SMELT BROOK
SECTION 1135 AQUATIC ECOSYSTEM RESTORATION

APPENDIX A
Environmental Documentation

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SMELT BROOK
SECTION 1135 AQUATIC ECOSYSTEM RESTORATION

APPENDIX A1
Environmental Correspondence

Smelt Brook Section 1135

State and Federal Agency Coordination Meeting:

February 10, 2020

From:	Foster, Kevin B CIV USARMY CENAE (USA)
To:	pondmeadowpark@beld.net; michael.d.richardi@gmail.com; susi_vonoettingen@fws.gov; Bryan_Sojkowski@fws.gov; kaitlyn.shaw@noaa.gov; zachary.jylkka@noaa.gov; James.Turek@noaa.gov; timmerman.timothy@epa.gov; Lyons.regina@epa.gov; Leclair.jackie@epa.gov; Cote.mel@epa.gov; Croy.Rachel@epa.gov; bettina@wampanoagtribe.net; David.Weeden@mwtribe-nsn.gov; brad.chase@state.ma.us; greg.skomal@state.ma.us; David.s.robinson@mass.gov; david.w.wong@mass.gov; jason.burtner@mass.gov; robert.boeri@mass.gov; erikk.hokenson@mass.gov; eve.schluter@mass.gov; patrice.bordonaro@mass.gov; Reed, Kristine A CIV USARMY CENAE (USA); Atwood, Kathleen A CIV (USA); pondmeadowpark@beld.net; michael.d.richardi@gmail.com; Hatfield, Christopher L CIV USARMY CENAE (USA); Cote, Janet CIV CEHQ NCR2 (USA)
Cc:	Blumeris, Patrick M CIV USARMY CENAE (USA)
Subject:	Smelt Brook 1135 Aquatic Ecosystem Restoration Project: Agency Coordinating Meeting - Power Point Presentation
Date:	Wednesday, February 10, 2021 2:50:00 PM
Attachments:	Smelt_Brook_1135_Feb_2021.pdf

Hi Everyone:

Thanks again to all of you who participated in the Smelt Brook coordination meeting today.

The discussion was helpful and we appreciated the your time and thoughtful comments and questions.

We will be in touch with you all as we move this project forward through the nepa process and required state and federal consultations.

I've attached the presentation to this email. Please feel free to reach out to Kristine or myself if you have any questions.

Best,

Kevin B. Foster
Marine Biologist
Evaluation Branch
New England District
U.S. Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751
Tel. 978/318-8621
"How like fish we are: ready, nay eager, to seize upon whatever new thing some wind of circumstance shakes down upon the river of time! And how we rue our haste, finding the gilded morsel to contain a hook". Aldo Leopold

C02 (atmosphere) as of June 18, 2020 = 416.28 ppm NOAA-ESRL
February, 1959 = 316.48 ppm NOAA-ESRL
Source: NOAA Earth Science Research Laboratory (Mauna Loa, Hawaii)

Smelt Brook Section 1135

Clean Water Act and other authorities
Coordination with EPA

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
696 VIRGINIA ROAD
CONCORD MA 01742-2751

January 27, 2021

Planning Division
Environmental Branch

Mr. Timothy Timmermann
Office of Environmental Review
EPA New England-Region 1
5 Post Office Square, Suite 100
Mail Code OEP 06-3
Boston, MA 02109-3912

Dear Mr. Timmermann:

I am writing to request your comments in accordance with the Clean Water Act of 1972 (CWA), as amended (33 U.S.C §1251 *et. seq*.), as well as other authorities, pertaining to the Smelt Brook Aquatic Ecosystem Restoration project, Weymouth and Braintree, Massachusetts. The project is being conducted under the authority provided by Section 1135 of the Water Resources Development Act of 1986 (PL 99-662), as amended. The Section 1135 program allows the USACE to modify existing USACE projects to restore the environment and construct features to restore areas degraded by USACE projects.

The feasibility study will develop an array of alternatives to restore anadromous fish passage in Smelt Brook, which was adversely impacted through the construction of the Smelt Brook Local Protection Project (LPP) in the mid-1970s. The LPP involved construction of a small concrete dam and outlet works at Pond Meadow Lake that maintains a permanent lake of 19 acres; an earthfill dike 300 feet long and five feet high adjacent to Pond Meadow Lake; widening, deepening, and straightening 800 feet of the channel at the lower end of Smelt Brook near the Monatiquot River; and a 1,140-foot long reinforced concrete conduit eight feet in diameter that conveys Smelt Brook through Weymouth Landing’s business district.

Also, we will convene an agency information sharing meeting on February 10, 2021 from 12:00 pm to 2:00 pm and request your participation. We will provide additional project-related information that may help facilitate development of your comments.

I would appreciate receiving your comments within 30 days of your receipt of this letter. If you have questions about the project or this request, please contact me at (978) 318-8963 (Kristine.A.Reed@usace.army.mil) or Kevin B. Foster, of the Environmental Resources Section at (978) 318-8620 (Kevin.B.Foster@usace.army.mil).

Sincerely,

REED.KRISTINE.A.1537945849

Digitally signed by REED.KRISTINE.A.1537945849
Date: 2021.01.27 15:51:40 -05'00'

Kristine Reed, PhD
Program Manager,
Civil Works, Planning Division

Enclosure

Figure 1. Project Area

Figure 2. Smelt Brook

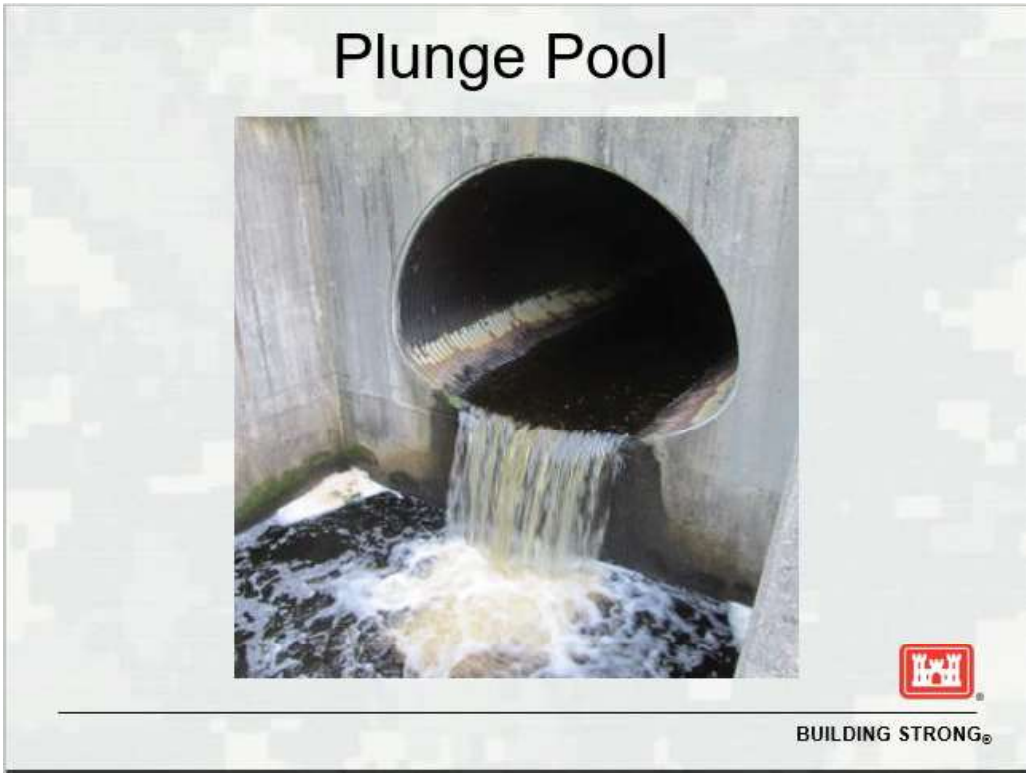


Figure 3. Plunge Pool

From: Timmermann, Timothy
To: Foster, Kevin B CIV USARMY CENAE (USA); Reed, Kristine A CIV USARMY CENAE (USA)
Cc: Reiner, Edward; Timmermann, Timothy; LeClair, Jacqueline; Wintrob, Paul
Subject: [Non-DoD Source] USACE - Section 1135 - Smelt Brook Study EA Scoping Input
Date: Tuesday, March 2, 2021 9:43:15 PM

Kristine and Kevin:

I hope you are both well.

Thank you for the recent presentation regarding the U.S. Army Corps of Engineers (USACE) Smelt Brook Aquatic Ecosystem Restoration project in Weymouth and Braintree, Massachusetts. We are writing to provide scoping input for the Environmental Assessment (EA) you intend to prepare for the project. EPA supports the USACE efforts to improve fish passage in Smelt Brook. We recommend that the EA fully explore whether the invert of the culvert at the plunge pool (stilling basin) can be modified in a cost effective manner to provide fish passage. This passage may be through the creation of a gently sloping notch to allow the bottom elevation of the culvert to transition smoothly and with a shallow gradient toward the stilling basin (without impairing the capacity of the stilling basin at the culvert outlet). Even though this change entails a modification to the existing culvert which is otherwise a local responsibility, we believe this alternative deserves to be fully analyzed in the EA.

Thank you for the opportunity to comment. Please contact me with any questions regarding our recommendation. We request the opportunity to review the draft EA when it is issued.

Regards,

Timothy L. Timmermann, Director
Office of Environmental Review
EPA New England-Region 1
5 Post Office Square, Suite 100
Mail Code 06-3
Boston, MA 02109-3912

Email: timmermann.timothy@epa.gov
Telephone: 617-918-1025
E-Fax: 617-918-0025

From: Foster, Kevin B CIV USARMY CENAE (USA) <Kevin.B.Foster@usace.army.mil>
Sent: Friday, January 29, 2021 8:56 AM
To: Timmermann, Timothy <Timmermann.Timothy@epa.gov>
Cc: Reed, Kristine A CIV USARMY CENAE (USA) <Kristine.A.Reed@usace.army.mil>
Subject: FW: USACE - Section 1135 - Smelt Brook Study

Tim and Kristine,

We have a bad email address for Tim circulating in our system. Each time we type in Tim's name, the email address auto populates with the incorrect email address.

We need to add the email address with the correct spelling of Tim's last name, that includes two "n"s at the end of his name.

As Tim knows, I'm guilty of selecting the incorrect email address.

Best,

Kevin

From: Reed, Kristine A CIV USARMY CENAE (USA) <Kristine.A.Reed@usace.army.mil>
Sent: Wednesday, January 27, 2021 4:04 PM
To: timmerman.timothy@epa.gov
Cc: Foster, Kevin B CIV USARMY CENAE (USA) <Kevin.B.Foster@usace.army.mil>
Subject: USACE - Section 1135 - Smelt Brook Study

Good Afternoon,
Attached find an electronic copy of correspondence for the USACE Smelt Brook Aquatic Ecosystem Restoration Study, in Weymouth and Braintree, Massachusetts that will go out in the mail tomorrow. Many colleagues are working remotely and not receiving hard copy mail in a timely manner so I am also sending an electronic copy. Please let me know if you have any questions.

Best Regards,
Kristine

Kristine Reed, PhD
Program Manager
Ecosystem Restoration
U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742
(978)318-8963

Smelt Brook Section 1135

Endangered Species Act
Section 7 Consultation with NMFS

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
696 VIRGINIA ROAD
CONCORD MA 01742-2751

January 29, 2021

Planning Division
Environmental Branch

Ms. Jennifer Anderson
Assistant Regional Administrator for Protected Species
NOAA Fisheries Service
Northeast Regional Office
Habitat Conservation Division
55 Great Republic Drive
Gloucester, MA 01930

Dear Ms. Anderson:

I am writing to initiate Section 7 consultation in accordance with the Endangered Species Act of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq*.), pertaining to the Smelt Brook Aquatic Ecosystem Restoration project, Weymouth and Braintree, Massachusetts. Please provide us with a list of federally listed species that you believe should be included in this consultation. The project is being conducted under the authority provided by Section 1135 of the Water Resources Development Act of 1986 (PL 99-662), as amended. The 1135 program allows the USACE to modify existing USACE projects to restore the environment and construct features to restore areas degraded by USACE projects.

The feasibility study will develop an array of alternatives to restore anadromous fish passage in Smelt Brook, which was adversely impacted through the construction of the Smelt Brook Local Protection Project (LPP) in the mid-1970s. The LPP involved construction of a small concrete dam and outlet works at Pond Meadow Lake that maintains a permanent lake of 19 acres; an earthfill dike 300 feet long and five feet high adjacent to Pond Meadow Lake; widening, deepening, and straightening 800 feet of the channel at the lower end of Smelt Brook near the Monatiquot River; and a 1,140-foot long reinforced concrete conduit eight feet in diameter that conveys Smelt Brook through Weymouth Landing’s business district.

Also, we will convene an agency information sharing meeting on February 10 from 12:00 pm to 2:00 pm and request your participation. We will provide additional project-related information that may help facilitate this Section 7 consultation.

I would appreciate receiving your list of affected federally listed species under the jurisdiction of the National Marine Fisheries Service, within 30 days of your receipt of this letter. If you have questions about the project or this request, please contact me at (978) 318-8963 (Kristine.A.Reed@usace.army.mil) or Kevin B. Foster, of the Environmental Resources Section at (978) 318-8620 (Kevin.B.Foster@usace.army.mil).

Sincerely,

REED.KRISTINE.A.1537945849

Digitally signed by REED.KRISTINE.A.1537945849
Date: 2021.01.29 16:03:34 -05'00'

Kristine Reed, PhD
Program Manager,
Civil Works, Planning Division

Enclosure

Figure 1. Project Area

Figure 2. Smelt Brook

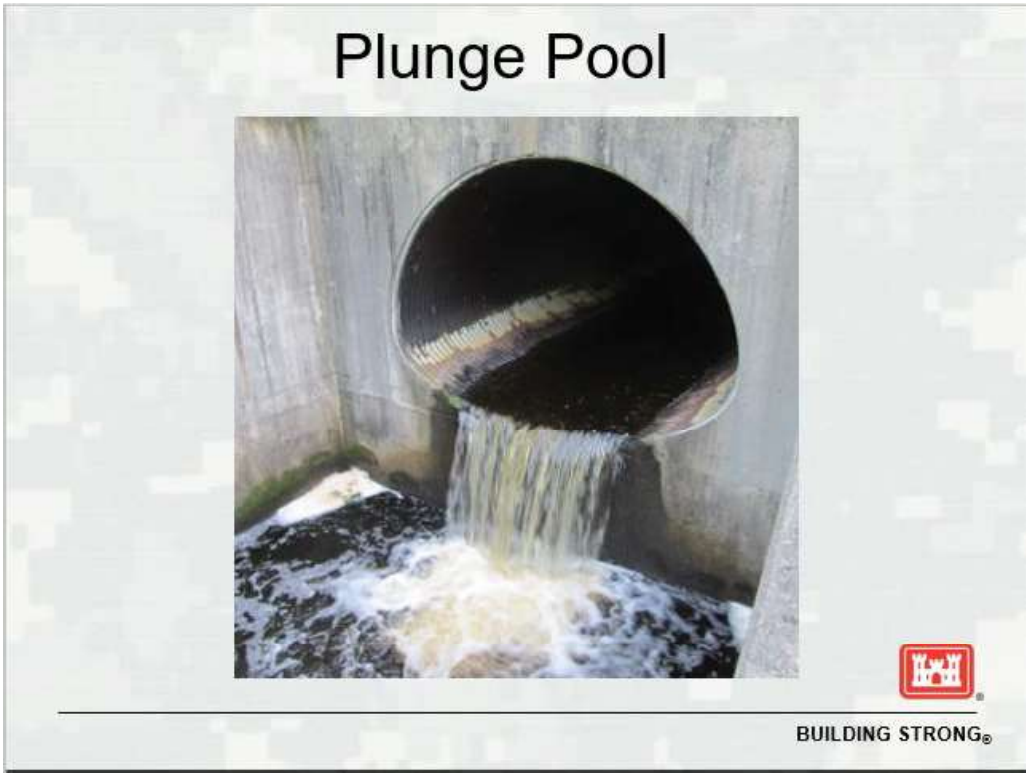


Figure 3. Plunge Pool

From: Zachary Jylkka - NOAA Federal
To: Foster, Kevin B CIV USARMY CENAE (USA)
Subject: [Non-DoD Source] Re: Smelt Brook 1135 Fish Passage Restoration - NMFS Section 7 Consultation
Date: Tuesday, March 9, 2021 9:56:21 AM

Hi Kevin,

Good to hear from you. It is NMFS policy that we do not concur with no effect determinations. I agree with your interpretation of the Section 7 Mapper results, and can confirm that we would not expect to find an ESA-listed species or critical habitat in your project action area.

Best,
Zach

On Fri, Mar 5, 2021 at 11:27 AM Foster, Kevin B CIV USARMY CENAE (USA) <Kevin.B.Foster@usace.army.mil> wrote:

> Hi Mark and Zach,
>
> Just wanted to get this project on your radar screen . We are planning some stream modifications in Smelt Brook (freshwater habitat) to pass rainbow smelts, and possibly other species (e.g., river herring and American eel) up stream.
>
> I was going through the section 7 mapper and the project is at located in fresh water (Smelt Brook) at least 1,000 feet from estuarine habitat that would support several listed species.
>
> Appreciate it if you could help me conclude Section 7 consultation with NMFS on this project and concur with our No Effects Determination. The project doesn't overlap with habitat identified to support federally listed species under NMFS jurisdiction.
>
> Please let me know if you have any questions.
>
> Best,
>
> Kevin B. Foster
>
> Marine Biologist
>
> Evaluation Branch

New England District

U.S. Army Corps of Engineers

696 Virginia Road

Concord, MA 01742-2751

Tel. 978/318-8621

"How like fish we are: ready, nay eager, to seize upon whatever new thing some wind of circumstance shakes down upon the river of time! And how we rue our haste, finding the gilded morsel to contain a hook". Aldo Leopold

C02 (atmosphere) as of June 18, 2020 = 416.28 ppm NOAA-ESRL

February, 1959 = 316.48 ppm NOAA-ESRL

Source: NOAA Earth Science Research Laboratory (Mauna Loa, Hawaii)

--
Zach Jylkka (he/him/his)
Fisheries Biologist
Protected Resources Division
Greater Atlantic Regional Fisheries Office
NOAA Fisheries | U.S. Department of Commerce
Office: (978) 282-8467
https://www.fisheries.noaa.gov/about/greater-atlantic-regional-fisheries-office

Smelt Brook Section 1135

Essential FishhHabitat Consultation with NMFS

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
696 VIRGINIA ROAD
CONCORD MA 01742-2751

January 27, 2021

Planning Division
Environmental Branch

Mr. Louis A. Chiarella
Assistant Regional Administrator for Habitat Conservation
NOAA Fisheries Service
Northeast Regional Office
Habitat Conservation Division
55 Great Republic Drive
Gloucester, MA 01930

Dear Mr. Chiarella:

I am writing to request your Essential Fish Habitat (EFH) conservation recommendations in accordance with the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (MSFCMA), as amended (16 U.S.C.§1801 *et. seq*.; 98 Stat.331) and the Fish and Wildlife Coordination Act of 1934 (FWCA), as amended (16 U.S.C. §661 et seq.; 48 Stat. 401), pertaining to the Smelt Brook Aquatic Ecosystem Restoration project, Weymouth and Braintree, Massachusetts. The project is being conducted under the authority provided by Section 1135 of the Water Resources Development Act of 1986 (PL 99-662), as amended. The Section 1135 program allows the USACE to modify existing USACE projects to restore the environment and construct features to restore areas degraded by USACE projects.

The feasibility study will develop an array of alternatives to restore anadromous fish passage in Smelt Brook, which was adversely impacted through the construction of the Smelt Brook Local Protection Project (LPP) in the mid-1970s. The LPP involved construction of a small concrete dam and outlet works at Pond Meadow Lake that maintains a permanent lake of 19 acres; an earthfill dike 300 feet long and five feet high adjacent to Pond Meadow Lake; widening, deepening, and straightening 800 feet of the channel at the lower end of Smelt Brook near the Monatiquot River; and a 1,140-foot long reinforced concrete conduit eight feet in diameter that conveys Smelt Brook through Weymouth Landing’s business district.

Also, we will convene an agency information sharing meeting on February 10, 2021 from 12:00 pm to 2:00 pm and request your participation. We will provide additional project-related information that may help facilitate development your conservation recommendations.

I would appreciate receiving your comments within 60 days of your receipt of this letter. If you have questions about the project or this request, please contact me at (978) 318-8963 (Kristine.A.Reed@usace.army.mil) or Kevin B. Foster, of the Environmental Resources Section at (978) 318-8620 (Kevin.B.Foster@usace.army.mil).

Sincerely,

Kristine Reed, PhD
Program Manager,
Civil Works, Planning Division

Enclosure

Figure 1. Project Area

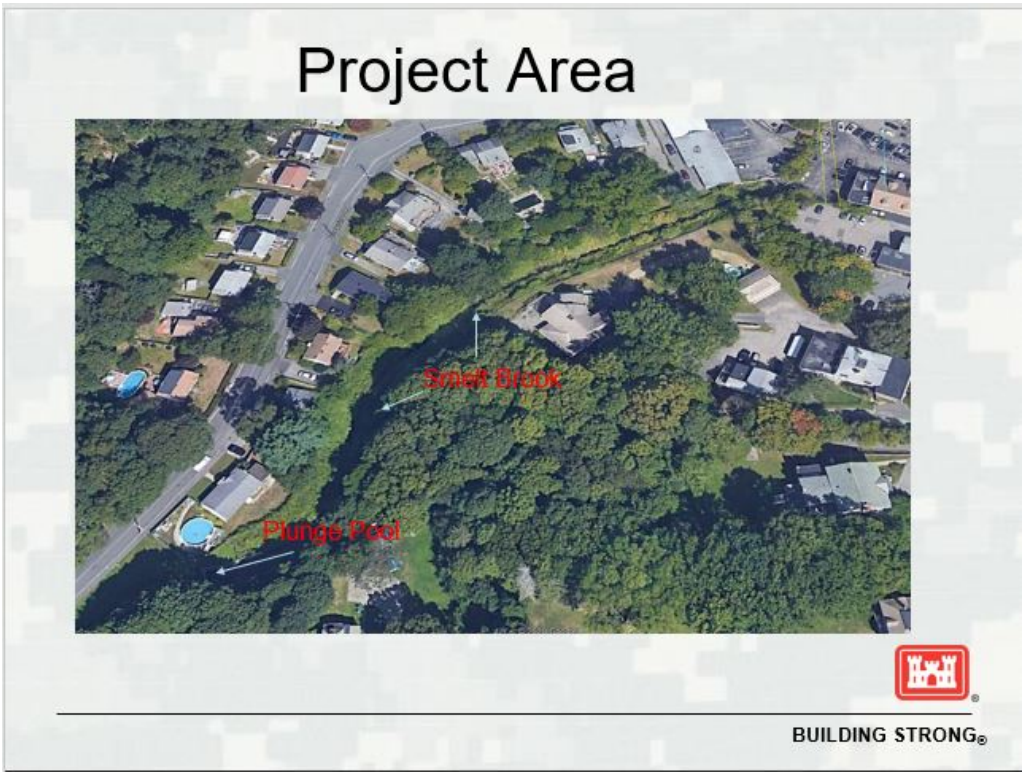


Figure 2. Smelt Brook

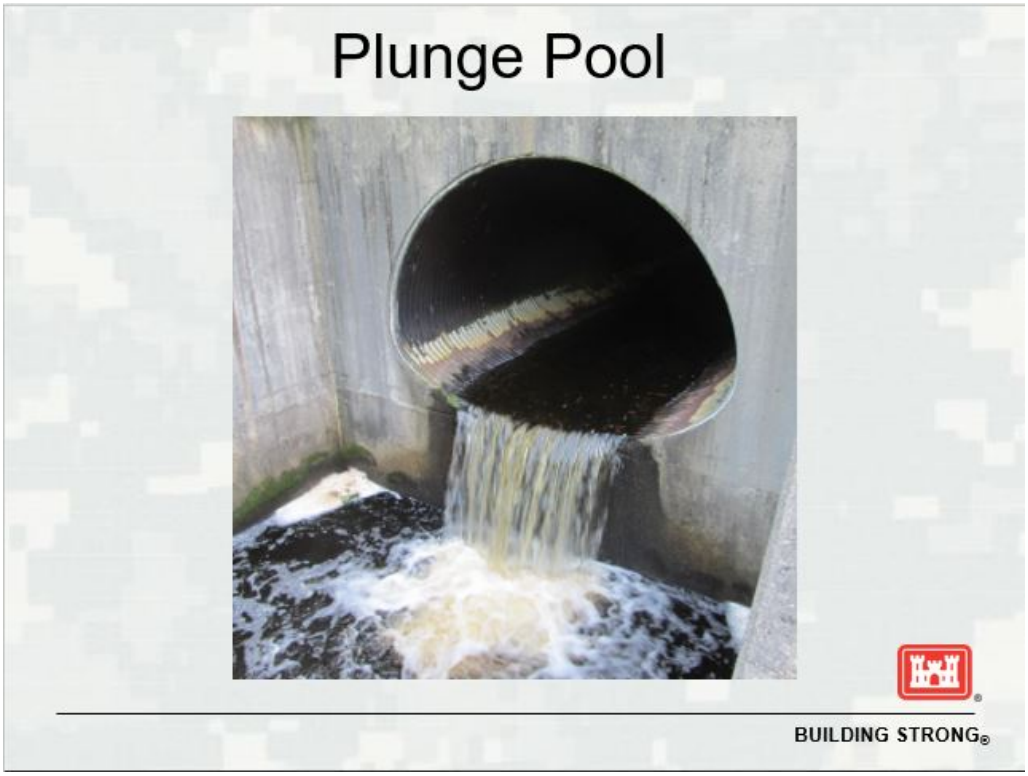


Figure 3. Plunge Pool

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
GREATER ATLANTIC REGIONAL FISHERIES OFFICE
55 Great Republic Drive
Gloucester, MA 01930-2276

Mr. John Kennelly
Chief, Planning Division
U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751

Re: Smelt Brook Aquatic Ecosystem Restoration Feasibility Study

Dear Mr. Kennelly,

We received your request for an Essential Fish Habitat (EFH) consultation on January 27, 2021 for the Smelt Brook Aquatic Ecosystem Restoration Feasibility Study located in Weymouth and Braintree, Massachusetts. We also attended the agency coordination meeting on February 10, 2021. The project is being conducted under the authority provided by Section 1135 of the Water Resources Development Act of 1986 (PL 99-662), as amended. The Section 1135 program allows you to modify existing USACE projects to restore the environment and construct features to restore areas degraded by prior USACE projects.

