains northwest where it discharges into Muddy Creek at the outfalls shown on Figure 2b where Route 28 crosses Muddy Creek. The portion of Route 28 that is within the groundwatershed drains northwest, but discharges outside of the groundwatershed thus not included as contributing area. Approximately 3.6 acres of impervious and 1.9 acres of pervious within the MassDOT right-of-way on Route 137, Route 6 and Route 28 drains to the groundwatershed, 0.6 acres of which is supplemental contributing area from Route 28.

Existing BMPs

MassDOT estimated the pollutant load reduction provided by existing BMPs by applying treatment reductions to existing BMPs based on their size, function and contributing groundwatershed. BMP performances were derived different sources depending on the BMP and engineering judgment as described in the *Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds.*[7]

MassDOT identified one existing BMP in place with the potential to treat roadway runoff from the discharging area before reaching the impaired water segment. The subsurface leaching bed is located adjacent to the ramp connecting Route 137 northbound to Route 6 westbound. Per the methodology, the subsurface leaching beds do not receive a nitrogen removal credit as they do not provide storage or advanced water quality treatment.

Assessment

In cases where a TMDL has been approved, MassDOT assesses the water body for the impairments covered by the TMDL under the BMP 7R methodology.[8] MassDOT separately assesses the water body for any stormwater-related impairments that are not covered by the TMDL under the BMP 7U methodology.[9] MassDOT assessed Muddy Creek (MA96-51) using the methodologies described below.

This assessment has been completed based on the Massachusetts Year 2012 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. [10] MassDEP has released a Proposed Massachusetts Year 2014 Integrated List[11] which has been reviewed for any proposed changes to the condition of the water bodies. The condition of Muddy Creek is not proposed to change.

[7] MassDOT, March 7, 2014. *Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds*. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[8] Massachusetts Department of Transportation (MassDOT), July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

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

[10] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[11] MassDEP, June 2014. Massachusetts Year 2014 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/14iwlistp.pdf

BMP 7R for Nitrogen TMDL (CN 244.0)

The *Total Maximum Daily Load (TMDL) for Total Nitrogen in the Pleasant Bay System (CN 244.0)*[12] addresses the total nitrogen impairment for this water body. MassDOT assessed the contribution of nitrogen from MassDOT properties to this water body using the approach described in BMP 7R[13] of MassDOT's Storm Water Management Plan (Water Quality Impaired Waters Assessment and Mitigation Plan), which applies to impairments that have been addressed by a TMDL, and MassDOT's application of BMP 7R to nitrogen in groundwater-controlled watersheds.[14]

For the nitrogen assessment under BMP 7R, MassDOT used USGS modeling[15] to estimate annual pollutant loads from its property. Based on the USGS SELDM model, which was run using precipitation data from the Hyannis site and an average of water quality data from Harwich and Marion, MassDOT estimates the nitrogen loading from impervious areas as 6.2 lbs/acre/yr and from pervious areas as 2.5 lbs/acre/yr.[15] The Nitrogen Loading for MassDOT property in the contributing area is summarized below:

- MassDOT Impervious Area: 3.6 acres
- MassDOT Pervious Area: 1.9 acres
- Estimated Existing MassDOT Load: 26.9 lbs/yr
- Total Existing Groundwatershed Nitrogen Load: 18,833 lbs/yr
- MassDOT Existing Load as a Percentage of Total Groundwatershed Nitrogen Load: 0.14%

The MassDOT existing load compared to the total groundwatershed nitrogen load is very small and considered negligible based on MassDOT's Nitrogen TMDL Method because it is less than 3.5% of the total nitrogen groundwatershed load.[15] In general, in areas where the MassDOT load is determined to be negligible, MassDOT does not implement BMPs because of their minimal impact on the overall groundwatershed load.

BMP 7R for Pathogen TMDL (CN 251.1)

MassDOT assessed the indicator bacteria (fecal coliform) impairment using the approach described in BMP 7R of MassDOT's Storm Water Management Plan (SWMP).[16] Muddy Creek (MA96-51) is covered by the Bacteria TMDL for Muddy Creek.[17]

Pathogen concentrations in stormwater vary widely and concentrations can vary by an order of magnitude within a given storm event at a single location making it difficult to predict pathogen concentrations in stormwater with accuracy. MassDOT generally will not conduct site specific

[12] MassDEP, 2007. Final Pleasant Bay System TMDL for Total Nitrogen. Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/pbtmdl.pdf

[13] MassDOT, July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

[14] MassDOT, March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[15] Granato, G.E., 2013, Stochastic empirical loading and dilution model (SELDM) version 1.0.0: U.S. Geological Survey Techniques and Methods, book 4, chap. C3, 112 p. Available at: http://pubs.usgs.gov/tm/04/c03

[16] MassDOT, July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

[17] MassDEP, 2005. Bacteria TMDL for Muddy Creek. Available at: http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/muddycrk.pdf

assessments of pathogen loading for each water body impaired for pathogens but instead developed an iterative adaptive management approach to address impaired waters and permit condition requirements and an approach to stormwater management. Greater detail of the assessment methodology is provided in MassDOT's BMP 7R Pathogen Methodology.[18]

According to the TMDL, the most likely sources of fecal coliform bacteria are waterfowl and stormwater runoff from paved surfaces abutting or crossing over the Creek. In addition to the generic recommendations provided in the draft MS4 permits for Massachusetts, the Muddy Creek Bacteria TMDL report (Section 8.0) recommends the specific BMPs to be addressed by the Town of Chatham and Harwich as well as the following:

- Investigate, design and construct appropriate measures to improve tidal flushing
- Further monitor water quality in specific locations to determine bacteria input
- Bacteria testing that can differentiate anthropogenic from non-anthropogenic sources
- Install BMPs and/or operational practices to the maximum extent feasible

Proposed Mitigation Plan

As described above, MassDOT's nitrogen contribution to the receiving water is negligible. Therefore, MassDOT has no plans to implement structural BMPs to control nitrogen in stormwater runoff from their property.

With respect to the fecal coliform impairment, 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. As discussed in MassDOT's BMP 7R Pathogen Methodology, MassDOT believes that existing efforts are consistent with the current and draft MS4 permit requirements and TMDL recommendations in regard to pathogens.

In accordance with the BMPs identified in the TMDL report as planned measures to reach compliance with the Muddy Creek bacteria TMDL report, MassDOT has documented the locations of its stormwater outfalls. In addition, as part of its pet waste management program, MassDOT has determined that no MassDOT targeted rest stops are located within the groundwatershed of this water body. MassDOT will be installing signs at rest stops within the groundwatershed of impaired water bodies. The signs will inform the public of the need to remove pet waste, which can minimize contributions of pathogens to stormwater runoff. Pet waste removal bags and disposal cans will be provided.

Although the TMDL report also identifies the benefits of structural BMPs to address runoff from impervious areas in some instances, MassDOT feels that it is not a beneficial approach to implement these BMPs in advance of other ongoing BMP efforts identified in the watershed, given the documented variability of pathogen concentrations in highway runoff, and the low probability of achieving substantial gains towards meeting the TMDL with solely implementing Impervious Cover reductions and controls.

Furthermore, MassDOT has an ongoing inspection and monitoring program aimed at identifying and addressing illicit discharges to MassDOT's stormwater management system. MassDOT investigates any suspicious flows noted, and will work with owners of confirmed illicit discharges to

[18] MassDOT. December 2014. Description of MassDOT's Application of BMP 7R for Pathogen Related Impairments.

remove these flows, and thereby minimize the possibility of pathogen contributions to receiving waters. At present, there are no suspected or known illicit discharges, or unauthorized drainage tie-ins, within the groundwatershed of this water body that could be contributing pathogens to the impaired water body.

MassDOT has concluded that the BMPs outlined in the SWMP are consistent with its existing permit requirements for the Muddy Creek. These measures achieve pathogen reductions (including fecal coliform) to the maximum extent practicable and are consistent with the intent of its existing stormwater permit. As stated previously, pathogen loadings are highly variable and although there is potential for stormwater runoff from MassDOT roadways to be a contributing source it is unlikely to warrant action relative to other sources of pathogens in the groundwatershed.

MassDOT will continue to ensure proper non-structural BMPs are being implemented within the groundwatershed of Muddy Creek (MA96-51), including regular roadway and drainage system maintenance, erosion and sedimentation control, and outreach and education. As described in MassDOT's Stormwater Handbook,[19] MassDOT does not use nitrogen based fertilizers as part of normal operations and maintenance procedures. In the rare circumstance where fertilizers are used, it is for the occasional vegetation establishment associated with recent ground disturbance. Further work by MassDOT 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 NPDES permit annual reports to EPA regarding proposed BMP design either through retrofit or programmed projects, plans for construction of BMPs, reduction achieved by finalized BMP designs and progress made towards meeting target reductions.

[19] MassDOT, May 2004. The MassHighway Storm Water Handbook for Highways and Bridges. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/wetlands/Stormwater_Handbook.pdf

