October 28, 2021
19569

Maureen O'Meara, Town Planner
Town of Cape Elizabeth
320 Ocean House Road
Cape Elizabeth, Maine 04107

Re: Resource Protection Permit Application – Willow Brook Culvert Replacement
Map U45/Lot 9

Dear Maureen:

Sebago Technics (Sebago) is pleased to submit the enclosed Planning Board Application for a Resource Protection Permit on behalf of our client, the Town of Cape Elizabeth (Town). This submission package is for the proposed replacement of the Willow Brook culvert. The existing culvert is located in Willow Brook on Cape Elizabeth Land Trust property and is shown within Lot 9 of Tax Map U45 on the Town's GIS map. The property is located within the Resource Protection 2 (RP-2) district as identified in the Town's Zoning Map.

Project Scope:
As you are aware, the Town conducted a study of sixteen priority culverts in 2019. The Willow Brook culverts were identified as an "immediate" priority for replacement. The existing culverts at this site were installed in 1984. Since their installation, the culverts have deteriorated appreciably and are coming to the end of their serviceable lifespan.

The project includes replacement of the two existing, 36-inch wide by 48-inch tall, elliptical corrugated metal pipe (cmp) culverts which convey surface water within Willow Brook and tidal flow from the Spurwink Marsh. The culverts are covered by an earthen embankment located on the Cape Elizabeth Land Trust (CELT) property. The Portland Water District holds a utility and access easement which has been used to install two, large diameter sanitary sewer pipes over the culverts. The Town also utilizes this easement as a part of a Greenbelt recreational trail that connects the Town Center to Starboard Drive and to the boardwalk crossing the Spurwink Marsh to the Town-owned Gull Crest property.

As the culverts are subject to tidal influence, the project features a replacement three-sided, pre-cast culvert with an 12-foot Span (11' Clear Width) by 4-foot Rise by 50-foot Length sitting on cast-in-place concrete foundations. The outlets of the current culverts are perched, which likely prevents upstream passage by aquatic organisms except during high tides and peak flows. The proposed culvert will have an open bottom with 2-feet of simulated streambed material matching the existing streambed elevations so within the culvert it will provide a natural stream flowing into and out of the new culvert.

This site is subject to tidal flooding and is also vulnerable to future sea level rise. The existing culverts have been documented by the Wells National Estuarine Research Reserve as a tidal restriction, which reduces tidal flooding upstream. In addition, the potential for upstream marsh migration under

projected sea level rise scenarios could be impeded by the existing culverts. Due to the tidal influence at the site, the future culvert design has incorporated an assessment of tidal flow under potential sea level rise conditions.

In order to assist in the funding of the project, the Town received a grant from the Natural Resource Conservation Program (MNRCP). According to the arcgis website, the Maine Natural Resource Conservation Program (MNRCP) was created to help compensate for unavoidable impacts to protected aquatic resources in the State of Maine by funding the restoration, enhancement, preservation, and creation of similar resources to maintain ecological benefits. The program manages the allocation of funds collected through the State's In-Lieu Fee Compensation Program, a voluntary program that allows entities impacting natural resources, primarily wetlands, to make a payment directly to the Maine Department of Environmental Protection (DEP) as an alternative to the traditional mitigation process. Fees collected by DEP are deposited into funds based on the biophysical regions in which the impacts occurred.

The Town and their environmental consultant, Flycatcher, are currently working with the MNRCP and their technical committee which consists of regulatory experts from various environmental agencies such as the U.S. Army Corps of Engineers (ACoE), U.S. Fish and Wildlife Service, and the Maine Department of Environmental Protection to finalize a work plan to monitor the marsh area's response after the installation of the replacement culvert.

Other approvals:
Additional regulatory agency review and approvals are required for this project through the Maine Department of Environmental Protection and the U.S. Army Corps of Engineers.

List of Submission Requirements (Section 19-8-3.A.2.c):

1. **Detailed Site Plan:**
   A detailed plan set of the site and the proposed improvements has been provided.

2. **Topographic Map:**
   Topography of the area has been provided in the attached plan set.

3. **Written Description of the property:**
   The Town has received an easement from the Cape Elizabeth Land Trust (CELT) to install the replacement culvert. A copy of that easement has been provided. In addition, this submittal package also includes three CELT deeds demonstrating their rights to the property.

4. **Abutting Property Owners:**
   A list of abutting property owners has been included with this submittal.

5. **Description of Vegetative Cover**
   Prior to the submission of the MNRCP grant application, the project team met with Maine Natural Areas Program's (MNAP) Ecologist Kristen Puryear to assess the potential grant application. From that meeting, Kristen provided a September 1, 2020 Site Visit Summary report which has been included in this application and includes an extensive evaluation of the vegetative cover and site conditions. This report also includes several pictures which provide a visual portrayal of the existing conditions associated with the vegetative cover.

6. **Soils:**
   As part of the design development, the firm of S.W. Cole Engineering conducted a subsurface geotechnical investigation of the culvert's underlying soils conditions. S.W. Cole Engineering then prepared a May 8, 2020 Explorations and Geotechnical Engineering Services report on their findings and their recommendations which is included in this submission package. The results of their investigation revealed the presence of underlying ledge conditions. As part of the culvert design of the 3-sided, open bottom replacement culvert will be that its cast-in-place footings will be attached to the rock to allow for greater stability and long-term structural durability of the culvert. Given that this in-depth analysis is specific to the actual construction of the culvert replacement project, we are submitting this information in lieu of a high-intensity soil map.

7. **Map of Wetland Upland Edge (if applicable):**
   Sebago mapped the wetland edges as part of our field investigation and those limits are indicated on the enclosed drawings.

8. **Location of Watercourses:**
   The location of the Willow Brook was also located as part of our field investigation and the limits of the stream through the Spurwink Marsh is also depicted on the enclosed drawings.

9. **Storm water:**
   Not Applicable. As this is a culvert replacement project, the typical Stormwater Management Plan assessment comparing pre- versus post-development conditions is not applicable to the project. Therefore, no drainage calculations or Stormwater Management Plans have been provided. The proposed project will not result in a change in the impervious area or drainage patterns of the site, however, the culvert's ability to convey the waters that it receives will be improved which will allow for increased tidal exchange activity and heightened resilience to sea level rise conditions.

   As part of the MNRCP grant review process for the proposed replacement culvert, the Town hired Joe McLean of Acadia Civil Works (ACW) to conduct a tidal evaluation of the proposed culvert. A copy of ACW's March 12, 2021 Summary of Tidal Hydraulic Assessment is included with this submission. The conclusion of the study is that the proposed culvert will be adequately sized to for tidal conditions with a design life of 60 to 80 years depending on a range of sea level rise condition assumptions.

   Please note that the proposed 11-foot span by 5-foot culvert referenced in the ACW study was based on a previous four-sided box culvert design with a solid concrete bottom which has been changed to a proposed 12-foot span (11-foot clear width) by 4-foot three-sided culvert with a foundation and an open bottom. The culvert rise shown differs due to the adjustment in design from a 4-sided structure to a 3-side structure. The 4-foot rise does not include the rise of the footings which are roughly a foot or higher depending on actual bedrock elevation. The existing streambed elevation as well as the top of the culvert have remained the same. Therefore, there will be no adverse change to capacity of the replacement culvert in comparison to the culvert shown within the tidal study

10. **Delineation of Building Envelope:**
    Not applicable. The proposed project does not include any buildings.

11. Draining, Filling, Grading sites:

The project will require the excavation of the embankment and removal of the two, deteriorated culverts. Additional excavation and subgrade/ledge preparation will be required to install the two cast-in-place concrete foundations on both sides of Willow Brook. The pre-fabricated, 3-sided concrete culvert will then be installed on the foundations and backfilled to restore the construction area and stabilize it with vegetation. The installation of the replacement culvert and its rip rap inlet and outlet aprons will impact 940 square feet of wetland area. Refer to the enclosed drawing for more information regarding the earthwork associated with the replacement culvert project.

12. Purpose of Project, Explanation of need:

The purpose of the culvert is to replace two culverts which are inadequately sized and have reached the end of their design life. These culverts are precariously located under an 18-inch gravity sanitary sewer pipe that conveys wastewater to the Cape Elizabet Treatment plant and a 16-inch force main which conveys treated effluent from the treatment plant to its outfall location. Should the existing culverts fail, that failure could lead to the compromising of one or both of the sanitary sewer pipes which could in turn lead to an adverse environmental condition in the Spurwink Marsh.

In addition, the existing culverts are not sized appropriately and are perched which leads to a detrimental flow condition. The new culvert will have a larger open area which will lead to a better tidal exchange and greater resiliency to future sea level rise.

13. Mitigation:

The project will essentially mitigate the poor condition of the existing culverts and provide assurance for future protection of the existing sanitary sewer pipes. The replacement culvert will also provide greater tidal exchange capabilities allowing for the healthier condition of the adjacent inland marsh and greater resiliency to future sea level rise.

Waiver of Submission items (Section 19-8-3.A.2.c):

No waivers are requested.

Resource Protection Permit Standards (Section 19-8-3.B):

The ordinance outlines the following permit standards:

1. *Will not materially obstruct the flow of surface or subsurface waters across or from the alteration area*

   The proposed project involves the replacement of two existing pipes in order to improve the function of the culvert and allow for better water flow conditions.

2. *Will not impound surface waters or reduce the absorptive capacity of the alteration area so as to cause or increase the flooding of adjacent properties*

   The proposed project will not result in the impounding of surface waters or the reduction of the absorptive capacity of the alteration area. The proposed replacement culvert will greatly improve the flow of water at the site.

3. *Will not increase the flow of surface waters across, or the discharge of surface waters from, the alteration area so as to threaten injury to the alteration area or to upstream and/or downstream lands by flooding, draining, erosion, sedimentation or otherwise*
   This project will not increase impervious areas or resultant rates of runoff. The replacement culvert will be more adequately sized to facilitate tidal exchanges and resiliency to sea level rise.

4. *Will not result in significant damage to spawning grounds or habitat for aquatic life, birds or other wildlife*
   As part of the MNRCP review of the project, this subject was reviewed with the conclusion that the new culvert would improve or have no ill effect onto the habitat conditions of aquatic life, birds or other wildlife.

5. *Will not pose problems related to the support of structures*
   The foundations for the culvert will be designed to be connected soundly to the underlying bedrock and properly support the three-sided precast concrete culvert.

6. *Will not be detrimental to aquifer recharge or the quantity or quality of groundwater*
   This project will not affect the current groundwater conditions.

7. *Will not disturb coastal dunes or contiguous back dune areas*
   There are no dunes associated with the project area.

8. *Will maintain or improve ecological and aesthetic values*
   The project scope should improve up ecological values and maintain the marsh's aesthetic value for many years to come.

9. *Will maintain an adequate buffer area between the wetland and adjacent land uses*
   There will be no appreciable change to the wetland buffer or adjacent land uses.

10. *Will be accomplished in conformance with the erosion prevention provisions of Environmental Quality Handbook Erosion and Sediment Control, published by the Maine Soil and Water conservation commission dated March 1986, or subsequent revisions thereof*
    Per the design plans and envisioned permit approvals, the contractor will be required to follow these Best Management Practices.

11. *Will be accomplished without discharging wastewater from buildings or from other construction into Wastewater Treatment Facilities in violation of Section 15-1-4 of the Sewage Ordinance*
    There is no wastewater discharge associated with this project.

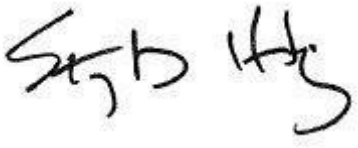
12. *Will in the case of Resource Protection Permits in the Resource Protection Floodplain District, also comply with Section 6-6-6 of the Floodplain Management Ordinance*
    A Floodplain permit application to be reviewed and issued by the Code Enforcement Officer will be necessary for this project.

We trust that we have adequately addressed the review criteria such that the Planning Board may consider the application at the next scheduled meeting in October. Given the nature of the project, we ask that the Board consider the review of this project under an expedited review format. We look

forward to meeting with the Board to discuss the project in further detail. Please feel free to contact us with any questions or comments regarding the submitted information. Thank you for your consideration.

Sincerely,

SEBAGO TECHNICS, INC.



Stephen D. Harding, P.E.
Town Engineer

SDH:rg

enc. (8) copies of site plan and supporting information
Digital copy of complete application submittal

Print Form

TOWN OF CAPE ELIZABETH
Planning Board Application

Applications for Planning Board Review shall be submitted to the Town Planner. Applicants should contact the Town Planner prior to submitting an application to confirm submission requirements.

