City of Quincy

City Hall
1305 Hancock Street
Quincy, Massachusetts 02169

Purchasing Department

ADDENDUM NUMBER 5

RE: **Town Brook Enhancement Project – Phase 2A Addendum No. 5**

BID DATE: 1/26/2012

BID TITLE: Town Brook Enhancement Project – Phase 2A

PLEASE NOTE THE FOLLOWING REVISIONS:

1. **A letter was submitted on 12/6/2011 requesting clarification on the following item(s):**

   Specification section 02180 Monitoring, Handling, Stockpiling and Disposal of Contaminated Soils — does not include T&D surplus at RCS less than one (I) and/or T&D in-state unlined facility. If the soil tests determined the surplus excavated soil can be disposed at RCS less than one and/or In-State Unlined Facility. How does the Contractor get paid for T&D surplus excavated soil at RCS less than one facility and/or In-State Unlined facility? Is it under each respective work item or paid by the allowance item?

   Response: The Licensed Site Professional shall make the determination as to the appropriate disposal site for the excavated soil based on the classification of the contamination. Disposal of Hazardous Material shall be in accordance with Section 02180 "Monitoring, Handling, Stockpiling and Disposal of Contaminated Soils", shall be covered under the Allowance for Disposal of Hazardous Material, and shall be paid for as described in these Contract Documents. If the LSP determines the Hazardous Soil may be disposed of at a facility other than as detailed in these Contract Documents, the contractor shall dispose of the contaminated material at the most economical disposal option for the City of Quincy. The work shall be measured and paid for at the unit price of the lowest cost classification submitted by the Contractor as part of the Bid, and no additional compensation will be allowed.

2. **An email was submitted on 12/6/2011 requesting clarification on the following item(s):**

   2.1 Are there any specifications for the ornamental fence?

   Response: Specifications and additional details have been provided as part of Addendum 2.

   2.2 Is all of the ornamental fence 6′ tall?

   Response: The height of the ornamental fence shall be 6-feet as indicated on the Plans, unless otherwise indicated. Revised Plans will be issued as Addendum 6, indicating the limits and heights of fencing prior to the Bid Opening.

3. **A letter was submitted on 12/9/2011 requesting clarification on the following item(s):**

3.1. Drawing C-4 — details a cutoff wall. No details are provided.

Response: Updated Plans to be issued as part of Addendum 6 will provide additional detail.

3.2. Drawing C-4 — details remove the existing bulkhead, no details are provided including flow diversions or culvert closure pieces.

Response: Removal of the existing bulkhead installed as part of the Town Brook Enhancement Project - Phase 1 construction shall consist of Removal and Disposal of an existing bulkhead as installed by the Phase 1 contractor. The Contractor shall assume for bidding purposes the Phase 1 bulkhead is a steel plate pressed against the opening of the termination of the Phase 1 Reinforced Box culvert.

See Sheet C-11 for a detail of the proposed Bulkhead/Endcap to be used, if required due to project phasing.

Flow Diversion will be required as part of this Contract, and the Contractor shall provide, maintain, and operate all temporary facilities such as dams, pumping equipment and conduits etc. required to bypass flows past the construction area. Flow diversion shall be as determined by the contractor and approved by the Engineer and shall be in accordance with Section 01625 – "Environmental Protection", as well as all applicable state, federal, local laws and regulations. The Contractor shall submit the intended method of Flow Diversion to the Engineer for review and approval no later than 30 days prior to the anticipated implementation of the diversion, and shall be in accordance with Section 01300 "Submittals". Flow Diversion, including all design, labor, materials, equipment, tools, and all else incidental to the satisfactory completion of the work, shall not be measured or paid for separately and shall be included in the lump sum item, refer to Section 01025.

3.3. C-5 — Vegetated retaining wall by others. Is this included in Alternate No. 1?

Response: The vegetated retaining wall is included as part of Alternate Work Item 1, as shown on the Plans and described in these Contract Documents. The preliminary design as shown on the Plans and designed by the vegetated wall manufacturer shall be the basis for the Bids. The final design of the vegetated wall shall be performed and stamped by a professional engineer and submitted to the City and City's Engineer for review in accordance with Section 01300 - Submittals, and in accordance with Section 02680 "Vegetated Retaining Wall".

Vegetated Retaining Wall, including all design, labor, materials, equipment, and tools, including preparation of sub-base, grading, leveling, compaction, placement of reinforcement steel, geomembrane, and planting finished surface, as required, and all else incidental to the satisfactory completion of the work, shall not be measured or paid for separately and shall be included in the lump sum item, refer to Section 01025.

3.4. C-5 — Retainage Wall and Headwall details are vague at best.

Response: Additional detail will be included on the Plans to be issued as part of the forthcoming Addendum 6.

3.5. C-7 — Work along the existing Town Brook is vague at best.

Response: Additional detail will be included on the Plans to be issued as part of the forthcoming Addendum 6.

3.6. Gas Service Relocations cannot be estimated. This is a private utility which is under the jurisdiction of others. An allowance for reimbursement is typical for this work. The same issue is for existing telephone and electrical relocations.

Response: See Item 11 of this Addendum for clarification on the allowance for Utility Relocations.

3.7. Paving — No details are provided at each location concerning temporary paving, permanent paving, milling, overlay, and line stripping.

Response: Additional detail has been included on the Plans to be issued as part of the Forthcoming Addendum 6 to clarify the limits of saw cutting, milling, overlay, and full depth pavement replacement.

3.8. Traffic Management Plans are non-existent.

Response: Refer to Item 14 of this Addendum for Traffic Management clarification.

3.9. Excess material may or may not be stored at the DPW yard. Either they can or cannot as the costs associated with soil stockpiled and disposed is significant.

Response: Stockpiling of Materials will **NOT** be allowed in the City of Quincy Department of Public Works (DPW) yard as originally allowed per Section 01025 – "Measurement and Payment". The Contractor is responsible for determining appropriate staging and laydown areas for the duration of the project as described in Section 01055 – "Temporary Construction Facilities".

4. An email was submitted on 12/19/2011 requesting clarification on the following item(s):

4.1. There is a utility pole in Mechanic Street that appears to be within the excavation for the 3-sided rigid frame structure. What arrangements have been made to relocate this pole?

Response: See Item 11 of this Addendum for clarification on the allowance for Utility Relocations.

4.2. Attempts to communicate with utility companies have been unsuccessful. Will you establish an allowance for the utility relocation work?

Response: See Item 11 of this Addendum for clarification on the allowance for Utility Relocations.

4.3. Based on the amount of design work that has been left for the contractor to do and then the subsequent submittal process and actual construction of the project, the contract duration of 120 days is not enough time. Will you reconsider the amount of time to complete?

Response: See Item 19 of this Addendum for clarification on Contract Duration.

4.4. Please provide the survey data that is needed to establish the baseline for the new alignment f the Town Brook.

Response: The Town Brook alignment shall be utilize the centerline of the Walter J. Hannon Parkway, with offsets as shown on the Plans to determine the horizontal alignment of the Town Brook Enhancement Project. The centerline information of the Walter J. Hannon Parkway has been included on the contract documents for reference. The Contract Plans will also be provided electronically FOR REFERENCE ONLY to the contractor awarded the Contract upon request.

5. An email was submitted on 12/22/2011 requesting clarification on the following item(s):

Application for payment information in section 1025 indicates 30 to 60 days for payment with no eligibility for interest. This is in conflict with MGL CH30, Sect. 39K as included in the specifications section 800, pg. 28. Since MGL governs this project, please confirm that the city will pay interest after 15 days as outlined in 39K.

Response: As this project no longer involves building demolition, MGL Chapter 30 Section 39K no longer applies. With the removal of building demolition from the scope of this Contract, all provisions that apply to building demolition or building related provisions in MGL shall not apply. The MGL provisions and payment terms for this project shall be in accordance with the Contract Documents, and relevant provisions of MGL for public works projects. As such, MGL Chapter 30 39G shall govern.

The specifications indicate no work from Thanksgiving through March 31st. Since there is only 120 days allowed for the base bid work and the first 4 alternates (if taken), will the notice to proceed be issued for work to start on 4/1/12 for completion 120 days thereafter?

Response: Refer to Item 19 of this Addendum for clarification on project completion and milestones, as well as Section 01010 "Schedule and Other Site Specific Requirements".

6. A letter was submitted on 1/3/2012 requesting clarification on the following item(s):

6.1. Alternate No. 1 — Wall details which outline the footing width is in conflict with Drawing S-5 "Retaining Wall Section."

Response: Updated Plans to be issued as part of Addendum 6 will address this discrepancy.

6.2. Alternate No. 3 — Refer to "1" Above.

Response: Updated Plans to be issued as part of Addendum 6 will address this discrepancy.

6.3. Alternate No. 4 — Refer to "1" Above.

Response: Updated Plans to be issued as part of Addendum 6 will address this discrepancy.

6.4. Alternate No. 8 — does not clearly define the Scope of Work. Drawing C10 details removing the channel walls and reconstructing the walls. No details are provided.

Response: Alternate Work Item 8 shall be bid as shown on the Plans, and the Contractor shall assume the existing wall to be removed shall be mortared granite block with cast-in-place concrete channel bottom, and shall be replaced with Cast-in-Place reinforced concrete retaining wall with the same size and finish as the walls as detailed as part of Alternative Work Item 4.

6.5. Alternate No. 4 — Drawing C-7 details saw cutting the existing channel walls. No details are provided as to the extent (depth of removal).

Response: Saw cutting the existing channel wall to be removed as part of Alternate Work Item 4 shall consist of removal of the existing mortared granite block wall at the existing face of wall at the invert elevation of the channel. For the purposes of bidding, the Contractor shall assume that the existing block wall is not integral to the channel bottom, and can be removed without affecting the structural integrity of the existing Town Brook Channel to remain. The Contractor shall enlist the services of a qualified structural engineer to evaluate the actual field conditions to make a determination of the stability of the existing Town Brook channel, if field conditions vary from these assumptions. Additional details for the proposed connection to the channel bottom will be included in the Plans issued as part of Addendum 6.

7. An email was submitted on 1/4/2012 requesting clarification on the following item(s):

7.1 What is the approximate length, size and type of pipe that will be installed?

Response: Refer to the Plans and Contract Documents for length, type and size of culvert to be installed.

7.2 Are there any portions of the project that will need to be bored?

Response: Refer to the Plans and Contract Documents for the scope of trenchless construction.

7.3 Are the crossings to be jack & bored or directionally bored?

Response: Performance Specifications are forthcoming that will detail the trenchless construction performance criteria.

7.4 What are the approximate lengths of the portions to be bored?

Response: Refer to the Plans and Contract Documents for the scope of trenchless construction.

8. An email was submitted on 1/5/2012 requesting clarification on the following item(s):

Do you anticipate the need for any dewatering or bypass pumping on this project?

Response: Groundwater dewatering and/or bypass is anticipated for this project. Refer to the Geotechnical Report for a summary of Groundwater Conditions and Section 01125 "Dewatering" for additional information. Refer to Question 3 of this Addendum for clarification on stream diversion or bypass.

9. An email was submitted on 1/11/2012 requesting clarification on the following item(s):

9.1. There is a utility pole in Mechanic Street that appears to be within the excavation for the 3-sided rigid frame structure. What arrangements have been made to relocate this pole? (2nd request)

Response: See Item 11 of this Addendum for clarification on the allowance for Utility Relocations.

9.2. Attempts to communicate with utility companies have been unsuccessful. Are we to assume that the telephone, electric and fire alarm duct banks that call out to be adjusted and/or relocated do not have any cables/wires in these duct banks?

Response: See Item 11 of this Addendum for clarification on the allowance for Utility Relocations. For bidding purposes, the contractor shall assume that the conduits have cables/wires installed within the conduit.

9.3. There is no item for rock excavation. Based on the borings, the successful contractor will encounter rock during the execution of the work and at this time, it is impossible to accurately estimate the quantity of rock we will be required to excavate. In fairness to all the bidding contractors we request that an item for rock or an allowance for such be included in the bid documents.

Response: See Item 18 of this Addendum for clarification on Rock Excavation and Miscellaneous Excavation.

10. An email was submitted on 1/17/2012 requesting clarification on the following item(s):

10.1. Per Addendum #4, "Addenda will be issued that will include at a minimum the following items; a geotechnical report summarizing the existing site soil conditions and design considerations, as well as performance specifications for the trenchless construction of the culvert; detailed structural drawings for the proposed cast-in-place retaining walls and foundations, rigid frame foundations and structural details; updated detailed civil improvement plans, and a revised schedule for the proposed work. Additional Requests for Information will be accepted until Tuesday, January 17th, 2012, and Addenda will be issued no later than Monday, January 23rd, 2012."

Do you have an estimate of when this new information will be available?

Response: The information is included with this Addendum, and additional Plans will be issued on Monday January 23rd, 2012, as Addendum 6 containing additional information for bidding purposes.

10.3 It sounds like there will be a lot of new information. If Addendum #5 will not be issued until 3 days before the current bid date, will the bid date be postponed?

Response: The bid opening date will not be extended.

10.4 The new box culvert at Parking Way (Alternate 5) shows an approximate 50′ radius bend. Is this radius bend required, or can the precast culvert be made with a ±35° angle point?

Response: This Radius is required as part of the approved, permitted design, and cannot be revised to include a single angle point of ±35°.

11. PRIVATE UTILITY RELOCATIONS

The relocation, adjustments and/or removal and resetting of electric, natural gas, telephone, cable, data and fire alarm conduits, utility poles and all other associated appurtenances included as part of the Core Improvements as well as all of the Alternate Work Items shall be bid as an Allowance, and shall **NOT** be included in the Lump Sum Price for the Core Improvements or Alternative Work Items. The work shall include coordination with the respective utility companies, engineer, and City staff to coordinate the proposed work to be done. The relocation, adjustments and/or removal of highway signalization poles, mast arms, highway lighting, and any other work items not specifically included as part of Bid Item 12 "Utility Relocations" shall be bid as part of the individual Alternative Work items as shown on the Plans and as described in these contract documents. The protection of existing utilities not specifically designated to be relocated, adjusted, removed and reset shall be included in the lump sum unit price for each Alternative Work item.

Bid Item 12 – "Private Utility Relocations" shall be bid with an allowance of **$60,000.**

The Contractor shall submit unit prices for the Pay Items as shown on the Plans, and as described in Section 02800 "Electric, Cable, Telephone Util.ity Adjustments", Section 02813 "Fire Alarm Modifications", and Section 02998 "Site Gas Lines". The Contractor will be paid at the Contract Unit Prices for the

quantities determined and experienced during construction as specified above. Any delays associated with the Private Utility Relocations shall not relieve the Contractor from performing the remainder of the work as described in these Contract Documents and no additional compensation will be allowed.

12. ALTERNATE WORK ITEMS 5 AND 6

Landscaping and Construction of the Open Space elements described as Alternative Work Items 6 and 7 as shown on the Plans and described in the Contract Documents shall be **EXCLUDED** from the scope of work under the Town Brook Enhancement Project-Phase 2A Contract, and will be bid under a separate contract. Please disregard any mention to the work contained as part of Alternative Work Items 6 and 7, and please bid accordingly.

The winning bidder for the "Town Brook Enhancement Project-Phase 2A" will be required to coordinate directly with the winning bidder for the subsequent "Town Brook Enhancement Project - Open Space" project to ensure that there is no impediment to construction for either party arising from concurrent construction activities, and the Contractor shall be fully responsible for delays or additional cost due to insufficient or improper coordination between both winning bidders, and no additional compensation will be allowed.

13. SITE TREES

The proposed 3-inch caliper shade trees included as part of Alternative Work Items 1 and 4 shall be replaced with 6-inch caliper shade trees and species shall be London Plane Trees in the Open Space Parcels associated with Alternate Work Items 1 and 4.

14. TRAFFIC MANAGEMENT

As noted in Addendum 1, a Traffic Management Plan will be required and the Contractor shall coordinate all work with the City of Quincy Planning and Community Development Department, Quincy DPW, Quincy Police Department for traffic control and the local school crossing guards.

All costs associated with preparation of and implementation of a Traffic Control Plan shall be the responsibility of the Contractor and shall be considered included in the contract lump sum price, and shall be in accordance with Section 01045 – "Safety Controls & Signs for Construction Operations", Section 850 of the Standard Specifications, and the Manual on Uniform Traffic Control Devices (MUTCD). For purposes procuring and acquiring a bid, the Contractor shall assume the following:

15 Reflectorized plastic drums with flashers (Type A) per calendar day of work for the duration of the project. Drums shall be placed as directed by the Engineer, and shall not be less than 19-inches in any diameter transverse to the direction of traffic in accordance with Section 010456 – "Safety Controls & Signs for Construction Operations"

4 Warning Signs with 16-inch minimum flags per Calendar day for the duration of the project, in accordance with Section 010456 – "Safety Controls & Signs for Construction Operations".

200 Linear feet of concrete jersey rail for the duration of the project in accordance with these Contract Documents, Section 850 of the Standard Specifications and the MUTCD.

2 Message Boards to be used and maintained by the contractor for the duration of the project and then are to be turned over to the City after Contract is complete, at which point they will become the property of the City of Quincy. The transfer of the Message Boards to the City of Quincy shall be at no cost to the City, and the Message Boards shall be in good working order at the time of transfer. The Message boards shall be "Metro VMS Compact Variable Message Signs" or approved equal. (See Attached Specification Sheet included in the Appendix)

All labor, materials, equipment, design, tools and all else incidental there to complete the Traffic Management in a satisfactory manner, shall not be measured or paid for separately and shall be included in the lump sum item, refer to Section 01025.

15. PLAN REVISIONS (Forthcoming)

The Town Brook Enhancement Project – Phase 2A Plans will be revised to provide additional information and detail to assist in bidding, in response to Requests for Information submitted during the Bidding Process. The Contractor shall thoroughly review any revisions and shall bid accordingly. These Plans shall be part of the Contract Documents.

16. GEOTECHNICAL REPORT (Dated 1/17/2012)

The Geotechnical Engineer for the Town Brook Enhancement Project – Phase 2A has prepared a Geotechnical Design Report summarizing site conditions and design considerations for the project. This Report is included as Attachment 1 to this Addendum, and shall be part of these Contract Documents. Inclusion of these design considerations does not relieve the Contractor from verifying the existing sub-surface conditions prior to construction, nor do the design considerations relieve the Contractor from additional subsurface investigation in support of the proposed Contractor provided design associated with, but not limited to the Jacking and Receiving Pits, Trenchless Construction, Precast Box Culvert and Precast Rigid Frame Structures, Temporary Earth Support and Construction Dewatering.

17. TRENCHLESS CONSTRUCTION SPECIFICATIONS & BID REQUIREMENTS

The Geotechnical Engineer for the Town Brook Enhancement Project – Phase 2A has prepared Performance Specifications for the trenchless construction that details the level of construction and standards as well as site specific design considerations. The Trenchless Construction specifications are included as Appendix 2 as part of this Addendum, and shall be part of these Contract Documents.

The permitted hours of operation for the trenchless construction shall not be restricted to the permitted time as specified elsewhere in these Contract Documents, and will be allowed to operate 24 hours per day continuously. The Contractor's Bids shall be based on working continuously around the clock for the duration of the trenchless construction, as shall include all costs for providing Police Details, traffic management, and all other associated costs for performing this work allowed and additional compensation will not be allowed. Should the Contractor decide that continuous operation is not required to meet the project deadlines, they may choose to work during normal operating hours, however, the City reserves the right to credits for the premium associated with the continuous operation activities as Bid.

Qualifications: In addition to the provisions and regulations listed in the Contract Documents, the Contractor shall submit qualifications of the contractor that will be performing the trenchless to be approved by the City of Quincy prior to the start of certain or all work. Those Qualifications shall include at a minimum the following information:

- The contractor shall submit the details regarding the trenchless method to be used. If no detail is provided, the bid will be considered non-responsive.
- If engineer determines that the minimum experience requirements are not met, the bid could be rejected or accepted after review of additional information submitted within a three day period from request made by the City of Quincy.
- The Contractor shall submit resumes and list intended on-site key personnel including at least one superintendent with experience managing underground construction projects of similar length, diameter, and dimensions to the underground structures, for the trenchless method chosen at bid time. Additional Minimum experience requirements shall be as follows:
    - The on-site manager / superintendent is required to have managed a minimum of two successful installations using the method submitted. These could be on different projects or one project with multiple installations. At least one must equivalent to or exceeding in length and size than the Town Brook trenchless culvert installation.
    - Tunnel machine operator must have at least successfully worked as tunnel machine operator on 5 previous projects with similar scopes, ground conditions, pipe sizes, and drive lengths within the past 3 years.
    - The Trenchless Contractor shall have at least 10 years of experience as a prime contractor involved with tunnel work with at least five years of similar project experience. The Contractor also shall have his Project superintendent with at least 10 years of experience in tunnel work.

- The Contractor shall retain the services of an Acoustics Consultant, who shall provide Noise Control and vibration monitoring consultant services for the duration of the trenchless construction. The Acoustics Consultant shall have a minimum of five years of experience from similar demolition work.
- The Contractor or Subcontractor shall have a minimum of five years of experience in the installation and abandonment of observation wells, and have successfully completed abandonment of at least 3 observation wells with the bottom of the well at a depth of at least 80 feet below ground surface and in similar geotechnical conditions, These qualifications are required for both the well abandonment firm and the superintendent that will perform the well abandonment work specified herein.
- Contractor or Subcontractor supplying and placing annular grout shall be capable of developing a mix design and hatching, mixing, handling and placing annular grout under tunnel conditions, shall have furnished and placed annular grout on at least three (3) tunnels of the general type and the size specified herein which have been in successful operation; and shall have a record of experience and quality of work using annular grout that is satisfactory to the Engineer. Experience shall include grouting large diameter culverts (exceeding 48-inch diameter) in tunnel headings of similar length on at least three previous projects.
- Workers including the grouting Contractor's superintendent and foreman shall be fully qualified to perform the work. The grouting Contractor's superintendent shall have had previous experience under similar ground and tunnel conditions.

The Contractor shall include the "List of Subcontractors" and accompanying "Statements of Experience" and the "Materials/Equipment Questionnaire" included in Appendix 4. These shall be completed and submitted with each bid on the forms included with the Bid Form and Attachments. The Bidders may submit more than one subcontractor or supplier for a particular work activity. If, after due investigation, Owner or Engineer has determined that any proposed Subcontractor, Supplier, material, equipment, or other individual or entity, does not meet the requirements stated in the relevant technical specification section, the City may, before the Notice of Award is given, request the apparent low Bidder to submit an acceptable substitute without an increase in the Bid. Declining to make requested substitutions will not constitute grounds for sacrificing the bid security of any Bidder. Any Subcontractor, Supplier, or other individual or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer, subject to revocation of such acceptance after the Effective Date of the Agreement as provided in the Supplementary Conditions. Contractor shall not be required to employ any Subcontractor, individual, or entity against whom Contractor has a reasonable objection.

