MASSACHUSETTS
watershed·based plans

WATERSHED-BASED PLAN

Monatiquot River (MA74-08)

August 2022

Prepared By:

Town of Braintree, MA
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Prepared For:

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection

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Contents

Executive Summary

Introduction: 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. This WBP was developed by Geosyntec Consultants (Geosyntec) under the direction of the Town of Braintree, Massachusetts, with funding, input, and collaboration from the Massachusetts Department of Environmental Protection (MassDEP).

This WBP was prepared for the Monatiquot River watershed, which is in the towns of Braintree, Randolph, Stoughton, Avon, Holbrook, and Milton, as well as the City of Quincy, Massachusetts. Major streams in the watershed include Beech Run, Blue Hill River, Bouncing Brook, Cochato River (MA74-06), Coon Hollow Brook, Cranberry Brook (MA74-22), Farm River (MA74-07), Glovers Brook, Mary Lee Brook (MA74-23), Monatiquot River (MA74-08), Stetson Brook, Three Swamp Brook, Trout Brook (MA74-12), and Tumbling Brook. Major lakes and ponds within the watershed include Sunset Lake (MA74020), Lake Holbrook (MA74013), Sylvan Lake (MA74021), Richardi Reservoir, Great Pond, and Upper Reservoir. The Monatiquot River is formed by the confluence of the Farm River and the Cochato River and flows into the Weymouth Fore River, which flows to the Atlantic Ocean; the Monatiquot River has a drainage area of approximately 19,610 acres (approximately 30.6 square miles).

Impairments and Pollution Sources: Monatiquot River (MA74-08) is identified as a category 5 water body on the Massachusetts Year 2016 Integrated List of Waters (303(d) list) due to benthic macroinvertebrates, curly-leaf pondweed, Dissolved Oxygen (DO), Fish Passage Barrier, Physical substrate alterations, Escherichia coli (*E. coli*), and Fecal Coliform. The listed sources of these impairments include channelization, introduction of non-native organisms, unspecified urban stormwater, dam or impoundment, hydrostructure impacts on fish passage, discharges from municipal separate sewer systems (MS4), and unknown sources. The other stream segments that are impaired in the watershed include Farm River (MA74-27 and MA74-28), Mary Lee Brook (MA74-23), Cranberry Brook (MA74-22), and the Cochato River (MA74-06). Mary Lee Brook and Cranberry Brook are impaired for *E. coli* due to MS4 discharges and unknown sources. The two segments of the Farm River are impaired for *E. coli* and fish passage barrier due to unknown sources and a dam or impoundment, respectively. The Cochato River is impaired for *E. coli* and Fecal Coliform due to MS4 discharges and unknown sources; the Cochato River also has numerous additional impairments due to Superfund sites. Additionally, the Weymouth-Weir basin, which includes the Monatiquot River watershed, has a pathogen total maximum daily load (TMDL) (MassDEP, et al., 2018).

Goals, Management Measures, and Funding: Water quality goals for this WBP are focused on addressing the pathogen TMDL, listed bacteria and DO impairments, and observed elevated concentrations of Total Phosphorus (TP) from ambient monitoring data. The pollutant load reductions needed to achieve water quality goals are focused on TP. It is expected that efforts to reduce TP loading will also result in improvements to *E. coli* and DO in the Monatiquot River watershed. This WBP includes an adaptive sequence to establish and track specific water quality goals. First, an interim goal has been established to reduce TP loading by 355 pounds/year in the next five years. From there, the focus will be shifted to the long-term goal of delisting all assessment units within the study area based on adaptively adjusting goals based on ongoing monitoring results.

It is expected that goals will be accomplished primarily through the installation of structural best management practices (BMPs) to capture runoff and reduce loading as well as implementation of non-structural BMPs (e.g., street sweeping, catch basin cleaning), and watershed education and outreach.

It is expected that funding for management measures will be obtained from a variety of sources including Section 319 Grant Funding, Town capital funds, volunteer efforts, and other sources. The Town of Braintree has previously used Clean Water Act (CWA) Section 319 Nonpoint Source Pollution Grant Program (CWA Section 319) and Municipal Vulnerability Preparedness (MVP) Action Grant funding to design and install BMPs to help improve water quality in Monatiquot River watershed.

Public Education and Outreach: Goals of public education and outreach are to provide information about proposed stormwater improvements and their anticipated benefits and to promote watershed stewardship. The Town of Braintree aims to engage watershed residents and businesses through interpretive signage, education mailing, online resources, and a variety of other means. It is expected that these programs will be evaluated by tracking coverage from local media, number of mailers distributed, activity on online resources, and other tools applicable to the type of outreach performed.

Implementation Schedule and Evaluation Criteria: Project activities will be implemented based on the information outlined in the following elements for monitoring, implementation of structural BMPs, public education and outreach activities, and periodic updates to the WBP. The WBP implementation schedule includes milestones for BMP implementation, monitoring, public education and outreach, and periodic updates to the WBP.

This WBP recommends establishing a water quality monitoring program to include sampling at key locations in the Monatiquot River watershed. This would support continued understanding of water quality trends in the Monatiquot River including determining sources of pollution, evaluating the effectiveness of implemented BMPs, and tracking compliance with the water quality goals identified in this WBP. Other indirect evaluation metrics are also recommended to continue, included quantification of potential pollutant load reductions from non-structural BMPs (e.g., street sweeping and catch basin cleaning).

This WBP is meant to be a living document, re-evaluated at least once every three years and adjusted as needed based on ongoing efforts (e.g., based on monitoring results, 319 funding, etc.). It is recommended that a working group of watershed stakeholders be established to meet at least biannually to implement and update this WBP, and track progress.

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 in order to be eligible for federal watershed implementation grant funds under CWA Section 319 of the Clean Water Act (CWA), 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 CWA Section 319 implementation grant funds.**

EPA guidelines promote the use of CWA Section 319 funding for developing and implementing WBPs. WBPs are required for all projects implemented with CWA 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 CWA 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

This WBP was developed by Geosyntec under the direction of the Town of Braintree, Massachusetts, with funding, input, and collaboration from MassDEP. This WBP was developed using funds from the CWA Section 319 program to assist grantees in developing technically robust WBPs using MassDEP's Watershed-Based Planning Tool (WBP Tool). The Town of Braintree was a recipient of Fiscal Year 2021 CWA Section 319 Nonpoint Source Pollution Grant Program funding to implement structural best management practices (BMPs) in the Monatiquot River watershed.

The following are core project stakeholders:

- Hillary Waite – Town of Braintree Stormwater Division
- Wednesday Walton – Town of Braintree Stormwater Division
- Kelly Phelan – Town of Braintree Conservation Commission
- James Arsenault – Town of Braintree Department of Public Works (DPW)
- Ben Hulke – Town of Braintree DPW
- Chris Trudel – Town of Braintree Engineering Division
- Meera Patel – Town of Milton DPW
- Meghan Selby – MassDEP
- Judith Rondeau – MassDEP
- Padmini Das – MassDEP
- Courtney Gilligan – MassDEP

This WBP was developed as part of an iterative process:

- First, the Geosyntec project team collected and reviewed existing data and reports for the Monatiquot River watershed received from the Town of Braintree and other stakeholders.
- Next, a core stakeholder conference call was facilitated on June 13, 2022, to solicit input and gain consensus on elements included in the plan (identifying problem areas, BMP projects, water quality goals, public outreach activities, etc.). The meeting minutes from the stakeholder conference call are included in **Appendix A**.
- Next, the Geosyntec project team reviewed additional data and reports received from stakeholders.

- Finally, the preliminary WBP was drafted and reviewed by MassDEP and finalized based on MassDEP input.

This WBP is meant to be a living document. It should be reevaluated at least once every three years and adjusted as-needed based on ongoing efforts (e.g., based on monitoring results, 319 funding, etc.). It is strongly recommended that a working group including additional stakeholders be established to meet at least biannually to implement and update this WBP, and track progress.

Data Sources

This WBP was developed using the framework and data sources provided by MassDEP's WBP Tool and supplemented by information provided in the FY2022 CWA Section 319 application for "Braintree Council on Elder Affairs Retrofit" (Town of Braintree, 2021). Additional data sources were reviewed and are included in subsequent sections of this WBP.

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

This WBP was prepared for the Monatiquot River watershed, which is in the towns of Braintree, Randolph, Stoughton, Avon, Holbrook, and Milton, as well as the City of Quincy, Massachusetts. Major streams in the watershed include Beech Run, Blue Hill River, Bouncing Brook, Cochato River (MA74-06), Coon Hollow Brook, Cranberry Brook (MA74-22), Farm River (MA74-07), Glovers Brook, Mary Lee Brook (MA74-23), Monatiquot River (MA74-08), Stetson Brook, Three Swamp Brook, Trout Brook (MA74-12), and Tumbling Brook. Major lakes and ponds within the watershed include Sunset Lake (MA74020), Lake Holbrook (MA74013), Sylvan Lake (MA74021), Richardi Reservoir, Great Pond, and Upper Reservoir. The Monatiquot River is formed by the confluence of the Farm River and the Cochato River and flows into the Weymouth Fore River, which flows to the Atlantic Ocean; the Monatiquot River has a drainage area of approximately 19,610 acres (approximately 30.6 square miles).

As further discussed below, land use in the Monatiquot River watershed is mostly forested and medium- and high-density residential, with industrial and commercial areas throughout. Impervious cover throughout the watershed is mostly associated with the residential and industrial/ commercial areas. Based on available soil maps, the watershed includes a mix of all the hydrologic soil groups (HSG) (e.g., A, B, C, D), with a large portion of the watershed comprised of urban fill.

Table A-1 presents the general watershed information for the Monatiquot River watershed[1] and **Figure A-1** includes a map of the watershed boundary.

[1] Watersheds are defined by the WBP-tool by utilizing MassGIS drainage sub-basins.

Table A-1: General Watershed Information

Watershed Name (Assessment Unit ID):	Beech Run; Blue Hill River; Bouncing Brook; Cochato River (MA74-06); Coon Hollow Brook; Cranberry Brook (MA74-22); Farm River (MA74-27); Farm River (MA74-27); Glovers Brook; Mary Lee Brook (MA74-23); Monatiquot River (MA74-08); Stetson Brook; Three Swamp Brook; Trout Brook (MA74-12); Tumbling Brook; Sunset Lake (MA74020); Lake Holbrook (MA74013); Sylvan Lake (MA74021); Richardi Reservoir; Great Pond; Upper Reservoir
Major Basin:	Weymouth and Weir River
Watershed Area (within MA):	19,610 acres

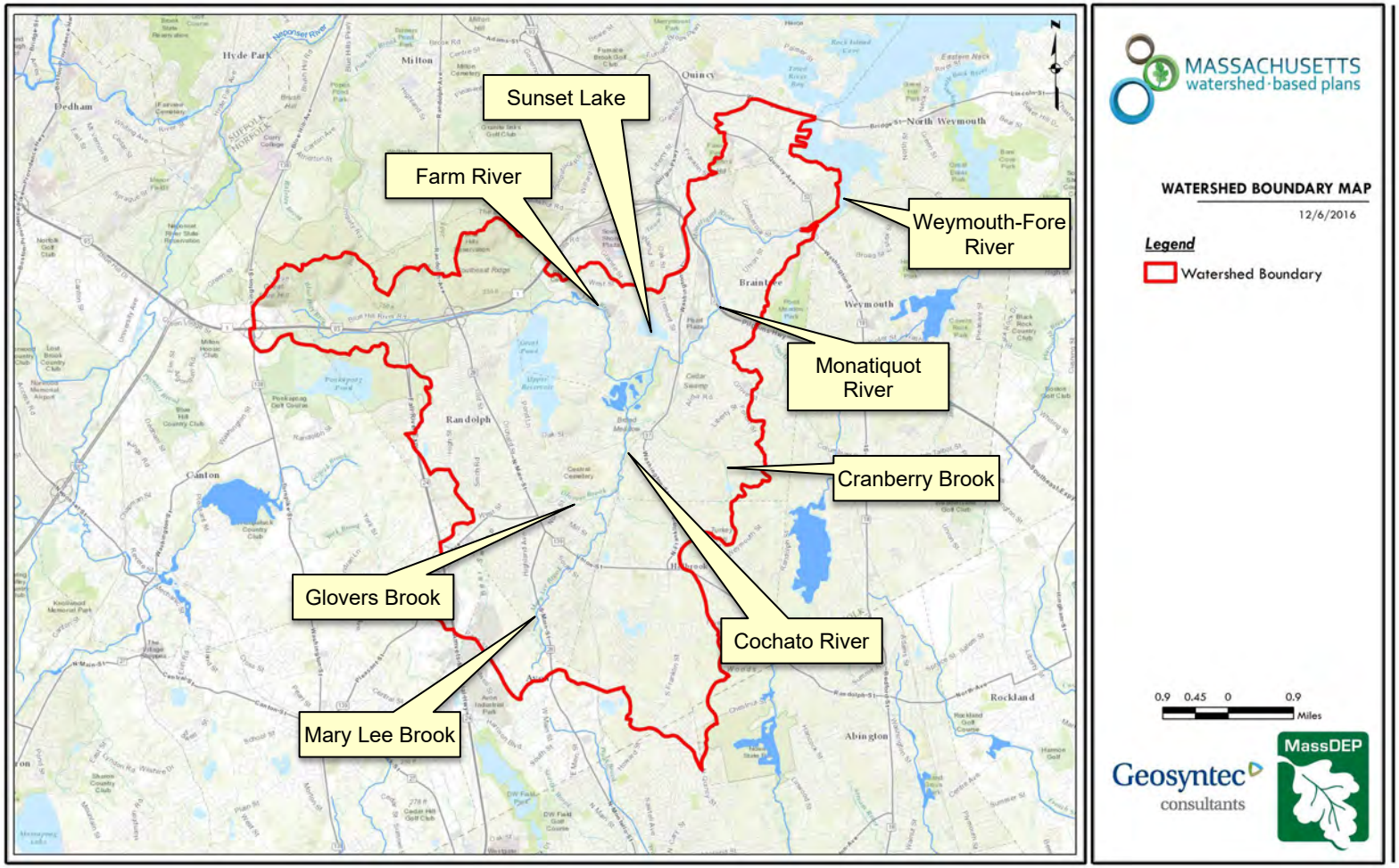

Figure A-1: Monatiquot River Watershed Boundary Map (MassGIS, 2007; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

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

MassDEP Water Quality Assessment Report and TMDL Review

A TMDL assessment for pathogens has been developed for segments of the Monatiquot River watershed and is listed below:

- Final Pathogen TMDL for the Boston Harbor, Weymouth-Weir, and Mystic Watersheds (MassDEP, et al., 2018)

A water quality assessment report was also developed and is listed below:

- Weymouth and Weir River Basin 2004 Water Quality Assessment Report (MassDEP, 2010)

Select excerpts from the water quality assessment report (MassDEP, 2003) relating to the water quality in the Monatiquot River watershed are included in **Appendix B** (note: relevant information is included directly from this document for informational purposes and has not been modified).

Additional Water Quality Data

MassDEP Water Quality Monitoring Program Data

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 CWA 305(b) assessment and 303(d) listing decisions.

Water quality monitoring data is available for the Monatiquot River from the years 2009 and 2017 for Escherichia coli (*E. coli*) and from the year 2009 for Total Phosphorus (TP) (MassDEP, 2020). The *E. coli* data available for major streams in the Monatiquot River watershed is presented in **Table A-2**. The 2009 data for all the locations sampled in the Monatiquot River, Cochato River and Cranberry Brook exceeded the Massachusetts Surface Water Quality Standards (MassDEP, 2013) for *E. coli*, which states that the geometric mean of samples from the most recent 6 months shall not exceed 126 colonies per 100 milliliters (typically based on a minimum of 5 samples) and no single sample shall exceed 235 colonies per 100 milliliters. Two locations sampled in 2017 in the Cochato River exceeded the Massachusetts Surface Water Quality Standards (MassDEP, 2013) for *E. coli*. The 2009 TP data is presented in **Table A-3**; some of the samples in Monatiquot River, Cranberry Brook and Cochato River exceeded the TP EPA "Gold Book" (EPA, 1986) standard of 50 micrograms per liter (µg/L).

Table A-2: Water Quality (*E. coli*) Data in Monatiquot River Watershed (MassDEP, 2020)

Waterbody	Sampling Station ID	Sampling Location Description	Date	*E. coli* (CFU/100mL)	*E. coli* (MPN/100mL)	Geometric Mean of minimum 5 samples within 6 months (CFU/100mL)
Monatiquot River	MONT02	[approximately 700 feet upstream from Commercial Street, Braintree]	5/5/2009	220	NA	307
			6/9/2009	480	NA	
			7/14/2009	430	NA	
			8/18/2009	430	NA	
			9/10/2009	140	NA	
			9/22/2009	140	NA	
Monatiquot River	MONT03	[River Street, Braintree]	5/5/2009	110	NA	192
			6/9/2009	460	NA	
			7/14/2009	50	NA	
			8/18/2009	170	NA	
			9/10/2009	130	NA	
			9/22/2009	230	NA	
Monatiquot River	MR01	[northern most footpath on the Braintree Municipal Golf Course, west of Jefferson Street, Braintree]	7/6/2017	NA	43	NA
			8/9/2017	NA	81	
Cranberry Brook	CRB02	[upstream of road and two stormwater outfalls, Route 37 (Washington Street), Braintree]	5/5/2009	3700		732
			6/9/2009	110		
			7/14/2009	210		
			8/18/2009	120		
			9/10/2009	130		
			9/22/2009	120		
Cochato River	CHR01	[downstream of road and two stormwater outfalls, Route 139 (Union Street), Holbrook]	5/5/2009	1500	NA	440
			6/9/2009	270	NA	
			7/14/2009	100	NA	
			8/18/2009	440	NA	
			9/10/2009	260	NA	
			9/22/2009	70	NA	
Cochato River	CHR01	[downstream at weir on the Braintree Municipal Golf Course, southeast of Richardi Reservoir, Braintree]	7/6/2017	NA	40	NA
			8/9/2017	NA	41	
Cochato River	CHR03	[east of Kingcrest Terrace (trail from eastern end of terrace), Randolph]	7/6/2017	NA	172	NA
			8/9/2017	NA	308	
Cochato River	CHR05	[Center Street, Holbrook]	7/6/2017	NA	142	NA
			8/9/2017	NA	121	
Cochato River	CHR06	[downstream of road and two stormwater outfalls, Route 139 (Union Street), Holbrook]	7/6/2017	NA	86	NA
			8/9/2017	NA	82	

"CFU/100 mL"= colony forming units per 100 milliliters

"MPN/100 ml"= most probable number per 100 milliliters

Table A-3: MassDEP Water Quality Monitoring Program TP Data for Monatiquot River Watershed

Waterbody	Sampling Station ID	Sampling Location Description	Date	TP (µg/L)
Monatiquot River	MONT02	[approximately 700 feet upstream from Commercial Street, Braintree]	5/5/2009	54
			6/9/2009	51
			7/14/2009	36
			8/18/2009	35
			9/22/2009	27
Monatiquot River	MONT03	[River Street, Braintree]	5/5/2009	27
			6/9/2009	32
			7/14/2009	32
			8/18/2009	27
			9/22/2009	25
Cranberry Brook	CRB02	[upstream of road and two stormwater outfalls, Route 37 (Washington Street), Braintree]	5/5/2009	260
			6/9/2009	61
			7/14/2009	38
			8/18/2009	42
			9/22/2009	36
Cochato River	CHR01	[downstream of road and two stormwater outfalls, Route 139 (Union Street), Holbrook]	5/5/2009	81
			6/9/2009	62
			7/14/2009	52
			8/18/2009	77
			9/22/2009	45

Sources: MassDEP, 2020
"µg/L" = micrograms per Liter

Sunset Lake Water Quality Data

Northeast Aquatic Research performed two aquatic plant surveys at Sunset Lake, in Braintree, MA. The first survey took place on August 20, 2019. This survey served as a pre-herbicide treatment investigation of the native and invasive plant community. Target aquatic plant species included invasive Curly-leaf pondweed (*Potamogeton crispus*), invasive Fanwort (*Cambomba caroliniana*), native Naiad (*Najas sp.*), and other Pondweeds (*Potamogeton sp.*). The second survey was performed on July 2, 2020 and served as the post-herbicide treatment survey. In addition to the 2020 plant surveying, water quality sampling was performed pre- and post-herbicide treatment on June 1st and 5th, 2020. The post-treatment monitoring was performed within 24-72hrs after the Reward (Diquat dibromide) treatment. Water quality monitoring included temperature, dissolved oxygen, pH, and conductivity profile measurements, nutrient testing, Secchi clarity, and Diquat herbicide residue testing, as required in the MA Department of Environmental Protection (DEP) Order of Conditions for the herbicide treatment permit. The purpose of the pre- and post-aquatic plant surveys was to document the native and invasive species presence, distribution, and density throughout the littoral zone of the lake before and after being treated with Diquat herbicide (Northeast Aquatic Research, 2021).

Overall, the aquatic herbicide treatment was very effective in reducing target species in Sunset Lake, despite some level of reduced control on invasive Fanwort (*Cabomba caroliniana*). The overall 2020 water quality was moderate, with the lake exhibiting known symptoms of eutrophication, while also managing to maintain relatively good water clarity and moderate surface nutrients (TP and TN) (Northeast Aquatic Research, 2021).

Water Quality Impairments

Impairment categories from the MassDEP 2018/2020 Massachusetts Integrated List of Waters (303(d) List) are listed in **Table A-2**. Known water quality impairments for stream segments in the Monatiquot River watershed, as documented in the 2018/2020 303(d) List, are listed in **Table A-3**.

Monatiquot River (MA74-08) is identified as a category 5 water body due to benthic macroinvertebrates, curly-leaf pondweed, Dissolved Oxygen (DO), Fish Passage Barrier, Physical substrate alterations, *E. coli*, and Fecal Coliform. The listed sources of these impairments include channelization, introduction of non-native organisms, unspecified urban stormwater, dam or impoundment, hydrostructure impacts on fish passage, discharges from municipal separate sewer systems (MS4), and unknown sources. The other stream segments that are impaired in the watershed include Farm River (MA74-27 and MA74-28), Mary Lee Brook (MA74-23), Cranberry Brook (MA74-22), and the Cochato River (MA74-06). Mary Lee Brook and Cranberry Brook are impaired for *E. coli* due to MS4 discharges and unknown sources. The two segments of the Farm River are impaired for *E. coli* and fish passage barrier due to unknown sources and a dam or impoundment, respectively. The Cochato River is impaired for *E. coli* and Fecal Coliform due to MS4 discharges and unknown sources; the Cochato River also has numerous additional impairments due to the presence of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites, also known as Superfund sites.

Table A-2: 2018/2020 MA Integrated List of Waters Categories (MassDEP, 2021)

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 2021)

Assessment Unit ID	Waterbody	Integrated List Category	Designated Use	Impairment Cause	Impairment Source
MA74-06	**Cochato River**	**5**	Fish Consumption	Chlordane in Fish Tissue	CERCLA NPL (Superfund) Sites
MA74-06	**Cochato River**	**5**	Fish Consumption	DDT in Fish Tissue	CERCLA NPL (Superfund) Sites
MA74-06	**Cochato River**	**5**	Fish, other Aquatic Life and Wildlife	Dissolved Oxygen	Discharges from Municipal Separate Storm Sewer Systems (MS4)
MA74-06	**Cochato River**	**5**	Fish, other Aquatic Life and Wildlife	Chlordane in Sediment	CERCLA NPL (Superfund) Sites
MA74-06	**Cochato River**	**5**	Fish, other Aquatic Life and Wildlife	Copper	Source Unknown
MA74-06	**Cochato River**	**5**	Fish, other Aquatic Life and Wildlife	DDT in Sediment	CERCLA NPL (Superfund) Sites
MA74-06	**Cochato River**	**5**	Fish, other Aquatic Life and Wildlife	Lead	CERCLA NPL (Superfund) Sites
MA74-06	**Cochato River**	**5**	Fish, other Aquatic Life and Wildlife	Lead	Source Unknown
MA74-06	**Cochato River**	**5**	Primary Contact Recreation	Escherichia coli (*E. coli*)	Discharges from Municipal Separate Storm Sewer Systems (MS4)
MA74-06	**Cochato River**	**5**	Primary Contact Recreation	Escherichia coli (*E. coli*)	Source Unknown
MA74-06	**Cochato River**	**5**	Primary Contact Recreation	Fecal Coliform	Discharges from Municipal Separate Storm Sewer Systems (MS4)
MA74-06	**Cochato River**	**5**	Primary Contact Recreation	Fecal Coliform	Source Unknown
MA74-08	**Monatiquot River**	**5**	Fish, other Aquatic Life and Wildlife	Benthic Macroinvertebrates	Channelization
MA74-08	**Monatiquot River**	**5**	Fish, other Aquatic Life and Wildlife	Benthic Macroinvertebrates	Source Unknown
MA74-08	**Monatiquot River**	**5**	Fish, other Aquatic Life and Wildlife	Curly-leaf Pondweed	Introduction of Non-native Organisms (Accidental or Intentional)
MA74-08	**Monatiquot River**	**5**	Fish, other Aquatic Life and Wildlife	Dissolved Oxygen	Unspecified Urban Stormwater
MA74-08	**Monatiquot River**	**5**	Fish, other Aquatic Life and Wildlife	Fish Passage Barrier	Dam or Impoundment
MA74-08	**Monatiquot River**	**5**	Fish, other Aquatic Life and Wildlife	Fish Passage Barrier	Hydrostructure Impacts on Fish Passage

Assessment Unit ID	Waterbody	Integrated List Category	Designated Use	Impairment Cause	Impairment Source
MA74-08	**Monatiquot River**	**5**	Fish, other Aquatic Life and Wildlife	Physical substrate habitat alterations	Channelization
MA74-08	**Monatiquot River**	**5**	Fish, other Aquatic Life and Wildlife	Physical substrate habitat alterations	Source Unknown
MA74-08	**Monatiquot River**	**5**	Primary Contact Recreation	Escherichia coli (*E. coli*)	Discharges from Municipal Separate Storm Sewer Systems (MS4)
MA74-08	**Monatiquot River**	**5**	Primary Contact Recreation	Escherichia coli (*E. coli*)	Source Unknown
MA74-08	**Monatiquot River**	**5**	Primary Contact Recreation	Fecal Coliform	Discharges from Municipal Separate Storm Sewer Systems (MS4)
MA74-08	**Monatiquot River**	**5**	Primary Contact Recreation	Fecal Coliform	Source Unknown
MA74-22	**Cranberry Brook**	**5**	Primary Contact Recreation	Escherichia coli (*E. coli*)	Discharges from Municipal Separate Storm Sewer Systems (MS4)
MA74-22	**Cranberry Brook**	**5**	Primary Contact Recreation	Escherichia coli (*E. coli*)	Source Unknown
MA74-23	**Mary Lee Brook**	**5**	Primary Contact Recreation	Escherichia coli (*E. coli*)	Discharges from Municipal Separate Storm Sewer Systems (MS4)
MA74-23	**Mary Lee Brook**	**5**	Primary Contact Recreation	Escherichia coli (*E. coli*)	Source Unknown
MA74-27	**Farm River**	**5**	Fish, other Aquatic Life and Wildlife	Fish Passage Barrier	Dam or Impoundment
MA74-27	**Farm River**	**5**	Primary Contact Recreation	Escherichia coli (*E. coli*)	Source Unknown
MA74-28	**Farm River**	**5**	Fish, other Aquatic Life and Wildlife	Fish Passage Barrier	Dam or Impoundment
MA74-28	**Farm River**	**5**	Primary Contact Recreation	Escherichia coli (*E. coli*)	Source Unknown

Water Quality Goals

Based on the impairments and water quality data identified above, the long-term water quality goal in the Monatiquot River watershed is to reduce bacteria and TP loading to the Monatiquot River so it meets its designated uses for fish, other aquatic life, and wildlife; fish consumption; and primary contact recreation. It is expected that efforts to reduce TP loading will also result in improvements to DO impairment. Excess TP can cause eutrophication which depletes dissolved oxygen. Effective management of TP can limit eutrophication and allow DO to naturally replenish (USEPA, 2015).

