



Town of Mashpee

Planning Board

16 Great Neck Road North
Mashpee, Massachusetts 02649

Meeting of the Mashpee Planning Board

Wednesday, November 16, 2022

Waquoit Meeting Room

Mashpee Town Hall

16 Great Neck Road North

Mashpee, MA 02649

7:00 PM

Broadcast Live on Local Channel 18

Streamed Live on the Town of Mashpee Website: <https://www.mashpeema.gov/channel-18>

Call Meeting to Order

- Pledge of Allegiance

Approval of Minutes

- Review of Meeting Minutes from September 29, 2022 and November 2, 2022

New Business

- Public education and outreach meeting with Tighe & Bond, and Catherine Laurent- DPW Director as required to be in compliance with the Town's MS4 Stormwater Permit
- Possible Amendment to Zoning Bylaw
 - Solar Bylaw
 - Tree Bylaw
 - Clean Water Bylaws

Old Business

- Local Comprehensive Plan Updates with Weston and Sampson
 - Survey Beta Test
 - Workshops and Focus Groups
 - Comments Gathered to Date
 - Future Events
 - Schedule of Work
 - Existing Condition Chapters
 - Updating the Vision Statement
 - Workshop on proposed actions
- Affordable and Workforce Housing
 - Coordination with Affordable Housing Committee and Community Preservation Program
 - ADU Workshop
- Clean Water Initiative

MASHPEE TOWN CLERK
NOV 14 '22 PM1:40



Town of Mashpee

*16 Great Neck Road North
Mashpee, Massachusetts 02649*

Chairman's Report

Town Planner Report

- Update and discussion relative to the Housing Production Plan consultant procurement process.
- Affordable Housing Project- 209 Old Barnstable Road

Board Member Committee Reports

- Cape Cod Commission, Community Preservation Committee, Design Review, Plan Review, Environmental Oversight Committee, Historic District Commission

Public Comment

Correspondence

- Town of Falmouth Notices
- September 2022 Discharge Monitoring Report for South Cape Village – N = 2.9
- August 2022 Discharge Monitoring Report for South Cape Village – N = 3.4
- July 2022 Discharge Monitoring Report for South Cape Village – N = 4.5

Additional Topics (not reasonably anticipated by Chair)

Adjournment

MASHPEE TOWN CLERK
NOV 14 '22 PM1:40



Town of Mashpee *Planning Board*

*16 Great Neck Road North
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**Mashpee Planning Board
Minutes of Meeting
Wednesday, September 29, 2022 at 7:05PM
Mashpee Town Hall - Waquoit Meeting Room
16 Great Neck Road North
Mashpee, Ma 02649**

**Broadcast Live on Local Channel 18
Call-in Conference Number: (508)-539-1400 x 8585
Streamed Live on the Town of Mashpee website
<https://www.mashpeema.gov/channel -18>**

Present: Chair Mary Waygan, Dennis Balzarini, Karen Faulkner

Also Present: Evan Lehrer – Town Planner (Via Zoom)

CALL TO ORDER

Chairwoman Waygan called the meeting of the Planning Board to order at 7:05P.M. with a quorum. The Pledge of Allegiance was recited.

NEW BUSINESS

Request for release of covenant recorded at the Barnstable County Registry of Deeds at Book 1480 Page 1154 pertaining to property addressed at 52 Oregon Road (Map 22 Parcel 126) in the Santuit Woods Subdivision (originally referred to as Timberlane Shores) plan recorded at the Barnstable Country Registry of Deeds in Tube 160 (property shown as lot 144).

Mr. Lehrer stated this subdivision, now known as Santuit Woods, was approved by the Planning Board back in 1970. These public ways are now owned by the Town of Mashpee. It is fully built out and there are numerous releases for individual lots throughout the subdivision and this one was never released because it remained vacant. They are approaching a closing next week and want the Board to consider a release of the covenant prior to the closing so they can convey the property. Given this is a completed subdivision there is no utility work or road work that needs to be accomplished to access the property. He would recommend release as requested.

MOTION:

Mr. Balzarini made a motion to approve the release of the covenant. Seconded by Ms. Faulkner. All in favor.



Town of Mashpee

Planning Board

16 Great Neck Road North
Mashpee, Massachusetts 02649

As Mr. Lehrer is not in the office, he will have the release document available if they can stop by the Town Clerks office tomorrow for signing. All three signatures will be needed.

Ms. Waygan suggested she have it emailed to her and she will have it notarized and bring it to Town Hall for Mr. Balzarini and Ms. Faulkner to sign on Monday.

PUBLIC HEARING

7:10PM

To review the following zoning articles proposed for action at the October 17, 2022 Town Meeting

- **Warrant Article 7:** To ask the Town amend §174-27.2 (A) Stormwater Management of the Mashpee Zoning Bylaw. This Article would mandate that stormwater low impact design strategies be utilized.
- **Warrant Article 8:** To ask the Town amend §174-27.2 (B)(2) of the Mashpee Zoning Bylaw by adding new subsections (d) and (e) after §174-27.2(B)(2)(c) (Stormwater Management). This Article specifies specific low impact design requirements for removal of nitrogen and phosphorus from stormwater at single and two family dwellings.
- **Warrant Article 9:** To ask the Town reformat and amend §174-27.2 (B) (3) of the Mashpee Zoning Bylaw by adding new subsections 'vi' and 'vii' under current §174.27.2 (B) (3) (v) and indenting appropriately (Stormwater Management) This Article specifies specific low impact design requirements for the removal of nitrogen and phosphorus from stormwater at all lots that are not single and two family dwellings. i.e. commercial and industrial buildings and multifamily residential
- **Warrant Article 10:** To see if Town will vote to repeal Article XI: Floodplain Zone Provisions in its entirety and replace with new Article XI: Floodplain Zone Overlay. This will replace current floodplain zone provisions. It is mandatory to remain in the national floodplain insurance program. (The prohibition of the use of fill no longer pertains).
- **Warrant Article 11:** To see if the Town will vote to add the floodplain definitions as a new subsection 174-3.1. It would add definitions that pertain to



Town of Mashpee

Planning Board

16 Great Neck Road North
Mashpee, Massachusetts 02649

development in the floodplain: development, floodway, functionally dependent use, highest adjacent grade, historic structure, new construction, recreational vehicle, regulatory floodway, special flood hazard area, start of construction, structure, substantial repair of foundation, variance violation, Zone A, Zone AE, Zone AH, Zone AO, Zone X, Zone V, and Zone VE.

Ms. Waygan asked for Public Comment on these proposed changes to the Zoning Bylaw.

Lynne Barbee - Ms. Barbee asked which Article pertained to the actual Floodplain bylaw. She was informed it was Article 10. Ms. Barbee then commented after watching what happened in Florida, it is astonishing to her that we might allow people to use fill somewhere on the floodplain.

Michaela Colombo- She echoes Ms. Barbee's concerns. She thinks it is inevitable we will get that type of hurricane this way. She was disappointed at the last meeting when it was recommended after all the time, thought, preparation, and document with the video that answered all the questions, she was disappointed fill was removed, its dangerous. Climate change is coming faster than anticipated. She is hoping this will be reconsidered in May.

MOTION:

Mr. Balzarini made a motion to close the Public Hearing. Seconded by Ms. Faulkner. All in favor.

MOTION:

Mr. Balzarini made a motion to recommend Articles 7, 8, 9, 10, and 11 to Town Meeting for approval. Seconded by Ms. Faulkner. All in favor.

Ms. Faulkner wanted to be clear, her recommendation does not mean approval. She asked if it was a 2/3 vote at Town Meeting.

Ms. Waygan reiterated if there is no recommendation it will not get to Town Meeting. You can either recommend or not recommend. She stated when these Articles come up she will report to Town Meeting how the Planning Board voted.



Town of Mashpee

Planning Board

*16 Great Neck Road North
Mashpee, Massachusetts 02649*

ADJOURNMENT

MOTION:

Mr. Balzarini made a motion to adjourn the meeting at 7:23p.m. Seconded by Ms. All in favor.

Respectfully Submitted,

Christine M. MacDonald
Board Secretary

DRAFT



Town of Mashpee *Planning Board*

*16 Great Neck Road North
Mashpee, Massachusetts 02649*

**Mashpee Planning Board
Minutes of Meeting
Wednesday, November 02, 2022 at 7:00PM
Mashpee Public Library - Events Room
64 Steeple Street
Mashpee, Ma 02649**

**Video Recorded Through Planning Department
*Not Televised***

Present: Chair Mary Waygan, Mike Richardson, Dennis Balzarini, Karen Faulkner, John Fulone

Absent: Robert (Rob) Hansen

Also Present: Evan Lehrer – Town Planner, Ed Pesce – Consulting Engineer, Christopher Kirrane – Attorney for Pleasantwood Homes, LLC

CALL TO ORDER

Chairwoman Waygan called the meeting of the Planning Board to order at 7:03P.M. The Pledge of Allegiance was recited. She introduced herself as Chair and welcomed all the new faces. She discussed Public Comment for those interested and described the Public Hearing process.

APPROVAL OF MEETING MINUTES – October 19, 2022

Ms. Waygan noted that the Adjournment motion needs to be moved to after Committee Reports. Correction made.

MOTION:

Mr. Richardson made a motion to approve the meeting minutes for October 19, 2022 as amended. Seconded by Ms. Faulkner. All in favor.

PUBLIC HEARING

7:10p.m.

Applicant: Pleasantwood Homes LLC
Location: 20 Tudor Terrace (Map 29, Block 198)
Request: The applicant requests approval of a modification to Spring Hill West Definitive Subdivision Plan of land that would modify the lot lines of Lots 40, 41, and 42, to give adequate frontage for three new building lots proposed for incorporation into the subdivision. The three



Town of Mashpee

Planning Board

16 Great Neck Road North
Mashpee, Massachusetts 02649

proposed lots to be created and incorporated into the cluster subdivision are on a parcel of land totaling 6.024 acres. This proposal will continue the cluster configuration of the existing subdivision and will add 2.49 acres to open space consistent with the requirements of the Mashpee Zoning Bylaw at the time of cluster subdivision's approval in 1989.

Attorney Christopher Kirrane is present tonight on behalf of the applicant, Pleasantwood Homes LLC. Mark Dibb with Cape and Islands Engineering is also present along with the applicant. This is a two-step process with the Subdivision Plan and the Special Permit for cluster subdivision that was approved in 1989. They are seeking a modification of the plan itself to redraw lot lines and add additional lots to the subdivision. The plan before the Board shows the existing configuration is at end of Tudor Terrace. Parcels 40, 41, and 42 are existing. The applicant is proposing to purchase acreage at the end and reconfigure those three parcels to 40a, 41a, and 42a with three additional lots numbered 47, 48, and 49. In summary, they will be creating three additional lots and reconfiguring the other three existing. A revised plan was submitted this evening. According to the cluster subdivision rules, it was required that open space meets 35% of total acreage, and they are showing 50% open space, which is consistent with current rules and regulations. The land that is being proposed as added is 6.024 acres, and the 3.012 acres of open space meets the 50% requirement, when creating a new subdivision under the new subdivision rules and regulations. There will be no changes to roadways as the cul-de-sac is existing. It was approved in 1989, and lots range from 19,000s.f to 35,000s.f. Lots 40a and 41a are consistent with previous lots square footage while 42a is larger. They are all being built as single family residential homes.

Mr. Balzarini inquired about the well easement on lot 48, he is wondering if the driveway will go over that. He also asked if the well was drinking water.

Mr. Dibb stated it may be abandoned, as it is part of the existing it remains on the map.

Mr. Balzarini wants to double check with the consulting engineer if that's legal.

Ms. Waygan asked what version of the Zoning Bylaw was being used, she asked if it was from 1989.

Mr. Dibb commented they are under the existing subdivision rules and regulations, back then frontage was 60-70ft.



Town of Mashpee

Planning Board

*16 Great Neck Road North
Mashpee, Massachusetts 02649*

Ms. Waygan doesn't have the Zoning Bylaw from back then. She noted it was a cluster and asked what the frontage requirement was back then.

Mr. Lehrer can confirm this was a cluster and noted a couple differences between today and the early inception. For decades it was prescriptive with dimension and lot sizes, while in today's 2022 Zoning Bylaw, the Planning Board has discretion of dimensional criteria.

Mr. Kirrane stated the lots are smaller in the R5 and they require 80,000 s.f., the dimensional requirements are reduced to not give up open space and things of that nature.

Ms. Waygan thought she read that the Planning Board could rule that any parcel of 5 acres or more, no subdivision may be approved except pursuant to special permit cluster under this section. Rules and regulations say it has to be made under current zoning, any new land being subdivided for a parcel of 5 acres or more, no subdivision in a residential zone may be perused except through 147-46. It states the Planning Board may waive upon written request from the applicant.

Mr. Lehrer commented these items under the land space table state minimum setbacks, lot coverage, and building height.

Ms. Waygan asked if it was R5, and if so, the minimum frontage is 150ft., unless approved on the Planning Board's discretion, the Board can make an exception.

Mr. Kirrane read provision 9.4 from 1989, stating the Planning Board may approve a special permit of 10 acres or more, lots do not conform, and frontage setbacks, provided the Planning Board makes a finding that the public good is served. Nine criteria's were listed and one states the lots have to be at least 15,000s.f.

Mr. Balzarini noted the turning radius was done in 1989 and fire trucks got bigger, he is curious if the radius is still enough for current fire trucks.

Mr. Kirrane did not submit plans to the Fire Department.

Mr. Dibb stated the current design is per current regulations.

Ms. Waygan would like that confirmed with the Fire Department.

Mr. Pesce stated the recent plan submitted is what is being proposed. He recently saw the cover letter, and there was a lot of information coming to the Boards attention to consume in a



Town of Mashpee

Planning Board

16 Great Neck Road North
Mashpee, Massachusetts 02649

short amount of time. He went out to the site and noted the existing cul-de-sac is in good shape. He has a couple recommendations to add as potential conditions for approval. He noted it would be more helpful to have existing conditions. He doesn't know where the catch basins are or where the water line is for existing storm water utilities. He is not trying to expand the existing storm water system, he has some recommendations about how to protect it. The previous consulting engineer inspected the construction, he doesn't see issues. In the subdivision rules and regulations there are certain requirements for new subdivisions. It would be helpful to include existing conditions, aerial photography, lots of homes, and not just hand the Board a lot plan. That information helps them understand what is there and what is being proposed to change. The course of this discussion will add 100% to the level of understanding for everyone. He wants to know about the nitrogen easement document. There is a bedroom limit assigned to that easement, and he can't tell if that's exceeding or not. The reference refers to a land court plan and identifies lot 2a, which isn't even on land court plan.

Mr. Balzarini inquired again if they can drive over the well easement. He would also like to know what kind of well it is.

Mr. Pesce noted the wellhead would need to be maintained and allow access to it. They could even go around it.

Ms. Faulkner asked about the nitrogen loading plan and the 77,000s.f. reserved for that. She would like to know where that will be located on the map and if there is any intention for IA systems.

Mr. Dibb noted the nitrogen loading area is the outer edge and dotted line, referring to the map. They are now at 40,000 s.f. and not intending IA systems. They are planning on Title 5 conventional.

Ms. Faulkner asked if they are located in the Phase 2 zone for the sewer.

Mr. Dibb will confirm that. Mr. Lehrer said it may be the newly configured Phase 2a.

Ms. Faulkner asked if there were wells on the property that people will drink from.

Mr. Dibb said there are private wells.

Ms. Faulkner asked if the open space being given is equal to 50%, she has a calculation of 131,223s.f. like what is being shown on the plan. Can someone explain to her, based on



Town of Mashpee

Planning Board

16 Great Neck Road North
Mashpee, Massachusetts 02649

square footage, how can 40a and 41a only allow 2 bedrooms, but now they can have three bedrooms.

Mr. Dibb stated lot 40a has an existing nitrogen aggregate, he pointed to the zone 2 area that had land reserved can be land elsewhere.

Ms. Waygan stated there was a reference to this in the plan. The nitrogen loading easement is in the packet this evening, the easement document grants Title V loading and was granted to the town. She is referring to a plan in the registry of deeds book 587-72. She would like the proponent to take them through the document.

Mr. Pesce noted 31 bedrooms can be in 6 lots with the reserving nitrogen credit, 31 bedrooms, at the 440 gallons per day per acre, qualifies as protection under Title 5. He said the math works. He stated Lot 40a looks to be under construction. There are a couple bedrooms already taken up. He would like the proponent to show the Board where the houses and bedrooms will be, so they can approve and confirm 31 bedrooms will not be exceeded.

Ms. Waygan asked the Town Planner to speak with the applicant to make a plan about this document. She wanted to clarify that the nitrogen credited space is only for lots in this subdivision.

Mr. Pesce stated the grant of the Title 5 nitrogen loading easement refers to two parcels, the facility land and credit land. If you add them up you get enough credit land to qualify by creating a condition you wouldn't exceed a certain gallon per acre. It's legal, conforms, and if you divide 6 into 31, that's five 5 bedroom houses, and someone gets a 6 bedroom house. The math is all adding up but some references aren't clear. He would appreciate an estimated assignment per lot. Your reserving land credit can actually go higher than 4 bedrooms. He is curious how this document was found and Ms. Waygan noted she found it in the registry of deeds. This is an old subdivision with old conditions they needed to be aware of.

The project proponent commented he is intending on 40,000s.f. lot sizes with 4 bedrooms for less of a nitrogen impact.

7:15p.m.

Applicant: Pleasantwood Homes LLC
Location: 20 Tudor Terrace (Map 29, Block 198)
Request: The applicant requests approval of a modification to a special permit approved October 6, 1989 that approved the creation of 45 single-family building lots in cluster configuration on 23.738 acres of land



Town of Mashpee

Planning Board

16 Great Neck Road North
Mashpee, Massachusetts 02649

and preserved 17.153 acres of open space. The applicant seeks to modify the special permit decision to incorporate the additional three building lots proposed.

Mr. Pesce proposed they show the bedroom count per lot. He added there is some confusion in the actual easement document, and the first page says bedrooms are restricted to 28 then states 31. He would like that to be clearer. He would also like to know where the facility land and nitrogen credit land is.

Ms. Waygan stated on the first page of restriction, 5th paragraph, credit land is 77,000 s.f.

The project proponent clarified the reference is to original plan that wasn't reflected on the new plan and the 77,000 s.f. is the total parcel 2a.

Mr. Pesce is seeing lot 1 and lot 2 but no 2a, there is an oversight somewhere, or it could be on another plan. He would like some documentation or proof.

Ms. Waygan would like something from the proponent regarding the 1989 Special Permit that confirms that all the special conditions have been met. If they have not been met, she would like to know what their plan is to meet them. They just passed a zoning bylaw about low impact development and anything that can be done is encouraged for something like this. This could mean rain gardens, vegetative swales for phosphorous pollution or storm water runoff etc., would be appreciated. The minimum lot size is up to the Planning Board. There will be no setback relief. It's her view that current zoning does apply, and with this plan being presented tonight, she would like to know what they aren't meeting in the current cluster subdivision zoning. The Planning Board could approve these lot sizes. In the 1989 Special Permit there was talk about lot 47 being put aside as open space. This new lot 47 is a duplication of numbers, she would like to make it clear, she would like to skip that and use 48, 49, and 50 instead. If there is reference to any previous lots they should be renumbered this time around. She also got confirmation there is no wetlands.

Mr. Balzarini asked about the map from 1989 with Wood Road and the dotted line, he is curious if that is an ancient way. He also notes it goes through the middle of one of the lots.

Ms. Waygan stated Mr. Lehrer gave her the subdivision plan from 1989 and if it is an ancient way they want to know so it can be preserved or know if it isn't.

Mr. Kirrane commented at this stage it may be going through the middle of people's houses at this point.



Town of Mashpee

Planning Board

*16 Great Neck Road North
Mashpee, Massachusetts 02649*

Ms. Waygan inquired about the water quality monitoring program for this development. She would like to be updated on that, and see if the program needs updating. She asked if it has been going on this whole time.

Mr. Lehrer asked if everyone understood what lots were from the existing subdivision that was originally approved, modified, and how it is distributed to new lots. In pointing to the map, the parcels in yellow are subject parcels being discussed that are currently approved and buildable. He notes these are 40a, 41a, and 42a. The area shaded in blue are the portions being modified. The south easterly portion of former lot 41 will be carved out and assigned as new lot 47. The southwesterly corner of former lot 42 will be carved off and will be newly assigned lot 48. Everything shaded in pink is the new subject parcel to be incorporated. There are 6 new lot lines. The open space parcel is in green. The nitrogen aggregation plan for 20 Tudor Terrace was a credit parcel, and credit areas are assigned to lots of existing by right 2 and 3, so these will be 4 bedrooms. They will produce that plan and not get credit.

Ms. Waygan asked if the Board of Health has that plan.

Mr. Lehrer stated the easement is for the town to access this parcel so that restrictions are being met. There will be no raising of livestock, no lawn, and no fertilizers. It can have trails but he wanted to clarify.

Ms. Waygan would like to let the Board of Health know what is going on. She doesn't want them to be surprised someday and she would like to get this to them for comment.

Mr. Lehrer thanked them for the revised plan. His only other comment would be to add concrete bounds on the proposed plan to signify open space. The Board will require that condition.

Mr. Pesce already mentioned a few items, but he wanted to offer a couple recommendations. As he discussed with Mr. Lehrer earlier that day, he would like to get the storm water cache basins in the vicinity of or abutting new lots, pumped out, and have a letter from the engineer they are working with. It's been 18 years since installment. He doesn't know where the discharge goes. He wants to ensure no runoff from roofs or driveways will contribute to the existing storm water management system in the cul-de-sac, so it's not overloaded. It is the responsibility of the lot owner to grade the lots properly. It may be reasonable to ask for roof infiltration, gutter, and downspouts.

Ms. Waygan will be looking for Low Impact Development with that.



Town of Mashpee

Planning Board

16 Great Neck Road North
Mashpee, Massachusetts 02649

Ms. Waygan called for Public Comment on this matter.

Nancy Ferreira- She came for the Public Hearing tonight regarding her second home, as she is a full time resident of Brockton. She would like clarification on the open space and square footage. They abut that little corner near lot 47. The reason they bought this house is because they plan to retire here and purchased a property surrounded by beautiful woods. She loves to walk down Tudor Terrace and now all those trees will be gone. Her home is off of Saxony Drive. She would like more clarification on how many trees will be coming down.

Mr. Lehrer stated the credit easement is more like 80s.f. but he is estimating this based on scale. At its narrowest point measures 60s.f. of credit easement.

Mr. Pesce clarified it would be 75 feet +/-, but against their lot it is an even further distance. He measured and that corner to her lot, the closest point is 180 feet at an angle.

Ms. Waygan asked if she was concerned about the visual impact.

The project proponent commented he wants to have more open space which is why he is doing a cluster. The lots are smaller to preserve more open space and the lots are deep with the homes situated more at the front of the lots. He only clears 30 feet from the back of the house, and he will leave the rest.

Ms. Waygan thinks there is a condition in the 1989 decision that talks about limiting the size of lawns to 1,000s.f. so that will help. She inquired if there was something in the plan about clear cutting lots. She noted it would be nice if there was a prohibition of clearing that would run with the land onto the future property owners. With the water quality crisis in town, any preserved tree does us good.

Steve Ferreira- His wife just spoke. He referenced the sections of lots in yellow as being the original lots. In 1989 the Planning Board at that time made those three lots buildable with correct frontage. Now here we are talking about chopping that up. When he and his wife bought their house the motivating factor was the woods. To him, 87 feet is not enough. He would invite anyone to come look at the yard, what is there, and what is at risk. The value of his property will decrease. He inquired about the 6 acre lot they are calling 20 Tudor Terrace, his assumption was it was town owned land. He heard someone bought that 6 acres. They must've known it was not buildable because it didn't meet the 150ft. requirements for frontage.

Mr. Lehrer stated the lot in question was not buildable and only limited by access. At the time of the original approval 20 Tudor Terrace was not owned but acquired thereafter. The property



Town of Mashpee

Planning Board

16 Great Neck Road North
Mashpee, Massachusetts 02649

owner had no plans to develop and did not want to access. Pleasantwood Homes LLC acquired the land and wants to develop it in accordance with the zoning bylaw. The logical way is through sub-divisible lots according to zoning baseline criteria. It can always be subdivided as long as the plan is consistent with the rules and regulations, access can be granted to Tudor Terrace. There is slight modification to the original lot lines that gain adequate compliance without having to build a new road. In closing, 20 Tudor Terrace is a divisible site and has met the minimum requirements, and there is Board discretion due to the Special Permit.

Mr. Ferreira is in opposition of adding the three additional lots. Rather than three additional small houses with small frontages, the houses would be more valuable. He doesn't want lot lines to change.

Catherine Haskell- She knew the original owner of the property, and she was told when she called the town, after seeing people poking around, nobody would be building due to it being land locked. She is an artist who works from home and she has started to see the trees come down. This forest is home to all sorts of wildlife such as red, black, and grey squirrels, osprey, turtles, turkeys, and deer. She has pictures of all of the animals and even recordings of owls at night. This is something, when people say Mashpee, and they think of Cape Cod, she lives in the woods, and it is so beautiful. If she could stop this she would. She was there for Windsor Way and Tudor Terrace has taken a while. She is fine with the lots already there, it's a creative way to get the money for each lot, but with these proposed new houses she doesn't feel there is enough information to make an educated say. She doesn't see the square footage for houses. She pointed to a location on the map where her neighbor is, and when she looks at that, the flood zone comes in beyond that point into 42a. Her well, her neighbor, and the other neighbor all back up to that. She saw the trees coming down at the first house on Tudor Terrace when you enter, the house was built, and the owner put up a fence that cleared the brush as well as protected open space. There is nobody protecting it. Trees have been coming down and she has gone to the police about it but people disregard her.

Ms. Waygan expressed concern that Ms. Haskell has seen existing open space encroached.

Ms. Haskell stated once the builder leaves, there is nobody to protect it and they are just taking it down. She has the original deed for taking trees down, when people resell a house she isn't sure that is passed on.

Ms. Waygan commented that the town has a way to protect open space. There is still opportunity to write in comments and this can be directed to the Town Planner.



Town of Mashpee

Planning Board

16 Great Neck Road North
Mashpee, Massachusetts 02649

Patrick Swanson- He has been here for 20 years and knew Tudor Terrace would get built. He doesn't have a problem. His cul-de-sac has three homes, Victoria Circle has two, and this proposal has six. How are they going to fit? The lot sizes make sense and 13 Tudor Terrace sold for \$1 Million as a three bedroom. To have that many houses in that cul-de-sac seems crazy. Lots 47 and 48 are huge lots.

Ms. Waygan will not be closing the Public Hearing this evening. If anyone has questions about their own lot in comparison to the subdivision, Mr. Lehrer can help. She called for any last questions. She would like a building envelope that will address a lot of these issues.

Mr. Kirrane stated he will also show distances. Under conditions, he pointed out the 1,000s.f. lawn space condition that is in the existing special permit. He is asking these lots be a part of that.

MOTION:

Mr. Balzarini makes a motion to authorize the Planning Board Consulting Engineer to work with the project proponent to address questions that arise. Seconded by Mr. Richardson. All in favor.

MOTION:

Mr. Richardson made a motion to continue the Public Hearings to December 21, 2022 at 7:10p.m. and 7:15p.m. Seconded by Mr. Balzarini. All in favor.

NEW BUSINESS

Vote to release funds held to secure the completion of the subdivision referred to as Casper Circle to former property owners Steven and Joyce Hynds and accept new cash security of equal value from new property owner/developer Carlos Manzi.

Mr. Lehrer updated the Board about a month ago that the former property owners, the Hynds, requested lot releases in exchange for cash security. Thereafter, he was not interested in further developing and found a buyer and sold. We can't transfer the bond to the new owner. His Department is asking the Board to release \$58,500 to the Hynds, in exchange the Department has received that amount from Mr. Manzi, the new owner. He will deposit these funds with the Treasurer upon acceptance and release of the currently held funds.

MOTION:

Mr. Richardson made a motion to release funds totaling \$58,500 back to the Hynds. Seconded by Mr. Balzarini. All in favor.



Town of Mashpee

Planning Board

16 Great Neck Road North
Mashpee, Massachusetts 02649

OLD BUSINESS

LCP Updates with Weston & Sampson

Survey Beta Test

Mr. Lehrer sent a very detailed list of comments, he noted there was another Survey Monkey issue, so it will look weird in the beta tests, but it will be rectified for the final launch. For future plans, he will 100% have a license and take this in house. The survey is looking much cleaner, and it will be distributed by the end of the week. Look for comments about what has changed and if there was any improvement with time. Barring feedback, he is looking to issue at the next meeting, November 16, 2022.

Workshops and Focus Groups

Ms. Waygan confirmed with Amber at the Tribal Government Administration Office that the LCP is an agenda item for the Tribal general membership meeting on November 13, 2022 at 2pm.

December 12, 2022 will be the virtual general workshop for the LCP. The plan is to invite participants with general visioning and have breakout rooms. Not everyone will be able to touch on every system. If there is a small turnout they will do it as one large group.

Updating the Vision Statement

Mr. Lehrer stated the next step is to sift through draft actions. He provided tabulated spreadsheets for review from the engagement workshops. They will work with the 1998 vision statement to review and enhance for a draft to work off of. It will provide a starting point with all findings from engagements.

Workshop on Proposed Actions

Soon, Mr. Lehrer would like to present a draft of action items to be amended or adjusted in consideration to findings from the survey.

Ms. Waygan would like to wait on publishing that until the survey.

Mr. Lehrer will be working on it behind the scenes with Weston & Sampson.

Ms. Waygan would like to take Public Comment. She recognized Paul Colombo.

Paul Colombo- He was looking at key takeaways from the various workshops and he attended all except one due to being ill. During Natural Systems, Built Systems, or Community Systems, there was an extremely heavy emphasis on water quality, degradation, and the problems we are facing. In looking under Natural Systems, one bullet out of seven shows



Town of Mashpee

Planning Board

16 Great Neck Road North
Mashpee, Massachusetts 02649

concerns over pollutants/nutrients in waterways. It looks as though it's being minimized. It was more than a concern but a state of alarm. He looks back at the 1998 LCP document, and there were two chapters about coastline and water quality. Those two topics make up close to 100 pages of information pertaining to water quality. From 1998 until now, water has not improved. He is hopeful when the LCP comes together this one little bullet of concern is expanded.

Lynne Barbee- She was glad to hear about ancient ways, she lives near one and it may seem like a minor pathway, but it's a significant part of the town's history. At all the workshops she attended people talked about small town character and wanting to keep that. There are issues about development and re-development but people talked a lot about maintaining small town character in these workshops. She looks forward to the last virtual meeting as well as the survey and will do whatever she can to move forward.

Marge Hecht- She noted in looking at the takeaways, one glaring omission was in keeping Mashpee's small town character as well as limits on development.

Anne Malone- She reviewed takeaways from the workshops. All sessions pronounced concern about the fragility and ill health of waterways and the legacy of development. Items such as sewer, better town management, preference to environmental health, and valuing the remains of rural character is what makes the community one people want to support.

Mr. Lehrer clarified for everyone that this was just an operational document to consider actions. Any omission shouldn't be construed as a key takeaway.

Ms. Waygan would like to note what session these came from and add a date, she would also like this to be marked as a draft.

Mr. Fulone stated there is a page and a half on water and wildlife.

Ms. Waygan asked if the charts were on the LCP webpage.

Mr. Lehrer stated the key takeaways were drafted for thinking purposes and are being misconstrued as proponents for the vision. Also, he would rather work on the vision sooner rather than later.

Mr. Richardson asked when this information will be shared with the Select Board and Finance Committee. In looking at this list, items are repeated from the previous LCP that haven't been addressed and will cost a lot of money to accomplish.



Town of Mashpee

Planning Board

*16 Great Neck Road North
Mashpee, Massachusetts 02649*

Mr. Lehrer commented it is too early to share. He would like the opportunity to present a draft to the Planning Board, and when the draft is in a reasonable condition, he will present to the Select Board and Conservation Commission. He would be hesitant to present an incomplete document.

Ms. Waygan would like to really publicize that 12/12 date again to all committees, and they will have the survey.

Mr. Lehrer's goal after getting through the survey and compiling actions by January, actions will be drafted, and they will proceed to building the document. Shortly thereafter, he will have a consumable draft to present to the Select Board and stakeholders. The best case scenario is it will be ready for the October 2023 Town Meeting.

Mr. Richardson understands timing, as they are all busy with what they are doing. He just wants to vocalize on record that the earlier they can review it the better, otherwise they will miss it.

Ms. Waygan asked Mr. Richardson to attend the November 7, 2022 Public Comment at the Select Board meeting.

Mr. Balzarini asked when this has to go to the Cape Cod Commission.

Mr. Fulone noted this LCP will have accountability, benchmarks, and actual follow-up.

Mr. Lehrer is making a useful document that doesn't just collect dust. The most difficult thing about the old document is it being hard to update, as no chapters are consistent with how tasks were assigned. He wants a useful document that is accessible and can be updated with ease every 5-10 years. Once this is adopted, he will start thinking about the update. The 1998 LCP called for an implementation committee, where we can hold each other accountable. He recognized that was one of the biggest issues. We want to go from a textbook sized document to a magazine size.

Mr. Fulone suggested adding some takeaways from the business roundtable.

Ms. Waygan asked if she can have a flyer for December 12th and she will bring it to the Select Board.



Town of Mashpee

Planning Board

*16 Great Neck Road North
Mashpee, Massachusetts 02649*

Affordable and Workforce Housing

The ADU workshop is starting to make headway. Mr. Lehrer has a draft HPP procurement document. He took statutory language and is wondering about the scope of work. He also wants to know if they should do charrettes for engagement. He can separate as a single line item to see costs. Thereafter, it can be done in house.

Mr. Balzarini wanted to follow up on the signs that say trucks entering on Rt. 130 before coming into the industrial district. He rode all the way up and down there and did not see one. He thinks there should be signs installed near the recreation area going towards Sandwich and one near the bakery coming into Mashpee.

Mr. Lehrer also has information regarding the Public Hearing regarding Forestdale Road, LLC and to call his office. Also, the Affordable Housing Trust is meeting on 11/7 at 6:00p.m. to discuss an application to the CPC regarding a site Town Meeting voted to set aside for Affordable Housing 12 years ago. The site is at the corner of Lowell Road and Old Barnstable Road by Quashnet School. The site is ready to go and already in the Trust. It already had a feasibility study and is authorized for affordable housing. 108 Commercial Street is in land court to settle title issues and it seems logical to pursue this site. When the Select Board was seeking development some time ago, the neighborhood got upset and the project was shelved. Affordable housing opportunities cannot be ignored, which is why he is proposing a neighborhood engagement, action plan, and the Trust to authorize pursuing procurement for development in coordination with the neighborhood.

Ms. Waygan would like to incorporate the neighbors for the RFP.

Mr. Lehrer would like to hold a session to get interest. The lot is 7 acres. The feasibility study showed a couple conceptual designs, one being 24 units with 2 bedrooms in one building. He thinks it would be a great cottage court concept and he is contemplating that as potential. He still has to discuss with the neighborhood, but he drafted an RFP for this for the Trust, and he would like two neighborhood representatives. The lead opponent from ten years ago has since moved on.

Ms. Waygan is asking for a vote to support this method that Mr. Lehrer is proposing.

MOTION:

Mr. Fulone made a motion to support Mr. Lehrer's RFP process for the pursuit of affordable housing efforts off of Lowell Road and Old Barnstable Road. Seconded by Mr. Balzarini. All in favor.



Town of Mashpee

Planning Board

16 Great Neck Road North
Mashpee, Massachusetts 02649

CHAIRMANS REPORT

Ms. Waygan would like a Consulting Engineer's Report added to the agenda. Other items are being covered under other agenda topics.

TOWN PLANNER REPORT

No reports at this time.

COMMITTEE REPORTS

Cape Cod Commission-

Community Preservation Committee-

No Report

There is a meeting 11/3 at 5:30p.m. with the subcommittee for the CPC plan for the town. The full committee will convene at 6:00p.m. Applications to the CPC are due Nov. 17th. If interested in preservation funds contact the Town Managers Office. CPC funds are local and raised with a surcharge of 2% on property tax for the creation of affordable housing, historic preservation, open space, and recreation.

Design Review-

Plan Review-

Environmental Oversight Committee-

Historic District Commission-

Harbor Management Plan Committee-

No Meeting

No Meeting

No Meeting

No Meeting

Town Planner is the representative on the committee. The first meeting will be at the end of November. He will add it under Town Planner Reports moving forward.

ADJOURNMENT

MOTION:

Mr. Balzarini made a motion to adjourn the meeting of the Planning Board at 9:08p.m.

Seconded by Mr. Richardson. All in favor.

Next Meeting: Wednesday, November 16, 2022 at 7:00P.M.



Town of Mashpee

Planning Board

*16 Great Neck Road North
Mashpee, Massachusetts 02649*

Respectfully Submitted,

Christine M. MacDonald
Board Secretary

LIST OF DOCUMENTS

Additional documents may be available in the Planning Department.

- Town of Falmouth Notices
- Town of Sandwich Notices
- Town of Barnstable Notices
- August 2022 Discharge Monitoring Report for South Cape Village – N= 3.4
- July 2022 Discharge Monitoring Report for South Cape Village – N= 4.5
- June 2022 Discharge Monitoring Report for South Cape Village – N= 5.3

Town of Mashpee – Local Code Assessment

To: Catherine Laurent, Director, Department of Public Works
Evan Lehrer, AICO, Mashpee Town Planner

FROM: Jessica Cajigas-Smith, Senior Project Manager, Tighe & Bond

COPY: Gabrielle Belfit, CFM, Senior Environmental Scientist, Tighe & Bond

DATE: September 2022

Sections 2.3.6.b. and 2.3.6.c of the United States Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NDPES) General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts (referred to herein as “2016 Small MS4 General Permit”) requires permittees, within four (4) years of the Permit effective date, to:

- Develop a report assessing current street design and parking lot guidelines and other local requirements that affect the creation of impervious cover; and
- Develop a report evaluating existing local regulations to determine the feasibility of making the following green infrastructure practices allowable when appropriate site conditions exist:
 - Green roofs;
 - Infiltration practices, such as rain gardens, curb extensions, planter gardens, porous and pervious pavements, and other designs to manage stormwater using landscaping and structured or augmented soils; and
 - Water harvesting devices, such as rain barrels and cisterns, and the use of stormwater for non-potable uses.

The following memorandum summarizes Tighe & Bond’s assessment of the Town of Mashpee’s local code related to these practices with potential to impact stormwater runoff. The assessment included review of current street design and parking lot guidelines that affect the creation of impervious cover and requirements related to stormwater management to allow the Town to determine if changes to design standards for streets and parking lots can be made to support low impact development (LID) options as required by the 2016 Small MS4 General Permit. The assessment also included review of allowable green infrastructure practices and under what circumstances they are allowed.

According to the 2016 Small MS4 General Permit:

Section 2.3.6.b. related to generation of impervious cover: *If the assessment indicates that changes can be made, the **assessment shall include recommendations and proposed schedules** to incorporate policies and standards into relevant documents and*

What are GI and LID?

Green Infrastructure (GI) includes both natural features such as forests and wetlands as well as engineered landscapes that mimic these natural processes like a rain garden.

Low Impact Development (LID) works to preserve the natural landscape and minimize impervious surfaces to keep stormwater close to the source and use it as a resource rather than a waste product.

Together, LID and GI not only manage stormwater and improve groundwater supplies, but also offer many free ecosystem services including cleaner air and water, flood control, shade and energy savings, recreational opportunities, and enhanced property values and quality of life.

Source: [MassAudubon LID Fact Sheets. https://www.massaudubon.org](https://www.massaudubon.org)

procedures to minimize impervious cover attributable to parking areas and street designs. The permittee shall implement all recommendations, in accordance with the schedules, contained in the assessment.

Section 2.3.6.c. related to allowing specific practices: *If the practices are not allowed, the **permittee shall determine what hinders the use of these practices, what changes in local regulations may be made to make them allowable, and provide a schedule for implementation of recommendations.** The permittee shall implement all recommendations, in accordance with the schedules, contained in the assessment.*

Recommended changes to the Town's Bylaws and Regulations are outlined in this memorandum and should be refined through collaboration with the Town's Planning Board, Department of Public Works, and Conservation Commission.

Review of Existing Bylaws and Regulations

The following existing bylaws and regulations of the Town of Mashpee were assessed relative to requirements that affect the creation of impervious cover or implementation of green infrastructure practices:

- Town of Mashpee Rules and Regulations Governing the Subdivision of Land (as adopted/updated November 15, 2017)
- Town of Mashpee Planning Board Special Permit Regulations (approved November 15, 2017), including Section IX.C Design and Performance Guidelines – Stormwater Management
- Town of Mashpee Zoning Bylaws (Chapter 174, as amended October 21, 2019), including Section 174-27.2 Stormwater Management (as amended October 16, 2006)
- Town of Mashpee General Bylaws, including:
 - Chapter 82: Earth Removal (as adopted 1980)
 - Chapter 84: Erosion and Sediment Control (as amended June 15, 2020)
 - Chapter 85: Illicit Connections and Discharges to the Municipal Storm Drain System (as adopted October 21, 2019)
 - Chapter 107: Mashpee Nitrogen Control Bylaw

The following documents were also reviewed:

- The Town of Mashpee Conservation Commission Wetlands Bylaw (Chapter 172 of the General Bylaws, as amended October 21, 2019) and Town of Mashpee Wetland Regulations (as revised April 28, 2017) were reviewed, and while several sections had applicable requirements for activities within resource protection areas, they are largely governed by the Massachusetts Wetlands Protection Act (WPA) Regulations (310 CMR 10.00). Because the WPA Regulations and the Massachusetts Stormwater Management Handbook are being updated, no changes are recommended at this time.

To document our review of local code and understand opportunities for improvement, Tighe & Bond used Mass Audubon's *Bylaw Review for LID & Climate-Smart, Nature Based Solutions*.¹

¹ Mass Audubon. *Bylaw Review: Encouraging Nature-Based Solutions*. URL: <https://www.massaudubon.org/our-conservation-work/policy-advocacy/shaping-climate-resilient-communities/publications-community-resources/bylaw-review>

This Excel worksheet will be delivered to the Town electronically as part of this memorandum. As described in the Mass Audubon checklist, it provides a framework to:

...evaluate local land use regulations in relation to models and examples from the Commonwealth of Massachusetts' Smart Growth/Smart Energy Toolkit and other sources in relation to the use of LID and Green Infrastructure (GI) techniques. The focus is primarily on residential development, but the concepts are also applicable to other forms of development and redevelopment.

Best practices minimize the alteration of natural green infrastructure such as forests; reduce creation of impervious surfaces; support retention of naturally vegetated buffers along wetlands and waterways; minimize grading and alterations to natural flow patterns; and support the use of LID techniques as the preferred, most easily permitted methods for managing stormwater.

The key areas of analysis in the checklist include overall site design (e.g., open space residential design or "OSRD" versus conventional subdivisions, consideration of environmental impact and existing conditions), project design and layout standards in relation to LID (road layout and width, curbing, drainage, sidewalks, parking, landscaping), maintenance and operations, and mechanisms for enforcement. See Tabs 1 through 4 in the checklist for additional information about the tool.

The analysis portion of the checklist is separated into two tabs; Tab 5 summarizes factors related to OSRD and Tab 6 summarizes factors related to Mass Audubon's five major goals of a robust LID program:

- Goal 1: Protect natural resources and open space
- Goal 2: Promote efficient, compact development patterns and infill
- Goal 3: Smart designs that reduce overall imperviousness
- Goal 4: Adopt green infrastructure stormwater management provisions
- Goal 5: Encourage efficient parking

A color-coded ranking system is used to categorize the state of current code compared to Mass Audubon's "Conventional", "Better", and "Best" categories for each factor. This allows the Town to visually perceive whether the Town's current code related to a particular LID goal or factor follows a more conventional approach and therefore may present an opportunity to update the code with more LID-focused parameters. Note that there is no EPA requirement to meet the "Best" category for each factor in the checklist, and the recommendations presented here are primarily focused on meeting the 2016 Small MS4 General Permit requirements.

Tighe & Bond met with the Town on September 7, 2022 to obtain initial input on this assessment. The Town also provided input on the Code Assessment Summary, this memorandum, and recommendations.

Summary of Findings

Tighe & Bond's assessment of the Town of Mashpee's local code has determined that several Bylaws and Regulations include provisions that affect the creation of impervious cover. As noted in the Recommendations section of this memorandum, there are opportunities to update the code to incorporate policies and standards to minimize impervious cover attributable to parking areas and street designs.

Several Bylaws and Regulations allow for the implementation of green roofs, infiltration practices, and water harvesting devices when appropriate site conditions exist. Tighe & Bond found no hinderances to these practices within the existing local codes; however, there are opportunities to more proactively encourage their use, as described in the Recommendations section of this memorandum.

This section provides a brief summary of findings from each code reviewed. For a more detailed summary of existing provisions included in the Bylaws or Regulations listed below, refer to the enclosed Code Assessment Summary.

Rules and Regulations Governing the Subdivision of Land in Mashpee

The Rules and Regulations Governing the Subdivision of Land in Mashpee (herein referred to as the "Subdivision Regulations") contain paved street width, right-of-way width, cul-de-sac diameter, and sidewalk requirements that affect the creation of impervious cover associated with subdivisions. The Subdivision Regulations set forward street layout and design standards that regulate the location, alignment, intersections, drainage, widths, and access of the streets of Mashpee. In general, streets shall be designed to provide safe vehicular travel through the proper provision of adequate sight distances, width of pavement, grades, intersection design, and other engineering standards.

The Subdivision Regulations limit construction site runoff control to road construction for new subdivisions with specific stormwater management standards to control sediment and erosion, as well as written inspection and enforcement procedures.

Overall, the Subdivision Regulations provide good protection for natural resources and open space within subdivisions, but there are opportunities to increase provisions to support the reduction of impervious cover during development and to encourage the use of green infrastructure stormwater provisions, as discussed in the Recommendations section of this memorandum. Refer to the Code Assessment Summary (see Enclosure, Tab 6, column F) for details of the applicable standards within the Subdivision Regulations relative to the creation of impervious cover and green infrastructure within Mashpee.

Zoning Bylaw

The Town's Zoning Bylaw was enacted in accordance with M.G.L., CH.40A, and the Home Rule Amendment, Article 89 of the Amendments to the Massachusetts Constitution and regulates the height, area, location and use of buildings and structures and the use of land throughout the Town of Mashpee. Mashpee's Zoning Bylaw includes specific provisions for different uses in various zoning and overlay districts, which include the following:

- Residential Districts (R-3, R-5);
- Commercial Districts (C-1, C-2, C-3 Limited Commercial);
- Industrial District (I-1);
- Overlay Districts (Floodplain District, Mashpee River and Quashnet River Protective Districts, Primary Conservation Areas, Secondary Conservation Areas, Groundwater Protection Districts, Areas of Critical Environmental Concern, Otis A.N.G.B. Accident Prevention Zone, Popponesset Overlay District, Wireless Facility Overlay District, IC Overlay District, and Mashpee Center Overlay District).

Open Space Development standards are included in the Zoning Bylaws under Section 174-46 Open Space Incentive Development. Section 174-31 Land Space Requirements Table of the Zoning Bylaw includes specifications on minimum lot area and frontage, minimum building setbacks for lot lines, maximum building height, and maximum of lot coverage. Additional requirements related to the creation of impervious cover and use of green infrastructure

techniques may be more or less stringent depending on the zoning or overlay district the proposed development is located within.

