CONTRACT DOCUMENTS

FOR

INDIAN LAKE ALUM DOSING STATION SITE PREPARATION

SHORE DRIVE

WORCESTER MA

BID NO.

DEPARTMENT OF PUBLIC WORKS AND PARKS

CITY OF WORCESTER, MASSACHUSETTS

APRIL 2022

LUMP SUM RESERVE

The Contractor is advised that the lump sum reserve for contingency work shall be utilized, as required by the City of Worcester for additional work that may be required by the City and agreed to by the Contractor. This reserve will also be used for the City to compensate directly for flag men (When police are unavailable) and testing as determined by the contracting officer. Any reserve balance remaining at the end of the contract will returned to the City of Worcester.

The City reserves the right to reject any and all bids, wholly or in part, and to make awards in a manner deemed in the best interests of the City.

The above estimated quantities form an approximate statement of the extent of the work to be done, based upon the estimate of the Contracting Officer. The City does not expressly or by implication agree that the actual quantity of work will correspond therewith, but reserves the right to increase or decrease the quantity of any class or portion of the work, as may be deemed necessary by the Contracting Officer.

TIME OF COMPLETION

The bidder shall complete all the work of this contract by August 1, 2022.

LIQUIDATED DAMAGES
(Contracts of $100,000.00 or more)

It is expressly understood and agreed, by and between the Contractor and the City, that the time for the completion of the work described herein is a reasonable time for the completion of the same, taking into consideration the average climate range and usual industrial and/or residential conditions prevailing in this locality. If the said Contractor shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof requested in writing by the Contractor and granted in writing by the Contracting Officer, then the Contractor does hereby agree, as a part consideration for the awarding of this contract, to pay to the City the amount of $250.00 per day, not as a penalty, but as liquidated damages for such breach of contract for each and every calendar day that the Contractor shall be in default after the time stipulated for completing the work. The said amount of $250.00 per day is fixed and agreed upon by and between the Contractor and the City because of impracticability and extreme difficulty of fixing and ascertaining the actual damages the City would in such event sustain and said amount is agreed to be the amount of damages which the City would sustain and the said amount shall be deducted by the City for periodic payments.

INFORMATION FOR BIDDERS

GENERAL DESCRIPTION

This bid consists of work in approximate quantities as listed in the Proposal Forms, which state the location and description of the work to be done and the materials to be furnished.

This Contract shall adhere to the City of Worcester's Standard Specification and Details dated FEBRUARY 1, 2022 (2-1-2022).

The plans and specifications, proposal and addenda shall form part of this contract.

QUANTITIES

All bids will be compared on the total estimate of quantities of work to be done, as shown in the proposal.

These quantities are approximate only, being given as a basis for the comparison of bids to determine the approximate amount of the consideration of the contract. The bidder will be required to complete the work specified or as shown on the drawings, within the required time period, whether the required quantities are more or less than the amounts herein estimated without any change in the contract unit price. The final payment will not be made until the work is so completed.

The unit price bid for each item must allow for all collateral or indirect costs connected with it.

INVESTIGATION OF CONDITIONS

Bidders are expected to visit the locality of the work and acquaint themselves with all available information concerning local conditions. They are also expected to make their own estimates of the facilities needed and difficulties attending the execution of the proposed contract including local conditions, availability of labor, uncertainties of weather and other contingencies. In no event will the City assume any responsibility whatever for an interpretation, deduction or conclusion drawn from the inspection of the site. Failure to acquaint himself with all available information concerning these conditions will not relieve the successful bidder from responsibility for estimating the difference and costs of successfully performing the complete work.

ADDENDA

The bidder is required to acknowledge receipt of any Addenda issued to this contract by inserting the Addendum number in the space provided on the proposal form.

EXPERIENCE

Each bidder shall state in his bid whether he is now or ever has been engaged on any other contract or other work similar to that proposed, giving the year in which it was done and the manner of its execution and shall submit such other information as will tend to show his ability to prosecute vigorously the work required in these specifications. A successful bidder will be required to employ an organization thoroughly experienced and skilled in the type of work to be done. After the opening of bids any bidder may be required to submit satisfactory evidence that the specific organization which he proposes to employ on this contract has successfully executed work of the nature and quality indicated herein.

EQUIPMENT

Each bidder shall state in his bid the character, make and amount of equipment that he proposes to employ on the work. After bids are opened any bidder may be required to show that he owns, controls by firm option, or can procure the equipment necessary for commencing, prosecuting, and completing the work as required by the specifications.

CONTRACTOR RESPONSIBILITY

The contractor must care for, replace and restore to good condition to the satisfaction of the Commissioner of Public Works & Parks any utilities, fences, sidewalks, posts, poles or other structures damaged by or interfered with by the contractor outside the scope of work. The contractor shall perform any necessary replacement, reparation or restoration at no additional compensation.

Damage resulting from the operation of the contractor to any structure in the street or ground near or within the scope of work (and not required to be changed under the contract) shall be replaced, repaired or restored by the contractor at no additional compensation.

The contractor shall have no grounds for additional compensation because of expenses due to encountering existing pipes, conduits or structures.

The contractor must perform construction work without damage to shade trees.

The contractor shall cooperate with all other contractors or other forces within the limits of the work specified. The contractor shall allow the necessary access to the site to other contractors and utility companies and their agents. The contractor shall be responsible for preventing damage by others to the work performed under this contract or for having damage repaired, either by the party responsible or at his own expense.

PUBLIC CONVENIENCE

Vehicular and pedestrian traffic will be maintained on all streets located within the project unless permission is received in writing from the Commissioner of Public Works or his representative to close the street.

Where construction operations are such that a hazard exists to the public, all safety precautions shall be maintained.

POLICE PROTECTION

The City of Worcester will furnish and pay for police when and where the City decides police protection is necessary. The contractor shall notify the Engineer of the anticipated requirements as the work progresses, so that each day's protection can be scheduled not later than the preceding day.

BID PRICE ADJUSTMENTS

This Contract contains a price adjustment for bituminous concrete mixtures. The base price for liquid asphalt on this project is $665.00 per ton.

This Contract contains price adjustments for diesel fuel and gasoline. The base price for diesel fuel on this project is $4.264 per gallon and for gasoline $3.404 per gallon.

This Contract contains price adjustments for Portland cement. The base price for Portland cement on this project is $165.52 per ton.

GENERAL NOTES

1. Prior to the start of any construction activity in any previously unoccupied location, the Contractor will supply the Contracting Officer with a traffic flow plan for the Contracting Officer's approval.

2. Where applicable the Contractor will supply all barricades, barriers, signing, lighting, etc. warranted to insure the safety of the general public throughout the work site as a subsidiary obligation without any additional cost to the City of Worcester and subject to the Contracting Officer's approval.

4. Any necessary detouring will be arranged by the Contractor subject to the approval of the Contracting Officer.

5. The Contractor will be required to provide adequate access to businesses affected by all construction activities.

6. The Contractor will be required to have on site at all times during the course of all construction activities a full time superintendent whom will be in responsible charge of this project. This individual will be the exclusive agent for the Contractor maintaining continuous correspondence with the Contracting Officer.

7. The Contractor will notify the Contracting Officer in writing whenever a change of superintendent is warranted.

8. The Contractor will be responsible for preservation of all benchmarks and highway bounds.

9. Item 804.2 2 INCH ELECTRICAL CONDUIT (FOOT) TYPE NM-PLASTIC_(NEMA) FOR STREET LIGHTING shall be used as method and payment for the installation of underground conduit on this project.

10. Item 810.3 PULL BOX 12x24 (SD2.031) FOR SIGNAL CABLE shall be used as method and payment for the handhole listed in the attached plans.

10. Any existing conditions disturbed by the construction operations shall be restored by the Contractor at his own expense**.**

11. The contractor will be responsible for the healthy growth of all grass seed placed until it is established, free of weeds, including watering. Any required replacement will be at no cost to the City. All required work, including excavation and re-loam and seeding, will be done at the contractor's expense. A component of any street being considered complete is the grass being fully established and healthy.

12. The Contractor will be responsible for the coordination of site preparation with the contractor responsible for the Alum Dosing Station installation.

SPECIAL PROVISIONS

NOTICE TO PROCEED

The Bidder must agree to commence work on or before the date specified in the written "Notice to Proceed" issued by the City, and/or Engineer acting on behalf of the City, and to fully complete the project within the time specified in the contract.

SCHEDULE OF WORK

The Contractor shall submit, to and for the comments of the Contracting Officer, a schedule of operations within ten (10) days after the mailing of the executed Contract to the Contractor. The schedule shall show the proposed methods of construction and sequence of work and the time the Contractor proposed to complete the various items of work within the time specified in the contract.

HOURS OF WORK

In general, the City will permit the Contractor to work Monday thru Friday between the hours of 7:00 A.M. and 3:30 P.M. except as provided by the Contracting Officer. All construction work shall be completed or suspended for the winter season by November 15th unless a specific waiver is granted by the Contracting Officer.

FINAL CLEAN-UP

Upon completion of the work and before acceptance and final payment, the Contractor shall remove and dispose of in an approved manner at his own expense, from the right-of-way, construction site, dredging site, and adjoining property, all temporary structures and all surplus materials and rubbish which the Contractor may have accumulated during the prosecution of the work, and shall leave the areas in a neat and orderly condition. No equipment or material shall be left within any of the aforementioned areas after acceptance of the Contract without the written permission of the Engineer. The Contractor shall not abandon any material at or near the site regardless of whether or not it has any value. All removed material must be disposed of in accordance with all Local, State, and Federal laws and regulations.

PERMITS

The Contractor will be responsible for any and all City of Worcester permits including the Street Opening Permit for each location, which can be obtained from the Department of Public Works and Parks Permit Section located at 20 East Worcester Street, Worcester, Massachusetts.

SPECIAL PROVISIONS (cont.)

EMERGENCY TELEPHONE NUMBER

A 24-hour telephone number must be supplied along with the name of the person to be notified for repairs or emergencies. Failure to respond will necessitate the actuation of City crews at the Contractor's expense.

PRE-BID CONFERENCE

No Pre-Bid Conference will be held due to Covid 19 restrictions.

MONTHLY PRICE ADJUSTMENT FOR DIESEL FUEL AND GASOLINE – ENGLISH UNITS

Document 00812
Revised: 01/26/2009

This monthly fuel price adjustment is inserted in this contract because the national and worldwide energy situation has made the future cost of fuel unpredictable. This adjustment will provide for either additional compensation to the Contractor or repayment to the City, depending on an increase or decrease in the average price of diesel fuel or gasoline.

This adjustment will be based on fuel usage factors for various items of work developed by the Highway Research Board in Circular 158, dated July 1974. These factors will be multiplied by the quantities of work done in each item during each monthly period and further multiplied by the variance in price from the Base Price to the Period Price.

The Base Price of Diesel Fuel and Gasoline will be the price as indicated in the Contract Documents.

The Period Price will be the average of prices charged to the State, including State Tax for the bulk purchased made during each month.

This adjustment will be effected only if the variance from the base Price is 5% or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5% from either upward or downward adjustments.

No adjustment will be paid for work done beyond the extended completion date of any contract.

The fuel price adjustment will apply only to the following items of work at the fuel factors shown:

MONTHLY PRICE ADJUSTMENT FOR DIESEL FUEL AND GASOLINE – ENGLISH UNITS (cont.)

ITEMS COVERED	FUEL FACTORS	
	Diesel	Gasoline
Excavation and Borrow Work: Items 116, 118, 120, 121, 122, 124, 125, 126, 128 (Both Factors Used)	0.29 Gallons/CY	0.15 Gallons/CY
Surfacing Work: All Items containing Hot Mix	2.90 Gallons/Ton	Does Not Apply

PRICE ADJUSTMENT FOR PORTLAND CEMENT CONCRETE MIXES

Document 00814
January 12, 2009

This provision applies to all projects using greater than 100 Cubic yards (76 Cubic Meters) of Portland cement concrete containing Portland cement as stipulated in the Information to Bidders section of the Bid Documents. This Price Adjustment will occur on a monthly basis.

The Price Adjustment will be based on the variance in price for the Portland cement component only from the Base Price to the Period Price. It shall not include transportation or other charges.

The Base Price of Portland cement on a project is a fixed price determined at the time of bid by the contracting officer by using the same method as for the determination of the Period Price (see below) and found in the Information to Bidders.

PRICE ADJUSTMENT FOR PORTLAND CEMENT CONCRETE MIXES (cont.)

The Period Price of Portland cement will be determined by using the latest published price, in dollars per ton (U.S.), for Portland cement (Type I) quoted for Boston, U.S.A. in the **Construction Economics** section of *ENR Engineering News-Record* magazine or at the ENR website http://www.enr.com under **Construction Economics**. The Period Price will be posted on the MassDOT website the Wednesday immediately following the publishing of the monthly price in ENR, which is normally the first week of the month.

The Contract Price of the Portland cement concrete mix will be paid under the respective item in the Contract. The price adjustment, as herein provided, upwards or downwards, will be made after the work has been performed, using the monthly period price for the month during which the work was performed.

The price adjustment applies only to the actual Portland cement content in the mix placed on the job in accordance with the Standard Specifications for Highways and Bridges, Division III, Section M4.02.01. No adjustments will be made for any cement replacement materials such as fly ash or ground granulated blast furnace slag.

The Price Adjustment will be a separate payment item. It will be determined by multiplying the number of cubic yards of Portland cement concrete placed during each monthly period times the Portland cement content percentage times the variance in price between the Base Price and Period Price of Portland cement.

This Price Adjustment will be paid only if the variance from the Base Price is 5% or more for a monthly period. The complete adjustment will be paid in all cases with no deductions of the 5% from either upward or downward adjustments.

No Price Adjustment will be allowed beyond the Completion Date of this Contract, unless there is an approved extension of time.

SUPPLEMENTAL SPECIFICATION ATTACHMENT A – WORCESTER CONSERVATION COMMISSION ORDER OF CONDITIONS

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP: 349-1288
MassDEP File #

eDEP Transaction #

Worcester
City/Town

A. General Information

Please note: this form has been modified with added space to accommodate the Registry of Deeds Requirements

1. From: City of Worcester
Conservation Commission

2. This issuance is for (check one): a. ☒ Order of Conditions b. ☐ Amended Order of Conditions

3. To: Applicant:

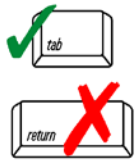
a. First Name | b. Last Name

City of Worcester Department of Public Works and Parks
c. Organization

18 East Worcester Street
d. Mailing Address

Worcester | MA | 01604
e. City/Town | f. State | g. Zip Code

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



4. Property Owner (if different from applicant):

a. First Name | b. Last Name

Bancroft School
c. Organization

110 Shore Drive
d. Mailing Address

Worcester | MA | 01605
e. City/Town | f. State | g. Zip Code

5. Project Location:

110 Shore Drive | Worcester
a. Street Address | b. City/Town

37-025 | -0001A
c. Assessors Map/Plat Number | d. Parcel/Lot Number

Latitude and Longitude, if known: d m s | d m s
d. Latitude | e. Longitude

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

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A. General Information (cont.)

6. Property recorded at the Registry of Deeds for (attach additional information if more than one parcel):

Worcester
a. County

b. Certificate Number (if registered land)

4344
c. Book

28
d. Page

7. Dates: 10/6/20 (a. Date Notice of Intent Filed) 11/16/20 (b. Date Public Hearing Closed) 12/9/20 (c. Date of Issuance)

8. Final Approved Plans and Other Documents (attach additional plan or document references as needed):

City of Worcester Notice of Intent Permitting Plans
a. Plan Title

ESS Group
b. Prepared By

Jason M. Gold, P.E.
c. Signed and Stamped by

10/6/20
d. Final Revision Date

1:10
e. Scale

NOI Application Materials
f. Additional Plan or Document Title

10/6/20
g. Date

B. Findings

1. Findings pursuant to the Massachusetts Wetlands Protection Act:

Following the review of the above-referenced Notice of Intent and based on the information provided in this application and presented at the public hearing, this Commission finds that the areas in which work is proposed is significant to the following interests of the Wetlands Protection Act (the Act). Check all that apply:

a. ☒ Public Water Supply
b. ☐ Land Containing Shellfish
c. ☒ Prevention of Pollution
d. ☒ Private Water Supply
e. ☒ Fisheries
f. ☒ Protection of Wildlife Habitat
g. ☒ Groundwater Supply
h. ☒ Storm Damage Prevention
i. ☒ Flood Control

2. This Commission hereby finds the project, as proposed, is: (check one of the following boxes)

Approved subject to:

a. ☒ the following conditions which are necessary in accordance with the performance standards set forth in the wetlands regulations. This Commission orders that all work shall be performed in accordance with the Notice of Intent referenced above, the following General Conditions, and any other special conditions attached to this Order. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, these conditions shall control.