Applicant:

Name: Town of Cape Elizabeth (Matthew Sturgis/Town Mgr.) Telephone: 207-619-6716

Address: P.O. Box 6260, Cape Elizabeth, ME 04107 Email: matthew.sturgis@capeelizabeth.org

Agent or Contact Person to whom all correspondence should be addressed:

Name: Stephen D. Harding, P.E. Telephone: 207-749-3541

Address: 75 John Roberts Road, Suite 4A Fax: _____

South Portland, ME 04106 Email: sharding@sebagotechnics.com

Name of Project: Willow Brook Replacement Culvert Map/ Lot U45/9

Location: Along Portland Water District easement/Greenbelt trail - 750+/- ft. east of Starboard Drive

Type of Review:

_____ Major Subdivision Review, Sec. 16-2-4, Subdivision Ordinance

_____ Minor Subdivision Review, Sec. 16-2-3, Subdivision Ordinance

_____ Site Plan Review, Sec. 19-9, Zoning Ordinance AMENDED

_____ Private Access Waiver, Sec. 19-7-9, Zoning Ordinance

_____ Earth Materials Permit, Sec. 19-8-5, Zoning Ordinance

__×__ Resource Protection Permit, Sec. 19-8-3, Zoning Ordinance

_____ Other: _____

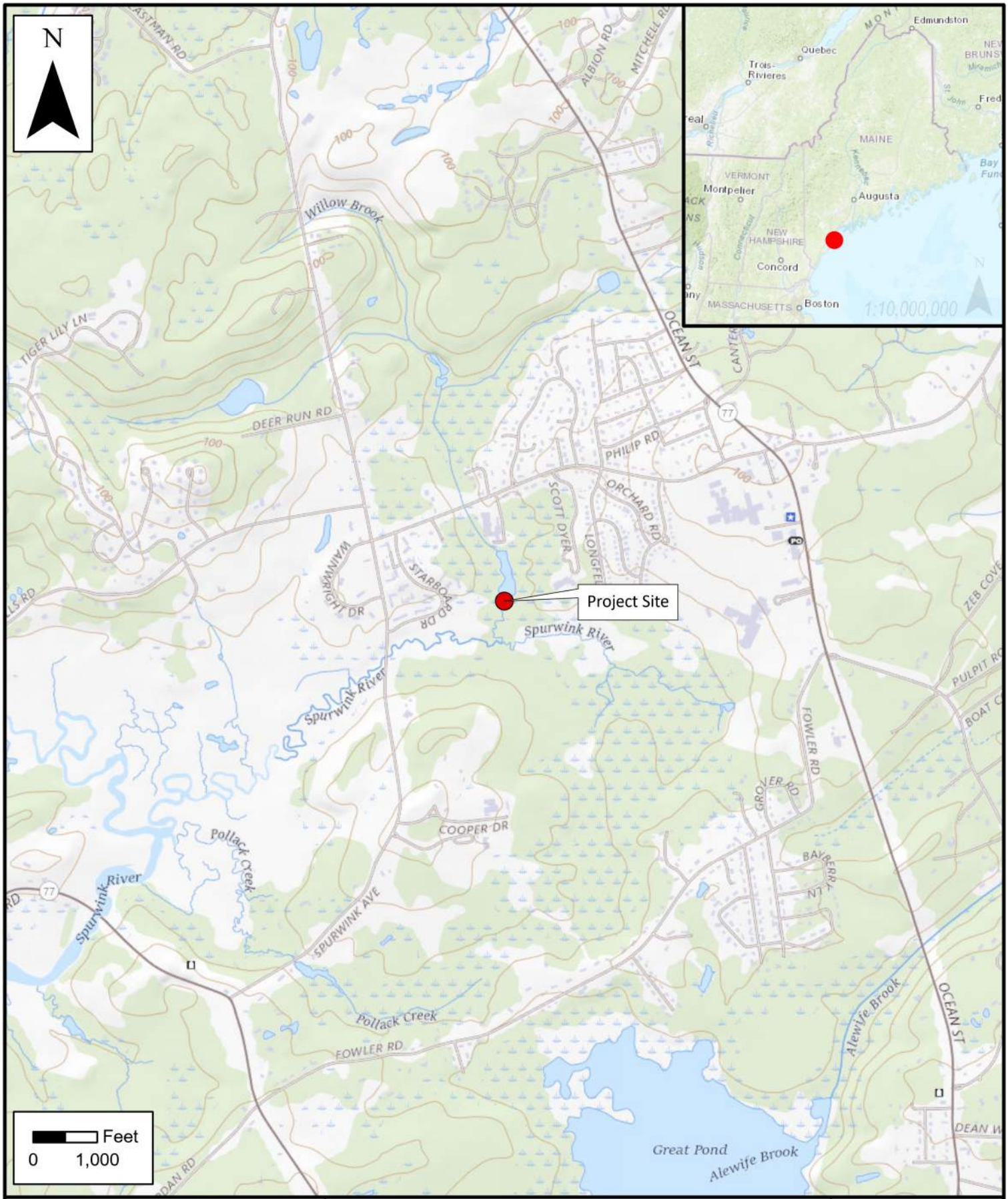
Fees Paid: $0.00

I attest that I have right, title, or interest in the property to be reviewed. I have reviewed a copy of the application regulations listed above and attest that I have read them and prepared my application in accordance with Town requirements.

Matthew Sturgis 10.25.2021.

Signature of Applicant Date

List of Attachments



SEBAGO TECHNICS

WWW.SEBAGOTECHNICS.COM
75 John Roberts Rd. - Suite 4A
South Portland, ME 04106
Tel. 207-200-2100

LOCATION MAP

WILLOW BROOK RECREATIONAL TRAIL CROSSING

SCALE: 1:24,000

DATE: 9/28/2021

LOCATION:
NEAR STARBOARD DRIVE
CAPE ELIZABETH, MAINE

INFORMATION:
PARCEL LINES - MAINE ORGANIZED TOWNS
USGS QUADRANGLE

ASSESSOR

Back

Map: U45 **Lot: 009** **Sub:** **Type:**
Account: C0214R

CAPE ELIZABETH LAND TRUST INC

330 OCEAN HOUSE ROAD
CAPE ELIZABETH, ME 04107

Property Location

00000 SPURWINK AVENUE

Description

EASTERLY SIDE

Assessment

Total Assessed Value	Land Value	Building Value	Tree Growth Value
$1700	$1700	$0	$0
	Exemption 1	**Exemption 2**	**Exemption 3**
	$$1700	$$0	$$0

Property Information

Property Type	Use Description	Zoning	Story Height
VACANT LOT	RESIDENTIAL	RA	
Acres - Hardwood	**Acres - Softwood**	**Acres - Mixed**	**Lot Size**

R05-2

SPURWINK AVE

SCOTT DYER ROAD

VILLAGE LN (PVT.)

PATRICIA DRIVE

SCOTT DYER

SEWER R/W

14
13 Ac

14L

5
19 Ac

32A
26,769

32
25,969

23
9,500
DP-2

5-2
19,637
DP-2

22
8,997
DP-1

8,550
DP-9

33
14,350

34
13,400

35
8,900

36
9,286

38
9,450

37
2.66 Ac

65
9,661

4
5.2 Ac

6
3.5 Ac

8
0.6 Ac

8-A
0.92 Ac

8-1
.78 Ac

8-2
1.94 Ac

5-999
1.8 Ac

1-999
2.6 Ac

CAPE COLONIAL VILLAGE

3C
2.14 Ac
(APTS)

7
5.9 Ac

4A
1.3 Ac

2
32 Ac

9
1.89 Ac

7
3.17 Ac

8
1.91 Ac

6
1.85 Ac

10
1.87 Ac

5
1.86 Ac

12
1.86 Ac

11
1.85 Ac

4
1.96 Ac

WAINWRIGHT DRIVE

U52

3
6.4 Ac

2
4.5 Ac

1
3.6 Ac

SPURWINK AVENUE

CAPE COLONIAL VILLAGE

2-999
3.2 Ac

3B
2.1 Ac
(APTS)

3-999
1.5 Ac

STARBOARD DRIVE

SEWER R/W

9
3.46 Ac

R05-2

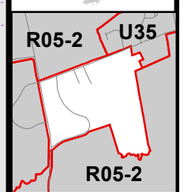
Legend

- Common
- Easement/ROW
- Stream
- Hook
- Cemetery
- Parcels
- Roads
- ROW / Paper Street
- State
- Town
- Water

Maps Prepared by:
Spatial Alternatives
207.846.2355
www.spatialalternatives.com

Tax Maps Town of Cape Elizabeth

Tax Maps are intended for assessing purposes only. Boundary locations are approximate and should not be used for conveyance of property.



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MAP U45

Maps Updated to April 1, 2020

80
Feet

BK7558PG0153

072638

Quitclaim Deed with Covenant
Maine Statutory Short Form

I, I. ALAN BALFOUR of Falmouth, Cumberland County, and State of Maine, for consideration paid grant to CAPE ELIZABETH LAND TRUST of Cape Elizabeth, Cumberland County, and State of Maine, with Quitclaim Covenants the land in Cape Elizabeth, Cumberland County, and State of Maine described as follows:

Beginning at the southwest corner of land now or formerly of John Dearborn and the easterly line of land formerly of the Grantor (now known as Cape Colonial Village);

Thence easterly (approximately South 89° 34' East) along said land of Dearborn to an iron fence post and land now or formerly of Stanley Jordan;

Thence southerly along said land of Jordan to the marsh;

Thence westerly and northerly along said marsh to the point of beginning.

Containing 3.46 acres, more or less, and being all the remaining land I have claim or title to east of Cape Colonial Village.

Subject to a sewer easement Forty feet (40') in width granted to the Town of Cape Elizabeth by deed dated December 15, 1975.

Being a portion of that property granted to Grantor herein by deed of Land Development Corporation dated November 28, 1966 and recorded in the Cumberland Registry of Deeds at Book 2981, Page 233.

WITNESS, my hand and seal this 22nd day of December 1986.

Patricia M. McKeon
Witness

I. Alan Balfour
Grantor - I. Alan Balfour

State of Maine,
Cumberland, SS

Personally appeared before me, the above named I. Alan Balfour, acknowledged the foregoing instrument to be his free act and deed, and subscribed same.

Before me,

12/22/86
Date

Patricia M. McKeon
~~Attorney At Law~~ / Notary Public

PATRICIA M. McKEON
NOTARY PUBLIC, MAINE
MY COMMISSION EXPIRES JULY 13, 1993

RECEIVED
RECORDED REGISTRY OF DEEDS
1986 DEC 29 PM 1:15
CUMBERLAND COUNTY
- James J Walsh

52768

WARRANTY DEED
(Maine Statutory Short Form)

52768 B 10905 P 267

KNOW ALL MEN BY THESE PRESENTS, that DUANE E. RANCOURT and BARBARA A. BOUTET, as Trustees of JUPITER IX TRUST, a Trust established under Declaration of Trust Dated March 28, 1979, and recorded in the Cumberland County Registry of Deeds in Book 4398, Page 9, as amended to date, and having a mailing address of business at 126 Scott Dyer Road, Cape Elizabeth, Maine 04107 (hereinafter called "Grantor"), for consideration paid, GRANT TO CAPE ELIZABETH LAND TRUST, INC., a Maine corporation with a mailing address of P.O. Box 265, Cape Elizabeth, Maine 04107 (hereinafter called "Grantee) with WARRANTY COVENANTS, certain interests in a certain lot or parcel of land, situated at and near Scott Dyer Road in the Town of Cape Elizabeth, County of Cumberland, and State of Maine, more fully described in Schedule A attached hereto and incorporated herein by reference, TO HAVE AND TO HOLD under the said Cape Elizabeth Land Trust, Inc. to use for public purposes and as open space, as more fully set forth in Schedule A hereto.

IN WITNESS WHEREOF, the said DUANE E. RANCOURT and BARBARA A. BOUTET, Trustees as aforesaid, have hereunto set their hands and seals this day of July, 1993.

Witness

Duane E. Rancourt, as Trustee of Jupiter IX Trust u/d/t dated March 28, 1979

Witness

Barbara A. Boutet, as Trustee of Jupiter IX Trust u/d/t dated March 28, 1979

State of Maine
Cumberland, ss.

August ~~July~~ 17, 1993

Then personally appeared the above-named, Duane E. Rancourt and Barbara A. Boutet, as Trustees of Jupiter IX Trust, and acknowledged the foregoing instrument to be their free act and deed in said capacities and the free act and deed of said Trust.

State of ME, County of York
Signed before me on this 17th day of August, 1993 by Duane Rancourt Barbara Boutet

Notary Public Victoria C. Stack

Before me,
Victoria C. Stack
Notary Public/Attorney-at-Law
Name:
Victoria C. Stack, Notary Public
State of Maine
My Commission Expires 12/11/96

6619D

1145-7 Scott Dyer Rd 8/20/93

L B2085R 10905/26

SCHEDULE A

Certain interests in a certain lot or parcel of land situated at and near the Scott Dyer Road in the Town of Cape Elizabeth, County of Cumberland and State of Maine, being part of the Scott Dyer homestead farm, so-called, which was purchased by Fred E. Libby from Mary E. Dyer and Martha J. Robinson, by deed recorded in Cumberland County Registry of Deeds at Book 652, Page 20, and bounded and described as follows:

Commencing at the center of a bridge over a ditch which separated the land formerly of one Cox from the land hereby conveyed, said bridge being on a farm road, and thence from said point of beginning running in a southerly direction five hundred fifty-seven (557) feet to an iron hub driven in the ground; thence in an easterly direction four hundred (400) feet to an iron hub driven in the ground on the bank of a brook and to the center of said brook; thence following the center of said brook to the land of said Cox, it being the center of the ditch aforementioned and five hundred fifty-seven (557) feet distant in a direct line from the hub last mentioned; thence following the line of said Cox's land in the center of said ditch to the point of beginning. Said lot containing five acres, more or less. Also a perpetual open right of way from the Pond Cove Road, so-called, without bars or fences over and through land formerly owned by Fred Libby along the westerly sideline of land conveyed by said Libby to Charles Cox by deed dated September 17, 1901, and recorded in Cumberland County Registry of Deeds at Book 709, Page 84. Said right-of-way to be fifteen feet in width and extending to a distance of fifteen feet beyond the northerly side line and along the westerly side line of the land hereby conveyed.

Being the same premises conveyed by Martha E. Durrance, Trustee of Dearborn Family Trust to Ronald A. Boutet and Duane E. Rancourt by virtue of an Executor's and Trustee's Deed dated June 8, 1982 and recorded in the Cumberland County Registry of Deeds at Book 4993, Page 99.

EXCEPTING AND RESERVING unto the Grantor, however, its successors and assigns forever, the right to use the area of the above-described parcel for the sole purpose of computing the density of land development under the ordinances of the Town of Cape Elizabeth, provided that the Grantor shall hereafter have no right to construct any improvements of any kind upon said land, and Grantor hereby covenants with Grantee

that Grantor shall also preserve said land as open space and shall not at any time seek to improve said land in any way, which covenant shall run with the interests conveyed herein and shall be binding upon the Grantor, its successors and assigns, and shall inure to the benefit of and be enforceable by the Grantee, its successors and assigns.

The interests conveyed hereby in the above-described parcel are restricted as follows: Grantee shall have the right to use said property as open space and for all public recreational and educational purposes, including the right to improve said property for public purposes, the right to public access to said land, the right to establish and maintain paths, benches, and common park amenities on said land and generally the right to improve the same for public purposes, provided however that Grantee shall not have the right to construct upon said parcel any structures that under the ordinances of the Town of Cape Elizabeth would require the ownership of any specified square footage or acreage of land, or that would otherwise implicate any so-called "density" requirements of said ordinances.