Mashpee's Zoning Bylaw requires stormwater management and artificial recharge of precipitation for any new residential or non-residential development requiring either subdivision approval, a special permit, plan review or building permit for a building over 1,000 square feet. The Zoning Bylaw requires stormwater management to prevent untreated discharges to wetlands and surface waters, preserve hydrologic conditions that closely resemble pre-development conditions, reduce or prevent flooding by managing the peak discharges and volumes of runoff, minimize erosion and sedimentation, not result in significant degradation of groundwater, reduce suspended solids, nitrogen, volatile organics and other pollutants to improve water quality and provide increased protection of sensitive natural resources.

The Zoning Bylaw includes excellent provisions to protect natural resources and open space, but there are opportunities to encourage efficient parking and promote efficient, compact development patterns with flexible or minimized lot sizes, setbacks, and frontage areas, as discussed in the Recommendations section of this memorandum. Applicable standards as they relate to open space residential design, street design, parking, impervious cover, and green infrastructure is summarized in more detail in the Code Assessment Summary (see Enclosure, Tab 6, column E).

General Bylaws of the Town of Mashpee

While the Town of Mashpee General Bylaws were reviewed, there were minimal provisions related to street design, parking, or green infrastructure. We included commentary in the Code Assessment Summary related to the Chapter 82 Earth Removal, Chapter 84 Erosion and Sediment Control, and Chapter 85 Illicit Connections and Discharges to the Municipal Storm Drain System.

The erosion and sediment control requirements in Chapter 84 exceed the new development and redevelopment one-acre thresholds for most types of development and provides written procedures for site inspection and enforcement. However, it exempts certain activities including construction of a single-family dwelling, existing nursery or agricultural operations, construction of a new roadway subject to approval by the Planning Board under subdivision control, or projects with an approved stormwater management plan under the Zoning Bylaw.

Refer to the Code Assessment Summary (see Enclosure, Tab 6, column J) for an outline of the applicable standards within the General Bylaws for those provisions relative to this assessment.

Recommendations

Tighe & Bond's recommendations are limited to updates to the Subdivision Rules and Regulations and the Zoning Bylaw, which have the most opportunity to generate impervious cover through construction of buildings, parking, streets, and sidewalks, as well as consideration for stand-alone stormwater management bylaw and rules and regulations. We have provided recommended areas for potential improvement; however, the ultimate updates to Town code will be determined after careful consideration by the Town's professional staff in Engineering and Planning, discussion with the Planning Board and other enforcing entities, and a process for public input.

Recommended Revisions to Subdivision Rules and Regulations

Responsible Parties: Planning Board and DPW Department

Target Completion Date: July 2025

The Subdivision Rules and Regulations would benefit from modifications designed to promote the use of LID and stormwater management techniques that improve water quality. In general, such modifications would reduce impervious area, incorporate more LID and GI, and better preserve open space.

The list below provides more specific recommendations on how to further promote LID in the Town of Mashpee for discussion and collaboration with the Town's Planning Board, Department of Public Works, and Conservation Commission based on recommendations from the Massachusetts Low Impact Development Toolkit² and the American Planning Association (APA) guidebook, *Sustainable Neighborhood Road Design: A Guidebook for Massachusetts Cities and Towns*.³

Street Design

- Section VIII A.6 requires dead end streets to have a turn-around with an outside roadway diameter of at least 100 feet. This section could be revised to specifically allow or require center landscaping in a cul-de-sac, and the vegetated center landscaping could specifically be a **bioretention area** (sometimes called a **rain garden**) for stormwater management. The Town could also allow a hammerhead turnaround to reduce pavement.
- Section IX provides Road Construction Standards including road base, road surface, shoulders and berms. This section could be revised to allow alleys and other low traffic or secondary emergency access and all shoulders to use alternative, permeable materials.

Sidewalks

- Section IX I. Sidewalks states that "*Sidewalks with a minimum width of 4' shall be installed on at least one side of a street. Sidewalks shall be designed to conform to the minimum dimensions and materials as shown on the design plates included herein.*" Consider adding text that specifically provides flexibility in material and design to allow/encourage the use of permeable pavement or permeable pavers with the implementation of a maintenance plan. Revisions to design requirements could be added that no longer require sidewalks and/or to site sidewalks with land contours and not necessarily immediately parallel to the road.

Stormwater Management

- Consider requirements to address runoff from roofs. In the Zoning Bylaw, roof runoff is specifically required to be routed through vegetated water quality swales, as sheet flow over lawn areas, or to constructed stormwater systems capable of removing nitrogen. However, within the Subdivision Rules and Regulations, green roofs, downspout disconnection, and rainwater harvesting could be encouraged in some cases through the permitting process. Downspout disconnection and rainwater harvesting are both considered green infrastructure elements. It is recommended that

² <https://www.mapc.org/resource-library/low-impact-development-toolkit/>

³ https://www.apa-ma.org/wp-content/uploads/2018/12/NRB_Guidebook_2011.pdf

these revisions include descriptions of the specific areas to which these elements can discharge to.

- Consider establishing limits of extent of lawn area on residential lots, either by area or by percentage of lots, to reduce outdoor water use for irrigation as well as application of chemicals for lawn maintenance that causes stormwater pollution.
- Consider requiring the submission of as-built record drawings in the Subdivision Rules & Regulations.

Recommended Revisions to the Zoning Bylaws

Responsible Parties: Planning Board

Target Completion Date: July 2026

The Town's Zoning Bylaw has established an Open Space Incentive Development (OSID), which allows for more flexible dimensional requirements to create open space. Other sections including Groundwater Protection Districts also have requirements for the creation of less impervious surface and better stormwater management.

The list below provides more specific recommendations on how to further promote LID and reduce impervious area in the Town of Mashpee for discussion and collaboration with the Town's Planning Board and Department of Public Works based on recommendations from the Massachusetts Low Impact Development Toolkit⁴ and the American Planning Association (APA) guidebook, Sustainable Neighborhood Road Design: A Guidebook for Massachusetts Cities and Towns.⁵ An overall comprehensive review of Zoning is also recommended to better address stormwater measures.

Parking Requirements and Standards

- Section 174-43 Spaces for commercial centers, provides minimum required parking spaces for commercial centers containing at least 50,000 square feet of gross leasable floor area. These requirements can be reduced if it can be demonstrated by means of data and studies from similar projects, that shared parking, staggered hours of operation or peak parking use and multi-purpose trips justify a reduced number of required spaces. Consider allowing a reduction in parking with a special permit for multi-use ("shared") parking, where the Planning Board may waive the actual installation of one or more parking spaces (i.e., green bank or land bank parking spaces) provided that site drainage is designed to accommodate full build-out, and provided that the Building Commissioner can require installation of some of the land banked parking spaces if needed. Land banking allows for designating a portion of land on a site that would be required for parking to be held and preserved as open space, rather than constructed as parking. Allowing a certain percentage (e.g., up to 25%) of the required parking spaces could be added to the Site Plan Review process.
- In Section 174-41 Parking Lot Design, consider adding language such as: "Pervious materials such as porous pavers, paving stones, reinforced grass, and pervious pavement may be allowed in lower volume stalls or overflow parking areas." An operation and maintenance plan must account for specialized maintenance in these areas.

⁴ <https://www.mapc.org/resource-library/low-impact-development-toolkit/>

⁵ https://www.apa-ma.org/wp-content/uploads/2018/12/NRB_Guidebook_2011.pdf

- Section 174-41 G. requires installation of curbs and gutters along the perimeter of any parking area over 10 spaces and any driveway or parking lot islands. Consider revising curb requirement to encourage open drainage.
- Section 174-41 L. encourages the use of landscaped berms or additional plantings to screen parking areas from view from abutting properties or public roadways. Consider requiring landscaping within parking lots (Section 174-41) and loading areas (Section 174-42), including curbed planting strips. Consider allowing or requiring stormwater practices in islands, landscaped areas, and setbacks. Consider adding language such as: "Low impact stormwater management techniques such as bioretention areas, rain gardens, vegetated swales, and filter strips may be located within the landscaped areas and count towards the landscaping requirement." This would require planting strips to be lower than the paved area with curb cuts to allow runoff into the landscaped area.
- Section 174-38 Parking Facility dimensions, requires parking stalls to be not less than 20 feet in length, except when part of a parking module sized as indicated in the table provided in 174-38. Consider setting parking stall dimensions with depth of 18 feet for residential and commercial parking.

Lot Layout and Dimensional and Density Requirements

- Section 174-80 Permitted uses within Groundwater Protection Districts, states that no more than 15% or 2,500 square feet of any lot may be rendered impervious. Consider establishing limits on impervious lot coverage (e.g., <15%) in all low-density areas. (Not appropriate for town centers or moderate density neighborhoods where compact development should be encouraged).
- In Section 174-31 Land Space Requirements Table, look for opportunities to examine minimum setback requirements in certain districts. Also consider establishing maximum setbacks, in addition to the minimums. Some of the current requirements may result in unneeded impervious area.

Stormwater Management

- Consider further requirements addressing runoff from roofs. Roof runoff is specifically required to be routed through vegetated water quality swales, as sheet flow over lawn areas, or to constructed stormwater systems capable of removing nitrogen. **Green Roofs** are allowed but could be encouraged in some cases through the permitting process. **Downspout Disconnection** and **Rainwater Harvesting** are both considered green infrastructure elements.⁶
- Consider adding language to Section 174-27.2.A requiring that the system of stormwater management and artificial recharge of precipitation also be designed so that post-development infiltration is equal to or greater than pre-development infiltration.
- Consider adding provisions to the Zoning Bylaws to allow for easy siting of LID features on lots, common open space, setback areas, or road ROWs and easements. Examples include allowing an increase in floor area ratio or other developmental incentives for green roofs for commercial development, specifying commercial landscaping

⁶ U.S. EPA. *What is Green Infrastructure?* URL: <https://www.epa.gov/green-infrastructure/what-green-infrastructure>

requirements for all parking areas, and allowing for vegetated areas with bioretention functions in commercial landscaping areas.

- Consider establishing limits of extent of lawn area within Cluster Developments, and/or for new and redevelopment in residential districts in Section 174-47, either by area or by percentage of lots, to reduce outdoor water use for irrigation as well as application of chemicals for lawn maintenance that causes stormwater pollution.
- As stated in the June 29, 2020 Town of Mashpee MS4 General Permit Bylaw Review Memorandum, it is also recommended that revisions be made to Section 174-24.B to include a Site Plan Review Checklist as part of the plan review process to assist the Town and applicant in determining when an application is complete; and to Section 174.27.2 to be consistent with and address specific requirements of the 2016 Small MS4 General Permit. A copy of the June 2020 Memorandum is attached.

Open Space Requirements

- The Zoning Bylaws allow OSRD/Flexible Development for OSID tracts by Special Permit. Consider reviewing Section 174-46 OSID in its entirety to increase flexibility for these uses to allow for actual implementation. OSID could be better encouraged by not requiring obtaining a Special Permit and by decreasing the minimum parcel(s) size.

Recommended Stormwater Management Rules and Regulations

Responsible Parties: Planning Board/Zoning Board of Appeals

Target Completion Date: July 2025

- Various sections of Mashpee's bylaws and rules and regulations are related to stormwater management including Section 174-27.2 Stormwater Management in the Zoning Bylaw, Section IX J Storm Water Management in the Subdivision Regulations, and Section IX C Stormwater Management of the Special Permit Regulations. Consider adopting stand-alone Stormwater Management Rules and Regulations to present performance standards and design criteria for new development, redevelopment sites, and sensitive areas in one location. As with existing sections of bylaws and regulations, the Stormwater Management Regulations would require the use of LID to the extent feasible, and contain specific design criteria promoting the use of alternative green infrastructure practices such as green roofs, porous pavement, or rain barrels. A stand-alone regulation would allow greater flexibility in revising requirements, particularly as revisions are made to the Massachusetts Stormwater Management Handbook.

Non-Regulatory Recommendations

Responsible Parties: Board of Health/DPW Department/Building Inspector

Target Completion Date: Implement 1 to 3 of the following recommendations by July 2025

- Provide opportunities for professional staff and members of the Planning Board and Zoning Board of Appeals to participate in workshops or conferences about LID, GI, and stormwater management.
- Consider implementing a Rain Barrel Program to allow residents to purchase and pick up a rain barrel at a discount or consider partnering with an organization with an established rain barrel program such as the Association to Preserve Cape Cod (APCC)

APCC uses Upcycle Products Inc. for its rain barrels; however, many Massachusetts communities have programs using The Great American Rain Barrel company.⁷

- Implement green infrastructure or LID demonstration projects on Town-owned properties.
- Modify and distribute public education materials available from MassDEP and EPA for developers regarding design, uses, and appropriate site conditions for green infrastructure such as rain gardens and porous pavement.^{8 9 10 11 12} Materials could be made available on the existing Mashpee Stormwater Management Program website.

Next Steps

The proposed recommendations for revision presented herein should be discussed and refined through a joint working meeting of relevant boards and commissions including the Town's Planning Board, Department of Public Works, Conservation Commission. Per the 2016 Small MS4 General Permit, recommended changes must have a corresponding proposed schedule to incorporate policies and standards into relevant documents and procedures to minimize impervious cover attributable to parking areas and street designs. The joint meeting should also include development of a schedule of implementation of proposed revisions and recommended actions.

Enclosures

Mashpee Code Assessment Summary via Mass Audubon's *Bylaw Review for LID & Climate-Smart, Nature Based Solutions* (delivered electronically)

J:\M\M1170 Mashpee DPW Transfer Station\023-FY22 NPDES Mashpee\Task 4- Local Code Review\Final Report\Mashpee Local Code Technical Memo_Final.docx

⁷ <https://upcycle-products.com/ma-programs/apcc/> or <https://www.greatamericanrainbarrel.com/>

⁸ <https://www.epa.gov/green-infrastructure/overcoming-barriers-green-infrastructure>

⁹ <https://www.epa.gov/soakuptherain>

¹⁰ <https://www3.epa.gov/region1/npdes/stormwater/assets/pdfs/BMPRetrofit.pdf>

¹¹ <https://www.thinkbluemassachusetts.org>

¹² <https://www.mass.gov/guides/stormwater-outreach-materials-to-help-towns-comply-with-the-ms4-permit>

Open Space Residential Design (OSRD) Overview

This section reviews how local bylaws for cluster, Open Space Residential Design (OSRD), or Natural Resource Protection Zoning (NRPZ) compare to the state's recommended best practices. Communities may currently have multiple bylaws that cover this in different residential areas, in which case they can each be compared to the model regulations. However, in most cases, we would encourage simplification and the use of a single OSRD bylaw with local priorities clearly defined.

Communities may also have no cluster, OSRD, or NRPZ bylaws on the books. In this case, the state's best practice model (see resources below) can be used to create one. If the community closely follows the model, they'll meet the characteristics described within the analysis. However, the analysis still provides a quick checklist.

Some of the most important aspects of OSRD in any community include: the four-step review process that carefully considers the natural landscape before drawing lot lines; the minimum amount of open space protected; the incorporation of LID practices; and allowing this type of development by right instead of special permit.

Zoning, Subdivision, Site Plan Review, and Stormwater Overview

This section reviews not only the individual bylaws and regulations, but also how they work together and how consistent they are. Communities often update portions of bylaws or regulations in a piecemeal way over decades, leading to inconsistencies among various provisions. This color-coded analysis provides a quick overview of not only which rules are out of date and not meeting best practices for LID and preservation of Green Infrastructure, but also how certain topics (such as siting of LID) may be inconsistent between different parts of land use rules.

Not all factors (such as road width, siting of LID, limits on clearing and grading, or allowing common drives) may be addressed in each of the sections considered (Zoning bylaws, Subdivision Rules and Regulations, Site Plan Review (SPR), and Stormwater/LID bylaw). Where that factor is not usually included within a regulation or bylaw, you'll notice that "(Not Applicable)" will appear in that box. For example, setbacks and frontage requirements are addressed under Zoning, but often not under other bylaws or regulations. Those boxes are available for editing where desired. The sections identified for review may also need to be adjusted for your analysis, and you may need to add or remove columns to reflect the unique set of bylaws and regulations applicable in your community.

This review may also help towns identify best practices that comply with MS4 permit requirements, issued by EPA and Mass DEP, though it is not comprehensive in relation to the permit requirements and additional actions may be needed. Consultation with EPA and/or DEP is strongly recommended. Visit www.mass.gov/guides/municipal-compliance-fact-sheet-stormwater for more info.

The analysis is broken into five goals, each with factors that address the goal:

Goal 1: Protect Natural Resources and Open Space

The focus of this section is to limit clearing and grading and encourage soil management, the use of native species, and revegetation of disturbed areas. Often, communities have language such as "due regard shall be shown for natural features" without any specific limitations or guidelines that can be used by local boards to ensure developers are following the true intent of the community. The retention of natural vegetation and soils is the single most efficient means of reducing development impacts on water resources, avoiding costs associated with piping and other "grey" stormwater management features as well as the need for irrigation. There are also many other benefits – including habitat for birds and pollinators, trees for shade and clean air, and protection of natural scenery that contributes to property values and a high quality of life.

Goal 2: Promote Efficient, Compact Development Patterns and Infill

Often, making dimensional requirements such as setbacks, lot size, and frontage more flexible as well as allowing common drives will help allow the community to encourage efficient, compact designs. These help to decrease the amount of impervious surfaces and increase infiltration, while still supporting new development.

Goal 3: Smart Designs that Reduce Overall Imperviousness

This section reviews site design such as street location, road width, cul-de-sac design, curbing, roadside swales, and sidewalk design and location. There are many opportunities for communities to minimize impervious surfaces and allow for infiltration through curb cuts, swales, and cul-de-sacs with bioretention, among other things.

Goal 4: Adopt Green Infrastructure Stormwater Management Provisions

This section looks to explicitly discuss LID as a preferred method, such as requiring roof runoff to be directed into vegetated areas, and a preference for infiltration wherever soils allow or can be amended. Bylaws and/or regulations should clearly specify what LID is and which BMPs are preferred or required. Communities should also require an operations and maintenance plan to encourage effective use of LID methods. Adopting a specific LID bylaw can help clearly define and incorporate LID as a preferential stormwater management technique. Defining LID within this bylaw also decreases the need to explain LID throughout each of the Zoning bylaws, SPR, and subdivision rules and regulations and reduce the potential for any conflict between regulations and bylaws. This section also includes additional stormwater management considerations relevant to the MS4 permit.

Goal 5: Encourage Efficient Parking

Parking accounts for a large amount of impervious surface within new and redevelopment projects and offers an enormous opportunity for using LID. By reducing the amount of required parking - or even including parking *maximums* instead of *minimums*, communities can drastically reduce their impervious surfaces and runoff. Many communities already require landscaping in parking areas, which also offers an opportunity to allow curb cuts and infiltration in these areas - improving water quality and reducing the need for irrigation.

Additional Notes and Recommendations

Stormwater Calculations

Ensure your regulations reference the most updated data on storm intensities.

MassDEP Stormwater rules and guidance

<https://www.mass.gov/info-details/stormwater-permitting>

NOAA I4 Atlas https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html

Northeast Climate Center at <http://www.nrcc.cornell.edu/>

Landscaping and Recommended Trees

Ensure your local landscaping regulations require native, pollinator friendly species such as those here: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_015043.pdf

Additional Considerations

Funding and Maintenance:

- Ensure sufficient funding for DPW to perform maintenance of stormwater management facilities, whether conventional or LID.
- Consider reduced costs of paving, plowing, salt when comparing LID maintenance costs with conventional designs
- Create mechanisms for enforcement of maintenance agreements; establish regulations/fines for property owners who fail to maintain stormwater facilities.

Training, Demonstration Projects, and Public Education:

- Provide opportunities for and encourage municipal staff and committee/board members to participate in LID workshops or conferences.
- Implement LID demonstration programs at city or town hall, schools, DPW, etc.

Nonpotable Uses of Clean Stormwater:

- Local plumbing codes should allow the use of clean (e.g. rooftop) rainwater for landscape irrigation and interior non-potable uses such as toilet flushing.

MA Open Space Residential Design Best Practices Factors	Conventional	Better	Best Practice	OSRD/Flexible Development
Permit Type	Special Permit	By Right	Mandatory	Zoning Bylaw 174-46: For the purposes of preserving critical open space and natural resource areas within the Town of Mashpee, of promoting an efficient pattern of land development and of promoting the health, safety and general welfare of the inhabitants of the town, an open space incentive development (OSID) may be allowed by Special Permit from the Planning Board in any residential district, except as provided under Subsection H. in accordance with the following procedures and standards:
Land area to which the zoning is applicable	Only a small amount of developable land	Land of particular environmental sensitivity	All developable land zoned residential	In any residential district.
Minimum Open Space	50-65%	65-75%	≥ 75%	A minimum of fifty percent (50%) of the upland area of the parcel or parcels included within the OSID shall be permanently dedicated as open space.
Yield Calculation	Full plan with full percolation tests	Sketch plan with selected percolation test(s)	By formula	Not addressed.
Minimum parcel size	≥ 10 acres	5-10 acres	None	An OSID shall include a parcel or parcels of land containing a total of at least twenty (20) acres, of which no developable parcel may be less than five (5) acres in size.
Review Process	No detailed analysis of site characteristics in relation to design	Cluster layout	Flexible "OSRD" 4 Step	No detailed analysis of site characteristics in relation to design
Ownership of Open Space	Appropriate to the resources present. For example, agricultural land by the farmer, watershed land by a water dept. or district, habitat land by the conservation commission, or recreational open space by a parks and recreation commission or homeowners association.			Any open space required to meet the minimum provisions of Subsection C shall be permanently dedicated in one of the following ways: Public Ownership, Ownership by a Nonprofit Organization, Ownership by a corporation or trust.
Dimensional Standards; area, frontage, etc.	Specified, < than for standard subdivision	Formulaic reduction with specified minimums	None set or small minimums	Formulaic reduction with specified minimums
Quality of open space conserved: Specificity of local priorities for natural, cultural, and historic resource conservation	No indication of local conservation priorities, or language that refers only to regulated resource areas.	Lack of specificity regarding local conservation priorities; no map of priority locations	Local priorities clearly and unambiguously stated and mapped for use in site design.	Priorities listed.
Contiguity of open space; relationship to previously protected open space	No contiguity requirement	Contiguity required within subdivision	Contiguity required; adjacent land considered	No contiguity requirement.
Quality of open space conserved: Allowed uses of open space	Allowed use of open space not addressed	Vague language regarding use of conserved open space	Clear list of allowed uses consistent with conservation and recreation goals	... shall be left in essentially its undisturbed natural state, except for pedestrian, equestrian or bicycle trails, minor clearing for passive recreation purposes such as picnicking... In no case shall such area be used for roads, playgrounds, golf courses, tennis courts or other uses requiring significant amounts of clearing, structures or paving.
Quality of open space conserved: Submission requirements - GIS maps, data, etc. to inform the review process	Vague or no language regarding submission of information on site resources and no specified process for the use of the data submitted	General non-comprehensive data and mapping requirements; vague process for the application of the data to site design and open space conservation	Specific plans, maps, & comprehensive data regarding natural, cultural, and historic resources required and used as the basis for open space conservation	Topographic plan, natural resource map, and sketch plan required.
Relationship to Plans	Relationship to plans not discussed	Optional consideration of open space goals of OSRP, master, and/or regional policy plan	Required consideration of open space goals of OSRP, master, and/or regional policy plan	Not discussed.
Low Impact Design	Not addressed	Encouraged	Required	Not addressed.

Density bonus for enhanced public benefit(s)	No bonus offered	Bonus by special permit	Automatic or formulaic bonus	<i>In order to encourage the preservation of critical open space and natural resource areas within the Town of Mashpee for the benefit of the inhabitants of the Town, as well as to provide affordable housing, certain increases in density of dwellings within an open space incentive development may be allowed in accordance with MGL C. 40A, §9. Such increase in density, in the form of bonuses allocated for transfer of development rights from portions of parcels within an OSID, which will be preserved as open space, to those portions of parcels of the OSID which will be developed, shall require approval by the Planning Board as part of its approval of a Special Permit for the OSID in conformance with the following guidelines.</i>
Review Entity	ZBA, council or selectmen as special permit authority	Planning Board	Planning Board	<i>Planning Board</i>
Flexibility re: open space protection to facilitate wastewater treatment facilities	No flexibility provided	Aggregate calculations allowed by board of health	If necessary, required open space may be reduced by < 10% to accommodate; disposal area deed restricted; aggregate calculations allowed by BoH, etc.	<i>Not addressed.</i>
Monitoring of open space	No specified monitoring requirements and no requirements that would assist the party responsible for monitoring	Loose provisions to facilitate, municipal monitoring, or no specificity regarding monitoring interval	Specific provisions to aid endowed monitoring by a conservation org at stated intervals	<i>Not addressed.</i>



Town of Mashpee

SMALL MS4 GENERAL PERMIT PHOSPHORUS SOURCE IDENTIFICATION REPORT FOR ASHUMENT & SANTUIT PONDS

Mashpee Department of Public Works
350 Meetinghouse Road
Mashpee, Massachusetts

August 2022

Tighe&Bond

Small Municipal Separate Storm Sewer System (MS4) General Permit “Phosphorous Source Identification Report” for Ashumet and Santuit Ponds

To: Town of Mashpee
FROM: Gabrielle Belfit, CFM, Senior Environmental Scientist
Jessica Cajigas-Smith, Senior Project Manager
DATE: December 30, 2021, revised August 10, 2022

Tighe & Bond is providing this memorandum to the Town of Mashpee to document requirements of the U.S. Environmental Protection Agency’s (EPA’s) *General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems* (MS4GP) related to discharges to Ashumet and Santuit Ponds (see Part 2.2.2.b and Appendix H of the MS4GP).

This Phosphorus Source Identification Report is required by Appendix H Part II.1.b. for discharges within the watersheds of Ashumet and Santuit Ponds, which are both listed as impaired for Total Phosphorus. This report includes the following elements:

- Section 1.** Calculations of total MS4 urbanized area within Mashpee’s jurisdiction that are within the Ashumet and Santuit Pond Watersheds incorporating updated mapping of the MS4, and catchment delineations produced pursuant to part 2.3.4.6 of the MS4GP.
- Section 2.** Screening and monitoring results pursuant to part 2.3.4.7.b., targeting the receiving water segment(s).
- Section 3.** Impervious areas and directly connected impervious areas (DCIA) for the target catchment. Tighe & Bond has estimated DCIA based on EPA guidance.
- Section 4.** Identification, delineation and prioritization of potential catchments with high phosphorus loading.
- Section 5.** Identification of potential retrofit opportunities or opportunities for the installation of structural BMPs during redevelopment. *This work is being completed separately and will be added once that work is completed.*

This is considered a baseline assessment based on existing Geographic Information System (GIS) data, available online tools including the Massachusetts Department of Environmental Protection (MassDEP) Watershed Based Plan Tool (MWBP)¹, and the methodology from Appendix H of the MS4GP.

¹ <http://prj.geosyntec.com/MassDEPWBP/PlanWizard/SelectWatershed>

Section 1 - Ashumet and Santuit Pond Watersheds within Mashpee's MS4 Area

Ashumet and Santuit Ponds are listed as impaired water bodies for Total Phosphorous according to the most recent Massachusetts 303(d) list as part of the Massachusetts Final 2018/2020 Integrated List of Waters, approved in November 2021 (**Appendix A**). Both Ashumet and Santuit Ponds are located in the Cape Cod Basin. Their entire watershed areas are considered urbanized according to the US Census mapping for determination of urbanized area coverage under the MS4GP. **Figure 1 (Appendix B)** shows the MS4 Mapping of the Urbanized Area for the northern part of the Town of Mashpee, including the stormwater system and limited catchment delineations produced pursuant to part 2.3.4.6 of the MS4GP.

Phosphorus is a nutrient that, when present at high levels in natural waterbodies, can cause overgrowth of aquatic plants, increased harmful algal blooms, decreased light in a waterbody, and decreased levels of dissolved oxygen, thereby impairing designated uses (aquatic life, fish consumption, primary and secondary contact, and aesthetics) per the Commonwealth's Surface Water Quality Standards (314 CMR 4.00). Phosphorus is a common pollutant in stormwater, with sources including leaf litter, pet waste, road salt, fertilizer, and atmospheric deposition. A variety of structural (infiltration and treatment structures) and non-structural (such as street sweeping and catch basin cleaning) Best Management Practices (BMPs) can be effective at reducing phosphorus loads from stormwater. **Sections 1.1 and 1.2** below provide an overview of the Ashumet and Santuit Pond Watersheds' physical characteristics and phosphorous loading issues. **Section 1.3** provides an overview of land use within the Mashpee portions of both watersheds.

1.1 Ashumet Ponds Watershed

Ashumet Pond occupies approximately 203 acres in Mashpee and is located north of Route 151, to the west of Johns Pond. The pond is a kettle hole pond with a maximum depth of 70 feet. It is fed by groundwater and has no outlet. The watershed to Ashumet Pond is approximately 1,642 acres including land in Mashpee, Falmouth and Sandwich. Approximately 269 acres of the watershed is located in Mashpee. **Figure 2 (Appendix B)** shows the location of Ashumet Pond, and the approximate watershed based on information from the MassDEP MWBP.¹

The Mashpee stormwater system within the Ashumet Pond Watershed consists of paved roadways and 35 leaching catch basins. There are no stormwater outfalls located in the Mashpee section of the Ashumet Pond watershed.

According to the "Final Ashumet Pond 2008 Trophic Health Technical Memorandum", completed by CH2M HILL in 2009, "Ashumet Pond is a kettle pond with a maximum depth of 19 meters (62.3 feet [ft]) and is located near the Massachusetts Military Reservation (MMR) on Cape Cod. The pond is fed primarily by groundwater seepage and has no surface water outlet..." The MMR Wastewater Treatment Plan (WWTP) began operation in 1936 and it was closed in 1995. Although the discharge of secondarily treated wastewater to the aquifer ceased in 1995, a large mass of residual phosphorus remains adsorbed to the aquifer matrix between the WWTP and the pond. This residual phosphorus has continued to feed the phosphorus plume that is discharging to the pond. Without further remedial action, this plume was expected to continue to contribute to the external phosphorus load of the pond (in the range of 48 to 110 kilograms [kg] per year) for decades (McCobb et al. 2003; AFCEE 2002a)."²

² CH2M HILL. 2009. *Final Ashumet Pond 2008 Trophic Health Technical Memorandum*. CH2M HILL, Otis ANGB, MA

1.2 Santuit Pond Watershed

Santuit Pond occupies approximately 164 acres in Mashpee and is located just south of the Sandwich Mashpee Town Line, north of Route 130, east of Cotuit Road, and west of Santuit Newtown Road. The pond is a kettle hole pond fed by groundwater and discharges to the Santuit River to the south. The watershed of Santuit Pond is approximately 1,408 acres and includes land in Mashpee, Barnstable and Sandwich. Approximately 629 acres of the watershed is located in Mashpee. **Figure 3 (Appendix B)**, shows the location of Santuit Pond and the approximate watershed based on the MassDEP MBWP.¹

The Mashpee stormwater system within the Santuit Pond Watershed consists of 182 leaching catch basins and no outfalls. One (1) outfall is located south of Santuit Pond, where groundwater is likely discharging from the Pond; however, it is not located within the watershed boundary.

Water quality in Santuit Pond has been monitored by state, tribal, and local agencies, as well as academic groups and volunteer monitors. A 2010 Diagnostic Study of Santuit Pond developed a nutrient budget identifying major sources of nutrients to the pond. Like most ponds experiencing Cyanobacterial Harmful Algal Blooms (CyanoHABs), phosphorus sources are a mix of internal and external sources and addressing both is part of a long-term solution to improving water quality. Addressing only internal loading is a short-term solution since reduction and/or elimination of external loads is critical to reduce the introduction of additional phosphorus to the water body. While the majority of the existing annual load of phosphorus comes from internal recycling of nutrients, and long-term plans for the pond include dredging, the Diagnostic Study concluded that “addressing the internal load without reducing external loading...will result in re-accumulation of phosphorus in sediments over time and future internal loading.” While the Town has been able to mitigate the influence of internal loading during the summer months through the use of in-pond aeration, rainfall events often trigger a CyanoHAB event. Heavy precipitation events in 2017 and 2019 have been reported to mobilize excess nutrients to the pond via stormwater runoff, overwhelming the Town’s remedial efforts and reactivating the toxic cyanobacteria blooms in this eutrophic system³. This situation is expected to become more frequent due to projected climate change.

In 2021, the Town of Mashpee was awarded a Municipal Vulnerability Preparedness (MVP) Program Action Grant for \$131,691 by the Massachusetts Executive Office of Energy and Environmental Affairs. The Project, “Watershed-based Solutions to Increase Resilience to Harmful Algal Blooms in Santuit Pond in a Warmer and Wetter Climate”, proposes to leverage the 2010 Diagnostic Study and over a decade of water quality monitoring to develop a multi-prong approach to improve the resilience of Santuit Pond to a warmer and wetter climate. The approach develops a concept design for nutrient pollution reduction at key wet water input locations around Santuit Pond and carries one design forward to permitting; reviews and provides recommended changes to municipal bylaws to reduce nutrient impacts to all surface waters in Mashpee; and creates a public education and outreach program that incorporates the knowledge and perspective of the Wampanoag.

1.3 Watershed Land Use

Land use information for the entire Ashumet and Santuit Pond Watersheds was obtained from the MWBP which used 2005 Land Use from MassGIS (2009b). The data is summarized in **Table 1**, and graphically illustrated in **Figures 4 and 5 (Appendix B)**. Based on the 2005 data, both watersheds are predominantly undeveloped (forest, water, agriculture and open land).

Tighe & Bond provided updated land use data from 2016 for the Town and portions of the Ashumet and Santuit Pond Watersheds that fall within the urbanized area in Mashpee (**Table**

³ Mashpee MVP CRB Summary of Findings Report, January 2020

2). As would be expected, land use distribution for the 2016 data is slightly different than the distribution in 2005. Based on the areas of the two watersheds within Mashpee, both watersheds are approximately 40% open space, water and agriculture and 40% developed. Data provided by the 2021 Cape Cod Pond Atlas⁴ indicates that 45% of the 300-foot buffer area to Santuit Pond is protected open space, but only 5% of the 300-foot buffer area to Ashumet Pond is protected open space.

Table 1: Entire Santuit and Ashumet Pond Watershed (2005) Land Uses

<i>Land Use</i>	<i>Area (acres)</i>	<i>% of Watershed</i>	<i>Area (acres)</i>	<i>% of Watershed</i>
	Santuit Pond Watershed		Ashumet Pond Watershed	
<i>Agriculture</i>	12.72	0.9	28.58	1.7
<i>Commercial</i>	2.37	0.2	243.91	14.9
<i>Forest</i>	773.62	54.9	611.7	37.2
<i>High Density Residential</i>	86.53	6.1	7.65	0.5
<i>Highway</i>	0	0	323.49	19.7
<i>Industrial</i>	0	0	3.02	0.2
<i>Low Density Residential</i>	110.21	7.8	35.14	2.1
<i>Medium Density Residential</i>	246.35	17.5	143.19	8.7
<i>Open Land</i>	2.98	0.2	30.42	1.9
<i>Water</i>	174.96	12.4	215.15	13.1

Table 2: Santuit and Ashumet Pond Watershed (2016) Land Use within Mashpee boundaries

<i>Land Use</i>	<i>Area (acres)</i>	<i>% of Watershed</i>	<i>Area (acres)</i>	<i>% of Watershed</i>
	Santuit Pond Watershed		Ashumet Pond Watershed	
<i>Agriculture</i>	38.96	6.19	0	0.00
<i>Commercial</i>	0	0.00	1.1	0.41
<i>Industrial</i>	0	0.00	0	0.00
<i>Open Land</i>	85.46	13.58	56.42	20.97
<i>Recreation</i>	0	0.00	0	0.00
<i>Residential – Multi-Family</i>	31.49	5.00	1.44	0.54
<i>Residential – Other</i>	30.18	4.80	0	0.00
<i>Residential Single Family</i>	192.61	30.61	32.71	12.16
<i>Right-of-way</i>	53.06	8.43	10.34	3.84
<i>Tax Exempt</i>	31.52	5.01	2.84	1.06
<i>Water</i>	165.97	26.38	164.22	61.03
<i>Total</i>	629.25	100.00	269.07	100.00

⁴

<https://cccommission.maps.arcgis.com/apps/instant/sidebar/index.html?appid=caf21fba822d426ba9e2593bfc999163>

Section 2 – Screening and Monitoring Results

The Town of Mashpee completed an outfall inventory and ranking in 2019 in accordance with Part 2.3.4.7 of the MS4GP. The results of the final inventory and ranking, which were submitted as required during Permit Year 3 of the MS4GP, are included in **Table 3**; however, it should be noted that no outfalls in Mashpee are located within the watershed boundaries of either Ashumet Pond or Santuit Pond.

Only one outfall, SR-1, is located near Santuit Pond (see inset to right). SR-1 is a curb cut, and is not a piped outfall. Based on hydrologic mapping, drainage during storm events from SR-1 will flow in a southerly direction towards cranberry bogs which in turn drain to the Santuit River downstream of the Pond.



Table 3: Mashpee Outfall Inventory and Priority Ranking

<i>Outfall</i>	<i>Type</i>	<i>Location</i>	<i>Receiving Water</i>	<i>Flood Zone</i>	<i>Discharging to Area of Concern</i>	<i>Within MS4</i>	<i>Priority</i>
CMR-5	Pipe	410 Meetinghouse Road	Mashpee River	No	Yes	Yes	High
UQR-2	Channel	Nathan Ellis Highway	Upper Quashnet River	No	Yes	Yes	High
JP-1	Pipe	Great Oak Road	Abigails Brook	Yes	No	Yes	High
SR-1	Curb cut	Shields Road	Santuit River	No	Yes	Yes	High
UMR-7	Pipe	80 Great Neck Road N	Mashpee River	No	Yes	Yes	High
RB-1	Pipe	Polaris Drive	Red Brook	Yes	Yes	Yes	High
CR-1	Channel	Old Barnstable Road	Childs River	No	Yes	Yes	High
UQR-1	Pipe	Route 151	Upper Quashnet River	No	Yes	Yes	High
UMR-9	Channel	311 Main Street	Cranberry Bog	No	No	Yes	High
UMR-8	Pipe	312 Main Street	Cranberry Bog	No	No	Yes	High
UMR-5	Channel	350 Main Street	Upper Mashpee River	No	No	Yes	Low
UMR-4	Channel	371 Main Street	Upper Mashpee River	No	No	Yes	High
UMR-3	Channel	414 Main Street	Upper Mashpee River	No	Yes	Yes	High
SR-2	Pipe	Sampsons Mill Road	Santuit River	No	Yes	Yes	High
OB-1	Pipe	Great Neck Road South	Popponesset Bay	Yes	Yes	Yes	High
HPFM-1	Channel	75 Monomoscoy Road	Dutchman's Creek	Yes	Yes	Yes	High
CMR-1	Pipe	457 Great Neck Road N	Cranberry Bog	No	No	Yes	Low

Section 3 - Calculation of Impervious Area and Directly Connected Impervious Area

3.1 Watershed Impervious Area

There is a strong link between impervious land cover and water quality. Impervious cover includes land surfaces that prevent the infiltration of water into the ground, such as paved roads and parking lots, roofs, basketball courts, etc. **Figures 6 and 7 (Appendix B)** show these impervious areas within the Ashumet and Santuit Pond Watersheds, respectively, located within Mashpee.

3.2 Directly Connected Impervious Area

Impervious areas that are directly connected (DCIA) to receiving waters (via storm sewers, gutters, or other impervious drainage pathways) produce higher runoff volumes and transport stormwater pollutants with greater efficiency than disconnected impervious cover areas which are surrounded by vegetated, pervious land. Runoff volumes from disconnected impervious cover areas are reduced as stormwater infiltrates when it flows across adjacent pervious surfaces.

The MWBP provides an estimate of DCIA for watersheds calculated based on the Sutherland equations. U.S. EPA provides guidance (USEPA, 2010) on the use of the Sutherland equations to predict relative levels of connection and disconnection based on the type of stormwater infrastructure within the **total impervious area (TIA)** of a watershed.

Tighe & Bond calculated the TIA and DCIA using updated 2016 land use data and the Sutherland equations, and focusing only on the Santuit Pond and Ashumet Pond Watershed areas located within Mashpee. The total area of each land use within each subwatershed were summed and used to calculate the percent TIA.

Table 4 provides the estimated DCIA and the calculated TIA for the Santuit and Ashumet Pond Watersheds using the MWBP (2005 land use data) for the entire watershed and Tighe & Bond's calculations (2016 land use data) for watershed areas in Mashpee. Additional data on Tighe & Bond impervious area calculations is provided in **Appendix C**.

Table 4: TIA and DCIA Values for Entire Santuit and Ashumet Watersheds

	<i>Estimated TIA (%)</i>	<i>Estimated DCIA (%)</i>
<i>Santuit Pond Entire Watershed</i>	11.3	11.3
<i>Town Only Watershed for Santuit Pond</i>	11.42	2.46
<i>Ashumet Pond Entire Watershed</i>	16.9	16.9
<i>Town Only Watershed for Ashumet Pond</i>	4.53	0.52

The relationship between TIA and water quality can generally be categorized as shown in **Table 5** (Schueler et al. 2009). Based on the TIA calculations for Santuit Pond, this table indicates the water body is showing signs of water quality degradation. This is consistent with observed and measured water quality data for Santuit Pond. There is a smaller TIA percentage for Ashumet Pond that can be attributed to the limited watershed area located in Town and fewer Town-owned roadways. Private roads and the historic sewage contribution of phosphorus

discussed in **Section 1.1** may skew the interpretation of the TIA and water quality relationship for Ashumet Pond.

Table 5: Relationship between Total Impervious Area (TIA) and water quality (Schueler et al. 2009)
% Watershed Impervious Cover *Stream Water Quality*

0-10%	Typically high quality, and typified by stable channels, excellent habitat structure, good to excellent water quality, and diverse communities of both fish and aquatic insects.
11-25%	These streams show clear signs of degradation. Elevated storm flows begin to alter stream geometry, with evident erosion and channel widening. Streams banks become unstable, and physical stream habitat is degraded. Stream water quality shifts into the fair/good category during both storms and dry weather periods. Stream biodiversity declines to fair levels, with most sensitive fish and aquatic insects disappearing from the stream.
26-60%	These streams typically no longer support a diverse stream community. The stream channel becomes highly unstable, and many stream reaches experience severe widening, downcutting, and streambank erosion. Pool and riffle structure needed to sustain fish is diminished or eliminated and the substrate can no longer provide habitat for aquatic insects, or spawning areas for fish. Biological quality is typically poor, dominated by pollution tolerant insects and fish. Water quality is consistently rated as fair to poor, and water recreation is often no longer possible due to the presence of high bacteria levels.
>60%	These streams are typical of “urban drainage”, with most ecological functions greatly impaired or absent, and the stream channel primarily functioning as a conveyance for stormwater flows.

Section 4 - Identification, Delineation and Prioritization of Catchments

4.1 Identification and Delineation of Catchments

The MS4 drainage system for Mashpee consists of roads, curbs, “cape cod” berms, leaching catch basins, and outfalls, including ten piped outfalls and seven curb cuts. Leaching catch basins are the largest component of the MS4 system for Mashpee. These work well on Cape Cod, where the soils are extremely sandy, and drainage is generally not an issue under average storm conditions. At this time, only one roadway in Mashpee has a connected, piped system, draining to a surface infiltration basins, with no outfall; however, this roadway is not located within the Ashumet Pond or Santuit Pond Watersheds.

Delineating catchments areas as defined by the MS4GP for leaching catch basins that lack a “piped system” requires a different approach than a typical delineation using digital elevation models, public rights of way, water features, road centerlines, catch basins, stormwater pipes and outfalls. This is particularly true where the geology is a glacial outwash comprised of very sandy soils. In addition, watershed areas for Cape Cod are not based on topography but on groundwater flow which further complicates a “typical outfall catchment” delineation. Finally, Mashpee by-laws prohibit discharge of stormwater from private development into the MS4, which further minimizes directly connected impervious areas contributing stormwater to the municipal catch basins.

The catchment delineation approach used for Mashpee was limited to the length of roadway between high spots which drained to individual leaching catch basins. For these reasons, MS4 defined stormwater catchments were not used in the phosphorous loading calculations. The watershed areas for Ashumet and Santuit Ponds were used as the boundaries to investigate and prioritize parcels with high phosphorus loading instead of catchment delineations.

4.2 Prioritization of Areas with High Phosphorous Loading

Two different methodologies were utilized to examine parcels with high phosphorus loading. First, the MassDEP MWBP tool was utilized, which conducted the pollutant loading analysis using GIS and included the entire watershed, not just the portion of the watershed that is in Mashpee. The land use data (MassGIS, 2009b) was intersected with impervious cover data (MassGIS, 2009a) and United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soils data (USDA NRCS and MassGIS, 2012) to create a combined land use/land cover grid. The grid was used to sum the total area of each unique land use/land cover type. The amount of DCIA was estimated using the Sutherland equations as described above. Any reduction in impervious area due to disconnection (i.e., the area difference between TIA and DCIA) was assigned to the “pervious D” soil category for that land use to simulate that some infiltration will likely occur after runoff from disconnected impervious surfaces passes over pervious surfaces.

Pollutant loading for key nonpoint source pollutants in the watershed was estimated by multiplying each land use/cover type area by its pollutant load export rate (PLER) as follows:

$$L_n = A_n * P_n$$

Where L_n = Loading of land use/cover type n (lb/yr); A_n = area of land use/cover type n (acres);
 P_n = pollutant load export rate of land use/cover type n (lb/acre/yr)

The PLERs are an estimate of the annual total pollutant load exported via stormwater from a given unit area of a particular land cover type. The PLER values for total nitrogen, total phosphorus (TP) and total suspended solids were obtained from U. S. EPA (USEPA, 2020;

UNHSC, 2018, Tetra Tech, 2015) (See **Appendix D** for values provided in the MWBP reports). **Table 6** presents the estimated land-use based TP pollutant loading in each watershed.

Table 6: Estimated Pollutant Loading for Nonpoint Source Watershed Pollutants

<i>Land Use Type</i>	<i>Pollutant Loading¹</i>	
	Total Phosphorus (TP) (lbs/yr) Santuit Pond Watershed	Total Phosphorus (TP) (lbs/yr) Ashumet Pond Watershed
<i>Agriculture</i>	6	13
<i>Commercial</i>	2	118
<i>Forest</i>	122	111
<i>High Density Residential</i>	60	5
<i>Highway</i>	0	145
<i>Industrial</i>	0	3
<i>Low Density Residential</i>	45	15
<i>Medium Density Residential</i>	138	82
<i>Open Land</i>	1	16
TOTAL	374	508

¹These estimates do not consider loads from point sources or septic systems.

Second, Tighe & Bond completed a parcel-based phosphorus loading analysis based on the latest Mashpee assessors' information (2022) and the TIA/DCIA calculations described in **Section 3.2**. Tighe & Bond calculated these phosphorus loadings by assigning all impervious area loading to the applicable DCIA export rate, regardless of whether the impervious area was "directly connected" or "disconnected". Therefore, these calculations may result in higher phosphorus loading than the MWBP results. These parcel-based phosphorus loads were used to update the BMP Hotspot analysis discussed in **Section 4.3**. The Town may decide to recalculate loadings using a more refined export rate for disconnected impervious area in the future to more accurately simulate total phosphorus loads for each watershed.