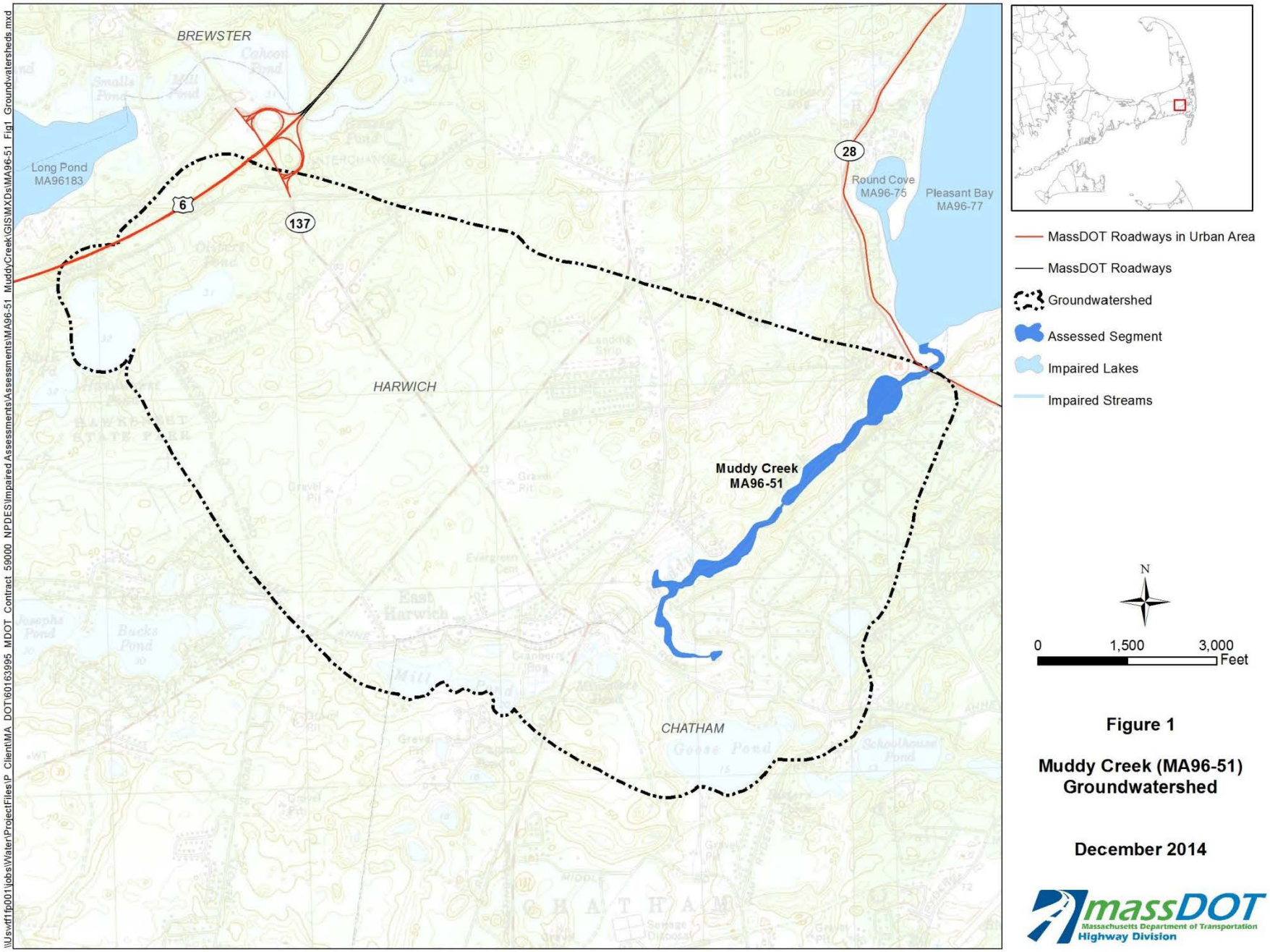

Figure 1

Muddy Creek (MA96-51) Groundwatershed

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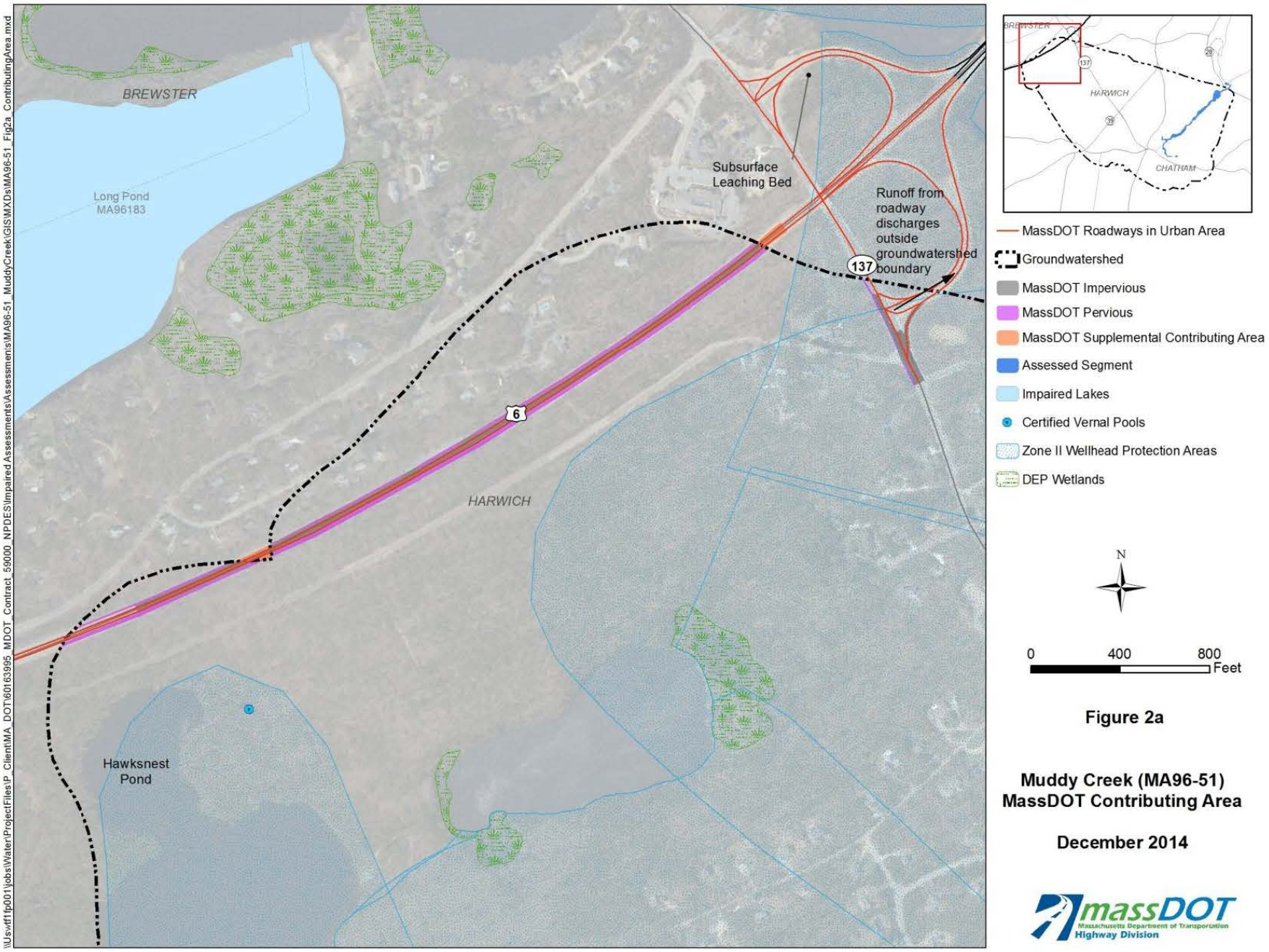
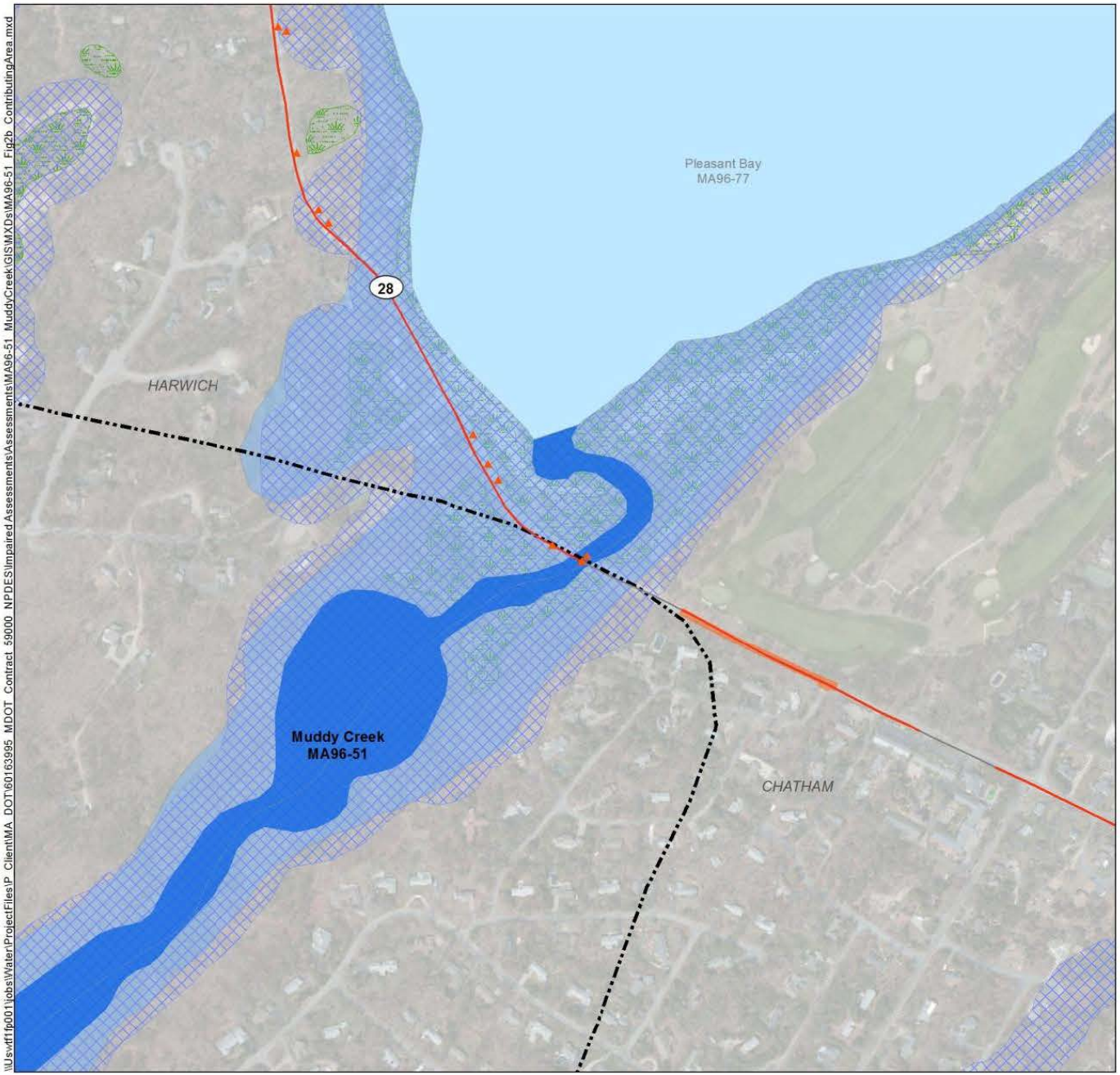
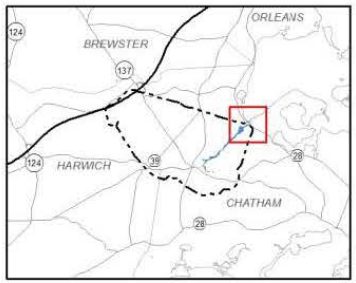


Figure 2a

Muddy Creek (MA96-51)
MassDOT Contributing Area

December 2014





- MassDOT Outfalls
- MassDOT Roadways in Urban Area
- Groundwatershed
- MassDOT Supplemental Contributing Area
- Assessed Segment
- Impaired Lakes
- Areas of Critical Environmental Concern
- Outstanding Resource Waters
- DEP Wetlands

N

0 300 600 Feet

Figure 2b

Muddy Creek (MA96-51)
MassDOT Contributing Area

December 2014

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Massachusetts Department of Transportation
Highway Division

Impaired Waters Assessment for Namequoit River (MA96-71)

Summary

Impaired Water[1]	Stormwater Impairments:	*Estuarine Bioassessments, Nitrogen (Total)*
	Category:	4A (TMDL is completed)
	Final TMDLs:	*Final Pleasant Bay System TMDL for Total Nitrogen*[2]
	WQ Assessment:	*Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[3]
Location	Towns:	*Brewster, Orleans*
	MassDOT Roads:	*Route 6, Route 28*
Assessment Method(s)	7R (TMDL Method) ☒	7U (IC Method) ☐
BMPs	Existing:	*None*
MassDOT Area and Targets		Nitrogen
	Estimated MassDOT Load:	*25.7 lbs/yr*
	Existing Load to Water Body:	*20,378 lbs/yr*
	MassDOT Contribution to Existing Load:	*0.13 %*

Site Description

An assessment for Namequoit River (MA96-71) was previously submitted to the EPA on March 8, 2011 as a no discharge. However, Namequoit River is now being evaluated on a groundwatershed delineation, so it has been reassessed herein using BMP 7R Nitrogen[4] methodology.

[1] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[2] MassDEP. 2007. Final Pleasant Bay System TMDL for Total Nitrogen. Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/pbtmdl.pdf

[3] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

[4] MassDOT. March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

Namequoit River (MA96-71) is a 0.06 square mile water body that headwaters at the outlet of Areys Pond (MA96-70) and extends to the confluence with The River (MA96-76) in Orleans Massachusetts. Figure 1 illustrates the groundwatershed for Namequoit River (MA96-71). The groundwatershed for this impaired segment is based on technical reports[5] developed by the Massachusetts Estuaries Project (MEP) which serve as the basis for the development of Total Maximum Daily Loads. The MEP team includes technical staff from USGS and the Cape Cod Commission and works collaboratively with MassDEP and the University of Massachusetts Dartmouth School of Marine Science and Technology (SMAST). For groundwatershed assessments, if a discharge occurs inside the groundwatershed boundary, it is considered to be a discharge that contributes to the impaired segment. If the discharge point is outside of the groundwatershed boundary, it is not considered to contribute to the impaired segment. As indicated in Figure 1, Namequoit River flows into The River (MA96-76) and receives inflow from the following upgradient water bodies: Areys Pond (MA96-70) and Higgins Pond. Areys Pond and The River are discussed in separate assessments. MassDOT property that contributes runoff or infiltration within the groundwatershed area is considered in this assessment as contributing to Namequoit River (MA96-71).

MassDEP's Water Quality Assessment Report titled *Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[6] identifies the Aquatic Life Use as "impaired" for Namequoit River (MA96-71). The "impaired" status for the Aquatic Life Use is reported to be caused by loss of eelgrass bed habitat (estuarine bioassessment) and total nitrogen due to subsurface wastewater disposal (septic) systems, stormwater runoff (unspecified urban stormwater) and fertilizers (yard maintenance and agriculture). The shellfish harvesting use, primary contact use, and secondary contact uses are supported. The other uses were not assessed. The area is also part of the Pleasant Bay Area of Critical Environmental Concern (ACEC).

Figures 2a, 2b, and 2c illustrate the MassDOT-owned road within the groundwatershed that contributes runoff to the water body. It should be noted that only a portion of the MassDOT-owned road inside the groundwatershed boundary is within an MS4-regulated urban area. Part of the MassDOT road is outside of the designated urban area; therefore, discharge from this roadway is not identified as contributing to the impaired segment. Runoff from Route 6 includes a 650 foot section of roadway south of the northern groundwatershed limits within Orleans (Figure 2a). Route 6 runs parallel to and west of Route 28. Roadway runoff is collected by catch basins that direct flow through drain pipes to adjacent wooded areas. Route 28 runs north to south through the watershed, west of Namequoit River and Areys Pond. Route 28 is a two-lane 50-foot right-of-way which has two urbanized sections contributing runoff. The northern section starts at the northern groundwatershed boundary and extends south to Areys Lane (Figure 2b). The southern section starts at the southern groundwatershed boundary and extends north to Namequoit Road. Based on a field visit, a 265-foot segment of Route 28 south of the groundwatershed boundary is considered "Supplemental Contributing Area". Any impervious area located outside the groundwatershed boundary that flows back into the groundwatershed via sheet flow, drainage pipes, or other means is considered "Supplemental"(Figure 2b). Flow from this area is collected in catchbasins and pipes discharging at an outfall between Namequoit Road and John Kenrick Road (Figure 2c).

[5] University of Massachusetts Dartmouth and MassDEP, 2006. Massachusetts Estuaries Project Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Pleasant Bay System, Orleans, Chatham, Brewster and Harwich, Massachusetts. Available at: http://www.oceanscience.net/estuaries/report/Pleasant_Bay/PleasantBay_MEP_Final.pdf

[6] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

Approximately 3.2 acres of impervious roadway area and 2.5 acres of pervious within the right-of-ways of Route 28 and Route 6 drain to the groundwatershed via overland flow, infiltration or catchbasins and pipes; therefore, these sections of roadway are considered discharging to Namequoit River (MA96-71). Most outfalls are either small, localized systems with one or two catchbasins and an outfall or curb cuts at a low point in the roadway where sheet flow is allowed to drain overland to the shoulder of the roadway.

Existing BMPs

MassDOT did not identify any existing BMPs in place to treat roadway runoff from the directly discharging area before reaching the impaired water segment.

Assessment

In cases where a TMDL has been approved, MassDOT assesses the water body for the impairments covered by the TMDL under the BMP 7R methodology.[7] MassDOT separately assesses the water body for any stormwater-related impairments that are not covered by the TMDL under the BMP 7U methodology.[8] MassDOT assessed Namequoit River (MA96-71) using the methodologies described below.

This assessment has been completed based on the Massachusetts Year 2012 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.[9] MassDEP has released a Proposed Massachusetts Year 2014 Integrated List[10] which has been reviewed for any proposed changes to the condition of the water bodies. The condition of Namequoit River (MA96-71) is not proposed to change.

BMP 7R for Nitrogen TMDL (CN 244)

The *Total Maximum Daily Load (TMDL) for Total Nitrogen in the Pleasant Bay System, Massachusetts (CN 244.0)*[11] identifies the total existing groundwatershed nitrogen load for this water body and attributes estuarine degradation to excess nitrogen loading from the groundwatershed. Therefore, MassDOT considers the following impairments to Namequoit River (MA96-71) to be linked to elevated nitrogen: estuarine bioassessments and nitrogen (total). MassDOT assessed the contribution of nitrogen from MassDOT properties to this water body using the approach described in BMP 7R[12] of MassDOT's Storm Water Management Plan (Water Quality Impaired Waters Assessment and Mitigation Plan), which applies to impairments that have been

[7] Massachusetts Department of Transportation (MassDOT), July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

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

[9] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[10] MassDEP, June 2014. Massachusetts Year 2014 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/14iwlistp.pdf

[11] MassDEP. 2007. Final Pleasant Bay System TMDL for Total Nitrogen. Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/pbtmdl.pdf

[12] MassDOT. July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

addressed by a TMDL, and MassDOT's application of BMP 7R to nitrogen in groundwater-controlled watersheds.[13]

For the nitrogen assessment under BMP 7R, MassDOT used USGS modeling[14] to estimate annual pollutant loads from its property. Based on the USGS SELDM model, which was run using precipitation data from the Hyannis site and an average of water quality data from Harwich and Marion, MassDOT estimates the nitrogen loading from impervious areas as 6.2 lbs/acre/yr and from pervious areas as 2.5 lbs/acre/yr.[14] The nitrogen loading for MassDOT property in the contributing area is summarized below:

- MassDOT Impervious Area: 3.2 acres
- MassDOT Pervious Area: 2.5 acres
- Estimated Existing MassDOT Load: 25.7 lbs/yr
- Total Existing Watershed Nitrogen Load: 20,378 lbs/yr
- MassDOT Existing Load as a Percentage of Total Watershed Nitrogen Load: 0.13%

The MassDOT existing load compared to the total watershed nitrogen load is very small and considered negligible based on MassDOT's Nitrogen TMDL Method because it is less than 3.5% of the total nitrogen watershed load.[14] In general, in areas where the MassDOT load is determined to be negligible, MassDOT does not implement BMPs because of their minimal impact on the overall watershed load.

Proposed Mitigation Plan

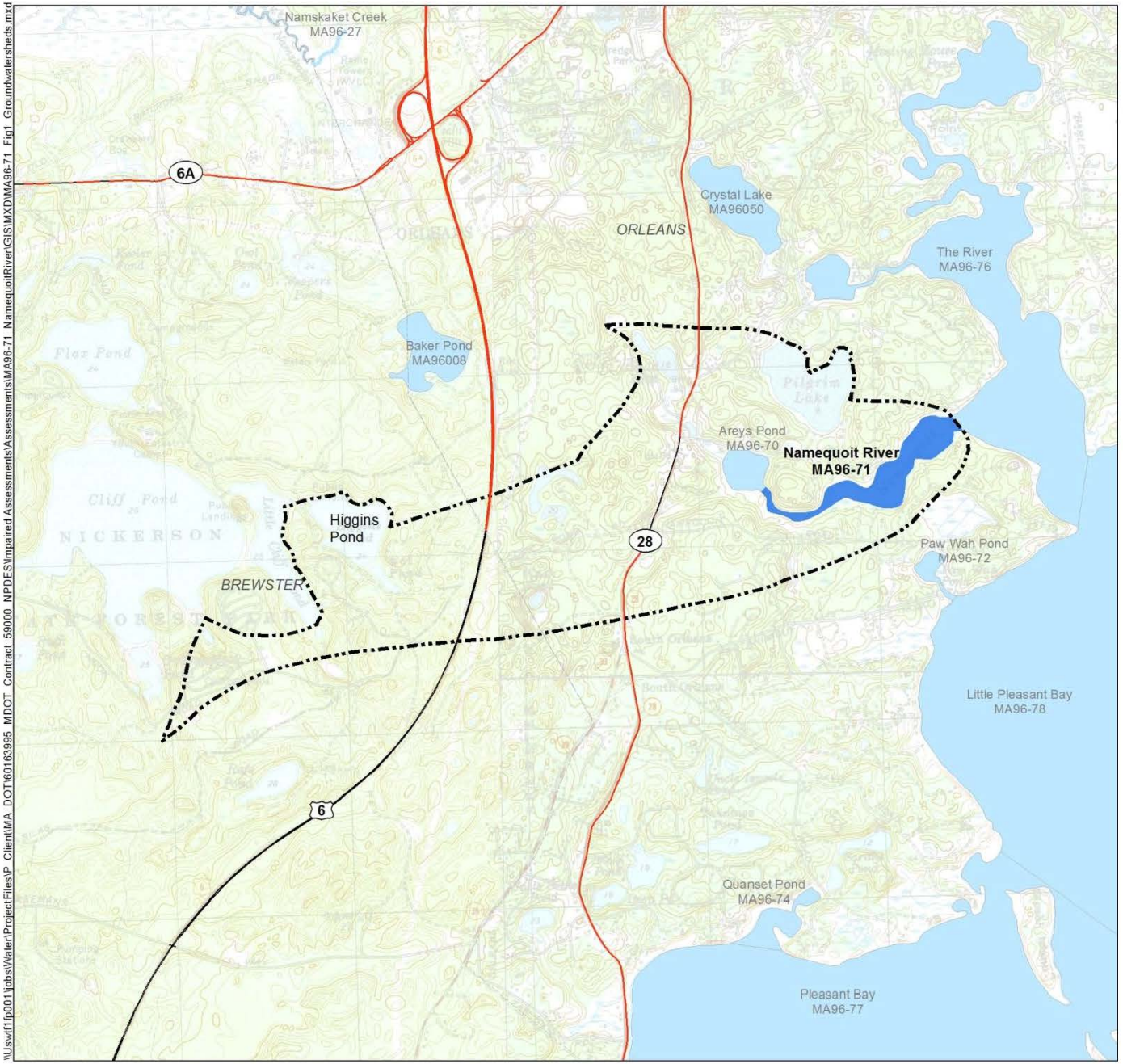
As described above, MassDOT's nitrogen contribution to the receiving water is negligible. Therefore, MassDOT has no plans to implement structural BMPs to control nitrogen in stormwater runoff from their property.