Specific reference is made to a letter attached hereto as Schedule B outlining the terms of the interpretation of the Code Enforcement Officer of the Town of Cape Elizabeth regarding the transfer of the above described real estate.

TOWN OF CAPE ELIZABETH

ERNEST W. MacVANE, JR.
BUILDING/PLUMBING INSPECTOR
320 OCEAN HOUSE ROAD
CAPE ELIZABETH, MAINE 04107

799-1619
AREA CODE 207

June 29, 1993

Duane E. Rancourt, Trustee
Jupiter IX Trust
c/o The Viking Nursing Home
136 Scott Dyer Road
Cape Elizabeth, ME 04107

Re: Donation of Land to the Cape Elizabeth Land Trust

Dear Mr. Rancourt:

In connection with the Planning Board approval for the sixty bed addition to the Viking Nursing Home owned by the Jupiter IX Trust, the Trust has agreed to donate approximately 5.9 acres of land to the Cape Elizabeth Land Trust. It is my understanding that this land was included in the density calculation pursuant to §19-3-15(a). You have asked me, as Code Enforcement Officer of the Town of Cape Elizabeth, whether the transfer of land to the Cape Elizabeth Land Trust will violate the density requirements pursuant to the Town's ordinances.

It is the position of the Town that the donation to the Cape Elizabeth Land Trust will not violate the density requirements of §19-3-15(a). My reason for this decision is as follows. The Town of Cape Elizabeth has routinely conditioned various approvals upon the donation to the Town or the Land Trust of all or a portion of "open-space" land which was included in the calculation of density as required by various sections of the ordinance, including standards for subdivisions, multi-plex housing and cluster developments.

This interpretation is in compliance with the spirit if not the letter of the Town's ordinances. Section 19-3-15(b)(5) requires that "at least fifty percent of the site's gross acreage shall be devoted to unpaved, non-vehicular open space." Since the land to be donated to the Cape Elizabeth Land Trust will be dedicated to open space, the requirement of this subsection is met by the donation of the land to the Trust. Although not directly applicable, §19-3-12(h), which deals with the open space requirements of cluster developments, specifically allows for the donation to the Town of the residual open space accumulated by reducing space requirements within the allowable density limits.

The same reasoning is applicable in §19-3-15 when calculating the open space requirement for housing for the elderly.

I trust that this letter will satisfy your concern that the Town will take no action and will not consider the Viking Nursing Home in violation of §19-3-15(a) by virtue of a donation of land to the Cape Elizabeth Land Trust. If you have any additional questions, please do not hesitate to give me a call.

Very truly yours,

TOWN OF CAPE ELIZABETH

Ernest W MacVane Jr

Ernest W. MacVane, Jr.
Code Enforcement Officer

EWM/cic

cc: Nicholas Bull, Esquire
Michael K. McGovern, Town Manager
Thomas G. Leahy, Town Attorney

Recorded
Cumberland County
Registry of Deeds
08/20/93 04:15:13PM
John B. O'Brien
Register

cic U:\CE\VIKING.JU9

PURCHASE AND SALE AGREEMENT

RONALD A. BOUTET AND DUANE E. RANCOURT or their assignees (hereinafter called the "SELLER"), agrees to sell and convey to Cape Elizabeth Land Trust of Maine, whose address is in Cape Elizabeth, Maine (hereinafter called the "BUYER"), agrees to buy, upon the terms and conditions hereinafter set forth, the following described premises:

A parcel of land situated in Cape Elizabeth described more fully in Exhibit A, Legal Descriptions.

1. PURCHASE PRICE. The two parcels are donated at no cost to the BUYER by the SELLER.

2. DEED. The Site is to be conveyed by Warranty Deed, which Deed shall convey good and marketable title thereto, free from encumbrances, except:

(a) The land is not to be developed; it is to be used for the common benefit of the Inhabitants of the Town ofCape Elizabeth and the State of Maine.

3. TIME FOR PERFORMANCE; DELIVERY OF DEED. The closing is to be held within Thirty (30) days from the date of financing the Assisted Living Wing to added to The Viking ICF. The closing shall be held at the offices of SELLER in Cape Elizabeth, Maine, unless another time or place are mutually agreed upon in writing.

4. POSSESSION AND CONDITION OF PREMISES. Possession of the Site free of all tenants and occupants is to be delivered at the time of closing. BUYER shall have the right to inspect the Site during the time period established by SELLER for such inspection, which shall not be less than ten (10) nor more than twenty (20) days prior to the closing and, if BUYER conducts such inspection, BUYER shall specify by notice in writing given to SELLER within ten (10) days of such inspection any manner in which BUYER claims that the Site does not conform to the requirements of this Agreement or any other obligation of SELLER.

5. TITLE. BUYER shall give SELLER notice, not less than ten (10) days prior to the closing, designating all the alleged defects in title existing at the time of such notice; all defects not so designated shall be deemed to have been waived by BUYER. BUYER shall provide SELLER with copies of all title documentation including, without limitation, abstracts of title, title opinion, title schedules and such other documents as shall support BUYER's claim that title defects exist, and BUYER shall instruct the attorney who did BUYER's title examination to fully cooperate and assist SELLER's attorney in identifying and resolving said title defects. If SELLER shall be unable to deliver marketable title or to make conveyance, or to deliver possession of the Site, all as herein stipulated, or if at the time of closing the Site does not substantially conform with the provisions hereof, then any payments made under this Agreement shall be refunded without interest, and all other obligations of the parties hereto shall cease and this Agreement shall be void and without recourse to the parties hereto, unless

SELLER elects to use reasonable efforts to remove any defects in title, or to deliver possession as provided herein, or to make the Site substantially conform to the provisions hereof, as the case may be, in which event SELLER shall give notice of such election to BUYER at or before the closing, and thereupon the time of closing shall be extended for period of one hundred twenty (120) days. If at the expiration of the extended time SELLER shall have failed so to remove any defects in title, deliver possession, or make the Site substantially conform, as the case may be, all as herein agreed, then any payments made under this Agreement shall be forthwith refunded, without interest, and all other obligations of all parties hereto shall cease and this Agreement shall be void and without recourse to the parties hereto.

6. BUYER'S ELECTION TO ACCEPT TITLE. The BUYER shall have the election, at either the original or any extended time for closing, to accept such title as the SELLER can deliver to the Site and to pay therefor the purchase price without deduction.

7. ACCEPTANCE OF DEED. The acceptance of the Deed by BUYER shall be deemed full performance and discharge of every agreement, obligation and representation made on the part of SELLER in accordance with the terms and provisions hereof, and the only agreements or representations which shall survive the delivery and acceptance of such Deed shall be those which may be herein specifically stated to survive the delivery and acceptance thereof.

8. PRORATIONS. The following items shall be prorated as of the closing date:
(a) taxes for the then-current tax year assessed against the Site.

9. RISK OF LOSS. The risk of loss or damage by fire or other casualty shall be borne by the SELLER until the Deed is delivered to BUYER at closing.

10. SPECIAL CONDITIONS. This purchase and sales agreement shall be null and void unless the following occur:

(a) Approval of The Viking Assisted Living Wing Site Review Application by the Planning Board of Cape Elizabeth, and
(b) Obtaining financing to build the The Viking Assisted Living Wing.

11. WARRANTIES. BUYER hereby acknowledges that no warranties or representations have been made by SELLER or any of its partners, agents, or affiliates, with respect to the construction and/or improvements of roads, or any other amenities or services to be provided by the SELLER.

12. GENERAL. This instrument, executed in duplicate, is governed by the laws of the State of Maine, is to take effect as a sealed instrument, and sets forth the entire Agreement of the parties. No statements, representations, warranties, writings, understandings or agreements of any party or of any representative of any party either in the negotiations leading to the execution of this Agreement or at any other time, which are not expressed herein, shall be binding. BUYER agrees that the interest of BUYER hereunder shall not be assigned or transferred without the prior written consent of SELLER. SELLER may, in its sole discretion, impose conditions or

restrictions to any such assignment by BUYER. In the event that BUYER assigns or transfers, or attempts to assign or transfer, his interest hereunder without SELLER's written consent having first been obtained, such act on the part of BUYER shall be treated and regarded as a default hereunder, and SELLER shall not be obligated to recognize the assignee or transferee. This Agreement is binding upon and inures to the benefit of the parties hereto and their respective heirs, successors and assigns (if SELLER consents to an assignment) and may be cancelled, modified or amended only by a written instrument executed by both the SELLER and the BUYER. If two or more persons are named herein as BUYER, the singular form herein is used only as a matter of convenience and is not to be considered as part of this Agreement or to be used in determining the intent of the parties to it. All notices required or permitted to be given hereunder shall be in writing and delivered by hand or mailed postage prepaid, by registered or certified mail addressed to BUYER and SELLER at the addresses shown in the first paragraph of this Agreement.

WITNESS:

_____ By: _____
Ronald A. Boutet

_____ By: _____
Duane E. Rancourt

_____ _____
Cape Elizabeth Land Trust of Maine

_____ _____
Cape Elizabeth Land Trust of Maine

EXHIBIT 1
Legal Description

A certain lot or parcel of land situated in said Cape Elizabeth, County of Cumberland and State of Maine, being the a part of the Scott Dyer homestead farm, so-called, which was purchased by Fred E. Libby from Mary E. Dyer and Martha J. Robinson, by deed recorded in Cumberland County Registry of Deeds, Book 652, Page 20, and bounded and described as follows, viz:

Commencing at the center of a bridge over a ditch which separated the land formerly of one Cox from the land hereby conveyed, said bridge being on a farm road, and thence from said point of beginning running in a southerly direction five hundred and fifty-seven (557) feet to an iron hub driven in the ground; thence in an easterly direction four hundred (400) feet to an iron hub driven in the ground on the bank of a brook and to the center of said brook; thence following the center of said brook to the land of said Cox, it being the center of the ditch aforementioned and five hundred and fifty-seven (557) feet distant in a direct line from the hub last mentioned; thence following the line of said Cox's land in the center of said ditch to the point of beginning. Said lot containing five acres, more or less. Also a perpetual open right-of-way from the Pond Cove Road, so-called, without bars or fences over and through land formerly owned by Fred Libby along the westerly sideline of land conveyed by said Libby to Charles Cox by deed dated September 17, 1901, and recorded in Cumberland County Registry of Deeds at Book 709, Page 84. Said right-of-way to be fifteen feet in width and extending to a distance of fifteen feet beyond the northerly side line and along the westerly side line of the land hereby conveyed.

Being the same premises conveyed to Ronald A. Boutet and Duane E. Rancourt by Martha E. Durrance herein by deed dated June 8, 1982 and recorded in the Cumberland County Registry of Deeds in Book 4993 Page 99.

WILLOW BROOK CULVERT
EASEMENT DEED

THE CAPE ELIZABETH LAND TRUST, with a mailing address of 326 Ocean House Road, Cape Elizabeth, Maine 04017 ("Grantor"), for consideration paid, grants to THE TOWN OF CAPE ELIZABETH, a municipal body corporate and politic situated in the County of Cumberland and State of Maine, with a mailing address of 320 Ocean House Road, P.O. Box 6260, Cape Elizabeth, Maine 04107, ("Grantee") its successors and assigns, with Warranty Covenants, the perpetual right and easement to enter at any and all times for the purposes outlined hereinafter on Schedule A, upon a certain lots or parcels of land situated southerly of Scott Dyer Road and lying easterly and westerly of Willow Brook (a.k.a. Mill Brook) in the Town of Cape Elizabeth, County of Cumberland and State of Maine, as more particularly bounded and described on **Schedule A** attached hereto and made a part hereof, within which parcels a town storm drainage culvert is located.

IN WITNESS WHEREOF, THE CAPE ELIZABETH LAND TRUST has caused this instrument to be signed this 29 day of September, 2021, by William Luneburg, as President of the Cape Elizabeth Land Trust, thereunto duly authorized.

THE CAPE ELIZABETH LAND TRUST

Witness

By: William Luneburg
Its: President

STATE OF MAINE
CUMBERLAND, SS.

September 29, 2021

Then personally appeared the above-named William Luneburg, in their capacity as President of THE CAPE ELIZABETH LAND TRUST, and acknowledged the foregoing instrument to be their free act and deed in said capacity, and the free act and deed of said Trust.

Before me,

Notary Public/~~Attorney at Law~~

Janet L. Staples
Printed Name

JANET L. STAPLES
NOTARY PUBLIC
State of Maine
My Commission Expires
November 8, 2025

SCHEDULE A

The Town of Cape Elizabeth, its successors and assigns forever, are hereby granted the perpetual right and easement to enter at any and all times upon certain lots or parcels of land situated southerly to Scott Dyer Road and lying easterly and westerly of Willow Brook (a.k.a. Mill Brook) in the Town of Cape Elizabeth, County of Cumberland and State of Maine, solely for the purposes of installing, maintaining, monitoring, repairing and replacing a drainage culvert and related drainage, grading, and shoulder stabilization over land more particularly described as Sewer Easement 1 and Sewer Easement 2 below.

Sewer Easement 1

An easement easterly of and not adjacent to Spurwink Avenue, and southerly of and not adjacent to Scott Dyer Road, situated northerly of and adjacent to an existing easement in Cape Elizabeth, County of Cumberland and State of Maine and shown on Exhibit B, Willow Brook Sewer Crossing, for the Town of Cape Elizabeth, by Sebago Technics, Inc, project number 19569, dated August 19, 2021, and being more particularly described as follows:

Beginning at a point on the northerly side of an existing easement as shown on referenced plan herein, being 35 feet left of station 28+75;

Thence N 10°-54'-35" E through said land of Cape Elizabeth Land Trust, perpendicular and parallel to the centerline of existing easement as shown on said plan, a distance of 40.00 feet;

Thence S 79°-05'-25" E through said land of Cape Elizabeth Land Trust, a distance of 175.00;

Thence S 10°-54'-35" W through said land of Cape Elizabeth Land Trust, a distance of 65.00 feet to the northerly side of said existing easement;

Thence N 79°-05'-25" W along said easement, a distance of approximately 60.4 feet to an angle point on the northerly side of said existing easement;

Thence N 10°-54'-35" E along said easement, a distance of 25.00 feet to an angle point on the northerly side of said existing easement;

Thence N 79°-05'-25" W along said easement, a distance of approximately 114.5 feet to the Point of Beginning.