The proposed feasibility study will develop an array of alternatives to restore anadromous fish passage in Smelt Brook, which was adversely impacted through the construction of the Smelt Brook Local Protection Project (LPP) in the mid-1970s. The LPP involved construction of a small concrete dam and outlet works at Pond Meadow Lake that maintains a permanent lake of 19 acres; an earthfill dike 300 feet long and five feet high adjacent to Pond Meadow Lake; widening, deepening, and straightening 800 feet of the channel at the lower end of Smelt Brook near the Monatiquot River; and a 1,140-foot long reinforced concrete conduit eight feet in diameter that conveys Smelt Brook through Weymouth Landing's business district.

We are supportive of this feasibility investigation and the improvements to fish habitat that will result in the completion of the fish passage project(s) included in the feasibility report. Specifically, the proposed improvements to fish passage will enhance fish habitat for diadromous species managed under the Fish and Wildlife Coordination act such as rainbow smelt, American eel and river herring; thereby enhancing prey to federally managed species and EFH. Given the timeline you provided and that an alternative has not yet been selected, we do not have conservation recommendations at this time. Once an alternative is selected your agency will make a determination as to whether the project will require an EFH consultation.

EFH Assessment

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) require Federal agencies to consult with one another on any action or proposed action authorized, funded, or undertaken that may adversely affect essential fish habitat. While the Fish and Wildlife Coordination Act requires consultation when "waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted . . . or otherwise controlled or modified" by any agency under a Federal permit. This process is guided by the requirements of our EFH regulation at 50 CFR 600.905, which mandates the preparation of EFH Assessments and generally outlines each agencies obligations in this consultation procedure.

The required contents of an EFH Assessment includes: 1) a description of the action; 2) an analysis of the potential adverse effects of the action on EFH and the managed species; 3) the ACOE's conclusions regarding the effects of the action on EFH; and 4) proposed mitigation, if applicable. Other information that should be contained in the EFH Assessment, if appropriate, includes: 1) the results of on-site inspections to evaluate the habitat and site-specific effects; 2) the views of recognized experts on the habitat or the species that may be affected; 3) a review of pertinent literature and related information; and 4) an analysis of alternatives to the action that could avoid or minimize the adverse effects on EFH.

Upon submittal of an EFH assessment, NOAA fisheries will provide official Conservation Recommendations for the proposed project.

We look forward to your continued coordination on this important project. Please contact Kaitlyn Shaw at 978-282-8457 or kaitlyn.shaw@noaa.gov if you would like to discuss this further.

Sincerely,

Christopher Boelke
Chief, New England Branch
Habitat and Ecosystem Services Division

Cc:
Kristine Reed, ACOE
Kevin Foster, ACOE

Smelt Brook Section 1135

Endangered Species Act Section 7 Consultation
and
Fish and Wildli e Coordination Act Coordination
with USFWS

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
696 VIRGINIA ROAD
CONCORD MA 01742-2751

January 27, 2021

Planning Division
Environmental Branch

Mr. David Simmons, Supervisor
New England Field Office
U.S. Fish and Wildlife Service
Ecological Services
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5094

Dear Mr. Simmons:

I am writing to request a Planning Aid Letter (PAL) to contain the U.S. Fish and Wildlife Service's (Service) conservation recommendations in accordance with the Fish and Wildlife Coordination Act of 1934 (FWCA), as amended (16 U.S.C. §661 et seq.; 48 Stat. 401), pertaining to the Smelt Brook Aquatic Ecosystem Restoration project, Weymouth and Braintree, Massachusetts. Also, we are interested in coordinating with you under Section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq*.). The project is being conducted under the authority provided by Section 1135 of the Water Resources Development Act of 1986 (PL 99-662), as amended. The 1135 program allows the USACE to modify existing USACE projects to restore the environment and construct features to restore areas degraded by USACE projects.

The feasibility study will develop an array of alternatives to restore anadromous fish passage in Smelt Brook, which was adversely impacted through the construction of the Smelt Brook Local Protection Project (LPP) in the mid-1970s. The LPP involved construction of a small concrete dam and outlet works at Pond Meadow Lake that maintains a permanent lake of 19 acres; an earthfill dike 300 feet long and five feet high adjacent to Pond Meadow Lake; widening, deepening, and straightening 800 feet of the channel at the lower end of Smelt Brook near the Monatiquot River; and a 1,140-foot long reinforced concrete conduit eight feet in diameter that conveys Smelt Brook through Weymouth Landing's business district.

Also, we will convene an agency information sharing meeting on February 10 from 12:00 pm to 2:00 pm and request your participation. We will provide additional project-related information that may help facilitate development of the PAL and Section 7 consultation.

I would appreciate receiving your comments within 60 days of your receipt of this letter. If you have questions about the project or this request, please contact me at (978) 318-8963 (kristine.a.reed@usace.army.mil) or Kevin B. Foster, of the Environmental Resources Section at (978) 318-8620 (kevin.b.foster@usace.army.mil)

Sincerely,

Kristine Reed, PhD
Program Manager,
Civil Works, Planning Division

Enclosure

Figure 1. Project Area

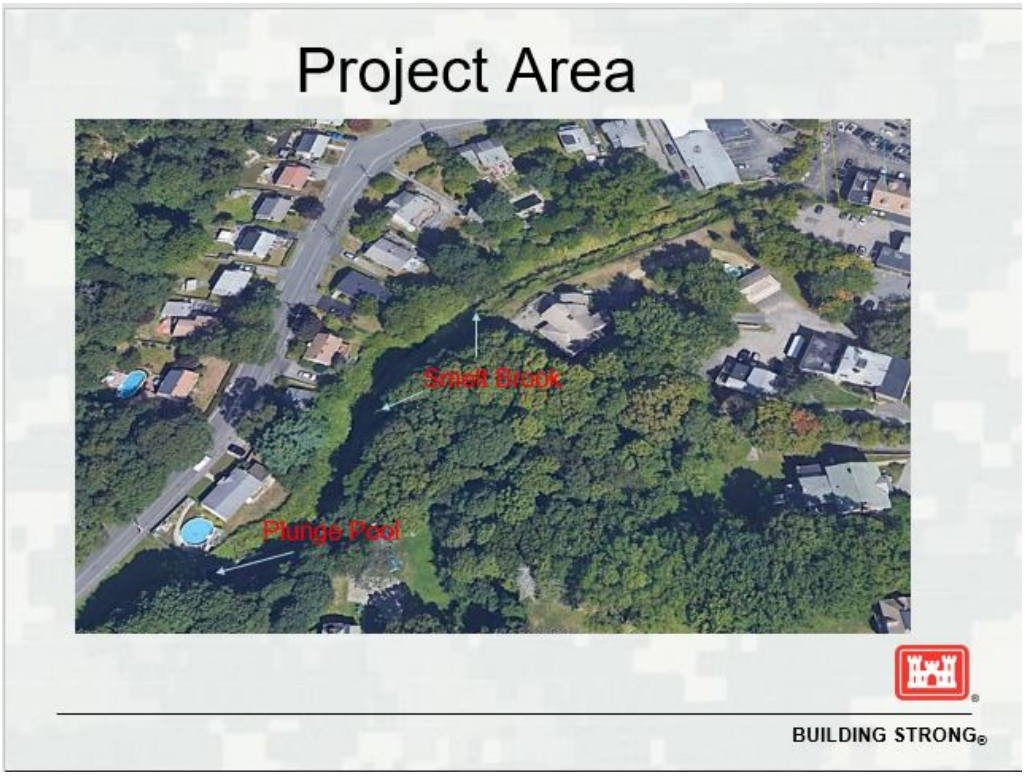


Figure 2. Smelt Brook

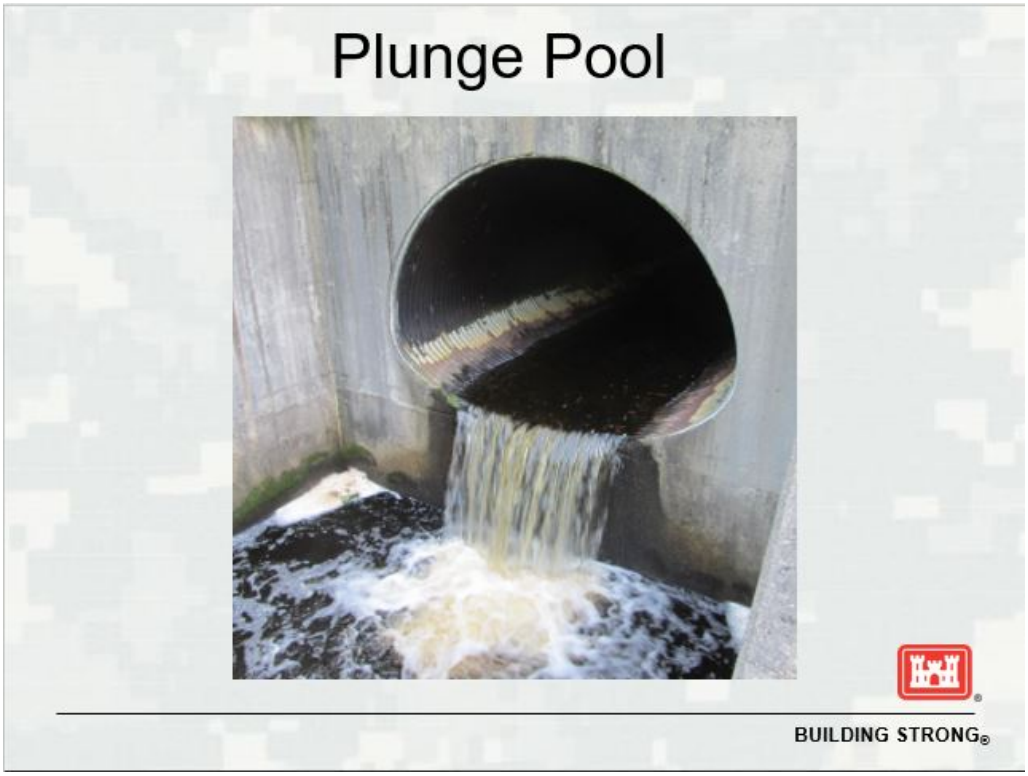


Figure 3. Plunge Pool

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104
http://www.fws.gov/newengland

In Reply Refer To: February 08, 2021
Consultation code: 05E1NE00-2021-TA-1271
Event Code: 05E1NE00-2021-E-04053
Project Name: Smelt Brook Aquatic Ecosystem Restoration, Weymouth and Braintree, Massachusetts

Subject: Verification letter for the 'Smelt Brook Aquatic Ecosystem Restoration, Weymouth and Braintree, Massachusetts' project under the January 5, 2016, Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-eared Bat and Activities Excepted from Take Prohibitions.

Dear Kevin Foster:

The U.S. Fish and Wildlife Service (Service) received on February 08, 2021 your effects determination for the 'Smelt Brook Aquatic Ecosystem Restoration, Weymouth and Braintree, Massachusetts' (the Action) using the northern long-eared bat (*Myotis septentrionalis*) key within the Information for Planning and Consultation (IPaC) system. This IPaC key assists users in determining whether a Federal action is consistent with the activities analyzed in the Service's January 5, 2016, Programmatic Biological Opinion (PBO). The PBO addresses activities excepted from "take"[1] prohibitions applicable to the northern long-eared bat under the Endangered Species Act of 1973 (ESA) (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.).

Based upon your IPaC submission, the Action is consistent with activities analyzed in the PBO. The Action may affect the northern long-eared bat; however, any take that may occur as a result of the Action is not prohibited under the ESA Section 4(d) rule adopted for this species at 50 CFR §17.40(o). Unless the Service advises you within 30 days of the date of this letter that your IPaC-assisted determination was incorrect, this letter verifies that the PBO satisfies and concludes your responsibilities for this Action under ESA Section 7(a)(2) with respect to the northern long-eared bat.

Please report to our office any changes to the information about the Action that you submitted in IPaC, the results of any bat surveys conducted in the Action area, and any dead, injured, or sick northern long-eared bats that are found during Action implementation. If the Action is not completed within one year of the date of this letter, you must update and resubmit the information required in the IPaC key.

If the Action may affect other federally listed species besides the northern long-eared bat, a proposed species, and/or designated critical habitat, additional consultation between you and this Service office is required. If the Action may disturb bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act is recommended.

---

[1]Take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct [ESA Section 3(19)].

Action Description
You provided to IPaC the following name and description for the subject Action.

1. Name

Smelt Brook Aquatic Ecosystem Restoration, Weymouth and Braintree, Massachusetts

2. Description

The following description was provided for the project 'Smelt Brook Aquatic Ecosystem Restoration, Weymouth and Braintree, Massachusetts':

> The Smelt brook aquatic ecosystem restoration project is located along the within Smelt Brook, for a distance of about 600 feet downstream of the 300-foot federal culvert, and including the federal culvert. The Corps is considering a design the pass fish, primarily Rainbow Smelt, through the culvert. Currently, a 4-foot vertical drop makes fish passage problematic. Therefore, the corps is considering raising the stream bed by 1% over a distance of 600-feet to pass smelt and other diadromous fish species upstream. No time or scope information is available. This is an 1135 Continuing Authorities Program project. Water Resources Development Act (WRDA) of 1986 (PL-99-662): Section 1135 – Project Modifications for Improvement of the Environment.

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@42.2182755,-70.97046265131515,14z

Determination Key Result

This Federal Action may affect the northern long-eared bat in a manner consistent with the description of activities addressed by the Service's PBO dated January 5, 2016. Any taking that may occur incidental to this Action is not prohibited under the final 4(d) rule at 50 CFR §17.40(o). Therefore, the PBO satisfies your responsibilities for this Action under ESA Section 7(a)(2) relative to the northern long-eared bat.

Determination Key Description: Northern Long-eared Bat 4(d) Rule

This key was last updated in IPaC on May 15, 2017. Keys are subject to periodic revision.

This key is intended for actions that may affect the threatened northern long-eared bat.

The purpose of the key for Federal actions is to assist determinations as to whether proposed actions are consistent with those analyzed in the Service's PBO dated January 5, 2016.

Federal actions that may cause prohibited take of northern long-eared bats, affect ESA-listed species other than the northern long-eared bat, or affect any designated critical habitat, require ESA Section 7(a)(2) consultation in addition to the use of this key. Federal actions that may affect species proposed for listing or critical habitat proposed for designation may require a conference under ESA Section 7(a)(4).

Determination Key Result

This project may affect the threatened Northern long-eared bat; therefore, consultation with the Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.) is required. However, based on the information you provided, this project may rely on the Service's January 5, 2016, *Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-Eared Bat and Activities Excepted from Take Prohibitions* to fulfill its Section 7(a)(2) consultation obligation.

Qualification Interview

1. Is the action authorized, funded, or being carried out by a Federal agency?

   Yes

2. Have you determined that the proposed action will have "no effect" on the northern long-eared bat? (If you are unsure select "No")

   No

3. Will your activity purposefully **Take** northern long-eared bats?

   No

4. [Semantic] Is the project action area located wholly outside the White-nose Syndrome Zone?

   Automatically answered
   No

5. Have you contacted the appropriate agency to determine if your project is near a known hibernaculum or maternity roost tree?

   Location information for northern long-eared bat hibernacula is generally kept in state Natural Heritage Inventory databases – the availability of this data varies state-by-state. Many states provide online access to their data, either directly by providing maps or by providing the opportunity to make a data request. In some cases, to protect those resources, access to the information may be limited. A web page with links to state Natural Heritage Inventory databases and other sources of information on the locations of northern long-eared bat roost trees and hibernacula is available at www.fws.gov/midwest/endangered/mammals/nleb/nhisites.html.

   Yes

6. Will the action affect a cave or mine where northern long-eared bats are known to hibernate (i.e., hibernaculum) or could it alter the entrance or the environment (physical or other alteration) of a hibernaculum?

   No

7. Will the action involve Tree Removal?

   No

Project Questionnaire

If the project includes forest conversion, report the appropriate acreages below. Otherwise, type '0' in questions 1-3.

1. Estimated total acres of forest conversion:

0

2. If known, estimated acres of forest conversion from April 1 to October 31

0

3. If known, estimated acres of forest conversion from June 1 to July 31

0

If the project includes timber harvest, report the appropriate acreages below. Otherwise, type '0' in questions 4-6.

4. Estimated total acres of timber harvest

0

5. If known, estimated acres of timber harvest from April 1 to October 31

0

6. If known, estimated acres of timber harvest from June 1 to July 31

0

If the project includes prescribed fire, report the appropriate acreages below. Otherwise, type '0' in questions 7-9.

7. Estimated total acres of prescribed fire

0

8. If known, estimated acres of prescribed fire from April 1 to October 31

0

9. If known, estimated acres of prescribed fire from June 1 to July 31

0

If the project includes new wind turbines, report the megawatts of wind capacity below. Otherwise, type '0' in question 10.

10. What is the estimated wind capacity (in megawatts) of the new turbine(s)?

0

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104
http://www.fws.gov/newengland

In Reply Refer To: February 08, 2021
Consultation Code: 05E1NE00-2021-SLI-1271
Event Code: 05E1NE00-2021-E-04052
Project Name: Smelt Brook Aquatic Ecosystem Restoration, Weymouth and Braintree, Massachusetts

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
(603) 223-2541

Project Summary

Consultation Code: 05E1NE00-2021-SLI-1271
Event Code: 05E1NE00-2021-E-04052
Project Name: Smelt Brook Aquatic Ecosystem Restoration, Weymouth and Braintree, Massachusetts
Project Type: LAND - FLOODING
Project Description: The Smelt brook aquatic ecosystem restoration project is located along the within Smelt Brook, for a distance of about 600 feet downstream of the 300-foot federal culvert, and including the federal culvert. The Corps is considering a design the pass fish, primarily Rainbow Smelt, through the culvert. Currently, a 4-foot vertical drop makes fish passage problematic. Therefore, the corps is considering raising the stream bed by 1% over a distance of 600-feet to pass smelt and other diadromous fish species upstream. No time or scope information is available. This is an 1135 Continuing Authorities Program project. Water Resources Development Act (WRDA) of 1986 (PL-99-662): Section 1135 – Project Modifications for Improvement of the Environment.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@42.2182755,-70.97046265131515,14z

Counties: Norfolk County, Massachusetts

Endangered Species Act Species

There is a total of 1 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis*	Threatened

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/9045

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

From: vonOettingen, Susi
To: Foster, Kevin B CIV USARMY CENAE (USA)
Subject: [Non-DoD Source] Re: [EXTERNAL] Smelt Brook, Weymouth, MA - Section 7 Consultation Species List and MA Verification Letter
Date: Tuesday, March 16, 2021 7:07:56 AM

Good morning, Kevin.

Thanks for the verification form. I already reviewed it (these come in automatically). So, you are set from the ESA perspective. Good luck with the rest of the project.

Your trip sounds like fun. We used to take our kids hiking when they were little. Then they grew up...and do their hikes their own way.

Cheers.

Susi
****
Susi von Oettingen
New Telephone Number: 603-748-8357 (mobile)
Endangered Species Biologist
New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301

Teleworking indefinitely

From: Foster, Kevin B CIV USARMY CENAE (USA) <Kevin.B.Foster@usace.army.mil>
Sent: Monday, March 15, 2021 10:20 AM
To: vonOettingen, Susi <susi_vonoettingen@fws.gov>
Subject: [EXTERNAL] Smelt Brook, Weymouth, MA - Section 7 Consultation Species List and MA Verification Letter

Hi Susi,

Just wanted you to have the two attachments, if nothing else for FWS-bean counting purposes.

The only federally listed species under FWS jurisdiction within the Smelt Brook 1135 project area is the NLEB. All restoration work will be conducted in the stream so no effects to NLEB or habitat.

On a personal note: I took my son and our three-year-old Siberian husky, Maile, up mount Haystack, Franconia notch. I started hiking the notch with my dad when I was 10 in the winter and happy to see the next generation develop a love for winter hiking. It was real cold and blowing 50 mph or thereabouts, but we were thoroughly enjoying the view. Its not a bad drive from Londonderry, but I must admit the 90 minute drive back required ample coffee.

All the best,

Kevin B. Foster
Marine Biologist
Evaluation Branch
New England District
U.S. Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751
Tel. 978/318-8621
"How like fish we are: ready, nay eager, to seize upon whatever new thing some wind of circumstance shakes down upon the river of time! And how we rue our haste, finding the gilded morsel to contain a hook". Aldo Leopold

C02 (atmosphere) as of June 18, 2020 = 416.28 ppm NOAA-ESRL
February, 1959 = 316.48 ppm NOAA-ESRL
Source: NOAA Earth Science Research Laboratory (Mauna Loa, Hawaii)

Smelt Brook Section 1135

State Natural Heritage and Endangered Species Program Coordination

From: Longsdorf, Jennifer (FWE)
To: Foster, Kevin B CIV USARMY CENAE (USA)
Subject: [Non-DoD Source] RE: Smelt Brook: Fish Passage Restoration - Massachusetts endangered species list
Date: Tuesday, March 23, 2021 12:50:35 PM

Hi Kevin,

The NHESP does not publish locations of rare species due to the potential for harm to come to those species, either through malice or through unintentional impacts—i.e. "loving something to death." Sensitive species, which are those considered highly susceptible to collection, are of high concern to the NHESP and are, therefore, excluded from our Town Species Viewer and associated lists. However, there are a few resources available online which can provide you with some information about the species in the area in question. Below are links to these resources which can be accessed from our website.

NHESP Species Viewer: https://www.mass.gov/info-details/rare-species-viewer

- This provides a list of all MESA-listed species and their last observation date within each town in Massachusetts. You can look at a species list by town, or you can look at the distribution of a species across the state.

BioMap2 Town Reports: https://www.mass.gov/service-details/biomap2-town-reports

- These town-level reports are associated with our statewide conservation plan known as BioMap2 and provide slightly more site-specific information. These reports were developed to provide local biodiversity information to assist in specific conservation efforts at the town or regional level. You can find additional information on BioMap2 here: https://www.mass.gov/service-details/biomap2-conserving-the-biodiversity-of-massachusetts-in-a-changing-world. This tool offers interactive maps and reports of important conservation areas and resources throughout Massachusetts.

MESA-listed Species Fact Sheets: https://www.mass.gov/info-details/list-of-endangered-threatened-and-special-concern-species

- The PDF hyperlink on the Species Common Name provides access to the fact sheet for an individual species which includes distribution and life history information.
- If the project is located in Western, Connecticut Valley, Central, or Northeastern MA, please contact Melany Cheeseman at melany.cheeseman@mass.gov. If your project is in Southeastern MA or the islands, please contact Emily Holt at emily.holt@mass.gov.

If the information and links above are not what you were looking for, please refer to the

"Request Species Information" page on our website for further information (https://www.mass.gov/how-to/request-rare-species-information). We can only release site-specific species information with supporting documentation. However, we cannot provide you with species-specific mapping. As stated above, site-specific locality information, if released in an unrestricted manner, can directly jeopardize specific rare species occurrences through collecting, harvesting, destroying, or disturbing with either malicious or benevolent intents.

If you have further questions, please reach out to our Regulatory Review team. Since the project falls in Southeastern MA, Emily Holt would be able to best answer any questions at emily.holt@mass.gov.

Best,

Jennifer Longsdorf
Natural Heritage Program Coordinator
Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife
1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6360 | f: (508) 389-7890 | e: jennifer.longsdorf@mass.gov
mass.gov/nhesp| facebook.com/masswildlife

From: Foster, Kevin B CIV USARMY CENAE (USA) <Kevin.B.Foster@usace.army.mil>
Sent: Tuesday, March 23, 2021 11:47 AM
To: Longsdorf, Jennifer (FWE) <jennifer.longsdorf@mass.gov>
Subject: Smelt Brook: Fish Passage Restoration - Massachusetts endangered species list

Hi Jennifer,

I work with the Army Corps in the Civil Works division and am consulting with USFWS and NMFS in accordance with section 7 of the Endangered Species Act for a restoration project we are planning for Smelt Brook, Weymouth, MA.

I've attached a power point presentation that summarizes the goals of our project. All of the proposed fish passage construction work will be conducted in Smelt Brook.

I've concluded Section 7 consultations with USFWS and NMFS. USFWS indicated in a species letter that northern long-eared bat may occur within the project are. The service has not designated critical habitat within our project area. We concluded consultation and received a verification letter

from the Service.

Likewise, we made a “no effects” call concerning federally listed species that may occur under NMFS’s jurisdiction, since the project will only occur within smelt brook.

I am reaching out to you to determine if any state listed species occur within the project area.

Please let me know if you have any concerns or if you wish to discuss the project.

Many thanks for your help!

Kevin B. Foster
Marine Biologist
Evaluation Branch
New England District
U.S. Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751
Tel. 978/318-8621
"How like fish we are: ready, nay eager, to seize upon whatever new thing some wind of circumstance shakes down upon the river of time! And how we rue our haste, finding the gilded morsel to contain a hook". Aldo Leopold

C02 (atmosphere) as of June 18, 2020 = 416.28 ppm NOAA-ESRL
February, 1959 = 316.48 ppm NOAA-ESRL
Source: NOAA Earth Science Research Laboratory (Mauna Loa, Hawaii)

Broad Tinker's-weed	Triosteum perfoliatum	Vascular Plant	Endangered	1905
Eastern Box Turtle	Terrapene carolina	Reptile	Special Concern	2018
Marbled Salamander	Ambystoma opacum	Amphibian	Threatened	1927
Mocha Emerald	Somatochlora linearis	Dragonfly/Damselfly	Special Concern	2003
Northern Harrier	Circus hudsonius	Bird	Threatened	1986
Pale Green Orchid	Platanthera flava var. herbiola	Vascular Plant	Threatened	1905
Peregrine Falcon	Falco peregrinus	Bird	Threatened	2018
Philadelphia Panic-grass	Panicum philadelphicum ssp. philadelphicum	Vascular Plant	Special Concern	1918
Philadelphia Panic-grass	Panicum philadelphicum ssp. philadelphicum	Vascular Plant	Special Concern	1918
Plymouth Gentian	Sabatia kennedyana	Vascular Plant	Special Concern	2011
Seabeach Dock	Rumex pallidus	Vascular Plant	Threatened	2009

Smelt Brook Section 1135

National Historic Preservation Act
Section 106 Coordination

SMELT BROOK

SECTION 1135 AQUATIC ECOSYSTEM RESTORATION

APPENDIX A2

Climate Change Analysis

Climate Assessment

This climate assessment for the Smelt Brook Watershed was developed to address the requirements contained in ECB 2018-14, Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects. The results of this qualitative assessment are presented to inform current and future studies regarding fish-passage changes proposed in the watershed. The analysis is tailored to provide an understanding of how the future condition may be altered by future changes in climate, which may have an influence in the selection of alternatives.

One Tentatively Selected Plan (TSP) has been considered in greater detail than alternative plans, but all plans incorporate options to reduce obstacles to fish migrating upstream from about elevation 19 feet NAVD to about 24 feet NAVD. The elevations listed here are below 30 ft NAVD and so a review of relative sea-level rise was performed, and it was agreed that the changes due to changes in sea-level were likely small.

The conclusions made in this review are not specific to any one alternative.