MassDOT will continue to ensure proper non-structural BMPs are being implemented within the groundwatershed of Namequoit River (MA96-71), including regular roadway and drainage system maintenance, erosion and sedimentation control, and outreach and education. As described in MassDOT's Stormwater Handbook,[15] MassDOT does not use nitrogen based fertilizers as part of normal operations and maintenance procedures. In the rare circumstance where fertilizers are used, it is for the occasional vegetation establishment associated with recent ground disturbance. Further work by MassDOT 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 NPDES permit annual reports to EPA regarding proposed BMP design either through retrofit or programmed projects, plans for construction of BMPs, reduction achieved by finalized BMP designs and progress made towards meeting target reductions.

[13] MassDOT, March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[14] Granato, G.E., 2013, Stochastic empirical loading and dilution model (SELDM) version 1.0.0: U.S. Geological Survey Techniques and Methods, book 4, chap. C3, 112 p. Available at: http://pubs.usgs.gov/tm/04/c03

[15] MassDOT, May 2004. The MassHighway Storm Water Handbook for Highways and Bridges. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/wetlands/Stormwater_Handbook.pdf



MassDOT Roadways in Urban Area

MassDOT Roadways

Groundwatershed

Assessed Segment

Impaired Lakes

Impaired Streams

N

0 1,500 3,000 Feet

Figure 1

Namequoit River (MA96-71) Groundwatershed

December 2014

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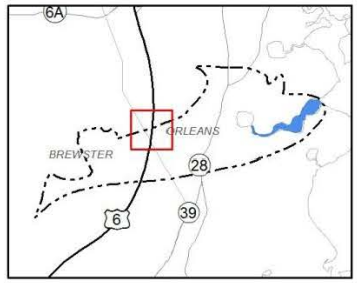

- MassDOT Outfalls
- MassDOT Roadways in Urban Area
- Groundwatershed
- MassDOT Impervious
- MassDOT Pervious
- Assessed Segment
- Zone II Wellhead Protection Areas
- DEP Wetlands

N

0 200 400 Feet

Figure 2a

Namequoit River (MA96-71)
MassDOT Contributing Area

December 2014

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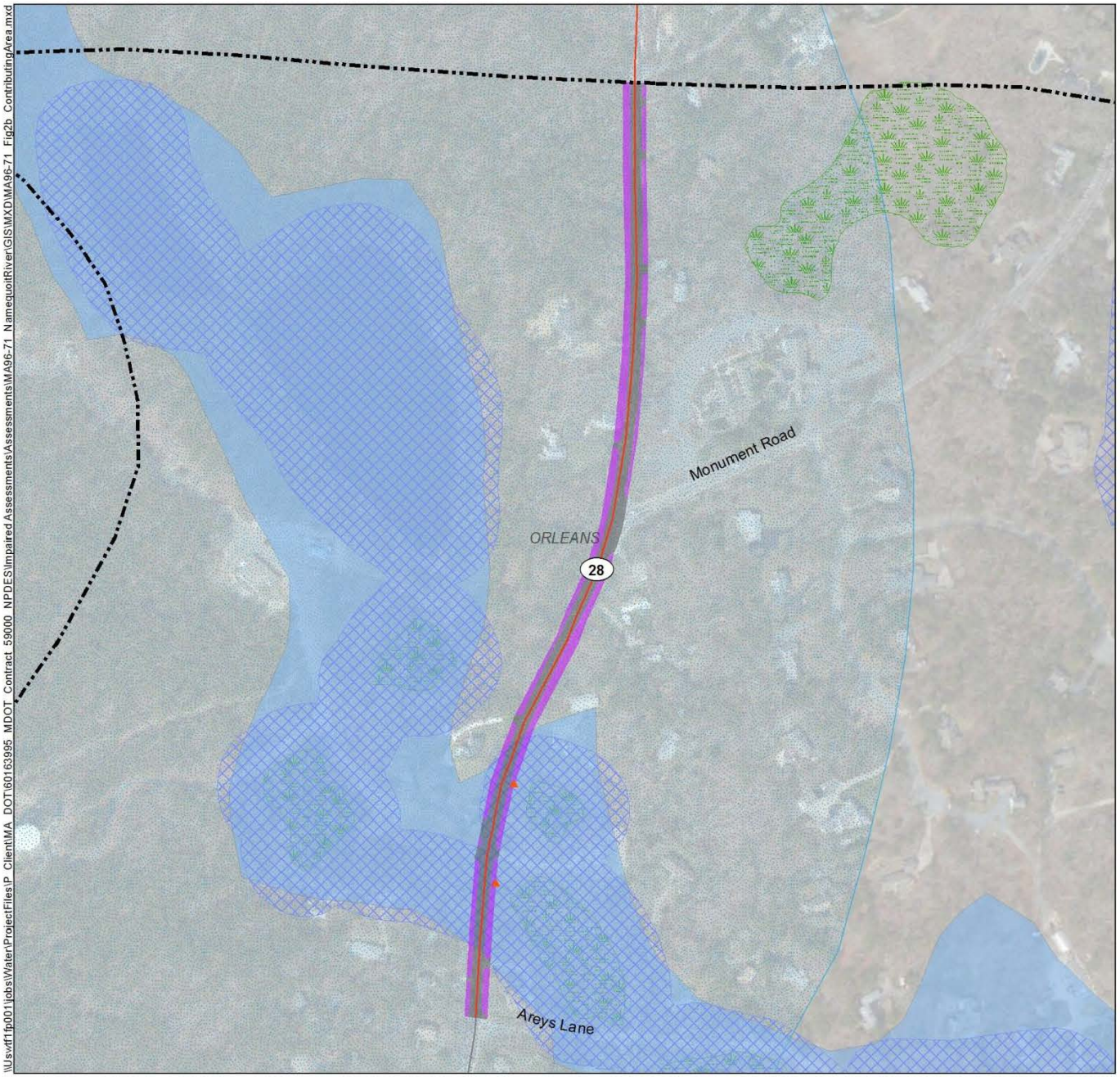
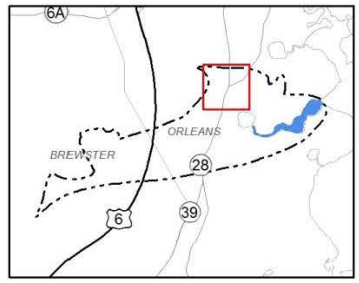
Highway Division





- MassDOT Outfalls
- MassDOT Roadways in Urban Area
- Groundwatershed
- MassDOT Impervious
- MassDOT Pervious
- Assessed Segment
- Areas of Critical Environmental Concern
- Outstanding Resource Waters
- Zone II Wellhead Protection Areas
- DEP Wetlands

N

0 200 400 Feet

Figure 2b

Namequoit River (MA96-71)
MassDOT Contributing Area

December 2014

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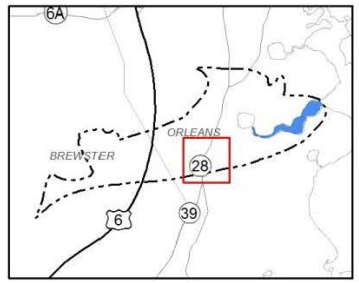

- MassDOT Outfalls
- MassDOT Roadways in Urban Area
- MassDOT Impervious
- MassDOT Pervious
- MassDOT Supplemental Contributing Area
- Assessed Segment
- Certified Vernal Pools
- Zone II Wellhead Protection Areas
- DEP Wetlands

N

0 200 400 Feet

Figure 2c

Namequoit River (MA96-71)
MassDOT Contributing Area

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12/08/2014

Impaired Waters Assessment for Quanset Pond (MA96-74)

Summary

Impaired Water[1]	Stormwater Impairments:	*Nitrogen (Total)*
	Category:	*4A (TMDL is completed)*
	Final TMDLs:	*Final Pleasant Bay System TMDL for Total Nitrogen*[2]
	WQ Assessment:	*Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[3]
Location	Towns:	*Brewster, Orleans*
	MassDOT Roads:	*Route 28*
Assessment Method(s)	7R (TMDL Method) ☒	7U (Non-TMDL Method) ☐
BMPs	Existing:	*None*
MassDOT Area and Targets		Nitrogen
	Estimated MassDOT Load:	*20.4 lbs/yr*
	Existing Load to Water Body:	*6,390 lbs/yr*
	MassDOT Contribution to Existing Load:	*0.32 %*

Site Description

An assessment for Quanset Pond (MA96-74) was previously submitted to the EPA on March 8, 2011 as a no discharge. However, Quanset Pond is now being evaluated on a groundwatershed delineation, so it has been reassessed herein using BMP 7R Nitrogen[4] methodology.

[1] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[2] MassDEP, 2007. Final Pleasant Bay System TMDL for Total Nitrogen. Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/pbtmdl.pdf

[3] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

[4] MassDOT. March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

Quanset Pond (MA96-74) is a 0.02 square mile water body located east of Route 28 and north of Pleasant Bay (MA96-77) in Orleans, Massachusetts. Figure 1 illustrates the groundwatershed for Quanset Pond (MA96-74). The groundwatershed for this impaired segment is based on technical reports[5] developed by the Massachusetts Estuaries Project (MEP) which serve as the basis for the development of Total Maximum Daily Loads. The MEP team includes technical staff from USGS and the Cape Cod Commission and works collaboratively with MassDEP and the University of Massachusetts Dartmouth School of Marine Science and Technology (SMAST). For groundwatershed assessments, if a discharge occurs inside the groundwatershed boundary, it is considered to be a discharge that contributes to the impaired segment. If the discharge point is outside of the groundwatershed boundary, it is not considered to contribute to the impaired segment. MassDOT property that contributes runoff or infiltration within the groundwatershed area is considered in this assessment as contributing to Quanset Pond (MA96-74).

MassDEP's Water Quality Assessment Report titled *Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[6] identifies the Aquatic Life Use as "impaired" for Quanset Pond (MA 96-74). The "impaired" status for the Aquatic Life Use is reported to be caused by total nitrogen from subsurface wastewater disposal (septic) systems, stormwater runoff (unspecified urban stormwater and discharges from municipal separate storm sewer systems) and fertilizers (yard maintenance). The Shellfish Harvesting Use, Primary Contact Use, and Secondary Contact Use are reported to be "supported". The other uses were not assessed.

Figure 2 illustrates the MassDOT-owned road within the groundwatershed that contributes runoff to the water body. It should be noted that only a portion of the MassDOT-owned road inside the groundwatershed boundary is within an MS4-regulated urban area. Route 6 is a MassDOT-owned road within the groundwatershed that is outside of the designated urban area; therefore, discharge from this roadway is not identified as contributing to the impaired segment. Route 28 bisects the groundwatershed in a north-south direction west of Quanset Pond. Approximately 2.9 acres of impervious roadway area and 0.9 acres of pervious area, within the right-of-way, drain to the groundwatershed via overland flow, infiltration or catchbasins and pipes. The majority of impervious roadway is collected in catch basins and discharged at one of the two outfalls within the groundwatershed shown along the roadway. This includes two areas, one to the north of the groundwatershed that ends approximately 200 feet south of the intersection between Route 28 and Quanset Road and one extending approximately 450 feet south of the groundwatershed boundary, are considered "Supplemental Contributing Area". Any impervious area located outside the groundwatershed boundary that flows back into the groundwatershed via sheet flow, drainage pipes, or other means is considered "Supplemental".

Existing BMPs

MassDOT did not identify any existing BMPs in place to treat roadway runoff from the directly discharging area before reaching the impaired water segment.

[5] University of Massachusetts Dartmouth and MassDEP, 2006. Massachusetts Estuaries Project Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Pleasant Bay System, Orleans, Chatham, Brewster and Harwich, Massachusetts. Available at: http://www.oceanscience.net/estuaries/report/Pleasant_Bay/PleasantBay_MEP_Final.pdf

[6] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

Assessment

In cases where a TMDL has been approved, MassDOT assesses the water body for the impairments covered by the TMDL under the BMP 7R methodology.[7] MassDOT separately assesses the water body for any stormwater-related impairments that are not covered by the TMDL under the BMP 7U methodology.[8] MassDOT assessed Quanset Pond (MA96-74) using the methodologies described below.

This assessment has been completed based on the Massachusetts Year 2012 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.[9] MassDEP has released a Proposed Massachusetts Year 2014 Integrated List[10] which has been reviewed for any proposed changes to the condition of the water bodies. The condition of Quanset Pond is not proposed to change.

BMP 7R for Nitrogen TMDL (CN 244.0)

The *Total Maximum Daily Load (TMDL) for Total Nitrogen in the Pleasant Bay System, Massachusetts (CN 244.0)*[11] addresses the total nitrogen impairment for this water body. MassDOT assessed the contribution of nitrogen from MassDOT properties to this water body using the approach described in BMP 7R[12] of MassDOT's Storm Water Management Plan (Water Quality Impaired Waters Assessment and Mitigation Plan), which applies to impairments that have been addressed by a TMDL, and MassDOT's application of BMP 7R to nitrogen in groundwater-controlled watersheds.[13]

For the nitrogen assessment under BMP 7R, MassDOT used USGS modeling[14] to estimate annual pollutant loads from its property. Based on the USGS SELDM model, which was run using precipitation data from the Hyannis site and an average of water quality data from Harwich and Marion, MassDOT estimates the nitrogen loading from impervious areas as 6.2 lbs/acre/yr and from pervious areas as 2.5 lbs/acre/yr.[13] The nitrogen loading for MassDOT property in the contributing area is summarized below:

- MassDOT Impervious Area: 2.9 acres

[7] MassDOT, July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

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

[9] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[10] MassDEP, June 2014. Massachusetts Year 2014 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/14iwlistp.pdf

[11] MassDEP, 2007. Final Pleasant Bay System TMDL for Total Nitrogen. Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/pbtmdl.pdf

[12] MassDOT. July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

[13] MassDOT, March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[14] Granato, G.E., 2013, Stochastic empirical loading and dilution model (SELDM) version 1.0.0: U.S. Geological Survey Techniques and Methods, book 4, chap. C3, 112 p. Available at: http://pubs.usgs.gov/tm/04/c03

- MassDOT Pervious Area: 0.9 acres
- Estimated Existing MassDOT Load: 20.4 lbs/yr
- Total Existing Groundwatershed Nitrogen Load: 6,390 lbs/yr (from TMDL)
- MassDOT Existing Load as a Percentage of Total Groundwatershed Nitrogen Load: 0.32%

The MassDOT existing load compared to the total groundwatershed nitrogen load is very small and considered negligible based on MassDOT's Nitrogen TMDL Method because it is less than 3.5% of the total nitrogen groundwatershed load.[15] In general, in areas where the MassDOT load is determined to be negligible, MassDOT does not implement BMPs because of their minimal impact on the overall groundwatershed load.

Proposed Mitigation Plan

As described above, MassDOT's nitrogen contribution to the receiving water is negligible. Therefore, MassDOT has no plans to implement structural BMPs to control nitrogen in stormwater runoff from their property.

MassDOT will continue to ensure proper non-structural BMPs are being implemented within the watershed of Quanset Pond, including regular roadway and drainage system maintenance, erosion and sedimentation control, and outreach and education. As described in MassDOT's Stormwater Handbook,[16] MassDOT does not use nitrogen based fertilizers as part of normal operations and maintenance procedures. In the rare circumstance where fertilizers are used, it is for the occasional vegetation establishment associated with recent ground disturbance.