The Contractor shall base the bid for the trenchless construction on the performance specifications, information contained in the geotechnical report prepared by Haley & Aldrich dated 1/17/2012, as well as all other available information provided in these Contract Documents. Inclusion of these performance specifications does not relieve the Contractor from verifying the existing sub-surface conditions prior to construction, nor do the design considerations relieve the Contractor from additional subsurface investigation in support of the proposed Contractor provided design associated with, but not limited to the Jacking and Receiving Pits, Trenchless Construction, Precast Box Culvert and Precast Rigid Frame Structures, Temporary Earth Support and Construction Dewatering.

18. MISCELLANEOUS EXCAVATION

An allowance shall be made for encountering miscellaneous subsurface materials, debris, obstructions, rock, building foundations and other unforeseen material that is required to be excavated and disposed of. Material shall either be classified as "Class A Rock Excavation", "Unclassified Excavation", or "Class B Rock Excavation" in accordance with Section 02120 "Excavation" of these Contract Documents, Section 120 "Excavation" of the Standard Specifications, and Section 140 "Excavation for Structures" of the Standard Specifications. Any excavation that can be classified as described herein shall be measured in accordance with the standard specifications and shall be considered "Miscellaneous Excavation" for the purposes of payment. The Contractor shall submit a unit price for "Miscellaneous Excavation", and payment will be made in accordance with the actual quantity encountered during construction and paid

for per unit price of the "Miscellaneous Excavation" in accordance with Section 120.80 of the Standard Specifications, and Section 01025 of these Contract Documents.

Bid Item 13 – "Miscellaneous Excavation" shall be bid with an allowance of **$100,000.**

19. WORK PERIOD

The project completion time shall be revised to a maximum duration **150** Calendar Days from the Notice to Proceed Given by the City.

The first paragraph of Section 01010 1.02.H "Schedule and Other Site Specific Requirements" shall be modified to include:

> *"In addition to being subject to the terms and conditions of the Contract Documents, and the schedule described therein, the work included as part of the Core Public Improvements and Alternative Work Items 1, 2, and 3 as shown on the Plans and described in these Contract Documents shall be completed no later than **July 15th, 2012,** or **150 Calendar Days** from the Notice to Proceed given by the City, whichever is sooner.*
>
> *Alternative Work Item 4 included as part of the Town Brook Enhancement Project – Phase 2, shall commence immediately following the Demolition of the American Legion Building performed by others under separate Contract, pending all necessary Permits have been obtained by the City, and shall have a maximum duration of **75** Calendar Days from the notice to Proceed given by the City.*
>
> *Alternative Work Item 5 included as part of the Town Brook Enhancement Project – Phase 2, shall commence immediately following the Notice to Proceed given by the City, pending all necessary Permits have been obtained by the City, and shall have a maximum duration of **60** Calendar Days from the notice to Proceed given by the City.*
>
> *Alternative Work Item 8 included as part of the Town Brook Enhancement Project – Phase 2, shall commence immediately following the Notice to Proceed given by the City, pending all necessary Permits have been obtained by the City, and shall have a maximum duration of **30** Calendar Days from the notice to Proceed given by the City.*
>
> *The Contractor shall assume worst case weather conditions for purposes of determining a bid, and no additional compensation will be allowed for demobilization or mobilization associated with delays due to non issuance of authorizations to proceed with any of the Alternative Work Items by the City."*

The trenchless construction of the Hancock Street crossing, and construction activities not impacting the travelled roadway as part of Alternative Work Items 1, 2 and 3 shall be permitted between Thanksgiving Day and March 31st. All other work within the restricted work period as indicated in Section 01010 will require prior approval from the City as long as it does not impact traffic operations.

20. MassDOT REQUIRMENTS

The MassDOT requirement for 50% of the work to be performed by the General Contractor shall be waived for the Town Brook Enhancement Project – Phase 2A in light of the significant cost and work associated with the trenchless construction of the Hancock Street crossing, which will likely utilize the services of a sub-consultant to perform the specialized work associated with this work.

The Contractors also do **NOT** need to be MassDOT pre-qualified.

21. GPS EQUIPMENT

The Contractor shall acquire GPS Survey Equipment to be used and maintained by the contractor for the duration of the project which are to be turned over to the City after Contract is complete, at which point they will become the property of the City of Quincy. The transfer of the GPS Survey Equipment to the City of Quincy shall be at no cost to the City, and the Equipment shall be in good working order at the time of transfer.

The GPS Survey Equipment shall be **One (1)** "Topcon Hiper II" GPS system, and must include a base and rover receiver with internal radios and Bluetooth, Glonass, and shall also include a tribrach, rotating adapter & 2m Carbon Fiber GPS pole. Radios shall be 915 Spread Spectrum.

The Contractor shall also provide **One (1)** "Topcon FC-250 Handheld Data Collector" with "Topsurv GPS+ Software" with Pole Bracket.

All materials and incidentals shall be included in the lump sum bid price for the Core Improvements, refer to Section 01025.

Thank you. PLEASE SIGN AND ATTACH IT TO YOUR BID, AS IT IS NOW PART OF THE BID.

_____

Kathryn R. Hobin, Purchasing Agent

Date: _____

Bidder's Signature: _____

Attachments:

Attachment 1 - Geotechnical Report
Attachment 2 - Trenchless Construction Specifications
Attachment 3 - Message Board Specification Sheets
Attachment 4 - Subcontractor's List to Accompany Bid; Material/Equipment Questionnaire

Attachment 1

Geotechnical Design Report (January 17, 2012)

Please note the report included in this Addendum does not include the Appendices.

A full version of the Geotechnical Design Report including Appendices can be downloaded via the following link:

https://sdg-eng.sharefile.com/d/se1c29a2197c45a6b

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REPORT ON
GEOTECHNICAL DESIGN REPORT
QUINCY CENTER REDEVELOPMENT
TOWN BROOK ENHANCEMENT PROJECT (PHASE 2A)
QUINCY, MASSACHUSETTS

by

Haley & Aldrich, Inc.
Boston, Massachusetts

for

Stephenson Design Group
Boston, Massachusetts

File No. 35571-012
17 January 2012

HALEY & ALDRICH

Haley & Aldrich, Inc.
465 Medford St.
Suite 2200
Boston, MA 02129

Tel: 617.886.7400
Fax: 617.886.7600
HaleyAldrich.com

17 January 2012
File No. 35571-012

Stephenson Design Group
51 Sleeper Street, Suite 600
Boston, Massachusetts 02210

Attention: Jon Stephenson

Subject: Geotechnical Design Report
Quincy Center Redevelopment
Town Brook Enhancement (Phase 2A)
Quincy, Massachusetts

Ladies and Gentlemen:

This report summarizes the results of our geotechnical evaluations for the Town Brook Culvert Enhancement project. Based on the available drawings and subsurface data, our evaluations are intended to assist the project team in preparation of construction contract documents.

We appreciate the opportunity to serve on the Stephenson Design Group team for this project. Please do not hesitate to contact us if you wish to discuss the contents of this report or any aspect of the project.

Sincerely yours,
HALEY & ALDRICH, INC.

Katelyn M. Tripp
Senior Engineer

Iliana Alvarado, P.E., LEED AP
Senior Project Manager

Steven R. Kraemer, P.E., D.GE
Senior Vice President

Enclosures
c: TEC, Inc., Attn: Daniel D. Martel, Jody P. Trunfio

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1. INTRODUCTION

1.1 General

This report presents geotechnical design recommendations and geotechnical related construction considerations for the proposed Phase 2A Realignment of the Quincy Town Brook. The work was undertaken in accordance with our proposal dated 30 December 2011 as authorized by Stephenson Design Group (SDG) on 3 January 2012. The geotechnical recommendations in this report are based on available subsurface data along and near the Phase 2A alignment.

1.2 Proposed Construction

The existing Town Brook Culvert is being relocated to a proposed alignment running northeast-southwest from the intersection of Revere Road and Mechanic Street under Hancock Street to meet the existing culvert just northeast of the Concourse Street Bridge. The general site area is shown on Figure 1 – Project Locus. Our understanding of the proposed realignment is based on drawings prepared by Stephenson Design Group (SDG) dated 16 November 2011 and updated 9 December 2011; and drawings prepared by TEC, Inc. dated 9 November 2011. The alignment is shown in detail on the SDG drawings (Appendix A).

The proposed alignment consists of several sections including an open channel enclosed by retaining walls, a rigid three-sided formed culvert, and a box culvert installed by conventional cut-and-cover and trenchless methods. The following culvert sections were considered in our evaluations (from northeast to southwest):

- STA 20+50 to 22+08, proposed to be a natural bottom open channel with reinforced concrete walls
- STA 22+08 to 23+00, proposed to be a natural bottom channel with three sided rigid frame
- STA 23+00 to 24+22, proposed to be a natural bottom open channel with reinforced concrete walls
- STA 24+22 to 25+25, proposed as a precast concrete box culvert
- STA 25+25 to 26+75, proposed as a precast concrete box culvert installed using trenchless construction methods beneath Hancock Street.
- STA to 32+16 to 33+30, proposed as a precast concrete box culvert

The culvert sections are described in greater detail in subsequent sections of the report. Generally, the proposed invert of the culvert ranges from El. 14 (southwest) to El. 9 (northeast).

1.3 Elevation Datum

Elevations given in this report refer to NAVD 1988 and are measured in feet. Ground surface elevations estimated at subsurface explorations are based on site topographic information provided by SDG.

2. SUBSURFACE CONDITIONS

2.1 Local Geology

Soil conditions in the Quincy Center area were created primarily from the most recent glacial advance and retreat, which deposited a broad range of soil types. Generally, the geology consists of glacial lake deposits (Estuarine and Glaciolacustrine Deposits) at the southwest section of the culvert alignment and Kame Terrace (Glaciofluvial) sands and gravels and Drumlins (Glacial Till) at the northeast section of the culvert alignment.

Historical construction and industrial activities modified the landscape with the placement of fill soils, the construction of various building foundations, and installation of utilities and other infrastructure. Miscellaneous fill soils of varying thickness are present along the alignment.

2.2 Available Subsurface Data

The following subsurface explorations were available for the evaluation of subsurface conditions along the proposed culvert alignment. No explorations were performed by Haley & Aldrich for this evaluation.

- Nine test borings, designated B-TB1 through B-TB8, drilled in December 2010 to depths ranging from 17 to 33 ft below ground surface along the alignment of the proposed culvert. The test borings were performed on behalf of the City of Quincy specifically for the Town Brook Enhancement project. A test boring log is available for B-TB3AA, but its location is not available to Haley & Aldrich as of the date of this report.
- One test boring, designated SDG-1(OW), drilled in April 2011 on behalf of SDG to a depth 26 ft below ground surface.
- Seven test borings, designated HA-11-B8 through HA-B13 and HA-B21, drilled to depths of 36 to 48 ft below ground surface in connection with the Quincy Center Redevelopment project.
- One test boring, designated HA08-3, drilled in April to May 2011 to a depth of 27 ft below ground surface in connection with the Quincy Center Redevelopment project.

Subsurface conditions encountered in the December 2010 test borings are summarized in Table I and presented on drawing C-14 by SDG. Subsurface conditions in the remaining test borings are summarized in Table II. Locations of the explorations are shown on SDG drawings and on Figure 2. Logs of the available test borings are provided in Appendix B.

2.3 Subsurface Conditions

Based on the available test borings, subsurface conditions along the Phase 2A alignment typically consist of miscellaneous fill soils overlying naturally-deposited glacial deposits. The fill thickness is variable, and intermittent organic soils were encountered locally between the fill and glacial soils especially along the northeast portion of the alignment. Generalized descriptions of each stratum encountered in vicinity of the alignment are provided below.

<u>Fill</u> - Miscellaneous fill was encountered directly below ground surface in the test borings. Fill thickness varied along the alignment as it has been placed to establish site grades and in connection with construction and removal of numerous below-grade facilities over time including former and current building foundations and basements, utilities and other facilities.

Organic Deposits - Organic deposits consisting of organic silt (peat and possibly buried topsoil) were encountered in SDG-1(OW) at the northeast limit of the alignment, but may be present at other locations.

Estuarine Deposits **-** Estuarine Deposits generally consisted of medium dense to dense SAND with traces of organic soil. Estuarine soils would typically be suitable for support of box culvert sections. Soil descriptions on the logs suggest medium to high soil permeability.

Glaciolacustrine Deposits – Glaciolacustrine deposits consisting of loose fine SAND to SILT was encountered at the northeast portion of the alignment. Glaciolacustrine Deposits are generally suitable for support of the box culvert section. Soil descriptions on the logs suggest low to medium soil permeability.

Glaciofluvial Deposits – Glaciofluvial deposits consisted of very dense SAND with silt and gravel, typically suitable for support of the culvert or retaining walls. A falling head permeability test was performed at SDG-1(OW) in the glaciofluvial deposits from El. 8 to 10. The results indicated a calculated coefficient of permeability equal to $1.2E^{-02}$ cm/sec.

Glacial Till Deposits – Glacial Till was generally described as dense to very dense silty SAND with gravel, sandy SILT, or silty GRAVEL with sand. Glacial Till Deposits are suitable for support of the culvert or retaining walls. Soil descriptions on the logs suggest low to medium soil permeability.

Bedrock was not encountered in the explorations to the maximum depth of 48 ft.

It is noted that not every stratum was encountered in every test boring, and were occasionally in a different sequence.

2.4 Groundwater

In most natural geologic settings groundwater seeps in the general direction of declining topography or toward local surface water bodies. Water levels measured for the Quincy Center Redevelopment project suggest a somewhat complex pattern of groundwater seepage directions in Quincy Center, which appear to be influenced by below-grade civil structures including the Town Brook Culvert, sewer and storm drain pipelines, and possibly the adjacent MBTA train corridor.

As part of Haley & Aldrich investigations in connection with the Quincy Center Redevelopment Project, observation wells were installed and monitored at HA-B11(OW), HA-B13(OW), HA11-B21, and SDG-1 (OW), the closest of which are 100 to 400 ft north of the Town Brook culvert alignment. Water elevations recorded in the four observation wells are summarized in Table 3.

Water levels recorded on the driller's logs for the December 2010 test boring ranged from approximately El. 7 in B-TB7 and B-TB8 to El. 10 at B-TB3 through B-TB6. These water levels appear to represent water levels measured in boreholes at "end of drilling" and may not be representative of stabilized groundwater.

As noted above, although a log for B-TB3AA is included in the SDG drawings, the location is not available. As the borings were labeled sequentially along the alignment, it is possible that the location is in vicinity of B-TB3 and B-TBAA. This boring log indicates the depth to water from ground surface was 16 ft. The ground surface elevation at B-TB3 and B-TBAA is approximately El. 35 and El. 36,

respectively. If the ground surface elevation at B-TB3AA is similar to those locations, the water could have been as high as El. 19 to El. 20 in the area of STA 26+50 to 27+00.

Groundwater levels vary with season, precipitation, local subsurface conditions, construction activity in the area, below-grade structures, leakage from utilities, and other factors. Long-term water levels could change as a result of future construction or changes to subsurface infrastructure.

3. GEOTECHNICAL DESIGN RECOMMENDATIONS

The following sections discuss geotechnical designs considerations, including groundwater, foundation requirements, lateral earth pressure loading, seismic design considerations, and trenchless construction methods as they pertain to the proposed culvert sections.

3.1 Building Code

Geotechnical design recommendations provided herein are based on the referenced subsurface information, drawings provided by the project team, and our engineering evaluations. Haley & Aldrich did not monitor the December 2010 test boring program, and soil samples from those explorations were not available for our review. Accordingly, our evaluations are based on information contained on the driller's exploration logs.

Retaining wall design and construction must conform to the applicable provisions of the current Massachusetts State Building Code (Building Code). Unless indicated otherwise, the recommendations in this report pertaining to retaining walls are intended to be consistent with requirements of the 8th Edition of the Building Code.

The project team is also using the design methodology provided by AASHTO LRFD Bridge Design Specifications 5th Edition, 2010 (AASHTO LRFD). To assist the project team, selected recommendations also reference the applicable design and resistance values provided in AASHTO LRFD.

3.2 Groundwater Levels

The available water level data near the proposed culvert alignment is limited to readings from SDG-1(OW) and water levels recorded on driller's logs for test borings. Accordingly, there is uncertainty in groundwater levels along the alignment. Based on our evaluation of the limited available data, site topography and subsurface soil conditions, we recommend that structures be designed to resist hydrostatic pressures associated with the following design groundwater levels:

- For the box culvert located from approximately STA 24+22 to 26+85, we recommend a high water level of El. 19 for calculation of hydrostatic pressures on the structure. Water levels in this section were measured as low as El. 10.

- For the retaining walls located between STA 20+50 to 24+22, we recommend a high water level of El. 13 for calculation of unbalanced lateral hydrostatic pressure on the retaining walls, which corresponds to the approximate weephole elevations. Note that high water levels in this area may range from El. 19 near STA 24+00 to El. 13 near STA 20+50.

- For the three sided rigid frame located at Mechanic Street from STA 23+00 to STA 22+08, we recommend a high water level of El. 13 in this area based on readings from SDG-1.

- For the box culvert located from approximately STA 32+16 to 33+30, we recommend a high water level of El. 16.

3.3 Cantilever Retaining Walls

Cantilever reinforced concrete retaining walls are planned at the following heights along the alignment: 13 to 14 ft from STA 20+50 to 22+08 and 8 to 26 ft from STA 24+22 to 25+00. From STA 24+22 to 25+00, a 4.5 to 10-ft tall grid-reinforced vegetated face retaining wall will be positioned directly behind the concrete wall located on the west side of the channel. The vegetated face will be inclined at 4V:1H. The total height of retained earth behind both walls is approximately 26 ft.

3.3.1 Foundation Design Recommendations

The following criteria are recommended for design of retaining wall footing foundations:

- Design footings using a nominal bearing pressure in kips per square foot (ksf) for bearing in glacial deposits (very dense glacial till or glaciofluvial), assuming no significant inclined or eccentric loads:
  - 15 ksf for 5 ft wide footings
  - 20 ksf for 10 ft wide footings
  - 30 ksf for 15 ft wide footings

- The bearing resistance factor for retaining walls in the strength limit state is 0.55 per AASHTO LRFD Table 11.5.6-1
- Design footings to have a minimum lateral dimension of 3 ft.
- Footings should bear a minimum of 4 ft below lowest adjacent ground surface, for frost protection.
- If removal of unsuitable material or other excavation below the bearing elevation is required, the footing subgrade should be backfill with lean concrete (1,000 psi 28-day compressive strength). Compacted structural backfill could be used in lieu of lean concrete if the nominal bearing pressure is *reduced* to two-thirds (0.67) of the above values and is placed above the natural bearing soils within the Zone of Influence (ZOI) beneath the footings. The ZOI is defined as the zone beneath the footings and beneath imaginary lines extending 1 ft laterally beyond the footing outer bottom edges and down and out on a one horizontal to one vertical (1H:1V) slope to the bearing stratum.
- Design footings to bear below a reference line drawn upward and outward on a 1.5 horizontal to 1 vertical (1.5H:1V) slope from the bottom of excavations for new utilities or other nearby underground structures. Where possible, footing elevations should be coordinated with utility elevations to allow utilities to pass through the foundation wall (rather than through or beneath the footing). Footing bearing may locally need to be lowered or stepped to achieve this criterion. Alternatively, where utilities are located within this zone, the footing subgrade can be over excavated and backfilled with lean concrete in order to transfer loads to material below the utility. If water lines or other pressurized fluid pipelines are located near new footings, considerations for footing protection should be considered on a case-by-case basis.

3.3.2 Lateral Earth Pressures

Walls retaining earth should be designed to resist static, seismic and surcharge loadings as provided below. Permanent drainage should be provided behind cantilever concrete walls, as recommended in subsequent sections of this report. Since drainage will be provided, the pressures do not include hydrostatic loads. The pressures assume that backfill slopes are no steeper than 1V:6H; pressures on walls having steeper backfill slopes should be developed on a case-by-case basis.

Cantilevered retaining walls that are unrestrained at the top should be designed for the following "active" earth pressures:

- Static earth pressures should be calculated based on backfill unit weight of 125 pcf and an active earth pressure coefficient of 0.3 (equivalent fluid unit weight of soil equal to 38 pcf), assuming permanent wall drainage is provided as recommended herein.
- Surcharge loads should be applied as a uniform lateral pressure over the full height of the concrete wall equal to 0.3 multiplied times the vertical surcharge pressure. The weight of the vegetated wall should be considered part of the surcharge.
- Seismic loading should be consider the following:
  - Seismic lateral earth pressures should be calculated assuming loading along the full height of the wall (cantilever wall plus vegetated wall) as an inverse triangle where the pressure magnitude at the top of the triangle (top of wall) is equal to 8 x H (psf), where H is the height of the wall. The magnitude at the base of the wall is zero.
  - The inertial effects of the wall and overlying soil due to a seismic event should also be considered for sliding. The horizontal seismic acceleration coefficient for yielding walls may be estimated as ½ of the peak ground acceleration (PGA = 0.085) which is 0.0425. Per AASHTO 11.6.5 and subset C11.6.5 the horizontal seismic acceleration coefficient for yielding walls (1 inch of movement) is 0.034. Where the vegetated slope is located above the concrete retaining wall, the inertial effects should consider the soil above the heel of the wall to the top of the vegetated slope. Refer to the sketch provided on Figure 3.

3.3.3 Sliding Resistance

A coefficient of friction may be calculated as the tangent of the angle of friction between cast-in-place concrete footing bases and the bearing strata (very dense glacial soils), $\delta = 28°$. The sliding resistance factor for gravity retaining walls is 1.0 per AASHTO LRFD Table 11.5.6-1.

3.3.4 Permanent Drainage

Permanent drainage should be provided behind the concrete retaining walls, consisting of the following:

- 4-in. minimum diameter perforated drain pipe positioned behind the wall at an elevation corresponding to approximately 10 to 16 in. above the ground surface in front of the wall, surrounded by at least 6-in. thickness of ¾-in. crushed stone.
- A 12-in. minimum wide zone of drainage fill (crushed stone) immediately behind the wall extending from the drain pipe up to within 12 in. below ground surface. Alternately, a

geocomposite drain board can be used behind the wall above the drain pipe to the top of the retaining wall.