Executive Summary

The following are the climate assessment conclusions for the Smelt Brook Watershed, Norfolk County, Massachusetts Fish Passage Enhancement Study:

1. There is a lack of flow gaging data pertaining directly to the Smelt Brook basin (no USGS station; one manually monitored water-level dataset, not yet calibrated)
2. A literature review indicated that Smelt Brook is perennial at the location of interest (Bent and Steeves 2006 for USGS), but anecdotal evidence exists to indicate that the stream does often run dry during the summer, and that this should be expected to increase because of groundwater pumping for apartment buildings in the basin. It is recommended as the project moves forward that the flow record be revisited periodically to assess the number of dry days in a typical summer, the associated variance, and whether these numbers are changing over time.
3. Despite regional (New England) trends of rising temperatures, the information in Weymouth is less clear (smaller changes, less significant). Trombulak and Wolfson (2004); Brown et al (2010).
4. NOAA expects continuing “unprecedented” increases in temperature during the 21st century, with increases in heat wave intensity and decreases in cold wave intensity.
5. There is a trend of warmer winters and earlier spring snowmelt. See, for example, Hayhoe et al (2008) and more than 10 other references reviewed in the section on temperature-related Relevant Climate Variables.
6. The HUC-4 level CHAT (Climate Hydrology Assessment Tool v.1.0) analysis performed for a wider area that includes southeastern Massachusetts and the states of Rhode Island, resulted in statistically significant projected trend of increase in the annual maximum monthly streamflow. Due to the nature of flooding in the region (being peak driven, rather volume driven), increases in predicted annual maximum monthly streamflow are not expected to increase the future risk of flooding. The trend must be viewed with skepticism, when considered for a Smelt Brook, given the much smaller scale of the subject basin (less than 2 square miles) as opposed to a wider study over multiple states.
7. In a study of 15-minute peak precipitation nation-wide, 1972 to 2002, there were no clear trends for the New England region in terms of storm magnitude, duration, or intensity for any season (Palecki et al 2005). Reviewing data 1950-2009, Wang et al (2009) noted increasing trends in New England for

spring, summer and fall, with decreases in winter. Wang and Zhang (2008) noted that the frequency of extreme rainfall events in the south and east of New England had increased (in some cases, doubled) during the period 1949 to 1999. Horton et al (2014) reported a 10% annual increase in average annual precipitation for the years 1995-2011, with an increase in precipitation received from extreme events. Hayhoe et al (2007) noted that the winter mix of rain and snow had changed to include more rain. Douglas and Fairbanks (2011) reviewed storm data in three New England states facing the Atlantic and noted an apparent increase of 1 to 2 inches in the size of the typical 100-year storm, relative to National Weather Service predictions. Frumhoff et al (2007) noted that there appeared to have been increases in the frequency of storms with more than 2 inches in 48 hours. NOAA (Runkle et al 2022) reviewed Massachusetts data 1895-2014, and expected increases in precipitation post 2022, with an increased frequency of extreme precipitation events.

8. Observed changes in annual average temperature for the Northeast Region have increased by 1.43°F for the 1986-2016 period relative to the 1901-1960 period. Observed annual average maximum and annual average minimum temperature has increased by 1.16°F and 1.70°F in the Northeast region, respectively (Dupigny-Giroux, L.A. et al (2018)).
9. The literature review of the USACE report titled *Recent US Climate Change and Hydrology Literature Applicable to US Army Corps of Engineers Missions- New England Region* concluded that most studies identified an increase in both average and extreme precipitation, although some studies identified significant spatial variability and that northern New England may have experienced either no increase or a decrease.
10. The Vulnerability Assessment VA module of the CHAT was used to examine the HUC-4 with respect to ecosystem restoration and flood risk reduction. The tool did not indicate vulnerabilities, relative to the rest of the USACE portfolio. The "0 HUCs vulnerable" result should be treated with caution in that the HUC-4 was defined for a broad basin area and is not site-specific, and because the tool merely ranks vulnerability as being in, or not in, the highest 20% of estimated HUC-4 basins for the business lines selected.
11. NOAA expected that sea-level along the Massachusetts coastline would rise by 1 to 4 feet during the 21st century. It is therefore likely that upstream fish migration will shift to a different part of the high-tide cycles so that fish are less subject to closed-pipe/pressure flow conditions.
12. Review of winter precipitation indicated reducing total winter precipitation and reducing snow quantities. It was not yet clear whether the mix of rain to snow had changed. It was also noted, however, that the NOAA (Runkle et al 2022) source materials implied increased winter precipitation and so were at variance with this finding.

A climate risk table is presented in Table 1 to assess risk to the recommended plan for key climate variables as recommended in ECB 2018-14. One of the primary performance risks to the recommended plan is erosion along Smelt Brook riverbank. This is mitigated with careful design; extreme high flows are already mitigated against by the presence of Pond Meadow Brook upstream of the project.

Table 1: Climate Risks Table

Feature or Measure	Trigger	Hazard	Harm	Qualitative Likelihood
Introduce a fish passage structure over 100 to 200 feet of the brook length (*objective of the project*)	Increased precipitation from more frequent high intensity storms	Future peak flows, flow velocities and erosion may be higher than present.	Lateral erosion of Smelt Brook may impact properties adjacent to river in the floodplain.	**Unlikely** Predicted climate changes are small, not statistically "significant"; mitigated by regulation at Pond Meadow Lake Dam, possibly also by proposed changes.
Increased groundwater pumping in the basin (*this has been noted, and may continue*)	Groundwater levels fall below the river channel. (Limiting factor: unknown point at which excessive pumping starts to pull up briny water – the community will stop pumping when the water turns salty).	Brook runs dry more frequently.	Young fish die during the summer. Downstream migration is limited. Warmer water with lower oxygen content could cause fish-kills.	**Reasonably likely.** Pumping will likely continue. Stranded migrating fish will need to find deep pools in the channel, wait for adequate flow.
Warmer winter, earlier snowmelt runoff	Shorter winter season Fish do not arrive at an appropriate time for the "attractive" flows to upstream spawning regions.	The mix of species and of fish maturity changes in response to the extended summer periods.	Changing list of migrating species. New species may displace existing species.	**Likely**

Feature or Measure	Trigger	Hazard	Harm	Qualitative Likelihood
Sea Level Rise	Water floods the railway station at Weymouth Landing. Properties at the Landing are flooded more frequently.	Roads and railway subject to flooding, salt damage, erosion. Parts of the underground sections of Smelt Brook go into pressure flow more frequently.	Roads and railway subject to flooding, salt damage, erosion. Fish are less likely to travel upstream through a pressurized pipe, so they will wait for a lower part of the tide cycle.	**Reasonably Likely** The design change occurs more than 10 feet vertically below the proposed project and is not expected to affect flows at the project site.

Relevant Climate Variables

The main climate variables that have been identified to potentially affect fish passage in the Smelt Brook watershed in Weymouth Massachusetts include:

- Precipitation volume, intensity, and seasonality
- Temperature variation.
- Sea-Level Rise

These topics are reviewed in the literature review sections that follow.

Literature Review (LR)

The main sources for this section are referenced in the fourth National Climate Assessment or NCA4 (Dupigny-Giroux et al, (2018)), the literature synthesis summary for New England as USACE 2015, the 2022 NOAA State Climate Summary for Massachusetts 150-MA (Runkle et al 2022), and USGS reports related to high streamflows (Zarriello 2017), low streamflows (Ries 2000), and perennial flows (Bent and Steeves 2006) in Massachusetts.

The references that are cited frequently quote results of tests to 95% or 90% significance (meaning that the chance of a conclusion being incorrect is 1-in-20 for 95% confidence or 1-in-10 for 90% confidence in the result). Corresponding significance tests are often framed in terms of whether the parameter p is found to be less than 0.05 (for a 95% confidence) or less than 0.1 (for a 90% confidence). The USACE Climate Hydrology Assessment Tool applies 95% tests routinely, with options to review other confidence levels. For this study, the default settings (95%) confidence/significance settings have been used.

LR: Precipitation Changes

The NCA4 (Dupigny-Giroux et al, (2018)) reviewed modeling results that indicated increases in precipitation in the New England region of about 10% in all four seasons. They reference Janssen et al. 2016, in a review of modeling results, and summarized the following: extreme heavy precipitation was expected to manifest in a tripling of the frequency of storms previously designated "5-year return period storms" throughout the US, with the greatest increases being in the Northeast. The size of a "20-year" storm was projected to increase by 10 to 13% by mid-21st-century, and by 14 to 22% by late-21st century, for the New England region. Trends associated with hurricanes were less clear from the modeling.

Thibeault and Seth (2014) assumed a high greenhouse gas emissions scenario to develop projections for the Northeast Region, some of which had statistically significant increases of 1.5 mm/day. Rawlins et al (2012) reviewed data since 1971 to develop projections of increases in precipitation through 2070 in New England of 12% in winter, 10% in spring; -2% (less rainy) in summer; and 3% in autumn. For Smelt Brook in Weymouth, near Boston Massachusetts, the ranges were 7 to 9% in winter, 6 to 8% in spring; 0 to -2% (less rainy) in summer; and 0 to 5% in autumn. These results can be inferred from review of Figure 1. The scope of the Rawlins study extended to New York, New Jersey, and Philadelphia.

The changes in projected precipitation noted in the previous paragraph suggest a potential shift in flood seasonality. Winter and spring precipitation have important implications for flood risk management as increase in precipitation during this time of year may exacerbate flooding at Smelt Brook.

Ahmed et al (2013) created two climate model ensembles, using data from 1976-1995 and projecting to 2065: the average number of rain-days exceeding 10 mm (0.4 inch) increased by 0 to 4 days per year by 2065 under both scenarios, although the frequency and intensity of big storms were less clear (depended on the location). Huntington et al (2009) noted that an increase of up to 10% in annual precipitation was expected by the end of the 21st century, although there was limited agreement between models; the projected increase in winter precipitation, however, was a common theme, as summarized in the fourth National Climate Assessment (Volume II) from NOAA (Dupigny-Giroux et al, 2018).

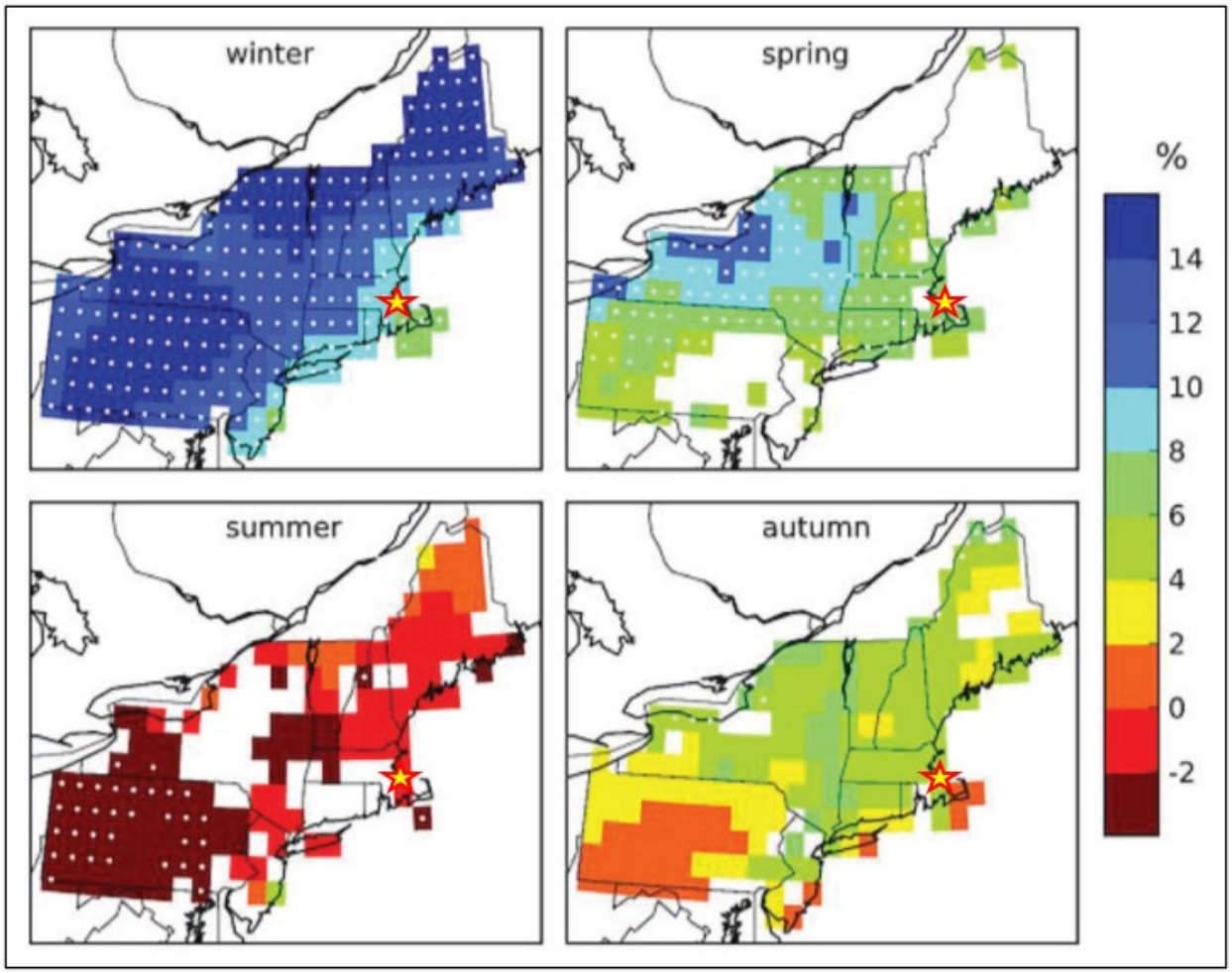


Figure 1: Projected changes in seasonal precipitation volumes, 1971-2000 compared with 2041-2070, as a percent of 1971-2000 precipitation volumes (Rawlins et al. 2012). The eastern Massachusetts Smelt Brook location is indicated with a red star symbol.

Palecki et al (2005) reviewed 15-minute national precipitation; for New England 1972-2002 they saw no significant trends with respect to storm magnitude, duration or intensity for any season. Grundstein (2009) noted significant increases in the Thornthwaite soil moisture index and total annual precipitation for southern New England. The greater Boston area, which includes the Smelt Brook basin, is in southern New England. Wang et al (2009) reviewed national trends 1950-2000, identifying positive trends in New England, except in Maine, for spring, summer, and fall, but decreases in winter; there was no report of the significance of the findings. McRoberts and Neilsen-Gammon reviewed national data 1895-2009. Statistical significance was not noted. For Massachusetts, they noted 10 to 15% increases in annual precipitation. Wang and Zhang (2008) reviewed extreme precipitation events 1949-1999. For New England, there was a pattern of extreme rainfall events either as frequent in 1977-1999 as in 1949-1976, or up to twice as frequent. The increased frequency was noted in the south and east.

Pryor et al (2009) reviewed national data at 643 stations during the 20th century, using a $p<0.1$ significance to report precipitation, precipitation intensity, and precipitation days per year. They noted increases in New England, with marked increases for intense events. Their analysis did indicate that there were more rapid increases towards the end of the study period, although they had not designed their study to quantify the rates of increase. The results are shown in Figure 2.

Horton et al (2014) (third NCA report) reviewed national records 1895-2011 and reported a 10% annual increase in average annual precipitation and an increase in precipitation received from extreme events. There was no statement of significance. Hayhoe et al (2007) reviewed records for 1900-1999 from New England, New York, and Pennsylvania, for annual, winter, and summer precipitation. Trends 1900 to 1970 were reversed during this period for all three parameters: in 1970-1999 annual precipitation decreased 8 mm/decade (0.31 inch/decade); winter precipitation increased 3 mm/decade (0.12 inch/decade); and summer precipitation decreased by 0.2 mm/decade (0.08 inch/decade). The winter mix of rain and snow changed to include more rain. These trends on the changes were not yet considered robust (not yet significant). Small et al (2006) reviewed annual and fall data in New England 1948-1997. Only one station appeared to register increases in both data sets at the 95% level. For a data set from more than 20 stations, this result is essentially inconclusive. Douglas and Fairbank (2011) reviewed the frequency of extreme rainfall (disaster) events as recorded at 48 stations in Massachusetts, New Hampshire, and Maine, from 1954 to 2008. They separated the years into four time periods with some overlap. Their method sought to separate the effects of natural increases in annual rainfall from increases in disaster events. They noted an apparent increase in rainfall for a typical 100-year storm of 1 to 2 inches over National Weather Service predictions.

Kunkel et al (2009) reviewed national extreme snowfall events 1900-2006, for both high and low deviations from the norm. For northeast, there appeared to be more winters with less snow in more recent years. Results were at 90% and 95% significance for the periods 1900-2006 and for 1950-2006, respectively.

Frumhoff et al (2007) (the NCIA) reviewed national data since 1900, essentially supporting the previously cited studies, but also finding that there seemed to be an increase in “heavy precipitation events” of more than 2 inches in 48 hours. Statistical significance was not reported.

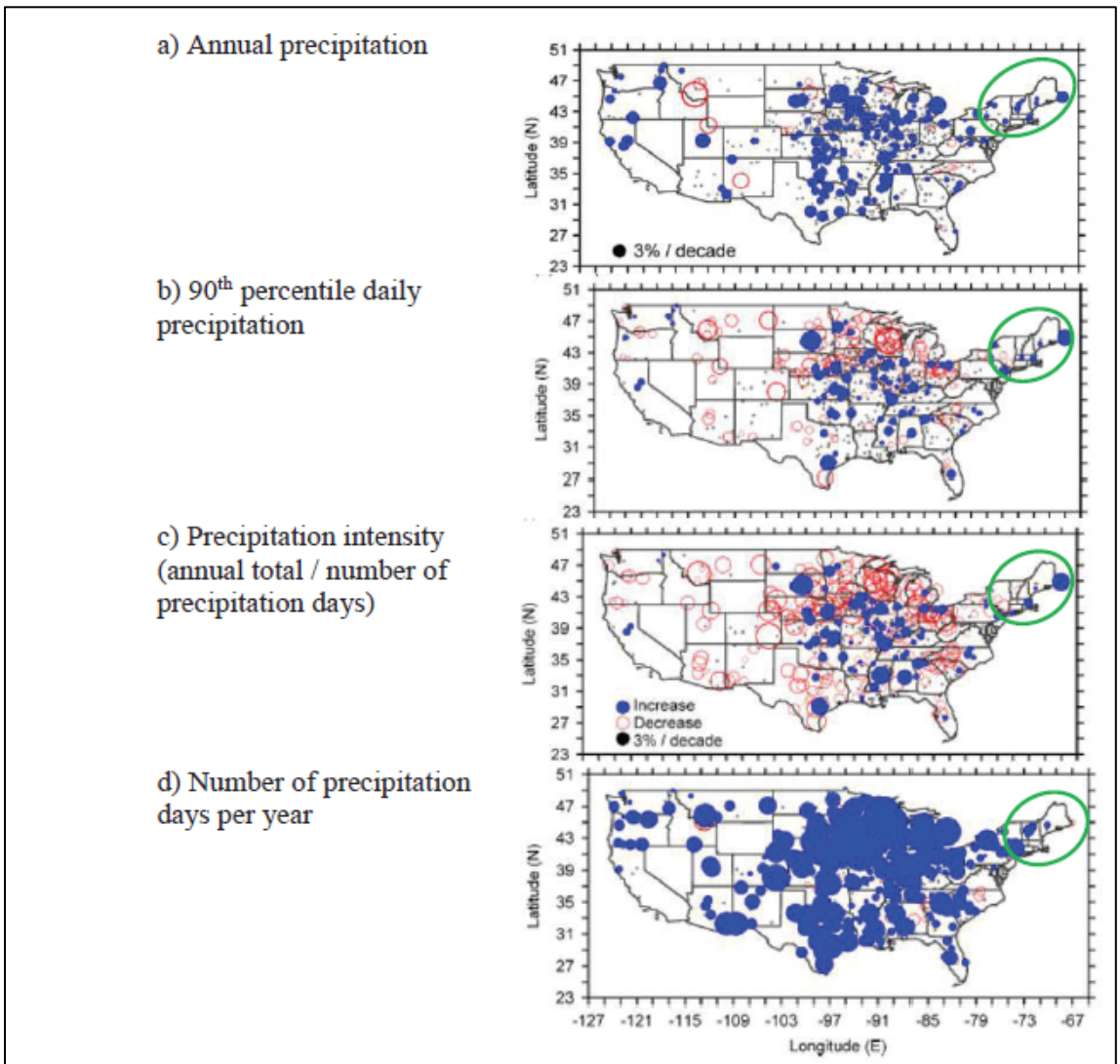


Figure 2.8. Historical precipitation trends in the 20th century. (a) Annual totals, (b) 90th percentile daily, (c) precipitation intensity (annual total/number of precipitation days), and (d) number of precipitation days per year. Blue dots indicate positive trend, red circles indicate negative trend, and symbol sizes are scaled to 3% change per decade. The New England Region is within the green oval (Pryor et al., 2009).

Figure 2: Pryor et al Precipitation Trends in the USA and in New England

Huntington et al (2004) reviewed 21 precipitation stations in New England with respect to the percentage of snow. They noted a 5 % to 10 % increase in annual precipitation over the 20th century. There did not appear to be a significant trend in the ratio of snow to total precipitation. Notably, for the Smelt Brook study, winter precipitation was noted to be decreasing over time at the nearby Blue Hill and Taunton stations: this could affect patterns of snowmelt and spring runoff (see Figure 3).

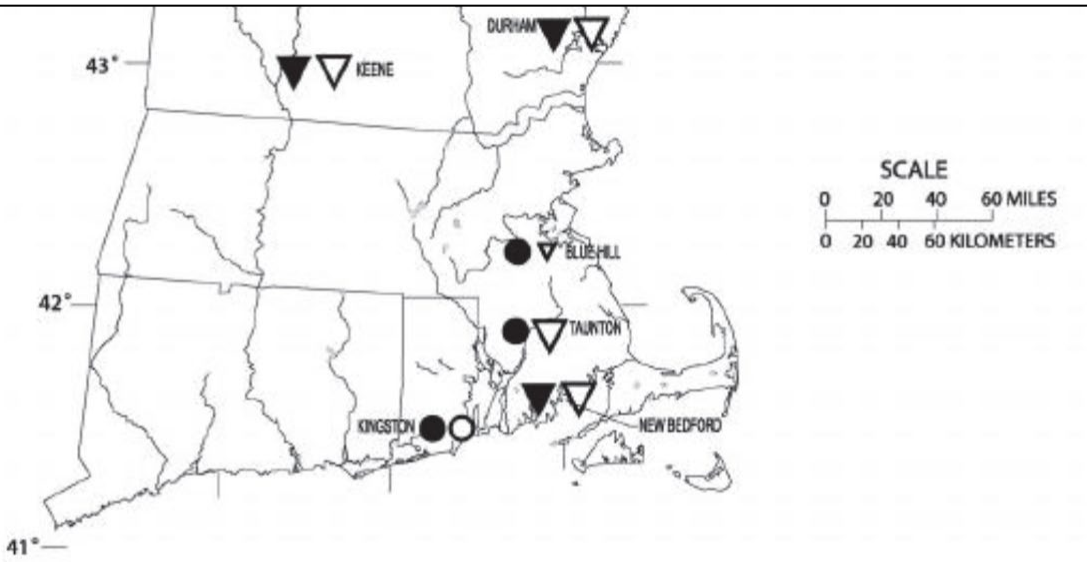


Figure 2.10. Trends in the ratio of snow to total precipitation at 21 stations in New England. Solid symbols indicate annual trends and hollow symbols indicate winter trends. Triangles indicate the direction of the trend; circles indicate no trend. Large triangles indicate significant trends ($p < 0.05$) (Huntington et al, 2004).

Figure 3: Excerpted View: Huntington et al 2004 Review of Data in Southern New England Region

LR: Temperature Changes

Wang et al (2009) reported regional temperature increases of 1.2°C (2.2°F) for the New England region over the period 1950 to 2000, coupled with cooling temperatures, also 1.2°C (2.2°F), in the autumn months (September to November) for that period. Statistical significance of these results was not stated. Westby et al (2013) reviewed data 1949-2011 to confirm the overall warming trend, at 0.008°C/year (0.014°F/year), but the significance was below the 95% level. Meehl et al (2012) reviewed climate data and model calculations for the years 1950 to 1999. Their findings for New England supported the general warming trend in the summer, but they reported a cooling trend in the months December to February. The significance of these results was not stated. Schwartz et al (2013) reported, based on comparing the decades 1951-1960 and 2001-2010 that spring warming appears to occur 0 to 4 days earlier in the more recent decade than it had in the 1950's. Details of significance were not reported.

DeGaetano et al (2002) reviewed 361 station records over 1930-1996, removing acknowledged drought years. There were 5 stations with increasing temperature trends of which 3 were significant at the 95% level; there were also four stations with decreasing temperatures, but these trends were not significant at the 95% level. Horton et al (2014) reported on their review of the Northeast Region (Water Resources Region 1), including New England states, over a period 1895 to 2011. They reported a 1.1 °C (2.0 °F) temperature rise over the period. Statistical significance was not reported.

Trombulak and Wolfson (2004) reviewed temperature data at 36 locations in New England and New York State for 1903-2000, reporting an average increase of 3°C per century (5.4 °F per century) for the region, without reporting on significance. For the Greater Boston area, the result was 1-2°C per century (1.8 – 3.6°F per century) (See Figure 4).