Massachusetts Department of Environmental Protection
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B. Findings (cont.)

Denied because:

b. ☐ the proposed work cannot be conditioned to meet the performance standards set forth in the wetland regulations. Therefore, work on this project may not go forward unless and until a new Notice of Intent is submitted which provides measures which are adequate to protect the interests of the Act, and a final Order of Conditions is issued. **A description of the performance standards which the proposed work cannot meet is attached to this Order.**

c. ☐ the information submitted by the applicant is not sufficient to describe the site, the work, or the effect of the work on the interests identified in the Wetlands Protection Act. Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides sufficient information and includes measures which are adequate to protect the Act's interests, and a final Order of Conditions is issued. **A description of the specific information which is lacking and why it is necessary is attached to this Order as per 310 CMR 10.05(6)(c).**

3. ☐ **Buffer Zone Impacts:** Shortest distance between limit of project disturbance and the wetland resource area specified in 310 CMR 10.02(1)(a) _____ a. linear feet

Inland Resource Area Impacts: Check all that apply below. (For Approvals Only)

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
4. ☒ Bank	5 (temp) a. linear feet	5 (temp) b. linear feet	5 c. linear feet	5 d. linear feet
5. ☐ Bordering Vegetated Wetland	a. square feet	b. square feet	c. square feet	d. square feet
6. ☐ Land Under Waterbodies and Waterways	a. square feet	b. square feet	c. square feet	d. square feet
	e. c/y dredged	f. c/y dredged		
7. ☒ Bordering Land Subject to Flooding	52 (temp a. square feet	52 (temp) b. square feet	52 c. square feet	52 d. square feet
Cubic Feet Flood Storage	0 e. cubic feet	0 f. cubic feet	0 g. cubic feet	0 h. cubic feet
8. ☐ Isolated Land Subject to Flooding	a. square feet	b. square feet		
Cubic Feet Flood Storage	c. cubic feet	d. cubic feet	e. cubic feet	f. cubic feet
9. ☐ Riverfront Area	a. total sq. feet	b. total sq. feet		
Sq ft within 100 ft	c. square feet	d. square feet	e. square feet	f. square feet
Sq ft between 100-200 ft	g. square feet	h. square feet	i. square feet	j. square feet

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B. Findings (cont.)

Coastal Resource Area Impacts: Check all that apply below. (For Approvals Only)

	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
10. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below			
11. ☐ Land Under the Ocean	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
12. ☐ Barrier Beaches	Indicate size under Coastal Beaches and/or Coastal Dunes below			
13. ☐ Coastal Beaches	a. square feet	b. square feet	c. nourishment cu yd	d. nourishment cu yd
14. ☐ Coastal Dunes	a. square feet	b. square feet	c. nourishment cu yd	d. nourishment cu yd
15. ☐ Coastal Banks	a. linear feet	b. linear feet		
16. ☐ Rocky Intertidal Shores	a. square feet	b. square feet		
17. ☐ Salt Marshes	a. square feet	b. square feet	c. square feet	d. square feet
18. ☐ Land Under Salt Ponds	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
19. ☐ Land Containing Shellfish	a. square feet	b. square feet	c. square feet	d. square feet
20. ☐ Fish Runs	Indicate size under Coastal Banks, Inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above			
	a. c/y dredged	b. c/y dredged		
21. ☐ Land Subject to Coastal Storm Flowage	a. square feet	b. square feet		
22. ☐ Riverfront Area	a. total sq. feet	b. total sq. feet		
Sq ft within 100 ft	c. square feet	d. square feet	e. square feet	f. square feet
Sq ft between 100-200 ft	g. square feet	h. square feet	i. square feet	j. square feet

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B. Findings (cont.)

*** #23**. If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.5.c (BVW) or B.17.c (Salt Marsh) above, please enter the additional amount here.

23. ☐ Restoration/Enhancement *:

a. square feet of BVW | b. square feet of salt marsh

24. ☐ Stream Crossing(s):

a. number of new stream crossings | b. number of replacement stream crossings

C. General Conditions Under Massachusetts Wetlands Protection Act

The following conditions are only applicable to Approved projects.

1. Failure to comply with all conditions stated herein, and with all related statutes and other regulatory measures, shall be deemed cause to revoke or modify this Order.
2. The Order does not grant any property rights or any exclusive privileges; it does not authorize any injury to private property or invasion of private rights.
3. This Order does not relieve the permittee or any other person of the necessity of complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.
4. The work authorized hereunder shall be completed within three years from the date of this Order unless either of the following apply:
   a. The work is a maintenance dredging project as provided for in the Act; or
   b. The time for completion has been extended to a specified date more than three years, but less than five years, from the date of issuance. If this Order is intended to be valid for more than three years, the extension date and the special circumstances warranting the extended time period are set forth as a special condition in this Order.
   c. If the work is for a Test Project, this Order of Conditions shall be valid for no more than one year.
5. This Order may be extended by the issuing authority for one or more periods of up to three years each upon application to the issuing authority at least 30 days prior to the expiration date of the Order. An Order of Conditions for a Test Project may be extended for one additional year only upon written application by the applicant, subject to the provisions of 310 CMR 10.05(11)(f).
6. If this Order constitutes an Amended Order of Conditions, this Amended Order of Conditions does not extend the issuance date of the original Final Order of Conditions and the Order will expire on _____ unless extended in writing by the Department.
7. Any fill used in connection with this project shall be clean fill. Any fill shall contain no trash, refuse, rubbish, or debris, including but not limited to lumber, bricks, plaster, wire, lath, paper, cardboard, pipe, tires, ashes, refrigerators, motor vehicles, or parts of any of the foregoing.

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C. General Conditions Under Massachusetts Wetlands Protection Act

8. This Order is not final until all administrative appeal periods from this Order have elapsed, or if such an appeal has been taken, until all proceedings before the Department have been completed.

9. No work shall be undertaken until the Order has become final and then has been recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land upon which the proposed work is to be done. In the case of the registered land, the Final Order shall also be noted on the Land Court Certificate of Title of the owner of the land upon which the proposed work is done. The recording information shall be submitted to the Conservation Commission on the form at the end of this Order, which form must be stamped by the Registry of Deeds, prior to the commencement of work.

10. A sign shall be displayed at the site not less then two square feet or more than three square feet in size bearing the words,

"Massachusetts Department of Environmental Protection" [or, "MassDEP"]

"File Number 349-1288 "

11. Where the Department of Environmental Protection is requested to issue a Superseding Order, the Conservation Commission shall be a party to all agency proceedings and hearings before MassDEP.

12. Upon completion of the work described herein, the applicant shall submit a Request for Certificate of Compliance (WPA Form 8A) to the Conservation Commission.

13. The work shall conform to the plans and special conditions referenced in this order.

14. Any change to the plans identified in Condition #13 above shall require the applicant to inquire of the Conservation Commission in writing whether the change is significant enough to require the filing of a new Notice of Intent.

15. The Agent or members of the Conservation Commission and the Department of Environmental Protection shall have the right to enter and inspect the area subject to this Order at reasonable hours to evaluate compliance with the conditions stated in this Order, and may require the submittal of any data deemed necessary by the Conservation Commission or Department for that evaluation.

16. This Order of Conditions shall apply to any successor in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by this Order.

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C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

17. Prior to the start of work, and if the project involves work adjacent to a Bordering Vegetated Wetland, the boundary of the wetland in the vicinity of the proposed work area shall be marked by wooden stakes or flagging. Once in place, the wetland boundary markers shall be maintained until a Certificate of Compliance has been issued by the Conservation Commission.

18. All sedimentation barriers shall be maintained in good repair until all disturbed areas have been fully stabilized with vegetation or other means. At no time shall sediments be deposited in a wetland or water body. During construction, the applicant or his/her designee shall inspect the erosion controls on a daily basis and shall remove accumulated sediments as needed. The applicant shall immediately control any erosion problems that occur at the site and shall also immediately notify the Conservation Commission, which reserves the right to require additional erosion and/or damage prevention controls it may deem necessary. Sedimentation barriers shall serve as the limit of work unless another limit of work line has been approved by this Order.

19. The work associated with this Order (the "Project")
    (1) ☒ is subject to the Massachusetts Stormwater Standards
    (2) ☐ is NOT subject to the Massachusetts Stormwater Standards

    If the work is subject to the Stormwater Standards, then the project is subject to the following conditions:

    a) All work, including site preparation, land disturbance, construction and redevelopment, shall be implemented in accordance with the construction period pollution prevention and erosion and sedimentation control plan and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Construction General Permit as required by Stormwater Condition 8. Construction period erosion, sedimentation and pollution control measures and best management practices (BMPs) shall remain in place until the site is fully stabilized.

    b) No stormwater runoff may be discharged to the post-construction stormwater BMPs unless and until a Registered Professional Engineer provides a Certification that:

    i. all construction period BMPs have been removed or will be removed by a date certain specified in the Certification. For any construction period BMPs intended to be converted to post construction operation for stormwater attenuation, recharge, and/or treatment, the conversion is allowed by the MassDEP Stormwater Handbook BMP specifications and that the BMP has been properly cleaned or prepared for post construction operation, including removal of all construction period sediment trapped in inlet and outlet control structures;

    ii. as-built final construction BMP plans are included, signed and stamped by a Registered Professional Engineer, certifying the site is fully stabilized;

    iii. any illicit discharges to the stormwater management system have been removed, as per the requirements of Stormwater Standard 10;

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C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

iv. all post-construction stormwater BMPs are installed in accordance with the plans (including all planting plans) approved by the issuing authority, and have been inspected to ensure that they are not damaged and that they are in proper working condition;

v. any vegetation associated with post-construction BMPs is suitably established to withstand erosion.

c) The landowner is responsible for BMP maintenance until the issuing authority is notified that another party has legally assumed responsibility for BMP maintenance. Prior to requesting a Certificate of Compliance, or Partial Certificate of Compliance, the responsible party (defined in General Condition 18(e)) shall execute and submit to the issuing authority an Operation and Maintenance Compliance Statement ("O&M Statement) for the Stormwater BMPs identifying the party responsible for implementing the stormwater BMP Operation and Maintenance Plan ("O&M Plan") and certifying the following:

i.) the O&M Plan is complete and will be implemented upon receipt of the Certificate of Compliance, and

ii.) the future responsible parties shall be notified in writing of their ongoing legal responsibility to operate and maintain the stormwater management BMPs and implement the Stormwater Pollution Prevention Plan.

d) Post-construction pollution prevention and source control shall be implemented in accordance with the long-term pollution prevention plan section of the approved Stormwater Report and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Multi-Sector General Permit.

e) Unless and until another party accepts responsibility, the landowner, or owner of any drainage easement, assumes responsibility for maintaining each BMP. To overcome this presumption, the landowner of the property must submit to the issuing authority a legally binding agreement of record, acceptable to the issuing authority, evidencing that another entity has accepted responsibility for maintaining the BMP, and that the proposed responsible party shall be treated as a permittee for purposes of implementing the requirements of Conditions 18(f) through 18(k) with respect to that BMP. Any failure of the proposed responsible party to implement the requirements of Conditions 18(f) through 18(k) with respect to that BMP shall be a violation of the Order of Conditions or Certificate of Compliance. In the case of stormwater BMPs that are serving more than one lot, the legally binding agreement shall also identify the lots that will be serviced by the stormwater BMPs. A plan and easement deed that grants the responsible party access to perform the required operation and maintenance must be submitted along with the legally binding agreement.

f) The responsible party shall operate and maintain all stormwater BMPs in accordance with the design plans, the O&M Plan, and the requirements of the Massachusetts Stormwater Handbook.

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C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

g) The responsible party shall:
1. Maintain an operation and maintenance log for the last three (3) consecutive calendar years of inspections, repairs, maintenance and/or replacement of the stormwater management system or any part thereof, and disposal (for disposal the log shall indicate the type of material and the disposal location);
2. Make the maintenance log available to MassDEP and the Conservation Commission ("Commission") upon request; and
3. Allow members and agents of the MassDEP and the Commission to enter and inspect the site to evaluate and ensure that the responsible party is in compliance with the requirements for each BMP established in the O&M Plan approved by the issuing authority.

h) All sediment or other contaminants removed from stormwater BMPs shall be disposed of in accordance with all applicable federal, state, and local laws and regulations.

i) Illicit discharges to the stormwater management system as defined in 310 CMR 10.04 are prohibited.

j) The stormwater management system approved in the Order of Conditions shall not be changed without the prior written approval of the issuing authority.

k) Areas designated as qualifying pervious areas for the purpose of the Low Impact Site Design Credit (as defined in the MassDEP Stormwater Handbook, Volume 3, Chapter 1, Low Impact Development Site Design Credits) shall not be altered without the prior written approval of the issuing authority.

l) Access for maintenance, repair, and/or replacement of BMPs shall not be withheld. Any fencing constructed around stormwater BMPs shall include access gates and shall be at least six inches above grade to allow for wildlife passage.

Special Conditions (if you need more space for additional conditions, please attach a text document):

See Attachment A.

20. For Test Projects subject to 310 CMR 10.05(11), the applicant shall also implement the monitoring plan and the restoration plan submitted with the Notice of Intent. If the conservation commission or Department determines that the Test Project threatens the public health, safety or the environment, the applicant shall implement the removal plan submitted with the Notice of Intent or modify the project as directed by the conservation commission or the Department.

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D. Findings Under Municipal Wetlands Bylaw or Ordinance

1. Is a municipal wetlands bylaw or ordinance applicable? ☒ Yes ☐ No

2. The City of Worcester Conservation Commission hereby finds (check one that applies):

   a. ☐ that the proposed work cannot be conditioned to meet the standards set forth in a municipal ordinance or bylaw, specifically:
   City of Worcester Wetlands Protection Ordinance & Regulations (1. Municipal Ordinance or Bylaw)
   COW GRO Part 1. Ch. 6. (2. Citation)

   Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides measures which are adequate to meet these standards, and a final Order of Conditions is issued.

   b. ☒ that the following additional conditions are necessary to comply with a municipal ordinance or bylaw:
   City of Worcester Wetlands Protection Ordinance & Regulations (1. Municipal Ordinance or Bylaw)
   COW GRO Part 1. Ch. 6. (2. Citation)

3. The Commission orders that all work shall be performed in accordance with the following conditions and with the Notice of Intent referenced above. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, the conditions shall control.
   The special conditions relating to municipal ordinance or bylaw are as follows (if you need more space for additional conditions, attach a text document):
   See Attachment A.

ATTACHMENT A

Worcester Conservation Commission

Special Order of Conditions

City of Worcester Wetlands Protection Ordinance & City of Worcester Wetlands Protection Regulations

(City of Worcester Revised Ordinance Part I, Chapter 6)

And

Massachusetts General Laws, Chapter 131, §40 - Massachusetts Wetlands Protection Act

110 Shore Drive (CC-2020-065; DEP#349-1288)

Project Description: For the City of Worcester Department of Public Works and Parks to construct an alum dosing station at the mouth of Ararat Brook, leading into Indian Lake and perform associated site work. A cabinet of pumps and valves, two 6,000 gallon tanks, and buried tubing will automatically deliver alum to Ararat Brook. Work to occur within Riverfront area of a perennial stream, and within Bordering Land Subject to Flooding, with no fill or permanent impacts within resource areas. This Order of Conditions is intended to permit the construction of the alum dosing station and its initial operation. The existing Order of Conditions permitting the treatment of Indian Lake (CC-2000-055; DEP#349-687) expires 7/26/2021 and shall be renewed with a new Order of Conditions that includes all treatment of the Lake, including this alum dosing in Indian Lake's tributary Ararat Brook.

Waivers Granted: Worcester Wetlands Protection Regulations performance standard 4.2.4. to allow work within the 15' buffer to bank for trenching. Project to improve water quality and public health in this recreational water body of Indian Lake.

Table of Contents:

Notes:

- **Office of the Commission** is located at the Division of Planning and Regulatory Services (455 Main Street 4th floor, Worcester, MA), which can be contacted by e-mailing planning@worcesterma.gov or calling 508-799-1400 ext. 31440.
- **Asterisked (*) conditions** are standard conditions of approval for all projects.