The herein described sewer easement contains approximately 8,510 square feet.

Meaning and intending to describe the Proposed Easement 1 shown on the attached Exhibit B, referenced above, over a portion of the Cape Elizabeth Land Trust property described in Deed Book 7558, Page 153.

Reference is also made to a plan titled Outfall-Force Main section STA. 16+50 to STA. 28+50, dated May 12, 1982 and revised through December 1987 for the Portland Water District, by Hunter-Ballew Associates (Project 800015, Drawing 8-20).

Bearings herein are referenced to Grid North, Maine State Plane Coordinate System, West Zone,

1802-NAD83.

Sewer Easement 2

An easement easterly of and not adjacent to Spurwink Avenue, and southerly of and not adjacent to Scott Dyer Road, situated southerly of and adjacent to an existing easement in Cape Elizabeth, County of Cumberland and State of Maine and shown on Exhibit B, Willow Brook Sewer Crossing, for the Town of Cape Elizabeth, by Sebago Technics, Inc, project number 19569, dated August 19, 2021, and being more particularly described as follows:

Beginning at a point on the southerly side of an existing easement as shown on referenced plan herein, being 30 feet right of station 28+75;

Thence S 79°-05'-25" E along said easement, a distance of approximately 175.00 feet;

Thence S 10°-54'-35" W through said land of Cape Elizabeth Land Trust, a distance of 55.00 feet;

Thence N 79°-05'-25" W through said land of Cape Elizabeth Land Trust, a distance of 175.00 feet;

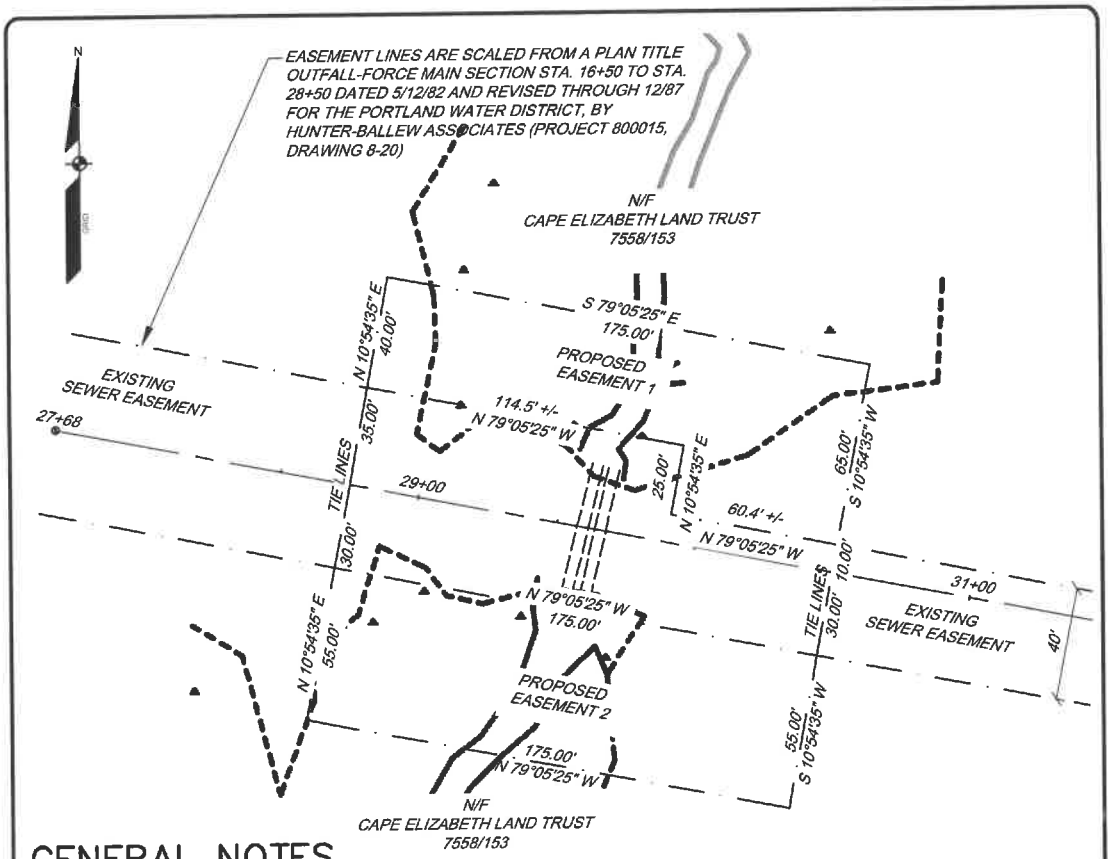
Thence N 10°-54'-35" E through said land of Cape Elizabeth Land Trust, a distance of 55.00 to the Point of Beginning.

The herein described sewer easement contains approximately 9,625 square feet.

Meaning and intending to describe the Proposed Easement 2 shown on the attached Exhibit B, referenced above, over a portion of the Cape Elizabeth Land Trust property described in Deed Book 7558, Page 153.

Reference is also made to a plan titled Outfall-Force Main section STA. 16+50 to STA. 28+50, dated May 12, 1982 and revised through December 1987 for the Portland Water District, by Hunter-Ballew Associates (Project 800015, Drawing 8-20).

Bearings herein are referenced to Grid North, Maine State Plane Coordinate System, West Zone, 1802-NAD83.



GENERAL NOTES

1. THE RECORD OWNER OF THE CAPE ELIZABETH LAND TRUST BY DEED DATE DECEMBER 22, 1986 AND RECORDED AT THE CUMBERLAND COUNTY REGISTRY OF DEEDS (CCRD) IN BOOK 7558 PAGE 153.
2. THE PROPERTY IS SHOWN AS LOT 9 ON THE CITY OF CAPE ELIZABETH TAX MAP U45.
3. THE AREA OF PROPOSED EASEMENT IS APPROXIMATELY 8,510 SQ. FEET AND THE AREA OF PROPOSED EASEMENT 2 IS APPROXIMATELY 9,625 SQ. FEET.
4. BOUNDARY AND TOPOGRAPHIC INFORMATION SHOWN HEREON IS BASED UPON AN ON THE GROUND SURVEY BY SEBAGO TECHNICS, INC. PERFORMED IN 2019.
5. PLAN REFERENCES:

   A. OUTFALL–FORCE MAIN SECTION STA. 16+50 TO STA. 28+50 DATED 5/12/82 AND REVISED THROUGH 12/87 FOR THE PORTLAND WATER DISTRICT, BY HUNTER–BALLEW ASSOCIATES (PROJECT 800015, DRAWING 8–20)

SEBAGO TECHNICS
WWW.SEBAGOTECHNICS.COM
75 John Roberts Rd
Suite 4A
South Portland, ME 04106
Tel. 207-200-2100

EASEMENT EXHIBIT B WILLOW BROOK SEWER CROSSING		SCALE: 1"=50' DATE: 8/19/21
LOCATION: WILLOW BROOK CROSSING CAPE ELIZABETH, ME	FOR: TOWN OF CAPE ELIZABETH CAPE ELIZABETH, ME	SHEET: 1 OF 1

19569EC.dwg, TAB: EAS EXIBIT

CAPE ELIZABETH LAND TRUST
330 OCEAN HOUSE ROAD
CAPE ELIZABETH, ME 04107

TOWN OF CAPE ELIZABETH
P O BOX 6260
CAPE ELIZABETH, ME 04107

EMERALD LLC
752 MAIN STREET
WESTBROOK, ME 04092

CAPE ELIZABETH LAND TRUST
330 OCEAN HOUSE ROAD
CAPE ELIZABETH, ME 04107

HEALTH CARE PROPERTY INVESTORS INC
1920 MAIN STR, STE #1200
IRVING, CA 92614

CAPE ELIZABETH LAND TRUST
330 OCEAN HOUSE ROAD
CAPE ELIZABETH, ME 04107

WOODLANDS SENIOR LIVING LLC
OF CAPE ELIZABETH
141 WEST RIVER RD #300
WATERVILLE, ME 15901

HALLBRIDGE CAPE ELIZABETH ASSISTED
LIVING LLC
1400 PROVIDENCE HWYSTE#1000
NORWOOD, MA 02062

Willow Brook Crossing Project
Cape Elizabeth

Site Visit Summary
Maine Natural Areas Program, 2020

MNAP Ecologist Kristen Puryear visited the Willow Brook Crossing project area on September 1, 2020 with Maureen O'Meara, Steve Harding, and Jay Reynolds (Town of Cape Elizabeth), Jake Aman (Wells NERR), Shane Kelly (Sebago Technics), and Chris Tolman (Cape Elizabeth Land Trust). The primary focus of the survey was to 1) conduct a functions and values assessment of the wetlands on the property, and 2) evaluate the proposed restoration at Willow Brook.

View of downstream end of one culvert.

Site Overview

The proposed culvert replacement project is located under a pedestrian trail that is part of a sewer line easement – the sewage pipes are buried beneath the trail but on top of the existing culverts. Both culverts are in poor condition, improperly sized, and perched. Willow Brook drains through the culverts to the Spurwink River, approximately 500 feet to the south of the crossing. The pedestrian trail is very important to the Town, and there are concerns about the integrity of the sewer lines if the culverts ultimately collapse, making this culvert crossing a top priority for replacement according to a town-wide assessment. Furthermore, the culverts represent a barrier to regular unimpeded movement of Willow Brook both upstream and down, with resulting impacts to the wetlands. Impacts will increase with sea level rise, in particular upstream and in the immediate area downstream.

View on Willow Brook, looking south (downstream).

The project area is located within the Scarborough Marsh Focus Area of Statewide Ecological Significance, and upstream of habitat mapped by the Maine Department of Inland Fisheries and Wildlife as Tidal Waterfowl and Wading Bird Habitat *and* Saltmarsh Sparrow habitat. The Maine Natural Areas Program has mapped Spartina Saltmarsh along the upper portion of the

Spurwink River, although brackish conditions and surrounding disturbance have contributed to a more transitional habitat this far up in the wetland system. The Cape Elizabeth Land Trust owns land on either side of Willow Brook downstream, as well as a portion upstream.

Current Conditions

Willow Brook experiences twice-daily tidal fluctuations on both the upstream and downstream sides and salinity levels have been measured in both locations within brackish range (J. Aman, personal communication). Downstream tidal range is approximately 1 meter, and salinity is at 12-16 ppt. Upstream salinity levels are slightly lower, but tidal height appears to be about the same.

At least moderate tidal restriction exists at the Rt. 77 crossing on the Spurwink River before it flows west/southwest out to Higgins Beach. This crossing may be considered for future repair by the Town, and at a minimum its impacts are being considered in the engineering calculations needed for the Willow Brook crossing.

Downstream of the crossing, there is a tall, well-established muddy bank that has a scoured opening at the outlet from restricted water movement. Vegetation on the bank is predominantly narrow-leaved cattail (*Typha angustifolia*) or the hybrid cattail (*Typha glauca*) – species that are present downstream in the Spurwink marsh as well. Narrow-leaved cattail is not native in New England and it can quickly form monocultures that out-compete native species (as it has here). This species is generally found in disturbed wetlands especially brackish or saltmarshes that have restrictions or are otherwise disturbed. Among other plant "indicators", saltmarsh tuber-bulrush (*Bolboschoenus maritimus*) and prairie cordgrass (*Spartina pectinata*) were also found on the banks. The latter can be found in freshwater marshes but both species are frequently found in brackish marshes and the upper edges of saltmarshes. On a portion of the exposed muddy banks, even seaside goldenrod (*Solidago sempervirens*) was also found. Together these prove the movement of at least brackish water through Willow Brook at the location of the crossing, in particular directly influencing the vegetation immediately on the banks, and likely further inland during higher tide events, though there was no clear evidence of regular overtopping at the time of the site visit.

Unfortunatly purple loosestrife (*Lythrum salicaria*) has also become established in the wetlands. With increasing sailinity, this species will not persist. In the meantime, the presence of Galerucella beetles may help with keeping the infestation at lower levels

Upstream of the crossing the marsh is mixed graminoid, and generally lacking the monoculture of cattail found downstream. Common plants are soft-stemmed bulrush (*Schoenoplectus tabernaemontani*), purple loosestrife, lake bank sedge (*Carex lacustris*), and common arrowhead (*Sagittaria latifolia*) – species that are typically within saturated wetlands, with standing water or seasonal flooding. The crossing has caused a back up of water in this portion of the wetland, resulting in the significant vegetation difference noted above and below the crossing. Removing the barrier will result in enhancement of the current and future conditions of the wetlands on both sides of the crossing, and can contribute to the resilience of the wetland as sea level rises.

View of wetland upstream of crossing, looking north.

The wetlands on either side provide a range of important functions and values (Table 1), in particular due to their thick vegetation and sediments within a watershed that has high impervious surface. If the culverts are appropriately replaced to allow for more regular and natural water exchange during tidal events and even large rain events, there will be functional improvements in the following: *Wildlife habitat, Fish and Shellfish Habitat, Nutrient Removal, and Shoreline Stabilization.*

Table 1: Current functions and values of the emergent wetlands on the Willow Brook Crossing project, Cape Elizabeth.