The water quality goals for bacteria are based on the Massachusetts Surface Water Quality Standards (MSWQS) (MassDEP, 2013) and the Pathogen TMDL (MassDEP, et al., 2018). The Massachusetts Surface Water Quality Standards (MassDEP, 2013) prescribe the minimum water quality criteria required to sustain a waterbody's designated uses. **Table A-4** includes the Massachusetts surface water classifications by assessment unit within the Monatiquot River watershed (MassDEP, 2021). Class A is assigned to waters designated as a source of public water supply and their tributaries. They are designated as excellent habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation, even if not allowed. These waters shall have excellent aesthetic value. These waters are protected as Outstanding Resource Waters. Class B is assigned to waters designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. Where designated in 314 CMR 4.06 (of the MSWQS), they shall be suitable as a source of public water supply with appropriate treatment ("Treated Water Supply"). Class B waters shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value.

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

Assessment Unit ID	Waterbody	Class
MA74-06	Cochato River	B
MA74-08	Monatiquot River	B
MA74-12	Trout Brook	B
MA74-22	Cranberry Brook	B
MA74-23	Mary Lee Brook	B
MA74-27	Farm River	A
MA74-28	Farm River	B

The water quality goal for TP is based on target concentrations established in the Quality Criteria for Water (EPA, 1986) (also known as the "Gold Book"). The Gold Book states that TP should not exceed 50 µg/L in any stream at the point where it enters any lake or reservoir, nor should TP exceed 25 µg/L within a lake or reservoir. For the purposes of developing WBPs, MassDEP has adopted 50 µg/L as the TP target for all streams (that do not have a TP TMDL) at their downstream discharge point, regardless of which type of water body the stream discharges to.

Refer to **Table A-5** for a list of water quality goals for TP, bacteria, and DO. Element C of this WBP includes proposed management measures to address these water quality goals.

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 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 (MassDEP, 2013) Final Pathogen TMDL for the Boston Harbor, Weymouth-Weir, and Mystic Watersheds (MassDEP, et al., 2018)
	Class A Standards • At water supply intakes in unfiltered public water supplies: either FC shall not exceed 20 FC organisms per 100 ml in all samples taken in any six-month period, or total coliform shall not exceed 100 organisms per 100 ml in 90% of the samples taken in any six-month period, if both FC and total coliform are measured, then only the FC criterion must be met. More stringent regulations may apply under the Massachusetts Drinking Water regulations, 310 CMR 22.00 (see 314 CMR 4.06(1)(d)1.); • At bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: where *E. coli* is the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml; alternatively, where enterococci are the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies per 100 ml and no single sample taken during the bathing season shall exceed 61 colonies per 100 ml; • For other waters and, during the non-bathing season, for waters at bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: the geometric mean of all *E. coli* samples taken within the most recent six months shall not exceed 126 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies per 100 ml; alternatively, where enterococci are the chosen indicator, the geometric mean of all enterococci samples taken within the most recent six months shall not exceed 33 colonies per 100 ml typically based on a minimum of five samples, and no single sample shall exceed 61 colonies per 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department	Massachusetts Surface Water Quality Standards (MassDEP, 2013) Final Pathogen TMDL for the Boston Harbor, Weymouth-Weir, and Mystic Watersheds (MassDEP, et al., 2018)
Dissolved Oxygen (DO)	Dissolved oxygen saturation should not be less than 5 mg/L in warm water fisheries or less than 6 mg/L in cold water fisheries.	Massachusetts Surface Water Quality Standards (MassDEP, 2013)

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

Land use in the Monatiquot watershed is approximately 43 percent forested, 32 percent medium- and high-density residential, 6 percent industrial, 6 percent commercial, 4 percent water, 4 percent open land, 2 percent highway, 2 percent low-density residential, and 1 percent agriculture (**Table A-6** and **Figure A-2**).

Table A-6: Watershed Land Uses

Land Use	Area (acres)	% of Watershed
Forest	8,515	43.4
Medium Density Residential	4,225	21.5
High Density Residential	2,070	10.6
Industrial	1,176	6
Commercial	1,159	5.9
Water	732	3.7
Open Land	719	3.7
Highway	431	2.2
Low Density Residential	394	2
Agriculture	191	1

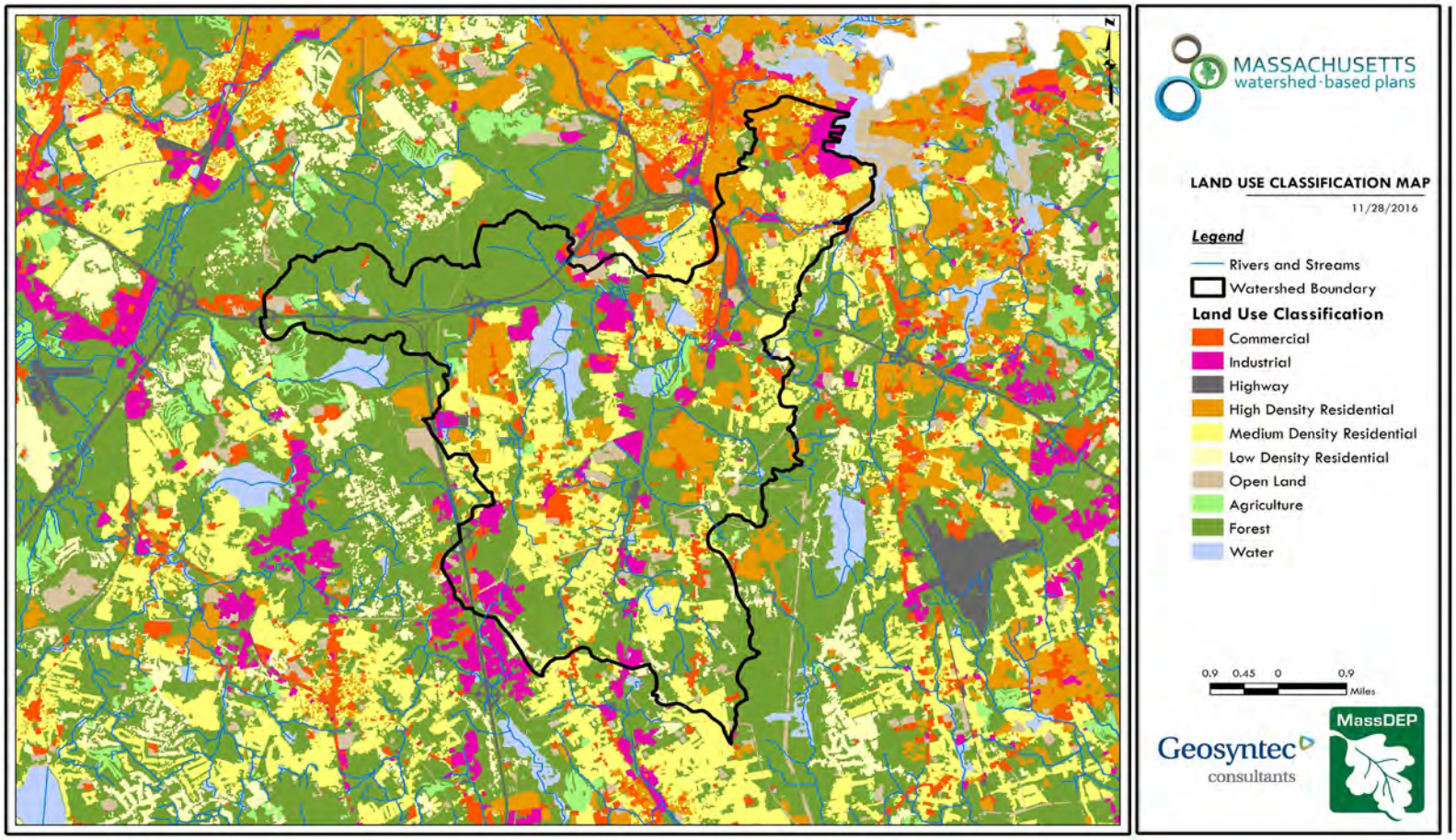

Figure A-2: Watershed Land Use Map (MassGIS, 2007; MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

(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 cover within the Monatiquot River watershed is most concentrated in the downstream area of the watershed (**Figure A-3**).

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. The estimated TIA and DCIA for the Monatiquot River watershed is 23.7 percent and 18.3 percent, respectively. The relationship between TIA and water quality can generally be categorized as shown in **Table A-7** (Schueler et al. 2009).

Table A-7: 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.

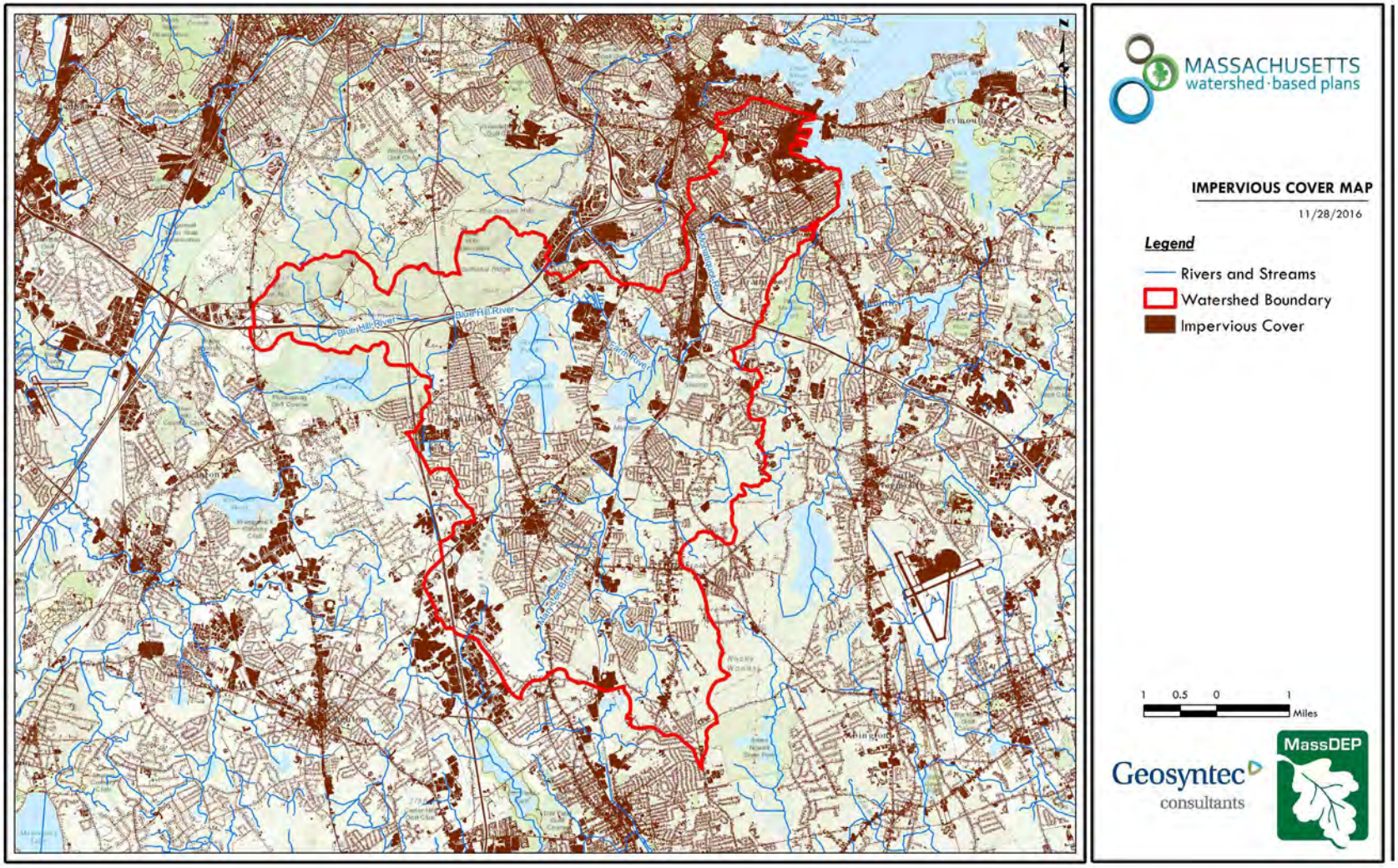

Figure A-3: Watershed Impervious Surface Map (MassGIS, 2007; MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

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

Pollutant Loading

A Geographic Information System (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 Hydrologic Soil Group (HSG) category for that land use to simulate 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 (pounds per year (lb/year))

A_n = area of land use/cover type n (acres)

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

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 C**). **Table A-9** presents the estimated land-use based TN, TP and TSS pollutant loading in the watershed. Bacteria loading has not been estimated for this WBP,. The Pathogen TMDL also did not include an existing loading estimate for bacteria as this type of analysis for pathogens and indicator bacteria is resource intensive and would have a large degree of uncertainty (MassDEP, et al., 2018). The largest contributor of the land-use-based TP, TN and TSS load for Monatiquot River originates from areas designated as medium- and high-density residential. Residential areas provide opportunities for pollutant load reductions through public education and outreach and implementation of residential BMPs.

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

Land Use Type	Pollutant Loading[1]		
	Total Phosphorus (TP) (pounds/year)	Total Nitrogen (TN) (pounds/year)	Total Suspended Solids (TSS) (tons/year)
Medium Density Residential	2,067	17,222	242.89
High Density Residential	2,036	13,842	204.04
Industrial	1,572	13,467	168.46
Commercial	1,516	12,983	162.43
Forest	1,237	6,483	323.17
Highway	374	3,067	182.25
Open Land	325	2,738	59.37
Low Density Residential	166	1,628	22.71
Agriculture	96	586	7.82
TOTAL	9,390	72,017	1,373.14

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

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

Estimated pollutant loads for TP (9,390 lb/yr), TN (72,017 lb/yr), and TSS (1,373 tons/yr) were previously presented in **Table A-9** of this WBP. Bacteria loading has not been estimated for this WBP,. The Pathogen TMDL also did not include an existing loading estimate for bacteria as this type of analysis for pathogens and indicator bacteria is resource intensive and would have a large degree of uncertainty (MassDEP, et al., 2018).

Water Quality Goals

There are many methodologies that can be used to set pollutant load reduction goals for a WBP. Goals can be based on water quality criteria, surface water standards, existing monitoring data, existing TMDL criteria, input by the watershed community, or other data. As discussed by Element A, water quality goals for this WBP are focused on addressing the Final Pathogen TMDL for the Boston Harbor, Weymouth-Weir, and Mystic Watersheds TMDL, the listed bacteria and DO impairment, and observed elevated concentrations of TP from ambient monitoring data. A description of criteria for each water quality goal is described by **Table B-1**. Since it is not practical to estimate bacteria and DO in terms of loading, the pollutant load reductions needed to achieve water quality goals are focused on TP. It is expected that efforts to reduce TP loading will also result in improvements to bacteria and DO in the Monatiquot River watershed.

Additionally, the following adaptive sequence is recommended to establish and track water quality goals for TP.

1. Establish an interim goal to reduce land use-based TP to the Monatiquot River by 355 pounds/year over the next 5 years (by 2027) within the watershed.
2. Establish a monitoring program in accordance with recommendations from Elements H&I. Use monitoring results to perform trend analysis to identify if proposed Element C management measures are resulting in improvements and to identify site candidates to be sampled as indicator sites.
3. Establish a long-term goal to reduce land use-based phosphorus by 3,551 pounds per year and to meet all applicable water quality standards over the next 20 years, leading to the delisting of the Monatiquot River and its tributaries from the 303(d) list.

Table B-1: Pollutant Load Reductions Needed

Pollutant	Existing Estimated Total Load	Water Quality Goal	Required Load Reduction
Total Phosphorus[1]	9,390 lb/year	5,839 lb/year	3,551 lb/year
Bacteria[2]	*Massachusetts Surface Water Quality Standards 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.*	**Class B Standards** • 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.	Not applicable – Concentration Based
		Class A Standards • At water supply intakes in unfiltered public water supplies: either FC shall not exceed 20 FC organisms per 100 ml in all samples taken in any six-month period, or total coliform shall not exceed 100 organisms per 100 ml in 90% of the samples taken in any six-month period, if both FC and total coliform are measured, then only the FC criterion must be met. More stringent regulations may apply under the Massachusetts Drinking Water regulations, 310 CMR 22.00 (see 314 CMR 4.06(1)(d)1.); • At bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: where *E. coli* is the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml; alternatively, where enterococci are the chosen indicator, the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies per 100 ml and no single sample taken during the bathing season shall exceed 61 colonies per 100 ml; For other waters and, during the non-bathing season, for waters at bathing beaches as defined by the Massachusetts Department of Public Health in 105 CMR 445.010: the geometric mean of all *E. coli* samples taken within the most recent six months shall not exceed 126 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies per 100 ml; alternatively, where enterococci are the chosen indicator, the geometric mean of all enterococci samples taken within the most recent six months shall not exceed 33 colonies per 100 ml typically based on a minimum of five samples, and no single sample shall exceed 61 colonies per 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department	Not applicable – Concentration Based

Pollutant	Existing Estimated Total Load	Water Quality Goal	Required Load Reduction
Dissolved Oxygen (DO)[3]	*Massachusetts Surface Water Quality Standards for DO are concentration standards (e.g., colonies of fecal coliform bacteria per 100 ml), which are difficult to predict based on estimated annual loading.*	DO saturation should not be less than 5 mg/L in warm water fisheries or less than 6 mg/L in cold water fisheries.	Not applicable – Concentration Based

"lb/year" = pounds per year

Notes:

1. *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 Monatiquot River. 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: 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 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.*
2. *For all waterbodies, including impaired waters that have a pathogen TMDL, the water quality goal for bacteria is based on the Massachusetts Surface Water Quality Standards (MSWQS) (MassDEP, 2013) that apply to the Water Class of the selected water body.*
3. *Dissolved oxygen criteria are based on the Massachusetts Surface Water Quality Standards (MSWQS) (MassDEP, 2013).*

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.

Management measures, also referred to as stormwater best management practices (BMPs) manage stormwater runoff by reducing peak runoff rates, managing runoff volume, and improving water quality by reducing nutrients and pollutants such as TP, TN, and TSS. There are two main types of BMPs: structural BMPs that are engineering systems such as (but not limited to) rain gardens, water quality swales, and subsurface infiltration units, and non-structural BMPs that are broader practices such as street sweeping and catch basin cleaning which indirectly reduce the nutrient load to waterbodies.

Existing Management Measures

The Town of Braintree was awarded funding through the Fiscal Year 2011 CWA Section 319 Nonpoint Source Pollution Grant Program to retrofit two untreated stormwater discharges at the swimming beach on the 57-acre Sunset Lake. The BMPs included permeable pavers, rain gardens, deep sump catch basins and an infiltration trench, all within or adjacent to the lake parking lot. The total estimated pollutant load reduction of the BMPs was 2,817 lb/year of TSS, 5.7 lb/year of TP, 14.1 lb/year of TN. Additionally, the infiltration trench and the rain gardens were estimated to reduce 90 percent of the incoming bacterial load (Town of Braintree, 2011).

Ongoing Management Measures

Braintree Council on Elders Affairs Site

The Town of Braintree was awarded funding through the Fiscal Year 2021 CWA Section 319 Nonpoint Source Pollution Grant Program to implement stormwater management BMPs at the Braintree Council on Elder Affairs property. This location was chosen based on recommendations from the Braintree Sub-Watershed Assessment and Stormwater Retrofit Plan (Nitsch Engineering, 2021), which was funded through the Fiscal Year 2019 CWA Section 604(b) Water Quality Management Planning Grant Program.

The Town of Braintree had imminent plans to reconstruct the existing parking lot and ball field area at this property in order to expand the available parking area. This is being phased so that the proposed stormwater BMPs can be readily integrated into the overall project. The project will retrofit the paved parking lot with two landscaped strips and a grass swale that direct stormwater into an infiltration basin at the base of the parking lot. The landscaped strips and grass swale were chosen for their relative ease of maintenance, ability to infiltrate, and aesthetic value. The larger bioretention basin will treat the majority of stormwater, and a supplementary sediment forebay will slow runoff from the upper parking area as it enters the basin. The BMPs will be designed to treat at least the first inch of stormwater runoff. The Town of Braintree currently owns and maintains similar structures

at the Sunset Lake location (see above) and understands typical maintenance of infiltration BMPs (Town of Braintree, 2021a).

The total estimated pollutant load reduction that the BMP will achieve is 11,280 lb/year of TSS, 34 lb/year of TP, 66 lb/year of TN, and 172,980 billion colonies of bacteria per year (Nitsch Engineering, 2021). Conceptual design plans for the project are included in **Appendix D**.

Smith Beach

The Town of Braintree was awarded funding through a Municipal Vulnerability Preparedness (MVP) Action Grant to complete design plans for proposed BMPs at this location. The proposed design involves leveling the existing Smith Beach parking lot and repaving with permeable pavement. The design also includes improvements to current stormwater systems in the adjacent street and the installation of vegetated islands and increased tree canopy to the parking lot. The total estimated pollutant load reduction that the BMP will achieve is 3,620 lb/year of TSS, 10 lb/year of TP, 18 lb/year of TN, and 399,620 billion colonies of bacteria per year (Nitsch Engineering, 2021). The final design plan set is included in **Appendix E**.

Watson Park

The Town of Braintree was awarded funding through the Fiscal Year 2022 CWA Section 319 Nonpoint Source Pollution Grant Program to implement stormwater management BMPs at the Watson Park property. This location was chosen based on recommendations from the Braintree Sub-Watershed Assessment and Stormwater Retrofit Plan (Nitsch Engineering, 2021), which was funded through the Fiscal Year 2019 CWA Section 604(b) Water Quality Management Planning Grant Program.

Under current conditions, runoff from the upland neighborhood flows into street drainage and is piped to outfalls directly on the banks of the Weymouth Fore River (just downstream of where the Monatiquot River becomes the Weymouth Fore River). The proposed BMPs will divert runoff from the existing street drainage into a bioretention basin with subsurface chambers. The BMP will be designed to meet the Massachusetts Stormwater Standards, including sizing to treat runoff from the 1-inch storm at a minimum, with additional treatment if feasible. Recent soil test pits indicate that infiltration is a suitable implementation strategy for the site.

The Town of Braintree is currently designing changes to the parking lot at Watson Park in order to expand the available parking area. The short-term plan is to construct additional parking to support recreational use, while also constructing a flood protection berm throughout the park (this berm project is underway and was partially funded by a grant from the Office of Coastal Zone Management). The proposed BMPs at Watson Park will complement the ongoing work and reduce potential stormwater impacts to the receiving water. The long-term plan is to construct sports fields elsewhere in Braintree, eventually ceasing use of the Watson Park fields and allowing for salt marsh migration into the park area. The stormwater BMPs will support this work and reduce the impacts of nonpoint source pollution to the river and marsh (Town of Braintree, 2021b).

The total estimated pollutant load reduction that the BMP will achieve is 6,530 lb/year of TSS, 14 lb/year of TP, 24 lb/year of TN, and 640,250 billion colonies of bacteria per year (Nitsch Engineering, 2021). Conceptual design plans for the project are included in **Appendix F**.

Future Management Measures

604(b) Assessment

The Town of Braintree was awarded funding through the Fiscal Year 2019 CWA Section 604(b) Water Quality Management Planning Grant Program to identify and prioritize town-owned properties within the Monatiquot River/upper Weymouth Fore River watershed for potential green infrastructure to reduce pathogen loading, focusing on designing BMPs with the greatest potential for bacterial load reduction. Conceptual BMP designs, pollutant load reduction estimates, and estimated construction costs were developed for each of the identified locations. The study provided the Town of Braintree with a menu of potential green infrastructure projects for future consideration (Nitsch Engineering, 2021). Table C-1 summarizes the seven conceptual designs and **Figure C-1** identifies the site locations.

The implementation of three of the recommended locations (Site 4 – Braintree Council on Elder Affairs, Site 1 – Smiths Beach, and Site 2 – Watson Park) are currently in progress (see above). The current goal is to complete implementation of BMPs at the remaining sites (Site 3, Site 5, Site 6, and Site 7) in future years.

Table C-1: Summary Table of Conceptual Designs from 604(b) Assessment (Nitsch Engineering, 2021)

	Site 1 - Vinedale Parking & Smiths Beach	Site 1 – Vinedale Parking & Smiths Beach	Site 2 – Watson Park	Site 3 – DPW Building	Site 4 – Braintree Council on Aging	Site 5 – 74 Pond Street	Site 6 – Hollingsworth Park	Site 7 – Oakden Ave & Braintree Town Forest
BMP Type	Porous Parking Lot	Infiltration Trench	Bioretention Basin	Bioretention Basin	Infiltration Basin	Infiltration Basin	Wet Water Quality Swale	Filtration Trench
Receiving Water	Weymouth Fore River	Weymouth Fore River	Weymouth Fore River	Weymouth Fore River	Monatiquot River	Monatiquot River	Farm River	Cranberry Brook
Drainage Area (acres)	6.9	2.4	14.9	0.8	4.2	1	1.3	4.6
Impervious Area (acres)	3.7	0.5	2.8	0.5	2.9	0.7	1.2	1.8
Pathogen Reduction (billion colonies/year)	399,620	399,600	640,250	30,310	172,980	41,810	138,170	168,060
TSS Reduction (lb/year)	3,620	3,600	6,530	2,220	11,280	2,730	177	1,500
TP Reduction (lb/year)	10	10	14	5	34	8	0	3
TN Reduction (lb/year)	18	18	24	9	66	16	22	9
Estimated Construction Cost	$712,300	$56,600	$535,700	$48,100	$172,800	$104,600	$58,500	$159,900
Estimated Cost/Impervious Acre Treated	$192,500	$113,200	$191,300	$96,200	$59,600	$149,400	$48,800	$88,800

"BMP" = Best Management Practice
"DPW" = Department of Public Works
"TSS" = Total Suspended Solids
"TP" = Total Phosphorus
"TN" = Total Nitrogen
"lb/year" = pounds per year

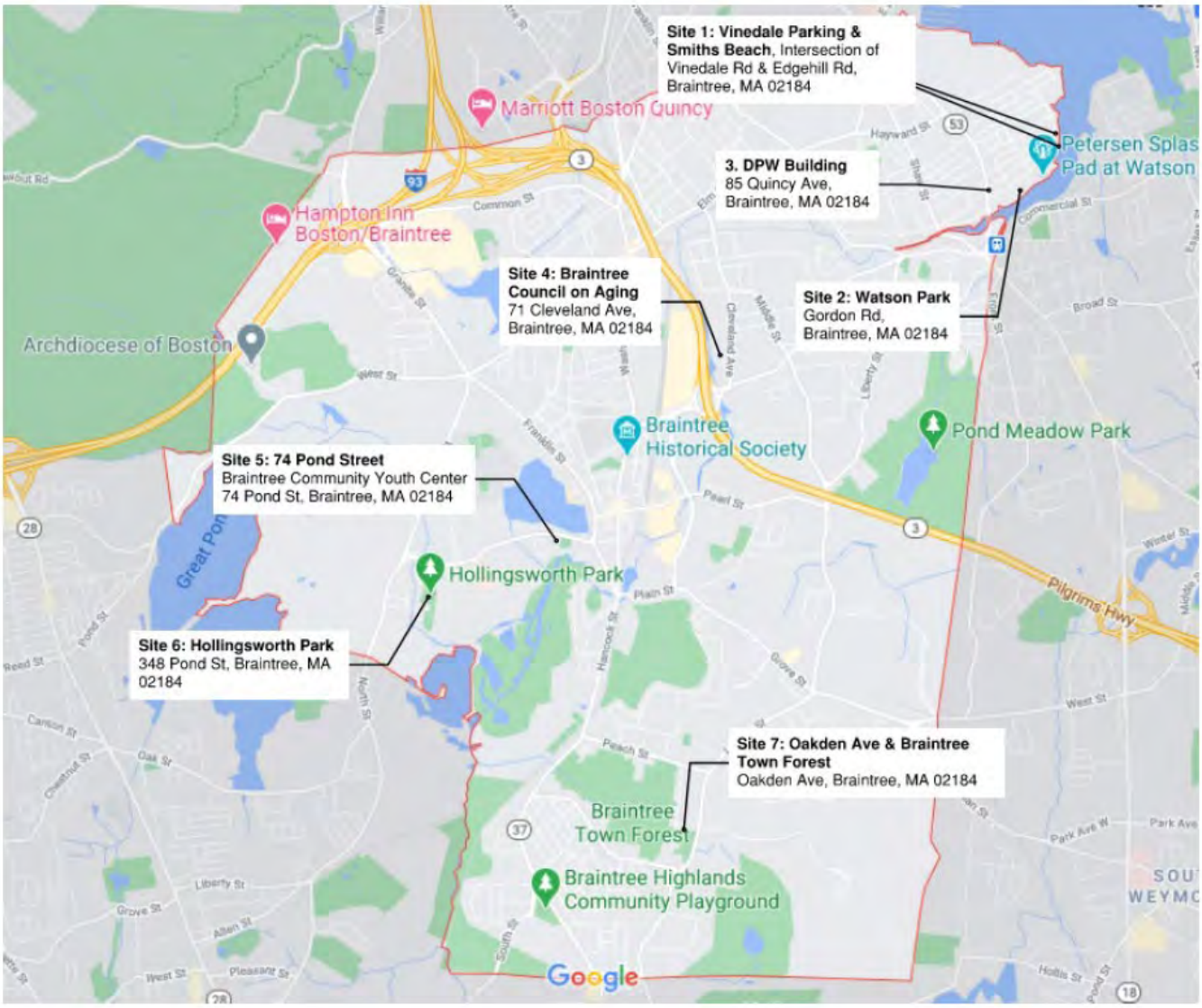

Figure C-1: Locus Map of Braintree 604(b) Site Locations (adapted from Nitsch Engineering, 2021)

BMP Hotspot Map

The following GIS-based analysis was performed within the Monatiquot River watershed as a planning-level screening to help identify high priority parcels for BMP or stormwater management measure implementation[2]:

- 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-2** 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);

[2] 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).