Further work by MassDOT 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 NPDES permit annual reports to EPA regarding proposed BMP design either through retrofit or programmed projects, plans for construction of BMPs, reduction achieved by finalized BMP designs and progress made towards meeting target reductions.

[15] MassDOT, March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[16] MassDOT, May 2004. The MassHighway Storm Water Handbook for Highways and Bridges. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/wetlands/Stormwater_Handbook.pdf

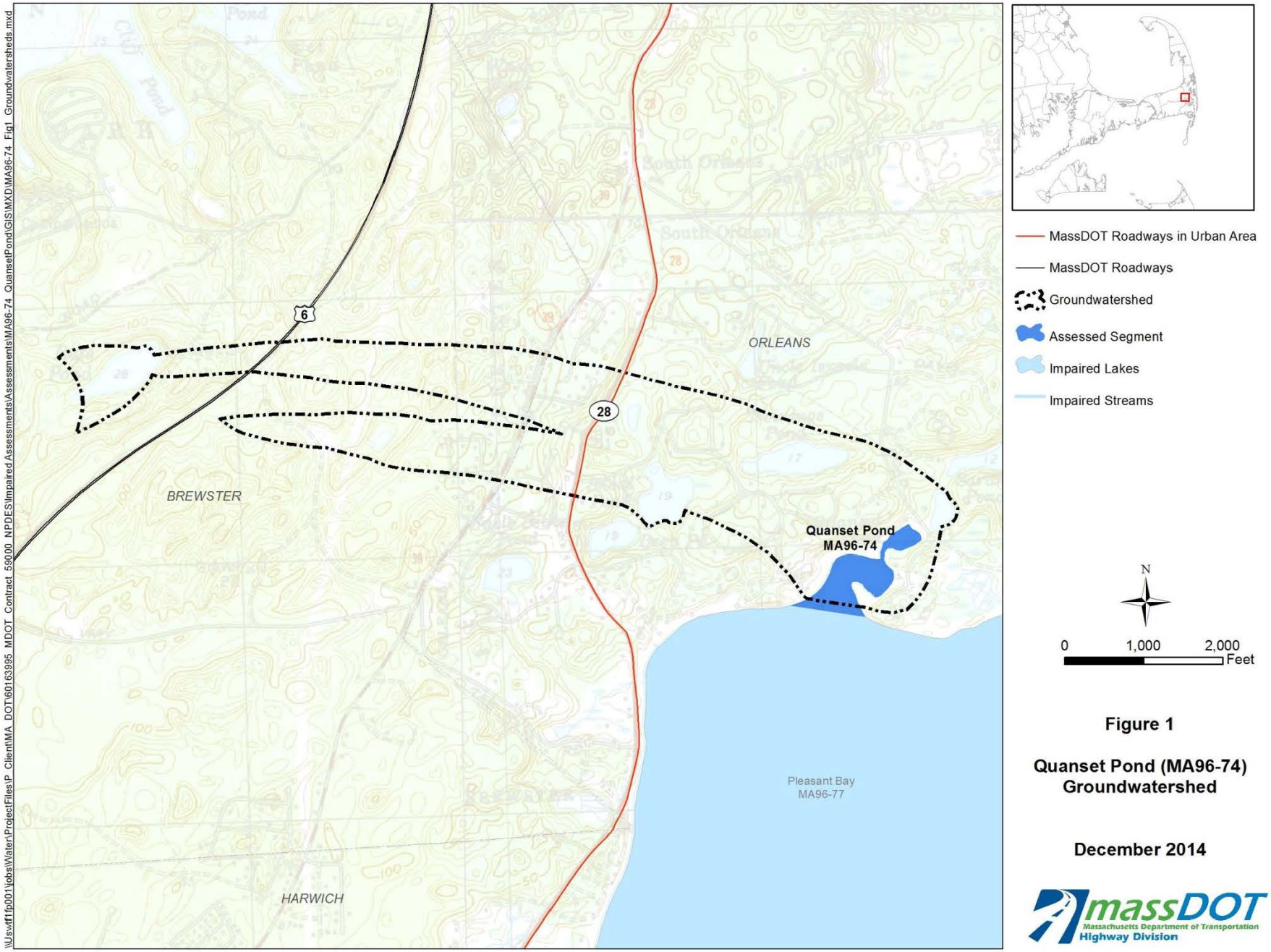

Figure 1

Quanset Pond (MA96-74) Groundwatershed

December 2014

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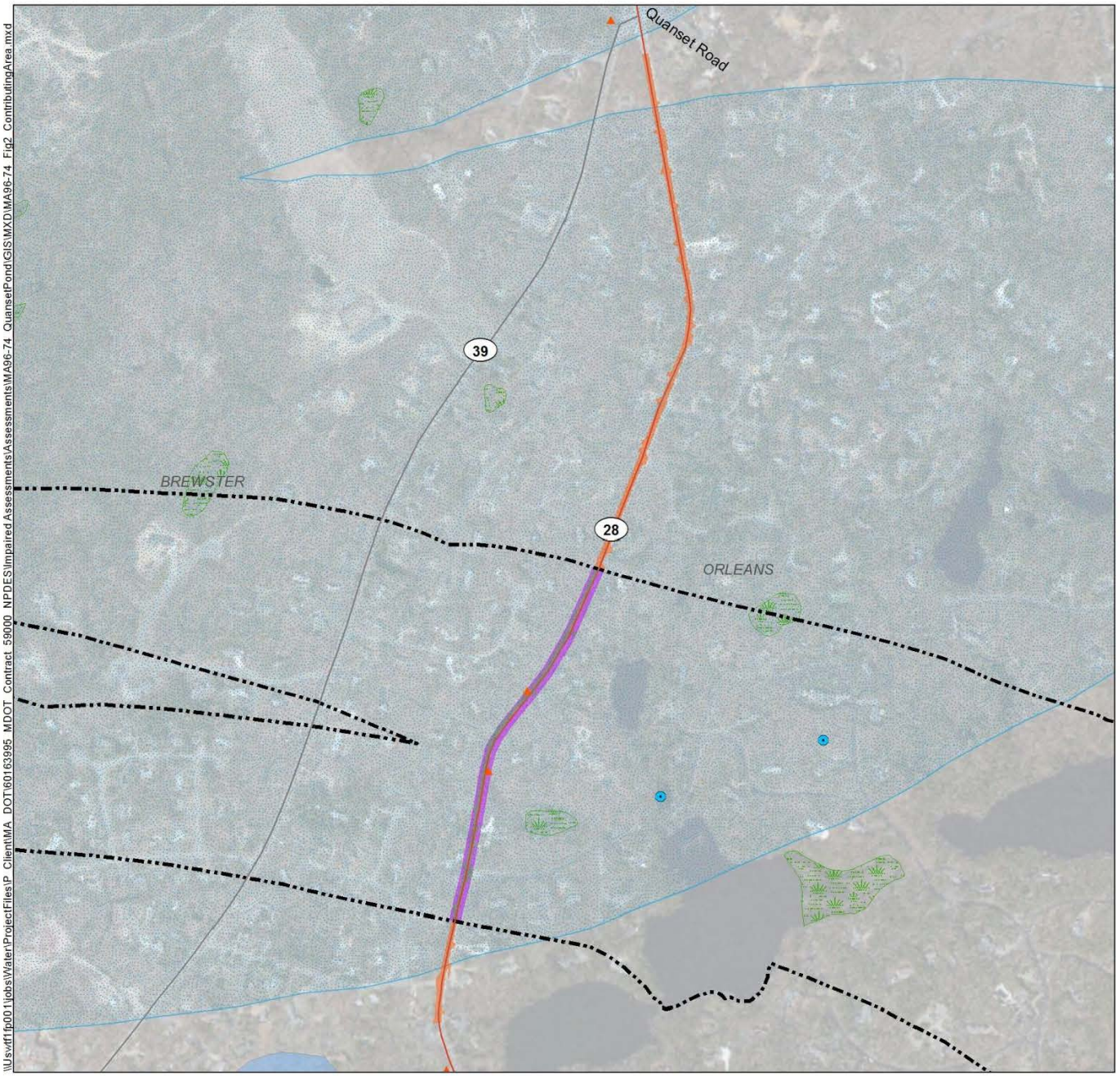
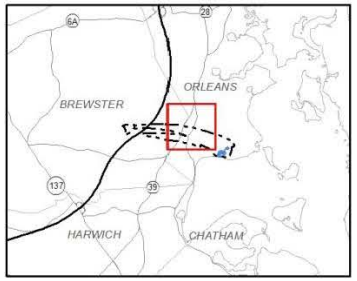
Massachusetts Department of Transportation
Highway Division





- MassDOT Outfalls
- MassDOT Roadways in Urban Area
- Groundwatershed
- MassDOT Impervious
- MassDOT Pervious
- MassDOT Supplemental Contributing Area
- Assessed Segment
- Certified Vernal Pools
- Zone II Wellhead Protection Areas
- DEP Wetlands
- Outstanding Resource Waters

N

0 400 800 Feet

Figure 2

Quanset Pond (MA96-74)
MassDOT Contributing Area

December 2014

massDOT
Massachusetts Department of Transportation
Highway Division

\\Usvtf1fp001\jobs\Water\ProjectFiles\P_Client\MA_DOT\60163995_MDOT_Contract_59000_NPDES\Impaired Assessments\Assessments\MA96-74_QuansetPond\GIS\MXD\MA96-74_Fig2_ContributingArea.mxd

massDOT Massachusetts Department of Transportation Highway Division

12/08/2014

Impaired Waters Assessment for Round Cove (MA96-75)

Summary

Impaired Water[1]	Stormwater Impairments:	*Nitrogen (Total)*
	Category:	*4A (TMDL is completed)*
	Final TMDLs:	*Final Pleasant Bay System TMDL for Total Nitrogen*[2]
	WQ Assessment:	*Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[3]
Location	Towns:	*Brewster, Harwich*
	MassDOT Roads:	*Route 28*
Assessment Method(s)	7R (TMDL Method) ☒	7U (Non-TMDL Method) ☐
BMPs	Existing:	*None*
MassDOT Area and Targets		Nitrogen
	Estimated MassDOT Load:	*10.6 lbs/yr*
	Existing Load to Water Body:	*10,310 lbs/yr*
	MassDOT Contribution to Existing Load:	*0.10 %*

Site Description

An assessment for Round Cove (MA96-75) was previously submitted to the EPA on June 8, 2011 using the BMP 7U[4] methodology. However, Ryder Cove is now being evaluated on a

[1] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[2] MassDEP. 2007. Final Pleasant Bay System TMDL for Total Nitrogen. Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/pbtmdl.pdf

[3] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

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

groundwatershed delineation, so it has been reassessed herein using BMP 7R Nitrogen[5] methodology.

Round Cove is a 0.02 square mile water body located east of Route 28 in Harwich, Massachusetts. Figure 1 illustrates the groundwatershed for Round Cove (MA96-75). The groundwatershed for this impaired segment is based on technical reports[6] developed by the Massachusetts Estuaries Project (MEP) which serve as the basis for the development of Total Maximum Daily Loads. The MEP team includes technical staff from USGS and the Cape Cod Commission and works collaboratively with MassDEP and the University of Massachusetts Dartmouth School of Marine Science and Technology (SMAST). For groundwatershed assessments, if a discharge occurs inside the groundwatershed boundary, it is considered to be a discharge that contributes to the impaired segment. If the discharge point is outside of the groundwatershed boundary, it is not considered to contribute to the impaired segment. MassDOT property that contributes runoff or infiltration within the groundwatershed area is considered in this assessment as contributing to Round Cove (MA96-75).

MassDEP's Water Quality Assessment Report titled *Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[7] identifies the Aquatic Life Use and Shellfishing Harvesting Use as "impaired" for Round Cove (MA96-75). The "impaired" status for the Aquatic Life Use is reported to be caused by estuarine bioassessment and low dissolved oxygen from subsurface wastewater disposal (septic) systems, stormwater runoff (unspecified urban stormwater and discharges from municipal separate storm sewer systems) and fertilizers. The Shellfish Harvesting Use is reported to be "impaired" due to elevated fecal coliform bacteria from waterfowl, waste from pets, on-site septic system discharges and discharges from municipal separate storm sewer systems. The other uses were not assessed.

Figure 2 illustrates the MassDOT-owned road within the groundwatershed that contributes runoff to the water body. It should be noted that only a portion of the MassDOT-owned road inside the groundwatershed boundary is within an MS4-regulated urban area. Route 6 is a MassDOT-owned roadway within the groundwatershed boundary that is outside of the designated urban area; therefore, discharge from this roadway is not identified as contributing to the impaired segment. Route 28 traverses the groundwatershed boundary west of and around Round Cove. Approximately 1.3 acres of impervious roadway area and 1.0 acres of pervious area within the right-of-way, drains to the groundwatershed via overland flow, infiltration or by catchbasins and pipes that discharge to subsurface leaching beds located on the west side of Route 28 . Along the northern edge of the groundwatershed, road topography is relatively flat and without curbing; runoff sheet flows to the shoulder and infiltrates. Runoff from the remainder of the roadway within the groundwatershed, which extends south to the intersection with Nauset Beach View Path, is collected in pipes which discharge to outfalls within the groundwatershed. This section of roadway is considered contributing to the water body and shown on Figure 2.

Existing BMPs

MassDOT estimated the pollutant load reduction provided by existing BMPs by applying treatment reductions to existing BMPs based on their size, function and contributing watershed. BMP

[5] MassDOT. March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[6] University of Massachusetts Dartmouth and MassDEP, 2006. Massachusetts Estuaries Project Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Pleasant Bay System, Orleans, Chatham, Brewster and Harwich, Massachusetts. Available at: http://www.oceanscience.net/estuaries/report/Pleasant_Bay/PleasantBay_MEP_Final.pdf

[7] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

performances were derived from different sources depending on the BMP and engineering judgment as described in the *Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds.*[8]

MassDOT identified five existing BMPs in place with the potential to treat roadway runoff from the discharging area before reaching the impaired water segment. The existing BMPs were all subsurface leaching beds located on the west side of Route 28 between Cove Landing Road and Mariner Drive. Per the methodology, the subsurface leaching beds do not receive a nitrogen removal credit as they do not provide storage or advanced water quality treatment.

Assessment

In cases where a TMDL has been approved, MassDOT assesses the water body for the impairments covered by the TMDL under the BMP 7R methodology.[9] MassDOT separately assesses the water body for any stormwater-related impairments that are not covered by the TMDL under the BMP 7U methodology.[10] MassDOT assessed Round Cove (MA96-75) using the methodologies described below.

This assessment has been completed based on the Massachusetts Year 2012 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. [11] MassDEP has released a Proposed Massachusetts Year 2014 Integrated List[12] which has been reviewed for any proposed changes to the condition of the water bodies. The condition of Round Cove is not proposed to change.

BMP 7R for Nitrogen TMDL (CN 244.0)

The *Total Maximum Daily Load (TMDL) for Total Nitrogen in the Pleasant Bay System, Massachusetts (CN 244.0)* [13] addresses the total nitrogen impairment for this water body. MassDOT assessed the contribution of nitrogen from MassDOT properties to this water body using the approach described in BMP 7R[14] of MassDOT's Storm Water Management Plan (Water Quality Impaired Waters Assessment and Mitigation Plan), which applies to impairments that have been

[8] MassDOT, March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[9] Massachusetts Department of Transportation (MassDOT), July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

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

[11] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[12] MassDEP, June 2014. Massachusetts Year 2014 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/14iwlistp.pdf

[13] MassDEP, 2007. Final Pleasant Bay System TMDL for Total Nitrogen. Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/pbtmdl.pdf

[14] MassDOT, July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

addressed by a TMDL, and MassDOT's application of BMP 7R to nitrogen in groundwater-controlled watersheds. [15]

For the nitrogen assessment under BMP 7R, MassDOT used USGS modeling[16] to estimate annual pollutant loads from its property. Based on the USGS SELDM model, which was run using precipitation data from the Hyannis site and an average of water quality data from Harwich and Marion, MassDOT estimates the nitrogen loading from impervious areas as 6.2 lbs/acre/yr and from pervious areas as 2.5 lbs/acre/yr.[16] The nitrogen loading for MassDOT property in the contributing area is summarized below:

- MassDOT Impervious Area: 1.3 acres
- MassDOT Pervious Area: 1.0 acres
- Estimated Existing MassDOT Load: 10.6 lbs/yr
- Total Existing Groundwatershed Nitrogen Load: 10,310 lbs/yr
- MassDOT Existing Load as a Percentage of Total Groundwatershed Nitrogen Load: 0.10%

The MassDOT existing load compared to the total groundwatershed nitrogen load is very small and considered negligible based on MassDOT's Nitrogen TMDL Method because it is less than 3.5% of the total nitrogen groundwatershed load.[16] In general, in areas where the MassDOT load is determined to be negligible, MassDOT does not implement BMPs because of their minimal impact on the overall groundwatershed load.