Ecological Functions / Values	**Rationale***
Groundwater Recharge/Discharge	*High Value*: Groundwater discharged into wetland
Floodflow Alteration	*High Value*: Wetland can retain water for long periods, absorb water from heavy rain events, and overland flow. Development and roads in immediate area.
Fish and Shellfish Habitat	Downstream habitat present; culverts present barrier
Sediment/Toxicant Retention	*High Value*: Basins and dense vegetation capable of trapping sediment

Nutrient Removal	*High Value*: Slow moving water, vegetation, hold potential for trapping sediment, removing and/or converting nutrients.
Production Export	Wildlife food sources present in wetland, conversion to higher trophic levels
Sediment/Shoreline Stabilization	Dense vegetation stabilizing shoreline; some erosion has occurred
Wildlife Habitat	*High Value:* Connected to other wetland types and uplands; upstream of breeding habitat for birds (IWWH); provides habitat for other songbirds, reptiles, amphibians and invertebrates
Recreation	*High Value:* Wildlife observation, accessible by foot on popular recreational trail
Educational/Scientific Value	*High Value:* within walking distance from school, neighborhoods; easily accessible
Uniqueness/Heritage	N/A
Visual Quality/Aesthetics	Contrasts with surrounding land use, plants turn bright colors in fall.
Endangered Species Habitat	None identified
MNAP Natural Community Type	Cattail Marsh, Brackish Tidal Marsh, Bulrush Bed

*Principle functions and values are indicated as "High Value"

Proposed Wetland Restoration Information

The Town is proposing removing the degraded culverts at the Willow Brook Crossing and replacing them with a box culvert that will included an embedded "natural cover" bottom. The exact span of the crossing (at least 11 feet wide) was still under discussion with engineers. The important consideration to be made is accommodation for sea level rise. With current tidal heights, and the current elevation position of the sewer lines (which limits how *high* the structure opening can be), a smaller design will leave insufficient room for any future increase in sea level. Various options were discussed on site.

Note: Several species of invasive shrubs (e.g. multiflora rose, purple loosestrife, Morrow's honeysuckle) were noted on the banks of the pedestrian trail. Soil and fill removal associated with construction should be done carefully and all soil should be disposed of properly to avoid spreading or transplanting seeds and other viable fragments to another area.

Willow Brook Crossing
Cape Elizabeth

Project area

Conserved Land

Spartina Saltmarsh

Sea Level Rise Scenario

HAT Plus 1.2 Feet

HAT Plus 1.6 Feet

0 0.1 0.2 Miles

Map created by Maine Natural Areas Program, 2020
Sea level rise modeling from Maine Geological Survey

REPORT

19-1756 S

May 8, 2020

Explorations and Geotechnical Engineering Services

Proposed Culvert Replacement
Willow Brook
Cape Elizabeth, Maine

Prepared For:
Town of Cape Elizabeth
Attention: Robert Malley
10 Cooper Drive
Cape Elizabeth, Maine 04107

Prepared By:
S. W. Cole Engineering, Inc.
286 Portland Road
Gray, Maine 04039
T: 207-657-2866

S.W.COLE ENGINEERING, INC.

- *Geotechnical Engineering*
- *Construction Materials Testing and Special Inspections*
- *GeoEnvironmental Services*
- *Test Boring Explorations*

www.swcole.com

TABLE OF CONTENTS

19-1756 S

May 8, 2020

Town of Cape Elizabeth
Attention: Robert Malley
10 Cooper Drive
Cape Elizabeth, Maine 04107

Subject: Explorations and Geotechnical Engineering Services
Proposed Culvert Replacement
Willow Brook
Cape Elizabeth, Maine

Dear Bob:

In accordance with our Proposal, dated January 29, 2020, we have performed subsurface explorations for the subject project. This report summarizes our findings and geotechnical recommendations and its contents are subject to the limitations set forth in Appendix A.

1.0 INTRODUCTION

1.1 Scope and Purpose

The purpose of our services was to obtain subsurface information at the site in order to develop geotechnical recommendations relative to foundations and earthwork associated with the proposed construction. Our scope of services included test boring explorations, a geotechnical analysis of the subsurface findings and preparation of this report.

1.2 Site and Proposed Construction

The site is a culvert crossing of an existing recreational trail over Willow Brook, about 750 east of Starboard Drive, in Cape Elizabeth, Maine. The culvert crossing currently consists of two 48-inch corrugated metal pipes conveying Willow Brook beneath the trail. The existing trail ground surface elevation is approximately 9 feet (project datum) at the crossing and existing culvert pipe inverts vary from about elevation 2 to 3 feet.

The existing trail embankment contains both a gravity sewer main and a sewer force main; the provided historic plan indicates these utility inverts are approximately 6 feet below ground surface, crossing above the existing culvert pipes.

We understand planning includes replacing the existing culvert pipes with a new 11-foot span, by 5-foot tall, by 70-foot long precast concrete box culvert. Proposed Box culvert inverts are currently set at elevation -0.15 and -0.31 feet, corresponding to a depth of about 9 to 9.5 feet below the existing trail ground surface at the crossing. We understand the base of the box culvert will be recessed into the ground about 2 feet below the stream bottom.

The general site location is shown on the "Site Location Map", and the proposed and existing site features are shown on the "Exploration Location Plan", both attached in Appendix B.

2.0 EXPLORATION AND TESTING

2.1 Explorations

Two test borings (B-1 and B-2) were made at the site on February 25, 2020 by S. W. Cole Explorations, LLC. The upper approximate 6 feet of soils were hydro-vacuum excavated at the boring locations by Badger Daylighting, working under subcontract to S. W. Cole Engineering, Inc. (S.W.COLE) to help avoid the existing sewer utilities. The exploration locations were selected and established in the field by S.W.COLE using measurements from existing site features, and were subsequently located by survey by Sebago Technics, Inc. The approximate exploration locations are shown on the "Exploration Location Plan" attached in Appendix B. Logs of the explorations and a key to the notes and symbols used on the logs are attached in Appendix C. The elevations shown on the logs were estimated based on topographic information shown on the "Exploration Location Plan".

2.2 Testing

The test borings were drilled using a hollow-stem augers. The soils were sampled at 2 foot intervals using a split spoon sampler and Standard Penetration Testing (SPT) methods. SPT blow counts are shown on the logs. Soil samples obtained from the explorations were returned to our laboratory for further visual classification.

3.0 SUBSURFACE CONDITIONS

3.1 Soil and Bedrock

Underlying a surficial layer of topsoil, the borings encountered a soil profile generally consisting of uncontrolled fill overlying glaciomarine sediments layered with peat and organics overlying refusal surfaces (probable bedrock). The uncontrolled fill generally consisted of soft, brown to gray-brown silty clay with varying portions of sand, gravel, and rootlets extending to depths of about 6 to 9 feet below ground surface. The glaciomarine sediments generally consisted of silts and sands with varying portions of clay, layered with organics and peat overlying refusal surfaces (probable bedrock) at depths of about 8 to 10 feet (approximate elevation 1 to -1 feet). A layer of probable weathered bedrock was penetrated by the augers at boring B-1 from a depth of about 10 to 11 feet below ground surface.

Not all the strata were encountered at each exploration; refer to the attached logs for more detailed subsurface information.

3.2 Groundwater

The soils encountered at the test borings were wet to saturated from the ground surface. Groundwater likely becomes perched on the relatively impervious silts, clays and bedrock encountered at the test borings. Long term groundwater information is not available. It should be anticipated that groundwater levels will fluctuate, particularly in response to the level of Willow Brook and periods of snowmelt and precipitation, as well as changes in site use.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

Based on the subsurface findings, the proposed construction appears feasible from a geotechnical standpoint. The principle geotechnical considerations include:

- The invert of the proposed box culvert will encounter bedrock and glaciomarine sediments with organics. The glaciomarine sediments with organics are unsuitable for support of the proposed box culvert. We recommend removing the glaciomarine sediments with organics to expose bedrock and backfilling with

compacted Crushed Stone. To remove potential hard points beneath the box culvert, we recommend the box culvert be underlain with at least 6-inches of Crushed Stone bedding material.

- Based on the proposed box culvert invert and the findings at the borings, we anticipate bedrock removal will be required to achieve proposed grades. Given the proximity to the existing sewer mains, we recommend bedrock removal be performed using a hydraulic hoe-ram in lieu of blasting.

- Excavation for the culvert replacement will require careful planning. We anticipate stream flow diversion and continuous dewatering will be needed. The existing sewer utilities must be adequately supported and protected during construction.

- Imported Crushed Stone and Structural Fill will be needed for construction.

4.1 Site and Subgrade Preparation

We recommend that site preparation begin with the construction of an erosion control system to protect adjacent drainage ways and areas outside the construction limits. Surficial organics, roots and topsoil should be completely removed from areas of proposed construction. As much vegetation as possible should remain outside the construction areas to lessen the potential for erosion and site disturbance.

As discussed, the borings encountered glaciomarine sediments layered with peat and organics at or below the proposed culvert bottom. We recommend glaciomarine sediments with organics be removed from beneath the proposed box culvert to expose bedrock. The extent of removal should extend 1 foot laterally outward from outside edge of culvert for every 1-foot of excavation depth (1H:1V bearing splay). The overexcavated area should be backfilled with compacted Crushed Stone. In all cases, the box culvert should be underlain by at least 6 inches of Crushed Stone bedding material.

4.2 Excavation and Dewatering

Excavation work will generally encounter clayey uncontrolled fills, glaciomarine sands, silts and clays layered with peat and organics, and bedrock. Care must be exercised during construction to limit disturbance of the bearing soils. Earthwork and grading activities should occur during drier, non-freezing weather of Spring, Summer and Fall. Equipment

should not operate directly on the soil subgrades. Final cuts to subgrades in soil should be performed with a smooth-edged bucket to help reduce strength loss from soil disturbance.

Based on the subsurface findings, we anticipate bedrock removal will be required. Given the proximity to existing water wells and infrastructure, we recommend hoe-ramming be used for bedrock removal in lieu of blasting. Pre-drilling could be used to perforate the bedrock prior to hoe-ramming to facilitate bedrock removal.

Vibrations from construction should be controlled below threshold limits of 0.5 in/sec for structures, water supply wells and infrastructure within 500 feet of the project site. More restrictive vibration limits may be warranted in specific cases with sensitive equipment, historic structures or artifacts on-site or within close proximity.

We anticipate that stream diversion and continuous dewatering will be needed during construction. Sumping and pumping dewatering techniques should be adequate to control groundwater in excavations. Controlling the water levels to at least one foot below planned excavation depths will help stabilize subgrades during construction. Excavations must be properly shored or sloped in accordance with OSHA Regulations to prevent sloughing and caving of the sidewalls during construction. Care must be taken to adequately support and protect the existing sewer mains throughout construction.

The design and planning of excavations, excavation support systems, and dewatering is the responsibility of the contractor. We recommend the construction documents require the contractor to prepare an excavation, shoring and dewatering submittal for review by the project team prior to the start of work.

4.3 Foundations

We recommend the box culvert be founded on at least 6-inches of compacted Crushed Stone, bearing on bedrock. For foundations bearing on properly prepared subgrades, we recommend the following geotechnical parameters for design consideration:

Geotechnical Parameters for Box Culvert Foundation	
Design Frost Depth (100 year AFI)	4.5 feet
Net Allowable Soil Bearing Pressure	3.0 ksf
Base Friction Factor	0.35
Total Unit Weight of Backfill	125 pcf
At-Rest Lateral Earth Pressure Coefficient	0.5
Internal Friction Angle of Backfill	30°
Seismic Soil Site Class	C (ASCE 7-16)
Estimated Total and Differential Settlement	½ -inch

4.4 Fill, Backfill and Compaction

We recommend the following fill and backfill materials: recycled products must also be tested in accordance with applicable environmental regulations and approved by a qualified environmental consultant.

Common Borrow: Fill to raise grades in landscape areas should be non-organic compactable earth meeting the requirements of 2014 MaineDOT Standard Specification 703.18 Common Borrow.

Structural Fill: Backfill for the proposed box culvert, along the side and at least 2 feet over the top, should be clean, non-frost susceptible sand and gravel meeting the gradation requirements for Structural Fill as given below:

Structural Fill	
Sieve Size	**Percent Finer by Weight**
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
No. 40	0 to 30
No. 200	0 to 6

Crushed Stone: Crushed Stone, used as base material beneath the proposed box culvert and to backfill overexcavations, should be washed ¾-inch crushed stone meeting the requirements of 2014 MaineDOT Standard Specification 703.22 Underdrain Backfill Material Type C.

Reuse of Site Soils: The on-site soils are unsuitable for reuse beneath and in direct contact around the culvert, but may be suitable for reuse as Common Borrow above

Structural Fill backfill zone over the culvert, as well as in landscape areas, provided they are free or organics and at a compactable moisture content at the time of reuse.

Placement and Compaction: Fill should be placed in horizontal lifts and compacted such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thicknesses for grading, fill and backfill activities should not exceed 12 inches. We recommend that fill and backfill in building and paved areas be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557. Crushed Stone should be compacted with 3 to 5 passes of a vibratory plate compactor having a static weight of at least 500 pounds.

4.5 Weather Considerations

Construction activity should be limited during wet and freezing weather and the site soils may require drying or thawing before construction activities may continue. The contractor should anticipate the need for water to temper fills in order to facilitate compaction during dry weather. If construction takes place during cold weather, subgrades must be protected during freezing conditions. Fill must not be placed on frozen soil and once placed, must be protected from freezing.

4.6 Design Review and Construction Testing

S.W.COLE should be retained to review the construction documents prior to bidding to determine that our earthwork and foundation recommendations have been properly interpreted and implemented.

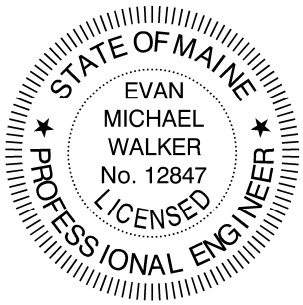
A soils and concrete testing program should be implemented during construction to observe compliance with the design concepts, plans, and specifications. S.W.COLE is available to observe earthwork activities and the preparation of foundation bearing, as well as to provide testing of soil and concrete construction materials.

5.0 CLOSURE

It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you during the construction phase of the project.