4.3 BMP Hotspot Mapping

The MWBP tool was used to conduct a GIS-based analysis for the watershed areas of Ashumet Pond and Santuit Pond within Mashpee to identify high priority Town-owned parcels for BMP implementation. The method included the following:

- Each municipal parcel within the watershed was evaluated based on ten different criteria accounting for the parcel ownership, social value, and implementation feasibility;
- Each criterion was then given a score from 0 to 5 to represent the priority for BMP implementation based on a metric corresponding to the criterion (e.g., a score of 0 would represent lowest priority for BMP implementation whereas a score of 5 would represent highest priority for BMP implementation);
- A multiplier was also assigned to each criterion, which reflected the weighted importance of the criterion (e.g., a criterion with a multiplier of 3 had greater weight on the overall prioritization of the parcel than a criterion with a multiplier of 1); and
- The weighted scores for all the criteria were then summed for each parcel to calculate a total BMP priority score.

Table 7 presents the criteria, indicator type, metrics, scores, and multipliers that were used for this analysis.

Table 7: Matrix for BMP Hotspot Map GIS-based Analysis Santuit/Ashumet Ponds

Criteria	Indicator Type	METRICS																									Multiplier	Maximum Potential Score	
		Yes or No?		Hydrologic Soil Group			Land Use Type								Water Table Depth				Parcel Area			Parcel Average Slope							
		Yes	No	A or A/D	B or B/D	C or C/D	D	Low and Medium Density Residential	High Density Residential	Commercial	Industrial	Highway	Agriculture	Forest	Open Land	Water	101-200 cm	62-100 cm	31-61 cm	0-30 cm	Greater than 2 acres	Between 1-2 acres	Less than 1 acre	Less than 2%	Between 2% and 15%	Greater than 15%			Less than 50%
Is the parcel a school, fire station, police station, town hall or library?	Ownership	5	0																									2	10
Is the parcel's use code in the 900 series (i.e. public property or university)?	Ownership	5	0																									2	10
Is parcel fully or partially in an Environmental Justice Area?	Social	5	0																									2	10
Most favorable Hydrologic Soil Group within Parcel	Implementation Feasibility			5	3	0	0																					2	10
Most favorable Land Use in Parcel	Implementation Feasibility							1	2	4	2	4	5	1	4	X ¹												3	15
Most favorable Water Table Depth (deepest in Parcel)	Implementation Feasibility																5	4	3	0								2	10
Parcel Area	Implementation Feasibility																				5	4	1					3	15
Parcel Average Slope	Implementation Feasibility																							3	5	1		1	5
Percent Impervious Area in Parcel	Implementation Feasibility																									5	2.5	1	5
Within 100 ft buffer of receiving water (stream or lake/pond)?	Implementation Feasibility	5	2																									2	10

Note 1: X denotes that parcel is excluded

Tables 8 and 9 list the municipal parcels within the Mashpee sections of the Santuit and Ashumet Pond Watersheds respectively and their scores. According to the MWBP tool, parcels with total scores above 60 are recommended for further investigation for BMP implementation suitability. **Figures 8 and 9 (Appendix B)** graphically display the resulting BMP Hotspot Maps for the Ashumet Pond and Santuit Pond watersheds. The hot spot analysis is included in the MWBP Reports in **Appendix D**.

This analysis solely evaluated individual parcels for BMP implementation suitability and likelihood for the measures to perform effectively within the parcel's features. This analysis does not quantify the pollutant loading to these parcels from the parcel's upstream catchment. When further evaluating a parcel's BMP implementation suitability and cost-effectiveness of BMP implementation, the existing pollutant loading from the parcel's upstream catchment and potential pollutant load reduction from BMP implementation should be evaluated.

Table 8 Hotspot Results within Mashpee Section of Santuit Pond Watershed

<i>Hotspot Score</i>	<i>Address</i>	<i>City</i>	<i>Parcel ID</i>	<i>T&B PO4 Loading lbs/yr</i>
70	0 WIMBLEDON DR	Mashpee	0030_0139	0.12854
70	0 RACQUET DR	Mashpee	0030_0138	0.00014
68	0 SANTUIT POND REAR	Mashpee	0038_0007	0.20702
66	0-OFF HEMLOCK DR	Mashpee	0029_109A	0.01301
63	0 SANTUIT LN	Mashpee	0030_0132	0.03471
61	215 SOUTH SANDWICH RD ⁵	Mashpee	0022_0154	3.75010
61	0 WAKEBY RD	Mashpee	0016_0008	0.82683
60	0-OFF CRANBERRY LN	Mashpee	0023_0002	2.85628
60	0 WINDSOR WAY	Mashpee	0029_0161	0.00033

Table 9 Hotspot Results within Mashpee section of Ashumet Pond Watershed

<i>Hotspot Score</i>	<i>Address</i>	<i>City</i>	<i>Parcel ID</i>	<i>T&B PO4 Loading lbs/yr</i>
69	0 OTIS AIR BASE ⁶	Mashpee	0025_0001	1.71
67	0 FALMOUTH-SANDWICH RD ⁷	Mashpee	0041_017A	1.83

As described in **Section 4.2**, Tighe & Bond completed an updated parcel-based phosphorus loading analysis based on 2022 Mashpee assessors' information. The phosphorus loadings were calculated by assigning the DCIA export rate to all impervious areas (DCIA and disconnected impervious area). Results for the Santuit and Ashumet Pond Watersheds are provided in **Tables 10 and 11**, respectively. These tables also include notes regarding individual parcels and their potential for BMP implementation or retrofit. The complete data for the updated phosphorus loading analysis is included in **Appendix C**.

⁵ Not a municipal parcel, Mashpee Wampanoag Rod & Gun Club

⁶ Not a municipal parcel, Otis Air Base US Army

⁷ Not a municipal parcel, Orenda Wildlife Land Trust

Table 10 Town owned parcels in the Santuit Watershed

<i>PO4 Loading lbs/year</i>	<i>Parcel ID</i>	<i>Lot Size (SF)</i>	<i>Land Use Code</i>	<i>Address</i>	<i>Owner</i>	<i>Potential Retrofit Notes</i>
2.85628	0023_0002	336719	9320	0-OFF CRANBERRY LN	MASHPEE TOWN OF	Parcel is the location for the Chop Chaque Bog Restoration Project, currently under funding from the MassDEP In-lieu Fee Program
0.84436	0016_0005	274428	9320	0 TOBEYS BACK RD	MASHPEE, TOWN OF	Undeveloped, wooded parcel in a residential area; abuts Sandwich town line; abuts parcels 0016_0006 and 0016_0007 listed here; higher elevation than abutting properties; Sachem's Field Conservation Area
0.82683	0016_0008	740520	9320	0 WAKEBY RD	MASHPEE, TOWN OF	Undeveloped, wooded parcel abutting Santuit Pond and Sandwich town line; contains three small areas of wetlands; abuts parcel 0016_0007 listed here; Sachem's Field Conservation Area
0.39834	0022_0135	113692	9320	0 SCITUATE RD	MASHPEE, TOWN OF	Undeveloped, wooded parcel in a residential area; abuts roadways with numerous manholes and catch basins to the north, south, and west; property card states "can't be built upon" ⁸
0.34557	0030_0117	152460	9320	6 CHOPCHAGUE RD	MASHPEE, TOWN OF	Undeveloped, wooded parcel; majority of parcel is a mapped freshwater forested wetland; abuts Santuit Pond
0.31641	0022_0114	60984	9320	0 RADCLIFFE RD	MASHPEE, TOWN OF	Undeveloped, wooded parcel in a residential area; majority of parcel is a mapped freshwater forested wetland
0.28068	0030_120	49658	9320	0 SHIELDS RD	MASHPEE, TOWN OF	Undeveloped, wooded parcel; majority of parcel is a mapped freshwater forested wetland and a stream; abuts Santuit Pond; Santuit Pond Conservation Area
0.20702	0038_0007	570636	9320	0 SANTUIT POND REAR	MASHPEE, TOWN OF	Undeveloped, wooded parcel; entire parcel is a mapped wetland; abuts Santuit Pond; held for conservation & passive recreation
0.15332	0029_0130	97574	9360	9 WINDSOR WAY	MASHPEE, TOWN OF	Undeveloped, wooded parcel in a residential area; designated as Open Space; abuts a roadway and is near an intersection with numerous manholes and catch basins ⁹
0.1360	0016_0007	174240	9300	0-REAR WAKEBY RD	MASHPEE, TOWN OF	Undeveloped, wooded parcel in a residential area; located between & connects parcels 0016_0005, 0016_0006, and 0016_008 listed here
0.12854	0030_0139	1154340	9320	0 WIMBLEDON DR	MASHPEE, TOWN OF	Undeveloped, wooded parcel; entire parcel is a mapped wetland; abuts Santuit Pond; held for conservation & passive recreation
0.10665	0016_0006	169884	9320	0-REAR WAKEBY RD	MASHPEE, TOWN OF	Undeveloped, wooded parcel in a residential area; abuts the Sandwich town line to the north; abuts Santuit Pond and parcels 0016_0005 and 0016_0007 listed here; Sachem's Field Conservation Area

⁸ One of only 2 parcels that may represent a suitable BMP site for runoff from surrounding roads; however, property cards state "can't be built upon". This would need to be further researched with the Town

⁹ Second of 2 parcels that may represent a suitable BMP site for runoff from the abutting Cotuit Road.

Table 11 Town owned parcels in the Ashumet Watershed

<i>PO4 Loading lbs/year</i>	<i>Parcel ID</i>	<i>Lot Size (SF)</i>	<i>Land Use Code</i>	<i>Address</i>	<i>Owner</i>	<i>Potential Retrofit Notes</i>
0.102786261	0040_0022	43560	9360	0-REAR TRI-TOWN CIR	MASHPEE TOWN OF	Undeveloped, wooded parcel in a residential area; surrounded by residences and then roadways
0.042999803	0040_0031	32104	9360	12 TRI-TOWN CIR	MASHPEE TOWN OF	Undeveloped, wooded parcel in a residential area; surrounded by residences and two undeveloped parcels (one of which is parcel 0048_0031 listed here) and then roadways; property card states “kettle hole, reserved area”
0.031844172	0048_0031	11892	9360	10 TRI-TOWN CIR	MASHPEE TOWN OF	Undeveloped, wooded parcel in a residential area; abuts parcel 0040_0031 listed here and a roadway; property card states “slope & wet”
0.020076158	0048_0028	11979	9360	15 TRI-TOWN CIR	MASHPEE TOWN OF	Undeveloped, wooded parcel in a residential area; abuts a roadway; property card states “steep slope”
0.011989673	0040_0059	4312	9530	0 FALMOUTH-SANDWICH RD	MASHPEE TOWN OF	Property card states “Burial Ground – see Plan 420 Book 24”

Section 5 - Identification of potential retrofit opportunities or opportunities for the installation of structural BMPs during re-development.

This work is being completed separately and will be added once that work is completed. On May 9, 2022, the MassDEP published the Final 2022 Clean Water State Revolving Fund's (CWSRF) Intended Use Plan which included The Town of Mashpee's Asset Management Planning (AMP) Project. The Town received this funding to develop an all-encompassing stormwater asset management plan and to develop the required Retrofit Inventory. The Inventory will compile a list and figures of municipally-owned properties with significant impervious cover that could be modified or retrofitted, and MS4 infrastructure including existing street rights-of-way, outfalls and conventional stormwater conveyances and controls (including swales and detention practices) that could be readily modified or retrofitted to provide reduction in frequency, volume or pollutant loads. Properties will be evaluated based on their potential for reduction of on-site impervious area as well as their potential to provide reduction of off-site impervious area. This work is expected to be completed by September 2023. In February 2022, as part of the ongoing Fiscal Year 2022 MVP Program Action Grant, Fuss & O'Neill, Inc. submitted a memorandum to the Town which characterized sources of pollutants in the Santuit Pond Watershed and examined watershed-based solutions which could increase resilience to Harmful Algal Blooms in the pond. This evaluation included potential stormwater retrofits and improvement opportunities, targeting areas within the watershed for non-structural source control measures and residential Low Impact Development practices.

The Fuss & O'Neill memorandum identified 21 sites within the residential neighborhoods of the Santuit Pond Watershed for opportunities to reduce sediment and nutrient loading to the pond. It is important to note that these 21 sites consist of roadways, cul-de-sacs, medians and other rights-of way, as well as portions of residential properties. This varies from the potential retrofit sites listed in **Tables 10 and 11** of this report, which are Town-owned parcels based on calculated pollutant load, and the Retrofit Inventory to be developed under the AMP Grant which will also consist of Town-owned parcels.

Table 2 of the Fuss & O'Neill memorandum summarizes the 21 sites, their existing conditions, the recommended retrofit or improvement, and a ranking of relative priority. Several of the sites include conditions of clogged and overtopped catch basins and retaining walls, and cul-de-sacs with excess pavement and poorly located catch basins. Many of the sites do provide potential retrofit opportunities for the installation of bioretention cells, water quality swales, and/or deep sump hooded catch basins. These retrofits and improved infrastructure maintenance (more frequent street sweeping, catch basin cleaning) would help reduce phosphorus and other pollutant loads to the pond.

Preliminary Conclusions & Recommendations

The Town of Mashpee is already aware that the cost for implementing stormwater management is higher than their current expenditures, but they have been creatively using current funding allocations to make steady progress towards permit compliance making improvements, one at a time, to programs, operations and facilities.

Results from the hotspot analysis conducted using the MWBP toolkit identified multiple Town-owned parcels in the Santuit Pond Watershed for further exploration. Hotspot results for parcels identified in the Mashpee portion of the Ashumet Pond Watershed were not considered for further exploration as the parcels are not actually Town-owned. The parcel-based phosphorus loadings calculated by Tighe & Bond will provide an additional layer of information to use in evaluating potential BMP locations. However, additional analysis is recommended due to the

overall low phosphorus loads contributed by Town-owned parcels in each watershed and identified hinderances to BMP implementation for some Town-owned parcels as indicated in **Tables 10 and 11.**

In order to evaluate and implement BMPs that will have a significant and cost-effective impact on (i.e., reduction of) phosphorus loads to the watersheds, the analyses conducted could be expanded to include privately-owned parcels within each watershed. For example, the list of Town-owned parcels generated during this current analysis could be re-prioritized for potential BMP implementation if the parcels are located in close proximity to privately-owned parcels with high phosphorus loads and/or the 21 sites identified in the Fuss & O'Neill memorandum. The Town could work with private property owners to implement BMPs that treat phosphorus loads from multiple parcels and/or reduce impervious cover. Once the AMP Grant Retrofit Inventory is completed, more detailed recommendations will be provided to ideally locate BMPs so they are cost effective.

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Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle



CN 505.1

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
Kathleen A. Theoharides, Secretary
Massachusetts Department of Environmental Protection
Martin Suuberg, Commissioner
Bureau of Water Resources
Kathleen Baskin, Assistant Commissioner

Category 2 waters listed alphabetically by major watershed
"Attaining some uses; other uses not assessed"
(Attained uses denoted by "X")

Waterbody	AU_ID	Description	Size	Units	Uses Attained					
					Aesthetic	Fish Consumption	Fish, other Aquatic Life and Wildlife	Primary Contact Recreation	Secondary Contact Recreation	Shellfish Harvesting
Sippican Harbor	MA95-69	The waters between a line demarcating the mouth of the harbor (from Converse Point to Butler Point, Marion) and a line from Allens Point, Marion around the southeastern tip of Ram Island, then westerly from the southern tip of Ram Island, to the point of land south of Nyes Wharf, Marion excluding Blanketship Cove and Planting Island Cove (formerly reported as a portion of segment MA95-08).	1.94	Square Miles			X	X	X	X
The Let	MA95-88	From north of East Beach Road, Westport to the confluence with Horseneck Channel, Westport.	0.22	Square Miles			X			
Unnamed Tributary	MA95-75	Unnamed tributary to Bread and Cheese Brook, headwaters north of Briggs Road, Westport to confluence with Bread and Cheese Brook, Westport.	1.90	Miles			X			
Unnamed Tributary	MA95-80	Unnamed tributary to Aucot Creek, headwaters west of Mill Street (Route 6), Marion to the Marion WWTF (MA0100030) discharge, Marion.	0.40	Miles			X			
Unnamed Tributary	MA95-81	Unnamed tributary to Aucot Creek from the Marion WWTF (MA0100030) discharge, Marion to the boundary of the saltwater wetland, Marion.	0.70	Miles			X			
Unnamed Tributary	MA95-84	Unnamed tributary to Snell Creek, perennial portion north of Brookwood Drive, Westport to mouth at Snell Creek, Westport.	0.80	Miles	X		X	X	X	
Wenham Pond	MA95158	Carver.	46.00	Acres	X		X			
Cape Cod										
Chatham Harbor	MA96-10	Harbor, bounded on east by Cape Cod National Seashore (CCNS), with northern extent as an imaginary line drawn northeast from northern tip of Strong Island to a point on inner CCNS and western extent as an imaginary line drawn from southern tip of Strong Island south to Allen Point including waters south to an imaginary line along northern edge of South Beach Bar extending from Chatham Lighthouse to inlet created by 1987 storm, Chatham (area within CCNS designated as ORW).	2.85	Square Miles				X	X	X
Coonamessett River	MA96-69	Headwaters, outlet Coonamessett Pond, Falmouth to mouth at inlet Great Pond, Falmouth.	3.40	Miles	X		X	X	X	
Crows Pond	MA96-47	To Bassing Harbor, Chatham.	0.19	Square Miles			X	X	X	X
Herring River	MA96-106	Headwaters, outlet Hinckleys Pond, Harwich to mouth at inlet Herring River Reservoir, Harwich.	2.50	Miles	X		X	X	X	
Marstons Mills River	MA96-127	Headwaters outlet Middle Pond, Barnstable to salt water portion approximately 1000 feet south of Route 28 (Falmouth Road), Barnstable.	2.00	Miles			X			
Mashpee River	MA96-89	Headwaters, outlet Mashpee Pond, Mashpee to Quinacisset Avenue, Mashpee.	2.70	Miles	X		X	X	X	



Category 2 waters listed alphabetically by major watershed
"Attaining some uses; other uses not assessed"
(Attained uses denoted by "X")

Waterbody	AU ID	Description	Size	Units	Uses Attained					
					Aesthetic	Fish Consumption	Fish, other Aquatic Life and Wildlife	Primary Contact Recreation	Secondary Contact Recreation	Shellfish Harvesting
Red Brook	MA96-25	From dam (NATID: MA01037) at Red Brook Road, Falmouth/Mashpee to mouth at inlet Hamblin Pond, Falmouth/Mashpee.	0.01	Square Miles				X	X	X
Seapit River	MA96-122	From confluence of Childs River and Eel Pond, Falmouth to inlet Waquoit Bay, Falmouth.	0.05	Square Miles			X			
Unnamed Tributary	MA96-105	Unnamed tributary to Herring River, headwaters outlet Walkers Pond, Harwich to outlet channelized wetland south of Great Western Road, Harwich.	3.30	Miles	X			X	X	
Upper Mill Pond	MA96324	Brewster.	249.00	Acres	X		X	X	X	
Charles										
Dopping Brook	MA72-40	Headwater outlet small unnamed pond on Holliston/Sherborn border to mouth at confluence with Bogastow Brook, Holliston/Sherborn.	2.60	Miles	X		X	X	X	
Godfrey Brook	MA72-51	Perennial portion, South Main Street, Milford to mouth at confluence with the Charles River, Milford.	0.70	Miles			X			
Mill Brook	MA72-39	Source wetlands, Pine Street, Medfield to mouth at confluence with the Charles River, Medfield.	3.70	Miles	X		X	X	X	
Shepards Brook	MA72-50	Perennial portion, north of Brook Street, Franklin to mouth at confluence with Charles River, Franklin.	2.30	Miles			X			
Chicopee										
Atherton Brook	MA36-30	Headwaters, confluence Town Farm and Osgood brooks, Shutesbury to mouth at inlet Quabbin Reservoir, Pelham.	1.90	Miles			X			
Bottle Brook	MA36-46	Headwaters, perennial portion, east of Dunhamtown Brimfield Road, Brimfield to mouth at confluence with Quaboag River, Brimfield.	2.00	Miles	X		X	X	X	
Bradish Brook	MA36-58	Headwaters, perennial portion east of New Braintree Road, West Brookfield to Wickaboag Valley Road and inlet of swamp east of Wickaboag Pond, West Brookfield.	0.70	Miles			X			
Briggs Brook	MA36-61	Headwaters, outlet unnamed pond west of Daniel Shays Highway (Route 202), Shutesbury to mouth at inlet Quabbin Reservoir, Pelham.	1.40	Miles			X			
Burnshirt River	MA36-37	Headwaters, outlet Stone Bridge Pond, Templeton/Phillipston to mouth at confluence with Canesto Brook, Barre (through former 2008 segment: Williamsville Pond MA36167).	8.60	Miles	X		X	X	X	
Cadwell Brook	MA36-54	Headwaters, south of Mt. Marcy, Wilbraham to mouth at confluence with Twelvemile Brook, Wilbraham.	1.80	Miles			X			
Cadwell Creek	MA36-29	Headwaters east of Route 202 and northwest of Dodge Hill, Pelham to mouth at inlet Quabbin Reservoir, Belchertown.	3.20	Miles			X			
Calkins Brook	MA36-26	Headwaters, perennial portion, southeast of Baptist Hill, Palmer to mouth at confluence with Twelvemile Brook, Wilbraham.	2.70	Miles	X		X	X	X	



**Category 4a waters listed alphabetically by major watershed
"TMDL is completed"**

Waterbody	AU_ID	Description	Size	Units	Impairment	ATTAINS Action ID
Wankinco River	MA95-50	From outlet of Parker Mills Pond, south of Elm Street, Wareham to the confluence with the Agawam River (at a line between a point south of Mayflower Ridge Drive and a point north of the railroad tracks near Sandwich Road (forming headwaters of the Wareham River)) just north of Route 6 bridge, Wareham.	0.05	Square Miles	Fecal Coliform	36172
West Falmouth Harbor	MA95-22	From the confluence with Harbor Head at Chappaquoit Road, Falmouth to the mouth at Buzzards Bay at a line connecting the ends of the seawalls from Little Island and Chappaquoit Point, Falmouth (including Inner West Falmouth Harbor, Outer West Falmouth Harbor, Snug Harbor, and Mashapaquit Creek).	0.29	Square Miles	Estuarine Bioassessments	34328
					Estuarine Bioassessments	34332
					Fecal Coliform	36172
					Nitrogen, Total	34328
					Nitrogen, Total	34332
					Nitrogen, Total	34917
					Nitrogen, Total	34918
Westport River	MA95-54	From the confluences of the East Branch Westport River and the West Branch Westport River to Rhode Island Sound (at a line from the southwestern tip of Horseneck Point to the easternmost point near Westport Light), Westport (includes Westport Harbor and Hulda Cove).	0.74	Square Miles	Fecal Coliform	36172
Cape Cod						
Baker Pond	MA96008	Orleans/Brewster.	26.00	Acres	Mercury in Fish Tissue	33880
Barnstable Harbor	MA96-01	From the mouths of Scorton and Spring creeks, Barnstable east to an imaginary line drawn from Beach Point to the western edge of the Mill Creek estuary, Barnstable.	3.20	Square Miles	Fecal Coliform	36771
Bass River	MA96-118	"Grand Cove" portion of Bass River, north of Main Street (Route 28), Yarmouth.	0.12	Square Miles	Nitrogen, Total	68003
					Nutrient/Eutrophication Biological Indicators	68003
Bass River	MA96-12	Headwaters outlet Kelleys Bay, Route 6, Dennis/Yarmouth to mouth at inlet Nantucket Sound, Yarmouth (excluding Grand Cove, Dennis).	0.69	Square Miles	Estuarine Bioassessments	68003
					Fecal Coliform	36771
					Nitrogen, Total	68003
Bearse Pond	MA96012	Barnstable.	64.00	Acres	(Fanwort*)	
					Mercury in Fish Tissue	42393
Bournes Pond	MA96-57	west of Central Avenue, Falmouth outlet to Vineyard Sound, including Israels Cove, Falmouth.	0.24	Square Miles	Estuarine Bioassessments	32535
					Estuarine Bioassessments	32638
					Fecal Coliform	36772
					Nitrogen, Total	32535
					Nitrogen, Total	32638
Bucks Creek	MA96-44	Outlet Harding Beach Pond (locally known as Sulfur Springs), Chatham to mouth at inlet Cockle Cove, Nantucket Sound, Chatham.	0.02	Square Miles	Enterococcus	36772
					Fecal Coliform	36772
					Nitrogen, Total	36230
Bumps River	MA96-02	From pond outlet, Bumps River Road, Barnstable through Scudder Bay to mouth at Main Street/South Main Street bridge (confluence with Centerville River), Barnstable.	0.07	Square Miles	Fecal Coliform	36771



**Category 4a waters listed alphabetically by major watershed
"TMDL is completed"**

Waterbody	AU_ID	Description	Size	Units	Impairment	ATTAINS Action ID
Centerville River	MA96-04	From approximately 300 feet west of Elliot Road, Barnstable to inlet Centerville Harbor, including East Bay, Barnstable.	0.24	Square Miles	Estuarine Bioassessments	33858
					Fecal Coliform	36771
					Nitrogen, Total	33858
Chase Garden Creek	MA96-35	New Boston Road, Dennis to mouth at inlet Cape Cod Bay, Dennis/Yarmouth.	0.13	Square Miles	Fecal Coliform	36771
Childs River	MA96-120	From confluence with fresh water portion south of Barrows Road, Falmouth to mouth at confluence with Seapit River, Falmouth (area within Waquoit Bay ACEC designated as ORW).	0.06	Square Miles	Nitrogen, Total	R1_MA_2020_08
					Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08
Cockle Cove Creek	MA96-79	Northeast of the bend in Cockle Drive, Chatham to mouth at confluence with Bucks Creek, Chatham (2005 orthophotos used to delineate segment).	0.01	Square Miles	Enterococcus	42353
					Fecal Coliform	42353
Cotuit Bay	MA96-63	From North Bay at Point Isabella, Barnstable oceanward to a line extended along Oyster Harbors Beach, Barnstable.	0.85	Square Miles	Fecal Coliform	36582
					Nitrogen, Total	33988
Dinahs Pond	MA96-112	Yarmouth.	0.04	Square Miles	Nitrogen, Total	68003
					Nutrient/Eutrophication Biological Indicators	68003
Dock Creek	MA96-86	From railroad crossing northeast of Route 6A, Sandwich to confluence with Old Harbor Creek, Sandwich.	0.02	Square Miles	Fecal Coliform	42354
Duck Pond	MA96068	Wellfleet.	11.00	Acres	Mercury in Fish Tissue	33880
Dyer Pond	MA96070	Wellfleet.	10.00	Acres	Mercury in Fish Tissue	33880
East Harbor (Pilgrim Lake)	MA96-83	Truro/Provincetown.	0.50	Square Miles	Fecal Coliform	42355
Eel Pond	MA96-121	Falmouth.	0.32	Square Miles	Estuarine Bioassessments	R1_MA_2020_08
					Nitrogen, Total	R1_MA_2020_08
					Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08
Falmouth Inner Harbor	MA96-17	Waters included north of Falmouth Inner Harbor Light, Falmouth.	0.05	Square Miles	Nitrogen, Total	R1_MA_2020_06
					Nutrient/Eutrophication Biological Indicators	R1_MA_2020_06
Follins Pond	MA96-114	Yarmouth/Dennis.	0.32	Square Miles	Nitrogen, Total	68003
					Nutrient/Eutrophication Biological Indicators	68003
Frost Fish Creek	MA96-49	Headwaters outlet cranberry bog northwest of Stony Hill Road, Chatham to mouth at inlet Ryder Cove, Chatham.	0.01	Square Miles	Fecal Coliform	22513
					Nitrogen, Total	33781
Great Pond	MA96114	Truro.	17.00	Acres	Mercury in Fish Tissue	33880
Great Pond	MA96117	Wellfleet.	41.00	Acres	Mercury in Fish Tissue	33880
Great Pond	MA96-54	From inlet of Coonamessett River, Falmouth to Vineyard Sound (excluding Perch Pond), Falmouth.	0.40	Square Miles	Enterococcus	36772
					Estuarine Bioassessments	32532
					Fecal Coliform	36772
					Nitrogen, Total	32532



Category 4a waters listed alphabetically by major watershed
"TMDL is completed"

Waterbody	AU_ID	Description	Size	Units	Impairment	ATTAINS Action ID
Great River	MA96-60	From inlet of Abigails Brook, Mashpee to mouth at inlet Waquoit Bay (excluding Jehu Pond), Mashpee.	0.16	Square Miles	Estuarine Bioassessments	33815
					Estuarine Bioassessments	R1_MA_2020_08
					Nitrogen, Total	33815
					Nitrogen, Total	R1_MA_2020_08
Green Pond	MA96-55	east of Acapesket Road, Falmouth outlet to Vineyard Sound, Falmouth.	0.21	Square Miles	Estuarine Bioassessments	32534
					Fecal Coliform	36772
					Nitrogen, Total	32534
Halls Creek	MA96-93	Estuarine portion, from Marchant Mill Way, Barnstable to mouth at inlet Centerville Harbor, Barnstable.	0.07	Square Miles	Fecal Coliform	42356
Hamblin Pond	MA96-58	From inlet of Red Brook, Falmouth/Mashpee to outlet of Little River, Mashpee and inlet/outlet of Waquoit Bay west of Meadow Neck Road, Falmouth/Mashpee.	0.19	Square Miles	Estuarine Bioassessments	33812
					Estuarine Bioassessments	R1_MA_2020_08
					Fecal Coliform	36771
					Nitrogen, Total	33812
					Nitrogen, Total	R1_MA_2020_08
Harding Beach Pond	MA96-43	locally known as Sulfur Springs (northeast of Bucks Creek), Chatham.	0.07	Square Miles	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08
					Fecal Coliform	36772
Herring River	MA96-22	From outlet Herring River Reservoir (at North Harwich Reservoir Dam NATID: MA02423) west of Bells Neck Road, Harwich to mouth at inlet Nantucket Sound, Harwich.	0.07	Square Miles	Nitrogen, Total	36229
					Estuarine Bioassessments	65960
					Fecal Coliform	36772
					Nitrogen, Total	65960
Horseleach Pond	MA96144	Truro.	23.00	Acres	Nutrient/Eutrophication Biological Indicators	65960
Hyannis Inner Harbor	MA96-82	Waters landward of an imaginary line drawn from Harbor Bluff, Barnstable to Hyannis Park, Yarmouth.	0.13	Square Miles	Mercury in Fish Tissue	42401
					Fecal Coliform	42357
Jehu Pond	MA96-59	Mashpee.	0.09	Square Miles	Nitrogen, Total	64145
					Estuarine Bioassessments	33814
					Estuarine Bioassessments	R1_MA_2020_08
					Nitrogen, Total	33814
					Nitrogen, Total	R1_MA_2020_08
Johns Pond	MA96157	Mashpee.	316.00	Acres	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08
					(Fish Passage Barrier*)	
Kelleys Bay	MA96-113	Dennis/Yarmouth.	0.10	Square Miles	Mercury in Fish Tissue	33880
					Nitrogen, Total	68003
					Nutrient/Eutrophication Biological Indicators	68003
Lawrence Pond	MA96165	Sandwich.	138.00	Acres	Mercury in Fish Tissue	42402



**Category 4a waters listed alphabetically by major watershed
"TMDL is completed"**

Waterbody	AU_ID	Description	Size	Units	Impairment	ATTAINS Action ID
Lewis Pond	MA96-109	north of Seagull Road, Yarmouth (segment includes tidal channel to Parkers River).	0.07	Square Miles	Nitrogen, Total	68369
					Nutrient/Eutrophication Biological Indicators	68369
Little Harbor	MA96-19	The waters north of an imaginary line drawn from Juniper Point, Falmouth east to Nobska Beach, Falmouth.	0.07	Square Miles	Fecal Coliform	36772
Little Namskaket Creek	MA96-26	Source west of Route 6, Orleans to mouth at inlet Cape Cod Bay, Orleans.	0.01	Square Miles	Fecal Coliform	36772
Little Pleasant Bay	MA96-78	Waters north and east of imaginary lines drawn from the northeasterly edge of Orleans (near The Horseshoe), southeasterly around the northeastern tip of Sipson Island, and Sipson Meadow, Orleans then south to the northern tip of Strong Island, Chatham then east to a point on the inner Cape Cod National Seashore (CCNS)(including SARIS named Hog Island and Broad creeks) (excluding the delineated segments; The River, Pochet Neck, and Paw Wah Pond) (areas within CCNS designated as ORW).	3.27	Square Miles	Nitrogen, Total	33794
Little Pond	MA96-56	west of Vista Boulevard, Falmouth outlet to Vineyard Sound, Falmouth.	0.07	Square Miles	Estuarine Bioassessments	34009
					Fecal Coliform	42364
Little River	MA96-61	Headwaters outlet Hamblin Pond, Mashpee to mouth at confluence with Great River, Mashpee.	0.03	Square Miles	Estuarine Bioassessments	33813
					Estuarine Bioassessments	R1_MA_2020_08
					Nitrogen, Total	33813
					Nitrogen, Total	R1_MA_2020_08
Long Pond	MA96179	Wellfleet.	35.00	Acres	Mercury in Fish Tissue	33880
Mashpee River	MA96-24	Quinquisset Avenue, Mashpee to mouth at inlet Shoestring Bay (formerly to mouth at Popponesset Bay), Mashpee.	0.08	Square Miles	Estuarine Bioassessments	33965
					Fecal Coliform	36771
Mill Creek	MA96-37	Headwaters outlet Halletts Millpond, Barnstable/Yarmouth to mouth at inlet Cape Cod Bay, Barnstable/Yarmouth.	0.03	Square Miles	Fecal Coliform	36771
Mill Creek	MA96-41	Headwaters outlet Taylors Pond, Chatham to mouth at inlet Cockle Cove, Chatham.	0.03	Square Miles	Fecal Coliform	36772
Mill Creek	MA96-80	Headwaters, outlet Mill Pond, Yarmouth to mouth at inlet Lewis Bay, Yarmouth.	0.07	Square Miles	Fecal Coliform	42365
					Nitrogen, Total	64148
					Nitrogen, Total	64149
Mill Creek	MA96-85	Headwaters, outlet Shawme Lake Lower, Sandwich to mouth at confluence with Old Harbor Creek, Sandwich.	0.02	Square Miles	Fecal Coliform	42366
Mill Pond	MA96-117	Yarmouth.	0.09	Square Miles	Nitrogen, Total	68003
					Nutrient/Eutrophication Biological Indicators	68003



Category 4a waters listed alphabetically by major watershed
"TMDL is completed"

Waterbody	AU_ID	Description	Size	Units	Impairment	ATTAINS Action ID
Mill Pond	MA96-52	including Little Mill Pond (PALIS # 96174), Chatham.	0.06	Square Miles	Estuarine Bioassessments	36222
					Nitrogen, Total	36222
Muddy Creek	MA96-51	Source south of Countryside Drive and north-northeast of Old Queen Anne Road, Chatham to mouth at inlet Pleasant Bay, Harwich/Chatham, including Upper and Lower reaches.	0.05	Square Miles	(Fish Passage Barrier*)	
					Fecal Coliform	22512
					Nitrogen, Total	33797
					Nitrogen, Total	33798
Namequoit River	MA96-71	Headwaters, outlet Areys Pond, Orleans to mouth at confluence with The River, Orleans.	0.06	Square Miles	Estuarine Bioassessments	33791
					Nitrogen, Total	33791
Namskaket Creek	MA96-27	Source west of Route 6, Orleans/Brewster to mouth at inlet Cape Cod Bay, Brewster/Orleans.	0.03	Square Miles	Fecal Coliform	36772
North Bay	MA96-66	From Prince Cove outlet at Fox Island to just south of Bridge Street (including Dam Pond) and separated from Cotuit Bay at a line from Point Isabella, Barnstable southward to the opposite shore, Barnstable.	0.47	Square Miles	Estuarine Bioassessments	33990
					Fecal Coliform	36584
Old Harbor Creek	MA96-84	From Foster Road, Sandwich to mouth at inlet Sandwich Harbor, Sandwich.	0.06	Square Miles	Fecal Coliform	42367
Oyster Pond	MA96-45	Including Stetson Cove, Chatham.	0.21	Square Miles	Estuarine Bioassessments	36219
					Fecal Coliform	36772
					Nitrogen, Total	36219
Oyster Pond	MA96-62	east of Fells Road, Falmouth.	0.10	Square Miles	Dissolved Oxygen	34345
					Estuarine Bioassessments	34345
					Fecal Coliform	36772
Oyster Pond River	MA96-46	Headwaters outlet Oyster Pond, Chatham to mouth at inlet Stage Harbor, Chatham.	0.14	Square Miles	Estuarine Bioassessments	36220
					Fecal Coliform	36772
					Nitrogen, Total	36220
Pamet River	MA96-31	From tidegate at Route 6A, Truro to mouth at inlet Cape Cod Bay (including Pamet Harbor), Truro.	0.14	Square Miles	Fecal Coliform	36772
Parkers River	MA96-38	Headwaters outlet Seine Pond, Yarmouth to mouth at inlet Nantucket Sound, Yarmouth (excluding Lewis Pond, Yarmouth).	0.04	Square Miles	Fecal Coliform	36771
					Nitrogen, Total	68361
					Nutrient/Eutrophication Biological Indicators	68361
Paw Wah Pond	MA96-72	Orleans.	0.01	Square Miles	Estuarine Bioassessments	33792
					Fecal Coliform	42368
					Nitrogen, Total	33792
Perch Pond	MA96-53	Connects to northwest end of Great Pond, west of Keechipam Way, Falmouth.	0.03	Square Miles	Nitrogen, Total	32537
Peters Pond	MA96244	Sandwich/Mashpee.	123.00	Acres	Mercury in Fish Tissue	33880



**Category 4a waters listed alphabetically by major watershed
"TMDL is completed"**

Waterbody	AU_ID	Description	Size	Units	Impairment	ATTAINS Action ID
Pochet Neck	MA96-73	outlet to Little Pleasant Bay, Orleans (areas within Cape Cod National Seashore designated as ORW).	0.24	Square Miles	Estuarine Bioassessments	33793
					Fecal Coliform	42369
					Nitrogen, Total	33793
Popponeset Bay	MA96-40	The waters seaward of an imaginary line connecting Ryefield Point, Barnstable and Punkhorn Point, Mashpee to inlet of Nantucket Sound (including Ockway Bay, Mashpee and Pinquisset Cove, Barnstable) (excludes Popponeset Creek, Mashpee).	0.68	Square Miles	Estuarine Bioassessments	33967
					Estuarine Bioassessments	33968
					Estuarine Bioassessments	33969
Prince Cove	MA96-07	Includes areas east of Prince Cove (which are locally known as "Warren Cove" and "Prince Cove Channel") to confluence with North Bay, Barnstable.	0.14	Square Miles	Estuarine Bioassessments	33991
					Estuarine Bioassessments	33992
					Estuarine Bioassessments	33993
					Fecal Coliform	36585
Provincetown Harbor	MA96-29	The waters northwest of an imaginary line drawn northeasterly from the tip of Long Point, Provincetown to Pilgrim Beach (in vicinity of Sandbars Inn), Truro (area within Cape Cod National Seashore designated as ORW).	4.33	Square Miles	Fecal Coliform	36772
Quanset Pond	MA96-74	Orleans.	0.02	Square Miles	Nitrogen, Total	33791
					Nitrogen, Total	33795
Quashnet River	MA96-20	From just south of Route 28, Falmouth to mouth at inlet Waquoit Bay, Falmouth. Also known as Moonakis River.	0.07	Square Miles	Dissolved Oxygen	33811
					Dissolved Oxygen	R1_MA_2020_08
					Fecal Coliform	36772
					Nitrogen, Total	33811
					Nitrogen, Total	R1_MA_2020_08
Rock Harbor Creek	MA96-16	Headwaters outlet Cedar Pond, Orleans to mouth at inlet Cape Cod Bay, Eastham/Orleans.	0.03	Square Miles	(Fish Passage Barrier*)	
					Fecal Coliform	36772
Round Pond (East)	MA96260	Truro.	6.00	Acres	Mercury in Fish Tissue	42403
Round Pond (west)	MA96261	Truro.	2.00	Acres	Mercury in Fish Tissue	42404
Ryder Cove	MA96-50	Chatham.	0.19	Square Miles	Estuarine Bioassessments	33780
					Fecal Coliform	36772
					Nitrogen, Total	33780
Sagelot Pond	MA96-119	west of Great Oak Road, Mashpee (segment includes tidal channels to Waquoit Bay).	0.06	Square Miles	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08
Santuit River	MA96-92	From confluence with fresh water portion south of Old Mill Road, Mashpee to mouth at inlet Shoestring Bay, Mashpee/Barnstable.	0.01	Square Miles	Fecal Coliform	42360
Saquatucket Harbor	MA96-23	South of Route 28, Harwich outlet to Nantucket Sound, Harwich.	0.02	Square Miles	Fecal Coliform	36772
					Nitrogen, Total	65884
					Nutrient/Eutrophication Biological Indicators	65884



**Category 4a waters listed alphabetically by major watershed
"TMDL is completed"**

Waterbody	AU_ID	Description	Size	Units	Impairment	ATTAINS Action ID
Scorton Creek	MA96-30	Jones Lane, Sandwich to mouth at inlet Cape Cod Bay, Sandwich (includes Scorton Harbor).	0.03	Square Miles	Fecal Coliform	36771
Seapuit River	MA96-64	south of Osterville Grand Island, Barnstable to Cotuit Bay and West Bay, Barnstable.	0.06	Square Miles	Fecal Coliform	36583
Seine Pond	MA96-110	east of Winslow Gray Road, Yarmouth.	0.13	Square Miles	Nitrogen, Total	68362
					Nutrient/Eutrophication Biological Indicators	68362
Sesuit Creek	MA96-13	Approximately 650 feet downstream from Route 6A, Dennis to mouth at inlet Sesuit Harbor, Cape Cod Bay, Dennis.	0.01	Square Miles	Fecal Coliform	36771
Sheep Pond	MA96289	Brewster.	139.00	Acres	Mercury in Fish Tissue	33880
Shoestring Bay	MA96-08	Quinaquisset Avenue, Mashpee/Barnstable to Popponesset Bay (line from Ryefield Point, Barnstable to Punkhorn Point, Mashpee, including Gooseberry Island), Barnstable/Mashpee.	0.31	Square Miles	Estuarine Bioassessments	33966
					Fecal Coliform	36771
Slough Pond	MA96298	Truro.	29.00	Acres	Mercury in Fish Tissue	33880
Snake Pond	MA96302	Sandwich.	81.00	Acres	Mercury in Fish Tissue	33880
Snow Pond	MA96303	Truro.	7.00	Acres	Mercury in Fish Tissue	33880
Snows Creek	MA96-81	East of Old Colony Road, Barnstable to mouth at inlet Lewis Bay, Barnstable.	0.02	Square Miles	Fecal Coliform	42361
Spectacle Pond	MA96306	Wellfleet.	2.00	Acres	Mercury in Fish Tissue	42405
Springhill Creek	MA96-87	From railroad crossing northeast of Route 6A, Sandwich to mouth at confluence with Old Harbor Creek, Sandwich.	0.01	Square Miles	Fecal Coliform	42362
Stewarts Creek	MA96-94	Estuarine portion west of Stetson Street, Barnstable to mouth at inlet Hyannis Harbor, Barnstable.	0.01	Square Miles	Fecal Coliform	42363
Swan Pond	MA96-111	Dennis.	0.22	Square Miles	Nitrogen, Total	68000
					Nutrient/Eutrophication Biological Indicators	68000
Swan Pond River	MA96-14	Headwaters, outlet Swan Pond, Dennis to mouth at inlet Nantucket Sound, Dennis.	0.04	Square Miles	Estuarine Bioassessments	68001
					Fecal Coliform	36771
					Nitrogen, Total	68001
					Nutrient/Eutrophication Biological Indicators	68001
Taylor's Pond	MA96-42	Chatham.	0.02	Square Miles	Fecal Coliform	36772
					Nitrogen, Total	36231
The River	MA96-76	The water landward of an imaginary line drawn between Old Field Point and Namequoit Point including Meetinghouse Pond, and Kescayo Gansett Pond (locally known as "Lonnie's Pond"), Orleans (excluding the delineated segments; Namequoit River and Areys Pond).	0.41	Square Miles	Fecal Coliform	42359
					Nitrogen, Total	33787
					Nitrogen, Total	33788
					Nitrogen, Total	33789
					Nitrogen, Total	33790



Category 5 waters listed alphabetically by major watershed
The 303(d) List – “Waters requiring a TMDL”

Waterbody	AU_ID	Description	Size	Units	Impairment	ATTAINS Action ID
Wareham River	MA95-03	From confluence of Wankinko and Agawam Rivers at Route 6 bridge, Wareham to Buzzards Bay (at an imaginary line from Cromeset Point to curved point east/southeast of Long Beach Point), Wareham. Including Marks Cove, Wareham.	1.18	Square Miles	Estuarine Bioassessments	
					Fecal Coliform	36172
					Nitrogen, Total	
West Branch Westport River	MA95-37	West of Quail Trail, Westport to mouth at Westport Harbor/Westport River, Westport.	1.29	Square Miles	Estuarine Bioassessments	
					Fecal Coliform	36172
					Nitrogen, Total	
					Nutrient/Eutrophication Biological Indicators	
Weweantic River	MA95-04	Headwaters confluence of Rocky Meadow and South Meadow brooks, Carver to the inlet of Horseshoe Pond, Wareham (through former 2014 segment: Tremont Mill Pond MA95150).	11.50	Miles	(Non-Native Aquatic Plants*)	
					Enterococcus	
Weweantic River	MA95-05	Outlet Horseshoe Pond, Wareham to mouth at Buzzards Bay, Marion/Wareham.	0.62	Square Miles	Enterococcus	36172
					Estuarine Bioassessments	
					Fecal Coliform	36172
					Nitrogen, Total	
Wild Harbor	MA95-20	Waters landward of an imaginary line from Crow Point to Nyes Neck (excluding Wild Harbor River), Falmouth.	0.13	Square Miles	Estuarine Bioassessments	
					Fecal Coliform	36172
					Nitrogen, Total	
					Nutrient/Eutrophication Biological Indicators	
Wild Harbor River	MA95-68	Headwaters, Falmouth to mouth at Wild Harbor, Falmouth.	0.03	Square Miles	Fecal Coliform	36172
					Nutrient/Eutrophication Biological Indicators	
Cape Cod						
Allens Harbor	MA96-95	south of Lower County Road, Harwich to Doanes Creek, Harwich.	0.02	Square Miles	Fecal Coliform	
					Nitrogen, Total	65883
					Nutrient/Eutrophication Biological Indicators	65883
Areys Pond	MA96-70	Orleans.	0.02	Square Miles	Nitrogen, Total	33786
					Nutrient/Eutrophication Biological Indicators	
Ashumet Pond	MA96004	Mashpee/Falmouth.	203.00	Acres	Abnormal Fish Deformities, Erosions, Lesions, Tumors (DELTS)	
					Dissolved Oxygen	
					Mercury in Fish Tissue	33880
					Phosphorus, Total	
Bassing Harbor	MA96-48	Excluding Crows Pond and Ryder Cove, Chatham.	0.13	Square Miles	Estuarine Bioassessments	