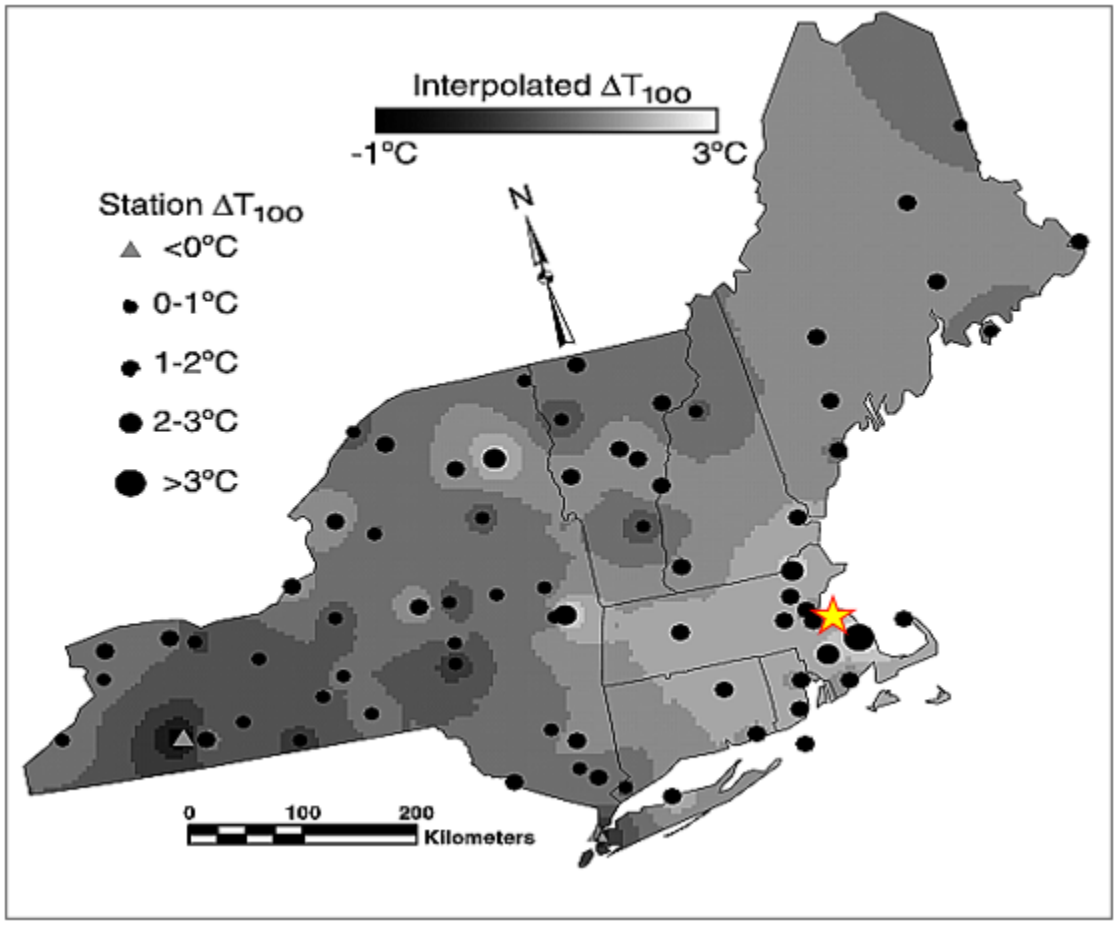
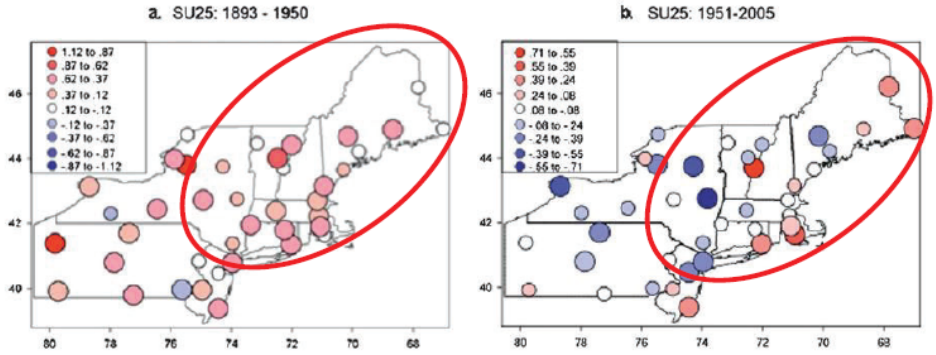


Figure 4: Trombulak and Wolfson 2004 review of Temperature Changes in the New England - New York Region. The study period is 1903 to 2000. The Smelt Brook location is indicated with a red star.

Hayhoe et al (2007) reviewed trends in New England, New York, and Pennsylvania from 1999 to 2000, and reported increasing trends of 0.08°C to 0.14°C per decade (0.14 to 0.25 °F per decade), depending on the season and location, with no report of significance. Burakowski et al (2008) reviewed a similar data set, for 1965 to 2005, included also locations in New Jersey, reporting similar upward trends and finding 95% significance in increases in mean, maximum, minimum values. The Northeast Climate Impacts Assessment (NCIA) (Frumhoff et al, 2007) reviewed rates of change in this region, noting an increase in average temperature of 1.5°C (2.7°F) during the 20th century, with a doubling in the number of days per year exceeding 32°C (90°F) since 1970. Information on statistical significance was not provided. Brown et al (2010) reviewed a data set 1893 - 2005 to show that this same region (New England, New York, New Jersey, and Pennsylvania) had more summer heat days with fewer "cold snap" days in the second half of their observation period. For the Greater Boston area, close to the Weymouth area of interest, the "summer heat days" trend was mild (0.12 to 0.37 days) with 95% significance up to 1950 but less pronounced in 1951-2005, while the "cold snap" data showed only a mild increase in annual instances, but the trend had limited significance. See Figure 5.

a) Summer extreme heat days (> 25 °C or 77 °F)



b) Cold spell duration indicator (annual count of days with at least six consecutive days with minimum temperatures below the 10th percentile)

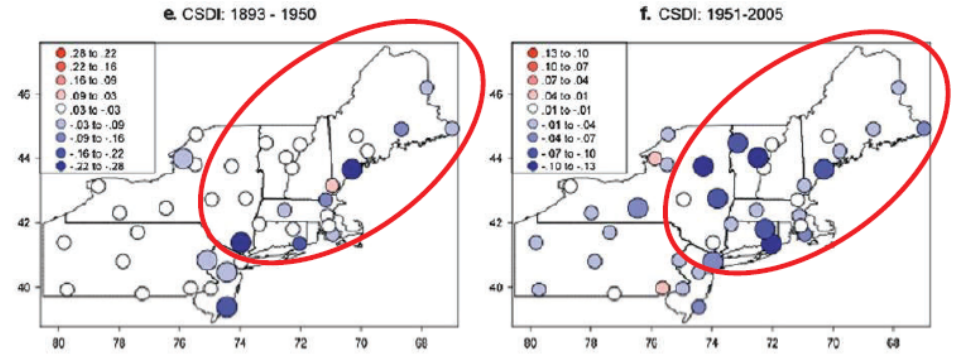


Figure 2.5. Observed trends (days/year) in climate-changes in extreme temperatures. 1893 – 1950 (left panels), 1951 – 2005 (right panels). Large circles indicate statistical significance ($p < 0.05$). The New England Region is within the red oval (Brown et al., 2010).

Figure 5: Brown et al Review of Changes in Extreme Hot and Cold Spells in the US Northeast Region

In New England, a general warming trend has been observed, with a rising trend of 0.8°C to 3.0°C per century (1.4 to 5.4°F per century), although two studies also detected a cooling trend for the months of December to February. Spring warming since 2001 appears to be occurring 0 to 4 days earlier than it did during the 1950's which indicates a potential change in seasonality. In a review of 361 station records over the period 1930 to 1996, only 4 stations had records of decreasing temperatures, and none of these results was statistically significant. These studies are included in Wang et al (2009); Westby et al (2013); Meehl et al (2012); Schwartz et al (2013); DeGaetano et al (2002); Horton et al (2014).

Trombulak and Wolfson (2004) noted that temperatures in the Greater Boston region appeared to be increasing by 1°C to 2°C per century (1.8 to 3.6°F per century). Mild trends of increased summer heat days and less clear increases in the incidence of cold snap days have been noted for the Boston area.

Huntington et al (2009) reviewed reviews of trends in the New England-New York area in the 20th century and projected into the 21st century, with respect to forested and aquatic ecosystems, and documented warming changes that became apparent, especially during and after the 1970s.

Observed changes in annual average temperature for the Northeast Region have increased by 1.43°F for the 1986-2016 period relative to the 1901-1960 period. Observed annual average maximum and annual average minimum temperature has increased by 1.16°F and 1.70°F in the Northeast region, respectively (Dupigny-Giroux, L.A. et al (2018)).

Observed increases in temperature in the Northeast Region (New England, New York State, Pennsylvania, and New Jersey), including statistically significant increasing trends, have been reported in numerous studies (Hayhoe et al (2008); Burakowski et al 2008; the Northeast Climate Impacts Assessment (NCIA) (Frumhoff et al, 2007); Brown et al (2010); Huntington et al (2009)). These included increases in summer temperatures, an average increase of temperature of 1.5°C (2.7°F) during the 20th Century, and a doubling of the number of days per year exceeding 32°C (90°F) since 1970.

The NCA4 (Dupigny-Giroux, L.A. et al (2018)) reviewed temperature changes and projections of temperature-change for 7 regions of the US. For the Northeast, they reported on average, minimum, and maximum temperatures and how these were expected to differ from "near-present" (1976-2005) conditions as projected by 32 climate models, under two sets of assumed inputs, during the 21st century. Time periods examined were for mid-century (2036-2065) or late-century (2071-2100). The average temperatures were expected to rise 4.0 to 5.1°F by mid-century and by 5.3 to 9.1°F by late-century.

For temperature extremes, NCA4 reported results for the mid-century (2036-2065) as these were projected to have shifted from the 1976-2005 conditions. For the Northeast, the change in the warmest day of the year was expected to be 6.5°F; the change in the coldest day of the year was expected to be 9.5°F. For 5-day periods, the 1-in-10 year coldest spell was expected to be 15.9°F warmer; the 1-in-10 year warmest spell was expected to be 12.9°F warmer.

For projections, GCMs are used to simulate future weather conditions. Scherer and Diffenbaugh (2014) used varying assumptions about emissions to model conditions in the United States: their results for New England indicated increased summer and winter temperatures of 5.2°C (9.4°F) and 1.7°C (3.1°F).

LR: Streamflow Changes

Hydrologic changes are most evident in the winter and spring seasons, where temperature-increases of approximately 1.67°F over the period 1940 to 2014 have led to an advance in the timing of snowmelt and spring runoff of more than 10 days. Winters have warmed three times faster than summers. Warmer winter temperatures have increased the fraction of precipitation that falls as rain instead of snow. The freeze-free period is expected to expand by 2069 and 2099. At the Massachusetts/ New Hampshire border, under the lower-emissions scenario (RCP4.5) the last spring freeze is expected to be 10-14 days earlier and the first fall freeze is expected to be 0-6 days later by the year 2069. At the same location, under a higher scenario (RCP8.5), the last spring freeze is expected to be 18-22 days earlier and the first fall freeze is expected to be 14-18 days later by the year 2069. This suggests that under the lower scenario there will be 10-20 additional frost-free days and under the higher scenario there will be 32 to 40 additional frost-free days. The projected higher temperatures and additional frost-free days would lead to later winter snowfall and earlier snowmelt in the Smelt Brook watershed.

The impact of heavy precipitation on streamflow will partly depend on watershed conditions, including preceding soil moisture and snowpack conditions. The NCA notes that although annual minimum streamflows have increased during the last century, late summer warming could lead to decreases in the minimum streamflows in the late summer and early fall by mid-century; however, the effects on daily flows at the site were expected to be minimal because of the effects of storage in the Pond Meadow reservoir in mediating flows and water temperatures. Moreover, despite a pattern of increasing peak annual flows in the Norfolk County region of Massachusetts, there is a not-yet-significant pattern of smaller monthly peak flows in the region (not specifically at Smelt Brook). The range of dates for migration is likely to be extended for both the upstream, and later the downstream migrations.

USGS noted in Zarriello (2017) that Walter and Vogel (2010) observed that peak flows appeared to increase with urbanization. Zarriello (2017) also noted that Hodgkins and Dudley (2005), Collins (2009), and Huntington et al (2009) saw similar increases in flows with no clear influence from urbanization. Zarriello's point in noting these observations was to stress the inherent uncertainty in assigning any direct causal relationship between urban development and increases in peak flows.

The NCA4 noted that the dominant trend in precipitation throughout the Northeast has been towards increases in rainfall intensity. Increases in precipitation are expected during the winter and spring but little change is expected during the summer with monthly precipitation projected to be about 1 inch greater for December through April by the end of the century (2070- 2100) under the higher-emissions scenario. Over the period 1958 to 2012, the amount of precipitation falling in the heaviest (1% ACE) precipitation events has increased 55% in the Northeastern U.S. Moderate flooding events are reportedly expected to become more frequent in the Northeast during the 21st century because of more intense precipitation related to climate change. A study identified that in Massachusetts heavy precipitation tended to occur with increases in flows into town sewage systems and into combined sewer overflows. Sump pumps from homes adjacent to Smelt Brook could degrade water quality during extreme floods, but the homes are on roads with significant grades and are therefore unlikely to experience significant need for sump pumps.

LR: Sea-Level Rise

The site being so close to sea level, a review of sea level changes has been included as part of this study. Although reference has been made to the sea-level change section of the USACE climate change tool, photographs of the flooding in the 1936 and 1938 floods indicate that those historic floods did not threaten the site at which Smelt Brook is to be modified under the various schemes proposed. The ability to discern the impact was limited in this study.

Changes to sea-level as recorded and projected at Boston MA was reviewed briefly, using the USACE climate change tool. The station reviewed was 844490. The gage indicated increases in sea-level from the 1990 elevation of approximately 1 foot by 2060 and 2 feet by 2100. Ranges for these results were shown as: 0.5 to 2.3 ft in 2060; and 1.0 to 5.2 ft for 2100. Given that the Smelt Brook fish passage project location is at elevation 20 ft NAVD, with the downstream monitoring fish monitoring station at 10 ft to 15 ft NAVD, the effect of sea level rise on the project was discounted.

The CESL notebook report is copied as Figure 6.

CESL Summary Report
ESSEX RIVER, MA

CORPS PROJECT NOTEBOOK (CPN) INFORMATION

Project Name: ESSEX RIVER, MA
Status: Active
Project Type:
Project Phase:
Business Lines:
County: Essex
District: New England
Latitude: +42.638678735
Longitude: -70.767610511
Distance to Tidally Influenced Water: 0.00 miles

CESL ANALYSIS RESULTS

Potentially Impacted by SLC : Yes
Initial Vulnerability Assessment Status : Not Started
Impacts Assessment Prioritization Ranking :
Impacts Assessment Ranking :

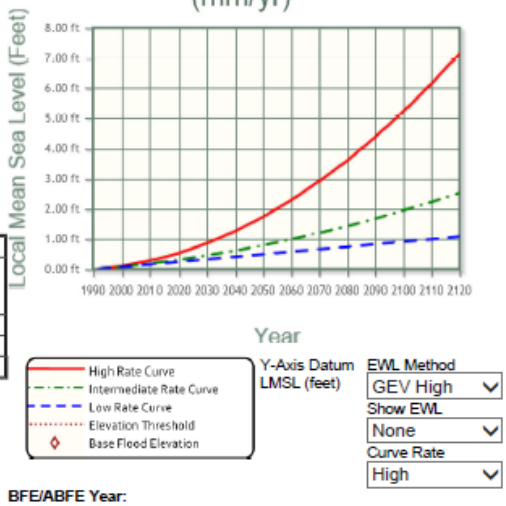
CESL INITIAL VULNERABILITY ASSESSMENT (IVA) DATA

Primary Mission Area :
FEMA Base Flood Elevation : N/A
Elevation Threshold : N/A
Elevation Threshold Data Source :
Description of Elevation Threshold :
Local Sponsor Support :
Suggested Priority for More Detailed Study:
Suggested Priority for More Detailed Study Reasoning:

	50-Year Planning Horizon		100-Year Planning Horizon	
Controlling Tidal Gauge Rate Curve	Impacted at 2070?	Level of Consequential Impacts	Impacted at 2120?	Level of Consequential Impacts
High				
Intermediate				
Low				

CONTROLLING TIDAL GAUGE

8443970 - Boston, MA: 2.54 (mm/yr)



BFE/ABFE Year:

CESL PARAMETERS ANALYSIS DATA

CEPD Compliance :
FEMA Flood Hazard :
Local Relative MSL Trend (mm/yr) :
Population Density :
Population Impacted :
Project Phase :
USGS CVI :

PROJECT MAP

This project does not have a project map.

CEPD COMPLIANCE TRACKING TOOL (CCTT) DATA

Tidally Influenced :
CEPD Compliant :
Local Sponsor Controlled :
Congressional Authorization Purpose :
Primarily Navigation :
Draft Type :
Benchmark PIDs :
NOAA Gauges :
Estimate Complete :
Actual Complete :

EXTREME WATER LEVELS & FREQUENCY

The method used to determine the Extreme Water Level Table values is based on methodology from Dr. David L. Kriebel. Extreme water levels derived by the Kriebel method are not available for non-NOAA gauges.

Method	Frequency	Monthly	1-year	2-year	10-year	20-year	50-year	100-yea
GEV High	Value above MSL (in ft)	N/A	2.1077	2.1077	2.615673	2.716512	2.84905	2.94988
GEV Low	Value above MSL (in ft)	N/A	-2.15521	-2.15521	-2.508717	-2.54985	-2.594718	-2.62307
USACE Percentile	Value above MSL (in ft)	6.79	7.54	7.82	8.68	8.89	9.04 *	9.14 *
User Entered	Value above MSL (in ft)	-	-	-	-	-	-	-

* Values based on NOAA Gauge 8443970 with years of records. Use extreme caution when extrapolating more than years!

Figure 6: Boston Area Sea Level Rise Summary Report for Station 844490 (Essex River, Massachusetts)

The water quality in Smelt Brook has the potential to be impacted by high flows from existing highways as well as by low flows (reduced dilution for wastewater treatment plant discharges). The watershed area includes 24.3% undeveloped forested land with hiking trails, and more developed land near the brook's outlet to the Monatiquot River.

The Smelt Brook basin, although only 1.85 square miles in area, ranges widely in elevation from approximately 20 feet NAVD to approximately 1,900 feet NAVD. Climate varies throughout the year and includes both snow and temperatures that can reach 100°F. Recreation possibilities include hiking and limited boating and fishing at Pond Meadow Lake Dam, which was designed with a permanent pool of 19 acres, increasing to 120 acres (~0.2 square miles) during a 100-year storm event. The timing of seasonal snowmelt and spring rainfall would give rise to potential changes in migration behavior of fish along Smelt Brook.

Warming has also affected ocean systems: The NCA4 reports that in the Northeast Continental Shelf, annual average sea surface temperatures have increased 0.06°F per year over the period 1982-2016, and coastal waters have become more acidic. Smelt Brook discharges into the ocean via a series of small bays and two parallel underground sections of river. The normal freshwater-saltwater boundary is at a location known as "The Landing" in Weymouth: clearly tidal at the north side of the complex, and 1,000 feet upstream, clearly freshwater. It is not known exactly where the change between the two "regimes" occurs, how diffuse or abrupt this boundary might be, or to what extent it varies with the tide cycles. The project is upstream of the interface between freshwater and saltwater.

In summary, while sea level rise has an impact, the extent is limited.

LR: NOAA Summary for the Commonwealth of Massachusetts

NOAA has published a set of individual state climate summaries containing information on historical climate variations and trends, future climate model projections of climate conditions, and past and future conditions of sea level and coastal flooding.

The three main points "key messages" of the NOAA report for Massachusetts were:

1. Temperatures in Massachusetts had risen by almost 3.5°F since the beginning of the 20th century. A higher emissions pathway would lead to unprecedented warming during the 21st century, with increases in heat wave intensity and reductions in cold wave intensity.
2. Precipitation since 1970 averaged about 4.7 inches more than during 1895-1969, and there was a record-setting number of extreme events in the decade 2005-2014. NOAA expected winter and spring precipitation, and the frequency of extreme storms, to increase.
3. Global sea level was expected to rise, with a likely range of 1 to 4 feet by 2100. Storm surge and sea-level rise were expected to exacerbate damages due to inundation and erosion-induced land loss.

Similar to the NCA, NOAA reported that the average annual temperature has increased approximately 3°F in Massachusetts since the early 20th century. Under the high scenario, unprecedented warming is projected by the end of the 21st century. Less warming is expected under a lower emission future (the coldest years being about 2°F warmer than the historical long-term average). More warming is expected under a higher emissions scenario (the hottest years being about 11°F warmer than the historical long-term average). See Figure 7.

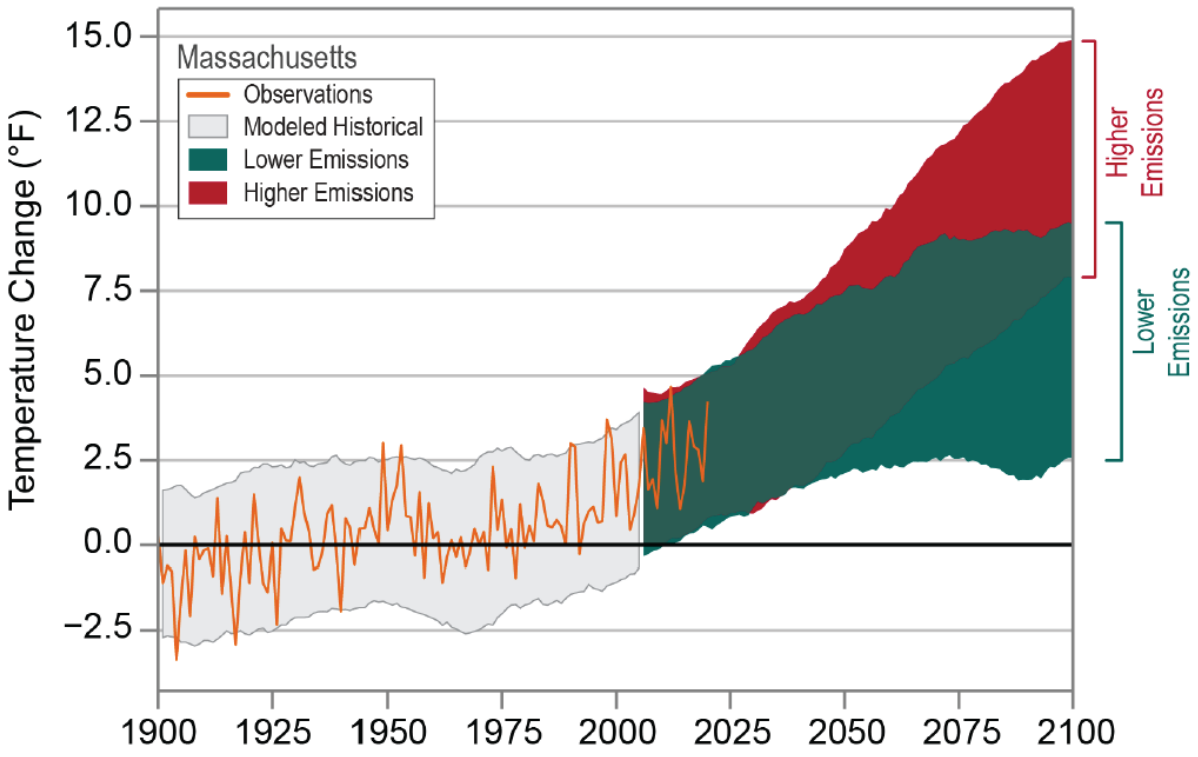


Figure 7: Observed and Projected Temperature Change in Massachusetts (Source: NOAA State Climate Summary 150-MA)

Figure 7 provides a summary of the expected changes, based on the two scenarios (RCP4.5 and RCP8.5) in which greenhouse emissions either continue to increase (higher emissions) or increase at a slower rate. Although the figure is taken from the state-specific NOAA report (Runkle et al 2022), the NOAA report makes reference to work by Vose et al at North Carolina State University in 2014. Historically unprecedented warming is projected to continue (higher emission) through the 21st century.

Temperatures have risen about 3°F since the beginning of the 20th century. Shading indicates the range of annual temperatures from the set of models. Observed temperatures are generally within the envelope of model simulations of the historical period (gray shading). Less warming is expected under a lower emissions future (the coldest years being about 3°F warmer than the long-term average; green shading) and more warming under a higher emissions future (the hottest years being about 10°F warmer than the hottest year in the historical record; red shading).

Less warming is expected under a lower emissions future (the coldest years being about 2°F warmer than the historical average; green shading) and more warming under a higher emissions future (the hottest years being about 12°F warmer than the hottest year in the historical record; red shading).

Similar to the NCA, NOAA also reported that during the last century, precipitation had increased. In Massachusetts, winter and spring precipitation is projected to increase, as well as the frequency of heavy precipitation events. The last decade saw the largest number of extreme precipitation events (days with more than 2 inches), about 30 percent above the long-term average. The driest five-year period was 1962-1966 and the wettest five-year period was 2005-2009. Above-average summer precipitation has been observed in Massachusetts since 2000.

Global sea level has risen about eight inches since approximately 1880. Sea level is projected to increase by another 1 to 4 feet by 2100 in Massachusetts.

LR: USACE Climate Change Literature Review

The USACE report titled *Recent US Climate Change and Hydrology Literature Applicable to US Army Corps of Engineers Missions- New England Region* summarizes observed and projected climate and hydrometeorologic patterns cited in reputable peer-reviewed literature and authoritative national and regional reports. Although the review was performed at the HUC-4 (hydrologic unit code) level, it was noted that USACE judged that the regional, sub-continental climate signals projected by the driving climate models are coherent and useful at the HUC-2 scale and that the confidence in the driving climate model outputs declines for areas smaller than the watershed scale of the 4-digit HUC.

The review found that most studies agree that there has been an overall increase in average temperatures over the past century. However, some indicate that there may be seasonal or localized cooling trends occurring. Some studies also indicate a greater temperature increase occurring during the winter months. Minimum temperatures also were deemed to appear to be increasing but it was reported that there was no clear trend in high temperature extremes. Based on the review, a strong consensus exists in the literature that projected temperatures show an increasing trend through the next century in both average temperatures and high temperature extremes. Although no literature was reviewed studying projected extreme low temperatures, some studies indicate that seasonal winter temperatures are expected to rise at a faster rate than the annual average.

The review concluded that most studies identified an increase in both average and extreme precipitation, although some studies identified that northern New England may have experienced either no increase or a decrease. Snowfall was reported to appear to be decreasing while winter rainfall increased. The lack of precipitation gages in the northern areas may limit the conclusions that can be drawn from the limited precipitation dataset. Based on the review, average precipitation volumes are generally expected to increase along with the frequency and total precipitation volume of extreme events. However, the review found low consensus in the literature as some studies show no trend or variability by season or by location in the New England region, while others noted that projected precipitation trends vary between different model output datasets.

The review concluded that most studies identified few or no trends in annual streamflow volumes, though some noted increases in both magnitude and frequency of peak flows throughout the region. Some studies noted significant changes in the timing of both low and high flows, with particularly strong agreement that spring peak streamflows have shifted earlier in the season. A study by Armstrong et. al. dated 2012 was included in the literature review. The study focused on rivers that had experienced minimal human impact and had found that both the frequency and magnitude of low-frequency floods was increasing in time. Several studies noted the potential for earlier spring peak streamflows, as well as both increased peak flow volumes and decreased low flow volumes. Snowpack-dominated areas such as the Smelt Brook basin may see the most dramatic changes, as snowpack volumes decrease and warmer temperatures increase the rate of snowmelt.

A summary of the Climate Change Assessment for New England is presented in Figure 8.