- 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-2 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-2** 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. This analysis may be used for future consideration when identifying additional BMP opportunity locations within the Monatiquot River watershed.

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

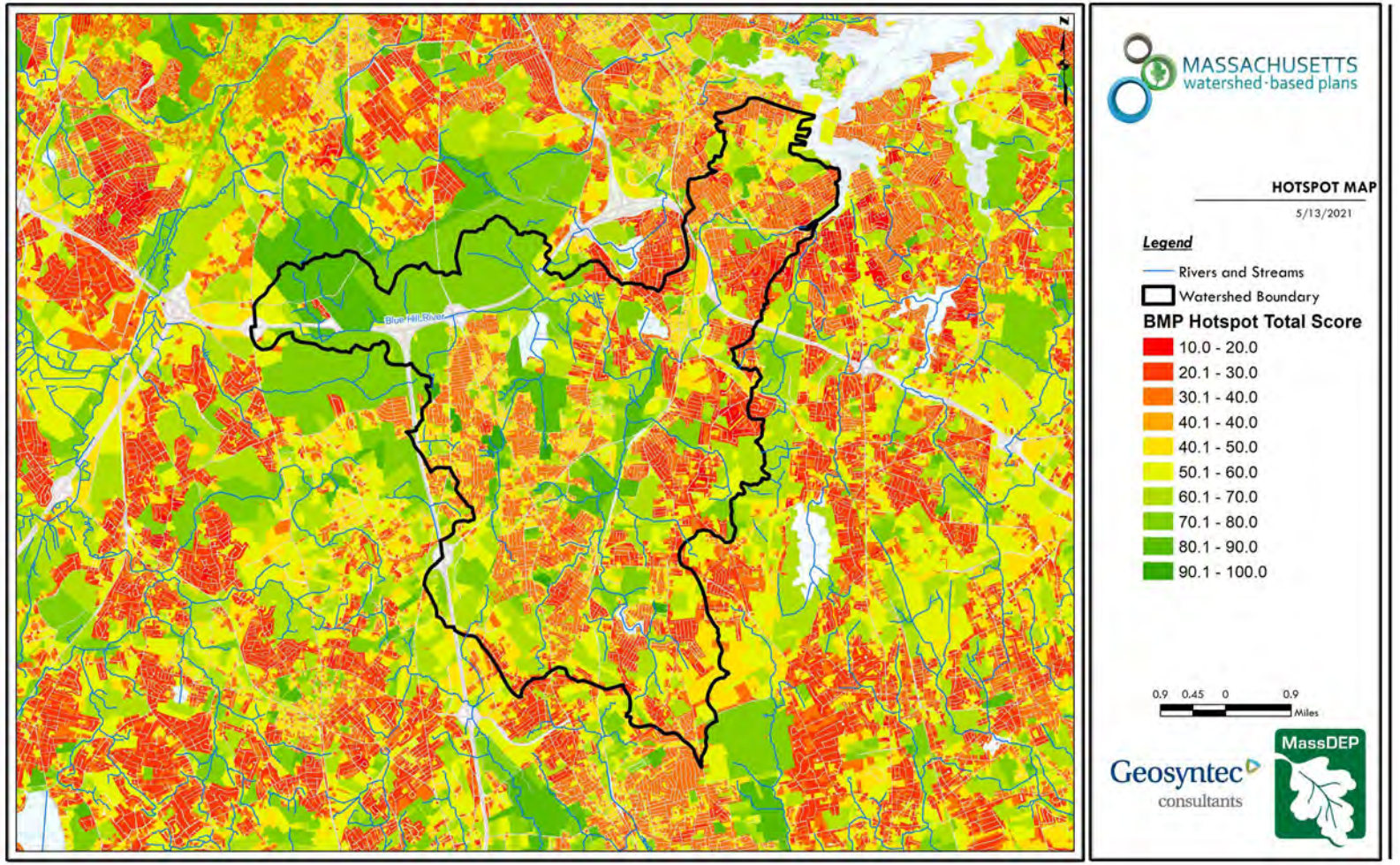

Figure C-2: BMP Hotspot Map (MassGIS (2015a), MassGIS (2015b), MassGIS (2017a), MassGIS (2017b), MassGIS (2020), MA Department of Revenue Division of Local Services (2016), MassGIS (2005), ArcGIS (2020), MassGIS (2009b), MassGIS (2012), ArcGIS (2020b))

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

Nonstructural BMPs

Nonstructural BMPs, including street sweeping and catch basin cleaning, are implemented by the municipalities within the Monatiquot River watershed in order to comply with their respective permits under the Clean Water Act's National Pollutant Discharge Elimination System (NPDES) Phase II stormwater regulations. It is recommended, if it has not already been done, that these nonstructural BMPs be evaluated, and potentially optimized for removal of TP and bacteria. First, it is recommended that potential pollutant load removals from ongoing activities be calculated in accordance with **Elements H and I** of this WBP. Next, it is recommended that ongoing activities be evaluated to see if potential improvements can be implemented to achieve higher pollutant load reductions, such as increased frequency or improved technology.

Other nonstructural BMPs could include septic system maintenance, municipal sewer system inspection and maintenance, land use regulation revision, protection of open space, impervious cover reduction, adoption of good housekeeping practices, and public education and outreach (see Element E). .

WBP Implementation

As stated in the introduction, this WBP is meant to be a living document. It should be reevaluated at least once every three years and adjusted as-needed based on ongoing efforts (e.g., based on monitoring results, 319 funding, etc.). It is strongly recommended that a working group including additional stakeholders be established to meet at least biannually to implement and update this WBP, and track progress.

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.

Current and Future Management Measures

The funding and cost estimates needed to implement the existing and ongoing management measures as well as future management measures, which are presented in Element C of this WBP, are included in **Table D-1**. These costs include the engineering design (technical assistance), construction, permitting (technical assistance), municipal staff hours, and public education.

Table D-1: Summary of Current Estimated Planning-level BMP Costs

Ongoing Management Measures							
BMP	**Construction Cost**	**Design and Permitting (Technical Assistance) Cost**	**Public Education and Outreach Cost**	**Municipal Staff Cost**	**Total Cost**	**Portion of Total Cost that is grant-funded**	**Grant**
Braintree Council on Elders Affairs	$189,350	$12,800	$17,246	$14,369	$233,764	$138,250	Section 319
Smith Beach	$1,139,787	Completed	TBD	TBD	TBD	TBD	TBD
Watson Park	$532,673	$65,000	$17,096	$22,824	$639,592	$375,000	Section 319
Future Management Measures							
BMP	**Construction Cost**	**Design and Permitting (Technical Assistance) Cost**	**Public Education and Outreach Cost**	**Municipal Staff Cost**	**Total Cost**	**Portion of Total Cost that is grant-funded**	**Grant**
DPW Building	$48,100	TBD	TBD	TBD	TBD	TBD	TBD
74 Pond Street	$104,600	TBD	TBD	TBD	TBD	TBD	TBD
Hollingsworth Park	$58,500	TBD	TBD	TBD	TBD	TBD	TBD
Oakden Avenue & Braintree Town Forest	$159,900	TBD	TBD	TBD	TBD	TBD	TBD

"TBD" = to be determined

"Section 319" = CWA Section 319 Nonpoint Source Pollution Grant Program

Funding for future BMP installations to further reduce loads within the Monatiquot River watershed may be provided by a variety of sources, such as the CWA Section 319 Nonpoint Source Pollution Grant Program, town capital funds, state grants such as Coastal Pollution Remediation grants, Municipal Vulnerability Preparedness or other grant programs such as hazard mitigation funding. Additional methods of funding include capital improvement funding and EPA's Clean Water State Revolving Funds (CWSRF) which provides communities low-cost financing for water quality infrastructure projects. At a more local level, other sources of funding could include businesses, service organizations, community foundations, watershed groups, and other organizations that could fund small projects and provide education and outreach.

The Town of Braintree has previously been successful with and will continue to pursue securing grant funding through various sources. Guidance is available to provide additional information on potential funding sources for nonpoint source pollution reduction efforts[3].

[3] http://prj.geosyntec.com/prjMADEPWBP_Files/Guide/Element%20D%20-%20Funds%20and%20Resources%20Guide.pdf

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.

Public information and education was one of the major topics discussed during the stakeholder meeting of June 13, 2022 (**Appendix A**). For example, the Town of Braintree is dedicating significant time to public outreach for the Council on Elder Affairs project (discussed in Element C), as the project has a built-in audience of residents who use town services and are invested in the Town. In addition, the Town of Braintree has a dedicated Stormwater Outreach Coordinator who has developed an adopt-a-drain program and has a presence in classrooms, as well developing typical outreach products such as mailers, flyers, etc.

Components of the nonpoint source public information and education program, within the Monatiquot River watershed, are described below. This section of the WBP will be updated when the plan is reevaluated in 2025 in accordance with Elements F&G of this document.

Step 1: Goals and Objectives

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

1. Provide information to promote watershed stewardship.
2. Provide information about nonpoint source pollution and structural and non-structural BMPs within the watershed.
3. Provide information about completed and proposed stormwater BMPs and their anticipated water quality benefits.
4. Meet Massachusetts MS4 Permit Requirements.

Step 2: Target Audience

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

1. Residents within the watershed.
2. Businesses, institutions, and commercial facilities within the watershed.
3. Schools within the watershed.
4. Watershed organizations and other user groups.
5. Developers (construction) within the watershed.
6. Industrial facilities within the watershed.

Step 3: Outreach Products and Distribution

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

1. Prior to construction of the Braintree Council on Elder Affairs project (Town of Braintree, 2021a), the Braintree Stormwater Division and Engineering Division will meet with representatives and constituents of the Elder Affairs building to share information about the project with the public. Following construction, the Stormwater Division will design and distribute printed outreach materials to the public to inform them of the project and educate them on the importance of structural BMPS in their community, including a town-wide mailer and a brochure for the Elder Affairs building. The Division will also design an interpretive sign for the site and host a planting event for the landscaped islands once the project is complete.
2. Prior to construction of the Watson Park project (Town of Braintree, 2021b), the Town's representatives will hold a public meeting to inform constituents of the project, provide design updates, and also listen to ideas and concerns about the proposed project. The Town of Braintree's current database will be used to update residents about the ongoing project via their newsletter "the Stormwater Splash", as well as provide project updates to the Town councilors. A town-wide mailing will be created and distributed that will present stormwater BMP projects in the Town of Braintree. As BMP projects are completed, the Stormwater Division will have a table set up during baseball opening weekend, inviting residents and families to interact and learn more about stormwater in Braintree, and ask questions about the finished project. During the project, the Town of Braintree will provide regular website and social media updates.
3. Similar outreach efforts to those listed above will be completed for future BMP projects in the Town of Braintree such as the Smith's Beach BMPs.
4. The Town of Braintree is part of the "Adopt-a-drain" (https://ma.adopt-a-drain.org/) program, which is an online system where residents can log in and select a catch basin to "adopt". Users are able to name "their" catch basin and upload pictures of it. The minimum requirement is to clean off the top of the catch basin and log the type of debris and amount into the system.
5. The Stormwater Management Program (SWMP) for the town of Braintree includes additional outreach efforts being conducted within the Town of Braintree (Town of Braintree, 2021c), including:
    a. Annually distributing a brochure to residents, which includes tips on what residents can do to help mitigate stormwater pollution (e.g., picking up pet waste, stormwater-friendly lawn care practices, car maintenance, etc.) and background on the importance of stormwater management.
    b. Annually distributing a brochure or digital poster describing the negative impacts of pet waste on Braintree's water quality and the importance of proper pet waste management.
    c. Publications in local newspapers and newsletters pertaining to stormwater management goals and public participation opportunities.
    d. Working with Braintree Schools to develop stormwater curriculum and presentations to classrooms about stormwater pollution; include demonstration BMPs in school construction projects.
    e. Working with the Fore River Stormwater Partnership, Sustainable Braintree, Braintree Farmers' Market, East Braintree Civic Association, Statewide Stormwater Coalition, Boy Scouts, Chamber of Commerce, Rotary Club, and others on stormwater related issues and projects.

f. Developing a webpage for business owners that includes BMPs for waste and material storage, indoor and outdoor cleaning, chemical spills, snow and ice removal, stormwater-friendly landscaping and irrigation practices.

g. Developing a webpage for developers that includes information about the NPDES Construction General Permit, links to developer-specific stormwater management literature from EPA and DCR, and LID fact sheets

h. Annually distributing a brochure that includes information on what developers can do to reduce stormwater runoff on construction sites, LID implementation, and statewide stormwater standards for construction projects

i. Developing a webpage that includes information about industrial SWPPPs, salt storage, employee training protocol, spill prevention and response procedure, erosion and dust control, runoff management, and illicit discharge detection/elimination

j. Annually distributing a brochure includes information on what industries can do to reduce or eliminate the exposure of industrial operations to rainfall and runoff

k. Hosting a bi-annual household hazardous waste and electronics collection for Braintree residents.

l. Hosting an annual watershed cleanup event.

Step 4: Evaluate Information/Education Program

Outreach products may be evaluated by the following methods:

1. Track the number of materials and information distributed, such as pamphlets, newsletters, and emails, and the size of the lists receiving these materials.
2. Track the number of people reached by each stormwater message using metrics such as number of subscribers to a given publication and hit counters on web articles.
3. Track number of presentations given, classes and/or students reached, and teachers using the curriculum each year.
4. Track the amount of debris logged within the "Adopt-a-drain" database within the watershed.
5. Track number of household hazardous waste collections and quantity of hazardous waste collected each year.
6. Track the number of watershed public outreach events and attendance at each.

Resources for Additional Outreach Products

The EPA's "Nonpoint Source Outreach Toolbox" www.epa.gov/nps/toolbox provides information, tools, and more than 700 outreach materials that can be used or adapted to develop an outreach campaign. The toolbox focuses on 6 nonpoint source pollution categories:

- stormwater
- household hazardeous waste
- septic systems
- lawn care
- pet care

- automotive care

Outreach products in the Toolbox include print ads, public service announcements, and a variety of materials for billboards, signage, kiosks, posters, brochures, fact sheets, and giveaways that help to raise awareness and promote non-polluting behaviors (see additional links in sections below). Permission-to-use information is included for outreach products, which makes it easy to tailor them to local priorities. Evaluations of several outreach campaigns also offer real-world examples of what works best in terms of messages, communication styles, and formats. Other helpful resources include:

- MassDEP's Clean Water Toolkit (https://megamanual.geosyntec.com/npsmanual/default.aspx)
- USEPA's Soak Up the Rain materials (https://www.epa.gov/soakuptherain)
- USEPA's Green Infrastructure Collaborative (https://www.epa.gov/green-infrastructure/green-infrastructure-federal-collaborative#Green%20Infrastructure%20Collaborative%20Resources)

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.

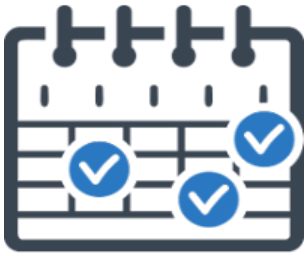

Table FG-1 provides a preliminary schedule for implementation of recommendations provided by this WBP. It is expected that the WBP will be re-evaluated and updated, by the Monatiquot River watershed stakeholders, in 2025, or as needed, based on ongoing monitoring results and other ongoing efforts. New projects will be identified through future data analysis and stakeholder engagement and will be included in updates to the implementation schedule.

Table FG-1: Implementation Schedule and Interim Measurable Milestones[4]

Category (and Stakeholder Involved)	Action	Estimated Cost	Year(s)
Monitoring (Town of Braintree and stakeholders)	Establish a monitoring program and perform water quality sampling at key locations along Monatiquot River watershed segments per Element H&I		Annual
Structural BMPs (Town of Braintree)	Implement Braintree Council on Elders Affairs Project	$216,518	2022—2023
	Implement Smith's Beach Project	$1,139,787	2022—2023
	Implement Watson Park Project	$622,496	2022—2023
	Obtain funding, design, prioritize, and implement structural BMP(s) at one of the future project areas identified in Element C		2023—2024
	Obtain funding, design, prioritize, and implement structural BMP(s) at one of the future project areas identified in Element C		2024—2025
Nonstructural BMPs (all Municipalities within the watershed)	Continue to document potential pollutant removals from ongoing nonstructural BMPs (i.e., street sweeping, catch basin cleaning). The methodology is included in the 2016 Massachusetts Small MS4 Permit and in Elements H&I of this WBP.		Annual
	Evaluate ongoing nonstructural BMPs and determine if modifications can be made to optimize pollutant removals (e.g., increase frequency).		2023
	Routinely implement optimized nonstructural BMPs.		Annual
Public Education and Outreach (Town of Braintree)	Braintree Council on Elders Affairs Project – Public Outreach	$17,246	2022—2023
	Watson Park Project – Public Outreach	$17,096	2022-2023
	Continue and expand adopt-a-drain program		Annual
	Continue watershed events and other public education and outreach efforts (see Element E)		Annual

[4] Note that goals and milestones of this WBP are intended to be adaptable and flexible. Stakeholders will perform tasks contingent on available resources and funding.

Category (and Stakeholder Involved)	Action	Estimated Cost	Year(s)
Adaptive Management and Plan Updates (all stakeholders)	Establish a working group that includes stakeholders and other interested parties to implement recommendations and track progress. Meet at least twice per year.		2022
	Reevaluate WBP at least once every three years and adjust, as needed, based on ongoing efforts (e.g., based on monitoring results, 319 funding, etc.). – Next update, July 2025		2025
	Reach interim goal to reduce land-based phosphorus by 355 lbs/yr		**2027**
	Reach long-term goal Delist Monatiquot River watershed segments from the 303(d) list.		**2042**

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 bacteria and TP water quality goals are presented under Element A and B of this WBP. To achieve the interim water quality goals, the annual TP 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 help make progress towards 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 the Monatiquot River watershed and in making progress toward achieving the water quality goals.

Direct Measurements

Direct measurements are generally expected to be performed as described below. Prior to implementing a direct measurement program, an abbreviated Quality Assurance Program Plan (QAPP)[5] and/or Standard Operating Procedures (SOPs) should be established to outline the details of the program and establish best practices for sample collection and analysis. It is suggested that the Town of Braintree and other stakeholders consider collaborating on this effort to perform the sampling outlined below. Water quality monitoring may also be performed through a volunteer training program to save on costs in accordance with established practices for MassDEP's water quality monitoring for volunteers[6]. MassDEP also provides support for water quality monitoring efforts through its Water Quality Monitoring Grant Program.

River Sampling

Regular sampling will be established to understand the water quality in the Monatiquot River and its tributaries, including determining sources of pollution and tracking achievements toward water quality goals. Key features of the water quality monitoring program will include:

[5] Additional information is provided at: https://www.mass.gov/guides/water-quality-monitoring-quality-management-program

[6] Additional EPA guidance is provided at: https://www.epa.gov/sites/production/files/2015-06/documents/stream.pdf

- Analytes: The samples collected should primarily be analyzed for *E. coli* and TP. Additional parameters such as chlorophyll-a, dissolved oxygen, temperature, conductivity, pH, dissolved phosphorus, and flow rate could provide additional data to better understand the health of the watershed and the Monatiquot River.
- Sampling Frequency: It is recommended that a minimum of five sampling events be completed during the months of May and October for the next three years. *E. coli* sampling which is aligned with proposed surface water quality standard revisions and MassDEP assessment requirements would provide the most value (sampling conducted every other week consistently between April 1st and October 15th, at a minimum sampling every other week June through September).
- Locations: The water quality monitoring program should be focused in the Monatiquot River and its major tributaries (at a minimum the MassDEP locations described in **Table A-2** and **Table A-3** of Element A). If possible, samples should also be collected directly downstream of implemented BMPs to determine the impact of BMPs within the watershed (samples at these locations prior to BMP implementation should also be collected to establish a baseline). Monitoring locations should ultimately be selected based on accessibility and representativeness and shall be appropriate to quantify water quality improvements in the watershed. BMP performance monitoring locations will be selected after BMPs have been identified for implementation.
- Planning: As noted above, it is suggested that the water quality monitoring program may be a collaboration between the Town of Braintree, other stakeholders, and possibly volunteers, and may seek support through the MassDEP Water Quality Monitoring Grant Program.

Indirect Indicators of Load Reduction

Nonstructural BMPs

Potential load reductions from non-structural BMPs (i.e., street sweeping and catch basin cleaning) can be estimated from indirect indicators, such as the number of miles of streets swept or the number of catch basins cleaned. The Town of Braintree, as well as the other municipalities in the watershed, currently perform street sweeping and catch basin cleaning, in addition to other non-structural BMPs. Appendix F of the 2016 Massachusetts Small MS4 General Permit provides specific guidance for calculating TP removal from these practices. As indicated by **Element C**, the Town of Braintree, and the other municipalities in the watershed, annually estimate the potential TP removal from these ongoing activities in accordance with the 2016 Massachusetts Small MS4 General Permit. TP load reductions from street sweeping and catch basin cleaning is estimated in accordance with Appendix F of the 2016 Massachusetts Small MS4 General Permit as summarized by **Figure HI-1 and HI-2**.

Other nonstructural efforts such as creating conservation land, replacing and inspecting septic systems, inspecting and maintaining municipal sewer systems, disconnecting impervious cover, and adopting good housekeeping practices also have associated load reductions and should be considered.

$$Credit_{sweeping} = IA_{swept} \times PLE_{IC\text{-}land\ use} \times PRF_{sweeping} \times AF \qquad \textbf{(Equation 2-1)}$$

Where:

$Credit_{sweeping}$	=	Amount of phosphorus load removed by enhanced sweeping program (lb/year)
IA_{swept}	=	Area of impervious surface that is swept under the enhanced sweeping program (acres)
$PLE_{IC\text{-}land\ use}$	=	Phosphorus Load Export Rate for impervious cover and specified land use (lb/acre/yr) (see Table 2-1)
$PRF_{sweeping}$	=	Phosphorus Reduction Factor for sweeping based on sweeper type and frequency (see Table 2-3).
AF	=	Annual Frequency of sweeping. For example, if sweeping does not occur in Dec/Jan/Feb, the AF would be 9 mo./12 mo. = 0.75. For year-round sweeping, AF=1.0[1]

As an alternative, the permittee may apply a credible sweeping model of the Watershed and perform continuous simulations reflecting build-up and wash-off of phosphorus using long-term local rainfall data.

Table 2-3: Phosphorus reduction efficiency factors ($PRF_{sweeping}$) for sweeping impervious areas

Frequency[1]	Sweeper Technology	$PRF_{sweeping}$
2/year (spring and fall)[2]	Mechanical Broom	0.01
2/year (spring and fall)[2]	Vacuum Assisted	0.02
2/year (spring and fall)[2]	High-Efficiency Regenerative Air-Vacuum	0.02
Monthly	Mechanical Broom	0.03
Monthly	Vacuum Assisted	0.04
Monthly	High Efficiency Regenerative Air-Vacuum	0.08
Weekly	Mechanical Broom	0.05
Weekly	Vacuum Assisted	0.08
Weekly	High Efficiency Regenerative Air-Vacuum	0.10

Figure HI-1. Street Sweeping Calculation Methodology

$$Credit_{CB} = IA_{CB} \times PLE_{IC\text{-}land\ use} \times PRF_{CB} \qquad \textbf{(Equation 2-2)}$$

Where:

$Credit_{CB}$	=	Amount of phosphorus load removed by catch basin cleaning (lb/year)
IA_{CB}	=	Impervious drainage area to catch basins (acres)
$PLE_{IC\text{-}and\ use}$	=	Phosphorus Load Export Rate for impervious cover and specified land use (lb/acre/yr) (see Table 2-1)
PRF_{CB}	=	Phosphorus Reduction Factor for catch basin cleaning (see Table 2-4)

Table 2-4: Phosphorus reduction efficiency factor (PRF_{CB}) for semi-annual catch basin cleaning

Frequency	Practice	PRF_{CB}
Semi-annual	Catch Basin Cleaning	0.02

Figure HI-2. Catch Basin Cleaning Calculation Methodology

Project-Specific Indicators

Number of BMPs Installed and Pollution Reduction Estimates

Anticipated pollutant load reductions from ongoing (i.e., under construction) and future BMPs will be tracked as BMPs are installed. For example, it was estimated that the existing, ongoing, and future management measures presented in Element C will result in a load reduction of approximately 148 lbs/yr of TP.

TMDL Criteria

The Pathogen TMDL states that municipalities are the primary responsible parties for achieving water quality standards through elimination of the sources identified in the TMDL. TMDL implementation to achieve these goals should be an iterative process with selection and implementation of mitigation measures followed by monitoring to determine the extent of water quality improvement realized. Recommended TMDL implementation measures include identification and elimination of prohibited sources such as leaky or improperly connected sanitary sewer flows and best management practices to mitigate stormwater runoff volume. The Town of Braintree, and other municipalities in the watershed, have Illicit Discharge Detection and Elimination (IDDE) plans, in accordance with the 2016 Massachusetts Small MS4 General Permit (MassDEP, et al. 2018).

In addition, the TMDL monitoring criteria, that is applicable to the Monatiquot River watershed (MassDEP, et al. 2018), includes:

- Monitoring areas within the watershed where data are lacking or absent to determine if the waterbody meets the use criteria,
- Monitoring areas where BMPs and other control strategies have been implemented or discharges have been removed to assess the effectiveness of the modification or elimination,
- Assembling data collected by each monitoring entity to formulate a concise report where the basin is assessed as a whole and an evaluation of BMPs can be made, and
- Adding/ removing/modifying BMPs as needed based on monitoring results.
- The monitoring plan should be an ever-changing document that requires flexibility to add, change or delete sampling locations, sampling frequency, methods and analysis. At the minimum, all monitoring should be conducted with a focus on:
    - capturing water quality conditions under varied weather conditions,
    - establishing sampling locations in an effort to pin-point sources,
    - researching new and proven technologies for separating human from animal bacteria sources, and
    - assessing efficacy of BMPs.

Adaptive Management

The baseline monitoring program will be used to evaluate progress towards achieving the water quality goals outlined in Element A and Element B. Long-term goals will be re-evaluated by stakeholders at least once every three years and adaptively adjusted based on additional monitoring results and other indirect indicators. If monitoring results and indirect indicators do not show improvement to the bacteria and TP concentrations and other possibly other indicators measured within the watershed, the management measures and loading reduction analysis as described in Elements A through C will be revisited and modified accordingly.

References

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.

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 (2010). ""*Weymouth and Weir River Basin 2004 Water Quality Assessment Report.* Report Number: 74-AC-1. April 2010.

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 (2013). *314 CMR 4: The Massachusetts Surface Water Quality Standards*. MassDEP, Boston, MA. https://www.mass.gov/doc/314-cmr-400-surface-water-quality-standards/download.

MassDEP, ENSR International, EPA (2018). "*Final Pathogen TMDL for the Boston Harbor, Weymouth-Weir, and Mystic Watersheds*". CN: 157.1. October 2018.

MassDEP (2020). "Water Quality Monitoring Program Data | Mass.gov"

MassDEP (2021). "*Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle*". November 2021.