I. Conditions to Meet Prior to and During Construction

21. Person Responsible for Compliance with the Order of Conditions* – A person shall be designated to be responsible to monitor compliance with the Order of Conditions. Their name and contact information (24/7) shall be provided to the Office of the Commission prior to start of any activity. This person shall conduct:
    a) periodic inspections to assure the adequacy and continued effectiveness of erosion and sediment controls;
    b) inspections of said controls following 0.5-inch or greater rain events, or after a heavy snow melt.
22. Contract* - This Order of Conditions and all approved plans shall be included as part of any contract and subcontract and shall be posted in a prominently displayed location in the supervisory office on site during all phases of construction.
23. Notification* - The applicant shall notify the Office of the Commission a minimum of 48 hours prior to the start of any activity.

II. Conditions to Meet Before the Start of Any Activity

24. Alum Station System Maintenance – Prior to the start of any activity, the applicant must submit in writing the name, address and telephone number of the party responsible for ongoing maintenance of the station's function and maintenance.
25. Stormwater Pollution Prevention Plan (SWPPP)* – That one (1) copy of the SWPPP submitted to the EPA in compliance with the NPDES permit requirements, if applicable, shall be provided to the Office of the Commission prior to commencement of work.
26. Tree Cutting* – Tree cutting is allowed following installation of erosion and sediment controls; otherwise, it may be allowed, prior to such installation, with the explicit permission of the Commission or its Agents.
27. Trees To Remain* – All trees to remain post construction shall be marked on site as shown on the approved plan so that the Commission or its representative can verify them before any clearing takes place.
28. Pre-Construction Conference* -
    a) The Conservation Commission or its Agents shall conduct a pre-construction conference prior to commencement of activities in each phase of the project. Phasing, if any, shall conform to the approved plans.
    b) The property owner / applicant and any person performing work that is subject to this Order are responsible for understanding and complying with the requirements of this Order, the Wetlands Protection Act, 310 CMR 10.00 and City of Worcester Wetlands Protection Ordinance and Regulations. Said persons shall acknowledge such in writing prior to commencement of activities.
29. Inspections Prior to Site Preparation and Site Work* - Erosion and sediment controls shall be installed and verified, in compliance with final approved plans, by the Commission or its Agents prior to the commencement of any excavation, grubbing and/or stumping of vegetation, grading, construction, or other site preparation.
30. Construction Schedule* - Submit a Construction Schedule consistent with Work Sequencing plans provided to the Office of the Commission prior to the start of any activities.
31. Demarcation of Limit of Work – For areas of work within the 100 foot buffer to a bordering vegetated wetland/bank, prior to construction, the contractor shall stake out the limit of work using an orange

snow/construction fence to demarcate the no-disturbance zone during construction in order to prevent encroachments beyond the approved limit of work and prevent resource area impacts.

III. Stormwater Management System

32. Catch Basins* –

    a) The paved roadways and parking lots shall be bermed and shall be installed with standard City of Worcester catch basins.

    b) Prior to start of activity on site that causes soil erosion and sedimentation, catch basin filter traps shall be installed in the existing and new catch basins.

    c) Catch basins shall be cleaned as warranted during construction to keep them clear of sediment, and minimum twice a year thereafter.

33. Stormwater Management System Maintenance* – The stormwater management system shall be maintained in accordance with the approved design plans and Operation and Maintenance Plan on file with the Office of the Commission. The system shall be maintained in good hydraulic condition (e.g. any accumulated silt/sediment shall be removed; the system shall be kept free of any litter, refuse, or other extraneous matter, etc.). This condition shall extend in perpetuity beyond the issuance of the Certificate of Compliance.

IV. Conditions to Meet During Construction

34. Chemical Storage & Containment - Storage of chemicals must be above ground, on an impervious surface, and within a container located within a building that includes a secondary containment system with the minimum storage capacity of 110% of all containers contents.

35. Limit of Work* – No removal, filling, dredging or altering of jurisdictional areas shall take place outside the approved work under this Order of Condition.

36. Work Sequencing* – Activities shall take place in accordance with all phasing and sequencing shown on the plan and/or provided in the application materials on file with the Office of the Commission and shall follow any lot opening restrictions otherwise provided herein.

37. Erosion Stabilization -

    a) *Erosion and Sediment Controls** - All erosion and sediment controls shall be monitored, maintained, and adjusted for the duration of the project to prevent adverse impacts to jurisdictional areas. Additional erosion and sediment controls may be utilized on site as needed.

    b) *Off Site Impacts** - There shall be no off-site erosion, flooding, ponding, or flood-related damage from runoff caused by the project activities.

    c) *Unanticipated Drainage or Erosion** - The applicant shall control any unanticipated drainage and/or erosion conditions that may cause damage to jurisdictional areas and/or abutting or downstream properties. Said control measures shall be implemented immediately upon need. The Office of the Conservation Commission shall be notified if such conditions arise and of the measures utilized.

    d) *Soil Stabilization due to Delay in Work** - If there is an interruption of more than 10, but less than 60 days between completion of grading and revegetation, the applicant shall sow all disturbed areas with annual rye grass to prevent erosion. If soils are to be exposed for longer than 60 days, a temporary cover of rye or other grass should be established following US Soil Conservation Services procedures, as recently amended, to prevent erosion and sedimentation. Once final grading is complete, loaming and seeding of final cover should be completed promptly.

e) *Grading of Slopes**-

i. >40% Slope – Slopes shall not exceed those specified in the plans approved by the Conservation Commission. Any slope equal to or greater than 40% (1 vertical to 2 1/2 horizontal) shall be stabilized with erosion control matting.

ii. <40% Slope – Final grades of vegetated areas shall not exceed a slope of 1 vertical to 2 1/2 horizontal (40%) and shall be stabilized to prevent erosion, particularly during the construction period.

f) *Stockpile Maintenance** - Any stockpiling of loose materials shall be properly stabilized to prevent erosion into and sedimentation of jurisdictional areas. Preventative controls such as haybales or erosion control matting shall be implemented to prevent such an occurrence.

g) *Stockpile Location* – In no case shall any soil or excavated material be stockpiled within 50 feet of any wetland, floodplain, or storm drain inlet.

h) *Site Stabilization Prior to Winter** - Prior to winter, exposed soils shall be stabilized (e.g. with demonstrated vegetative growth, impermeable barriers, erosion control blankets, etc.).

38. Invasive Insects* -

a) *Plantings* – No trees to be planted shall be species susceptible to the Asian Longhorned Beetle or Emerald Ash Borer.

b) *Wood Removal* – All tree, brush & wood removal shall adhere to the most recently amended requirements set forth by the Massachusetts Department of Conservation & Recreation for any project located in the Asian Longhorned Beetle Quarantine Zone.

39. Dust Control* - Provisions for dust control shall be provided during all construction and demolition activities. Such provisions shall be conducted in compliance with all City of Worcester Water Use Restrictions, if in effect, during such activities.

40. Dewatering* – If dewatering is required,

a) Notice of such activities shall be given to the Office of the Commission within 24 hours of commencement;

b) There shall be no discharge of untreated dewatered stormwater or groundwater to jurisdictional areas either by direct or indirect discharge to existing drainage systems;

c) Any discharge to surface waters or drainage structures must be visibly free of sediment;

d) To the maximum extent practicable, proposed dewatering activities should be located outside of the 100' buffer. If such activities must be located within the 100' buffer, they shall be monitored at all times when the pumps are running;

e) Dewatering activities shall be confined within an area of secondary containment at all times.

41. Cement Truck Washing - Cement trucks shall not discharge washout effluent directly to any resource area, the 30' buffer thereto, or into any drainage system. Designated washout areas shall be located out of the 100 buffer zone to any wetland.

42. Equipment/Material Placement - No equipment or materials are to enter or be placed in the bank or land under water at any time except as required to install the trenching of 5' of bank as permitted.

43. Spill Prevention* -

a) No fuel, oil, or other pollutants shall be stored in any resource area or the buffer zone thereto, unless specified in this Order;

b) No refueling shall take place within resource areas or 100-ft to a resource area;

c) The applicant shall take all necessary precautions to prevent discharge or spillage of fuel, oil or other pollutants onto any part of the site;

d) A spill kit shall be present on site at all times.

44. Fertilizers – The use of fertilizers shall be used as minimally as necessary in order to establish vegetation in order to stabilize soil as quickly as possible.

V. Conditions to Meet at Completion of Project

45. Site Stabilization* - All disturbed areas shall be properly stabilized with well-established perennial vegetation or other approved methods before the project is considered complete.

46. Erosion and Sediment Controls* - Erosion and sediment controls shall not be removed from the site until all disturbed areas have been stabilized with final vegetative cover and approval has been received from the Commission or its Agents to do so. The controls must then be removed within two weeks of receipt of that certification.

47. No Fill in Floodplain – Temporary alteration of Bordering Land Subject to Flooding is permitted only for trenching. No stockpiling of fill or other alterations to bordering land subject to flooding are permitted. If any fill is required, the applicant shall submit a new Notice of Intent to the Commission in order to determine and permit the creation of compensatory storage.

48. Certificate of Compliance* - Upon completion of the project, the applicant shall request in writing a Certificate of Compliance from the Commission. If the project has been completed in accordance with plans stamped by a registered professional engineer, architect, landscape architect, or land surveyor, certification must include a written statement by such professional certifying the same.

a) If the project required compliance with the Massachusetts Stormwater Standards and/or work was conducted within Riverfront Area or Bordering Land Subject to Flooding, a certified as-built plan-of-land shall be provided showing final grades, resource areas, and all constructed improvements;

b) Upon completion of the construction of this project, the applicant shall seek a Certificate of Compliance. This Order of Conditions is intended to permit the construction of the alum dosing station and its initial operation. The existing Order of Conditions permitting the treatment of Indian Lake (CC-2000-055; DEP#349-687) expires 7/26/2021 and shall be renewed with a new Order of Conditions that includes all treatment of the Lake, including this alum dosing in Indian Lake's tributary Ararat Brook.

49. Pesticides, Etc. – No pesticides, herbicides, or fertilizers, with the exception of lime, shall be used on lawn(s) within the buffer zone to bordering vegetated wetland or bank after completion of the project.

50. Sand/Salt – The use of sand and salt on paved surfaces shall be kept to an absolute minimum during the winter months.

51. Snow Storage – At no time shall snow be stored or stockpiled within 30' of a bordering vegetated wetland or bank, a stormwater basin, or compensatory storage area.

52. Deed Condition – Conditions numbered 34 shall extend beyond the Certificate of Compliance, in perpetuity, and shall be referred to in all future deeds to this property.

VI. General Conditions

53. Change in Ownership* - If a change in ownership takes place while this Order is still in effect, it is the responsibility of the new owner to notify the Commission of the change and to provide the name of the person responsible for compliance with the Order.

54. Conservation Agent's Power to Act* - With respect to all conditions, except _____, the Conservation Commission designates the Conservation Agent, as its Agent with full powers to act on its behalf in administering and enforcing this Order, unless the Agent determines approval from the Commission is appropriate.

55. Right to Inspect* - A member of the Conservation Commission or its Agent may enter and inspect the property and the activity that are the subjects of this Order at all reasonable times, with or without probable cause or prior notice, and until a Certificate of Compliance is issued, for the purpose of evaluating compliance with this Order (and other applicable laws and regulations).

56. Changes to the Plan or Errors & Omissions* -

    (a) If any plan, calculation, or other data presented to the Office of the Commission is in error or have omissions, and are deemed significant by the Commissioners or their Agents, all work will stop at the discretion of the Commission, until the discrepancies have been rectified to the Commission's satisfaction.

    (b) The applicant must notify the Commission in writing of any changes in the plans or implementation of the proposed activity where mandated by any local, state, or federal agencies having jurisdiction over the proposed activity. If, in the opinion of the Commission, any changes in the plans or implementation of the proposed activity so require, then the Commission may modify, amend or rescind this Order in a way consistent with:

    - M.G.L. Chapter 131, Section 40,
    - 310 CMR 10.00, *Wetlands Protection*,
    - the City of Worcester's *Wetlands Protection Ordinance*, and
    - the Commission's *Wetlands Protection Regulations*

    If any provisions of any conditions, or application thereof is held to be invalid, such invalidity shall not affect any other provisions of this Order. If the Commission deems that a proposed change is major or substantial, a new hearing may be required.

57. Liability* - The applicant shall indemnify and save harmless the Commonwealth, the City of Worcester, the Conservation Commission, and its Agents against all sites, claims or liabilities of every name and nature arising at any time out of or in consequence of the acts of the Commission or its Agents in the performance of the work covered by this Order and/or failure to comply with the terms and conditions or this Order whether by itself or its employees or subcontractors.

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Worcester
City/Town

E. Signatures

This Order is valid for three years, unless otherwise specified as a special condition pursuant to General Conditions #4, from the date of issuance. 12/9/20 — 1. Date of Issuance

Please indicate the number of members who will sign this form. 4/5 — 2. Number of Signers
This Order must be signed by a majority of the Conservation Commission.

The Order must be mailed by certified mail (return receipt requested) or hand delivered to the applicant. A copy also must be mailed or hand delivered at the same time to the appropriate Department of Environmental Protection Regional Office, if not filing electronically, and the property owner, if different from applicant.
The names typed below represent the intent to sign the foregoing document in accordance with MGL Chapter 110G §9
Duly authorized by Ch.110G and recorded at Worcester Registry of Deeds in Book 62537 Page 329.

Signatures:

Joseph Charpentier

Amanda Amory

Azal Khaled

Devin Canton

☐ by hand delivery on

Date

☒ by certified mail, return receipt requested, on 12/9/20

Date

F. Appeals

The applicant, the owner, any person aggrieved by this Order, any owner of land abutting the land subject to this Order, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate MassDEP Regional Office to issue a Superseding Order of Conditions. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and a completed Request for Departmental Action Fee Transmittal Form, as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Order. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.
Any appellants seeking to appeal the Department's Superseding Order associated with this appeal will be required to demonstrate prior participation in the review of this project. Previous participation in the permit proceeding means the submission of written information to the Conservation Commission prior to the close of the public hearing, requesting a Superseding Order, or providing written information to the Department prior to issuance of a Superseding Order.
The request shall state clearly and concisely the objections to the Order which is being appealed and how the Order does not contribute to the protection of the interests identified in the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40), and is inconsistent with the wetlands regulations (310 CMR 10.00). To the extent that the Order is based on a municipal ordinance or bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.

Massachusetts Department of Environmental Protection
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G. Recording Information

Prior to commencement of work, this Order of Conditions must be recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land subject to the Order. In the case of registered land, this Order shall also be noted on the Land Court Certificate of Title of the owner of the land subject to the Order of Conditions. The recording information on this page shall be submitted to the Conservation Commission listed below.

Conservation Commission

Detach on dotted line, have stamped by the Registry of Deeds and submit to the Conservation Commission.

To:

Conservation Commission

Please be advised that the Order of Conditions for the Project at:

Project Location | MassDEP File Number

Has been recorded at the Registry of Deeds of:

County | Book | Page

for: Property Owner

and has been noted in the chain of title of the affected property in:

Book | Page

In accordance with the Order of Conditions issued on:

Date

If recorded land, the instrument number identifying this transaction is:

Instrument Number

If registered land, the document number identifying this transaction is:

Document Number

Signature of Applicant

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

Request for Departmental Action Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

DEP File Number:

Provided by DEP

A. Request Information

1. Location of Project

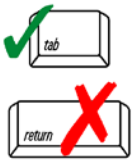
a. Street Address

b. City/Town, Zip

c. Check number

d. Fee amount

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



2. Person or party making request (if appropriate, name the citizen group's representative):

Name

Mailing Address

City/Town

State

Zip Code

Phone Number

Fax Number (if applicable)

3. Applicant (as shown on Determination of Applicability (Form 2), Order of Resource Area Delineation (Form 4B), Order of Conditions (Form 5), Restoration Order of Conditions (Form 5A), or Notice of Non-Significance (Form 6)):

Name

Mailing Address

City/Town

State

Zip Code

Phone Number

Fax Number (if applicable)

4. DEP File Number:

B. Instructions

1. When the Departmental action request is for (check one):

☐ Superseding Order of Conditions – Fee: $120.00 (single family house projects) or $245 (all other projects)

☐ Superseding Determination of Applicability – Fee: $120

☐ Superseding Order of Resource Area Delineation – Fee: $120

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

Request for Departmental Action Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

DEP File Number:

Provided by DEP

B. Instructions (cont.)

Send this form and check or money order, payable to the *Commonwealth of Massachusetts,* to:

Department of Environmental Protection
Box 4062
Boston, MA 02211

2. On a separate sheet attached to this form, state clearly and concisely the objections to the Determination or Order which is being appealed. To the extent that the Determination or Order is based on a municipal bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.

3. Send a **copy** of this form and a **copy** of the check or money order with the Request for a Superseding Determination or Order by certified mail or hand delivery to the appropriate DEP Regional Office (see http://www.mass.gov/eea/agencies/massdep/about/contacts/).

4. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

SUPPLEMENTAL SPECIFICATION ATTACHMENT B – GEOTECHNICAL PARTNERSHIP, INC. – GEOTECHNICAL DATA SUMMARY REPORT

Geotechnical Partnership, Inc.

Since 1987

Geotechnical Engineering Services for New England

Lisa R. Casselli,PE Principal - A WBE Firm

Subsurface Exploration ***Laboratory Soil Testing*** ***Geothermal Testing***
Foundation Specialty Systems ***Ground Improvement*** ***Earthwork Testing***

28 September 2021
File No. 2140

ESS Group, Inc.
404 Wyman Street – Suite 375
Waltham, MA 02451

Attention: Jason Gold, PE

Subject: ***Geotechnical Data Summary Report***
Proposed Alum Tanks' Site – 110 Shore Drive
Worcester, Massachusetts

Dear Jason:

This geotechnical data summary report provides our site background data review, subsurface explorations, field soil and bedrock review, engineering data summary, analyses and calculations for the proposed alum tanks' foundation on Shore Drive in Worcester, Massachusetts (*Figure 1A: Project Vicinity*).

Figure 1A: Project Vicinity

45 New Ocean Street – Suite A
Swampscott, MA 01907
Tel. 617/201-0914

354 Ashburnham Street
Fitchburg, MA 01420
Tel. 781/646-6982

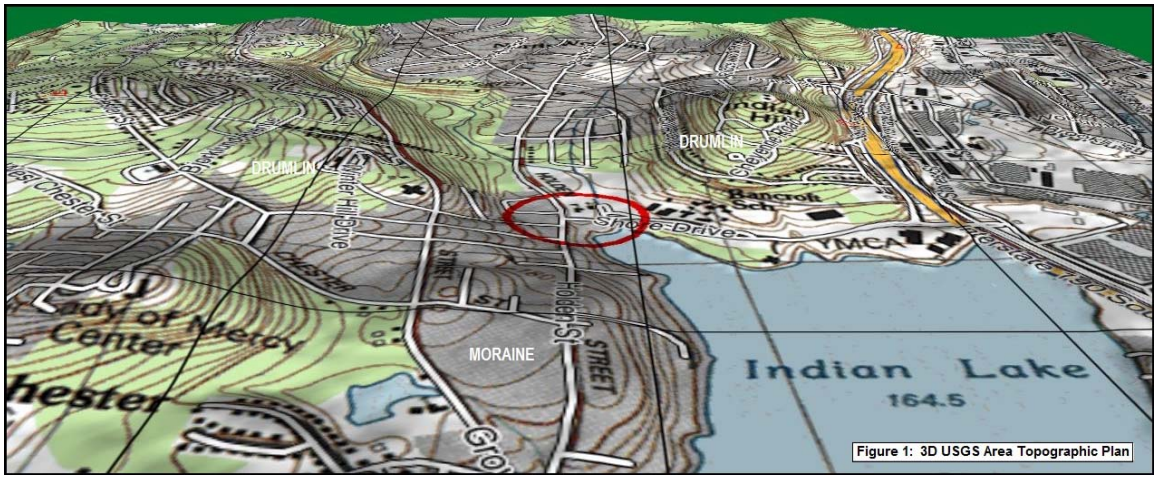


Figure 1: 3D USGS Area Topographic Plan

I. Proposed Construction:

Existing Conditions:

- Plan reference: an untitled pre-development site plan prepared by ESS Group dated 15 November 2019 (*Figure 2*).

- Direction, Datum, Elevation and Coordinates:
  - Direction:
    - Plan north: *Figure 1A, Figure 1*
    - Called north for this review: in the general direction of Ararat Street (*Figure 1*).
  - Elevation and datum:
    - Vertical elevations:
      - Site topographic elevations were provided on the 2019 site plan (*Figure 2*).
      - The alum tank locus was field estimated to be relatively level (*Figure 5)*.
    - Elevation datum:
      - No elevation datum was referenced on the 2019 site plan.
      - No elevation datum (e.g. NAV88) has been assumed in this review.
  - Site coordinates:
    - Latitude: 42.4043° N
    - Longitude: -71.0596° W

- Existing Site Conditions:
  - No attempt has been made to undertake a detailed history of this site. Historic review is included in research for environmental site assessments.
    - 1896 historic property mapping showed the site to be undeveloped. Shore Road did not exist. Indian Lake was known as North Pond (refer to *Figure 1B*).
    - 1900, 1917 and 1922 historic property maps revealed the same site conditions as shown in 1896.
    - Recent work on Shore Drive (reconfiguration) appears to have changed the ground surface on at least part of this site by addition of some leveling fill (see *Figure 1A*).
  - Site area topography is slightly sloping to steeply sloping (*Figure 1*).
    - The site is situated on a relatively level section of Shore Drive (*Figure 1*).
    - The work area itself is estimated to have less than 2 vertical feet of grade change (*Figure 2*).
  - Active site underground utilities lists are held by the test boring contractor. A Department of transportation steel cover box was found on-site near Shore Drive.

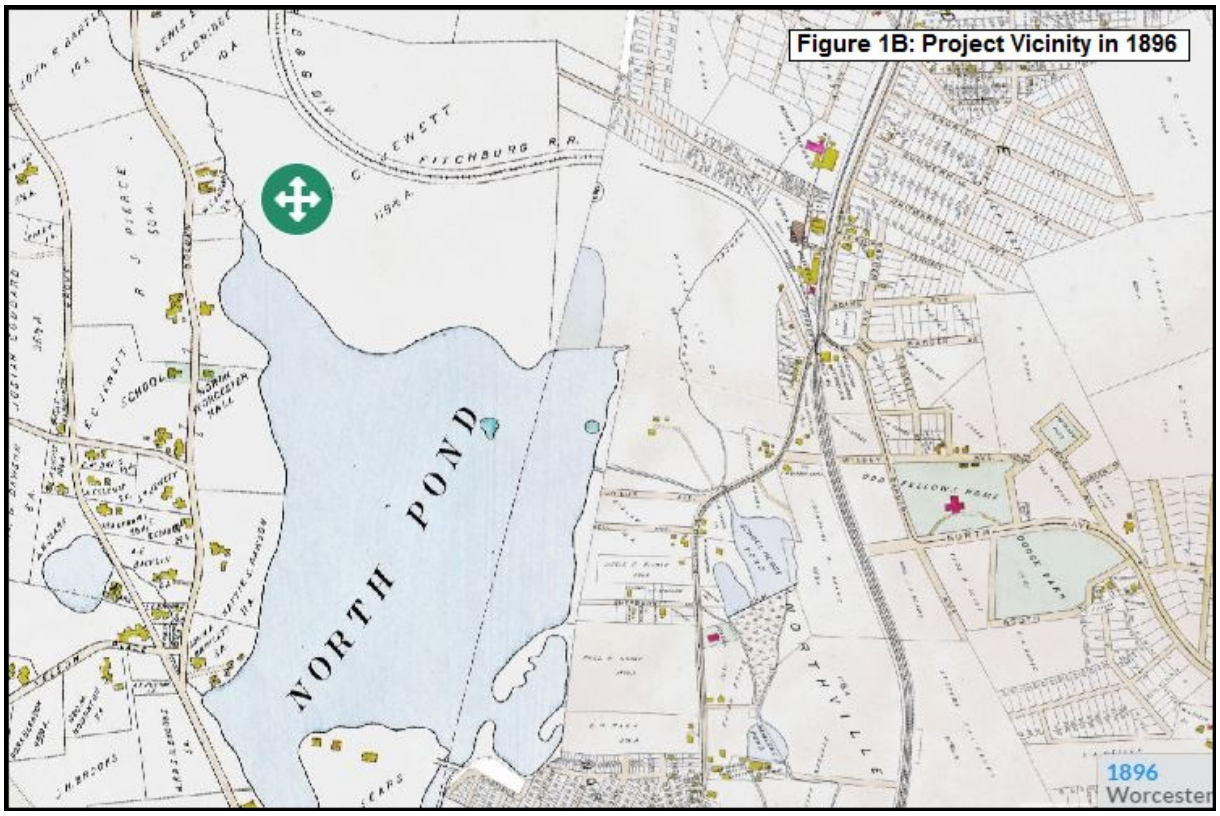


Figure 1B: Project Vicinity in 1896

Anticipated New Construction:

- Plan Reference:
  - *Proposed Construction City of Worcester – Notice of Intent Permitting Plans – 110 Shore Drive Worcester, MA 01605;* prepared by ESS Group of Waltham, MA; dated 6 October 2020.

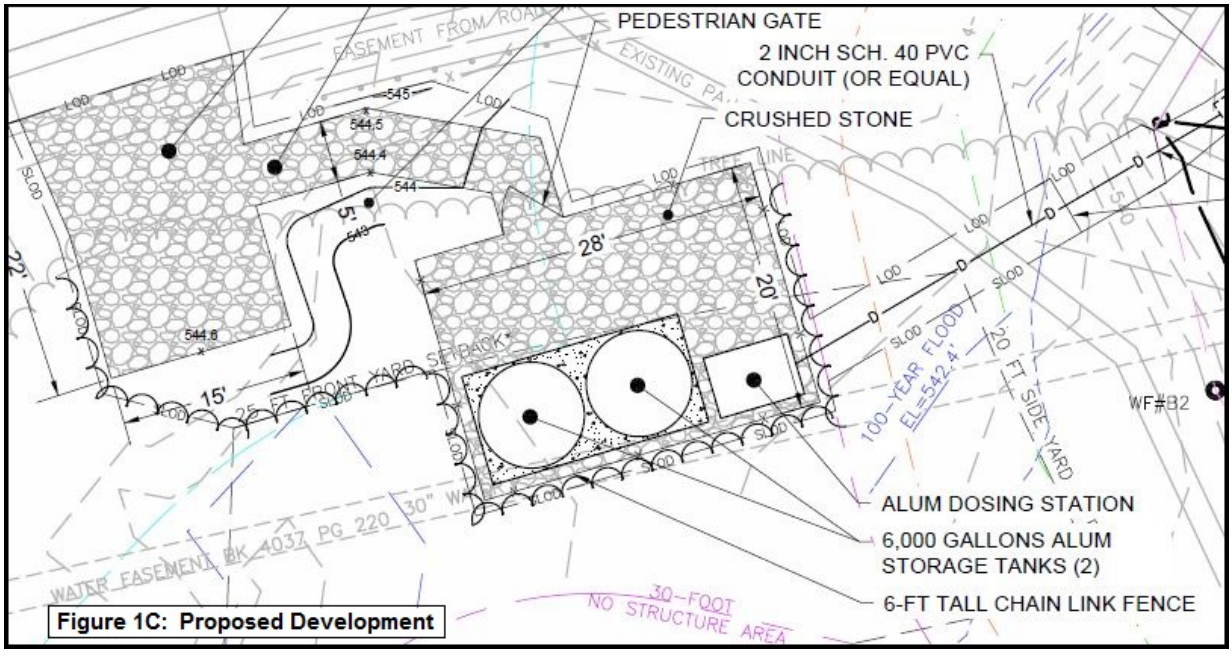


Figure 1C: Proposed Development

- Alum Tank Installation Information: (refer to *Figure 1C*)
  - New construction:
    - Two 6000 gallon tanks
    - Assumed mat support or circular footing support.
  - Mat foundation:
    - Top of mat elevation: estimated at El. 543 ft.+/- (Figure 2)
    - Applied mat load (assumed maximum) per Tripi Engineering Services: 1.5 KSF
    - Bottom of mat perimeter frost wall: at recommended frost depth (*Figure 5*)

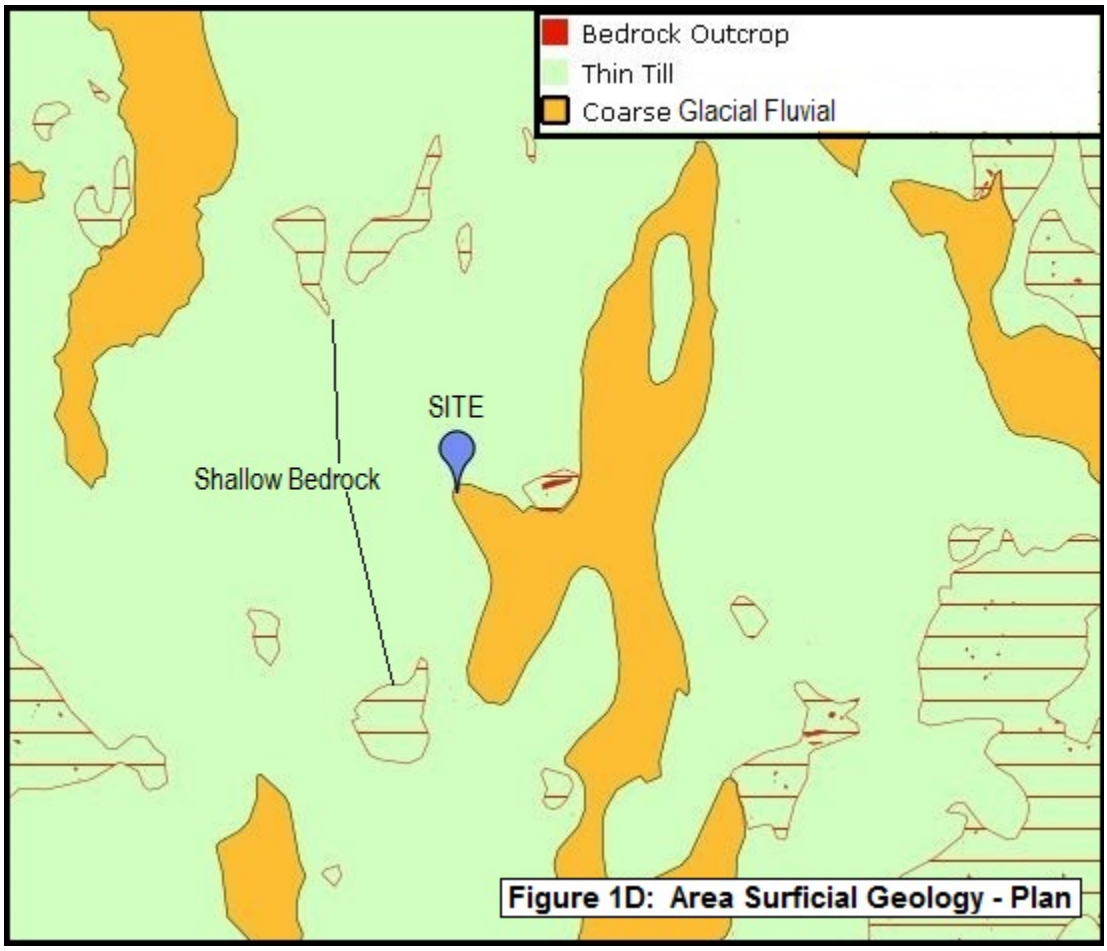


Figure 1D: Area Surficial Geology - Plan

II. Subsurface Conditions:

Topographic Data:

- Elevation Range: The immediate site area topography is slightly to steeply sloping.

- Area Surficial Geology:
  - Area surficial geology is the result of glacial advance and retreat and post-glacial surface changes.
    - The result was extensive land areas of glacial moraines and glacial drumlins (*Figure 1, Figure 1D-1*) and included glacial outwash plains.
    - The glacial drumlin and moraine formations were left behind by glacial scour and melt.