Sincerely,

S. W. Cole Engineering, Inc.



Evan M. Walker, P.E.
Geotechnical Engineer

EMW:tjb

APPENDIX A

Limitations

This report has been prepared for the exclusive use of the Town of Cape Elizabeth for specific application to the proposed Culvert Replacement at Willow Brook in Cape Elizabeth, Maine. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct our services in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

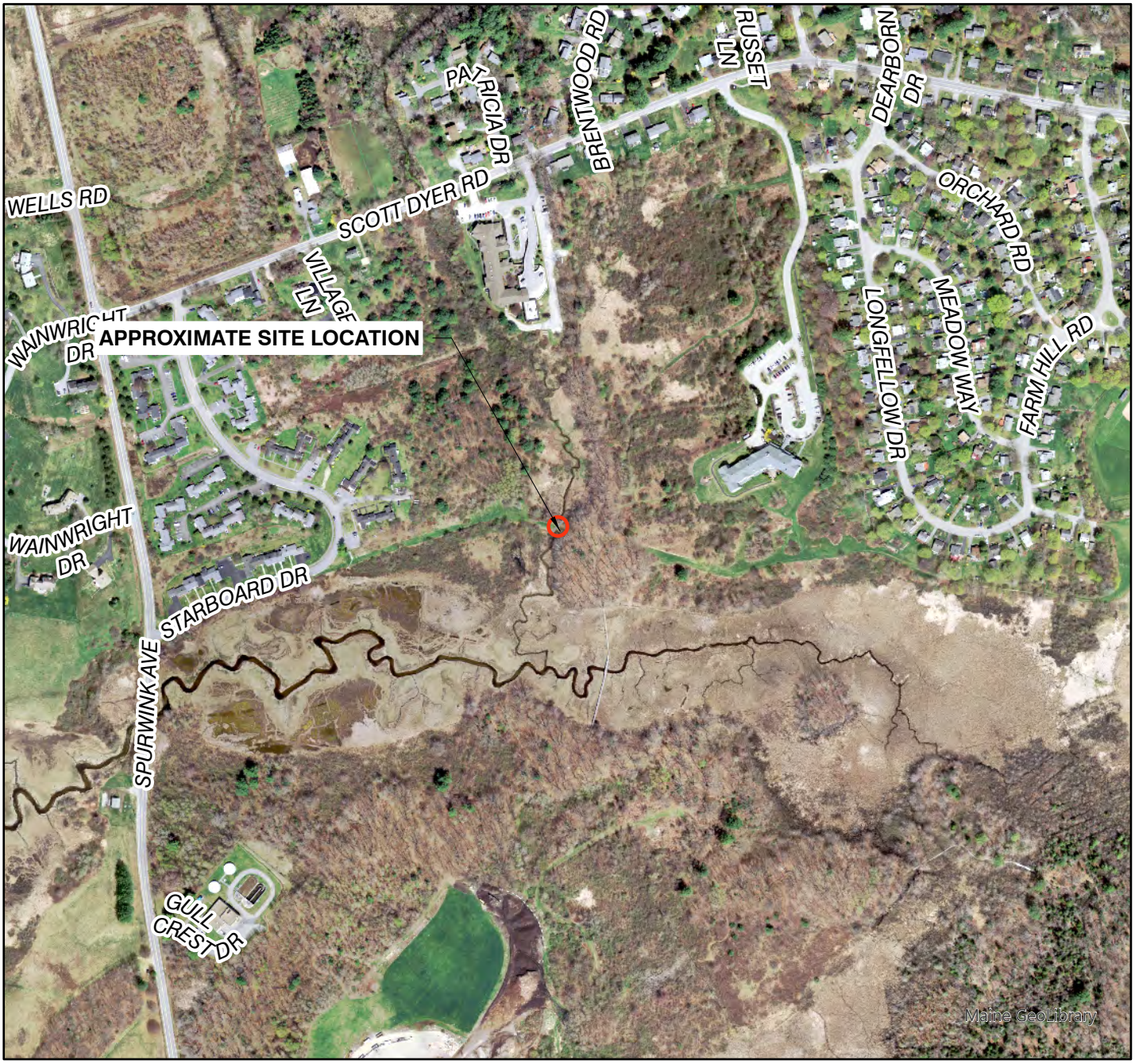
Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE's scope of services has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE.

APPENDIX B

Figures



N
W E
S

500 0 500 1,000

Scale in Feet

S.W.COLE ENGINEERING, INC.

TOWN OF CAPE ELIZABETH

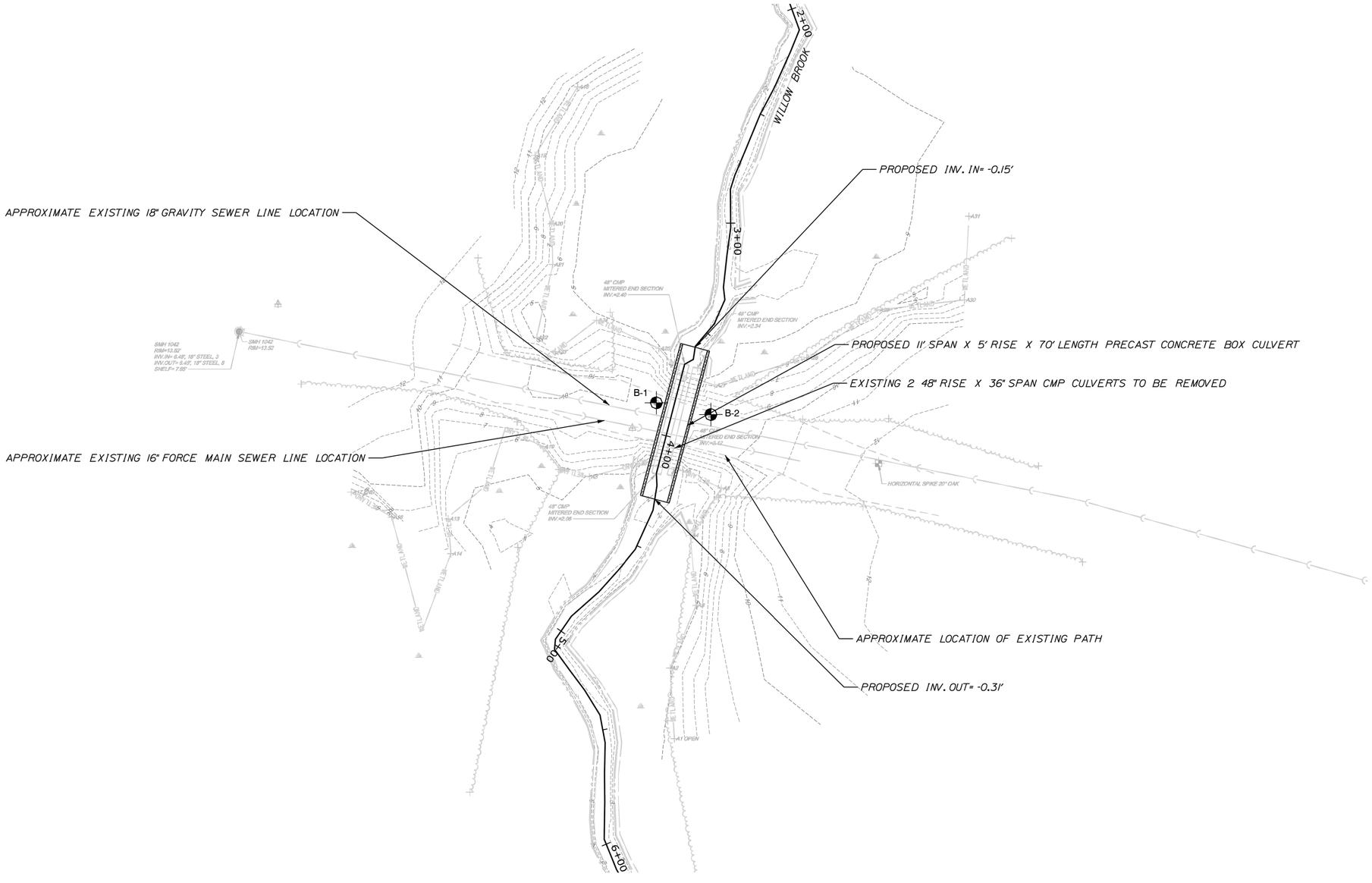
SITE LOCATION MAP

PROPOSED CULVERT REPLACEMENT
WILLOW BROOK
CAPE ELIZABETH, MAINE

Job No.	19-1756	Scale	1" = 500'
Date:	5/5/2020	Sheet	1

NOTE:
SITE LOCATION MAP PREPARED FROM IMAGERY FROM MAINE GEOLIBRARY ENTITLED "MAINE ORTHOIMAGERY REGIONAL 2017.

R:\2019\19-1756\GIS\Project\19-1756.aprx, 2/27/2020 4:30 PM, 1:6,000,



LEGEND:

APPROXIMATE BORING LOCATION

NOTES:

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=25' SCALE PLAN OF THE SITE ENTITLED "CONCEPTUAL PLAN," PREPARED BY SEBAGO TECHNICS, DATED 04/29/2020.
2. THE BORINGS WERE LOCATED IN THE FIELD BY SURVEY BY SEBAGO TECHNICS AND PROVIDED ON THE ABOVE REFERENCED PLAN.
3. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S. W. COLE ENGINEERING, INC. GEOTECHNICAL REPORT.
4. THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND PROPOSED CONSTRUCTION AND IS NOT TO BE USED FOR CONSTRUCTION.

0 25 50 Feet

NO.	DATE	DESCRIPTION	BY
1	05/07/2020	FINAL REPORT SUBMISSION	CEM
0	02/27/2020	PRELIMINARY DATA REPORT	CEM

S.W.COLE ENGINEERING, INC.

TOWN OF CAPE ELIZABETH

EXPLORATION LOCATION PLAN

PROPOSED CULVERT REPLACEMENT
WILLOW BROOK
CAPE ELIZABETH, MAINE

Job No.: 19-1756 Scale: 1" = 25'
Date : 02/27/2020 Sheet: 2

APPENDIX C

Exploration Logs and Key

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Town of Cape Elizabeth
PROJECT: Proposed Culvert Replacement
LOCATION: Willow Brook, Cape Elizabeth, Maine

BORING NO.: B-1
SHEET: 1 of 1
PROJECT NO. 19-1756
DATE START: 2/25/2020
DATE FINISH: 2/25/2020

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 9' +/- | **TOTAL DEPTH (FT):** 11.0 | **LOGGED BY:** Evan Walker
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Jeff Lee | **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted CME 850 | **AUGER ID/OD:** 2 1/4 in / 5 5/8 in | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic | **HAMMER WEIGHT (lbs):** 140 | **CASING ID/OD:** N/A /N/A | **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: 0.8 | **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): All Soils Wet to Saturated
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; Ø = Friction Angle (Estimated); N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
										Hydro-Vacuum Excavate to 6' for Utility Clearance Reworked, soft, brown, silty CLAY with some sand (FILL)		
5	5		1D		6-8	24/18	WOH					
										6.0 Reworked, soft, gray-brown, silty CLAY, some sand, trace gravel, with rootlets (FILL)		
			2D		8-10	24/24	WOH/12"-1-6					
0										9.0 Loose, gray, SILT AND CLAY, with organic fibers		
	10		3D		10-10.7	8/8	18-50/2"			9.5 10.1 Medium dense, gray, silty SAND, with black and brown organics and peat seams		
										Probable Weathered BEDROCK		
										Bottom of Exploration at 11.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

S.W.COLE ENGINEERING, INC.

BORING LOG

CLIENT: Town of Cape Elizabeth
PROJECT: Proposed Culvert Replacement
LOCATION: Willow Brook, Cape Elizabeth, Maine

BORING NO.: B-2
SHEET: 1 of 1
PROJECT NO. 19-1756
DATE START: 2/25/2020
DATE FINISH: 2/25/2020

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 9' +/- | **TOTAL DEPTH (FT):** 8.0 | **LOGGED BY:** Evan Walker
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Jeff Lee | **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted CME 850 | **AUGER ID/OD:** 2 1/4 in / 5 5/8 in | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic | **HAMMER WEIGHT (lbs):** 140 | **CASING ID/OD:** N/A /N/A | **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: 0.8 | **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): All Soils Wet to Saturated
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; Ø = Friction Angle (Estimated); N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
										Hydro-Vacuum Excavate to 5.5' for Utility Clearance Reworked, soft, brown, silty CLAY with some sand (FILL)		
5	5		1D		5.5-7.5	24/18	1-1-2-2			5.5 Reworked, soft, gray-brown, silty CLAY, some sand, with rootlets (FILL)		
										6.0		
										6.7 Loose, black and dark brown, PEAT and organic muck		
			2D		7.5-8	6/6	3-50/0"			7.9 Loose, gray, layered clayey SILT, and silty fine SAND with organic fibers		
										Probable Weathered BEDROCK Bottom of Exploration at 8.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

KEY TO NOTES & SYMBOLS
Test Boring and Test Pit Explorations

Stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q_u	-	unconfined compressive strength, kips/sq. ft. - laboratory test
S_v	-	field vane shear strength, kips/sq. ft.
L_v	-	lab vane shear strength, kips/sq. ft.
q_p	-	unconfined compressive strength, kips/sq. ft. – pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W_L	-	liquid limit - Atterberg test
W_P	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass.
γ_T	-	total soil weight
γ_B	-	buoyant soil weight

Description of Proportions:

Trace:	0 to 5%
Some:	5 to 12%
"Y"	12 to 35%
And	35+%
With	Undifferentiated

Description of Stratified Soils

Parting:	0 to 1/16" thickness
Seam:	1/16" to 1/2" thickness
Layer:	½" to 12" thickness
Varved:	Alternating seams or layers
Occasional:	one or less per foot of thickness
Frequent:	more than one per foot of thickness

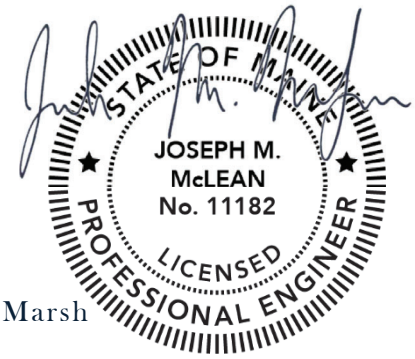
REFUSAL: **Test Boring Explorations** - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

REFUSAL: **Test Pit Explorations** - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.