Category 5 waters listed alphabetically by major watershed
The 303(d) List – “Waters requiring a TMDL”

Waterbody	AU_ID	Description	Size	Units	Impairment	ATTAINS Action ID
Boat Meadow River	MA96-15	Headwaters east of old railway grade, Eastham to mouth at inlet Cape Cod Bay, Eastham.	0.05	Square Miles	Estuarine Bioassessments	
					Fecal Coliform	36772
Cedar Pond	MA96-88	Orleans (in Inner Cape Cod Bay ACEC).	0.03	Square Miles	(Fish Passage Barrier*)	
					Chlorophyll-a	
					Dissolved Oxygen	
					Dissolved Oxygen Supersaturation	
Centerville Harbor	MA96-03	From an imaginary line that extends from Dowses Beach, Barnstable to Hyannis Point, Barnstable including all waters north to the shore, Barnstable.	1.46	Square Miles	Estuarine Bioassessments	
Chase Garden Creek	MA96-103	Headwaters south of Roads End and west of Jericho Road, Dennis to New Boston Road, Dennis.	1.20	Miles	(Curly-leaf Pondweed*)	
					Escherichia Coli (E. Coli)	
Childs River	MA96-98	Headwaters outlet Johns Pond, Mashpee to confluence with tidal portion south of Barrows Road, Falmouth.	2.40	Miles	(Curly-leaf Pondweed*)	
					(Fish Passage Barrier*)	
					Lead	
Cliff Pond	MA96039	Brewster.	190.00	Acres	Harmful Algal Blooms	
Crystal Lake	MA96050	Orleans.	33.00	Acres	Dissolved Oxygen	
Duck Creek	MA96-32	Source west of Route 6, Wellfleet to mouth at inlet Wellfleet Harbor (at a line from Shirttail Point to Taylor Road), Wellfleet.	0.15	Square Miles	Benthic Macroinvertebrates	
					Dissolved Oxygen	
					Fecal Coliform	36772
					Nitrogen, Total	
					Nutrient/Eutrophication Biological Indicators	
Flax Pond	MA96091	Brewster.	47.00	Acres	Dissolved Oxygen	
Great Harbor	MA96-18	The waters north of an imaginary line drawn east from Penzance Point, Falmouth to Devils Foot Island, Falmouth and southeast from Devils Foot Island to Juniper Point (excludes Eel Pond), Falmouth.	0.31	Square Miles	Estuarine Bioassessments	
					Fecal Coliform	36772
Great Pond	MA96115	Eastham.	109.00	Acres	Chlorophyll-a	
					Dissolved Oxygen	
					Phosphorus, Total	
Hamblin Pond	MA96126	Barnstable.	114.00	Acres	Dissolved Oxygen	
					Harmful Algal Blooms	
					Mercury in Fish Tissue	33880
Hawes Run	MA96-101	Headwaters outlet small unnamed pond west of Higgins Crowell Road, Yarmouth to mouth at inlet Mill Pond, Yarmouth.	1.70	Miles	(Debris*)	
					Trash	
Herring River	MA96-33		0.40		(Fish Passage Barrier*)	



Category 5 waters listed alphabetically by major watershed
The 303(d) List – “Waters requiring a TMDL”

Waterbody	AU_ID	Description	Size	Units	Impairment	ATTAINS Action ID
		South of High Toss Road, Wellfleet to mouth at inlet Wellfleet Harbor (at an imaginary line drawn due north from the eastern tip of Great Island to the opposite shore), Wellfleet.		Square Miles	(Flow Regime Modification*)	
					Aluminum	
					Estuarine Bioassessments	
					Fecal Coliform	36772
					pH, Low	
Herring River	MA96-67	Headwaters outlet Herring Pond, Wellfleet to south of High Toss Road, Wellfleet.	3.60	Miles	(Fish Kill(s)*)	
					(Fish Passage Barrier*)	
					(Flow Regime Modification*)	
					Aluminum	
					pH, Low	
Hyannis Harbor	MA96-05	The waters from the shoreline to an imaginary line drawn from the light at the end of Hyannis breakwater, Barnstable to the point west of Dunbar Point, Barnstable.	0.68	Square Miles	Estuarine Bioassessments	
Lewis Bay	MA96-36	Includes portion of Pine Island Creek and Uncle Roberts Cove, Yarmouth to confluence with Nantucket Sound, Barnstable/Yarmouth (excluding Hyannis Inner Harbor, Barnstable/Yarmouth and Mill Creek, Yarmouth).	1.79	Square Miles	Estuarine Bioassessments	64146
					Estuarine Bioassessments	64147
					Fecal Coliform	36771
					Nitrogen, Total	
					Nutrient/Eutrophication Biological Indicators	
Little River	MA96-99	Headwaters outlet Lovells Pond, Barnstable to confluence with tidal portion south of Old Post Road, Barnstable.	1.80	Miles	(Fish Passage Barrier*)	
					Escherichia Coli (E. Coli)	
Loagy Bay	MA96-125	Wellfleet.	0.20	Square Miles	Chlorophyll-a	
					Dissolved Oxygen	
Long Pond	MA96183	Brewster/Harwich.	715.00	Acres	Dissolved Oxygen	
Lovells Pond	MA96185	Barnstable.	54.00	Acres	(Fish Passage Barrier*)	
					Chlorophyll-a	
					Dissolved Oxygen	
					Harmful Algal Blooms	
					Phosphorus, Total	
					Transparency / Clarity	
					Turbidity	
Lovers Lake	MA96186	Chatham.	37.00	Acres	Transparency / Clarity	
Lower Mill Pond	MA96188	Brewster.	44.00	Acres	Algae	
					Chlorophyll-a	
					Phosphorus, Total	
					Turbidity	
Maraspin Creek	MA96-06		0.03		Fecal Coliform	36771



Category 5 waters listed alphabetically by major watershed
The 303(d) List – “Waters requiring a TMDL”

Waterbody	AU_ID	Description	Size	Units	Impairment	ATTAINS Action ID
		From Commerce Road, Barnstable to mouth at inlet Barnstable Harbor at Blish Point, Barnstable.		Square Miles	Nutrient/Eutrophication Biological Indicators	
Mashpee Pond	MA96194	Mashpee/Sandwich.	377.00	Acres	Dissolved Oxygen	
					Mercury in Fish Tissue	33880
Middle Pond	MA96198	Barnstable.	104.00	Acres	(Curly-leaf Pondweed*)	
					Dissolved Oxygen	
					Harmful Algal Blooms	
Moll Pond	MA96355	Eastham.	3.00	Acres	Harmful Algal Blooms	
Mystic Lake	MA96218	Barnstable.	146.00	Acres	(Non-Native Aquatic Plants*)	
					Dissolved Oxygen	
Nauset Harbor	MA96-28	The waters south of an imaginary line drawn east from Woods Cove, Orleans around the southern point of Stony Island, around the southern end of the unnamed island in the harbor, to Cape Cod National Seashore (CCNS), excluding Mill Pond, Orleans (area within CCNS designated as ORW).	0.41	Square Miles	Estuarine Bioassessments	
Pleasant Bay	MA96-77	The waters between the mouth of Muddy Creek, Harwich and imaginary lines drawn from the northeastern edge of Orleans (near The Horseshoe and The Narrows), southeasterly around the northeastern tip of Sipson Island, and Sipson Meadow, Orleans then south to the northern tip of Strong Island, Chatham and from the southeastern tip of Strong Island to Allen Point, Chatham (excluding the delineated segments; Bassing Harbor, Round Cove and Quanset Pond).	2.88	Square Miles	Estuarine Bioassessments	
					Nitrogen, Total	33799
Popponesset Creek	MA96-39	All waters west of Popponesset Island (from Popponesset Island Road bridge at the north to a line extended from the southeastern most point of the island southerly to Popponesset Beach), Mashpee.	0.05	Square Miles	Estuarine Bioassessments	
					Fecal Coliform	36772
Quashnet River	MA96-90	Headwaters, outlet Johns Pond, Mashpee to just south of Route 28, Falmouth (area within Waquoit Bay ACEC designated as ORW).	4.10	Miles	(Curly-leaf Pondweed*)	
					Temperature	
Quivett Creek	MA96-09	Outlet of unnamed pond just south of Route 6A, Brewster/Dennis to mouth at inlet Cape Cod Bay, Brewster/Dennis.	0.04	Square Miles	(Curly-leaf Pondweed*)	
					Dissolved Oxygen	
					Fecal Coliform	36771
Red Lily Pond	MA96257	Barnstable.	4.00	Acres	(Aquatic Plants (Macrophytes)*)	



Category 5 waters listed alphabetically by major watershed
The 303(d) List – “Waters requiring a TMDL”

Waterbody	AU_ID	Description	Size	Units	Impairment	ATTAINS Action ID
					Fecal Coliform	
					Nutrient/Eutrophication Biological Indicators	
Red River	MA96-107	Headwaters west of Mayflower Drive, Chatham to south Chatham Road, Chatham.	0.90	Miles	Escherichia Coli (E. Coli)	
Round Cove	MA96-75	east of Route 28, Harwich outlet to Pleasant Bay, Harwich.	0.02	Square Miles	Fecal Coliform	
					Nitrogen, Total	33796
Ryder Pond	MA96268	Truro.	18.00	Acres	Dissolved Oxygen	
					Mercury in Fish Tissue	33880
					Phosphorus, Total	
Santuit Pond	MA96277	Mashpee.	164.00	Acres	(Fish Passage Barrier*)	
					Abnormal Fish Deformities, Erosions, Lesions, Tumors (DELTS)	
					Chlorophyll-a	
					Harmful Algal Blooms	
					Nutrient/Eutrophication Biological Indicators	
					pH, High	
					Phosphorus, Total	
					Transparency / Clarity	
Santuit River	MA96-91	Headwaters, outlet Santuit Pond, Mashpee to confluence with tidal portion south of Old Mill Road/Old Kings Road, Mashpee/Barnstable.	1.60	Miles	(Fish Passage Barrier*)	
					Temperature	
Shawme Lake Lower	MA96288	Sandwich.	25.00	Acres	Nutrient/Eutrophication Biological Indicators	
Spectacle Pond	MA96307	Sandwich.	93.00	Acres	Dissolved Oxygen	
					Mercury in Fish Tissue	42406
Stage Harbor	MA96-11	From outlet Mill Pond, Chatham (includes Mitchell River SARIS# 9661975) to inlet of Nantucket Sound at a line from the southernmost point of Harding Beach southeast to Harding Beach Point, Chatham.	0.56	Square Miles	Estuarine Bioassessments	
					Fecal Coliform	36772
Stillwater Pond	MA96309	Chatham.	18.00	Acres	(Fish Passage Barrier*)	
					Transparency / Clarity	
Town Cove	MA96-68	Entire cove, Orleans/Eastham (including Rachael Cove and Woods Cove, Orleans) outlet to Nauset Harbor, Orleans (area within Cape Cod National Seashore designated as ORW).	0.79	Square Miles	Estuarine Bioassessments	
Uncle Harvey Pond	MA96319	Orleans.	6.00	Acres	Harmful Algal Blooms	



BOURNE

SANDWICH

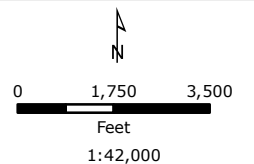
FALMOUTH

**FIGURE 1
WATERSHED OVERVIEW**

LEGEND

- Catchbasin
- ▲ Outfall
- Town Owned Road
- Private Road
- Outfall Catchments
- Watershed of Focus
- Watershed Boundary
- - - Town Boundary

LOCUS MAP



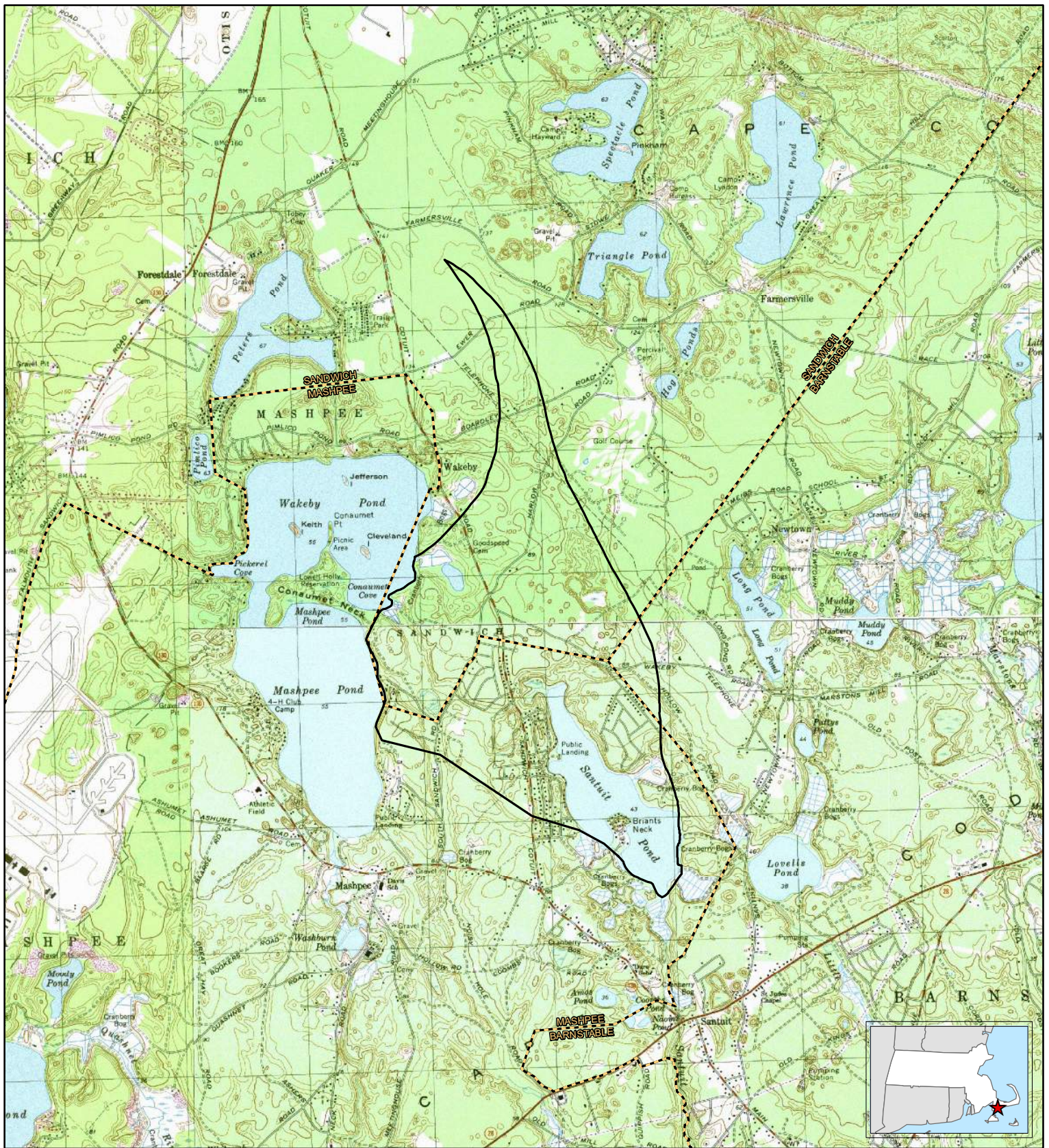
NOTES

Based on USGS Topo Map Pocasset, 1979 (10ft), Cotuit, 1974 (10ft), Falmouth, 1979 (10ft)
2. MassGIS: 2014 Integrated List Data (2016), Major Drainage Basins (2003), Subbasins (2007) Community Boundary (2017), National Wetlands Inventory (2007), FEMA National Flood Hazard (2017), MassDOT Major Roads (2014), Urban Area (2000 and 2010)
3. USGS: Groundwater contributing areas for Cape Cod and the Plymouth-Carver Regions of Massachusetts (2009)

Town of Mashpee
Massachusetts

December 2021

Tighe & Bond



Legend

- Watershed Boundary
- Municipal Boundary

Tighe & Bond

Based on USGS Topographic Map for Sandwich, MA Revised 1972 and Cotuit, MA Revised 1974 and Groundwater contributing areas for Cape Cod and the Plymouth-Carver Regions of Massachusetts (2009)

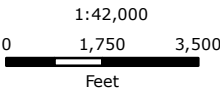
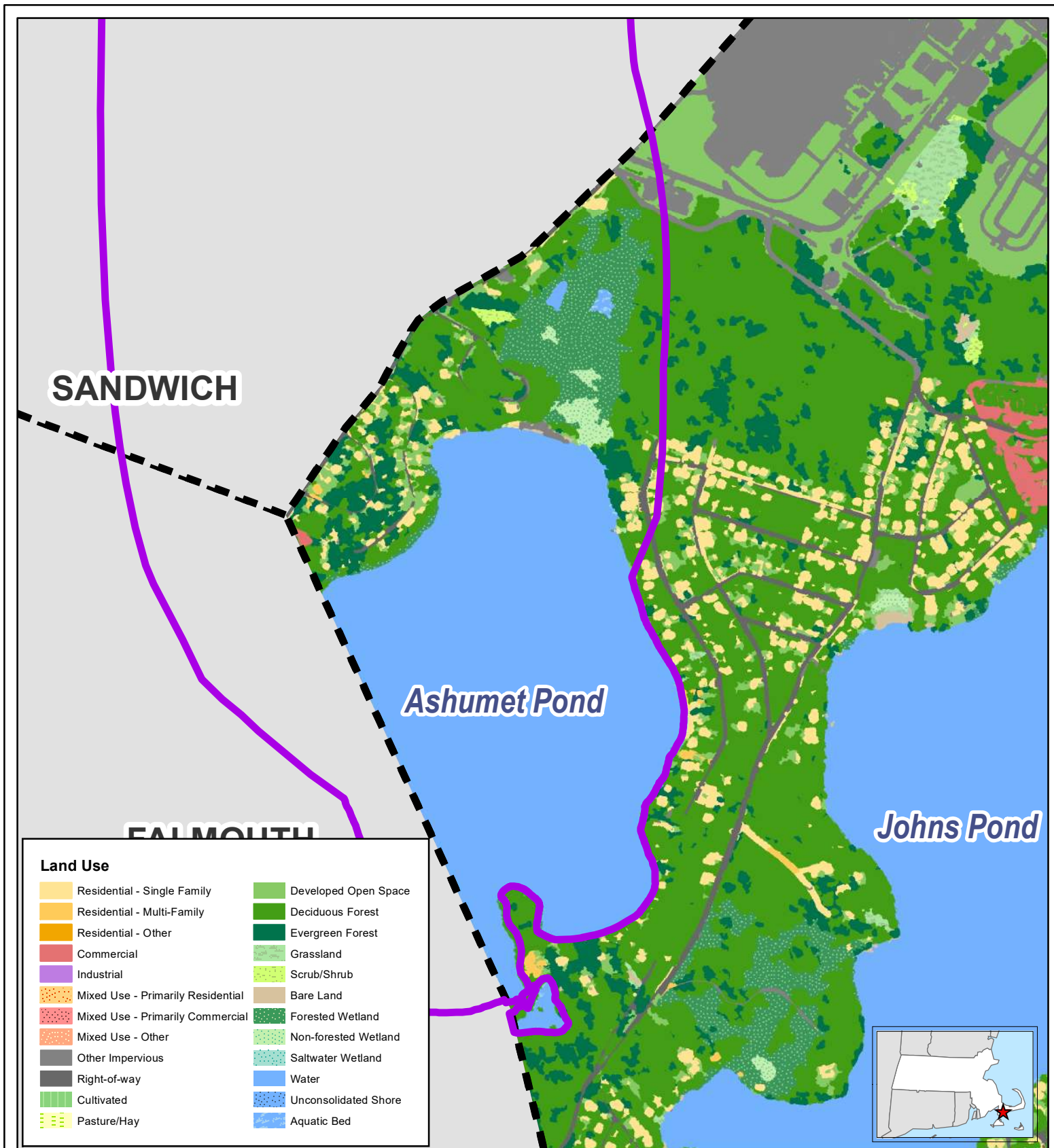


FIGURE 3
SITE LOCATION
Santuit Pond Watershed
Mashpee, Massachusetts

December 2021



Legend

- Municipal Boundary
- Watershed Boundary

Tighe&Bond

Based on MassGIS Land Cover / Land Use (2016), Community Boundary (2017) and USGS Groundwater contributing areas for Cape Cod and the Plymouth-Carver Regions of Massachusetts (2009)

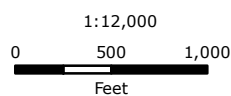
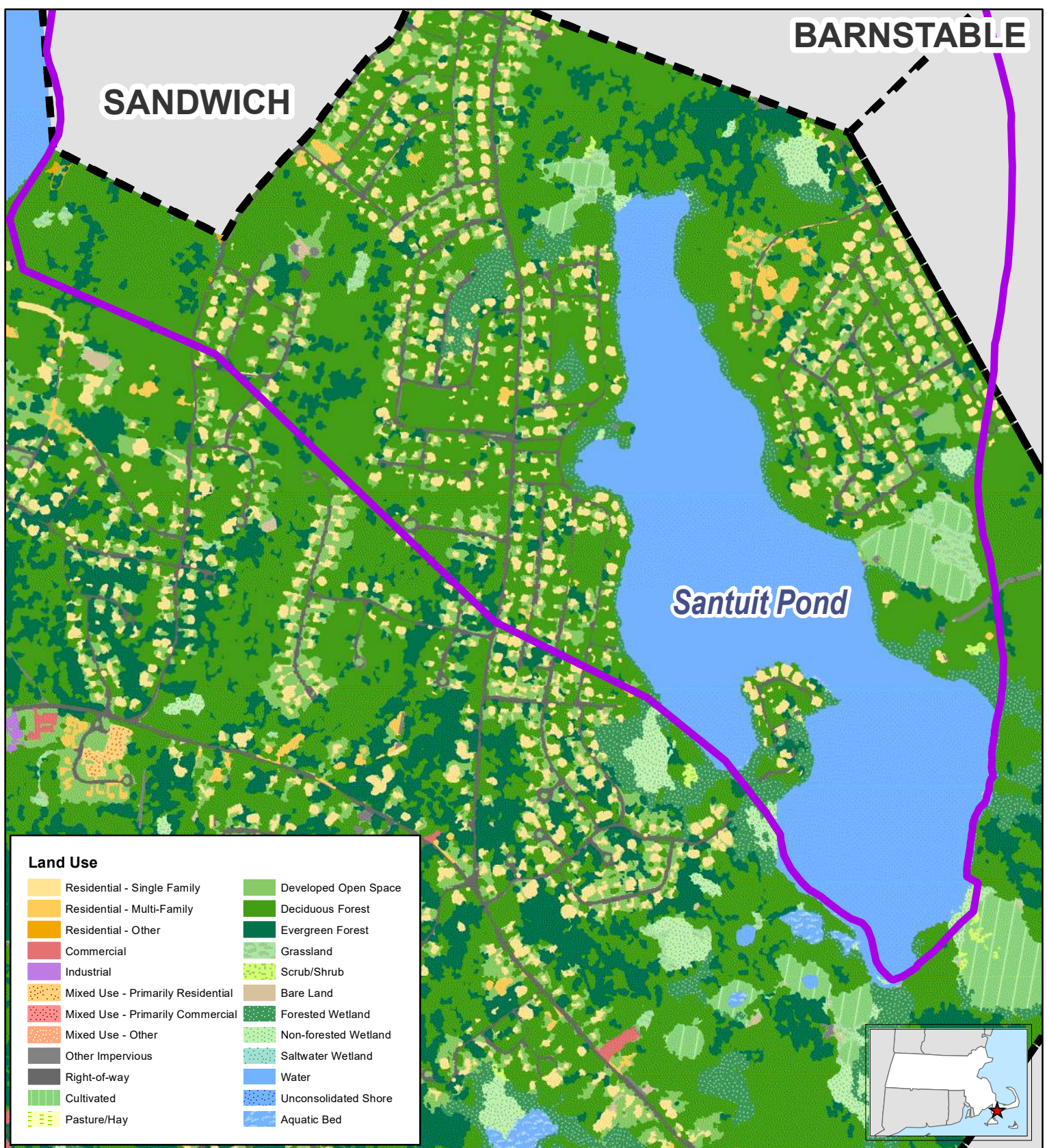


FIGURE 4

LAND USE CLASSIFICATION

Ashumet Pond Watershed
Mashpee, Massachusetts

December 2021



Legend

- Municipal Boundary
- Watershed Boundary

Tighe&Bond

Based on MassGIS Land Cover / Land Use (2016), Community Boundary (2017) and USGS Groundwater contributing areas for Cape Cod and the Plymouth-Carver Regions of Massachusetts (2009)

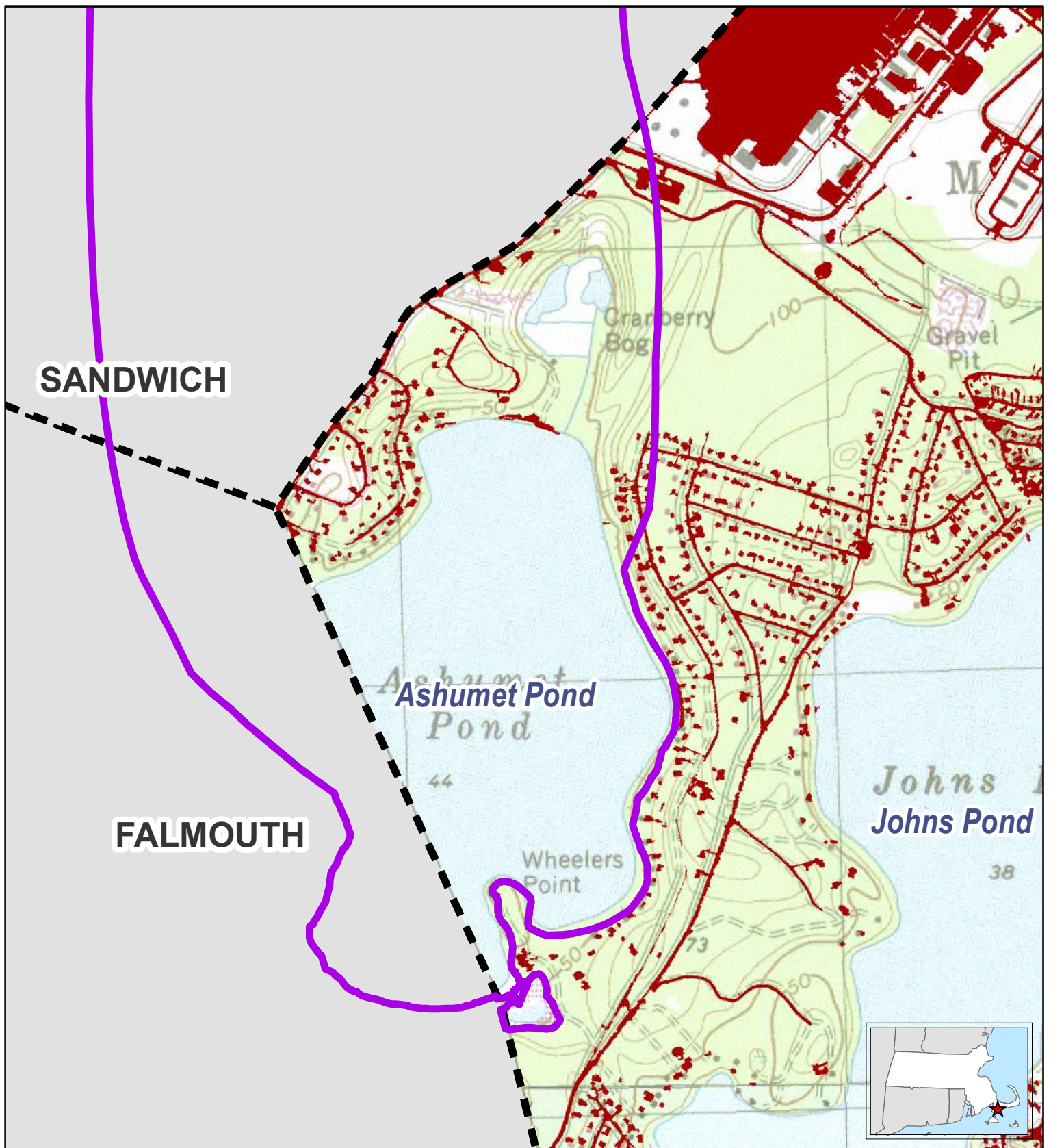
1:12,000
0 500 1,000
Feet



FIGURE 5 LAND USE CLASSIFICATION

Santuit Pond Watershed
Mashpee, Massachusetts

December 2021



Legend

- Impervious Area
- Municipal Boundary
- Watershed Boundary

Tighe&Bond

Based on MassGIS Land Cover / Land Use (2016), Community Boundary (2017) and on USGS Topographic Map for Pocasset, MA Revised 1979 and Groundwater contributing areas for Cape Cod and the Plymouth-Carver Regions of Massachusetts (2009)

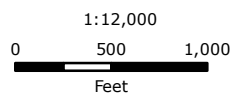
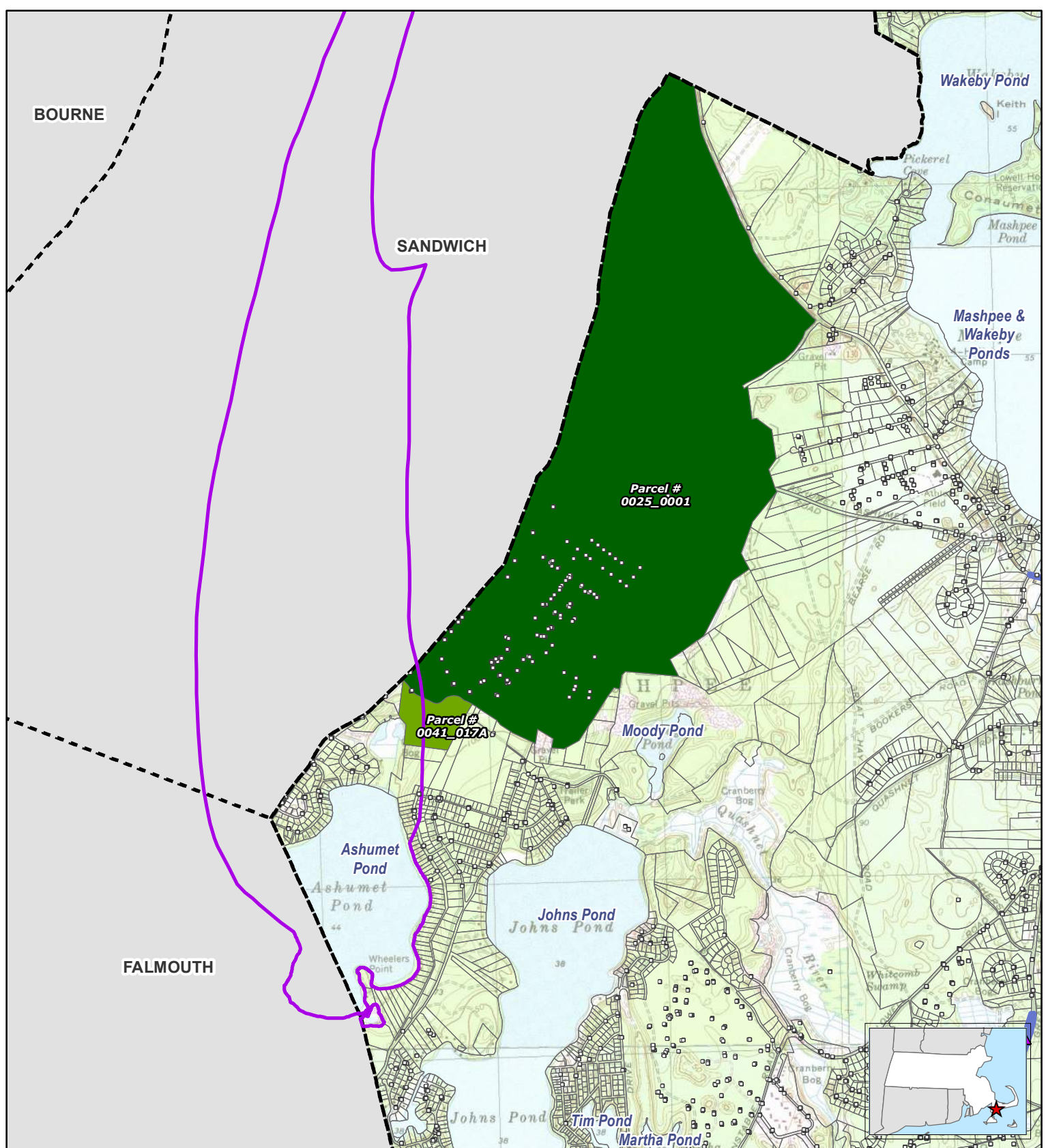


FIGURE 6

IMPERVIOUS AREA

Ashumet Pond Watershed
Mashpee, Massachusetts

December 2021



Legend

- Hot Spot Score 69
- Hot Spot Score 67
- Approximate Parcel Boundary
- Watershed Boundary
- Municipal Boundary
- Outfall
- Catchbasin
- Outfall Catchments

Tighe&Bond

Based on MassGIS Land Cover / Land Use (2016) and Parcels for the town of Mashpee (FY2020) and USGS Topographic Map for Pocasset, MA revised 1979 and Groundwater contributing areas for Cape Cod and the Plymouth-Carver Regions of Massachusetts (2009)

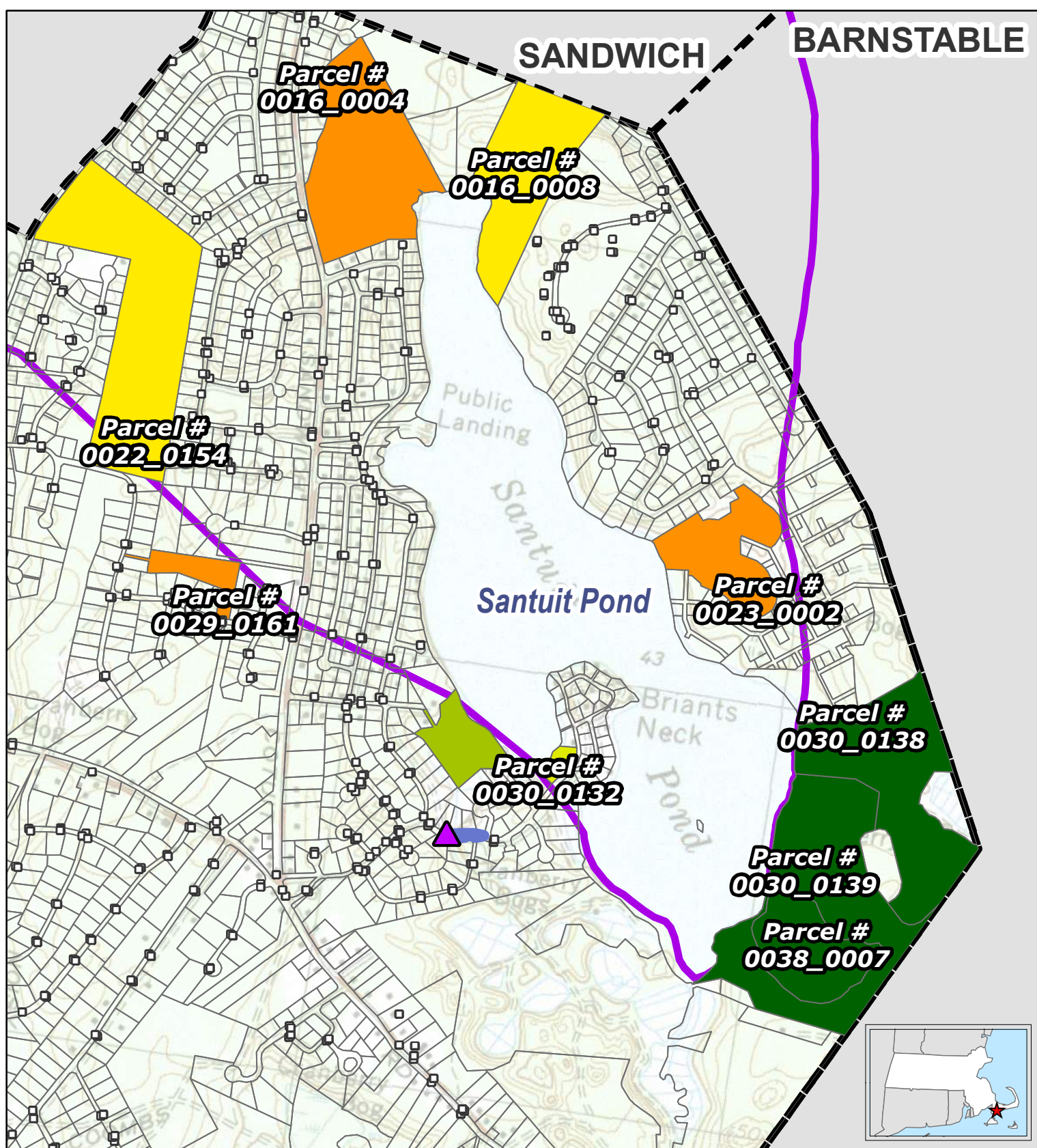
1:30,000
0 1,250 2,500
Feet

FIGURE 8

BMP HOT SPOT FOR MUNICIALLY OWNED PARCELS

Ashumet Pond Watershed
Mashpee, Massachusetts

December 2021



Legend

- | | | |
|-------------------|-----------------------------|--------------------|
| Hot Spot Score 70 | Approximate Parcel Boundary | Outfall |
| Hot Spot Score 60 | Watershed Boundary | Catchbasin |
| Hot Spot Score 60 | Municipal Boundary | Outfall Catchments |

Tighe&Bond

Based on MassGIS Land Cover / Land Use (2016) and Parcels for the town of Mashpee (FY2020) and USGS Topographic Map for Cotuit, MA revised 1974 and Groundwater contributing areas for Cape Cod and the Plymouth-Carver Regions of Massachusetts (2009)

1:12,000
0 500 1,000
Feet



FIGURE 9

BMP HOT SPOT FOR MUNICIPIALLY OWNED PARCELS

Santuit Pond Watershed
Mashpee, Massachusetts

December 2021

Ashument Pond Municipal Parcels PO4 Loads

Phos Loading lbs/year	Parcel ID	Lot Size (SF)	Use Code	Address	Owner
1.709623768	0025_0001	50529600	9000	0 OTIS AIR BASE	UNITED STATES OF AMERICA
1.183134202	0041_017A	749232	9500	0 FALMOUTH-SANDWICH RD	ORENDA WILDLIFE LAND TRUST INC
0.731538997	0041_0077	457380	9500	265 ASHUMET AVE	ORENDA WILDLIFE LAND TRUST INC
0.102786261	0040_0022	43560	9360	0-REAR TRI-TOWN CIR	MASHPEE TOWN OF
0.042999803	0040_0031	32104	9360	12 TRI-TOWN CIR	MASHPEE TOWN OF
0.031844172	0048_0031	11892	9360	10 TRI-TOWN CIR	MASHPEE TOWN OF
0.020076158	0048_0028	11979	9360	15 TRI-TOWN CIR	MASHPEE TOWN OF
0.011989673	0040_0059	4312	9530	0 FALMOUTH-SANDWICH RD	MASHPEE TOWN OF

Santuit Pond Municipal Parcels PO4 Loads

Phos Loading lbs/year	Parcel ID	Lot Size (SF)	Use Code	Address	Owner
3.750098418	0022_0154	1437044	9540	215 SOUTH SANDWICH RD	MASHPEE WAMPANOAG ROD & GUN
2.856276717	0023_0002	336719	9320	0-OFF CRANBERRY LN	MASHPEE TOWN OF
0.844365692	0016_0005	274428	9320	0 TOBEYS BACK RD	MASHPEE, TOWN OF
0.826834106	0016_0008	740520	9320	0 WAKEBY RD	MASHPEE, TOWN OF
0.398338389	0022_0135	113692	9320	0 SCITUATE RD	MASHPEE, TOWN OF
0.345565705	0030_0117	152460	9320	6 CHOPCHAGUE RD	MASHPEE, TOWN OF
0.316413974	0022_0114	60984	9320	0 RADCLIFFE RD	MASHPEE, TOWN OF
0.280681655	0030_120	49658	9320	0 SHIELDS RD	MASHPEE, TOWN OF
0.207024393	0038_0007	570636	9320	0 SANTUIT POND REAR	MASHPEE, TOWN OF
0.153322172	0029_0130	97574	9360	9 WINDSOR WAY	MASHPEE, TOWN OF
0.13602405	0016_0007	174240	9300	0-REAR WAKEBY RD	MASHPEE, TOWN OF
0.128541778	0030_0139	1154340	9320	0 WIMBLEDON DR	MASHPEE, TOWN OF
0.106653084	0016_0006	169884	9320	0-REAR WAKEBY RD	MASHPEE, TOWN OF
0.090625392	0030_0119	20996	9320	0 SANTUIT LN	MASHPEE, TOWN OF
0.08888578	0023_0213	29490	9320	0 BRACKETT ST	MASHPEE TOWN OF
0.086188369	0022_0020	47916	9360	117 TIMBERLANE DR	MASHPEE, TOWN OF
0.076356683	0022_0115	13504	9320	35 RADCLIFFE RD	MASHPEE, TOWN OF
0.07450041	0021_0079	97574	9360	0 DAVID WAY	MASHPEE, TOWN OF
0.052535308	0029_0046	69696	9320	56 TIMBERLANE DR	MASHPEE, TOWN OF
0.051827645	0029_0146	97139	9360	0 LEEWARD LN	MASHPEE, TOWN OF
0.047463577	0022_0023	37636	9360	95 TIMBERLANE DR	MASHPEE, TOWN OF
0.046584507	0023_0070	46770	9320	4 CRANBERRY LN	MASHPEE TOWN OF
0.040725926	0021_0038	14898	9360	77 FOX HILL RD	MASHPEE, TOWN OF
0.040108726	0022_0019	28706	9320	125 TIMBERLANE DR	MASHPEE, TOWN OF
0.039105104	0023_0208	46397	9320	14 CRANBERRY LN	MASHPEE TOWN OF
0.034714556	0030_0132	43212	9320	0 SANTUIT LN	MASHPEE, TOWN OF
0.033657298	0023_0008	93262	9320	29 BRACKETT ST	MASHPEE TOWN OF
0.033250855	0030_0143	5576	9320	0 JOSEPHINE BEND	MASHPEE, TOWN OF
0.029633895	0030_121	42602	9320	0 SANTUIT LN	MASHPEE, TOWN OF
0.024942349	0022_0022	19994	9360	105 TIMBERLANE DR	MASHPEE, TOWN OF
0.021433977	0030_0048	9358	9320	18 BRACKETT ST	MASHPEE, TOWN OF
0.017517798	0022_016F	6360	9360	147 TIMBERLANE DR	MASHPEE, TOWN OF
0.017365765	0030_0046	4008	9360	0 JOSEPHINE BEND	MASHPEE, TOWN OF
0.016852462	0022_0006	12807	9320	0 TIMBERLANE DR	MASHPEE, TOWN OF
0.016017027	0022_0021	20996	9320	111 TIMBERLANE DR	MASHPEE, TOWN OF

Santuit Pond Municipal Parcels PO4 Loads

Phos Loading lbs/year	Parcel ID	Lot Size (SF)	Use Code	Address	Owner
0.015107864	0023_0009	4008	9360	0 BRACKETT ST	MASHPEE, TOWN OF
0.014820982	0030_0044	2178	9360	0 JOSEPHINE BEND	MASHPEE, TOWN OF
0.013013415	0029_109A	250034	9320	0-OFF HEMLOCK DR	MASHPEE, TOWN OF
0.012421757	0022_008L	17990	9320	13 AUTUMN DR	MASHPEE, TOWN OF
0.011895327	0022_008K	15987	9320	17 AUTUMN DR	MASHPEE, TOWN OF
0.011364047	0022_014B	6970	9320	183 TIMBERLANE DR	MASHPEE, TOWN OF
0.011312103	0023_0006	16596	9320	38 BRACKETT ST	MASHPEE TOWN OF
0.011189155	0022_008I	16204	9320	27 AUTUMN DR	MASHPEE, TOWN OF
0.011186946	0022_008J	16379	9320	23 AUTUMN DR	MASHPEE, TOWN OF
0.010975963	0023_0007	8189	9320	46 BRACKETT ST	MASHPEE TOWN OF
0.010752521	0023_0018	17511	9320	60 ABBOTSFORD RD	MASHPEE TOWN OF
0.010547921	0030_0019	9932	9320	0 SANTUIT LN	MASHPEE, TOWN OF
0.010382	0022_0034	13286	9320	480 COTUIT RD	MASHPEE, TOWN OF
0.009674823	0022_0116	13678	9360	29 RADCLIFFE RD	MASHPEE, TOWN OF
0.009532899	0022_016G	6534	9320	145 TIMBERLANE DR	MASHPEE, TOWN OF
0.009485059	0023_0071	13000	9320	10 CRANBERRY LN	MASHPEE TOWN OF
0.009065141	0022_008H	13591	9320	33 AUTUMN DR	MASHPEE, TOWN OF
0.00870637	0017_0009	13112	9360	17 SANTUIT POND RD	MASHPEE, TOWN OF
0.008521789	0017_0008	13112	9360	23 SANTUIT POND RD	MASHPEE, TOWN OF
0.006675501	0030_0018	9757	9320	0 SANTUIT LN	MASHPEE, TOWN OF
0.00574818	0030_101	7928	9360	17 FULLER ST	MASHPEE, TOWN OF
0.005684709	0030_0017	8015	9320	0 SANTUIT LN	MASHPEE, TOWN OF
0.005681192	0030_0016	8407	9320	0 SANTUIT LN	MASHPEE, TOWN OF
0.004734902	0030_0036	6400	9360	0 JOSEPHINE BEND	MASHPEE, TOWN OF
0.003010289	0030_0039	4443	9360	0 JOSEPHINE BEND	MASHPEE, TOWN OF
0.002647266	0030_0097	43996	9320	31 FULLER ST	MASHPEE, TOWN OF
0.002497113	0023_0005	3659	9360	0 BRACKETT ST	MASHPEE, TOWN OF
0.002201115	0030_100	3136	9500	19 FULLER ST	NATIVE LAND CONSERVANCY INC
0.0021344	0023_0016	6795	9360	50 ABBOTSFORD RD	MASHPEE, TOWN OF
0.002123312	0030_102	3354	9500	13 FULLER ST	NATIVE LAND CONSERVANCY INC
0.001341976	0023_0210	17990	9320	0 COOLIDGE ST	MASHPEE TOWN OF
0.001282389	0023_0020	58370	9320	16 LOWELL ST	MASHPEE, TOWN OF
0.001264879	0030_0131	19210	9320	0 SANTUIT LN	MASHPEE, TOWN OF
0.001002874	0030_103	1699	9500	0 FULLER ST	NATIVE LAND CONSERVANCY INC
0.000951539	010_0013	1968912	9500	0 SOUTH SANDWICH RD	TRUSTEES OF RESERVATIONS

Santuit Pond Municipal Parcels PO4 Loads

Phos Loading lbs/year	Parcel ID	Lot Size (SF)	Use Code	Address	Owner
0.000633454	0030_012B	741	9360	11 SANTUIT LN	MASHPEE, TOWN OF
0.000326492	0029_0161	152678	9320	0 WINDSOR WAY	MASHPEE, TOWN OF
0.000325223	0023_0212	21998	9320	29 BRACKETT ST	MASHPEE, TOWN OF
0.000137784	0030_0138	1020175	9950	0 RACQUET DR	MASHPEE, TOWN OF
2.60619E-05	0021_0072	36285	9360	0 SANDY FOX DR	MASHPEE, TOWN OF

Landuse Percentage Calculations for TIA DCIA

Land Use Percentage Calcs:

Whole Town 2016 Land Use (IA + PA):	Acres	%
Ag	40.6	0.25
Commercial	1000.18	6.11
Industrial	121.72	0.74
Mixed Use, Primarily Residential	56.17	0.34
Open Land	5027.91	30.70
Recreation	176.7	1.08
Residential - Multi-Family	947.99	5.79
Residential - Other	44.39	0.27
Residential Single Family	3248.89	19.84
Right-of-way	974.64	5.95
Tax Exempt	3166.81	19.34
Unknown	54.84	0.33
Water	1516.39	9.26
Total	16377.23	100.00

Landuse Percentage Calculations for TIA DCIA

Land Use Percentage Calcs:

Ashumet Embayment within Mashpee

Land Use (IA+PA):	Acres	%
Ag	0	0.00
Commercial	1.1	0.41
Industrial	0	0.00
Mixed Use, Primarily Residential	0	0.00
Open Land	56.42	20.97
Recreation	0	0.00
Residential - Multi-Family	1.44	0.54
Residential - Other	0	0.00
Residential Single Family	32.71	12.16
Right-of-way	10.34	3.84
Tax Exempt	2.84	1.06
Unknown	0	0.00
Water	164.22	61.03
Total	269.07	100.00

Landuse Percentage Calculations for TIA DCIA

Land Use Percentage Calcs:

Santuit Embayment within Mashpee

Land Use (IA+PA):	Acres	%
Ag	38.96	6.19
Commercial	0	0.00
Industrial	0	0.00
Mixed Use, Primarily Residential	0	0.00
Open Land	85.46	13.58
Recreation	0	0.00
Residential - Multi-Family	31.49	5.00
Residential - Other	30.18	4.80
Residential Single Family	192.61	30.61
Right-of-way	53.06	8.43
Tax Exempt	31.52	5.01
Unknown	0	0.00
Water	165.97	26.38
Total	629.25	100.00

Landuse Percentage Calculations for TIA DCIA

TIA & DCIA Calcs

% DCIA Within Mashpee within Ashumet Embayment: 0.52

% TIA Within Mashpee within Ashument Embayment: 4.53

% DCIA Within Mashpee within Santuit Embayment: 2.459

% TIA Within Mashpee within Santuit Embayment: 11.42422



WATERSHED-BASED PLAN

Ashumet Pond

December 15, 2021



Prepared For:

Town of Mashpee, Massachusetts



Contents

Prior to finalizing your Watershed-based Plan, don't forget to right click on Table of Contents below and select "Update Field" to update the page numbers using the "Update entire table" option

Executive Summary	11
Introduction.....	22
Purpose & Need.....	22
Watershed-Based Plan Outline	22
Project Partners and Stakeholder Input	33
Data Sources.....	33
Summary of Completed Work.....	33
Element A: Identify Causes of Impairment & Pollution Sources	44
General Watershed Information	44
MassDEP Water Quality Assessment Report and TMDL Review.....	55
Water Quality Impairments.....	99
Water Quality Goals	1111
Land Use and Impervious Cover Information.....	1212
Pollutant Loading.....	1515
Element B: Determine Pollutant Load Reductions Needed to Achieve Water Quality Goals.....	1717
Estimated Pollutant Loads.....	1717
Water Quality Goals	1717
TMDL Pollutant Load Criteria	1919
Element C: Describe management measures that will be implemented to achieve water quality goals.....	2020
Element D: Identify Technical and Financial Assistance Needed to Implement Plan	2424
Element E: Public Information and Education.....	2525
Elements F & G: Implementation Schedule and Measurable Milestones.....	2626
Elements H & I: Progress Evaluation Criteria and Monitoring	2727
References	2929
Appendices	3232

Executive Summary

Consider adding an executive summary.