- Areas near rivers and streams also had alluvial (river flood) contributions within their lowland formation (alluvial land) as contrasted with glacial outwash plains (*Figure 1D-1*).
- According to *Figure 1D-1*, 110 Shore Drive is situated on or near the nose of a glacial drumlin formation; however *Figure 1D* reveals the site native subsoil is likely thinly bedded over shallow bedrock.
  - Glacial moraines are an accumulation of glacial drift (silt, sand and gravel) within a glaciated region by deposition and thrust of glacial ice (bulldozed material. Exposed bedrock is common.
  - Glacial drumlins are oval hills of clay, silt, sand and gravel compacted under pressure at the base of hundreds of vertical feet of glacial ice. A drumlin's axis indicates the direction of ice movement (compacted material).
  - An alluvial plain is formed by granular soil left behind by the repeated river flooding providing the silt, sand and gravel commonly found in the relatively level areas beyond the local moraine below fill. Glacial fluvial (outwash plain) soils are similarly formed within glacial meltwater.

o According to area surficial geologic mapping utilizing the site latitude and longitude coordinates [*Massachusetts GIS, Surficial Geology;* Commonwealth of Massachusetts Office of Geographic Information; September 2012; updated 2018] the site was predicted to be situated upon one or both of the following surficial native soil units:
- Glacial outwash: water sorted silt, sand and gravel
- Glacial till (ablation till; basal till)

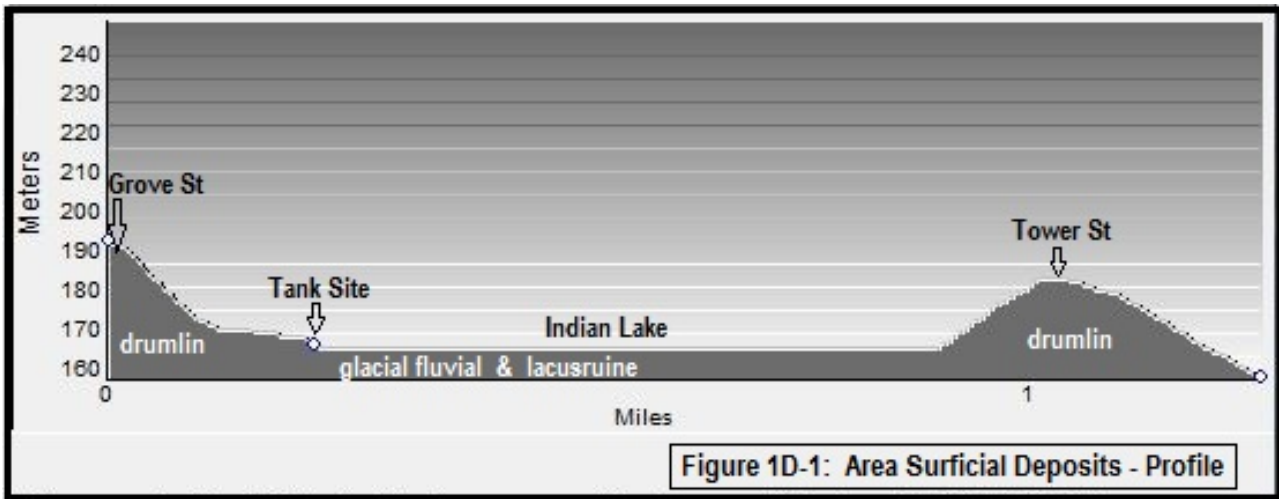
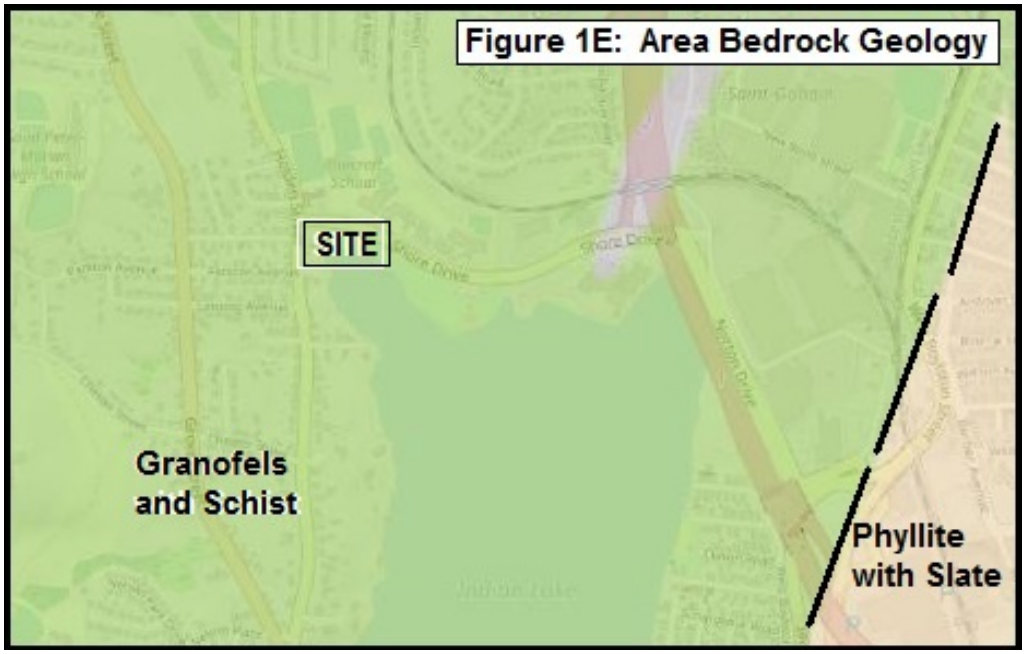


Figure 1D-1: Area Surficial Deposits - Profile

- Water Bodies:
  - o The following mapped water bodies are closest to the subject site:
    - Indian Lake: adjacent
    - Former stream emptying into Indian Lake (North Pond) as seen on *Figure 1B*).
  - o No other significant project area water bodies (ponds, lakes, rivers, streams) are mapped on *Figure 1* within a 1 mile radius of the subject site.
  - o Unmapped woodland wetlands exist sporadically in low spots, typically below fill.

- Anticipated Site Substrata: Based upon the collected geologic and topographic data, anticipated native site substrata were considered to potentially include:
  - o Man-placed fill
  - o Glacial outwash
  - o Glacial till
  - o Bedrock



- Area Bedrock Geology: [US Department of the Interior; US Geological Survey, *Massachusetts State Geologic Map*; 1998; updated 2018; see *Figure 1E*]
  - Common area rock:
    - Common rock: granofels
      - Hardness: a medium hard rock; metamorphic
      - Structure: very irregular fine grained (granoblastic)
      - Mineralogy: silt sized quartz and feldspar grains
    - Secondary rock: schist
      - Hardness: a medium hard rock; metamorphic
      - Structure: schistose; foliated
      - Mineralogy: quartz, feldspar; other components vary
  - Other area rock: phyllite and slate
    - Hardness: medium hard; metamorphic
    - Structure: foliated; slaty texture
    - Mineralogy: mica, quartz
  - Depth to bedrock was estimated as relatively shallow from the MA GIS (2018 database; see *Figure 1D*)

Previous Test Borings and Monitoring Wells

- On-Site Borings: no on-site boring records were found
- Nearby Borings: no immediate area boring records were found
- Existing Groundwater Monitoring Wells:
  - No remnant active groundwater monitoring wells were found on this site.
  - No new well was installed as part of this review.

Test Borings Undertaken for this Study

- Dig Safe:
  - General Dig Safe site underground utility clearance: was provided by the test boring contractor.
    - The Dig Safe ticket number is held by the test boring contractor.
    - Utilities contacted: utilities' list is held by the test boring contractor.
  - Test boring drilling locations were laid out as part of the Dig Safe site clearance.

- Test Borings:
  - Drilling was performed by Cosmo Drilling. of Ocean Bluffs, MA:
    - Two (2) structural test borings (designated B1 and B2) were planned to be drilled on-site on 17 September 2021.
    - Refer to *Figure 2: Subsurface Explorations* for approximate as-drilled test boring locations.
  - A track mounted drill-rig equipped with an auto-hammer drilled and sampled soils in the borings below grade (*Photo 1*).
    - 6-in. dia. NW percussion borings were advanced to a refusal surface (340 pound hammer driven casing and 140 pound hammer driven split spoon) with soil samples taken continuously.
    - Drive and wash drilling was undertaken once groundwater was encountered from 10 foot depth.
    - Soil samples were retrieved continuously in 2 foot length split spoons.

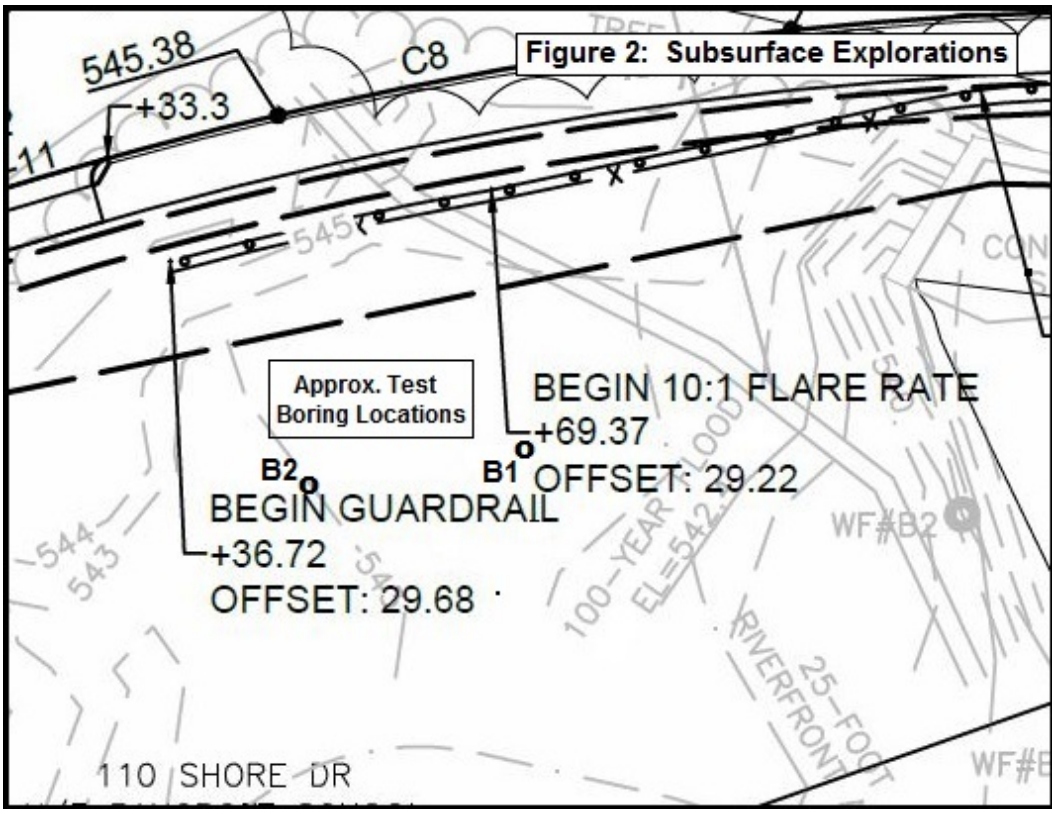


Figure 2: Subsurface Explorations

- Digital Boring Logs:
  - Recovered test boring soil samples were digitally logged by the geotechnical engineer in accordance with *ASTM D-5434-97: Standard Guide for Logging of Subsurface Explorations of Soil and Rock*.

- Boring logs prepared by the engineer are presented in soil boring log sheets in *Appendix A.* Log details soil type, boundary elevation or depth, density, consistency, thickness, coloration, moisture and composition.

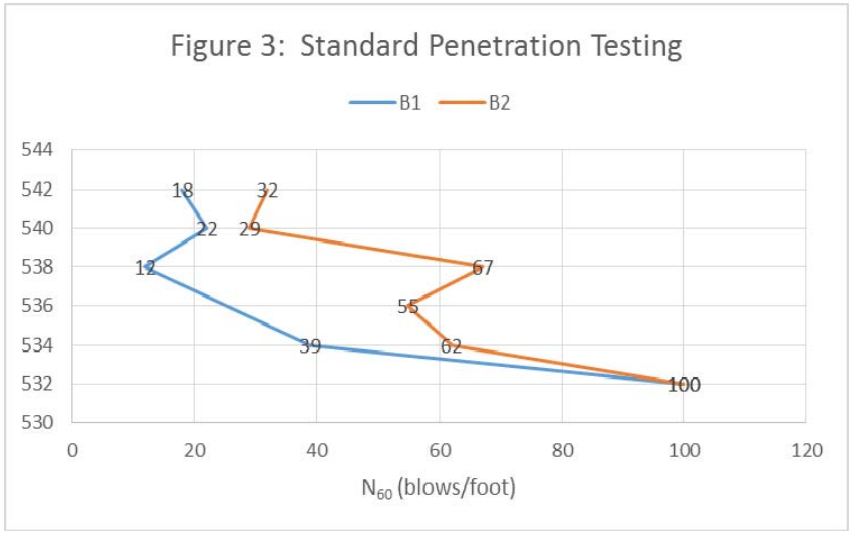
III. Geotechnical Testing:

Field Testing Performed:

- Standard Penetration Tests (SPT) (N_{70} in blows/foot)
- Field Gradation Tests

Standard Penetration Testing (SPT):

- SPT Presentation and Definition:
  - A standard penetration test is defined as the number of blows of a 140 lb. hammer falling 30 inches to drive a standard soil split spoon sampler 12 vertical inches. The number of blows is designated as "N"
  - Standard penetration tests (SPT) N are summarized for the borings with depth on the boring logs in *Appendix A* and in *Figure 5.*
  - Field SPT N (blows/foot) is taken from blow count graphs provided on the boring logs.
  - Standard penetration test N is plotted for the borings in *Figure 3.*



- SPT Type: The borings drilled for this study (see *Appendix A*) used a rope and cathead manual sampler drive system (*Photo 1*).

- SPT N Data Analysis of this Site:
  - Note that in the plots of N with depth in *Figure 3*:
    - Boring N values are lower within the near surface existing fill
    - Boring N values jump up in value in the native glacial till deposit.
      - Plotted N drop in value at the water table.
      - Plotted curves show some minor oscillation which is typical of random soil particle relative percentages found in soil formation within glacial till
    - Refusal surface found in the borings drilled may have been indicative of potential top of bedrock. Area surficial geologic mapping expected thin glacial till soil over bedrock (*Figure 1D*).
  - See also the N pattern variation with respect to soil type in *Figure 5* as well as in the blow count graphs on individual boring logs in *Appendix A.*

- SPT N Engineering Uses: SPT data can be useful in determination of values of soil bearing capacity, Young's Modulus for footing settlement evaluation, as well as input to footing base soil friction angle, seismic site class and slab subgrade modulus determination.

Field Gradation Tests:

- Test Use:
  - Limited field gradation tests were performed to better determine the relative percents of coarse gravel, fine gravel, coarse sand, and medium sand and fines (silt and fine sand) in recovered site granular fill and sandy glacial till subsoil samples.
  - Basal glacial till (hardpan) soils were not found in the borings to the refusal depths drilled.

- Limitations:
  - Field tests are limited to recovered dry or field air dried soil samples.
  - 4-sieve method does not allow for separation of silt from fine sand.

Laboratory Soil Tests:

- Test Boring Sampling:
  - No laboratory soil particle gradation testing was undertaken for this review.
  - Test boring samples are typically too small in recovered volume for accurate lab testing.

- Quality of Sampled Soils for Re-use: this subject is addressed in the report section entitled "Site Subsoil Descriptions" as well as in the final section of this report.

IV. Soil Strata:

Data Summaries:

- Subsoil Profile Data Summary: general summaries of soil substrata found in the subsurface explorations are provided in:
  - *Table I: Exploration Summary*;
  - The subsoil profile drawing (*Figure 5*);
  - The "Site Subsoil Descriptions" section; and
  - The test boring logs (*Appendix A*).

- Exploration Summary Table:

Table I: Exploration Summary

Location	***Surface El. (ft.)***	***Depth Drilled (ft.)***	***Granular Fill (ft.)***	***Common Fill; Buried Topsoil Loam (ft.)***	***Ablation Glacial Till (ft.)***	***Basal Glacial Till (ft.)***	***Depth to Top of Possible Bedrock (ft.)***
B1	543	11.8R	2.5	2.8	5.3	---	11.8R
B2	543	10.5R	2.3	3.7	4.5	---	10.5R

R – indicates rock refusal surface found; massive boulder or possible bedrock

- Subsurface Profile Drawing:
  - Refer to the subsoil profile sketched in *Figure 5* to gain an overview of site subsurface soil conditions at the locations drilled (*Figure 2*).
  - Subsoil profiles' orientations are parallel to Shore Drive (*Figure 2)*.

- Subsoil Profile Field Descriptions: Detailed field subsoil descriptions are given in the logs of the borings presented in *Appendix A*.