- Non-woven geotextile separating the crushed stone from adjacent soils
- Weep holes through the walls or other permanent outlets for drain discharge water at the elevation of the perforated pipe
- Behind the drainage layer, backfill within 4 ft of the wall face should contain no more than 12 percent finer by weight than a #200 sieve.
- Wall backfill should consist of granular soils compacted to at least 95 percent of maximum dry density in accordance with ASTM D1557.
- At ground surface, an 8-in. minimum thickness of low-permeability soil (such as topsoil) should be provided above the drainage fill and within the 8 ft immediately behind the walls in unpaved areas, to limit surface water infiltration into the drainage system.

The presence of weep hole would allow for some exfiltration of stormwater from the culvert into the soil behind the retaining walls when the water level in the culvert is elevated, which may cause localized increases in groundwater levels. SDG has indicated that such water level increases will not adversely impact nearby facilities.

3.3.5 Slope Stability

The retaining walls are being constructed in an area where subsurface conditions consist of shallow existing fill over dense glacial deposits. Based on our evaluations, adequate factors of safety are achieved for global stability of the concrete retaining wall under static and seismic loading conditions, provided that the wall has been designed to resist sliding with adequate factors of safety.

Haley & Aldrich did not perform an analysis of the internal stability of the vegetated wall, as it is assumed that internal stability was evaluated by others.

3.4 Rigid Three-Sided Culvert Section

From STA 22+08 to 23+00, a rigid three-sided reinforced concrete culvert is proposed, consisting of two walls supported by strip footings, braced at the top with a concrete roof. The earthen channel bottom will be underlain by an impermeable synthetic liner. Two existing pipelines (water and natural gas) are planned to be relocated beneath the culvert elevation.

3.4.1 Foundation Design Recommendations (Rigid Frame)

The following criteria are recommended for design of three-sided culvert footings:

- Design footings using a nominal bearing pressure in kips per square foot (ksf) for footing bearing on Compacted Granular fill or Natural (inorganic) Deposits, assuming no significant inclined or eccentric loads:
  - 8 ksf for 2-ft wide footings
  - 12 ksf for 6-ft wide footings
- The bearing resistance factor for shallow foundations in the strength limit state is 0.45 per AASHTO LRFD Table 10.5.5.2.2.
- Design footings to have a minimum lateral dimension of 18 inches.

- Footings should have a minimum of 4 ft of permanent earth cover above their bearing elevation, for frost protection.
- Unsuitable materials should be removed from within the zone of influence (ZOI) beneath foundations, and replaced with Compacted Granular Fill as necessary to achieve design footing bearing elevations. The ZOI is defined as the zone beneath the footing and beneath imaginary lines extending 1 ft laterally beyond the footing outer bottom edges and down and out on a one horizontal to one vertical (1H:1V) slope to the bearing stratum. Compacted Granular Fill or other suitable approved structural fill should also be used to raise the grade beneath footings, where required.
- Utilities planned below or near footing elevations should be encased in concrete and be designed to accommodate loads from the culvert. The concrete encasement should extend at least 2 ft or 5 ft beyond the ZOI of the footing, for gravity pipes or pipes under pressure, respectively.

Gradation and placement procedures for Compacted Granular Fill are discussed in subsequent sections of this report.

3.4.2 Lateral Earth Pressures and Surcharge Loads (Rigid Frame)

Rigid framed walls retaining earth should be designed to resist static, hydrostatic and surcharge loadings as recommended below. Culverts should be designed to support full overburden loading and applicable traffic/ surcharge loadings. Overburden loads may be calculated assuming a unit weight of soil of 125 pounds per cubic foot.

Design culvert walls that are braced or restrained at the top for the following "at-rest" earth pressures:

- Static earth pressures should be calculated based on backfill unit weight of 125 pcf and earth pressure coefficient of 0.5 (equivalent fluid unit weight of soil equal to 63 pcf).
- Design for lateral hydrostatic pressures based on a high water levels given in Section 3.2 of this report.
- Surcharge loads should be applied as a uniform lateral pressure over the full height of the concrete wall equal to 0.5 multiplied times the surcharge pressure.
- Seismic lateral earth pressures should be calculated assuming loading along the full height of the wall as an inverse triangle where the pressure magnitude of the top of the triangle (top of wall) is equal to 8 x H (psf), where H is the height of the wall. The magnitude at the base of the wall is zero.

3.5 Impermeable Membrane

An impermeable membrane is proposed below the open channel sections of the three-sided section (STA 20+50 to 24+22). The following criteria are recommended in consideration of the impermeable membrane:

- Impermeable membranes should not be placed beneath retaining wall footings.

- A minimum of 3 ft of mineral (inorganic) earth cover, or equivalent, should be provided above the membranes to resist hydrostatic uplift pressures for membranes between the retaining walls that have weep holes (STA 20+50 to 22+08 and STA 24+22 to 25+00).

- Minimum of 4 ft of mineral (inorganic) earth cover, or equivalent, should be provided to resist hydrostatic uplift pressures for membranes along the three sided rigid frame (STA 22+08 to 23+00).

- Membranes should be sealed to retaining walls or footings with compatible mastic or similar adhesive, to achieve a relatively watertight connection, for at least 8 inches height at the top of the membrane.

3.6 Box Culvert

An 11 ft by 6 ft precast concrete box culvert is proposed at STA 24+22 to 25+25 and STA 33+30 to 32+16. The following criteria are recommended for design of the box culvert:

- The proposed culvert should be designed to support full overburden loads, and applicable traffic/ surcharge loading. Overburden loads may be calculated assuming a unit weight of soil of 125 pounds per cubic foot.

- The culvert should bear on natural inorganic deposits, Compacted Granular Fill overlying natural inorganic deposits, or other suitable granular backfill material. The granular backfill should extend 1 ft laterally beyond the width of the culvert.

- In some areas of the alignment existing fill soil will need to be over excavated and replaced with suitable granular backfill materials.

4. CONSTRUCTION CONSIDERATIONS

This section comments on items related to excavation, foundation construction, dewatering, earthwork, and related geotechnical engineering aspects of the proposed construction. Prospective contractors for this project should evaluate potential construction issues on the basis of their knowledge and experience with similar soil conditions in the Quincy area, taking into account their own proposed construction methods.

In addition to the construction considerations and recommendations made herein, construction should conform to the requirements of OSHA and all other applicable Municipal and State regulatory agencies.

4.1 Open Cuts

Where open cuts are performed, excavations must conform to the requirements of OSHA and other local or federal standards. OSHA classifies soils into types A, B, or C. OSHA sloping and shoring requirements are based on the type of soil present at each work site.

- Type A soils are defined as cohesive. They stick together easily and resist breaking apart under pressure. Clay, silty clay, sandy clay, and clay loam are examples of cohesive soils. Type A soils must have an unconfined compressive strength greater than or equal to 1.5 tons per square foot. Soil cannot be classified as Type A if it is fissured, subject to vibration, or if it has been previously disturbed or backfilled.

- Type B soils include cohesive soil that has an unconfined compressive strength between 0.5 and 1.5 tons per square foot. Soil that has an unconfined compressive strength greater than 1.5 tons per square foot and is fissured or subject to vibration is also classified as Type B. Some other soils that are granular and exhibit poor cohesion may be included as Type B materials. Angular gravel (similar to crushed rock), silt, silty loam, and sandy loam are examples of these materials.

- Type C soils include cohesive soil that has an unconfined compressive strength less than 0.5 tons per square foot. Loose granular soils such as gravel, sand, and loamy sand are also classified as Type C.

OSHA requirements for excavations less than 20 feet deep in dry conditions include the following:

- Type A soils may be sloped at 0.5 horizontal to 1 vertical

- Type B soils at 1 horizontal to 1 vertical

- Type C soils at 1.5 horizontal to 1 vertical

4.2 Support of Excavation

Excavations for construction may require excavation support in areas where open cuts are not possible due to limited available space or presence of nearby utilities or other facilities that must be maintained. In some cases, trench boxes may be used. In general, we anticipate that steel sheet pile walls would be difficult or impossible to install to required depths into the very dense glacial soils along the alignment. Soldier pile and lagging wall systems are anticipated to be well suited for lateral support for excavations

in the glacial deposits that do not extend to significant depths below groundwater. Solder pile and lagging walls could potentially be cantilever or braced (or tied-back) systems depending on the particular conditions. Examples of locations that may require excavation support include the following:

- South Retaining wall near STA 23+00 to 24+22, with cuts of up to 26 ft or greater required; may require bracing.
- North Retaining wall near STA 23+00 to 24+22 has excavation cuts of up to 25 ft; may require bracing or benching.
- Jacking and receiving pits for the culvert/pipe jacking beneath Hancock Street will require support of excavation and bracing, as discussed further in Section 4.9 below.
- At STA 20+40 to 20+70, two utilities (water and gas) are planned to be installed below the 3-sided rigid frame culvert resulting an approximately 18 ft deep cut. If open cut is not possible, a support of excavation system would be required.

4.3 Construction Dewatering

Based on the water levels measured at SDG-1 and site geology, groundwater may be encountered during construction along most or all of the alignment. Temporary dewatering should be performed as necessary to enable construction in the dry. The Contractor should control the flow of surface water and seepage water into excavations at all times. Dewatering procedures should be conducted in a manner that protects exposed footing and culvert subgrades, and in-place compacted fills and that avoids pumping of fines. Dewatering for cut-and-cover culvert sections can likely be accomplished with sumps and collection trenches.

Dewatering effluent must be discharged in accordance with all regulatory requirements. If practical and feasible, dewatering effluent should be recharged into on-site excavations for infiltration back into the ground. Where glaciofluvial deposits are encountered, moderate infiltration rates could occur locally. Where glacial till deposits are encountered, lower infiltration rates are likely. Actual rates will depend on the conditions at the time and the contractor's approach to dewatering.

If site recharge is not possible, the effluent would likely have to be discharged under a discharge permit (NPDES General Permit or RGP, as required) to storm water municipal systems. Permit application would likely involve groundwater testing and a several week approval process. Requirements for dewatering effluent discharge should be included in the project construction contract documents, incorporating environmental considerations related to effluent discharge.

4.4 Subgrade Preparation and Protection

All unsuitable materials such as vegetation, topsoil, pavements, organic matter, debris, existing unsuitable fill and other unsuitable materials should be removed from within the zone of influence (ZOI) beneath footing foundations and be replaced with Compacted granular fill down to the suitable bearing strata. If lean concrete is used as backfill, it should be placed beneath the footing and within 6 in. laterally beyond the footing edges. For box culverts, unsuitable material should be removed and replaced with Granular Fill. If Granular existing fill is encountered, it could be left in place beneath box culverts subject to acceptance by the Geotechnical Engineer based on exposed conditions.

Following excavation to required subgrade elevation, exposed subgrades should be observed in the field by the Engineer's representative to confirm the assumed foundation bearing conditions. It may be necessary to over-excavate and replace disturbed or otherwise unacceptable foundation bearing materials, if encountered. Exposed surfaces should be re-compacted prior to placing Structural Fill or constructing foundations with a minimum of two passes with a heavy vibratory compactor.

Care should be taken to prevent surface water from collecting on exposed soil bearing surfaces. Worker and equipment traffic over bearing surfaces should be minimized. When exposed in cold and wet weather, it may be difficult to prepare and maintain soil subgrades. If weaving or other disturbance is noticed during recompaction due to shallow depth to water, vibratory re-compaction should be discontinued based on the recommendations of the Engineer. If subgrade protection difficulties are encountered due to cold weather, various methods can be utilized:

- Leave subgrades high until immediately before forming and concreting to minimize the time the subgrade is exposed.

- Place a 3 to 4-in. thick concrete mudmat over the prepared subgrade immediately after subgrade preparation.

Fill materials or wall concrete should not be placed on snow, ice, or frozen subgrades. Soil bearing surfaces below completed foundations must be protected against freezing before and after foundation construction. If construction is performed during freezing weather, footings should be backfilled to a sufficient depth (up to 4 ft) as soon as possible after they are constructed. Alternatively, insulating blankets, heating or other means may be used for protection against freezing. Footing bearing levels could also be lowered such that they are protected from freezing temperatures after backfilling.

4.5 Mudmats Below Retaining Wall Footings

The design considers sliding resistance based on footings being in contact with glacial deposited soil. If the contractor elects to use mudmats or lean concrete below footings, the surface must be raked/ roughened parallel to the wall face.

4.6 Earthwork and Backfilling

The following are general recommendations for earthwork and backfilling. The contractor should conduct all excavation, backfill and compaction in accordance will project specifications.

4.6.1 Reuse of Excavated Materials

Excavated topsoil or topsoil fill is not suitable for re-use as backfill beneath or adjacent to new structures. Excavated glacial deposits and fill soils (after removal of over-size particle) are expected to be suitable for reuse as common fill to raise site grades and for backfilling, and possibly as structural fill subject to weather conditions and the local characteristics of the excavated materials.

The site fill soils and natural soils have medium to high content of fine-grained soils, and will be susceptible to disturbance when water is present, or in freezing weather, during placement and compaction activities. Use of these materials as fill or backfill during wet weather or winter periods may difficult or impossible.

Boulders and cobbles could be re-used as fill or backfill if processed by crushing to the appropriate size.

4.6.2 Compacted Granular Fill

Compacted Granular Fill beneath rigid frame footings and under box culverts should consist of either suitable on-site glacial deposits or imported bank-run sand and gravel. Compacted Granular Fill should not be used beneath retaining wall footings with prior approval from the Design Engineer. The materials should be free of organic material, snow, ice, or other unsuitable materials. In open areas, Compacted Granular Fill should be placed in lift thicknesses not exceeding 12 inches loose measure, and compacted with heavy self-propelled vibratory rollers. In confined areas, hand-guided equipment such as a large vibratory plate compactor should be used and the loose lift thickness should not exceed 8 in.

Structural fill supporting rigid frame footings, box culvert, roadways and the vegetated wall should be compacted to at least 95% of the maximum dry density determined in accordance with ASTM D1557. A minimum of four systematic passes of the compaction equipment should be used to compact each lift. Cobbles or boulders having a size exceeding 2/3 of the loose lift thickness should be removed prior to compaction.

We recommend that heavy compaction equipment not be used immediately behind retaining walls. Lighter weight walk behind compactors should be used to avoid excess lateral loads on the wall.

4.6.3 Compacted Common Fill

In landscape areas and other locations not requiring special treatment, backfill and fill may consist of Common Fill such as excavated existing fill and glacial soils.

4.7 Excavated Soil Management

Excavated soils to be disposed off-site should be managed in accordance with regulatory requirements and within the framework of an Excavated Soil and Materials Management Plan (ESMMP) and appropriate soil characterization testing. Soil characterization testing is typically performed prior to excavation, to expedite soil management and disposal ("pre-characterization"). The objectives of a pre-characterization program include the following:

- Characterize soils prior to off-site disposition, to facilitate direct loading and hauling during the excavation work.

- Classify the material to be removed from the site into groups based on the levels and types of oil and hazardous material detected in the samples, as well as physical characteristics. Group classification is determined, in part, based on a comparison to established MassDEP and typical facility criteria for off-site reuse, disposal, recycling, and/or treatment.

- Package information related to soil disposition to facilitate: (i) review by contractor-selected off-site receiving facilities for potential acceptance, (ii) excavation and off-site disposition planning and sequencing, and (iii) off-site soil disposition with little to no temporary stockpiling.

For off-site disposal, disposal facilities typically require that samples be tested at a frequency of 1 sample per 250 to 500 cy of soil. If pre-characterization is not performed, excavated soils would be stockpiled and tested prior to taking the material off site.

It is possible that soil characterization for off-site disposal would result in conditions that must be reported to the Massachusetts Department of Environmental Protection (MassDEP) under the Massachusetts Contingency plan (MCP).

4.8 Culvert Installation by Trenchless Methods

The proposed 11 ft by 6 ft box culvert will cross beneath existing Hancock Street from STA 25+25 to 26+75. In order to maintain operation of Hancock Street, pipe jacking methods are planned for installation of the culvert in this area, designed and performed by the Contractor. Top to bottom, the culvert extends from approximately El. 19 to El. 9. The alignment soil and groundwater conditions could potentially present significant challenges to jacking installation of the culvert.

4.8.1 Subsurface Conditions

Test borings B-TB2 and B-TB3A indicate dense to very dense glacial deposits containing sand, gravel and cobbles within the planned culvert horizon. Boulders may also be present. The local composition of the glacial deposits within the culvert horizon (i.e., glaciaofluvial versus glacial till) is somewhat uncertain from the available subsurface data.

"Normal" groundwater is expected to be at or above the culvert invert in this area, and could be locally several feet above the invert. Water levels recorded measured in B-TB3A was approximately El. 10, however this level may not be indicative of stable groundwater. As discussed above, water was recorded in B-TB3AA (possibly in the vicinity of the jacking alignment) at 16 ft depth, which could correspond to about El. 19 to 20 if the ground surface at this boring similar to B-TB2. Water was measured in HA11-21(OW), which has similar geology to this section of the alignment, at about El. 15.2 to 15.5.

Pipe jacking in an urban environment requires areas on both sides of the crossing for jacking/receiving pits and equipment/materials lay-down. Typical jacking and receiving pits are on the order of 15 to 20 ft wide by 25 to 30 ft long. Pits for the proposed crossing are likely to extend below groundwater. As jacking of the pipe/ culvert proceeds incrementally from the jacking to the receiving pit, soil is typically excavated by hand labor and removed with the aid of carts winched between the face and jacking pit.

Open face jacking is typically used in soil types with low permeability and good stand-up time, or in soils that have been dewatered or otherwise pre-stabilized by ground improvement methods such as grouting. Open face jacking does not enable pressure regulation or systematic soil control at the face. Control of the excavation face is sometimes facilitated with the use of a face shield. If loss of ground occurs at the face, subsidence of the overlying ground and supported facilities (utilities, roadway, etc.) could occur.

As noted above, the soils encountered during jacking could range from dense to very dense highly permeable glacial fluvial deposits to low-permeability, bonded glacial till. The dense nature and presence of cobbles and boulders could result in large required jacking forces and difficulty in

excavation at the face. Soil lubrication using bentonite injection is sometimes performed to reduce the required jacking force.

Depending on the actual nature of the glacial soils, particularly their degree of cohesion or bonding, facial instabilities may be experienced, especially when below groundwater. Locally high seepage flows could be experienced. If the soils are cohesionless or have low cohesion, stabilization of the alignment by pre-dewatering and/or grouting will likely be required to limit groundwater infiltration and soil face instability during the work. Ideally, grouting is performed using vertical drilling methods. If vertical drilling is not possible or practical due to access or obstruction limitations, horizontal directional drilling or grouting through the face may be required.

Specific requirements and performance criteria for pipe jacking should be detailed in the project specifications. The Contractor may wish to perform supplemental subsurface explorations to enable preparation of his final design and means and methods.

The SDG drawings show the proposed jacking pit location adjacent to the Phase 1 culvert alignment. It is our understanding the Phase 1 culvert will be installed prior to the start of Phase 2a construction. Design and installation of the jacking pit and thrust system should be coordinated with the Phase 1 construction.

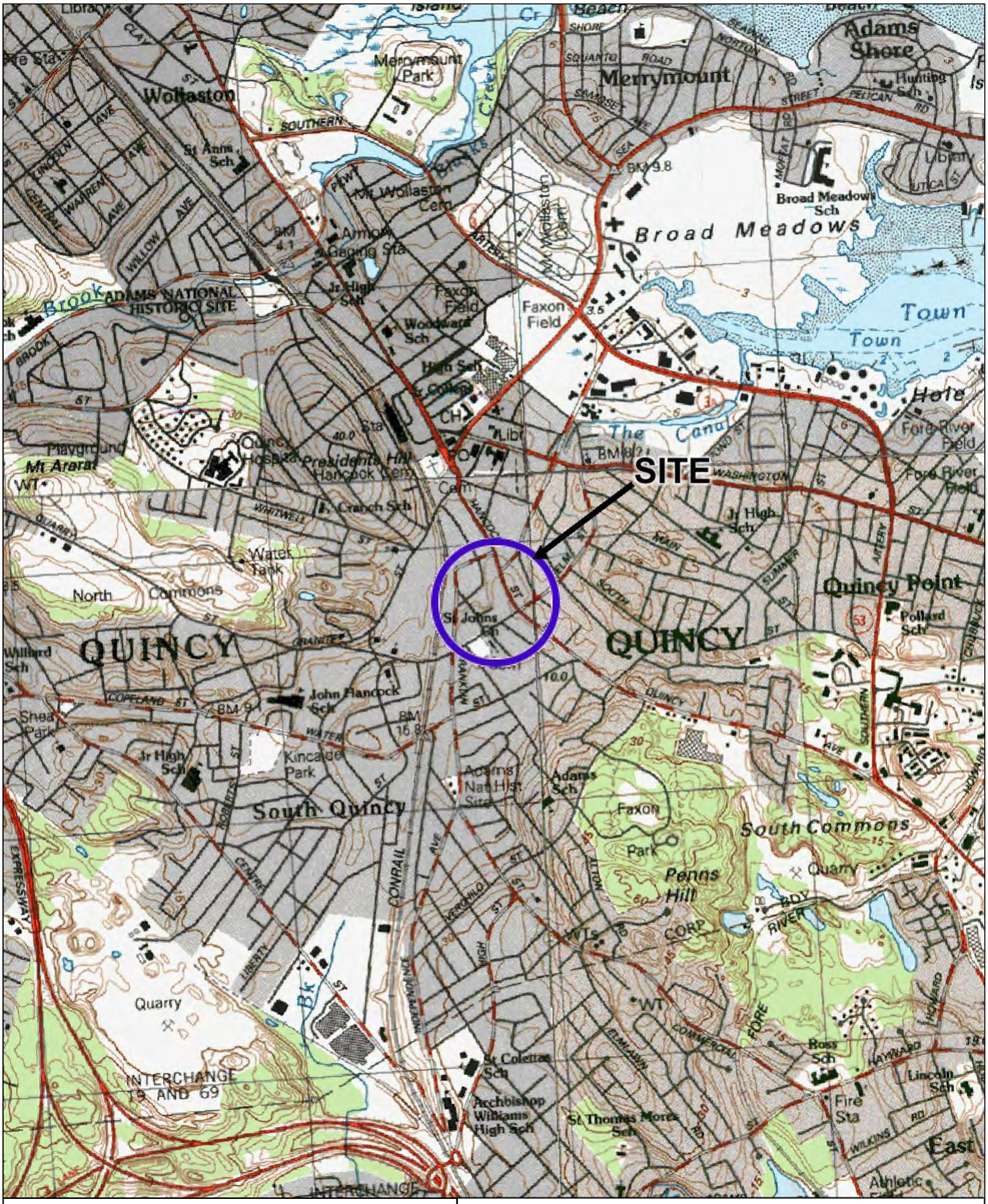
The drawings indicate that there is an existing 10-in. diameter clay sewer pipe approximately 4 ft above the top of the proposed culvert. Other utilities are present 10 to 15 ft above the top of the culvert. The jacking methods should consider the requirements to support the overlying utilities and roadway

5. REPORT APPLICABILITY AND LIMITATIONS

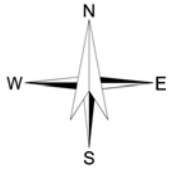
This report has been prepared for specific application to the proposed Town Brook Relocation project in Quincy, Massachusetts, as understood by Haley & Aldrich at this time. In the event that changes in the design or location of the culvert alignment are planned, the conclusions and recommendations contained in this report should not be considered valid unless they are reviewed and modified or verified in writing by Haley & Aldrich.