Introduction

What is a Watershed-Based Plan?



Purpose & Need

The purpose of a Massachusetts Watershed-Based Plan (WBP) is to organize information about Massachusetts' watersheds and present the information in a format that will enhance the development and implementation of projects that will restore water quality and beneficial uses in the Commonwealth. The Massachusetts WBP follows the United States Environmental Protection Agency's (EPA's) recommended format for "nine-element" watershed plans, as described below.

All states are required to develop WBPs, but not all states have taken the same approach. Most states develop WBPs only for selected watersheds. Massachusetts Department of Environmental Protection's (MassDEP's) approach has been to develop a tool to support statewide development of WBPs so **that good projects in all areas of the state may be eligible for federal watershed implementation grant funds** under [Section 319 of the Clean Water Act](#).

EPA guidelines promote the use of Section 319 funding for developing and implementing WBPs. WBPs are required for all projects implemented with Section 319 funds and are recommended for all watershed projects, whether they are designed to protect unimpaired waters, restore impaired waters, or both.

Watershed-Based Plan Outline

This WBP includes nine elements (a through i) in accordance with EPA Guidelines:

- a) An **identification of the causes and sources** or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this WBP and to achieve any other watershed goals identified in the WBP, as discussed in item (b) immediately below.
- b) An **estimate of the load reductions** expected for the management measures described under paragraph (c) below, recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time.
- c) A **description of the nonpoint source (NPS) management measures** needed to achieve the load reductions estimated under paragraph (b) above as well as to achieve other watershed goals identified in this WBP and an identification (using a map or a description) of the critical areas in which those measures will be needed to implement this plan.
- d) An **estimate of the amounts of technical and financial assistance needed**, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan. As sources of funding, States should consider the use of their Section 319 programs, State Revolving Funds, United States Department of Agriculture's (USDA's) Environmental Quality Incentives Program and Conservation Reserve Program, and other relevant federal, state, local, and private funds that may be available to assist in implementing this plan.

- e) An **information/education component** that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the NPS management measures that will be implemented.
- f) A **schedule for implementing the NPS management measures** identified in this plan that is reasonably expeditious.
- g) A description of **interim, measurable milestones** for determining whether NPS management measures or other control actions are being implemented.
- h) A set of **criteria to determine if loading reductions are being achieved** over time and substantial progress is being made toward attaining water quality standards and, if not, the criteria for determining whether this WBP needs to be revised or, if a NPS total maximum daily load (TMDL) has been established, whether the TMDL needs to be revised.
- i) A **monitoring component** to evaluate the effectiveness of the implementation efforts over time measured against the criteria established under item (h) immediately above.

Project Partners and Stakeholder Input

Consider adding information on the project partners and stakeholder input.

Data Sources

This WBP was developed using the framework and data sources provided by MassDEP's [WBP Tool](#).

Consider adding additional information on data sources used for the WBP Tool.

Summary of Completed Work

Consider adding information on completed nonpoint source best management practice (BMP) projects in the watershed.

Element A: Identify Causes of Impairment & Pollution Sources

Element A: Identify the causes and sources or groups of similar sources that need to be controlled to achieve the necessary pollutant load reductions estimated in the watershed based plan (WBP).



General Watershed Information

Table A-1: General Watershed Information

Watershed Name (Assessment Unit ID):	Ashumet Pond (MA96004)
Major Basin:	Cape Cod
Watershed Area (within MA):	1642.3 (ac)
Water Body Size:	203 (ac)

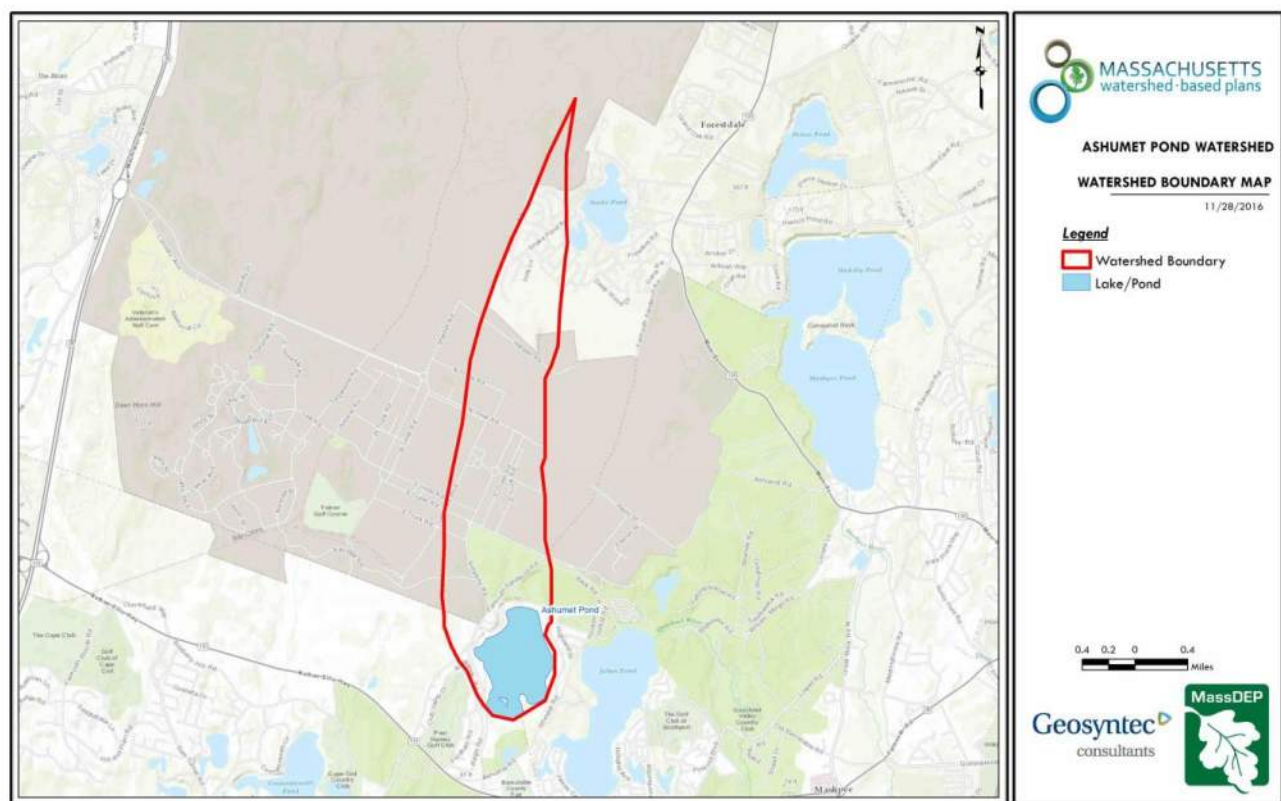


Figure A-1: Watershed Boundary Map (MassGIS, 1999; MassGIS, 2001; USGS, 2016)

Ctrl + Click on the map to view a full sized image in your web browser.

General watershed information:

MassDEP Water Quality Assessment Report and TMDL Review

The following reports are available:

- [Cape Cod Coastal Drainage Areas 2004 - 2008 Surface Water Quality Assessment Report](#)

The section below summarizes the findings of any available Water Quality Assessment Report and/or TMDL that relate to water quality and water quality impairments. Select excerpts from these documents relating to the water quality in the watershed are included below (note: relevant information is included directly from these documents for informational purposes and has not been modified).

Aquatic Life Use

Habitat and Flow

According to CH2M HILL (2009) "Ashumet Pond is a kettle pond with a maximum depth of 19 meters (62.3 feet [ft]) and is located near the Massachusetts Military Reservation (MMR) on Cape Cod. The pond is fed primarily by groundwater seepage and has no surface water outlet...The WWTP began operation in 1936 and it was closed in 1995. Although the discharge of secondarily treated wastewater to the aquifer ceased in 1995, a large mass of residual phosphorus remains adsorbed to the aquifer matrix between the WWTP and the pond. This residual phosphorus has continued to feed the phosphorus plume that is discharging to the pond. Without further remedial action, this plume was expected to continue to contribute to the external phosphorus load of the pond (in the range of 48 to 110 kilograms [kg] per year) for decades (McCobb et al. 2003; AFCEE 2002a)."

Biology

Several studies by the Installation Restoration Program (IRP) at the MMR in the 1990s identified the presence of tumors on brown bullhead in Ashumet Pond (Baumann et al. 2008). The IRP's technical advisory group recommended that future evaluations of the problem include a statistically based prevalence study that sampled more fish from the lakes of concern and similar reference lakes. USGS conducted a study of the prevalence of tumors in brown bullhead in Ashumet Pond and two reference lakes, Santuit and Great Herring Ponds in cooperation with USEPA and MassWildlife. As part of this study brown bullhead were collected from Ashumet Pond between May and July 2002. The following findings were reported (Baumann et al. 2008) "Brown bullhead from Ashumet Pond, which has been subjected to contamination from the Massachusetts Military Reservation, had a high prevalence of raised lesions, which included histopathologically verified papillomas and squamous cell carcinoma, an elevated incidence of liver neoplasms, and an elevated level of genetic damage to red blood cell nuclei. Because red blood cells in fish have a lifespan of about 100 days, these results indicate an ongoing exposure to genotoxins in Ashumet Pond...The high prevalence of melanistic lesions on Ashumet Pond brown bullhead, combined with the tumor pathology and genetic damage, implicates chemical carcinogens as one of the causal factors in that lake. Because many of the brown bullhead were large and ages may have been underestimated, chemical exposure contributing to the pathology may have occurred as long ago as the early 1990s. An additional prevalence survey would help to clarify whether the causal factors are still active".

It should also be noted that a blue-green algal bloom occurred in the pond in July 2008 (CH2M HILL 2009).

Water Chemistry

According to CH2M HILL (2007a), "In an effort to address the effects of the phosphorus plume on the trophic state of Ashumet Pond, AFCEE developed the following three-phase remedial strategy: (1) implement a targeted phosphorus inactivation of the pond sediments in the deepest area of the pond to reduce the internal phosphorus load in the pond; (2) install a geochemical barrier within the plume discharge area in the pond to reduce the external phosphorus loading from groundwater seepage; and (3) continue the on-going water quality monitoring program for Ashumet Pond. Consistent with this strategy, a targeted phosphorus inactivation (alum treatment) of the hypolimnion was conducted in September 2001 using aluminum sulfate and sodium aluminate solutions. A geochemical barrier consisting of zero-valent iron (ZVI) filings mixed with the native sandy shoreline sediments was installed in August 2004 along that part of the shoreline where the highest concentrations of phosphorus are discharging.

The barrier is 300 ft long, approximately three ft thick, and extends approximately 40 ft offshore from the mean shoreline of Ashumet Pond. Barrier performance data collected in 2004 and 2005 indicated that the barrier was effectively removing phosphorus from the targeted part of the plume (AFCEE 2006). During 2006, the USGS collected barrier performance data from a permanent barrier monitoring network and from approximately 200 temporary drive point sampling locations. The 2006 USGS data indicate that phosphorus is being removed from that part of the wastewater plume discharging to the pond through the barrier and that most of the removal is occurring within the interior of the barrier, well before reaching the interface between the barrier and the pond. These data suggest that the barrier is effectively reducing the external phosphorus load to the pond.

In 2006, AFCEE collected general water quality and phosphorus concentration data from five temporary drive point locations within the barrier and sediment data from 13 locations within or in the vicinity of the barrier. The general groundwater chemistry data indicate that highly reducing (e.g., denitrifying, sulfate reducing, and methanogenic) conditions have developed within the interior of the barrier where the majority of the phosphorus removal is occurring. These data suggest that the precipitation of a ferrous iron phase (vivianite) and/or a mixed valent iron-based layered double hydroxide phase (green rust) are the primary mechanisms of phosphorus removal by the barrier. The relatively low levels of phosphorus associated with oxidized iron-rich surface sediment samples of the barrier collected by AFCEE in 2006 support the conclusion that phosphorus is being removed from groundwater within the reducing interior of the barrier and before it can reach, and be adsorbed by, the thin oxidized iron-rich layer at the interface of the barrier and the pond."

Monthly depth profiles for DO and temperature and Secchi disc depth monitoring has been conducted at the deep hole of Ashumet Pond by CH2M HILL personnel between 2005 and 2008 for the Air Force Center for Engineering and the Environment (AFCEE) at the

Massachusetts Military Reservation on Cape Cod (CH2M HILL 2009). DO depletion (i.e., <1.0 to 5.0 mg/L) often occurred at depths greater than 7.5 m during August and September. The maximum temperature was 27.7°C. None of the Secchi disk transparency measurements were below the bathing beach guidelines (<1.2 m).

According to MA DPH (2010) there are two groundwater plumes (CS-10 and Ashumet Valley) that were found to be upwelling in the northwest portion of Ashumet Pond. No plume-related contaminants have been detected in the pond, however, since 2000. The treatment system/cleanup plan for CS-10 is summarized as follows (AFCEE 2010): “The Chemical Spill 10 (CS-10) groundwater plume resulted from spills and releases from multiple sources. The primary source area originated from the former Boeing Michigan Aerospace Research Center Missile Site (from 1960 to 1973) and Unit Training Equipment Site (UTES). From 1996 through 2005, several source area cleanup actions were conducted at the site, including 15 drainage structure removals, and soil treatment with soil vapor extraction. More than 1,500 tons of contaminated soil were excavated and taken off site for disposal. Groundwater concentrations in monitoring wells located in the source area no longer exceed cleanup levels and the plume is detached from its primary source area. Studies have shown that portions of the CS-10 plume no longer discharge to Ashumet and Johns Ponds. Surface water sampling from both ponds in 2009 showed zero detections of contaminants associated with CS-10. The primary contaminants in the CS-10 plume are the cleaning solvents PCE and TCE, which have been detected above the state and federal MCLs of 5 µg/L. Long-term remediation is occurring with a treatment system comprised of a series of extraction wells, treatment plants, reinjection wells, and infiltration galleries. The treatment plants use granular activated carbon to remove the solvents from the groundwater and the treated water is returned to the aquifer through the infiltration galleries and reinjection wells. An additional extraction well to address the southern trench contamination, an additional reinjection well to improve hydraulic capture of the plume, and revised flow rates in several extraction wells were completed in February 2009. The CS-10 Plume final ROD, signed in 2009, specified continued operation and monitoring of the existing treatment system along with land use controls.”

The treatment system/cleanup plan for Ashumet Valley plume is summarized as follows (AFCEE 2010): “The Ashumet Valley plume has two sources: the former firefighter-training area 1 (FTA-1) and the former MMR Sewage Treatment Plant (CS-16 and CS-17). Firefighter-training exercises were held from 1958 to 1985 at FTA-1, during which time flammable waste liquids were burned and extinguished, some of which entered the sandy soil and eventually reached the groundwater aquifer. The former sewage treatment plant, which operated from 1936 to 1995, released treated water to a series of sand infiltration beds. Sludge materials were kept on site. Treatment of contaminated soils at FTA-1 was completed in September 1997. A total of 42,531 tons of soil were treated at FTA-1 using a thermal treatment process. In 2001 and 2002, contaminated soil was removed from the CS-16 and CS-17 sites and taken off base for proper disposal. The primary contaminants in the Ashumet Valley plume are the cleaning solvents PCE and TCE, which have been detected above the state and federal MCLs of 5µg/L. The Ashumet Valley plume is currently in long-term remediation. Remediation is occurring with two treatment systems, each comprised of a single extraction well, treatment plant, and infiltration galleries/river discharge. The treatment plants use granular activated carbon to remove the solvents from the groundwater and the treated water is returned to the aquifer through the infiltration galleries in the central portion of the plume, and to a bog ditch along the Backus River in the southern area. The Ashumet Valley Plume final ROD, which was signed in 2009, specified continued operation of the existing treatment system plus additional treatment for the southern portion of the plume. The southern treatment system has been installed. The ROD also required land use controls. AFCEE does not believe that any portion of the plume is currently discharging into Ashumet Pond. Surface water sampling from Ashumet Pond in 2009 showed that no plume contaminants were detected.”

The Aquatic Life Use is assessed as impaired for Ashumet Pond based on the severe oxygen depletion that occurred below about 7.5 m representing approximately 40% of the lake’s surface area. While remediation efforts are underway, a phosphorus-rich groundwater plume, originating from the MMR wastewater treatment plant (WWTP) that operated between 1936 and 1995, has been discharging to Ashumet Pond for more than 20 years. A large mass of easily mobilized phosphorus remains adsorbed to the aquifer matrix between the former WWTP and Ashumet Pond and “is expected to continue discharging (in the range of 48 to 110 kilograms [kg] per year) to the pond for decades” (CH2M Hill 2007a). This use is also assessed as impaired based on the high prevalence of melanistic lesions on Ashumet Pond brown bullhead, combined with the tumor pathology and genetic damage. Chemical carcinogens are implicated as one of the causal factors (Baumann et al. 2008).

Fish Consumption Use

Fish toxics monitoring was conducted in Ashumet Pond in June 1999 and edible fillets were analyzed for select metals, PCBs, and organochlorine pesticides (data reported in DeCesare and Connors 2002). Due to the presence of mercury in largemouth bass, MA DPH issued the following advisory (MA DPH 2009c) recommending:

“Children under 12 years of age, pregnant women, nursing mothers, and women of childbearing age who may become pregnant should refrain from consuming largemouth bass from Ashumet Pond” and

“The general public should limit consumption of largemouth bass to two meals per month”.

Because of the site-specific fish consumption advisory for Ashumet Pond due to Mercury contamination, the Fish Consumption Use is

assessed as impaired. The Northeast Regional Mercury Total Maximum Daily Load (TMDL) was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. The TMDL covers waterbodies that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007). The TMDL will be reassessed in 2010 based on an evaluation of new on-going monitoring and air deposition data. Final targets will be determined at that time.

Primary and Secondary Contact Recreational and Aesthetics Uses

Monthly Secchi disc depth monitoring has been conducted at the deep hole of Ashumet Pond by CH2M HILL personnel between 2005 and 2008 for the Air Force Center for Engineering and the Environment (AFCEE) at the Massachusetts Military Reservation on Cape Cod (CH2M HILL 2009). None of the Secchi disk transparency measurements were below the bathing beach guidelines (<1.2 m). It should be noted that a blue-green algal bloom occurred in the pond in July 2008.

There are several public bathing beaches along the shoreline of Ashumet Pond. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no Primary Contact Recreational Use assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

The Primary Contact Recreational Use is not assessed for Ashumet Pond due to the lack of quality assured bacteria data. The Secondary Contact Recreational Use is assessed as support since none of the Secchi disk transparency measurements were below the bathing beach guidelines (<1.2 m). The Aesthetics Use is not assessed. All of these uses, however, are identified with an Alert Status because of the blue-green algal bloom which occurred in July 2008.

Superfund OTIS AIR NATIONAL GUARD BASE/CAMP EDWARDS information below excerpted online from

<http://www.epa.gov/region1/mmr/resources.html>

http://yosemite.epa.gov/r1/npl_pad.nsf/f52fa5c31fa8f5c885256adc0050b631/EFABE4BC615B22288525692D0061823F?OpenDocument

"The Otis Air National Guard Base/Camp Edwards site covers approximately 22,000 acres and is more commonly known as the Massachusetts Military Reservation (MMR). Although the occupants and property boundaries have changed several times since MMR was established in 1935, the primary mission has always been to provide training and housing to Air Force and/or Army units. A review of past and present operations and waste disposal practices identified numerous potentially contaminated areas, including several areas located on the southern portion of MMR. These contaminated areas are the result of historic chemical/fuel spills, fire training activities, landfills, and drainage structures. Additionally, effluent from the former sewage treatment plant was historically discharged into sand beds where it seeped into the groundwater. In 1984, the U.S. Geological Survey detected contaminants in monitoring wells downgradient of this former plant. In 1983 and 1984, the Air Force detected volatile organic compounds (VOCs) in on-site monitoring wells near the Base Landfill and a Fire Training Area. Monitoring had also detected VOCs in several hundred private wells (all of which are now on municipal water) and in one town well (which is shut down). The EPA has designated the Sagamore Lens underlying MMR as a sole source aquifer under the Safe Drinking Water Act.

Numerous remediation projects addressing both the soil and groundwater contamination at MMR have been implemented since the mid to late 1990's. Approximately 100,000 tons of soil have been treated at MMR, while to date, there are numerous treatment plants in place which treat approximately 18 million gallons a day of contaminated groundwater. All treated groundwater is returned to the aquifer or discharged to surface water.

The groundwater is contaminated with VOCs, including trichloroethene, tetrachloroethylene, ethylene dibromide (EDB), carbon tetrachloride, and dichloroethylene. Ethylene dibromide has been found to be upwelling in two separate locations, outside the MMR property boundaries, within cranberry bogs in Mashpee and Falmouth. People could be at risk if they accidentally drink or come into direct contact with contaminated groundwater. Contaminated groundwater could also pose a threat to the environment within several ponds and streams used for recreational purposes. Soil contaminated with heavy metals, polycyclic aromatic hydrocarbons (PAHs), pesticides, PCBs, and petroleum hydrocarbons has been removed in cleanup actions in 2001-2002. Other principle threats such as contaminants in drainage structures and underground storage tanks have been removed thus eliminating potential future sources of groundwater contamination.

MMR was placed on NPL in 1989; a Federal Facility Agreement (FFA) was signed in 1991 (and subsequently amended in March 2000) governing the Superfund cleanup. Signatories to the FFA include the National Guard Bureau, the Air Force and EPA (Commonwealth of Massachusetts did not sign original FFA, and U.S. Coast Guard was recently removed as a signatory). An Interim Record of Decision (IROD) was signed in September 1995 describing the cleanup decision for seven groundwater plumes; subsequent design issues. Public input required modifications to these cleanup decisions prior to implementation. Final RODs are currently being planned for each of these groundwater plumes.

Twelve groundwater treatment systems are currently in operation on 11 groundwater plumes; combined treatment system rate exceeds 18 million gallons per day. Three recent groundwater RODs call for additional treatment systems on five contaminated plumes; enforceable milestone dates for treatment system start ups are planned for 2005 and 2006. Cleanups at approximately 25 separate source areas have recently been completed. The cleanup included excavation-offsite disposal and soil vapor extraction/biosparging. Site Investigations/Remedial Investigations at several additional source areas are continuing; future disposition of these source areas is uncertain at this time.

Contaminants frequently found in the MMR plumes are volatile organic compounds (VOCs). Examples include solvents used in metal degreasing such as tetrachloroethylene (PCE), trichloroethylene (TCE), and carbon tetra-chloride (CCl₄), as well as fuel constituents and an aviation gasoline additive, ethylene dibromide (EDB)".

Report Recommendations:

Continue to conduct fish toxics monitoring for Hg to evaluate changes and success of TMDL.

According to CH2M HILL (2009), "while the trophic health of the pond improved as the result of the alum treatment and the installation of the geochemical barrier, it was recognized prior to the alum application, however, that the effectiveness of the alum treatment would likely be temporary (e.g., three to five years). It was hoped that the installation of the geochemical barrier would extend the length of time before an additional alum treatment was necessary. The available data suggests that the barrier has been effective, but the decrease in water clarity, and the notably higher TP and ammonium in the tropholytic zone in 2008, suggests that the trophic health of the pond may be beginning to decline. The Ashumet Pond data collected in 2009 will be evaluated to determine if the signs of decreasing water quality and clarity observed in 2008 represent the beginning of a trend toward poorer water quality conditions. If the 2009 data further indicate that the pond is beginning to decline, further remedial actions will be evaluated for implementation".

Baumann et al. (2008): "The high prevalence of melanistic lesions on Ashumet Pond brown bullhead, combined with the tumor pathology and genetic damage, implicates chemical carcinogens as one of the causal factors in that lake. Because many of the brown bullhead were large and ages may have been underestimated, chemical exposure contributing to the pathology may have occurred as long ago as the early 1990s. An additional prevalence survey would help to clarify whether the causal factors are still active".

Historical and current Technical Memoranda (TM) produced by the MassDEP Watershed Planning Program are available here: [Water Quality Technical Memoranda | Mass.gov](#) and are organized by major watersheds in Massachusetts. Most of these TMs present the water chemistry and biological sampling results of WPP monitoring surveys. The TMs pertaining primarily to biological information (e.g., benthic macroinvertebrates, periphyton, fish populations) contain biological data and metrics that are currently not reported elsewhere. The data contained in the water quality TMs are also provided on the "Data" page ([Water Quality Monitoring Program Data | Mass.gov](#)). Many of these TMs have helped inform Clean Water Act 305(b) assessment and 303(d) listing decisions. *(Review available technical memoranda and water quality monitoring data at hyperlinks above and add relevant information in Element A.)*

Literature review information:

Water Quality Impairments

Known water quality impairments, as documented in the Massachusetts Department of Environmental Protection (MassDEP) 2016 Massachusetts Integrated List of Waters (MassDEP, 2019), are listed below. Impairment categories from the Integrated List are as follows:

Table A-2: 2016 MA Integrated List of Waters Categories

Integrated List Category	Description
1	Unimpaired and not threatened for all designated uses.
2	Unimpaired for some uses and not assessed for others.
3	Insufficient information to make assessments for any uses.
4	Impaired or threatened for one or more uses, but not requiring calculation of a Total Maximum Daily Load (TMDL), including: 4a: TMDL is completed 4b: Impairment controlled by alternative pollution control requirements 4c: Impairment not caused by a pollutant - TMDL not required
5	Impaired or threatened for one or more uses and requiring preparation of a TMDL.

Table A-3: Water Quality Impairments (MassDEP 2019)

Assessment Unit ID	Waterbody	Integrated List Category	Designated Use	Impairment Cause	Impairment Source
MA96004	Ashumet Pond	5	Fish Consumption	Mercury in Fish Tissue	Atmospheric Deposition - Toxics
MA96004	Ashumet Pond	5	Fish Consumption	Mercury in Fish Tissue	Source Unknown
MA96004	Ashumet Pond	5	Fish, other Aquatic Life and Wildlife	Abnormal Fish Deformities, Erosions, Lesions, Tumo	CERCLA NPL (Superfund) Sites
MA96004	Ashumet Pond	5	Fish, other Aquatic Life and Wildlife	Abnormal Fish Deformities, Erosions, Lesions, Tumo	Contaminated Groundwater
MA96004	Ashumet Pond	5	Fish, other Aquatic Life and Wildlife	Abnormal Fish Deformities, Erosions, Lesions, Tumo	Nps Pollution from Military Base Facilities (Other than Port Facilities)
MA96004	Ashumet Pond	5	Fish, other Aquatic Life and Wildlife	Dissolved Oxygen	CERCLA NPL (Superfund) Sites
MA96004	Ashumet Pond	5	Fish, other Aquatic Life and Wildlife	Dissolved Oxygen	Contaminated Groundwater
MA96004	Ashumet Pond	5	Fish, other Aquatic Life and Wildlife	Dissolved Oxygen	Nps Pollution from Military Base Facilities (Other than Port Facilities)
MA96004	Ashumet Pond	5	Fish, other Aquatic Life and Wildlife	Phosphorus, Total	CERCLA NPL (Superfund) Sites
MA96004	Ashumet Pond	5	Fish, other Aquatic Life and Wildlife	Phosphorus, Total	Contaminated Groundwater
MA96004	Ashumet Pond	5	Fish, other Aquatic Life and Wildlife	Phosphorus, Total	Nps Pollution from Military Base Facilities (Other than Port Facilities)

					Facilities)
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Water Quality Goals

Water quality goals may be established for a variety of purposes, including the following:

- a.) For **water bodies with known impairments**, a [Total Maximum Daily Load](#) (TMDL) is established by MassDEP and the United States Environmental Protection Agency (USEPA) as the maximum amount of the target pollutant that the waterbody can receive and still safely meet water quality standards. If the waterbody has a TMDL for total phosphorus (TP) or total nitrogen (TN), or total suspended solids (TSS), that information is provided below and included as a water quality goal.
- b.) For **water bodies without a TMDL for total phosphorus (TP)**, a default water quality goal for TP is based on target concentrations established in the [Quality Criteria for Water](#) (USEPA, 1986) (also known as the “Gold Book”). The Gold Book states that TP should not exceed 50 ug/L in any stream at the point where it enters any lake or reservoir, nor 25 ug/L within a lake or reservoir. For the purposes of developing WBPs, MassDEP has adopted 50 ug/L as the TP target for all streams at their downstream discharge point, regardless of which type of water body the stream discharges to.
- c.) [Massachusetts Surface Water Quality Standards](#) (314 CMR 4.00, 2013) prescribe the minimum water quality criteria required to sustain a waterbody’s designated uses. Ashumet Pond is a Class 'B' waterbody. The water quality goal for fecal coliform bacteria is based on the Massachusetts Surface Water Quality Standards.

Table A-4: Surface Water Quality Classification by Assessment Unit

Assessment Unit ID	Waterbody	Class
MA96004	Ashumet Pond	B

- d.) **Other water quality goals set by the community** (e.g., protection of high quality waters, in-lake phosphorus concentration goal to reduce recurrence of cyanobacteria blooms, etc.).

Table A-5: Water Quality Goals

Pollutant	Goal	Source
Total Phosphorus (TP)	Total phosphorus should not exceed: --50 ug/L in any stream --25 ug/L within any lake or reservoir	Quality Criteria for Water (USEPA, 1986)
Bacteria	Class B Standards • Public Bathing Beaches: For E. coli, geometric	Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2013)

	<p>mean of 5 most recent samples shall not exceed 126 colonies/ 100 ml and no single sample during the bathing season shall exceed 235 colonies/100 ml. For enterococci, geometric mean of 5 most recent samples shall not exceed 33 colonies/100 ml and no single sample during bathing season shall exceed 61 colonies/100 ml;</p> <ul style="list-style-type: none"> • Other Waters and Non-bathing Season at Bathing Beaches: For E. coli, geometric mean of samples from most recent 6 months shall not exceed 126 colonies/100 ml (typically based on min. 5 samples) and no single sample shall exceed 235 colonies/100 ml. For enterococci, geometric mean of samples from most recent 6 months shall not exceed 33 colonies/100 ml, and no single sample shall exceed 61 colonies/100 ml. 	
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Note: There may be more than one water quality goal for bacteria due to different Massachusetts Surface Water Quality Standards Classes for different Assessment Units within the watershed.

Land Use and Impervious Cover Information

Land use information and impervious cover is presented in the tables and figures below. Land use source data is from 2005 and was obtained from MassGIS (2009b).

Watershed Land Uses

Table A-6: Watershed Land Uses

Land Use	Area (acres)	% of Watershed
Agriculture	28.58	1.7
Commercial	243.91	14.9
Forest	611.7	37.2
High Density Residential	7.65	0.5
Highway	323.49	19.7
Industrial	3.02	0.2
Low Density Residential	35.14	2.1
Medium Density Residential	143.19	8.7
Open Land	30.42	1.9
Water	215.15	13.1

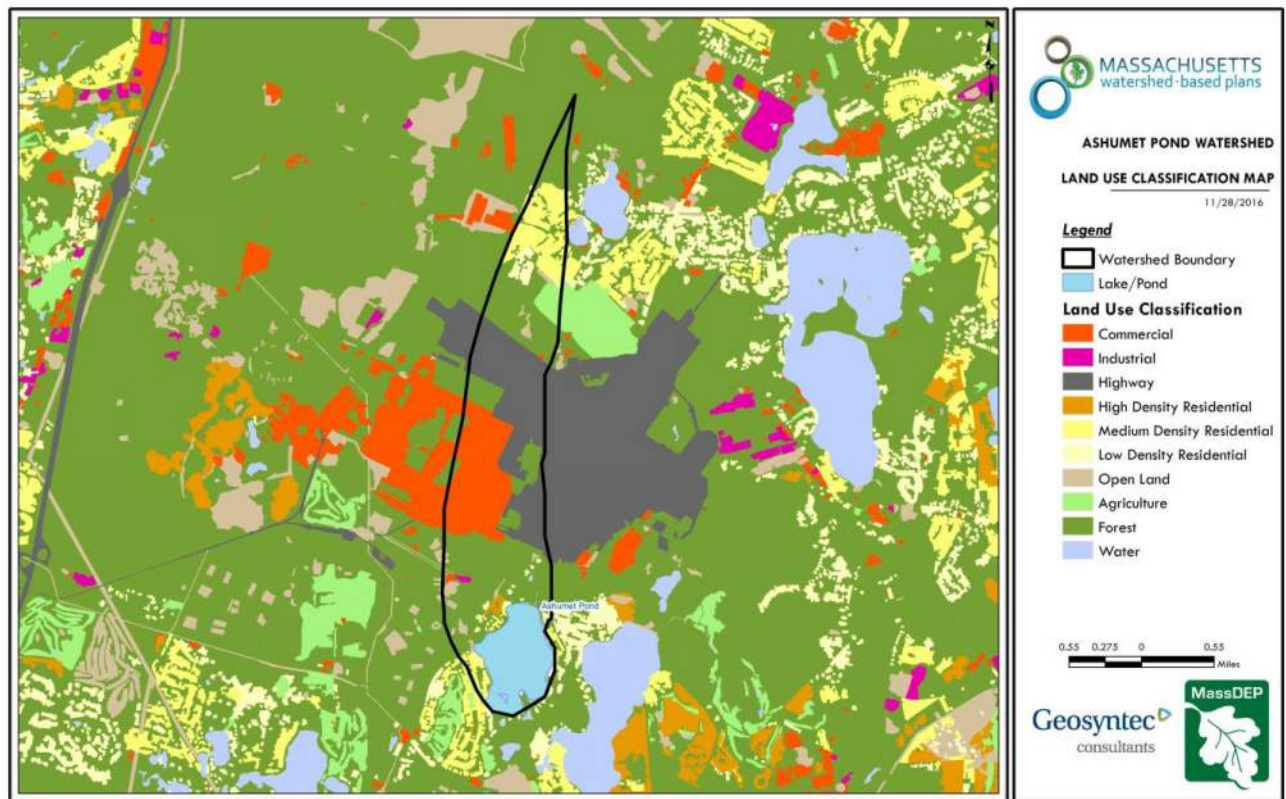


Figure A-2: Watershed Land Use Map (MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

Ctrl + Click on the map to view a full sized image in your web browser.

Watershed Impervious Cover

There is a strong link between impervious land cover and stream water quality. Impervious cover includes land surfaces that prevent the infiltration of water into the ground, such as paved roads and parking lots, roofs, basketball courts, etc.

Impervious areas that are directly connected (DCIA) to receiving waters (via storm sewers, gutters, or other impervious drainage pathways) produce higher runoff volumes and transport stormwater pollutants with greater efficiency than disconnected impervious cover areas which are surrounded by vegetated, pervious land. Runoff volumes from disconnected impervious cover areas are reduced as stormwater infiltrates when it flows across adjacent pervious surfaces.

An estimate of DCIA for the watershed was calculated based on the Sutherland equations. USEPA provides guidance (USEPA, 2010) on the use of the Sutherland equations to predict relative levels of connection and disconnection based on the type of stormwater infrastructure within the **total impervious area (TIA)** of a watershed. Within each subwatershed, the total area of each land use were summed and used to calculate the percent TIA.

Table A-7: TIA and DCIA Values for the Watershed

	Estimated TIA (%)	Estimated DCIA (%)
Ashumet Pond	16.9	16.9

The relationship between TIA and water quality can generally be categorized as shown in **Table A-8** (Schueler et al. 2009):

Table A-8: Relationship between Total Impervious Area (TIA) and water quality (Schueler et al. 2009)

% Watershed Impervious Cover	Stream Water Quality
0-10%	Typically high quality, and typified by stable channels, excellent habitat structure, good to excellent water quality, and diverse communities of both fish and aquatic insects.
11-25%	These streams show clear signs of degradation. Elevated storm flows begin to alter stream geometry, with evident erosion and channel widening. Stream banks become unstable, and physical stream habitat is degraded. Stream water quality shifts into the fair/good category during both storms and dry weather periods. Stream biodiversity declines to fair levels, with most sensitive fish and aquatic insects disappearing from the stream.
26-60%	These streams typically no longer support a diverse stream community. The stream channel becomes highly unstable, and many stream reaches experience severe widening, downcutting, and streambank erosion. Pool and riffle structure needed to sustain fish is diminished or eliminated and the substrate can no longer provide habitat for aquatic insects, or spawning areas for fish. Biological quality is typically poor, dominated by pollution tolerant insects and fish. Water quality is consistently rated as fair to poor, and water recreation is often no longer possible due to the presence of high bacteria levels.
>60%	These streams are typical of “urban drainage”, with most ecological functions greatly impaired or absent, and the stream channel primarily functioning as a conveyance for stormwater flows.

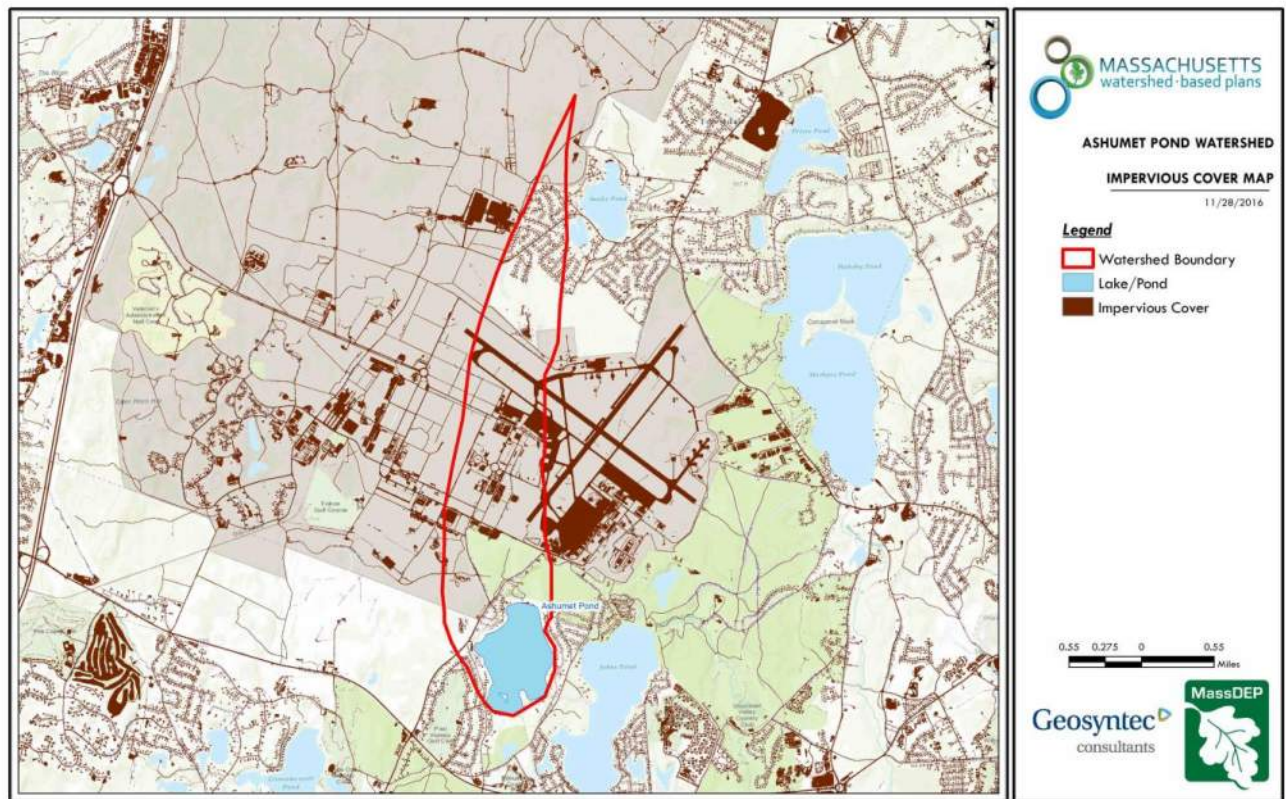


Figure A-3: Watershed Impervious Surface Map (MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

Ctrl + Click on the map to view a full sized image in your web browser.

Land use information:

Pollutant Loading

Geographic Information Systems (GIS) was used for the pollutant loading analysis. The land use data (MassGIS, 2009b) was intersected with impervious cover data (MassGIS, 2009a) and United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soils data (USDA NRCS and MassGIS, 2012) to create a combined land use/land cover grid. The grid was used to sum the total area of each unique land use/land cover type.

The amount of DCIA was estimated using the Sutherland equations as described above and any reduction in impervious area due to disconnection (i.e., the area difference between TIA and DCIA) was assigned to the pervious D soil category for that land use to simulate that some infiltration will likely occur after runoff from disconnected impervious surfaces passes over pervious surfaces.

Pollutant loading for key nonpoint source pollutants in the watershed was estimated by multiplying each land use/cover type area by its pollutant load export rate (PLER) as follows:

$$L_n = A_n * P_n$$

Where L_n = Loading of land use/cover type n (lb/yr); A_n = area of land use/cover type n (acres);

P_n = pollutant load export rate of land use/cover type n (lb/acre/yr)

The PLERs are an estimate of the annual total pollutant load exported via stormwater from a given unit area of a particular land cover type. The PLER values for TN, TP and TSS were obtained from USEPA (USEPA, 2020; UNHSC, 2018, Tetra Tech, 2015) (see values provided in Appendix A). **Table A-9** presents the estimated land-use based TN, TP and TSS pollutant loading in the watershed.

Table A-9: Estimated Pollutant Loading for Key Nonpoint Source Pollutants

Land Use Type	Pollutant Loading ¹		
	Total Phosphorus (TP) (lbs/yr)	Total Nitrogen (TN) (lbs/yr)	Total Suspended Solids (TSS) (tons/yr)
Agriculture	13	76	0.38
Commercial	118	1,007	12.64
Forest	111	633	14.42
High Density Residential	5	34	0.52
Highway	145	1,184	72.60
Industrial	3	22	0.27
Low Density Residential	15	144	2.19
Medium Density Residential	82	610	9.28
Open Land	16	128	3.09
TOTAL	508	3,836	115.40
¹ These estimates do not consider loads from point sources or septic systems.			

Pollutant loading information:

Element B: Determine Pollutant Load Reductions Needed to Achieve Water Quality Goals

Element B of your WBP should:

Determine the pollutant load reductions needed to achieve the water quality goals established in Element A. The water quality goals should incorporate Total Maximum Daily Load (TMDL) goals, when applicable. For impaired water bodies, a TMDL establishes pollutant loading limits as needed to attain water quality standards.



Estimated Pollutant Loads

Table B-1 lists estimated pollutant loads for the following primary nonpoint source (NPS) pollutants: total phosphorus (TP), total nitrogen (TN), total suspended solids (TSS). These estimated loads are based on the pollutant loading analysis presented in Section 4 of Element A.