Proposed Mitigation Plan

As described above, MassDOT's nitrogen contribution to the receiving water is negligible. Therefore, MassDOT has no plans to implement structural BMPs to control nitrogen in stormwater runoff from their property.

MassDOT will continue to ensure proper non-structural BMPs are being implemented within the groundwatershed of Round Cove, including regular roadway and drainage system maintenance, erosion and sedimentation control, and outreach and education. As described in MassDOT's Stormwater Handbook,[17] MassDOT does not use nitrogen based fertilizers as part of normal operations and maintenance procedures. In the rare circumstance where fertilizers are used, it is for the occasional vegetation establishment associated with recent ground disturbance. Further work by MassDOT 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 NPDES permit annual reports to EPA regarding proposed BMP design either through retrofit or programmed projects, plans for construction of BMPs, reduction achieved by finalized BMP designs and progress made towards meeting target reductions.

[15] MassDOT, March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[16] Granato, G.E., 2013, Stochastic empirical loading and dilution model (SELDM) version 1.0.0: U.S. Geological Survey Techniques and Methods, book 4, chap. C3, 112 p. Available at: http://pubs.usgs.gov/tm/04/c03

[17] MassDOT, May 2004. The MassHighway Storm Water Handbook for Highways and Bridges. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/wetlands/Stormwater_Handbook.pdf

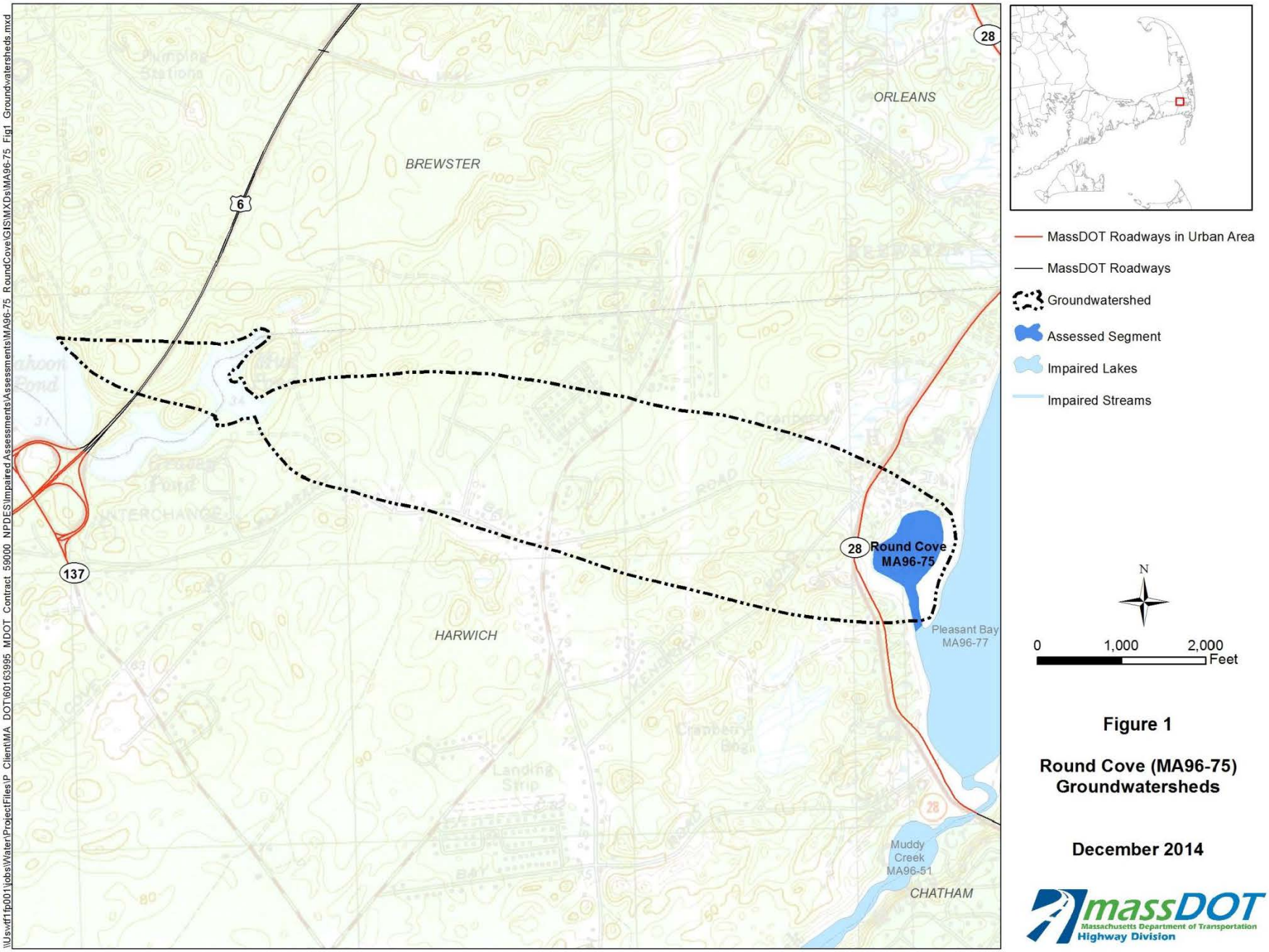
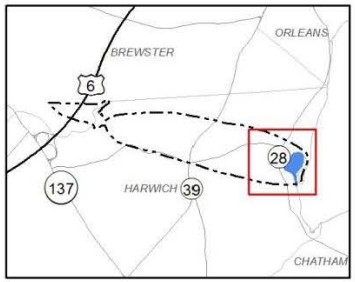


Figure 1

Round Cove (MA96-75)
Groundwatersheds

December 2014

massDOT
Massachusetts Department of Transportation
Highway Division



- MassDOT Outfalls
- MassDOT Roadways in Urban Area
- Groundwatershed
- MassDOT Supplemental Contributing Area
- MassDOT Impervious Area
- MassDOT Pervious Area
- Assessed Segment
- Impaired Lakes
- DEP Wetlands

N

0 300 600 Feet

Figure 2

Round Cove (MA96-75)
MassDOT Contributing Area

December 2014

massDOT
Massachusetts Department of Transportation
Highway Division

Impaired Waters Assessment for Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78)

Summary

Impaired Water[1]	**Pleasant Bay (MA96-77)**:	Stormwater Impairments:	*Nitrogen (Total)*
		Category:	*4A (TMDL is completed)*
		Final TMDLs:	*Final Pleasant Bay System TMDL for Total Nitrogen*[2]
		WQ Assessment:	*Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[3]
	Little Pleasant Bay (MA96-78):	Stormwater Impairments	*Fecal Coliform, Nitrogen (Total)*
		Category:	*4A (TMDL is completed)*
		Final TMDLs:	*Addendum: Final Pathogen TMDL for the Cape Cod Watershed*[4] *Final Pleasant Bay System TMDL for Total Nitrogen*[2]
		WQ Assessment:	*Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[3]
Location		Towns:	*Brewster, Chatham, Harwich, Orleans*
		MassDOT Roads:	*Route 6, Route 28, Route 137*
Assessment Method(s)	7R (TMDL Method) ☒		7U (Non-TMDL Method) ☐
BMPs		Existing:	*None*
MassDOT Area and Targets			Nitrogen
		Estimated MassDOT Load:	*312.6 lbs/yr*
		Existing Load to Water Body:	*358,002 lbs/yr*
		MassDOT Contribution to Existing Load:	*0.09 %*

[1] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

[2] MassDEP. 2007. Final Pleasant Bay System TMDL for Total Nitrogen. Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/pbtmdl.pdf

[3] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

[4] MassDEP. 2012. Addendum: Final Pathogen TMDL for the Cape Cod Watershed. Available at: http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/capeadd.pdf

Site Description

Pleasant Bay (MA96-77), a 2.88 square mile water body, and Little Pleasant Bay (MA96-78), a 3.3 square mile water body, are located adjacent to Chatham Harbor in Brewster, Harwich, Orleans, and Chatham, Massachusetts. Figure 1 illustrates the groundwatershed for the entire Pleasant Bay system, including both Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78). The groundwatersheds are based on technical reports[5] developed by the Massachusetts Estuaries Project (MEP) which serve as the basis for the development of Total Maximum Daily Loads. The MEP team includes technical staff from USGS and the Cape Cod Commission and works collaboratively with MassDEP and the University of Massachusetts Dartmouth School of Marine Science and Technology (SMAST). The Pleasant Bay and Little Pleasant Bay systems were assessed within the overall Pleasant Bay watershed since the groundwatershed for Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78) were combined within the MEP report. For groundwatershed assessments, if a discharge occurs inside the groundwatershed boundary, it is considered to be a discharge that contributes to the impaired segment. If the discharge point is outside of the groundwatershed boundary, it is not considered to contribute to the impaired segment.

As indicated in Figure 1, Pleasant Bay and Little Pleasant Bay are two parts of a larger Pleasant Bay system including Chatham Harbor (MA 96-10) which ultimately drains to the Atlantic Ocean. Chatham Harbor is not being assessed as part of the Impaired Waters Program because it is designated a category 2 water on the Massachusetts 303(d) list; [6] however, the Pleasant Bay system groundwatershed includes a number of upgradient impaired water bodies and their delineated groundwatersheds: Frost Fish Creek (MA 96-49), Ryder Cove (MA 96-50), Muddy Creek (MA 96-51), Areys Pond (MA96-70), Namequoit River (MA96-71), Paw Wah Pond (MA 96-72), Pochet Neck (MA 96-73), Quanset Pond (MA 96-74), Round Cove (MA 96-75), The River (MA 96-76), Baker Pond (MA96008), Crystal Lake (MA96050), Lovers Lake (MA96186), and Stillwater Pond (MA96309). These water bodies and their water quality conditions are discussed in separate assessments. MassDOT property that contributes runoff or infiltration within the groundwatershed area is considered in this assessment as contributing to Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78).

For Pleasant Bay (MA96-77), MassDEP's Water Quality Assessment Report titled *Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report*[3] identifies the Aquatic Life Use as "impaired". The Aquatic Life Use is reported to be caused by total nitrogen from subsurface wastewater disposal (septic) systems, stormwater runoff (unspecified urban stormwater and discharges from municipal separate storm sewer systems) and fertilizers (yard maintenance, agriculture, golf courses). Shellfish Harvesting, Primary Contact and Secondary Contact Uses are reported as "supported". The other uses were not assessed.

For Little Pleasant Bay (MA96-78), MassDEP's Water Quality Assessment Report titled "Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report"[3] identifies the Aquatic Life Use as "impaired" and 0.001 square miles as "impaired" for the Shellfishing Harvesting Use. The Aquatic Life Use is reported to be caused by total nitrogen from subsurface wastewater

[5] University of Massachusetts Dartmouth and MassDEP, 2006. Massachusetts Estuaries Project Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for the Pleasant Bay System, Orleans, Chatham, Brewster and Harwich, Massachusetts. Available at: http://www.oceanscience.net/estuaries/report/Pleasant_Bay/PleasantBay_MEP_Final.pdf

[6] MassDEP, 2013. Massachusetts Year 2012 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

disposal (septic) systems, stormwater runoff (unspecified urban stormwater and discharges from municipal separate storm sewer systems) and fertilizers (yard maintenance). The Shellfish Harvesting Use is reported to be "impaired" due to elevated fecal coliform bacteria from marina or boating pumpout releases, waterfowl, and discharges from waterfowl and upstream sources. The Primary and Secondary Contact Uses are reported as "supported". The other uses were not assessed.

Figures 2A through 2I illustrate the MassDOT-owned roads in the urban area within the groundwatershed that contribute runoff to the water bodies. It should be noted that only a portion of the MassDOT-owned roads inside the groundwatershed boundary are within an MS4-regulated urban area. Portions of the MassDOT roads are outside of the designated urban area; therefore, discharges from these roadways are not identified as contributing to the impaired segment.
Route 6 crosses through the groundwatershed west of Route 28, from the east side of Baker Pond running just south of Long Pond. Route 6, a two-lane highway, has two urbanized sections contributing runoff (Figures 2A and 2B). As described in The River (MA96-76) assessment, the northern section has surrounding land uses of conservation land, state park, and residential land uses. This section of contributing roadway starts at the northern groundwatershed limits extending south to approximately the Orleans town limits. Roadway runoff is collected by catch basins that direct flow through drain pipes to adjacent wooded areas. A 300-foot segment of Route 6 north of the groundwatershed border is located outside of the groundwatershed boundary and is considered "Supplemental Contributing Area" (Figure 2A). Any impervious area located outside the groundwatershed boundary that flows back into the groundwatershed via sheet flow, drainage pipes, or other means is considered "Supplemental". Stormwater from this area flows along the roadway south where it is collected in catchbasins which discharge to a leaching basin west of Route 6 within the groundwatershed.

The southern section of Route 6 includes the area described in the Muddy Creek assessment, as well as additional ramp areas at the intersection between Route 137 and Route 6 (Figure 2B). At the Route 137/ Route 6 interchange a small section of Route 137 and the ramp connecting Route 137 northbound to Route 6 eastbound contributes runoff within the Muddy Creek groundwatershed via overland flow, infiltration or catchbasins and pipes. MassDOT roadway includes Route 6 areas from the intersection with Route 137 to a high point approximately 325 feet north of the southern groundwatershed boundary close to Hawksnest Pond; the roadway south of this is collected in pipes and conveyed south where the runoff discharges outside of the groundwatershed. Approximately 11.4 acres of impervious roadway area and 6.3 acres of pervious within the Route 6 or Route 137 rights-of-way drains to the groundwatershed.

Route 28 crosses the groundwatershed boundary just west of Crystal Lake and wraps around Pleasant Bay (Figures 2C-2I). The MassDOT urban right-of-way contributing to Pleasant Bay and Little Pleasant Bay includes the entire length of the Route 28 roadway within the groundwatershed except for a 2,000-foot stretch of impervious roadway, from north of Barcliffe Avenue to the southern groundwatershed border, which drains south outside the groundwatershed via catch basins and pipes. Additional area on Route 28 that is not included in this assessment is a non-urban stretch of road within The River groundwatershed between Areys Lane and Namequoit Road (Figures 2Cand 2D). The remainder of Route 28 runoff drains to the watershed via overland flow, infiltration or catchbasins and pipes. A section of Route 28 that is also discussed in the Round Cove (MA96-75) assessment drains to the groundwatershed via overland flow and infiltrates or by catchbasins and pipes that discharge to subsurface leaching beds located on the west side of Route 28 (Figure 2F). Approximately 25.1 acres of impervious roadway area and 16.1 acres of pervious within the Route 28 right-of-way drains to the groundwatershed.

Existing BMPs

MassDOT estimated the pollutant load reduction provided by existing BMPs by applying treatment reductions to existing BMPs based on their size, function and contributing watershed. BMP performances were derived different sources depending on the BMP and engineering judgment as described in the *Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds.*[7]

MassDOT identified seven existing BMPs in place with the potential to treat roadway runoff from the discharging area before reaching the impaired water segment. All BMPs are subsurface leaching beds within the Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78) groundwatersheds; of these, one is also within the Muddy Creek (MA96-51) groundwatershed shown on Figure 2A, one is located in The River (MA96-76) groundwatershed shown on Figure 2B and five are also within the Round Cove (MA96-75) groundwatershed (Figure2F). The southernmost subsurface leaching bed is located west of Route 28 south of Misty Meadow Lane and approximately 670 feet north of Stoney Hill Road to the ramp connecting Route 137 northbound to Route 6 westbound. The subsurface leaching bed within the Muddy Creek groundwatershed is located adjacent to the ramp connecting Route 137 northbound to Route 6 westbound. The five subsurface leaching beds within the Round Cove groundwatershed are located on the west side of Route 28 between Cove Landing Road and Mariner Drive. However, none of these BMP's account for reduction credit for nitrogen removal from this system, per the methodology.