The recommendations are based in part upon explorations conducted by others. Actual conditions, and the nature and extent of variations between explorations, may not become evident until construction. If significant variations or unanticipated conditions then appear, it may be necessary to re-evaluate the recommendations of this report.

G:\35571\012 Town Brook\2012-0117-HAI-Geotech Report-TownBrook-F.docx



SITE COORDINATES:42°14'45"N 71°7'416"W



U.S.G.S. QUADRANGLE: BLUE HILLS, MA

HALEY & ALDRICH

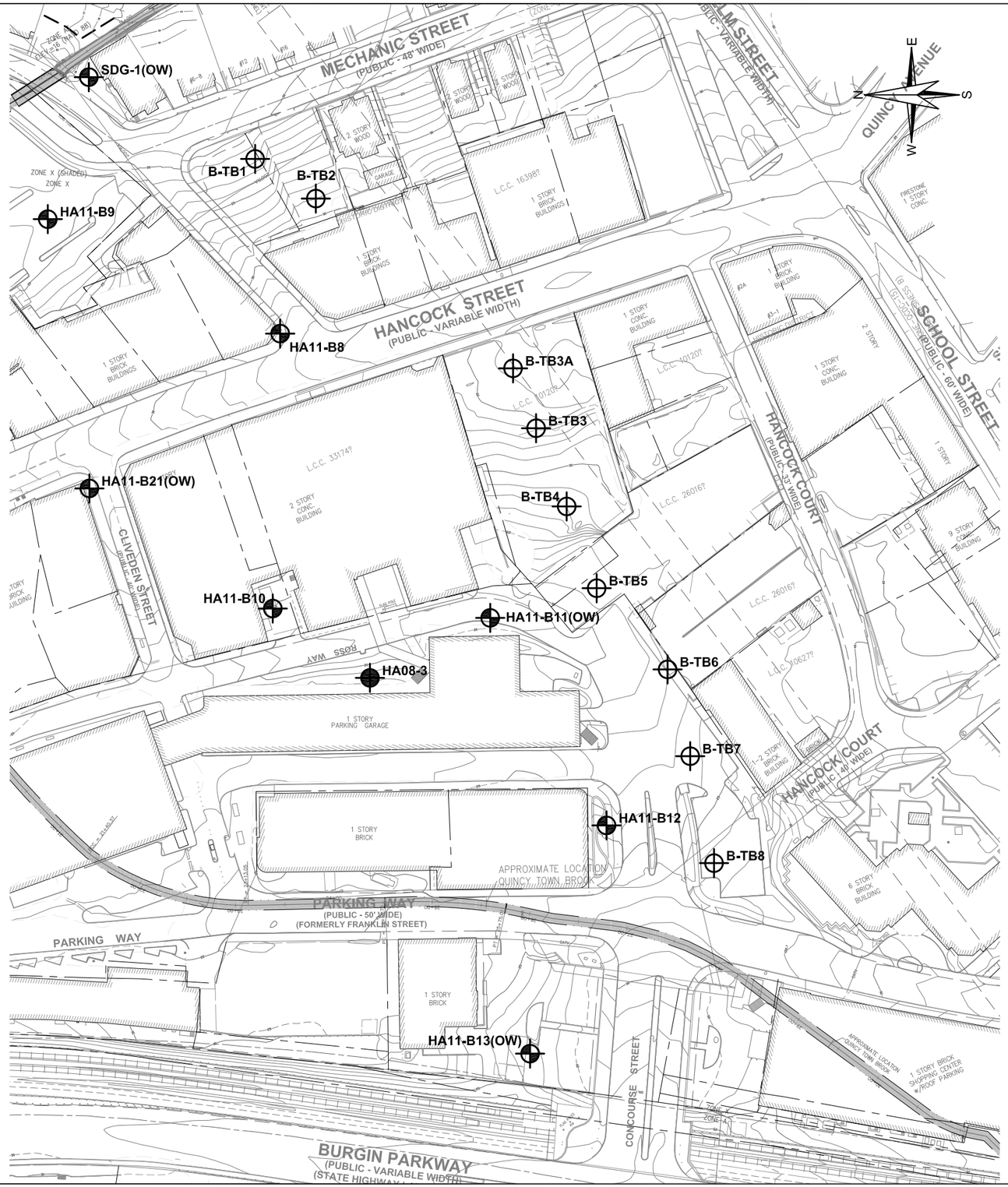
QUINCY CENTER REDVELOPMENT
TOWN BROOK RELOCATION
QUINCY, MASSACHUSETTS

PROJECT LOCUS

SCALE: 1:24,000
JANUARY 2012

FIGURE 1

35571 012.PDF



LEGEND:

HA11-B1 — DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING COMPLETED BY GEOLOGIC EARTH EXPLORATIONS, INC. AND MONITORED BY HALEY & ALDRICH, INC. IN MAY 2011

SDG-1 — DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING COMPLETED BY GEOLOGIC-EARTH EXPLORATIONS, INC. AND MONITORED BY HALEY & ALDRICH, INC. IN APRIL 2011

B-TB1 — DESIGNATION AND REPORTED LOCATION OF TEST BORING COMPLETED BY CARR-DEE CORP. IN DECEMBER 2010

HA08-1 — DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING COMPLETED BY NEW HAMPSHIRE BORING, INC. AND MONITORED BY HALEY & ALDRICH, INC. IN JUNE 2008.

(OW) — INDICATES OBSERVATION WELL INSTALLED IN COMPLETED BOREHOLE

NOTES:

1. BASE PLAN TAKEN FROM DRAWING ELECTRONIC FILE "10_006_EX.dwg" PROVIDED BY STEPHENSON DESIGN GROUP OF BRIGHTON, MASSACHUSETTS ON 28 JUNE 2011 .
2. ELEVATION ARE IN FEET AND ARE REFERENCED TO NAVD 88.
3. CARR DEE BORING LOCATIONS ARE APPROXIMATE. REFER TO APPENDIX A FOR LOCATIONS.

DRAFT

0 — 120 — 240
SCALE IN FEET

HALEY & ALDRICH

QUINCY CENTER REDEVELOPMENT
TOWN BROOK ENHANCEMENT PROJECT (PHASE 2A)
QUINCY, MASSACHUSETTS

EXPLORATION LOCATIONS ON EXISTING CONDITIONS

SCALE: AS SHOWN
JANUARY 2012

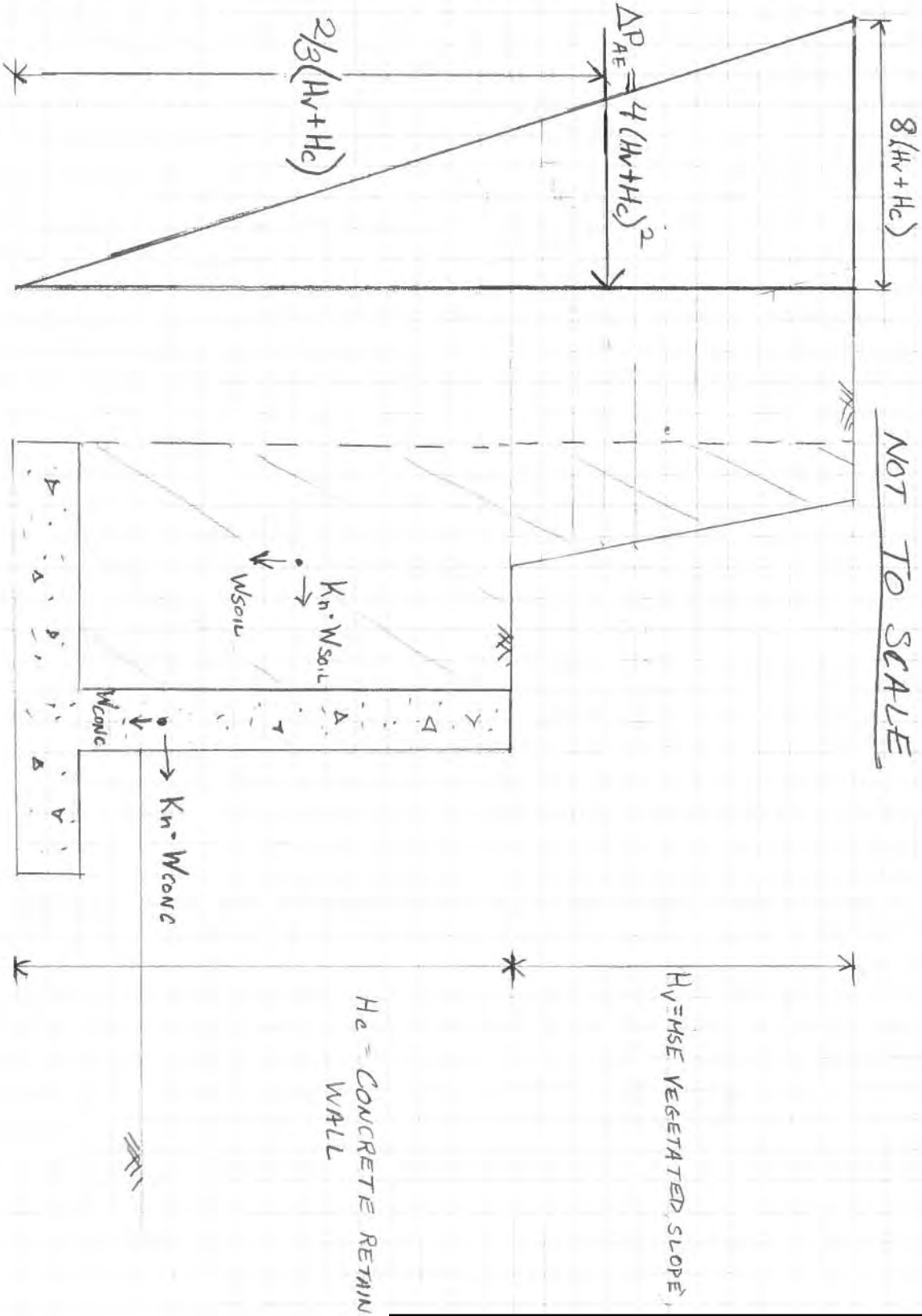
FIGURE 2

J:\GRAPHICS\35571\35571-009-B031.DWG

HALEY & ALDRICH

Calculations

Client	SDG	File No.	35571-012
Project	QUINCY TOWN BROOK	Sheet	1 of 1
Subject	SEISMIC FORCES FOR RETAINING WALLS	Date	1/6/12
		Computed By	KMT
		Checked By	JLL



LEGEND:
K_h = HORIZONTAL SEISMIC ACCELERATION COEFFICIENT

NOTE: SEISMIC FORCES ARE TO BE ADDED TO STATIC AND WATER FORCES.

CAL02AFH.FRP 20 November 1997

QUINCY CENTER REDEVELOPMENT
TOWN BROOK ENHANCEMENT PROJECT (PHASE 2A)
FIGURE 3

TABLE I
SUMMARY OF TEST BORING DATA - PROVIDED BY OTHERS
QUINCY CENTER REDEVELOPMENT
TOWN BROOK ENHANCEMENT PROJECT (PHASE 2A)
QUINCY, MASSACHUSETTS
FILE NO. 35571-012

Test Boring	Driller	Date	Approx. GS. Elev. (ft)[1]	Depth to BOE (ft)	Fill			Organic Soil (Peat, Loam)			Natural Deposit			Bedrock		Water[5]	
					Depth to Top of Stratum (ft)	Layer Thickness (ft)	Top of Layer El.	Depth to Top of Stratum (ft)	Layer Thickness (ft)	Top of Layer El.	Depth to Top of Stratum (ft)	Layer Thickness (ft)	Top of Layer El.	Depth to Top of Stratum (ft)	Top of Layer El.	Depth (ft)	Top of Layer El.
B-TB1	Carr-Dee	12/15/2010	21.5	17	0	5	21.5	--	--	--	5	>12	16.5	--	--	NE	NE
B-TB2	Carr-Dee	12/15/2010	29.5	19	0.3	4.7	29.2	--	--	--	5	>14	24.5	--	--	NE	NE
B-TB3	Carr-Dee	12/15/2010	35	33	0	15	35	--	--	--	15	>18	20	--	--	25	10
B-TB3A	Carr-Dee	12/15/2010	36	25	0	10	36	--	--	--	10	>15	26	--	--	25	11
B-TB3AA	Carr-Dee	12/15/2010	-	29	0	9	--	--	--	--	9	>20	--	--	--	16	--
B-TB4	Carr-Dee	12/15/2010	29	25	0	9	29	9	2	20	11	>14	18.0	--	--	19	10
B-TB5	Carr-Dee	12/15/2010	22	17	0.3	8.2	21.7	--	--	--	8.5	>9	13.5	--	--	12	10
B-TB6	Carr-Dee	12/15/2010	22	20	0.3	3.7	21.7	4	2.5	18	6.5	>14	15.5	--	--	11.5	10.5
B-TB7	Carr-Dee	12/15/2010	23.5	19	0	8	23.5	8	3.5	15.5	11.5	>8	12	--	--	16.5	7
B-TB8	Carr-Dee	12/15/2010	26	22	0.3	15.2	25.7	--	--	--	15.5	>7	10.5	--	--	19	7

Notes and Abbreviations:

1. Ground Surface Elevations for Carr-Dee Borings taken from "Profile View" of SDG Plans dated 9 December 2011. Elevations refer to National American Vertical Datum (NAVD) of 1988.
   The ground surface elevation is not presented for Test borings 3-AA as it is not presented on SDG drawings.
2. "BOE" = Bottom of Exploration
3. "--" = Soil unit not encountered during exploration
4. "-" = Information not available
5. "NE" = Not Encountered
6. Water depth provided on Carr-Dee Test Boring Logs. Refer to Carr-Dee Test Boring Logs for water level disclaimer.

TABLE II
SUMMARY OF HALEY & ALDRICH TEST BORING DATA
QUINCY CENTER REDEVELOPMENT
TOWN BROOK ENHANCEMENT PROJECT (PHASE 2A)
QUINCY, MASSACHUSETTS
FILE NO. 35571-012

Test Boring	Approx. GS. Elev.[1]	Depth to BOE (ft)	Fill			Organic Soil			Estuarine Deposits			Glaciolacustrine Deposits			Glaciofluvial Deposits			Glacial Till		
			Depth to Top of Stratum (ft)	Layer Thickness (ft)	Top of Layer El.	Depth to Top of Stratum (ft)	Layer Thickness (ft)	Top of Layer El.	Depth to Top of Stratum (ft)	Layer Thickness (ft)	Top of Layer El.	Depth to Top of Stratum (ft)	Layer Thickness (ft)	Top of Layer El.	Depth to Top of Stratum (ft)	Layer Thickness (ft)	Top of Layer El.	Depth to Top of Stratum (ft)	Layer Thickness (ft)	Top of Layer El.
HA11-B8	33.5	44.5	0.5	4	33	--	--	--	--	--	--	--	--	--	--	--	--	4.5	>40	29
HA11-B9	19.1	36	0.2	5.8	18.9	--	--	--	--	--	--	--	--	--	6	2.5	13.1	8.5	>27.5	10.6
HA11-B10	20	41	0.2	6.8	19.8	7	1.5	13	8.5	19.5	11.5	28	2	-8	30	2.5	-10	--	--	--
HA11-B11(OW)	18.7	46	0.5	5.5	18.2	--	--	--	6	21.5	12.7	27.5	13	-8.8	40.5	>5.5	-21.8	--	--	--
HA11-B12	24	46	0.4	11.1	23.6	--	--	--	11.5	16	12.5	27.5	9.5	-3.5	37	>9	-13	--	--	--
HA11-B13(OW)	22.5	41	0.5	4.5	22	--	--	--	5	1	17.5	--	--	--	6	>35	16.5	--	--	--
HA11-B21(OW)	28	48	0.5	1.5	27.5	--	--	--	--	--	--	--	--	--	--	--	--	2	>46	26
SDG-1(OW)	17.9	25.5	0.5	6	17.4	6.5	1	11.4	--	--	--	--	--	--	7.5	2.5	10.4	10	>15.5	7.9
HA08-3	22	27	0	14	22	--	--	--	14	>13.0	8	--	--	--	--	--	--	--	--	--

Notes and Abbreviations:
1. Ground surface elevations are in feet and refers to the National American Vertical Datum (NAVD) of 1988
2. "BOE" = Bottom of Exploration
3. "--" = Soil unit not encountered during exploration
4. Explorations are located 100 to 450 ft from the culvert alignment, with the exception of SDG-1(OW) which is within the culvert alignment.

TABLE III - SUMMARY OF OBSERVATION WELL READINGS

QUINCY CENTER REDEVELOPMENT
TOWN BROOK ENHANCEMENT PROJECT (PHASE 2A)
QUINCY, MASSACHUSETTS
FILE NO. 35571-012

Monitoring Well Designation	Well Installation Date	Ground Surface Elevation[1]	Well Depth From Ground Surface (ft)	Screened Formation	Depth To Screened Interval		Elevation Of Screened Interval		Monitoring Date	Depth To Water From Ground Surface (ft)	Water Elevation[1]
					Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft)			
HA11-B11 (OW)	5/13/11	18.7	15	Estuarine Deposits	5	15	13.7	3.7	24-May-11 3-Jun-11 17-Jun-11 6-Jan-12	8.0 8.3 8.3 8.0	10.7 10.4 10.4 10.7
HA11-B13 (OW)	5/31/2011	22.5	20	Glaciofluvial Deposits	5	20	17.5	2.5	3-Jun-11 6-Jan-12	13.2 13.2	9.3 9.4
HA11-B21 (OW)	5/13/2011	28.0	20	Glacial Till	5	20	23.0	8.0	20-May-11 3-Jun-11 17-Jun-11 6-Jan-12	12.5 12.6 12.8 12.8	15.5 15.4 15.3 15.2
SDG-1 (OW)	4/20/2011	17.9	20	Fill, Organics, Glaciofluvial, and Glacial Till	5	20	12.9	-2.1	17-Jun-11 6-Jan-12	7.4 7.6	10.5 10.3

Notes:
1. Elevations are in feet and reference the North American Vertical Datum (NAVD) of 1988
2. Observation wells are located 120 to 450 ft from culvert alignment.

APPENDIX A

Drawings for Town Brook Enhancement Project (Phase 2A) dated 16 November 2011 and updated 9 December 2011

APPENDIX B

Available Test Boring Logs

Haley & Aldrich, Inc.
Relevant Test Borings

HALEY & ALDRICH

TEST BORING REPORT

Boring No. SDG-1(OW)

Project QUINCY CENTER REDEVELOPMENT, QUINCY, MA
Client HANCOCK ADAMS ASSOCIATES, LLC
Contractor GEOLOGIC-EARTH EXPLORATION, INC.