Water Quality Goals

Water quality goals for primary NPS pollutants are listed in **Table B-1** based on the following:

- TMDL water quality goals (if a TMDL exists for the water body);
- For all water bodies, including impaired waters that have a pathogen TMDL, the water quality goal for bacteria is based on the [Massachusetts Surface Water Quality Standards](#) (314 CMR 4.00, 2013) that apply to the Water Class of the selected water body.
- If the water body does not have a TMDL for TP, a default target TP concentrations is provided which is based on guidance provided by the USEPA in [Quality Criteria for Water \(1986\)](#), also known as the “Gold Book”. Because there are no similar default water quality goals for TN and TSS, goals for these pollutants are provided in **Table B-1** only if a TMDL exists or alternate goal(s) have been optionally established by the WBP author.
- According to the USEPA Gold Book, total phosphorus should not exceed 50 ug/L in any stream at the point where it enters any lake or reservoir. The water quality loading goal was estimated by multiplying this target maximum phosphorus concentration (50 ug/L) by the estimated annual watershed discharge for the selected water body. To estimate the annual watershed discharge, the mean flow was used, which was estimated based on United States Geological Survey (USGS) “Runoff Depth” estimates for Massachusetts (Cohen and Randall, 1998). Cohen and Randall (1998) provide statewide estimates of annual Precipitation (P), Evapotranspiration (ET), and Runoff (R) depths for the northeastern U.S. According to their method, Runoff Depth (R) is defined as all water reaching a discharge point (including surface and groundwater), and is calculated by:

$$P - ET = R$$

A mean Runoff Depth R was determined for the watershed by calculating the average value of R within the watershed boundary. This method includes the following assumptions/limitations:

- a. For lakes and ponds, the estimate of annual TP loading is averaged across the entire watershed. However, a given lake or reservoir may have multiple tributary streams, and each stream may drain land with vastly different characteristics. For example, one tributary may drain a highly developed residential area, while a second tributary may drain primarily forested and undeveloped land. In this case, one tributary may exhibit much higher phosphorus concentrations than the average of all streams in the selected watershed.
- b. The estimated existing loading value only accounts for phosphorus due to stormwater runoff. Other sources of phosphorus may be relevant, particularly phosphorus from on-site wastewater treatment (septic systems) within close proximity to receiving waters. Phosphorus does not typically travel far within an aquifer, but in watersheds that are primarily unsewered, septic systems and other similar groundwater-related sources may contribute a significant load of phosphorus that is not captured in this analysis. As such, it is important to consider the estimated TP loading as "the expected TP loading from stormwater sources."
- c. If the calculated water quality goal is higher than the existing estimated total load; the water quality goal is automatically set equal to the existing estimated total load.

Table B-1: Pollutant Load Reductions Needed

Pollutant	Existing Estimated Total Load	Water Quality Goal	Required Load Reduction
Total Phosphorus	508 lbs/yr	502 lbs/yr	4 lbs/yr
Total Nitrogen	3836 lbs/yr		
Total Suspended Solids	115 ton/yr		
Bacteria	<i>MSWQS for bacteria are concentration standards (e.g., colonies of fecal coliform bacteria per 100 ml), which are difficult to predict based on estimated annual loading.</i>	<p>Class B. <u>Class B Standards</u></p> <ul style="list-style-type: none"> Public Bathing Beaches: For E. coli, geometric mean of 5 most recent samples shall not exceed 126 colonies/ 100 ml and no single sample during the bathing season shall exceed 235 colonies/100 ml. For enterococci, geometric mean of 5 most recent samples shall not exceed 33 colonies/100 ml and no single sample during bathing season shall exceed 61 colonies/100 ml; Other Waters and Non-bathing 	

		<p>Season at Bathing Beaches: For E. coli, geometric mean of samples from most recent 6 months shall not exceed 126 colonies/100 ml (typically based on min. 5 samples) and no single sample shall exceed 235 colonies/100 ml. For enterococci, geometric mean of samples from most recent 6 months shall not exceed 33 colonies/100 ml, and no single sample shall exceed 61 colonies/100 ml.</p>	
--	--	--	--

TMDL Pollutant Load Criteria

No TMDL Pollutant Load Criteria Data Found

Pollutant load reduction information:

Element C: Describe management measures that will be implemented to achieve water quality goals

Element C: A description of the nonpoint source management measures needed to achieve the pollutant load reductions presented in Element B, and a description of the critical areas where those measures will be needed to implement this plan.



BMP Hotspot Map:

The following GIS-based analysis was performed within the watershed to identify high priority parcels for best management practice (BMP) (also referred to as management measure) implementation:

- Each parcel within the watershed was evaluated based on ten different criteria accounting for the parcel ownership, social value, and implementation feasibility (See **Table C-1** for more detail below);
- Each criterion was then given a score from 0 to 5 to represent the priority for BMP implementation based on a metric corresponding to the criterion (e.g., a score of 0 would represent lowest priority for BMP implementation whereas a score of 5 would represent highest priority for BMP implementation);
- A multiplier was also assigned to each criterion, which reflected the weighted importance of the criterion (e.g., a criterion with a multiplier of 3 had greater weight on the overall prioritization of the parcel than a criterion with a multiplier of 1); and
- The weighted scores for all the criteria were then summed for each parcel to calculate a total BMP priority score.

Table C-1 presents the criteria, indicator type, metrics, scores, and multipliers that were used for this analysis. Parcels with total scores above 60 are recommended for further investigation for BMP implementation suitability. **Figure C-1** presents the resulting BMP Hotspot Map for the watershed. The following link includes a Microsoft Excel file with information for all parcels that have a score above 60: [hotspot spreadsheet](#).

This analysis solely evaluated individual parcels for BMP implementation suitability and likelihood for the measures to perform effectively within the parcel's features. This analysis does not quantify the pollutant loading to these parcels from the parcel's upstream catchment. When further evaluating a parcel's BMP implementation suitability and cost-effectiveness of BMP implementation, the existing pollutant loading from the parcel's upstream catchment and potential pollutant load reduction from BMP implementation should be evaluated.

GIS data used for the BMP Hotspot Map analysis included:

- MassGIS (2015a);
- MassGIS (2015b);
- MassGIS (2017a);
- MassGIS (2017b);
- MassGIS (2020);
- MA Department of Revenue Division of Local Services (2016);

- MassGIS (2005);
- ArcGIS (2020);
- MassGIS (2009b);
- MassGIS (2012); and
- ArcGIS (2020b).

Table C-1: Matrix for BMP Hotspot Map GIS-based Analysis

Criteria	Indicator Type	METRICS																											Multiplier	Maximum Potential Score
		Yes or No?	Hydrologic Soil Group				Land Use Type								Water Table Depth		Parcel Area		Parcel Average Slope											
		Yes	No	A or A/D	B or B/D	C or C/D	D	Low and Medium Density Residential	High Density Residential	Commercial	Industrial	Highway	Agriculture	Forest	Open Land	Water	101-200 cm	62-100 cm	31-61 cm	0-30 cm	Greater than 2 acres	Between 1-2 acres	Less than 1 acre	Less than 2%	Between 2% and 15%	Greater than 15%	Less than 50%	Between 51% and 100%		
Is the parcel a school, fire station, police station, town hall or library?	Ownership	5	0																										2	10
Is the parcel's use code in the 900 series (i.e. public property or university)?	Ownership	5	0																										2	10
Is parcel fully or partially in an Environmental Justice Area?	Social	5	0																										2	10
Most favorable Hydrologic Soil Group within Parcel	Implementation Feasibility			5	3	0	0																						2	10
Most favorable Land Use in Parcel	Implementation Feasibility							1	2	4	2	4	5	1	4	X¹													3	15
Most favorable Water Table Depth (deepest in Parcel)	Implementation Feasibility																5	4	3	0									2	10
Parcel Area	Implementation Feasibility																				5	4	1						3	15
Parcel Average Slope	Implementation Feasibility																							3	5	1			1	5
Percent Impervious Area in Parcel	Implementation Feasibility																									5	2.5		1	5
Within 100 ft buffer of receiving water (stream or lake/pond)?	Implementation Feasibility	5	2																										2	10

Note 1: X denotes that parcel is excluded

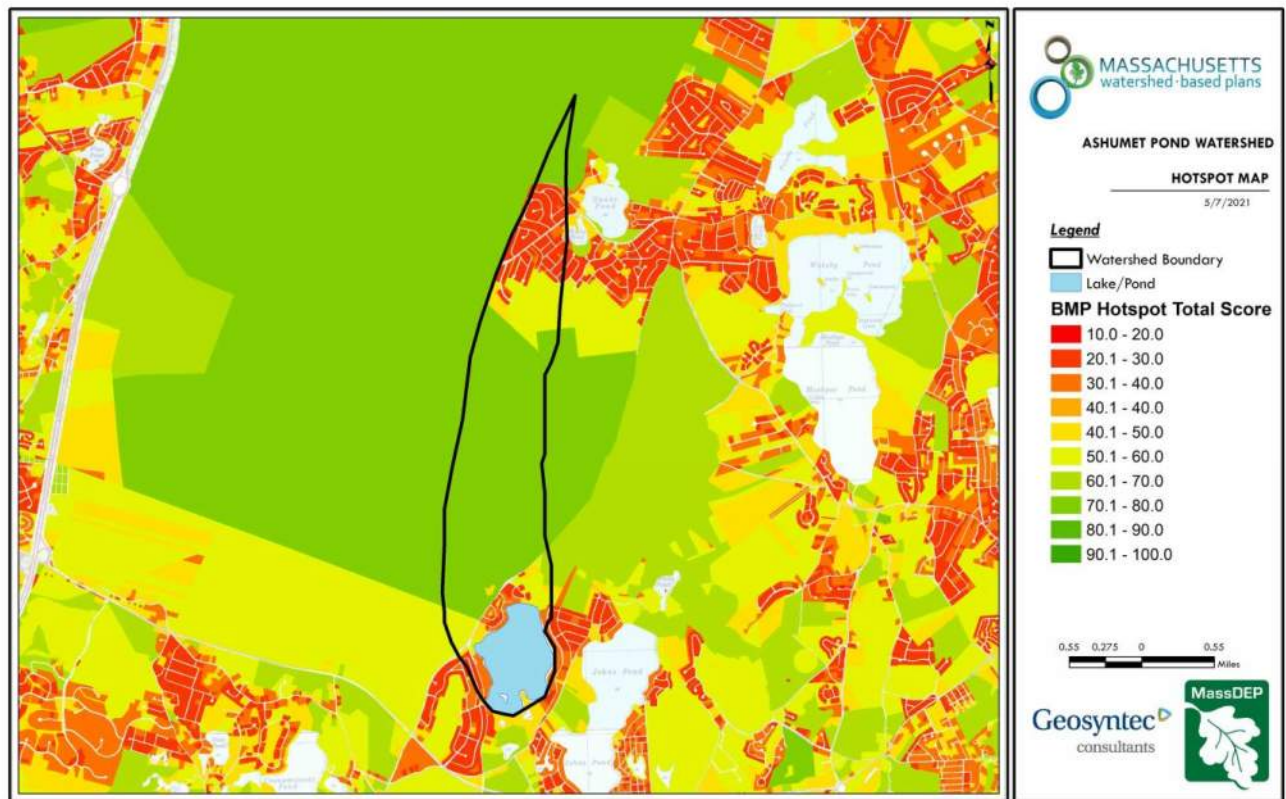


Figure C-1: BMP Hotspot Map (MassGIS (2015a), MassGIS (2015b), MassGIS (2017a), MassGIS (2017b), MassGIS (2020), MA Department of Revenue Division of Local Services (2016), MassGIS (2005), ArcGIS (2020), MassGIS (2009b), MassGIS (2012), ArcGIS (2020b))

Ctrl + Click on the map to view a full sized image in your web browser.

Proposed Management Measures:

Table C-2 presents the proposed management measures as well as the estimated pollutant load reductions and costs. The planning level cost estimates and pollutant load reduction estimates and estimates of BMP footprint were based off information obtained in the following sources and were also adjusted to 2016 values using the Consumer Price Index (CPI) (United States Bureau of Labor Statistics, 2016):

- Geosyntec Consultants, Inc. (2014);
- Geosyntec Consultants, Inc. (2015);
- King and Hagen (2011);
- Leisenring, et al. (2014);
- King and Hagen (2011);
- MassDEP (2016a);
- MassDEP (2016b);
- University of Massachusetts, Amherst (2004);
- USEPA (2020);
- UNHSC (2018);
- Tetra Tech, Inc. (2015);

Table C-2: Proposed Management Measures, Estimated Pollutant Load Reductions and Costs

Structural BMPs	
No Structural BMP Data Found	
Additional BMPs	
No Additional BMP Data Found	

Element D: Identify Technical and Financial Assistance Needed to Implement Plan

Element D: Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan.



Table D-1 presents the funding needed to implement the management measures presented in this watershed plan. The table includes costs for structural and non-structural BMPs, operation and maintenance activities, information/education measures, and monitoring/evaluation activities.

Table D-1: Summary of Funding Needed to Implement the Watershed Plan.

Management Measures	Location	Capital Costs	Operation & Maintenance Costs	Relevant Authorities	Technical Assistance Needed	Funding Needed
Structural and Non-Structural BMPs (from Element C)						
Information/Education (see Element E)						
Monitoring and Evaluation (see Element H/I)						
Total Funding Needed:						
Funding Sources:						

Element E: Public Information and Education

Element E: Information and Education (I/E) component of the watershed plan used to:

1. Enhance public understanding of the project; and
2. Encourage early and continued public participation in selecting, designing, and implementing the NPS management measures that will be implemented.



Step 1: Goals and Objectives

The goals and objectives for the watershed information and education program.

Step 2: Target Audience

Target audiences that need to be reached to meet the goals and objectives identified above.

Step 3: Outreach Products and Distribution

The outreach product(s) and distribution form(s) that will be used for each.

Step 4: Evaluate Information/Education Program

Information and education efforts and how they will be evaluated.

Other Information

Elements F & G: Implementation Schedule and Measurable Milestones

Element F: Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious.

Element G: A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.



Table FG-1: Implementation Schedule and Interim Measurable Milestones

Structural & Non-Structural BMPs
No Data Found
Public Education & Outreach
No Data Found
Monitoring
No Data Found

Scheduling and milestone information:

Elements H & I: Progress Evaluation Criteria and Monitoring

Element H: A set of criteria used to determine (1) if loading reductions are being achieved over time and (2) if progress is being made toward attaining water quality goals. Element H asks "**how will you know if you are making progress towards water quality goals?**" The criteria established to track progress can be direct measurements (e.g., E. coli bacteria concentrations) or indirect indicators of load reduction (e.g., number of beach closings related to bacteria).

Element I: A monitoring component to evaluate the effectiveness of implementation efforts over time, as measured against the Element H criteria. Element I asks "**how, when, and where will you conduct monitoring?**"



The water quality target concentration(s) is presented under Element A of this plan. To achieve this target concentration, the annual loading must be reduced to the amount described in Element B. Element C of this plan describes the various management measures that will be implemented to achieve this targeted load reduction. The evaluation criteria and monitoring program described below will be used to measure the effectiveness of the proposed management measures (described in Element C) in improving the water quality of Gulf Pond.

Indirect Indicators of Load Reduction

Project-Specific Indicators

TMDL Criteria

Direct Measurements

Adaptive Management

References

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Water Quality Assessment Reports

["Cape Cod Coastal Drainage Areas 2004 - 2008 Surface Water Quality Assessment Report"](#)

TMDL

No TMDL Found

Appendices

Appendix A – Pollutant Load Export Rates (PLERs)

Land Use & Cover ¹	PLERs (lb/acre/year)		
	(TP)	(TSS)	(TN)
AGRICULTURE, HSG A	0.45	7.14	2.6
AGRICULTURE, HSG B	0.45	29.4	2.6
AGRICULTURE, HSG C	0.45	59.8	2.6
AGRICULTURE, HSG D	0.45	91	2.6
AGRICULTURE, IMPERVIOUS	1.52	650	11.3
COMMERCIAL, HSG A	0.03	7.14	0.3
COMMERCIAL, HSG B	0.12	29.4	1.2
COMMERCIAL, HSG C	0.21	59.8	2.4
COMMERCIAL, HSG D	0.37	91	3.7
COMMERCIAL, IMPERVIOUS	1.78	377	15.1
FOREST, HSG A	0.12	7.14	0.5
FOREST, HSG B	0.12	29.4	0.5
FOREST, HSG C	0.12	59.8	0.5
FOREST, HSG D	0.12	91	0.5
FOREST, HSG IMPERVIOUS	1.52	650	11.3
HIGH DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.3
HIGH DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.2
HIGH DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.4
HIGH DENSITY RESIDENTIAL, HSG D	0.37	91	3.7
HIGH DENSITY RESIDENTIAL, IMPERVIOUS	2.32	439	14.1
HIGHWAY, HSG A	0.03	7.14	0.3
HIGHWAY, HSG B	0.12	29.4	1.2
HIGHWAY, HSG C	0.21	59.8	2.4
HIGHWAY, HSG D	0.37	91	3.7
HIGHWAY, IMPERVIOUS	1.34	1,480	10.5
INDUSTRIAL, HSG A	0.03	7.14	0.3
INDUSTRIAL, HSG B	0.12	29.4	1.2

INDUSTRIAL, HSG C	0.21	59.8	2.4
INDUSTRIAL, HSG D	0.37	91	3.7
INDUSTRIAL, IMPERVIOUS	1.78	377	15.1
LOW DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.3
LOW DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.2
LOW DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.4
LOW DENSITY RESIDENTIAL, HSG D	0.37	91	3.7
LOW DENSITY RESIDENTIAL, IMPERVIOUS	1.52	439	14.1
MEDIUM DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.3
MEDIUM DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.2
MEDIUM DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.4
MEDIUM DENSITY RESIDENTIAL, HSG D	0.37	91	3.7
MEDIUM DENSITY RESIDENTIAL, IMPERVIOUS	1.96	439	14.1
OPEN LAND, HSG A	0.03	7.14	0.3
OPEN LAND, HSG B	0.12	29.4	1.2
OPEN LAND, HSG C	0.21	59.8	2.4
OPEN LAND, HSG D	0.37	91	3.7
OPEN LAND, IMPERVIOUS	1.52	650	11.3
¹ HSG = Hydrologic Soil Group			



WATERSHED-BASED PLAN

Santuit Pond

December 14, 2021



Prepared For:

Town of Mashpee, MA



Contents

Prior to finalizing your Watershed-based Plan, don't forget to right click on Table of Contents below and select "Update Field" to update the page numbers using the "Update entire table" option

Executive Summary	11
Introduction.....	22
Purpose & Need.....	22
Watershed-Based Plan Outline	22
Project Partners and Stakeholder Input	33
Data Sources.....	33
Summary of Completed Work.....	33
Element A: Identify Causes of Impairment & Pollution Sources	44
General Watershed Information	44
MassDEP Water Quality Assessment Report and TMDL Review.....	66
Water Quality Impairments.....	77
Water Quality Goals	99
Land Use and Impervious Cover Information.....	1111
Pollutant Loading.....	1414
Element B: Determine Pollutant Load Reductions Needed to Achieve Water Quality Goals.....	1717
Estimated Pollutant Loads.....	1717
Water Quality Goals	1717
TMDL Pollutant Load Criteria	1919
Element C: Describe management measures that will be implemented to achieve water quality goals.....	2020
Element D: Identify Technical and Financial Assistance Needed to Implement Plan	2424
Element E: Public Information and Education.....	2525
Elements F & G: Implementation Schedule and Measurable Milestones.....	2626
Elements H & I: Progress Evaluation Criteria and Monitoring	2727
References	2929
Appendices	3232

Executive Summary

Consider adding an executive summary.

Introduction

What is a Watershed-Based Plan?



Purpose & Need

The purpose of a Massachusetts Watershed-Based Plan (WBP) is to organize information about Massachusetts' watersheds and present the information in a format that will enhance the development and implementation of projects that will restore water quality and beneficial uses in the Commonwealth. The Massachusetts WBP follows the United States Environmental Protection Agency's (EPA's) recommended format for "nine-element" watershed plans, as described below.

All states are required to develop WBPs, but not all states have taken the same approach. Most states develop WBPs only for selected watersheds. Massachusetts Department of Environmental Protection's (MassDEP's) approach has been to develop a tool to support statewide development of WBPs so **that good projects in all areas of the state may be eligible for federal watershed implementation grant funds** under [Section 319 of the Clean Water Act](#).

EPA guidelines promote the use of Section 319 funding for developing and implementing WBPs. WBPs are required for all projects implemented with Section 319 funds and are recommended for all watershed projects, whether they are designed to protect unimpaired waters, restore impaired waters, or both.

Watershed-Based Plan Outline

This WBP includes nine elements (a through i) in accordance with EPA Guidelines:

- a) An **identification of the causes and sources** or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this WBP and to achieve any other watershed goals identified in the WBP, as discussed in item (b) immediately below.
- b) An **estimate of the load reductions** expected for the management measures described under paragraph (c) below, recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time.
- c) A **description of the nonpoint source (NPS) management measures** needed to achieve the load reductions estimated under paragraph (b) above as well as to achieve other watershed goals identified in this WBP and an identification (using a map or a description) of the critical areas in which those measures will be needed to implement this plan.
- d) An **estimate of the amounts of technical and financial assistance needed**, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan. As sources of funding, States should consider the use of their Section 319 programs, State Revolving Funds, United States Department of Agriculture's (USDA's) Environmental Quality Incentives Program and Conservation Reserve Program, and other relevant federal, state, local, and private funds that may be available to assist in implementing this plan.

- e) An **information/education component** that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the NPS management measures that will be implemented.
- f) A **schedule for implementing the NPS management measures** identified in this plan that is reasonably expeditious.
- g) A description of **interim, measurable milestones** for determining whether NPS management measures or other control actions are being implemented.
- h) A set of **criteria to determine if loading reductions are being achieved** over time and substantial progress is being made toward attaining water quality standards and, if not, the criteria for determining whether this WBP needs to be revised or, if a NPS total maximum daily load (TMDL) has been established, whether the TMDL needs to be revised.
- i) A **monitoring component** to evaluate the effectiveness of the implementation efforts over time measured against the criteria established under item (h) immediately above.

Project Partners and Stakeholder Input

Consider adding information on the project partners and stakeholder input.

Data Sources

This WBP was developed using the framework and data sources provided by MassDEP's [WBP Tool](#).

Consider adding additional information on data sources used for the WBP Tool.

Summary of Completed Work

Consider adding information on completed nonpoint source best management practice (BMP) projects in the watershed.

Element A: Identify Causes of Impairment & Pollution Sources

Element A: Identify the causes and sources or groups of similar sources that need to be controlled to achieve the necessary pollutant load reductions estimated in the watershed based plan (WBP).



General Watershed Information

Table A-1: General Watershed Information

Watershed Name (Assessment Unit ID):	Santuit Pond (MA96277)
Major Basin:	Cape Cod
Watershed Area (within MA):	1409.7 (ac)
Water Body Size:	164 (ac)

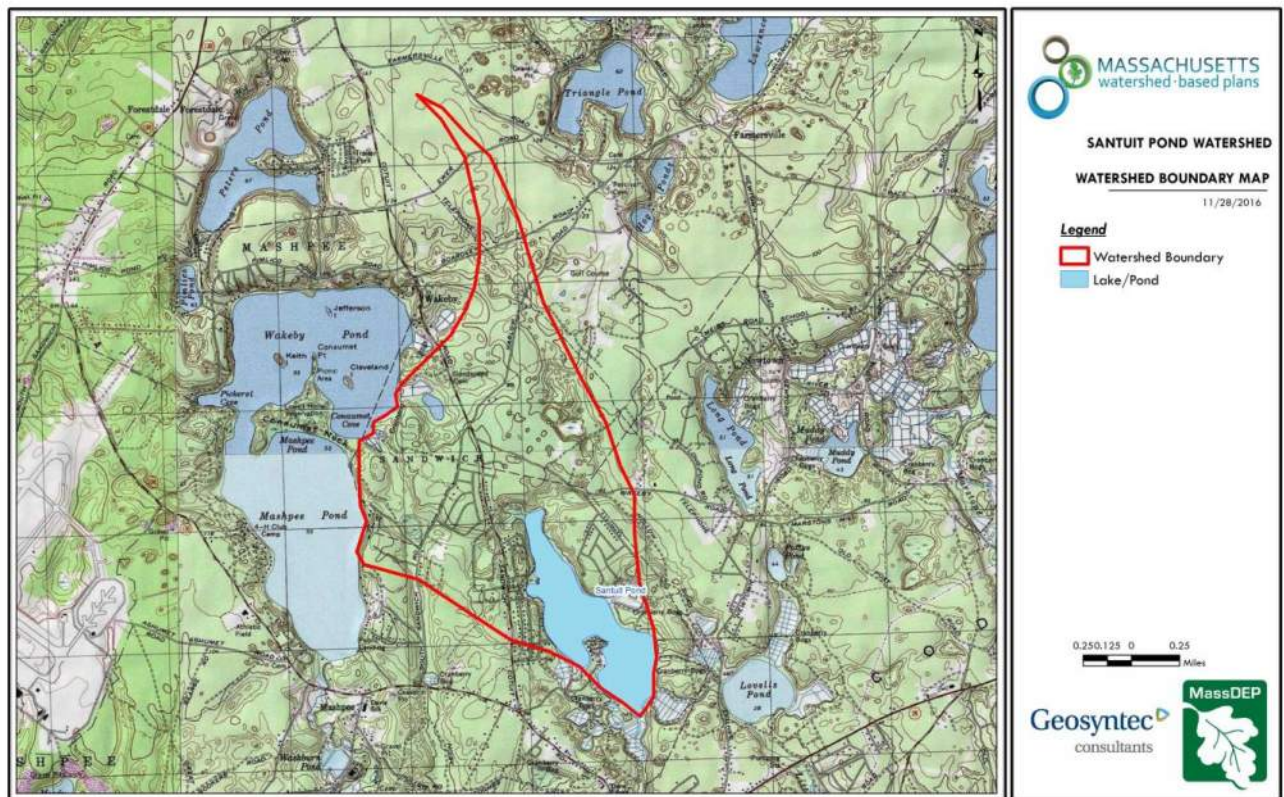


Figure A-1: Watershed Boundary Map (MassGIS, 1999; MassGIS, 2001; USGS, 2016)

Ctrl + Click on the map to view a full sized image in your web browser.

General watershed information:

Water quality in the 170-acre Great Pond has been monitored by state, tribal, and local agencies, as well as academic groups and volunteer monitors. A 2010 Diagnostic Study of Santuit Pond developed a nutrient budget identifying major sources of nutrients to the pond. Like most ponds experiencing cyanoHABs, phosphorus sources are a mix of internal and external sources and addressing both is part of a long-term solution to improving water quality. However, only addressing internal loading is a short-term solution since reduction and/or elimination of external loads is critical to reduce the introduction of additional phosphorus to the water body. While the majority of the existing annual load of phosphorus comes from internal recycling of nutrients, and long-term plans for the pond include dredging, the Diagnostic Study concluded that “addressing the internal load without reducing external loading...will result in re-accumulation of phosphorus in sediments over time and future internal loading.” While the Town has been able to mitigate the influence of internal loading during the summer months through the use of in-pond aeration, rainfall events often trigger a cyanoHAB event. Heavy precipitation events in 2017 and 2019 have been reported to mobilize excess nutrients to the pond via stormwater runoff, overwhelming the Town’s remedial efforts and reactivating the toxic cyanobacteria blooms in this eutrophic system (MVP Workshop Summary of Findings Report, January 2020). This situation is expected to become more frequent due to projected climate change.

MassDEP Water Quality Assessment Report and TMDL Review

The following reports are available:

- [Cape Cod Coastal Drainage Areas 2004 - 2008 Surface Water Quality Assessment Report](#)

The section below summarizes the findings of any available Water Quality Assessment Report and/or TMDL that relate to water quality and water quality impairments. Select excerpts from these documents relating to the water quality in the watershed are included below (note: relevant information is included directly from these documents for informational purposes and has not been modified).

Cape Cod Coastal Drainage Areas 2004 - 2008 Surface Water Quality Assessment Report (MA96277 - Santuit Pond)

Aquatic Life Use

Habitat and Flow

According to Reback et al. (2004) the dam at the outlet Santuit Pond was fitted with a new wooden Denil fishway by DMF in 1997. The ladder functions adequately, however, the dam is leaking badly and, if replaced, should be equipped with a more permanent fish passage structure. The report also mentioned a bog impact unique to the Santuit system is the diversion of thousands of juvenile herring to Lovells Pond due to withdrawals from Santuit Pond. Lovells Pond is essentially land locked and the loss to the Santuit population may be significant. This situation is also correctable with proper screening (Reback et al. 2004). Since the report was written some bogs in this area were abandoned so concerns regarding herring losses are now likely limited (Chase 2010).

Biology

Several studies by the Installation Restoration Program (IRP) at the MMR in the 1990s identified the presence of tumors on brown bullhead in Ashumet Pond (Baumann et al. 2008). The IRP's technical advisory group recommended that future evaluations of the problem include a statistically based prevalence study that sampled more fish from the lakes of concern and similar reference lakes. USGS conducted a study of the prevalence of tumors in brown bullhead in Ashumet Pond and two reference lakes, Santuit and Great Herring Ponds in cooperation with USEPA and MassWildlife. As part of this study brown bullhead were collected from Santuit Pond between May and July 2002. The following findings were reported (Baumann et al. 2008) "Brown bullhead from Santuit Pond also had elevated prevalences of raised lesions and liver neoplasms, although the prevalences of large and multiple lesions were significantly lower than that in Ashumet Pond fish. These differences, along with additional differences in internal pathology, may point to differing causes of the raised lesions in the two lakes".

No non-native macrophytes were noted in Santuit Pond during the 21 September 2004 macrophyte and density mapping survey conducted by DWM biologists (Mass DEP 2004). Moderate to dense algal blooms were observed by DWM personnel in the pond during the three sampline events (one day each in June, July, and August 2004) (Mass DEP 2004).

Water Chemistry

DO and temperature measurements were recorded at the deep hole in the mid pond "narrows" at 15 minute intervals by an unattended multiprobe meter deployed at a depth of 1.2 meters between 1100 hours on 24 August 2004 and 1900 hours on 26 August 2004. DO ranged from 8.4 to 12.1 mg/L and temperature from 22.7 to 25.1°C. A depth profile for DO was also made by DWM personnel on 24 August 2004. There was no evidence of stratification but supersaturation was present (109 to 114%) at all depths (0.5 - 2.0 m) and pH was extremely high (9.1 – 9.2 SU). Water quality sampling at the deep hole of Santuit Pond was also conducted by DWM personnel (one day each in June, July, and August 2004). Chlorophyll a measurements were elevated ranging from 13.5 - 70 mg/m³ on the three sampling dates. Reportable total phosphorus concentrations ranged from 0.08 to 0.35 mg/L. The Secchi disk transparency was highest in June (1.6 m) but was below the bathing beach guideline (i.e., was <1.2 m) on both the July and August sampling dates (0.7 and 0.6 m, respectively).

The Aquatic Life Use is assessed as impaired for Santuit Pond based on the biological indicators of nutrient enrichment/eutrophication including excess algal growth (blooms), elevated chlorophyll a, elevated total phosphorus, and high pH, as well as the prevalence of melanistic lesions on Santuit Pond brown bullhead. Internal nutrient recycling in the pond is one identified source of the enriched conditions. The potential impact to the river herring population is noted as a concern.

Primary and Secondary Contact Recreational and Aesthetics Uses

There are several public bathing beaches along the shoreline of Santuit Pond. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no Primary Contact Recreational Use assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody. Moderate to dense algal blooms were observed by DWM personnel in the pond during the three sampling events (one day each in June, July, and August 2004) (Mass DEP 2004). Secchi disk transparency measurements ranged from 0.6 - 1.6 m on the three dates, with two dates below the bathing beach guidelines (<1.2 m). It should also be noted that there was a cyanobacteria bloom that occurred in Santuit Pond in 2009.

The Primary and Secondary Contact Recreational and Aesthetic Uses are assessed as impaired for Santuit Pond based on the presence of moderate to dense algal blooms and the poor Secchi disk transparency. Internal nutrient recycling in the pond is one identified source of the enriched conditions.

Report Recommendations:

Support improvement of freshwater Beaches Bill data quality and reporting.

Historical and current Technical Memoranda (TM) produced by the MassDEP Watershed Planning Program are available here: [Water Quality Technical Memoranda | Mass.gov](#) and are organized by major watersheds in Massachusetts. Most of these TMs present the water chemistry and biological sampling results of WPP monitoring surveys. The TMs pertaining primarily to biological information (e.g., benthic macroinvertebrates, periphyton, fish populations) contain biological data and metrics that are currently not reported elsewhere. The data contained in the water quality TMs are also provided on the “Data” page ([Water Quality Monitoring Program Data | Mass.gov](#)). Many of these TMs have helped inform Clean Water Act 305(b) assessment and 303(d) listing decisions. *(Review available technical memoranda and water quality monitoring data at hyperlinks above and add relevant information in Element A.)*

Literature review information:

AECOM, Santuit Pond Diagnostic Study, Mashpee MA July 19, 2021

Water Quality Impairments

Known water quality impairments, as documented in the Massachusetts Department of Environmental Protection (MassDEP) 2016 Massachusetts Integrated List of Waters (MassDEP, 2019), are listed below. Impairment categories from the Integrated List are as follows:

Table A-2: 2016 MA Integrated List of Waters Categories

Integrated List Category	Description
1	Unimpaired and not threatened for all designated uses.
2	Unimpaired for some uses and not assessed for others.
3	Insufficient information to make assessments for any uses.

4	Impaired or threatened for one or more uses, but not requiring calculation of a Total Maximum Daily Load (TMDL), including: 4a: TMDL is completed 4b: Impairment controlled by alternative pollution control requirements 4c: Impairment not caused by a pollutant - TMDL not required
5	Impaired or threatened for one or more uses and requiring preparation of a TMDL.

Table A-3: Water Quality Impairments (MassDEP 2019)

Assessment Unit ID	Waterbody	Integrated List Category	Designated Use	Impairment Cause	Impairment Source
MA96277	Santuit Pond	5	Aesthetic	Chlorophyll-a	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Aesthetic	Chlorophyll-a	Source Unknown
MA96277	Santuit Pond	5	Aesthetic	Harmful Algal Blooms	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Aesthetic	Harmful Algal Blooms	Source Unknown
MA96277	Santuit Pond	5	Aesthetic	Phosphorus, Total	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Aesthetic	Phosphorus, Total	Source Unknown
MA96277	Santuit Pond	5	Aesthetic	Transparency / Clarity	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Aesthetic	Transparency / Clarity	Source Unknown
MA96277	Santuit Pond	5	Fish, other Aquatic Life and Wildlife	Abnormal Fish Deformities, Erosions, Lesions, Tumor	Source Unknown
MA96277	Santuit Pond	5	Fish, other Aquatic Life and Wildlife	Chlorophyll-a	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Fish, other Aquatic Life and Wildlife	Chlorophyll-a	Source Unknown
MA96277	Santuit Pond	5	Fish, other Aquatic Life and Wildlife	Harmful Algal Blooms	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Fish, other Aquatic Life and Wildlife	Harmful Algal Blooms	Source Unknown
MA96277	Santuit Pond	5	Fish, other Aquatic Life and Wildlife	Nutrient/Eutrophication Biological Indicators	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Fish, other Aquatic Life and Wildlife	pH, High	Source Unknown
MA96277	Santuit Pond	5	Fish, other Aquatic Life and Wildlife	Phosphorus, Total	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Fish, other Aquatic Life and Wildlife	Phosphorus, Total	Source Unknown
MA96277	Santuit Pond	5	Primary Contact Recreation	Chlorophyll-a	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Primary Contact Recreation	Chlorophyll-a	Source Unknown

MA96277	Santuit Pond	5	Primary Contact Recreation	Harmful Algal Blooms	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Primary Contact Recreation	Harmful Algal Blooms	Source Unknown
MA96277	Santuit Pond	5	Primary Contact Recreation	Phosphorus, Total	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Primary Contact Recreation	Phosphorus, Total	Source Unknown
MA96277	Santuit Pond	5	Primary Contact Recreation	Transparency / Clarity	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Primary Contact Recreation	Transparency / Clarity	Source Unknown
MA96277	Santuit Pond	5	Secondary Contact Recreation	Chlorophyll-a	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Secondary Contact Recreation	Chlorophyll-a	Source Unknown
MA96277	Santuit Pond	5	Secondary Contact Recreation	Harmful Algal Blooms	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Secondary Contact Recreation	Harmful Algal Blooms	Source Unknown
MA96277	Santuit Pond	5	Secondary Contact Recreation	Phosphorus, Total	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Secondary Contact Recreation	Phosphorus, Total	Source Unknown
MA96277	Santuit Pond	5	Secondary Contact Recreation	Transparency / Clarity	Internal Nutrient Recycling
MA96277	Santuit Pond	5	Secondary Contact Recreation	Transparency / Clarity	Source Unknown

Water Quality Goals

Water quality goals may be established for a variety of purposes, including the following:

- a.) For **water bodies with known impairments**, a [Total Maximum Daily Load](#) (TMDL) is established by MassDEP and the United States Environmental Protection Agency (USEPA) as the maximum amount of the target pollutant that the waterbody can receive and still safely meet water quality standards. If the waterbody has a TMDL for total phosphorus (TP) or total nitrogen (TN), or total suspended solids (TSS), that information is provided below and included as a water quality goal.

- b.) For **water bodies without a TMDL for total phosphorus (TP)**, a default water quality goal for TP is based on target concentrations established in the [Quality Criteria for Water](#) (USEPA, 1986) (also known as the “Gold Book”). The Gold Book states that TP should not exceed 50 ug/L in any stream at the point where it enters any lake or reservoir, nor 25 ug/L within a lake or reservoir. For the purposes of developing WBPs, MassDEP has adopted 50 ug/L as the TP target for all streams at their downstream discharge point, regardless of which type of water body the stream discharges to.

c.) [Massachusetts Surface Water Quality Standards](#) (314 CMR 4.00, 2013) prescribe the minimum water quality criteria required to sustain a waterbody's designated uses. Santuit Pond is a Class 'B' waterbody. The water quality goal for fecal coliform bacteria is based on the Massachusetts Surface Water Quality Standards.

Table A-4: Surface Water Quality Classification by Assessment Unit

Assessment Unit ID	Waterbody	Class
MA96277	Santuit Pond	B

d.) **Other water quality goals set by the community** (e.g., protection of high quality waters, in-lake phosphorus concentration goal to reduce recurrence of cyanobacteria blooms, etc.).

Table A-5: Water Quality Goals

Pollutant	Goal	Source
Total Phosphorus (TP)	Total phosphorus should not exceed: --50 ug/L in any stream --25 ug/L within any lake or reservoir	Quality Criteria for Water (USEPA, 1986)
Bacteria	<p><u>Class B Standards</u></p> <ul style="list-style-type: none"> Public Bathing Beaches: For E. coli, geometric mean of 5 most recent samples shall not exceed 126 colonies/ 100 ml and no single sample during the bathing season shall exceed 235 colonies/100 ml. For enterococci, geometric mean of 5 most recent samples shall not exceed 33 colonies/100 ml and no single sample during bathing season shall exceed 61 colonies/100 ml; Other Waters and Non-bathing Season at Bathing Beaches: For E. coli, geometric mean of samples from most recent 6 months shall not exceed 126 colonies/100 ml (typically based on min. 5 samples) and no single sample shall exceed 235 colonies/100 ml. For enterococci, geometric mean of samples from most recent 6 months shall not exceed 33 colonies/100 ml, and no single sample shall exceed 61 colonies/100 ml. 	Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2013)

Note: There may be more than one water quality goal for bacteria due to different Massachusetts Surface Water Quality Standards Classes for different Assessment Units within the watershed.

Land Use and Impervious Cover Information

Land use information and impervious cover is presented in the tables and figures below. Land use source data is from 2005 and was obtained from MassGIS (2009b).

Watershed Land Uses

Table A-6: Watershed Land Uses

Land Use	Area (acres)	% of Watershed
Agriculture	12.72	0.9
Commercial	2.37	0.2
Forest	773.62	54.9
High Density Residential	86.53	6.1
Highway	0	0
Industrial	0	0
Low Density Residential	110.21	7.8
Medium Density Residential	246.35	17.5
Open Land	2.98	0.2
Water	174.96	12.4

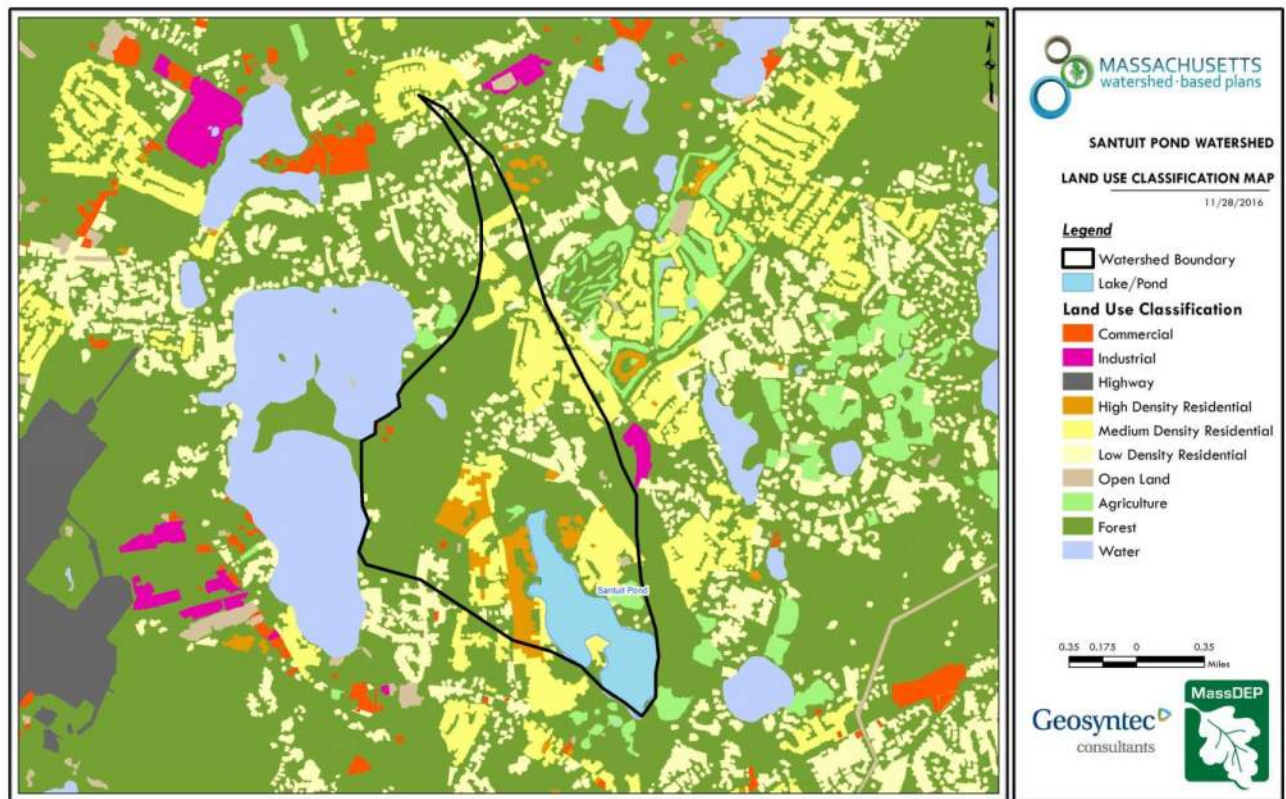


Figure A-2: Watershed Land Use Map (MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

Ctrl + Click on the map to view a full sized image in your web browser.

Watershed Impervious Cover

There is a strong link between impervious land cover and stream water quality. Impervious cover includes land surfaces that prevent the infiltration of water into the ground, such as paved roads and parking lots, roofs, basketball courts, etc.

Impervious areas that are directly connected (DCIA) to receiving waters (via storm sewers, gutters, or other impervious drainage pathways) produce higher runoff volumes and transport stormwater pollutants with greater efficiency than disconnected impervious cover areas which are surrounded by vegetated, pervious land. Runoff volumes from disconnected impervious cover areas are reduced as stormwater infiltrates when it flows across adjacent pervious surfaces.

An estimate of DCIA for the watershed was calculated based on the Sutherland equations. USEPA provides guidance (USEPA, 2010) on the use of the Sutherland equations to predict relative levels of connection and disconnection based on the type of stormwater infrastructure within the **total impervious area (TIA)** of a watershed. Within each subwatershed, the total area of each land use were summed and used to calculate the percent TIA.

Table A-7: TIA and DCIA Values for the Watershed

	Estimated TIA (%)	Estimated DCIA (%)
Santuit Pond	11.3	11.3

The relationship between TIA and water quality can generally be categorized as shown in **Table A-8** (Schueler et al. 2009):

Table A-8: Relationship between Total Impervious Area (TIA) and water quality (Schueler et al. 2009)

% Watershed Impervious Cover	Stream Water Quality
0-10%	Typically high quality, and typified by stable channels, excellent habitat structure, good to excellent water quality, and diverse communities of both fish and aquatic insects.
11-25%	These streams show clear signs of degradation. Elevated storm flows begin to alter stream geometry, with evident erosion and channel widening. Streams banks become unstable, and physical stream habitat is degraded. Stream water quality shifts into the fair/good category during both storms and dry weather periods. Stream biodiversity declines to fair levels, with most sensitive fish and aquatic insects disappearing from the stream.
26-60%	These streams typically no longer support a diverse stream community. The stream channel becomes highly unstable, and many stream reaches experience severe widening, downcutting, and streambank erosion. Pool and riffle structure needed to sustain fish is diminished or eliminated and the substrate can no longer provide habitat for aquatic insects, or spawning areas for fish. Biological quality is typically poor, dominated by pollution tolerant insects and fish. Water quality is consistently rated as fair to poor, and water recreation is often no longer possible due to the presence of high bacteria levels.
>60%	These streams are typical of “urban drainage”, with most ecological functions greatly impaired or absent, and the stream channel primarily functioning as a conveyance for stormwater flows.

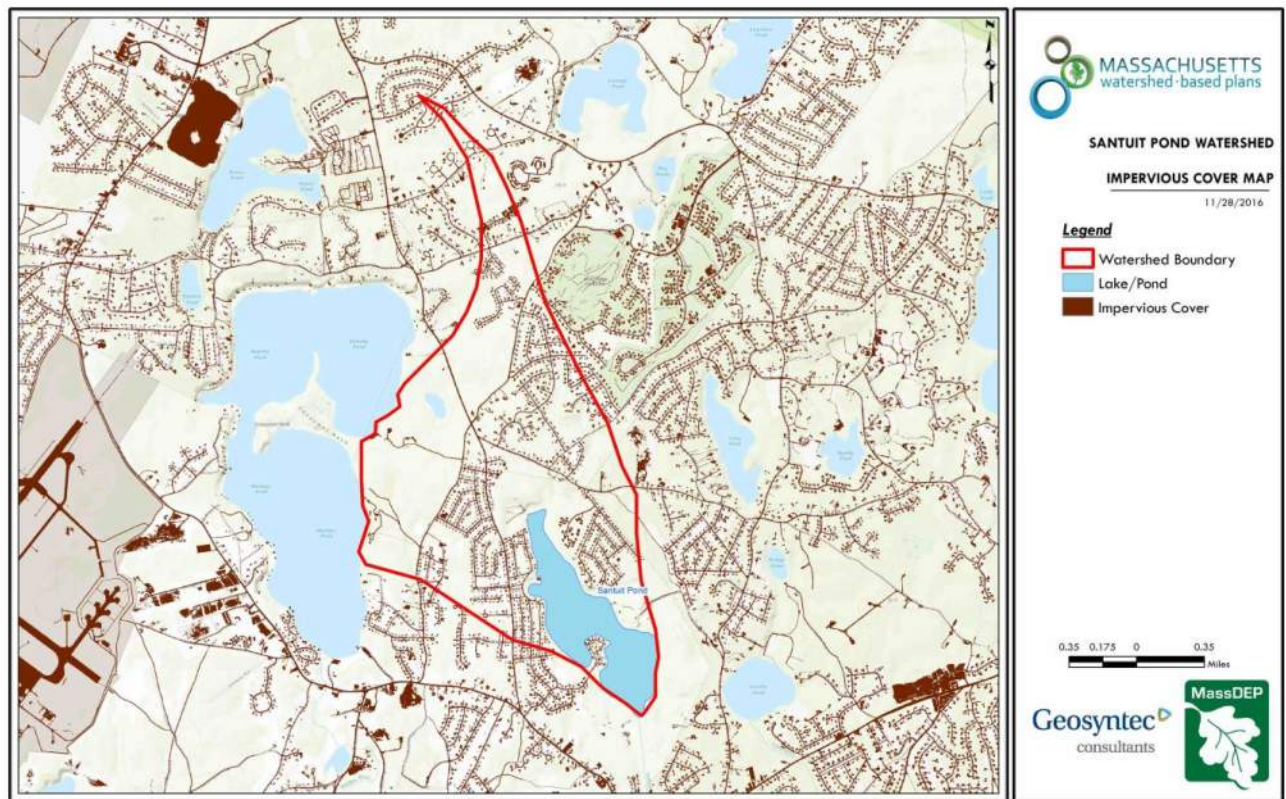


Figure A-3: Watershed Impervious Surface Map (MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

Ctrl + Click on the map to view a full sized image in your web browser.