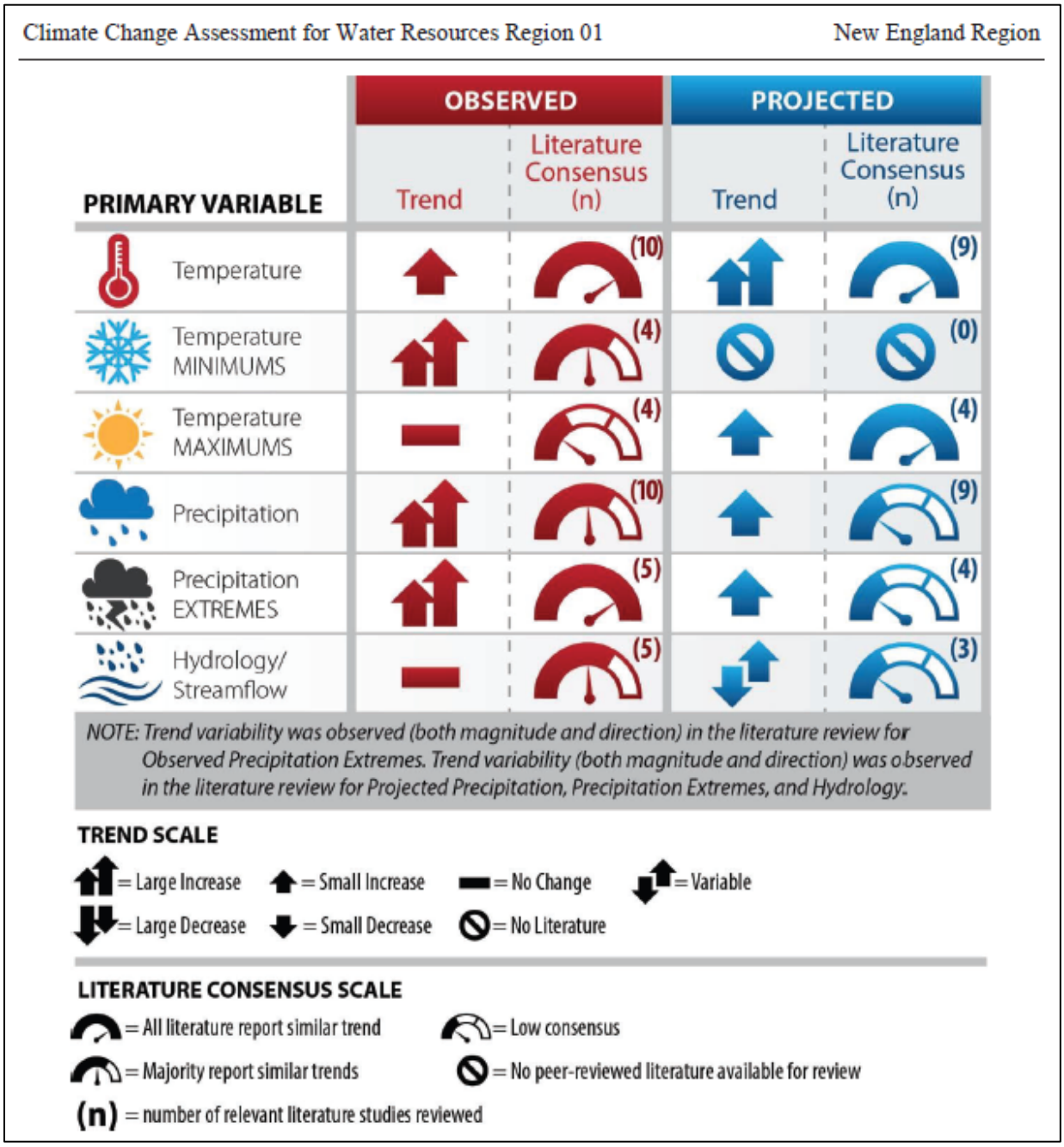


Figure 8: Summary matrix of observed and projected climate trends (USACE 2015)

LR: Summary of the Literature Synthesis

The following discussion is based largely on content summarized in the 2018 National Climate Assessment, Dupigny-Giroux et al. 2018, and Hayhoe et al. 2008. The NCA content and the knowledge gained through the quantitative modeling were translated to develop conclusions on how the Smelt Brook basin would be impacted.

Increases of 10 to 15% in annual precipitation have been noted for the Commonwealth of Massachusetts. Extreme events in the southern and eastern New England region have been noted. Wang and Zhang (2008) noted that the region has been noted as receiving about twice the number of extreme storms as was the case in the middle of the twentieth century. Huntington et al (2004) noted that the winter mix of snow to rain did not have a clear pattern, but the total winter precipitation appeared to be decreasing at two observatories near Smelt Brook.

Observed changes in annual average temperature for the Northeast Region have increased by 1.43°F for the 1986-2016 period relative to the 1901-1960 period. Observed annual average maximum and annual average minimum temperature has increased by 1.16°F and 1.70°F in the Northeast region, respectively (Dupigny-Giroux, L.A. et al (2018)).

Reference to the sea level rise tool indicated a potential rise of up to 5.2 feet above the 1990 levels by 2100, which is comfortably below the project site (elevation 19 ft NAVD and above) and so is not expected to be an issue.

The NCA4 noted that in Massachusetts heavy precipitation tended to occur with increases in flows into town sewage systems and into combined sewer overflows. Sump pumps from homes adjacent to Smelt Brook could degrade water quality during extreme floods, but the homes are on roads with significant grades and are therefore unlikely to experience significant need for sump pumps.

Warming has also affected ocean systems: in the Northeast Continental Shelf, annual average sea surface temperatures have increased 0.06°F per year over the period 1982-2016, and coastal waters have become more acidic. Smelt Brook discharges into the ocean via a series of small bays and two parallel underground sections of river. The normal freshwater-saltwater boundary is at a location known as “The Landing” in Weymouth: clearly tidal at the north side of the complex, and 1,000 feet upstream, clearly freshwater. It is not known exactly where the change between the two “regimes” occurs, how diffuse or abrupt this boundary might be, or to what extent it varies with the tide cycles.

Stream Flows and Streamgage Analyses

The flow in the Smelt Brook basin is not measured by any USGS gages, although four nearby gages on relatively small watersheds were reviewed briefly for comparison purposes.

Stream Flow Analyses: Flow Gage on Smelt Brook

The flow in Smelt Brook is not well-monitored. Although there is no USGS gage on the brook, USACE has generated a USGS StreamStats report for the location of the proposed project renovation. StreamStats noted the flow as having a 95% probability of being perennial. The StreamStats region is shown in Figure 9.

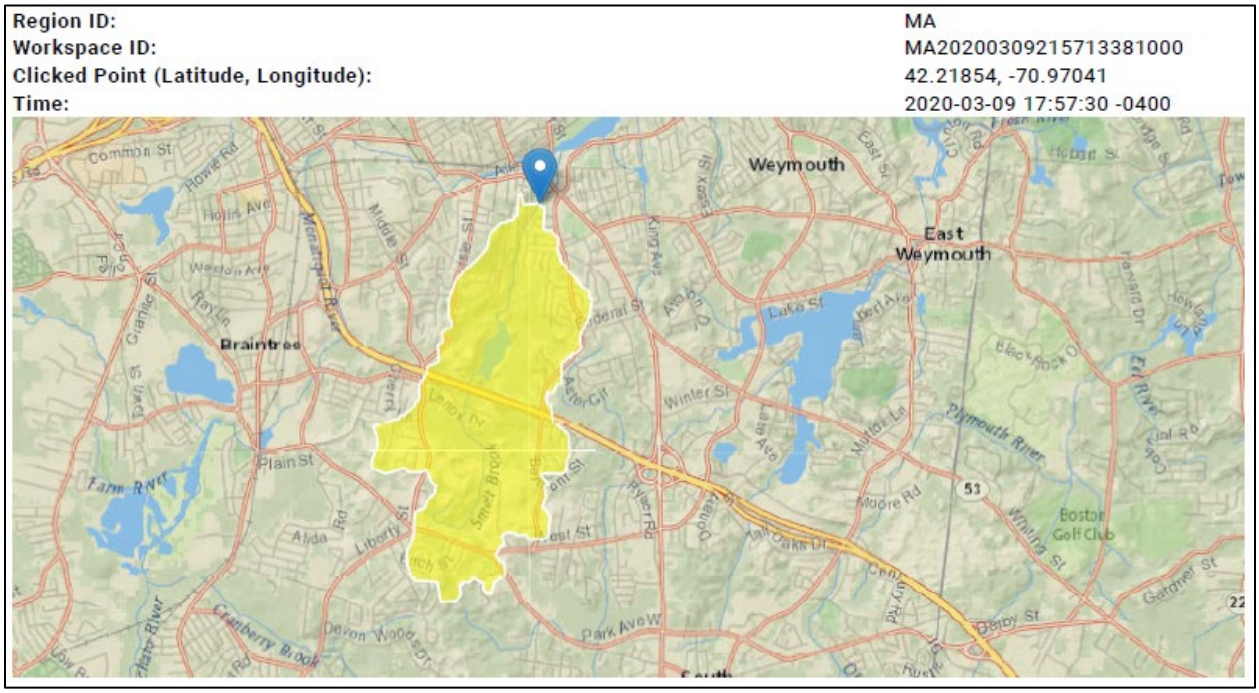


Figure 9: StreamStats Delineation of the Smelt Brook Basin

The region is shown in an aerial photo view taken from Google Earth (see Figure 10).

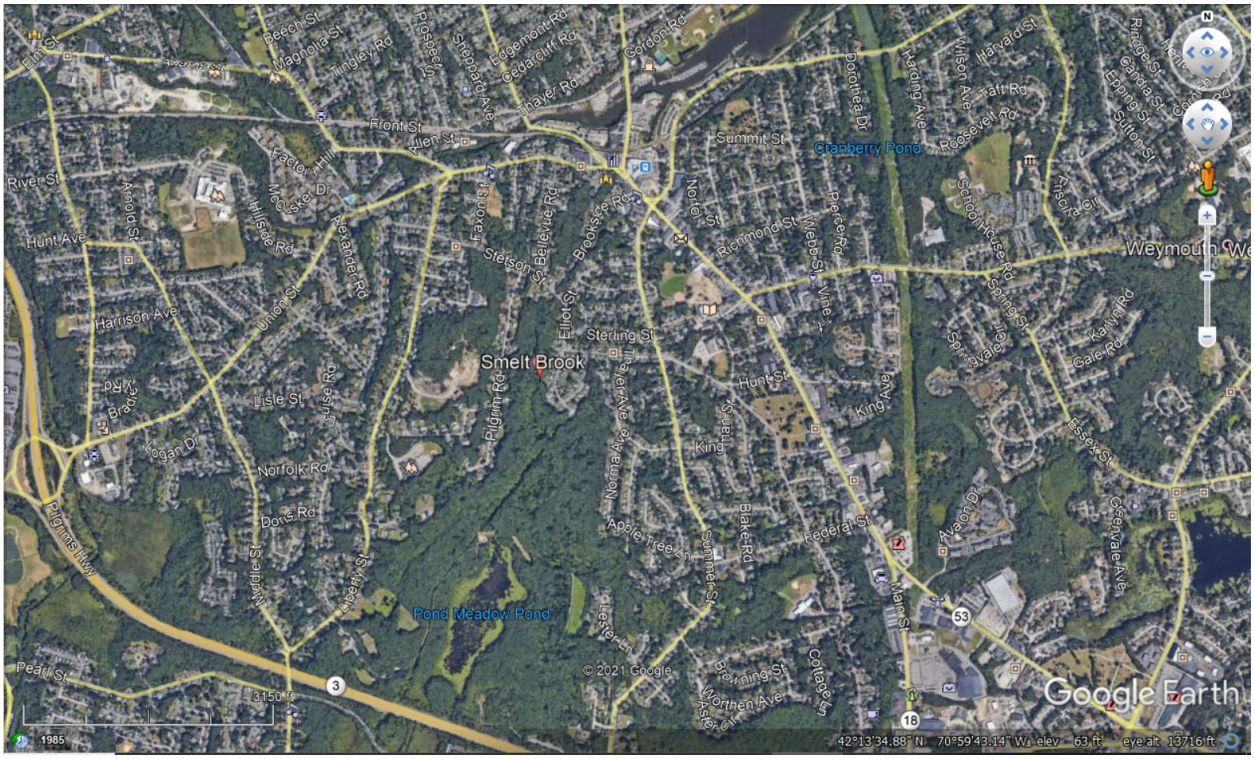


Figure 10: View of the Smelt Brook System from Pond Meadow Lake (Pond) to Weymouth Landing

The flow is interrupted by one USACE-constructed dam at Pond Meadow Lake Dam as part of a Local Protection Project (LPP) in 1976. The pond is the starting point (southern-most point) of the yellow trace in Figure 11.

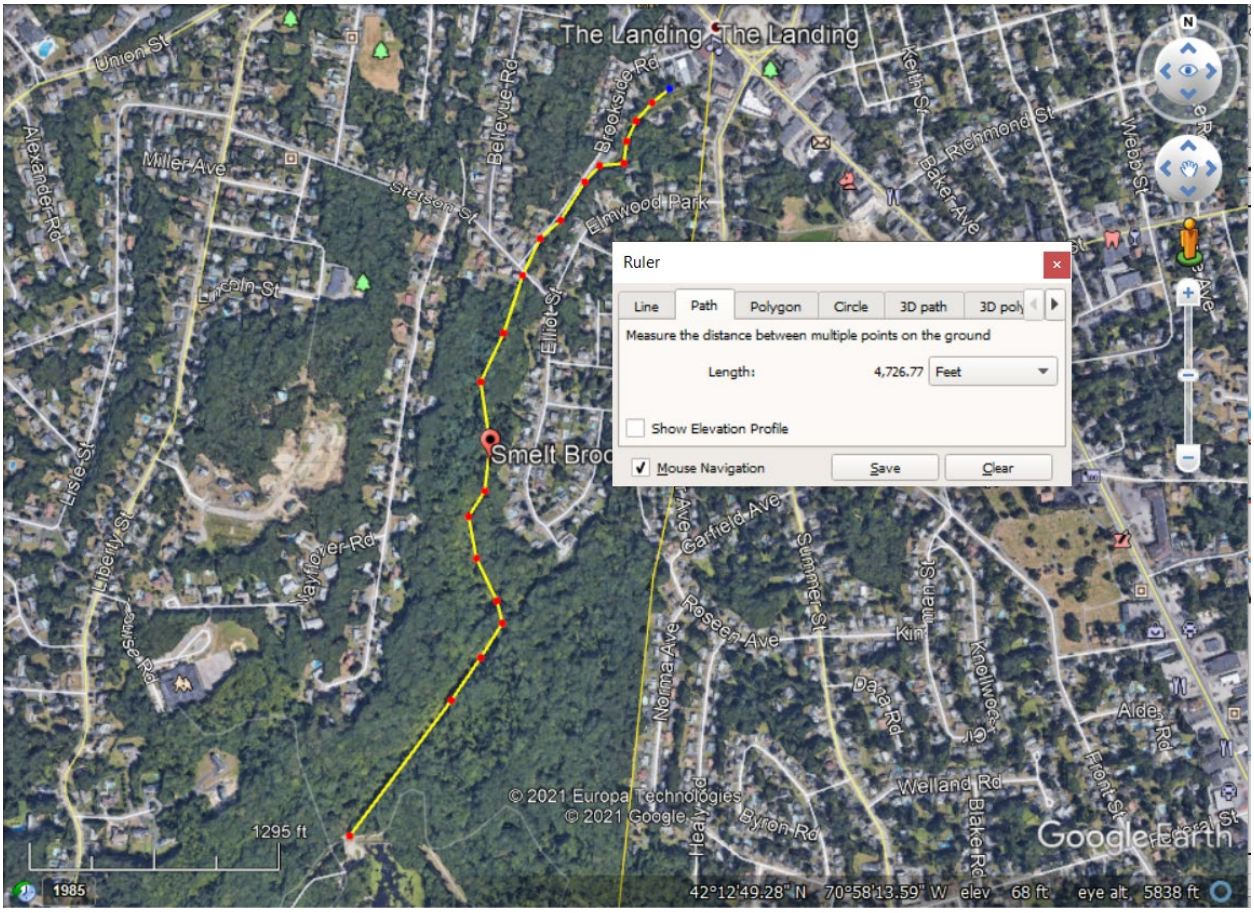


Figure 11: 4,700-ft Distance from the lake to where the brook has been buried

Downstream of Pond Meadow Lake Dam the stream flows approximately 3,700 feet leading to the corrugated metal pipe of interest, the location for this fish passage project, and after a further 650 feet, a shallow holding area where the brook flow splits in two (See Figure 12).

Figure 12: Gaging Point where flow splits (left for normal fish passage flows; augmented by flow to the right for high flows)

From this location, the flow proceeds underground for 1,140 feet underneath the Weymouth business district (Weymouth Landing, also called The Landing). Parts of this buried section are being opened ("daylighted") in a new development project in the business district.

The lake area is 19 acres, increasing to 120 acres (approximately 0.2 square miles) during the design storm, an estimated 100-year event.

The design flow for this event was 600 cfs passing through a gated weir section and a spillway.

A 51-week record (March 17, 2020 through March 10, 2021) at a gaging station 650 feet downstream of the site of interest recorded 200 observations, with a range from 51 "DRY" entries to an estimated maximum of 61 cfs and an average flow of 12.1 cfs. The period included observations during a regional drought that ended during 2020.

A summary of the data is shown in Figure 13.

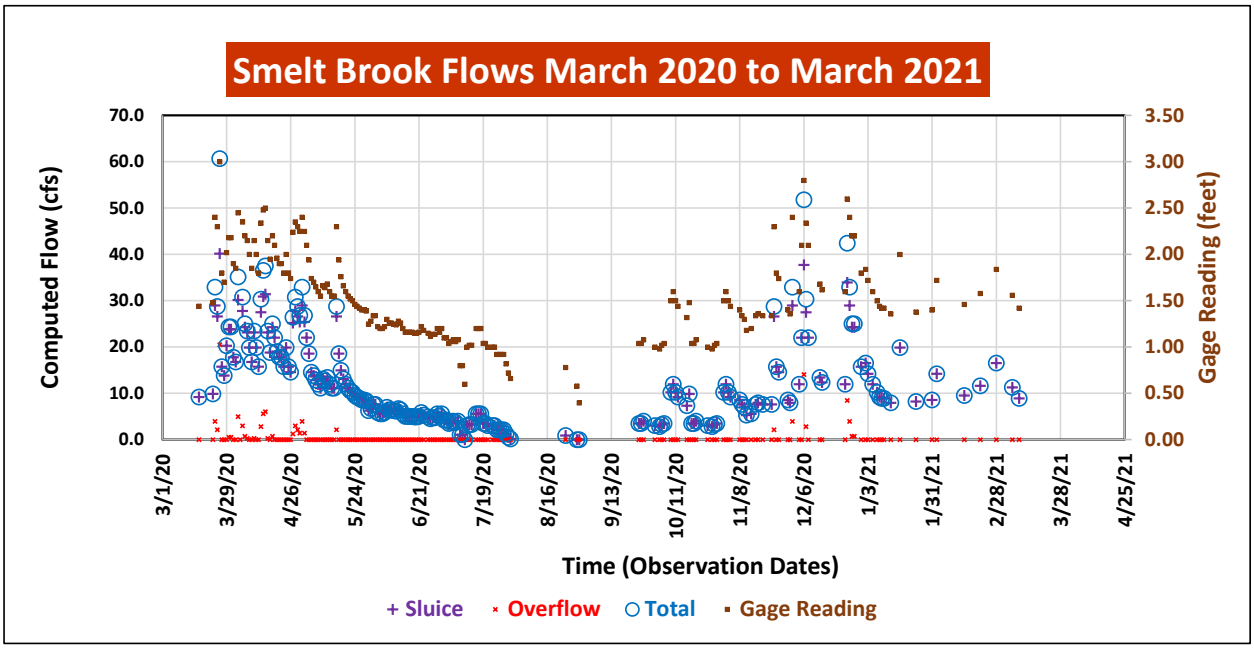


Figure 13: Available Gage Information for Smelt Brook Upstream of Weymouth Landing

The basin of interest, although only 1.85 square miles in area, ranges widely from approximately 20 to approximately 1,900 feet NAVD. Climate varies throughout the year and includes both snow and temperatures that can reach 100°F. Recreation possibilities include hiking and limited boating and fishing at Pond Meadow Lake Dam, which was designed with a permanent pool of 19 acres, increasing to 120 acres (~0.2 square miles) during a 100-year storm event.

A summary of information at the nearest gage on Smelt Brook is presented in Table 2.

Table 2: Smelt Brook Mainstem Streamflow Gage

Gage Name	Gage Number	Period of Record (POR)	USACE Dams that Augment Flows	Drainage Area (sq mi)
Smelt Brook Upstream of Weymouth Landing	N/A; 650 ft downstream of proposed changes	3/17/2020 – 3/10/2021	N/A. Pond Meadow Lake Dam was designed and constructed with USACE assistance but is not owned or operated by USACE.	1.88 (Located 650 feet downstream of the proposed project)

Stream Flow Analyses: Regional USGS Gages

A summary of four nearby USGS gage details is included in Table 3 below.

The table describes four regional USGS stream gages considered for the climate assessment. The table also includes details regarding the nature of known regulation from upstream structures (embankments, dams, etc.)

Table 3 USGS Annual Peak Instantaneous Flow – HUC109 Regional Streamflow Gages

Gage Name	Gage Number	Period of Record	Mean of Annual Peak Flows	Trend Details
Old Swamp River near South Weymouth, MA 4.5 sq mi	1105600 Potentially useful for comparison with Smelt Brook. Not used for direct flow estimates.	1967-2021	220 cfs or 48.9 cfs/sq mi	Reducing by 0.5 to 1.3 cfs/year. P=0.23 to 0.54 P>0.05 => Trend taken as not statistically significant at the 5% level.
Town Brook at Quincy, MA 4.11 sq mi *As with Smelt Brook, this site includes some regulation from an FRM structure.*	1105585 Relatively short record with a 12-year gap - not used for direct estimates at Smelt Brook site.	1973-2013	~340 cfs or ~83 cfs/sq mi	Reducing by 0.31 cfs/year. P = 0.711>0.05 => Trend taken as not statistically significant at the 5% level.
Monatiquot River at East Braintree, MA 28.7 sq mi *Site includes regulation from highway and railroad embankments (bridges/culverts) and at Ames Pond, Hollingsworth Pond, Sunset Lake and Richardi Reservoir outlets.*	1105583 Relatively large basin - not used for direct estimates at Smelt Brook site.	2006 - 2014	~600 cfs or ~21 cfs/sq mi	Reducing by 17.5 cfs/year. P = 0.753>0.05 => Trend taken as not statistically significant at the 5% level.

Gage Name	Gage Number	Period of Record	Mean of Annual Peak Flows	Trend Details
Whitman's Pond Fish Ladder at East Weymouth, MA 12.5 sq mi	1105608 Relatively large basin not used for direct estimates at the site.	2002 - 2014	~42 cfs or ~ 3.4 cfs/sq mi	Reducing by 1.76 cfs/year. P = 0.343>0.05 => Trend taken as not statistically significant at the 5% level.

Stream Flow Analyses: Climate Hydrology Assessment Tool

In accordance with ECB 2018-14, consideration of USGS gages on Smelt Brook and its tributaries was made. There are no USGS gages on the river. The StreamStats USGS tool was used to prepare a site-specific report for the proposed construction site and a second report for downstream 650 feet downstream, where there is a gaging staff that is monitored from time to time by Brad Chase (Massachusetts DEP, and staff at the Pond Meadow Park, the small 19-acre upstream lake and surroundings), Michael Richardi, and Sean Cleaves (non-Federal sponsor). The selected StreamStats locations record drainage areas of 1.85 and 1.88 square miles respectively. A 51-week data-set with 200 water level observations was obtained from Pond Meadow Park, from this gaging location (Cleaves 2021). The data obtained included observations during an acknowledged drought period that ended during 2020. The observations included 51 "DRY" (no flow) observations, despite the StreamStats reports that the locations had a 95% probability of being perennial based on the computational procedure of Bent and Steeves (2006/2008). The results are shown in Figure 14. Mr. Richardi had indicated that pumping for water for recently constructed (last 20 years) apartment complexes in the basin was a likely contributing cause for the unusually long series of dry readings in August-October 2020.

The data set includes shows increased flows in March-April 2020 and in December-January, with decreased flows in the summer months June to September. It must be noted that the seasonal lack of flows is considered unusual, although there remains the possibility that this will become a permanent feature of the hydrology of the system because of groundwater pumping at new apartment complexes.

The USACE Climate Hydrology Assessment Tool (CHAT) (https://maps.crrel.usace.army.mil/projects/rcc/portal.html) was not used for review of flow data in the Smelt Brook basin because there were no USGS gages on the system. Records from four regional gages of similar size were reviewed. The gages are listed in Table 4, with flow data illustrated in Figure 15 Figure 16, Figure 17 and Figure 18.

Table 4: Instantaneous Flow Results

Gage Name, details	Gage Number	Trend in Historic Flow	P Value	R Squared
Old Swamp River near South Weymouth, MA 1967 – 2021, one nonstationarity detected by TST for 1988, not corroborated by any other tests. *Mean annual peak flow ~220 cfs*	1105600	Reducing by ~ 1 cfs (0.5 to 1.3) cfs/year. Not statistically significant	P = 0.23 to 0.54 No statistically significant trend.	0.018
Town Brook at Quincy, MA 1973-2013 12-year gap leaves two separate datasets, each too short for useful regression. *Mean annual peak flow ~340 cfs* *As with Smelt Brook, this site includes some regulation from an FRM structure.*	1105585	Reducing by 0.31 cfs/year. Not statistically significant	P = 0.711 No statistically significant trend.	0.005
Monatiquot River at East Braintree, MA 2006 – 2014 9-year total dataset too short for useful regression/translation. Screened out by the TST. *Mean annual peak flow ~600 cfs*	1105583	Reducing by 17.5 cfs/year. Not statistically significant	P = 0.753 No statistically significant trend.	0.015
Whitman's Pond Fish Ladder at East Weymouth, MA 2002 – 2014 13-year total dataset too short for useful regression/translation. Screened out by the TST. *Mean annual peak flow ~42 cfs*	1105608	Reducing by 1.76 cfs/year. Not statistically significant	P = 0.343 No statistically significant trend.	0.09

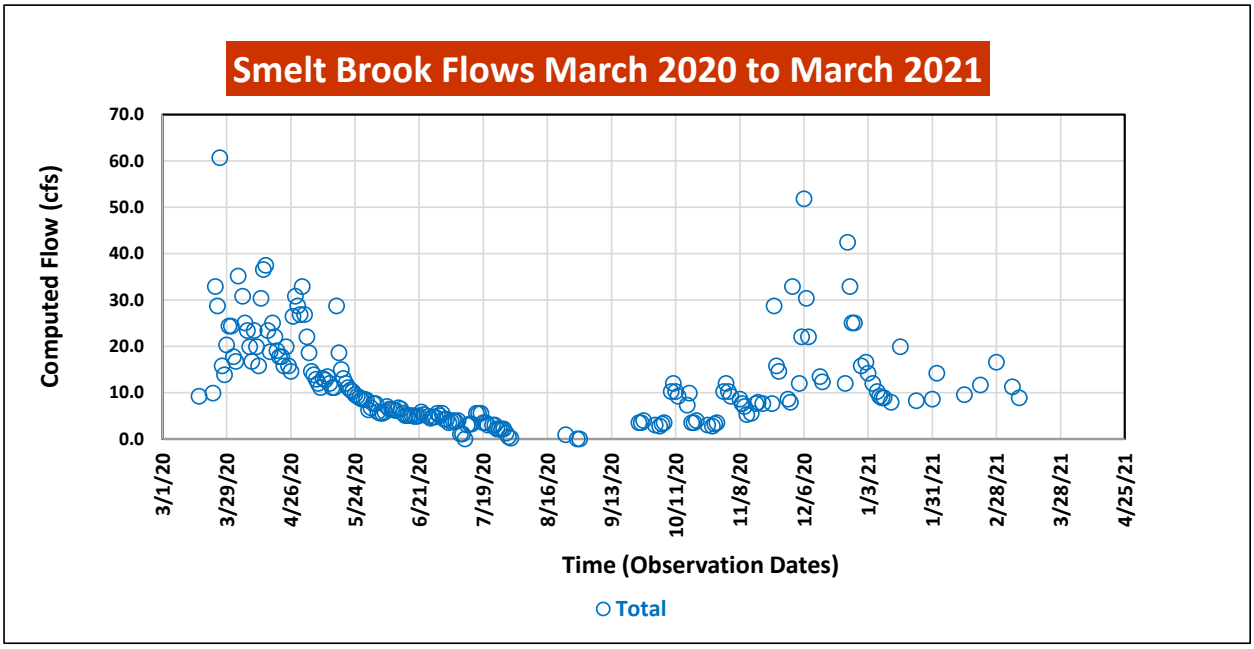


Figure 14: Smelt Brook Upstream of Weymouth Landing: Total Flow Observations March 2020 to March 2021.