File No. 35571-005
Sheet No. 1 of 2
Start 20 April 2011
Finish 20 April 2011
Driller J. Galvin
H&A Rep. D. Warren
Elevation 17.9
Datum NAVD 1988
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model:
Inside Diameter (in.)	4	1 3/8	-	Bit Type:
Hammer Weight (lb)	300	140	-	Drill Mud:
Hammer Fall (in.)	24	30	-	Casing: HW Driven
				Hoist/Hammer:
				PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Toughness	Plasticity	Strength
0					17.4	-BLACK BITUMINOUS ASPHALT-										
	9 12 16 22	S1 9	0.5 2.5	SM	0.5	Medium dense brown silty SAND with gravel (SM), mps 1.5 in., no structure, no odor, moist PID = 0.0/0.0 ppm	5	15	5	10	50	15				
	5 2 2	S2 4	2.5 4.0	SW-SM		Loose brown well-graded SAND with silt and gravel (SW-SM), mps 1.5 in., no structure, no odor, moist, trace brick and concrete fragments PID = 0.0/0.0 ppm	10	25	15	25	15	10				
	12 15 13 12	S3 8	4.0 6.0	SM		Medium dense gray-brown silty SAND with gravel (SM), mps 1.5 in., no structure, no odor, moist PID = 0.0/0.0 ppm	10	15	15	15	30	15				
5						-FILL-										
	12	S4 5	6.0 6.5	SW	11.4	S4: Medium dense brown well-graded SAND with gravel (SW), mps 1.5 in., no structure, no odor, wet PID = 0.0/0.0 ppm	15	30	20	20	10	5				
	4 18	S4A 9	6.5 7.5	OL/OH	6.5	S4A: Very stiff brown sandy ORGANIC SOIL (OL/OH), mps <1 mm, no structure, organic odor, moist, trace gravel PID = 0.0/0.0 ppm					20	80				
	26	S4B 6	7.5 8.0	SW	10.4 7.5	-ORGANIC DEPOSITS-	15	20	15	20	25	5				
	31 38 48 38	S5 10	8.0 10.0	SW-SM		S4B: Very dense orange-brown well-graded SAND with gravel (SW), mps 1.5 in., no structure, no odor, wet PID = 0.0/0.0 ppm S5: Very dense gray well-graded SAND with silt and gravel (SW-SM), mps 1.5 in., no structure, no odor, wet PID = 0.0/0.0 ppm	10	15	15	15	35	10				
10	29 32 38 29	S6 15	10.0 12.0	SM	7.9 10.0	-GLACIOFLUVIAL DEPOSITS- Note: Performed Falling Head Permeability Test from 8.0 to 10.0 ft. S6: Very dense gray silty SAND with gravel (SM), mps 1.5 in., moderately bonded, wet PID = 0.0/0.0 ppm	10	10	5	5	35	35				
	31 24 24 24	S7 17	12.0 14.0	SM		Similar to above PID = 0.0/0.0 ppm	5	10	5	5	35	40				
						-GLACIAL TILL-										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
4/20/11	1445			20.0	5.6*

*Initial OW reading; not stabilized

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 18.0
Rock Cored (ft) -
Samples S10

Boring No. SDG-1(OW)

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Plasticity**: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 REV HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\FIELD DATA\-005\35571-500_TB.GPJ 6 May 11

HALEY & ALDRICH

TEST BORING REPORT

Boring No. SDG-1(OW)

File No. 35571-005
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
15	26 27 36 32	S8 16	14.0 16.0	ML			Very dense gray sandy SILT with gravel (ML), mps 1.5 in., no structure, no odor, wet	5	5	5	5	30	50				
							-GLACIAL TILL-										
20	19 50 76 25/0"	S9 12	19.0 21.0	ML			Similar to above PID = 0.0/0.0 ppm	5	5	5	5	30	50				
25	55 76 128	S10 14	24.0 25.5	ML			Similar to above PID = 0.0/0.0 ppm Note: Performed Falling Head Permeability Test in open borehole from 19.0 to 25.5 ft.	5	5	5	5	20	60				
						-7.6 25.5	BOTTOM OF EXPLORATION 25.5 FT Note: Groundwater observation well installed at 20.0 ft upon completion.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. SDG-1(OW)

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY & ALDRICH

Well No. SDG-1(OW)
Boring No. SDG-1(OW)

Project QUINCY CENTER REDEVELOPMENT
Location QUINCY, MA
Client HANCOCK ADAMS ASSOCIATES, LLC
Contractor GEOLOGIC-EARTH EXPLORATION, INC.
Driller J. Galvin

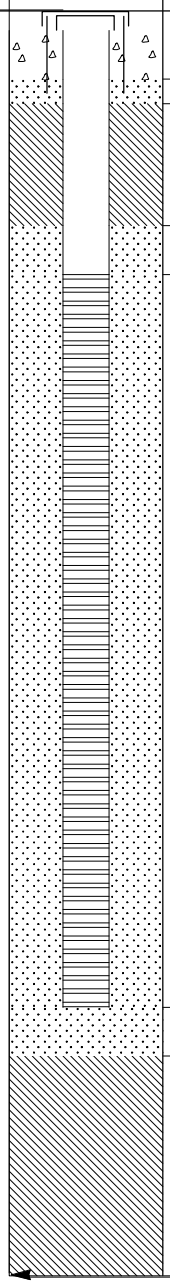
Initial Water Level (depth bgs) 5.6* ft

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

File No. 35571-005
Date Installed 20 Apr 2011
H&A Rep. D. Warren
Location See Plan

Ground El. 17.9
Datum NAVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	17.9
BLACK BITUMINOUS ASPHALT	0.5			1.0	16.9
				1.5	16.4
FILL				4.0	13.9
				5.0	12.9
ORGANIC DEPOSITS	6.5 – 7.5				
GLACIOFLUVIAL DEPOSITS	10.0				
GLACIAL TILL	25.5			20.0	-2.1
				21.0	-3.1
				25.5	-7.6



WELL CONSTRUCTION DETAILS

Type of protective cover: Roadway Box
Height of Roadway Box above ground surface: 1.0 ft
Depth of top of riser below ground surface: 0.2 ft

Type of protective casing: Roadway Box
Length: 1.0 ft
Inside diameter: 6.0 in.
Depth of bottom of Roadway Box: 0.0 ft

Type of riser pipe: Schedule 40 PVC
Inside diameter of riser pipe: 2.0 in.
Depth of bottom of riser pipe: 5.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	1.0
Bentonite	1.5	2.5
Bentonite	21.0	4.5

Diameter of borehole: 4.5 in.
Depth to top of well screen: 5.0 ft
Type of screen: Machine slotted Sch 40 PVC
Screen gauge or size of openings: 0.010 in.
Diameter of screen: 2.0 in.
Type of Backfill around Screen: Filter Sand
Depth to bottom of well screen: 20.0 ft
Bottom of silt trap: -
Depth of bottom of borehole: 25.5 ft

GW INSTALLATION REPORT-07-1 HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\FIELD DATA\-005\35571-500_TB.GPJ 6 May 11

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA11-B8

Project PROPOSED QUINCY CENTER REDEVELOPMENT, QUINCY, MA
Client HANCOCK ADAMS ASSOCIATES, LLC
Contractor GEOLOGIC-EARTH EXPLORATION, INC.

File No. 35571-006
Sheet No. 1 of 2
Start 19 May 2011
Finish 20 May 2011
Driller C. O'Donnell
H&A Rep. C. Toscano
Elevation 33.5 (est.)
Datum NAVD 1988
Location See Plan

	Casing	Sampler	Barrel
Type	HW / NW	S	-
Inside Diameter (in.)	4 / 3	1 3/8 / 3	-
Hammer Weight (lb)	300 / Spun	140 / 300	-
Hammer Fall (in.)	24	30	-

Drilling Equipment and Procedures

Rig Make & Model: Mobile B-57 Drill Truck
Bit Type: Roller Bit
Drill Mud: None
Casing: HW Driven to 19.0 ft; HW Spun to 39.0 ft
Hoist/Hammer: Winch Doughnut Hammer
PID Make & Model: MiniRAE 2000 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					33.2 / 0.3	-CONCRETE SIDEWALK-										
					33.0 / 0.5	-GRAVEL SUB-BASE-										
						-GRANULAR FILL-										
	5* 8 12 30	S1 18	2.0 4.0	SP		Medium dense light brown poorly graded SAND with gravel (SP), mps 30 mm, no structure, no odor, dry PID = 0.0/0.0 ppm	10	5	10	55	20					
	45* 50/0"	S2 4	4.0 4.5	ML	29.0 / 4.5	Very dense gray-brown sandy SILT with gravel (ML), mps 30 mm, well bonded, no odor, dry, cobbles present PID = 0.0/0.0 ppm	15	10	5	5	10	55				
5						-GLACIAL TILL-										
	50/0"	NR 0	8.0 8.0			Note: No recovery.										
10						Note: Drilled through granite boulder from 8.2 to 11.5 ft.										
	42 71 75 85	S3 15	11.5 13.5	ML		Very dense yellow-brown sandy SILT with gravel (ML), no odor, moist PID = 0.0/0.0 ppm	5	15		5	20	55				
15	50/0"	NR 0	15.0 15.0			Note: No recovery.										
						Note: Boulder from 15.0 to 16.5 ft.										
						Note: HW casing tip driven to 19.0 ft.										
20	66 50*	S4 8	19.0 21.0	ML		Very dense olive-gray-brown gravelly SILT with sand (ML), mps 25 mm, well bonded, no odor, moist, cobbles present	20	5			15	60				

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
5/20/11	1000	0.25	*	40.0	12.0
5/20/11	1030	0.25	*	44.5	16.0

*See note at BOE

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 44.5
Rock Cored (ft) -
Samples S9

Boring No. HA11-B8

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA11-B8

File No. 35571-006

Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
25	100/6"	S5 6	24.0 24.5	ML		Very dense olive-gray-brown sandy SILT with gravel (ML), mps 25 mm, no odor, moist	15	5	5	5	20	50				
						-GLACIAL TILL-										
						Note: Common cobbles from 24.5 to 29.0 ft.										
30	100/6"	S6 6	29.0 29.5	SM		Very dense olive-gray-brown silty SAND with gravel (SM), mps 25 mm, no odor, moist, cobbles present	15	5	5	5	35	35				
						Note: Bottom of borehole collapsed to 27.0 ft. Telescoped NW (3-in.) casing through HW (4-in.) casing. NW casing tip was spun and washed out to 34.0 ft.										
35	100/6"	S7 6	34.0 34.5	SM		Similar to above	15	5	5	5	35	35				
40	61 100/6"	S8 8	39.0 40.0	GM		Very dense olive-gray-brown silty GRAVEL with sand (GM), mps 25 mm, no odor, moist	25	15	5	5	15	35				
						Note: Common cobbles from 40.0 to 44.0 ft.										
	100/6"	S9 6	44.0 44.5		-11.0 44.5	Similar to S6										
						BOTTOM OF EXPLORATION 44.5 FT										

*indicates 3-in. spoon and 300-lb hammer used to attain enough sample for lab testing.

Note:
Water Level Bottom of Casing:
5/10/11 1000 39.0/3-in. casing
5/10/11 1030 19.0/4-in. casing

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA11-B8

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA11-B9

Project PROPOSED QUINCY CENTER REDEVELOPMENT, QUINCY, MA
Client HANCOCK ADAMS ASSOCIATES, LLC
Contractor GEOLOGIC-EARTH EXPLORATION, INC.

File No. 35571-006
Sheet No. 1 of 2
Start 16 May 2011
Finish 17 May 2011
Driller J. Galvin
H&A Rep. Shay/Warren
Elevation 19.1 (est.)
Datum NAVD 1988
Location See Plan

	Casing	Sampler	Barrel
Type	HW	S	-
Inside Diameter (in.)	4	1 3/8	-
Hammer Weight (lb)	300	140	-
Hammer Fall (in.)	24	30	-

Drilling Equipment and Procedures
Rig Make & Model: Mobile B-57 Drill Truck
Bit Type: Roller Bit
Drill Mud: None
Casing: HW Driven to 29.0 ft
Hoist/Hammer: Winch Doughnut Hammer
PID Make & Model: MiniRAE 2000 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					18.9											
	24 25	S1 20	0.5 2.0	GP	0.2	Dense brown poorly graded GRAVEL with sand (GP), mps 3.2 cm, no structure, no odor, wet from drilling PID = 0.0/0.0 ppm	45	30	15	5	5					
	11 9 11	S2 20	2.0 4.0	SP	16.6 2.5	Medium dense dark brown poorly graded SAND (SP), mps 1 cm, no structure, no odor, wet PID = 0.0/0.0 ppm		10	15	30	40	5				
	5 2 2 3	S3 10	4.0 6.0	SP		Loose brown poorly graded SAND with gravel (SP), mps 3 cm, no structure, no odor, wet, appears to be disturbed PID = 0.0/0.0 ppm	10	25	50	10	5					
5						-GRANULAR FILL-										
	13 14 19 12	S4 8	6.0 8.0	SW	13.1 6.0	Dense yellow-brown well-graded SAND with gravel (SW), mps 2.5 cm, no structure, no odor, wet PID = 0.0/0.0 ppm	5	10	25	30	30					
						-GLACIOFLUVIAL DEPOSITS-										
					10.6 8.5											
	48 42 30 35	S5 18	9.0 11.0	SM		Very dense olive-brown silty SAND with gravel (SM), mps 2 cm, no structure although well bonded, no odor, wet PID = 0.0/0.0 ppm	5	10	15	15	35	20				
10						-GLACIAL TILL-										
	33 39 29 34	S6 20	14.0 16.0	SM		Very dense olive-brown silty SAND with gravel (SM), mps 3 cm, moderately bonded in zones, no odor, wet, occasional irregular sandy pockets	5	10	15	15	40	15				
15																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 36.0
Rock Cored (ft) -
Samples S10

Boring No. HA11-B9

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 REV HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\FIELD DATA\-006\35571-006_TB.GPJ 6 Jul 11

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA11-B9

File No. 35571-006

Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	31 35 33 40	S7 16	19.0 21.0	SM		Similar to above including irregular sandy pockets										
						-GLACIAL TILL-										
25	37 33 32 37	S8 16	24.0 26.0	SM		Very dense brown silty SAND with gravel (SM), mps 1.5 in., no structure, no odor, wet	5	10	5	5	55	20				
30	61 70 66 83	S9 15	29.0 31.0	ML		Very dense tan sandy SILT with gravel (ML), mps 1.5 in., no structure, no odor, moist, well bonded in situ with cobbles	5	10	5	5	20	55				
35	54 51 58 52	S10 16	34.0 36.0	ML/ SM		Very dense tan sandy SILT (ML) to silty SAND with gravel (SM), mps 1.5 in., no structure, no odor, wet, well bonded in situ with cobbles	5	10	5	5	30	45				
					-16.9 36.0	BOTTOM OF EXPLORATION 36.0 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA11-B9

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA11-B10

Project PROPOSED QUINCY CENTER REDEVELOPMENT, QUINCY, MA
Client HANCOCK ADAMS ASSOCIATES, LLC
Contractor GEOLOGIC-EARTH EXPLORATION, INC.

File No. 35571-006
Sheet No. 1 of 2
Start 23 May 2011
Finish 23 May 2011
Driller J. Galvin
H&A Rep. S. Shay
Elevation 20.0 (est.)
Datum NAVD 1988
Location See Plan

	Casing	Sampler	Barrel
Type	HW	S	-
Inside Diameter (in.)	4	1 3/8	-
Hammer Weight (lb)	300	140	-
Hammer Fall (in.)	24	30	-

Drilling Equipment and Procedures

Rig Make & Model: Mobile B-57 Drill Truck
Bit Type: Roller Bit
Drill Mud: None
Casing: HW Driven to 39.0 ft
Hoist/Hammer: Winch Doughnut Hammer
PID Make & Model: MiniRAE 2000 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					19.8 / 0.2	-ASPHALT-										
	25 24 17	S1 12	0.5 2.0	SP		Dense brown poorly graded SAND with gravel (SP), mps 2 cm, no structure, no odor, wet	5	10	15	50	15	5				
	14 13 12 12	S2 10	2.0 4.0	SP		Similar to above except medium dense, 5% brick -GRANULAR FILL-										
	5 6 6 4	S3* 6	4.0 6.0	GP	16.0 / 4.0	Gray to brown poorly graded GRAVEL (GP), mps 4 cm, no structure, no odor, wet	10	80	10							
5	12 5	S4 4	6.0 7.0	GP		Similar to above										
	3 4	S4A 2	7.0 8.0	PT	13.0 / 7.0	Medium stiff dark brown fibrous PEAT (PT) -ORGANIC DEPOSITS-						100				
	22 17 15 21	S5 15	9.0 11.0	SP	11.5 / 8.5	Dense olive-gray poorly graded SAND (SP), mps 3 mm, weakly stratified, no odor, wet -ESTUARINE DEPOSITS-			5	80	10	5				
10					7.5 / 12.5											
	11 10 10 13	S6 16	14.0 16.0	SP-SM		Medium dense olive-gray poorly graded SAND with silt (SP-SM), mps 0.5 mm, no structure, no odor, wet					90	10				
15					2.5 / 17.5											

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
5/23/11	1230	0.5	39.0	41.0	10.1

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 41.0
Rock Cored (ft) -
Samples S11

Boring No. HA11-B10

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 REV HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\FIELD DATA\-006\35571-006_TB.GPJ 6 Jul 11

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA11-B10

File No. 35571-006

Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	4 6 3 3	S7 18	19.0 21.0	ML		Loose dark olive-gray sandy SILT (ML), mps 0.1 mm, occasional partings, no odor, wet					35	65	R	L	N	L
						-ESTUARINE DEPOSITS-										
25	3 1 1 2	S8 24	24.0 26.0	ML		Very loose dark olive-gray SILT with sand (ML), mps 0.1 mm, occasional partings, no odor, wet					15	85	R	L	N	L
					-8.0 28.0	-GLACIOLACUSTRINE DEPOSITS-										
30	4 3 13 24	S9 24	29.0 31.0	ML	-10.0 30.0	Loose yellow-brown with irregular orange-brown iron-staining SILT (ML), mps 2 mm, no structure except abrupt change in sand content at 30.0 ft, no odor, wet						100	R	L	N	L
				SM		Medium dense yellow-brown silty SAND with gravel (SM), mps 2.5 in., interbedded, no odor, wet		15	10	10	20	45				
					-12.5 32.5	-GLACIOFLUVIAL DEPOSITS-										
35	39 9 8 8	S10 5	34.0 36.0	SW		Medium dense olive-brown well-graded SAND with gravel (SW), mps 2.5 cm, no structure, no odor, wet	10	10	30	25	25					
						-GLACIAL OUTWASH-										
40	20 28 19 14	S11 10	39.0 41.0	SW		Similar to above except dense	10	10	30	25	25					
					-21.0 41.0	BOTTOM OF EXPLORATION 41.0 FT										

*indicates 3-in. spoon and 300-lb hammer used.

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 REV HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\FIELD DATA\-006\35571-006_TB.GPJ 6 Jul 11

HALEY & ALDRICH — TEST BORING REPORT

Boring No. HA11-B11 (OW)

Project	PROPOSED QUINCY CENTER REDEVELOPMENT, QUINCY, MA
Client	HANCOCK ADAMS ASSOCIATES, LLC
Contractor	GEOLOGIC-EARTH EXPLORATION, INC.

File No.	35571-006
Sheet No.	1 of 2
Start	12 May 2011
Finish	13 May 2011
Driller	J. Galvin
H&A Rep.	S. Shay
Elevation	18.7 (est.)
Datum	NAVD 1988
Location	See Plan

	Casing	Sampler	Barrel
Type	HW	S	-
Inside Diameter (in.)	4	1 3/8	-
Hammer Weight (lb)	300	140	-
Hammer Fall (in.)	24	30	-

Drilling Equipment and Procedures

Rig Make & Model: Mobile B-57 Drill Truck
Bit Type: Roller Bit
Drill Mud: None
Casing: HW Driven to 44.0 ft
Hoist/Hammer: Winch Doughnut Hammer
PID Make & Model: MiniRAE 2000 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	9	S1	0.0	SM	18.2	Dark brown silty SAND (SM) PID = 0.0/0.0 ppm			10	30	30	30				
	12 11 20	S1A	0.5 0.5 2.0	SP	0.5	Medium dense yellow-brown poorly graded SAND with gravel (SP), mps 2.5 cm, no structure, no odor, moist PID = 0.0/0.0 ppm	10	10	15	40	20	5				
	20 11 10 18	S2	2.0 4.0	SP		Similar to above -GRANULAR FILL-										
5	24 23 4 5	S3	4.0 6.0	GP		Medium dense yellow-brown poorly graded GRAVEL with sand (GP), mps 3 cm, no structure, no odor, wet PID = 0.0/0.0 ppm	20	40	20	15	5					
	10 13 10 8	S4	6.0 8.0	SP	12.7 6.0	Medium dense olive-brown poorly graded SAND (SP), mps 2 mm, stratified, no odor although 5% organic fibers, wet, frequent dark brown seams PID = 0.0/0.2 ppm				15	80	5				
	12 18 10 13	S5 20	8.0 10.0	SP-SM		Medium dense olive-gray with occasional dark brown seams poorly graded SAND with sorting and silty SAND (SP-SM), mps 4 mm, interbedded, well stratified, no odor, wet PID = 0.0/0.2 ppm			20	50	20	10				
10						-ESTUARINE DEPOSITS-										
					6.7 12.0											
15	6 8 8 8	S6 19	14.0 16.0	SP		Medium dense olive-brown poorly graded SAND (SP), mps 2 mm, stratified, no odor, wet PID = 0.0/0.0 ppm				40	55	5				
20	6 5 6 6	S7 20	19.0 21.0	SP		Similar to above PID = 0.0/0.0 ppm				40	55	5				

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
5/13/11	0430	17	44.0	46.0	6.4
5/24/11					8.0
6/3/11	1630				8.3

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	46.0
Rock Cored (ft)	-
Samples	S12

Boring No. HA11-B11 (OW)

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 REV HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\FIELD DATA\-006\35571-006_TB.GPJ 6 Jul 11

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA11-B11 (OW)
File No. 35571-006
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
							-ESTUARINE DEPOSITS-										
25	6 4 7 8	S8 9	24.0 26.0	SP			Medium dense dark olive-gray poorly graded SAND (SP), mps 1 mm, weak stratification , no odor, wet				5	90	5				
						-8.8 27.5											
30	2 2 1 1	S9	29.0 31.0	ML			Very loose dark olive-gray SILT (ML), mps <0.1 mm, occasional varves, no odor, wet						100	R	L	N	N
							-GLACIOLACUSTRINE DEPOSITS-										
35	2 1 1 1	S10 24	34.0 36.0	ML			Very loose yellow-brown SILT (ML), mps <0.2 mm, no structure except irregular oxidation staining throughout, no odor, wet						100	N	L	N	N
40	4 4 7 13	S11 14	39.0 41.0	ML			Similar to above except medium dense										
				SM		-21.8 40.5	Medium dense yellow-brown with orange-brown mottling silty SAND (SM), mps 2.8 cm as single rounded gravel piece	5			5	75	15				
							-GLACIOFLUVIAL DEPOSITS-										
						-24.3 43.0											
45	21 11 9 5	S12 4	44.0 46.0	SW			Medium dense olive-brown well-graded SAND with gravel (SW), mps 2 cm, no structure, no odor, wet		15	25	25	35					
						-27.3 46.0	BOTTOM OF EXPLORATION 46.0 FT										

Note: Installed observation well only. Pulled casing back to 24.0 ft. Borehole had collapsed to 40.0 ft. Continued with well construction.

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 REV HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\FIELD DATA\-006\35571-006_TB.GPJ 6 Jul 11

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. HA11-B11 (OW)
Boring No. HA11-B11 (OW)

Project PROPOSED QUINCY CENTER REDEVELOPMENT
Location QUINCY, MA
Client HANCOCK ADAMS ASSOCIATES, LLC
Contractor GEOLOGIC-EARTH EXPLORATION, INC.
Driller J. Galvin

Initial Water Level (depth bgs) 8.3 ft

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

File No. 35571-006
Date Installed 13 May 2011
H&A Rep. S. Shay
Location See Plan

Ground El. 18.7 (est.)
Datum NAVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	18.7
GRANULAR FILL	0.5			0.5	18.2
				2.0	16.7
				4.0	14.7
	6.0			5.0	13.7
				15.0	3.7
				16.0	2.7
ESTUARINE DEPOSITS	27.5				
GLACIOLACUSTRINE DEPOSITS (ML)	40.5			40.0	-21.3
GLACIOFLUVIAL DEPOSITS	46.0			46.0	-27.3

WELL CONSTRUCTION DETAILS

Type of protective cover _____

Depth of below ground surface 0.0 ft

Depth of top of riser below ground surface 0.0 ft

Type of protective casing _____

Length _____

Inside diameter _____

Depth of bottom of ft

Type of riser pipe Schedule 40 PVC

Inside diameter of riser pipe 2.0 in.

Depth of bottom of riser pipe 5.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	0.5
Bentonite	2.0	2.0
Bentonite	16.0	24.0

Diameter of borehole 4.5 in.

Depth to top of well screen 5.0 ft

Type of screen Machine slotted Sch 40 PVC

Screen gauge or size of openings 0.010 in.

Diameter of screen 2.0 in.

Type of Backfill around Screen #0 Filter Sand

Depth to bottom of well screen 15.0 ft

Bottom of silt trap -

Depth of bottom of borehole 46.0 ft

COMMENTS: Borehole collapsed from 40.0 to 46.0 ft.

GW INSTALLATION REPORT-07-1 HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\FIELD DATA\-006\35571-006_TB.GPJ 6 Jul 11

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA11-B12

Project	PROPOSED QUINCY CENTER REDEVELOPMENT, QUINCY, MA
Client	HANCOCK ADAMS ASSOCIATES, LLC
Contractor	GEOLOGIC-EARTH EXPLORATION, INC.