ACADIA CIVIL WORKS
ENGINEERING DESIGN & CONSULTATION

MEMO



To: Ms. Maureen O'Meara
From: Joseph M. McLean, PE
Date: March 12, 2021
Subject: Summary of Tidal Hydraulic Assessment
Willow Brook Crossing of the Sewer/Trail at Spurwink Marsh
Cape Elizabeth, ME

Acadia Civil Works has reviewed the conceptual design plans (six sheets) prepared by Sebago Technics, Inc. dated March 9, 2020 for the Willow Brook Crossing of the sewermains/trail adjacent to Spurwink Marsh. This crossing is located just downstream of the Willow Brook crossing of Scott Dyer Road. As you have requested, Acadia Civil Works has evaluated the tidal influence at this site and assessed the hydraulic performance of the crossing under a variety of potential future sea level rise (SLR) conditions.

In December of 2019, Acadia Civil Works provided the Town of Cape Elizabeth with a Preliminary Design Report associated with the Tidal Crossing Assessment at the Sawyer Road Culvert that crosses the Spurwink River (within the Spurwink Marsh). The hydraulic and hydrologic models, as well as the associated assessment methodology prepared for that study have been utilized to evaluate the subject crossing at Willow Brook. Further detail associated with the model construction and the assessment methodology are included in the aforementioned report.

PROJECT UNDERSTANDING

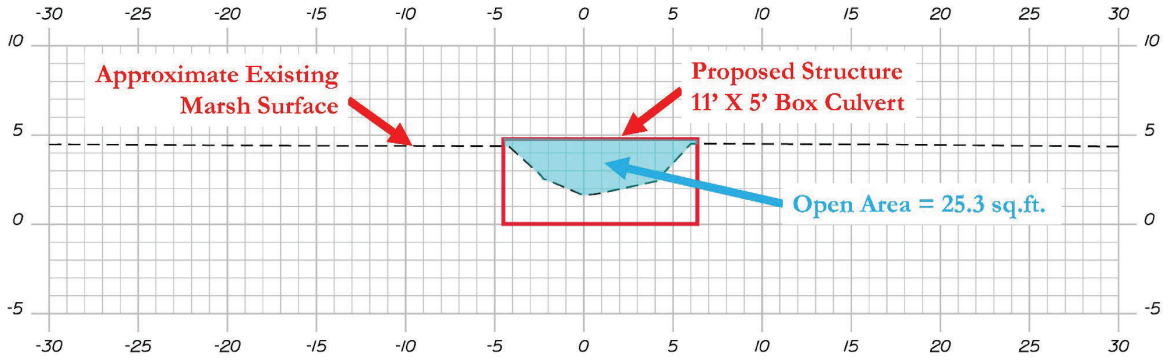
The Town of Cape Elizabeth desires to replace the existing culverts located under the 18" diameter sanitary sewer gravity interceptor and 16" diameter forcemain at Willow Brook. As shown on the plans prepared by Sebago Technics (attached), the existing culverts are twin 48" by 36" corrugated metal pipes and are significantly deteriorated. A proposed 11' by 5' concrete box culvert is proposed to replace the existing culverts. As shown on the plans, the box culvert includes an invert filled with approximately two feet of gravel, which will result in an effective open height of approximately 3' (max).

Several cross sections of Willow Brook and a profile are shown on the plans. The bank width of Willow Brook appears to be approximately 9 feet, so the 11 foot span box culvert provides an approximate 1.2 times bank width. The proposed inverts of the culvert fill (Inlet Inv.=1.85' and Outlet Inv.=1.69') also appear to be in appropriate alignment with the longitudinal channel profile.

A sketch of the proposed box culvert section has been overlain on the surveyed cross section at Sta. 3+00 (shown on the Sebago Technics Plans), below in Figure 1A. As shown in Figure 1A, the crown of the culvert (approx. elevation of 5 feet, NAVD88) is in close alignment with the elevation of the marsh surface (approx. elevation 4.5 feet, NAVD88). It is notable that peak high tide water surfaces (as they exist and in the future) exceed these elevations. In general, it would be desirable to raise the crown of the crossing structure above the marsh

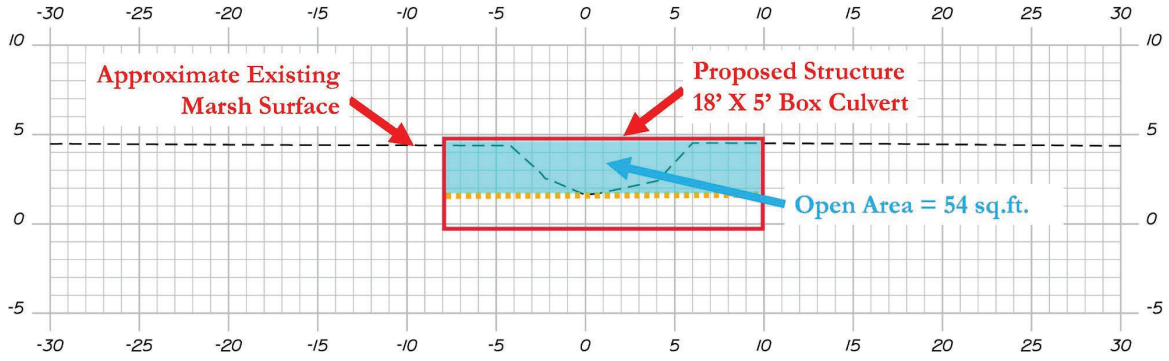
surface, and ideally higher to limit surcharging of the culvert during periods of high tide. However, the box culvert crown elevation is limited by the presence of the existing sewermains (18" gravity interceptor and 16" forcemain), which has an invert of approximately 6.4 feet in the vicinity of the crossing. Unless the sewermains are relocated, the height of the proposed box culvert cannot be increased.

Figure 1A – Approximate Structure Cross Section (11' X 5' Box)



As a potential option to provide additional hydraulic capacity at the crossing, Sebago Technics has proposed to increase the span of the box culvert from 11' to 18' in width (See Figure 1B, below). While this may be possible, it would require that pools are formed (presumably excavated) at the inlet and outlet of the structure to allow for the full span of the culvert to be utilized. If the channel morphology is to be maintained through the crossing (as is recommended by Stream Smart, Stream Simulation, and similar design techniques) there is little additional capacity to be gained from extending the culvert span beyond 11 feet. As illustrated in Figure 1B, the bulk of the additional culvert span (beyond 11 feet) is largely located below the bank/marsh surface elevation.

Figure 1B – Approximate Structure Cross Section (18' X 5' Box)



Considering the constraints of the existing sewermains and the existing channel morphology, it appears the largest single open area that can be provided at the site is being proposed with the 11' by 5' box culvert. As shown on Figure 1A, this equals an approximate open area within the crossing of 25.3 square feet.

HYDRAULIC PERFORMANCE

Acadia Civil Works evaluated the hydraulic performance for a range of crossing structure sizes at the subject location. The MDEP Highest Annual Tide was used primarily as the design tidal condition (similar to the aforementioned study of Spurwink Marsh). While it is

anticipated that the tidal hydrology will be a primary factor in the sizing of the proposed structure, it is important to note that this assessment did not evaluate the effects of upstream flows (freshwater discharge and watershed runoff).

The hydraulic model covers the footprint and wetland associated with Spurwink Marsh upstream of the Route 77 Bridge. As part of the aforementioned prior study of Spurwink Marsh the MDEP Highest Annual Tide was synthesized at this location. It was then also translated utilizing the US Army Corps of Engineers Sea Level Rise methodology for several potential sea level rise(SLR) scenarios published by NOAA in 2017. The general NOAA 2017 sea level rise (SLR) curves are shown below in Figure 2 and the associated design tides (MDEP Highest Annual tide located downstream of the Route 77 Bridge) are shown in Figure 3.

Figure 2 – NOAA (2017) Potential Sea Level Rise (SLR) Curves

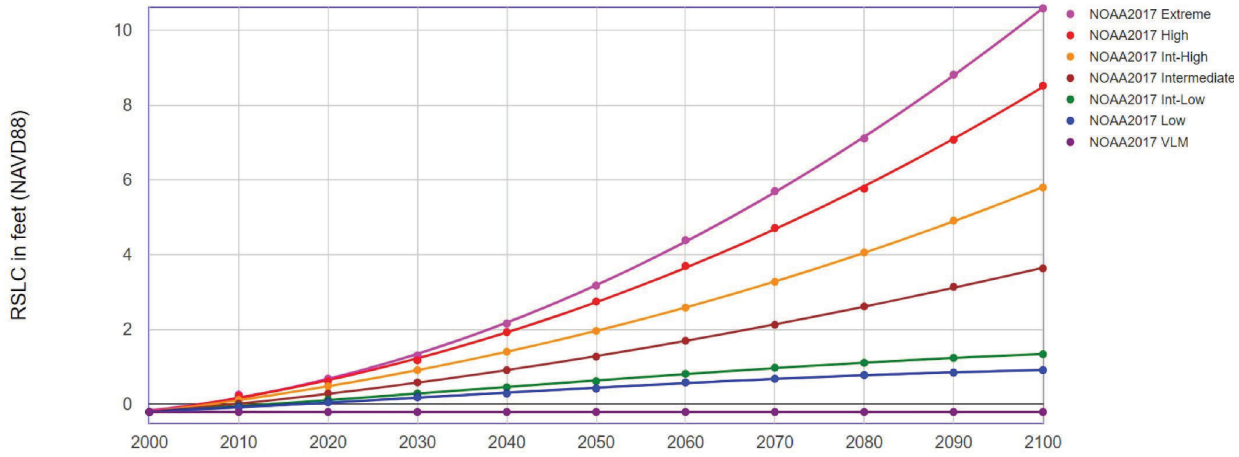
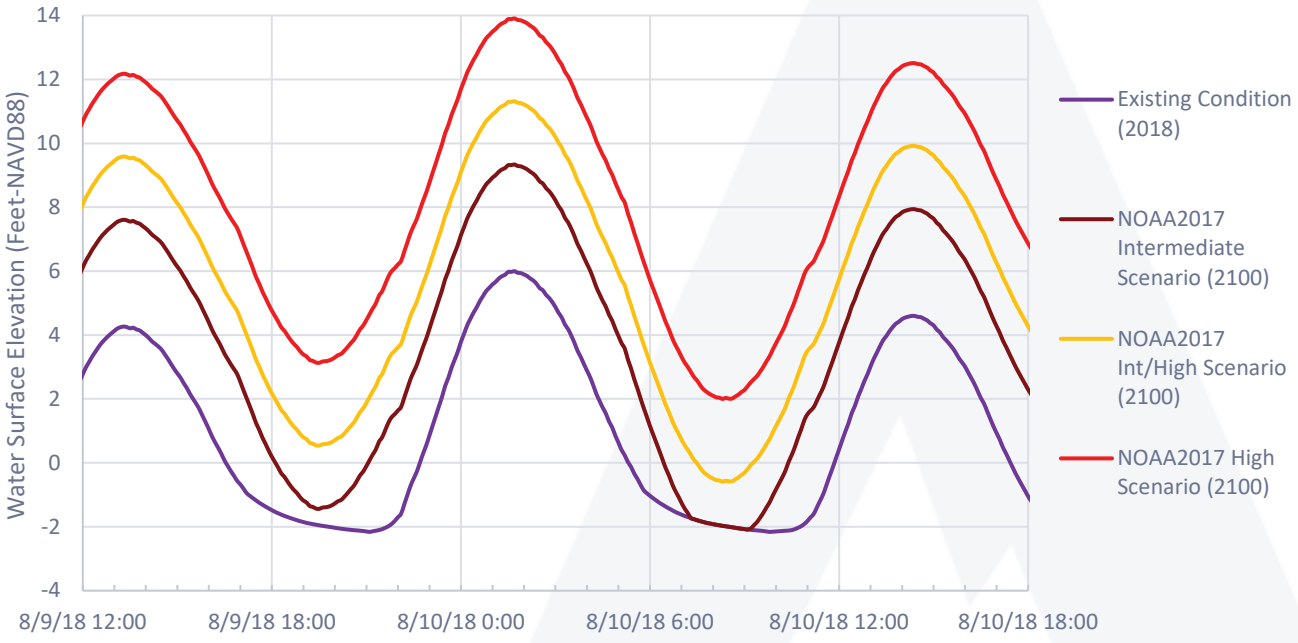


Figure 3 – Design Tides
MDEP Highest Annual Tide (Synthesized)
for Select Potential Sea Level Rise (SLR) Scenarios in 2100



A hydraulic performance curve focused on the peak instantaneous head differential experienced at the crossing location was prepared for each of the three (3) selected NOAA 2017 future SLR scenarios: the Intermediate, the Intermediate-High, and the High scenarios. A variety of crossing structures were evaluated in the model during each of these tidal conditions to generate the performance data. The resulting curves are shown in the following three figures (Figures 4, 5, and 6). It should be noted that the trail/sewermain embankment was not allowed to overtop in the model. All tidal exchange was required to flow through the proposed crossing structure.