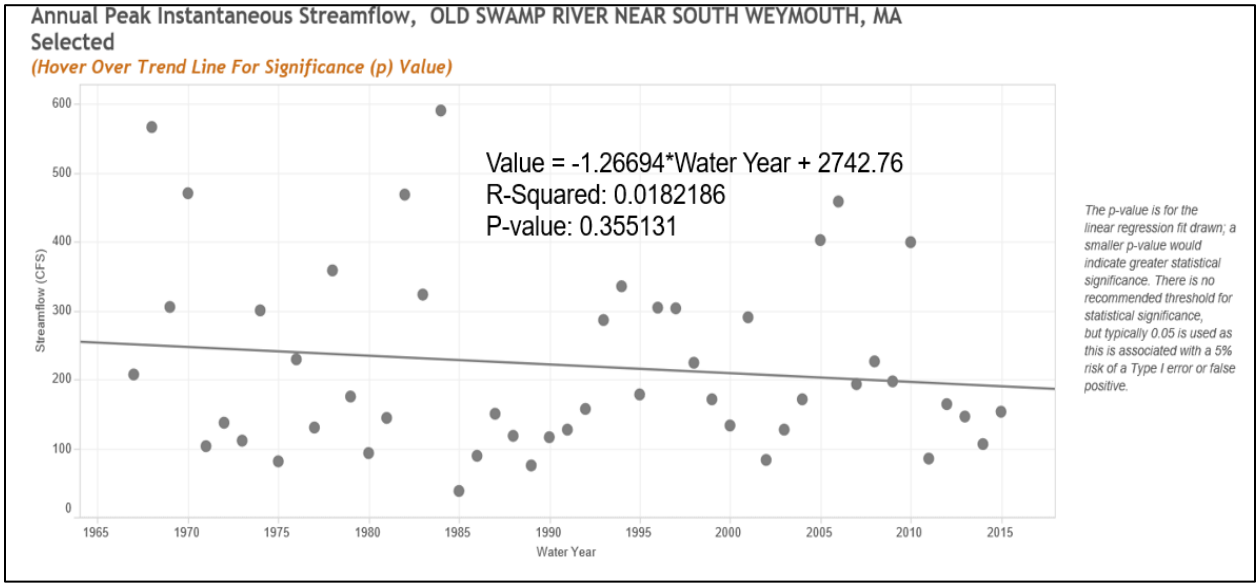


Figure 15: CHAT Result: Annual Peak Instantaneous Streamflow: Old Swamp River Near South Weymouth, MA

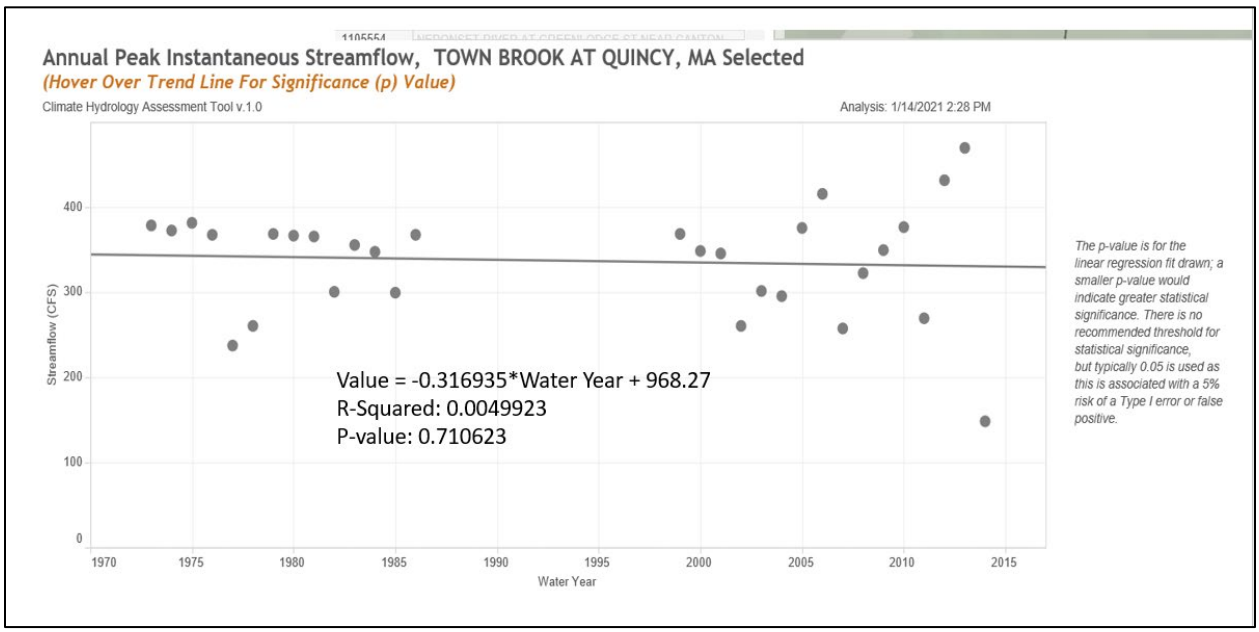


Figure 16: CHAT Result: Annual Peak Instantaneous Streamflow: Town Brook at Quincy, MA

Missing data on the gage on Town Brook, a nearby river in Quincy MA, renders the results of the CHAT analysis not meaningful when considering its entire period of record. The data gap indicates a high potential for change in measurement location, or method, and possibly changes in channel geometry that could be impacting the data. A significant trend (i.e., increase) for the annual peak flows was found for this gage (Figure 16) when considered its entire period of record; however, the missing data renders the results of the CHAT analysis not meaningful (p value greater than 0.05). If only the records before or after the missing data are analyzed, the two short records would exhibit less statistically significant results.

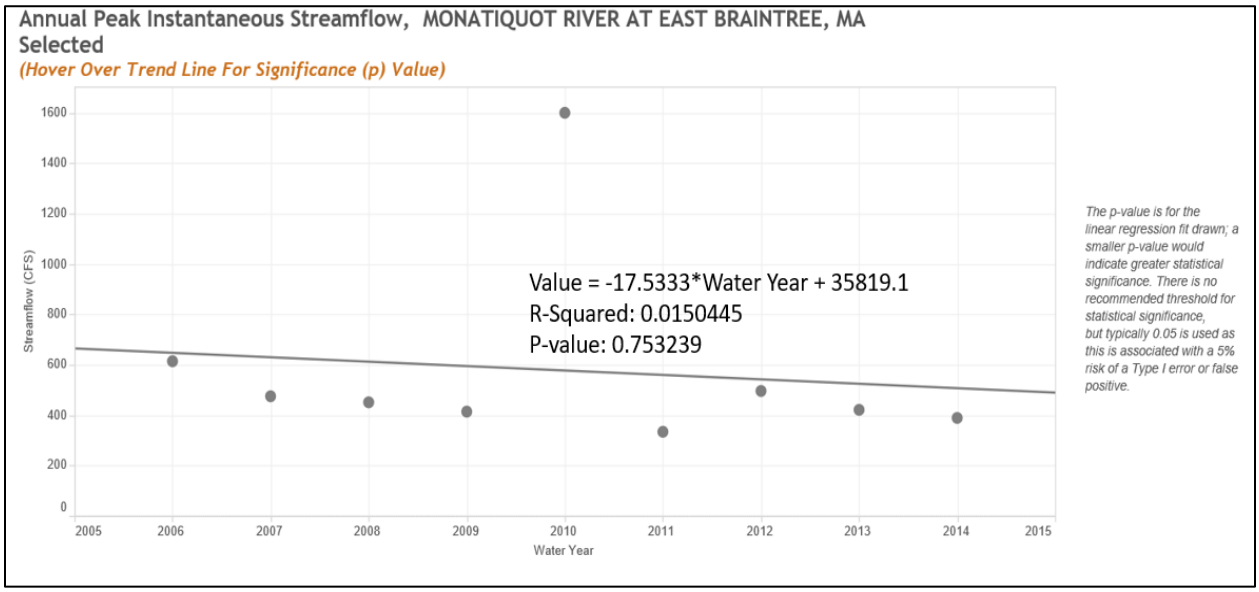


Figure 17: CHAT Result: Annual Peak Instantaneous Streamflow: Monatiquot River at East Braintree, MA – short data set with only 9 points: screened out by TST program.

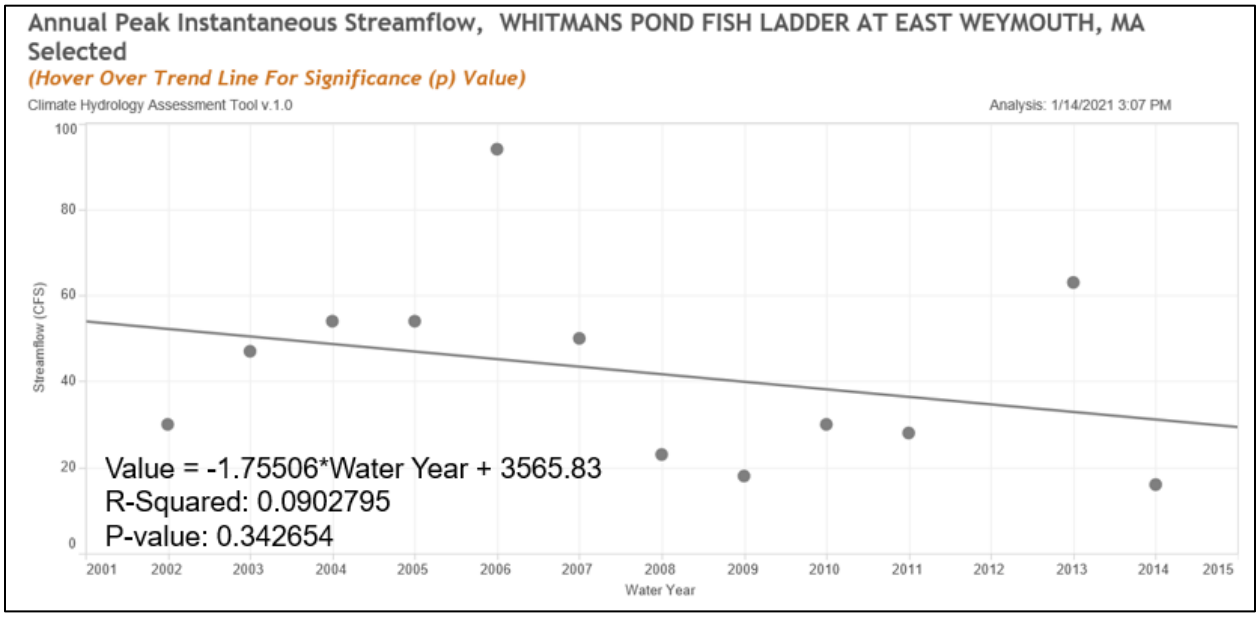


Figure 18: CHAT Result: Annual Peak instantaneous Streamflow, Whitman's Pond Fish Ladder at East Weymouth, MA – short data set only 12 points with 2 missing years: screened out by TST program.

CHAT analysis for annual peak instantaneous peak flows at similarly sized streams in the region demonstrated that there is not a statistically significant trend.

The CHAT tools for assessing hydrology on a HUC-4 level was used to assess projected climate-change hydrology for the Massachusetts-Rhode Island HUC 4 region (Figure 19), to perform statistical analysis for the mean of the projected annual maximum monthly streamflow records for the area. In contrast with the annual maxima, these results suggest a trend of projected increase in the annual maximum monthly streamflow.

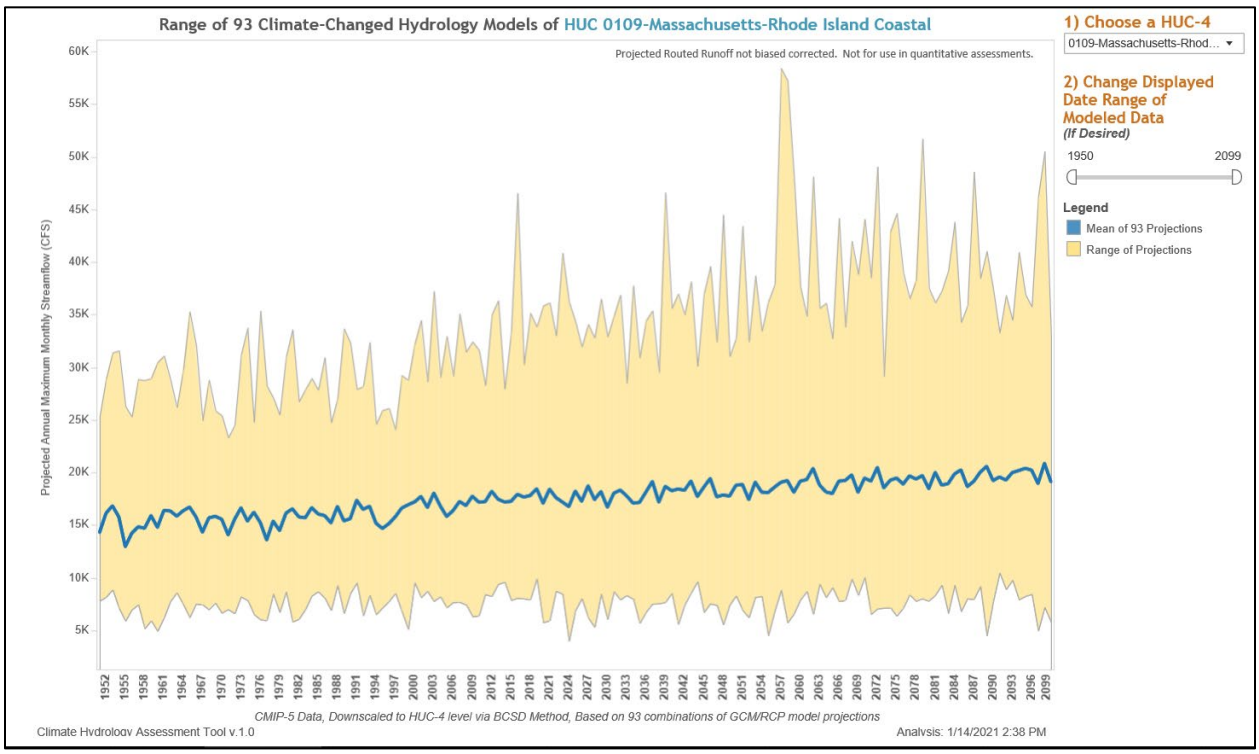


Figure 19: CHAT Result: Projected Annual Monthly Streamflow for Massachusetts-Rhode Island Coastal Region.

Stream Flow Analyses: Nonstationarity Detection Tool

The nonstationarity detection tool could not be used for this study because there are no USGS records in the watershed with an adequate record length. The one data set obtained had 51 weeks of record with 158 missing entries. Nevertheless, a clear image did emerge of high flows in the spring and again in early winter, with the least flow during the summer. The observation team reported that this was an unusually dry summer with 51 "dry" entries, although they noted that the stream does often run dry during the summer. They anticipated that the low flows were possibly due to increased groundwater pumping in the basin for new apartment buildings. At the same time, it is noted that there was a drought that appears to have ended during 2020.

Based on anecdotal evidence (increasing groundwater pumping since approximately 2001 and a drought that ended in 2020) it is not possible to state exactly how unusual the summer of 2020 was, or whether there is an underlying statistically significant trend.

The available basin-specific information was inadequate to establish definitively whether there were any nonstationarities in the record.

Vulnerability Assessment

A vulnerability assessment was conducted using the Civil Works Vulnerability Assessment Tool (https://maps.crrel.usace.army.mil/projects/rcc/portal.html). The HUC-4 for the Massachusetts-Rhode Island coastal region is 109 and it is located within the New England District (NAE), which is part of the North Atlantic Division (NAD). Figure 20 shows a reference map of the HUC-4 watershed by District. Figure 21 and Figure 22 show the WOWA scores for the four scenarios, for the ecosystem restoration and flood risk reduction business lines. Figure 23 to Figure 26 show the output (screen capture) of the Vulnerability Assessment Tool (VA Tool) for the four scenarios. However, it is important to note that it still can be vulnerable at a local level particularly due to possible flood magnification changes in the future.

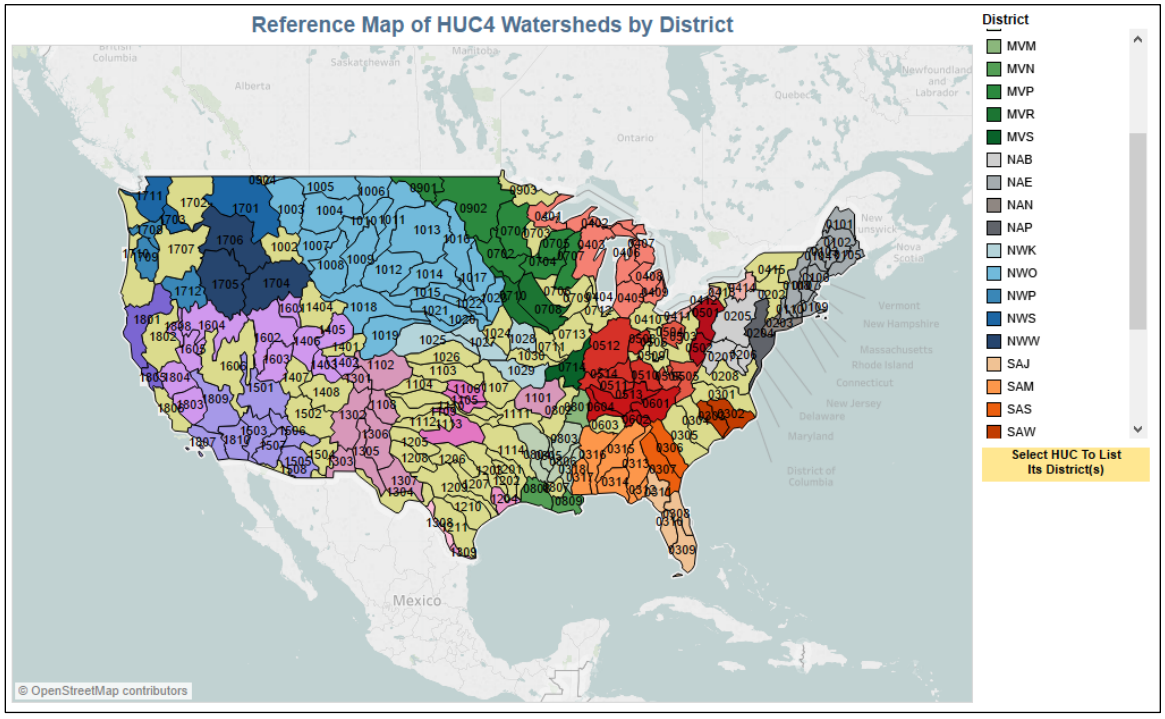


Figure 20: Reference Map of HUC4 Watersheds by District

The VA Tool assessed the likely future conditions in the HUC-4 region, based on expected changes under a range of atmospheric emissions assumptions to develop the likely conditions for the years 2050 and 2085. Ranked against expected conditions in other HUC-4 regions, the condition with respect to the "ecosystem restoration" business line was ranked below the level where it would be in the top 20% of USACE HUC-4 regions (not in the greatest vulnerability group). Similarly, for the "flood risk management" business line, the HUC-4 did not fall in the high-vulnerability group. These assessments are based on HUC-4-wide groupings of many factors, and should be translated to the site-specific location with caution. A single new species, or a change in land use (different crops or increased urban development), might mean that site-specific changes will cause the actual vulnerability to differ from the tool's assessment for the Massachusetts-Rhode Island Coastal HUC-4.

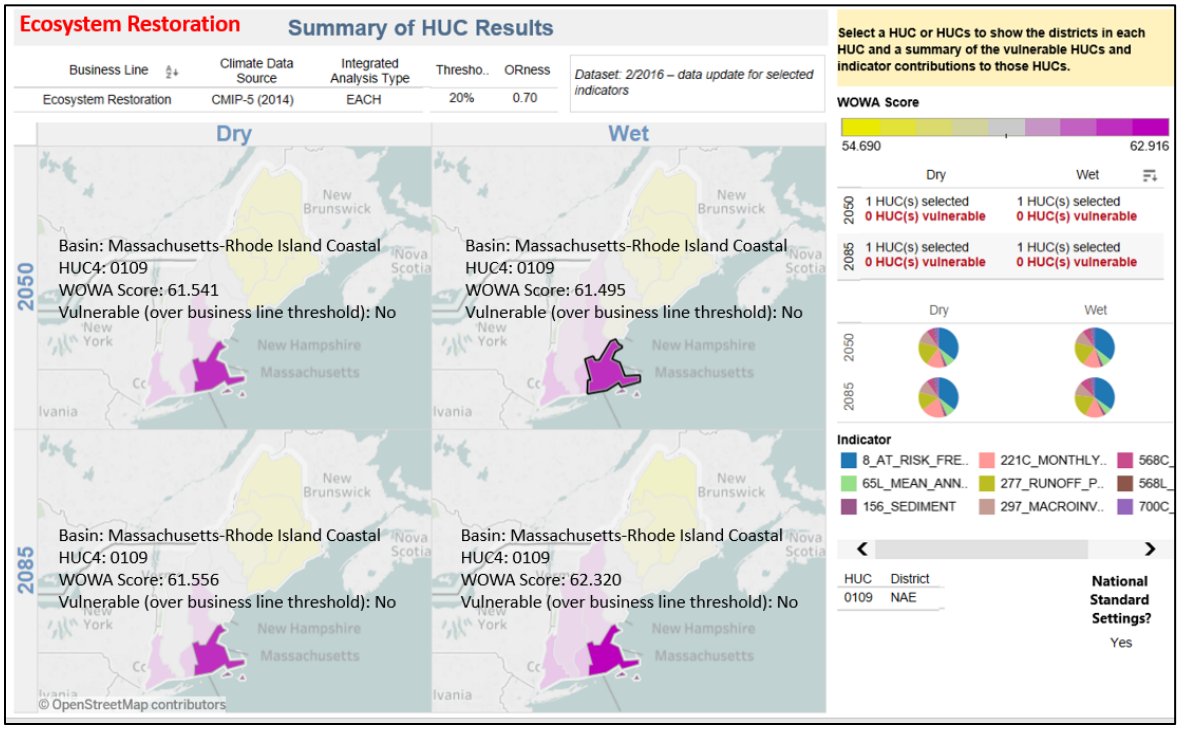


Figure 21: WOWA Scores (Ecosystem Restoration Business Line)

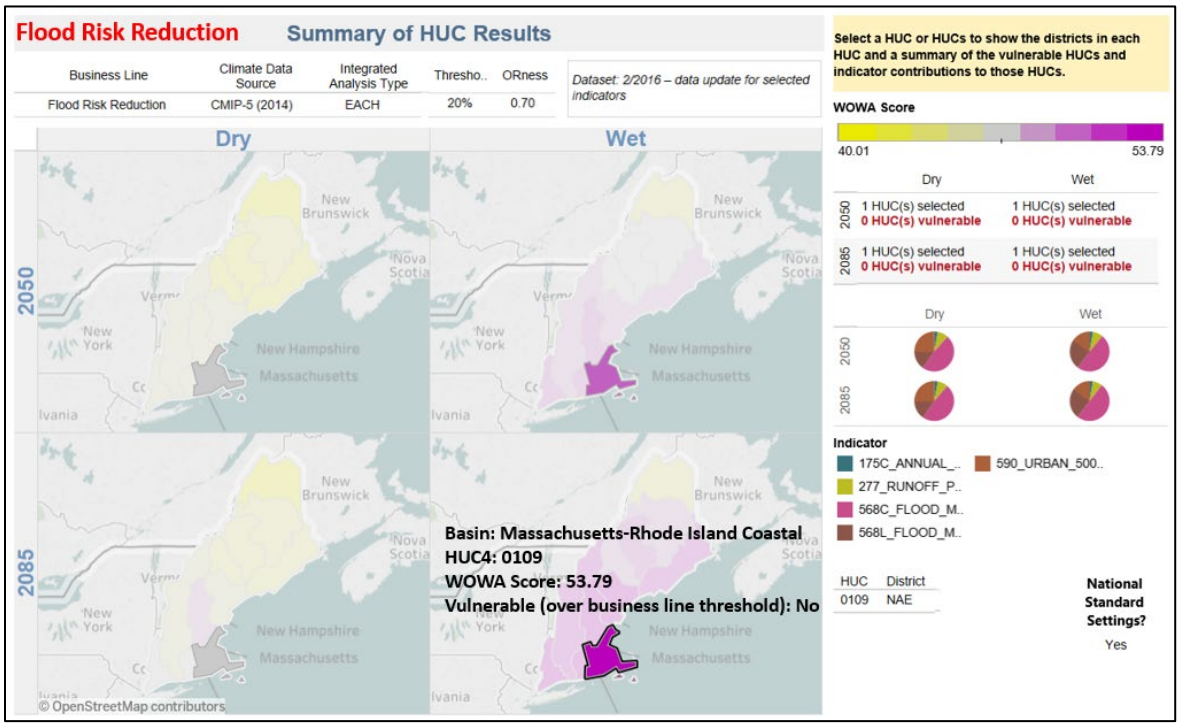


Figure 22: WOWA Scores (Flood Risk Reduction Business Line)

The VA Tool was used to examine likely vulnerabilities to the full suite of seven business lines.