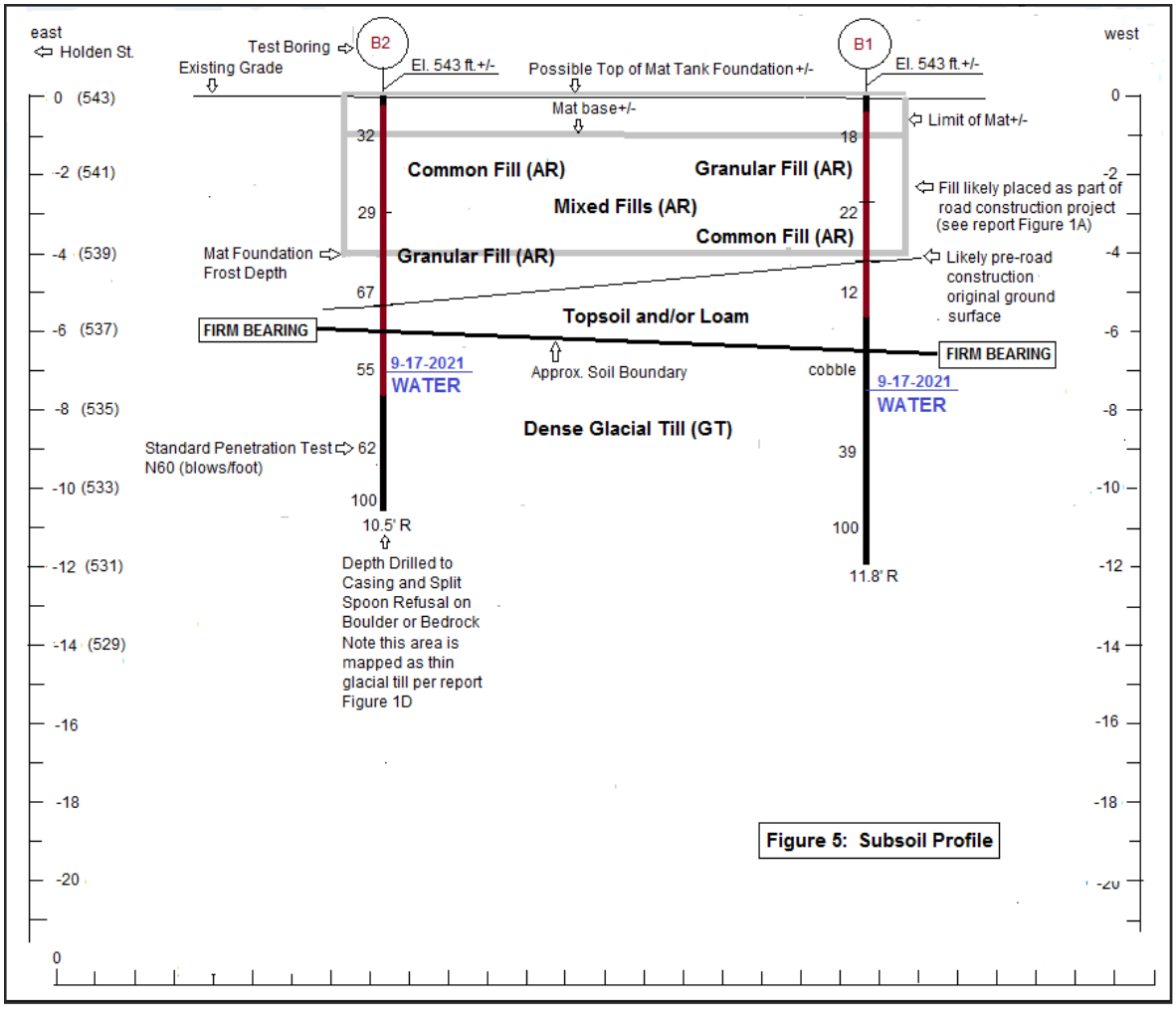


Figure 5: Subsoil Profile

Soil Classification System Used for this Site Investigation:

- Soil Classification System: Project soils have been classified in accordance with the Unified Soil Classification System (USCS; MIT System). This is reflected in the test boring logs in *Appendix A*.

- Soil Descriptions: Soils are described in terms of color, grain size, moisture content, density (coarse grained soils), consistency (fine grained soils), plasticity and cementation, as appropriate.

Grain	Size Boundaries (dia.)	Common Size Example
Boulder	>12 in.	>Basketball
Cobble	3-in. to 12-in.	Grapefruit size
Coarse Gravel	¾-in. to 3-in.	Lemon size
Fine Gravel	#4 Sieve (4.75mm) to ¾-in.	Pea to grape size
Coarse Sand	#10 Sieve (2 mm) to #4 Sieve	Peppercorn size
Medium Sand	# 40 Sieve (.425 mm) to #10 Sieve	Sugar to table salt size
Fine Sand	#200 Sieve (.075 mm) to #40 Sieve	Powdered sugar size
Silt/Clay	<#200 Sieve (.075 mm)	Flour particle or finer

- Soil Moisture Content:
  - Dry: no moisture noted
  - Moist: some moisture observed
  - Very moist: very moist, but not saturated (possible vadose zone)
  - Wet: saturated above the liquid limit (likely groundwater zone)

- Soil Density and Consistency:
  - Density of coarse grained soils (non-plastic silts, sands, gravels): defined in terms of standard penetration test blowcount N values (refer to the summary table at the bottom of any boring log)
  - Consistency (plastic silts, clay, and organics): defined secondarily in terms of blowcount N values and primarily with respect to field unconfined compressive strength in TSF (refer to the summary table at the bottom of any boring log).

- Soil Particle Percentage Field Designation: Relative soil particle size percentages (trace, few, little, some, mostly [capitalized soil unit]): refer to summary table at bottom of any boring log. These are more accurately tallied by laboratory soil particle gradation tests.

- Subsoil Classes on this Site: USCS soil type designations utilized in this report:
  - AR = man placed fill; artificial soil stratum; granular fill, common fill
  - GT = glacial till; ablation till
  - ME = bedrock; metamorphic rock; granofels, schist, phyllite

Photo 1: Trailer mounted drill rig

Photo 2: Granular Fill (AR) in boring B1 at 1 ft.

Site Subsoil Descriptions:

- Existing Fill (AR):
  - Fill types: two (2) general types of fill were found on-site:
    - Granular fill: cohesionless soil with a lesser silt content (< 20%); possibly imported during Shore Drive reconfiguration work (see *Figure 1A*) (*Photo 2, Photo 3*)
    - Common fill: cohesionless soil with a high silt content (> 25%)
  - Coloration:
    - Granular fill: tan, tan-yellow
    - Common fill: tan, tan-brown, brown
  - Thickness (t): at the borings drilled
    - Granular fill: 2.3 ft. ≤ t ≤ 2.5 ft.
    - Common fill: 1.6 ft. ≤ t ≤ 3.0 ft.

- Density:
  - Granular fill: medium dense to dense in-situ soil density (*Appendix A*)
  - Common fill: low medium dense to medium dense in-situ soil density (*Appendix A*)
- Fill source:
  - Granular fill: possibly imported during Shore Drive reconfiguration work (*Figure 1A*)
  - Common fill: possibly imported during Shore Drive reconfiguration work (*Figure 1A*)
- Competence:
  - Granular fill: where found, could be re-used as earthwork phase engineered fill ("granular fill", see final report sections) pending results of earthwork phase laboratory soil gradation tests.
  - Common fill: no common fill type observed should be allowed to remain in-place below structural units (footings, grade slabs). Topsoil should not be left in-place.
  - Re-use of non-urban fill common fill would be limited as backfill in planted areas
  - Re-use of any urban fill, if found, could have environmental engineering limitations with associated off-site disposal restrictions.

- Organics:
  - No woodland wetland organic soils (peat, organic silt) were found in the borings drilled
  - Buried topsoil and silt/silt loam subsoils were found (*Figure 5, Appendix A, Photo 4*) which are indicative of the likely former site original ground surface and native subsoils.

- Glacial Fluvial (Glacial Outwash): no water sorted silt, sand or gravel deposits were found

Photo 3: Granular Fill (AR) in B2 at 4 ft.

Photo 4: Buried Topsoil & Silt/Silt Loam in B1 at 4.2 ft.

- Glacial Till:
  - Types: two varieties of glacial till are found in the general site area
    - Ablation till: a cohesionless, granular glacial till (*Photo 5, Photo 6*)
    - Basal till: a cohesive or particle-cemented granular glacial till
  - Description:
    - Coloration:
      - Ablation till: tan, tan-yellow
      - Basal till: typically darker colors
    - Soil description:
      - Ablation till (*Photo 5, Photo 6*):
        - Can be water bearing (*Photo 5*)
        - Ablation till here is sandy throughout and can transmit water within the entire subsoil unit rather than being restricted to highly sandy flow channels.

- Ablation till was found below the existing fill, topsoil and loam soils (*Figure 5*; *Appendix A*).
- Ablation till on this site is a granular cohesionless uncemented till and varies in soil particle distribution; typical soil type characterizations include:
  - Variable non-plastic silt content
  - In general sandy ablation till was a sand with variable gravel content or a gravel with variable sand content.
  - Particle variation reflects the randomness of formation within the ablation till formation.
  - Cobbles were encountered.

Photo 5: Water in Ablation Till (GT) in B1 at 8 ft.

Photo 6: Ablation Till (GT) in B2 at 6 ft.

- Basal till: was not found to the depth drilled on-site
  - Basal till is found directly below the ablation till zone
  - Can be water bearing within internal sand seams and lenses within the low permeable basal till soil mass.
  - Characteristics include:
    - Basal till is typically cohesive (plastic) or strongly cemented fine grained granular soil with lesser sand and gravel
    - Typically, where cohesive, a high clayey silt content soil; with sand and gravel found in varying percentages.
    - Particle variation shows the randomness of soil formation within the basal till.

▪ Thickness (t) (*Table I*):
- Ablation till: 4.5 ft. ≤ t ≤ 5.3 ft.
- Basal till: not found at the drilled boring locations to the depth drilled.

o Density or consistency:
▪ Ablation till: dense
▪ Basal till: typically hard
▪ A false higher N can occur due to the presence of encountered included cobbles.

o Competence: dense granular ablation till on this site in natural undisturbed state is an acceptable bearing material.

o Re-use:
▪ The granular ablation till may be re-usable and should undergo soil particle gradation testing during earthwork to confirm re-use as an engineered fill material.
▪ The silt of some of the ablation till (*Appendix A, Figure 5*) precludes re-use as engineered fill and is limited to re-use as common (ordinary) fill below planted areas.

- Bedrock:
  - No rock outcropping was noted either on-site or in the general site area.
  - Shallow bedrock below thin glacial till and isolated rock outcrops were noted in the area surficial geology plan (*Figure 1D*). The plan is not meant to be site specific.
  - It is highly possible that the rock refusal surfaces seen in the borings were top of bedrock. It is also possible, but less likely, the refusals were upon two separate massive boulders.
  - See also the "Area Bedrock Geology" report section and *Figure 1E*

V. Groundwater Behavior

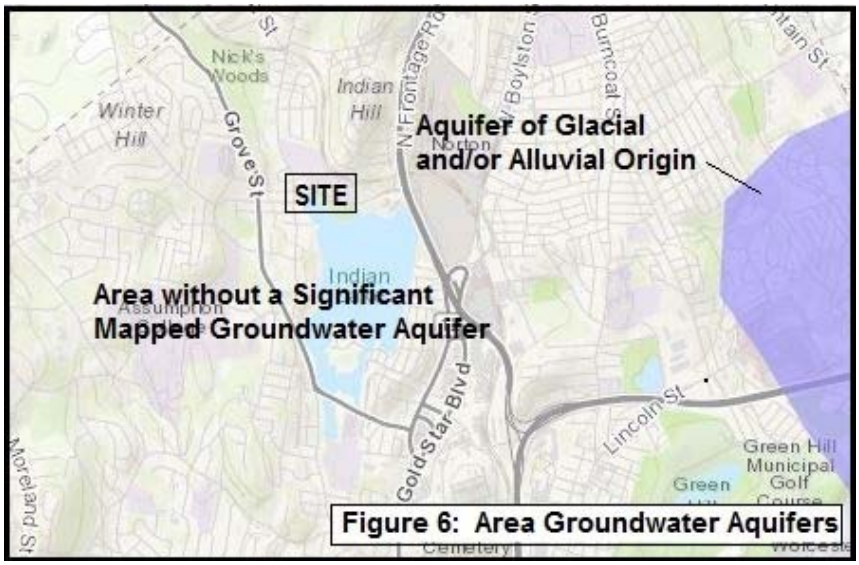


Figure 6: Area Groundwater Aquifers

- Free Water:
  - Wet (saturated) soil was encountered at depth in both borings (*Figure 5*, *Appendix A*).
  - Test boring drill holes were dry to moist throughout much of the depths drilled.
  - No groundwater monitoring well was installed in completed boreholes.
  - Water in some ablation till can occur within a largely interconnected network of water bearing sandy channels. On this site, however the granular ablation till is clean enough to readily transmit water throughout the entire deposit itself (*Photo 5*).
  - The site does not lie within a mapped significant groundwater aquifer (*Figure 6*).

- Groundwater Level Variation:
  - Clear soil mottling (color variation, typically splotches, due to past or current water presence) or rust staining was not seen in site soil borings.
    - Rust staining and mottling give an indication of a past water level possibly indicative of seasonal high groundwater level.
    - No mottling or rust staining was found in the borings to depth.
  - Found water levels are summarized in *Table II:*

Table II: Groundwater Data

Location	Surface Elevation	Depth to Water	Water Elevation
B1	543 ft.+/-	7.5 ft.	535.5 ft.+/-
B2	543 ft.+/-	7.0 ft.	536.0 ft.+/-

  - Localized temporary and long term changes to groundwater level can be natural or man-made. These changes source from activities such as:
    - The 2016 extreme drought condition and the relatively dry summer of 2017, and the recent 2020 and 2021 droughts.
    - A notably wetter 2018 and parts of 2019, with near record high water levels in many parts of eastern and central Massachusetts. Alternating dry and wet periods now seem to be the norm.
    - Winter drier season water levels.
    - Heavy rainstorms or lengthy precipitation periods exacerbated by snow melt.

        - Leaky underground structures (pipes, tunnels)
        - Underground flow retarders (buried structures, walls, rock outcrops)
        - Percent of land surface covered by pavement and buildings without ability to recharge.
        - Nearby construction dewatering or recharging.
        - Changes to the existing surface drainage pattern due to new site topography, trenches, infiltrators, bio-retention basins and subgrade structures.
    - Groundwater impact based upon the data collected to date (*Table II, Appendix A*):
        - Groundwater was found at depth and is not expected to impact foundation excavations.
        - Based on the data collected Seasonal High Groundwater is initially estimated for this site at El. 536.5 ft..
        - Underground utilities on some sites are designed to be installed deeper than foundations, however such data has not been provided us to-date for this project.

Hydraulic Conductivity (K in GPD/ft.^{2}):

- Scope: Laboratory soil gradation testing was not undertaken for this study and associated calculations and estimations of soil hydraulic conductivity (K) were not undertaken for any site subsoil unit.

- K Determination:
    - Many input factors go into determination of K. K is a function of particle grain sizes, soil density, soil particle uniformity, gravel content, soil cementation and soil layering.
    - Granular fill and granular ablation till soils (*Photo 2, Photo 3, Photo 5, Photo 6*) found in the borings are expected to be of at least moderate soil permeability.

Site Civil and Environmental Site Investigation and Remediation Structural Unit Impact:

- Intrusive Site Civil and Environmental Testing and Remediation:
    - Site civil and environmental exploration (test pits and test trenches) can damage anticipated building structural unit bearing soils by lowering native bearing capacity.
    - Site remediation work including underground tank removal and soil replacement can remove significant volumes of contaminated soil materials from within proposed new construction footprints and inadvertently cause structural unit bearing soil degradation at the excavation base.
    - Any new site soil remediation work should be reviewed by the design team for quality of soil material placed to replace removed soils and/or tanks, as well as documentation that replacement soils were placed in compacted lifts.

- Protection of Structural Unit Bearing Subgrade: to protect structural bearing areas, project specifications should require:
    - Test pit and test trench areas avoid proposed project footing and slab bearing zones.
    - Test pit and test trench depths be limited to structural bearing depths minus one foot.
    - Where contaminated soil removal is required, replacement soil should be structural fill placed in compacted lifts, verified by field soil density testing to a laboratory Proctor standard for the placed soil.

VI. Foundation Review and Recommendations:

Foundation System:

- Subsoil Impacts to a Tank Foundation System with Top of Mat at about El. 543 ft.l:
  - Key considerations are:
    - Existing poor quality uncontrolled site fill and buried topsoil and loam soils (*Figure 5, Table I, Appendix A*) should not remain below structural units.
    - Competent granular ablation till soil exists at depth (see "Firm Bearing" line on *Figure 5)*
    - Found groundwater is not expected to significantly impact anticipated site excavation (*Figure 5, Table II*).

- Required Bulk Excavation and Replacement:
  - Existing fill, buried topsoil and loam soils would have to be excavated out to the top of the undisturbed granular ablation till (see "Firm Bearing" line shown on *Figure 5*) and be replaced with acceptable engineered fill (see later section: "Engineered Fills and their Uses") to structural unit bearing level.
  - Note that excavated granular fill and possibly some granular ablation till might be able to be re-used as engineered fill beyond the limits of the tank foundations dependent upon the results of earthwork phase soil particle gradation tests (*Figure 5*).