Assessment

In cases where a TMDL has been approved, MassDOT assesses the water body for the impairments covered by the TMDL under the BMP 7R methodology.[8] MassDOT separately assesses the water body for any stormwater-related impairments that are not covered by the TMDL under the BMP 7U methodology.[9] MassDOT assessed Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78) using the methodologies described below.

This assessment has been completed based on the Massachusetts Year 2012 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. [10] MassDEP has released a Proposed Massachusetts Year 2014 Integrated List[11] which has been reviewed for any proposed changes to the condition of the water bodies. The conditions of Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78) are not proposed to change.

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[7] Massachusetts Department of Transportation (MassDOT), March 7, 2014. *Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds*. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[8] Massachusetts Department of Transportation (MassDOT), July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

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

[10] MassDEP, 2011. Cape Cod Coastal Drainage Areas, 2004 – 2008 Surface Water Quality Assessment Report. Available at: http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/96wqar12.pdf

[11] MassDEP, June 2014. Massachusetts Year 2014 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. Massachusetts. Available at: http://www.mass.gov/eea/docs/dep/water/resources/07v5/14iwlistp.pdf

BMP 7R for Nitrogen TMDL (CN 244.0)

The *Total Maximum Daily Load (TMDL) for Total Nitrogen in the Pleasant Bay System, Massachusetts (CN 244.0)*[12] addresses the total nitrogen impairments for these water bodies. MassDOT assessed the contribution of nitrogen from MassDOT properties to these water bodies using the approach described in BMP 7R[13] of MassDOT's Storm Water Management Plan (Water Quality Impaired Waters Assessment and Mitigation Plan), which applies to impairments that have been addressed by a TMDL, and MassDOT's application of BMP 7R to nitrogen in groundwater-controlled watersheds.[14]

For the nitrogen assessment under BMP 7R, MassDOT used USGS modeling[15] to estimate annual pollutant loads from its property. Based on the USGS SELDM model, which was run using precipitation from the Hyannis site and an average of water quality data from Harwich and Marion, MassDOT estimates the nitrogen loading from impervious areas as 6.2 lbs/acre/yr and from pervious areas as 2.5 lbs/acre/yr.[14] The nitrogen loading for MassDOT property in the contributing area is summarized below:

- MassDOT Impervious Area: 36.5 acres
- MassDOT Pervious Area: 34.5 acres
- Estimated Existing MassDOT Load: 312.6 lbs/yr
- Total Existing Groundwatershed Nitrogen Load: 358,002 lbs/yr
- MassDOT Existing Load as a Percentage of Total Groundwatershed Nitrogen Load: 0.09%

The MassDOT existing load compared to the total groundwatershed nitrogen load is very small and considered negligible based on MassDOT's Nitrogen TMDL Method because it is less than 3.5% of the total nitrogen groundwatershed load.[14] In general, in areas where the MassDOT load is determined to be negligible, MassDOT does not implement BMPs because of their minimal impact on the overall groundwatershed load.

BMP 7R for Pathogen TMDL (CN 252.2)

MassDOT assessed the indicator bacteria impairment using the approach described in BMP 7R of MassDOT's Storm Water Management Plan (SWMP). [16] Little Pleasant Bay (MA96-78) is covered

[12] MassDEP. 2007. Final Pleasant Bay System TMDL for Total Nitrogen. Available at: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/pbtmdl.pdf

[13] MassDOT. July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

[14] MassDOT, March 7, 2014. Application of BMP 7R to Nitrogen in Groundwater-Controlled Massachusetts Watersheds. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/impairedWaters/Year4/Attachment_5.pdf

[15] Granato, G.E., 2013, Stochastic empirical loading and dilution model (SELDM) version 1.0.0: U.S. Geological Survey Techniques and Methods, book 4, chap. C3, 112 p. Available at: http://pubs.usgs.gov/tm/04/c03

[16] MassDOT. July 22, 2010. BMP 7R: TMDL Watershed Review. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/npdes/BMP_7R_TMDL_WatershedReview.pdf

by the *Final Pathogen TMDL for the Cape Cod Watershed*,[17] which is an *Addendum to the 2009 Final Pathogen TMDL for the Cape Cod Watershed.*[18]

Pathogen concentrations in stormwater vary widely and concentrations can vary by an order of magnitude within a given storm event at a single location making it difficult to predict pathogen concentrations in stormwater with accuracy. MassDOT generally will not conduct site specific assessments of pathogen loading for each water body impaired for pathogens but instead developed an iterative adaptive management approach to address impaired waters and permit condition requirements and an approach to stormwater management. Greater detail of the assessment methodology is provided in MassDOT's BMP 7R Pathogen Methodology.[19]

According to the 2009 Cape Cod Pathogen TMDL, sources of indicator bacteria throughout the watershed were found to be many and varied. Most of the bacteria sources are believed to be failing septic systems, combined sewer overflows (CSO), sanitary sewer overflows (SSO), sewer pipes connected to storm drains, certain recreational activities, wildlife including birds along with domestic pets and animals and direct overland stormwater runoff. Additionally, the TMDL states that implementation to achieve the TMDL goals should be an iterative process with selection and implementation of mitigation measures followed by monitoring to determine the extent of water quality improvement realized. Recommended TMDL implementation measures include identification and elimination of prohibited sources such as leaky or improperly connected sanitary sewer flows and best management practices to mitigate stormwater runoff volume.

The TMDL states that several impaired segments carry a higher priority due to their location, use, and risk to human health. The higher priority areas in the Cape Cod watershed stand out as likely priority areas to address bacteria pollution sources. These segments tend to be located nearest to sensitive areas such as Outstanding Resource Waters (ORWs) or designated uses that require higher water quality standards than Class B. Little Pleasant Bay (MA96-78) is not prioritized due to inefficient data; however the water body is designated as a Class SA ORW and has value based on its shellfishing use. [20]

In addition to the generic recommendations provided in the draft MS4 permits for Massachusetts, the Cape Cod Watershed TMDL report[21] (Section 8.0) recommends the following specific BMPs to address elevated fecal coliform levels in the watershed:

- Correction of failing septic systems
- Public education regarding illicit sewer connection and failing infrastructure, as well as stormwater runoff and boat wastes
- Identification and elimination of prohibited sources such as leaky or improperly connected sanitary sewer flows
- Best management practices to mitigate stormwater runoff volume

[17] MassDEP. 2012. Addendum: Final Pathogen TMDL for the Cape Cod Watershed. Available at: http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/capeadd.pdf

[18] MassDEP. 2009. Final Pathogen TMDL for the Cape Cod Watershed. Available at: http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/capecod1.pdf

[19] MassDOT. December 2014. Description of MassDOT's Application of BMP 7R for Pathogen Related Impairments.

[20] MassDEP. 2012. Addendum: Final Pathogen TMDL for the Cape Cod Watershed. Available at: http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/capeadd.pdf

[21] MassDEP. 2009. Final Pathogen TMDL for the Cape Cod Watershed. Available at: http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/capecod1.pdf

The TMDL report also indicates that structural BMPs may be appropriate if less costly non-structural BMPs are not effective. Many non-structural BMPs are in place, including public education and outreach, street sweeping, and catch basin cleanouts. In addition to practices like these, many communities have formed advisory committees to help resolve existing stormwater issues. Many of the communities on Cape Cod practice their own stormwater BMPs. Additionally, the TMDL states that implementation to achieve the TMDL goals should be an iterative process with selection and implementation of mitigation measures followed by monitoring to determine the extent of water quality improvement realized.

The following BMPs are specifically identified in the TMDL as being ongoing and/or planned in order to meet the bacteria TMDL for the Cape Cod Watershed:

- Septic tank controls
- Documentation of storm drain outfall locations
- Resident education
- Additional water quality monitoring
- Designation of “No Discharge” areas in high priority coastal waters

Proposed Mitigation Plan

As described above, MassDOT’s nitrogen contribution to the receiving water is negligible. Therefore, MassDOT has no plans to implement structural BMPs to control nitrogen in stormwater runoff from their property.

With respect to the fecal coliform impairment for Little Pleasant Bay (MA96-78), 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. As discussed in MassDOT’s BMP 7R Pathogen Methodology, MassDOT believes that existing efforts are consistent with the current and draft MS4 permit requirements and TMDL recommendations in regard to pathogens.

In accordance with the BMPs identified in the TMDL report as planned measures to reach compliance with the Cape Cod Pathogen TMDL report, MassDOT has documented the locations of its stormwater outfalls. In addition, as part of its pet waste management program, MassDOT has determined that no MassDOT targeted rest stops are located within the groundwatershed of this water body. MassDOT will be installing signs at rest stops within the groundwatershed of impaired water bodies. The signs will inform the public of the need to remove pet waste, which can minimize contributions of pathogens to stormwater runoff. Pet waste removal bags and disposal cans will be provided.”

Although the TMDL report also identifies the benefits of structural BMPs to address pathogens in runoff from impervious areas in some instances, MassDOT feels that it is not a beneficial approach to implement these BMPs in advance of other ongoing BMP efforts identified in the groundwatershed, given the documented variability of pathogen concentrations in highway runoff, and the low probability of achieving substantial gains towards meeting the TMDL with solely implementing impervious cover reductions and controls.

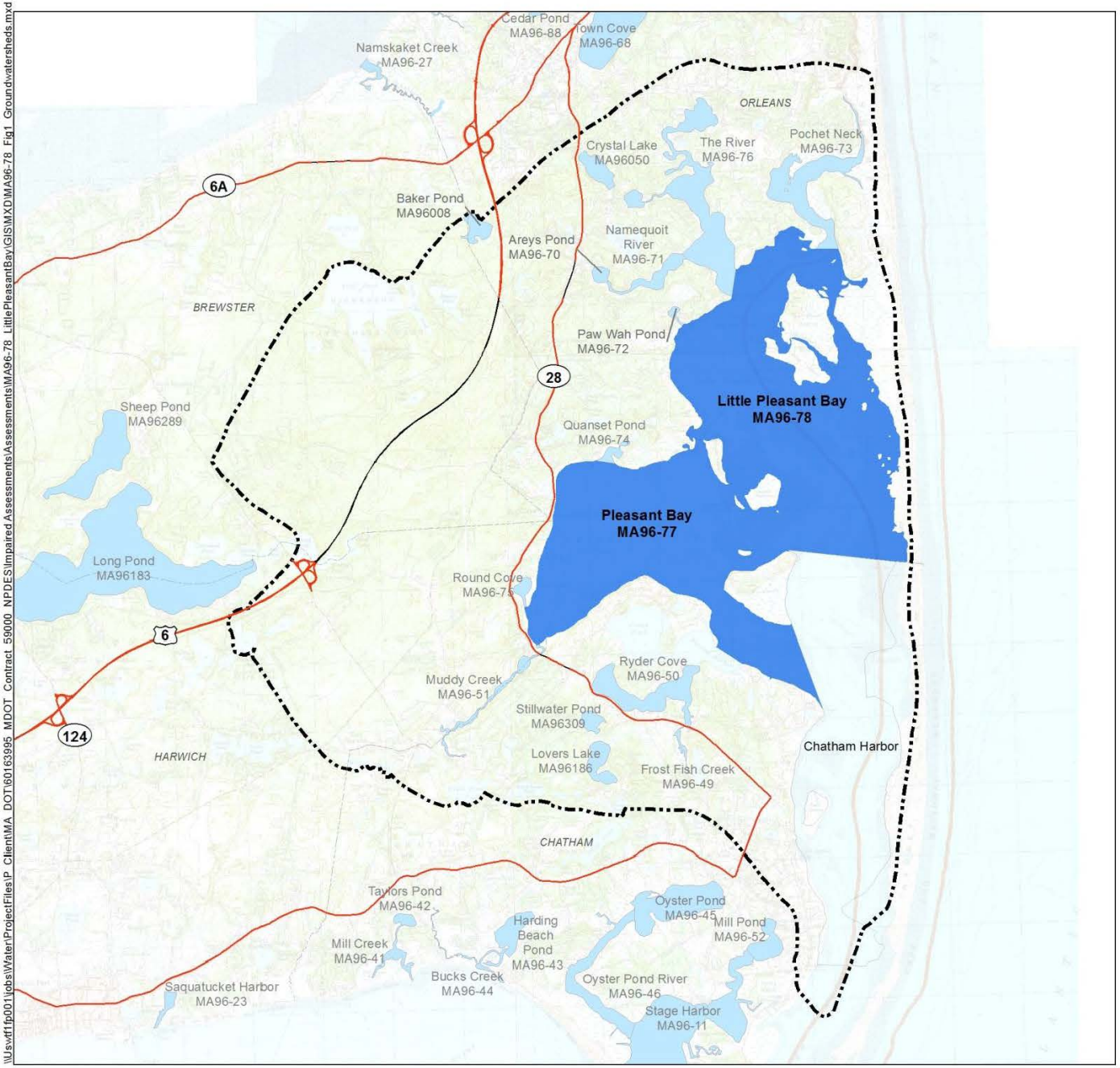
Furthermore, MassDOT has an ongoing inspection and monitoring program aimed at identifying and addressing illicit discharges to MassDOT’s stormwater management system. MassDOT

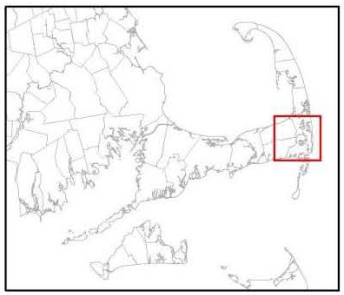
investigates any suspicious flows noted, and will work with owners of confirmed illicit discharges to remove these flows, and thereby minimize the possibility of pathogen contributions to receiving waters. At present, there are no suspected or known illicit discharges, or unauthorized drainage tie-ins, within the groundwatershed of this water body that could be contributing pathogens to the impaired water body.

MassDOT has concluded that the BMPs outlined in the SWMP are consistent with its existing permit requirements for Little Pleasant Bay. These measures achieve pathogen reductions (including fecal coliform) to the maximum extent practicable and are consistent with the intent of its existing stormwater permit. As stated previously, pathogen loadings are highly variable and although there is potential for stormwater runoff from MassDOT roadways to be a contributing source it is unlikely to warrant action relative to other sources of pathogens in the groundwatershed.

MassDOT will continue to ensure proper non-structural BMPs are being implemented within the groundwatershed, including regular roadway and drainage system maintenance, erosion and sedimentation control, and outreach and education. As described in MassDOT's Stormwater Handbook,[22] MassDOT does not use nitrogen based fertilizers as part of normal operations and maintenance procedures. In the rare circumstance where fertilizers are used, it is for the occasional vegetation establishment associated with recent ground disturbance. Further work by MassDOT 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 NPDES permit annual reports to EPA regarding proposed BMP design either through retrofit or programmed projects, plans for construction of BMPs, reduction achieved by finalized BMP designs and progress made towards meeting target reductions.