MassGIS (1999). "*Networked Hydro Centerlines*" Shapefile

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 (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

Nitsch Engineering (2021). "*Braintree sub-watershed Assessment and Stormwater Retrofit Plan, 2019-05/604, 2019—2021*". Prepared by Nitsch Engineering for the Town of Braintree. Prepared for MassDEP and EPA, Region 1. December 31, 2021

Northeast Aquatic Research (2021). "*Water Quality Monitoring & Aquatic Plant Survey Report for Sunset Lake (Braintree, MA)*". February 2021.

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.

Tetra Tech, Inc. (2015). "*Update of long-term runoff time series for various land uses in New England.*" Memorandum in Opti-Tool zip package. 20 November 2015. Available at: Opti-Tool: EPA Region 1's Stormwater Management Optimization Tool | US EPA

Town of Braintree (2011). "*Project Final Report, Sunset Lake Watershed Stormwater BMPs, 11-10/319*". Dates: 2011—2012. Prepared for MassDEP and USEPA.

Town of Braintree (2019). "*Town of Braintree Hazard Mitigation Plan, 2019 Update*". July 16, 2019.

Town of Braintree (2021a). "*Braintree Council on Elder Affairs Retrofit*". Response Form 319 Nonpoint Source Pollution Grant Program, 4/14/2021. RFR#: BWR-RFR-FFY2022-319.

Town of Braintree (2021b). "*Watson Park BMP Implementation*". Response Form 319 Nonpoint Source Pollution Grant Program, 10/13/2021. RFR#: BWR-RFR-FFY2022-319-FALL GRANT ROUND.

Town of Braintree (2021c). "*2021 Braintree Stormwater Management Program*".

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

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.

USDA NRCS and MassGIS (2012). "*NRCS SSURGO-Certified Soils*" Shapefile

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

USEPA. (2010). "*EPA's Methodology to Calculate Baseline Estimates of Impervious Area (IA) and Directly Connected Impervious Area (DCIA) for Massachusetts Communities.*"

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.

Appendices

Appendix A – Stakeholder Meeting Minutes

Meeting Minutes

Project Name:	Monatiquot River Watershed-Based Plan		
Location:	Monatiquot River Watershed (Braintree, Randolph, Stoughton, Avon, Holbrook, Quincy, and Milton MA)		
Meeting Date, #:	June 13, 2022	Meeting Time:	2:00 – 3:30 PM
Prepared By:	Emma Williamson	Meeting Location:	Zoom videoconference per Geosyntec invitation
Distribution:	All listed below		

Attendees:

Name	Organization	Contact Information
Emma Williamson	Geosyntec Consultants, Inc	EWilliamson@Geosyntec.com
Julia Keay	Geosyntec Consultants, Inc	JKeay@Geosyntec.com
Judith Rondeau	Massachusetts Department of Environmental Protection (MassDEP)	Judith.Rondeau@mass.gov
Meghan Selby	MassDEP	Meghan.Selby@mass.gov
Padmini Das	MassDEP	Padmini.Das@mass.gov
Courtney Gilligan	MassDEP	Courney.Gilligan@mass.gov
Hillary Waite	Town of Braintree, Stormwater Manager	hwaite@braintreema.gov
Kelly Phelan	Town of Braintree, Conservation Agent	kphelan@braintreema.gov
James Arsenault	Town of Braintree, Department of Public Works (DPW) Director	jarsenault@braintreema.gov
Ben Hulke	Town of Braintree, DPW Assistant Director	bhulke@braintreema.gov
Chris Trudel	Town of Braintree, Engineering Manager	ctrudel@braintreema.gov
Wednesday Walton	Town of Braintree, Stormwater Outreach Coordinator	wwalton@braintreema.gov
Meera Patel	Town of Milton, Environmental Coordinator	mpatel@townofmilton.org

"*This project has been financed with Federal Funds from the Environmental Protection Agency (EPA) to the Massachusetts Department of Environmental Protection (the Department) under an s. 319 competitive grant. The contents do not necessarily reflect the views and policies of EPA or of the Department, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.*"

Minutes to be considered final unless comments are received within five (5) business days.

AGENDA

- Greeting – Julia Keay, Geosyntec & Meghan Selby, MassDEP
- Watershed & Goals Overview – Julia Keay, Geosyntec
- s. 319 Grant Project Spotlight – Hillary Waite, Town of Braintree
- Brief Introductions from All Participants – All
- Discussion of Completed, Ongoing, and Future Efforts – All

WATERSHED & GOALS OVERVIEW/SECTION 319 GRANT PROJECT SPOTLIGHT

Julia Keay. Good afternoon, thanks for joining. This is a stakeholder meeting for Monatiquot River Watershed-based Plan (WBP). The purpose of this meeting is to get stakeholders together and to get your input and information for the WBP. The Town of Braintree received a Section 319 grant and as part of the 319 grant project, a WBP is required which is the reason for creating this plan. I also want to emphasize that once a WBP is developed, it will be helpful for obtaining funding for future s. 319 grant funding or other grant funding. The agenda is as follows: we will give a basic overview of the watershed and water quality goals, then will pass it of to Hillary Waite of Braintree to describe the 319 project, then everyone will give a brief introduction, and then will we open it up for a discussion. The purpose of this call is mainly to get input on the WBP.

Julia Keay. This is a brief overview of the watershed. The area of watershed is 31 square miles and it is a Category 5 on the Massachusetts integrated list. Impairments include macroinvertebrates, dissolved oxygen, and bacteria and sources of these impairments include channelization, introduction of non-native organisms, and others. A large percentage of the watershed land use is urban and a good percentage is industrial and commercial and land use. The long-term goal will be focused on bacteria as well as phosphorus because it is a good indicator of other impairments.

Julia Keay. Showed reference map with main tributaries to the Monatiquot River. I also have a Google Earth delineations to share in order to look at specific locations later on in the meeting. Also showed land use map with land use classifications and impervious cover map. The impervious cover is concentrated at the downstream end of the watershed. I will now turn it over to Hillary to give an overview of the current s. 319 project.

Hillary Waite. The 319 project is located at an existing property owned by Town of Braintree that abuts the Monatiquot River at the Council on Elder Affairs. There is a need for parking at this location, which is partially paved and partially stone dust. It needs to be accessible. We are hoping to mitigate the upland area and additional parking with this project and to make it a great example of publicly owned green infrastructure. This project was targeted because it has a great build-in audience of people who care about the town and who already use town services. We are dedicating lots of time for public outreach. The project will be a rain garden with supplementary swales and the drainage area will all flow towards the larger structure instead of the current condition where runoff flows into the structural stormwater system through drain pipes and discharges into the Monatiquot River.

Hillary Waite. Showed aerial image of watershed and plans.

Julia Keay. Stated that the 604b study was done to identify priority locations and asked if the seven (7) selected sites were prioritized.

Hillary Waite. Stated that the 7 sites are of equal priority but that there is a Town-wide sense of a priority list. We want to be able to do those projects that are able to get outside of Town funding such as the Council on Aging, Watson Park, and Smiths Beach projects and we will use grant funding to prioritize these sites.

Julia Keay. Asked if of these seven sites, the Council of Aging project is the most progressed so far.

Hillary Waite. It is tied with the Smiths Beach parking lot which is also in final design. It is the closest to being ready to build green infrastructure project, especially since we have the grant funding. Smiths Beach is an Municipal Vulnerability Preparedness (MVP) grant to take to final design, but there has not been any construction yet.

Julia Keay. So, the goal is to ultimately construct all of these?

Hillary Waite. In an ideal situation, yes. They are just conceptual designs as of now so that may change depending on findings as the design progresses. The three projects that are advanced the furthest are those that are quite close to the Monatiquot where it becomes the Weymouth Weir river. The proximity to waterways makes them better candidates for grant funding.

Julia Keay. Great Pond is the water supply for Randolph, Braintree, and Holbrook, correct?

Hillary Waite. Yes.

Julia Keay. Is there anything else you can think of that you want to add?

Hillary Waite. Not right now.

Julia Keay. We will do the introductions now. I have already introduced myself.

Meghan Selby. I work for MassDEP as the Section 604b grant program coordinator. I work on managing the WBP projects. As Julia mentioned, a WBP is required by EPA to be eligible for 319 funding. I am glad we are able to get additional people to join outside of Braintree and I appreciate people taking the time to attend the meeting today. If you have additional information or insight, I would be glad to hear it.

Padmini Das. I am the Section Chief of the non-point source (NPS) pollution program at MassDEP. Both 604b and 319 grants are under the NPS program.

Judy Rondeau. I am also with MassDEP as the NPS watershed specialist and outreach coordinator.

Jim Arsenault. I am the DPW director for the Town of Braintree. Monatiquot River goes through the community and it is an important river or watershed throughout the community. I would like to reduce pollution impacts as much as possible, especially regarding the impairments. I want to do as much as we can to correct and rectify some of these things. I have done a lot of public outreach as part of National Pollutant Discharge Elimination System (NPDES) program. We have our own stormwater fee so we are able to hire staff and make sure that the work gets done and that we stay in compliance. We have a good team and are putting together a lot of good projects to make things as good as the can be.

Ben Hulke. I am the assistant DPW director for the Town of Braintree. I am curious about the project and hope we can get the plan together to move forward with 319 work.

Meera Patel. I am the environmental coordinator for Town of Milton and am interested to see what is going on with the project.

Kelly Phelan. I am the conservation planner for the Town of Braintree. We have been working on a big dam removal project for many years that includes public access and restoration. I also work on other public access and trail projects to provide more access to the Monatiquot. This includes permitting with redevelopment along the river, trying to address impairments, and get retrofits to address water quality.

Julia Keay. Where is the dam removal project?

Kelly Phelan. It is located at the former Armstrong Factory site at the center of town on Hancock and Plain St. The project is very close to happening and will start in the fall if all goes well.

Courtney Gilligan. I am an engineering aide with MassDEP working with Meghan this summer. I'm here to learn about the process of WBP and getting funding.

Wednesday Walton. I'm the stormwater outreach coordinator for Town of Braintree. My role is to make sure that we are following permit regulations and getting community outreach done. As we move forward with these projects, I would be interested in advice regarding outreach mechanisms that have worked. I am working on moving into the community more than just mailers. Excited about the project and to hear everyone's thoughts.

Chris Trudel. I'm the engineering manager for Town of Braintree. I work on capital projects for DPW including stormwater projects. I also work with Hillary on what she is able to get funding for.

DISCUSSION OF COMPLETED, ONGOING, AND FUTURE PROJECTS

A general discussion was held on the following topics:

- ⇒ **Past, current, or planned stormwater best management practice (BMP) projects in the watershed**
- ⇒ **Pollutant load reduction estimates for BMP projects**
- ⇒ **Water quality monitoring efforts**
- ⇒ **Potential pollution sources or problem areas**
- ⇒ **Public education and outreach**
- ⇒ **Additional grant funding available**

Julia Keay. We are looking for information, reports, maps, etc. It is also useful for any projects if there are estimates or calculations regarding pollutant load reduction. For water quality monitoring we have data from MassDEP. I don't think we have other data that we have looked at yet. We are also interested in any other problem areas that haven't been addressed or mentioned in the 604b assessment. There is information on public education and outreach in the stormwater management plan (SWMP) but if there is anything specific anyone wanted to share. We can also talk about other opportunities for grant funding that are available.

Meghan Selby. The 604b report is only looking at town-owned property. We also want to identify non-town owned property during this process.

Julia Keay. We have a final report for Sunset Lake in 2014 besides that it is a retrofit of two untreated stormwater discharges. How is that doing?

Meghan Selby. Has there been any water quality sampling?

Kelly Phelan. There has. The health department tests every summer for bacteria at the bathing beach. It is less frequent than before the project. We also do water quality monitoring as part of the aquatic weed treatment at the lake. There are issues with dissolved oxygen (DO), algal blooms, and high phosphorus in the summer.

Hillary Waite. In terms of the impervious cover further downstream there is a prior Monatiquot River watershed report. There are lots of commercial/industrial uses in that area that has contributed a lot in the past to lack of water quality.

Meghan Selby. For the dam removal projects, are there stormwater BMPs in place?

Kelly Phelan. There will be a walking trails and channel restoration but nothing along the river. We want to include BMPs as part of redevelopment projects.

Julia Keay. The prior watershed report, was that a 9-element plan?

Hillary Waite. No, it is not in WBP format. It is from spring 2011 done by folks at UMass Amherst. It is a comprehensive study of water quality improvement and access and recreation. The town is working on opening the river corridor back up to people instead of industry.

Julia Keay. That report would be helpful to look at.

Hillary Waite. I will note that we don't have any studies or calculations except for the 604b report in terms of pollutant load calculations.

Julia Keay. Does anyone from other towns have any information on BMP locations?

Hillary Waite. Milton has done work that has focused on Neponset River watershed. But Houghtons Pond is owned by the Department of Conservation and Recreation (DCR), so it is hands off in terms of town's ability to manage. Most of Town's contributory MS4 area is near Route 128. There was 604b study in Milton but not within this watershed.

Meghan Selby. Are there issues within this area of Milton? We have not concentrated on this area.

Hillary Waite. I would check the Illicit Discharge Detection and Elimination (IDDE) monitoring. It may have potential findings from outfall monitoring. Apart from that, folks have suspicions that the Blue Hills are contributory to pathogen impairments due to the level of animal activity (deer poop, dog walking, recreational, goose, etc.).

Julia Keay. Is there any information on the existing water supply?

Hillary Waite. There is ongoing construction of the water treatment plant (WTP) going through the pond.

Jim Arsenault. There is a tri-town (Holbrook, Randolph, and Braintree) water treatment plant. It is all coming together, and we've done most of the permitting. We probably will be moving forward in the next month or two with advertising and bidding. There are two conduits that run on the bottom of Great Pond. The conduits go from the Braintree side to the Randolph side and it crosses over to where the other (secondary) treatment plant is. Next to the existing Braintree plant is a wooded area. The new plant will have the capacity of both of the plants. The existing plant was built in the 1800s and so is the secondary plant, so they are in bad shape. The new WTP was designed to provide future expansion (due to the availability of land that we own) and if there is a type of treatment that is desired. It is starting up in the fall and should take 2-2.5 years to complete. It will be a great change for the community to have a new treatment plant. It is the same process but disseminating from the Braintree side, using the same conduits. The current plant treats PFAS with a granulated activated charcoal (GAC) system. The water quality is pretty good and is well under the minimums but the new plant would be even better than that. But the current plant is still meeting the water quality standards as of now. The water quality in Great Pond is slightly above the thresholds but with treatment the water quality meets the standards. The new plant has the ability to provide treatment. The 3 ponds in the area are connected. When there is a water shortage, we can get water from other ponds. When there are water events, it flows through the golf course and doesn't completely stop. There is a dam created in the north area of Great Pond but it does have a discharge point that ties into the drainage system. Kelly [Phelan] is providing fish passage to get to Great Pond.

Kelly Phelan. There was a fish ladder installed. Once the dam is removed, the fish can get to Great Pond which is a spawning habitat. They also flow in Farm River. We want to make sure there is good flow for juvenile fish in the fall and mature fish in the spring. There was an analysis in 2009 (on the Town's website) that shows the flow level in the system.

Julia Keay. Where is the dam removal project?

Kelly Phelan. It is past the golf course towards the east of Sunset Lake, right downstream of the golf course. There are two dams on that site that will be removed. That's it for dams until you get up to Great Pond.

Hillary Waite. The municipal golf course.

Kelly Phelan. It may be worth a conversation about geese; they use dogs to chase them away. Also the fertilizer use.

Julia Keay. Asked about permits.

Hillary Waite. The stormwater permitting process is separate from conservation commission which controls solids rather than pathogen removal. There is a permit specific to stormwater division. If you disturb over 2500 square feet it is the first trigger for eligibility for the stormwater permit. For a grading permit, the obligations are slightly reduced since the Planning Board are also

reviewing for stormwater impacts. Over 1 acre is considered major development and under 1 acre is considered minor development.

Julia Keay. Does anyone have any information about public education and outreach? I can look at the stormwater management plan (SWMP) and MS4 requirements.

Wednesday Walton. Public education and outreach. Look at SWMP and MS4 requirements. Going above and beyond, have an adopt a drain project, presence in classrooms. The downside of the MS4 permit is that are not a ton of guidelines in terms of community outreach. It's been fun to do our own mailers, our own flyers, that kind of thing. A big part of it is getting the community to understand stormwater in general. There is a stormwater fee for the enterprise fund but we still have residents that call about the stormwater fee, even though it's been in place for a few years. It's been important for us to get our name out there on our community but also make it a positive thing. We have an incredible relationship with the Thayer library and Children's library. I've done readings there and they ordered stormwater specific children's books. We also have been able to get in with schools (kindergarten class and other teachers have expressed interested). We also have an adopt a drain program that puts the initiative on the residents in terms of stormwater system. It is an online system where they can go in and log on and can choose which ones to adopt. People are able to name it and take pictures with it. The minimum requirement is to clean off the top of the drain only and go online and log it. They can log the type of debris (leaves, garbage), amount of time spent cleaning, and how much debris they needed to clear off. They can see the impact that they have made in the watershed and in the Town of Braintree. In 13 months, over 400 pounds of debris have been cleared off by residents. Most surprising, residents are already cleaning their drains off. Now can do it a fun way to get credit. We are working on different ways to reward them and recognize community leaders. We also do the stormwater splash (newsletter) which includes general stormwater facts. We also highlight superstar residents that have done an exceptional job in cleaning. I started last May so I am new as well. I am looking for ways to spread the word. I'm looking for a better, more effective way to provide outreach to businesses. I'm happy to share information as well.

Meghan Selby. Going out and canvassing and talking to owners is probably a more effective way than mailers.

Wednesday Walton. It's better to have a friendly interaction than an enforcement one.

Judy Rondeau. The adopt a drain program sounds like a great example.

Wednesday Walton. A realty company signed up to clean off a drain. The other difficult thing is that the adopt a drain project is only for Town-owned drains. Commercial drains/parking lots won't show up because they aren't mapped. School drains aren't cleaned out by Town they cleaned by the school department.

Julia Keay. Is it possible to add private drains in there?

Wednesday Walton. It is based on town mapping system. I could see if they could add specific coordinates in.

Hillary Waite. That's essentially the challenge.

Kelly Phelan. We occasionally ask for records from commercial/private owners. Many times people have no idea that they need to have an Operation and Maintenance (O&M) plan that they should be following, even though they did the permitting and planning.

Julia Keay. Can you view the adopt a drain program online?

Wednesday Walton. Sent the link in the meeting chat: https://ma.adopt-a-drain.org/

Hillary. There are also programs in Medford and Braintree.

Wednesday Walton. The program is most successful for families and children. There are a lot of kids that are really interested in it. Parents like that they can do it outside and that it is safe and family oriented.

Julia Keay. Asked about water quality monitoring.

Hillary Waite. I can check in with the health department. There is monitoring at the bathing beach near Yacht Club and at Sunset Lake too. There is an ongoing sanitary sewer overflow (SSO) issue in the same neighborhood at or around Allen St. It is something we are actively working on mitigating. It happens during high rain water event (approximately 1 time/year). We believe the issue has to due to MWRA interceptor's downstream capacity.

Julia Keay. Are there any watershed associations?

Kelly Phelan. There is the Fore River watershed association made up of a couple of people. There is also Sustainable Braintree which is a community group with an environmental interest.

Julia Keay. Asked Meghan to provide more information on grant funding.

Meghan Selby. We just announced this year's base allocation for 604b grant program. There is a pre RFR info session this Thursday at 10 o'clock. There is a link on MassDEP's website. It is an opportunity for us to describe what will be in this grant announcement. It's a good time for questions and project ideas. Once the RFR goes out (late June), we cannot provide any more information. Any questions to make a project more competitive have to be asked before that. There is another RFR in the fall (Bill Fund, bipartisanship infrastructure bill), that has more funding than typical. I'll have more information in the future. The focus is for projects that look at climate change and have environmental justice at the forefront as well. We are looking for guidance from EPA on bill funding. Section 319 will also have a spring RFR. Feel free to send me an email to join the list.

Hillary Waite. Are communities that have previously done a 604b eligible and can receive funding?

Meghan Selby. I don't think having a previous 604 will impact eligibility. It will depend on competitiveness and other applications. We can have a chat offline. It will give me a chance to look at what you already have and can dive in deeper.

Julia Keay. Can you use 604b to expand on WBP?

Meghan Selby. Yes, it is assessment planning and designs up to conceptual level. For example if you needed to go back and look more in depth in certain areas or do water quality monitoring or if there are areas with not a lot of detail that you want to focus on. Once we get through conceptual design, then you are shifting towards s. 319 for final design and implementation. Current 604bs are focusing on projects that are completing or already have a WBP in place.

Hillary Waite. We have done other 319 projects at Watson Park. Work has been done there already. Kelly spearheaded walking paths and berms.

Kelly Phelan. Also rain gardens.

Meghan Selby. That would fall under this s. 319 project. Updating the plan would fall under 604b but you would need to consider competitiveness.

Padmini Das. Talk to me and Malcolm for potential 319 projects. Looks like there are a few with potential here. The RFR is coming out soon.

Kelly Phelan. What do you think the plan will have for recommendations? What kind of outcomes do we expect to see in the plan?

Meeting Minutes

Julia Keay. The plan follows the EPA recommended format with 9 elements, including: outlining watershed information, water quality goals, and pollutant loading reduction goals. It will also include identifying locations for implementing management measures, identifying schedules, costs, and grant funding that will be used to implement the BMPs, and a monitoring section on data that is available and locations to monitor in the future to help track progress at meeting water quality goals. There is also a public education section where you can outline current and future work. The goal of the plan is to have all of the information compile and to track the attainment of water quality goals.

Hillary Waite. And it focuses on non-point sources?

Julia Keay. It also identifies point sources but the focus is mainly on non-point sources. Thank you all for contributing to this meeting.

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Appendix B – Select excerpts from the Weymouth and Weir River Basin 2004 Water Quality Assessment Report (MassDEP, 2003) note: relevant information is included directly from these documents for informational purposes and has not been modified).

Weymouth and Weir River Basin 2004 Water Quality Assessment Report (MA74-06 - Cochato River)

Aquatic Life

The Baird & McGuire Superfund Site, located approximately 500 feet west of the Cochato River on South Street near the Holbrook/Randolph line, was a chemical manufacturing and batching facility that operated from 1912 to 1983. Activities included mixing, packaging, storing and distribution of various products, including herbicides, pesticides, disinfectants, soaps, floor waxes, and solvents. The soils, the groundwater and the Cochato River sediments at or near the Baird & McGuire Site were contaminated with pesticides and organic and inorganic chemicals. The contaminated soils and sediments were excavated and incinerated between the years of 1994 and 1997. The on-site treatment system has continued to treat contaminated groundwater since 1991 through the present. The groundwater treatment system has been designed to capture the contaminated groundwater and prevent residual groundwater contamination from reaching the river. The most recent sampling and analysis of the river sediments and fish were conducted by US EPA in 2002. The results of the sampling and analysis showed no consistent increase or decrease in contamination levels in sediments or fish and indicated that action levels for clean-up established by US EPA for the river were being maintained. The performance of future sampling and analysis of the Cochato River sediments and fish was set at five-year intervals.

Cochato River sediments downstream of the Baird and McGuire site were last sampling in 2002. Metcalf and Eddy sampled three stations (B,C,D) downstream of the Baird and McGuire site At each station three transects were created and six sediment grab samples were collected using an Eckmann dredge. The six grab samples consisted of three samples each both upstream and downstream of and within three feet of each transect were collected. Bank soil samples were also taken at station C and D. For the sediment grab samples, sediment physical characteristics were characterized including particle sizes, total organic carbon and moisture content and sediment contaminants total polycyclic aromatic hydrocarbon (PAH), total dichlorodiphenyltrichloroethane (DDT), total chlordane and arsenic were sampled at each of the sampling stations. Mean total sediment PAH from stations B, C, D ranged from 1,911 ng/g to 7,119 ng/g dry weight. All of the mean total PAH are lower than Severe Effect Concentrations and Lowest Effect Level concentrations. Total mean DDT in river sediments ranged from 645 to 796 ng/g dry weight at the three stations sampled and exceed the Lowest Effect Concentration at two of the three stations. The Severe Effect Concentration for total DDT is only exceeded at station B. Mean total chlordane at the three stations ranged from 133 to 159 ng/g dry weight and all values are below both the low effect and severe effect concentrations. The mean arsenic sediment concentrations at the three stations ranged between 10.1 and 56 ug/g dry weight. All values exceeded the low effect concentration and one station exceeded the severe effect concentration.

In the last five-year review of the Baird and McGuire superfund site, a number of constituents in the groundwater exceeded interim cleanup criteria including arsenic, petachlor expoxide, gamma-BHC, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). The state (MassDEP) continues to operate the groundwater treatment system on site as part of the ongoing cleanup process.

Insufficient information is available to assess the Aquatic Life Use but given the presence of contaminants in excess of lowest effect concentrations and severe effect concentrations along with the continued on-site superfund cleanup, this used is identified with an “Alert Status”.

Fish Consumption

Due to the presence of pesticides, MA DPH has issued the following advisory for the Cochato River:

Children younger than 12 years or age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any fish from this water body. The general public should not consume any of the affected fish species (Brown Bullhead, Carp, American Eel) from this water body. The general public should limit consumption of non-affected fish from this water body to two meals per month.

EPA conducted their second five-year review of the site in 2004. Fish tissue samples taken between 2000 and 2002 showed elevated concentrations of contaminants including DDT and Chlordane.

Due to the presence of a site-specific fish consumption advisory, the fish consumption use is assessed as impaired.

Primary Contact
Insufficient data were available to assess the Primary Contact Use.

Secondary Contact
Insufficient data were available to assess the Secondary Contact Use.

Aesthetics
Insufficient data were available to assess the Aesthetics Use.

Report Recommendations:
NA

Weymouth and Weir River Basin 2004 Water Quality Assessment Report (MA74-07 - Farm River)

Aquatic Life
DMF contracted with Gomez and Sullivan Engineers P.C. to help evaluate the feasibility of restoring river herring to the Fore River watershed. Gomez and Sullivan estimated using water withdrawal records for Great Pond from 1989-2006 that “virtually all the runoff in the watershed above the Great Pond Dam is used for water supply”. As part of their work they also sampled water quality in Great Pond including one station immediately below the dam. They conducted water sampling in 2008 on May 28, June 17, July 22, August 19, and September 29. On all occasions they found no water being passed below Great Pond Dam.

Given insufficient information the Aquatic Life Use is not assessed. Due to the observed ack of water being passed over Great Pond and into the Farm River segment, this use is given an "Alert Status".

Fish Consumption
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 1).

Primary Contact
Insufficient data were available to assess the Primary Contact Use.

Secondary Contact
Insufficient data were available to assess the Secondary Contact Use.

Aesthetics
Insufficient data were available to assess the Aesthetics Use.

Report Recommendations:
NA

Weymouth and Weir River Basin 2004 Water Quality Assessment Report (MA74-12 - Trout Brook)

Aquatic Life
Insufficient data were available to assess the Aquatic Life Use.

Fish Consumption
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 1).

Primary Contact
Insufficient data were available to assess the Primary Contact Use.

Secondary Contact
Insufficient data were available to assess the Secondary Contact Use.

Aesthetics
Insufficient data were available to assess the Aesthetics Use.

Report Recommendations:
NA

Weymouth and Weir River Basin 2004 Water Quality Assessment Report (MA74-08 - Monatiquot River)

Aquatic Life
The Monatiquot River supports one of the largest smelt runs in Massachusetts. The Massachusetts Division of Marine Fisheries maintains a smelt fyke net station to monitor spring smelt spawning runs in this segment. The fyke net has been set annually since 2004. The fyke net catches include six diadromous fish species and 10 other fish species. The catch per unit effort of rainbow smelt, American eel and Atlantic tomcod is the highest among eight smelt fyke net stations maintained by the project in Massachusetts. Insufficient data were available to assess the Aquatic Life Use.

Fish Consumption
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 1).

Primary Contact
Insufficient data were available to assess the Primary Contact Use.

Secondary Contact
Insufficient data were available to assess the Secondary Contact Use.

Aesthetics
Insufficient data were available to assess the Aesthetics Use.