- Bearing Capacity and Settlement: shallow foundations
  - Initial settlement and bearing capacity calculations were undertaken for this review.
  - Bearing capacity (net allowable soil bearing pressure) was reviewed for the borings:

    Structural units will bear directly upon engineered fill over a minimum medium dense undisturbed granular ablation till (*Figure 5, Appendix A*).
    Net allowable soil bearing pressures for site subsoils are as follows.

    Medium dense granular ablation till = 8 KSF
    Dense granular ablation till = 12 KSF

    Recommended net allowable soil bearing pressure for this project = 8 KSF

  - Settlement calculations basis: the elastic method

    $S = qBI\,(1 - \mu^2) / E_s$ S-settlement; B-footing width; I-Westergaard depth factor; E_s – Young's Modulus or elastic modulus; μ-Poisson's ratio

  - Calculated total settlement for a 8 KSF net allowable soil bearing pressure for site foundations was as follows:
    - < 1 in. total settlement and
    - < ½ in. differential settlement.
  - Granular ablation till on this site in natural undisturbed state is an acceptable bearing material in dry undisturbed condition. Granular ablation till is expected to be encountered at depth (*Figure 5, Appendix A*).

Seismic Recommendations:

- Seismic Site Hazard Review:
  - Probabilistic Site Hard Analysis [*PSHA Interactive Deagregation*; Geologic Hazards Science Center, US Geologic Survey; 2008 v.2]
    - Decimal site latitude and longitude utilized in this review: (42.3045° N, -71.8172° W)

- Probability of magnitude 5 (M5.0) or greater earthquake occurrence within 50 miles of the subject site within a 50-year building design life is considered relatively low (< 1.5%+/-) according to *Figure 7*.

o Area earthquake history:
- Typical measured earthquakes within the past 40 years have magnitude ≤ 3.1+/-
- Past significant earthquakes with area impact recreated from the geologic record:

Year	Magnitude	Location	Intensity in Boston
1638	6.5	Central New Hampshire	MMI: V-VII
1663	7.0	Charlevoix, Quebec	MMI: V-VI
1727	5.6	Newbury, MA	MMI: V-VI
1755	5.9	Scituate, MA	MMI: IX

MMI: Modified Mercalli Scale (subjective; observed damage and effects)

- Seismic Site Class: The collected site subsoil data has been applied to the Massachusetts adopted *International Building Code (2015)*. According to the *Building Code*
  - o Analytic depth:
    - The upper 100 feet of soil and bedrock are subject to analysis.
    - Soil data on-site has been collected to 11.8 ft. depth; *Table I, Appendix A*).
    - Native soils tested were typically dense granular ablation till.
  - o Bedrock:
    - Bedrock is hard metamorphic rock (see "Area Bedrock Geology" report section).
    - Bedrock may have been found at less than 8 ft. below frost depth foundations.
    - Depth to probable intact bedrock as measured from likely bottom of foundation is < 10 ft. which would allow assignment of a rock controlled seismic Site Class B to this project.
    - However as a precaution, this site is classified as seismic Site Class C.

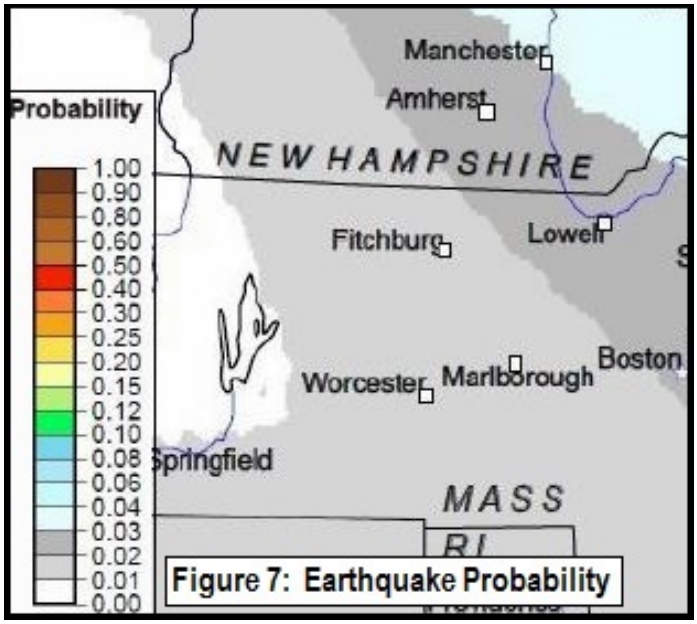


Figure 7: Earthquake Probability

- Seismic Design Factors: Preliminary estimated Earthquake Design Factors for Worcester, Massachusetts (*Massachusetts Amendments to the International Building Code (2017; 9th Edition))* and *IBC (2015)*:
  - S_s = 0.180g (short interval)
  - S_1 = 0.066g (1-second interval)
  - F_a = 1.2 (site coefficient, classification as Site Class C)
  - F_v = 1.7 (site coefficient, classification as Site Class C)

Liquefaction:

- Liquefaction Factors:
  - o Earthquake magnitude
  - o Earthquake amplitude (duration)
  - o Subsoil types and condition

- Earthquake Magnitude:
  - Collected data indicates that the probability of occurrence of an earthquake of magnitude 5 or higher is low probable during a 50 year building design life.
  - However, with a time period measured in centuries instead of decades, earthquakes of magnitude 5 or greater can be expected to occur as the earthquakes listed above indicate.

- Earthquake Duration: This topic is beyond the scope of this review.

- Subsoil Data Input: Review of the site subsoil profile was necessary for soil liquefaction determination below structural units:
  - Relevant test boring information: no thickness of post compaction, loose to very loose saturated silty to clean sands and non-plastic silts (SM, SP, SW, ML) would be found below structural units.
  - Drill rig, site groundwater level and measured soil strength data with depth:
    - Drill rig hammer type: drop hammer
    - Groundwater level: El. 536.5 ft. (seasonal high estimate; page 15)
    - Plotted field N_{60}-values from the borings with depth (*Figure 3*).

- Site Liquefaction Determination:
  - Review of field drop hammer N_{60} from the borings with depth with respect to *Figure 1806.4a* of the *Massachusetts Amendments (2017; 9th Edition)* for preliminary liquefaction exclusion review compared to a range of (seasonal high) groundwater levels.
  - Assumption that site subgrade preparation will be performed as described in the "Excavated Base and Working Base" report section.
  - Result: liquefaction settlement is not of concern for this site were a 5M or greater earthquake to occur here.

Structural Unit Frost Protection Depth:

- Definition:
  - Frost depth, freezing depth or frost line is the depth to which moisture in subsoil is expected to freeze.
  - Frost line varies in position (elevation) during seasonal freeze and thaw.

- *Massachusetts State Building Code* Mandated Frost Protection Depth Changes:
  - 7th Edition: "All foundations for buildings and structures shall extend to a minimum of 4 ft. below (exterior) finished grades…"
  - 8th Edition: Foundations and permanent building supports should be protected by "extending below the frost line of the locality…" This suggests a 4 ft. frost depth is too deep for coastal and southern areas and too shallow for northern or topographically elevated locales.

- Site Structural Unit Frost Protection Depth:
  - Frost line:
    - Average area frost line value: 0.9 m = 35.5 in. [J.E. *Bowles; Foundation Analysis and Design 5th Ed*.; 1997; Figure 7-1].
    - Extreme frost line based upon state average: 53 in. [NAVFAC DM-7.1; *Soil Mechanics Design Manual 7.1*; Figure 7; 1982].
    - Based upon the data collected to-date: recommended minimum site structural unit frost protection depth in soil bearing for this property as measured from final adjacent exterior grade: = 48 in. (4 ft.)
    - Direct bearing on intact bedrock does not require a minimum frost depth embedment.

- Cold Weather Work Soil Protection:
  - During construction earthwork the contractor must be prepared to provide protection and/or thawing of foundation bearing soils against freezing.
    - Footings: insulation blankets and/or ground heating hoses should be utilized if footing subgrade is exposed to freezing during cold weather periods.
    - Lowest Level Slabs:
      - Typically slab subgrade areas are thawed once basic framing is up by providing heaters after enclosing the lowest level in plastic sheeting.
      - Then any remaining required grade raise fill, treatment and placement of the slab base pad can be properly performed.

Structural Units Bearing on Soil and Bedrock:

- Structural Units Bearing on Soil:
  - Structural units may be founded directly upon:
    - Compacted structural fill, compacted ¾ inch crushed stone, mudmats, or 300 PSI flowable fill.
    - Undisturbed, medium dense to dense glacial till (ablation till)
  - Structural units should be designed to bear such that:
    - They meet frost depth (page 18)
    - They meet the requirements of "Bulk Excavation and Replacement" (page 16)
    - They are founded below a minimum 1H:1V line as drawn from the bottom exterior edge of adjacent footings or utilities.
  - Water intrusion:
    - Groundwater seepage within bulk excavation zones on-site is not expected based upon the water levels found in the borings (*Figure 5, Table II, Appendix A*).
    - However, seepage and influx following rain and melt events should be anticipated.
    - Wet conditions require use of protective caps where any highly silty ablation till is exposed or allowance for adequate on-site drying of bearing soils prior to re-commencing structural unit subgrade preparation and concrete placement.

- Footing Soil Base Friction:
  - Anticipated footing base friction angle is given as:
    Φ' = 36° (compacted structural fill over medium dense sandy ablation till)
    Φ' = 36° (medium dense ablation till)
    Use: Φ' = 36°

- Footings Bearing on Rock: none anticipated on this project

Foundation Wall Design (Restrained Walls): if excavation to direct bearing of structural units on undisturbed granular ablation till is undertaken in lieu of bulk excavation and replacement; otherwise this section can be ignored.

- Lateral Earth Pressure and Hydrostatic Pressure:
  - New foundation walls should be designed to resist lateral pressures calculated on the basis of an equivalent fluid weight of:
    - 65 PCF (not designed to resist hydrostatic pressure: drains provided)
    - 95 PCF (designed to resist hydrostatic pressure: no drains provided)
  - The recommendations assume an at-rest earth pressure coefficient (K_o) as follows [Knappett & Craig, *Craig's Soil Mechanics*; 2012; Figure 11.11]:
    - $K_o = 0.42$ (Φ'=36°)
    - Where the calculated earth pressure behind walls is < 250 PSF, it should be increased to 250 PSF to account for stresses caused by compaction within 5 lateral feet from the wall face.

- Surcharge Loads:
  - Surcharge loads are generated by adjacent loads of construction equipment, materials, stockpiles and traffic loads
  - Surcharge loads can be determined on the basis of a uniform lateral pressure equal to K_o multiplied by the vertical surcharge load applied over the full height of the wall.

- Seismically Induced Loads:
  - Seismically-induced earth pressures (*earthquake force*, F_w) should be distributed as an inverted triangle over the height of the wall (*Massachusetts Amendments (2017))*.
  - $F_w = 0.1 (S_s)(F_a)(Y_t)(H)^2$
    - S_s = 0.180g (see "Seismic Recommendations" report section)
    - F_a = Site Coefficient = 1.2 (classification as Site Class C)
    - Y_t = Total Soil Unit Weight = use 125 PCF (ablation till or granular fill as back fill)
    - H = height of foundation wall

- Total Lateral Stress: The two static lateral pressures and the seismic pressure when added yield the total lateral stress for structural design of the walls.

Cantilever Earth Retaining Wall Design:

- Retaining Wall Construction:
  - It is not known if a cantilever wall will be required in site design.
  - Clean, free-draining granular backfill should be placed behind a new wall.
  - Weep holes should be provided in the wall to prevent hydrostatic pressure build up behind the wall.
  - Wall should be founded upon compacted structural fill placed upon an undisturbed glacial till subgrade or native conglomerate rock.

- Retaining Wall Design:
  - Backfill design factors: soil at 120 PCF; Φ=30°; k_a = 0.33; triangular soil load distribution
  - Equivalent fluid pressure behind the wall: 40 PCF; level backfill, no surcharge loads; resultant (P), located at P = 1/3 H above base of wall.
  - Surcharge load (Q): an additional, uniform load on the wall = k_a x Q (resultant at 0.5 H)

Drainage and Waterproofing:

- General Comments/Good Practice:
  - Exterior grading at the tanks should be designed to carry surface water runoff away from the structures.
  - Planted areas or pavements should enhance the exterior grading performed to insure surface water runoff beyond building limits.
  - Roof downspout water or other water should not be allowed to pool near the building.

- Review Summary of Groundwater and Structural Unit Assumed Elevation Data:
  - Structural unit elevations were estimated at the time of this review (*Figure 5*):
    - Top of tank mat: El. 543 ft.
    - Structural unit frost depth: El. 539 ft.
    - Top of native ablation till bearing (bulk excavation to "Firm Bearing" line, *Figure 5*): El. 536.5 ft. to El. 537 ft.
  - Groundwater elevations*:*
    - Found groundwater in borings B1 and B2: El. 535.5 ft. to El. 536 ft.
    - Estimated seasonal high groundwater level: estimated at El. 536.5 ft. (page 15).
  - Site flooding: considered highly unlikely; confirm with project site civil engineer.

- Structural Unit Foundation Wall Drainage and Waterproofing: based upon the groundwater data collected and the assumed structural bearing elevations, foundation wall drains are not required.

- Mat Base Drainage and Waterproofing: waterproofing such as an under mat underdrain system (e.g. under mat perimeter and interior underdrain pipes set in a ¾ in. crushed stone bed upon geotextile outletting to a sump pit) is not required based upon the groundwater data collected.

Mat Design: mat is assumed to be soil supported as described in previous sections

- Subgrade Modulus: for mat design
  - The recommended modulus of subgrade reaction (K_s) is given in *Table III.*
  - The values given assume medium dense to dense undisturbed granular ablation till underlies any compacted structural fill material (*Figure 5*).

Table III: Slab Subgrade Moduli (K_s)

Mat	Soil Type	K_s (KCF)
Top at El. 536 ft. Alternate (TBD)	Compacted Structural Fill or Ablation Till	350 KCF

- Under Mat Pad and Control Joints:
  - A mat base pad will be provided as compacted ¾ inch crushed stone or compacted structural fill
  - Interior mat control joints, if any, should be utilized within patterns as determined by the Project Structural Engineer.

Excavation and Bracing:

- Excavation Depth ≤ 4 ft.+/- in Soil:
  - Common practice is to maintain a 1H:1V temporary side slope for shallow excavation (≤ 4 ft.+/-) during construction. Benched steps can also be executed.
  - Note that the sidewall stability will be undermined by:
    - Minor sloughing when sidewall bleeding occurs either from release of trapped water in soil or drainage following storm events; and
    - Surficial exposed granular sidewall soil drying and subsequent caving or sloughing.

- Excavation > 4 ft. in Soil: excavation up to about 6.5 ft. depth is expected on-site
  - Excavate with a 1.5 H:1 V sidewall layback.
  - A braced excavation is required where adequate lateral space does not exist for a temporary sloped excavation. On this site adequate lateral soil excavation layback space exists. Braced excavation will be unnecessary.
  - Excavation at this depth will take place primarily within granular soils which can be classified as OSHA Type C subsoils (*Appendix A*).

Construction Dewatering:

- Groundwater Impact:
  - Based upon the data collected to-date, groundwater seepage into excavations for foundations and lowest level floor slabs is unlikely (*Appendix A, Table II, Figure 5*).
  - Rain and melt seepage water intrusion should be expected.
  - Refer also to the "Groundwater Behavior" report section (pages 14-15).