Land use information:

The municipal stormwater system within the Santuit Pond Watershed consists of ## leaching catch basins and 2 piped outfalls. The outfall locations are located south of Santuit Pond, where groundwater is likely discharging from the Pond.

Pollutant Loading

Geographic Information Systems (GIS) was used for the pollutant loading analysis. The land use data (MassGIS, 2009b) was intersected with impervious cover data (MassGIS, 2009a) and United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soils data (USDA NRCS and MassGIS, 2012) to create a combined land use/land cover grid. The grid was used to sum the total area of each unique land use/land cover type.

The amount of DCIA was estimated using the Sutherland equations as described above and any reduction in impervious area due to disconnection (i.e., the area difference between TIA and DCIA) was assigned to the pervious D soil category for that land use to simulate that some infiltration will likely occur after runoff from disconnected impervious surfaces passes over pervious surfaces.

Pollutant loading for key nonpoint source pollutants in the watershed was estimated by multiplying each land use/cover type area by its pollutant load export rate (PLER) as follows:

$$L_n = A_n * P_n$$

Where L_n = Loading of land use/cover type n (lb/yr); A_n = area of land use/cover type n (acres);

P_n = pollutant load export rate of land use/cover type n (lb/acre/yr)

The PLERs are an estimate of the annual total pollutant load exported via stormwater from a given unit area of a particular land cover type. The PLER values for TN, TP and TSS were obtained from USEPA (USEPA, 2020; UNHSC, 2018, Tetra Tech, 2015) (see values provided in Appendix A). **Table A-9** presents the estimated land-use based TN, TP and TSS pollutant loading in the watershed.

Table A-9: Estimated Pollutant Loading for Key Nonpoint Source Pollutants

Land Use Type	Pollutant Loading ¹		
	Total Phosphorus (TP) (lbs/yr)	Total Nitrogen (TN) (lbs/yr)	Total Suspended Solids (TSS) (tons/yr)
Agriculture	6	37	0.51
Commercial	2	16	0.20
Forest	122	659	14.24
High Density Residential	60	377	5.81
Highway	0	0	0.00
Industrial	0	0	0.00
Low Density Residential	45	421	6.38
Medium Density Residential	138	1,020	15.64
Open Land	1	7	0.18
TOTAL	374	2,538	42.95
¹ These estimates do not consider loads from point sources or septic systems.			

Pollutant loading information:

According to the Mashpee Board of Health, there were 121 septic systems within 300 feet of Santuit Pond, nine of which were cesspools. There were 56 septic systems within 100 feet of Santuit Pond, seven of which were cesspools. Out of the 121 total properties, 60 properties had their system pumped in the last 10 years. Of those 60 properties 43 systems were pumped in the last 5 years.

Element B: Determine Pollutant Load Reductions Needed to Achieve Water Quality Goals

Element B of your WBP should:

Determine the pollutant load reductions needed to achieve the water quality goals established in Element A. The water quality goals should incorporate Total Maximum Daily Load (TMDL) goals, when applicable. For impaired water bodies, a TMDL establishes pollutant loading limits as needed to attain water quality standards.



Estimated Pollutant Loads

Table B-1 lists estimated pollutant loads for the following primary nonpoint source (NPS) pollutants: total phosphorus (TP), total nitrogen (TN), total suspended solids (TSS). These estimated loads are based on the pollutant loading analysis presented in Section 4 of Element A.

Water Quality Goals

Water quality goals for primary NPS pollutants are listed in **Table B-1** based on the following:

- TMDL water quality goals (if a TMDL exists for the water body);
- For all water bodies, including impaired waters that have a pathogen TMDL, the water quality goal for bacteria is based on the [Massachusetts Surface Water Quality Standards](#) (314 CMR 4.00, 2013) that apply to the Water Class of the selected water body.
- If the water body does not have a TMDL for TP, a default target TP concentrations is provided which is based on guidance provided by the USEPA in [Quality Criteria for Water \(1986\)](#), also known as the “Gold Book”. Because there are no similar default water quality goals for TN and TSS, goals for these pollutants are provided in **Table B-1** only if a TMDL exists or alternate goal(s) have been optionally established by the WBP author.
- According to the USEPA Gold Book, total phosphorus should not exceed 50 ug/L in any stream at the point where it enters any lake or reservoir. The water quality loading goal was estimated by multiplying this target maximum phosphorus concentration (50 ug/L) by the estimated annual watershed discharge for the selected water body. To estimate the annual watershed discharge, the mean flow was used, which was estimated based on United States Geological Survey (USGS) “Runoff Depth” estimates for Massachusetts (Cohen and Randall, 1998). Cohen and Randall (1998) provide statewide estimates of annual Precipitation (P), Evapotranspiration (ET), and Runoff (R) depths for the northeastern U.S. According to their method, Runoff Depth (R) is defined as all water reaching a discharge point (including surface and groundwater), and is calculated by:

$$P - ET = R$$

A mean Runoff Depth R was determined for the watershed by calculating the average value of R within the watershed boundary. This method includes the following assumptions/limitations:

- a. For lakes and ponds, the estimate of annual TP loading is averaged across the entire watershed. However, a given lake or reservoir may have multiple tributary streams, and each stream may drain land with vastly different characteristics. For example, one tributary may drain a highly developed residential area, while a second tributary may drain primarily forested and undeveloped land. In this case, one tributary may exhibit much higher phosphorus concentrations than the average of all streams in the selected watershed.
- b. The estimated existing loading value only accounts for phosphorus due to stormwater runoff. Other sources of phosphorus may be relevant, particularly phosphorus from on-site wastewater treatment (septic systems) within close proximity to receiving waters. Phosphorus does not typically travel far within an aquifer, but in watersheds that are primarily unsewered, septic systems and other similar groundwater-related sources may contribute a significant load of phosphorus that is not captured in this analysis. As such, it is important to consider the estimated TP loading as "the expected TP loading from stormwater sources."
- c. If the calculated water quality goal is higher than the existing estimated total load; the water quality goal is automatically set equal to the existing estimated total load.

Table B-1: Pollutant Load Reductions Needed

Pollutant	Existing Estimated Total Load	Water Quality Goal	Required Load Reduction
Total Phosphorus	374 lbs/yr	374 lbs/yr <i>(warning: the calculated water quality goal is higher than the existing estimated total load; in this situation the water quality goal is set equal to the current estimated load.)</i>	0 lbs/yr
Total Nitrogen	2538 lbs/yr		
Total Suspended Solids	43 ton/yr		
Bacteria	<i>MSWQS for bacteria are concentration standards (e.g., colonies of fecal coliform bacteria per 100 ml), which are difficult to predict based on estimated annual loading.</i>	Class B. <u>Class B Standards</u> <ul style="list-style-type: none"> Public Bathing Beaches: For E. coli, geometric mean of 5 most recent samples shall not exceed 126 colonies/ 100 ml and no single sample during the bathing season shall exceed 235 colonies/100 ml. For enterococci, geometric mean 	

		<p>of 5 most recent samples shall not exceed 33 colonies/100 ml and no single sample during bathing season shall exceed 61 colonies/100 ml;</p> <ul style="list-style-type: none"> • Other Waters and Non-bathing Season at Bathing Beaches: For E. coli, geometric mean of samples from most recent 6 months shall not exceed 126 colonies/100 ml (typically based on min. 5 samples) and no single sample shall exceed 235 colonies/100 ml. For enterococci, geometric mean of samples from most recent 6 months shall not exceed 33 colonies/100 ml, and no single sample shall exceed 61 colonies/100 ml. 	
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TMDL Pollutant Load Criteria

No TMDL Pollutant Load Criteria Data Found

Pollutant load reduction information:

Element C: Describe management measures that will be implemented to achieve water quality goals

Element C: A description of the nonpoint source management measures needed to achieve the pollutant load reductions presented in Element B, and a description of the critical areas where those measures will be needed to implement this plan.



BMP Hotspot Map:

The following GIS-based analysis was performed within the watershed to identify high priority parcels for best management practice (BMP) (also referred to as management measure) implementation:

- Each parcel within the watershed was evaluated based on ten different criteria accounting for the parcel ownership, social value, and implementation feasibility (See **Table C-1** for more detail below);
- Each criterion was then given a score from 0 to 5 to represent the priority for BMP implementation based on a metric corresponding to the criterion (e.g., a score of 0 would represent lowest priority for BMP implementation whereas a score of 5 would represent highest priority for BMP implementation);
- A multiplier was also assigned to each criterion, which reflected the weighted importance of the criterion (e.g., a criterion with a multiplier of 3 had greater weight on the overall prioritization of the parcel than a criterion with a multiplier of 1); and
- The weighted scores for all the criteria were then summed for each parcel to calculate a total BMP priority score.

Table C-1 presents the criteria, indicator type, metrics, scores, and multipliers that were used for this analysis. Parcels with total scores above 60 are recommended for further investigation for BMP implementation suitability. **Figure C-1** presents the resulting BMP Hotspot Map for the watershed. The following link includes a Microsoft Excel file with information for all parcels that have a score above 60: [hotspot spreadsheet](#).

This analysis solely evaluated individual parcels for BMP implementation suitability and likelihood for the measures to perform effectively within the parcel's features. This analysis does not quantify the pollutant loading to these parcels from the parcel's upstream catchment. When further evaluating a parcel's BMP implementation suitability and cost-effectiveness of BMP implementation, the existing pollutant loading from the parcel's upstream catchment and potential pollutant load reduction from BMP implementation should be evaluated.

GIS data used for the BMP Hotspot Map analysis included:

- MassGIS (2015a);
- MassGIS (2015b);
- MassGIS (2017a);
- MassGIS (2017b);
- MassGIS (2020);
- MA Department of Revenue Division of Local Services (2016);

- MassGIS (2005);
- ArcGIS (2020);
- MassGIS (2009b);
- MassGIS (2012); and
- ArcGIS (2020b).

Table C-1: Matrix for BMP Hotspot Map GIS-based Analysis

Criteria	Indicator Type	METRICS																									Multiplier	Maximum Potential Score		
		Yes or No?	Hydrologic Soil Group				Land Use Type								Water Table Depth		Parcel Area		Parcel Average Slope											
		Yes	No	A or A/D	B or B/D	C or C/D	D	Low and Medium Density Residential	High Density Residential	Commercial	Industrial	Highway	Agriculture	Forest	Open Land	Water	101-200 cm	62-100 cm	31-61 cm	0-30 cm	Greater than 2 acres	Between 1-2 acres	Less than 1 acre	Less than 2%	Between 2% and 15%	Greater than 15%			Less than 50%	Between 51% and 100%
Is the parcel a school, fire station, police station, town hall or library?	Ownership	5	0																										2	10
Is the parcel's use code in the 900 series (i.e. public property or university)?	Ownership	5	0																										2	10
Is parcel fully or partially in an Environmental Justice Area?	Social	5	0																										2	10
Most favorable Hydrologic Soil Group within Parcel	Implementation Feasibility			5	3	0	0																						2	10
Most favorable Land Use in Parcel	Implementation Feasibility							1	2	4	2	4	5	1	4	X ¹													3	15
Most favorable Water Table Depth (deepest in Parcel)	Implementation Feasibility																5	4	3	0									2	10
Parcel Area	Implementation Feasibility																				5	4	1						3	15
Parcel Average Slope	Implementation Feasibility																							3	5	1			1	5
Percent Impervious Area in Parcel	Implementation Feasibility																									5	2.5		1	5
Within 100 ft buffer of receiving water (stream or lake/pond)?	Implementation Feasibility	5	2																										2	10

Note 1: X denotes that parcel is excluded

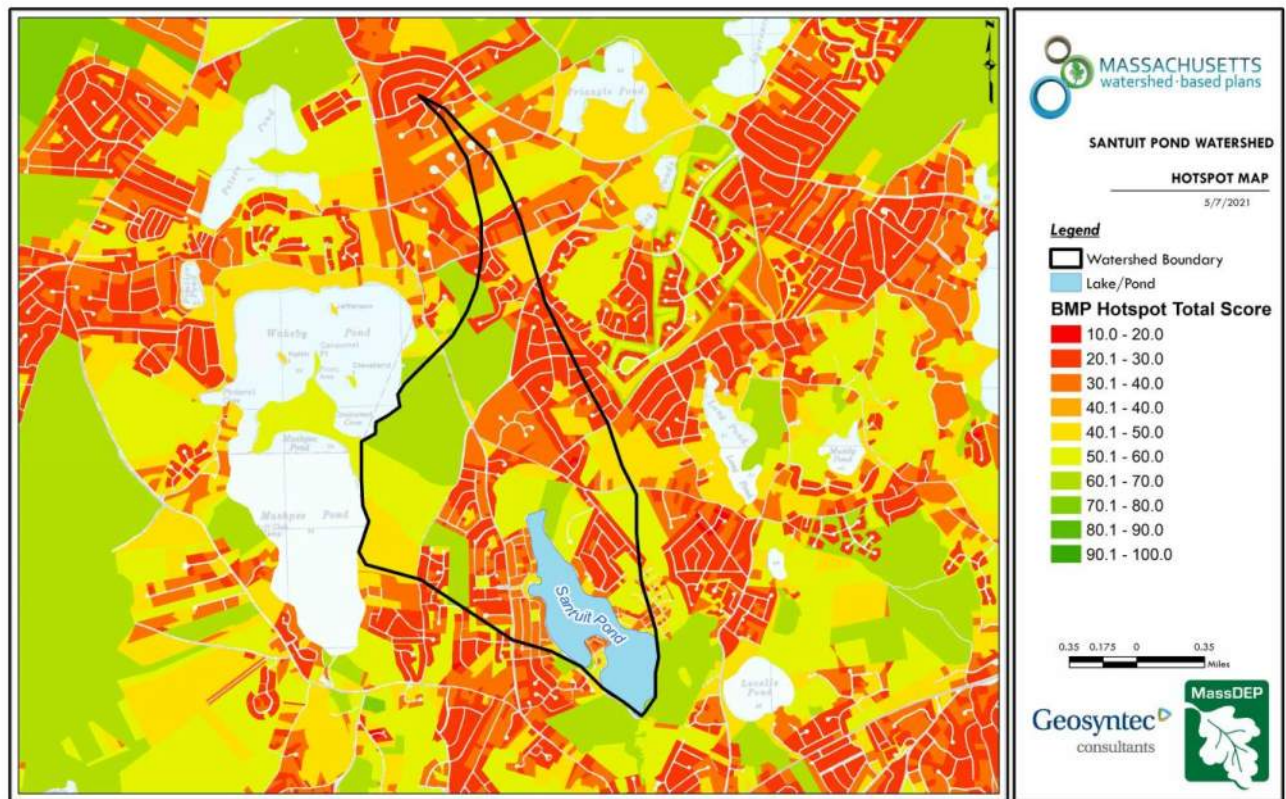


Figure C-1: BMP Hotspot Map (MassGIS (2015a), MassGIS (2015b), MassGIS (2017a), MassGIS (2017b), MassGIS (2020), MA Department of Revenue Division of Local Services (2016), MassGIS (2005), ArcGIS (2020), MassGIS (2009b), MassGIS (2012), ArcGIS (2020b))

Ctrl + Click on the map to view a full sized image in your web browser.

Proposed Management Measures:

Table C-2 presents the proposed management measures as well as the estimated pollutant load reductions and costs. The planning level cost estimates and pollutant load reduction estimates and estimates of BMP footprint were based off information obtained in the following sources and were also adjusted to 2016 values using the Consumer Price Index (CPI) (United States Bureau of Labor Statistics, 2016):

- Geosyntec Consultants, Inc. (2014);
- Geosyntec Consultants, Inc. (2015);
- King and Hagen (2011);
- Leisenring, et al. (2014);
- King and Hagen (2011);
- MassDEP (2016a);
- MassDEP (2016b);
- University of Massachusetts, Amherst (2004);
- USEPA (2020);
- UNHSC (2018);
- Tetra Tech, Inc. (2015);

Table C-2: Proposed Management Measures, Estimated Pollutant Load Reductions and Costs

Structural BMPs	
No Structural BMP Data Found	
Additional BMPs	
No Additional BMP Data Found	

Element D: Identify Technical and Financial Assistance Needed to Implement Plan

Element D: Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan.



Table D-1 presents the funding needed to implement the management measures presented in this watershed plan. The table includes costs for structural and non-structural BMPs, operation and maintenance activities, information/education measures, and monitoring/evaluation activities.

Table D-1: Summary of Funding Needed to Implement the Watershed Plan.

Management Measures	Location	Capital Costs	Operation & Maintenance Costs	Relevant Authorities	Technical Assistance Needed	Funding Needed
Structural and Non-Structural BMPs (from Element C)						
Information/Education (see Element E)						
Monitoring and Evaluation (see Element H/I)						
Total Funding Needed:						
Funding Sources:						

Element E: Public Information and Education

Element E: Information and Education (I/E) component of the watershed plan used to:

1. Enhance public understanding of the project; and
2. Encourage early and continued public participation in selecting, designing, and implementing the NPS management measures that will be implemented.



Step 1: Goals and Objectives

The goals and objectives for the watershed information and education program.

Step 2: Target Audience

Target audiences that need to be reached to meet the goals and objectives identified above.

Step 3: Outreach Products and Distribution

The outreach product(s) and distribution form(s) that will be used for each.

Step 4: Evaluate Information/Education Program

Information and education efforts and how they will be evaluated.

Other Information

Elements F & G: Implementation Schedule and Measurable Milestones

Element F: Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious.

Element G: A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.



Table FG-1: Implementation Schedule and Interim Measurable Milestones

Structural & Non-Structural BMPs
No Data Found
Public Education & Outreach
No Data Found
Monitoring
No Data Found

Scheduling and milestone information:

Elements H & I: Progress Evaluation Criteria and Monitoring

Element H: A set of criteria used to determine (1) if loading reductions are being achieved over time and (2) if progress is being made toward attaining water quality goals. Element H asks "**how will you know if you are making progress towards water quality goals?**" The criteria established to track progress can be direct measurements (e.g., E. coli bacteria concentrations) or indirect indicators of load reduction (e.g., number of beach closings related to bacteria).

Element I: A monitoring component to evaluate the effectiveness of implementation efforts over time, as measured against the Element H criteria. Element I asks "**how, when, and where will you conduct monitoring?**"



The water quality target concentration(s) is presented under Element A of this plan. To achieve this target concentration, the annual loading must be reduced to the amount described in Element B. Element C of this plan describes the various management measures that will be implemented to achieve this targeted load reduction. The evaluation criteria and monitoring program described below will be used to measure the effectiveness of the proposed management measures (described in Element C) in improving the water quality of Gulf Pond.

Indirect Indicators of Load Reduction

Project-Specific Indicators

TMDL Criteria

Direct Measurements

Adaptive Management

References

- 314 CMR 4.00 (2013). "[Division of Water Pollution Control, Massachusetts Surface Water Quality Standards](#)"
- ArcGIS (2020a). "[USA Soils Hydrologic Group](#)" Imagery Layer
- ArcGIS (2020b). "[USA Soils Water Table Depth](#)" Imagery Layer
- Cohen, A. J.; Randall, A.D. (1998). "[Mean annual runoff, precipitation, and evapotranspiration in the glaciated northeastern United States, 1951-80.](#)" Prepared for United States Geological Survey, Reston VA.
- Geosyntec Consultants, Inc. (2014). "*Least Cost Mix of BMPs Analysis, Evaluation of Stormwater Standards Contract No. EP-C-08-002, Task Order 2010-12.*" Prepared for Jesse W. Pritts, Task Order Manager, U.S. Environmental Protection Agency
- Geosyntec Consultants, Inc. (2015). "*Appendix B: Pollutant Load Modeling Report, Water Integration for the Squamscott-Exeter (WISE) River Watershed.*"
- King, D. and Hagan, P. (2011). "*Costs of Stormwater Management Practices in Maryland Counties.*" University of Maryland Center for Environmental Science Chesapeake Biological Laboratory. October 11, 2011.
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- MA Department of Revenue Division of Local Services (2016). "[Property Type Classification Codes, Non-arm's Length Codes and Sales Report Spreadsheet Specifications](#)" June 2016
- MassDEP (2012). "[Massachusetts Year 2012 Integrated List of Waters Final Listing of Massachusetts' Waters Pursuant to Sections 305\(b\), 314 and 303\(d\) of the Clean Water Act](#)"
- MassDEP (2016a). "[Massachusetts Clean Water Toolkit](#)"
- MassDEP (2016b). "[Massachusetts Stormwater Handbook, Vol. 2, Ch. 2, Stormwater Best Management Practices](#)"
- MassDEP (2019). "[Massachusetts Year 2016 Integrated List of Waters Final Listing of Massachusetts' Waters Pursuant to Sections 305\(b\), 314 and 303\(d\) of the Clean Water Act](#)" December 2019.
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- MassGIS (2001). "[USGS Topographic Quadrangle Images](#)" Image
- MassGIS (2005). "[Elevation \(Topographic\) Data \(2005\)](#)" Digital Elevation Model
- MassGIS (2007). "[Drainage Sub-basins](#)" Shapefile

MassGIS (2009a). "[Impervious Surface](#)" Image

MassGIS (2009b). "[Land Use \(2005\)](#)" Shapefile

MassGIS (2012). "[2010 U.S. Census Environmental Justice Populations](#)" Shapefile

MassGIS (2013). "[MassDEP 2012 Integrated List of Waters \(305\(b\)/303\(d\)\)](#)" Shapefile

MassGIS (2015a). "[Fire Stations](#)" Shapefile

MassGIS (2015b). "[Police Stations](#)" Shapefile

MassGIS (2017a). "[Town and City Halls](#)" Layer

MassGIS (2017b). "[Libraries](#)" Layer

MassGIS (2020). "[Massachusetts Schools \(Pre-K through High School\)](#)" Datalayer

MassGIS (2021). "[Standardized Assessors' Parcels](#)" Mapping Data Set

Schueler, T.R., Fraley-McNeal, L, and K. Cappiella (2009). "*Is impervious cover still important? Review of recent research*" Journal of Hydrologic Engineering 14 (4): 309-315.

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United States Bureau of Labor Statistics (2016). "[Consumer Price Index](#)"

United States Geological Survey (2016). "*National Hydrography Dataset, High Resolution Shapefile*"

University of Massachusetts, Amherst (2004). "*Stormwater Technologies Clearinghouse*"

University of New Hampshire Stormwater Center (UNHSC) (2018). "*Stormwater Control Measure Nomographs with pollutant removal and design cost estimates.*" Available at: Stormwater Tools in New England | US EPA.

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USEPA (1986). "*Quality Criteria for Water (Gold Book)*" EPA 440/5-86-001. Office of Water, Regulations and Standards. Washington, D.C.

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USEPA. (2020). "General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts (as modified); Appendix F – Requirements for MA Small MS4s Subject to Approved TMDLs." 7 December 2020.

Water Quality Assessment Reports

["Cape Cod Coastal Drainage Areas 2004 - 2008 Surface Water Quality Assessment Report"](#)

TMDL

No TMDL Found

Appendices

Appendix A – Pollutant Load Export Rates (PLERs)

Land Use & Cover ¹	PLERs (lb/acre/year)		
	(TP)	(TSS)	(TN)
AGRICULTURE, HSG A	0.45	7.14	2.6
AGRICULTURE, HSG B	0.45	29.4	2.6
AGRICULTURE, HSG C	0.45	59.8	2.6
AGRICULTURE, HSG D	0.45	91	2.6
AGRICULTURE, IMPERVIOUS	1.52	650	11.3
COMMERCIAL, HSG A	0.03	7.14	0.3
COMMERCIAL, HSG B	0.12	29.4	1.2
COMMERCIAL, HSG C	0.21	59.8	2.4
COMMERCIAL, HSG D	0.37	91	3.7
COMMERCIAL, IMPERVIOUS	1.78	377	15.1
FOREST, HSG A	0.12	7.14	0.5
FOREST, HSG B	0.12	29.4	0.5
FOREST, HSG C	0.12	59.8	0.5
FOREST, HSG D	0.12	91	0.5
FOREST, HSG IMPERVIOUS	1.52	650	11.3
HIGH DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.3
HIGH DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.2
HIGH DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.4
HIGH DENSITY RESIDENTIAL, HSG D	0.37	91	3.7
HIGH DENSITY RESIDENTIAL, IMPERVIOUS	2.32	439	14.1
HIGHWAY, HSG A	0.03	7.14	0.3
HIGHWAY, HSG B	0.12	29.4	1.2
HIGHWAY, HSG C	0.21	59.8	2.4
HIGHWAY, HSG D	0.37	91	3.7
HIGHWAY, IMPERVIOUS	1.34	1,480	10.5
INDUSTRIAL, HSG A	0.03	7.14	0.3
INDUSTRIAL, HSG B	0.12	29.4	1.2

INDUSTRIAL, HSG C	0.21	59.8	2.4
INDUSTRIAL, HSG D	0.37	91	3.7
INDUSTRIAL, IMPERVIOUS	1.78	377	15.1
LOW DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.3
LOW DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.2
LOW DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.4
LOW DENSITY RESIDENTIAL, HSG D	0.37	91	3.7
LOW DENSITY RESIDENTIAL, IMPERVIOUS	1.52	439	14.1
MEDIUM DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.3
MEDIUM DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.2
MEDIUM DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.4
MEDIUM DENSITY RESIDENTIAL, HSG D	0.37	91	3.7
MEDIUM DENSITY RESIDENTIAL, IMPERVIOUS	1.96	439	14.1
OPEN LAND, HSG A	0.03	7.14	0.3
OPEN LAND, HSG B	0.12	29.4	1.2
OPEN LAND, HSG C	0.21	59.8	2.4
OPEN LAND, HSG D	0.37	91	3.7
OPEN LAND, IMPERVIOUS	1.52	650	11.3
¹ HSG = Hydrologic Soil Group			

W1983	5/19	N	Slightly Turbid	Clear	N	U	U	U	U	No	No	sample grabbed at boat launch
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Cape Cod Watersheds 2009 Water Quality Technical Memorandum DWM CN 344.1
Page 41 of 99

Unique ID	Date	Odor	Water Clarity	Color	Aquatic Plants	Filamentous Algae	Film Algae	Loose Floc	Moss	Floating Scum	Floating Scum Comments	Objectionable Deposits	Objectionable Deposit Comments	Fieldsheet Comments
W1983	6/23	N	Slightly Turbid	Light Yellow/Tan	N	NR	NR	M	NR	No		No		samples taken off pond shore at about 2 foot depth, photo at boat ramp tried to show algae bloom very green in water, also took sample for phytoplankton ID-lots suspended in water column
W1983	7/28	N	Highly Turbid	Greenish	N					Yes	algal mat	Yes	other: algae bloom (lake is closed by health department)	algae quite dense, wind blowing onto shore at boat launch
W1983	7/29	N	Moderately Turbid	Greenish	NR					Yes	algal mat-cyanobacteria	Yes	trash: light	sample 96-0573 with file name W1983:
W1983	8/13	N	Highly Turbid	Greenish	NR					Yes	algal mat - massive cyanobacteria bloom in progress	No		major cyanobacteria bloom in progress - green!
W1983	9/1	N	Highly Turbid	Greenish	N					Yes	foam	No		
W1983	10/6	N	Highly Turbid	Greenish	N					Yes	cyanobacteria	Yes	massive cyanobacteria	

Article ____:

To see if the Town will vote to add new section 174-45.7: Solar Energy Systems to the Mashpee Zoning Bylaws as follows:

Solar Energy Systems

Purpose and Intent

This section promotes the creation of new small, medium and large-scale, ground-mounted solar energy systems by providing standards for the placement, design, construction, operation, monitoring, modification and removal of such installations that address public safety, minimize impacts on scenic, natural and historic resources and for providing adequate financial assurance for the eventual decommissioning of such installations. This section ordinance is adopted pursuant to the Commonwealth of Massachusetts Green Communities Act and Massachusetts General Laws Chapter 40A Section 3.

General Provisions

- A.** Small scale ground mounted solar energy systems and roof mounted solar energy systems shall be considered an accessory use allowed as-of-right in the R-3, R-5, C-1, C-2, C-3, and I-1 districts. In issuing such building permit, the Building Inspector shall ensure that neighboring properties are effectively protected from any adverse impacts from glare.
- B.** Any medium or large scale solar energy system shall be allowed in the R-3, R-5, C-1, C-2, C-3 and I-1 Zoning Districts only after the issuance of a Special Permit by the Planning Board. In issuing such Special Permit, the Board shall ensure that neighboring properties are effectively protected from any significant adverse impacts from glare, that any such systems are properly fenced or otherwise secured, and that no hazardous materials are stored in quantities greater than permitted by other sections of this bylaw.
- C.** The construction and operation of all ground-mounted solar energy systems shall be consistent with all applicable local, state and federal requirements, including but not limited to all applicable safety, construction, electrical, and communications requirements. All buildings and fixtures forming part of a ground-mounted solar energy system shall be constructed in accordance with the Massachusetts State Building Code.
- D.** The solar energy system's owner or operator shall maintain the facility in good condition. Maintenance shall include, but not be limited to, painting, structural repairs, and integrity of security measures. Site access shall be maintained to a level acceptable to the local Fire Chief and Emergency Management Director. The owner or operator shall be responsible for the cost of maintaining the ground-mounted solar energy system and any access road(s).

E. Dimensional Criteria

Small Scale Solar Energy Systems

1. Small scale ground mounted systems shall comply with the setback requirements typical of the zoning district and shall not exceed fifteen (15') feet in height.
2. Small scale ground mounted systems shall be exempt from the performance standards defined in Section G of this chapter.

Medium and Large Scale Solar Energy Systems

1. Medium and Large Scale Solar energy systems may be accessory to another principal structure or use provided that they satisfy the dimensional criteria and performance standards contained in this section.
2. Ground-mounted solar energy systems shall be set back a distance of at least 100 feet from a public or private way. The Planning Board may reduce the minimum setback distance as appropriate based on site-specific considerations.
3. Ground-mounted solar energy systems shall be set back a distance of at least 125 feet from any inhabited Residence, and 100 feet from any property in residential use. For the purposes of this section, a Residence is defined as the primary living structure and not accessory structures. The Planning Board may reduce the minimum setback distance as appropriate based on site-specific considerations.
4. Ground-mounted solar energy systems shall be set back a distance of at least 50 feet from any commercial property or use, and 25 feet from any industrial property or use notwithstanding the provisions of paragraph 2 above (relative to medium and large scale solar energy systems). The Planning Board may reduce the minimum setback distance as appropriate based on site-specific considerations.
5. Ground-mounted solar energy systems shall be set back a distance of at least 50 feet from abutting conservation land and any property not included in the Ground-mounted solar array application. The Planning Board may reduce the minimum setback distance as appropriate based on site-specific considerations.
6. Fixed tilt Ground-mounted solar energy systems shall have a maximum height of 15 feet above grade. In the case of single or dual axis tracking Ground-mounted solar energy systems, the Planning Board may increase the maximum height as appropriate based on site-specific considerations.
7. Inverters, energy storage systems, and transmission system substations shall be set back a distance of at least 200 feet from any residence. The Planning Board may reduce the minimum setback distance as appropriate based on site-specific considerations.

F. Special Permits Rules and Application Requirements

A Solar Energy System Special Permit shall not be granted unless each of the following requirements, in addition to the requirements in §174-24 C Special Permit use, are satisfied:

1. A properly completed and executed application form and application fee
2. Any requested waivers
3. Name, address, phone number and signature of the project proponent, as well as all co-proponents or property owners, if any
4. Name, contact information and signature of any agents representing the project proponent
5. Name, address, and contact information for proposed system installer
6. Documentation of actual or prospective access and control of the project site sufficient to allow for construction and operation of the proposed solar energy system
7. Proposed hours of operation and construction activity
8. Blueprints or drawings of the solar energy system signed by a Massachusetts licensed Registered Professional Engineer showing the proposed layout of the system and any potential shading from nearby structures
9. Utility Notification - evidence that the utility company that operates the electrical grid where a grid-intertie solar energy system is to be located has been informed of the system owner or operator's intent to install an interconnected facility and acknowledges receipt of such notification, and a copy of an Interconnection Application filed with the utility including a one or three line electrical diagram detailing the solar electric installation, associated components, and electrical interconnection methods, with all Massachusetts Electrical Code (527 CMR § 12.00) compliant disconnects and overcurrent devices. Off-grid solar energy systems shall be exempt from this requirement.
10. Documentation of the major system components to be used, including the electric generating components, battery or other electric storage systems, transmission systems, mounting system, inverter, etc.
11. Preliminary Operation & Maintenance Plan for the solar energy system, which shall include measures for maintaining safe access to the installation, storm water management, vegetation controls, and general procedures for operational maintenance of the installation
12. Abandonment & Decommissioning Plan - Any ground-mounted solar energy system which has reached the end of its useful life or has been abandoned (i.e., when it fails to operate for more than one year without the written consent of the Planning Board) shall be removed. The owner or operator shall physically remove the installation within 150 days of abandonment or the proposed date of decommissioning. The owner or operator shall notify the Planning Board by certified mail of the proposed date of discontinued operations and plans for removal. The Abandonment & Decommissioning Plan shall include a detailed description of how all of the following will be addressed:
 - a. Physical removal of all structures; equipment, building, security barriers and transmission lines from the site, including any materials used to limit vegetation.
 - b. Disposal of all solid and hazardous waste in accordance with local, state, and federal waste disposal regulations.
 - c. Stabilization or re-vegetation of the site as necessary to minimize erosion. The Planning Board may allow landscaping or below-grade foundations left *in situ* in order to minimize erosion and disturbance of the site.

- d. Description of financial surety for decommissioning - Proponents of ground-mounted solar energy systems shall provide a form of surety, either through escrow account, bond or other form of surety approved by the Planning Board to cover the cost of removal in the event the Town must remove the installation and remediate the landscape, in an amount and form determined to be commercially reasonable by the Planning Board, but in no event to exceed more than 125 percent of the cost of removal and compliance with the additional requirements set forth herein, as determined by the project proponent and the Town. Such surety will not be required for municipal or state-owned facilities. The project proponent shall submit a fully inclusive estimate of the costs associated with removal, prepared by a qualified engineer. The amount shall include a mechanism for calculating increased removal costs due to inflation.
 - e. It shall be a condition of any special permit that all legal documents required to enable the Town to exercise its rights and responsibilities under the plan to decommission the site, enter the property and physically remove the installation shall be provided prior to the issuance of a building permit.
13. Proof of liability insurance
14. A storm water management plan prepared by a Massachusetts licensed Registered Professional Engineer
15. A Site Plan, with stamp and signature of the Massachusetts licensed Registered Professional Engineer that prepared the plan, including the following:
- a. Everything required under this bylaw and Site Plan Approval
 - b. Existing Conditions Plan, showing property lines, map and lot from the Assessor's records, and physical features, including roads and topography, for the entire project site, signed and sealed by a Massachusetts licensed Registered Land Surveyor
 - c. Proposed changes to the landscape of the site, grading, vegetation clearing and planting, exterior lighting, screening vegetation, fencing or structures including their height, and placement of system components, including solar arrays and related structures and equipment
 - d. An estimate of earthwork operations including the volume of cut and fill and the amount of soil material to be imported or exported from the site
 - e. Locations of wetlands, vernal pools, and Priority Habitat Areas defined by the Natural Heritage & Endangered Species Program (NHESP)
 - f. Locations of floodplain area(s)
 - g. Zoning district designation for the parcel(s) of land comprising the project site (submission of a copy of a zoning map with the parcel(s) identified is suitable for this purpose)
 - h. Materials storage and delivery and equipment staging area(s)
 - i. Location of screening vegetation or structures

G. Required Performance Standards – Medium and Large Scale Solar Energy Systems

1. Visual Impact Mitigation – The site plan for a ground-mounted solar energy system shall be designed to screen the array to the maximum extent practicable year round from adjacent properties in residential use and from all roadways.
2. All required setbacks shall be left in their undisturbed natural vegetated condition for the duration of the solar energy system's installation. In situations where the naturally vegetated condition within required setbacks is not wooded and does provide adequate screening of the solar array, the Planning Board may require additional intervention including, but not limited to:
 - a. A landscaping plan showing sufficient trees and understory vegetation, of a type common in natural areas of Mashpee, to replicate a naturally wooded area and to constitute a visual barrier between the proposed array and neighboring properties and roadways
 - b. Berms along property lines and roadways with suitable plantings to provide adequate screening to neighboring properties and roadways.
3. Lighting – Lighting of ground-mounted solar energy systems shall be limited to that required for safety and operational purposes, and shall be reasonably shielded from abutting properties. Lighting shall be directed downward and shall incorporate full cut-off fixtures to reduce light pollution.
4. Signage – Signs on ground-mounted solar energy systems shall comply with all applicable regulations of this bylaw and/or any Town sign bylaw. A sign shall be required to identify the owner, operator and interconnected utility and provide a 24-hour emergency contact phone number. Ground-mounted solar energy systems shall not be used for displaying any advertising signage.
5. Utility Connections – Within setback distances and except where soil conditions, location, property shape, and topography of the site or requirements of the utility provider prevent it, all utility connections from grid-intertie solar energy systems shall be placed underground. Electrical transformers for utility interconnections may be above ground if required by the utility provider.
6. Vegetation Management – All land associated with the ground-mounted solar energy system shall be covered and grown in natural vegetation. The height of vegetation must be managed by regular mowing or grazing so as to minimize the amount and height of combustible material available in case of fire. Herbicides, pesticides, or chemical fertilizers shall not be used to manage vegetation. To the greatest extent practicable, a diversity of plant species shall be used, with preference given to species that are native to New England. Use of plants identified by the most recent copy of the "Massachusetts Prohibited Plant List" maintained by the Massachusetts Department of Agricultural Resources is prohibited. Management of all vegetated areas shall be maintained throughout the duration of the

solar energy system's installation through mechanical means without the use of chemical herbicides.

7. Noise Generation – Noise generated by ground-mounted solar energy systems and associated equipment and machinery shall conform to applicable state and local noise regulations, including the DEP's Division of Air Quality noise regulations, 310 CMR 7.10.
 8. Fencing – Fencing around solar arrays shall provide a minimum 6" clearance between the fence bottom and the ground to allow passage of small wildlife. The Planning Board shall require residential style fencing where necessary to screen the solar energy systems year round from adjacent residences.
 9. Land Clearing and Soil Erosion – Clearing of natural vegetation and topsoil shall be limited to what is necessary for the construction, operation and maintenance of the ground-mounted solar energy system. No topsoil removed during construction shall be exported from the site.
 10. Erosion Control and Stormwater – Erosion Control and Stormwater Management notation shall be included to show that adequate provisions against erosion and adverse impacts of runoff are appropriately mitigated.
 11. Emergency Services – The ground-mounted solar energy system owner or operator shall provide a copy of the project summary, electrical schematic, and site plan to the Mashpee Fire Department, and any other neighboring Fire Department upon request. Upon request the owner or operator shall cooperate with local emergency services in developing an emergency response plan. All means of shutting down the solar energy system shall be clearly marked. The owner or operator shall identify a responsible person for public inquiries throughout the life of the installation.
- H. The Planning Board may, upon the prior written request of the applicant, waive any of the requirements of this Section, but must state their reasons for doing so in writing as part of their decision.

Submitted by Planning Board

EXPLANATION

This section promotes the creation of new small, medium and large-scale, ground-mounted solar energy systems by providing standards for the placement, design, construction, operation, monitoring, modification and removal of such installations that address public safety, minimize impacts on scenic, natural and historic resources and for providing adequate financial assurance for the eventual decommissioning of such installations.

Already
Approved

Article ____:

To see if the Town will vote to amend §174-3 of the Mashpee Zoning Bylaw- Terms Defined as follows:

Photovoltaic System (also referred to as Photovoltaic Installation): An active solar energy system that converts solar energy directly into electricity.

Rated Nameplate Capacity: The maximum rated output of electric power production of a photovoltaic system in watts of Direct Current (DC).

Solar Collector: A device, structure, or a part of a device or structure for the primary purpose of harvesting solar energy for use in a solar energy system.

Solar Energy: Radiant energy received from the sun that can be collected in the form of heat or light by a solar collector.

Solar Energy System: A device or structural design feature for the collection, storage and distribution of solar energy for space heating or cooling, electricity generation, or water heating.

Solar Energy System, Active: A solar energy system that collects and transforms solar energy into another form of energy or transfers heat from a solar collector to another medium, via mechanical, electrical, or chemical means.

Solar Energy System, Grid-Intertie: A photovoltaic system or other active solar energy system designed to generate electricity that is connected to an electric circuit served by an electric utility.

Solar Energy System, Ground-Mounted: An active solar energy system that is structurally mounted to the ground and is not roof-mounted; may be of any size (small-, medium- or large-scale).

Solar Energy System, Large-Scale: An active solar energy system that occupies more than 40,000 square feet of surface area (equivalent to a rated nameplate capacity of about 250kW DC or greater).

Solar Energy System, Medium-Scale: An active solar energy system that occupies more than 1,750 but less than 40,000 square feet of surface area (equivalent to a rated nameplate capacity of about 10 - 250 kW DC).

Solar Energy System, Off-Grid: A photovoltaic system or other active solar energy system designed to generate electricity in which the circuits energized by the solar energy system are not electrically connected in any way to electric circuits that are served by an electric utility.

Solar Energy System, Passive: A solar energy system that captures solar light or heat without transforming it to another form of energy or transferring the energy via a heat exchanger.

Solar Energy System, Roof-Mounted: An active solar energy system that is structurally mounted to the roof of a building or structure; may be of any size (small-, medium- or large-scale).

Solar Energy System, Small-Scale: An active solar energy system that occupies 1,750 square feet of surface area or less (equivalent to a rated nameplate capacity of about 15 kW DC or less).

Submitted by Planning Board

EXPLANATION

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Article____:

To see if the Town will vote to amend §174-31, Landspace Requirements Table, Footnote 4 of the as follows:

⁴ These height restrictions shall not apply to chimneys, water towers, skylights, roof-mounted solar energy systems and other necessary features appurtenant to buildings which are usually carried above roofs and are not used for human occupancy nor to wireless or broadcasting towers and other like unenclosed structures, except that when any structure or portion of a structure is proposed to exceed forty (40) feet in height, construction shall require a Federal Aviation Administration (FAA) Determination of No Hazard or evidence of exemption for the determination process. Other than for those items excepted above, height shall be measured from the average original grade of the land adjacent to the foundation line of any proposed structure (prior to the clearance of the natural vegetation from said site) to any applicable point on a structure. Except for a traditional widow's walk of up to one hundred (100) 58 square feet in area, roof decks will be permitted only if located directly on top of the first or second story of any building.

Article____:

To see if the Town will vote to amend §174-31, Landspace Requirements Table by adding new footnote 15 to read as follows:

¹⁵ Minimum lot frontage required for the development of solar energy systems shall be twenty-five (25) feet.

Article____:

To see if the Town will vote to add §174-25 (I)(16) of the Mashpee Zoning By Law “Table of Use Regulations” by adding the letter ‘Y’ located in the columns identified as R-3, R-5, C-1, C-2, and C-3 and replacing the letters ‘SP’ in the column identified as I-1 with a ‘Y’ as follows:

Type of Use	Residential		Commercial			Industrial
	R-3	R-5	C-1	C-2	C-3	I-1
Small-scale Solar Energy System, subject to the provisions of Sec. 174-45.7	Y	Y	Y	Y	Y	Y

Submitted by Planning Board

EXPLANATION:

This article would allow the development of small scale solar energy systems in the residential, commercial and industrial zoning districts of the Town as a by-right accessory use.

Article____:

To see if the Town will vote to amend §174-25 (H)(12) of the Mashpee Zoning By Law “Table of Use Regulations” by adding the letters ‘SP’ located in the columns identified as R-3, R-5, C-1, C-2, and C-3 and replacing the letters ‘PR’ in the column identified as I-1 with a ‘SP’ as follows:

Type of Use	Residential		Commercial			Industrial
	R-3	R-5	C-1	C-2	C-3	I-1
Medium-scale Solar Energy System, subject to the provisions of Sec. 174-45.7	SP	SP	SP	SP	SP	SP

Submitted by Planning Board

EXPLANATION:

This article would allow the development of medium scale solar energy systems in the residential, commercial and industrial zoning districts with a Special Permit from the Planning Board.

Article____:

To see if the Town will vote to add §174-25 (H)(13) of the Mashpee Zoning By Law "Table of Use Regulations" by adding the letters 'SP' located in the columns identified as R-3, R-5, C-1, C-2, and C-3 and replacing the letters 'PR' in the column identified as I-1 with a 'SP' as follows:

Type of Use	Residential		Commercial			Industrial
	R-3	R-5	C-1	C-2	C-3	I-1
Large-scale Solar Energy System, subject to the provisions of Sec. 174-45.7	SP	SP	SP	SP	SP	SP

Submitted by Planning Board

EXPLANATION:

This article would allow the development of large scale solar energy systems in the residential, commercial and industrial zoning districts of the Town as a by-right accessory use.

Article 29

To see if the Town will vote to amend §174-3 of the Mashpee Zoning By-Law, Terms Defined as follows:

Photovoltaic System (also referred to as Photovoltaic Installation): An active solar energy system that converts solar energy directly into electricity.

Rated Nameplate Capacity: The maximum rated output of electric power production of a photovoltaic system in watts of Direct Current (DC).

Solar Collector: A device, structure or a part of a device or structure for the primary purpose of harvesting solar energy for use in a solar energy system.

Solar Energy: Radiant energy received from the sun that can be collected in the form of heat or light by a solar collector.

Solar Energy System: A device or structural design feature for the collection, storage and distribution of solar energy for space heating or cooling, electricity generation or water heating.

Solar Energy System, Active: A solar energy system that collects and transforms solar energy into another form of energy or transfers heat from a solar collector to another medium, via mechanical, electrical or chemical means.

Solar Energy System, Grid-Intertie: A photovoltaic system or other active solar energy system designed to generate electricity that is connected to an electric circuit served by an electric utility.