The seven business lines reviewed were:

1. Flood Risk Reduction
2. Ecosystem Restoration
3. Recreation
4. Regulatory
5. Navigation
6. Water Supply
7. Emergency Management

For each, a green symbol was returned, for both the 2050 and the 2085 epochs. These less detailed reviews are summarized in Figure 23 through Figure 26. The tool separated projected results into WET and DRY sections, but the results for this "at a glance" review were essentially the same for all four sets of results: green symbols (or "not vulnerable") for all seven business lines. The same cautions that were mentioned for flood risk and ecosystem restoration apply: that future changes in how the HUC develops, or how the site varies from the HUC-wide summary, may mean that the VA tool's assessment may not apply for the HUC, or for the Smelt Brook site, relative to the expected condition of the rest of the USACE portfolio at the selected future dates.

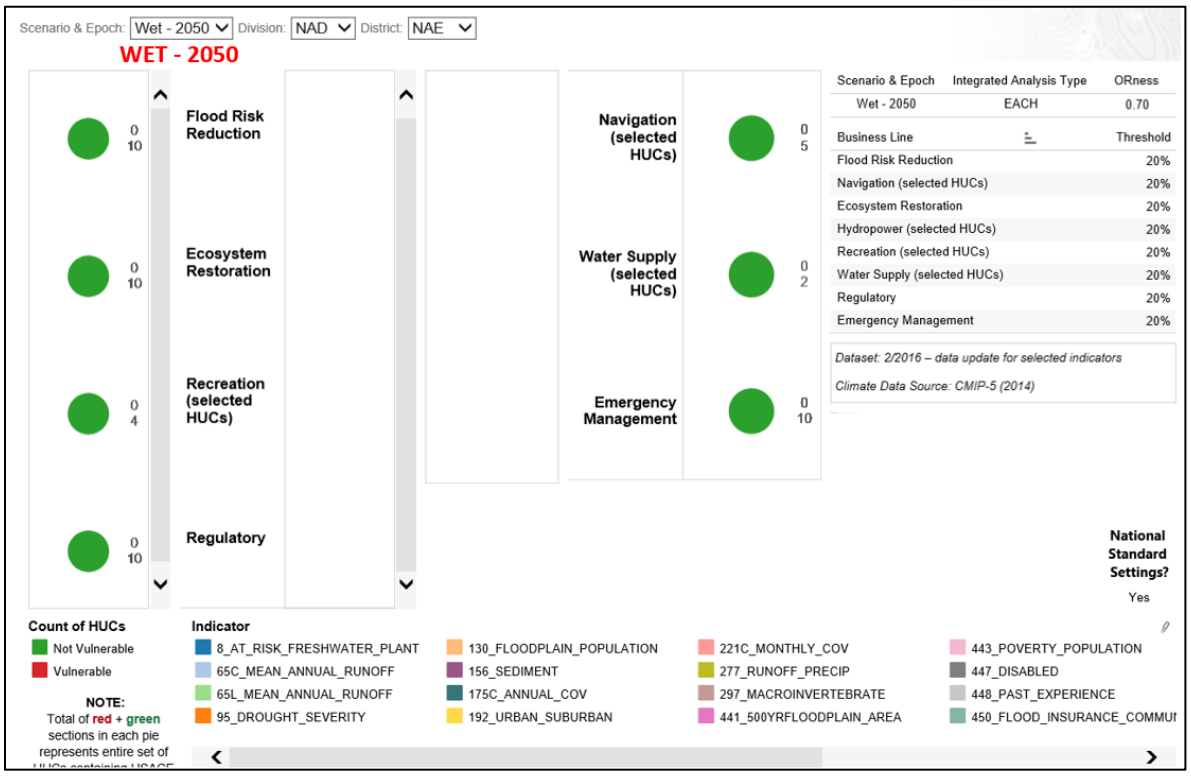


Figure 23: Business Line Details: Scenario Wet 2050

Figure 24: Business Line Details: Scenario Wet 2085

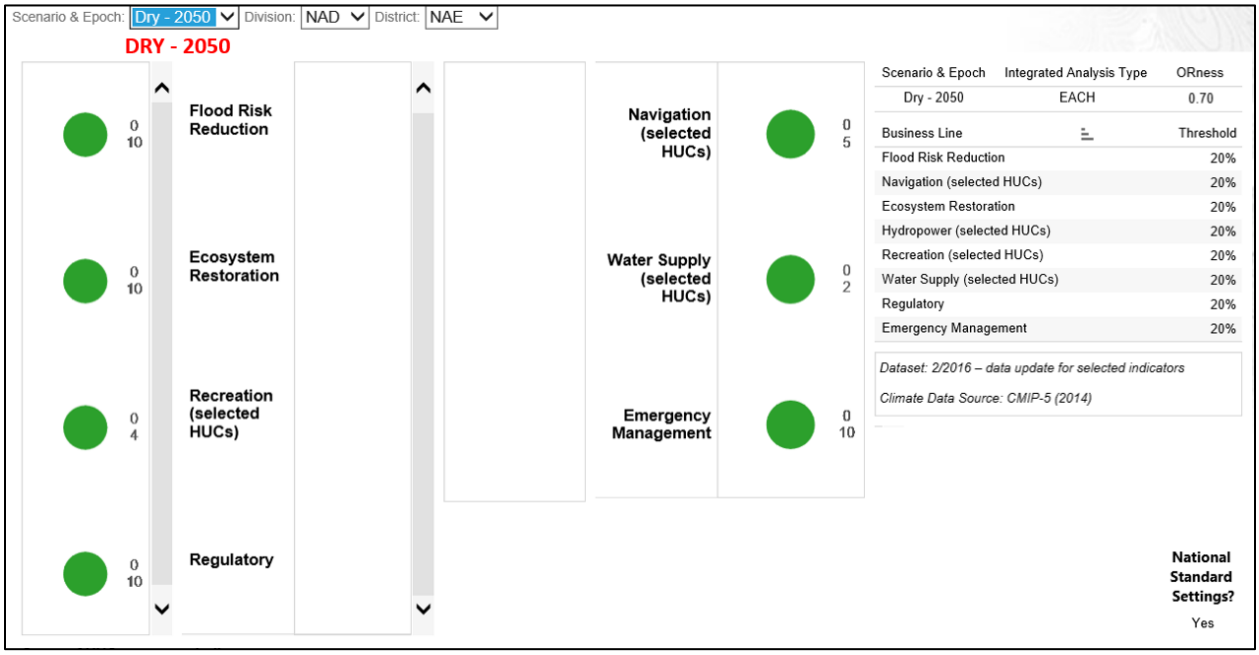


Figure 25: Business Line Details: Scenario Dry 2050

Figure 26: Business Line Details: Scenario Dry 2085

Incorporation of Climate Assessment Findings

The USACE literature review noted that Northern New England may have experienced either no increase or a decrease in both average and extreme precipitation. The trend analysis in the HUC for rivers of similar-size indicated that the annual instantaneous peak flows appeared to be decreasing, while the monthly average peaks appeared to be increasing year-over-year. Based on this information there is not sufficient information to make an informed projection that the future condition of the project differs from present annual peak flow conditions used in the frequency analyses in this study.

The nonstationary detection tool was not utilized for the basin because there were no USGS data sets in the basin itself. There is one 51-week data set of 200 readings. It included 51 notes of "dry", which the observing team attributed to groundwater pumping for recently developed apartment buildings in the basin; but it should be noted that the observations began during a drought that broke during the observation period. Therefore, the flow frequency analyses incorporated could not be used with confidence to establish any flow trends in the Smelt Brook basin.

The literature review indicates that increases in peak streamflows should be expected. The CHAT analyses located nearby sites for which the opposite seemed to be holding true with respect to observed peak flows, although the data generated results with trends that had significance values vastly greater than $p=0.05$ (confidence much less than 95%). Site-specific data has been generated but only one year's worth of data, not calibrated, was available at the time of writing, and even 10 years of data would not be considered acceptable to indicate any trends with respect to extreme flows (whether stormflows or droughts). The CHAT did indicate that the annual peak of the mean monthly flow in the HUC-4 region was projected to increase over time. Given the uncertainty over whether to expect increasing or decreasing flows in a stream with significant upstream storage, the confidence associated with the streamflow data was limited.

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SMELT BROOK
SECTION 1135 AQUATIC ECOSYSTEM RESTORATION

APPENDIX A3
Habitat Analysis

Smelt Brook Section 1135 Restoration Project
Habitat Analysis

March 22, 2022

Prepared by
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Smelt Brook Section 1135 Restoration Project
Habitat Analysis

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Introduction

This report documents the habitat analysis performed by the New England District of the Corps of Engineers for the Smelt Brook, Massachusetts. The habitat analysis evaluates alternatives for restoring reproductive habitat on Smelt Brook for the Rainbow smelt (*Osmerus mordax*) and other diadromous species, such as Blueback herring (*Alosa aestivalis*) and American eel (*Anguilla rostrata*). Rainbow smelt and other diadromous species presence and reproductive capacity within Smelt Brook have declined significantly since the construction of the Smelt Brook Local Protection Project in 1974 (ACOE, 1976; Chase and Childs, 2001; Chase 2006). The Local Protection Project involved construction of a small concrete dam and outlet works at Pond Meadow Lake that maintains a permanent lake of 19 acres; an earth fill dike 300 feet long and five feet high adjacent to Pond Meadow Lake; widening, deepening, and straightening 800 feet of the channel at the lower end of Smelt Brook near the Monatiquot River; and a 1,140-foot long reinforced concrete conduit eight feet in diameter that conveys Smelt Brook through Weymouth Landing's business district (Figures 1, 2 and 3). The USACE flood control structures obstruct upstream migration to historic spawning habitat for Rainbow smelt and fish passage for other diadromous species. The result is the loss of reproductive potential for Rainbow smelt and other species.

Assessments done in 1988-1990 and other observations suggest that Rainbow smelt populations within the Fore River have the potential to re-occupy reaches of Smelt Brook, previously used by adult Rainbow smelt for spawning purposes (Chase and Childs, 2001). Between late February and late May, adults migrate into the Smelt Brook to deposit eggs. Spawning begins in late February to March and may continue through the end of May. Eggs are negatively buoyant and sink and attach to the benthic substrate. After spawning, adults return to the deeper waters, such as the estuarine habitat of the Fore River.

Surveys conducted by the State of Massachusetts Division of Marine Fisheries between 1988 and 1990 indicate that smelt spawning primarily occurred within the Monatiquot River, with a minor amount of spawning observed within Smelt Brook (Chase and Childs, 2001). Sedimentation, stormwater runoff, and the flood control structures limit spawning success within Smelt Brook. Chase and Childs describe egg deposition at the downstream opening of the USACE culvert as, "light and intermittent" within the reach of river between the sluice gate and 8-foot culvert and plunge pool, with highest densities of eggs deposited at the railroad embankment (Chase and Childs, 2001).

Modifications to Smelt brook have had consequences for other diadromous species and have also impeded fish passage to spawning habitat above the existing flood control system. Other species that have been observed in the Fore river that may migrate to spawning habitat in Smelt Brook include alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestrivalis*) and American eel (*Anguilla rostrata*). Observations of these species during the April to May spawning run in the Fore River suggest improvements to the fish passage within Smelt Brook may benefit these species, as well as Rainbow smelt (Chase, 2006).

Figure EA-2
Smelt Brook Local Protection Project
Weymouth & Braintree, Massachusetts

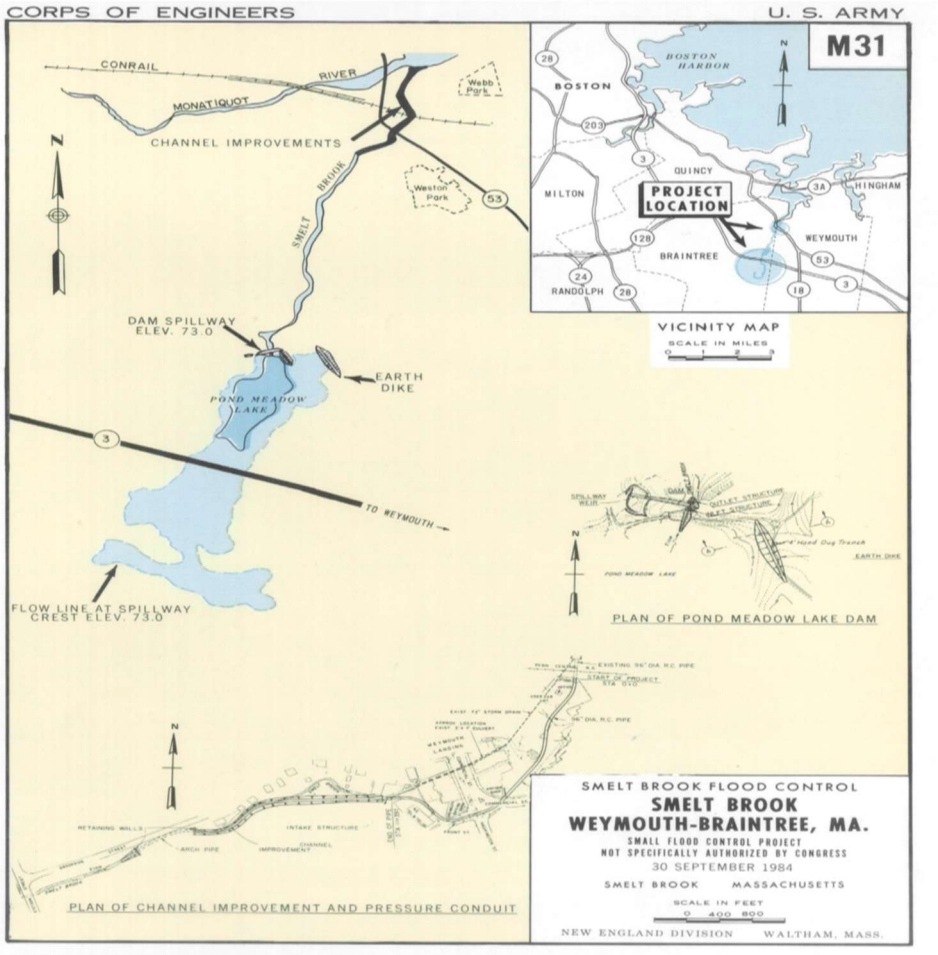


Figure EA-3
Smelt Brook, Pond Meadow Pond (lake) and the Landing

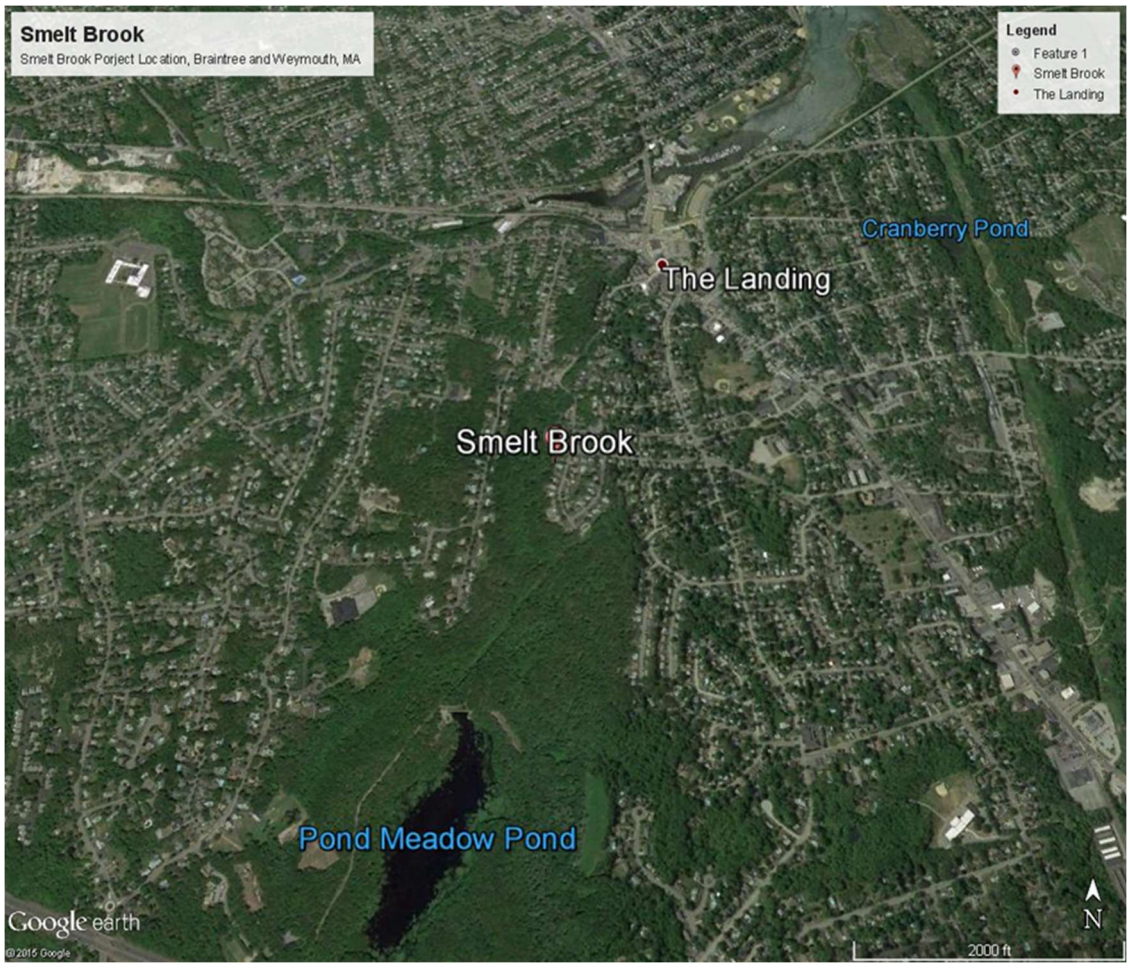
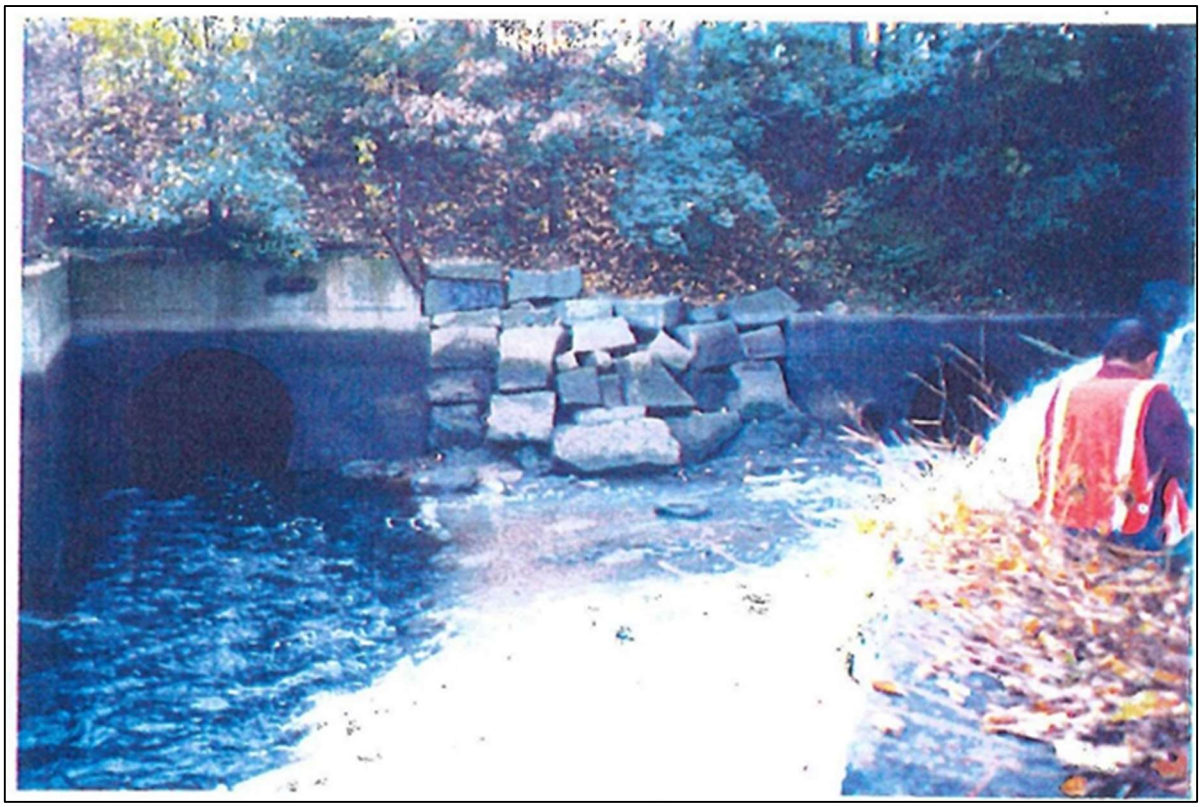


Figure EA-4 –.
72-inch culvert that rainbow smelt use to access spawning ground



Environmental Quality Goals and Objectives

The purpose of this document is to display and evaluate the fish passage and reproductive habitat benefits for the Rainbow smelt of each of the various restoration alternatives for the project. The habitat analysis associated with an alternative is the additional benefit of reproductive capacity for Rainbow smelt in terms of added habitat to support adult spawning and juvenile nursery. The information generated in this assessment will help to identify the best restoration alternative.

Fish and wildlife resources may have both economic and ecological value. The Army Corps of Engineers guidance for performing habitat analysis describes fish and wildlife resources within the project area. Fish and wildlife resources with substantial non-monetary, ecological value are defined as Environmental Quality (EQ) resources. This incremental analysis displays the EQ outputs of alternative plans.

The New England District of the U.S. Army Corps of Engineers (Corps) is working with the Weymouth Braintree Regional Recreation Conservation Districts (WBRRCD) to

restore anadromous fish passage in the Smelt Brook tributary to the Weymouth-Fore River in the towns of Weymouth and Braintree, MA in September.

An array of alternatives (*i.e.*, six alternatives) were considered with only two plans (*e.g.*, No Action and Alternative B) carried forward to restore anadromous fish passage in Smelt Brook and throughout the Weymouth Fore River watershed which was adversely impacted through the construction of the Smelt Brook Local Protection Project (LPP) in the mid-1970s. The LPP involved construction of a small concrete dam and outlet works at Pond Meadow Lake that maintains a permanent lake of 19 acres; an earthfill dike 300 feet long and five feet high adjacent to Pond Meadow Lake; widening, deepening, and straightening 800 feet of the channel at the lower end of Smelt Brook near the Monatiquot River; and a 1,140-foot long reinforced concrete conduit eight feet in diameter that conveys Smelt Brook through Weymouth Landing's business district.

The Corps concluded during the initial appraisal that an aquatic ecosystem restoration under the §1135 authority is in the Federal interest. There are feasible opportunities to improve aquatic habitat for anadromous fish, including rainbow smelt (*Osemerus mordax*), which is listed by the National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries) as a Species of Concern.

To access additional spawning habitat upstream, smelt must enter a 72-inch diameter culvert (Figure 4) and swim through several hundred meters of pipe and stone box culverts, which pass under a railroad embankment, parking areas, roadways, and several businesses in Weymouth Landing. A second 96-inch diameter culvert carries flood control waters a similar underground distance and discharges 7.6 meters east of the 72-inch culvert. As part of the Smelt Brook LPP, a sluice gate was included to allow smelt to pass upstream from the 72-inch culvert to an upper 800-meter, channelized section of the brook, which offers good spawning habitat. The sluice gate is raised approximately 0.3 meters from early February and closed at the end of May each year by rangers of the Pond Meadow Park to allow smelt access. When the sluice gate is not opened, the brook's flow is forced though the flood control pressure conduit and out of the 96-inch diameter culvert.

Approximately 800 meters of brook exist between the sluice gate and a perched culvert upstream. The perched culvert was a feature that was added to the LPP after design and is not included in any of the original design plans. It was included to decelerate the flow of water as the brook curves around a bend and nears the backside of several residential properties. According to Pond Meadow Park Ranger, Sean Cleaves, smelt eggs have been observed covering the rocky substrate throughout that 800 meter stretch up to the perched culvert (S. Cleaves, personal communication, November 2015). Upstream of the perched culvert, approximately 1 mile of suitable rainbow smelt spawning habitat exists. The dam at Pond Meadow is located at the end of the mile and prevents fish from accessing the Pond or migrating further upstream.

Goals and Objectives

Prior to beginning a restoration project, it is important to establish and agree on the goals and objectives. These statements form the basis of project design and evaluation and are the basis for developing performance criteria for project monitoring and success evaluation. Goals refer to the target characteristics to be restored, such as suitable fish passage for Rainbow smelt and other diadromous fish species. Objectives are more precise, such as the specific characteristics of nesting substrate to be achieved or the density of vegetation for the nesting habitat. Performance indicators, such as the acreage of reproductive habitat, are developed and applied to a monitoring plan to quantitatively determine the success of the project in meeting its goals. The goals and objectives for the Smelt Brook Restoration project area outlined below.

Project Goals

- Increase spawning potential for Rainbow smelt in the downstream area, approximately 4,850 square feet or 0.11 acres, between the floodgate and the 8-foot culvert to support increased numbers of Rainbow smelt.
- Restore fish passage through the 300-foot long 8-foot culvert that supports Rainbow smelt and other diadromous species migration to upstream areas and to the Pond Meadow.
- Restore spawning habitat for the reach of stream, approximately 27,900 square feet or 0.64 acres, above the 300-ft long, 8-ft culvert for Rainbow smelt.
- Avoid impacts to riparian resources to the maximum extent practicable throughout Smelt Brook.
- Avoid impacts to benthic stream habitat.
- Avoid impacts to established Rainbow smelt spawning habitat.
- Avoid impacts to structures related to the flood control project.

Project Objectives

- Fish passage ladder should be structured to support the weak swimming Rainbow smelt and accept 1 to 2 cubic feet per second (cfs) during dry periods and up to 3.3 cfs through the pools during spring migration periods.
- Elevation of fish ladder weirs to next pool should be 22.5 National Geodetic Vertical Datum (NGVD).
- Fish ladder weir system with Manning flows along the unaffected banks then the design storm passes approximately 90 cfs over the weir and 1940 cfs over the banks and through the “undeveloped” half of the stilling basin. This leads to a total flow of 2030 cfs before the water level reaches 24 ft NGVD in a 42-ft-wide total channel. This flow requirement of 600 cfs is therefore satisfied.
- Provide cobble material in each weir similar to the existing stream bed.

Units of Measurement and Habitat Requirements

Considerations

Once the project goals and objectives are established and alternative means of achieving them are formulated, the units of measurement must be determined. The existing environmental resources at Smelt Brook are reproductive habitat for adult Rainbow smelt to spawn and nursery habitat for eggs to mature. The spawning timeframe is approximately from the middle of March to the middle part of May, with peak egg deposition occurring in mid-April (Chase, 2006).