Report Recommendations:
NA

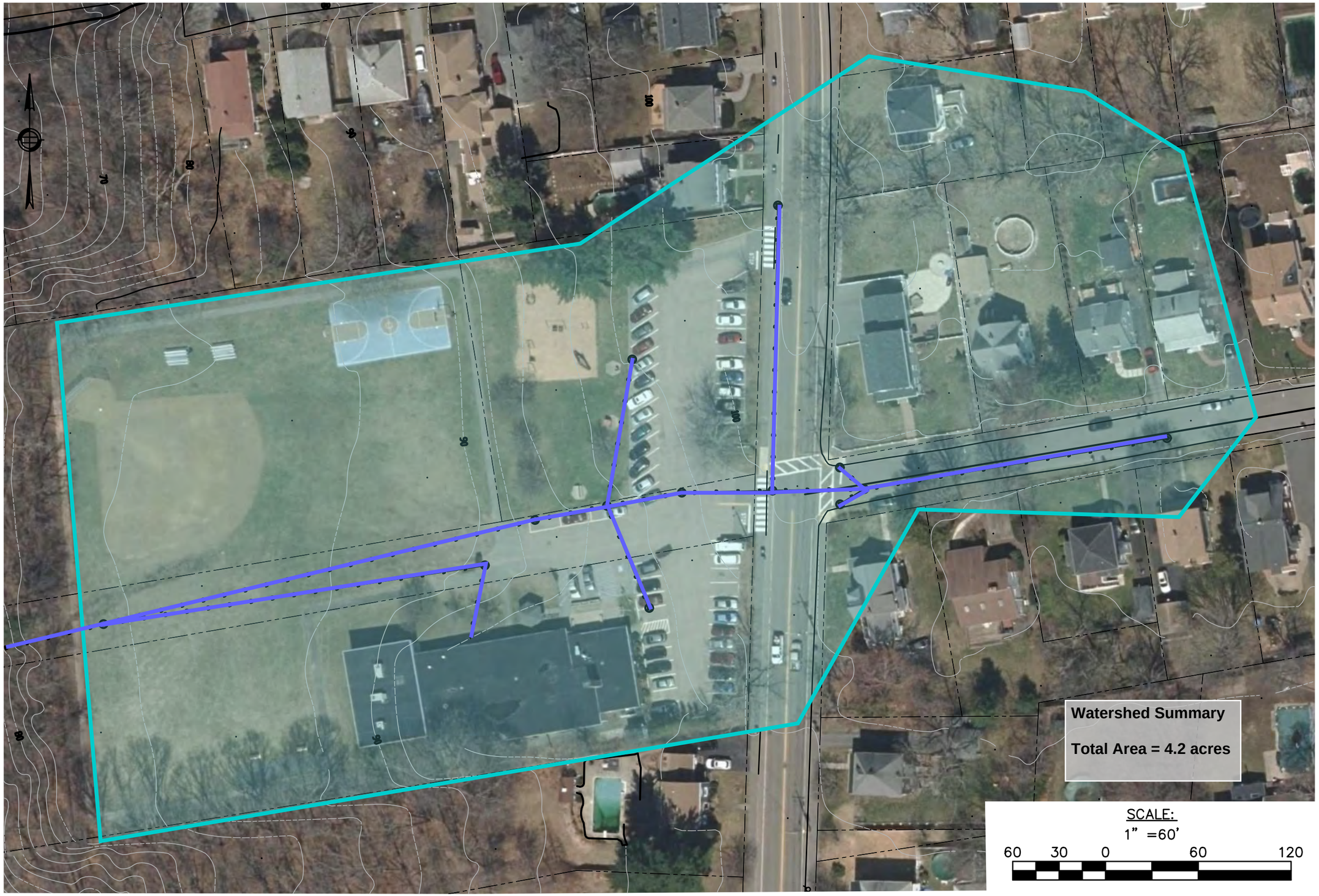
Appendix C – Pollutant Load Export Rates (PLERs)

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			

Appendix D – Braintree Council on Elders Affairs Site – Conceptual Design

6/22/2021 12:21 PM



SCALE:
1" =60'
60 30 0 60 120

Nitsch Engineering
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- Structural Engineering
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SITE 4 WATERSHED PLAN
OFFICE OF ELDER AFFAIRS
71 CLEVELAND AVE, BRAINTREE, MA

PREPARED FOR:
TOWN OF BRAINTREE
BRAINTREE, MA

PROJECT # 13447
FILE:
SCALE: 1"= 60''
DATE:
PROJECT MGR: JLJ
SURVEYOR:
DRAFTED BY: AMG
CHECKED BY:

SHEET:
C4-A

OF REV.

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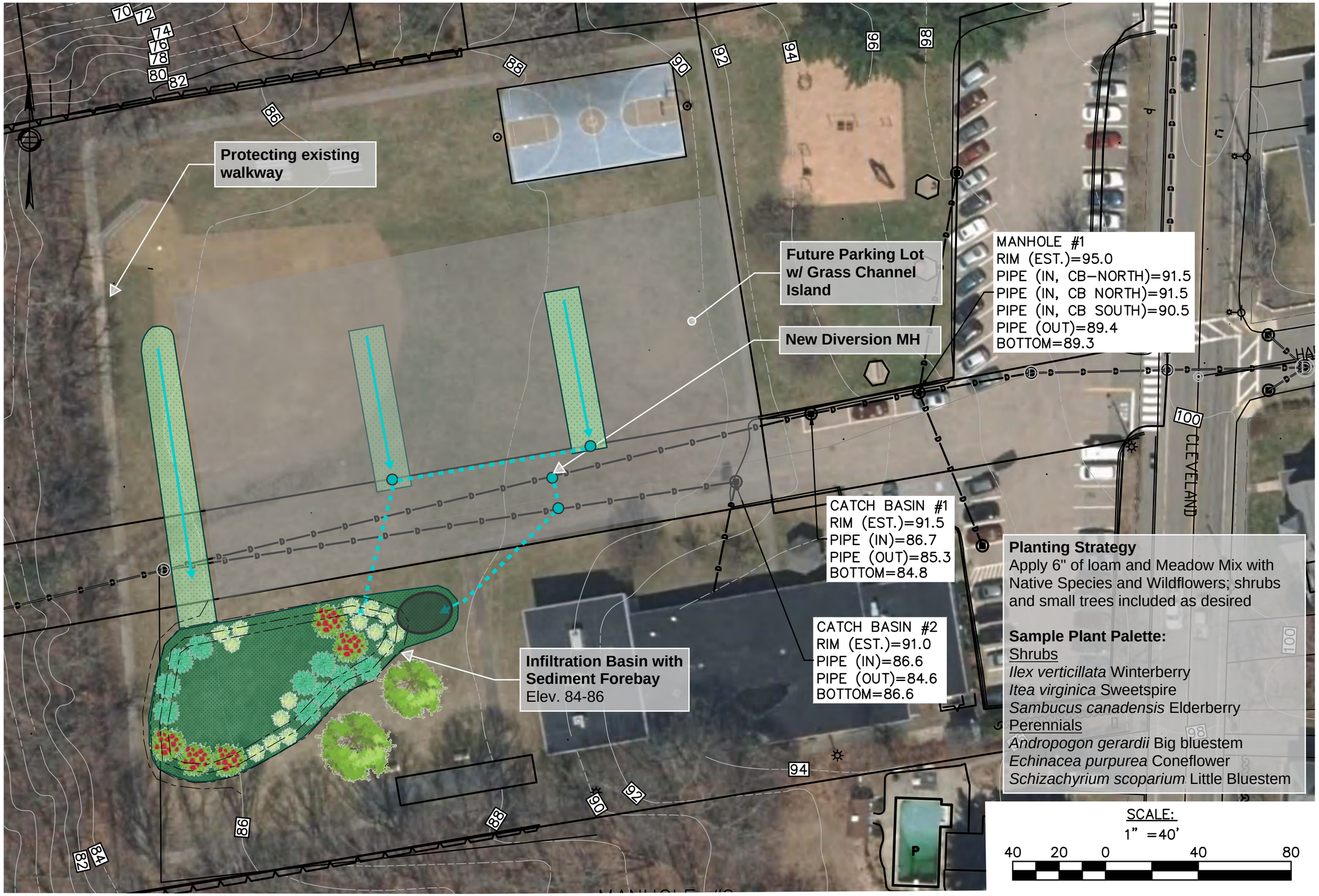

Planting Strategy
Apply 6" of loam and Meadow Mix with Native Species and Wildflowers; shrubs and small trees included as desired

Sample Plant Palette:
Shrubs
Ilex verticillata Winterberry
Itea virginica Sweetspire
Sambucus canadensis Elderberry
Perennials
Andropogon gerardii Big bluestem
Echinacea purpurea Coneflower
Schizachyrium scoparium Little Bluestem

SCALE:
1" =40'
40 20 0 40 80

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SITE 4 WATERSHED PLAN
OFFICE OF ELDER AFFAIRS
71 CLEVELAND AVE, BRAINTREE, MA

PREPARED FOR:
TOWN OF BRAINTREE
BRAINTREE, MA

PROJECT # 13447
FILE:
SCALE: 1"= 40''
DATE:
PROJECT MGR: JLJ
SURVEYOR:
DRAFTED BY: AMG
CHECKED BY:

SHEET:
C4-B

OF REV.

Appendix E – Smith Beach Site – Final Design

SMITH BEACH PARKING LOT GREEN INFRASTRUCTURE RETROFIT BRAINTREE, MASSACHUSETTS

FINAL PLAN SET

JUNE 24, 2022

SITE DATA

1. OWNER
   TOWN OF BRAINTREE DEPT. OF PUBLIC WORKS
   85 QUINCY AVENUE
   BRAINTREE, MA 02184
   CONTACT: CHRISTOPHER TRUDEL, ENGINEERING MANAGER
   PHONE: 781-794-8017

2. ENGINEER
   NITSCH ENGINEERING
   2 CENTER PLAZA, SUITE 430
   BOSTON, MA 02108
   CONTACT: JENNIFER JOHNSON, PE
   PHONE: 617-338-0063

3. ADDRESS
   SMITH BEACH PARKING LOT
   VINEDALE RD & BEECHWOOD RD
   BRAINTREE, MA 02184

DRAWING INDEX	
SHEET NUMBER	SHEET TITLE
--	COVER SHEET
C-000	CIVIL NOTES, LEGEND, & ABBREVIATIONS
C-100	SITE PREPARATION & DEMOLITION PLAN
C-200	SITE LAYOUT & MATERIALS PLAN
C-201	SITE LAYOUT & CURBING PLAN
C-300	SITE UTILITY PLAN
C-400	GRADING PLAN
C-500	CIVIL DETAILS SHEET I
C-501	CIVIL DETAILS SHEET II
C-502	CIVIL DETAILS SHEET III
C-503	CIVIL DETAILS SHEET IV
C-504	CIVIL DETAILS SHEET V
C-600	PLANTING PLAN

VICINITY MAP
Not to Scale

LOCUS MAP
Not to Scale

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► Structural Engineering
► Green Infrastructure
► Planning
► GIS

BRAINTREE DPW
85 Quincy Avenue
Braintree, Massachusetts 02184

DEMOLITION NOTES:

1. SITE PREPARATION AND DEMOLITION SHALL INCLUDE THOSE AREAS WITHIN THE LIMIT OF WORK LINE AS SHOWN ON THE CONTRACT DOCUMENTS.
2. ANY AREA OUTSIDE THE LIMIT OF WORK THAT IS DISTURBED SHALL BE RESTORED TO ITS ORIGINAL CONDITION AT NO ADDITIONAL COST TO THE OWNER.
3. CONSULT ALL OF THE DRAWINGS AND SPECIFICATIONS FOR COORDINATION REQUIREMENTS BEFORE COMMENCING DEMOLITION.
4. THE CONTRACTOR SHALL COORDINATE SITE DEMOLITION EFFORTS WITH ALL TRADES THAT MAY BE AFFECTED BY THE WORK.
5. ALL ITEMS REQUIRING REMOVAL SHALL BE REMOVED TO FULL DEPTH TO INCLUDE BASE MATERIAL AND FOOTINGS OR FOUNDATIONS AS REQUIRED TO FACILITATE CONSTRUCTION, AND LEGALLY DISPOSED OF OFFSITE BY CONTRACTOR.
6. UTILITY PIPES DESIGNATED TO BE ABANDONED IN PLACE SHALL BE PLUGGED AT THEIR ENDS WITH WATERTIGHT BRICK MASONRY OR CEMENT MORTAR WITH A MINIMUM THICKNESS OF 8 INCHES.
7. UTILITY PIPES DESIGNATED TO BE REMOVED SHALL CONSIST OF THE COMPLETE REMOVAL AND DISPOSAL OF THE ENTIRE LENGTH OF PIPE AND BACKFILL AND 95% COMPACTION OF THE VOID WITH ORDINARY BORROW. WHEN THE VOID IS WITHIN THE FOOTPRINT OF THE NEW BUILDING, GRAVEL BORROW SHALL BE USED TO BACKFILL THE VOID.
8. UTILITY STRUCTURES DESIGNATED TO BE ABANDONED IN PLACE SHALL HAVE THEIR CAST IRON CASTINGS REMOVED AND DISPOSED, INLET AND OUTLET PIPES PLUGGED, THE BOTTOM OF THE STRUCTURES SHALL BE BROKEN, THE VOID OF THE STRUCTURES SHALL BE BACKFILLED AND COMPACTED TO 95% WITH ORDINARY BORROW OR FLOWABLE FILL, AND THE TOP OF THE STRUCTURE SHALL BE REMOVED SO THAT IT IS AT LEAST 36 INCHES BELOW FINISH GRADE.
9. UTILITY STRUCTURES DESIGNATED TO BE REMOVED SHALL CONSIST OF THE REMOVAL AND DISPOSAL OF CAST IRON CASTINGS, PLUGGING OF INLET AND OUTLET PIPES, REMOVAL OF THE STRUCTURE, AND BACKFILL AND 95% COMPACTION OF THE VOID WITH ORDINARY BORROW. WHEN HE VOID IS WITHIN THE FOOTPRINT OF THE NEW BUILDING, GRAVEL BORROW SHALL BE USED TO BACKFILL THE VOID.
10. ALL DEBRIS GENERATED DURING SITE PREPARATION ACTIVITIES SHALL BE LEGALLY DISPOSED OF OFFSITE.
11. AT ALL LOCATIONS WHERE EXISTING CURBING, CONCRETE PAVEMENT OR BITUMINOUS CONCRETE ROADWAY ABUTS NEW CONSTRUCTION, THE EDGE OF THE EXISTING CURB OR PAVEMENT SHALL BE SAW CUT TO A CLEAN, SMOOTH EDGE.
12. EXTEND DESIGNATED LIMIT OF WORK AS NECESSARY TO ACCOMPLISH ROUGH GRADING, EROSION CONTROL, TREE PROTECTION, AND SITE WORK AS REQUIRED BY THESE DRAWINGS AND SPECIFICATIONS.
13. THE CONTRACTOR SHALL REMOVE FROM THE SITE ALL RUBBISH AND DEBRIS FOUND THEREON. STORAGE OF SUCH MATERIALS ON THE PROJECT SITE WILL NOT BE PERMITTED. THE CONTRACTOR SHALL LEAVE THE SITE IN SAFE, CLEAN, AND LEVEL CONDITION UPON COMPLETION OF THE SITE DEMOLITION WORK.
14. REMOVE AND STOCKPILE ALL EXISTING SITE LIGHTS, BENCHES, TRASH RECEPTACLES, TRAFFIC SIGNS, GRANITE CURB, AND OTHER SITE IMPROVEMENTS WITHIN LIMIT OF WORK LINE UNLESS OTHERWISE NOTED.
15. ALL EXISTING TREES AND SHRUBS TO REMAIN SHALL BE PROTECTED AND MAINTAINED THROUGHOUT THE TIME OF CONSTRUCTION, AS SPECIFIED AND DIRECTED BY THE LANDSCAPE ARCHITECT.
16. BEFORE ANY TREES OR SHRUBS ARE REMOVED, THE CONTRACTOR SHALL ARRANGE A CONFERENCE ON THE SITE WITH THE OWNER OR OWNER'S REPRESENTATIVE TO IDENTIFY TREES AND SHRUBS THAT ARE TO BE REMOVED, AS WELL AS THOSE WHICH ARE TO BE PROTECTED. DO NOT COMMENCE CLEARING OPERATIONS WITHOUT A CLEAR UNDERSTANDING OF EXISTING CONDITIONS TO BE PRESERVED.
17. THE CONTRACTOR SHALL REMOVE FROM THE AREA OF CONSTRUCTION PAVEMENT, CONCRETE, CURBING, POLES AND FOUNDATIONS, ISLANDS, TREE BERMS AND OTHER FEATURES WITHIN THE LIMITS OF CONSTRUCTION AS REQUIRED TO ACCOMMODATE NEW CONSTRUCTION WHETHER SPECIFIED ON THE DRAWINGS OR NOT.

EROSION AND SEDIMENT CONTROL NOTES:

1. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE CONSTRUCTED AND MAINTAINED IN ACCORDANCE WITH THE LATEST EDITION OF THE "MASSACHUSETTS EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN AND SUBURBAN AREAS" PREPARED BY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF RESOURCE PROTECTION, AND THE CURRENT NPDES GENERAL PERMIT FOR STORMWATER DISCHARGES FROM CONSTRUCTION ACTIVITIES.
2. MEANS OF EROSION AND SEDIMENT PROTECTION AS NOTED ON THE DRAWINGS INDICATE MINIMUM RECOMMENDED PROVISIONS. THE CONTRACTOR IS RESPONSIBLE FOR FINAL SELECTION AND PLACEMENT OF EROSION AND SEDIMENTATION CONTROLS BASED ON ACTUAL SITE CONDITIONS AND CONSTRUCTION CONDITIONS. ADDITIONAL MEANS OF PROTECTION SHALL BE PROVIDED BY THE CONTRACTOR AS REQUIRED FOR CONTINUED OR UNFORESEEN EROSION PROBLEMS, OR AS DIRECTED BY CONTROLLING MUNICIPAL AUTHORITIES, AT NO ADDITIONAL EXPENSE TO THE OWNER.
3. AN EROSION CONTROL BARRIER SHALL BE INSTALLED ALONG THE EDGE OF PROPOSED DEVELOPMENT AS INDICATED IN THE PLAN PRIOR TO COMMENCEMENT OF DEMOLITION OR CONSTRUCTION OPERATIONS.
4. SEDIMENT CONTROL MEASURES SHALL BE ADJUSTED TO MEET FIELD CONDITIONS AT THE TIME OF AND DURING ALL PHASES OF CONSTRUCTION AND BE CONSTRUCTED PRIOR TO AND IMMEDIATELY AFTER ANY GRADING OR DISTURBANCE OF EXISTING SURFACE MATERIAL ON THE SITE.
5. AFTER ANY SIGNIFICANT RAINFALL (GREATER THAN 0.25 INCHES OF RAINFALL WITHIN 24 HOURS), SEDIMENT CONTROL STRUCTURES SHALL BE INSPECTED FOR INTEGRITY. ANY DAMAGE SHALL BE CORRECTED IMMEDIATELY.
6. PERIODIC INSPECTION AND MAINTENANCE OF ALL SEDIMENT CONTROL STRUCTURES SHALL BE PROVIDED TO ENSURE THAT THE INTENDED PURPOSE IS ACCOMPLISHED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL SEDIMENT LEAVING THE LIMIT OF WORK. SEDIMENT CONTROL MEASURES SHALL BE IN WORKING CONDITION AT THE END OF EACH WORKING DAY.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PREVENTING SEDIMENT FROM ENTERING ANY STORM DRAINAGE SYSTEM AND FROM BEING CONVEYED TO ANY WETLAND RESOURCE AREA, PUBLIC WAYS, ABUTTING PROPERTY, OR OUTSIDE OF THE PROJECT LIMITS.
8. THE CONTRACTOR SHALL PROTECT ALL DRAINAGE SWALES AND GROUND SURFACES WITHIN THE LIMIT OF WORK FROM EROSIVE CONDITIONS. STRAW BALE, CRUSHED STONE OR EQUIVALENT CHECK DAMS ARE TO BE PROVIDED AT A MAXIMUM OF TWO HUNDRED (200) FOOT SPACING, OR LESS AS SITE-SPECIFIC CONDITIONS WARRANT, WITHIN ALL DRAINAGE SWALES AND DITCHES AND AT UPSTREAM SIDES OF ALL DRAINAGE INLETS.
9. ALL STOCK PILES SHALL BE PROTECTED AND LOCATED A MINIMUM OF 100' FROM EXISTING WETLAND RESOURCE AREAS & WITHIN THE LIMIT OF WORK.
10. ANY SEDIMENT TRACKED ONTO PAVED AREAS SHALL BE SWEPT AT THE END OF EACH WORKING DAY.
11. ALL SEDIMENT RETAINED BY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE LEGALLY DISPOSED OF OFFSITE.
12. TEMPORARY DIVERSION DITCHES, PERMANENT DITCHES, CHANNELS, EMBANKMENTS, AND ANY DENUDED SURFACE THAT WILL BE EXPOSED FOR A PERIOD OF 14 CALENDAR DAYS OR MORE SHALL BE CONSIDERED CRITICAL VEGETATION AREAS. THESE AREAS SHALL BE STABILIZED/PROTECTED WITH APPROPRIATE EROSION CONTROL MATTING OR OTHER EROSION CONTROL METHODS.
13. DUST SHALL BE CONTROLLED BY WATERING OR OTHER APPROVED METHODS AS DIRECTED BY THE PERMITTING AUTHORITY OR OWNER.
14. THE CONTRACTOR SHALL USE TEMPORARY SEEDING, MULCHING, OR OTHER APPROVED STABILIZATION MEASURES TO PROTECT EXPOSED AREAS DURING PROLONGED CONSTRUCTION OR OTHER LAND DISTURBANCE. STOCKPILES THAT WILL BE EXPOSED FOR LONGER THAN 14 DAYS SHALL BE STABILIZED.
15. THE CONTRACTOR IS RESPONSIBLE FOR REMOVAL OF ALL EROSION AND SEDIMENT CONTROLS AT THE COMPLETION OF SITE CONSTRUCTION, BUT ONLY WHEN DIRECTED BY THE TOWN OF BRAINTREE CONSERVATION AGENT. STABILIZE OR SEED BARE AREAS LEFT AFTER EROSION CONTROL REMOVAL.

GENERAL NOTES:

1. TOPOGRAPHIC DATA, PROPERTY LINE INFORMATION, AND EXISTING SITE FEATURES WERE OBTAINED FROM A PLAN ENTITLED "SMITH BEACH GPS", PREPARED BY BRAINTREE DPW., DATED 11/19/2021.
2. FLOODPLAIN INFORMATION WAS OBTAINED FROM THE FLOOD INSURANCE RATE MAP (FIRM) NO. 25021C0227F. THE SITE IS IN ZONE AE (1% CHANCE OF FLOOD HAZARD) AND A SMALL PORTION IS WITHIN ZONE X (0.2% ANNUAL CHANCE OF FLOODING).
3. THE CONTRACTOR SHALL COMPLY WITH MASSACHUSETTS GENERAL LAWS CHAPTER 82, SECTION 40, AS AMENDED, WHICH STATES THAT NO ONE MAY EXCAVATE IN THE COMMONWEALTH OF MASSACHUSETTS EXCEPT IN AN EMERGENCY WITHOUT 72 HOURS NOTICE, EXCLUSIVE OF SATURDAYS, SUNDAYS, AND LEGAL HOLIDAYS, TO NATURAL GAS PIPELINE COMPANIES, AND MUNICIPAL UTILITY DEPARTMENTS THAT SUPPLY GAS, ELECTRICITY, TELEPHONE, OR CABLE TELEVISION SERVICE IN OR TO THE CITY OR TOWN WHERE THE EXCAVATION IS TO BE MADE. THE CONTRACTOR SHALL CALL "DIG SAFE" AT 1-888-DIG-SAFE.
4. THE CONTRACTOR SHALL COMPLY WITH MASSACHUSETTS GENERAL LAWS CHAPTER 82A, ALSO REFERRED TO AS JACKIE'S LAW, AS DETAILED IN SECTION 520 CMR 14.00 OF THE CODE OF MASSACHUSETTS REGULATIONS.
5. THE CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL LAWS, RULES, REGULATIONS AND SAFETY CODES IN THE CONSTRUCTION OF ALL IMPROVEMENTS.
6. THE LOCATIONS AND ELEVATIONS OF ALL EXISTING UTILITIES ARE APPROXIMATE AND ALL UTILITIES MAY NOT BE SHOWN. PRESENCE AND LOCATIONS OF ALL UTILITIES WITHIN THE LIMIT OF WORK MUST BE DETERMINED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IDENTIFYING AND CONTACTING THE CONTROLLING AUTHORITIES AND/OR UTILITY COMPANIES RELATIVE TO THE LOCATIONS AND ELEVATIONS OF THEIR LINES. THE CONTRACTOR SHALL KEEP A RECORD OF ANY DISCREPANCIES OR CHANGES IN THE LOCATIONS OF ANY UTILITIES SHOWN OR ENCOUNTERED DURING CONSTRUCTION. ANY DISCREPANCIES SHALL BE REPORTED TO THE OWNER AND NITSCH ENGINEERING. ANY DAMAGE RESULTING FROM THE FAILURE OF THE CONTRACTOR TO MAKE THESE DETERMINATIONS AND CONTACTS SHALL BE BORNE BY THE CONTRACTOR.
7. THE CONTRACTOR SHALL, THROUGHOUT CONSTRUCTION, TAKE ADEQUATE PRECAUTIONS TO PROTECT ALL WALKS, GRADING, SIDEWALKS AND SITE DETAILS OUTSIDE OF THE LIMIT OF WORK AS DEFINED ON THE DRAWINGS AND SHALL REPAIR AND REPLACE OR OTHERWISE MAKE GOOD AS DIRECTED BY THE ENGINEER OR OWNER'S DESIGNATED REPRESENTATIVE ANY SUCH OR OTHER DAMAGE SO CAUSED.
8. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR JOB SITE SAFETY AND ALL CONSTRUCTION MEANS AND METHODS.
9. PRIOR TO BEGINNING CONSTRUCTION, THE CONTRACTOR SHALL BECOME FAMILIAR WITH THE SITE AND CONSTRUCTION DOCUMENTS TO DEVELOP A THOROUGH UNDERSTANDING OF THE PROJECT, INCLUDING ANY SPECIAL CONDITIONS AND CONSTRAINTS.
10. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BECOME FAMILIAR WITH THE PROJECT SITE AND TO VERIFY ALL CONDITIONS IN THE FIELD AND REPORT DISCREPANCIES BETWEEN PLANS AND ACTUAL CONDITIONS TO THE OWNER OR OWNER'S REPRESENTATION IMMEDIATELY.
11. THE CONTRACTOR SHALL CONDUCT ALL NECESSARY CONSTRUCTION NOTIFICATIONS AND APPLY FOR AND OBTAIN ALL NECESSARY CONSTRUCTION PERMITS.
12. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR THE ESTABLISHMENT AND USE OF ALL VERTICAL AND HORIZONTAL CONSTRUCTION CONTROLS.
13. ELEVATIONS REFER TO NAVD88.
14. THE CONTRACTOR SHALL COMPLY WITH THE ORDER OF CONDITIONS DATED MAY 03, 2022 AND ISSUED BY THE BRAINTREE CONSERVATION COMMISSION (DEP FILE #8-707).
15. FOR RESOURCE AREA DELINEATION INFORMATION, REFER TO "WETLAND RESOURCE AREA ANALYSIS REPORT, SMITH BEACH STORMWATER IMPROVEMENTS PROJECT" PREPARED BY LEC, DATED FEBRUARY 14, 2022.