[22] MassDOT, May 2004. The MassHighway Storm Water Handbook for Highways and Bridges. Available at: http://www.massdot.state.ma.us/Portals/8/docs/environmental/wetlands/Stormwater_Handbook.pdf





MassDOT Roadways in Urban Area

MassDOT Roadways

Groundwatershed

Assessed Segment

Impaired Lakes

Impaired Streams

N

0 0.75 1.5 Miles

Figure 1

Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78) Groundwatershed

December 2014

massDOT Massachusetts Department of Transportation Highway Division

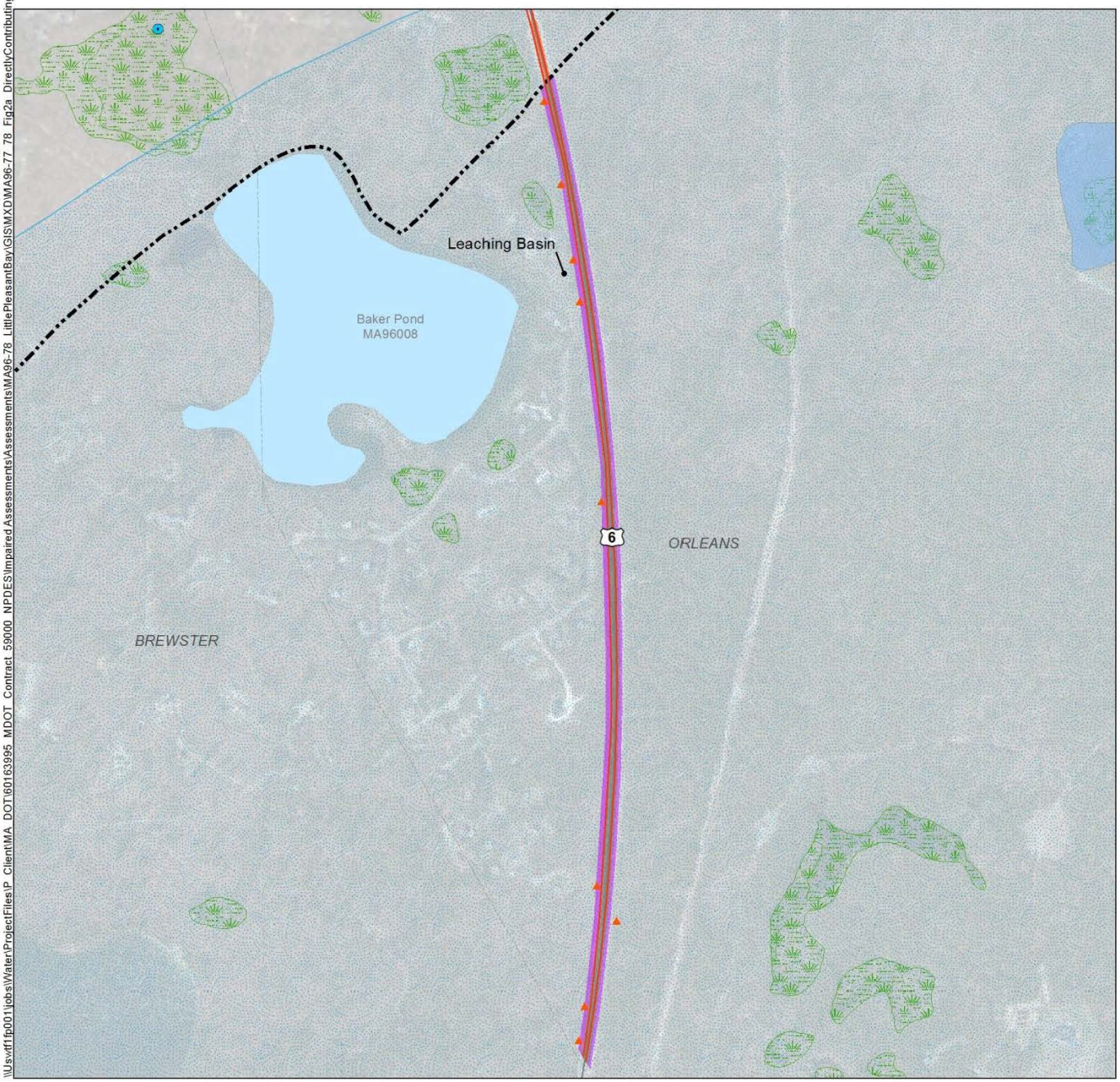


Figure 2A

Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78) MassDOT Contributing Area

December 2014

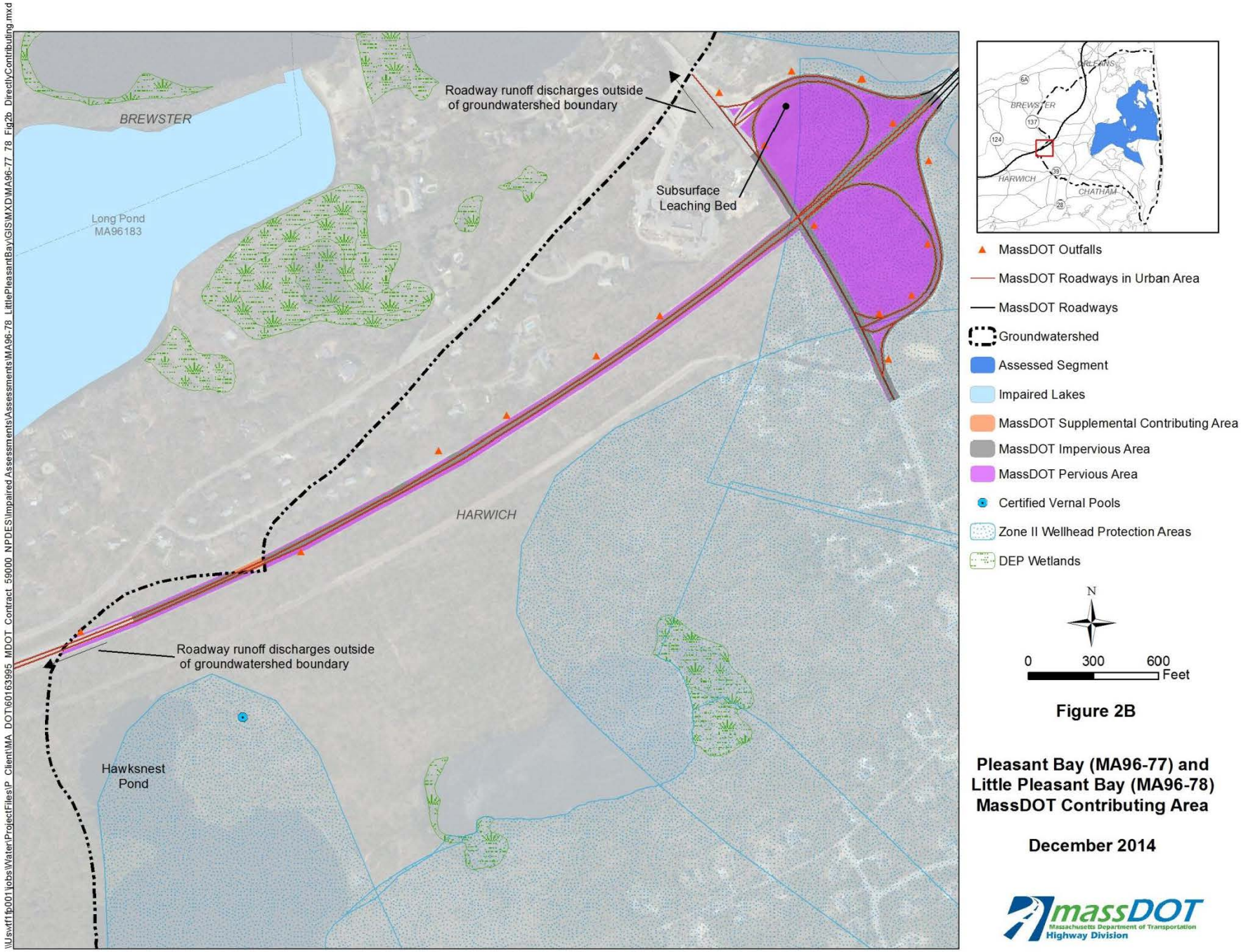
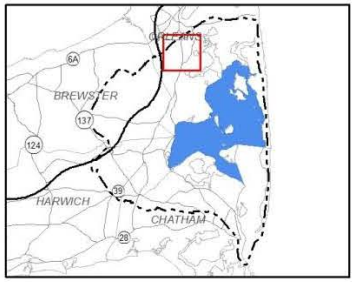


Figure 2B

Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78) MassDOT Contributing Area

December 2014



- MassDOT Outfalls
- MassDOT Roadways in Urban Area
- Groundwatershed
- Assessed Segment
- Impaired Lakes
- MassDOT Supplemental Contributing Area
- MassDOT Impervious Area
- MassDOT Pervious Area
- Certified Vernal Pools
- Outstanding Resource Waters
- Areas of Critical Environmental Concern
- Zone II Wellhead Protection Areas
- DEP Wetlands

N

0 300 600 Feet

Figure 2C

Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78) MassDOT Contributing Area

December 2014

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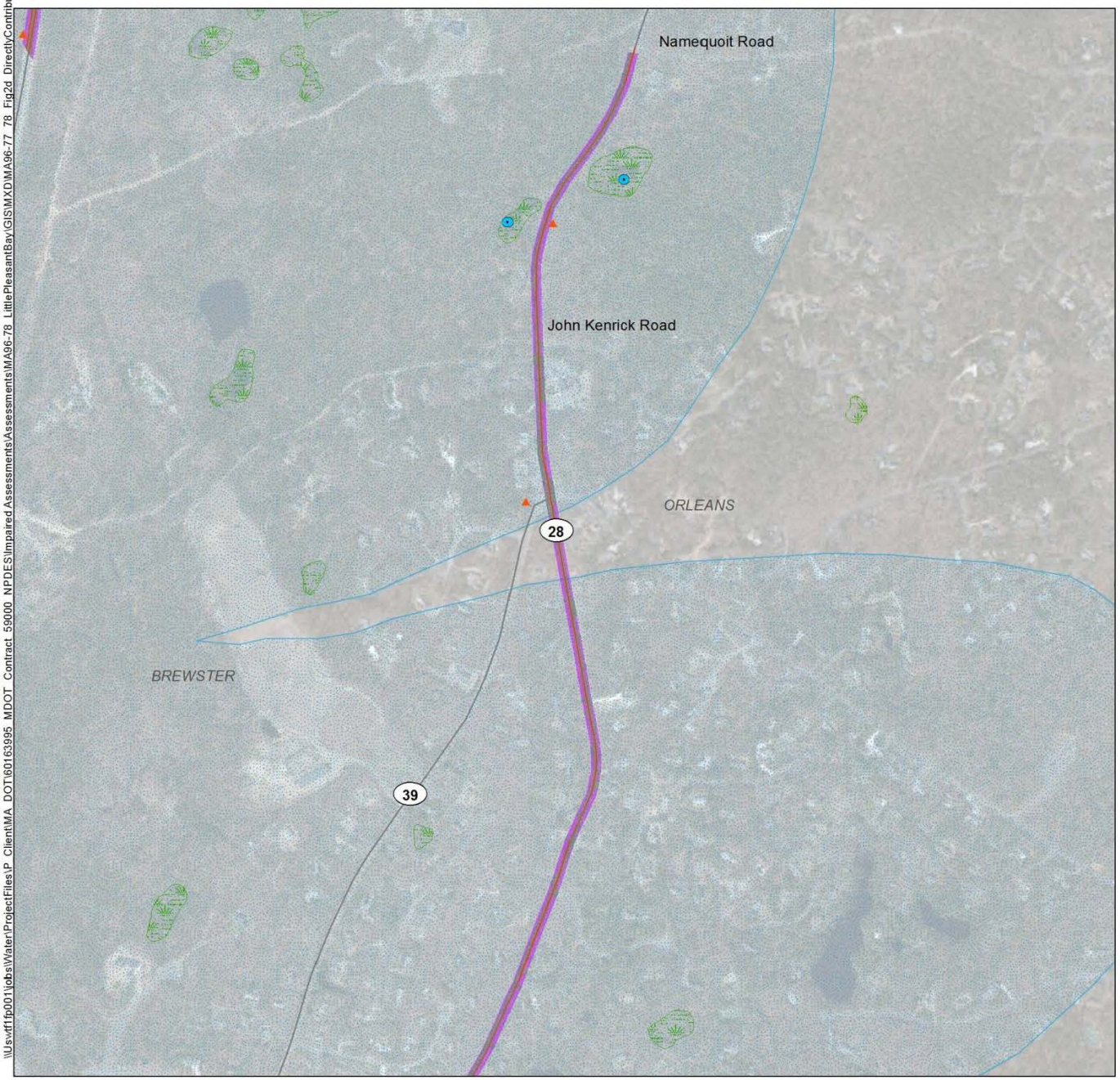

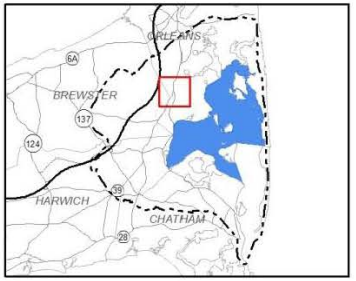

- MassDOT Outfalls
- MassDOT Roadways in Urban Area
- Groundwatershed
- Assessed Segment
- Impaired Lakes
- MassDOT Impervious Area
- MassDOT Pervious Area
- Certified Vernal Pools
- Zone II Wellhead Protection Areas
- DEP Wetlands

N

0 300 600 Feet

Figure 2D

Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78) MassDOT Contributing Area

December 2014

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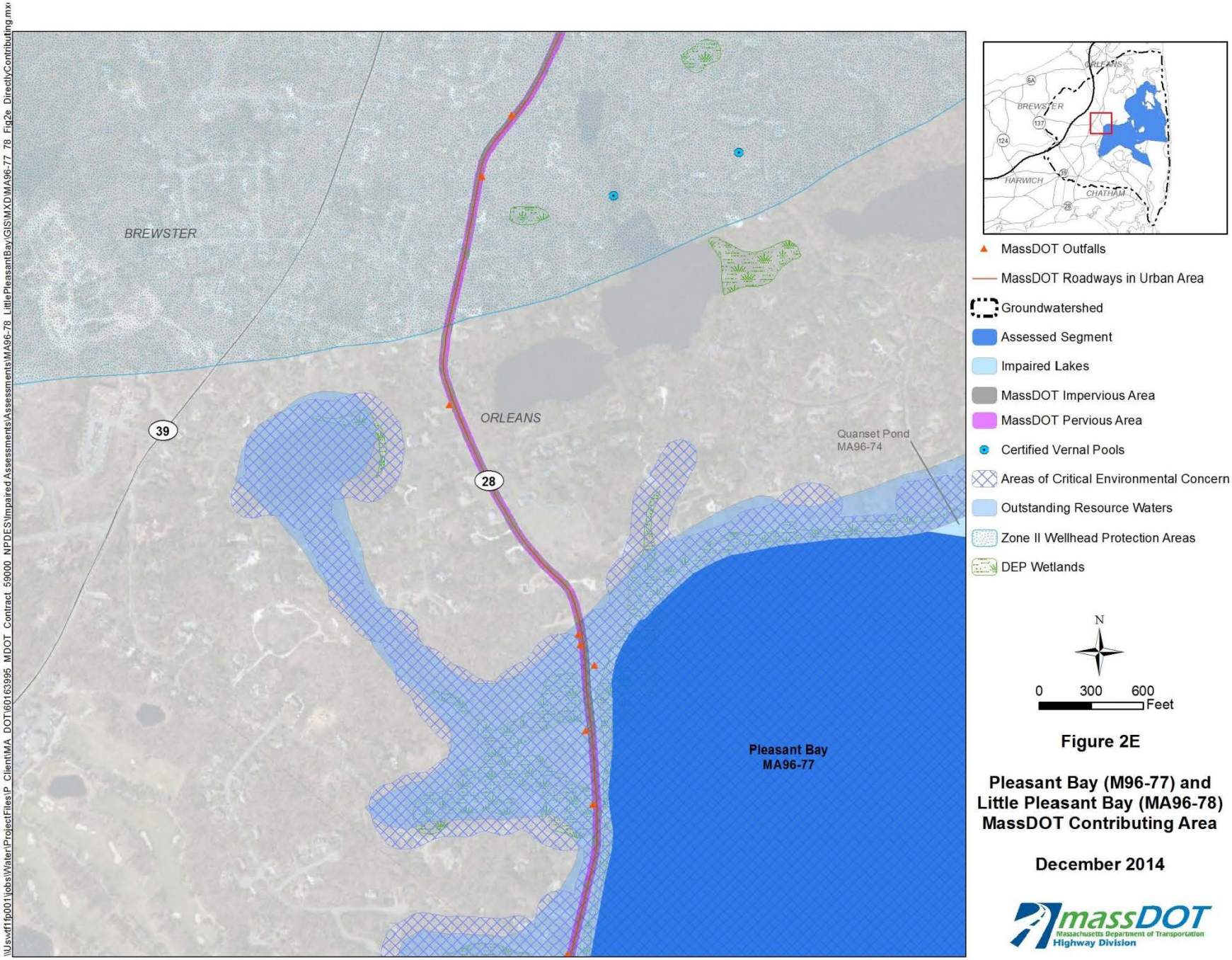

Figure 2E

Pleasant Bay (M96-77) and Little Pleasant Bay (MA96-78) MassDOT Contributing Area