File No.	35571-006
Sheet No.	1 of 2
Start	24 May 2011
Finish	24 May 2011
Driller	J. Galvin
H&A Rep.	M. Dodson
Elevation	24.0 (est.)
Datum	NAVD 1988
Location	See Plan

	Casing	Sampler	Barrel
Type	HW	S	-
Inside Diameter (in.)	4	1 3/8	-
Hammer Weight (lb)	300	140	-
Hammer Fall (in.)	24	30	-

Drilling Equipment and Procedures

Rig Make & Model: Mobile B-57 Drill Truck
Bit Type: Roller Bit
Drill Mud: None
Casing: HW Driven to 19.0 ft
Hoist/Hammer: Winch Doughnut Hammer
PID Make & Model: MiniRAE 2000 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					23.6	-CONCRETE SIDEWALK-										
	16	S1 7	0.5 1.5	SP-SM	0.4	Medium dense gray-brown to yellow-brown poorly graded SAND with silt (SP-SM), mps 1.0 in., layered, no odor, moist, 5% cinders and ash, 5% brick specks and fragments PID = 0.0/0.0 ppm	5	5	10	30	40	10				
	5 2 6 25	S2 12	2.0 4.0	SM		Loose dark gray-brown with silty SAND with gravel (SM), mps 1.2 in., no structure, no odor, moist, trace cinders, ash, brick specks PID = 0.0/0.0 ppm	5	10	25	20	20	20				
	29 55 31 20	S3 11	4.0 6.0	SM		Similar to above except very dense PID = 0.0/0.0 ppm	15	15	15	15	25	15				
5						-MISCELLANEOUS FILL-										
	29 104 100 96	S4 16	6.0 8.0	SW-SM		Very dense light gray-brown well-graded SAND with silt and gravel (SW-SM), mps 1.375 in., layered, moderate naphthalene-like odor, moist, one, 2-in. layer of black asphalt-like material PID = 5.1/0.0 ppm	20	20	15	15	20	10				
	8 12 16 26	S5 10	8.0 10.0	SW-SM/OL/OH	16.0 8.0	Similar to above except disturbed/interbedded with dark gray-black sandy ORGANIC SOIL (OL/OH), no odor, moist, trace shell specks PID = 0.0/0.0 ppm	15	20	15	10	10	30				
10	19 27 17 16	S6 14	10.0 12.0	SW-SM/OL/OH	12.5 11.5	Similar to above except bottom of recovery is fine to medium sand PID = 0.0/0.0 ppm	10	20	15	10	15	30				
	17 25 50 66	S7 15	12.0 14.0	SW-SM		Very dense gray well-graded SAND with silt and gravel (SW-SM), mps 1.3 in., weakly layered, no odor, moist PID = 0.0/0.0 ppm	10	35	15	15	15	10				
						-ESTUARINE DEPOSITS-										
	39 21	S8 10	14.0 15.0	SW-SM	9.0	Similar to above except occasional organic material	10	35	15	15	15	10				
15	19 17	S8A 3	15.0 16.0	SP	15.0	Dense gray poorly graded SAND (SP), mps 0.5 in., stratified, no odor, wet, occasionally silty or with silt PID = 0.0/0.0 ppm		5	5	15	70	5				
	15 19 19 21	S9 15	16.0 18.0	SP		Similar to above except mps 3 mm PID = 0.0/0.0 ppm			5	5	85	5				

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
5/24/11	1355	0.25	Pulled	14.7	14.2

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	46.0
Rock Cored (ft)	-
Samples	S15

Boring No. HA11-B12

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 REV HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\FIELD DATA\-006\35571-006_TB.GPJ 6 Jul 11

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TEST BORING REPORT

Boring No. HA11-B12
File No. 35571-006
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	6 8 9 14	S10 14	19.0 21.0	SP		Medium dense light gray to oxidized red-yellow poorly graded SAND (SP), mps 4 mm, weakly stratified/layered, no odor, wet			5	15	75	5				
						-ESTUARINE DEPOSITS-										
					1.5 22.5											
25	4 5 6 9	S11 16	24.0 26.0	SM/ SP		Medium dense gray-brown to light olive-brown silty SAND (SM) interbedded with poorly graded SAND (SP), occasional trace organics, no odor, wet				10	65 85	35 5				
					-3.5 27.5											
30	3 2 2 2	S12 21	29.0 31.0	SM		Loose gray-brown to yellow-brown silty SAND (SM), mps 1 mm, bedded, no odor, wet					60	40				
						-GLACIOLACUSTRINE DEPOSITS-										
35	2 2 2 2	S13 24	34.0 36.0	EH		Soft yellow elastic SILT (EH), mps <1 mm, laminated/bedded, no odor, wet, frequent partings					10	90				
					-13.0 37.0											
40	12 13 15 17	S14 15	39.0 41.0	SW		Medium dense brown poorly to well-graded SAND (SW), mps 0.6 in., occasionally with gravel, layered, no odor, wet		10	25	40	20	5				
						-GLACIOFLUVIAL DEPOSITS-										
45	16 23 25 25	S15 9	44.0 46.0	SW		Similar to above except dense, mps 0.8 in.		10	35	30	20	5				
					-22.0 46.0	BOTTOM OF EXPLORATION 46.0 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA11-B12

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA11-B13 (OW)

Project	PROPOSED QUINCY CENTER REDEVELOPMENT, QUINCY, MA
Client	HANCOCK ADAMS ASSOCIATES, LLC
Contractor	GEOLOGIC-EARTH EXPLORATION, INC.

File No.	35571-006
Sheet No.	1 of 2
Start	31 May 2011
Finish	31 May 2011
Driller	C. O'Donnell
H&A Rep.	C. Toscano
Elevation	22.5 (est.)
Datum	NAVD 1988
Location	See Plan

	Casing	Sampler	Barrel
Type	HW/PW	S	-
Inside Diameter (in.)	4/5	1 3/8	-
Hammer Weight (lb)	300	140	-
Hammer Fall (in.)	24	30	-

Drilling Equipment and Procedures

Rig Make & Model: Mobile B-57 Drill Truck
Bit Type: Roller Bit
Drill Mud: None
Casing: PW Driven to 15.0 ft; HW Driven to 29.0 ft
Hoist/Hammer: Winch Doughnut Hammer
PID Make & Model: MiniRAE 2000 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					22.3	-BITUMINOUS ASPHALT-										
					0.3 / 22.0	-GRAVEL SUB-BASE-										
					0.5											
	18 14 14 16	S1 15	2.0 4.0	SP		Medium dense light to dark brown poorly graded SAND with gravel (SP), mps 25 mm, no odor, dry PID = 0.0/0.0 ppm	5	10		50	30	5				
						-GRANULAR FILL-										
	14 12 8 9	S2 5	4.0 6.0	SP		Similar to above										
5					17.5											
				SP-SM	5.0	Medium dense dark brown poorly graded SAND with silt (SP-SM), mps 15 mm, no odor, wet PID = 0.0/0.0 ppm		5		45	40	10				
	12 16 13 14	S3 12	6.0 8.0	SP	16.5 / 6.0	-ESTUARINE DEPOSITS-			5	50	45					
						Medium dense brown poorly graded SAND (SP), mps 5 mm, no odor, wet PID = 0.0/0.0 ppm										
						-TRANSITION ZONE-										
10	9 8 7 7	NR 0	9.0 11.0			Note: No recovery on first attempt from 9.0 to 11.0 ft. Overdrove with 3-in. spoon to obtain sample S4 from 11.0 to 13.0 ft.										
					11.5 / 11.0											
	4 4 4 6	S4* 8	11.0 13.0	SW		Loose gray-brown well-graded SAND with gravel (SW), mps 30 mm, no odor, moist	10	5	15	40	30					
						Note: Having trouble cleaning out casing due to gravel and common cobbles from 12.0 to 14.0 ft.										
15	16 16 14 12	S5 14	14.0 16.0	SP		Medium dense light brown poorly graded SAND (SP), mps 30 mm, no odor, wet	5	5	10	50	30					
						-GLACIOFLUVIAL DEPOSITS-										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
5/31/11	1400	0.5	29.0	41.0	7.5
6/3/11	1540				13.2

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	41.0
Rock Cored (ft)	-
Samples	S10

Boring No. HA11-B13 (OW)

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 REV HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\FIELD DATA\-006\35571-006_TB.GPJ 6 Jul 11

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA11-B13 (OW)

File No. 35571-006
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	20 16 16 16	S6 12	19.0 21.0	SP			Dense light brown to yellow-brown poorly graded SAND (SP), mps 5 mm, no odor, moist, trace coarse to fine gravel			5	55	40					
25	18 17 16 17	S7 16	24.0 26.0	SP			Similar to above except gray-brown										
							-GLACIOFLUVIAL DEPOSITS-										
30	10 15 16 19	S8 15	29.0 31.0	SP			Dense light brown poorly graded SAND (SP) with occasional layers of coarse to medium sand, mps 5 mm, no odor, wet			5	85	10					
35	15 18 19 19	S9 12	34.0 36.0	SP			Similar to above except with frequent interbedded layers of coarse to medium sand			5	85	10					
40	19 24 27 33	S10 15	39.0 41.0	SP			Similar to above except very dense and gray-brown			5	85	10					
						-18.5 41.0	BOTTOM OF EXPLORATION 41.0 FT										

*indicates 3-in. spoon and 300-lb hammer used.

Note: Installed groundwater observation well to 20.0 ft; screen 5.0 to 20.0 ft.

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA11-B13 (OW)

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. HA11-B13 (OW)
Boring No. HA11-B13 (OW)

Project PROPOSED QUINCY CENTER REDEVELOPMENT
Location QUINCY, MA
Client HANCOCK ADAMS ASSOCIATES, LLC
Contractor GEOLOGIC-EARTH EXPLORATION, INC.
Driller C. O'Donnell
Initial Water Level (depth bgs) 13.2 ft

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 35571-006
Date Installed 31 May 2011
H&A Rep. C. Toscano
Location See Plan

Ground El. 22.5 (est.)
Datum NAVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	22.5
BITUMINOUS ASPHALT	0.3				
GRAVEL SUB-BASE	0.5			1.0	21.5
GRANULAR FILL				3.0	19.5
				4.0	18.5
				5.0	17.5
ESTUARINE DEPOSITS	5.0				
	6.0				
				20.0	2.5
				24.0	-1.5
GLACIOFLUVIAL DEPOSITS					
	41.0			41.0	-18.5

WELL CONSTRUCTION DETAILS

Type of protective cover: Bolted Cover
Depth of Steel Road Box below ground surface: 0.0 ft
Depth of top of riser below ground surface: 0.3 ft
Type of protective casing: Steel Road Box
- Length: 0.9 ft
- Inside diameter: 4.0 in.
- Depth of bottom of Steel Road Box: 0.9 ft

Type of riser pipe: Schedule 40 PVC
- Inside diameter of riser pipe: 2.0 in.
- Depth of bottom of riser pipe: 5.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	1.0
Bentonite	3.0	1.0
	-	-

Diameter of borehole: 4.5 in.
Depth to top of well screen: 5.0 ft
- Type of screen: Machine slotted Sch 40 PVC
- Screen gauge or size of openings: 0.010 in.
- Diameter of screen: 2.0 in.
- Type of Backfill around Screen: Filter Sand
- Depth to bottom of well screen: 20.0 ft

Bottom of silt trap: -
Depth of bottom of borehole: 41.0 ft

GW INSTALLATION REPORT-07-1 HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\FIELD DATA\-006\35571-006_TB.GPJ 6 Jul 11

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA11-B21 (OW)

Project PROPOSED QUINCY CENTER REDEVELOPMENT, QUINCY, MA
Client HANCOCK ADAMS ASSOCIATES, LLC
Contractor GEOLOGIC-EARTH EXPLORATION, INC.

File No. 35571-006
Sheet No. 1 of 3
Start 12 May 2011
Finish 13 May 2011
Driller C. O'Donnell
H&A Rep. C. Toscano
Elevation 28.0 (est.)
Datum NAVD 1988
Location See Plan

	Casing	Sampler	Barrel
Type	HW / PW	S	-
Inside Diameter (in.)	4 / 5	1 3/8	-
Hammer Weight (lb)	300	140	-
Hammer Fall (in.)	24	30	-

Drilling Equipment and Procedures

Rig Make & Model: Mobile B-57 Drill Truck
Bit Type: Roller Bit
Drill Mud: None
Casing: PW Driven to 10.0 ft; HW Driven to 24.0 ft
Hoist/Hammer: Winch Doughnut Hammer
PID Make & Model: MiniRAE 2000 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					27.7 / 0.3	-CONCRETE SIDEWALK-										
					27.5 / 0.5	-GRAVEL SUB-BASE-										
					26.0 / 2.0	-GRANULAR FILL-										
	19* 10 21 23	S1 12	2.0 4.0	ML		Dense yellow-brown sandy SILT (ML), mps 25 mm, well bonded, no odor, dry PID = 0.0/0.0 ppm	5	5	5	10	10	65				
5	36 36 41 50/0"	S2 8	4.0 5.5	SM		Very dense yellow-brown silty SAND with gravel (SM), mps 25 mm, well bonded, no odor, moist, cobbles likely present PID = 0.0/0.0 ppm	5	10	5	10	25	45				
						Note: Drill action indicated dense Glacial Till with occasional cobbles from 5.0 to 9.0 ft.										
	76 100	S3 8	9.0 10.0	ML		Similar to S1, cobbles likely present Note: Drove PW casing to 10.0 ft.	5	10	5	10	25	45				
10						-GLACIAL TILL-										
						Note: Drill action indicated dense Glacial Till with common cobbles from 10.0 to 14.0 ft.										
	41 100/0"	S4 10	14.0 15.0	ML		Similar to S1 except gray-brown, cobbles likely present	5	5	5	10	15	60				
15																
						Note: Drill action indicated common cobbles and very dense Glacial Till from 15.0 to 19.0 ft.										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
5/13/11	0730	16	10.0	24.0	4.5
5/20/11					12.5
6/3/11	1645				12.6

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 48.0
Rock Cored (ft) -
Samples S11

Boring No. HA11-B21 (OW)

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 REV HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\FIELD DATA\-006\35571-006_TB.GPJ 6 Jul 11

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA11-B21 (OW)

File No. 35571-006
Sheet No. 2 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	38 68 100/6"	S5 9	19.0 20.5	ML			Very dense olive-brown sandy SILT with gravel (ML), mps 25 mm, well bonded, no odor, moist, cobbles present	5	10	5	5	15	60				
							Note: Numerous cobbles from 19.0 to 21.0 ft.										
							Note: Encountered boulder from 21.0 to 23.5 ft.										
25	22 71 100/6"	S6 6	24.0 25.5	ML			Similar to above	10	5		5	20	60				
							-GLACIAL TILL-										
							Note: Common cobbles from 25.0 to 29.0 ft.										
30	85 25*	S7 6	29.0 30.0	ML			Very dense yellow-brown sandy SILT with gravel (ML), mps 1.25 in., well bonded, no odor, moist, cobbles present	20			10	10	60				
35	69 100/6"	S8 12	34.0 35.0	ML			Similar to above	10	5	5	10	15	55				
							Note: Common cobbles from 35.0 to 39.0 ft.										
40	35 90 100/2"	S9 12	39.0 40.2	ML			Similar to S7 except with frequent pockets silty sand	5	10	5	5	10	65				
							Note: Common cobbles from 40.0 to 44.0 ft.										
45	70 25*	S10 5	44.0 45.0	ML			Similar to S7 except olive-brown	5	10	5	10	15	55				

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA11-B21 (OW)

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. HA11-B21 (OW)
Boring No. HA11-B21 (OW)

Project PROPOSED QUINCY CENTER REDEVELOPMENT
Location QUINCY, MA
Client HANCOCK ADAMS ASSOCIATES, LLC
Contractor GEOLOGIC-EARTH EXPLORATION, INC.
Driller C. O'Donnell

Initial Water Level (depth bgs) 12.6 ft

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

File No. 35571-006
Date Installed 13 May 2011
H&A Rep. C. Toscano
Location See Plan

Ground El. 28.0 (est.)
Datum NAVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	28.0
CONCRETE SIDEWALK	0.3			1.0	27.0
GRAVEL	0.5			2.0	26.0
SUB-BASE	2.0			3.0	25.0
GRANULAR FILL				5.0	23.0
				20.0	8.0
GLACIAL TILL				48.0	-20.0

0, 5, 10, 15, 20, 25, 30, 35, 40, 45

48.0

WELL CONSTRUCTION DETAILS

Type of protective cover: Bolted Cover
Depth of Alum. Road Box below ground surface: 0.0 ft
Depth of top of riser below ground surface: 0.3 ft
Type of protective casing: Alum. Road Box
Length: 0.9 ft
Inside diameter: 6.0 in.
Depth of bottom of Alum. Road Box: 0.9 ft
Type of riser pipe: Schedule 40 PVC
Inside diameter of riser pipe: 2.0 in.
Depth of bottom of riser pipe: 5.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	1.0
Bentonite	2.0	1.0
	-	-

Diameter of borehole: *
Depth to top of well screen: 5.0 ft
Type of screen: Machine slotted Sch 40 PVC
Screen gauge or size of openings: 0.010 in.
Diameter of screen: 2.0 in.
Type of Backfill around Screen: Filter Sand
Depth to bottom of well screen: 20.0 ft
Bottom of silt trap: -
Depth of bottom of borehole: 48.0 ft

COMMENTS: *5.5 in. from 0.0 to 10.0 ft; 4.5 in. from 10.0 to 47.0 ft

GW INSTALLATION REPORT-07-1 HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\FIELD DATA\-006\35571-006_TB.GPJ 6 Jul 11

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-3

Project	QUINCY CENTER SUBSURFACE INVESTIGATION, QUINCY, MASSACHUSETTS
Client	STREET-WORKS
Contractor	NEW HAMPSHIRE BORING, INC.

File No. 35571-000
Sheet No. 1 of 2
Start 26 June 2008
Finish 26 June 2008
Driller P. Labossiere
H&A Rep. O. Lawlor
Elevation 22.0 (est.)
Datum NAVD 1988
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	Auger	S	-	Rig Make & Model: B-57 Mobile Truck
Inside Diameter (in.)	2.25	1 3/8	-	Bit Type: Cutting Head Drill Mud: None
Hammer Weight (lb)	Spin	140	-	Casing: Auger
Hammer Fall (in.)	-	30	-	Hoist/Hammer: Cat-Head Doughnut Hammer PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	5 24 32 32	S1 18	0.0 2.0		SM	Very dense brown silty SAND with gravel (SM), mps 0.5 in., no structure, no odor, dry -FILL-	5	10	20	25	30	15				
5	20 31 15 6	S2 8	5.0 7.0	15.5 6.5	SW	Dense brown well graded SAND with gravel (SW), trace brick, mps 0.25 in., no structure, no odor, dry	5	10	30	25	30					
					ML	Medium stiff dark brown SILT (ML), mps 4.0 mm, no structure, no odor, moist -FILL-						100				
10	2 2 2 16	S3 4	10.0 12.0	8.0 14.0	ML	Very loose dark brown sandy SILT with gravel (ML), mps 0.25 in., no structure, no odor, moist		15	10	10	10	55				
15	18 14 53 48	S4 22	15.0 17.0		SP	Very dense gray poorly graded SAND (SP), mps 0.25 in., no structure, no odor, wet NOTE: Mottled at approximately at 16.8 ft. -GLACIOFLUVIAL DEPOSITS-		5	35	40	20					
20	6 8 8 8	S5 23	20.0 22.0		SW	Medium dense mottled red brown well graded SAND (SW), mps 4 mm, no structure, no odor, wet			35	40	25					

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
6/26/08		0.0	-	-	14.0

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 27.0
Rock Cored (ft) -
Samples S5

Boring No. HA08-3

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\000 - INITIAL STUDY 2008\FIELD DATA\35571-000TB.GPJ 15 Jul 11

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-3

File No. 35571-000

Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
						-GLACIOFLUVIAL DEPOSITS-										
25						NOTE: Unable to obtain sample at 25.0 ft due to 3.0 ft of running sands.										
				-5.0 27.0		BOTTOM OF EXPLORATION 27.0 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

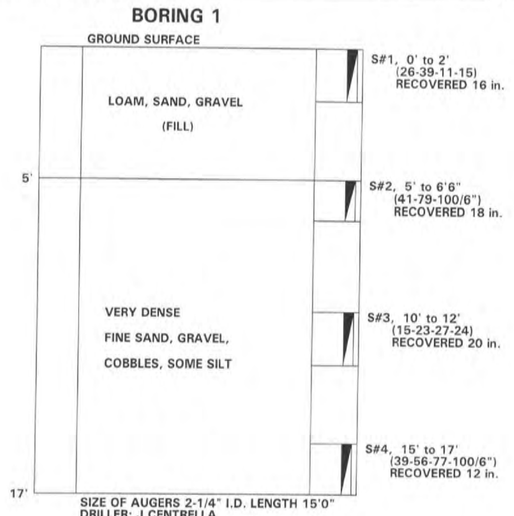
Boring No. HA08-3

Carr-Dee Corp.
2010 Test Borings

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500
To: J.DERENZO CO. 338 HOWARD STREET, BROCKTON, MA Date: 12-15-2010 Job No.: 2010-176
Location: REVERE ROAD, QUINCY, MA Scale: 1 in. = 4 ft.

BORING 1



SIZE OF AUGERS 2-1/4" I.D. LENGTH 15'0"
DRILLER: J.CENTRELLA
DATE STARTED & COMPLETED 12-15-2010

NOTE: NO WATER ENCOUNTERED

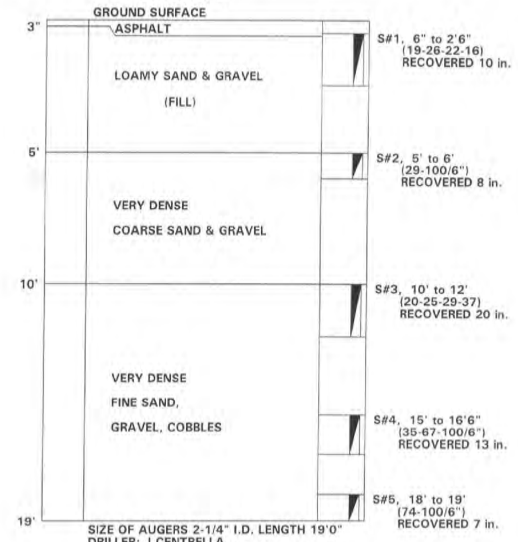
All samples have been visually classified by 1RILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

Sheet 1 of 1

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500
To: J.DERENZO CO. 338 HOWARD STREET, BROCKTON, MA Date: 12-15-2010 Job No.: 2010-176
Location: REVERE ROAD, QUINCY, MA Scale: 1 in. = 4 ft.