PROPOSED LEGEND

- LIMIT OF WORK
- EXISTING UTILITY TO BE ABANDONED, REMOVED AND DISPOSED IF IN CONFLICT WITH NEW SITE IMPROVEMENTS, OR AS INDICATED ON DRAWINGS
- EROSION CONTROL BARRIER
- CONSTRUCTION FENCE
- W — DOMESTIC WATER PIPE
- FP — FIRE PROTECTION PIPE
- S — SANITARY SEWER PIPE
- D — STORM DRAIN PIPE
- G — GAS PIPE
- E — ELECTRIC DUCTBANK
- T/C — TELECOM DUCTBANK
- CW — CHILLED WATER PIPE
- STM — STEAM PIPE
- CR — CONDENSATE RETURN PIPE
- HW — HOT WATER PIPE/RETURN
- HHW — HEATING HOT WATER
- RW — REUSE WATER PIPE
- GW — GREY WATER PIPE
- X — FUTURE UTILITY, SHOWN FOR INFORMATION ONLY
- INLET PROTECTION
- ELEVATION CONTOURS
- MATCH LINE
- CENTERLINE
- CO — CLEANOUT
- AREA DRAIN
- ACCESS BASIN
- DRAIN MANHOLE
- Q — WATER QUALITY STRUCTURE
- CATCH BASIN
- DOUBLE CATCH BASIN
- WATER QUALITY INLET
- SEWER MANHOLE
- STMH — STEAM MANHOLE
- TMH — TELECOM MANHOLE
- EMH — ELECTRIC MANHOLE
- CWV — CHILLED WATER VALVE
- WV — WATER VALVE
- HYD — FIRE HYDRANT
- REMOVE & DISPOSE OF EXISTING PAVEMENT
- STANDARD PERMEABLE PAVEMENT SECTION
- DEEP PERMEABLE PAVEMENT SECTION
- MILL & OVERLAY PAVEMENT

ABBREVIATIONS

AB	ACCESS BASIN
AD	AREA DRAIN
BC	BOTTOM OF CURB ELEVATION
BW	BOTTOM OF WALL ELEVATION
CB	CATCH BASIN
CCB	CAPE COD BERM
CI	CAST IRON
CJ	CONTROL JOINT
CL	CENTER LINE
CO	CLEANOUT
COP	CENTER OF PIPE
CP	CARRIER PIPE
CPP	CORRUGATED POLYETHYLENE PIP
DCB	DOUBLE CATCH BASIN
DI	DUCTILE IRON PIPE CEMENT LINE
DMH	DRAIN MANHOLE
EHH	ELECTRIC HANDHOLE
EJ	EXPANSION JOINT
EMH	ELECTRIC MANHOLE
EOP	EDGE OF PAVEMENT
FD	FOUNDATION DRAIN
FFE	FINISHED FLOOR ELEVATION
HP	HIGH POINT
HYD	FIRE HYDRANT
INV	INVERT ELEVATION
LF	LINEAR FEET
LOW	LIMIT OF WORK
LP	LOW POINT
LW	LAB WASTE
M&P	MAINTAIN AND PROTECT
MHWL	MEAN HIGH WATER LINE
NFHL	NATIONAL FLOOD HAZARD LAYER
NIC	NOT IN CONTRACT
OC	ON CENTER
OCS	OUTLET CONTROL STRUCTURE
PD	PERIMETER DRAIN
PERF	PERFORATED
PVC	POLYVINYL CHLORIDE PIPE
R&D	REMOVE AND DISPOSE
R&S	REMOVE AND STOCKPILE
RD	ROOF DRAIN
RFA	RIVER FRONT AREA
RIM	RIM ELEVATION
SMH	SEWER MANHOLE
SS	SEWER SERVICE
TC	TOP OF CURB ELEVATION
TW	TOP OF WALL ELEVATION
THH	TELECOM HANDHOLE
TMH	TELECOM MANHOLE
TOP	TOP OF PIPE
TOD	TOP OF DUCT BANK
TYP	TYPICAL
UD	UNDERDRAIN
USD	UNDERSLAB DRAIN
V.I.F.	VERIFY IN FIELD
VGC	VERTICAL GRANITE CURB
WQI	WATER QUALITY INLET
WQS	WATER QUALITY STRUCTURE
WV	WATER VALVE

EARTH MOVING AND GRADING NOTES:

1. ALL TOPSOIL ENCOUNTERED WITHIN THE WORK AREA SHALL BE STRIPPED TO ITS FULL DEPTH AND STOCKPILED FOR REUSE. EXCESS TOPSOIL SHALL BE REMOVED FROM THE SITE UNLESS OTHERWISE DIRECTED BY THE OWNER. TOPSOIL PILES SHALL REMAIN SEGREGATED FROM EXCAVATED SUBSURFACE SOIL MATERIALS.
2. GRADES WITHIN HANDICAP PARKING SPACES AND ACCESS AISLES SHALL NOT EXCEED 1.5% IN ANY DIRECTION.
3. CROSS SLOPES OF ALL PEDESTRIAN WALKS SHALL NOT EXCEED 1.5%.
4. RUNNING SLOPE OF ALL PEDESTRIAN WALKS SHALL NOT EXCEED 4.5%, UNLESS OTHERWISE NOTED.
5. THE CONTRACTOR SHALL EXERCISE CAUTION IN ALL EXCAVATION ACTIVITY DUE TO POSSIBLE EXISTENCE OF UNRECORDED UTILITY LINES.
6. ALL PAVED AREAS MUST PITCH TO DRAIN AT A MINIMUM OF 1% UNLESS OTHERWISE NOTED.
7. PROVIDE POSITIVE DRAINAGE AWAY FROM FACE OF BUILDINGS AT ALL LOCATIONS.
8. PITCH EVENLY BETWEEN CONTOUR LINES AND BETWEEN SPOT GRADES. SPOT GRADE ELEVATIONS TAKE PRECEDENCE OVER CONTOUR LINES.
9. ALL PROPOSED TOP OF CURB ELEVATIONS ARE SIX INCHES (6") ABOVE BOTTOM OF CURB ELEVATIONS UNLESS OTHERWISE NOTED. ALL PROPOSED TOP OF CAPE COD BERM ELEVATIONS ARE FOUR INCHES (4") ABOVE BOTTOM OF CURB ELEVATION UNLESS OTHERWISE NOTED.
10. THE CONTRACTOR SHALL BLEND NEW GRADING SMOOTHLY INTO EXISTING GRADING AT LIMITS OF GRADING.
11. WHERE NEW PAVING MEETS EXISTING PAVING, MEET LINE AND GRADE OF EXISTING PAVING WITH SMOOTH TRANSITION BETWEEN EXISTING AND NEW SURFACES.
12. THE CONTRACTOR SHALL VERIFY EXISTING GRADES IN THE FIELD AND REPORT ANY DISCREPANCIES IMMEDIATELY TO THE ARCHITECT OR OWNER'S REPRESENTATIVE PRIOR TO STARTING WORK.
13. PITCH TOPS OF ALL WALLS AT ONE-EIGHTH INCH (1/8") PER FOOT FROM BACK OF WALL TO FACE OF WALL.
14. SURPLUS MATERIALS SHALL BE REMOVED FROM THE SITE UNLESS DIRECTED BY THE OWNER OR OWNER'S REPRESENTATIVE. REFER TO EARTHWORK SPECIFICATIONS.
15. ANY AREAS OUTSIDE OF THE LIMIT OF WORK THAT ARE DISTURBED SHALL BE RESTORED BY THE CONTRACTOR TO THE PRE-CONSTRUCTION CONDITION/GRADE AT NO COST TO THE OWNER.
16. EXCAVATION REQUIRED WITHIN PROXIMITY OF EXISTING UTILITY LINES SHALL BE DONE BY HAND. CONTRACTOR SHALL REPAIR ANY DAMAGE TO EXISTING UTILITY LINES OR STRUCTURES INCURRED DURING CONSTRUCTION OPERATIONS AT NO ADDITIONAL COST TO OWNER.

UTILITY NOTES:

1. ALL UTILITY CONNECTIONS ARE SUBJECT TO THE APPROVAL OF, AND GRANTING OF PERMITS BY, THE LOCAL MUNICIPALITY. IT SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR TO OBTAIN ALL PERMITS AND APPROVALS RELATED TO UTILITY WORK PRIOR TO COMMENCEMENT OF CONSTRUCTION.
2. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR OBTAINING ALL PERMISSIONS FOR, AND FOR CONDUCTING ALL PREPARATIONS RELATED TO, WORK AFFECTING ANY UTILITIES WITHIN THE JURISDICTION OF ANY NON-MUNICIPAL UTILITY COMPANY, INCLUDING BUT NOT LIMITED TO ELECTRIC, TELEPHONE, AND/OR GAS. THE CONTRACTOR SHALL NOTIFY ALL APPROPRIATE AGENCIES, DEPARTMENTS, AND UTILITY COMPANIES, IN WRITING, AT LEAST 7 DAYS (OR PER UTILITY COMPANY REQUIREMENT) AND NOT MORE THAN 30 DAYS PRIOR TO ANY CONSTRUCTION.
3. THE CONTRACTOR SHALL MAINTAIN UTILITIES SERVICING BUILDINGS AND FACILITIES WITHIN OR OUTSIDE THE PROJECT LIMIT UNLESS THE INTERRUPTION OF SERVICE IS COORDINATED WITH THE OWNER.
4. ALL WATER, SEWER, AND DRAIN WORK SHALL BE PERFORMED ACCORDING TO THE REQUIREMENTS AND STANDARD SPECIFICATIONS OF THE LOCAL MUNICIPALITY.
5. GAS, TELECOMMUNICATIONS AND ELECTRIC SERVICES ARE TO BE DESIGNED BY EACH UTILITY COMPANY IN COORDINATION WITH THE MECHANICAL, ELECTRIC, AND PLUMBING CONSULTANTS.
6. THE CONTRACTOR SHALL COORDINATE CONSTRUCTION ACTIVITIES OF NEW UTILITIES WITH GAS, TELECOMMUNICATION AND ELECTRICAL SERVICES.
7. MAINTAIN 10 FEET HORIZONTAL SEPARATION AND 18 INCHES VERTICAL SEPARATION (WATER OVER SEWER) BETWEEN SEWER AND WATER LINES. WHEREVER THERE IS LESS THAN 10 FEET OF HORIZONTAL SEPARATION AND 18 INCHES OF VERTICAL SEPARATION BETWEEN A PROPOSED OR EXISTING SEWER LINE TO REMAIN AND A PROPOSED OR EXISTING WATER LINE TO REMAIN BOTH WATER MAIN AND SEWER MAIN SHALL BE CONSTRUCTED OF MECHANICAL JOINT CEMENT LINED DUCTILE IRON PIPE FOR A DISTANCE OF 10-FEET ON EITHER SIDE OF THE CROSSING. ONE (1) FULL LENGTH OF WATER PIPE SHALL BE CENTERED OVER THE SEWER AT THE CROSSING.
8. THE CONTRACTOR SHALL MAINTAIN ALL EXISTING UTILITIES EXCEPT THOSE NOTED TO BE ABANDONED AND/OR REMOVED & DISPOSED.
9. THE GENERAL CONTRACTOR IS RESPONSIBLE FOR TRENCHING, BACKFILLING, AND SURFACE RESTORATION FOR GAS UTILITY SYSTEMS.
10. ALL ONSITE UTILITIES SHALL BE INSTALLED UNDERGROUND UNLESS OTHERWISE NOTED.
11. ALL EXISTING AND PROPOSED MANHOLE FRAMES, COVERS, VALVES, CLEANOUTS, CASTINGS, ETC. SHALL BE RAISED TO FINISHED GRADE PRIOR TO FINAL GRADING AND PAVING CONSTRUCTION.
12. ALL GRATES IN WALKWAYS SHALL BE ADA COMPLIANT.

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CIVIL NOTES, LEGEND, & ABBREVIATIONS

SMITH BEACH PARKING LOT GREEN INFRASTRUCTURE RETROFIT

BRAINTREE, MA

PREPARED FOR:

BRAINTREE DPW

85 QUINCY AVENUE, BRAINTREE, MA 02184

FINAL PLAN SET

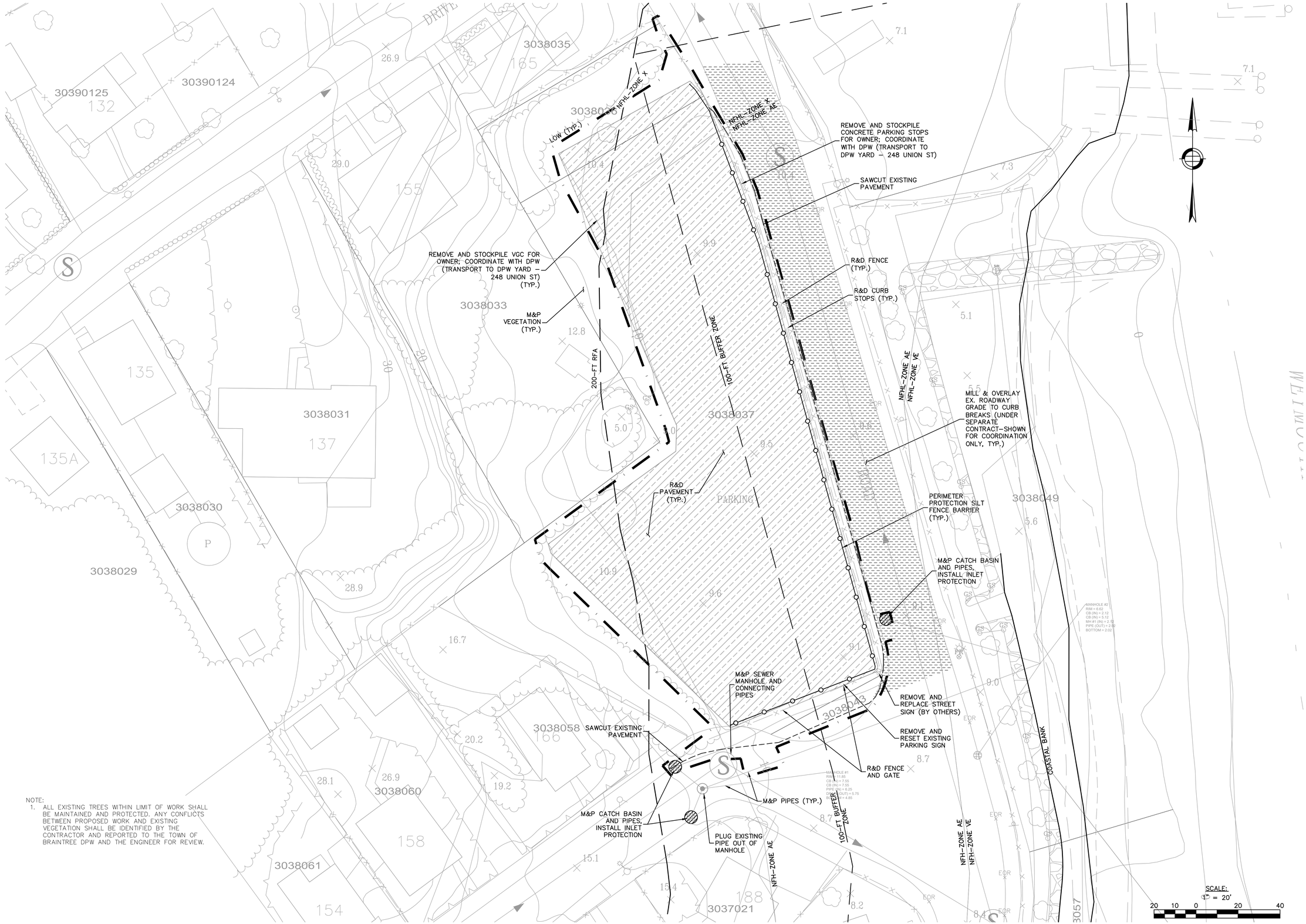
REV.	COMMENTS	DATE
	REVISIONS	

NITSCH PROJECT #	13447.1
FILE:	13447.1_NOTES.DWG
SCALE:	NTS
DATE:	6/24/2022
PROJECT MANAGER:	JLJ
SURVEYOR:	DPW
DRAFTED BY:	JLW
CHECKED BY:	JLW

SHEET:

C-000

OF REV.



NOTE:
1. ALL EXISTING TREES WITHIN LIMIT OF WORK SHALL BE MAINTAINED AND PROTECTED. ANY CONFLICTS BETWEEN PROPOSED WORK AND EXISTING VEGETATION SHALL BE IDENTIFIED BY THE CONTRACTOR AND REPORTED TO THE TOWN OF BRAINTREE DPW AND THE ENGINEER FOR REVIEW.

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SITE PREPARATION & DEMOLITION PLAN

SMITH BEACH
BRAINTREE, MA

PREPARED FOR:
BRAINTREE DPW
85 QUINCY AVENUE, BRAINTREE, MA 02184

FINAL PLAN SET

REV.	COMMENTS	DATE
	REVISIONS	

NITSCH PROJECT #	13447.1
FILE:	13447.1_CDM.DWG
SCALE:	1"=20'
DATE:	6/24/2022
PROJECT MANAGER:	JLJ
SURVEYOR:	DPW
DRAFTED BY:	JLW
CHECKED BY:	JLW

SHEET:
C-100
OF REV.

PARKING SUMMARY:
57 PARKING SPOTS
(3 ADA)

3038035
EDUCATIONAL SIGN 2

PLANT PREVIOUSLY PAVED AREA (SEE PLANTING PLAN – C-600, TYP.)

NFHL-ZONE X

NFHL-ZONE X
NFHL-ZONE AE

SPLASH PAD AT CURB BREAK (TYP.)

PAVEMENT STRIPIING

RAIN GARDEN AREA, SEE C-600

MILL & OVERLAY EX. ROADWAY GRADE TO CURB BREAKS (TYP.) (UNDER SEPARATE CONTRACT– SHOWN FOR COORDINATION ONLY, TYP.)

STANDARD PERMEABLE PAVEMENT SECTION (TYP.)

200-FT RFA

100-FT BUFFER ZONE

NFHL-ZONE AE
NFHL-ZONE VE

FULL REVEAL VGC – SEE SHEET C-201 FOR DETAILED CURBING AND LAYOUT INFORMATION (TYP.)

PAVEMENT MARKINGS ACCESSIBLE AISLE AND 5-FT WALKWAY

ADA SIGNS (3 TOTAL)

PAVEMENT STRIPIING

FULL REVEAL VGC – SEE SHEET C-201 FOR DETAILED CURBING AND LAYOUT INFORMATION (TYP.)

RAIN GARDEN AREA, SEE C-600

DEEP PERMEABLE PAVEMENT SECTION WITH ISOLATOR ROW (TYP.)

CURB RAMP WITH DETECTABLE WARNING PANEL

5-FT WIDE CONCRETE SIDEWALK

REMOVE AND REPLACE STREET SIGN (BY OTHERS)

EDUCATIONAL SIGN 1

CURB RAMP WITH DETECTABLE WARNING PANEL

RESET PARKING SIGN

CONC. PAD WITH GATE POST (TYP.)

OPERABLE GATE

CONC. PAD WITH GATE POST (TYP.)

TYPICAL PAVEMENT SECTION

100-FT BUFFER ZONE

NFH-ZONE AE

NFH-ZONE AE
NFH-ZONE VE

COASTAL BANK

SCALE:
1" = 20'
20 10 0 20 40

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SITE LAYOUT & MATERIALS PLAN

SMITH BEACH PARKING LOT GREEN INFRASTRUCTURE RETROFIT
BRAINTREE, MA

PREPARED FOR:
BRAINTREE DPW
85 QUINCY AVENUE, BRAINTREE, MA 02184

FINAL PLAN SET

REV.	COMMENTS	DATE
	REVISIONS	

NITSCH PROJECT #	13447.1
FILE:	13447.1_CLO.DWG
SCALE:	1"=20'
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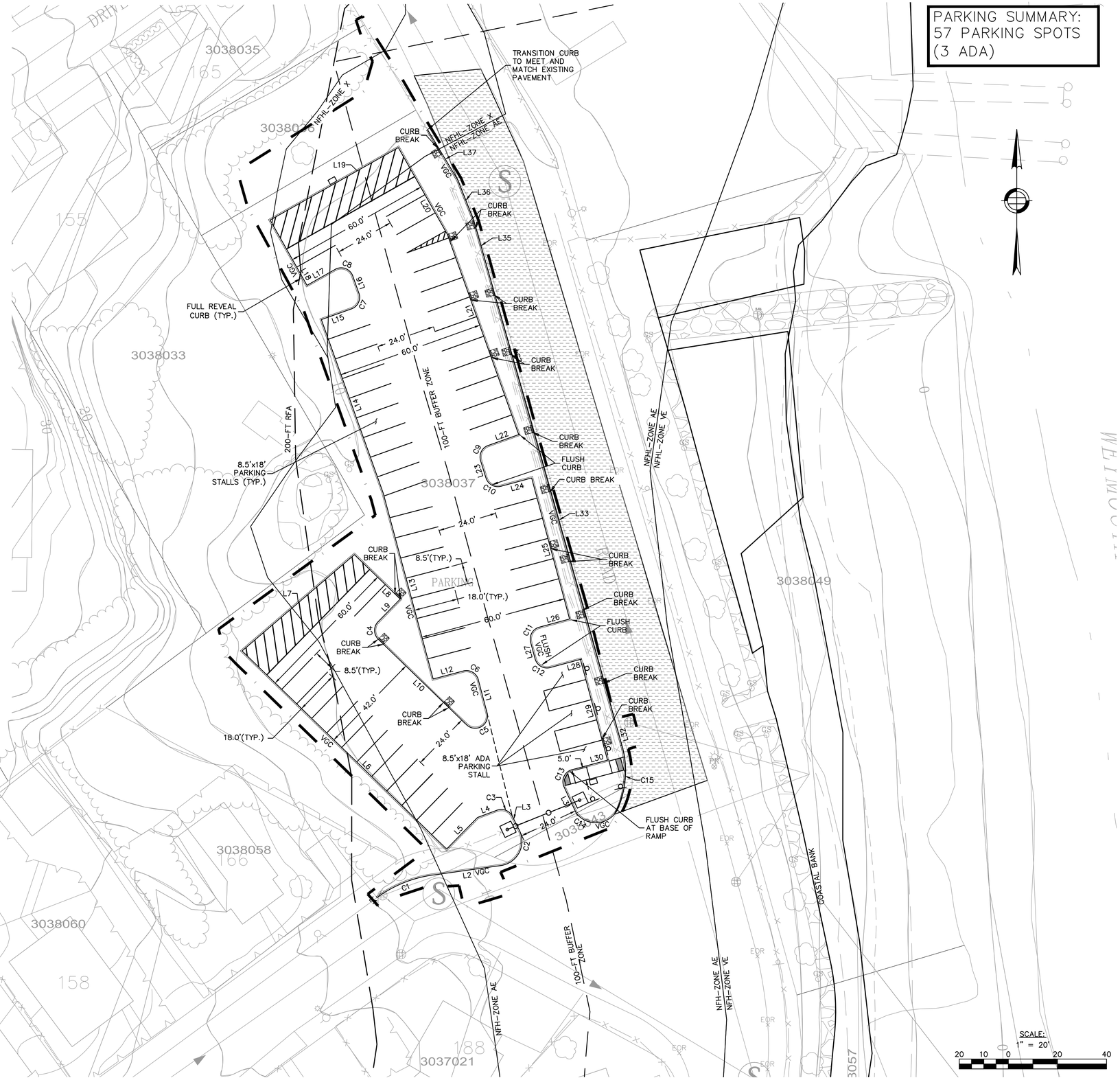
PROJECT MANAGER:	JLJ
SURVEYOR:	DPW
DRAFTED BY:	JLW
CHECKED BY:	JLW

SHEET:
C-200
OF REV.

CURVE TABLE			
CURVE #	LENGTH	RADIUS	DELTA
C1	24.57	50.00	28°09'13"
C2	18.99	10.00	108°48'50"
C3	7.29	5.00	83°34'41"
C4	7.86	5.00	90°02'09"
C5	12.95	5.00	148°26'50"
C6	7.85	5.00	90°00'00"
C7	7.85	5.00	90°00'00"
C8	8.71	5.00	99°50'07"
C9	7.65	5.00	87°42'46"
C10	7.65	5.00	87°42'46"
C11	7.85	5.00	90°00'00"
C12	7.85	5.00	90°00'00"
C13	8.58	5.00	98°20'19"
C14	21.10	10.00	120°55'07"
C15	25.94	40.00	37°09'23"

LINE TABLE		
LINE #	LENGTH	DIRECTION
L1	0.50	N41°37'58"W
L2	28.07	S82°02'37"W
L3	6.35	S26°46'13"E
L4	8.46	N69°39'06"E
L5	18.00	N44°20'13"E
L6	115.99	S45°55'14"E
L7	60.26	S49°24'05"W
L8	26.02	N45°55'14"W
L9	12.95	N44°20'13"E
L10	50.15	N45°54'20"W
L11	13.93	S14°49'21"E
L12	12.69	N75°10'39"E
L13	78.38	S15°02'53"E
L14	75.00	S19°37'21"E
L15	13.00	S70°22'39"W
L16	7.42	S19°37'21"E
L17	13.17	N60°32'32"E
L18	30.54	S29°27'15"E
L19	60.00	S60°32'45"W
L20	40.59	N29°27'28"W

LINE TABLE		
LINE #	LENGTH	DIRECTION
L21	86.55	N19°37'21"W
L22	13.20	N70°22'39"E
L23	7.38	N17°20'07"W
L24	12.96	S74°57'07"W
L25	59.50	N15°02'53"W
L26	12.77	N74°57'07"E
L27	7.00	N15°02'53"W
L28	12.77	S74°57'07"W
L29	42.50	N15°02'53"W
L30	14.99	N74°57'07"E
L31	11.99	N24°51'49"W
L32	53.13	S15°29'55"E
L33	83.58	S15°44'28"E
L34	54.64	S15°58'36"E
L35	30.29	S15°51'59"E
L36	17.76	S21°31'12"E
L37	23.97	S30°57'51"E



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SITE LAYOUT & CURBING PLAN

SMITH BEACH PARKING LOT GREEN INFRASTRUCTURE RETROFIT
BRAINTREE, MA

PREPARED FOR:
BRAINTREE DPW
85 QUINCY AVENUE, BRAINTREE, MA 02184

FINAL PLAN SET

REV.	COMMENTS	DATE
REVISIONS		

NITSCH PROJECT #	13447.1
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PROJECT MANAGER:	JLJ
SURVEYOR:	DPW
DRAFTED BY:	JLW
CHECKED BY:	JLW

SHEET:

C-201

OF REV.

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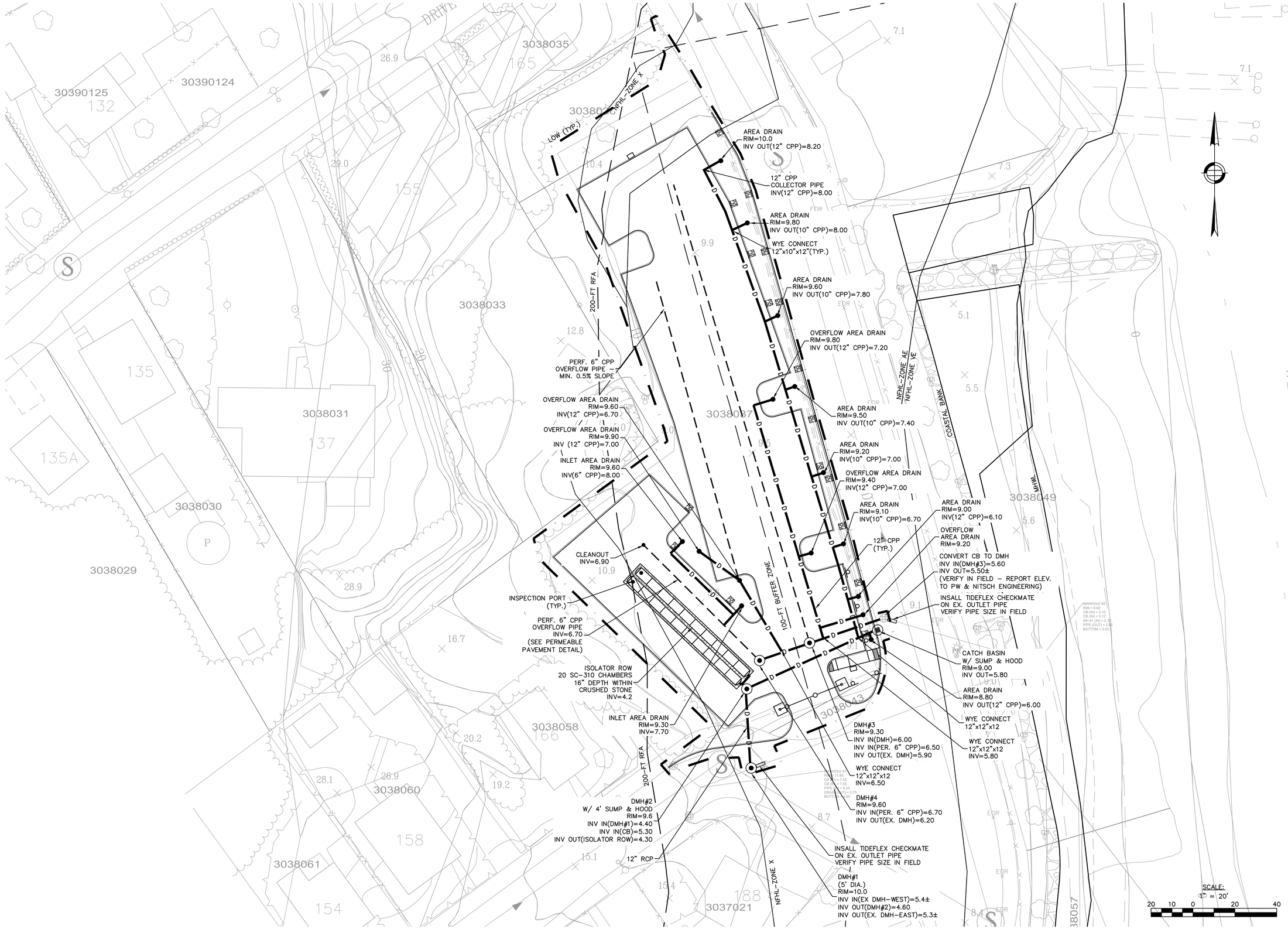

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SITE UTILITY PLAN

SMITH BEACH PARKING LOT GREEN INFRASTRUCTURE RETROFIT
BRAINTREE, MA

PREPARED FOR:

BRAINTREE DPW

85 QUINCY AVENUE, BRAINTREE, MA 02184

FINAL PLAN SET

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NITSCH PROJECT #	13447.1
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SCALE:	1"=20'
DATE:	6/24/2022
PROJECT MANAGER:	JLJ
SURVEYOR:	DPW
DRAFTED BY:	JLW
CHECKED BY:	JLW

SHEET:

C-300

OF REV.