At Smelt Brook, the spawning habitat of the anadromous rainbow smelt exists between the flood gate and the 8-foot culvert, a length of about 600-feet, or about 4,850 square feet (0.11 acres). Spatial and biological information was collected in 1988-1990 by the State of Massachusetts Department of Marine Fisheries. These data suggest that fisheries for rainbow smelt have declined over the past 30 years as a consequence of lower populations within Massachusetts Bay. Obstructions to fish passage and habitat degradation are considered the primary contributing factor to the species population decline. Smelt brook has been altered significantly over the last 50 years due to human-related development in the area, including flood control modifications in 1975. Also, DMF reports that the discharge of raw sewage continues to be an issue in Smelt brook and reduced water quality conditions have had a negative consequence for rainbow smelt.

The goal of this project is to increase reproductive habitat in Smelt brook to support increased numbers of Rainbow smelt. This project seeks to minimize impacts to stream habitat in the achievement of the project goal and to minimize long-term impacts to associated fish and wildlife resources. The environmental effects of the Alternative A and B are described in detail in the Environmental Assessment.

Habitat Requirements

Rainbow Smelt

Rainbow smelt is a small anadromous fish that occurs ranges from Newfoundland to Massachusetts bay. Smelts mature in coastal waters and use coastal rivers and streams for spawning habitat during spring period. Smelt fidelity to natal rivers is presumably high. Smelt are about 25 centimeters in length and longevity is about 5 years (Murawski and Cole, 1978). Fertilized eggs are negatively buoyant and adhere to substrates comprised of rocks, cobble, and algae. Estimates of fecundity suggest that between 33,000 and 70,000 eggs are release by middle aged (2-3 year old) smelt (Clayton, 1976). The population status of Rainbow smelt in Massachusetts is uncertain as there are no ongoing or even recent assessments of either fisheries or regional populations (Chase, 2006). For example, commercial landings of Rainbow smelt amounted to about 163 metric tons in 1966 and as of 1988, were reduced to about 1.3 metric tons (NOAA, 2004). NOAA suggests that primary cause for the reduction in the Rainbow smelt population is the loss of reproductive habitat

due to watershed alterations and obstructions to fish passage and degradation of spawning habitat.

Units of Measurement

Access to reproductive habitat located upstream of the 8-foot culvert in Smelt brook for Rainbow smelt will depend upon installing a fish passage structure in the stilling basin that is support migrating fish from the stream bed to the edge of the 8-foot Culvert, which is a gain in height of approximately 4-feet. The fish passage structure needs to account for the weak swimming capacity of Rainbow smelt. Chase (2006) suggests that observations of stream velocity is a limiting factor to the upstream migration for Rainbow smelt, as well as egg survival. Stream velocities of 1.2 meters per second or greater may limit passage of average sized adults (Chase, 2006). Optimal stream velocities of between 0.5 to 0.8 m/s induce spawning and support high egg survival. Construction of a fish passage structure that meets the velocity requirements for Rainbow smelt is critical to ensuring most adult spawning fish migrate above the 8-foot culvert structure. Currently, reproductive habitat is limited to about 4,850 square feet or 0.11 acres. The installation of an effective fish passage structure would realize a gain in an additional 27,900 square feet or 0.64 acres of reproductive habitat for Rainbow smelt. There is no recent data available to estimate the abundance of Rainbow smelt in Smelt Brook. Therefore, success can only be evaluated in terms of successfully passing spawning adults upstream during the spring migration period.

Environmental Plan Increments and Project Analysis

Alternative A - No Action (Without Project Conditions)

The guidance for performing habitat analysis requires a prediction of the Without Project Condition. The Without Project Condition (also known as No Action Alternative) predicts site conditions in the future without the project and is the basis for the evaluation of the action alternatives. Under the Without Project Condition, the Rainbow smelt population would remain limited to the existing 4,850 square feet of reproductive habitat downstream of the 8-foot culvert and not have access to historical habitat for spawning, nursery, and juvenile maturation. Furthermore, the species would remain at risk of reduced reproductive habitat potential, a limiting factor in population growth.

Alternative B –Ladder on One Side of the Stilling Basin

Alternative B involves restoring the fish passage through the 8-foot culvert and upstream to historical spawning grounds between the culvert and the Pond Meadow Lake. The historic reproductive habitat upstream of the culvert would offer substantial area for Rainbow smelt to the increase the specie's population in this stream and potentially contribute to the Rainbow smelt population in Massachusetts bay. Under this alternative, the area of suitable reproductive habitat would improve by expanding the existing reproductive capacity from 4,850 square-feet below the 8-foot culvert by adding an additional 27,900 square-feet (0.64 acres) for a total about 32,750 square-feet (0.75 acres) of reproductive habitat in Smelt Brook

Table 1 – Reproductive Habitat Assessment Analysis for Rainbow Smelt in Smelt Brook by Alternative

Alternatives	Acres of Suitable Reproductive Habitat in Smelt Brook	Total/Combined Acres of Suitable Reproductive Habitat
Alternative A No Action	0.11(Existing, between flood gate and below Culvert)	0.11
Alternative B Revetment Restoration	0.64 (Historic upstream of Culvert)	0.75 (Existing 0.11 + Historic Passage 0.64)

Recommendation

The Habitat Assessment Analysis provides information to consider in selecting a project alternative among the two alternatives considered. Table 1 summarizes the information generated in this analysis. Alternative A, the No Action Alternative, would result in no additional reproductive habitat, beyond the existing conditions, for Rainbow smelt over time. However, Alternative B, would pass Rainbow smelt upstream, above the existing 8-foot Culvert to historic reproductive habitat, resulting in an additional 0.64 acres for a total 0.75 acres of reproductive habitat. Alternative B is the recommended plan.

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SMELT BROOK
SECTION 1135 AQUATIC ECOSYSTEM RESTORATION

APPENDIX A4
Monitoring and Adaptive Management Plan

Smelt Brook Local Protection Project
Section 1135 Environmental Restoration Project

Monitoring and Adaptive Management Plan

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1.0 Introduction

This Monitoring and Adaptive Management Plan has been developed for the planned modification of Smelt Brook Local Protection Project (LPP) Section 1135 Environmental Restoration Detailed Project Report/Environmental Assessment in Weymouth and Braintree, Massachusetts. Section 2039 of Water Resource Development Act (WRDA) 2007 (as amended by Section 1161 of WRDA 2016) directs the Secretary of the Army to ensure, when conducting a feasibility study for a project (or component of a project) under the U.S. Army Corps of Engineers (USACE) ecosystem restoration mission, that the decision document include a monitoring plan to measure the success of the ecosystem restoration and to dictate the direction adaptive management should proceed, if needed. The purpose of this monitoring plan is to measure the success of the Section 1135 project. The procedure in this plan will be performed by or under the guidance of the U.S. Army Corps of Engineers, New England District. The plan is intended to measure and ensure achievement of the goals and objectives established during planning. It is intended to be flexible to allow readjustment as new information and conditions develop.

Section 1161 of WRDA 2016 also directs USACE to develop an adaptive management plan for all ecosystem restoration projects. The adaptive management plan must be appropriately scoped to the scale of the project. The information generated by the monitoring plan will be used by the New England District in consultation with the federal and state resources agencies and the USACE North Atlantic Division (NAD) to guide decisions on operational or structural changes that may be needed to ensure that the ecosystem restoration project meets the success criteria.

Goals and objectives formulated during the early planning of the project are the basis for the establishment of monitoring criteria. Performance indicators are specific, measurable quantities such as pH, amount of chlorophyll in a water sample, or Secchi disk visibility. The goals, objectives and performance criteria for this project are specified in this document.

1.1 Project Goal

Restore access to the river reach within the LPP to support the reproduction of rainbow smelt and other diadromous fish.

1.2 Objectives

1. Restore upstream and downstream passage for rainbow smelt at the culvert and stilling basin.

2. Rainbow smelt utilize habitats upstream of the culvert and still basin for spawning.

3. Fishway maintains biological design characteristics of the target species.

4. Modification does not alter the ability to fulfill the authorized project purposes.

2.0 Project Area Description

Smelt Brook is located within the Monatiquot River-Frontal Quincy Bay watershed (Hydrologic Unit Code 010900010901) and forms a portion of the boundary between the towns of Braintree and Weymouth, in Norfolk County, Massachusetts. It is a relatively small second order stream that converges with the Monatiquot River in an area commonly referred to as Weymouth Landing. Here, it becomes the Weymouth-Fore River and flows into both Hingham Bay and Quincy Bay south of Boston.

Smelt Brook LPP includes an arched culvert that conveys flow underground for approximately 200 feet before discharging the channel flow 7.5 feet above a stilling basin floor through a perched culvert where hydraulic energy is dissipated (also known as a "plunge pool"). The perched culvert blocks the passage of rainbow smelt (*Osmerus mordax*) and other diadromous species from traveling upstream to suitable spawning habitat. The recommended plan involves the construction of a fishway that consists of a fish ladder on one side of the stilling basin of the perched culvert.

3.0 Monitoring Protocols

3.1 Objective 1:

Restore upstream and downstream passage for rainbow smelt and other diadromous fish at the perched culvert and stilling basin.

Success Criteria:

Rainbow smelt and other diadromous fish are observed using the fish ladder within the plunge pool of the culvert.

Monitoring Procedure:

To determine presence and count of diadromous fish species, an observer at the fish ladder will record upstream and downstream fish movement counts for four hours, one day a month during the migration season, between March and May.

3.2 Objective 2:

Rainbow smelt utilize habitats upstream of the culvert and still basin for spawning.

Success Criteria:

Fish eggs are observed and counted upstream of the culvert and stilling basin.

Method:

Smelt egg trays will be placed at suitable smelt spawning riffles upstream of the culvert during the spawning season. The egg trays are wood framed and filled with sphagnum moss held in place by a wire screen and weighted to hold on the rivered bed. The wire screen provides 288 cells where smelt eggs can adhere to the moss. There will be at least one tray placed upstream of the culvert and one placed downstream to provide the opportunity for comparison.

The trays will be deployed during the second week of March and checked one day a week for nine weeks, until early May. Random cell numbers will be generated for each egg tray to count eggs to estimate random stratified egg densities from 5% of the cells (16 cells per egg tray). Rainbow smelt eggs will be counted and categorized by total eggs, dead eggs, and eyed eggs with egg identification based on diameter and adhesive properties with assistance from a qualified fish biologist. The counts will be extrapolated to provide estimate rainbow smelt spawning above and below the culvert and stilling basin. This will be performed for at least one-year post-construction.

3.3 Objective 3:

Fishway maintains the biological design characteristics of the target species.

Success Criteria:

Water velocities through the fishway will be adequate for rainbow smelt during the spawning season.

Method:

During the migration and spawning season of rainbow smelt, water velocities at weir openings within the fishway will be measured, using a current meter. The measurements will occur during each visit to the culvert and stilling basin in conjunction with the spawning monitoring/egg counts (one day a week for nine weeks between mid-March and May). The maximum water velocity of weir openings for rainbow smelt passage is 3.25 feet/second.

3.4 Objective 4:

Modification does not alter the ability to fulfill the authorized project purposes.

Success Criteria:

The LPP is operated and maintained to its specified purposes and requirements.

Method:

USACE will inspect the culvert and fishway to identify structural or maintenance

concerns at least once a year following construction. Any debris or other materials that would impede the movement of fish or water would be removed. Damage to the fish ladder or flood protection structures will be noted, photographed, and repaired. The LPP will continue to be inspected based on the requirements of its Operating and Maintenance manual to ensure its operation is meeting the authorized project purposes.

4.0 Adaptive Management

Objective:

In the face of uncertainty, adaptive management strategies will be implemented to maintain the viability of the fish ladder to restore passage of rainbow smelt and other diadromous fish to the upper reaches of Smelt Brook.

Success Criteria:

Rainbow smelt are migrating and spawning upstream of the perched culvert while maintaining the authorized purposes of the LPP.

Methods:

If the fish ladder fails to retain its designed structure or achieve its designed function, the following adaptive management procedures will be implemented.

Failure condition	**Adaptive Management Procedure**
Debris gathering within the structure that inhibits the movement of fish	Clear
Change to the structural integrity of the ladder that inhibits movement of fish or indicates larger structural failure	Repair/Modification of structure
Streamflow is not appropriate for the passage of the target species for the fish ladder	Modification of structure to achieve streamflow for target species
Water depths in perched culvert do not meet minimum guidelines for target species passage	Modification of culvert to include lining that provides water depths that increase passage
LPP does not fulfill authorized project purposes	Modification of structure to achieve project purposes and achieve designed function

5.0 Monitoring Costs

Required efforts and man-hours were determined and costs developed of the monitoring for a five-year monitoring period at $51,000 fully funded. Preconstruction baseline monitoring will take place in the year before construction. Monitoring will be conducted for five years following construction for the durations included in each procedure listed in Section 3.0.

6.0 Adaptive Management Costs

Adaptive management costs were calculated based on efforts and criteria described in Section 4.0 and based on level 3 cost estimates prepared prior to final design and implementation.

7.0 References

Massachusetts Division of Marine Fisheries. 2022. Rainbow Smelt Spawning Habitat Study, Jones River, Kingston, MA.

Turek, J., Haro, A., and Towler, B. 2016. Technical Memorandum: Federal Interagency Nature-like Fishway Passage Design Guidelines for Atlantic Coast Diadromous Fishes.

SMELT BROOK
SECTION 1135 AQUATIC ECOSYSTEM RESTORATION

APPENDIX A5
Clean Air Act Record of Non-Applicability

DRAFT RECORD OF NON-APPLICABILITY
(RONA)

January 22, 2023

Project/Action Name: Smelt Brook Local Protection Project Section 1135 Environmental Restoration Project

Project/Action Point of Contact: Hannah Doherty Phone: 978-318-8685

Begin Date: TBD

End Date: TBD

1. The project described above has been evaluated for Section 176 of the Clean Air Act. Project related emissions associated with the Federal action were estimated to evaluate the applicability of General Conformity regulations (40CFR§93 Subpart B).
2. Total direct and indirect emissions from this project have been estimated (NOx = 0.36 tons per year and VOC = 0.05 tons per year), and are below the conformity threshold value of NOx = 100 tons per year and VOC = 50 tons per year (40CFR§93.153(b)(1) & (2)).
3. The project/action is not considered regionally significant under 40CFR§93.153(i).
4. Supporting documentation and emissions estimates are attached.

Date: _____ Signed: _____

Grace Moses, Chief
Environmental and Cultural Resources Section

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General Conformity Review and Emission Inventory for the Smelt Brook Environmental Restoration Project, Braintree and Weymouth, MA

Estimates from Cost Engineer

26-Jan-23

1	2	3	4	5	6	7	8	9	10	11
	Project Emission Sources and Estimated Power						NOx Emission Estimates		VOC Emission Estimates	
Equipment/Engine Category	# of Engines	hp	LF	hrs/day	Days of Operation	hp-hr	NOx EF (g/hp-hr)	NOx Emissions (tons)	VOC EF (g/hp-hr)	VOC Emissions (tons)
Skid steer	1	120	1.00	8	4	3,840	9.200	0.04	1.300	0.01
Generator and water pump	1	10	1.00	24	60	14,400	9.200	0.15	1.300	0.02
Crane, Mech LB, crawler, D/C 2.5CY/60T/50' Boom	1	285	1.00	8	2	4,560	9.200	0.05	1.300	0.01
DUMP TRK, HWY 16-20CY, 75,000lb GVW 6x4 2 Axel	1	360	1.00	8	2	5,760	9.200	0.06	1.300	0.01
Concrete Vib, 2.5", Generator	1	7.5	1.00	8	2	120	9.200	0.00	1.300	0.00
Concrete pump and boom, 177CY/HR, 75' boom TM	1	405	1.00	8	2	6,480	9.200	0.07	1.300	0.01
Total Emissions							**NOx Total**	**0.36**	**VOC Total**	**0.05**
Total Emissions Per Year							**NOx Total**	**0.36**	**VOC Total**	**0.05**

Horsepower Hours

hp-hr = # of engines*hp*LF*hrs/day*days of operation

Load Factors

Load Factor (LF) represents the average percentage of rated horsepower used during a source's operational profile. For this worst case estimate, LF is held at 1 for all equipment. Typical is 0.4 to 0.6

Emission Factors

NOx Emissions Factor for Off-Road Construction Equipment is 9.20 g/hp-hr

VOC Emissions Factor for Off-Road Construction Equipment is 1.30 g/hp-hr

Emissions (g) = Power Demand (hp-hr) * Emission Factor (g/hp-hr)

Emissions (tons) = Emissions (g) * (1 ton/907200 g)

Actual Work Days of Construction

Assumptions:

Project construction period is	8	weeks	2 months
Project construction occurs 5 days per week.	40		
There are 10 holidays in a calendar year.	2		
There are 30 weather days (no work) in a year.	5		

Actual work days = construction duration (days) - weekend days off - holidays off - weather days off.

Specify Duration	Calculated Weekend days off	Specifiy Holidays	Specify Weather days
60	16	2	5

Actual work days = 37

SMELT BROOK
SECTION 1135 AQUATIC ECOSYSTEM RESTORATION

APPENDIX A6
Preliminary Coastal Zone Management Consistency Determination

Coastal Zone Management Consistency Determination
Smelt Brook Local Protection Project
Section 1135 Environmental Restoration Project
Weymouth and Braintree, Massachusetts
October 2022

Below are the applicable enforceable policies of the Massachusetts Coastal Zone Management Program along with a Summary Statement below each Policy. Below each Policy and Summary Statement is pertinent information relative to the U.S. Army Corps of Engineers (USACE) proposal to construct a fishway within the stilling basin of a perched culvert that has obstructed access to suitable rainbow smelt spawning habitat upstream in Braintree and Weymouth, Massachusetts. This consistency determination is preliminary as all details of the project are not yet final. A final CZM consistency determination will be prepared and provided during the next phase of the project.

COASTAL HAZARDS POLICY #1 - *Preserve, protect, restore, and enhance the beneficial functions of storm damage prevention and flood control provided by natural coastal landforms, such as dunes, beaches, barrier beaches, coastal banks, land subject to coastal storm flowage, salt marshes, and land under the ocean.*

This policy is not applicable

COASTAL HAZARDS POLICY #2 - *Ensure that construction in water bodies and contiguous land areas will minimize interference with water circulation and sediment transport. Flood or erosion control projects must demonstrate no significant adverse effects on the project site or adjacent or downcoast areas.*

The project will not significantly interfere with water circulation patterns or sediment transport. The project is consistent with this policy.

COASTAL HAZARDS POLICY #3 - *Ensure that state and federally funded public works projects proposed for location within the coastal zone will:*

- *Not exacerbate existing hazards or damage natural buffers or other natural resources.*
- *Be reasonably safe from flood and erosion-related damage.*
- *Not promote growth and development in hazard-prone or buffer areas, especially in velocity zones and Areas of Critical Environmental Concern.*
- *Not be used on Coastal Barrier Resource Units for new or substantial reconstruction of structures in a manner inconsistent with the Coastal Barrier Resource/Improvement Acts.*

The project as proposed is consistent with this policy.

COASTAL HAZARD POLICY #4 - *Prioritize acquisition of hazardous coastal areas that have high conservation and/or recreation values and relocation of structures out of coastal high-hazard areas, giving due consideration to the effects of coastal hazards at the location to the use and manageability of the area.*

This policy is not applicable.

ENERGY POLICY #1 - *For coastally dependent energy facilities, assess siting in alternative coastal locations. For non-coastally dependent energy facilities, assess siting in areas outside of the coastal zone. Weigh the environmental and safety impacts of locating proposed energy facilities at alternative sites.*

This policy is not applicable.

ENERGY POLICY #2 - *Encourage energy conservation and the use of renewable sources such as solar and wind power in order to assist in meeting the energy needs of the Commonwealth.*

This policy is not applicable.

GROWTH MANAGEMENT POLICY #1 – *Encourage sustainable development that is consistent with state, regional, and local plans and supports the quality and character of the community.*

This policy is not applicable.

GROWTH MANAGEMENT POLICY #2 - *Ensure that state and federally funded infrastructure projects in the coastal zone primarily serve existing developed areas, assigning highest priority to projects that meet the needs of urban and community development centers.*

This policy is not applicable.

GROWTH MANAGEMENT POLICY #3 – *Encourage the revitalization and enhancement of existing development centers in the coastal zone through technical assistance and financial support for residential, commercial, and industrial development.*

This policy is not applicable.

HABITAT POLICY #1 – *Protect coastal, estuarine, and marine habitats—including salt marshes, shellfish beds, submerged aquatic vegetation, dunes, beaches, barrier beaches, banks, salt ponds, eelgrass beds, tidal flats, rocky shores, bays, sounds, and other ocean habitats—and coastal freshwater streams, ponds, and wetlands to preserve critical wildlife habitat and other important functions and services including nutrient and sediment attenuation, wave and storm damage protection, and landform movement and processes.*

The proposed project will not significantly impact coastal resources. The application of a work windows (July 1 to January 31) will limit adverse impacts to diadromous fish migrations. Project construction will be schedule to occur during the time of year when streamflow is at its lowest (less that 3 cfs) to mitigate impacts of sediment transport

downstream of the project area. An autopump connected to a bypass pipe will pump water around the construction area when flows exceeds 3 cfs. Therefore, the project as proposed is consistent with this policy.

HABITAT POLICY #2 - *Advance the restoration of degraded or former habitats in coastal and marine areas.*

The proposed project is an environmental restoration project with the objective of restoring access of rainbow smelt to historic spawning habitat that has been limited by flood control structures.

OCEAN RESOURCES POLICY #1 – *Support the development of sustainable aquaculture, both for commercial and enhancement (public shellfish stocking) purposes. Ensure that the review process regulating aquaculture facility sites (and access routes to those areas) protects significant ecological resources (salt marshes, dunes, beaches, barrier beaches, and salt ponds) and minimizes adverse effects on the coastal and marine environment and other water-dependent uses.*

The policy is not applicable; no aquaculture exists within project areas.

OCEAN RESOURCES POLICY #2 – *Except where such activity is prohibited by the Ocean Sanctuaries Act, the Massachusetts Ocean Management Plan, or other applicable provision of law, the extraction of oil, natural gas, or marine minerals (other than sand and gravel) in or affecting the coastal zone must protect marine resources, marine water quality, fisheries, and navigational, recreational and other uses.*

The policy is not applicable.

OCEAN RESOURCES POLICY #3 – *Accommodate offshore sand and gravel extraction needs in areas and in ways that will not adversely affect marine resources, navigation, or shoreline areas due to alteration of wave direction and dynamics. Extraction of sand and gravel, when and where permitted, will be primarily for the purpose of beach nourishment or shoreline stabilization.*

The policy is not applicable.

PORTS AND HARBORS POLICY #1 – *Ensure that dredging and disposal of dredged material minimize adverse effects on water quality, physical processes, marine productivity, and public health and take full advantage of opportunities for beneficial re-use.*

The policy is not applicable. Dredging and disposal of dredged material is not part of the proposed action.

PORTS AND HARBORS POLICY #2 - *Obtain the widest possible public benefit from channel dredging and ensure that Designated Port Areas and developed harbors are given highest priority in the allocation of resources.*

The policy is not applicable.

PORTS AND HARBORS POLICY #3 – *Preserve and enhance the capacity of Designated Port Areas to accommodate water-dependent industrial uses and prevent the exclusion of such uses from tidelands and any other DPA lands over which an EEA agency exerts control by virtue of ownership or other legal authority.*

The policy is not applicable.

PORTS AND HARBORS POLICY #4 – *For development on tidelands and other coastal waterways, preserve and enhance the immediate waterfront for vessel-related activities that require sufficient space and suitable facilities along the water's edge for operational purposes.*

The proposed project is not on waterway that supports vessel-related activities. Therefore, the policy is not applicable.

PORTS AND HARBORS POLICY #5 - *Encourage, through technical and financial assistance, expansion of water-dependent uses in Designated Port Areas and developed harbors, re-development of urban waterfronts, and expansion of physical and visual access.*

The policy is not applicable.

PROTECTED AREAS POLICY #1 – *Preserve, restore, and enhance coastal Areas of Critical Environmental Concern, which are complexes of natural and cultural resources of regional or statewide significance.*

Not applicable; no ACECs exist in the proposed project area.

PROTECTED AREAS POLICY #2 - Protect state and locally designated scenic rivers and state classified scenic rivers in the coastal zone.

The policy is not applicable; no scenic rivers will be impacted by this project.

PROTECTED AREAS POLICY #3 - *Ensure that proposed developments in or near designated or registered historic places respect the preservation intent of the designation and that potential adverse effects are minimized.*

The proposed project does not include development and will not impact any designated or registered historic places. Therefore, this project is consistent with this policy.

PUBLIC ACCESS POLICY #1 – *Ensure that development (both water-dependent or nonwater-dependent) of coastal sites subject to state waterways regulation will promote general public use and enjoyment of the water's edge, to an extent commensurate with the Commonwealth's interests in flowed and filled tidelands under the Public Trust Doctrine.*

The proposed project will not interfere with existing public recreation but will increase the populations of diadromous fish by providing more spawning habitat, thereby improving recreational fishing opportunities. Therefore, this project is consistent with this policy.

PUBLIC ACCESS POLICY #2 - *Improve public access to existing coastal recreation facilities and alleviate auto traffic and parking problems through improvements in public transportation and trail links (land- or water-based) to other nearby facilities. Increase capacity of existing recreation areas by facilitating multiple use and by improving management, maintenance, and public support facilities. Ensure that the adverse impacts of developments proposed near existing public access and recreation sites are minimized.*

The policy is not applicable; the project will not impact public access to coastal recreation.

PUBLIC ACCESS POLICY #3 - *Expand existing recreation facilities and acquire and develop new public areas for coastal recreational activities, giving highest priority to regions of high need or limited site availability. Provide technical assistance to developers of both public and private recreation facilities and sites that increase public access to the shoreline to ensure that both transportation access and the recreation facilities are compatible with social and environmental characteristics of surrounding communities.*

The policy is not applicable; the project will not impact public access to coastal recreation.

WATER QUALITY POLICY #1 - *Ensure that point-source discharges and withdrawals in or affecting the coastal zone do not compromise water quality standards and protect designated uses and other interests.*

There are no point-source discharges resulting from this project or withdrawals in or affecting the coastal zone. A request for 401 Water Quality Certification (WQC) for fill/excavation in State waters will be submitted to the Massachusetts Department of Environmental Protection (MADEP). The proposed project is consistent with the policy.

WATER QUALITY POLICY #2 - *Ensure the implementation of nonpoint source pollution controls to promote the attainment of water quality standards and protect designated uses and other interests.*

Not applicable.

WATER QUALITY POLICY #3 - *Ensure that subsurface waste discharges conform to applicable standards, including the siting, construction, and maintenance requirements for on-site wastewater disposal systems, water quality standards, established Total Maximum Daily Load limits, and prohibitions on facilities in high-hazard areas.*

Not applicable.

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