BORING 2



SIZE OF AUGERS 2-1/4" I.D. LENGTH 19'0"
DRILLER: J.CENTRELLA
DATE STARTED & COMPLETED 12-15-2010

NOTE: NO WATER ENCOUNTERED

NOTE: AUGER REFUSAL @ 19'FT

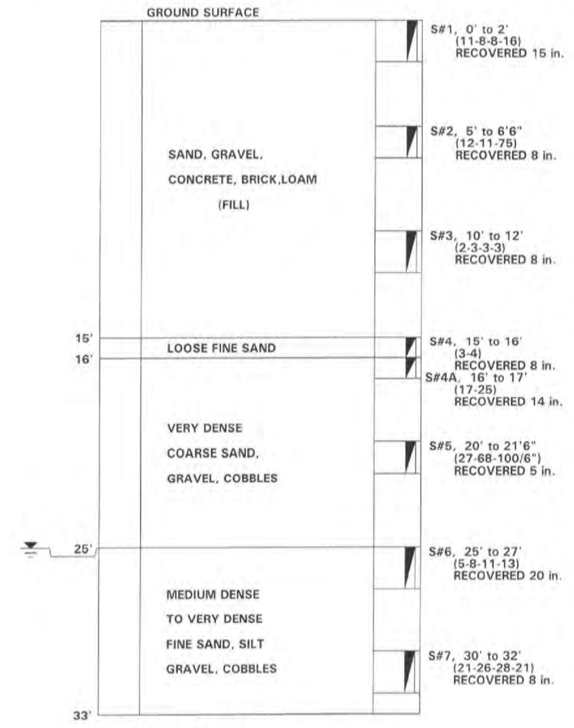
All samples have been visually classified by 1RILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

Sheet 1 of 1

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500
To: J.DERENZO CO. 338 HOWARD STREET, BROCKTON, MA Date: 12-15-2010 Job No.: 2010-176
Location: REVERE ROAD, QUINCY, MA Scale: 1 in. = 5 ft.

BORING 3



WATER LEVEL 25'
SIZE OF AUGERS 2-1/4" I.D. LENGTH 30'0"
DRILLER: J.CENTRELLA
DATE STARTED & COMPLETED 12-13-14-2010

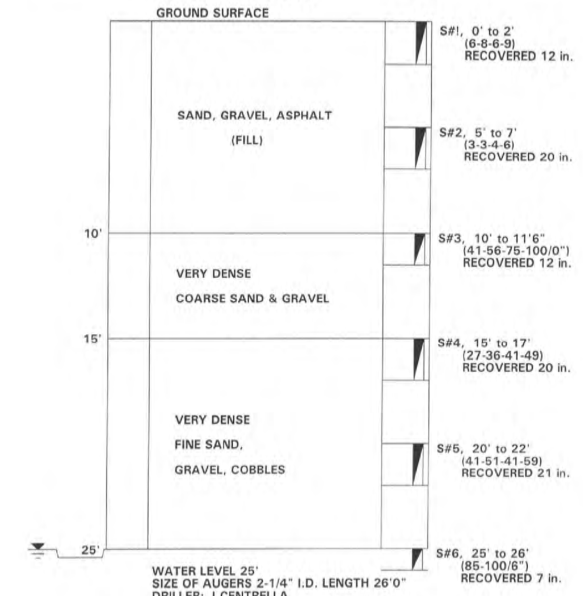
All samples have been visually classified by 1RILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

Sheet 1 of 1

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500
To: J.DERENZO CO. 338 HOWARD STREET, BROCKTON, MA Date: 12-15-2010 Job No.: 2010-176
Location: REVERE ROAD, QUINCY, MA Scale: 1 in. = 5 ft.

BORING 3-A



WATER LEVEL 25'
SIZE OF AUGERS 2-1/4" I.D. LENGTH 26'0"
DRILLER: J.CENTRELLA
DATE STARTED & COMPLETED 12-14-2010

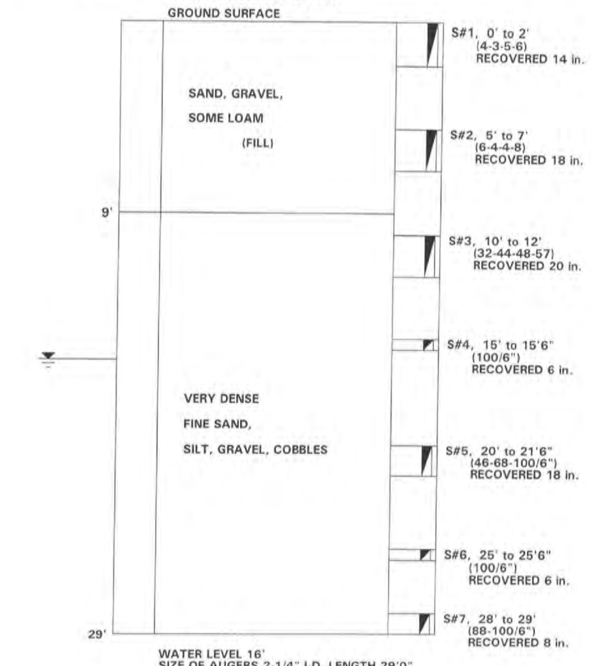
All samples have been visually classified by 1RILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

Sheet 1 of 1

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500
To: J.DERENZO CO. 338 HOWARD STREET, BROCKTON, MA Date: 12-15-2010 Job No.: 2010-176
Location: REVERE ROAD, QUINCY, MA Scale: 1 in. = 5 ft.

BORING 3-AA



WATER LEVEL 16'
SIZE OF AUGERS 2-1/4" I.D. LENGTH 29'0"
DRILLER: J.CENTRELLA
DATE STARTED & COMPLETED 12-15-2010

NOTE: AUGER REFUSAL @ 29'FT

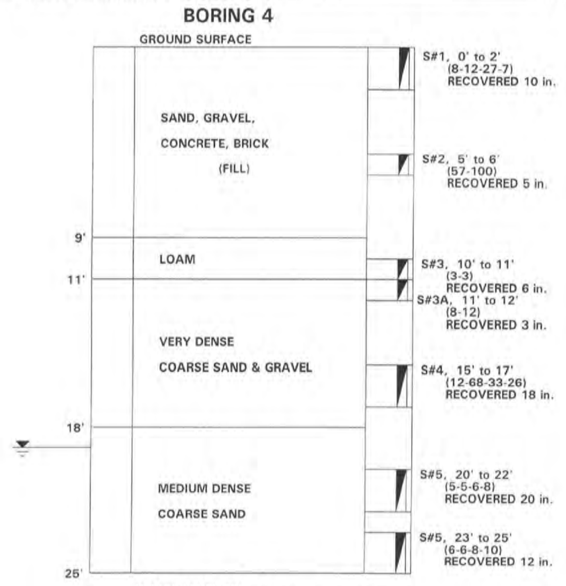
All samples have been visually classified by 1RILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

Sheet 1 of 1

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500
To: J.DERENZO CO. 338 HOWARD STREET, BROCKTON, MA Date: 12-15-2010 Job No.: 2010-176
Location: REVERE ROAD, QUINCY, MA Scale: 1 in. = 5 ft.

BORING 4



WATER LEVEL 19'
SIZE OF AUGERS 2-1/4" I.D. LENGTH 23'0"
DRILLER: J.CENTRELLA
DATE STARTED & COMPLETED 12-13-2010

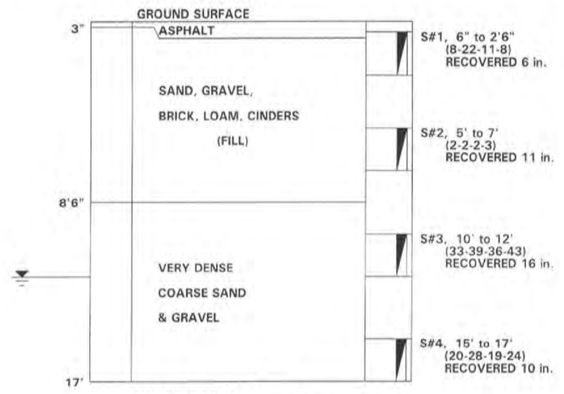
All samples have been visually classified by 1RILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

Sheet 1 of 1

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500
To: J.DERENZO CO. 338 HOWARD STREET, BROCKTON, MA Date: 12-15-2010 Job No.: 2010-176
Location: REVERE ROAD, QUINCY, MA Scale: 1 in. = 5 ft.

BORING 5



WATER LEVEL 12'
SIZE OF AUGERS 2-1/4" I.D. LENGTH 15'0"
DRILLER: J.CENTRELLA
DATE STARTED & COMPLETED 12-13-2010

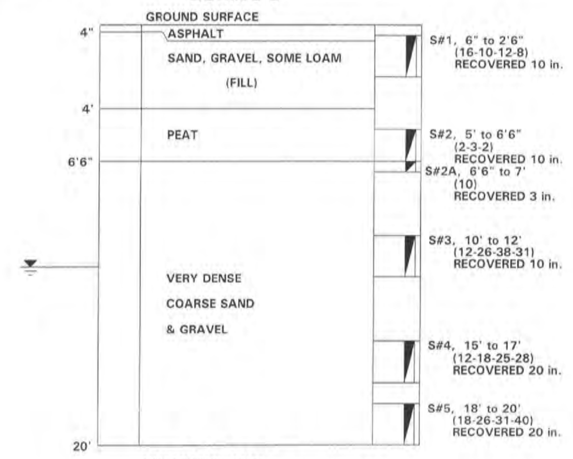
All samples have been visually classified by 1RILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

Sheet 1 of 1

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500
To: J.DERENZO CO. 338 HOWARD STREET, BROCKTON, MA Date: 12-15-2010 Job No.: 2010-176
Location: REVERE ROAD, QUINCY, MA Scale: 1 in. = 5 ft.

BORING 6



WATER LEVEL 11'6"
SIZE OF AUGERS 2-1/4" I.D. LENGTH 18'0"
DRILLER: J.CENTRELLA
DATE STARTED & COMPLETED 12-10-2010

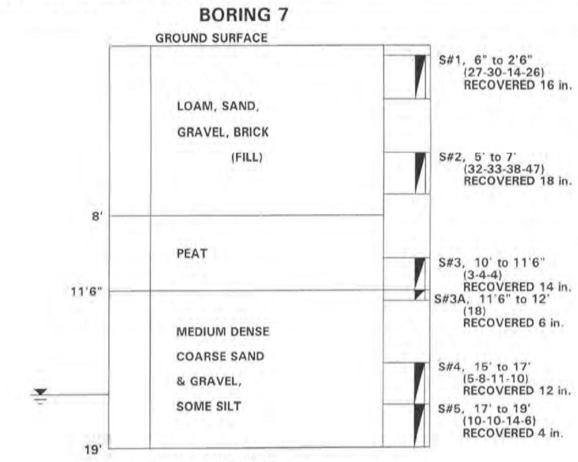
All samples have been visually classified by 1RILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

Sheet 1 of 1

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500
To: J.DERENZO CO. 338 HOWARD STREET, BROCKTON, MA Date: 12-15-2010 Job No.: 2010-176
Location: REVERE ROAD, QUINCY, MA Scale: 1 in. = 5 ft.

BORING 7



WATER LEVEL 16'6"
SIZE OF AUGERS 2-1/4" I.D. LENGTH 15'0"
DRILLER: J.CENTRELLA
DATE STARTED & COMPLETED 12-10-2010

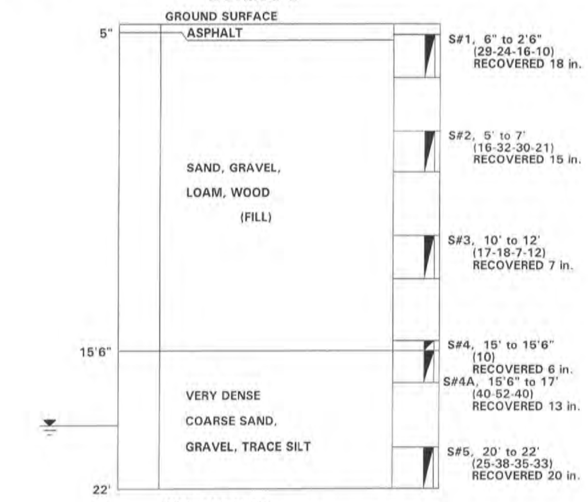
All samples have been visually classified by 1RILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

Sheet 1 of 1

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone (781) 391-4500
To: J.DERENZO CO. 338 HOWARD STREET, BROCKTON, MA Date: 12-15-2010 Job No.: 2010-176
Location: REVERE ROAD, QUINCY, MA Scale: 1 in. = 5 ft.

BORING 8



WATER LEVEL 19'
SIZE OF AUGERS 2-1/4" I.D. LENGTH 20'0"
DRILLER: J.CENTRELLA
DATE STARTED & COMPLETED 12-10-2010

All samples have been visually classified by 1RILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

Sheet 1 of 1

HALEY & ALDRICH — TEST BORING REPORT

Boring No. SDG-1(OW)

Project QUINCY CENTER REDEVELOPMENT, QUINCY, MA
Client HANCOCK ADAMS ASSOCIATES, LLC
Contractor GEOLOGIC-EARTH EXPLORATION, INC.

File No. 35571-005
Sheet No. 1 of 2
Start 20 April 2011
Finish 20 April 2011
Driller J. Galvin
H&A Rep. D. Warren
Elevation 17.9
Datum NAVD 1988
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model:
Inside Diameter (in.)	4	1 3/8	-	Bit Type: / Drill Mud:
Hammer Weight (lb)	300	140	-	Casing: HW Driven / Hoist/Hammer:
Hammer Fall (in.)	24	30	-	PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0					17.4 / 0.5	-BLACK BITUMINOUS ASPHALT-										
	9 12 16 22	S1 9	0.5 2.5	SM		Medium dense brown silty SAND with gravel (SM), mps 1.5 in., no structure, no odor, moist PID = 0.0/0.0 ppm	5	15	5	10	50	15				
	5 2 2	S2 4	2.5 4.0	SW-SM		Loose brown well-graded SAND with silt and gravel (SW-SM), mps 1.5 in., no structure, no odor, moist, trace brick and concrete fragments PID = 0.0/0.0 ppm	10	25	15	25	15	10				
5	12 15 13 12	S3 8	4.0 6.0	SM		Medium dense gray-brown silty SAND with gravel (SM), mps 1.5 in., no structure, no odor, moist PID = 0.0/0.0 ppm; -FILL-	10	15	15	15	30	15				
	12	S4 5	6.0 6.5	SW	11.4 / 6.5	S4: Medium dense brown well-graded SAND with gravel (SW), mps 1.5 in., no structure, no odor, wet PID = 0.0/0.0 ppm	15	30	20	20	10	5				
	4 18	S4A 9	6.5 7.5	OL/OH	10.4 / 7.5	S4A: Very stiff brown sandy ORGANIC SOIL (OL/OH), mps <1 mm, no structure, organic odor, moist, trace gravel PID = 0.0/0.0 ppm; -ORGANIC DEPOSITS-					20	80				
	26	S4B 6	7.5 8.0	SW		S4B: Very dense orange-brown well-graded SAND with gravel (SW), mps 1.5 in., no structure, no odor, wet PID = 0.0/0.0 ppm	15	20	15	20	25	5				
	31 38 48 38	S5 10	8.0 10.0	SW-SM	7.9 / 10.0	S5: Very dense gray well-graded SAND with silt and gravel (SW-SM), mps 1.5 in., no structure, no odor, wet PID = 0.0/0.0 ppm; -GLACIOFLUVIAL DEPOSITS-; Note: Performed Falling Head Permeability Test from 8.0 to 10.0 ft.	10	15	15	15	35	10				
10	29 32 38 29	S6 15	10.0 12.0	SM		S6: Very dense gray silty SAND with gravel (SM), mps 1.5 in., moderately bonded, wet PID = 0.0/0.0 ppm	10	10	5	5	35	35				
	31 24 24 24	S7 17	12.0 14.0	SM		Similar to above PID = 0.0/0.0 ppm; -GLACIAL TILL-	5	10	5	5	35	40				

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
4/20/11	1445			20.0	5.6*

*Initial OW reading; not stabilized

Sample ID: O - Open End Rod; T - Thin Wall Tube; U - Undisturbed Sample; S - Split Spoon Sample

Well Diagram: Riser Pipe; Screen; Filter Sand; Cuttings; Grout; Concrete; Bentonite Seal

Summary: Overburden (ft) 18.0; Rock Cored (ft) -; Samples S10

Boring No. SDG-1(OW)

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 REV HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\FIELD DATA\-005\35571-500_TB.GPJ 6 May 11

HALEY & ALDRICH — TEST BORING REPORT

Boring No. SDG-1(OW)
File No. 35571-005
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
15	26 27 36 32	S8 16	14.0 16.0	ML		Very dense gray sandy SILT with gravel (ML), mps 1.5 in., no structure, no odor, wet; -GLACIAL TILL-	5	5	5	5	30	50				
20	19 50 76 25/0"	S9 12	19.0 21.0	ML		Similar to above PID = 0.0/0.0 ppm	5	5	5	5	30	50				
25	55 76 128	S10 14	24.0 25.5	ML	-7.6 / 25.5	Similar to above PID = 0.0/0.0 ppm; Note: Performed Falling Head Permeability Test in open borehole from 19.0 to 25.5 ft.	5	5	5	5	20	60				
						BOTTOM OF EXPLORATION 25.5 FT; Note: Groundwater observation well installed at 20.0 ft upon completion.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc. Boring No. SDG-1(OW)

H&A-TEST BORING-07-1 REV HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\35571\FIELD DATA\-005\35571-500_TB.GPJ 6 May 11

SDG

STEPHENSON DESIGN GROUP, LLC
Civil Engineering-Strategic Planning-Municipal Services
51 SLEEPER STREET, SUITE 600
BOSTON, MASSACHUSETTS 02210
PHONE: 617.695.7799

PROFESSIONAL ENGINEER DATE

PROPONENT:

CITY OF QUINCY
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

No.	Revision	Date	Appvd.

Designed by JDS Drawn by JDS Checked by
CAD checked by Approved by
Scale N.T.S. Date November 16, 2011

Project Title
Quincy Center Redevelopment Town Brook Enhancement Project (Phase 2A)
QUINCY, MASSACHUSETTS

Issued for
Bidding
Not Approved for Construction

Drawing Title
Construction Details
Geotechnical Boring Logs

Drawing Number
C-14

Sheet 14 of 20

Project Number 10-006

10-006_DT.DWG

Attachment 2

Trenchless Construction Specifications

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SECTION 02245

TRENCHLESS CONSTRUCTION

PART 1 GENERAL

1.01 DESCRIPTION

A. The Work of this Section includes installation of a precast reinforced concrete box culvert by jacking to achieve the crossing below the existing Hancock Street from Station 25+25 to 26+65 as shown on the Contract Drawings.

B. Install, operate and demobilize jacking and receiving pits including excavation support, excavation, soil management, dewatering and other associated facilities and activities.

C. The Contractor will be allowed to operate 24 hours per day continuously.

D. Avoid loss of ground and limit ground movements due to the Work to prevent impacts to nearby and overlying utilities, roadways and other facilities. Revise procedures and take other measures as necessary to limit and mitigate ground movements or impacts.

E. Protect and coordinate with the Phase 1 culvert conditions.

F. Perform dewatering and take other measures as required to accomplish the Work and protect nearby facilities.

G. Stabilize the ground by grouting or comparable means prior to or during jacking unless the Contractor can demonstrate that such means are not required, such as use of face stabilization shields or methods, performance of additional subsurface explorations, installation of groundwater observation wells or other means accepted by the Engineer in writing.

H. Cooperate fully with the Owner and provide access to all instrumentation locations, maintain locations clear of obstructions and debris, and protect instruments from damage.

I. Obtain all permits and perform the Work in accordance with all local, state and federal requirements.

1.02 RELATED SECTIONS

A. Carefully examine all of the Contract Documents for requirements which affect the work in this Section. Other Specification Sections which directly relate to the work of this Section include, but are not limited to, the following:

1. Section 01100 TEMPORARY SHEETING, SHORING, BRACING AND DECKING

2. Section 01125 DEWATERING

3. Section 02110 PRECONSTRUCTION SURVEY AND VIBRATION MONITORING OF EXISTING BUILDINGS

4. Section 02120 EXCAVATION

5. Section 02180 MONITORING, HANDLING, STOCKPILING, AND DISPOSAL OF CONTAMINATED MATERIAL

6. Section 02240 PRECAST REINFORCED CONCRETE DRAINAGE STRUCTURE

B. Standard Specifications for Highways and Bridges: Division II, Section 104 – Excavation for Structures

1.03 REFERENCES AND DEFINITIONS

A. Owner: City of Quincy

B. Engineer: Authorized representatives of the Owner.

C. Contractor: The person or organization identified as being responsible for the work of this Section.

D. ASTM: American Society of Testing and Materials

1. ASTM A36: Standard specification for Carbon Structural Steel

2. ASTM A134: Specifications for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

3. ASTM C144: Specification for Aggregate for Masonry Mortar

4. ASTM C150: Specification for Portland Cement

E. AASHTO: The American Association of State Highway and Transportation Officials

F. ACI: American Concrete Institute

1.04 PROJECT CONDITIONS

A. The Contractor shall expect to encounter groundwater, variable soils, cobbles boulders and other potential obstructions or below-grade objects during the Work.

B. Subsurface information is available in the Haley & Aldrich, Inc. “Report on Geotechnical Design Report, Quincy Center Redevelopment Town Brook Enhancement (Phase 2A), 17 January 2012”. Prior to submitting a bid, the Contractor shall review and understand the available information. The information is made available to the Contractor for information on factual data only and shall not be interpreted as a warranty of subsurface conditions whether interpreted from written text, boring logs, or other data.

C. Personnel and equipment shall be utilized that are qualified and suitable for entry and work within the culvert sections including Confined Space Entry. The Contractor shall prepare and implement a project-specific Health and Safety plan for personnel involved in the Work. The Health and Safety Plan shall be prepared by a qualified professional in accordance with all regulatory requirements.

1.05 QUALITY ASSURANCE

A. Qualifications: The Contractor and personnel assigned to the Work shall have successfully performed at least three jacking projects of similar size and character to that specified in this project, within the past 5 years.

1.06 SUBMITTALS

A. Submit detailed plans and other information of the proposed culvert jacking equipment, materials and methods, as specified herein.

B. Shop Drawings: The Contractor shall submit, at least 3 weeks prior to construction, detailed shop drawings, cut sheets, mix designs and design calculations prepared by a Registered Professional Engineer in the State of Massachusetts, showing construction methods and sequence, design and details of pits, excavation support systems, jacking systems and thrust blocks, shields, soil lubrication, specialized equipment, dewatering, grouting, other activities and proposed work schedule. Include face stabilization methods that will be used if the work is not performed continuously.