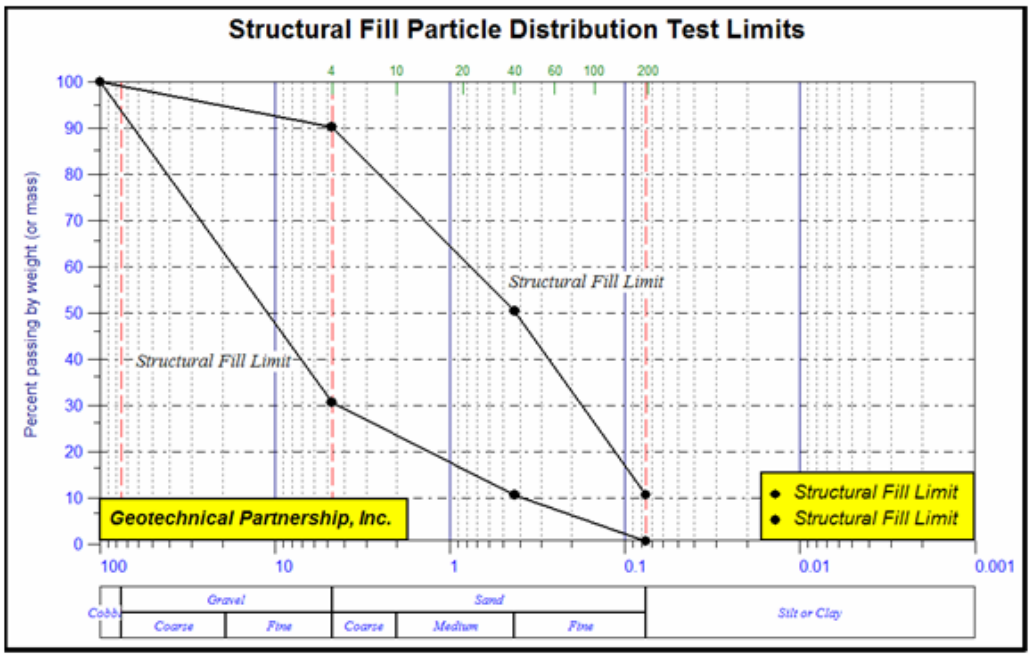
- Dewatering Required:
  - Intruding water into site excavation would be limited to rain and melt events.
  - Expected water can be controlled by ditching to filtered sumps.

- Pumped Discharge:
  - Discharge of any pumped water should be performed in accord with all City, Commonwealth and Federal regulations. Filtering of pumped water prior to discharge should be expected.
  - Permitting required by the USEPA, MWRA, or the City should be reviewed. Assessment by the Project Civil Engineer should be sought.
  - The contractor would be responsible for obtaining all permits and any associated laboratory testing required for construction dewatering.
  - Based upon City requirements the contractor may be required to use frac tanks to temporarily store pumped water at the work site. This possibility should be reviewed in conjunction with the Project Civil Engineer.

Engineered Fills and their Uses:

- Crushed stone: ¾ in. clean, hard, durable crushed stone; uses:
  - As a construction working pad
  - As a surface protection below structural units
  - As drainage media in wall and under slab drainage systems.

- Gravel: sandy gravel, bank run gravel; max. 3-in. gravel; limit No. 200 sieve content to about 6%; uses:
  - As base in a pavement section



- Structural fill: hard, durable sand and gravel;
  - Common gradation limits for structural fill are given in the plot shown above.
  - Gradation adjustments: gradations often specify
    - Minimum of 2% passing No. 200 to aid compaction
    - Maximum of 15% passing No. 200 with the assumption that work may not proceed during wet conditions using this material (Dense Grade can be substituted)

- Structural Fill Uses (in lieu of crushed stone):
  - To form a protective base directly below structural units
  - As a slab base pad
  - As a replacement fill below structural units (over-excavated soft areas)
  - As sub base in a pavement section

- Dense Grade Structural Fill/2-in. Crushed Stone: Structural fill/crushed stone meeting the following minimum requirements

Sieve Size	Percent Finer by Weight
2 in.	100
1.5 in.	70 – 100
¾ in.	50 – 85
No. 4	30 – 55
No. 50	8 – 24
No. 200	3 – 10

  - Dense grade structural fill uses:
    - As a readily workable replacement for conventional or recycled concrete type structural fill when work must proceed during cold and/or wet conditions.
    - As a base pad for structural units

- Granular Fill: minor gravel; primarily medium to fine sand and silt meeting the following minimum requirements

Sieve Size	Percent Finer by Weight
4 in.	100
No. 10	30 – 95
No. 40	10 – 70
No. 200	0 – 15*

** May be as high as 20% if field compaction can be verified in **dry** conditions*

  - Granular Fill Uses:
    - As under a building slab as fill below 12 in. depth as measured from the slab base.
    - As densified trench backfill

Re-use of Existing Site Subsoils as Engineered Fill:

- Existing Granular Fill:
  - Refer to the "Existing Fill" report section on pages 11-12.
  - Granular fill volume appears random with respect to vertical and horizontal control (see *Figure 5, Appendix A*).
  - Where granular fill soils are encountered and can be separated and stockpiled, they may be re-used as engineered fill (see previous section: "Engineered Fills and their Uses") pending construction phase soil particle gradation test results.
  - Any found excavated granular fill soil should be considered non-engineered:
    - Thus undertaking laboratory Proctor and associated field compaction tests is not useful as the silt-sand-gravel ratios will vary.
    - Re-use of these soils on-site would require experienced third party field observation of compaction equipment behavior, supported by consideration of addition of water to dry soil or drying of saturated soils (harrowing, land spreading) as needed.

- Existing Common Fill and Silty Ablation Till:
  - Refer to the "Existing Fill" report section on pages 11-12 and the glacial till section on pages 12-13.
  - The existing common fill (till fill) and silty ablation till can only be classified as ordinary fill or common fill.
  - Common fill can only be reused on-site below planted areas or any structural slabs.
  - Some earthwork specifications commonly in use provide strict silt content limits for "common fill". The site common fill soil may not meet such a specification.

- Existing Sandy Ablation Till:
  - Refer to the "Glacial Till" report section on pages 12-13.
  - Sandy ablation till that is found in site excavations has low silt content: some (see *Appendix A*).
  - Low silt content sandy ablation till (<20% silt) could be re-used as engineered fill (granular fill, structural fill) pending construction phase soil particle gradation test results.
  - Sandy ablation till would be treated the same as "existing granular" fill summarized above as an uncontrolled material if it is re-used on-site.

Thank you for inviting us to perform this site study. Please contact us with any questions.

Sincerely yours,
Geotechnical Partnership, Inc.

Lisa R. Casselli, PE
Principal

Attachments: *Appendix A*: *Logs of Test Borings B1 and B2*

APPENDIX A: Logs of Structural Test Borings B1 and B2

Indian Lake – 110 Shore Drive
Worcester, Massachusetts

Geotechnical Partnership, Inc.
Swampscott, MA
File No. 2140

Geotechnical Partnership, Inc.
Swampscott, Massachusetts
Sanford, Maine

PROJECT: New Construction
Indian Lakes - 6000 gal. Tanks
Worcester, Massachusetts

CLIENT: ESS Group, Inc.

File No. 2140

Date Drilled	: 17 September 2021
Boring Location	: Refer to Report Figure 2
Drilling Contractor	: Cosmo Drilling
	: Ocean Bluffs, MA
Driller	: F. Sviokla
Rock Core	: ---
GPI Field Engineer	: LR Casselli, PE, MASCE CSI
Elevation and Datum	: El. 543 ft.+/-
Drilling Mud Utilized	: Not necessary
Constant Water Head	: Wash boring from 10 ft

Test Boring No. B1

(1 of 1)

Drill Rig Type	: Trailer mounted
Hammer Type	: Drop
Cat-Head or Winch	: Cat-Head
Soil Casing Type	: 6 in. NW
Sampler Type	: SS - 1.375 in. I.D.; unlined
Sampler Hammer Fall	: 140 lbs. / 30 in.

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	Sample No.	Blow Count	REMARKS
0	543	Dark-brown, SILT LOAM, few medium to fine sand (very soft; moist); fibers, roots	AR	1	2	Groundwater=7.5'
					10	Well Set: no
1	542	Tan, medium to fine SAND, little coarse to fine gravel, few silt and coarse sand (medium dense; dry) with lens recycled pavment fragments	AR		8	Fill likely placed druing road reconstruction (see Figure 1A)
					12	SS-1: 0' - 2'
2	541	--Granular Fill--		2	50	R=14 N=18
		3.0 ft.			18	
3	540	Tan-brown to tan, medium to fine sandy SILT (non-plastic), little coarse to fine gravel, trace coarse sand (medium dense; dry to moist)	AR		4	SS-2: 2' - 4'
					10	R=19 N=22
4	539	4.2 ft. --Common Fill--	MH	3	10	
		Dark-brown, SILT LOAM, little medium to fine sand, few coarse to fine gravel (moist)			7	
5	538	4.4 ft. --Buried Topsoil--			5	SS-3: 4' - 6'
		Orange-brown, SILT (non-plastic) to SILT LOAM, few medium to fine sand and fine gravel (loose; moist)	ML		5	R=14 N=12
6	537	--Loam--		4	8	
		6.5 ft.			32	
7	536	Tan, coarse to fine GRAVEL (angular), some silt and medium to fine sand, trace coarse sand (very dense; very moist); cobble			89	SS-4: 6' - 8'
					53	R=15 N=121
8	535				35	likely ablation till cobble elevated N value
		Tan, silty medium to fine SAND and coarse to fine GRAVEL (angular), few coarse sand (dense; very moist)	GT	5	18	
9	534				21	SS-5: 8' - 10'
					45	R=16 N=39
10	533				37	
		Tan to tan-orange, coarse to fine GRAVEL (angular), some to mostly silt and medium to fine sand, trace coarse sand (very dense; very moist) ; cobble			65	
11	532	--Glacial Till--		6	105	SS-6: 10' - 12'
					100/4"	R=12 N=170
12	531	Casing Refusal on Rock at 11.8 feet Depth				cobble in sample
						Boulder or top of bedrock refusal
13	530					
						P=Penetrometer
14	529	Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%				
15						

Blow Count Graph: 10 50

Average qu-Field

Average qu-Field (TSF): 0 1 2 3 4

COHESIONLESS SOILS: (DENSITY) L: Sands; R: Gravels				COHESIVE SOILS: (CONSISTENCY)	
0-6	Very Loose	0-8		0-2	Very Soft (<0.25 TSF)
6-10	Loose	8-15		2-4	Soft (0.25-0.5 TSF)
11-30	Med-Dense	16-40		4-8	Med. Stiff (0.5-1.0 TSF)
>30	Dense	41-50		9-20	Stiff (1.0-4.0 TSF)
	Very Dense	>50		>20	Hard (>4.0 TSF)

Test Boring No. B1

(1 of 1)

Geotechnical Partnership, Inc.
Swampscott, Massachusetts
Sanford, Maine

PROJECT: New Construction
Indian Lakes - 6000 gal. Tanks
Worcester, Massachusetts

CLIENT: ESS Group, Inc.

File No. 2140

Date Drilled	: 17 September 2021
Boring Location	: Refer to Report Figure 2
Drilling Contractor	: Cosmo Drilling
	: Ocean Bluffs, MA
Driller	: F. Sviokla
Rock Core	: ---
GPI Field Engineer	: LR Casselli, PE, MASCE CSI
Elevation and Datum	: NA
Drilling Mud Utilized	: El. 543 ft.+/-
Constant Water Head	: Not necessary

Test Boring No. B2

(1 of 1)

Drill Rig Type	: Trailer mounted
Hammer Type	: Drop
Cat-Head or Winch	: Cat-Head
Soil Casing Type	: 6 in. NW
Sampler Type	: SS - 1.375 in. I.D.; unlined
Sampler Hammer Fall	: 140 lbs. / 30 in.

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	Sample No.	Blow Count	Blow Count Graph (10 50)	Average qu-Field	Average qu-Field (TSF) (0 1 2 3 4)	REMARKS
0	543	Dark-brown, SILT LOAM, few medium to fine sand (dry to moist); fibers; roots	AR						Groundwater=7'
0.2		--Topsoil Fill--							Well Set: no
1	542	Brown, silty medium to fine SAND, few to little coarse to fine gravel few coarse sand (medium dense; dry)	AR	1	6 16 16 10				Fill likely placed during roadway reconstruction: see Figure 1A SS-1: 0' - 2' R=11 N=32
2	541								
3	540	Brown, silty medium to fine SAND, few to little coarse to fine gravel few coarse sand (medium dense; dry)		2	8 7 22 28				SS-2: 2' - 4' R=14 N=29 cobble?
3.0		--Common Fill--							
4	539	Tan to tan-yellow, medium to fine SAND, few to little silt, few coarse sand (medium dense; dry)	AR						
5	538	Tan, medium to fine SAND, little to some coarse to fine gravel, little silt, few coarse sand (dense; dry); cobble		3	20 24 43 37				SS-3: 4' - 6' R=19 N=67
5.3		--Granular Fill--	MH						
6	537	Dark-brown, SILT LOAM, little medium to fine sand, trace fine gravel							
6.0		--Buried Topsoil--							
7	536	Tan-yellow, silty medium to fine SAND, some to mostly coarse to fine gravel (angular), few coarse sand (dense; very moist)	GT	4	23 26 29 17				SS-4: 6' - 8' R=17 N=55 likey ablation till
8	535								
9	534	Tan-yellow, silty medium to fine SAND,and coarse to fine GRAVEL (angular), few coarse sand (dense; very moist)		5	14 30 32 100				SS-5: 8' - 10' R=16 N=62
10	533	--Glacial Till--		6	120				SS-6: 10' - 12' R=6 N>120 On rock/boulder
10.5		Casing Refusal on Rock at 10.5 feet Depth							
11	532								P=Penetrometer
12	531								
13	530								
14	529								
15		Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%							

COHESIONLESS SOILS: (DENSITY) L: Sands; R: Gravels
0-6 Very Loose
6-10 Loose
11-30 Med-Dense
>30 Dense
0-8
8-15
16-40
41-50
Very Dense >50

COHESIVE SOILS: (CONSISTENCY)
0-2 Very Soft (<0.25 TSF)
2-4 Soft (0.25-0.5 TSF)
4-8 Med. Stiff (0.5-1.0 TSF)
9-20 Stiff (1.0-4.0 TSF)
>20 Hard (>4.0 TSF)

Test Boring No. B2

(1 of 1)

09-29-2021 C:\Documents and Settings\Owner\My Documents\M-Tech\samples\2140 B2-17.bor

THE BIDDER MUST FILL IN THESE UNIT PRICES. Also carry out all extensions and fill in "Computed Totals."
In case of error or discrepancies, UNIT PRICES govern and written works take precedence over figures.

ITEM NUMBER AND DESCRIPTION	ESTIMATED QUANTITY		COMPUTED TOTALS
100.0000 CLEARING & GRUBBING			
	Dollars	1.00	$
	($) AC		
116.0000 EXCAVATION			
	Dollars	60.00	$
	($) CY		
124.0000 ORDINARY BORROW/SELECTED COMMON FILL			
	Dollars	55.00	$
	($) CY		
126.0000 GRAVEL BORROW			
	Dollars	6.00	$
	($) CY		
127.0000 DENSE GRADED CRUSHED STONE			
	Dollars	22.00	$
	($) CY		
154.0000 TOPSOIL EXCAVATED AND STACKED			
	Dollars	30.00	$
	($) CY		
155.0000 TOPSOIL REHANDLED AND SPREAD			
	Dollars	10.00	$
	($) CY		
156.0000 SEEDING			
	Dollars	60.00	$
	($) SY		
171.0000 INSTALLATION AND MAINTENANCE OF EROSION CONTROLS			
	Dollars	300.00	$
	($) LF		

ITEM NUMBER AND DESCRIPTION		ESTIMATED QUANTITY	COMPUTED TOTALS
402.0000	FINE GRADING, ROLLING AND FINISHING		
	Dollars	185.00	$
	($) SY		
446.2000	CLASS A CONCRETE (4,000 P.S.I. 1-1/2" 565)		
	Dollars	5.00	$
	($) CY		
476.0000	CHAIN LINK FENCE, 72 INCHES		
	Dollars	90.00	$
	($) LF		
520.0000	WARNING AND REGULATORY SIGNS		
	Dollars	4.00	$
	($) EA		
804.2000	2-INCH ELECTRICAL CONDUIT (FOOT) TYPE NM PLASTIC (UL)		
	Dollars	35.00	$
	($) LF		
810.3000	PULL BOX 12"X24" (SD2.031) FOR SIGNAL CABLE		
	Dollars	1.00	$
	($) EA		

TOTAL BID PRICE INCLUDING CONTINGENCY

_____Dollars and _____Cents
(amount in words)

$ _____
(amount in figures)

This proposal is based on provisions of the following addenda:

No. _____ No. _____

No. _____ No. _____

All amounts and totals given above will be subject to verification by the City. In case of variation between Unit Bid Price and Totals shown by the Bidder, the Unit Price written in words will be considered to be the bid.

The City reserves the right to reject any and all bids, wholly or in part, and to make awards in a manner deemed in the best interests of the City.

The above estimated quantities form an approximate statement of the extent of the work to be done, based upon the estimate of the Contracting Officer. The City does not expressly or by implication agree that the actual quantity of work will correspond therewith, but reserves the right to increase or decrease the quantity of any class or portion of the work, as may be deemed necessary by the Contracting Officer.