Solar Energy System, Ground-Mounted: An active solar energy system that is structurally mounted to the ground and is not roof-mounted; may be of any size (small-, medium- or large-scale).

Solar Energy System, Large Scale: An active solar energy system that occupies more than 40,000 square feet of surface area (equivalent to a rated nameplate capacity of about 250kW DC or greater).

Solar Energy System, Medium Scale: An active solar energy system that occupies more than 1,750 but less than 40,000 square feet of surface area (equivalent to a rated nameplate capacity of about 10-150 kW DC).

Solar Energy System, Off-Grid: A photovoltaic system or other active solar energy system designed to generate electricity in which the circuits energized by the solar energy system are not electrically connected in any way to electric circuits that are served by an electric utility.

Solar Energy System, Passive: A solar energy system that captures solar light or heat without transforming it to another form of energy or transferring the energy via a heat exchanger.

Solar Energy System, Roof-Mounted: An active solar energy system that is structurally mounted to the roof of a building or structure; may be of any size (small-, medium- or large-scale).

Solar Energy System, Small-Scale: An active solar energy system that occupies 1,750 square feet of surface area or less (equivalent to a rated nameplate capacity of about 15 kW DC or less).

Submitted by the Petition

Explanation: This amendment serves to define terms that are used in the new proposed Solar Energy Systems Overlay District.

The Board of Selectmen will make a recommendation at Town Meeting of Article 29 by a vote of 5-0
The Finance Committee will make a recommendation at Town Meeting of Article 29 by a vote of 6-1

Article 30

To see if the Town will vote to amend §174-4, Enumeration of Districts by adding:

SOLAR ENERGY SYSTEMS OVERLAY DISTRICT

Submitted by Petition

Explanation: This article would create and establish a Solar Energy System Overlay District as enumerated in proposed Section 174-45.7.

The Board of Selectmen will make a recommendation at Town Meeting of Article 30 by a vote of 5-0

The Finance Committee will make a recommendation at Town Meeting of Article 30 by a vote of 6-1

Article 31

To see if the Town will vote to amend §174-5, Establishment of Zoning Map by adding §174-5 (H) as follows:

The Solar Energy Systems Overlay District shall include all of the parcels of land described as follows:

All of the land as shown on Town of Mashpee Assessor Fiscal Year 2022 Tax Maps: 72-117; 72-113; 72-112; 72-111; 72-110; 72-118; 79-80; 79-79; 79-71; 79-72; 79-73; 79-74; 79-75; 79-76; 79-77 and 79-78.

All are located in the R-5 and C-2 Zoning District.

Submitted by Petition

Explanation: This article is intended to define by reference to the Mashpee Assessor Fiscal Year 2022 tax maps, the land within the Solar Energy Systems Overlay District that should be attached to this zoning map.

The Board of Selectmen will make a recommendation at Town Meeting of Article 31 by a vote of 5-0

The Finance Committee will make a recommendation at Town Meeting of Article 31 by a vote of 6-1

Article 32

To see if the Town will vote to amend §174-25 (H)(12) of the Mashpee Zoning By Law "Table of Use Regulations by adding "SP" under Zoning Districts R-5 and C-2

TYPE OF USE	RESIDENTIAL		COMMERCIAL			INDUSTRIAL
	R-3	R-5	C-1	C-2	C-3	I-1
Medium-scale and Large-scale Ground mounted Solar Energy Systems, provided that neighboring properties are effectively protected from any significant adverse impacts from glare, that any such systems are properly fenced or otherwise secured, and that no hazardous materials are stored in quantities greater than permitted by other sections of this By-Law, subject to approval by the Plan Review Committee and Design Review Committee. (Allowed by SP under 174-45.7 only in the Solar Energy System Overlay District).		SP		SP		PR

Submitted by Petition

Explanation: This article would allow the development of medium and large scale solar energy systems in the residential (R-5) and commercial (C-2) zoning districts with a Special Permit from the Planning Board provided they are within the Solar Energy Systems Overlay District.

The Board of Selectmen will make a recommendation at Town Meeting of Article 32 by a vote of 5-0
The Finance Committee will make a recommendation at Town Meeting of Article 32 by a vote of 6-1

Article 33

To see if the Town will vote to amend Article VII Land Space Requirement, Section 174-31, Land Space Requirement Table by adding footnote "25" to "maximum of lot coverage (percent)." Footnote 25 would read as follows:

Structures erected solely for the purpose of roof-mounted solar energy systems in permitted parking lots/areas shall not contribute to a parcel's lot coverage maximum but shall comply with all setback criteria of the applicable zoning district. For medium and large scale solar energy systems requiring a special permit from the Planning Board, pursuant to Sec.174-25(H)12 Solar Energy Systems Overlay District, the Planning Board may, at its sole discretion, approve in its decision a solar energy system whose lot coverage exceeds 20% in consideration of site specific conditions.

Submitted by Petition

Explanation: Rationale and support for zoning change to enhance the density of solar projects in Mashpee: In 2018 the Commonwealth of Massachusetts put forth a new solar initiative called the Smart program. This groundbreaking concept will help Massachusetts be a leader in solar energy. Given the high cost of land in Mashpee, it is essential to achieve enough density to make a solar project meaningful. The proposed footnote to the By-Law will give the planning board sufficient tools and oversight to achieve an appropriate balance between solar project density and the needs of the community.

The Board of Selectmen will make a recommendation at Town Meeting of Article 33 by a vote of 5-0
The Finance Committee will make a recommendation at Town Meeting of Article 33 by a vote of 6-1

Article 34

To see if the Town will vote to establish within the Town of Mashpee a Solar Energy System Overlay District by adding a new Section 174-45.7 as follows:

SOLAR ENERGY SYSTEMS OVERLAY DISTRICT

A. Purpose and Intent

1. This section promotes the creation of new small, medium and large-scale, ground-mounted solar energy systems overlay district, in the areas which are delineated on a map dated January 25, 2021 and entitled "Solar Energy Systems Overlay District, ROUTE 151, ALGONQUIN AVENUE AND OLD BARNSTABLE ROAD, Mashpee, Massachusetts," (attached hereto) and which shall be considered as superimposed over other districts established by the zoning by-laws of the Town. This map, as it may be amended from time to time, is on file with the office of the Town Clerk and with any explanatory material therein, is hereby made a part of this chapter, by providing standards for the placement, design, construction, operation, monitoring, modification and removal of such installations that address public safety, minimize impacts on scenic, natural and historic resources and for providing adequate financial assurance for the eventual decommissioning of such installations. This Overlay District Ordinance is adopted pursuant to the Commonwealth of Massachusetts green Communities Act and Massachusetts General Laws Chapter 40A Section 3.

2. Uses, other than Solar Energy Systems, otherwise not permitted in the portions of a zoning district superimposed by this district shall not be permitted in this district.
3. The Solar Energy Systems Overlay District shall include all of the land within the lines described in subsection B, which are in the R-5 and C-2 zoning districts. Medium and large scale solar energy systems located in the industrial zoning district (I-1) are exempt from the requirements of this chapter and require approval only from the Plan Review Committee pursuant to the applicable dimensional criteria of the zoning district.

B. Bounds

1. Including all of the land within the following described lines:

Property Description: The land in the Town of Mashpee, Barnstable County, Massachusetts beginning at the Northeast corner of the premises at Route 151; thence South 05°54'17" West, a distance of 203.10'; thence South 82°22'02" East, a distance of 107.07'; thence South 08°34'16" West, a distance of 154.18'; thence South 84°05'40" East, a distance of 272.51'; thence South 09°46'40" West, a distance of 1,026.79' by Algonquin Avenue; thence North 77°51'29" West, a distance of 320.36' by Old Barnstable Road; thence South 89°31'13" West, a distance of 731.65' by Old Barnstable Road; thence North 73°24'07" West, a distance of 125.90' by Old Barnstable Road; thence North 66°44'57" West, a distance of 568.90' by Old Barnstable Road; thence Northerly along centerline old brick yard road West, a distance of 1,080'+/-; thence North 83°31'22" West, a distance of 27.59' +/- to ditch; thence Northerly along ditch West a distance of 175'+/-; thence North 85°34'30" East a distance of 5'+/-; thence North 24°26'35" West, a distance of 150.11' to Old Barnstable Road; thence With a curve turning to the left with an arc length of 76.29' by Route 151 with a radius of 4,189.42' to a concrete bound; thence South 09°02'50" East, a distance of 159.61'; thence South 10°46'40" East a distance of 42.72'; thence South 04°15'30" East, a distance of 206.16'; thence South 76°43'49" East, a distance of 300.57'; thence North 09°46'40" East, a distance of 433.00' to Route 151; thence South 84°05'40" East, a distance of 63.18' by Route 151; thence With a curve turning to the left with an arc length of 37.30' with a radius of 25.00'; thence South 09°46'40" West, a distance of 154.04'; thence South 80°13'20" East, a distance of 199.99'; thence North 09°46'36" East, a distance of 190.94' to Route 151; thence South 84°05'40" East, a distance of 405.08' along Route 151, which is the point of beginning and having an area of 39.674 acres.

Meaning and intending to include all of the land as shown on Town of Mashpee Assessor Fiscal Year 2021 Tax Maps: 72-117; 72-113; 72-112; 72-111; 72-110; 72-118; 79-80; 79-79; 79-71; 79-72; 79-73; 79-74; 79-75; 79-76; 79-77 and 79-78.

C. Permitted Uses

Within the Solar Energy Systems Overlay District, the following uses are permitted provided all necessary permits, orders and approvals required by local, state and federal law are obtained.

1. Any medium or large scale solar energy system shall be allowed in the Solar Energy Overlay District only after the issuance of a Special Permit by the Planning Board. In issuing such Special Permit, the Board shall ensure that neighboring properties are effectively protected from any significant adverse impacts from glare that any such systems are properly fenced or otherwise secured and that no hazardous materials are stored in quantities greater than permitted by other sections of this by-law, subject to approval by the Plan Review Committee and Design Review Committee.

2. The Solar Energy System's owner or operator shall maintain the facility in good condition. Maintenance shall include, but not be limited to, painting, structural repairs and integrity of security measures. Site access shall be maintained to a level acceptable to the local Fire Chief and Emergency Management Director. The owner or operator shall be responsible for the cost of maintaining the ground-mounted solar energy system and any access road(s).

D. Dimensional Criteria

Small, Medium and Large Scale Solar Energy Systems

1. Small, Medium and Large Scale Solar Energy Systems may be accessory to another principal structure or use provided that they satisfy the dimensional criteria and performance standards contained in this section.

2. Ground-mounted solar energy systems shall be set back a distance of at least 100 feet from a public or private way. The Planning Board may reduce the minimum setback distance as appropriate based on site-specific considerations.

3. Ground-mounted solar energy systems shall be set back a distance of at least 125 feet from any inhabited residence, and 100 feet from any property in residential use. For the purposes of this section, a residence is defined as a primary living structure and not accessory structures. The Planning Board may reduce the minimum setback distance as appropriate based on site-specific considerations.

4. Ground-mounted solar energy systems shall be set back a distance of at least 50 feet from any commercial property or use and 25 feet from any industrial property or use notwithstanding the provisions of paragraph 2 above (relative to medium and large scale solar energy systems). The Planning Board may reduce the minimum setback distance as appropriate based on site-specific considerations.

5. Ground-mounted solar energy systems shall be set back a distance of at least 50 feet from abutting conservation land and any property not included in the Ground-mounted solar array application. The Planning Board may reduce the minimum setback distance as appropriate based on site specific considerations.

6. Fixed tilt Ground-mounted solar energy systems shall have a maximum height of 15 feet above grade. In the case of single or dual axis tracking Ground-mounted solar energy systems, the Planning Board may increase the maximum height as appropriate based on site-specific considerations.

7. Inverters, energy storage systems, and transmission system substations shall be set back a distance of at least 200 feet from any residence. The Planning Board may reduce the minimum setback distance as appropriate based on site-specific conditions.

E. Special Permits Rules and Application Requirements

A Solar Energy System Special Permit shall not be granted unless each of the following requirements, in addition to the requirements in §174-24 C Special Permit use, are satisfied:

1. A properly completed and executed application form and application fee.
2. Any requested waivers. To this end, as part of its Special Permit decision, the Planning Board may, at its sole discretion, establish a lot coverage maximum that exceeds 20% in consideration of site specific conditions.
3. Name, address, phone number and signature of the project proponent, as well as all co-proponents or property owners, if any.
4. Names, contact information and signatures of any agents representing the project proponent.
5. Name, address and contact information for proposed system installer.
6. Documentation of actual or prospective access and control of the project site sufficient to allow for construction and operation of the proposed solar energy system.
7. Proposed hours of operation and construction activity.
8. Blueprints or drawings of the solar energy system signed by a Massachusetts' licensed Registered Professional Engineer showing the proposed layout of the system and any potential shading from nearby structures.
9. Utility Notification: Evidence that the utility company that operates the electrical grid where a grid-intertie solar energy system is to be located has been informed of the system owner or operator's intent to install an interconnected facility and acknowledges receipt of such notification, and a copy of an Interconnection Application filed with the utility including a one or three line electrical diagram detailing the solar electric installation, associated components, and electrical interconnection methods, with all Massachusetts Electrical Code (527 CMR§ 12.00) compliant disconnects and overcurrent devices. Off-grid solar energy systems shall be exempt from this requirement.

10. Documentation of the major system components to be used, including the electric generating components, battery or other electric storage systems, transmission systems, mounting system, inverter, etc.

11. Preliminary Operation and Maintenance Plan for the solar energy system, which shall include measures for maintaining safe access to the installation, storm water management, vegetation controls, and general procedures for operational maintenance of the installation.

12. Abandonment and Decommissioning Plan: Any ground-mounted solar energy system which has reached the end of its useful life or has been abandoned (i.e., when it fails to operate for more than one year without the written consent of the Planning Board) shall be removed. The owner or operator shall physically remove the installation within 150 days of abandonment or the proposed date of decommissioning. The owner or operator shall notify the Planning Board by certified mail of the proposed date of discontinued operations and plans for removal. The Abandonment and Decommissioning Plan shall include a detailed description of how all of the following will be addressed:

(a) Physical removal of all structures; equipment, building, security barriers and transmission lines from the site, including any materials used to limit vegetation.

(b) Disposal of all solid and hazardous waste in accordance with local, state and federal waste disposal regulations.

(c) Stabilization or re-vegetation of the site as necessary to minimize erosion. The Planning Board may allow landscaping or below-grade foundations left *in situ* in order to minimize erosion and disturbance of the site.

(d) Description of financial surety for decommissioning: Proponents of ground-mounted solar energy systems shall provide a form of surety, either through escrow account, bond or other form of surety approved by the Planning Board to cover the cost of removal in the event the Town must remove the installation and remediate the landscape, in an amount and form determined to be commercially reasonable by the Planning Board, but in no event to exceed more than 125 percent of the cost of removal and compliance with the additional requirements set forth herein, as determined by the project proponent and the Town. Such surety will not be required for municipal or state-owned facilities. The project proponent shall submit a fully inclusive estimate of the costs associated with removal, prepared by a qualified engineer. The amount shall include a mechanism for calculating increased removal costs due to inflation.

(e) It shall be a condition of any special permit that all legal documents required to enable the Town to exercise its rights and responsibilities under the plan to decommission the site, enter the property and physically remove the installation shall be provided prior to the issuance of a building permit.

F. Required Performance Standards: Small, Medium and Large Scale Solar Energy Systems

1. Visual Impact Mitigation: The site plan for a ground-mounted solar energy system shall be designated to screen the array to the maximum extent practicable year round from adjacent properties in residential use and from all roadways.

2. All required setbacks shall be left in their undisturbed natural vegetated condition for the duration of the solar energy system's installation. In situations where the naturally vegetated condition within required setback is not wooded and does not provide adequate screening of the solar array, the Planning Board may require additional intervention including, but not limited to:

(a) A landscaping plan showing sufficient trees and understory vegetation, of a type common in natural areas of Mashpee, to replicate a naturally wooded area and to constitute a visual barrier between the proposed array and neighboring properties and roadways.

(b) Berms along property lines and roadways with suitable plantings to provide adequate screening to neighboring properties and roadways.

3. Lighting: Lighting of ground-mounted solar energy systems shall be limited to that required for safety and operational purposes, and shall be reasonably shielded from abutting properties. Lighting shall be directed downward and shall incorporate full cut-off fixtures to reduce light pollution.

4. Signage: Signs on ground-mounted solar energy systems shall comply with all applicable regulations of this by-law and/or any Town sign by-law. A sign shall be required to identify the owner, operator and interconnected utility and provide a 24-hour emergency contact phone number. Ground-mounted solar energy systems shall not be used for displaying any advertising signage.

5. Utility Connections: Within setback distances and except where soil conditions, location, property shape, and topography of the site or requirements of the utility provider prevent it, all utility connections from grid-intertie solar energy systems shall be placed underground. Electrical transformers for utility interconnections may be above ground if required by the utility provider.

6. Vegetation Management: All land associated with the ground-mounted solar energy system shall be covered and grown in natural vegetation. The height of vegetation must be managed by regular mowing or grazing so as to minimize the amount and height of combustible material available in case of fire. Herbicides, pesticides, or chemical fertilizers shall not be used to manage vegetation. To the greatest extent practicable, a diversity of plant species shall be used, with preference given to species that are native to New England. Use of plants identified by the most recent copy of the "Massachusetts Prohibited Plant List" maintained by the Massachusetts department of Agricultural Resources is prohibited. Management of all vegetated areas shall be maintained throughout the duration of the solar energy system's installation through mechanical means without the use of chemical herbicides.

7. Noise Generation: Noise generated by ground-mounted solar energy systems and associated equipment and machinery shall conform to applicable state and local noise regulations, including the DEP's Division of Air Quality Noise Regulations, 310 CMR 7.10.

8. Fencing: Fencing around solar arrays shall provide a minimum 6" clearance between the fence bottom and the ground to allow passage of small wildlife. The Planning Board shall require resident style fencing where necessary to screen the solar energy systems year round from adjacent residences.

9. Land Clearing and Soil Erosion: Clearing of natural vegetation and topsoil shall be limited to what is necessary for the construction, operation and maintenance of the ground-mounted solar energy system. No topsoil removed during construction shall be exported from the site.

10. Erosion Control and Stormwater: Erosion Control and Stormwater Management notation shall be included to show that adequate provisions against erosion and adverse impacts of runoff are appropriately mitigated.

11. Emergency Services: The ground-mounted solar energy system owner or operator shall provide a copy of the project summary, electrical schematic, and site plan to the Mashpee Fire Department and any other neighboring Fire Department upon request. Upon request the owner or operator shall cooperate with local emergency services in developing an emergency response plan. All means of shutting down the solar energy system shall be clearly marked. The owner or operator shall identify a responsible person for public inquiries throughout the life of the installation.

Submitted by Petition

Explanation: This section promotes the creation of new Solar Energy Systems Overlay District for small, medium and large-scale, ground-mounted solar energy systems on land with the Overlay District currently zoned R-5 and C-2 by providing standards for the placement, design, construction, operation, monitoring, modification and removal of such installations that address public safety, minimize impacts on scenic, natural and historic resources and for providing adequate financial assurance for the eventual decommissioning of such installation.

The Board of Selectmen will make a recommendation at Town Meeting of Article 34 by a vote of 5-0
The Finance Committee will make a recommendation at Town Meeting of Article 34 by a vote of 6-1

Article 35

To see if the Town will vote to amend the Zoning By-law as follows:

Add a new sub-Section to any Solar Energy System Overlay District zoning bylaw by adding to the Required Performance Standards for Small, Medium and Large Scale Solar Energy Systems the following:

174-45.7 SOLAR ENERGY SYSTEMS OVERLAY DISTRICT

Section F. Required Performance Standards: Small, Medium and Large Scale Solar Energy Systems

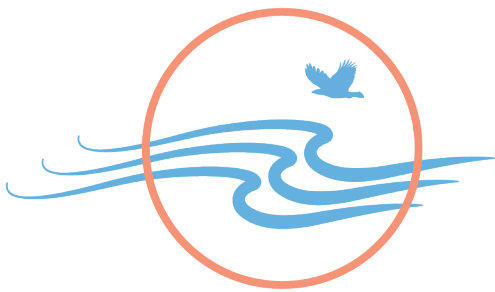
12. Open Space Requirement. A Solar Energy System which encompasses a minimum land area of seven acres, which may be in one or more parcels, and shall consist of one acre of allowed developed area for each half acre of upland (i.e. excluding water bodies or wetlands as defined under MGL C. 131, §40) permanently set aside as undeveloped open space and deeded to the Town of Mashpee in the care and custody of its Conservation Commission (provided that said land is not subject to any previous conservation restriction or other prohibition on its development), or to a nonprofit organization, the principal purpose of which is the conservation of open space, in either case subject to a formal conservation restriction to be held by the Town of Mashpee. The developer's declaration of his choice of the open space preservation methods described above, which may be different for individual such parcels, shall be included in his application for a Special Permit to develop a Solar Energy System, along with maps and plans describing the open space areas. Any water bodies or wetlands, as defined under MGL C. 131, §40, which lie within the boundaries of the Solar Energy System shall also be permanently set aside and deeded to one of the entities identified above under the terms described. When delineating the upland to be set aside as undeveloped open space, any land which is forested shall be prioritized as open space. Before final approval of the Solar Energy System Special Permit, the developer shall also file with the Planning Board a copy of the conservation restrictions necessary to secure the permanent legal existence of the open space and a copy of any proposed deed for transfer in fee to the Town or to a nonprofit organization. Approval of the Solar Energy System shall require approval by the Planning Board of said conservation restrictions after consultation with Town Counsel. As required by law, any such restrictions may also require approval by the Commonwealth of Massachusetts. Any open space required to meet the provisions of this Section shall be surveyed, properly bounded on the ground by concrete monuments and shown on a plan recorded at the Barnstable County Registry of Deeds or Land Court Registry. Said plan shall be recorded and said boundary monuments shall be set within six (6) months of the approval of the Solar Energy System Special Permit. Any transfer of the fee title to property to the Town or a nonprofit organization shall be recorded, along with the required conservation or agricultural restrictions, within one (1) year of the approval of the Solar Energy System Special Permit. Said transfer shall be completed before the issuance of any building permit for development within said phase.

13. Setbacks from water bodies and wetlands. The developed area within a Solar Energy System development may not lie within three hundred (300) feet of any water body or stream or within one hundred (100) feet of any wetland as defined under MGL C. 131, §40.
or take any other action related thereto.

Submitted by Petition

Explanation: This article would amend the Zoning By-law to require that any Solar Energy Systems developments of seven acres or more provide open space (one half acre open space per one acre developed) as well as setbacks from water bodies (300') and wetlands (100') in order to preserve the Town's environment.

The Board of Selectmen will make a recommendation at Town Meeting of Article 35 by a vote of 5-0
The Finance Committee will make a recommendation at Town Meeting of Article 35 by a vote of 7-0



MASHPEE

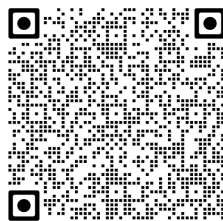
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VIRTUAL COMMUNITY WORKSHOP

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DECEMBER 12, 2022
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Size of File: **1027.78K**

Status of Transaction: **Submitted**

Date and Time Created: **10/28/2022:2:18:36 PM**

Note: This file only includes forms that were part of your transaction as of the date and time indicated above. If you need a more current copy of your transaction, return to eDEP and select to "Download a Copy" from the Current Submittals page.



Groundwater Permit DAILY LOG SHEET

668

1. Permit Number

2. Tax identification Number

2022 SEP DAILY

3. Sampling Month & Frequency

A. Facility Information

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



1. Facility name, address:

SOUTH CAPE VILLAGE

a. Name

672 FALMOUTH ROAD/RTE. 28

b. Street Address

MASHPEE

c. City

MA

d. State

02649

e. Zip Code

2. Contact information:

MYLES OSTROFF

a. Name of Facility Contact Person

6174311097

b. Telephone Number

myles@chartweb.com

c. e-mail address

3. Sampling information:

9/30/2022

a. Date Sampled (mm/dd/yyyy)

WHITEWATER

b. Laboratory Name

JAIME STEWART

c. Analysis Performed By (Name)

B. Form Selection

1. Please select Form Type and Sampling Month & Frequency

Daily Log Sheet - 2022 Sep Daily



All forms for submittal have been completed.

2.

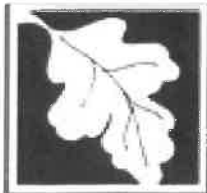


This is the last selection.

3.



Delete the selected form.



Groundwater Permit

DAILY LOG SHEET

668

1. Permit Number

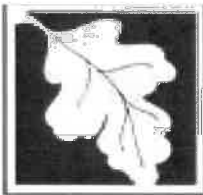
2. Tax identification Number

2022 SEP DAILY

3. Sampling Month & Frequency

C. Daily Readings/Analysis Information

Date	Effluent Flow GPD	Reuse Flow GPD	Irrigation Flow GPD	Turbidity	Influent pH	Effluent pH	Chlorine Residual (mg/l)	UV Intensity (%)
1	3909					7.3		
2	10251					7.3		
3	10251							
4	10251							
5	10251							
6	6773					7.1		
7	15842					7.3		
8	6248					7.3		
9	10274					7.4		
10	10274							
11	10274							
12	8862					7.2		
13	8263					7.2		
14	8465					7.2		
15	11299					7.3		
16	9456					7.3		
17	9456							
18	9456							
19	8042					7.1		
20	8272					7.3		
21	7951					7.3		
22	18871					7.2		
23	7346					7.2		
24	7347							
25	7346							
26	10088					7.1		
27	8084					7.5		
28	10377					7.4		
29	8529					7.4		
30	9381					7.3		
31								



Groundwater Permit
MONITORING WELL DATA REPORT

668
1. Permit Number
2. Tax identification Number
2022 SEP MONTHLY
3. Sampling Month & Frequency

A. Facility Information

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



1. Facility name, address:

SOUTH CAPE VILLAGE		
a. Name		
672 FALMOUTH ROAD/RTE. 28		
b. Street Address		
MASHPEE	MA	02649
c. City	d. State	e. Zip Code

2. Contact information:

MYLES OSTROFF	
a. Name of Facility Contact Person	
6174311097	myles@chartweb.com
b. Telephone Number	c. e-mail address

3. Sampling information:

9/27/2022	WHITEWATER
a. Date Sampled (mm/dd/yyyy)	b. Laboratory Name
JAIME STEWART	
c. Analysis Performed By (Name)	

B. Form Selection

1. Please select Form Type and Sampling Month & Frequency

Monitoring Well Data Report - 2022 Sep Monthly	▼
--	---

☐ All forms for submittal have been completed.

2. ☐ This is the last selection.

3. ☐ Delete the selected form.



Groundwater Permit
MONITORING WELL DATA REPORT

668
1. Permit Number
2. Tax identification Number
2022 SEP MONTHLY
3. Sampling Month & Frequency

C. Contaminant Analysis Information

- For "0", below detection limit, less than (<) value, or not detected, enter "ND"
- TNTC = too numerous to count. (Fecal results only)
- NS = Not Sampled
- DRY = Not enough water in well to sample.

<

Parameter/Contaminant	P-1	P-2	P-4	P-6		
	Well #: 1	Well #: 2	Well #: 3	Well #: 4	Well #: 5	Well #: 6
PH	6.1	DRY	5.7	5.9		
S.U.						
STATIC WATER LEVEL	18.7	DRY	47.5	50.8		
FEET						
SPECIFIC CONDUCTANCE	975	DRY	360	1025		
UMHOS/C						



Groundwater Permit
DISCHARGE MONITORING REPORT

668

1. Permit Number

2. Tax identification Number

2022 SEP MONTHLY

3. Sampling Month & Frequency

A. Facility Information

Important:When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



1. Facility name, address:

SOUTH CAPE VILLAGE

a. Name

672 FALMOUTH ROAD/RTE. 28

b. Street Address

MASHPEE

c. City

MA

d. State

02649

e. Zip Code

2. Contact information:

MYLES OSTROFF

a. Name of Facility Contact Person

6174311097

b. Telephone Number

myles@chartweb.com

c. e-mail address

3. Sampling information:

9/16/2022

a. Date Sampled (mm/dd/yyyy)

RI ANALYTICAL

b. Laboratory Name

BRENT PLANT

c. Analysis Performed By (Name)

B. Form Selection

1. Please select Form Type and Sampling Month & Frequency

Discharge Monitoring Report - 2022 Sep Monthly



All forms for submittal have been completed.

2. ☐ This is the last selection.

3. ☐ Delete the selected form.



Groundwater Permit

DISCHARGE MONITORING REPORT

668

1. Permit Number

2. Tax identification Number

2022 SEP MONTHLY

3. Sampling Month & Frequency

D. Contaminant Analysis Information

- For "0", below detection limit, less than (<) value, or not detected, enter "ND"
- TNTC = too numerous to count. (Fecal results only)
- NS = Not Sampled

1. Parameter/Contaminant	2. Influent	3. Effluent	4. Effluent Method
Units			Detection limit
BOD	66	ND	3.0
MG/L			
TSS	110	ND	2.0
MG/L			
TOTAL SOLIDS	340		
MG/L			
AMMONIA-N	9.1		
MG/L			
NITRATE-N		0.88	0.050
MG/L			
TOTAL NITROGEN(NO3+NO2+TKN)		2.9	0.50
MG/L			
OIL & GREASE		1.0	0.50
MG/L			



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Groundwater Discharge Program

Groundwater Permit

668

1. Permit Number

2. Tax identification Number

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



Any person signing a document under 314 CMR 5.14(1) or (2) shall make the following certification

If you are filing electronic-ally and want to attach additional comments, select the check box.



Facility Information

SOUTH CAPE VILLAGE

a. Name

672 FALMOUTH ROAD/RTE. 28

b. Street Address

MASHPEE

c. City

MA

d. State

02649

e. Zip Code

Certification

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

ELIZABETH BELAIR

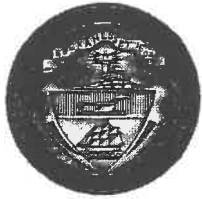
a. Signature

10/28/2022

b. Date (mm/dd/yyyy)

Reporting Package Comments

PLANT MET ALL DISCHARGE PERMIT REQUIREMENTS FOR SEPTEMBER 2022. PUMPED 5,500 GALLONS FOR CLEARWELL MAINTENANCE.



Falmouth Planning Board

59 Town Hall Square, Falmouth, MA 02540

Telephone: 508-495-7440 Fax: 508.495.7443 email: planning@falmouthma.gov

RECEIVED
NOV 1, 2022 AM 9:09
TOWN CLERK

November 1, 2022

Michael Palmer, Town Clerk
Falmouth Town Hall
59 Town Hall Square
Falmouth, Massachusetts 02540

**Re: Special Permit Decision – Woods Hole Oceanographic Institution
86 Water Street
49 A 02 000K 001**

Dear Michael,

At its meeting on October 25, 2022, the Planning Board voted to approve the application of Woods Hole Oceanographic Institution (WHOI), under Article XXXIX (39) – Site Plan Review and GRANT a Special Permit pursuant to section 240-2.1 Exempt Uses of the Zoning Bylaw to construct a 3-story building located at 86 Water Street, also shown on Assessors Map 49A, Section 02, Parcel 000K, Lot 001 as depicted on the plan entitled: *"CWATER Project Iselin Dock Replacement Site Plan Review"*, prepared by WSP Marine Engineer (37 sheets), dated July 15, 2022 with scales, as well as elevation and floor plans, entitled *"CWATER Project New Waterfront Building"*, prepared by Payette Associates Inc. (7 sheets), dated August 25, 2022, scale of 1/8"=1', as well as a landscaping plan, a lighting plan, a stormwater runoff analysis and operation and maintenance plan, and a traffic study with the following:

FINDINGS:

The applicant, Woods Hole Oceanographic Institution (WHOI), is applying to the Planning Board for Site Plan Review under Article XXXIX (39) and a Special Permit under §240-2.1 Exempt Uses to allow the Complex for Waterfront Access to Exploration and Research (CWATER) Project, which includes the replacement of their existing dock; the removal of several existing buildings on the property; and the construction of a new three-story adaptable and resilient waterfront building.

Pursuant to §240-2.1 Exempt Uses of the town's Zoning Bylaw, the application shall be subject to the regulations concerning the bulk and height of structures, yard sizes, lot area, setbacks, open space, parking and building coverage requirements found in the town's Zoning Bylaw, unless, by special permit, the Planning Board grants relief from these dimensional regulations as applied to exempt uses, subject to the criteria set forth in Article XLII Special Permits. The applicant is seeking Special Permit relief for building height, on-site parking requirements, front setback for an electrical transformer, and total impervious conditions. Further, relief is also sought from Article XXIV Landscape Requirements of the Zoning Bylaw through a waiver of the Site Plan Review requirements.

The 2.92-acre property is located within the Public Use (“PU”) zoning district, the Floodplain Overlay District, and the Wind Bourne Debris Overlay District. The property consists of developed waterfront and contains several buildings, individually known as the Smith Building, Bigelow Laboratory, Iselin Laboratory, Alvin High Bay, Smith Connector and Flume. The Iselin Laboratory straddles the existing bulkhead and is located partially on the pile supported pier portion of the site and partially on the solid fill portion of the site.

The new dock will replace the existing dock in-place and in-kind as a pile supported structure essentially within its existing footprint. There are minor bulkhead alignment modifications proposed to enhance dock operations, improve berthing positions, and facilitate vessel loading/unloading and navigation. In addition, the test well will be relocated under proposed conditions to the southwest portion of the reconstructed dock thereby providing access to deeper water. Lastly, the dock is designed such that it can be raised an additional 1.5 feet in the future to accommodate sea level rise.

Meanwhile, the Iselin Laboratory, Alvin High Bay, Smith Connector and the Flume will be removed and replaced with a new 44,667 gross square foot, three-story waterfront building that will be built entirely landward of the bulkhead, behind the Smith Building, and outside of the existing FEMA VE-zone boundary. The first floor of the new building will be raised to approximately elevation 10.5 feet NAVD88, a dry floodproofing system will be employed to protect the lowest functionally dependent levels of the building from flooding, the first floor of the new building is designed to enable the floors to be elevated an additional 1.5 feet in the future.

WAIVERS:

§240-115 Landscape Plan Required: To waive the requirement that a landscape plan be submitted with the application for Site Plan Review.

FINDINGS Specific to § 240-2.1 (Exempt Uses) of the Zoning Bylaw:

The applicant is seeking Special Permit relief pursuant to §240-2.1 Exempt Uses of the Zoning Bylaw from the building height limit, the on-site parking requirements, the front setback for an electrical transformer, and for the total impervious coverage.

Building Height

The applicant is seeking a special permit to allow the new building to exceed the building height limit in the Public Use (PU) zoning district of 50 feet. The proposed building height, at 55.2 feet from calculated mean grade, exceeds the zoning maximum by 5.2 feet to allow the high bays to be elevated an additional 1.5 feet in the future. The high bay space must continue maintain the necessary crane pick heights to functionally accommodate working and maintenance on the underwater vessels even with the additional future 1.5-foot increased floor height.

Parking

The applicant is seeking a special permit to allow a reduced number of parking spaces on the property. The applicant is proposing to stripe 9 on-site parking spaces, which is the same number as existing conditions. The applicant has worked to relocate many of the existing parking spaces away from the busy Water Street area to other locations that are better served to accommodate the demand and the associated traffic. With the reduction of building square footage on the property, the relocation of departments off the waterfront and onto WHOI's

Quissett Campus, and WHOI's shuttle, the proposed parking remains adequate for WHOI's demand.

Front Setback

The applicant is seeking a special permit to allow a new electrical transformer to be located within the 25-foot front yard setback. The applicant is working with Eversource to site the new electrical transformer and one of the proposed locations would put it in front of the existing Bigelow building, approximately 10 feet from Water Street. Provided the utility company allows it, WHOI would agree to implement screening measures to help minimize the visibility of the transformer within the setback.

Impervious Coverage

The applicant is seeking a special permit to allow relief from the overall impervious coverage limit of 70% by structures, paving, and parking as the proposed conditions show 92%. Although the project will only slightly reduce the amount of impervious coverage (reduction of 188 square feet), the project does include relocating and formalizing the proposed green space on the site and designing it in a way to potentially allow guest access and views of the working waterfront.

A special permit granting authority shall grant a special permit only upon its written determination that the proposed use will not have adverse effects which overbalance its beneficial effects on either the neighborhood or the Town, in view of the particular characteristics of the site.

FINDINGS Specific to § 240-216 (Special Permits) of the Zoning Bylaw

A. Adequacy of the site in terms of size for the proposed use

The Planning Board finds the size of the site to be adequate. The proposed project includes a number of improvements to this 127,224 square foot property focused on improving circulation, increasing safety, consolidating buildings, and adapting to anticipated sea level rise.

B. Suitability of the site for the proposed use

The Planning Board finds the site suitable for the proposed use. Access to the ocean is critical for the applicant's mission and ongoing study of the ocean environment. The proposed project will make significant improvements to the site and thus will help WHOI maintain its position as a leader in ocean research.

C. Impact on traffic flow and safety

The Planning Board finds the impact on traffic flow and safety to be acceptable. The project includes a vast improvement to the circulation on the pier by removing a number of buildings and moving the new building landward. Due to the unique operations on the pier, maintaining safety is very important to the applicant and the proposed project achieves that goal.

D. Impact on neighborhood visual character, including views and vistas

The Planning Board finds no impact on neighborhood visual character, including views and vistas. The proposed project moves the new waterfront building toward Water Street, opening up the views of the waterfront and includes a more formalized landscaping area that is anticipated to allow public access.

E. Adequacy of method of sewage disposal, source of water and drainage

The Planning Board finds the method of sewage disposal, source of water, and drainage to be acceptable. The property is served by the municipal sewer service, municipal water service, and will improve the existing drainage system as part of the project.

F. Adequacy of utilities and other public services

The Planning Board finds the site to have adequate utilities and other public services. The property is served by municipal electric, telephone, cable and internet infrastructure.

G. The effect of the proposed project on the adequacy of the supply of affordable housing in the Town

The Planning Board finds no effect on the supply of affordable housing in Town.

THEREFORE, given the above and the conditions to be imposed below, the Planning Board finds the application for Site Plan Review and Special Permit for the Complex for Waterfront Access to Exploration and Research (CWATER) Project will be in harmony with the general purpose and intent of this chapter and that the proposal will not have adverse effects which overbalance its beneficial effects on either the neighborhood or the Town.

CONDITIONS

1. The plan shall be constructed as approved. Any changes shall be reviewed by the Planning board to determine if a modification of this decision is necessary. Pursuant to §240-183.B. of the Zoning Bylaw, no permit for occupancy of the new construction shall be issued until the Planning board is satisfied that the conditions of this approval have been met.
2. The Applicant shall obtain an approved Street Opening Permit and post any required bond with the Engineering Division prior to start of construction. The Applicant shall complete the work as approved by the Engineering Division in the Street Opening Permit.
3. Pursuant to §240-221 of the Zoning Bylaw, this special permit shall lapse three years from the date it is granted if a substantial use thereof has not sooner commenced except for good cause.

Ms. Kerfoot	Yes	Mr. Druley	Yes
Ms. Harris	Recused	Ms. Harting-Barrat	Yes
Mr. Dreyer	Yes	Mr. Fox	Yes
Mr. Leary	Yes		

NOTE: Any appeal from this decision of the Planning Board can be made only to the Court and must be made pursuant to Section 17, Chapter 40A (MGL) as amended, and must be filed within twenty (20) days after the date of filing of this decision with the Town Clerk.

Sincerely,



Jed Cornock, AICP
Town Planner

cc: Applicant



**TOWN OF FALMOUTH
MASSACHUSETTS**

BOARD OF APPEALS

Notice of Decision

Notice is hereby given that the Board of Appeals of the Town of Falmouth has made a decision on a petition by **Cape Cod Aggregates Corp.**, for properties located on Dimmock Avenue and Draper Road, East Falmouth, Ma.

(Map(s) 22, 23 Lot(s) 014,013,015,017) under 240-150-156 and 240-212 of the Zoning By-Law, as amended to **grant** the special permit to continue the earthmoving and reclamation operations.

Appeals, if any, shall be made pursuant to the Massachusetts General Laws, Chapter 40A, Section 17, and shall be filed within twenty (20) days after **October 28, 2022** which is the date the Decision was filed in the office of the Town Clerk.

Please contact Noreen Stockman at 508-495-7460
or Noreen.stockman@falmouthma.gov if you have any questions or comments
full text of decision available at <http://www.falmouthmass.us>



**TOWN OF FALMOUTH
MASSACHUSETTS**

BOARD OF APPEALS

Notice of Decision

Notice is hereby given that the Board of Appeals of the Town of Falmouth has made a decision on a petition by Court Ordered Remand - **James B. and Mary E. Knox**, 9 Dartmouth Avenue, Falmouth, Ma.

(Map 46B Lot(s) 009) under 240-3 C. of the Zoning By-Law, as amended to **grant** the special permit to raze and rebuild the pre-existing, non-conforming, single family dwelling.

Appeals, if any, shall be made pursuant to the Massachusetts General Laws, Chapter 40A, Section 17, and shall be filed within twenty (20) days after **November 4, 2022** which is the date the Decision was filed in the office of the Town Clerk.

Please contact Noreen Stockman at 508-495-7460
or Noreen.stockman@falmouthma.gov if you have any questions or comments
full text of decision available at <http://www.falmouthmass.us>



TOWN OF FALMOUTH

ZONING BOARD OF APPEALS

59 TOWN HALL SQUARE, FALMOUTH, MA 02540
508-495-7460 – FAX 508-495-7463

BOARD OF APPEALS NOTICE OF PUBLIC HEARING

Being all persons deemed affected by the Board of Appeals under Section 11 of Chapter 40A of the Massachusetts General Laws you are hereby notified that:

Application #090-22 Christopher Coppellotti, 29 Fern Street, Natick, Ma.: Applied to the Zoning Board of Appeals for a special permit pursuant to section(s) 240-3 C. and 240-69 E. of the Code of Falmouth to allow renovations to include additions to the first floor and a second floor addition, increasing lot coverage by structures on subject property known as 63 Glen Avenue, North Falmouth, Ma.

Map 04A Section 03 Parcel 000 Lot(s) 112

A public hearing will be given on this application, in the Select Board's Meeting Room, Town Hall, on **Thursday, December 1, 2022 at 6:30PM**
You are invited to be present.

By Order of the Board of Appeals,
Chairman, Terrence Hurrie

Plans are available for review prior to the hearing at the Board of Appeals office, Town Hall during the hours of 8:00 AM to 4:00 PM.*Plans are available to review at <https://www.falmouthma.gov/1113/Applications-under-review-by-the-ZBA>



TOWN OF FALMOUTH

ZONING BOARD OF APPEALS

59 TOWN HALL SQUARE, FALMOUTH, MA 02540
508-495-7460 – FAX 508-495-7463

BOARD OF APPEALS NOTICE OF PUBLIC HEARING

Being all persons deemed affected by the Board of Appeals under Section 11 of Chapter 40A of the Massachusetts General Laws you are hereby notified that:

Application #091-22 Patricia J. Barksdale, 71 Philadelphia Street, Teaticket, MA.: Applied to the Zoning Board of Appeals for a special permit pursuant to section(s) 240-3 C. and 240-69 E. of the Code of Falmouth to remove a portion of the existing deck and construct a second story addition to the nonconforming, single family dwelling on subject property known as 71 Philadelphia Street, Teaticket, Ma.

Map 39A Section 09 Parcel 000 Lot(s) 029

A public hearing will be given on this application, in the Select Board's Meeting Room, Town Hall, on **Thursday, December 1, 2022 at 6:30PM**
You are invited to be present.

By Order of the Board of Appeals,
Chairman, Terrence Hurrie

Plans are available for review prior to the hearing at the Board of Appeals office, Town Hall during the hours of 8:00 AM to 4:00 PM.*Plans are available to review at <https://www.falmouthma.gov/1113/Applications-under-review-by-the-ZBA>



TOWN OF FALMOUTH

ZONING BOARD OF APPEALS

59 TOWN HALL SQUARE, FALMOUTH, MA 02540
508-495-7460 – FAX 508-495-7463

BOARD OF APPEALS NOTICE OF PUBLIC HEARING

Being all persons deemed affected by the Board of Appeals under Section 11 of Chapter 40A of the Massachusetts General Laws you are hereby notified that:

Application #094-22 Michael Duffany, 200 Palmer Avenue, Falmouth, MA.: Applied to the Zoning Board of Appeals for a special permit pursuant to section(s) 240-28 E. and 240-3 C. of the Code of Falmouth to convert the existing church into professional office space on subject property known as 175 Palmer Avenue, Falmouth, Ma.

Map 38A Section 03 Parcel 034 Lot(s) 000

A public hearing will be given on this application, in the Select Board's Meeting Room, Town Hall, on **Thursday, December 1, 2022 at 6:30PM**
You are invited to be present.

By Order of the Board of Appeals,
Chairman, Terrence Hurrie

Plans are available for review prior to the hearing at the Board of Appeals office, Town Hall during the hours of 8:00 AM to 4:00 PM. *Plans are available to review at <https://www.falmouthma.gov/1113/Applications-under-review-by-the-ZBA>



TOWN OF FALMOUTH

ZONING BOARD OF APPEALS

59 TOWN HALL SQUARE, FALMOUTH, MA 02540
508-495-7460 – FAX 508-495-7463

BOARD OF APPEALS NOTICE OF PUBLIC HEARING

Being all persons deemed affected by the Board of Appeals under Section 11 of Chapter 40A of the Massachusetts General Laws you are hereby notified that:

Application #093-22 Carole Ann Spear, Trustee, 405 Sandwich Road, East Falmouth, MA.:

Applied to the Zoning Board of Appeals for a special permit pursuant to section(s) 240-69 E. of the Code of Falmouth to construct a single-family dwelling exceeding 20% lot coverage by structures on subject property known as 42 Lake Leaman Road, Falmouth, MA.

Map 46 Section 00K Parcel 000 Lot(s) 002

A public hearing will be given on this application, in the Select Board's Meeting Room, Town Hall, on

Thursday, December 1, 2022 at 6:30PM

You are invited to be present.

By Order of the Board of Appeals,
Chairman, Terrence Hurrie

Plans are available for review prior to the hearing at the Board of Appeals office, Town Hall during the hours of 8:00 AM to 4:00 PM. *Plans are available to review at <https://www.falmouthma.gov/1113/Applications-under-review-by-the-ZBA>



**TOWN OF SANDWICH
PUBLIC HEARING NOTICE
BOARD OF APPEALS**

The Sandwich Board of Appeals will hold a Public Hearing on the application of Rebecca R. Dion, Applicant and Property Owner, for a Special Permit under Sections 1330 and 2420 of the Sandwich Protective Zoning By-Law for property located at 21 Knott Avenue, Sandwich, MA Assessor's Map #93, Parcel #64, for the purpose of razing and rebuilding a pre-existing, non-conforming single-family dwelling. The Public Hearing will be held on November 22, 2022 at the Sand Hill School Community Center, 16 Dewey Ave, Sandwich, MA at 6:00 p.m. The public record information can be viewed at the Planning & Development office, 16 Jan Sebastian Drive, Sandwich, MA, Monday-Friday 8:30 a.m. to 4:30 p.m.

James Killion, Chair
Sandwich Board of Appeals
Publication: Sandwich Enterprise
Publication Dates: November 4 and November 11, 2022