C. Contactor-prepared Health & Safety plan.

D. If the Contractor proposes to not grout prior to jacking, they shall submit rationale and supporting information demonstrating face stability, such as supplemental explorations, groundwater data, ground performance information and a narrative on the rational on why pre-grouting is not required.

E. Quality Control Submittals:

1. The Contractor shall submit all information necessary to demonstrate that the minimum qualification requirements indicated herein will be complied with.

2. Equipment and Methods

a. Submit shop drawings and narratives describing proposed culvert jacking means and methods including; equipment, equipment layout, procedures, materials, and schedule. Submittal shall include sequencing of the Phase 2A culvert section with the Phase 1 culvert, including a description of how the Phase 1 culvert section will be protected and the connection process. Submit drawings, designs, calculations and narratives describing jacking pits. Comply with all requirements indicated herein, in Section 01100 TEMPORARY SHEETING, SHORING, BRACING AND DECKING, and in the Drawings.

b. For the jacking shield show design, dimensions, method of operation, and steering control capability. Submit proposed procedures, material and equipment for removing, clearing or otherwise making it possible for culvert and shield to advance past natural and man-made obstructions.

c. Submit description of proposed methods for ground stabilization and minimizing over excavation and loss of ground. The submittal shall include, but not be limited to, additional explorations performed in the area (if completed) and description of precautions to be taken to ensure face stability below the roadway crossing.

Information on grouting shall include type, sequencing, configuration, mix designs, pressures and all aspects of the Work.

d. Submit equipment and methods of dewatering all work areas required for box culvert jacking. Discharge requirements, and other pertinent information are specified in Section 01125 DEWATERING. Water levels are anticipated to be within box culvert jacking working elevations.

e. Submit description of proposed line and grade control methods.

f. Submit proposed procedures, materials and equipment for lubricating the exterior of the culvert during jacking.

g. Submit proposed grouting methods, materials and sequencing to be performed upon the completion of culvert jacking.

h. Submit grout pressure and calculations that show grout shall fill voids and not damage utilities.

3. Calculations

a. Submit calculations, prepared and stamped by a Professional Engineer registered in the State of Massachusetts, that demonstrate that the precast reinforced box culvert to be jacked has been designed to support the maximum anticipated earth loads and superimposed live loads, including but not limited to jacking loads, that may be imposed on the culvert during construction. The Contractor shall determine the additional stresses imposed on the culvert during jacking operations and upgrade the quality and strength of the culvert and culvert joints, and provide other supplemental protections as required, to the extent necessary to withstand the additional stresses imposed by the jacking operation. The Contractor shall determine and accommodate any potential impacts jacking may have to previously installed Phase 1 culvert sections.

1.07 PERFORMANCE CRITERIA

A. Ground movements due to the Work shall be limited to prevent impacts to adjacent and overlying utilities, roadways and other facilities. Settlements as measured by instrumentation on the ground surface or other features along the alignment shall not exceed 0.5 (one-half) inch. If movements approaching this limit or other effects of construction are noted, revise construction procedures and take measures to mitigate and abate further movement.

B. The Contractor shall be solely responsible for all damages resulting from ground movement associated with grouting, jacking or other aspects of the Work.

C. The Owner shall install and monitor elevation reference points on the ground and other site features. Data from the monitoring shall be provided to the Contractor on a timely basis. Cooperate fully with the Owner and provide access to all instrumentation locations, maintain locations clear of obstructions and debris, and protect instruments from damage. The Contractor may install additional and monitor instrumentation or monitor the Owner's points, with the approval of the Engineer, at no additional cost to the Owner.

PART 2 – PRODUCTS

2.01 CONCRETE CULVERT AND JACKING SHIELD

A. The precast reinforced box culvert shall be designed and constructed as indicated in the Drawings. The culvert shall be able to withstand traffic and other loading as required by the project specifications.

B. The connections between the culvert segments shall be capable of transmitting 100 percent of the allowable compression loading and shall prevent the flow of groundwater into the culvert. The details of the connection design shall be the responsibility of the Contractor.

C. The jacking shield shall be of steel construction designed to support the required soil loading and jacking stresses and shall be adequately braced and be provided with the necessary appurtenances for bulkheading the face (i.e., boarding, porting, face grouting). The shield shall be capable of being steered by steering jacks located in the shield or other suitable means.

2.02 JACKING EQUIPMENT

A. Jacking and Receiving Pits: Materials for temporary excavation support systems for jacking and receiving shafts shall be as specified in Section 01100 TEMPORARY SHEETING, SHORING, BRACING, AND DECKING.

B. The equipment jacks, shield, rails, backstop, bracing and associated materials shall be adequate to successfully complete the jacking work in a timely manner without harm to any facilities.

2.03 DRAINAGE STRUCTURE

A. Drainage structure shall consist of a precast reinforced concrete box culvert. Refer to Project Contract Drawings and Section 02240 PRECAST REINFORCED CONCRETE DRAINAGE STRUCTURE for all drainage structure requirements.

2.04 PORTLAND CEMENT GROUT

A. Cement: AASHTO M85, Type I.

B. Water: Potable.

C. Sand: Masonry sand, AASHTO M45

D. Admixtures: Fly ash or other pozzolanic materials, fluidifiers, and bentonite, acceptable to the Engineer.

E. Mix grout to a pumpable consistency that is also sufficient to fill voids.

2.05 BENTONITE SLURRY

A. Bentonite slurry is a stable suspension of powdered bentonite in water designed to lubricate the culvert during jacking through soil.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall field-verify locations of any existing utilities and their condition before jacking operations begin. The Contractor shall submit the location of the utilities and documentation of the utility conditions to the Owner and Utility Owners for review. DigSafe notifications shall be made.

B. The Contractor shall submit a preconstruction survey that includes spot elevations of manhole structures/sidewalks/streets and a photo log of ground surfaces and adjacent structures (lights/building/hydrants) along the culvert alignment (25 ft beyond the edge of the excavation). The survey shall be submitted to the Owner. In addition, Contractor shall complete work as specified in Section 021110.

C. The Contractor shall protect utilities and other facilities in the vicinity of the jacking operations. If movement or other adverse effects occurs, the Contractor shall take immediate action to grout all voids and take other actions as required at no increase in Contract Price or Contract Time and shall make any necessary repairs to damaged facilities.

D. The culvert shall be installed to the lines, grades and location, and to the tolerances indicated on the Drawings.

3.02 INSTALLATION:

A. Bracing and backstops shall be so designed and jacks shall be of sufficient rating so that the jacking can progress without stoppage, except for adding lengths of box culvert.

B. The use of water or other liquids to facilitate spoil removal is prohibited.

C. Where voids are created outside the box culvert during the advance of the box culvert, or due to the removal of material at the front of the culvert, such voids shall be immediately filled with sand, clay, bentonite, or other non-decomposable material and rammed into place. When the culvert has been completely installed, all voids including those filled with temporary material shall be finally filled with Portland Cement grout pumped through the grout holes in the culvert, starting at the low end.

D. Any methods that employ simultaneous boring or excavating ahead of the culvert and jacking is not permitted without the written approval of the Engineer.

E. Grouting of the soils before and/or during jacking shall be conducted as required to stabilize the soils, control water, prevent loss of material, and prevent settlement or displacement overlying structures and of the ground surface at no additional cost to the Owner. Grout shall be cement, chemical or other special injection material selected by the Contractor to accomplish the necessary stabilization without heaving of the ground. The materials to be used and the method of injections shall be prepared by a Registered Professional Engineer in the State of Massachusetts and submitted for approval before the start of work. Proof of experience and competency shall accompany the submission. Grout pressure shall fill voids and not damage utilities, and shall not exceed 1.5 times the overburden pressure.

F. When water is expected to be encountered, pumps and other facilities of appropriate character and sufficient capacity to maintain stability and handle the flow shall be used. See Section 01125 DEWATERING.

G. At all times when the work is being progressed, a field supervisor for the work with no less than 12 months experience in the operation of the equipment being used shall be present.

3.03 JACKING AND RECEIVING PITS (SHAFTS)

A. Refer to Section 01100 TEMPORARY SHEETING, SHORING, BRACING AND DECKING for additional requirements related to jacking pits.

B. Provide a concrete slab, to provide a safe working platform capable of supporting working loads from equipment and materials, at the bottom of the jacking and receiving pits.

C. At the locations of the jacked box culvert, the Contractor shall be solely responsible for stabilizing the soil and controlling the groundwater outside the excavation support system prior to cutting the sheeting or shoring so as to avoid ground loss through the opening. The Contractor shall maintain the soil stabilization and groundwater control measures throughout the Work.

D. The Contractor shall design, furnish, install and remove thrust blocks or whatever provisions may be required in driving the culvert forward. Provide sufficient bearing area to avoid significant jacking reaction system movement and to avoid excessive movements or impacts to facilities.

E. At the completion of the jacking operation, remove all elements of the pits and jacking facilities, and furnish and place backfill as specified.

F. Provide culvert terminations as indicated on the Drawings.

G. Dispose of excavated material in accordance with Section 02120 EXCAVATION or Section 02180 MONITORING, HANDLING, STOCKPILING, AND DISPOSAL OF CONTAMINATED MATERIAL, if applicable.

3.04 JACKING OPERATIONS

A. The box culvert manufacturer's design jacking loads shall not be exceeded during the installation process. The culvert shall be designed to take full account of all temporary installation loads. The jacking system shall develop a uniform distribution of jacking forces on the end of the culvert by the use of jacking rings and packing. The culvert shall be jacked in place without damaging the culvert joints or culvert sections. Any culvert section or joint that has been damaged during installation shall be repaired or replaced to the satisfaction of the Engineer, at no additional cost.

B. The Contractor shall use a fabricated structural steel jacking frame to distribute the stresses from the jacks evenly to the jacking ring. The main jacks shall be mounted in a jacking frame and located in the jacking pit. The jacking frame shall successively push the connected culvert toward a receiving shaft. The jacking capacity of the system must be sufficient to push the string of piping through the ground. The main jacking equipment installed must have a capacity greater than the total jacking load required.

C. A culvert lubrication system shall be utilized when anticipated jacking forces on the culvert are expected to exceed the capacity of the main jacks or exceed the culvert design strength with the

appropriate safety factor. An accepted lubricant such as bentonite slurry shall be injected at the head of the jacked culvert and, if necessary, along the culvert walls to lower the friction developed on the surface of the culvert walls during jacking, thereby reducing the jacking forces. Clean-up, removal and disposal of all waste is also part of the Work.

D. The Contractor shall prevent the occurrence of voids outside the culvert that will endanger the existing roadway, utilities, and structures.

E. When the box culvert is set in the jacking guides, one of the grout holes shall be located at the top of the culvert. Immediately following the jacking operation, the Contractor shall pressure grout the jacked sections to fill all voids outside of the culvert. Grouting shall be from the interior of the culvert through all grout holes, starting from the low point and progressing upward.

F. The design of the jacking shield shall include provisions to fully brace the tunnel face and immediately stop the loss of material at the face. Face grouting or external grouting may be necessary to facilitate jacking through groundwater within the culvert horizon, in which case grouting prior to culvert advancement shall be performed to prevent loss of ground and infiltration of soil into the culvert. Where possible, the Contractor shall keep a one foot minimum plug at the face of the shield at all times.

G. After the culvert has been completely installed, the Contractor shall thoroughly clean the interior.

H. Dispose of excavated material in accordance with Section 02120 Excavation or Section 02180 MONITORING, HANDLING, STOCKPILING, AND DISPOSAL OF CONTAMINATED MATERIAL, if applicable.

3.05 <u>GROUTING OF VOIDS AROUND JACKED CULVERT</u>

A. At least three (3) ports shall be provided on each culvert section to enable post-jacking grouting of voids around the section. Ports shall be positioned at the mid-length of the section, and evenly spaced around the culvert perimeter.

B. Upon completion of the culvert jacking operations, all voids outside the culvert shall be filled by pressure grouting.

C. Grouting equipment and material shall be on the jobsite before jacking operations are completed so that grouting around the jacked culvert may be started immediately after the jacking operations have finished. The Contractor's responsibilities shall include but not limited to:

1. Supply water to the jacking site and elsewhere as required.

2. Use equipment for mixing and injecting grout which is designed for grouting service, and maintain it in satisfactory operating condition at all times, capable of satisfactorily mixing and agitating the grout and forcing it into the void spaces in a continuous flow.

3. Provide grout plant capable of delivering grout under a uniform flow and developing the required pressure at the grout connection. A standby pump will be required during grouting operations

4. Keep equipment and lines clean by constant circulation of grout and periodic flushing with water. Provide a by-pass line in the grout plant, set up to allow continuous grout circulation at all times.

5. Use colloidal mixers and mechanical agitator tanks of sufficient capacity to ensure an

uninterrupted supply of grout slurry to the grout pump. Equipment shall be equipped with an accurate water meter.

6. Provide suitable stop valves in the grouting pressure lines for use in maintaining pressure as required until the grout has set.

7. Provide a means of accurately measuring grout pressures and the amount of grout injected, including standby gages.

8. Control grouting pressures to fill voids without causing ground heave, grout escape or other adverse impacts.

D. Method of grouting shall ensure that lubricants in the voids are displaced by grout.

3.06 TOLERANCES

A. Culvert alignment shall not vary from that shown on the Drawings by more than 2 inches vertically and 2 inches horizontally. Local slope of the culvert shall not vary more than ½ percent from that indicated. No reverse slope of the culvert shall be permitted.

B. When the jacked culvert deviates from design line or grade by amounts greater than specified, the culvert shall be returned to design line or grade plus or minus the specified tolerance at a rate of not more than ½ inch per 50 feet, unless otherwise approved by the Engineer.

C. All additional work and redesign necessary due to nonconformance of the Contractor's Work shall be performed by the Contractor at no increase in the Contract Time or Contract price.

D. Settlement or heave of ground surface along and adjacent to the culvert jacking alignment shall not exceed ½ inch.

3.07 OBSTRUCTION REMOVAL DURING JACKING

A. The Contractor shall remove, clear, or otherwise make it possible for the culvert to advance past all man-made or naturally-occurring obstructions. Removal of obstructions at the face shall be conducted in a manner that does not cause loss-of-ground. Obstruction removal shafts will not be allowed without written approval by the Engineer.

3.08 FIELD QUALITY CONTROL

A. After completion of a reach of jacking between adjacent pits, the Contractor shall provide the Engineer with access to both shafts for visual inspection of line and grade of the completed reach.

END OF SECTION

Attachment 3

Message Board Specification Sheets

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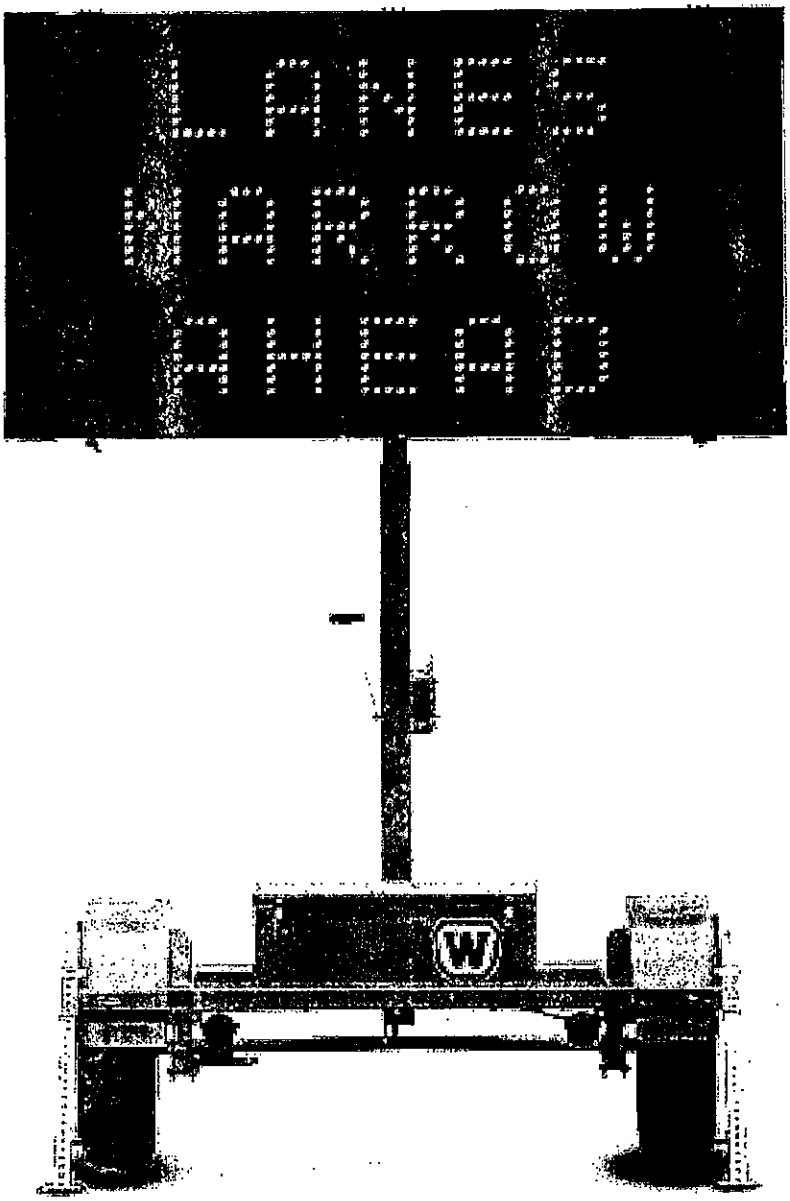
Metro VMS

Compact Variable Message Sign



Small footprint, energy efficiency and superior performance

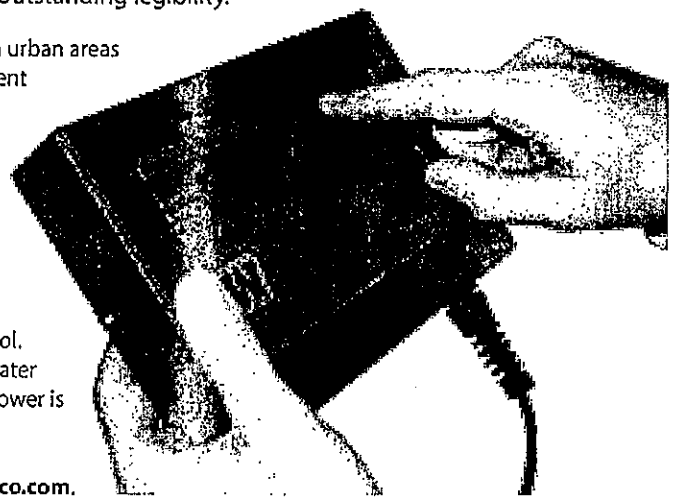
WANCO® Driving traffic safety.

800-972-0755
www.wanco.com

Wanco's new, compact design for metropolitan areas

- Full-matrix message sign available in three sizes
- Compact trailer
- Touchscreen controller with intuitive interface
- High quality from the brand you trust

Wanco's new Metro Variable Message Sign is our most compact portable message sign, designed for use in metropolitan areas. The Metro VMS features a full matrix of high-efficiency LEDs for reduced energy consumption, superior performance and outstanding legibility.



The Metro's compact trailer is easy to maneuver and deploy, particularly in urban areas where traffic is heavy and space is limited. The full-matrix display can present messages as text, graphics or a combination of both, for traffic safety, emergency response and special events.

Like all Wanco message signs, the Metro is versatile and dependable. It uses our new touchscreen interface for the easiest programming in the industry. For optimal positioning, the sign rotates independent of the trailer, and its height is fully adjustable.

Optional equipment includes radar-based speed detection, the Wanco Traffic Data Collector, GPS and remote communications with remote control. Optional jack-legs and outriggers provide even more adjustability and greater stability, while additional solar panels and batteries are available if more power is required.

To see or order the new Metro VMS, call **800.972.0755** or visit **wanco.com**.

Basic specifications

	Model WVTMM-L	Model WVTMM-M	Model WVTMM-S
Display	60 x 30 pixels	48 x 30 pixels	48 x 20 pixels
Sign cabinet size	89 x 49 in. (226 x 124 cm)	72 x 49 in. (183 x 124 cm)	72 x 36 in. (183 x 91 cm)
Deployed footprint	120 x 78 in. (305 x 198 cm)	120 x 78 in. (305 x 198 cm)	109 x 54 in. (277 x 137 cm)
Deployed height	131 in. (333 cm)	118 in. (300 cm)	80 in. (203 cm)
Travel height	98 in. (249 cm)	85 in. (216 cm)	80 in. (203 cm)
Weight, approx.	1500 lbs. (680 kg)	1400 lbs. (635 kg)	1000 lbs. (454 kg)
Tires	15-inch	15-inch	15-inch

Maintenance-free batteries
Solar charging system with standard 45-amp charger
Handheld touchscreen controller
10-inch standard font-height
Up to 12 fonts, from 4x5 to 11x23 pixels
Up to 12 characters per line
Up to 5 lines of text with smallest font on largest sign
Preprogrammed, custom and MUTCD-standard graphics
Bold arrow graphics
NTCIP-compliant

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Printed on recycled paper

Attachment 4

Subcontractor's List to Accompany Bid

Material/Equipment Questionnaire

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SUBCONTRACTORS LIST TO ACCOMPANY BID

This form, listing subcontractors to be used by _____ in performing The Town Brook Enhancement Project – Phase 2A Contract, is hereby made a part of this proposal. Bidders are advised that this list shall be a part of the bid submission and binds the Prime Contractor to use the subcontractors so designed unless receiving written consent from New Castle County for replacement. Bids submitted without completion of the following list and required statement of qualifications are subject to rejection.

CONTRACTOR shall list all intended subcontractors including firm name, primary business address and the intended general scope of work for the Town Brook Enhancement Project.

Qualifications and past experience shall be attached for all tunneling and jack and bore subcontractors.

Name	Address	Scope of Work

MATERIAL / EQUIPMENT QUESTIONNAIRE

PROJECT_____

The materials and/or equipment for use in the execution of the work required on the above project will be secured from the sources designated below.

NAME OF PRIME CONTRACTOR_____

MAILING ADDRESS_____ZIP CODE_____

SUBMITTED BY_____DATE_____

E-MAIL ADDRESS_____

"I" - Inspection; "C" - Certification; "N" - Not Approved; "R" - Requires Regional Material's Approval; "NA"- No Action Required

MATERIAL/EQUIPMENT (See comment above for instructions)	Item Nos.	MANUFACTURER/SOURCE & MAILING ADDRESS	SUPPLIER/PLANT LOCATION & MAILING ADDRESS	*