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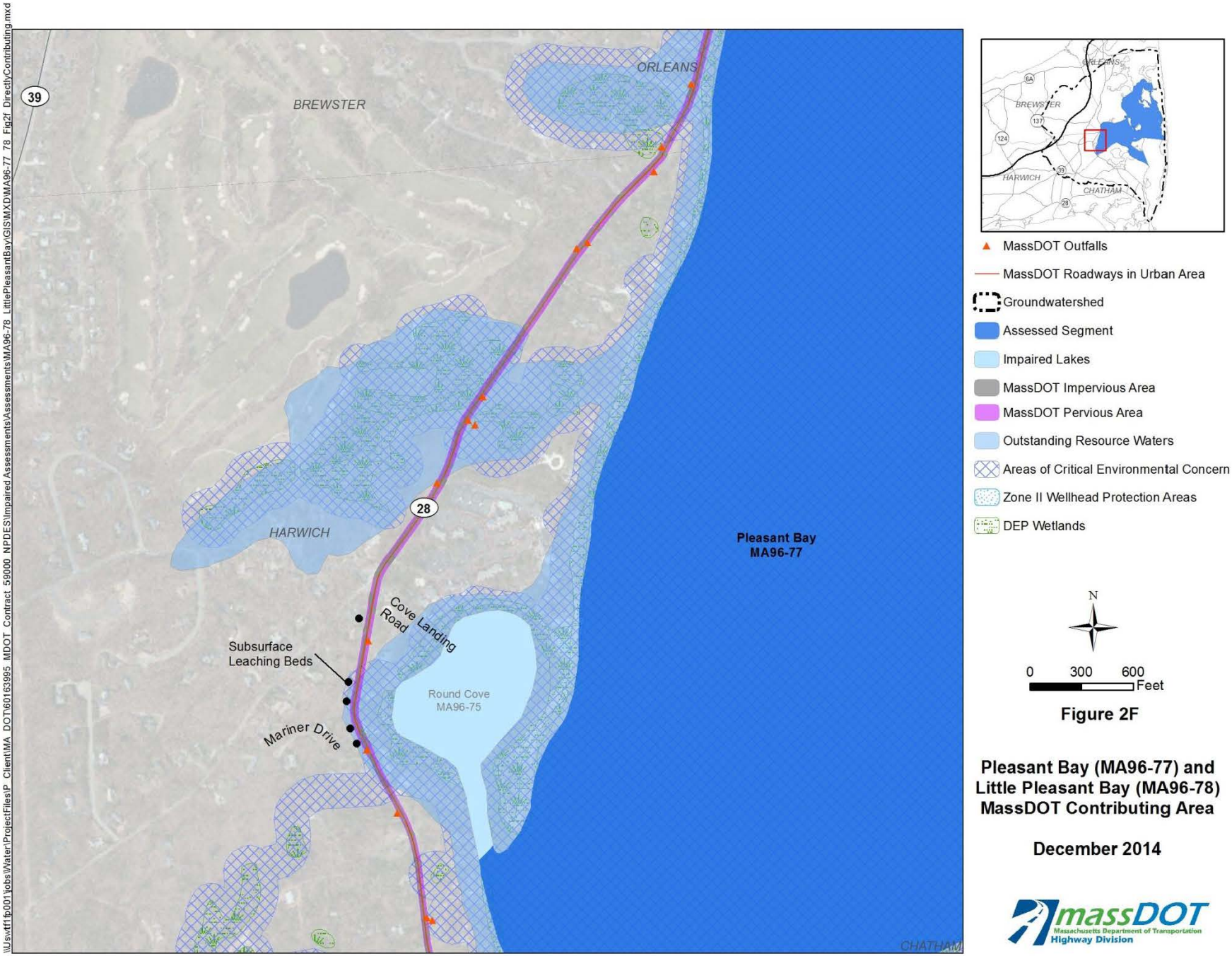

Figure 2F

Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78) MassDOT Contributing Area

December 2014

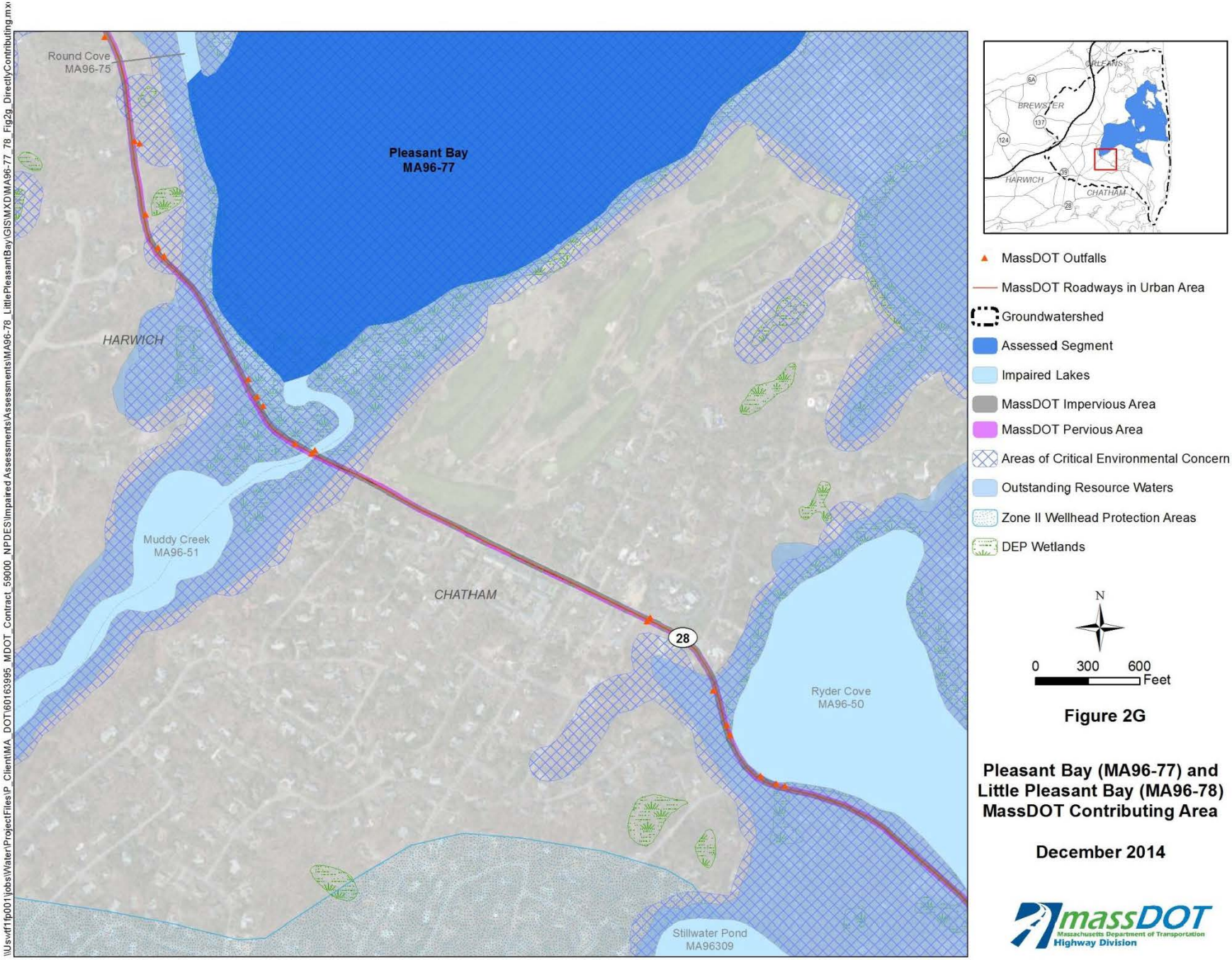

Figure 2G

Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78) MassDOT Contributing Area

December 2014

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Highway Division

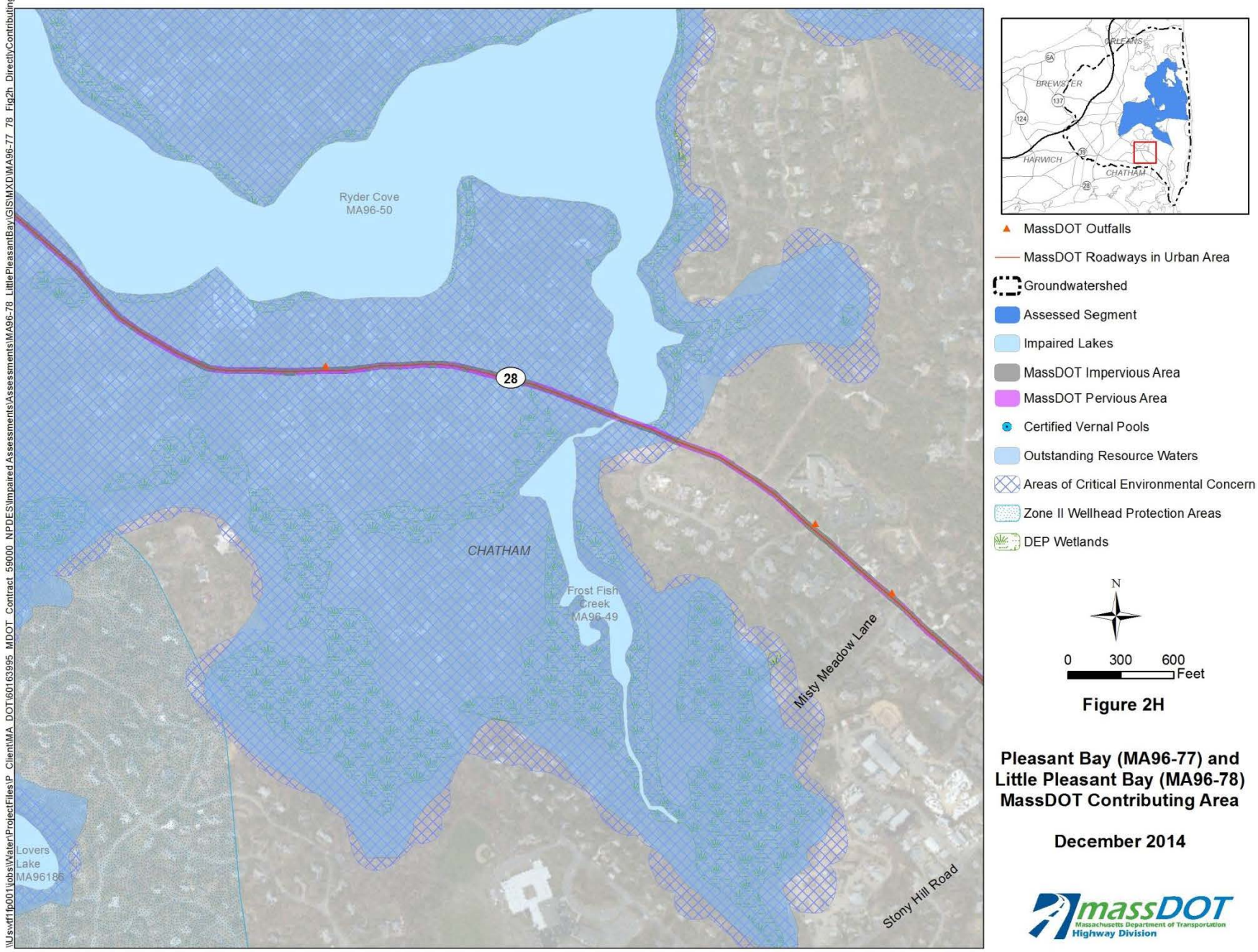
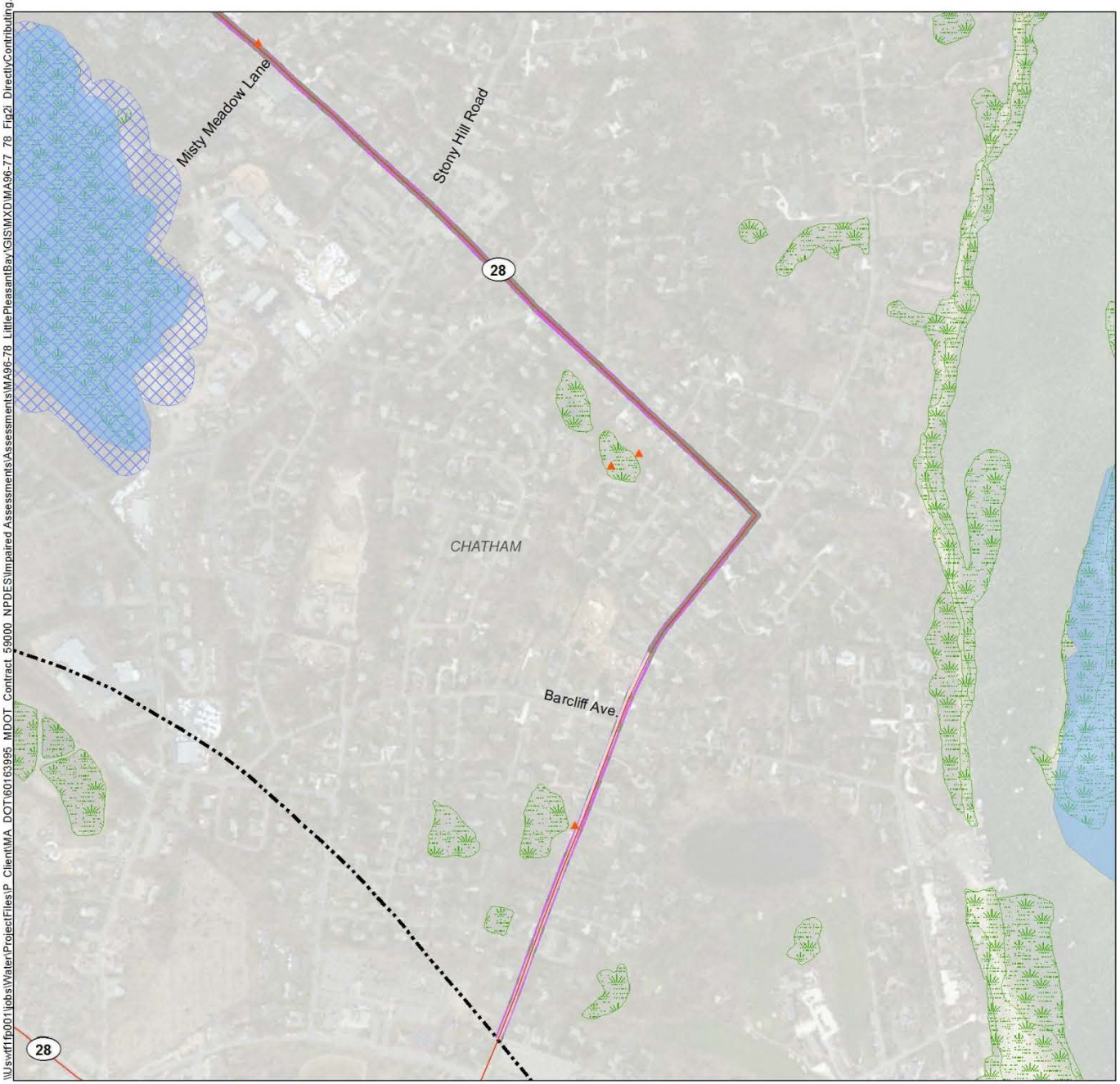
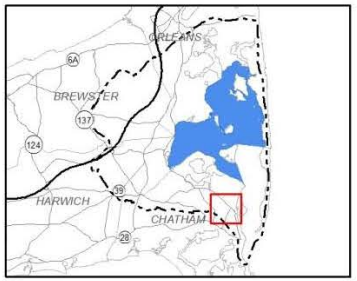


Figure 2H

Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78) MassDOT Contributing Area

December 2014





- MassDOT Outfalls
- MassDOT Roadways in Urban Area
- Groundwatershed
- Assessed Segment
- Impaired Lakes
- MassDOT Impervious Area
- MassDOT Pervious Area
- Outstanding Resource Waters
- Areas of Critical Environmental Concern
- Zone II Wellhead Protection Areas
- DEP Wetlands

N

0 300 600 Feet

Figure 2I

Pleasant Bay (MA96-77) and Little Pleasant Bay (MA96-78) MassDOT Contributing Area

December 2014

massDOT Massachusetts Department of Transportation Highway Division