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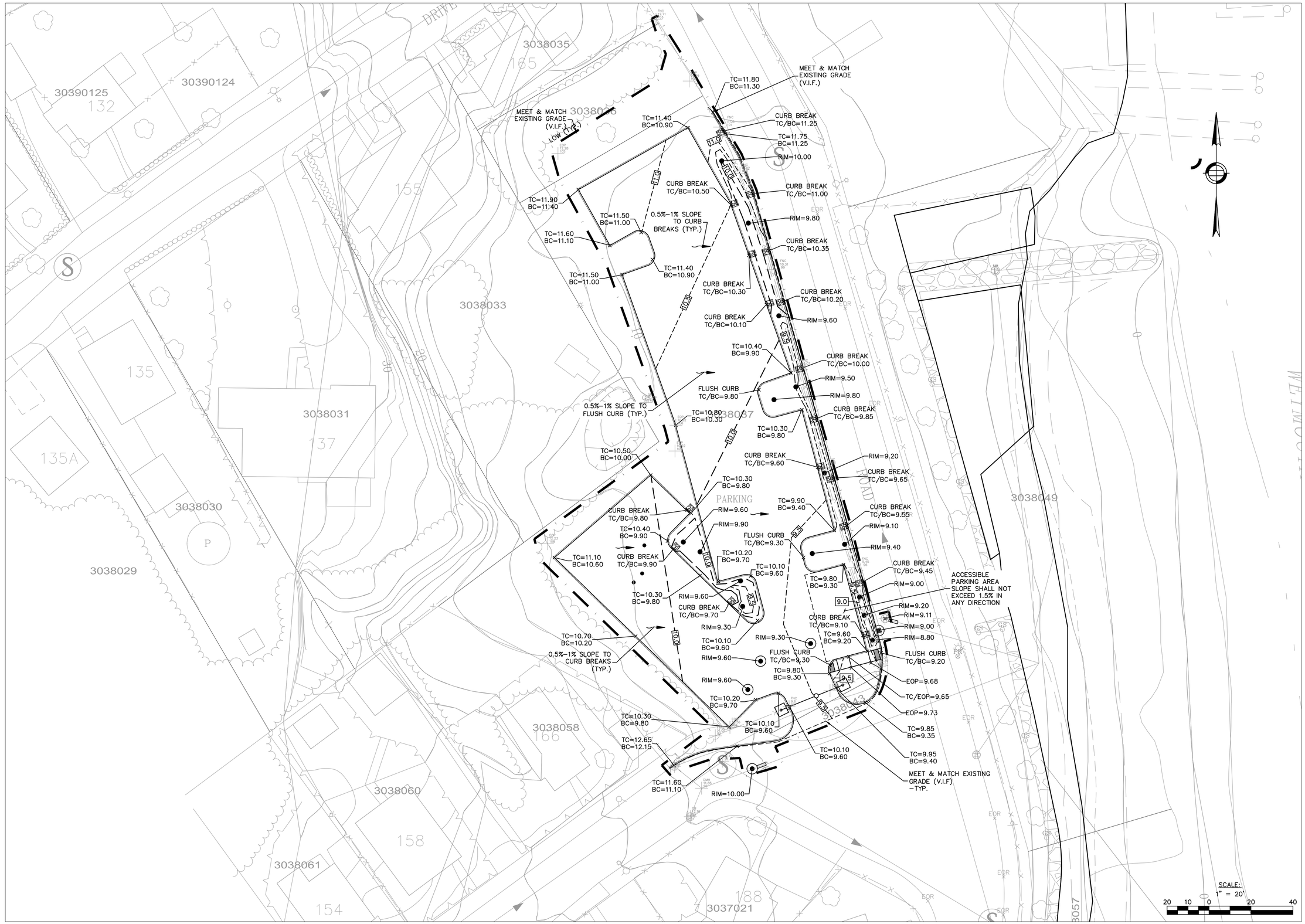

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GRADING PLAN

SMITH BEACH PARKING LOT GREEN INFRASTRUCTURE RETROFIT
BRAINTREE, MA

PREPARED FOR:
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FINAL PLAN SET

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NITSCH PROJECT #	13447.1
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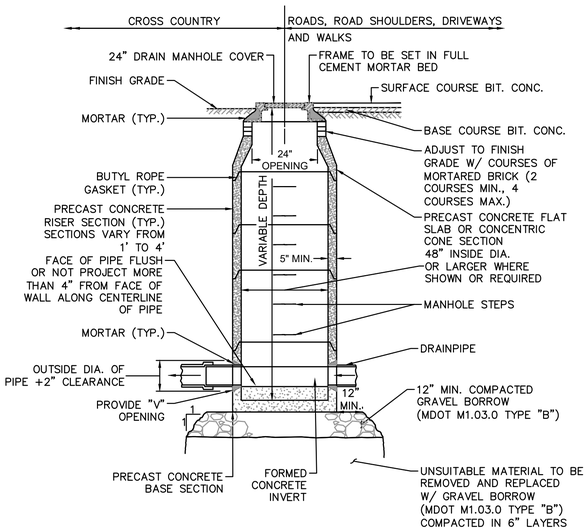
SCALE:	1"=20'
DATE:	6/24/2022
PROJECT MANAGER:	JLJ
SURVEYOR:	DPW
DRAFTED BY:	JLW
CHECKED BY:	JLW

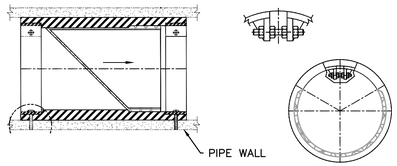
SHEET:
C-400
OF REV.



TYPICAL DRAIN MANHOLE DETAIL

NOT TO SCALE

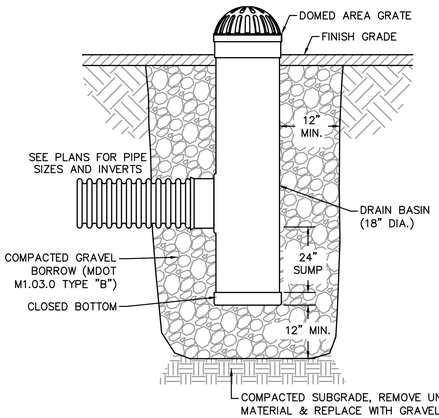
NOTES:
1. VERIFY PIPE INSIDE DIAMETER IN FIELD
2. CLAMP INSTALLED IN UPSTREAM OR DOWNSTREAM CUFF DEPENDING ON INSTALLATION ORIENTATION
3. MAXIMUM ALLOWABLE BACK PRESSURE - 40.0 FEET
4. IT IS RECOMMENDED TO BOLT OR PIN TIDEFLEX TO PIPE AS SHOWN, 4 PLACES 90° APART



PIN PER NOTE #4
RECOMMENDED PINNING CONFIGURATION
(SUPPLIED BY CUSTOMER) (SEE I.O.M.) NOT TO SCALE

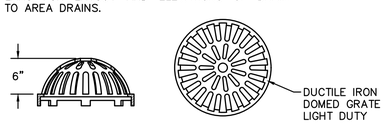
TIDEFLEX CHECKMATE CHECK VALVE DETAIL

NOT TO SCALE



SECTION VIEW

NOTES:
1. FRAME AND GRATE SHALL BE DUCTILE IRON CONFORMING TO ASTM A536 GRADE 70-50-05.
2. 15" AREA DRAINS SHALL BE NYLOPLAST MODEL 2815 AS MANUFACTURED BY ADVANCED DRAINAGE SYSTEMS, INC., OR APPROVED EQUAL.
3. AREA DRAINS SHALL BE CUSTOM MANUFACTURED ACCORDING TO THE PLANS AND DETAIL.
4. CASTINGS SHALL BE FURNISHED WITH A BLACK PAINT.
5. SEE PLANS FOR LAYOUT AND ELEVATIONS OF DRAIN PIPES TO AREA DRAINS.



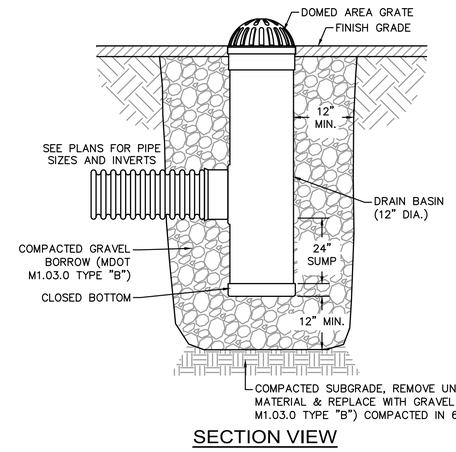
DOMED GRATE

18" OVERFLOW AREA DRAIN DETAIL

NOT TO SCALE

TYPICAL CATCH BASIN DETAIL

NOT TO SCALE



SECTION VIEW

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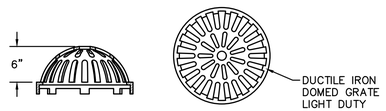
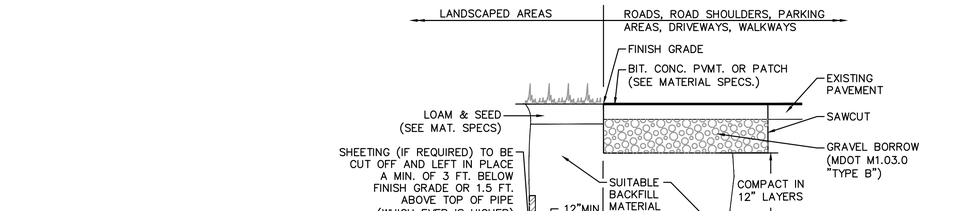


DOMED GRATE

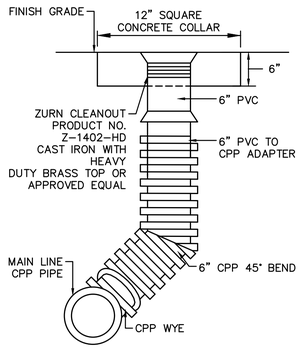
12" INLET AREA DRAIN DETAIL

NOT TO SCALE



STANDARD TRENCH DETAIL FOR UTILITY PIPE

NOT TO SCALE



TYPICAL CLEANOUT DETAIL

NOT TO SCALE

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CIVIL DETAILS SHEET I

SMITH BEACH PARKING LOT GREEN INFRASTRUCTURE RETROFIT
BRAINTREE, MA

PREPARED FOR:
BRAINTREE DPW
85 QUINCY AVENUE, BRAINTREE, MA 02184

FINAL PLAN SET

REV.	COMMENTS	DATE
	REVISIONS	

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SHEET:

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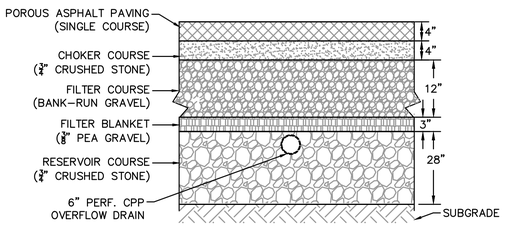
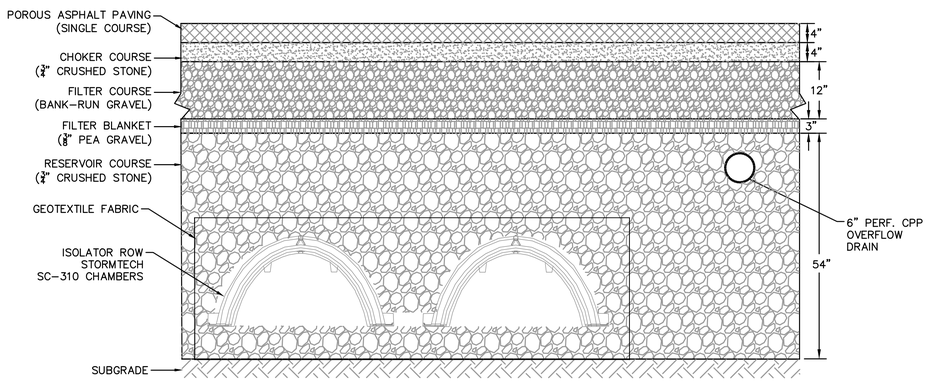


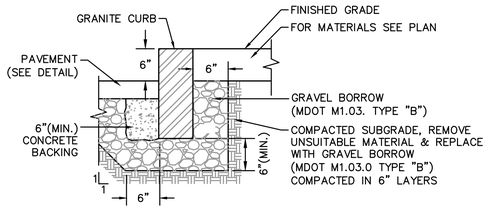
STANDARD POROUS ASPHALT SECTION DETAIL

NOT TO SCALE



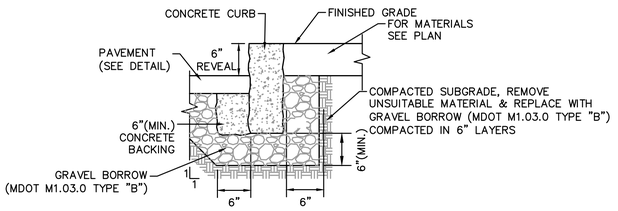
DEEP POROUS ASPHALT SECTION DETAIL

NOT TO SCALE



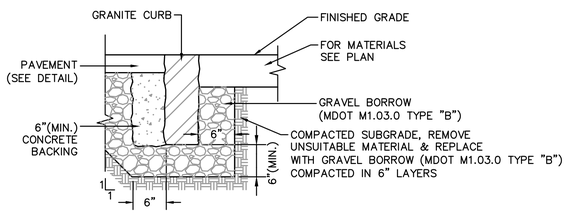
VERTICAL GRANITE CURB SETTING DETAIL

NOT TO SCALE



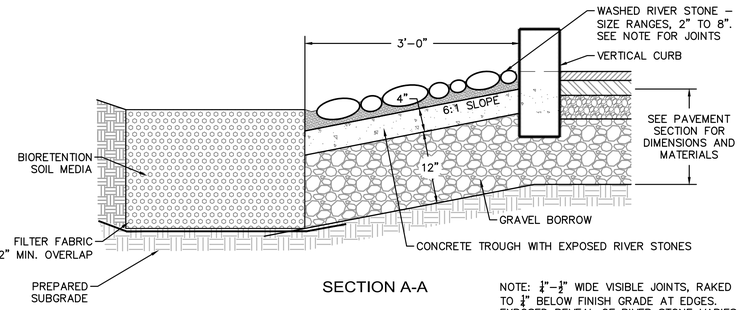
VERTICAL CONCRETE CURB SETTING DETAIL

NOT TO SCALE



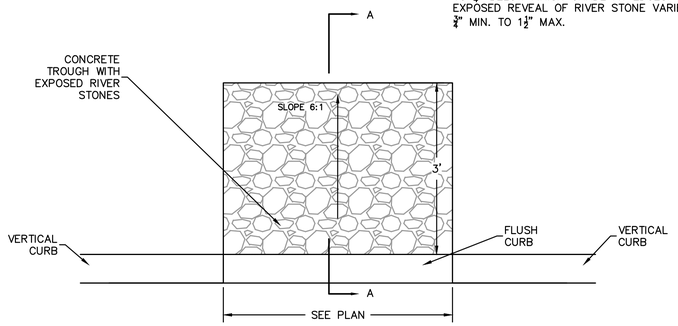
FLUSH GRANITE CURB SETTING DETAIL

NOT TO SCALE



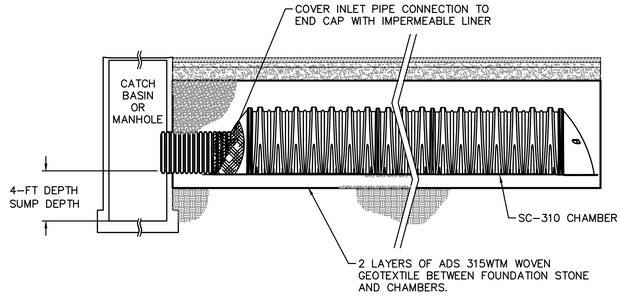
SECTION A-A

NOTE: ¼"–½" WIDE VISIBLE JOINTS, RAKED TO ¼" BELOW FINISH GRADE AT EDGES. EXPOSED REVEAL OF RIVER STONE VARIES, ¾" MIN. TO 1½" MAX.



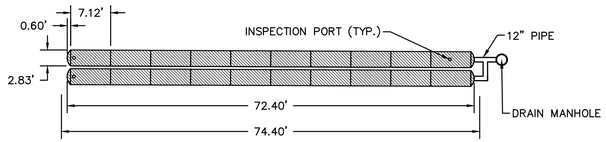
CURB BREAK DETAIL FOR VERTICAL GRANITE CURB

NOT TO SCALE



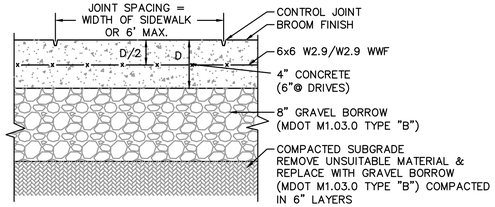
ISOLATOR ROW SECTION DETAIL

NOT TO SCALE



SC-310 CHAMBERS ISOLATOR ROW LAYOUT DETAIL

NOT TO SCALE



CONCRETE SIDEWALK DETAIL

NOT TO SCALE

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CIVIL DETAILS SHEET II

SMITH BEACH PARKING LOT GREEN INFRASTRUCTURE RETROFIT
BRAINTREE, MA

PREPARED FOR:
BRAINTREE DPW
85 QUINCY AVENUE, BRAINTREE, MA 02184

FINAL PLAN SET

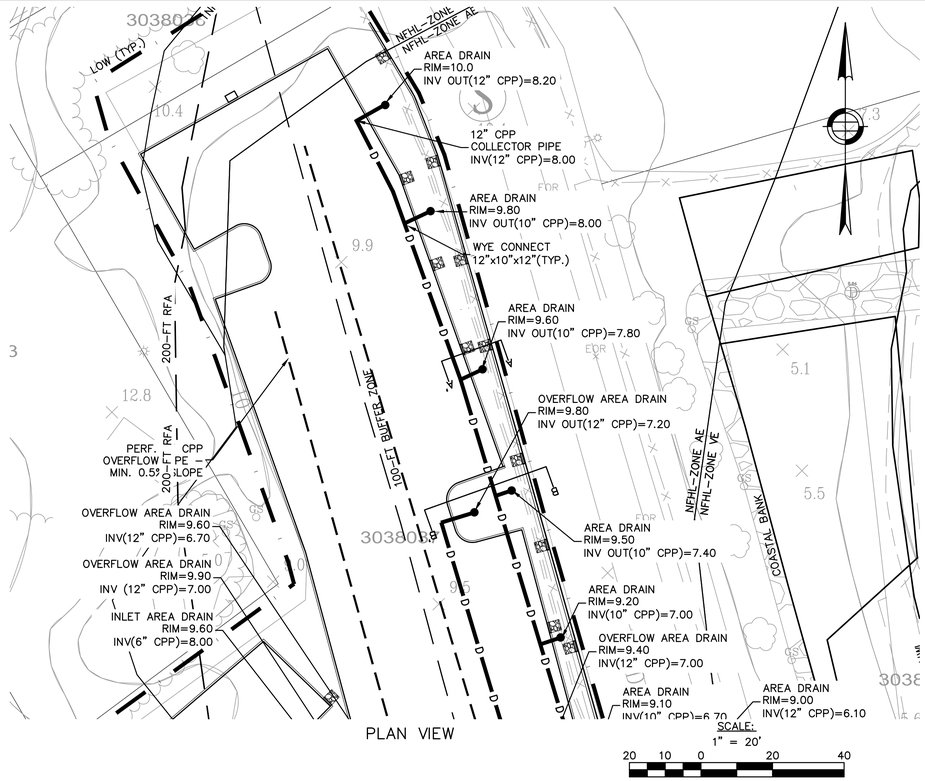
REV.	COMMENTS	DATE
	REVISIONS	

NITSCH PROJECT #	13447.1
FILE:	13447.1_CDT.DWG
SCALE:	NTS
DATE:	6/24/2022
PROJECT MANAGER:	JLJ
SURVEYOR:	DPW
DRAFTED BY:	JLW
CHECKED BY:	JLW

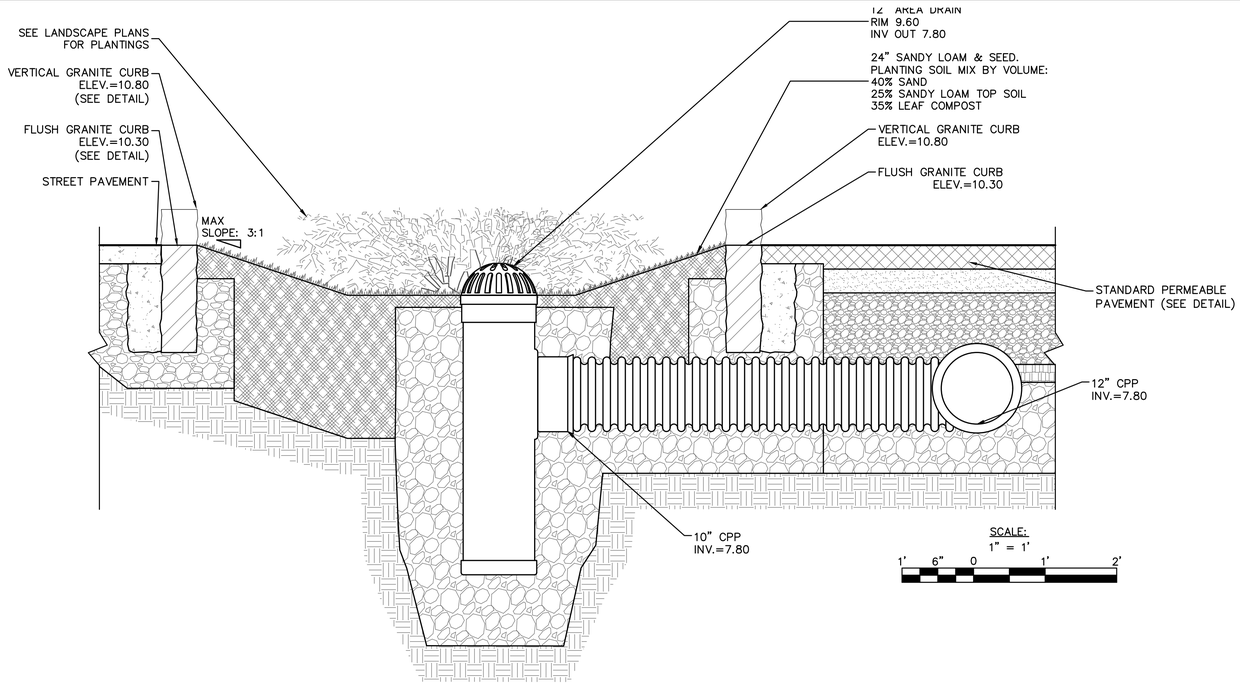
SHEET:

C-501

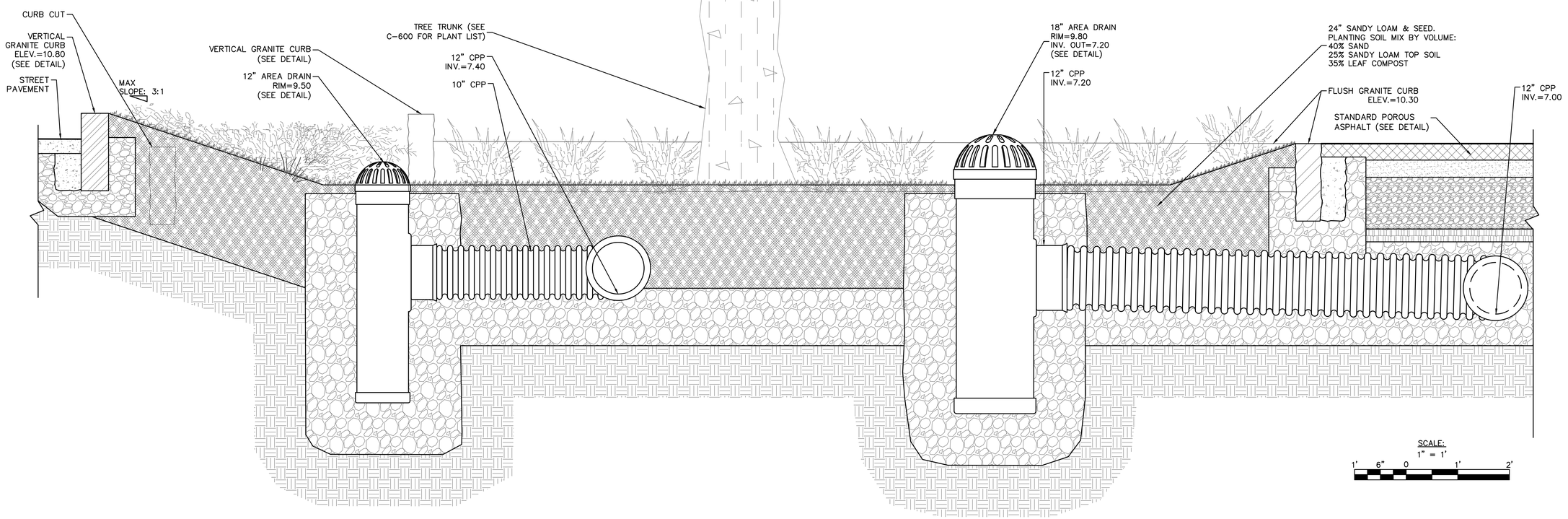
OF REV.



PLAN VIEW



SECTION A–A'



SECTION B–B'

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CIVIL DETAILS SHEET III

SMITH BEACH PARKING LOT GREEN INFRASTRUCTURE RETROFIT
BRAINTREE, MA

PREPARED FOR:
BRAINTREE DPW
85 QUINCY AVENUE, BRAINTREE, MA 02184

FINAL PLAN SET

REV.	COMMENTS	DATE
	REVISIONS	

NITSCH PROJECT #	13447.1
FILE:	13447.1_CUT.DWG
SCALE:	
DATE:	6/24/2022
PROJECT MANAGER:	JLJ
SURVEYOR:	DPW
DRAFTED BY:	KLK
CHECKED BY:	JLW

SHEET:

C-502

OF REV.