Figure 4 – Tidal Hydraulic Performance
for the Intermediate (NOAA2017) Sea Level Rise (SLR) Scenario in 2100

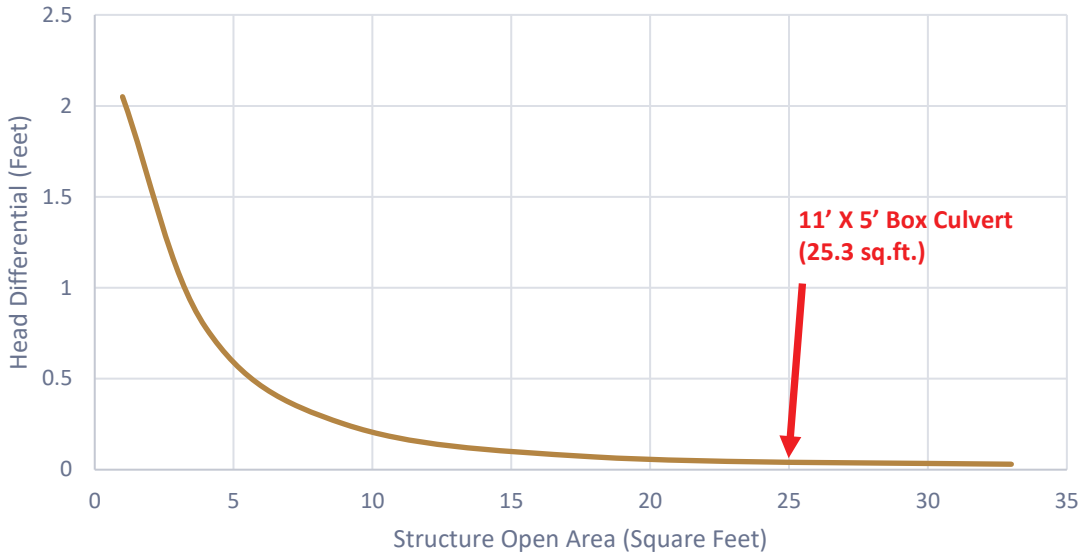


Figure 5 – Tidal Hydraulic Performance
for the Intermediate-High (NOAA2017) Sea Level Rise (SLR) Scenario in 2100

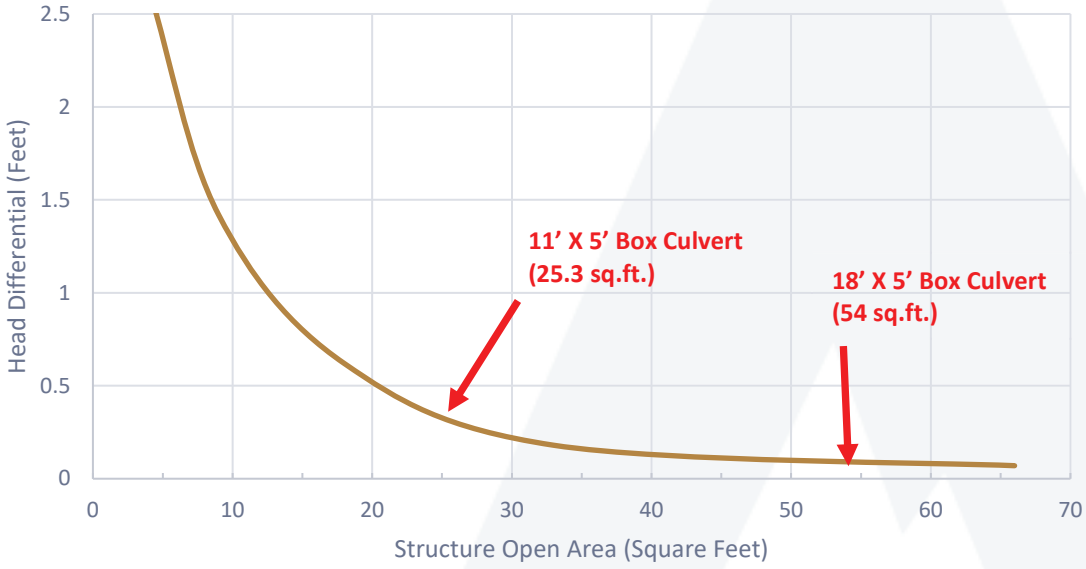
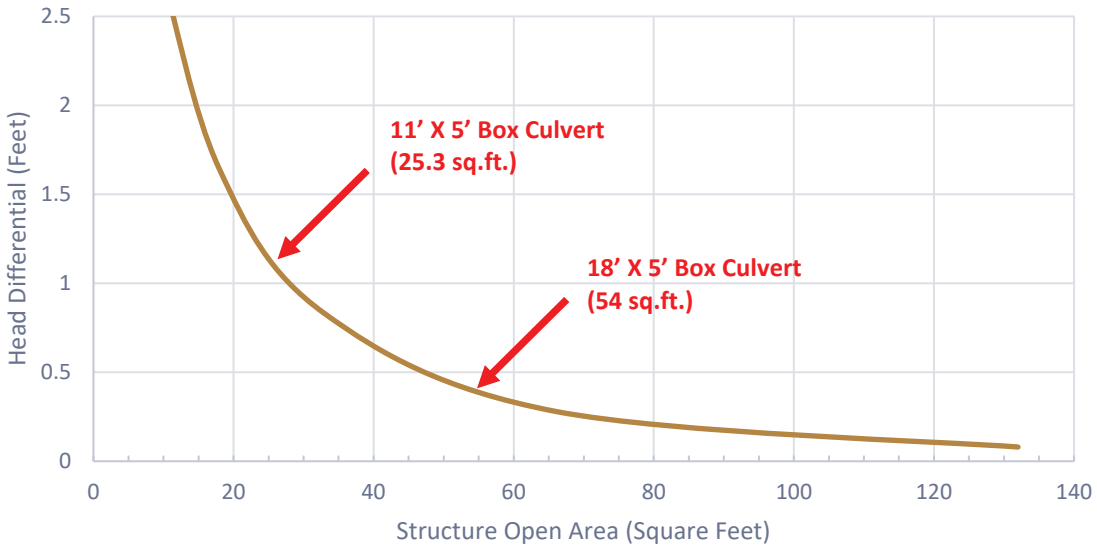


Figure 6 – Tidal Hydraulic Performance
for the High (NOAA2017) Sea Level Rise(SLR) Scenario in 2100



As shown in Figure 4, the open area (25.3 sq.ft.) provided by the proposed 11' by 5' box culvert has less than an inch of peak head differential, which demonstrates that the crossing is effective in exchanging tidal waters in the Intermediate SLR scenario in the year 2100. Conversely, Figure 6 shows that the crossing experiences over a foot of peak head differential in the High SLR scenario, which would be a substantive impact to tidal exchange in the year 2100. Figure 5 depicts the Intermediate-High SLR scenario, which (as the name implies) reflects a head differential that is higher than the Intermediate scenario but lower than the High scenario (between 3 and 4 inches of peak head differential).

There is currently no definitive regulatory standard for acceptable tidal hydraulic performance, however based upon prior project experience it is generally accepted that an appropriately sized crossing is located to the right of the curve inflection point as it begins its approach to the x-axis (head differential of zero feet). In that respect, the 11' by 5' foot box culvert is adequately sized for both the Intermediate and Intermediate-High SLR scenarios. However during the High SLR scenario in the year 2100, the hydraulic performance of the proposed structure lies to the left of the curve inflection, which indicates that it is not appropriate for that condition.

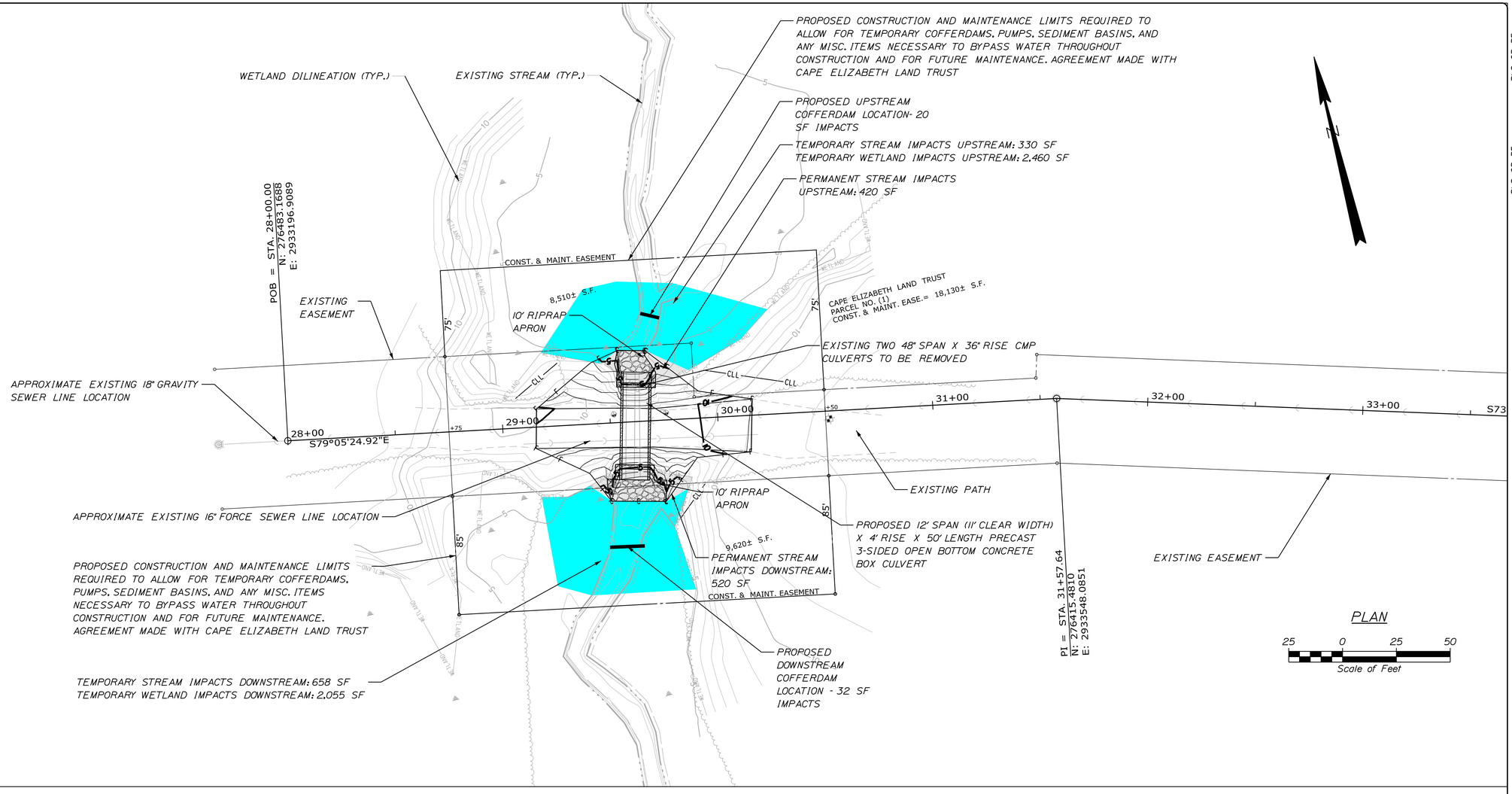
As noted the hydraulic performance considered tidal conditions in the year 2100. This reflects a design life of approximately 80 years for the box culvert (2020 to 2100). Another way to view the tidal performance of the structure may be to shorten the design life. As shown in Figure 2, the High SLR curve in 2080 is equivalent to the Intermediate-High SLR curve in 2100. As such, the hydraulic performance curve in Figure 5 can also represent the High SLR scenario in the year 2080. Assuming the performance shown on Figure 5 is acceptable, then the proposed culvert could be considered appropriately sized with a design life that may vary from 60 years (2020 to 2080 in the High scenario) to 80 years (2020 to 2100 in the Int-High scenario).

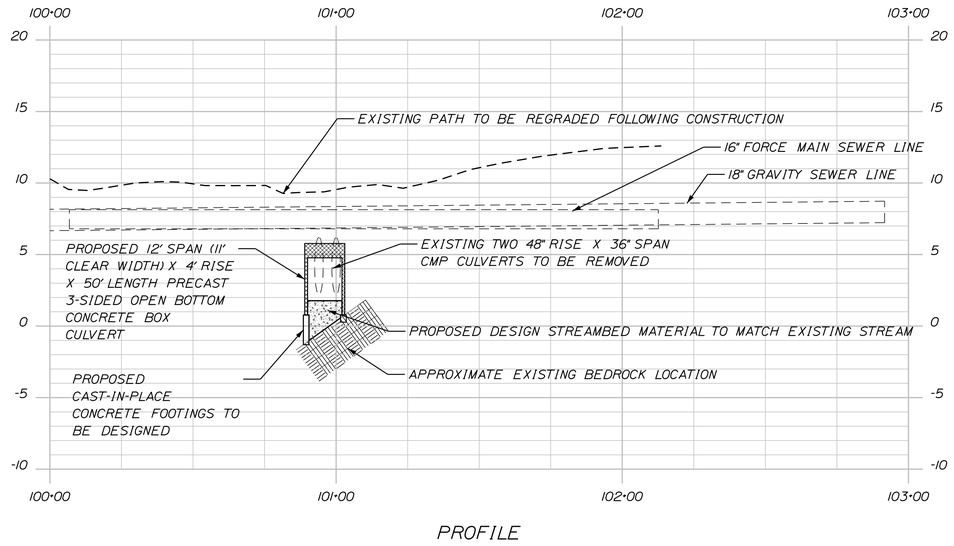
CONCLUSION AND RECCOMENDATIONS

It appears that the proposed 11' by 5' concrete box culvert is adequately sized for tidal conditions with a design life that will vary from 60 years (under a High SLR scenario) to 80 years (under and Int-High SLR scenario). This assumes that a peak instantaneous head differential during the MDEP Highest Annual Tide of between 3 and 4 inches is acceptable.

If improved hydraulic performance is desired at this location, it may be achieved by increasing the span of the box culvert. However, the increased span will require inlet and outlet pools to be formed (excavated) and would not provide geomorphic connectivity in Willow Brook from up to downstream (which is a goal of Stream Smart, Stream Simulation, and similar stream crossing design standards).

To maintain stream channel morphology through the crossing structure (and also allow the two sewermains to remain in place), it may be possible to improve the proposed hydraulic capacity by allowing the trail/sewer embankment to be overtopped during high tide events. A design that provides for stable (non-erosive) tidal overtopping of the embankment may be able to significantly increase the open area of the crossing and perhaps achieve peak head differentials in the range of one inch or less. If this option is pursued (either now or in the future), it should be verified by the design engineer with additional hydraulic modeling of that proposed condition.





PROFILE

PROFILE
Horiz. 25 0 25 50
Vert. 5 0 5 10
Scale of Feet

PLS OR PE

PROGRESS PRINT

PLS OR PE

NOT FOR CONSTRUCTION

DESIGNED	CHECKED
SCK	SDH

REV'I	BY:	DATE:	STATUS:
2	SCK	11/10/21	UPDATE WITH CONTOURS
1	SCK	10/28/21	PB SUBMISSION WETLAND IMPACTS AND EASEMENT

SEBAGO TECHNICS
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WETLAND IMPACTS
OF:
WILLOW BROOK CROSSING

FOR:
CAPE ELIZABETH
1022 PORTLAND ROAD
SACO, MAINE 04072

PROJECT NO.	SCALE
19569	1" = 25'

SHEET 1 OF 1

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