6/24/2022 2:26 PM

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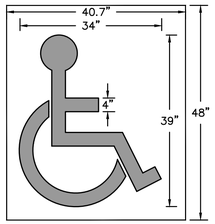
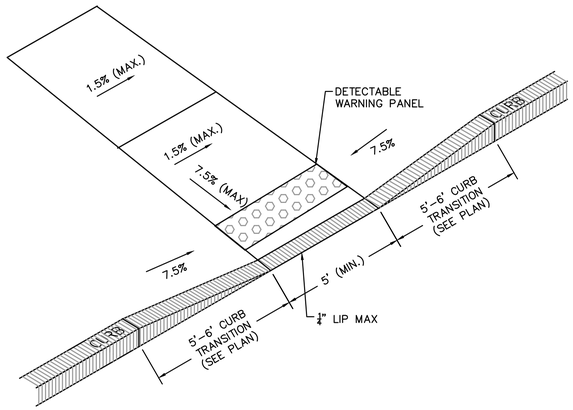


ACCESSIBLE PARKING STENCIL DETAIL

NOT TO SCALE



ACCESSIBLE RAMPS SLOPE DOWN

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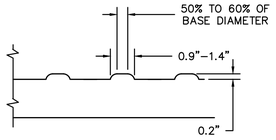
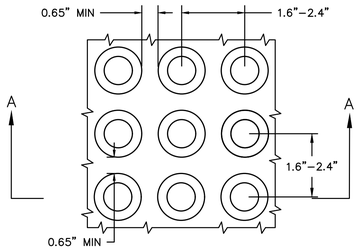


SECTION A-A

NOTES:

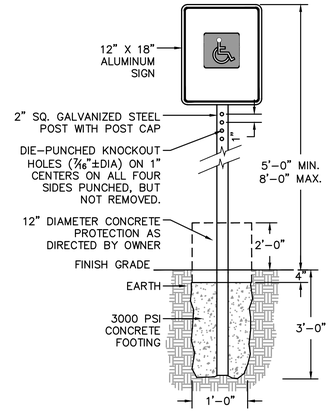
1. DETECTABLE WARNING PANELS SHALL BE PERMANENTLY APPLIED TO THE RAMP.
2. DETECTABLE WARNING PANELS SHALL CONTRAST VISUALLY WITH THE ADJACENT WALKWAY SURFACES PER THE FOLLOWING COLOR SCHEDULE:
   - PALE YELLOW ON CEMENT CONCRETE PEDESTRIAN RAMPS
3. DETECTABLE WARNING PANELS SHALL BE AS MANUFACTURED BY ADA SOLUTIONS, INC. OF NORTH BILLERICA, MA OR AN APPROVED EQUAL.
4. DETECTABLE WARNING PANELS SHALL BE INSTALLED PER THE MANUFACTURER'S RECOMMENDATIONS.



DETECTABLE WARNING PANEL

DETECTABLE WARNING PANEL FOR PEDESTRIAN RAMPS DETAIL

NOT TO SCALE



HANDICAPPED PARKING SIGNAGE DETAIL

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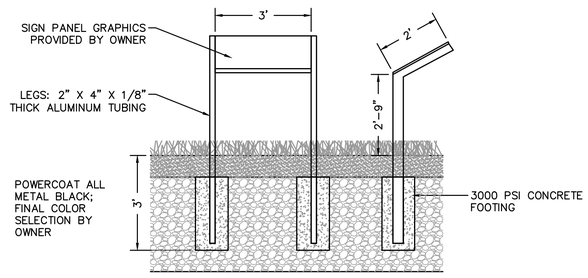
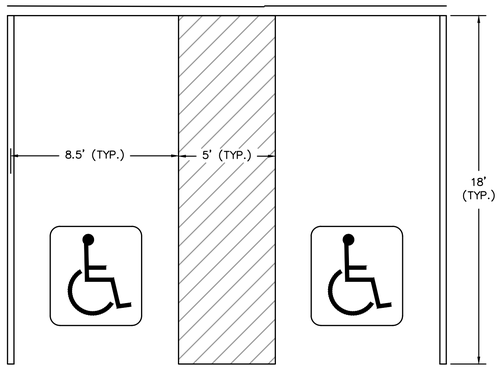


EDUCATIONAL SIGNAGE DETAIL

NOT TO SCALE



ACCESSIBLE PARKING DETAIL

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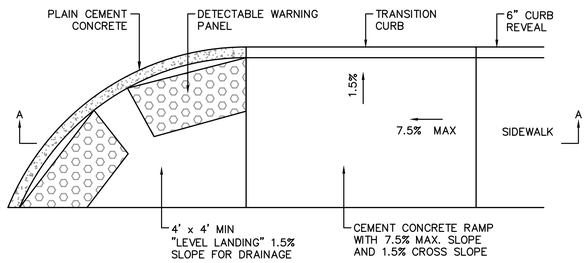

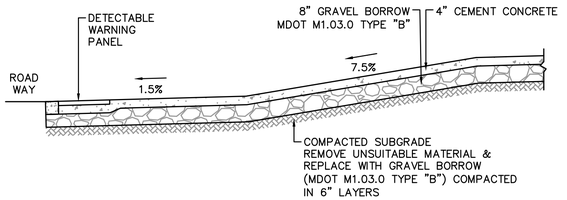

SECTION A-A

PARALLEL PEDESTRIAN RAMP AT CORNER DETAIL

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CIVIL DETAILS SHEET IV

SMITH BEACH PARKING LOT GREEN INFRASTRUCTURE RETROFIT
BRAINTREE, MA

PREPARED FOR:

BRAINTREE DPW

85 QUINCY AVENUE, BRAINTREE, MA 02184

FINAL PLAN SET

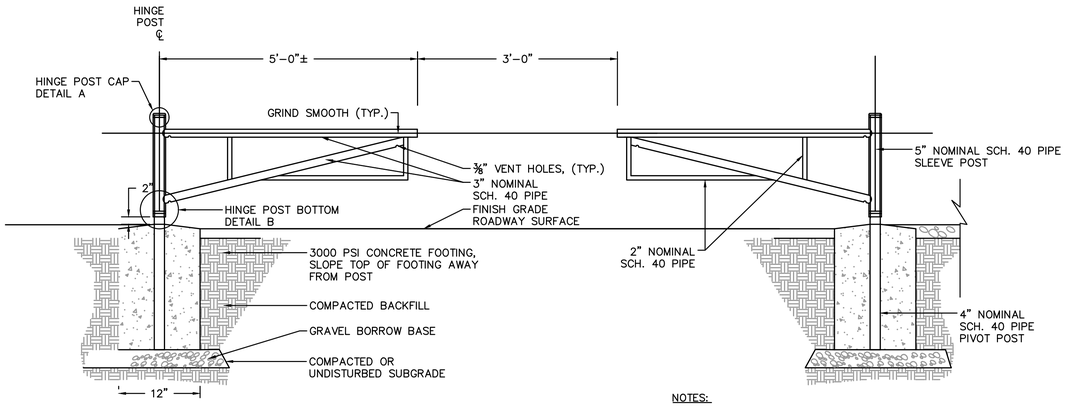
REV.	COMMENTS	DATE
	REVISIONS	

NITSCH PROJECT #	13447.1
FILE:	13447.1_CDT.DWG
SCALE:	NTS
DATE:	6/24/2022
PROJECT MANAGER:	JLJ
SURVEYOR:	DPW
DRAFTED BY:	JLW
CHECKED BY:	JLW

SHEET:

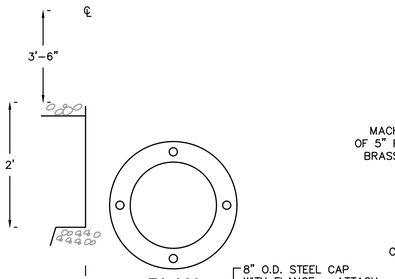
C-503

OF REV.

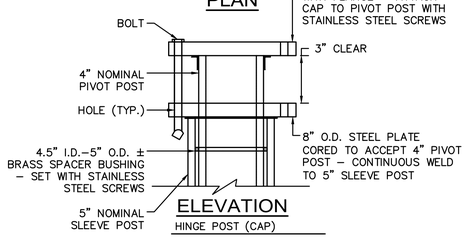


NOTES:

1. AS MANUFACTURED BY UNITED FENCE OR APPROVED EQUAL
2. FULL SEAM WELD AND GRIND SMOOTH PRIOR TO FINISH
3. ALL STEEL SHALL BE GALVANIZED INSIDE AND OUT
4. PROVIDE ½" DIA. WEEP HOLES AT WELD SEAMS
5. INSTALL BRASS BUSHING AFTER GALVANIZING
6. SUBMIT SHOP DRAWINGS
7. FINISH TWO COATS OF YELLOW PAINT



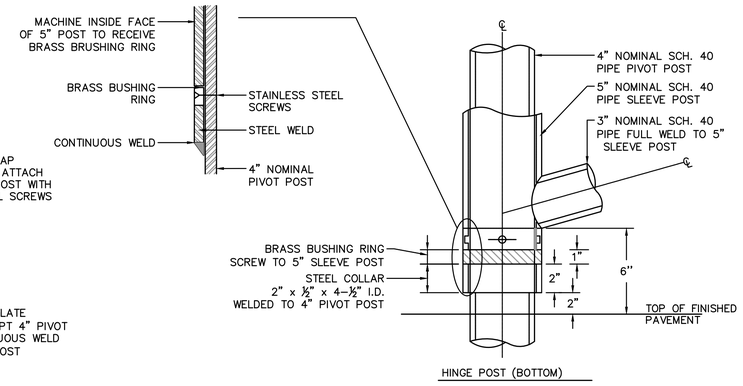
PLAN



ELEVATION

DETAIL A

NOT TO SCALE

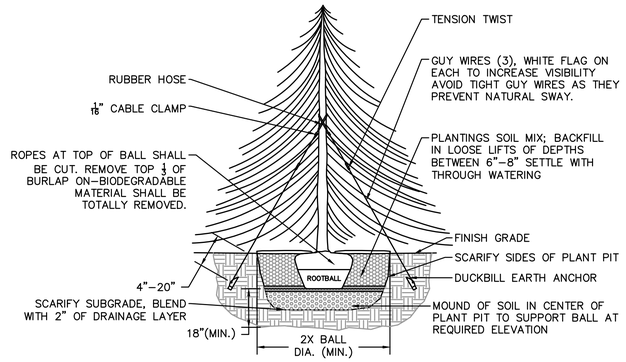


DETAIL B

NOT TO SCALE

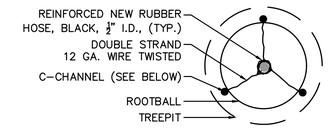
SWING GATE DETAIL

NOT TO SCALE



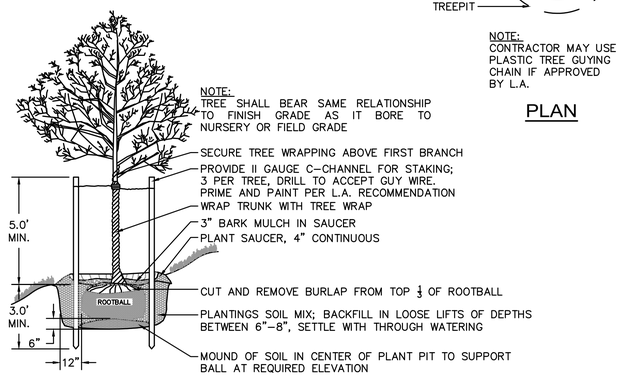
EVERGREEN TREE PLANTING DETAIL

NOT TO SCALE



NOTE:
CONTRACTOR MAY USE PLASTIC TREE GUYING CHAIN IF APPROVED BY L.A.

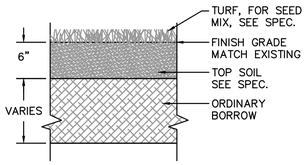
PLAN



NOTE: NON–PLOT INSERT INTO DRAWING AT ½ SCALE

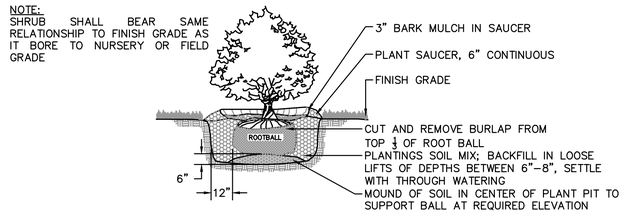
DECIDUOUS TREE PLANTING & STAKING

NOT TO SCALE



LOAM AND SEED DETAIL

NOT TO SCALE



TYPICAL SHRUB

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CIVIL DETAILS SHEET V

SMITH BEACH PARKING LOT GREEN INFRASTRUCTURE RETROFIT
BRAINTREE, MA

PREPARED FOR:
BRAINTREE DPW
85 QUINCY AVENUE, BRAINTREE, MA 02184

FINAL PLAN SET

REV.	COMMENTS	DATE
	REVISIONS	

NITSCH PROJECT #	13447.1
FILE:	13447.1_CDT.DWG
SCALE:	NTS
DATE:	6/24/2022
PROJECT MANAGER:	JLJ
SURVEYOR:	DPW
DRAFTED BY:	JLW
CHECKED BY:	JLW

SHEET:

C-504

OF REV.

PLANT SCHEDULE

SYMBOL	KEY	BOTANICAL NAME	COMMON NAME	QUANTITY	SIZE	SPACING
TREES AND SHRUBS						
	NS	NYSSA SYLVATICA	BLACK TUPELO	6	1.5/2" CAL	AS SHOWN
	BP	BETULA POPULIFOLIA	GRAY BIRCH	4	8/10' CLUMP	AS SHOWN
	JV	JUNIPERUS VIRGINIANA	EASTERN RED CEDAR	7	10/12 B&B	AS SHOWN
	PM	PRUNUS MARITIMA	BEACH PLUM	29	#7	AS SHOWN
	IGS	ILEX GLABRA	INKBERRY	25	24/30" B&B	AS SHOWN
	JH	JUNIPERUS HORIZONTALIS	CREEPING JUNIPER	16	#3	AS SHOWN
	RHA	RHUS AROMATICA	FRAGRANT SUMAC	11	#7	AS SHOWN
	TO	THUJA OCCIDENTALIS	ARBORVITAE	33	#10	6' O.C.
PERENNIALS, GROUNDCOVERS, AND BULBS						
		GRASS MIX (NEW ENGLAND WETLAND MOIST MIX)				

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PLANTING PLAN

SMITH BEACH PARKING LOT GREEN INFRASTRUCTURE RETROFIT
BRAINTREE, MA

PREPARED FOR:

BRAINTREE DPW

85 QUINCY AVENUE, BRAINTREE, MA 02184

FINAL PLAN SET

REV.	COMMENTS	DATE
	REVISIONS	

NITSCH PROJECT #	13447.1
FILE:	13447.1_CLA.DWG
SCALE:	1"=20'
DATE:	6/24/2022
PROJECT MANAGER:	JLJ
SURVEYOR:	DPW
DRAFTED BY:	KLK
CHECKED BY:	JLW

SHEET:

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Appendix F – Watson Park Site – Conceptual Design

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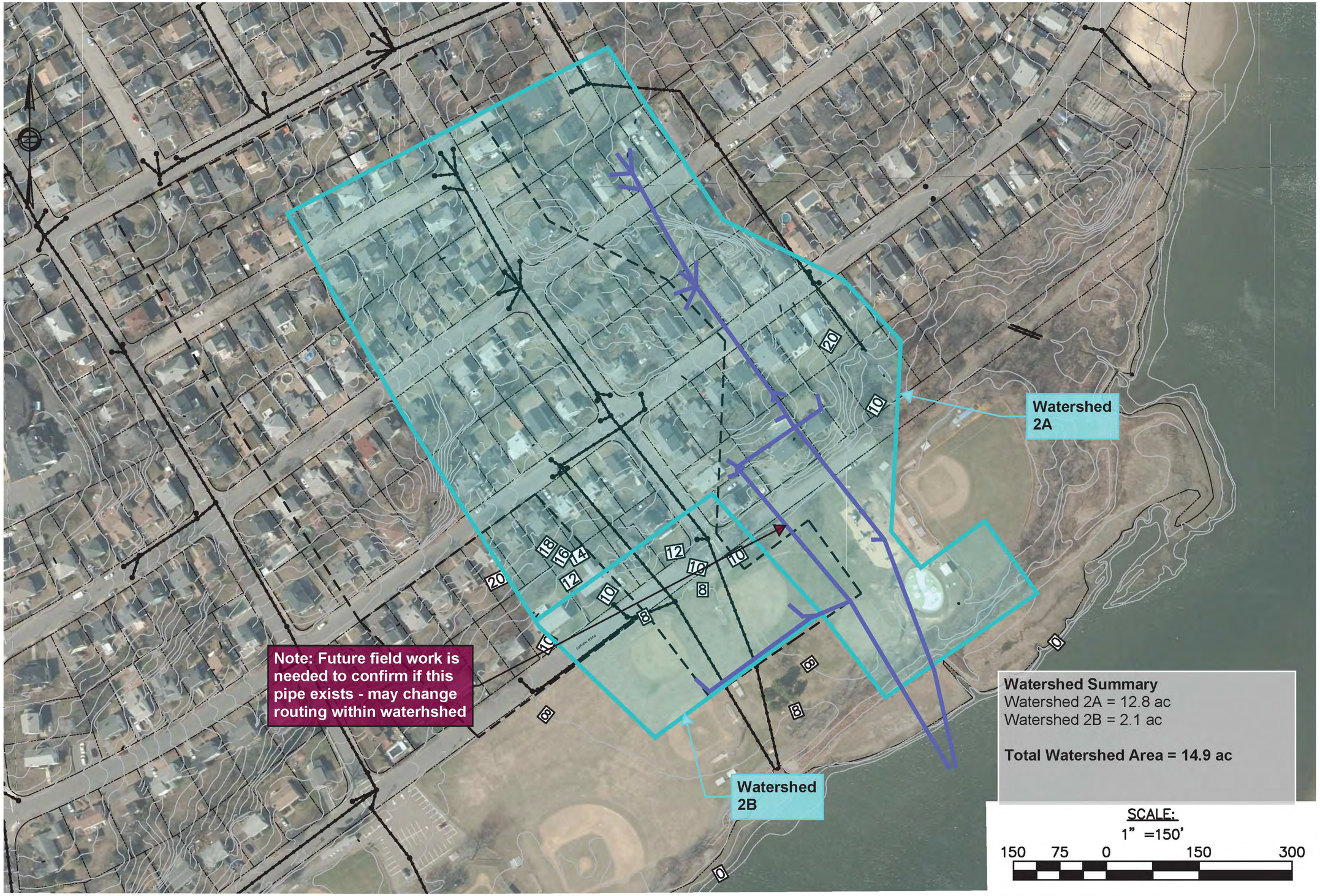

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SITE 2 WATERSHED PLAN
WATSON PARK
GORDON RD, BRAINTREE, MA

PREPARED FOR:
TOWN OF BRAINTREE
BRAINTREE, MA

PROJECT #	13447
FILE:	
SCALE:	1"= 150'
DATE:	
PROJECT MGR:	JLJ
SURVEYOR:	
DRAFTED BY:	AMG
CHECKED BY:	

SHEET:
C2-A
OF REV.

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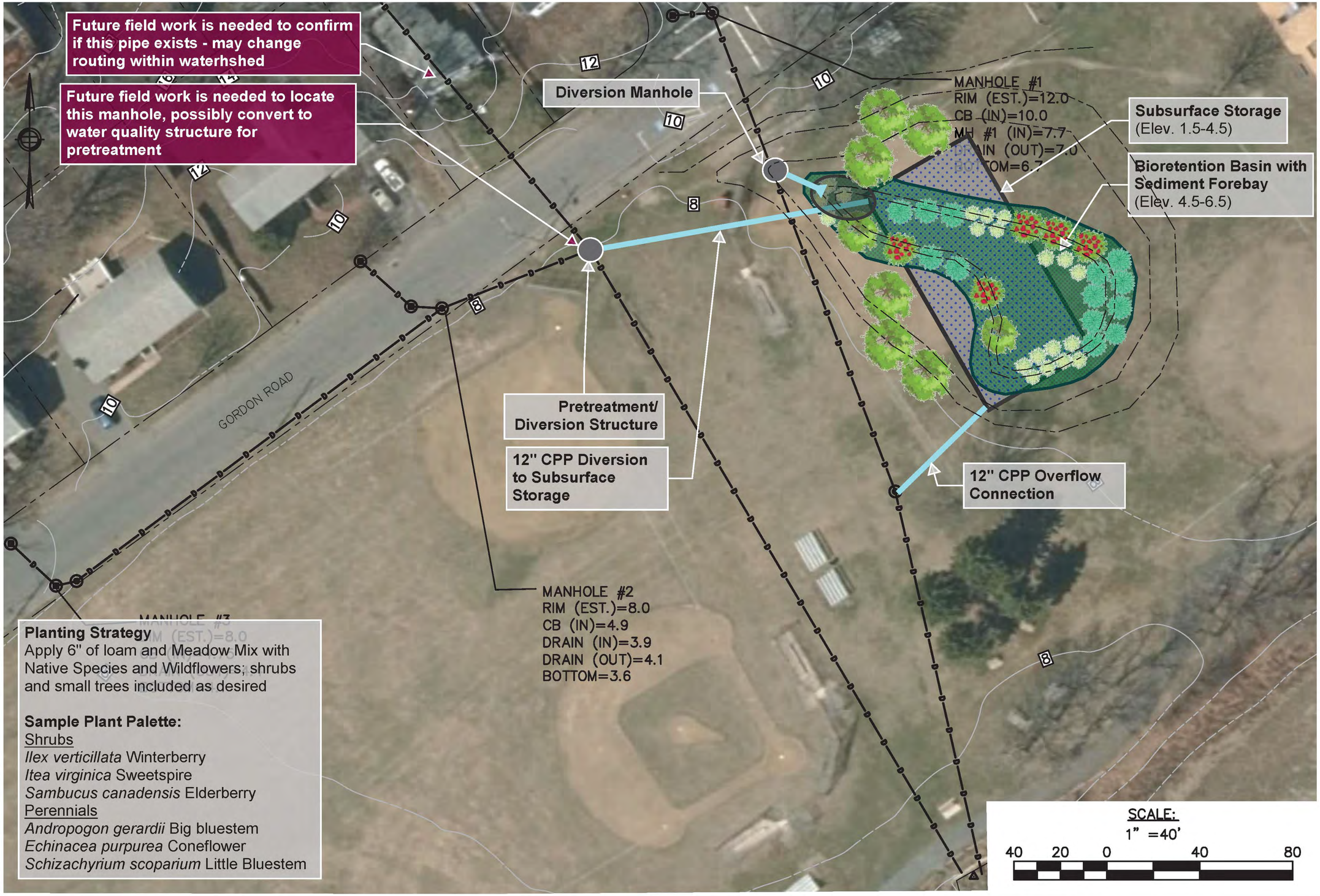

Planting Strategy
Apply 6" of loam and Meadow Mix with Native Species and Wildflowers; shrubs and small trees included as desired

Sample Plant Palette:
Shrubs
Ilex verticillata Winterberry
Itea virginica Sweetspire
Sambucus canadensis Elderberry
Perennials
Andropogon gerardii Big bluestem
Echinacea purpurea Coneflower
Schizachyrium scoparium Little Bluestem

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- Structural Engineering
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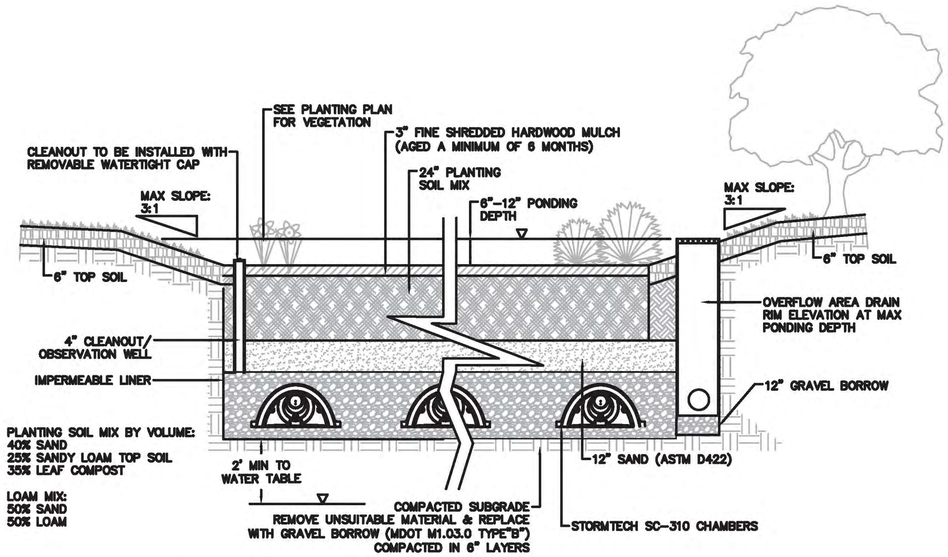
SITE 2 WATERSHED PLAN
WATSON PARK
GORDON RD, BRAINTREE, MA

PREPARED FOR:
TOWN OF BRAINTREE
BRAINTREE, MA

PROJECT #	13447
FILE:	
SCALE:	1"= 40'
DATE:	
PROJECT MGR:	JLJ
SURVEYOR:	
DRAFTED BY:	AMG
CHECKED BY:	

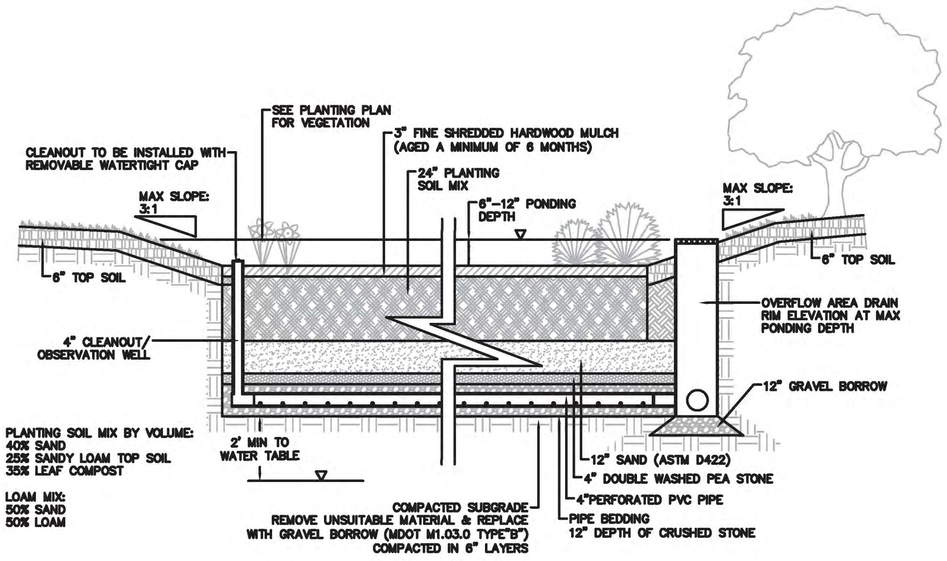
SHEET:
C2-B

OF REV.



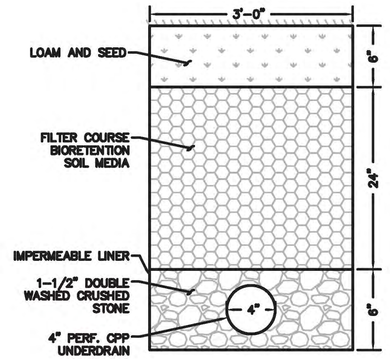
BIORETENTION BASIN WITH STORMTECH SC-310 SYSTEM (SITE 2)

NOT TO SCALE



BIORETENTION BASIN (SITE 3)

NOT TO SCALE



FILTRATION TRENCH (SITE 7)

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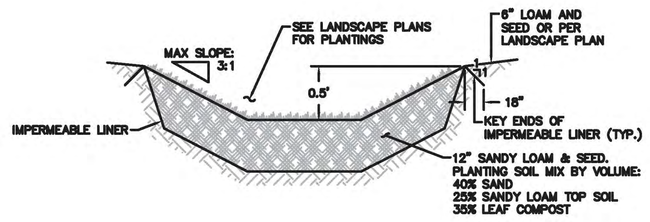

WATER QUALITY SWALE SECTION (SITE 6)

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STORMWATER MANAGEMENT DETAILS

PREPARED FOR:
TOWN OF BRAINTREE
BRAINTREE, MA

PROJECT # 13447
FILE: 13347_DETAILS.DWG
SCALE: NTS
DATE:
PROJECT MGR: JLJ
SURVEYOR:
DRAFTED BY: KLK
CHECKED BY:

SHEET:

D-1

OF REV.